STATUS OF WILDLIFE POPULATIONS, FALL 2012

(Including 2002-2012 Hunting and Trapping Harvest Statistics)

edited by
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Note: Data in this report may change as a result of future verification and more comprehensive analysis.

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This is the 36th year that the DNR has compiled this booklet; it is primarily an administrative document intended for DNR personnel. Since 1984 we have also generated a companion volume, *Summaries of Wildlife Research Findings*, containing annual summaries of activities and findings from ongoing research projects in the Wildlife Policy and Research Unit. This publication will be posted on the DNR website and available in other formats upon request. In the on-line format links are available to the U.S. Fish and Wildlife Service Division of Migratory Bird Management to access their reports for Waterfowl Population Status; Migratory Bird Harvest Information Preliminary Estimates; American Woodcock Population Status; and Mourning Dove Population Status.

Most of the fieldwork associated with collection of census and survey data for farmland, wetland, and forest wildlife is performed by wildlife biologists and managers (conservation officers also participate in August roadside counts). The Farmland, Wetland, and Forest Wildlife Population and Research groups coordinate these activities, analyze and interpret data, and prepare recommendations for harvest regulations and season setting. Due to staffing changes and workload considerations some reports were not available at time of publication.

Most of the hunting and trapping harvest estimates are calculated and summarized by St. Paul central office personnel.

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FARMLAND WILDLIFE POPULATIONS

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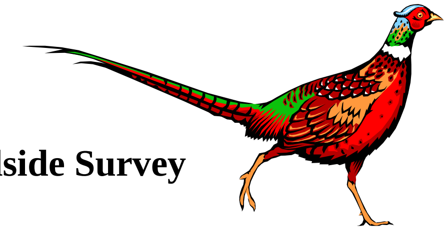

2012 Minnesota August Roadside Survey

Kurt J. Haroldson, Farmland Wildlife Populations and Research Group

ABSTRACT

Population indices for ring-necked pheasants, gray partridge, and mourning doves increased from last year, and population indices for cottontail rabbits and white-tailed jackrabbits were similar to 2011 but below long-term averages. The population index for white-tailed deer was similar to 2011 and the 10-year average. Sandhill crane indices were also unchanged from last year. Conservation Reserve Program (CRP) enrollment in Minnesota declined by 43,000 acres from 2011, but increases in enrollment of other farm programs and acquisition of public lands partially offset CRP losses, yielding a net loss of about 4,300 acres of protected grassland habitat. Within the pheasant range, a net gain of farm program enrollments and public land acquisitions yielded a net gain of nearly 32,000 acres of protected habitat. The winter of 2011-12 was unusually mild for the entire farmland region, and it was followed by a warm spring. Thus, conditions for overwinter survival of farmland wildlife in 2012 were above average, and reproductive conditions were generally favorable.

The 2012 pheasant index (38.9 birds/100 mi) increased 68% from 2011, but remained 51% below the 10-year average, 62% below the long-term average, and 87% below the benchmark years of 1955-64 (soil-bank years with marginal cropland in long-term set-aside, a diversified agricultural landscape, more small grains and tame hay, and less pesticide use). The 2012 hen pheasant index was 75% above last year but 51% below the 10-year average, reflecting progress toward recovery from last year's dramatic decline. The number of broods observed was 105% above last year but 48% below the 10-year average. Projecting from the roadside index, an estimated 291,000 roosters may be harvested this fall, similar to 2001. The best opportunity for harvesting pheasants appears to be in the West Central, East Central, and Southwest regions.

The gray partridge index increased 180% from last year, was similar to the 10-year mean, but 68% below the long-term average. Observed regional changes were not significant, but were based on small samples. Gray partridge counts were highest in the Southwest, South Central, and Southeast regions.

The cottontail rabbit index was similar to last year, but 34% below the 10-year average and 34% below the long-term average. Counts of cottontail rabbits were highest in the East Central, Southeast, and South Central regions. The jackrabbit index did not change significantly in 2012, but was 93% below the long-term average. The range-wide jackrabbit population peaked in the late 1950's and declined to low levels in the 1980s, from which populations have not recovered. Counts of white-tailed jackrabbits were highest in the South Central region.

The number of mourning doves observed in 2012 was 36% above last year, similar to the 10-year average, but 16% below the long-term average. In contrast, the white-tailed deer index was similar to last year and the 10-year average, but 51% higher than the long-term average. Sandhill crane indices were unchanged from 2011.

INTRODUCTION

This report summarizes the 2012 Minnesota August roadside survey. The survey is conducted annually during the first half of August by Minnesota Department of Natural Resources (MNDNR) enforcement and wildlife personnel throughout the farmland region of Minnesota (Figure 1). The August roadside survey consists of 171 25-mile routes (1-4 routes/county); 152 routes are located in the ring-necked pheasant range.

Observers drove each route in the early morning at 15-20 miles/hour and recorded the number of pheasants, gray (Hungarian) partridge, cottontail rabbits, white-tailed jackrabbits, and other wildlife they saw. Counts conducted on cool, clear, calm mornings with heavy dew yield the most consistent results because wildlife, especially pheasants, gray partridge, and rabbits, move to warm, dry areas (e.g., gravel roads) during early-morning hours. These data provide an **index of relative abundance** and are used to monitor annual changes and long-term trends in regional and range-wide populations. Results are reported by agricultural region (Figure 1) and range-wide; however, population indices for species with low detection rates are imprecise and <u>should be interpreted cautiously</u>.

ACKNOWLEDGMENTS

I thank all cooperators for their efforts in completing routes in 2012; without their help the survey would not be possible. Tonya Klinkner provided logistical assistance including mailing packages and entering data. John Giudice and Marrett Grund reviewed an early draft of this report. Tabor Hoek of the Minnesota Board of Water & Soil Resources (BWSR) provided enrollment data on cropland-retirement programs in Minnesota.

WEATHER SUMMARY

The winter of 2011-12 was the unusually mild for the farmland region of Minnesota. Snow cover from early-December through late March was intermittent throughout the farmland zone, with snow depths exceeding 6 inches for less than 3 consecutive weeks (Minnesota Climatology Working Group [MCWG], http://climate.umn.edu/doc/snowmap.htm). In addition, monthly temperatures averaged 10°F above normal (range 6°F to 16°F, MCWG, http://climate.umn.edu/cawap/monsum/monsum.asp) in all farmland regions from December through March. Warm conditions continued through April, May, and June in most farmland regions, and spring precipitation was normal to below normal except in May. Thus, conditions for over-winter survival of farmland wildlife were very good throughout most of the farmland region in 2012, and conditions for production of young were generally favorable except for excessive rain in May.

HABITAT CONDITIONS

Habitat changes since 2011 varied widely across Minnesota. CRP enrollment declined by nearly 43,000 acres statewide, but losses in northwestern Minnesota's prairie chicken range

(46,987 acres lost) were contrasted by a net gain of 10,027 acres in Minnesota's pheasant range. In addition, gains in enrollments of Reinvest in Minnesota (RIM), Wetlands Reserve Program (WRP), RIM- WRP, and acquisitions of Wildlife Management Areas (WMA) and Waterfowl Production Areas (WPA) offset CRP losses, yielding a net loss of protected habitat statewide of 4,318 acres. In Minnesota's pheasant range, a net gain of 24,758 acres of farm program enrollments plus 6,942 new acres protected as WMAs and WPAs yielded a net increase of 31,701 acres of protected habitat. Within the pheasant range, protected habitats account for about 6.2% of the landscape (range: 3.0-10.3%; Table 1).

Farm programs make up the largest portion of protected grasslands in the state. The expiration of a large proportion of existing CRP contracts is a major concern for future wildlife populations, with over 620,000 acres in Minnesota scheduled to expire in the next 3 years. Furthermore, the 43rd general CRP signup held during spring, 2012, enrolled far fewer acres (99,565) than are expiring on September 30, 2012 (289,796 acres). The future of farmland retirement programs remains under threat due to competing economic opportunities (e.g., high land rental rates, ethanol production).

New funding from the Legacy Amendment has accelerated acquisition of WMAs and WPAs throughout Minnesota's farmland zone. In addition, the Working Lands Initiative (http://www.dnr.state.mn.us/workinglands/index.html) continues to protect and expand large wetland-grassland complexes in selected counties in western Minnesota.

SURVEY CONDITIONS

Observers completed all 171 routes in 2012. Weather conditions during the survey ranged from excellent (calm, heavy dew, clear sky) to medium (light dew and overcast skies). Medium-to-heavy dew conditions were present at the start of 97% of the survey routes, which was similar to 2011 (96%) but better than the 10-year average (93%). Clear skies (<30% cloud cover) were present at the start of 88% of routes, with wind speeds <7 mph recorded for 95% of routes. The survey period was extended to July 30th - August 20th to allow all routes to be completed.

RING-NECKED PHEASANT

The average number of pheasants observed (38.9/100 mi) increased 68% (Table 2) from 2011 but remained 51% below the 10-year average (Table 2; Figure 2A), 62% below the long-term average (Table 2), and 87% below the benchmark years of 1955-64. Total pheasants observed per 100 miles ranged from 3.6 in the Southeast to 58.0 in the West Central region (Table 3). Changes from last year were significant in the West Central (+105%), Central (+57%), and Southwest regions (+173%; Table 3).

The range-wide hen index (6.0 hens/100 mi) was 75% above last year, but 51% below the 10-year average (Table 2). The hen index varied from 1.1 hens/100 miles in the Southeast to 8.9 hens/100 miles in the East Central region, and was higher than last year for the Southwest region. The range-wide cock index (4.4 cocks/100 mi) was similar to 2011 but 48% below the 10-year average (Table 2). The 2012 hen:cock ratio was 1.33, which was very close to average (1.47 ± 0.33 [SD]) for the CRP years (1987-2011).

The number of pheasant broods observed (6.4/100 mi) was 105% above last year, but 48% below the 10-year average, and 52% below the long-term average (Table 2). The brood index remains far below the benchmark years of 1955-64 (34.8 broods/100 mi). Regional brood indices ranged from 0.8 broods/100 miles in the Southeast to 9.5 broods/100 miles in the West Central region. Average brood size in 2012 (4.4 ± 0.2 [SE] chicks/brood) was similar to last year (4.6 ± 0.2 [SE] chicks/brood), but below the 10-year mean (4.7 ± 0.1 [SE] chicks/brood) and the long-term average (5.5 ± 0.1 [SE] chicks/brood; Table 2). The median hatch date for pheasants was June 7 (n = 236), similar to the 10-year average (Table 2). The distribution of estimated hatch dates for observed broods was unimodal and normally distributed, which suggests that the heavy rains in May were not abnormally disruptive to nesting attempts. Successful late-season nests tend to be underrepresented in roadside data. Median age of broods observed was 8 weeks (range: 1-16 weeks).

A mild winter throughout the pheasant range was expected to result in greater hen counts, and this was observed in the survey data. In addition, warm weather during April - June likely contributed to greater brood survival rates. Thus, an increase in the range-wide pheasant index was expected, but counts remain well below the 10-year average. Projecting from the roadside index, an estimated 291,000 roosters may be harvested this fall, similar to 2001 (Figure 2A). The best opportunity for harvesting pheasants appears to be in the West Central, East Central, and Southwest regions.

GRAY PARTRIDGE

Range-wide, the gray partridge index (4.8 partridge/100 miles) was greater than last year, similar to the 10-year average and 68% below the long-term average (Table 2, Figure 2B). Within regions, the partridge index ranged from 0.3/100 miles in the East Central region to 9.9/100 miles in the Southwest region (Table 3). There were no significant regional changes from last year (Table 3). Observations of gray partridge were too few for analysis by age class (n=18 broods statewide).

Conversion of diversified agricultural practices to more intense land-use with fewer haylands, pastures, small grain fields, and hedgerows have reduced the amount of suitable habitat for the gray partridge in Minnesota. Gray partridge in their native range (southeastern Europe and northern Asia) are associated with arid climates and their reproductive success is limited in the Midwest except during successive dry or drought years. Consequently, gray partridge are more strongly affected by weather conditions during nesting and brood rearing than are pheasants. The Southwest, South Central , and Southeast offer the best opportunity for harvesting gray partridge in 2012.

COTTONTAIL RABBIT and WHITE-TAILED JACKRABBIT

The eastern cottontail rabbit index (4.1 rabbits/100 mi) was similar to last year, but 34% below the 10-year average and 34% below the long-term average (Table 2, Figure 3A). The cottontail rabbit index ranged from 0.2 rabbits/100 miles in the Northwest to 12.6 rabbits/100 miles in the East Central region (Table 3). Among regions, cottontail indices increased significantly from last year only in the West Central region +218%; Table 3). The best opportunities for harvesting cottontail rabbits are in the East Central, Southeast, and South Central regions.

The index of white-tailed jackrabbits did not change significantly from 2011 or the 10-year average, but was 93% below the long-term average (Table 2, Figure 3B). The range-wide jackrabbit population peaked in the late 1950's and declined to low levels in 1980s (Figure 3B). The long-term decline in jackrabbits reflects the loss of their preferred habitats (i.e., pasture, hayfields, and small grains). The greatest potential for white-tailed jackrabbit hunting is likely in the Southwest and South Central regions (Table 3). However, indices of relative abundance and annual percent change should be interpreted cautiously because estimates are based on a small number of sightings.

WHITE-TAILED DEER

The index for white-tailed deer (14.2 deer/100 mi) was similar to last year and the 10-year average, but 51% above the long-term average (Table 2, Figure 4A). Among regions, deer indices were comparable to indices derived in 2011 (Table 3).

MOURNING DOVE

The number of mourning doves observed (213.8 doves/100 mi) in 2012 was 36% above last year, similar to the 10-year average, but 16% below the long-term average (Table 2, Figure 4B). The mourning dove index ranged from 80.1 doves/100 miles in the Northwest region to 315.5 doves/100 miles in the South Central Region (Table 3). The number of mourning doves heard along U.S. Fish and Wildlife Service call-count survey (CCS) routes (n = 14) in Minnesota was similar to last year. Trend analyses indicated the number of mourning doves heard along the CCS routes declined 0.8% per year (95% CI: -2.6 to 1.5%) during 2003-2012 and declined 1.3% per year (95% CI: -2.0 to -0.5%) during 1966-2012 (Seamans et al. 2012).

SANDHILL CRANE

For only the fourth consecutive year, observers were asked to report the number of adult and juvenile sandhill cranes observed on the August Roadside Survey. Range-wide, the 2012 index averaged 10.3 cranes/100 miles of survey, including 1.4 juveniles/100 miles (Table 2). Compared to 2011, we detected no change in the total number of cranes observed or the number of juvenile cranes observed (Table 2). Among regions, crane indices ranged from 0.0/100 miles in the Southwest and Southeast regions to 42.0 cranes/100 miles in the Northwest region (Table 3). Regional crane indices were not significantly different from last year (Table 3). Juvenile cranes were observed in the Central (3.9/100 mi), East Central (1.7/100 mi), West Central (0.6/100 mi), South Central (0.4/100 mi), and Northwest (3.1/100 mi) regions.

OTHER SPECIES

Notable incidental sightings: trumpeter swan (Clay and Kandiyohi Counties), indigo bunting (Le Sueur County), red-headed woodpecker (Todd County), northern shrike (Le Sueur County), and upland sandpiper (Watonwan and Wilkin Counties).

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Table 1. Abundance (total acres) and density (acres/mi^2) of undisturbed grassland habitat within Minnesota's pheasant range, 2012[a].

	Cropland Retirement									Density
AGREG	CRP	CREP	RIM	RIM-WRP	WRP	USFWS[c]	MNDNR[d]	Total	%	ac/mi2
WC[b]	316,175	39,240	19,732	10,628	19,176	183,630	108,917	697,497	10.3	65.7
SW	105,154	25,286	17,990	1,251	766	20,643	58,160	229,248	6.1	38.8
C	136,743	15,320	17,273	4,694	3,100	86,708	47,137	310,975	5.1	32.9
SC	90,358	28,237	12,397	7,107	8,791	8,515	32,474	187,880	4.6	29.8
SE	74,443	2,733	9,589	630	812	36,370	52,659	177,237	4.8	30.6
EC	4,387	0	1,131	0	4	4,720	86,315	96,556	3.0	19.3
Total	727,260	110,816	78,112	24,309	32,649	340,587	385,661	1,699,393	6.2	39.4

[a] Unpublished data, Tabor Hoek, BWSR, 23 August 2012.
[b] Does not include Norman County.
[c] Includes Waterfowl Production Areas (WPA) and USFWS refuges.
[d] MNDNR Wildlife Management Areas (WMA).

Table 2. Range-wide trends (% change) in number of wildlife observed per 100 miles driven, Minnesota August roadside survey, 1955-2012.

Species	Change from 2011[a]					Change from 10-year average[b]				Change from long-term average[c]			
Subgroup	*n*	2011	2012	%	95% CI	*n*	2002-11	%	95% CI	*n*	LTA	%	95% CI
Ring-necked pheasant													
Total pheasants	147	23.2	38.9	68	±34	147	79.7	-51	±14	150	99.4	-62	±9
Cocks	147	5.2	4.4	-15	±25		8.6	-48	±13		11.2	-61	±12
Hens	147	3.4	6.0	75	±42		12.2	-51	±14		14.4	-60	±11
Broods	147	3.1	6.4	105	±41		12.4	-48	±14		13.0	-52	±11
Chicks per brood	236	4.6	4.4	-4			4.7	-6			5.5	-20	
Broods per 100 hens	147	92.1	107.8	17			101.6	6			101.3	6	
Median hatch date	236	Jun 9	Jun 7				Jun 09						
Gray partridge													
Total partridge	165	1.7	4.8	180	±175	166	6.4	-26	±40	150	15.5	-68	±21
Eastern cottontail	165	3.6	4.1	12	±30	166	6.1	-34	±15	150	6.7	-34	±15
White-tailed jackrabbit	165	0.2	0.2	1	±121	166	0.3	-41	±50	150	1.8	-93	±15
White-tailed deer	165	14.9	14.2	-5	±22	166	15.2	-5	±18	169	9.4	51	±22
Mourning dove	165	157.0	213.8	36	±18	166	219.1	-3	±11	150	272.9	-16	±12
Sandhill Crane													
Total cranes	165	10.7	10.3	-4	±44								
Juveniles	165	2.4	1.4	-43	±50								

[a] Includes Northwest region, except for pheasants. Estimates based on routes (*n*) surveyed in both years.

[b] Includes Northwest region, except for pheasants. Estimates based on routes (*n*) surveyed at least 9 of 10 years.

[c] LTA = 1955-2011, except for deer = 1974-2011. Estimates for all species except deer based on routes (*n*) surveyed $\geq$40 years; estimates for deer based on routes surveyed $\geq$25 years. Thus, Northwest region (8 counties in Northwest were added to survey in 1982) included only for deer.

Table 3. Regional trends (% change) in number of wildlife observed per 100 miles driven, Minnesota August roadside survey, 1955-2012.

Region	Change from 2011[a]					Change from 10-year average[b]				Change from long-term average[c]			
Species	*n*	2011	2012	%	95% CI	*n*	2002-11	%	95% CI	*n*	LTA	%	95% CI
Northwest[d]													
Gray partridge	18	0.0	2.0			17	0.4	-100	±104	17	4.0	-100	±70
Eastern cottontail		0.0	0.2				1.0	-100	±81		1.0	-100	±63
White-tailed jackrabbit		0.0	0.4				0.5	-100	±47		0.7	-100	±46
White-tailed deer		33.2	27.3	-18	±68		44.1	-28	±44		26.9	18	±78
Mourning dove		94.5	80.1	-15	±108		83.6	19	±123		129.1	-23	±67
Sandhill Crane		33.6	42.0	25	±75								
West Central													
Ring-necked pheasant	33	28.2	58.0	105	±84	33	85.2	-67	±30	33	105.0	-73	±18
Gray partridge		0.0	0.6				2.7	-100	±58		10.0	-100	±23
Eastern cottontail		0.7	2.3	218	±162		3.2	-77	±27		4.3	-83	±18
White-tailed jackrabbit		0.1	0.2	100	±461		0.5	-74	±82		2.1	-94	±22
White-tailed deer		18.2	14.1	-23	±28		12.8	42	±46		9.1	99	±75
Mourning dove		201.7	244.2	21	±24		267.7	-25	±21		371.3	-46	±12
Sandhill Crane		1.2	2.3	90	±289								
Central													
Ring-necked pheasant	30	18.9	29.7	57	±51	29	70.2	-72	±22	29	76.2	-74	±19
Gray partridge		0.3	3.9	1350	±2040		3.5	-92	±64		9.9	-97	±42
Eastern cottontail		2.7	3.2	20	±69		6.5	-57	±36		6.4	-57	±21
White-tailed jackrabbit		0.0	0.0				0.2	-100	±74		1.3	-100	±22
White-tailed deer		12.7	13.2	4	±43		7.2	83	±70		4.3	204	±123
Mourning dove		155.5	238.7	54	±55		196.5	-19	±27		235.5	-32	±23
Sandhill Crane		17.2	22.0	28	±95								
East Central													
Ring-necked pheasant	13	50.6	55.2	9.1	±56	14	55.5	-9	±57	14	85.9	-41	±36
Gray partridge		0.0	0.3				0.0				0.1	-100	±133
Eastern cottontail		9.1	12.6	38	±96		10.1	-10	±70		8.7	5	±68
White-tailed jackrabbit		0.0	0.0				0.0				0.2	-100	±57
White-tailed deer		19.1	17.4	-9	±98		16.0	20	±127		8.1	137	±248
Mourning dove		99.4	92.5	-7	±50		100.1	-1	±30		127.1	-22	±36
Sandhill Crane		42.0	11.7	-72	±72								

Table 3. Continued.

Region / Species	Change from 2011					Change from 10-year average				Change from long-term average			
	n	2011	2012	%	95% CI	*n*	2002-11	%	95% CI	*n*	LTA	%	95% CI
Southwest													
Ring-necked pheasant	19	19.2	52.4	173	±134	19	159.8	-88	±20	19	119.5	-84	±15
Gray partridge		4.0	9.9	147	±307		23.3	-83	±46		42.4	-91	±27
Eastern cottontail		3.8	3.8	0	±89		7.6	-50	±40		8.2	-54	±33
White-tailed jackrabbit		0.6	0.2	-67	±173		1.0	-39	±93		3.9	-84	±30
White-tailed deer		9.7	18.3	89	±89		14.5	-33	±38		8.2	17	±58
Mourning dove		189.6	229.8	21	±25		334.1	-43	±18		314.9	-40	±18
Sandhill Crane		0.0	0.0										
South Central													
Ring-necked pheasant	32	23.1	33.7	46	±77	32	85.1	-73	±26	32	133.3	-83	±13
Gray partridge		4.3	9.5	123	±271		12.4	-66	±49		19.3	-78	±28
Eastern cottontail		4.6	4.8	3	±50		9.0	-48	±21		7.7	-40	±23
White-tailed jackrabbit		0.4	0.3	-32	±155		0.2	73	±158		1.8	-79	±32
White-tailed deer		6.0	6.0	0	±76		5.5	9	±62		3.4	79	±98
Mourning dove		177.4	315.5	78	±52		278.3	-36	±15		259.0	-32	±16
Sandhill Crane		0.6	1.3	100	±176								
Southeast													
Ring-necked pheasant	19	4.8	3.6	-26	±139	19	26.6	-80	±30	19	73.7	-93	±27
Gray partridge		3.2	6.1	93	±347		5.7	-44	±133		13.9	-77	±59
Eastern cottontail		7.6	4.8	-36	±57		8.0	-5	±51		7.7	-2	±51
White-tailed jackrabbit		0.0	0.0				0.1	-100	±90		0.6	-100	±43
White-tailed deer		12.9	11.4	-12	±39		15.9	-19	±47		10.2	26	±47
Mourning dove		116.6	150.7	29	±40		194.6	-39	±19		225.1	-47	±17
Sandhill Crane		0.0	0.0										

[a] Based on routes (*n*) surveyed in both years.

[b] Based on routes (*n*) surveyed at least 9 of 10 years.

[c] LTA = 1955-2011, except for Northwest region (1982-2011) and white-tailed deer (1974-2011). Estimates based on routes (*n*) surveyed $\geq$40 years (1955-2011), except for Northwest ($\geq$20 years) and white-tailed deer ($\geq$25 years).

[d] Eight Northwestern counties (19 routes) were added to the August roadside survey in 1982.

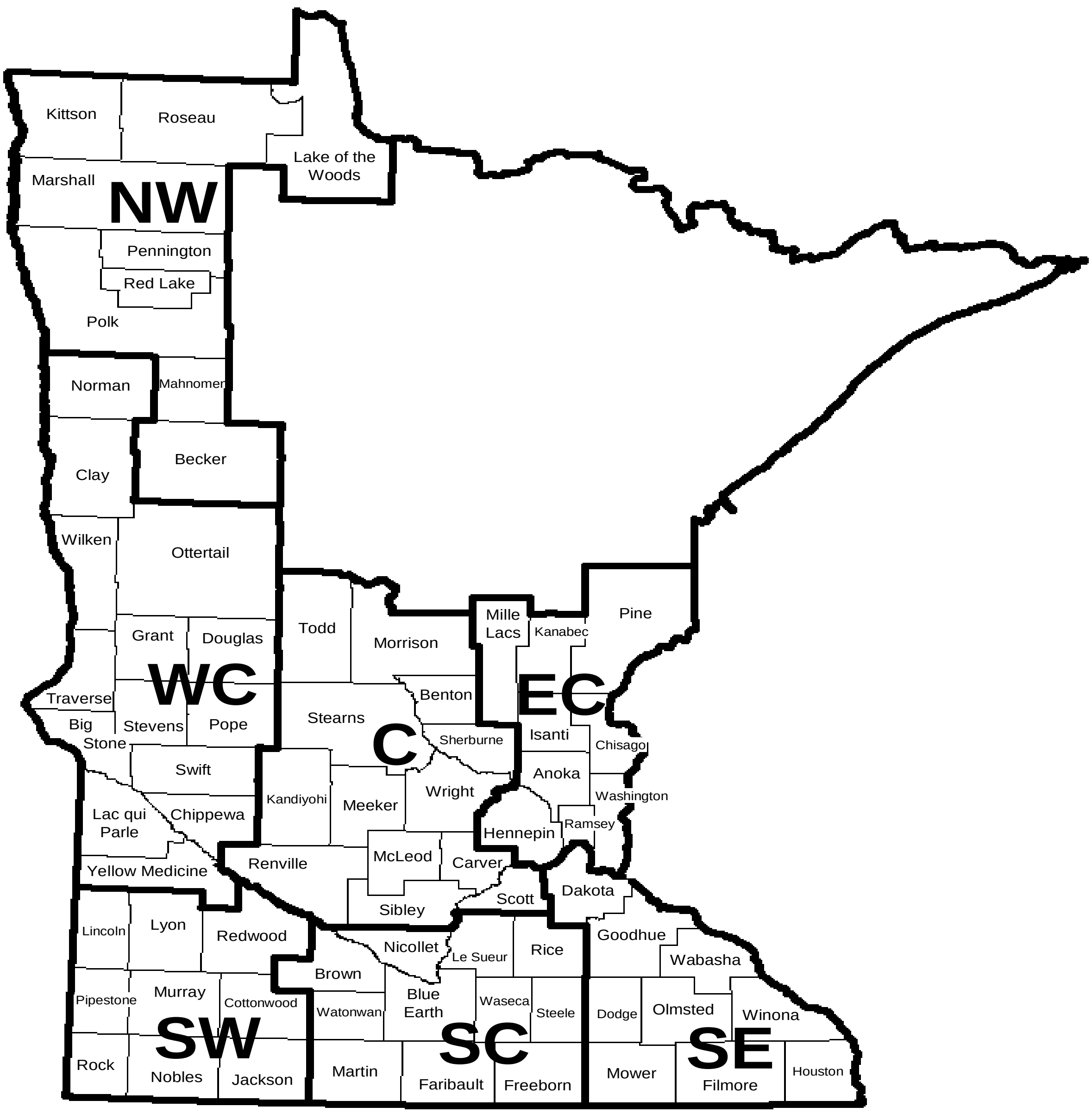


Figure 1. Survey regions for Minnesota's August roadside survey, 2012.

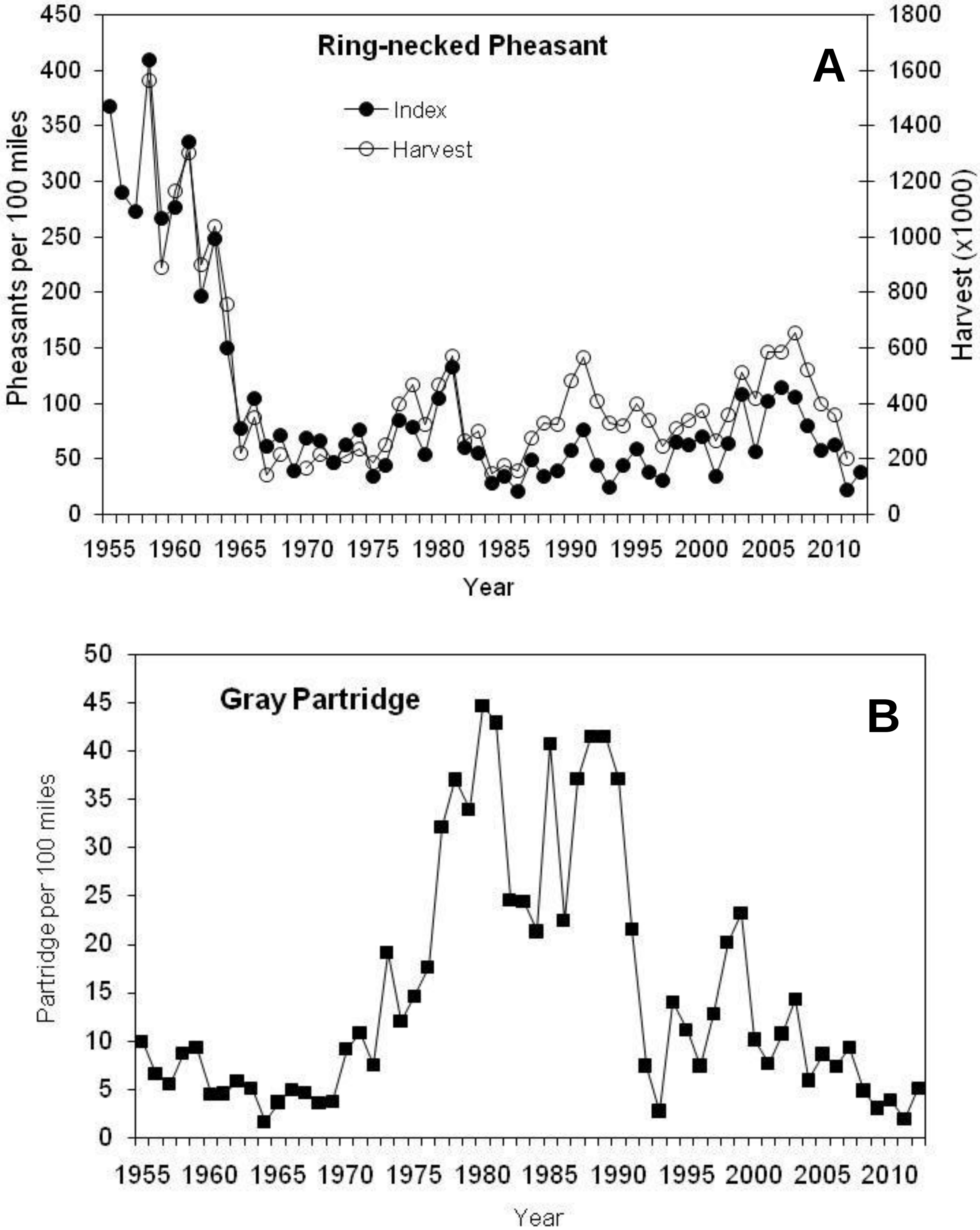
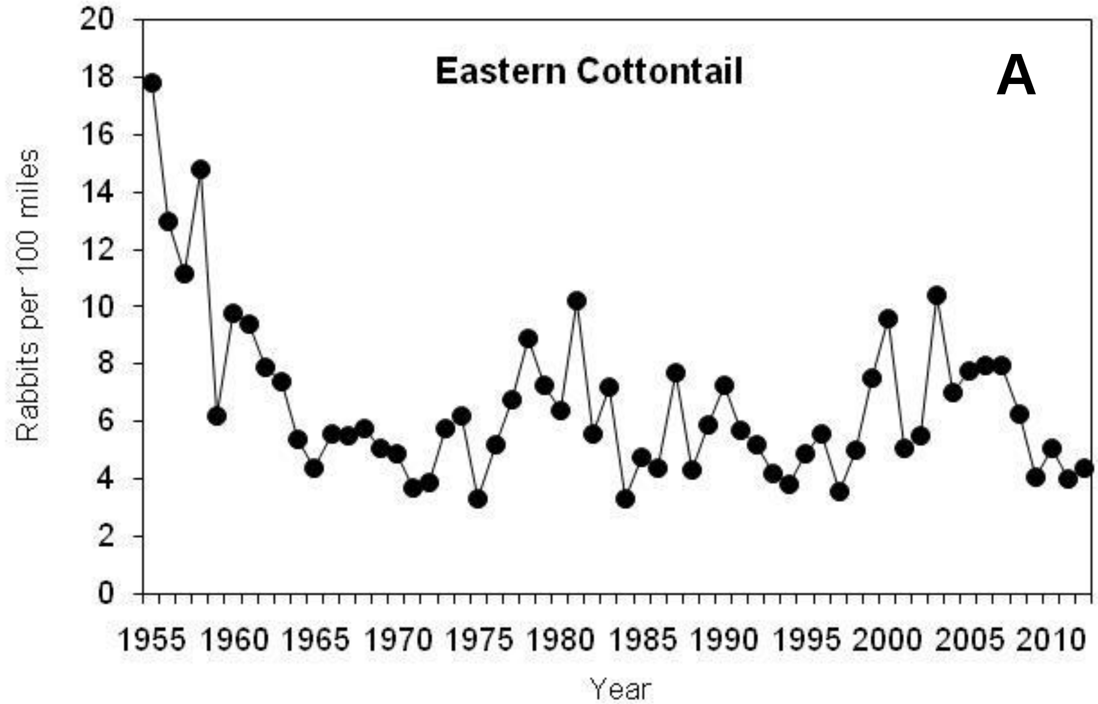


Figure 2. Range-wide index of ring-necked pheasants (**A**) and gray partridge (**B**) seen per 100 miles driven in Minnesota, 1955-2012. Does not include the Northwest region. Based on all survey routes completed.



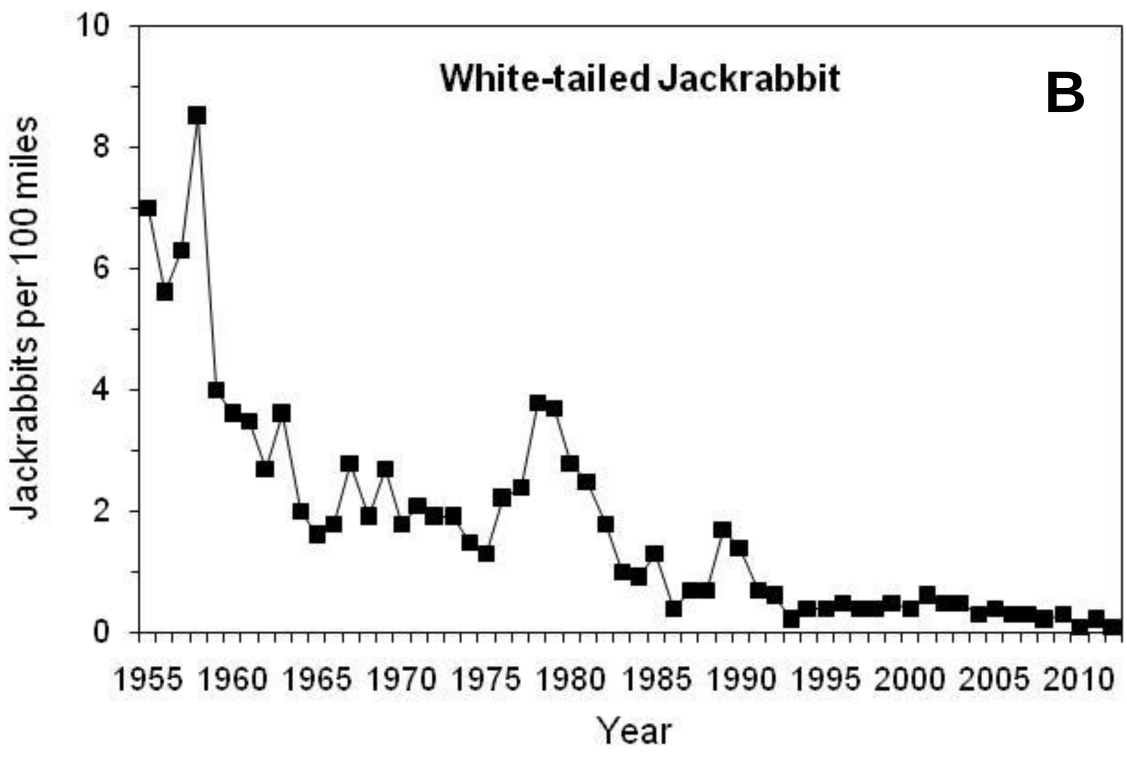


Figure 3. Range-wide index of eastern cottontail (**A**) and white-tailed jackrabbits (**B**) seen per 100 miles driven in Minnesota, 1955-2012. Does not include the Northwest region. Based on all survey routes completed.

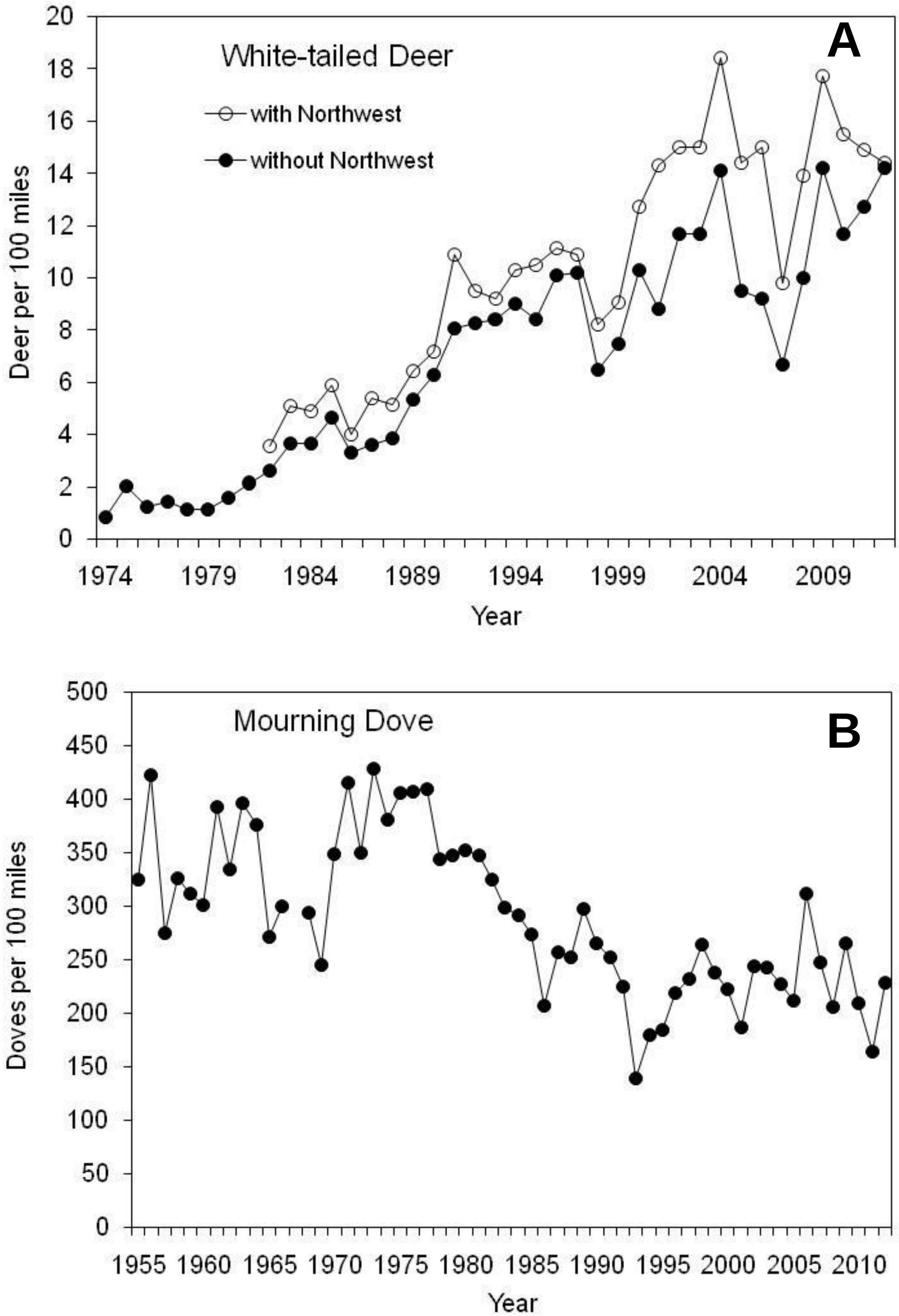


Figure 4. Range-wide index of white-tailed deer (**A**) and mourning doves (**B**) seen per 100 miles driven in Minnesota, 2012. Doves were not counted in 1967 and the dove index does not include the Northwest region. Based on all survey routes completed.

Monitoring Population Trends Of White-Tailed Deer In Minnesota - 2012

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INTRODUCTION

White-tailed deer (*Odocoileus virginianus*) represent one of the most important big game mammals in Minnesota. Although viewed as being important by both hunters and non-hunters, deer also pose serious socioeconomic and ecological challenges for wildlife managers, such as deer-vehicle collisions, crop depredation, and forest regeneration issues. Thus, monitoring the status of deer populations is critical to determine appropriate harvest levels based on established management goals.

This document 1) describes the structure of and data inputs for the population model used on white-tailed deer in Minnesota, and 2) discusses general trends of deer density and current abundance.

METHODS

I arbitrarily pooled permit areas (PAs) into 12 geographic units to describe general population trends and management issues at a broader scale (Figure 1). Several management strategies were available in 2011 including: 1) lottery with varying number of antlerless permits, 2) hunter's choice where hunters could hunt either-sex, 3) managed, and 4) intensive (Figure 2). The strategy employed during a given year depended upon where the population density was in relation to the population density goal. The Twin Cities metro region (PA 601) was not modeled due to limited hunting opportunities, and PAs 224, 235 and 238 were not modeled due to demographic stochastic error associated with their small population sizes (Grund and Woolf 2004).

Population Modeling

The population model used to analyze past population trends and test harvest strategies can be best described as an accounting procedure that subtracts losses, adds gains, and keeps a running total of the number of animals alive in various sex-age classes during successive periods of the annual cycle. The deer population is partitioned into 4 sex-age classes (fawns, adults, males, and females). The 12-month year is divided into 4 periods representing important biological events in the deer's life (hunting season, winter, reproduction, and summer). The primary purposes of the population model were to 1) organize and synthesize data on farmland deer populations, 2) advance the understanding of farmland deer populations through population analysis, 3) provide population estimates and simulate vital rates for farmland deer populations, and 4) assist with management efforts through simulations, projections, and predictions of different management prescriptions (Figure 2).

The 3 most important parameters within the model reflect the aforementioned biological events, which include reproduction, harvest, and non-hunting mortality. Fertility rates were typically estimated at the regional level via fetal surveys conducted each spring (for details, see Dunbar 2005). Fertility rates were then used to estimate population reproductive rates for each deer herd within a particular region. The deer population increased in size after reproduction was simulated. Non-hunting mortality rates occurring during summer months (prior to the hunting season) were estimated from field studies conducted in Minnesota and other agricultural and forested regions. Although summer mortality rates were low, they did represent a reduction in the annual deer population. Previous research suggests virtually all mortality occurring during the year can be attributed to hunter harvests. Annual harvests were simulated in the model by subtracting the numerical harvest (adjusted for crippling and non-registered deer) from the pre-hunt population for each respective sex-age class. In heavily hunted deer populations, like those in the farmland/transition region, the numerical harvest data “drive” the population model by substantially reducing the size of the deer herd (Grund and Woolf 2004). Winter mortality rates were estimated from field studies conducted in Minnesota and other Midwest regions, similar to summer mortality. After winter mortality rates were simulated, the population was at its lowest point during the 12-month period and the annual cycle began again with reproduction.

RESULTS

Population Trends and Densities

Northwest Management Units

Karlstad Unit – Deer numbers have declined 25-30% in this unit since 2007 and most populations are at or slightly below the goal density. Thus, management strategies applied during the 2012 hunting season were more conservative than those used over the past 5-7 years. However, deer populations immediately to the west of PA 101 were managed more aggressively than what would have been used if Bovine TB was not a concern. Spring deer densities were 3 - 5 deer per square mile in this unit, which is substantially lower than the Spring 2007 deer density (>5.0 deer per square mile).

Crookston/TRF Unit – Deer densities have declined 25-35% in this unit due to the use of early antlerless seasons in 5 consecutive years and winter mortality associated with the severe winter of 2010/2011 (Table 1). Consequently, most of these herds are at or below goal and the PAs were designated as hunter’s choice or lottery. The unit deer density was 4-6 deer per square mile in Spring 2012.

Mahnomen Unit – Deer herd dynamics in this unit have been very stable over the last 5 years with deer densities varying between 3-5 deer per square mile (Table 1). All populations are at or slightly below goal densities (Figs. 3 and 4) and all permit areas were designated as lottery throughout the unit (Figure 2) in attempt of maintaining or slightly increasing the deer density.

Central Management Units

Morris Unit – Deer densities have increased from about 3 deer per square mile in 2007 and were on track to reach deer goals, but the severe winter of 2010/2011 significantly increased winter mortality on fawns so the populations remain slightly below goal (Table 1). Most 2012 management strategies used in this unit were designed to slightly increase deer densities toward goal through 2013 (Figure 2).

Osakis Unit – Deer densities have been very stable in the Osakis unit over the past 5 years with deer densities fluctuating between 12-14 deer per square mile (Table 1). All populations were at or near goal densities in 2012 (Figs. 3 and 4). Due to increased thermal cover and slightly less snow in this region during the winter of 2010/2011, it appears winter mortality rates were not as significant compared to western and southern farmland units. However, management strategies used in 2012 were more conservative to protect additional antlerless deer and allow the population to slightly increase (Figure 2).

Cambridge Unit – Deer densities have been very stable with about 13 deer per square mile over the last 5 years (Table 1). Snow depths in this region were not a concern during the winter of 2010/2011 and therefore the winter had almost no impact on this deer herd. Consequently, this was the only region in the state where management strategies continued to be more aggressive. This unit was an active participant in the ADM study and 3 of the PAs were managed with early antlerless seasons for 5 consecutive years. Aerial surveys conducted in 2010 confirmed deer densities did not decline as a result of the early antlerless seasons, however.

Hutchinson Unit – Deer densities were increasing in this unit since 2007, but the winter of 2010/2011 included deep snow and this unit has significantly less thermal cover than the units to the north. Consequently, winter mortality rates were higher in this unit and as a result and more conservative management strategies were used in 2012 to allow the populations to increase through the 2013 season (Figure 2).

Southern Management Units

Minnesota River Unit – Although this unit has substantially more thermal cover than the surrounding units, the adult buck harvest unexpectedly declined in 2011, an indication of high winter mortality rates on fawn males. All trend indicators were increasing, but winter mortality rates on fawns in 2010 and 2011 could be as high as 30%, which significantly reduced recruitment during those years. Modeling suggests the deer densities were about 4 deer per square mile (Table 1). Management strategies were conservative again this year to allow the deer density to increase (Figure 2).

Slayton Unit – Harvest sex ratios have been heavily skewed towards adult bucks over the past 5 years, an indication that populations have been increasing. The impact the 2010 and 2011 winters had on these populations is very apparent, particularly with the unexpected drop in the adult buck harvest in 2011. Current deer densities remain low and are 2-4 deer per square mile. Many of these permit areas have been recalibrated using distance sampling, so most modeling estimates are based on field studies. Management strategies used in 2012 were conservative again this year in attempt to allow the population to increase (Figure 2).

Waseca Unit – The winter of 2010/2011 impacted deer populations along the western edge of this unit, but lower snow depths and more thermal cover throughout most of the unit lessened the impact of winter severity. Consequently, management strategies were more conservative along the western portion of the unit but were more liberal in other permit areas (Figure 2).

Rochester Unit – Deer densities are at or are approaching desired goal densities throughout the unit (Table 1). Consequently, management strategies used were more conservative throughout the unit and the antlerless harvest is expected to decline in this unit during 2012 (Fig 2.). Similar to the Cambridge unit, snow depths were less in 2010 than in the southwestern deer units and this unit also has some of the best deer habitat in the state. Consequently, no measureable impact was observed from the winters of 2010 and 2011.

Forest Unit – The model used to monitor these populations changed between years due to a staff retirement and a slightly different approach at studying population characteristics and interpreting population dynamics across time. Catch-per-unit effort analyses and harvest sex ratio analyses indicated that most populations had declined so that they were at goal or slightly below goal. Modeling harvest data to generate population estimates suggested similar patterns throughout the forest unit. Thus, most management strategies were more conservative in 2012 than they have been in the past few years (Figure 2). Due to good habitat conditions and a mild winter in 2011/2012, recruitment rates will likely be high and these populations should rebound quickly so they are at goal again. Harvest age structure data should be collected from this unit so that additional analyses can be performed, such as population reconstruction analyses.

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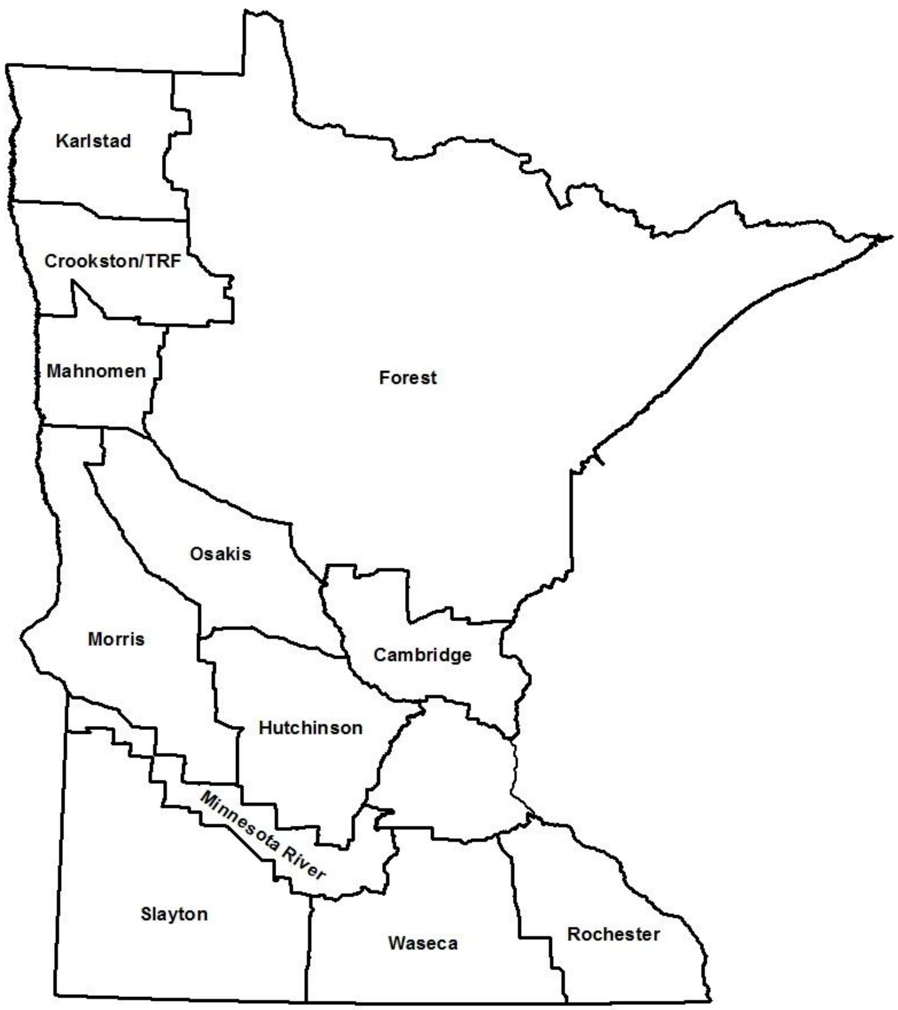

Figure 1. Deer management units in Minnesota, 2012.

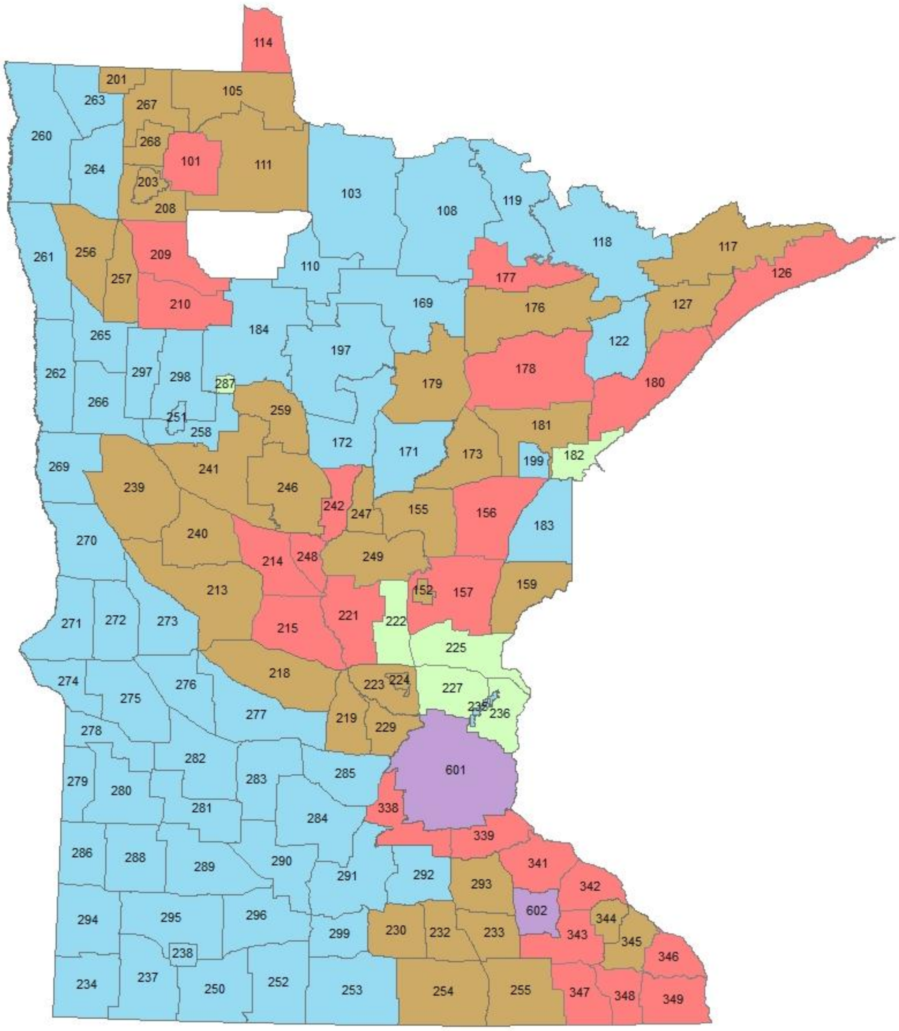

Figure 2. Deer management strategies used in permit areas throughout Minnesota, 2012. Permit areas are numbered and management strategies are color-coded. Permit areas are designated as: 1) lottery if colored blue, 2) hunter's choice if colored brown, 3) managed if colored red, 4) intensive if colored green, and 5) unlimited antlerless if colored purple.

Table 1. Pre-fawn deer density (deer/mi^2) as simulated from population modeling in each permit area in Minnesota, 2007-2012.

Region		**Pre-fawning Density**					
Permit Area	**Area (mi^2)**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Karlstad							
201	155	6	6	6	6	6	5
203	108	6	6	7	7	8	5
208	443	4	4	4	4	4	3
260	1249	4	3	3	2	2	2
263	512	5	5	5	5	4	3
264	669	7	7	7	6	5	3
267	472	4	3	3	2	2	1
268	230	9	8	9	8	7	9
Total	3,838	5	5	5	4	4	3
Crookston							
209	576	9	9	9	9	9	5
210	485	13	12	12	11	10	6
256	654	7	6	6	5	5	3
257	413	8	8	7	7	7	4
261	795	2	2	2	2	2	1
Total	3,053	7	7	7	6	6	4
Mahnomen							
262	677	2	2	2	2	2	2
265	494	10	9	10	8	7	5
266	617	5	6	7	7	7	3
297	438	3	3	2	3	3	3
Total	2,226	4	5	5	4	4	3

Morris							
269	651	2	2	2	3	4	3
270	749	1	1	2	2	3	2
271	634	1	2	2	3	3	2
272	531	1	2	2	2	3	2
273	575	4	5	5	6	7	5
274	360	3	3	5	6	7	3
275	766	4	3	4	5	6	5
276	544	4	4	4	5	7	5
282	779	1	2	2	3	4	1
Total	5,589	2	2	3	3	3	3
Osakis							
213	1058	12	12	13	15	15	13
214	557	20	20	19	19	19	20
215	702	9	9	10	10	10	10
239	924	10	10	9	10	11	9
240	642	19	18	18	18	19	16
Total	3,879	13	13	13	14	12	13
Cambridge							
221	642	13	12	12	12	11	11
222	412	16	15	15	15	15	15
223	376	11	10	11	12	14	16
225	619	15	16	16	16	15	14
227	472	14	13	14	14	14	15
229	287	6	6	6	7	8	6
236	374	17	16	16	16	16	16
Total	2,895	14	14	14	14	14	14

Hutchinson							
218	813	6	6	6	7	7	7
219	393	7	7	8	9	10	10
229	288	6	6	6	7	8	6
277	885	3	3	4	4	5	2
283	614	4	2	3	3	4	3
284	837	2	2	2	3	3	3
285	550	3	3	4	4	4	3
Total	4,380	4	4	4	5	5	4
Minnesota River							
278	397	6	6	7	8	10	6
281	575	4	4	4	5	6	4
290	662	3	3	3	4	5	4
291	806	4	4	4	5	5	4
Total	2,440	4	4	4	5	4	4
Slayton							
234	637	2	2	2	2	3	2
237	729	1	1	2	2	2	4
250	712	2	2	2	2	3	2
279	345	3	3	4	4	5	4
280	675	3	2	2	3	3	2
286	447	3	3	3	4	5	5
288	625	2	2	1	2	2	2
289	816	2	2	1	2	2	2
294	687	2	1	2	2	2	2
295	839	2	2	2	3	3	2
296	666	2	2	2	2	2	2
Total	7,178	2	2	2	2	2	2

Waseca							
230	453	3	2	3	3	3	2
232	377	5	5	4	5	5	3
233	390	4	4	4	4	4	3
252	715	2	2	2	2	2	2
253	974	2	2	2	2	3	3
254	931	3	3	3	3	3	2
255	774	3	3	3	3	4	3
292	481	8	8	7	7	7	5
293	506	7	7	7	6	6	7
299	386	4	4	4	4	5	4
Total	5,987	4	3	3	4	3	3
Rochester							
338	452	4	4	5	5	6	5
339	409	4	5	5	6	6	6
341	596	10	10	10	10	10	11
342	352	12	13	13	13	14	11
343	663	11	11	11	10	10	11
344	189	11	12	12	15	16	13
345	326	10	10	9	8	8	9
346	319	22	21	20	19	19	17
347	434	11	10	10	10	12	10
348	332	18	17	14	14	13	13
349	492	23	22	21	20	19	18
Total	4,564	12	12	11	11	11	11
Forest							
103	1824	6	6	5	5	4	5
105	932	13	12	9	8	6	6
108	1701	9	9	6	6	6	7
110	530	26	26	23	21	18	20
111	1440	4	4	3	3	2	3
117	1129	2	2	2	3	2	3
118	1445	6	5	4	5	4	5

119	946	7	7	5	5	4	5
122	622	5	5	4	5	5	5
126	979	5	4	4	4	3	4
127	587	4	3	3	3	3	3
155	639	13	12	12	13	14	14
156	834	15	14	14	14	13	12
157	904	21	20	17	18	16	14
159	575	19	18	17	16	15	14
169	1202	10	9	9	9	8	9
171	729	12	10	9	9	10	10
172	786	17	15	13	13	13	13
173	617	9	9	8	8	8	8
176	1150	8	9	8	9	7	8
177	553	24	23	17	20	16	18
178	1325	17	18	14	16	13	13
179	939	16	15	15	15	14	14
180	999	11	10	9	9	8	9
181	746	19	18	17	17	14	13
182	280	25	27	28	25	21	19
183	675	14	13	12	13	12	13
184	1318	19	18	16	16	14	16
197	1343	7	8	7	7	5	5
241	1047	33	33	28	30	24	25
242	307	23	22	22	22	21	21
246	860	16	14	14	15	15	15
247	263	20	18	19	20	21	22
248	229	23	22	21	21	20	21
249	729	11	10	11	12	11	11
251	68	16	16	16	17	14	16
258	381	25	23	17	20	16	18
259	546	21	22	17	20	16	15
287	51	53	64	62	74	71	85
298	677	19	20	17	18	14	18
Total	32,907	13	12	11	11	10	10

CARNIVORE SCENT STATION SURVEY

AND

WINTER TRACK INDICES

NOTE: This survey is organized and coordinated by the Forest Wildlife Populations and Research Group, 1201 E. Hwy 2, Grand Rapids, MN 55744. Results are presented at this location in the book because of the statewide nature of the data.

CARNIVORE SCENT STATION SURVEY SUMMARY, 2011

John Erb, Minnesota Department of Natural Resources, Forest Wildlife Research Group

INTRODUCTION

Monitoring the distribution and abundance of carnivores can be important for documenting the effects of harvest, habitat change, and environmental variability on these populations. However, many carnivores are highly secretive, difficult to repeatedly capture, and naturally occur at low to moderate densities, making it difficult to estimate abundance over large areas using traditional methods (e.g., mark-recapture, distance sampling, etc.). Hence, indices of relative abundance are often used to monitor such populations over time (Sargeant et al. 1998, 2003, Hochachka et al. 2000, Wilson and Delahay 2001, Conn et al. 2004).

In the early 1970's, the U.S. Fish and Wildlife Service initiated a carnivore survey designed primarily to monitor trends in coyote populations in the western U.S. (Linhart and Knowlton 1975). In 1975, the Minnesota DNR began to utilize similar survey methodology to monitor population trends for numerous terrestrial carnivores within the state. This year marks the 36th anniversary of the carnivore scent station survey.

METHODS

Scent station survey routes are composed of tracking stations (0.9 m diameter circle) of sifted soil with a fatty-acid scent tab placed in the middle. Scent stations are spaced at 0.5 km intervals on alternating sides of a road or trail. During the initial years (1975-82), survey routes were 23.7 km long, with 50 stations per route. Stations were checked for presence/absence of tracks on 4 consecutive nights (old tracks removed each night), and the mean number of station visits per night was the basis for subsequent analysis. Starting in 1983, following suggestions by Roughton and Sweeny (1982), design changes were made whereby routes were shortened to 4.3 km, 10 stations/route (still with 0.5 km spacing between stations), and routes were surveyed only once on the day following route placement. The shorter routes and fewer checks allowed for an increase in the number and geographic distribution of survey routes. In either case, the design can be considered two-stage cluster sampling.

Survey routes were selected non-randomly, but with the intent of maintaining a minimum 5 km separation between routes, and encompassing the variety of habitat conditions within the work area of each survey participant. Most survey routes are placed on secondary (unpaved) roads/trails, and are completed from September through October. Survey results are currently stratified based on 3 habitat 'zones' within the state (forest, farmland, and transition).

Track presence/absence is recorded at each station, and track indices are computed as the percentage of scent stations visited by each species. Confidence intervals (95%) are computed using bootstrap methods (percentile method; Thompson et al. 1998). For each of 1000 replicates, survey routes are randomly re-sampled according to observed zone-specific route sample sizes, and station visitation rates are computed for each replicate sample of routes. Replicates are ranked according to the magnitude of the calculated index, and the 25th and 975th values constitute the lower and upper bounds of the confidence interval.

RESULTS AND DISCUSSION

A total of 283 routes were completed this year (Figure 1). There were 2,671 operable scent stations examined on the 283 4.3 km routes. Route density varied from 1 route per 538 km^2 in the Forest zone to 1 route per 1,194 km^2 in the Farmland zone (Figure 1).

Statewide, route visitation rates (% of routes with detection) were highest for red fox (40%), followed by skunk (35%), raccoon (30%), domestic cat (29%), coyote (19%), and domestic dog (19%). Regionally, route visitation rates were as follows: red fox – Farmland (FA) 33%, Transition (TR) 40%, Forest (FO) 42%; coyote – FA 22%, TR 26%, FO 15%; skunk – FA 63%, TR 47%, FO 18%; raccoon – FA 53%, TR 46%, FO 14%; domestic cat – FA 61%, TR 39%, FO 12%; and dog – FA 42%, TR 26%, FO 8%.

Figures 2-5 show station visitation indices (% of stations visited) from the survey's inception through the current year. Although the survey is largely intended to document long-term trends in populations, confidence intervals improve interpretation of the significance of annual changes. Based on the presence/absence of confidence interval overlap, the only significant change this year was a decline in the Forest zone striped skunk index (Figure 4). In addition, some changes occurred that approached significance, including decreases in both the bobcat and wolf indices in the Transition Zone (Figure 3). However, the Transition Zone represents a comparatively small percent of both wolf and bobcat range in Minnesota. In the Forest Zone, point estimates for the wolf index reached a new high and the bobcat track index remained well above the long-term average, though neither index was statistically different from last year (Figure 5).

Over the last 10 years, red fox indices in both the Farmland and Transition zones had declined to levels well below their long-term averages (Figures 2 and 3). However, red fox indices in the Transition zone have been steadily increasing and have now returned to their long-term average. Red fox indices in the Farmland Zone have also increased in recent years, though they remain below the long-term average. After increasing for many years, Farmland coyote indices appear to have stabilized in recent years (Figure 2). Coyote indices remain comparatively low in the Forest zone (Figure 4), likely attributable to the presence of wolves. No significant trends have been observed in raccoon or skunk indices in recent years, and with the exception of the Forest zone skunk index, most indices remain near or moderately above long-term averages throughout the state.

ACKNOWLEDGEMENTS

I wish to thank all of the cooperators who participated in the 2011 survey: DNR Division of Wildlife staff; Superior National Forest Aurora District; Agassiz, Rydell, Sherberne, and Tamarac National Wildlife Refuges; USFWS Detroit Lakes Wetland Management Districts; 1854 Treaty Authority, White Earth, Red Lake, and Leech Lake Tribal Natural Resource Departments; St. Croix National Scenic Waterway; Vermillion Community College; Beltrami County Land Department; Marshall County Central High School; and Richard Nelles and Tom Stuber.

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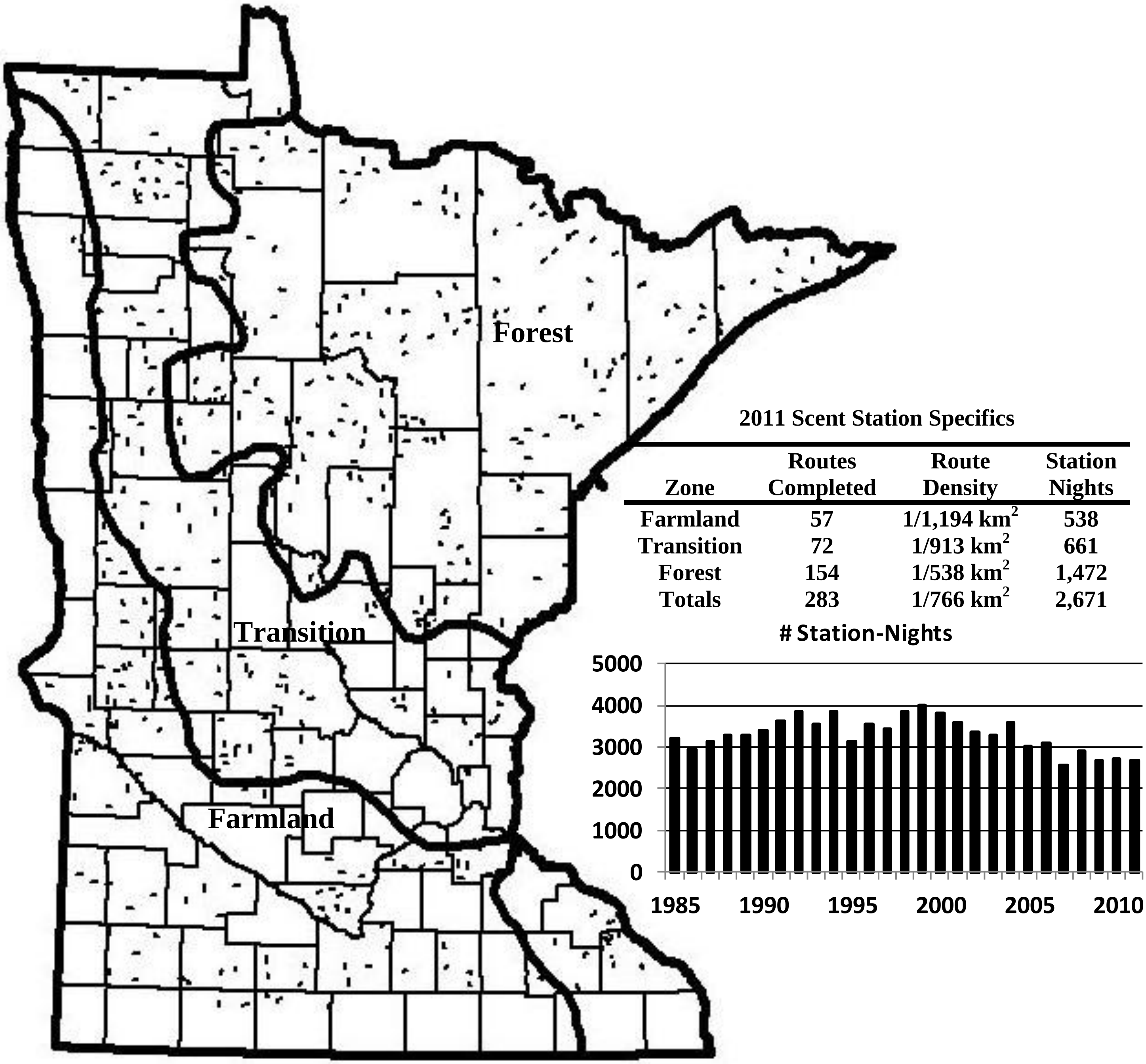

2011 Scent Station Specifics

Zone	Routes Completed	Route Density	Station Nights
Farmland	57	1/1,194 km^2	538
Transition	72	1/913 km^2	661
Forest	154	1/538 km^2	1,472
Totals	283	1/766 km^2	2,671

Figure 1. Locations of existing scent station routes (not all completed every year). Insets show 2011 route specifics and the number of station-nights per year since 1983.

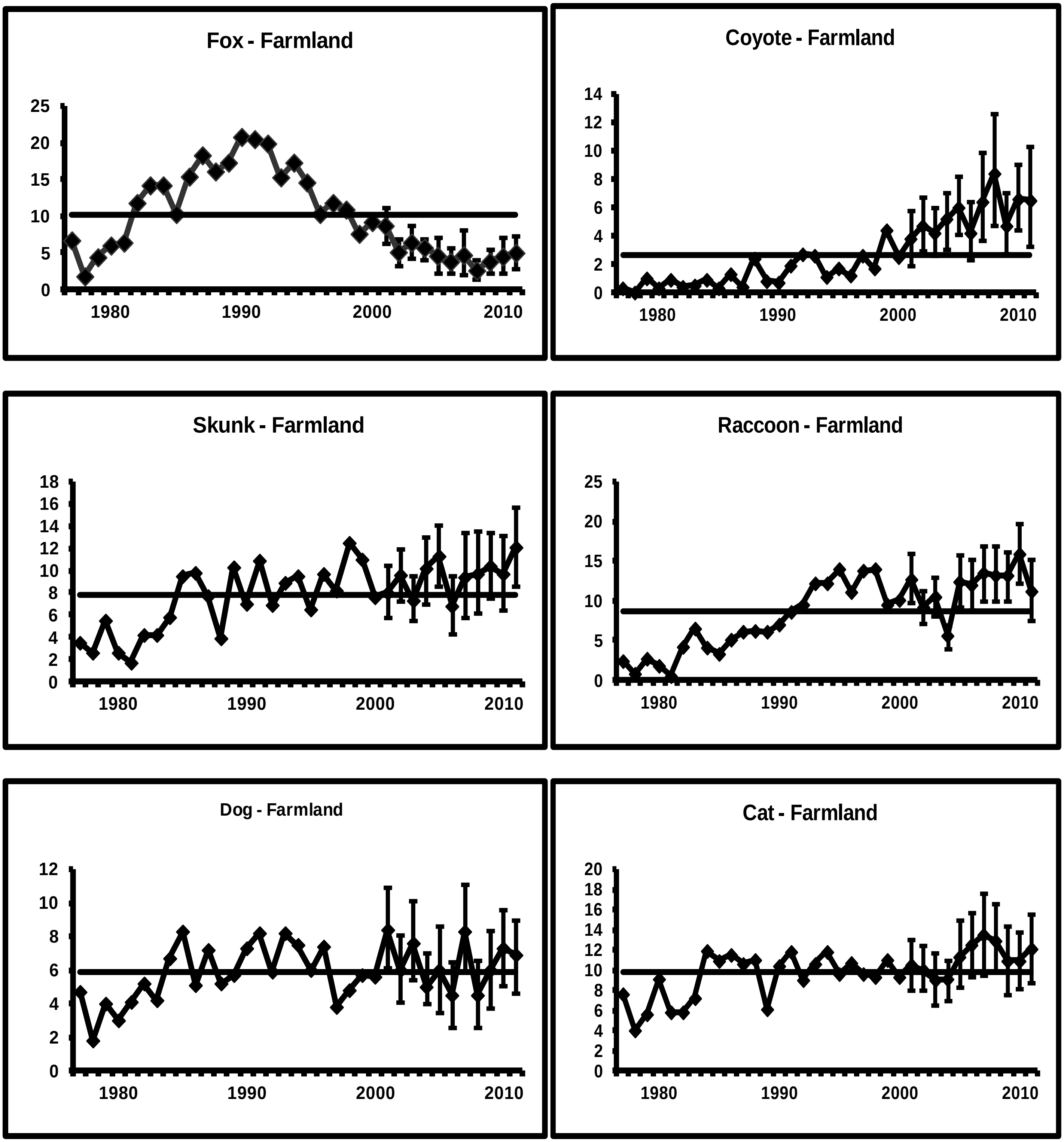

Figure 2. Percentage of scent stations visited by selected species in the Farmland Zone of Minnesota, 1977-2011. Horizontal line represents long-term mean.

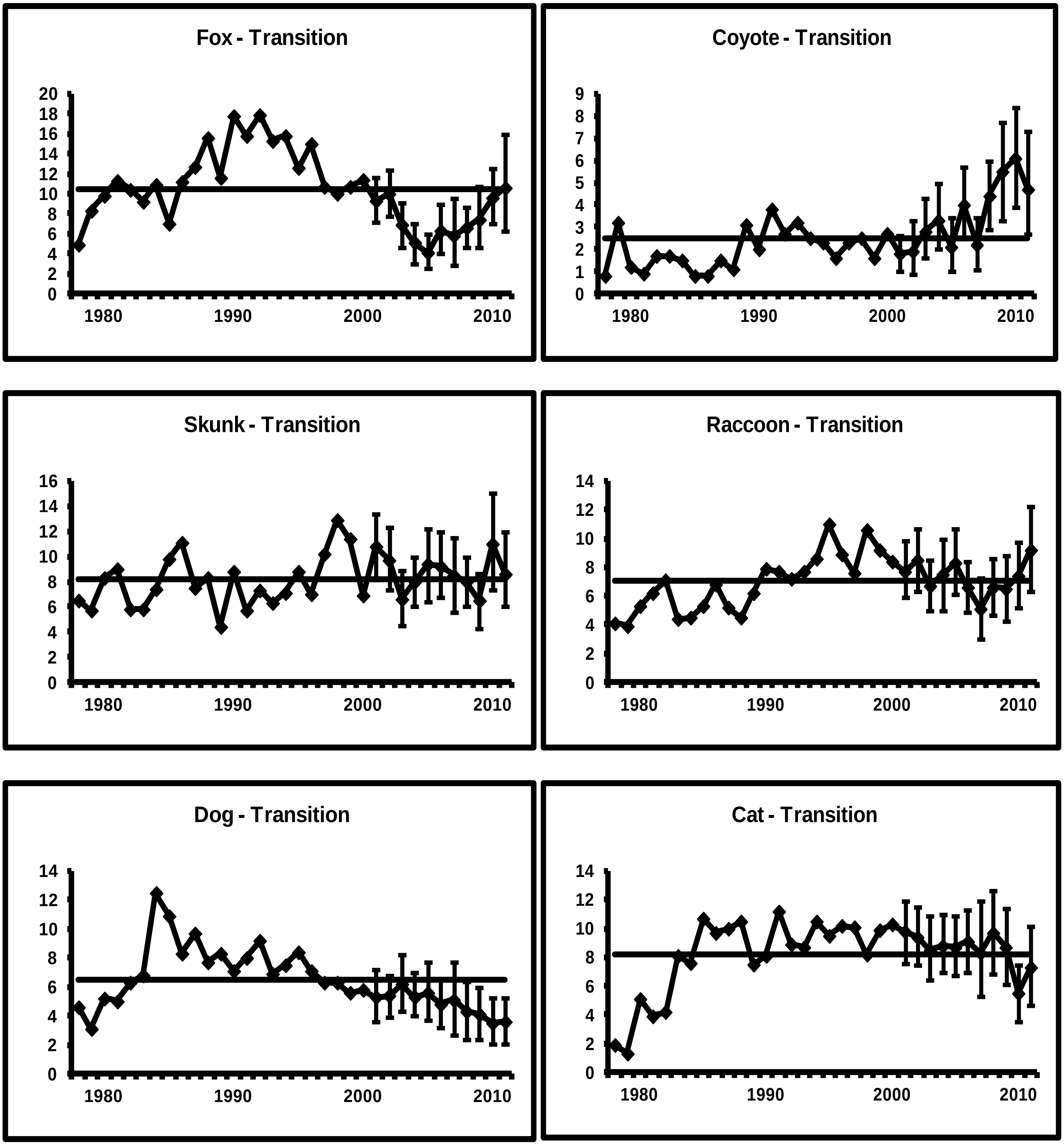

Figure 3. Percentage of scent stations visited by selected species in the Transition Zone of Minnesota, 1978-2011. Horizontal line represents long-term mean.

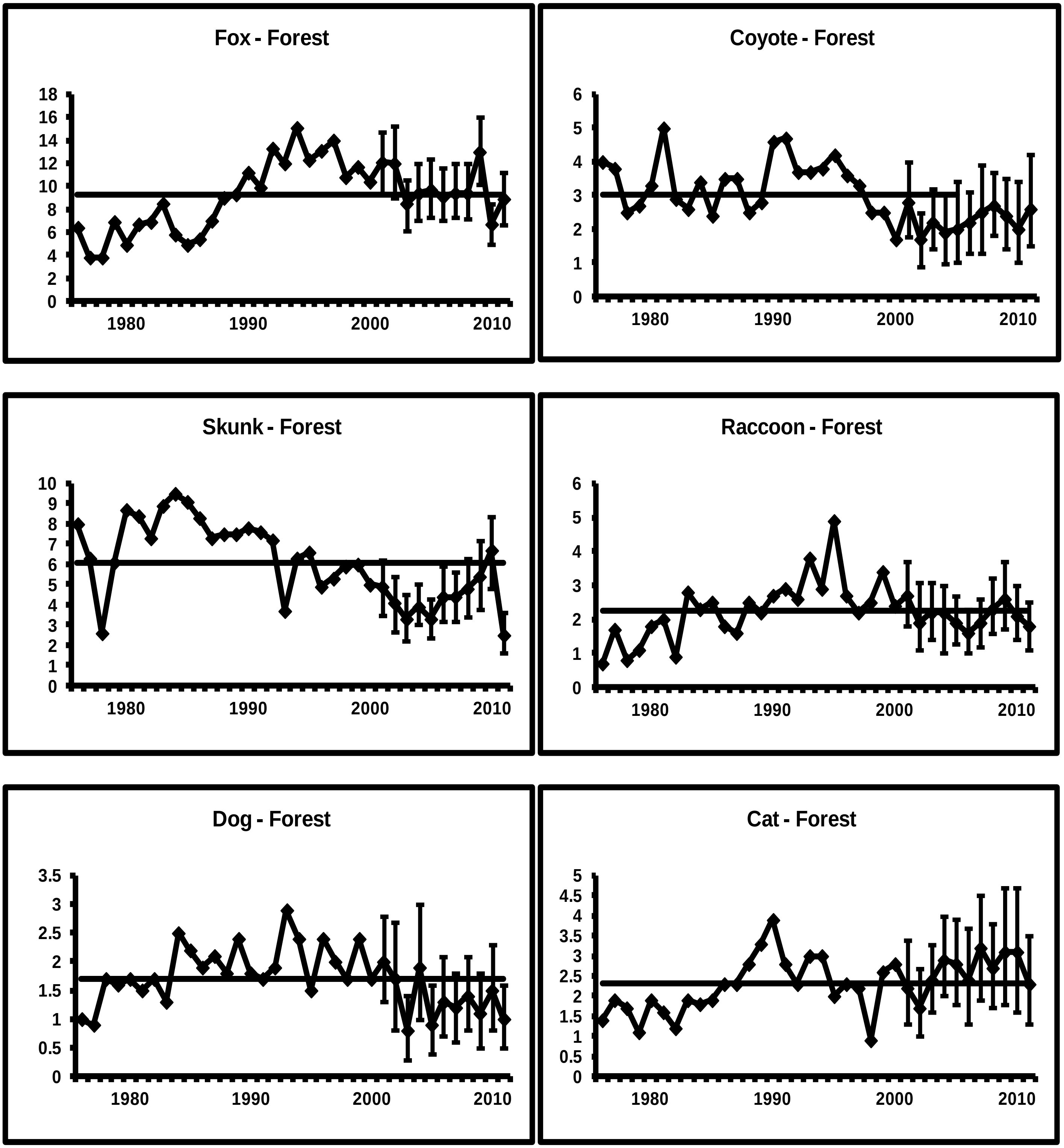

Figure 4. Percentage of scent stations visited by selected species in the Forest Zone of Minnesota, 1976-2011. Horizontal line represents long-term mean.

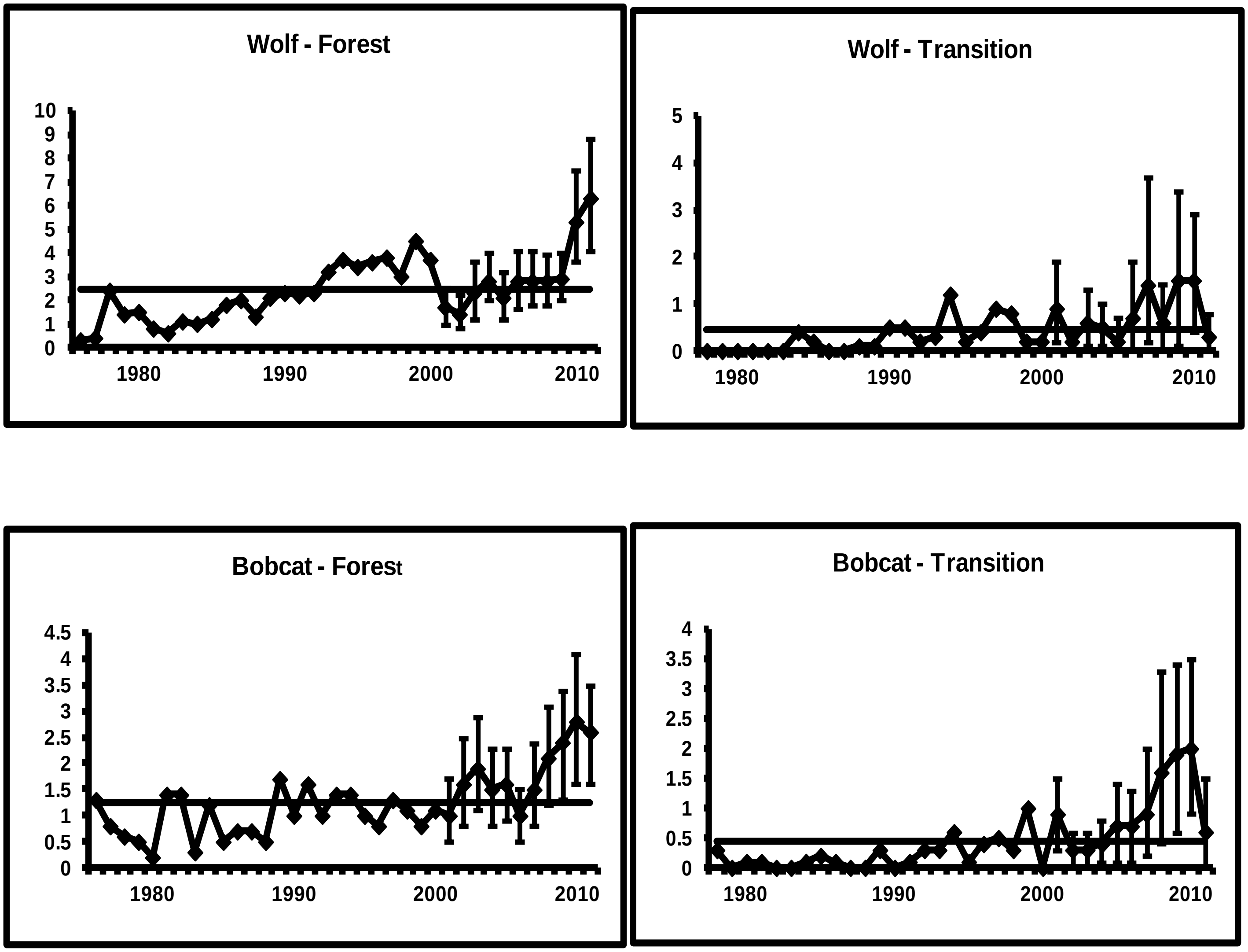

Figure 5. Percentage of scent stations visited by wolves and bobcat in the Forest and Transition Zones of Minnesota, 1976-2011. Horizontal lines represents long-term mean.

FURBEARER WINTER TRACK SURVEY SUMMARY, 2011

John Erb, Forest Wildlife Populations and Research Group

INTRODUCTION

Monitoring the distribution and abundance of carnivores can be important for documenting the effects of harvest, habitat change, and environmental variability on these populations. However, many carnivores are highly secretive, difficult to repeatedly capture, and naturally occur at low to moderate densities, making it difficult to estimate abundance over large areas using traditional methods (e.g., mark-recapture, distance sampling, etc.). Hence, indices of relative abundance are often used to monitor such populations over time (Hochachka et al. 2000, Wilson and Delahay 2001, Conn et al. 2004).

In winter, tracks of carnivores are readily observable following snowfall. Starting in 1991, Minnesota initiated a carnivore snow track survey in the northern portion of the State. The survey's primary objective is to use a harvest-independent method to monitor distribution and population trends of fisher (*Martes pennanti*) and marten (*Martes americana*), 2 species for which no other survey data was available. Because sign of other carnivores is readily detectable in snow, participants also record tracks for other selected species. After 3 years of evaluating survey logistics, the survey became operational in 1994.

METHODS

Presently, 60 track survey routes are distributed across the northern portion of the state (Figure 1). Each route is a total of 10 miles long and follows secondary roads or trails. A majority of routes are continuous 10-mile stretches of road/trail, but a few are composed of multiple discontinuous segments. Route locations were subjectively determined based on availability of suitable roads/trails, but were chosen, where possible, to represent the varying forest habitat conditions in northern Minnesota. For data recording, each 10-mile route is divided into 20 0.5-mile segments.

Each route is surveyed once following a fresh snow typically from December through mid-February, and track counts are recorded for each 0.5-mile segment. When it is obvious the same animal crossed the road multiple times within a 0.5-mile segment, the animal is only recorded once. If it is obvious that an animal ran along the road and entered multiple 0.5 mile segments, which often occurs with canids, its tracks are recorded in all segments but circled to denote it was the same animal. While such duplicate tracks are not included in calculation of track indices (see below), recording data in this manner allows for future analysis of animal activity in relation to survey 'plot' size and habitat. Snowshoe hare (*Lepus americanus*) are recorded only as present or absent in the first 0.1 miles of each 0.5-mile segment. While most routes are surveyed 1 day after the conclusion of a snowfall (ending by 6:00 pm), thereby allowing 1 night for track 'registry', a few routes are usually completed 2 nights following snowfall. In such cases, track counts on those routes are divided by the number of days post-snowfall.

Currently, 3 summary statistics (2 graphs) are presented for each species. First, I compute the percentage of 0.5-mile segments with species presence after removing any duplicates (e.g., if the same fox clearly traverses 2 adjacent 0.5-mile segments along the road, and it was the only 'new' red fox (*Vulpes vulpes*) in the second segment, only 1 of the 2 segments is considered independently occupied). In addition to this metric, but on the same graph, the average number of tracks per 10-mile route is presented after removing any obvious duplicate tracks across segments. For wolves (*Canis lupus*) traveling through adjacent segments, the maximum number of pack members recorded in any 1 of those segments is used as the track total for that particular group, though this is likely an underestimate of true pack size. Because individuals from many of the species surveyed tend to be solitary, these 2 indices (% segments occupied and # tracks per route) will often yield mathematically equivalent results (i.e., on average, one tends to differ from the other by a constant factor). In the case of wolf packs, and to a lesser extent red fox and coyotes (*Canis latrans*) which may start traveling as breeding pairs in winter, the approximate equivalence of these 2 indices will still be true if average (detected) group sizes are similar across years. However, the solitary tendencies in some species are not absolute, potential abundance (in relation to survey plot size) varies across species, and for wolves, pack size may vary annually. For these reasons, as well as to provide an intuitive count metric, both indices are currently presented. Because snowshoe hares are tallied only as present/absent, the 2 indices will by definition be equivalent. Dating back to 1974, hare survey data has also been obtained via counts of hares observed on ruffed grouse drumming count surveys conducted in spring. Post-1993 data for both the spring and winter hare indices are presented for comparison.

In the second graph for each species, I illustrate the percentage of <u>routes</u> where each species was detected (hereafter, the 'distribution index'). This measure is computed to help assess whether any notable changes in the above-described track indices are a result of larger-scale changes in distribution (more/less routes with presence) and/or finer-scale changes in density along routes.

Using bootstrap methods, I compute confidence intervals (90%) for the percent of segments with species presence and the percent of routes with species presence. For each of 1000 replicates, survey routes are randomly re-sampled according to the observed route sample size. Replicates are ranked according to the magnitude of the calculated index, and the 50th and 950th values constitute the lower and upper bounds of the confidence interval.

RESULTS

Forty of the 60 routes were completed this year (Figure 2). Survey routes took an average of 2.1 hours to complete. Total snow depths averaged 6" for completed routes, slightly below the long-term average (Figure 3). Mean overnight low temperature the night preceding the surveys was 8°F, similar to the long-term average (Figure 3). Survey routes were completed between December 24th and February 23rd. The mean survey date of January 23rd was the second latest since the survey began (Figure 3).

Though not a statistically significant change, both fisher track indices were the lowest since the survey began (Figure 4). Because poor snow conditions pushed the average date of survey completion into mid-January, a time when ongoing research has shown fishers are least active, it's possible that the declines may partially reflect lower detection rates. Fishers were detected on only 4% of the route segments, and along 53% of the routes (Figure 4). While also a non-significant change, both marten track indices also declined (Figure 4). Marten were detected on 6% of the route segments, and 53% of the survey routes.

In spite of a record bobcat harvest (70% above previous record), bobcat (*Lynx rufus*) track indices increased, though the changes were not statistically significant. Bobcats were detected on 55% of the survey routes, the most since the survey began. Both wolf track indices increased to record levels, with wolves being detected on 9% of the track segments and 93% of the survey routes, the latter representing a statistically significant increase. No notable changes were observed in red fox or coyote indices, though the red fox track index remains below its long-term average (Figure 4). After a significant increase last year, the weasel (*Mustela* spp.) index decreased appreciably (though not statistically significant) this year, and through time is best characterized as exhibiting a slight downward trend with periodic irruptions. Although historic data for snowshoe hares clearly exhibited 10-year cycles, in recent times the cycle appears to have significantly dampened, though hints of a cycle remain. Cycle peaks have historically occurred, on average, near the beginning of each decade. This year's spring hare index did undergo a large increase to its highest level since the 1980 peak (pre-1994 data not depicted in this report). Following the large increase in this spring's hare index, the hare winter track indices declined significantly (Figure 4), collectively suggesting that hares have peaked and are now beginning a cyclic decline.

DISCUSSION

Reliable interpretation of changes in these track survey results is dependent on the assumption that the probability of detecting animals remains relatively constant across years (Gibbs 2000) Because this remains an untested assumption, caution is warranted when interpreting changes, particularly annual changes of low to moderate magnitude, or short-term trends. Of note this year, average survey date was the second latest (January 23rd) since the survey began, although snow depths and temperatures at this time were similar to previous surveys. Nevertheless, ongoing research has suggested that fishers, and to a lesser extent martens, may reduce activity in January, which may have reduced detection rates this year. However, repeat surveys are not conducted on this winter survey, so it is not currently possible to determine whether detection rates in fact differed from the previous year.

Based on confidence intervals, the only statistically significant changes from last year were an increase in the percentage of routes on which wolves were detected, and a decline in the track index for snowshoe hares. Acknowledging the potential for reduced detection rates for fisher and marten this year, neither species appears to be appreciably increasing in response to the reduced harvest seasons over the past 5 years.

Confidence interval data for previous years will continue to be incorporated in future years, and I hope to begin a formal review of the adequacy of survey route sample size and distribution. We also hope to expand ongoing fisher and marten research to examine track survey assumptions and possible approaches for estimating, and hence correcting for, any differences in the probability of detecting animals across years (e.g., MacKenzie et al. 2004). In particular, I hope to initiate repeat surveys on a subset of survey routes each winter, thereby allowing for estimation of year-specific detection rates.

ACKNOWLEDGEMENTS

I wish to thank all those who participated in this year's survey, including DNR field staff, Superior National Forest staff (Ely District), Tamarac National Wildlife refuge, and staff from the Fond-du-Lac, Red Lake, and Grand Portage Bands, and the 1854 Treaty Authority.

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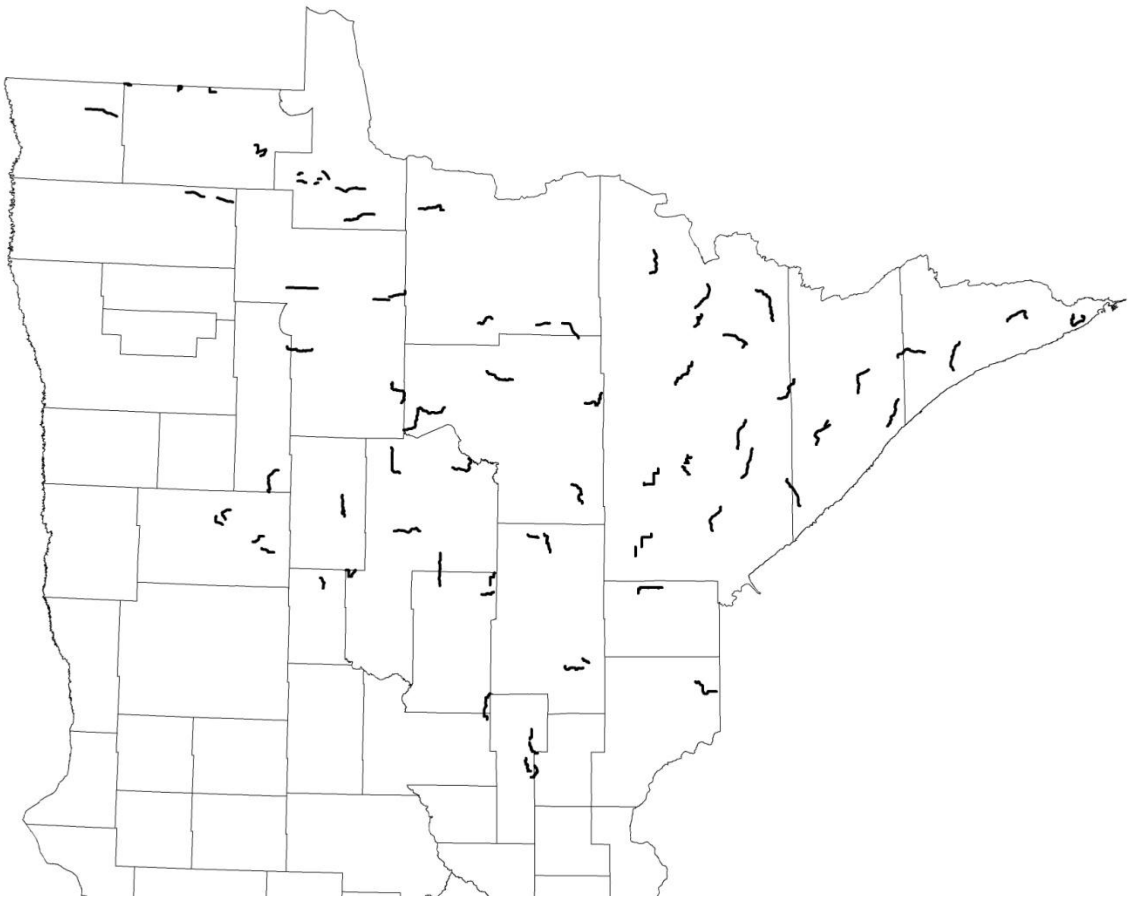

Figure 1. Locations of established furbearer winter track survey routes in northern Minnesota.

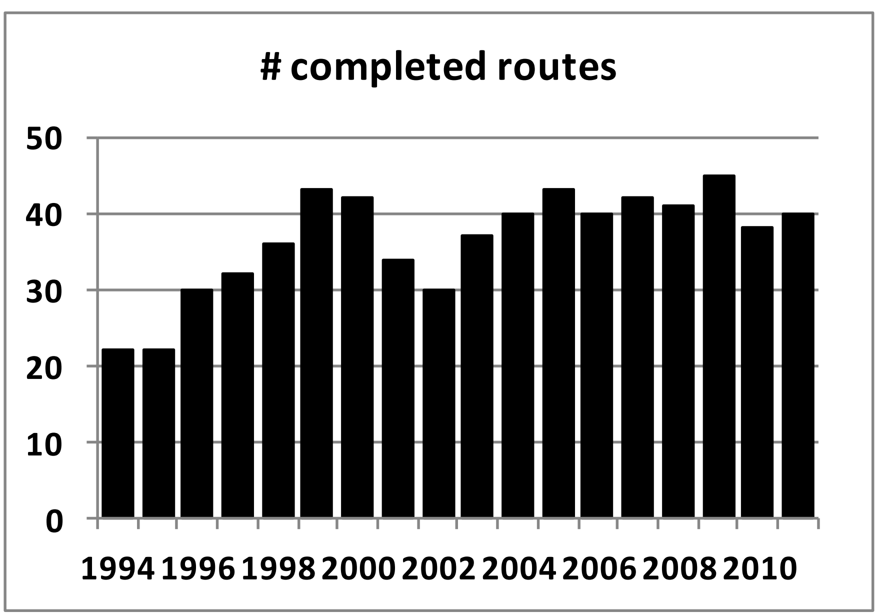

Figure 2. Number of winter track routes surveyed in Minnesota, 1994-2011.

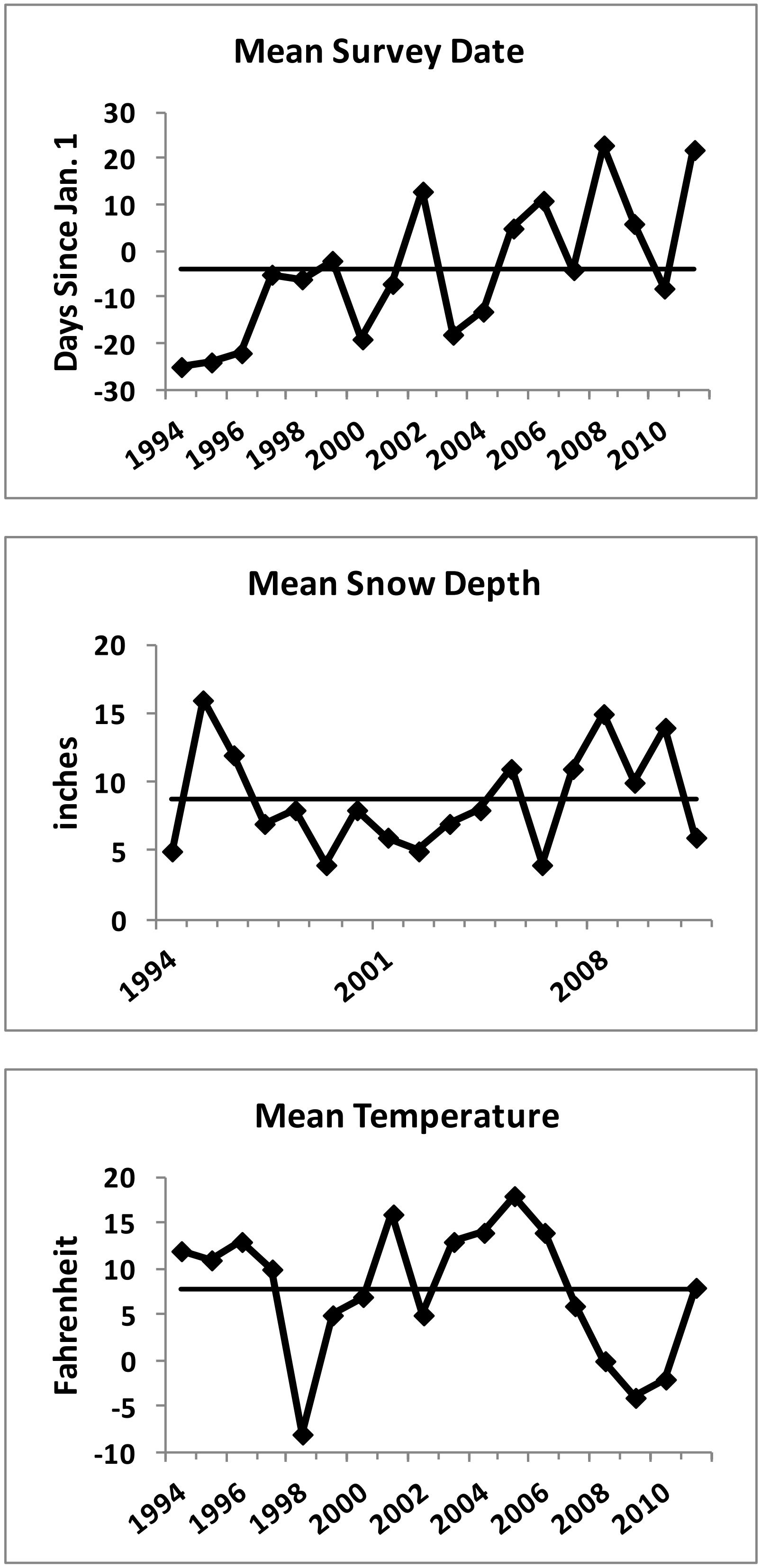

Figure 3. Average survey date, snow depth, and temperature for track routes completed in Minnesota, 1994-2011. Horizontal line represents long-term mean.

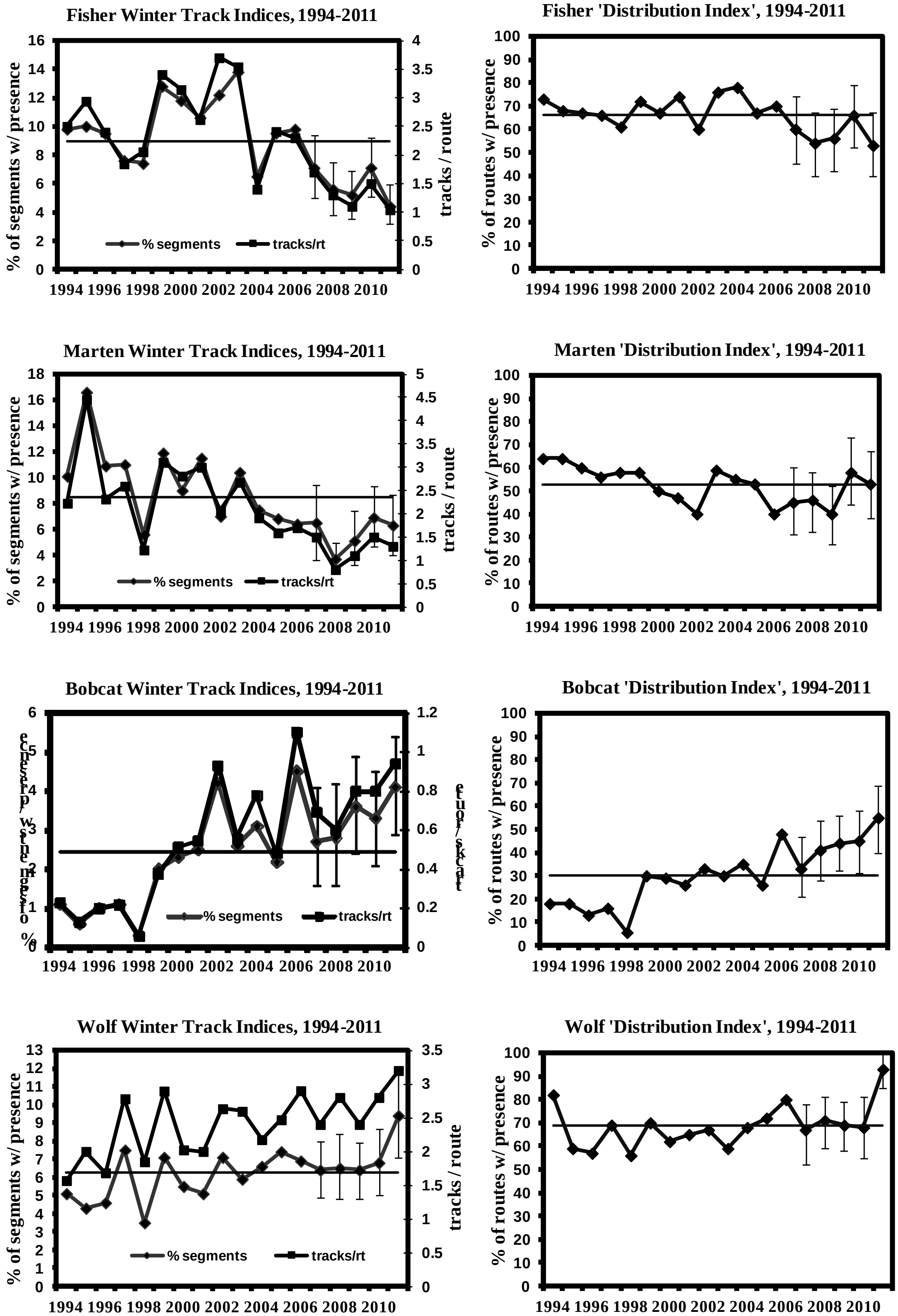

Figure 4. Winter track indices for selected species in Minnesota, 1994-2011. Confidence intervals only presented for % segments and % routes with track presence. Horizontal lines represent long-term average for percentage of segments and routes with presence.

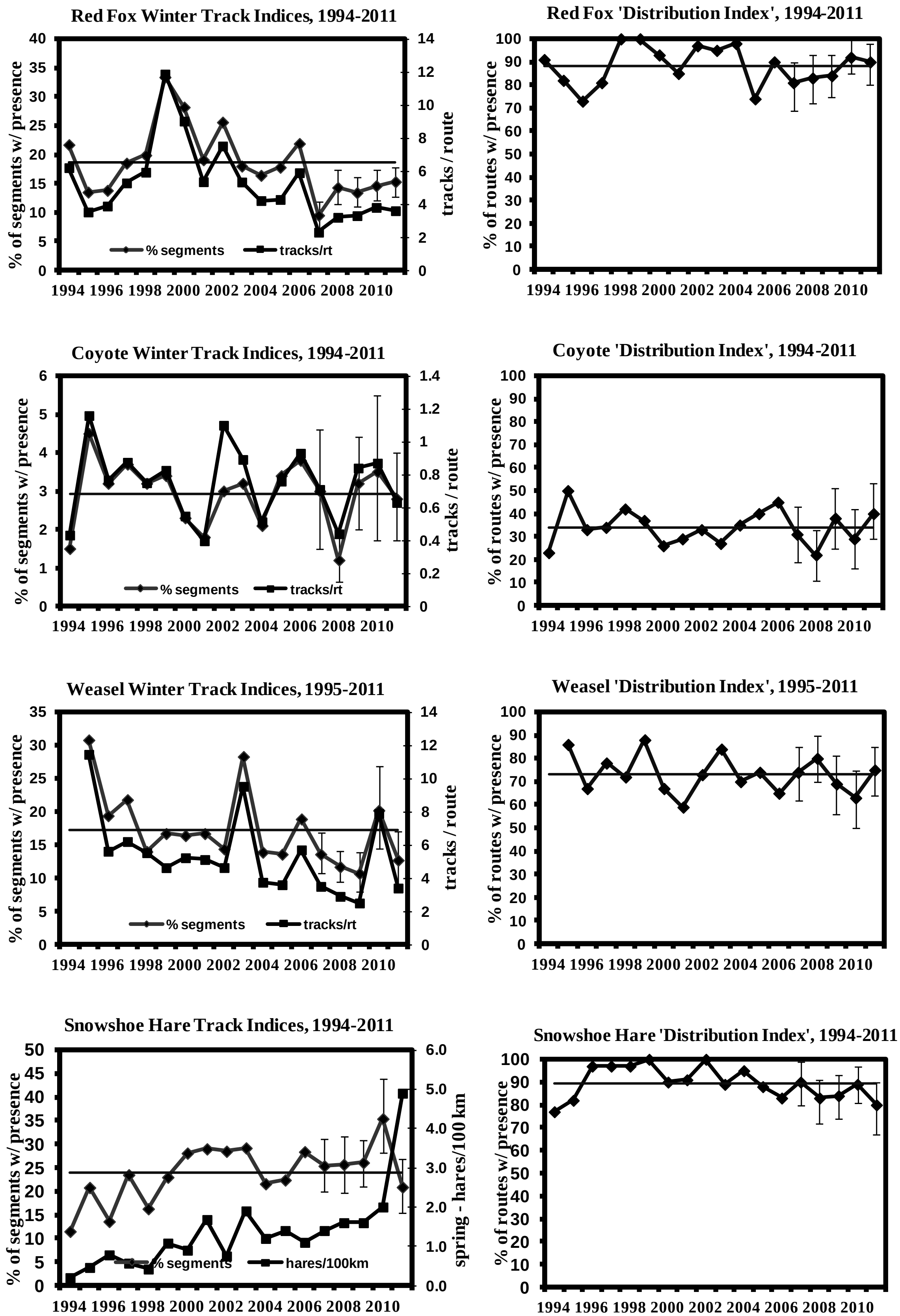

Figure 4 (continued). Winter track indices for selected species in Minnesota.

FOREST WILDLIFE POPULATIONS

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GROUSE SURVEYS IN MINNESOTA DURING SPRING 2012

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SUMMARY OF FINDINGS

Surveys for ruffed grouse (*Bonasa umbellus*) and sharp-tailed grouse (*Tympanuchus phasianellus*) were conducted during April and May 2012. Mean counts of ruffed grouse drums throughout the forested regions of Minnesota were 1.0 (95% confidence interval = 0.8–1.1) drums per stop (dps). That was significantly less than mean counts from the previous 4 years, indicating that the grouse population is in the declining phase of its 10-year cycle. The most recent peak in drum counts was the 2.0 (1.8–2.3) dps observed during 2009.

During the spring 2012 survey 1,404 sharp-tailed grouse were observed at 154 dancing grounds. The mean number of sharp-tailed grouse per dancing ground was 6.3 (5.4–7.3) in the East Central survey region, 10.7 (9.3–12.3) in the Northwest region, and 9.2 (8.2–10.3) statewide. Counts among dancing grounds observed during both 2011 and 2012 declined 22% (12–31%), but the statewide index value for 2012 was similar to the long-term average observed since 1980.

INTRODUCTION

Index Surveys

The purpose of surveys of grouse populations in Minnesota is to monitor changes in the densities of grouse over time. Estimates of density, however, are difficult and expensive to obtain. Simple counts of animals, on the other hand, are convenient and, assuming that changes in density are the major source of variation in counts among years, they can provide a reasonable index to long-term trends in populations. Other factors, such as weather and habitat conditions, observer ability, and grouse behavior, vary over time and also affect simple counts of animals. These other factors make it difficult to make inferences about potential changes in wildlife populations over short periods of time (e.g., a few annual surveys) or from small changes in index values. Over longer periods of time or when changes in index values are large, assumptions upon which grouse surveys in Minnesota depend are more likely to be valid, thereby making inferences about grouse populations more valid. For example, index values from the ruffed grouse drumming count survey have documented what is believed to be true periodic fluctuations in ruffed grouse densities (i.e., the 10-year cycle).

Ruffed Grouse

The ruffed grouse (*Bonasa umbellus*) is Minnesota's most popular game bird. It occurs throughout the forested regions of the state. Annual harvest varies from approximately 150,000 to 1.4 million birds and averages >500,000 birds. Information derived from spring drumming counts and hunter harvest statistics indicates that ruffed grouse populations fluctuate cyclically at intervals of approximately 10 years.

During spring there is a peak in the drumming behavior of male ruffed grouse. Ruffed grouse drum to communicate to other grouse the location of their territory. The purpose is to attract females for breeding and deter encroachment by competing males. Drumming makes male ruffed grouse much easier to detect, so counts of drumming males is a convenient basis for surveys to monitor changes in the densities of ruffed grouse. Ruffed grouse were first surveyed in Minnesota during the mid-1930s. Spring drumming counts have been conducted annually since the establishment of the first survey routes in 1949.

Sharp-tailed Grouse

Sharp-tailed grouse (*Tympanuchus phasianellus*) in Minnesota occur in brushlands, which often form transition zones between forests and grasslands. Sharp-tailed grouse are considered a valuable indicator of the availability and quality of brushlands for wildlife. Although sharp-tailed grouse habitat was more widely distributed in Minnesota during the early- and mid-1900s, the range of sharp-tailed grouse is now limited to areas in the Northwest (NW) and East Central (EC) portions of the state (Figure 1). Since the early-1990s annual harvest of sharp-tailed grouse by hunters has varied between 6,000 and 22,000 birds, and the number of hunters has varied between 5,000 and 10,000.

During spring male sharp-tailed grouse gather at dancing grounds, or leks, in grassy areas and fields where they defend small territories and make displays to attract females for breeding. Surveys of sharp-tailed grouse populations are based on counts of grouse at dancing grounds. The first surveys of sharp-tailed grouse in Minnesota were conducted between the early 1940s and 1960. The current sharp-tailed grouse survey was initiated in 1976.

METHODS

Ruffed Grouse

Roadside routes consisting of 10 semipermanent stops approximately 1.6 km (1 mile) apart have been established. Routes were originally located along roads with little automobile traffic that were also near apparent ruffed grouse habitat. Therefore, route locations were not selected according to a statistically valid spatial sampling design, which means that data collected along routes is not necessarily representative of the larger areas (e.g., counties, regions) in which routes occur. Approximately 50 routes were established by the mid-1950s, and approximately 70 more were established during the late-1970s and early-1980s.

Observers from the Department of Natural Resources (DNR) Area Wildlife Offices and a variety of other organizations drove along each survey route once just after sunrise during April or May. Observers were not trained but often were experienced with the survey. At each designated stop along the route the observer listened for 4 minutes and recorded the number of ruffed grouse drums (not necessarily the number of individual grouse) he or she heard. Attempts were made to conduct surveys on days near the peak of drumming activity that had little wind and no precipitation.

The survey index value was the number of drums heard during each stop along a route. The mean number of drums per stop (dps) was calculated for each of 4 survey regions and for the entire state (Figure 2). As an intermediate step to summarizing survey results by region, I calculated the mean number of dps for each route. Mean index values for survey regions were calculated as the mean of route-level means for all routes occurring within the region. Some routes crossed regional boundaries, so data from those routes were included in the means for both regions. The number of routes within regions was not proportional to any meaningful characteristic of the regions or ECS section upon which they were based. Therefore, mean index values for the Northeast region and the state were calculated as the weighted mean of index values for the 4 and 7 ECS sections, respectively, that they included. The weight for each section mean was the geographic area of the section (i.e., AAP = 11,761 km^2, MOP = 21,468 km^2, NSU = 24,160 km^2, DLP = 33,955 km^2, WSU = 14,158 km^2, MIM = 20,886 km^2, and PP = 5,212 km^2). Only approximately half of the Minnesota and Northeast Iowa Morainal (MIM) and Paleozoic Plateau (PP) sections were within the ruffed grouse range, so the area used to weight drum index means for those sections was reduced accordingly using subsection boundaries.

Stops along survey routes are a small sample of all possible stops within the range of ruffed grouse in Minnesota. Survey index values based on the sample of stops are not the same as they would be if drum counts were conducted at a different sample of stops or at all possible stops. To account for the uncertainty in index values because they are based on a sample, I calculated 95% confidence intervals (CI) for each mean. A 95% confidence interval is a numerical range in which 95% of similarly estimated intervals (i.e., from different hypothetical samples) would contain the true, unknown mean. I used 10,000 bootstrap samples of route-level means to estimate percentile CIs for mean index values for survey regions and the whole state. Limits of each CI were defined as the 2.5^{th} and 97.5^{th} percentiles of the bootstrap frequency distribution. I calculated mean index values and CIs for all years since 1982. Data from earlier years were not analyzed because they were not available in a digital form.

Sharp-tailed Grouse

Over time, DNR Wildlife Managers have recorded the locations of sharp-tailed grouse dancing grounds in their work areas. As new dancing grounds were located, they were added to the survey list. Known, accessible dancing grounds were surveyed by Wildlife Area staff and their volunteers between sunrise and 2.5 hours after sunrise during April and early-May to count sharp-tailed grouse. When possible, surveys were conducted when the sky was clear and the wind was <16 km/hr (10 mph). Attempts were made to conduct surveys on >1 day to account for variation in the attendance of male grouse at the dancing ground. Survey data consist of the maximum of daily counts of sharp-tailed grouse at each dancing ground.

The dancing grounds included in the survey were not selected according to a statistically valid spatial sampling design. Therefore, data collected during the survey were not necessarily representative of the larger areas (e.g., counties, regions) in which the dancing grounds occur. It was believed, however, that most dancing grounds within each work area were included in the sample, thereby minimizing the limitations caused by the sampling design.

I calculated the mean number of sharp-tailed grouse per dancing ground (i.e., index value), averaged across dancing grounds within the NW and EC regions and statewide. The number of grouse included those recorded as males and those recorded as being of unknown sex, and only leks with ≥2 grouse were included when calculating mean index values. It was not valid to compare the full survey data and results from different years because survey effort and success in detecting and observing sharp-tailed grouse was different between years and the survey samples were not necessarily representative of other dancing grounds. To estimate differences in sharp-tailed grouse index values between 2 consecutive years, therefore, I analyzed separately sets of data that included counts of birds only from dancing grounds that were surveyed during both years. Although the dancing grounds in the separate data sets were considered comparable, the counts of birds at the dancing grounds still were not. Many factors can affect the number of birds counted, so inferences based upon comparisons of survey data between years are tenuous.

To account for the uncertainty in index values because they are based on a sample of dancing grounds rather than all dancing grounds, I calculated 95% confidence intervals (CI) for each mean. I used 10,000 bootstrap samples of dancing ground counts to estimate percentile confidence intervals for mean index values for the NW and EC regions and the whole state.

The current delineation between the NW and EC survey regions was based on ECS section boundaries (Figure 1), with the NW region consisting of the Lake Agassiz & Aspen Parklands, Northern Minnesota & Ontario Peatlands, and Red River Valley sections and the EC region consisting of selected subsections of the Northern Minnesota Drift & Lake Plains, Western Superior Uplands, and Southern Superior Uplands sections. The 2005 Grouse Survey Report detailed the transition from the former to the current delineation of regions.

RESULTS & DISCUSSION

Ruffed Grouse

Observers from 15 cooperating organizations surveyed 126 routes between 29 March and 16 May 2012. Most routes (91%) were run between 17 April and 10 May. The median date this year (25 April) was similar to the median during 2010 when much spring phenology occurred relatively early. The median dates during 2009 and 2011 were 1 May and 3 May, respectively. Observers reported survey conditions as Excellent, Good, and Fair on 55%, 41%, and 4% of 119 routes, respectively. The distribution of survey conditions has been consistent for at least the last 6 years.

Survey cooperators included the DNR Divisions of Fish & Wildlife and Parks & Trails; Chippewa and Superior National Forests (USDA Forest Service); Fond du Lac, Leech Lake, Red Lake, and White Earth Reservations; 1854 Treaty Authority; Agassiz and Tamarac National Wildlife Refuges (U.S. Fish & Wildlife Service); Vermilion Community College; Cass and Beltrami counties; and UPM Blandin Paper Mill.

Mean counts of ruffed grouse drums throughout the forested regions of Minnesota were 1.0 (95% confidence interval = 0.8–1.1) drums per stop (dps) during 2012. Drum counts by survey region during 2012 were 1.1 (0.9–1.2) dps in the Northeast (n = 106 routes), 0.9 (0.7–1.2) dps in the Northwest (n = 8), 0.6 (0.4–0.9) dps in the Central Hardwoods (n = 14), and 0.7 (0.3–1.1) dps in the Southeast (n = 6) (Figures 3 and 4). Median index values for bootstrap samples were similar to observed means (i.e., within 0.02 dps), so no bias-correction was necessary.

The statewide mean of drum counts this spring was significantly less than the mean counts from the previous 4 years, indicating that the grouse population is in the declining phase of its 10-year cycle. The most recent peak in drum counts was the 2.0 (1.8–2.3) dps observed during 2009. Given that factors other than changes in grouse density may influence counts and the resulting index values, emphasis when interpreting results from index surveys like the drum count survey should be on large and long-term changes in counts, not on small or short-term changes.

Sharp-tailed Grouse

A total of 1,404 sharp-tailed grouse was observed at 154 dancing grounds with ≥2 male grouse (or grouse of unknown sex) during spring 2012. Leks with ≥2 grouse were visited a mean of 1.9 times. There were 334 grouse on 53 leks in the East Central survey region and 1,070 grouse on 101 leks in the Northwest region. Twenty-nine percent fewer leks were observed than during 2011, mostly due to shortages in DNR Wildlife staff in northwestern Minnesota. The index value (i.e., grouse/lek) in both regions declined slightly from 2011 (Table 1), and counts at leks observed during both years declined 22% (12–31%, Table 2).

The statewide index value of 9.2 (8.2–10.3) was near the middle of values observed since 1980 (Figure 5). The peak in population index values for sharp-tailed grouse that occurred in 2009 coincided with the peak in the abundance of ruffed grouse in Minnesota. The spring index values for both species have followed an approximately 10-year cyclical pattern, with peaks in the sharp-tailed grouse index occurring up to 2 years after peaks in the ruffed grouse index.

ACKNOWLEDGEMENTS

I sincerely appreciate the efforts of all the DNR staff, partners, and volunteer cooperators who conducted and helped coordinate the grouse surveys. I thank Laura Gilbert for helping with data entry and archiving and Lou Cornicelli for reviewing a draft of this report. The ruffed grouse survey data for 1982–2004 were entered into a database by Doug Mailhot and another volunteer through a special effort organized by Gary Drotts, John Erb, and Rick Horton. The grouse surveys reported here were funded in part under the Federal Aid in Wildlife Restoration Act.

Table 1. Number of sharp-tailed grouse observed per active lek (≥2 males) during spring in Minnesota.

	Statewide			Northwest[a]			East Central[a]		
Year	Mean	95% CI[b]	*n*[c]	Mean	95% CI[b]	*n*[c]	Mean	95%CI[b]	*n*[c]
2004	11.2	10.1–12.3	183	12.7	11.3–14.2	116	8.5	7.2– 9.9	67
2005	11.3	10.2–12.5	161	13.1	11.5–14.7	95	8.8	7.3–10.2	66
2006	9.2	8.3–10.1	161	9.8	8.7–11.1	97	8.2	6.9– 9.7	64
2007	11.6	10.5–12.8	188	12.7	11.3–14.1	128	9.4	8.0–11.0	60
2008	12.4	11.2–13.7	192	13.6	12.0–15.3	122	10.4	8.7–12.3	70
2009	13.6	12.2–15.1	199	15.2	13.4–17.0	137	10.0	8.5–11.7	62
2010	10.7	9.8–11.7	202	11.7	10.5–12.9	132	8.9	7.5–10.5	70
2011	10.2	9.5–11.1	216	11.2	10.2–12.2	156	7.8	6.7–8.9	60
2012	9.2	8.2–10.3	153	10.7	9.3–12.3	100	6.3	5.4–7.3	53

[a] Survey regions; see Figure 1.
[b] 95% CI = 95% confidence interval for the mean. It is an estimate of the uncertainty in the value of the mean.
[c] *n* = number of leks in the sample.

Table 2. Difference in the number of sharp-tailed grouse per lek on dancing grounds that were observed during consecutive spring surveys in Minnesota.

	Statewide			Northwest[a]			East Central[a]		
Comparison[b]	Mean	95% CI[c]	*n*[d]	Mean	95% CI[c]	*n*[d]	Mean	95%CI[c]	*n*[d]
2004 - 2005	-1.3	-2.2– -0.3	186	-2.1	-3.5– -0.8	112	0.0	-1.0– 1.1	74
2005 - 2006	-2.5	-3.7– -1.3	126	-3.6	-5.3– -1.9	70	-1.1	-2.6– 0.6	56
2006 - 2007	2.6	1.5– 3.8	152	3.3	1.7– 5.1	99	1.2	0.1– 2.3	53
2007 - 2008	0.4	-0.8– 1.5	166	0.0	-1.6– 1.6	115	1.2	0.1– 2.5	51
2008 - 2009	0.9	-0.4– 2.3	181	1.8	-0.1– 3.8	120	-0.8	-2.1– 0.6	61
2009 - 2010	-0.6	-1.8– 0.6	179	-0.8	-2.6– 1.0	118	-0.1	-1.2– 1.0	61
2010 - 2011	-1.7	-2.7– -0.8	183	-1.8	-3.1– -0.5	124	-1.5	-2.8– -0.3	59
2011 - 2012	-2.0	-2.9– -1.1	170	-1.7	-2.9– -0.4	112	-2.4	-3.3– -1.6	58

[a] Survey regions; see Figure 1.
[b] Consecutive years for which comparable leks were compared.
[c] 95% CI = 95% confidence interval for the mean. It is an estimate of the uncertainty in the value of the mean.
[d] *n* = number of dancing grounds in the sample.

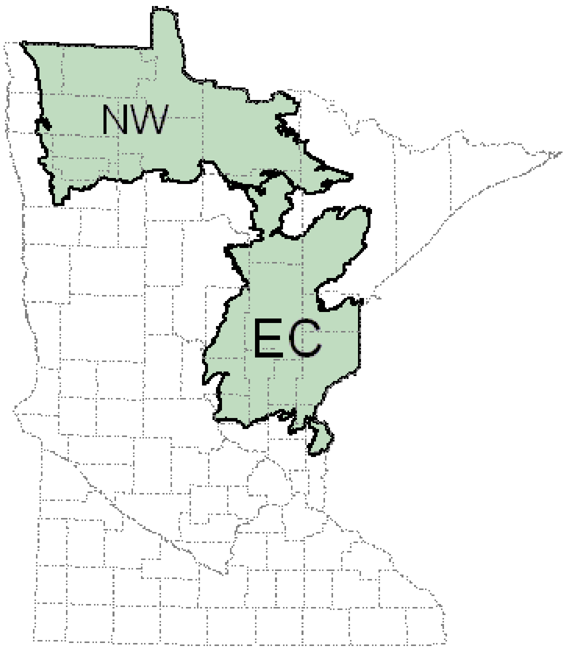


Figure 1. Northwest (NW) and East Central (EC) survey regions for **sharp-tailed grouse** relative to county boundaries in Minnesota. The regions were based largely on boundaries of ECS Subsections.

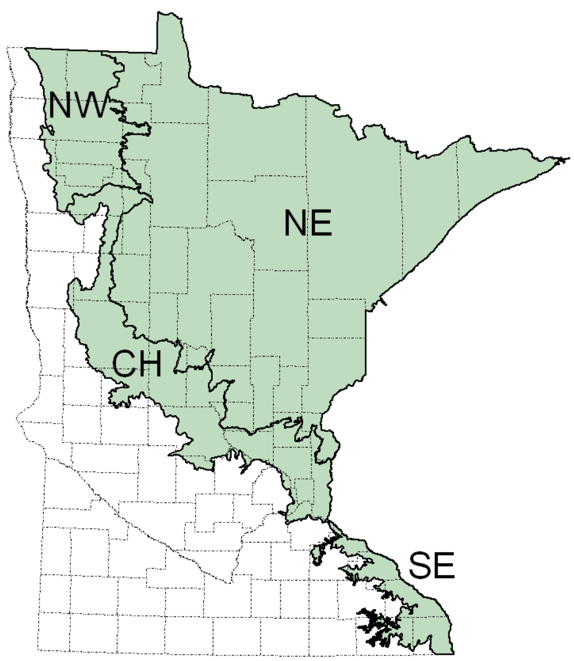


Figure 2. Survey regions for **ruffed grouse** (shaded, curved boundaries) relative to county boundaries (dashed lines) in Minnesota. The regions are based on the Ecological Classification System.

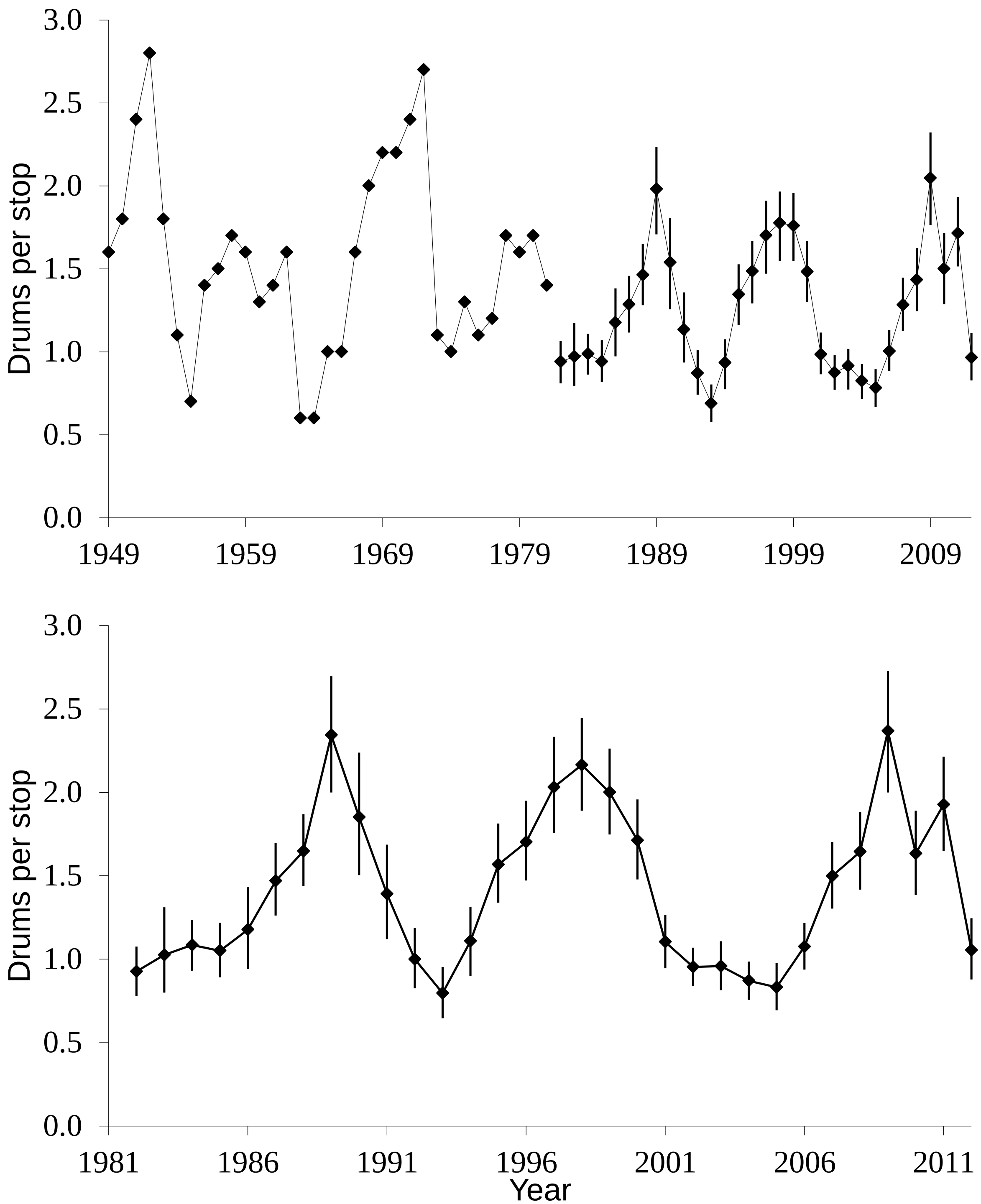


Figure 3. Ruffed grouse drum count index values in **Minnesota** (top) and just the **Northeast** region (bottom). Vertical error bars represent 95% confidence intervals based on bootstrap samples. Statewide means before 1982 were not re-analyzed with the current weighted average and bootstrapping methods, so confidence intervals were not available. The difference in index values between 1981 and 1982 reflected a real decrease in drums counted, not an artifact of the change in analysis methods.

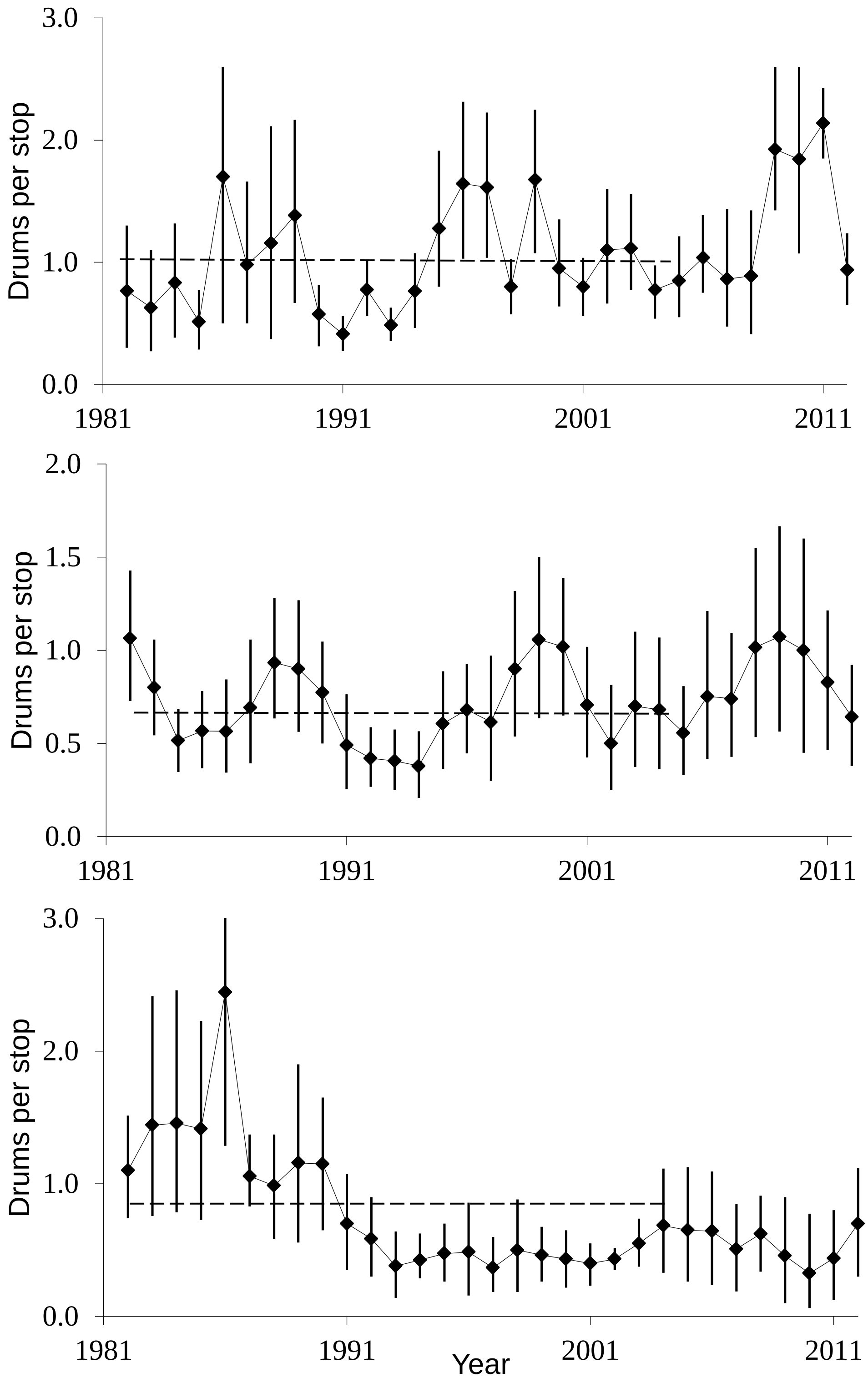


Figure 4. Ruffed grouse drum count index values in the **Northwest** (top), **Central Hardwoods** (middle), and **Southeast** (bottom) survey regions of Minnesota. Dashed horizontal lines indicate the mean from 1984 to 2004. Vertical error bars represent 95% confidence intervals based on bootstrap samples. The highest error bar in the bottom panel was truncated.

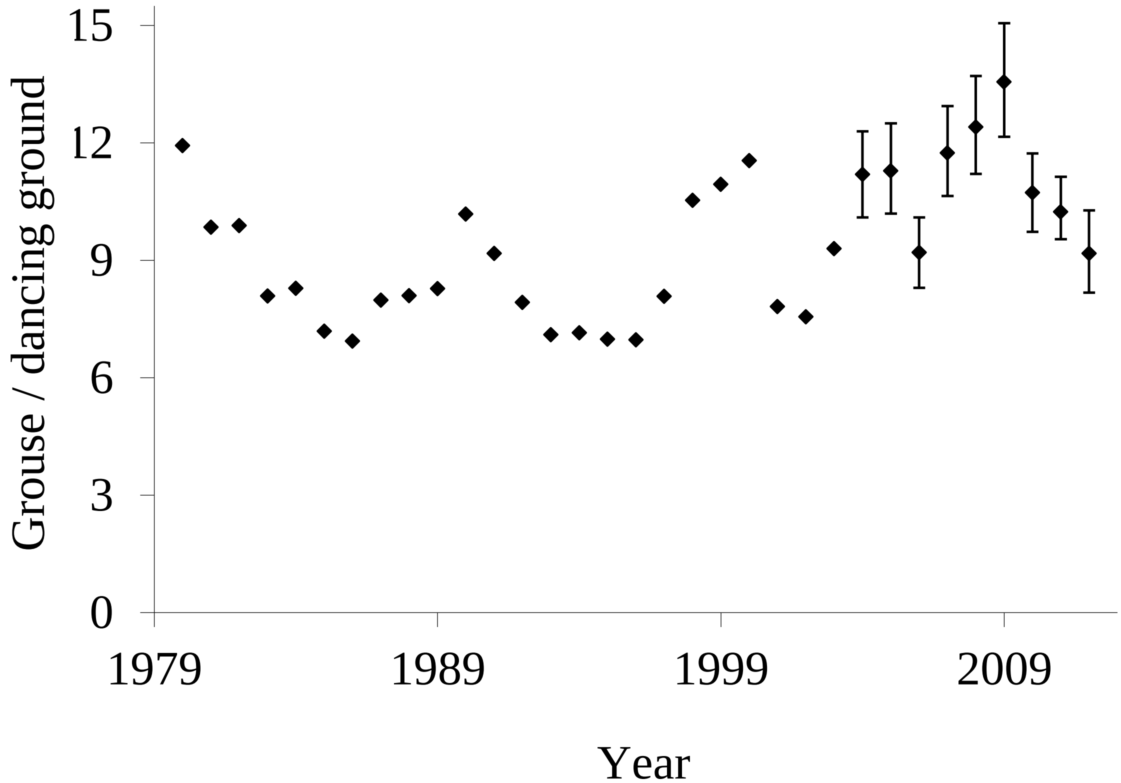


Figure 5. Mean number of **sharp-tailed grouse** observed in Minnesota during spring surveys of dancing grounds, 1980–2012. Vertical error bars, which were calculated only for recent years, represent 95% confidence intervals based on bootstrap samples. No line connects the annual means because they are not based on comparable samples of leks.

PRAIRIE-CHICKEN SURVEY IN MINNESOTA DURING 2012

Michael A. Larson, Forest Wildlife Populations and Research Group

SUMMARY OF FINDINGS

Surveys for greater prairie-chickens (*Tympanuchus cupido pinnatus*) were conducted in all 17 survey blocks during April and May of 2012. Observers located 128 booming grounds and counted 1,226 male prairie-chickens, including birds of unknown sex, in and near 15 of the survey blocks. Counts from the other 2 survey blocks were not available for analysis at the time of this report. Estimated densities of booming grounds and males/booming ground within the survey blocks were similar to densities during recent years and during the 10 years prior to modern hunting seasons (i.e., 1993–2002).

INTRODUCTION

Index Surveys

The purpose of surveys of grouse populations in Minnesota is to monitor changes in the densities of grouse over time. Estimates of density, however, are difficult and expensive to obtain. Simple counts of animals, on the other hand, are convenient and, assuming that changes in density are the major source of variation in counts among years, they can provide a reasonable index to long-term trends in populations. Other factors, such as weather and habitat conditions, observer ability, and grouse behavior, vary over time and also affect simple counts of animals. These other factors make it difficult to make inferences about potential changes in wildlife populations over short periods of time (e.g., a few annual surveys) or from small changes in index values. Over longer periods of time or when changes in index values are large, assumptions upon which grouse surveys in Minnesota depend are more likely to be valid, thereby making inferences about grouse populations more valid. For example, index values from the ruffed grouse drumming count survey have documented what is believed to be true periodic fluctuations in ruffed grouse densities (i.e., the 10-year cycle).

Greater Prairie-Chickens

During the early 1800s greater prairie-chickens (*Tympanuchus cupido pinnatus*) were present along the southern edge of Minnesota. Their range expanded and contracted dramatically during the next 150 years. Currently, most prairie-chickens in Minnesota occur along the beach ridges of glacial Lake Agassiz in the west (Figure 1). The population of prairie-chickens was expanded southward to the upper Minnesota River valley by a series of relocations during 1998–2006. Hunters in Minnesota have harvested approximately 120 prairie-chickens annually since 2003 when a limited-entry hunting season was opened for the first time since 1942.

During spring male prairie-chickens gather at communal display areas, or leks. The display areas of prairie-chickens are called booming grounds because males make a low-frequency, booming vocalization during their displays. From 1974 to 2003 the Minnesota Prairie Chicken Society coordinated annual counts of prairie-chickens at booming grounds. During

2004 the Minnesota Department of Natural Resources (DNR) began coordinating the annual prairie-chicken surveys, and a standardized survey design was adopted.

METHODS

During the few hours near sunrise from late-March until mid-May cooperating biologists and numerous volunteers counted prairie-chickens at booming grounds in western Minnesota. They attempted to locate and observe multiple times all booming grounds within 17 designated survey blocks (Figure 2). Each block was a square comprising 4 sections of the Public Land Survey (approximately 4,144 ha) and was selected nonrandomly based upon the spatial distribution of booming grounds and the presence of relatively abundant grassland habitat. I separated the survey blocks into 2 groups—core and periphery—based upon densities of prairie-chickens, with a threshold of approximately 1.0 male/km^2 during 2010, and geographic location relative to other survey blocks (Figure 2).

Observations of booming grounds outside the survey blocks were also recorded. They contribute to the known minimum abundance of prairie-chickens and may be of historical significance. These observations, however, were only incidental to the formal survey. Bird counts from areas outside the survey blocks cannot be used to make inferences about the relative abundance of prairie-chickens among different geographic areas (e.g., counties, permit areas) or points in time (e.g., years) because the amount of effort expended to obtain the observations was not standardized or recorded.

Observers counted prairie-chickens at booming grounds from a distance using binoculars. If vegetation or topography obscured the view of a booming ground, the observer attempted to flush the birds to obtain an accurate count. Observed prairie-chickens were classified as male, female, or unknown sex. Male prairie-chickens were usually obvious due to their display behavior. Birds were classified as unknown sex when none of the birds at a booming ground was observed displaying or when the birds had to be flushed to be counted. Most birds classified as unknown likely were males because most birds at booming grounds are males. Although most male prairie-chickens attend booming grounds most mornings, female attendance at booming grounds is much more limited and sporadic. Females are also more difficult to detect because they do not vocalize or display like males. Counts of males and unknowns, rather than females, therefore, were used to make comparisons between core and peripheral ranges and between years.

I summarized counts of booming grounds and prairie-chickens by hunting permit areas and spring survey blocks. Surveys were conducted in all traditional areas, but the counts from several permit areas and survey blocks were not available for analysis at the time of this report. Therefore, I did not calculate densities of booming grounds or prairie-chickens for comparison to estimated densities from previous years.

RESULTS & DISCUSSION

Observers from at least 3 cooperating organizations and many unaffiliated volunteers counted prairie-chickens during April and May 2012. Cooperators included the DNR Division of Fish and Wildlife, the Fergus Falls and Detroit Lakes Wetland Management Districts (U.S. Fish & Wildlife Service), and The Nature Conservancy.

Observers located 128 booming grounds and counted 1,226 male prairie-chickens during 2012 (Table 1). Minimum counts in Table 1 are not comparable among permit areas or years because they included surveys that were conducted outside of the survey blocks and did not follow a predetermined spatial sampling design.

Table 1. Minimum abundance of prairie-chickens within and outside of hunting permit areas in western Minnesota during spring 2012. Counts of booming grounds and birds are not comparable among permit areas or years.

Permit Area	Area (km^2)	Booming grounds	Males	Unk.[a]
801A	603	0	0	0
802A	826	7	46	1
803A	668	0	0	0
804A	435	0	0	0
805A	267	8	110	0
806A	749	7	49	0
807A	440	31	272	0
808A	417	17	224	0
809A	743	20	217	0
810A	505	12	122	0
811A	704	8	64	37
PA subtotal	6,356	110	1,104	38
Outside PAs[b]	NA[c]	18	122	29
Grand total	NA[c]	128	1,226	67

[a] Unk. = prairie-chickens of unknown sex. It is likely that most were males.
[b] Counts from outside the permit areas (PA).
[c] NA = not applicable. The size of the area outside permit areas was not defined.

Each booming ground was observed on a median of 2 (mean = 1.9) different days, and 38% of booming grounds were observed only once during 2012. Attendance of males at booming grounds varies among days and by time of day. Single counts of males at a booming ground, therefore, may be an unreliable indication of true abundance. Similar counts on multiple days, on the other hand, demonstrate that the counts may be a good indicator of true abundance. Even multiple counts, however, cannot overcome the problems associated with the failure to estimate the probability of detecting booming grounds and individual birds at booming grounds. Without estimates of detection probability, the prairie-chicken survey is an index to, not an estimate of, prairie-chicken abundance within the survey blocks. The credibility of the index for monitoring changes in abundance among years is dependent upon the untested assumption that a linear relationship exists between counts of male prairie-chickens and true abundance. In other words, we assume that (the expected value of) the probability of detection does not change among years.

Within survey blocks we counted 729 males, including birds of unknown sex, on 70 booming grounds during 2012 (Table 2). Booming grounds were defined as having ≥2 males, so observations of single males were excluded from summaries by survey block. In the 10 core survey blocks we observed 0.14 (0.10–0.17) booming grounds/km^2 and 10.6 (8.8–12.3) males/booming ground (Table 2, Figure 2). In the 7 peripheral survey blocks we observed 0.04 (0.01–0.08) booming grounds/km^2 and 9.8 (6.7–12.8) males/booming ground. The density of booming grounds observed among all survey blocks during 2012 was slightly less than densities during recent years (Figure 3) but slightly greater than the average of 0.08 (0.06–0.09) booming grounds/km^2 observed during the 10 years before recent hunting seasons (i.e., 1993–2002). The density of males at booming grounds observed among all survey blocks during 2012, however, was similar to densities during recent years but less than the average of 11.5 (10.1–12.9) males/booming ground observed during 1993–2002 (Table 2, Figure 3).

Table 2. Counts of prairie-chickens within survey blocks in Minnesota.

			2012		Change from 2011[a]	
Range[b]	Survey Block	Area (km^2)	Booming grounds	Males[c]	Booming grounds	Males[c]
Core	Polk 1	41.2	6	41	-1	-19
	Polk 2	42.0	8	110	0	21
	Norman 1	42.0	3	22	-1	1
	Norman 2	42.2	6	56	0	10
	Norman 3	41.0	9	78	-2	-23
	Clay 1	46.0	6	73	NA[d]	NA[d]
	Clay 2	41.0	2	39	NA[d]	NA[d]
	Clay 3	42.0	8	77	NA[d]	NA[d]
	Clay 4	39.0	3	31	NA[d]	NA[d]
	Wilkin 1	40.0	6	75	1	28
	Core subtotal	415.0	57	602	-3[e]	18[e]
Periphery	Mahnomen	41.7	NA[d]	NA[d]	NA[d]	NA[d]
	Becker 1	41.4	NA[d]	NA[d]	NA[d]	NA[d]
	Becker 2	41.7	5	29	NA[d]	NA[d]
	Wilkin 2	41.7	2	32	NA[d]	NA[d]
	Wilkin 3	42.0	3	34	-2	9
	Otter Tail 1	41.0	1	12	0	4
	Otter Tail 2	40.7	2	20	-1	5
	Periphery subtotal	290.6	13[e]	127[e]	-3[e]	18[e]
Grand total		705.5	70[e]	729[e]	-6[e]	36[e]

[a] The 2011 count was subtracted from the 2012 count, so a negative value indicates a decline.
[b] Survey blocks were classified as either in the core or periphery of the prairie-chicken range in Minnesota based upon bird densities and geographic location.
[c] Includes birds recorded as being of unknown sex but excludes lone males not observed at a booming ground.
[d] Surveys were conducted in these blocks during both years, but the counts from either 2011 or 2012 were not available for analysis at the time this report was written.
[e] These sums reflect only the blocks for which count data were available.

ACKNOWLEDGMENTS

I sincerely appreciate the efforts of all the DNR staff and volunteer cooperators who conducted and helped coordinate the prairie-chicken survey. DNR contributions to this survey were funded in part under the Federal Aid in Wildlife Restoration Act, U.S. Fish & Wildlife Service, Minnesota project W-69-S.

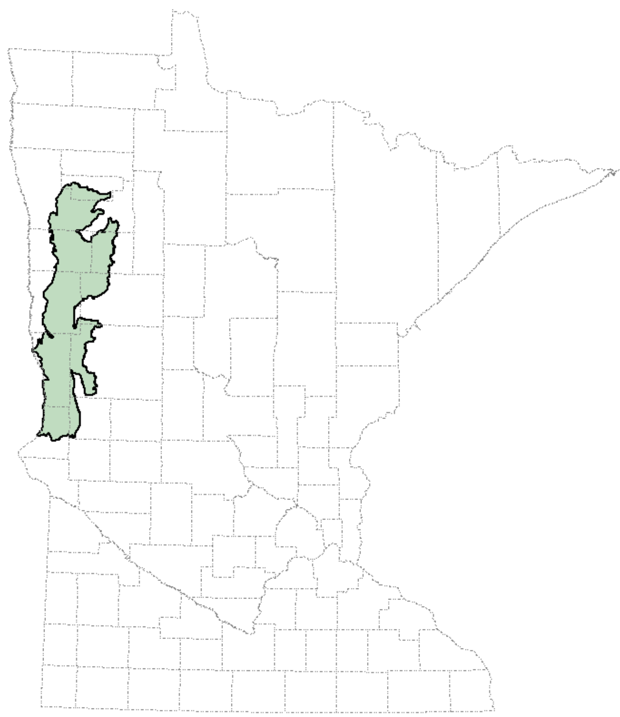


Figure 1. Primary range of greater prairie-chickens (shaded area) relative to county boundaries in Minnesota. This range boundary was based on ECS Land Type Associations and does not include all areas that are known to be occupied by prairie-chickens.

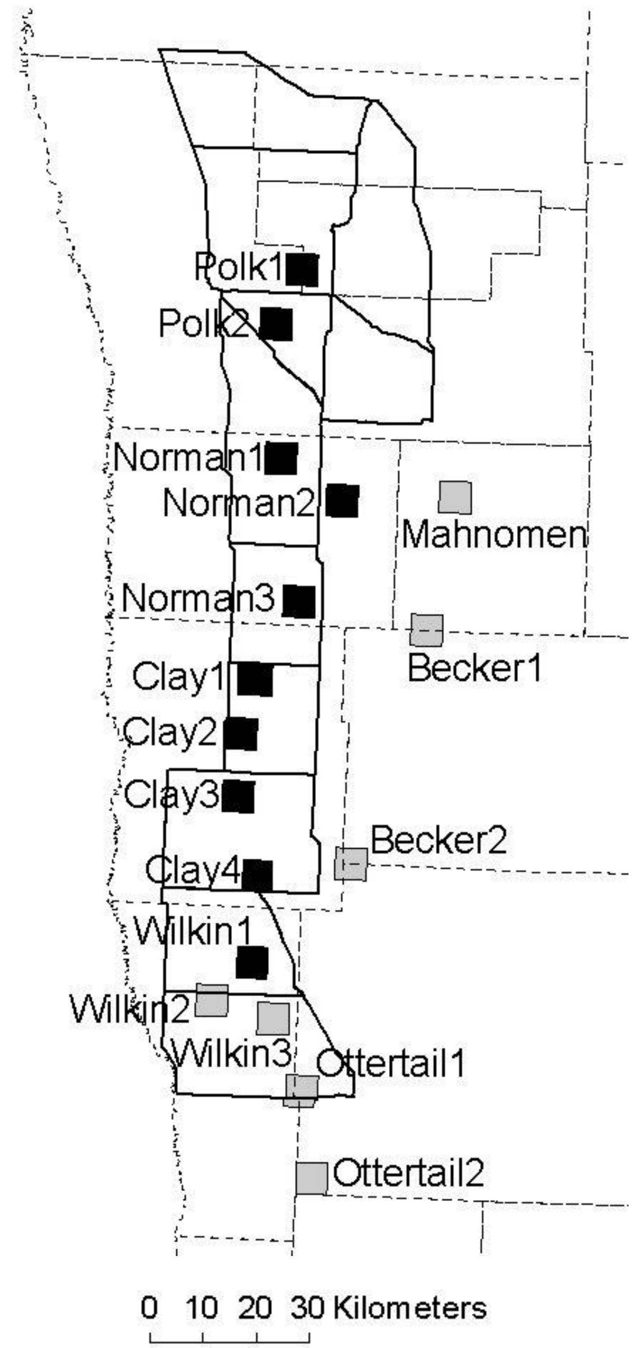


Figure 2. Survey blocks (41 km^2, labeled squares) and hunting permit area boundaries (solid lines) for prairie-chickens in western Minnesota. Survey blocks were designated as being in either the core (black) or periphery (gray) of the range. Blocks were named after the counties (dashed lines) in which they were primarily located. Permit areas were labeled sequentially from 801A in the north to 811A in the south.

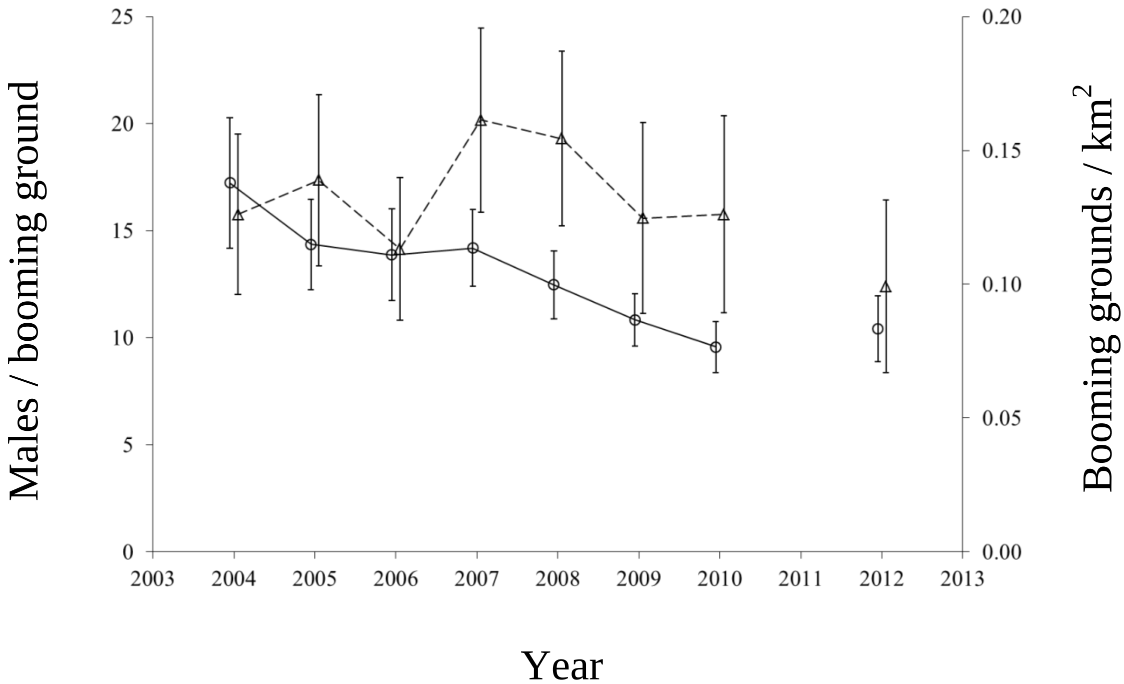
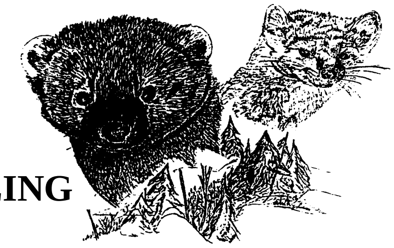


Figure 3. Number of prairie-chicken males/booming ground (circles connected by solid line) and booming grounds/km^2 (triangles connected by dashed line) observed in 17 41-km^2 survey blocks in western Minnesota. Vertical error bars represent 95% confidence intervals. Counts from 2011 for 6 of the survey blocks, including 4 of the 10 blocks in the core, were not available for this report.



REGISTERED FURBEARER POPULATION MODELING
2012 Report

Drawing by Gilbert Proulx

John Erb, Forest Wildlife Populations and Research Group

INTRODUCTION

For populations of secretive carnivores, obtaining field-based estimates of population size remains a challenging task (Hochachka et al. 2000; Wilson and Delehay 2001; Conn et al. 2004). This is particularly true when one is interested in annual estimates, multiple species, or large areas. Nevertheless, population estimates are desirable to assist in making management or harvest decisions. Population modeling is a valuable tool for synthesizing our knowledge of population demography, predicting outcomes of management decisions, and approximating population size.

In the late 1970s, Minnesota developed population models for 4 species of carnivores (fisher, marten, bobcat, and otter) to help 'estimate' population size and track population changes. All are deterministic accounting models that do not currently incorporate density-dependence. However, juvenile survival adjustments are made for bobcats and fisher during cyclic lows in hare abundance and following severe winters, particularly those where northern deer populations decline. For juvenile marten, survival is adjusted downward during apparent lows in small mammal abundance. Modeling projections are interpreted in conjunction with harvest data and results from any annual field-based track surveys.

METHODS

Primary model inputs include the estimated 1977 'starting' population size, estimates of age-specific survival and reproduction, and sex- and age-specific harvest data. Reproductive inputs are based largely on carcass data collected in the early 1980s, and for bobcats, additional data collected in 1992 and from 2003-present. Initial survival inputs were based on a review of published estimates in the literature, but are periodically adjusted as noted above. In some cases, parameter adjustments for previous years are delayed until additional data on prey abundance trends is available. Hence, population estimates reported in previous reports may not always match those reported in current reports. Obtaining updated Minnesota-specific survival and reproductive estimates is the goal of ongoing research.

Harvest data is obtained through mandatory furbearer registration. A detailed summary of 2011 harvest information is available in a separate report. Bobcat, marten, and fisher age data is obtained via x-ray examination of pulp cavity width or microscopic counts of cementum annuli from teeth of harvested animals. Although the population models only utilize data for the 3 age-classes (juvenile, yearling, adult), cementum annuli counts have periodically been collected for all non-juveniles either to examine age-specific reproductive output (bobcats) or to obtain periodic information on year-class distribution for selected species. In years where age data is not obtained for a given species, harvest age proportions are approximated using averages computed from the most recent period when data was collected.

For comparison to model projections, field-based track survey indices are presented in this report as running 3-year (t-1, t, t+1) averages of the observed track index, with the most recent year's average computed as (2/3*current index + 1/3*previous index). More detailed descriptions of scent post and winter track survey methods and results are available in separate reports.

RESULTS AND DISCUSSION

Bobcat. The 2011 registered DNR trapping and hunting harvest reached a new record level (1,711), exceeding last year's record harvest by 70% (Table 1). Total modeled harvest, which includes reported tribal take, was 1,898. The juvenile to adult female ratio in the harvest (0.8; Table 1) was below both the long-term average (1.5) and the recent 10-year average (1.1). A total of 1,626 bobcat carcasses were examined (Table 1), with a mean age of 3.0 for females. Approximately 10% of the harvested female bobcats were ≥ 6.5 years old (Figure 1).

Based on examination of reproductive tracts, 13% of yearling females produced a litter in 2011, the lowest since data collection resumed in 2003 (Figure 2). Average litter size for pregnant yearlings was 2.5, slightly above the previous 8-year average of 2.2. Pregnancy rate for 2+ year olds was 73%, similar to the previous 8-year mean (74%). Mean litter size for pregnant adults was 2.8 (8-year mean = 2.8). For both yearlings and adults, pregnancy rates appear to fluctuate more than average litter size, though neither has shown significant variability or trend since data collection resumed in 2003.

Based on the recently recalibrated bobcat population model, 35% of the 2011 fall population was harvested. As a result of the record harvest, population modeling projects a 12% decline in the bobcat population (Figure 3), with an estimated 2012 spring population size of ~ 3,400 (Figure 3). Both track indices remain at record levels (Figure 3).

Fisher. For the past 4 years, the fisher harvest season was reduced from 16 days to 9 days. In addition, the fisher limit was reduced the past 2 seasons from 5 to 2. Fisher harvest this year under the DNR framework increased 63% to 1,473 (Table 2). Modeled harvest, which includes reported tribal take, was 1,651.

Fisher carcass collections were resumed in 2010 to collect current information on age distribution. A total of 1,314 carcasses were collected in 2011 (Table 2). The juvenile:adult female ratio was 3.0, below last year's estimate of 4.3, and well below the 1977-1994 average of 6.6 (Table 2). Average age of harvested males and females was 1.4 and 1.8, respectively. Very few fishers over the age of 2.5 were harvested (Figures 4 and 5).

Based on projections from the fisher population model, 21% of the fall fisher population was harvested during the 2011 season. Although the conservative seasons in recent years appeared to have stabilized the previous decline, this year's harvest may have exceeded current sustainable levels, and the 3-year-averaged winter track index for fisher once again declined, though not significantly (Figure 6). Modeling projects a 7% decrease in the population, with an estimated 2012 spring population size of ~ 6,000 fishers (Figure 6).

Marten. As with fisher, the marten harvest season the last 4 years was shortened from 16 days to 9 days, though the marten limit has remained unchanged. Harvest this year under the

DNR framework was 2,525, up 37% from last year (Table 3). Modeled harvest, which includes reported tribal take, was 2,744. Age-class information was obtained from a sample of 70% of the carcasses collected this year. Juveniles comprised 39% of the total harvest, slightly below the recent 10-year average (46%), and well below the longer-term average of 55% (Table 3; Figure 7). The juvenile:adult female ratio (2.6) in the harvest was below both the recent 10-year average (4.6) and the longer-term average (7.6; Table 3).

Based on projections from the marten population model, 22% of the fall marten population was harvested. After declining for ~ 8 years, the 3-year-averaged winter track index has been rebounding after implementing more conservative harvest seasons. However, the higher than expected harvest this year appears to have dampened the recovery (Figure 8). Modeling projects a 6% decline in the population from last year (Figure 3), with an estimated 2012 spring population size of ~ 9,000 martens.

Otter. From 1977 - 2007, otter harvest was only allowed in the northern part of the state. From 2007-2009, otter harvest was allowed in 2 separate zones with differing limits (4 otter in the north zone, 2 in the southeast zone). Beginning in 2010, otter harvest was allowed statewide, with a consistent limit of 4 otter per trapper. Statewide harvest in 2011 under the DNR framework increased 26% to 2,294 (Table 4), of which approximately 50 (2%) were taken in the former southeast zone and 90 (4%) in the recently opened SC/SW portion of the state.

Modeled statewide otter harvest, which includes tribal take, was 2,490 (Table 4). An estimated 17% of the fall population was harvested. Carcass collections ended in 1986, so no age or reproductive data are available. After the population declined for several years as a result of high fur prices (harvests) and then rebounded to previous levels as fur prices (harvests) declined, modeling indicates that this year’s harvest had a stabilizing effect on the population (Figure 7). The 2012 spring population is estimated to be ~ 12,300, essentially unchanged from last year.

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Table 1. Bobcat harvest data, 1982 to 2011.

Year	DNR Harvest	Modeled Harvest[1]	% Autumn Pop. Taken[2]	Carcasses Examined	% juveniles	% yearlings	% adults	Juv: Ad. Female ratio	% male juveniles	% male yearlings	% male adults	Overall % males	Mean Pelt Price[3]
1982	274	320	15	261	35	15	50	1.3	47	49	47	48	$66
1983	208	212	10	205	37	26	37	1.5	54	53	30	45	$61
1984	280	288	15	288	37	13	50	1.4	52	66	44	51	$76
1985	119	121	6	99	33	19	48	1.2	41	41	43	42	$70
1986	160	160	8	132	26	17	57	0.9	53	32	51	51	$120
1987	214	229	12	163	33	16	51	1.4	44	52	48	48	$101
1988	140	143	7	114	40	18	42	1.7	58	62	46	54	$68
1989	129	129	6	119	39	17	44	2	49	53	56	53	$48
1990	84	87	4	62	20	34	46	0.8	58	80	44	59	$43
1991	106	110	5	93	35	33	32	3.6	59	55	70	61	$37
1992	167	167	7	151	28	22	50	1.2	55	45	53	53	$28
1993	201	210	8	161	32	20	48	1.4	51	45	52	50	$43
1994	238	270	11	187	26	16	58	0.8	64	43	45	50	$36
1995	134	152	6	96	31	15	54	2.7	57	71	79	71	$32
1996	223	250	10	164	35	20	45	1.5	51	30	49	46	$33
1997	364	401	17	270	35	16	49	1.2	60	37	43	48	$30
1998	103	107	5	77	29	26	45	1.6	59	60	60	60	$28
1999	206	228	8	163	18	24	58	0.8	55	59	62	60	$24
2000	231	250	8	183	31	26	43	1.5	54	59	50	53	$33
2001	259	278	9	213	30	21	49	1.3	52	51	53	52	$46
2002	544	621	16	475	27	25	48	1	66	49	46	52	$72
2003	483	518	14	425	25	13	62	0.9	61	46	53	54	$96
2004	631	709	16	524	28	34	38	1.6	51	40	54	49	$99
2005	590	638	14	485	25	13	62	0.8	51	48	46	48	$96
2006	890	983	20	813	26	17	57	1.1	61	50	58	57	$101
2007	702	758	16	633	34	14	52	1.2	55	60	47	52	$93
2008	853	928	18	714	26	25	49	1.1	56	52	51	52	$75
2009	884	942	18	844	23	22	55	0.9	57	46	54	53	$43
2010	1012	1042	19	955	38	16	46	1.4	62	55	43	52	$71
2011	1711	1898	35	1626	23	21	56	0.8	61	73	47	56	$98

[1] Includes DNR and Tribal harvests

[2] Estimated from population model; includes estimated non-reported harvest of 10%.

[3] Average pelt price based on a survey of in-state fur buyers only.

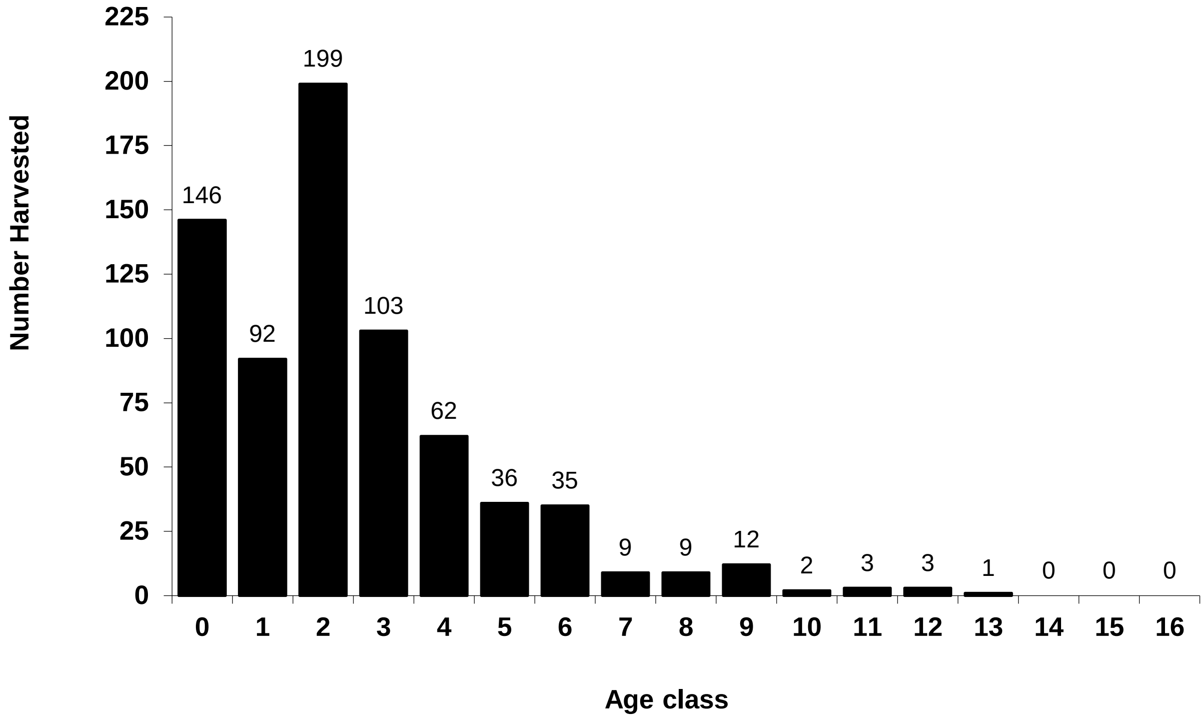

Figure 1. Age structure of female bobcats in the 2011-12 harvest.

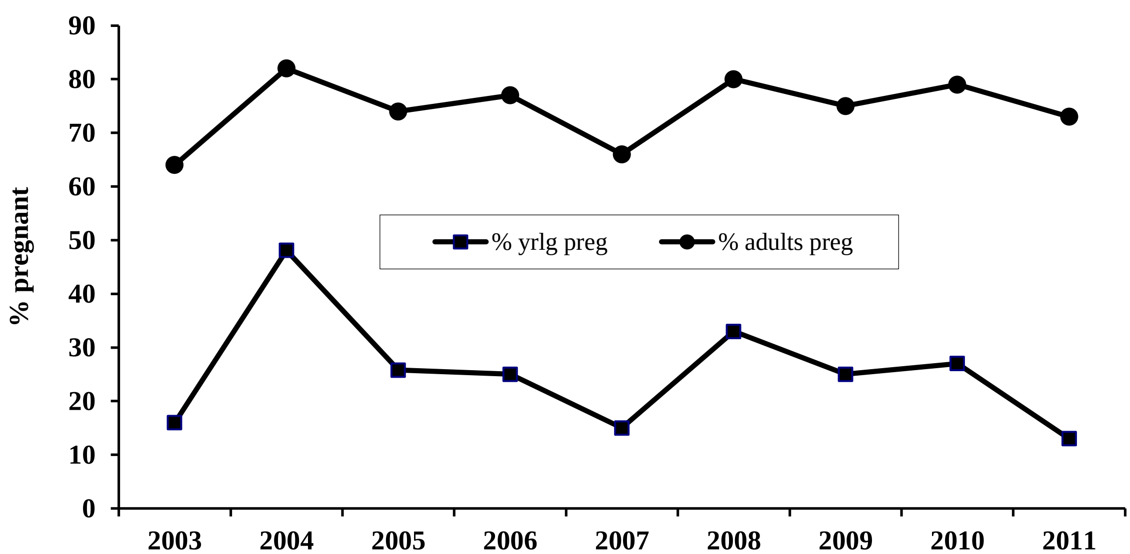

Figure 2. Pregnancy rates for yearling and adult bobcats in Minnesota, 2003-2011.

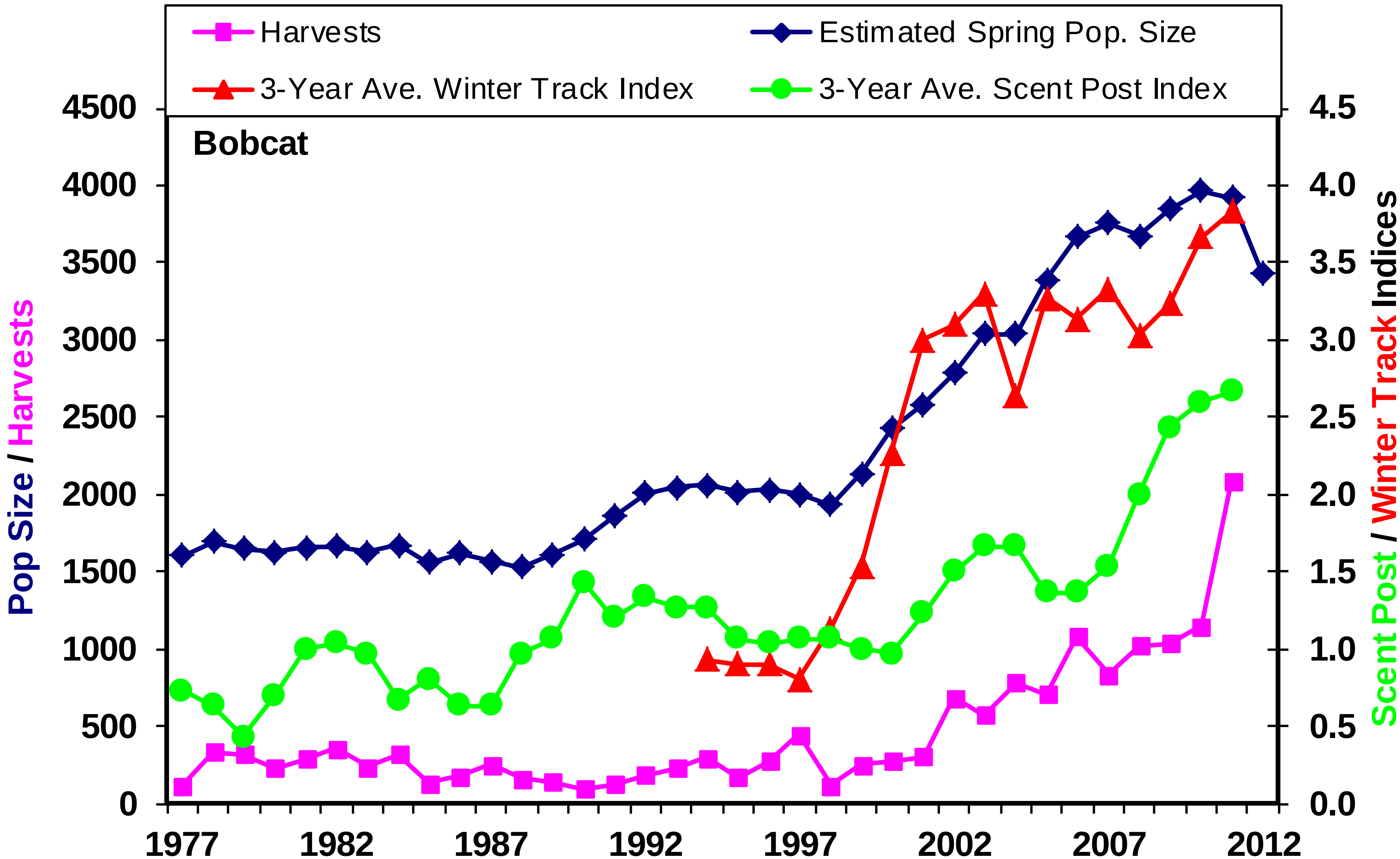

Figure 3. Bobcat populations, harvests, and survey indices, 1977-2012. Harvests include an estimate of non-reported take.

Table 2. Fisher harvest data, 1982 to 2011.

Year	DNR harvest	Modeled Harvest[1]	% Autumn Pop. Harvested[2]	Carcasses examined	% juveniles	% yearlings	% adults	Juv: Ad. Female ratio	% male juveniles	% male yearlings	% male adults	% males overall	Pelt price Males[3]	Pelt price Females[3]
1982	912	1073	16	1073	66	19	15	9.4	46	41	52	46	$70	$99
1983	631	735	11	662	69	18	13	8.8	45	40	40	44	$71	$121
1984	1285	1332	18	1270	63	20	17	7.2	52	45	45	49	$70	$122
1985	678	735	10	712	63	20	18	5.4	46	40	34	43	$74	$130
1986	1068	1186	16	1186	59	24	18	5.3	48	50	37	46	$84	$162
1987	1642	1749	23	1534	63	15	22	4.7	46	40	37	43	$84	$170
1988	1025	1050	15	805	70	15	15	6.8	48	45	33	45	$54	$100
1989	1243	1243	17	1024	64	19	17	5.8	47	47	36	45	$26	$53
1990	746	756	10	592	65	14	21	4.5	44	55	30	43	$35	$46
1991	528	528	6	410	66	21	13	7.8	50	52	35	48	$21	$48
1992	778	782	8	629	58	21	21	4.9	42	55	45	46	$16	$29
1993	1159	1192	11	937	59	22	19	5.3	47	37	42	44	$14	$28
1994	1771	1932	16	1360	56	18	26	4	47	54	44	48	$19	$30
1995	942	1060	9	-	-	-	-	-	-	-	-	45	$16	$25
1996	1773	2000	15	-	-	-	-	-	-	-	-	45	$25	$34
1997	2761	2974	22	-	-	-	-	-	-	-	-	45	$31	$34
1998	2695	2987	23	-	-	-	-	-	-	-	-	45	$19	$22
1999	1725	1880	16	-	-	-	-	-	-	-	-	45	$19	$20
2000	1674	1900	15	-	-	-	-	-	-	-	-	45	$20	$19
2001	2145	2362	19	-	-	-	-	-	-	-	-	54	$23	$23
2002	2660	3028	24	-	-	-	-	-	-	-	-	54	$27	$25
2003	2521	2728	22	-	-	-	-	-	-	-	-	55	$27	$26
2004	2552	2753	23	-	-	-	-	-	-	-	-	52	$30	$27
2005	2388	2454	22	-	-	-	-	-	-	-	-	52	$36	$31
2006	3250	3500	33	-	-	-	-	-	-	-	-	51	$76	$68
2007	1682	1811	21	-	-	-	-	-	-	-	-	51	$63	$48
2008	1712	1828	22	-	-	-	-	-	-	-	-	52	$22	$37
2009	1259	1323	17	-	-	-	-	-	-	-	-	53	$35	$34
2010	903	951	12	759	52	25	23	4.3	54	53	49	52	$38	$37
2011	1473	1651	21	1314	46	28	26	3	56	50	39	50	$48	$40

[1] Includes DNR and Tribal harvests

[2] Estimated from population model, includes estimated non-reported harvest of 22% 1977-1992, and 10% from 1993-present.

[3] Average pelt price based on a survey of in-state fur buyers only.

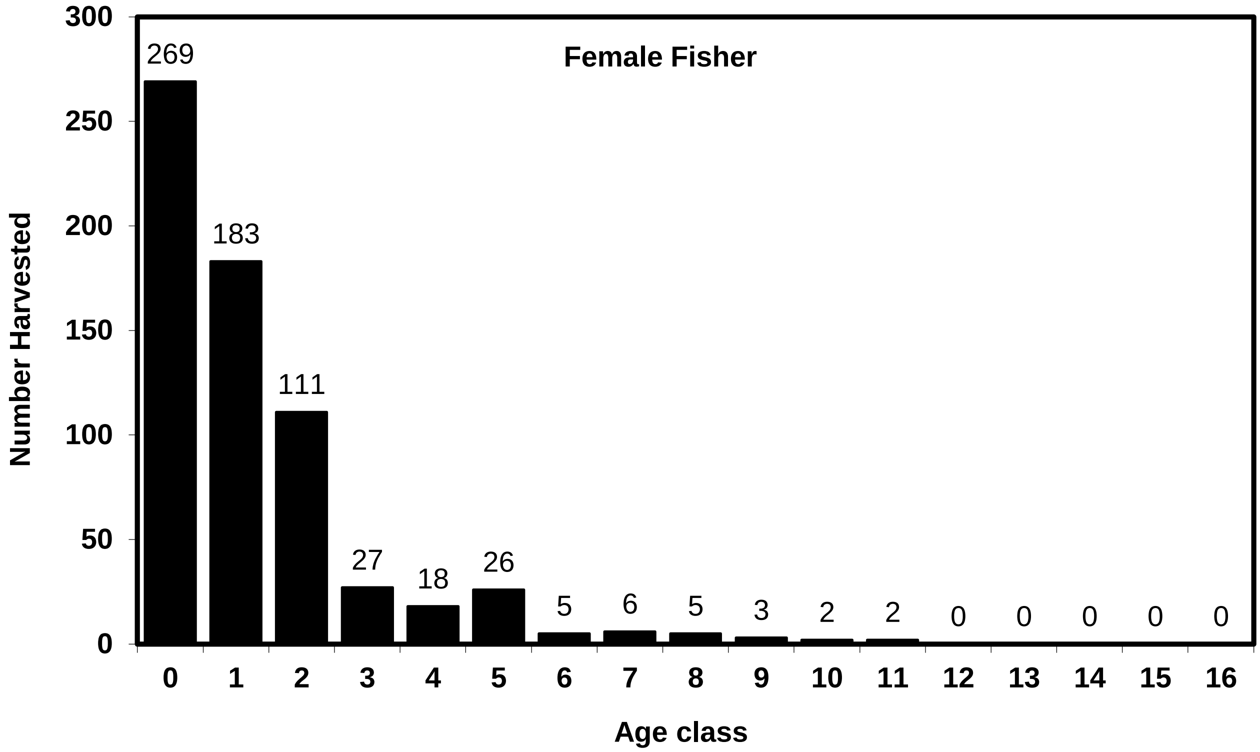

Figure 4. Age structure of female fishers in the 2011 harvest.

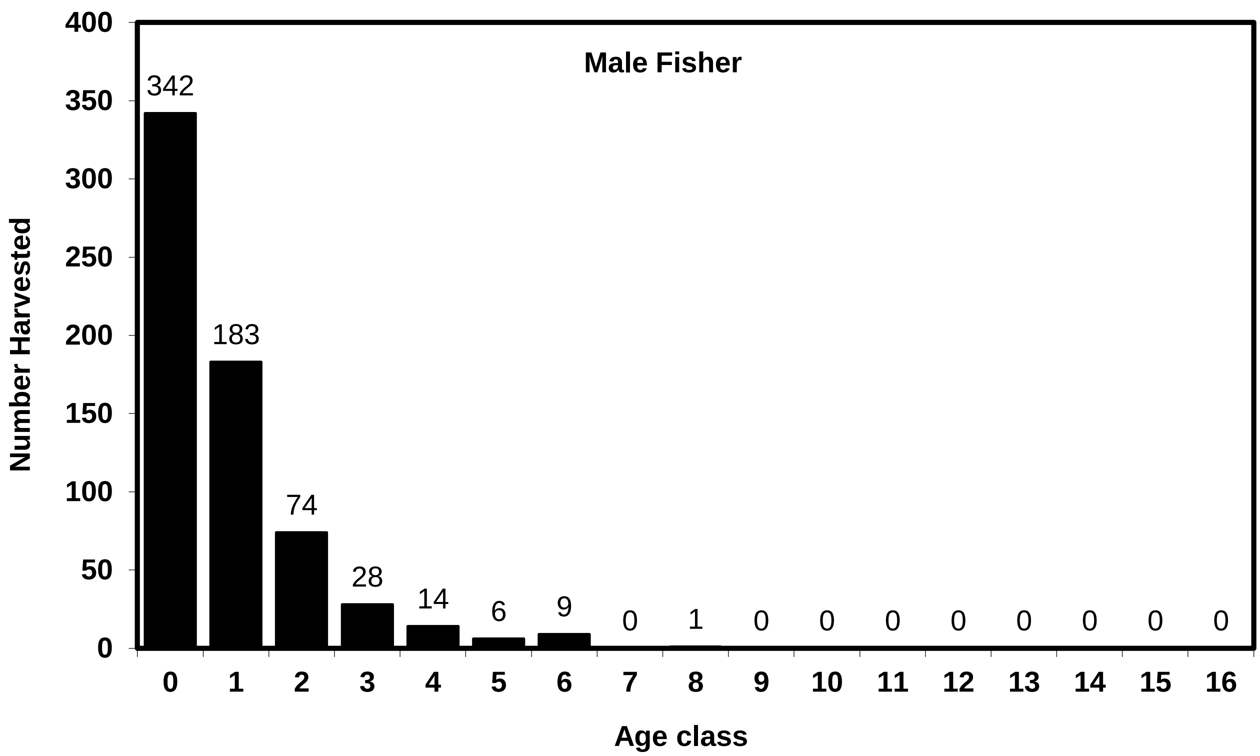

Figure 5. Age structure of male fishers in the 2011 harvest.

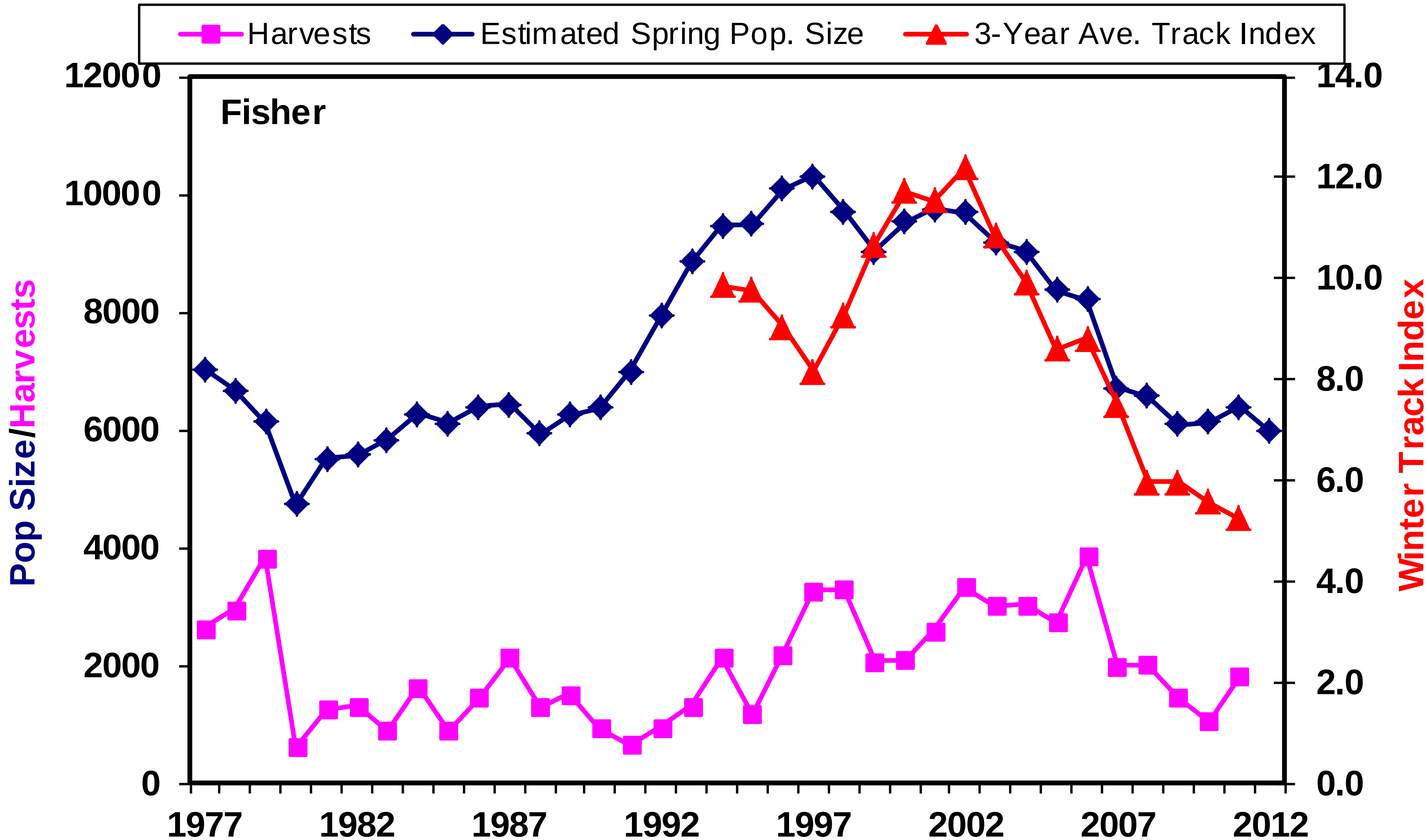

Figure 6. Fisher populations, harvests, and survey indices, 1977-2012. Harvests include an estimate of non-reported take.

Table 3. Marten harvest data, 1985 to 2011.

Year	DNR harvest	Modeled Harvest[1]	% Autumn Pop. Harvested[2]	Carcasses Examined[3]	% juveniles	% yearlings	% adults	Juv: Ad. Female ratio	% male juveniles	% male yearlings	% male adults	% males overall	Pelt price Males[4]	Pelt price Females[4]
1985	430	430	5	507	73	18	9	17.2	69	68	82	70	$30	$28
1986	798	798	9	884	64	21	15	12.3	65	71	81	69	$36	$27
1987	1363	1363	13	1754	66	18	16	11.2	65	67	75	67	$43	$39
1988	2072	2072	17	1977	66	11	23	8.6	58	50	66	59	$50	$43
1989	2119	2119	17	1014	68	12	20	9.7	57	63	65	59	$48	$47
1990	1349	1447	12	1375	48	18	34	3.6	59	54	61	59	$44	$41
1991	686	1000	9	716	74	9	17	16.1	69	71	72	70	$40	$27
1992	1602	1802	13	1661	65	18	17	15.1	63	70	75	66	$28	$25
1993	1438	1828	13	1396	57	20	23	7.5	61	71	67	64	$36	$30
1994	1527	1846	13	1452	58	15	27	6.4	62	76	67	66	$34	$28
1995	1500	1774	12	1393	60	18	22	8.2	63	68	66	65	$28	$21
1996	1625	2000	13	1372	48	22	30	4.8	62	69	67	65	$34	$29
1997	2261	2762	18	2238	61	13	26	6.2	60	60	63	61	$28	$22
1998	2299	2795	18	1577	57	18	25	6.6	62	66	65	63	$20	$16
1999	2423	3000	18	2013	67	12	21	9.8	65	66	67	66	$25	$21
2000	1629	2050	12	1598	56	25	19	8.9	62	69	66	64	$28	$21
2001	1940	2250	12	1895	62	15	23	11	66	73	75	69	$24	$23
2002	2839	3192	18	2451	39	30	31	3.1	57	63	61	60	$28	$27
2003	3214	3548	20	2391	48	17	35	4	57	65	66	62	$30	$27
2004	3241	3592	22	2776	26	28	46	1.3	52	64	57	58	$31	$27
2005	2653	2873	19	1992	53	16	31	4.9	64	63	65	64	$37	$32
2006	3788	4120	28	1914	64	17	20	9.2	66	67	65	66	$74	$66
2007	2221	2481	20	1355	30	29	41	1.5	56	64	50	56	$59	$50
2008	1823	1953	16	1095	40	21	39	2.1	58	60	53	56	$31	$28
2009	2073	2250	18	1252	55	16	29	4.9	65	46	61	61	$27	$30
2010	1842	1977	16	1202	47	29	25	4.1	69	54	60	63	$40	$37
2011	2525	2744	22	1615	39	25	36	2.6	63	63	59	62	$42	$39

[1] Includes DNR and Tribal harvests

[2] Estimated from population model; includes estimated non-reported harvest of 40% in 1985-1987 and 1991, 20% in 1988-1990 and 1992-1998, and 10% from 1999-present.

[3] Starting in 2005, the number of carcasses examined represents a random sample of ~ 70% of the carcasses collected in each year.

[4] Average pelt price based on a survey of in-state fur buyers only

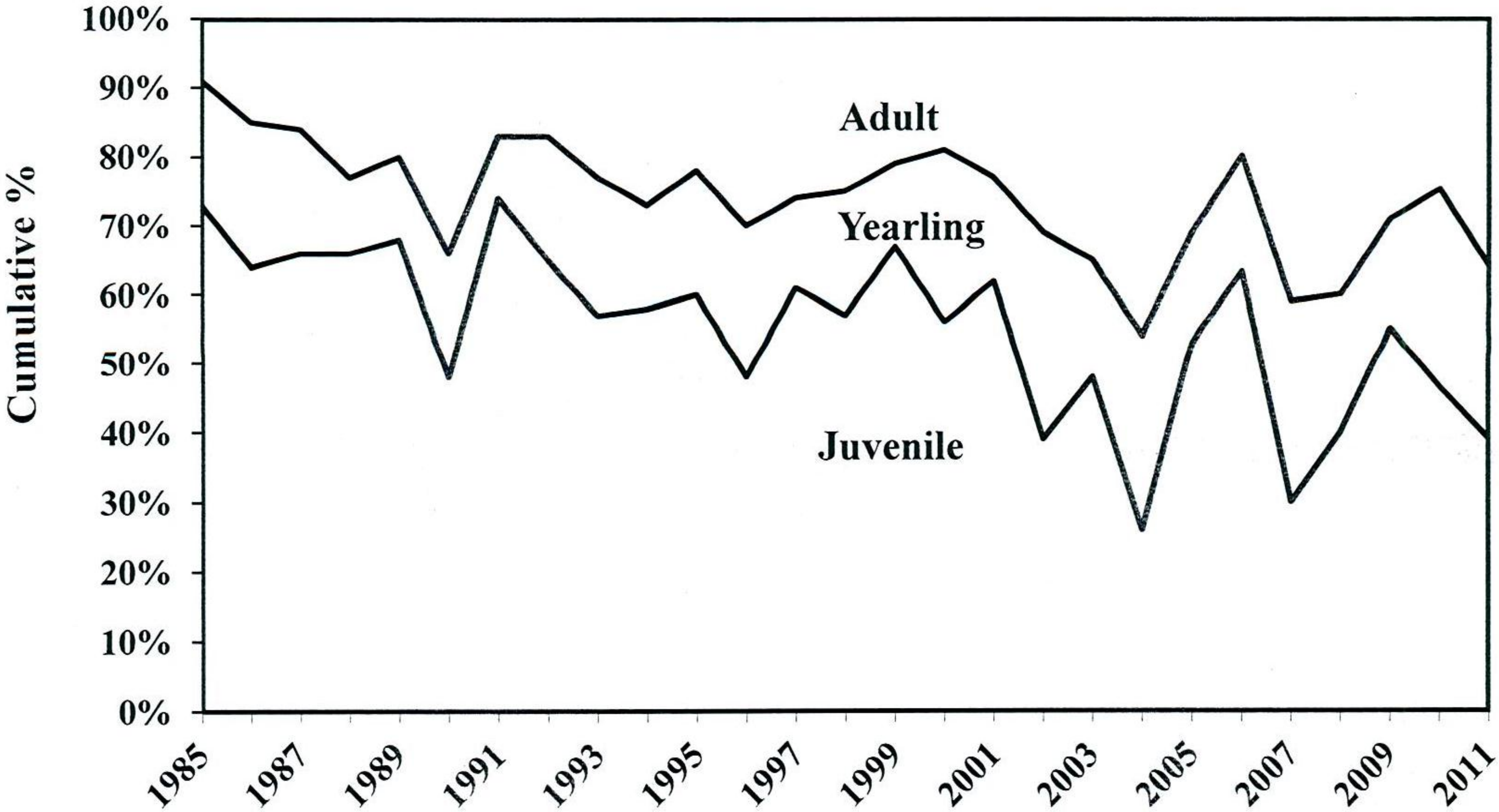

Figure 7. Marten harvest age-class proportions, 1985-2011.

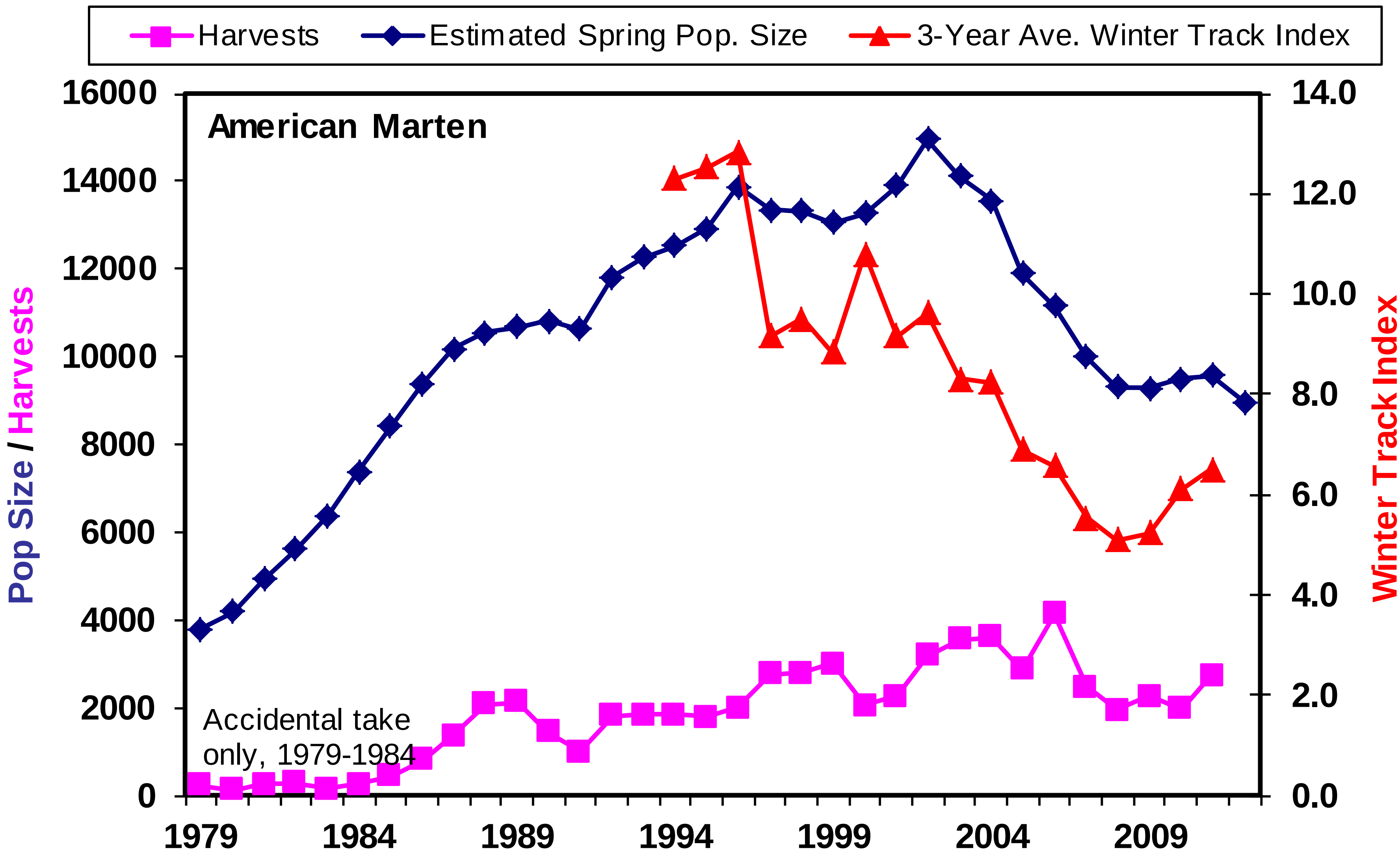

Figure 8. American marten populations, harvests, and survey indices, 1979-2012. Harvests include an estimate of non-reported take.

Table 4. Otter harvest data[1], 1982 to 2011. Carcasses were only collected from 1980-86.

Year	DNR harvest	Modeled Harvest[1]	% Autumn Pop. Harvested[2]	Carcasses examined	% juveniles	% yearlings	% adults	Juv:ad. females	% male juveniles	% male yearlings	% male adults	% males overall	Pelt price Otter[3]	Pelt price Beaver[3]
1982	385	625	9	389	51	26	23	6	57	65	65	60	$26	$11
1983	408	604	8	433	42	31	27	3.7	56	57	57	56	$25	$12
1984	529	561	7	549	48	23	29	3.2	47	50	49	49	$22	$12
1985	559	572	7	572	43	23	34	2.2	53	50	43	51	$21	$15
1986	777	777	8	745	45	23	32	2.7	45	48	46	47	$24	$20
1987	1386	1484	15	-	-	-	-	-	-	-	-	52	$23	$17
1988	922	922	9	-	-	-	-	-	-	-	-	52	$22	$14
1989	1294	1294	12	-	-	-	-	-	-	-	-	52	$22	$12
1990	888	903	8	-	-	-	-	-	-	-	-	52	$24	$9
1991	855	925	8	-	-	-	-	-	-	-	-	51	$25	$9
1992	1368	1365	10	-	-	-	-	-	-	-	-	52	$30	$7
1993	1459	1368	10	-	-	-	-	-	-	-	-	52	$43	$10
1994	2445	2708	19	-	-	-	-	-	-	-	-	52	$48	$14
1995	1435	1646	12	-	-	-	-	-	-	-	-	52	$39	$12
1996	2219	2500	18	-	-	-	-	-	-	-	-	52	$39	$19
1997	2145	2313	17	-	-	-	-	-	-	-	-	52	$40	$17
1998	1946	2139	16	-	-	-	-	-	-	-	-	52	$34	$13
1999	1635	1717	13	-	-	-	-	-	-	-	-	52	$41	$11
2000	1578	1750	13	-	-	-	-	-	-	-	-	52	$51	$14
2001	2301	2531	18	-	-	-	-	-	-	-	-	57	$46	$13
2002	2145	2390	16	-	-	-	-	-	-	-	-	59	$61	$10
2003	2766	2966	20	-	-	-	-	-	-	-	-	57	$85	$12
2004	3450	3700	25	-	-	-	-	-	-	-	-	56	$87	$14
2005	2846	3018	22	-	-	-	-	-	-	-	-	58	$89	$15
2006	2720	2873	22	-	-	-	-	-	-	-	-	56	$43	$17
2007	1861	1911	15	-	-	-	-	-	-	-	-	55	$29	$16
2008	1938	1983	15	-	-	-	-	-	-	-	-	59	$24	$12
2009	1544	1578	12	-	-	-	-	-	-	-	-	59	$36	$13
2010	1814	1830	13	-	-	-	-	-	-	-	-	57	$35	$13
2011	2294	2490	17	-	-	-	-	-	-	-	-	58	$51	$17

[1] Includes DNR and Tribal harvests

[2] Estimated from population model. Incl. estimated non-reported harvest of 30% to 1991, 22% from 1992-2001, and 10% from 2002-present.

[3] Weighted average of spring (beaver only) and fall prices based on a survey of in-state fur buyers.

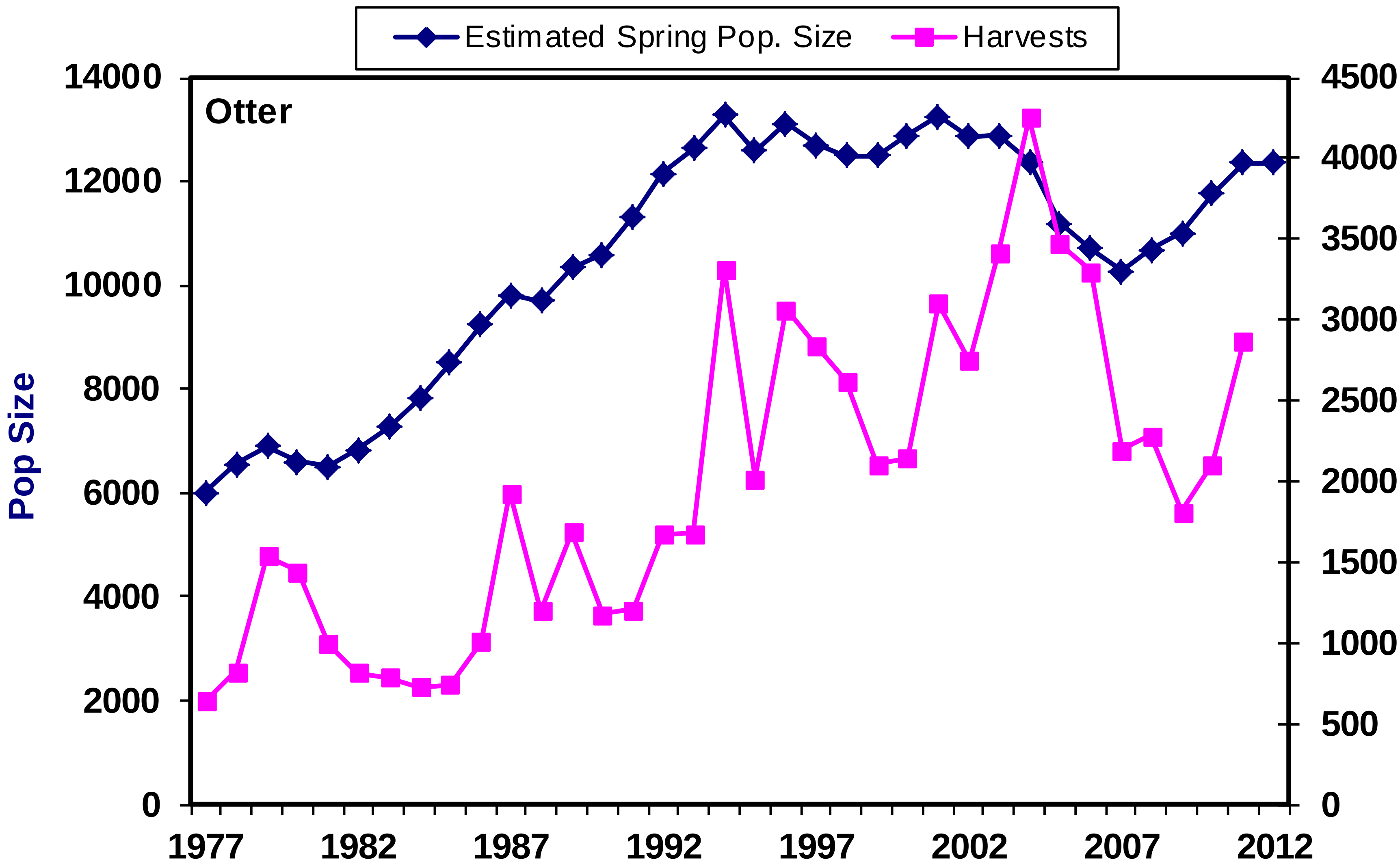

Figure 9. Otter populations and harvests, 1977-2012. Harvests include an estimate of non-reported take.

2012 AERIAL MOOSE SURVEY

Mark S. Lenarz, Forest Wildlife Populations and Research Group

INTRODUCTION

Each year, we conduct an aerial survey in northeastern Minnesota in an effort to monitor moose (*Alces alces*) numbers and identify fluctuations in the status of Minnesota's largest deer species. The primary objectives of this annual survey are to estimate moose numbers and determine the calf:cow and bull:cow ratios. We use these data to determine population trends and set the harvest quota for the subsequent hunting season

METHODS

We estimated moose numbers and age/sex ratios by flying transects within a stratified random sample of survey plots (Figure 1). Survey plots were last stratified in 2009. As in previous years, all survey plots were rectangular (5 x 2.67 mi.) and all transects were oriented east to west. DNR Enforcement pilots flew the Bell Jet Ranger (OH-58) helicopters used to conduct the survey. We sexed moose using the presence of antlers and or presence of a vulval patch (Mitchell 1970), and identified calves on the basis of size and behavior. We used the program DNRSurvey on Toughbook® tablet style computers to record survey data. DNRSurvey allowed us to display transect lines superimposed on a background of aerial photography, observe the aircraft's flight path over this background in real time, and record data using a tablet pen with a menu-driven data entry form.

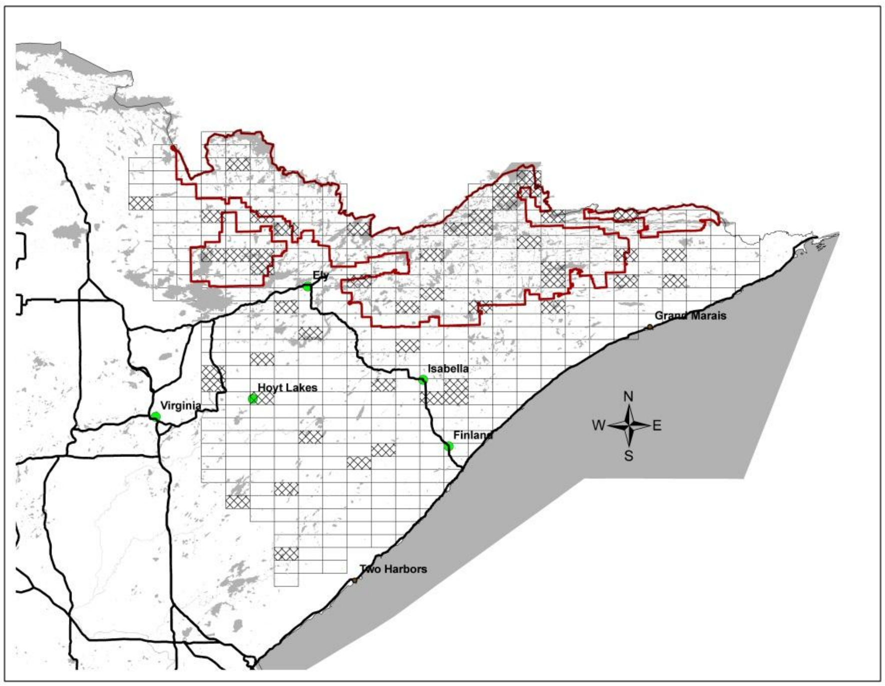

Figure 1. Northeast moose survey area and sample plots (cross hatching) flown in the 2012 aerial moose survey. The red line delineates the boundary of the Boundary Waters Canoe Area Wilderness.

In previous years, we used 3 strata based on expected moose density in an effort to optimize precision of our survey estimates. In 2012, we added a 4th stratum to represent a series of 9 plots that have undergone disturbance (wild fire, prescribed burning, timber harvest). Each year, these same 9 plots will be surveyed in an effort to evaluate the effect of disturbance on moose density.

We accounted for visibility bias by using a sightability model (Giudice et al. 2012). We developed this model between 2004 and 2007 using moose that were radiocollared as part of research on the population dynamics of the northeastern moose population. Logistic regression indicated that the covariate "visual obstruction" (VO) was the most important covariate in determining whether radiocollared moose were observed. We defined VO as the proportion of vegetation within a circle (10m radius or roughly 4 moose lengths) that would prevent you from seeing a moose when circling that spot from an oblique angle. If we observed more than one moose at a location, VO was based on the first moose sighted. We used uncorrected estimates (no visibility bias correction) of bulls, cows, and calves to calculate the bull:cow and calf:cow ratios.

Recent research indicated that variance calculations used in earlier analyses underestimated the total variance of survey estimates (Fieberg in press). We reanalyzed survey data 2004-2011 using the package SightabilityModel in Program R (Fieberg in press, R Development Core Team 2011) to recalculate confidence intervals. Based on this approach, confidence intervals are asymmetrical around the estimates. Minor corrections to our sightability model also modified population estimates slightly (0-4%) from those reported in previous reports.

RESULTS AND DISCUSSION

We initiated the survey on 26 January and completed it on 9 February. Normally the survey begins in early January but the start was delayed because of insufficient snow on the ground in western portions of the survey area. Observers rated survey conditions as "marginal" (low rank) on 17 plots, and "good" (highest rank) on 32 plots. Snow conditions for the survey were <8" on 7 plots, between 8" and 16" on 26 plots, and >16" on 16 plots. During the survey flights, observers located 344 moose on the 49 plots (653 mi^2) including 144 bulls, 140 cows, 55 calves, and 5 unidentified moose. After adjusting for sampling and sightability, we estimated that the moose population in northeastern Minnesota contained 4,230 (3,190 – 5,600) animals (Table 1). Estimates of the calf:cow and bull:cow ratios were 0.36 and 1.08, respectively (Table 1).

Table 1. Estimated moose numbers, 90% confidence interval, calves:cow, % calves, % cows with twins, and bulls:cow from aerial surveys in northeastern Minnesota.

Survey	Estimate	90% Confidence Interval	Calves: Cow	**% Calves**	**% Cows w/ twins**	**Bulls: Cow**
2005	8,160	5,960 – 11,170	0.52	19	9	1.04
2006	8,840	6,670 – 11,710	0.34	13	5	1.09
2007	6,860	5,230 – 9,000	0.29	13	3	0.89
2008	7,890	5,970 – 10,420	0.36	17	2	0.77
2009	7,840	6,190 – 9,910	0.32	14	2	0.94
2010	5,700	4,480 – 7,250	0.28	13	3	0.83
2011	4,900	3,810 – 6,290	0.24	13	1	0.64
2012	4,230	3,190 – 5,600	0.36	15	6	1.08

The 2012 population estimate was 14% lower than the 2011 estimate but the overlap in confidence intervals (Table 1, Figure 2) indicates no statistical difference between the two estimates. Gasaway and Dubois (1987) indicated that even with precise survey estimates, a change of 20% may be required to detect a significant change in population size. Time series analysis of estimates since 2005 indicates a significant downward trend (Figure 2, $P = 0.004$). This corroborates several data sets that suggest the northeastern Minnesota moose population is declining. Lenarz et al, (2010), for example, used simulation modeling to integrate survival and reproductive rates measured between 2002 and 2008 and found that the population was decreasing approximately 15% per year over the long term.

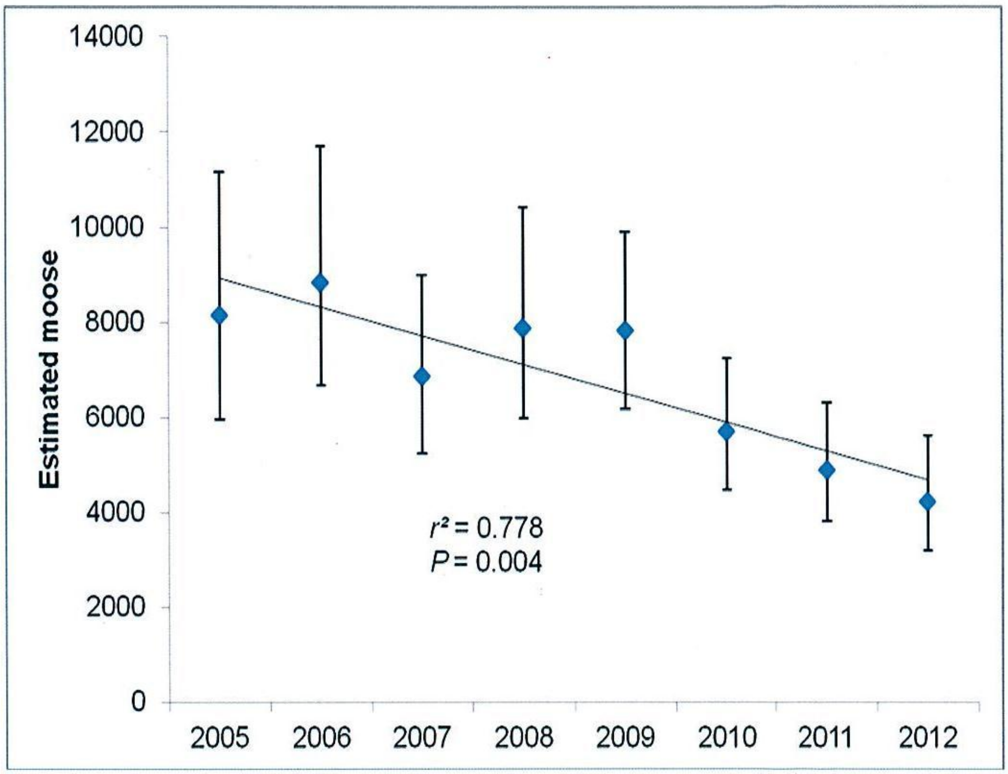

Figure 2. Point estimates, 90% confidence intervals, and trend line of estimated moose numbers in northeastern Minnesota, 2005-2012.

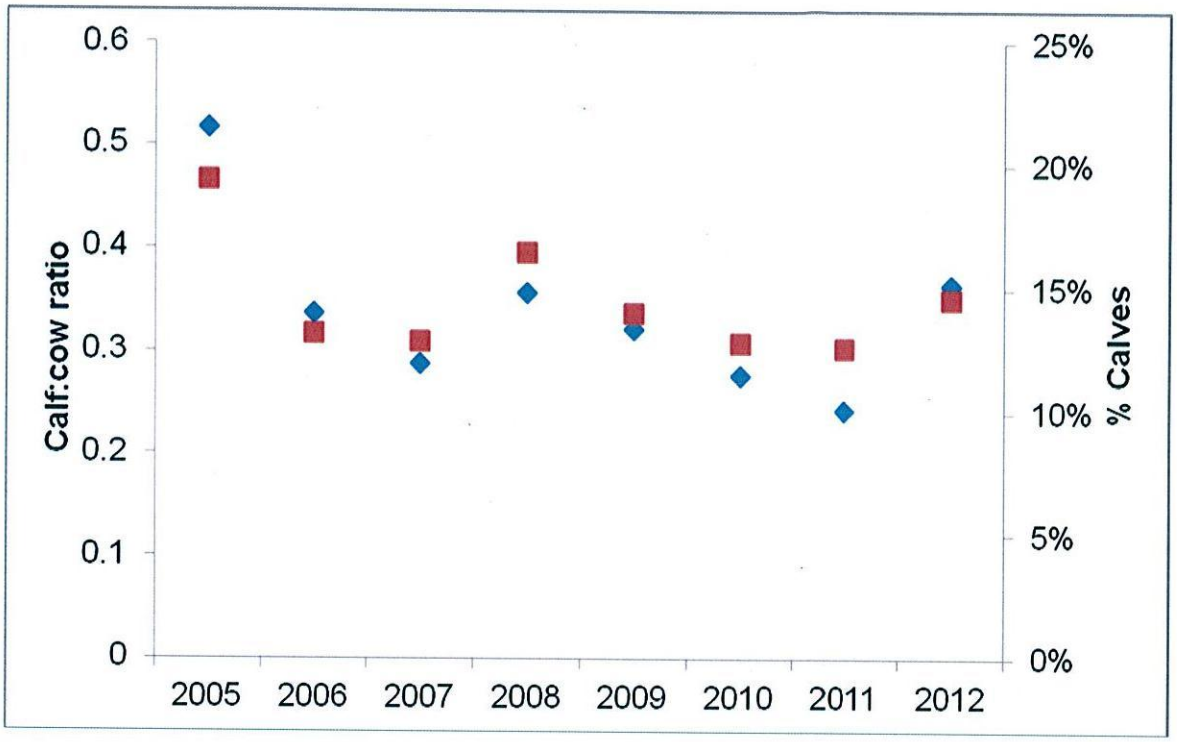

Figure 3. Estimated calf:cow ratio and % calves from aerial moose surveys in northeastern Minnesota.

Estimated recruitment from this year's survey was the highest it has been since 2005 (Table 1). The calf:cow ratio in early February was 0.36 and calves represented 15% of the total moose observed (Table 1). Almost 6% of the cow moose were accompanied by twins (Table 1), up over 5% from 2011. This increase undoubtedly contributed to this year's increased recruitment and it is likely that survival of single calves increased as well. The close agreement between calf:cow ratio and % calves (Figure 3, $r = 0.94$, $P < 0.001$) suggests that classification of adult moose to sex is accurate. Despite the improvement to recruitment, it is important to note, that adult survival is much more important to the population growth rate than calf survival (Lenarz et al. 2010).

The estimated bull:cow ratio (Table 1; Figure 4) increased considerably since 2011 and this suggests that numbers of adult males and females were roughly equal. This year's survey was delayed approximately 3½ weeks and fewer than normal antlered bulls were observed (<10% vs. 20-30%). It is unlikely that the absence of antlers biased the bull:cow ratio higher because cows would have had to be misclassified as bulls, an unlikely consequence of the absence of antlers. Moreover, the close agreement between calf:cow ratio and % calves (Figure 3) suggests that cows were correctly classified.

Several authors have indicated that moose move into thicker conifer cover as the winter progresses and are more difficult to observe (Gasaway et al 1986, Peterson and Page 1993). During the 2012 survey, however, the mean VO was 36 which was within the range observed in previous years (30 – 44). Presumably the moose have not shifted into the thicker cover because of a warmer than normal winter with lower snow depths. Our use of a sightability model should correct for sightability bias even if the moose had shifted to denser conifer cover. It is unlikely, therefore, that the late start of this year's survey biased the population estimates.

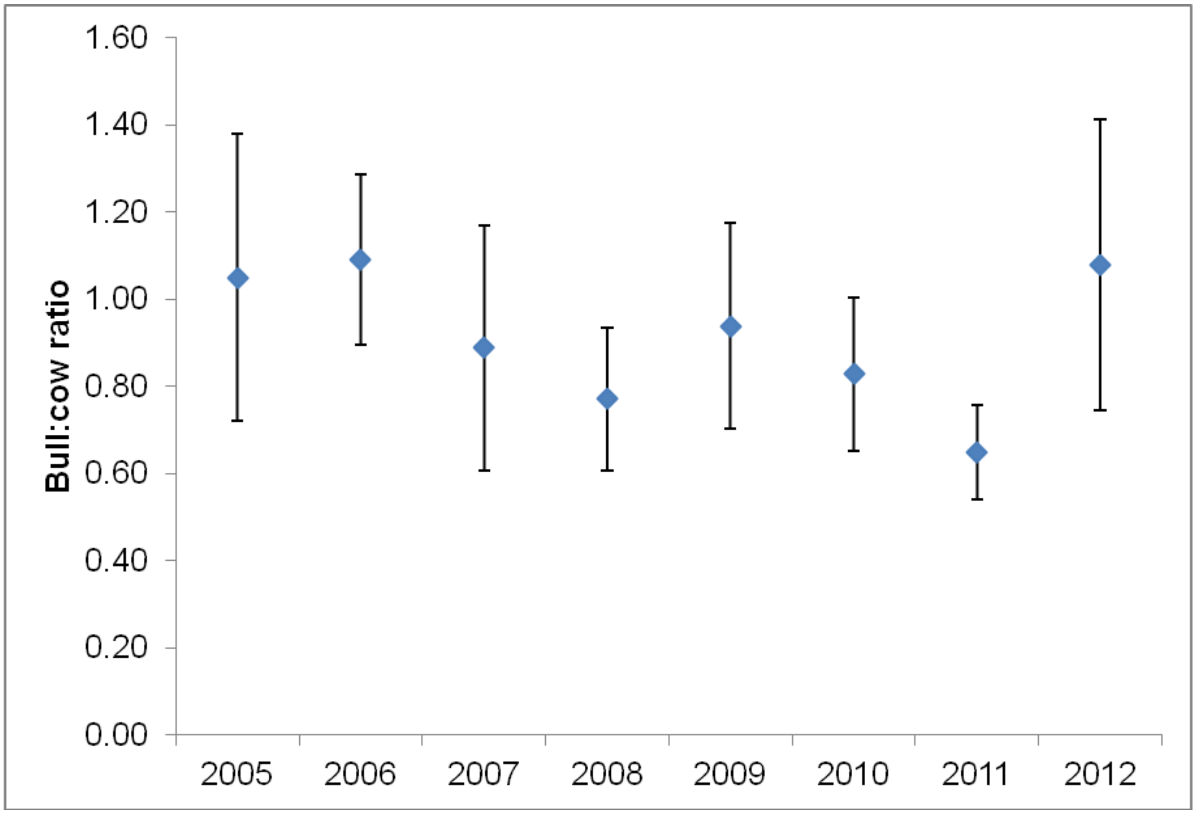

Figure 4. Estimated bull:cow ratio from aerial moose surveys in northeastern Minnesota.

ACKNOWLEDGMENTS

These surveys would not be possible without the excellent partnership between the Division of Enforcement, the Division of Fish and Wildlife, the Fond du Lac Band of Lake Superior Chippewa and the 1854 Treaty Authority. In particular, I would like to thank Al Buchert for coordinating all of the aircraft and pilots; Tom Rusch for coordinating flights and survey crews; and Mike Schrage (Fond du Lac Band of Lake Superior Chippewa) and Andy Edwards (1854 Treaty Authority) for securing supplemental survey funding from their respective groups. I want to thank Enforcement pilots Brad Maas and John Heineman, for their skill in piloting aircraft during the surveys. I also want to thank Tom Rusch, Andy Edwards, Mike Schrage, Nancy Gellerman, and Lance Overland who flew as observers; it takes dedication and a strong stomach. I want to thank Barry Sampson for the creating the process to generate the GIS survey maps and GPS coordinates for the transect lines. Finally, I want to thank Bob Wright, Brian Haroldson and Chris Pouliot for the creation of the program DNRSurvey and Bob's assistance in modifying this software for use on this year's moose survey.

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WETLAND WILDLIFE POPULATIONS

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2012 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 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, Figure 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.

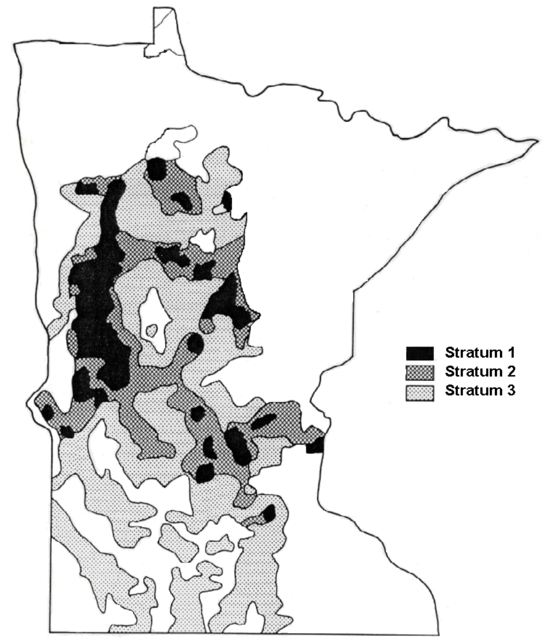

Figure. 1. Location of waterfowl breeding population survey strata in Minnesota.

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 (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 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; Figure 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, Figure 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, Figure 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, Figure 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, Figure 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, Figure 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.

Air Crew: Pilot/Observer: Tom Pfingsten, Conservation Officer Pilot, MNDNR, Division of Enforcement; Observer: Steve Cordts, Waterfowl Staff Specialist, MNDNR, Division of Wildlife

Ground Crew Leaders: Sean Kelly, Asst. Chief, Migratory Bird & Refuges, USFWS, Region III, Twin Cities; Wayne Brininger, USFWS, Tamarac National Wildlife Refuge; Dan Hertel and Fred Oslund, USFWS, HAPET, Fergus Falls; Paul Richert, Tom Cooper, and Jim Kelley, USFWS, Region III, Twin Cities; Kim Bousquet, USFWS, Big Stone National Wildlife Refuge; Greg Dehmer and Sally Zodrow, USFWS, Sherburne National Wildlife Refuge
Ground Crew Assistants: Brad Nylin, Minnesota Waterfowl Association; Jihadda Govan and K. Halver, USFWS, Big Stone National Wildlife Refuge; Lowell Deede and Gina Kemper, USFWS, Tamarac National Wildlife Refuge ; Ben Anderson and Paul Soler, USFWS, Sherburne National Wildlife Refuge; Joe Braun and Kelsey Norton, USFWS, HAPET, Fergus Falls; Tim Moser, USFWS, retired

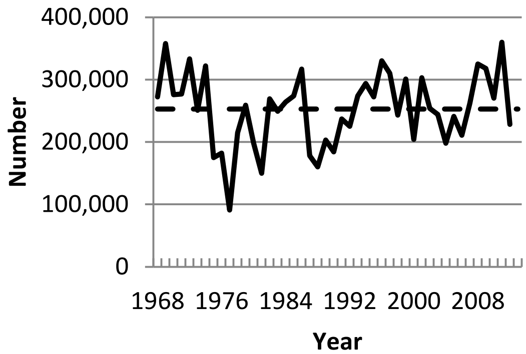

Figure 2. Number of May ponds (Types II-V) and long-term average (dashed line) in Minnesota, 1968-2012.

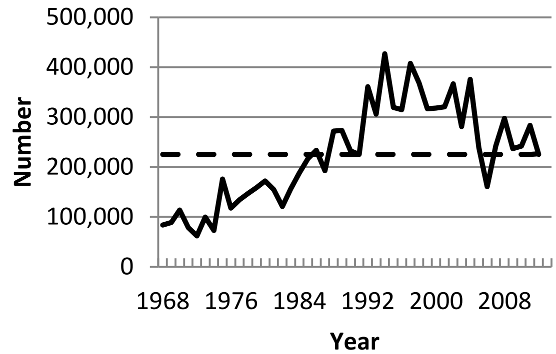

Figure 3. Mallard population estimates (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1968-2012.

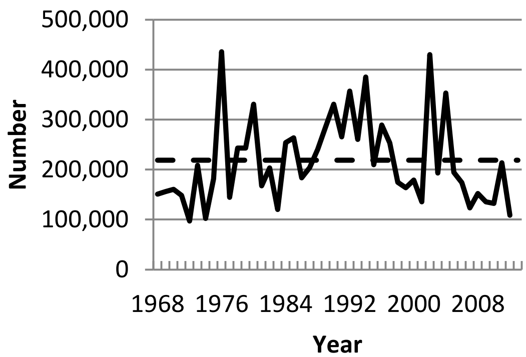

Figure 4. Blue-winged teal population estimates (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1968-2012.

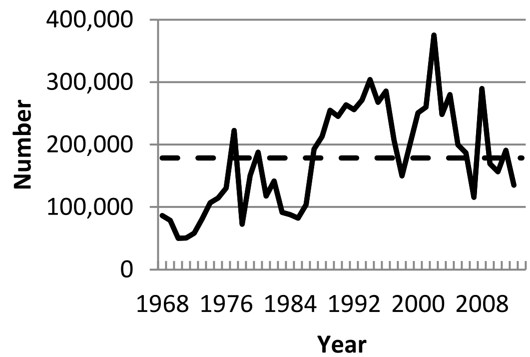

Figure 5. Other duck (excluding scaup) population estimates (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1968-2012

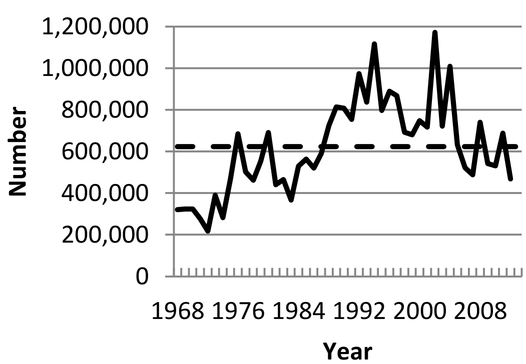

Figure 6. Total duck (excluding scaup) population estimates (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1968-2012

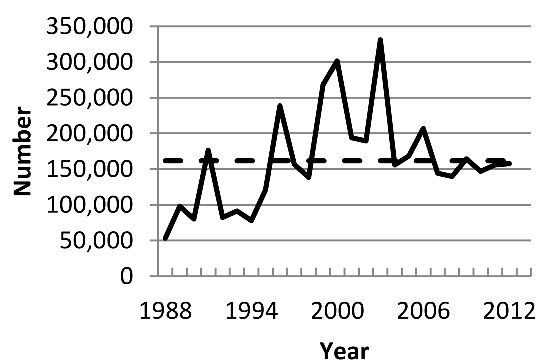

Figure 7. Canada goose population (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1988-2012.

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Table 1. Survey design for Minnesota, May 2012.[1]

	Stratum			
	1	2	3	Total
Survey design				
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	
Current year coverage				
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.

	Year																		
Species	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.

	Year																		
Species	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.

	Year																		
Species	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.

	Year																		
Species	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.

	Mallard				Blue-winged teal				Other ducks (exc. scaup)		
Year	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

Table 7. Cont.

	Mallard				Blue-winged teal				Other ducks (exc. scaup)		
Year	Unad. PI	VCF	PI	SE	Unad. PI	VCF	PI	SE	Unad. PI	VCF	PI
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
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%

	Scaup			Total Ducks (exc. scaup)		Total ducks		Canada geese		
Year	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

	Scaup			Total Ducks (exc. scaup)		Total ducks		Canada geese		
Year	Unad. PI	VCF	PI	Unad. PI	PI	Unad. PI	PI	Unad. PI	VCF	PI
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
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).

		Temperature (F) for week ending:															Precipitation departure from normal
		22-April		29-April		6-May		13-May		20-May		Total weekly precipitation (inches)					
Region	City	Avg[1]	Depart[2]	Avg[1]	Depart[2]	Avg[1]	Depart[2]	Avg[1]	Depart[2]	Avg[1]	Depart[2]	22-April	29-April	6-May	13-May	20-May	1 Apri1-May 20
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
	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
C	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															
	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
EC	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																
	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
SW	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.

Waterfowl information is taken from the U.S. Fish and Wildlife Service report Waterfowl Population Status, 2012 by Kathy Fleming, Pamela 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, 1971-2012 (from: U.S. Fish and Wildlife Service. 2012. Waterfowl population status, 2012. U.S. Department of the Interior, Washington, D.C. U.S.A.).

Year	Population[a]
1972	95.0
1973	116.6
1974	96.7
1975	121.5
1976	168.4
1977	110.8
1978	111.2
1979	72.8
1980	n.a.
1981	78.9
1982	96.4
1983	92.8
1984	112.0
1985	105.6
1986	126.4
1987	145.9
1988	137.0
1989	132.1
1990	163.4
1991	167.4
1992	158.4
1993	136.2
1994	136.2
1995	139.0
1996	141.0
1997	130.5
1998	99.3
1999	139.5
2000	130.0
2001	122.2
2002	152.0
2003	122.4
2004	145.5
2005	161.6
2006	134.8
2007	153.4

Year	Population[a]
2008	161.1
2009	169.2
2010	172.6
2011	133.1
2012	116.3

[a] Number of indicated singles (x2) and breeding pairs.

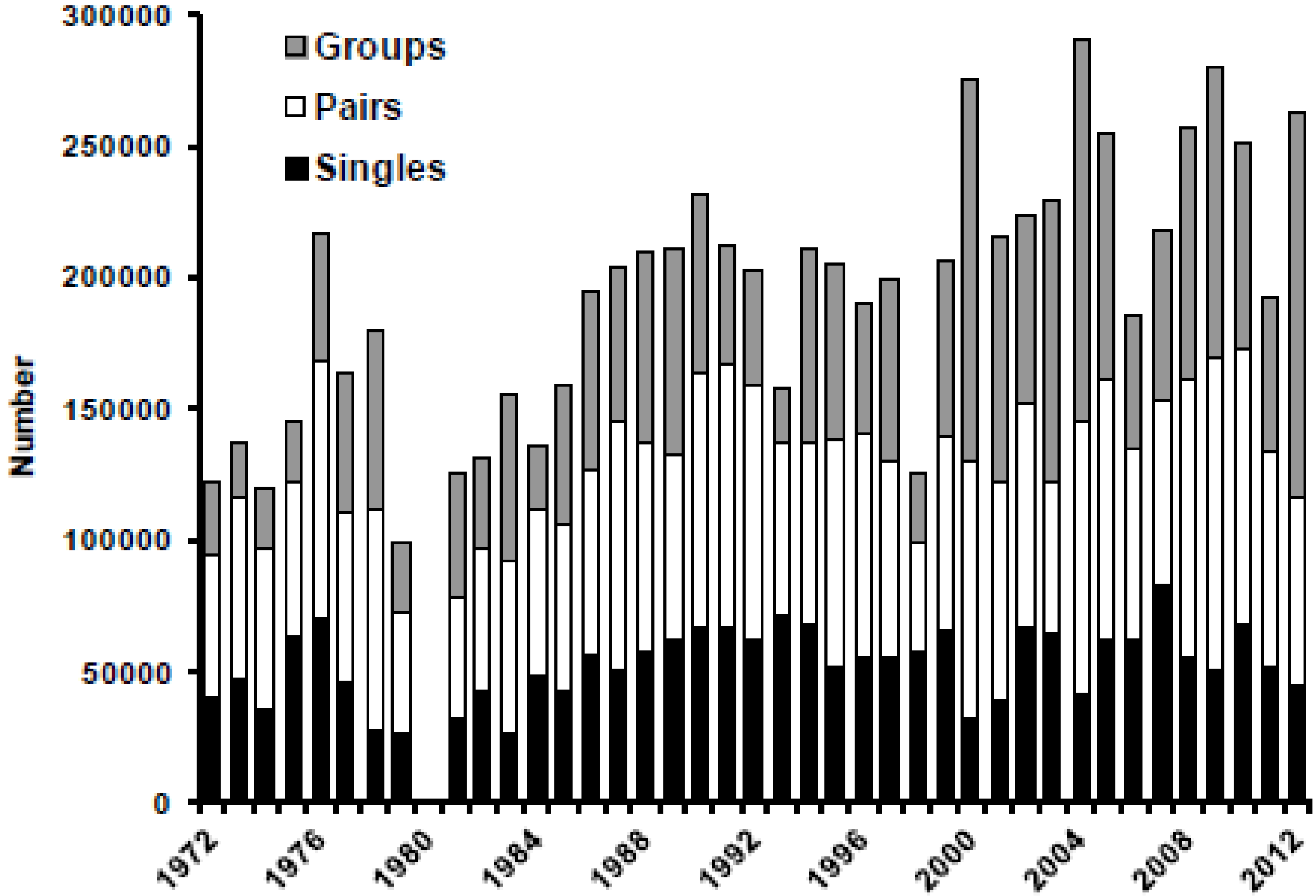

Figure 1. Breeding ground survey estimates of the Eastern Prairie Population of Canada geese, 1972-2012. (from: Baldwin, F., J. Wollenberg, and B. Lubinski. 2012. 2012 EPP Breeding Population Survey. Unpublished report prepared for the Mississippi Flyway Council Technical Section). Data not available for 1980.

Table 2. Estimated number of May ponds (adjusted for visibility) in Prairie Canada (portions of Alberta, Saskatchewan and Manitoba) 1967-2011 and north-central U.S. (North Dakota, South Dakota and Montana) 1974-2011. (from: U.S. Fish and Wildlife Service. 2011. Waterfowl population status, 2011. U.S. Department of the Interior, Washington, D.C. U.S.A.)

	Ponds (thousands)	
Year	Prairie Canada	North Central U.S.[a]
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
2010	3,729	2,936
2011	4,893	3,239
2012	3,885	1,659
Average	3,457	1,651
% Change in 2012 from:		
2011	- 21	- 49
Long term Average	+ 12	+ 1

[a] No comparable survey data available for the north-central U.S. during 1967-73.

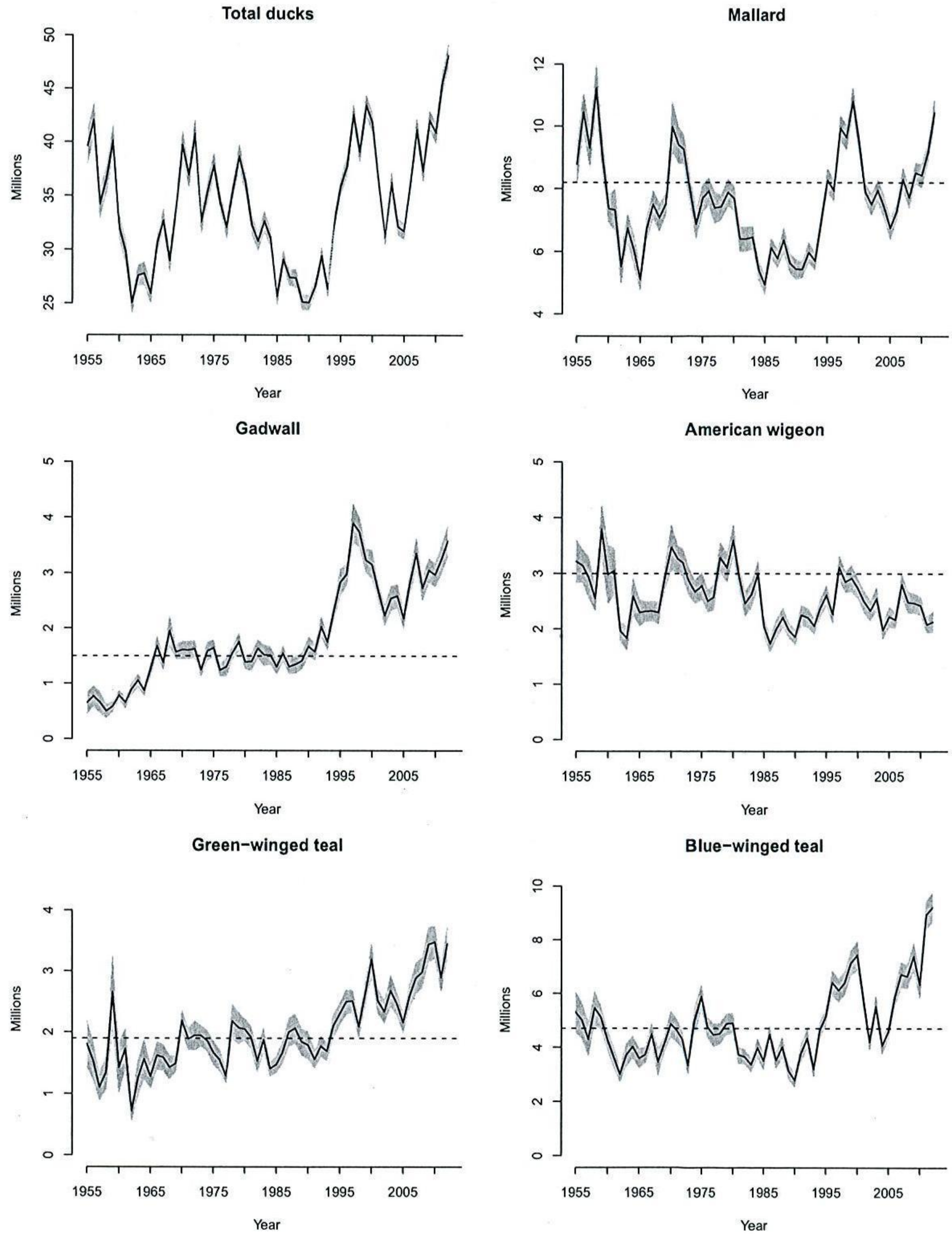

Figure 2. Estimates of North American breeding populations, 95% confidence intervals, and North American Waterfowl Management Plan population goal (dashed line) for selected species and number of water areas in May in Prairie Canada and Northcentral U.S. (from: U.S. Fish and Wildlife Service. 2012. Waterfowl population status, 2012. U.S. Department of the Interior, Washington, D.C. U.S.A.)

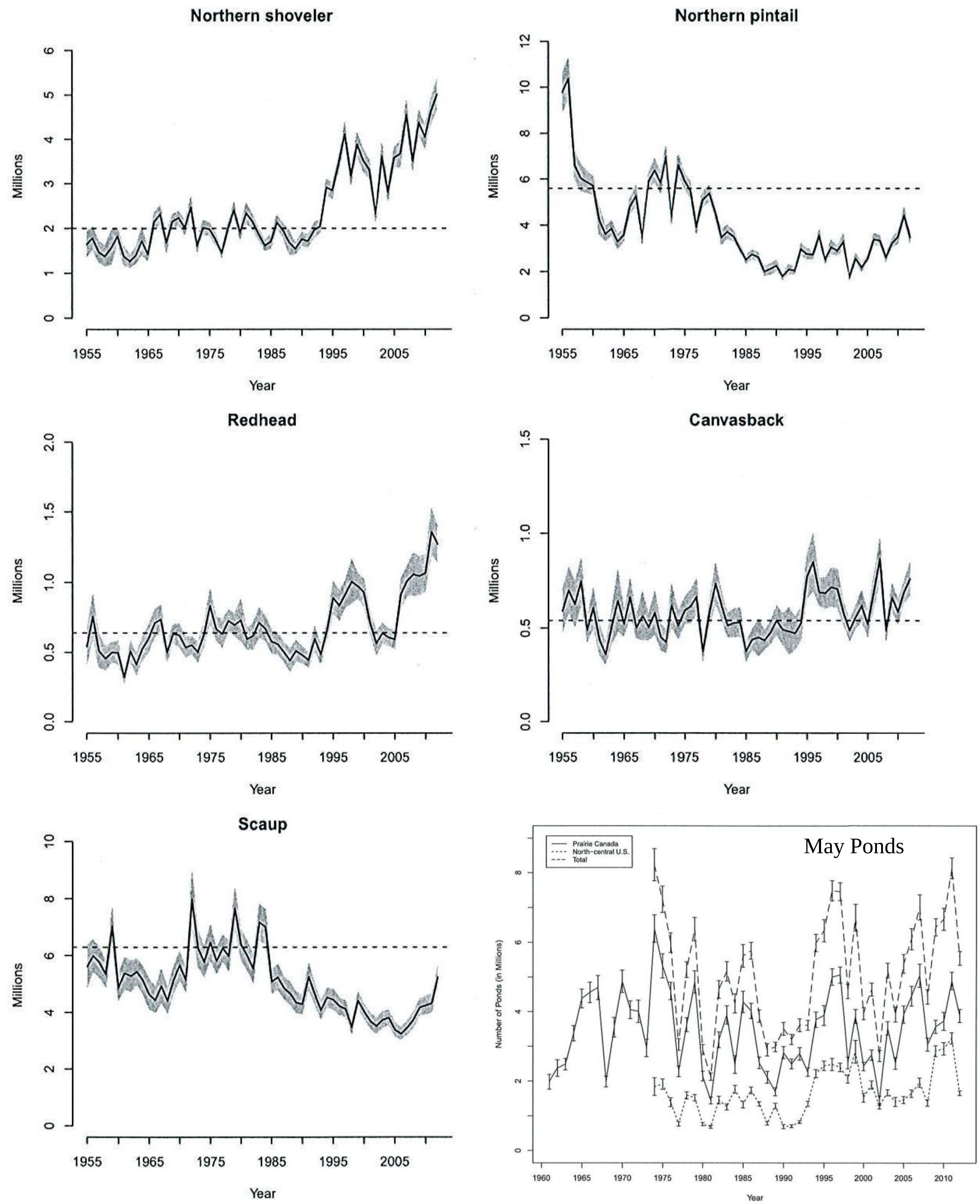

Figure 2. (continued).

2012 MINNESOTA SPRING CANADA GOOSE SURVEY

David Rave, Wetland Wildlife Populations and Research Group

INTRODUCTION

This report presents results from the eleventh 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).

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 ≥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. Prior to 2011, 30 plots were randomly selected in each of the 5 remaining strata using ArcView's AlaskaPak extension, and these 150 plots were surveyed at low level using a helicopter. The stratification was modified slightly in 2011 to include a binary stratification variable (zone), which permitted a domain analysis of total geese in a proposed new hunting zone (Figure 1). Thus, the 9 strata for 2012 were Forest–12, Transition–12new, Transition–12other, Transition–3new, Transition– 3other, Prairie–12new, Prairie–12other, Prairie–3new, and Prairie–3other. Thirty plots (quartersections) were randomly selected from strata in the new zone (using proportional allocation) and 130 plots were selected from strata not in the new zone for a total of 160 sample plots (Figure 1). Ideally, the survey should be conducted during mid-incubation.

Pilot John Heineman and I flew the survey on 6 days between 16 and 23 April, 2012. 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.

RESULTS AND DISCUSSION

The total Canada goose population estimate in the surveyed area for 2012 was 416,198 (±132,344). Adding 17,500 for the Twin Cities metro area (Cooper 2004) yields a statewide estimate of 433,698 (Table 1). Relative error (95% CI half-width) was 31.8% of the estimate. The survey tallied 30.0% singles, 49.6% pairs, and 20.4% 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 2012, 35.1% of the geese seen were classified as Productive Geese (Table 2).

The 2012 Canada goose breeding population estimate for the surveyed area was similar to the 2011 estimate, although goose numbers appeared to be higher in the Transition and Forest regions (Table 1). A time-series plot suggested the goose population in the survey area has been reasonably stable over the last 12 years, with an increasing trend over the past 4 years (Figure 2). The estimated breeding population in the proposed new hunting zone was 127,220 (±64,628), which was similar to the 2011 estimate for this zone (151,699±105,319).

Weather conditions in 2012 were characterized by warmer than normal March temperatures and record early lake ice-out statewide, and normal weather throughout most of the incubation period and during the survey period. The early spring and the number of productive geese observed this year indicates that 2012 will likely be a very good year for Canada goose production. Weather conditions throughout May and June may influence goose productivity. Regardless, the 2012 Canada goose population estimate remained well above the state Canada goose population goal of 250,000 geese.

Wetland and habitat quality were variable in the state this year. Wetland conditions were drier than average throughout the state. However, timely rainfall in late April and early May moderated the dry conditions. Due to the early spring weather conditions, which will lead to large broods, and the high number of geese in the population, I expect average to above average Canada goose production throughout the state again in 2012.

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 and Michael Trenholm piloted the helicopter and served as the second observer. Robert Wright provided GIS expertise. John Giudice provided statistical assistance. Christine Herwig helped with printing aerial photos. Cindy Kuettel helped with excel graphics.

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Maxson, S.J. 2002. 2002 Minnesota Spring Canada Goose Survey. Unpublished Report.

Table 1. Spring Canada goose population estimates in Minnesota, 2001-2012.

Year	Prairie	Transition	Forest	Subtotal	95% CI	Metro	**TOTAL**
2001	77,360	95,470	92,390	265,220	±69,500	20,000	**285,220**
2002	135,850	144,900	33,940	314,690	±134,286	20,000	**334,690**
2003	106,520	121,290	56,420	284,230	±78,428	20,000	**304,230**
2004	128,501	130,609	95,636	354,747	±107,303	20,000	**374,747**
2005	113,939	149,286	57,529	320,754	±90,541	17,500	**338,254**
2006	126,042	164,085	67,994	358,071	±108,436	17,500	**375,571**
2007	137,151	99,274	25,509	261,933	±80,167	17,500	**279,433**
2008*	113,483	127,490	30,400	271,372	±69,055	17,500	**288,872**
2009	129,115	114,737	23,644	267,496	±70,607	17,500	**284,996**
2010	83,911	151,902	57,421	293,234	±70,760	17,500	**310,734**
2011	143,266	117,711	91,199	352,175	±119,814	17,500	**369,674**
2012	144,762	166,727	104,710	416,198	±132,344	17,500	**433,698**

*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 2008-2012 are based on the updated sampling frame.

Table 2. Percent of Canada Geese seen as singles, pairs, groups, and productive geese on the Minnesota Spring Canada Goose Survey, 2001-2012.

Year	Singles[1]	Pairs[1]	Groups	Productive Geese[2]	Dates of Survey
2001	27.0	63.9	9.1	36.4	4/14 to 5/02/2001
2002	30.7	52.0	17.2	41.5	4/26 to 5/11/2002
2003	27.9	58.2	13.9	29.3	4/22 to 5/01/2003
2004	26.5	57.5	16.0	35.5	4/22 to 5/04/2004
2005	33.0	50.2	16.8	40.7	4/20 to 5/03/2005
2006	43.5	45.9	10.6	50.3	4/24 to 5/05/2006
2007	31.0	51.5	17.5	36.2	4/23 to 4/28/2007
2008	38.4	55.4	6.2	42.6	4/23 to 5/05/2008
2009	41.8	50.7	7.5	45.2	4/21 to 5/01/2009
2010	42.5	48.2	9.3	46.6	4/15 to 4/20/2010
2011	50.3	47.2	2.6	55.7	4/21 to 4/29/2011
2012	30.0	49.6	20.4	35.1	4/16 to 4/23/2012

[1]Singles and pairs were doubled before calculating proportions.
[2]Productive geese equals Singles + Pairs with nests.

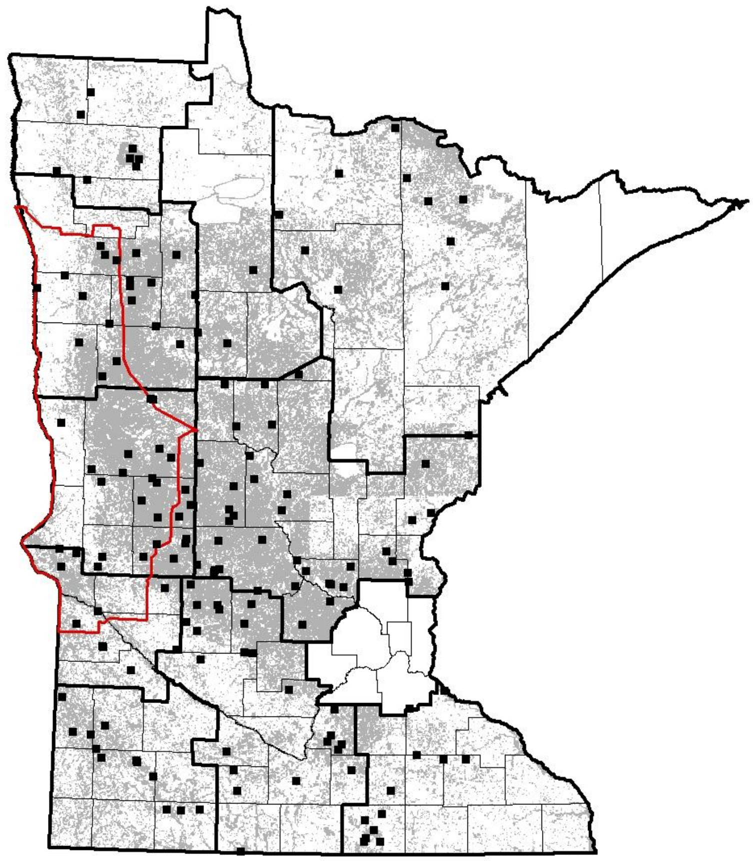

Figure 1. Location of 160 ¼ mi^2 plots surveyed for the 2012 Canada goose breeding pair survey within 3 ecoregions of Minnesota; forest, transition, and prairie. Red outlined polygon is the location of a possible "new" Early Season Canada goose hunting zone.

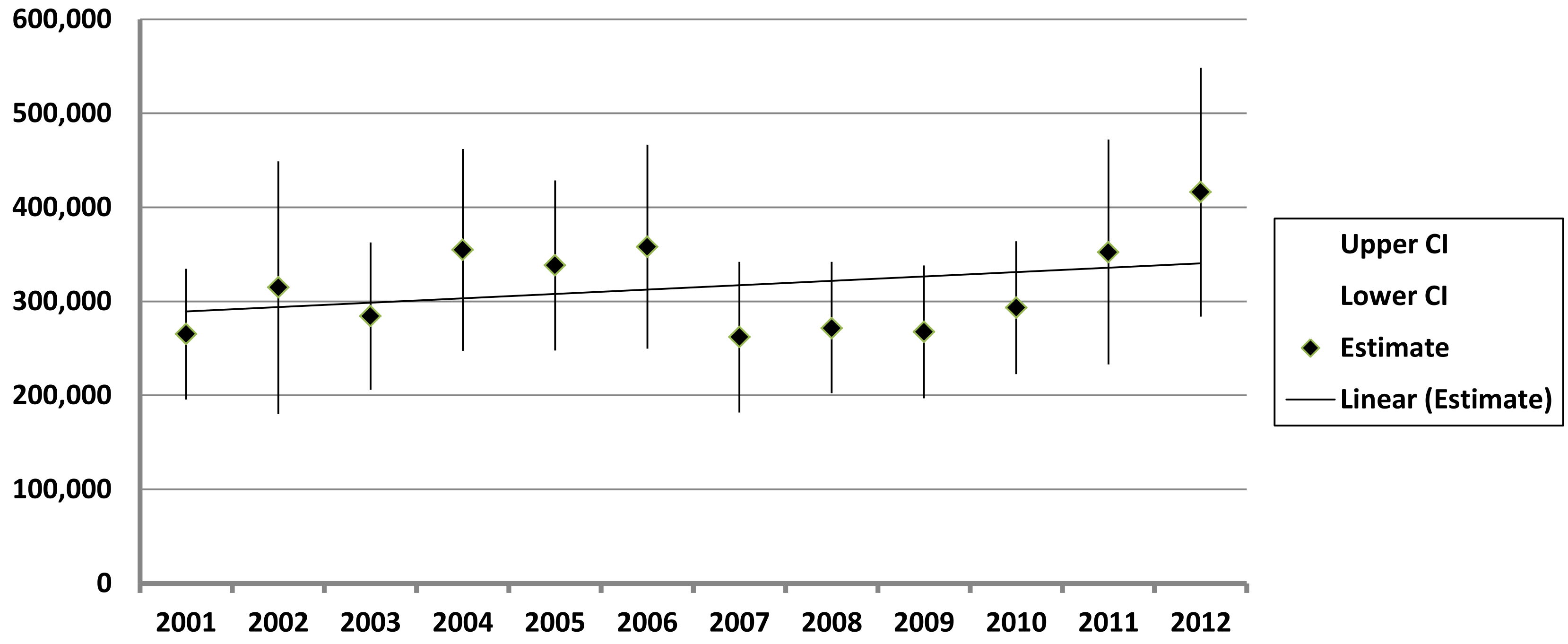

Figure 2. Spring Canada goose population estimates (±95% CI) in Minnesota, 2001-2012. (Does not include Metro area.)

Mourning dove information is taken from the U.S. Fish and Wildlife Service report by Seamans, M.E., R.D. Rau, and T.A. Sanders. 2012. Mourning dove population status, 2012. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 37 pp. The entire report is available on the Division of Migratory Bird Management web site (http://www.fws.gov/migratorybirds/NewReportsPublications/PopulationStatus.html).

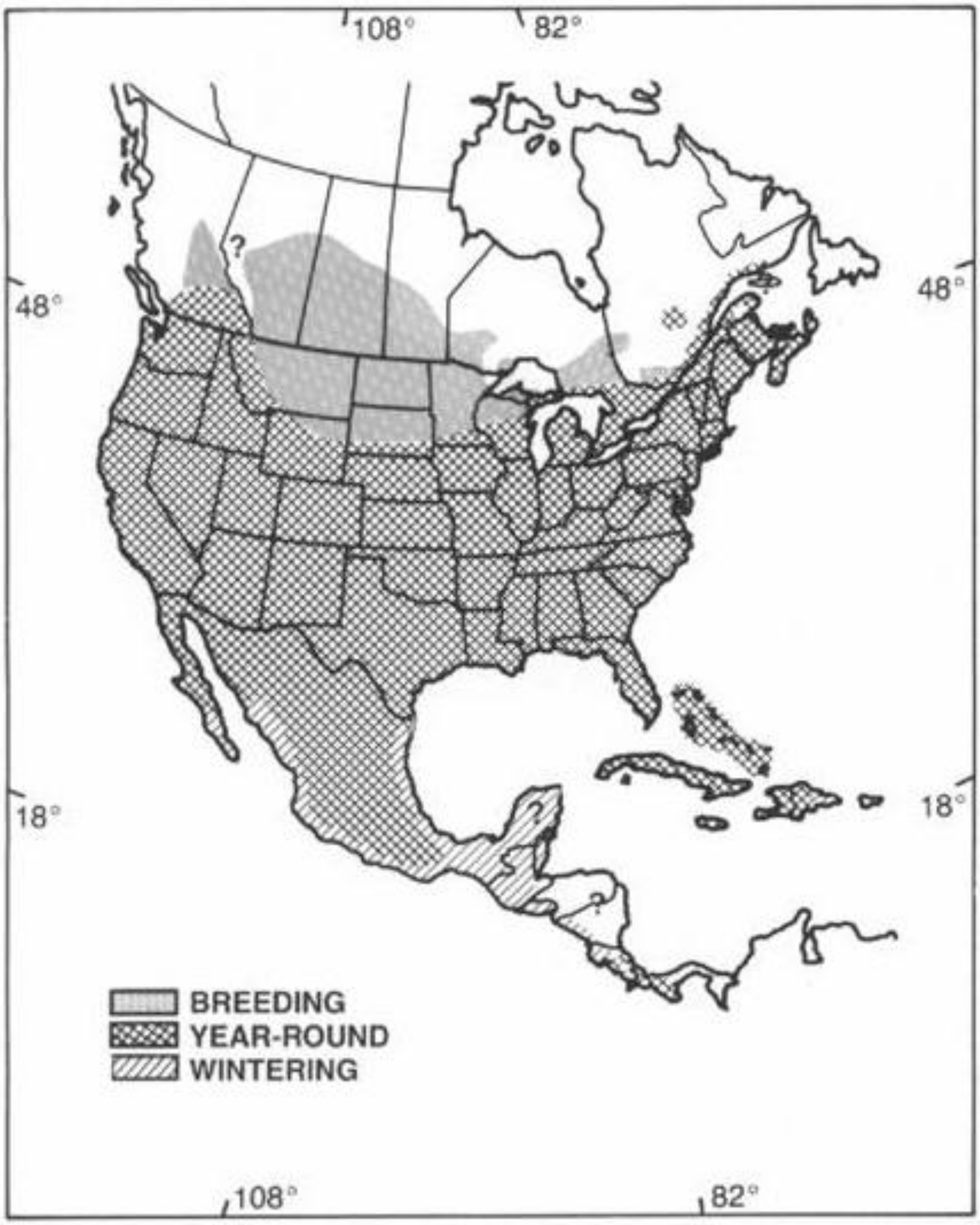

Figure 1. Breeding and wintering ranges of the mourning dove (adapted from Mirarchi and Baskett 1994). (From: Seamans, M.E., R.D. Rau, and T.A. Sanders. 2012. Mourning dove population status, 2012. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 37 pp.)

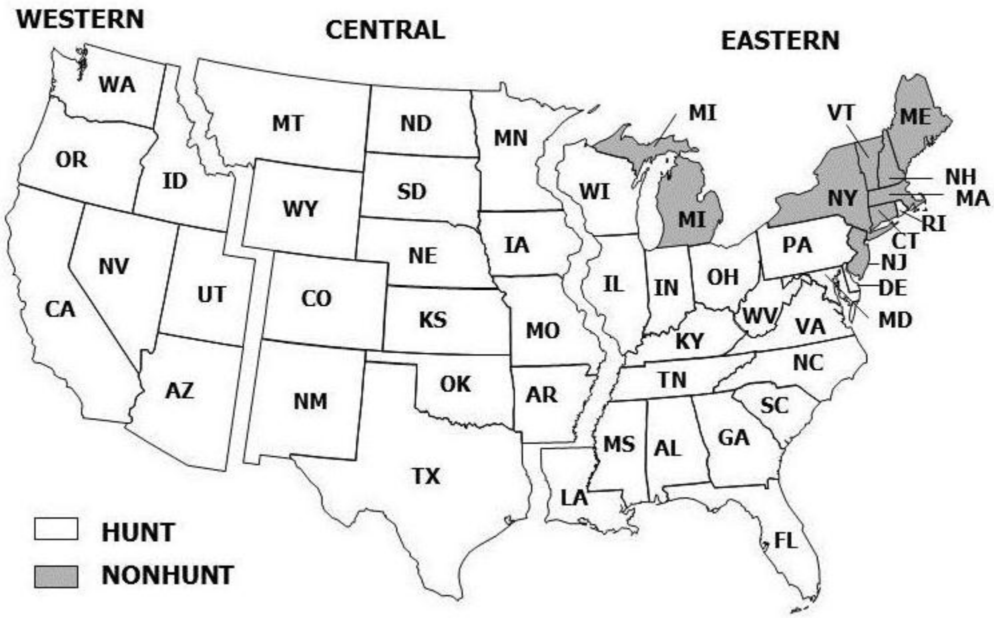

Figure 2. Mourning dove management units with 2011 hunting and non-hunting states. (From: Seamans, M.E., R.D. Rau, and T.A. Sanders. 2012. Mourning dove population status, 2012. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 37 pp.)

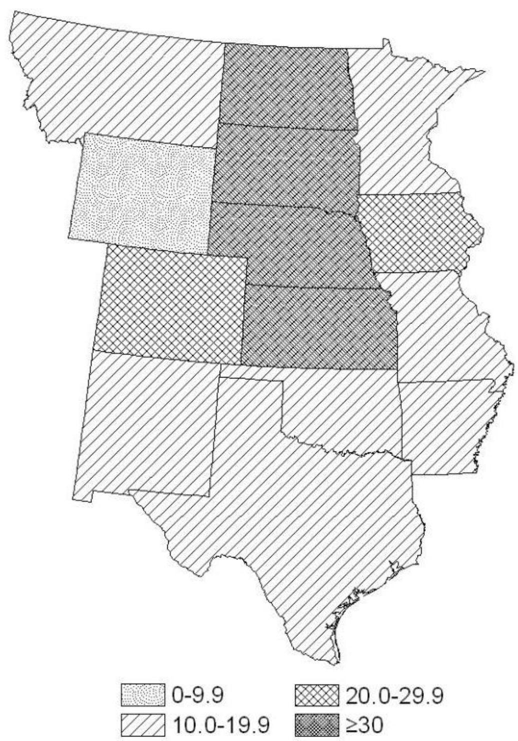

Figure 3. Mourning dove abundance in the Central Management Unit, based on the mean of the 2 CCS-heard index values from the last 2 years (2011-12). (From: Seamans, M.E., R.D. Rau, and T.A. Sanders. 2012. Mourning dove population status, 2012. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 37 pp.)

Table 1. Preliminary estimates and 95% confidence intervals (CI, expressed as the interval half width in percent) of mourning dove harvest and hunter activity for the Central management unit during the 2009, 2010 and 2011 seasons [a]. (From: Seamans, M.E., R.D. Rau, and T.A. Sanders. 2012. Mourning dove population status, 2012. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 37 pp.)

Management unit / State	Active Hunters			Hunter Days Afield			Total Harvest		
	2009	2010	2011	2009	2010	2011	2009	2010	2011
CENTRAL	393,400 † [b]	406,100 †	427,700 †	1,312,700	1,362,300	1,444,800	7,474,600 ± 12	7,194,900 ± 10	7,657,700
AR	22,400 ±19	23,900 ±20	25,300 ±20	53,800 ± 26	63,300 ± 28	63,800 ±34	353,500 ± 21	446,400 ± 28	519,300 ±43
CO	20,300 ± 13	15,900 ± 14	15,300 ±14	45400 ± 18	38,400 ± 19	44,500 ±24	242,400 ± 17	172,000 ± 18	178,700 ±14
IA			5,800 ±11			19,000 ±17			56,800 ±21
KS	29,400 ± 10	28,200 ± 10	32,800 ±10	97,000 ± 14	93,900 ± 13	95,800 ±15	572,600 ± 16	511,200 ± 15	534,800 ±18
MN	6,800 ± 36	10,000 ± 42	9,400 ±49	24,100 ± 64	55,300 ± 115	25,100 ±51	61,500 ± 67	98,900 ± 58	57,300 ±40
MO	21,500 ± 16	29,300 ± 10	31,600 ±11	58,700 ± 21	75,200 ± 14	74,600 ±14	294,700 ± 26	426,000 ± 20	359,600 ±16
MT	2,500 ± 32	1,600 ± 35	2,200 ±37	6,400 ± 46	4,700 ± 44	5,900 ±47	12,700 ± 32	17,400 ± 36	14,400 ±61
NE	16,000 ± 12	15,800 ± 14	15,500 ±16	51,800 ± 15	49,700 ± 21	46,900 ±28	277,600 ± 17	276,400 ± 19	265,500 ±23
NM	7,800 ±16	5,900 ±20	6,700 ±39	35,700 ± 26	21,000 ± 20	24,600 ±49	170,200 ± 26	128,000 ± 29	76,900 ±42
ND	2,800 ± 28	3,800 ± 28	3,700 ±25	10,800 ± 50	11,800 ± 37	10,400 ±29	40,000 ± 31	54,200 ± 38	41,800 ±31
OK	18,600 ± 12	19,500 ± 14	17,100 ±15	55,500 ± 15	51,300 ± 22	54,200 ±25	378,400 ± 17	268,700 ± 28	379,400 ±33
SD	6,500 ± 19	5,000 ± 21	6,200 ±21	21,700 ± 23	14,200 ± 26	16,300 ±26	105,400 ± 24	64,300 ± 23	87,200 ±26
TX	236,600 ± 10	244,600 ± 10	253,200 ±11	846,200 ± 12	876,500 ± 10	958,600 ±16	4,945,100 ± 18	4,699,300 ± 14	5,061,100 ±13
WY	2,300 ± 27	2,700 ± 26	2,700 ±30	5,800 ± 31	7,100 ± 32	5,100 ±38	20,600 ± 31	32,100 ± 36	25,000 ±52

[a] Hunter number estimates at the Management Unit and national levels may be biased high, because the HIP sample frames are state specific; therefore hunters are counted more than once if they hunt in >1 state. Variance is inestimable.

[b] † No estimate available.

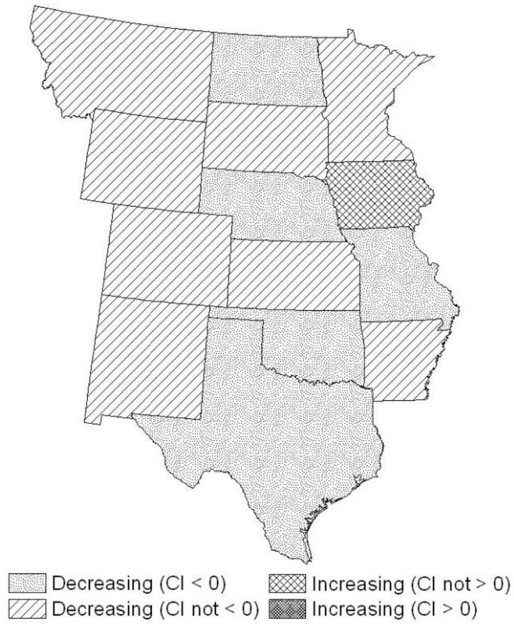

Figure 4. Trend in mourning dove abundance by state in the Central Management Unit over the last 10 years (2003-2012) based on CCS-heard data. Credible intervals (CI, 95%) that exclude zero provide evidence for an increasing or decreasing trend (From: Seamans, M.E., R.D. Rau, and T.A. Sanders. 2012. Mourning dove population status, 2012. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 37 pp.)

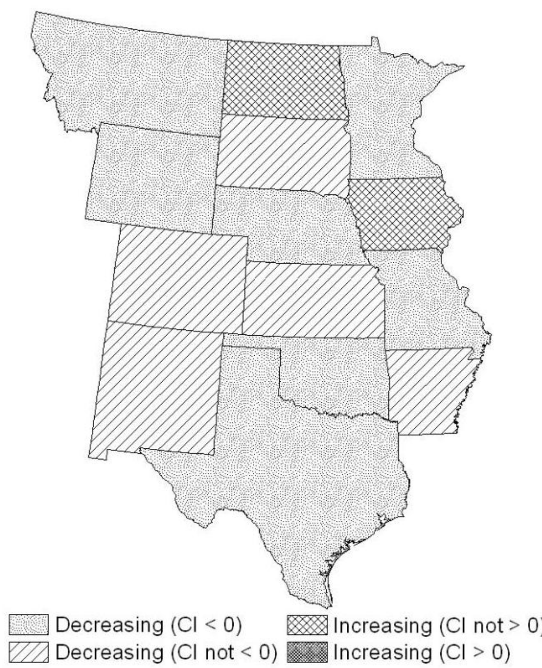

Figure 5. Trend in mourning dove abundance by state in the Central Management Unit over the last 47 years (1966-2012) based on CCS-heard data. Credible intervals (CI, 95%) that exclude zero provide evidence for an increasing or decreasing trend. (From: Seamans, M.E., R.D. Rau, and T.A. Sanders. 2012. Mourning dove population status, 2012. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 37 pp.)

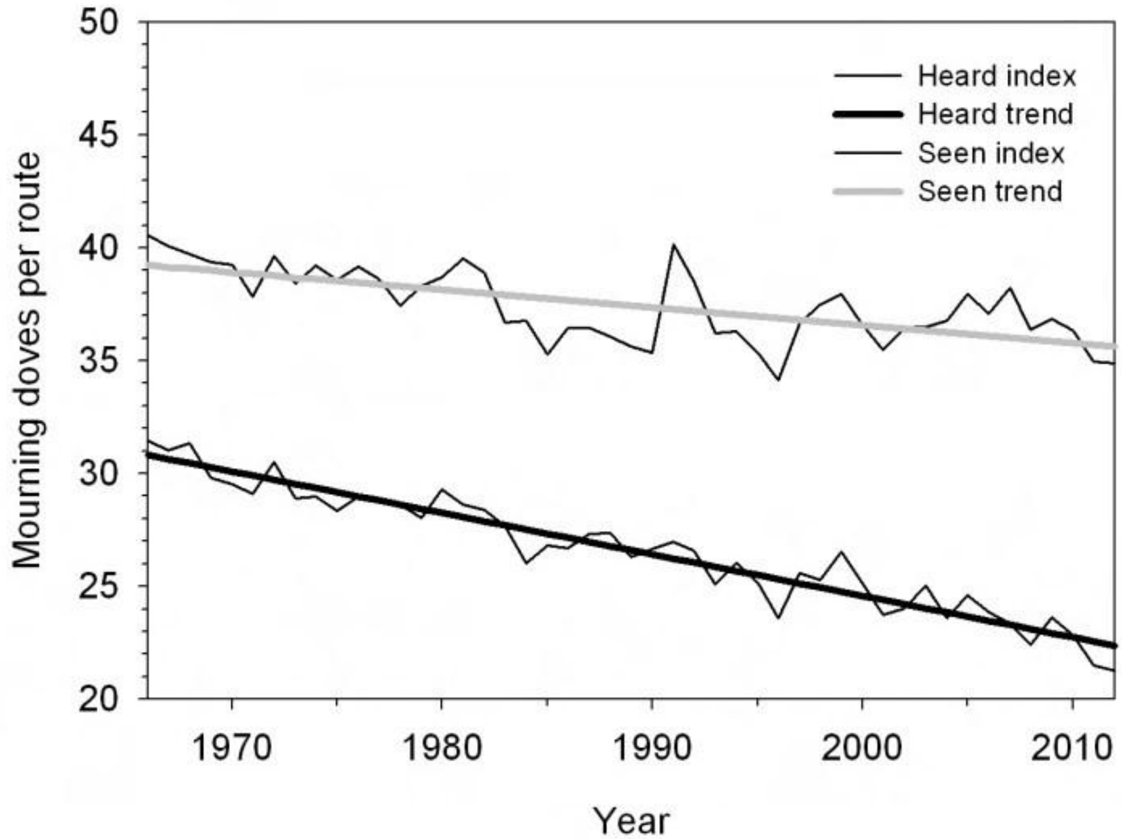

Figure 6. Mourning dove abundance indices and predicted trends in the Central Management Unit based on CCS data, 1966-2012. Trend lines are exponentiated predicted values from fitting a regression line through the log transformed annual indices. (From: Seamans, M.E., R.D. Rau, and T.A. Sanders. 2012. Mourning dove population status, 2012. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 37 pp.)

American Woodcock information is taken from the U.S. Fish and Wildlife Service report American Woodcock Population Status, 2012. Cooper, T.R. and R.D. Rau. Us. Fish and Wildlife Service, Laurel, MD. 16 pp.
The entire report is available on the Division of Migratory Bird Management home page (http://www.fws.gov/migratorybirds/NewReportsPublications/PopulationStatus.html).

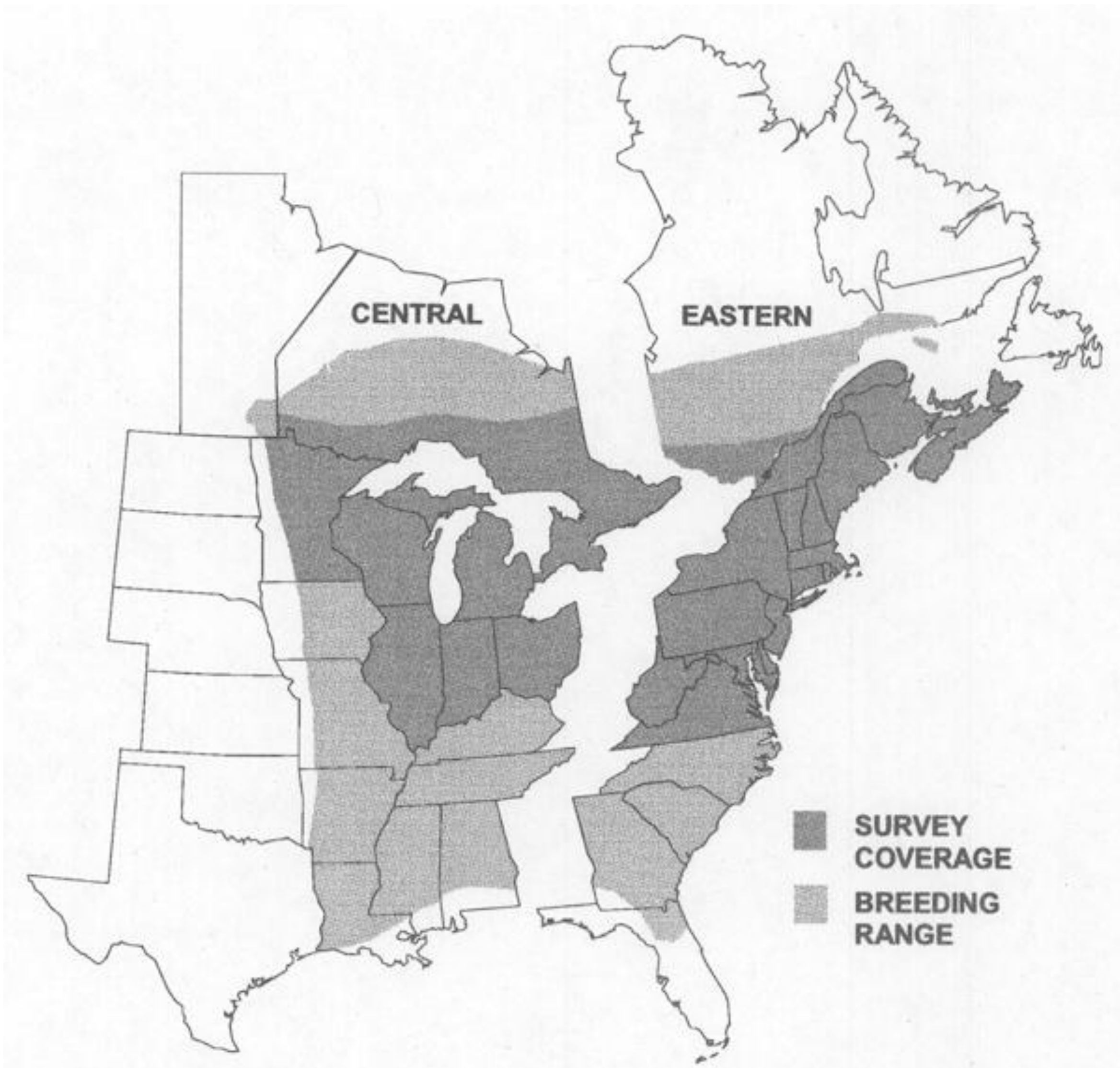

Figure 1. Woodcock management regions, breeding range, singing-ground survey coverage, (from: Cooper, T.R. and R.D. Rau. 2012. American woodcock population status, 2012. U.S. Fish and Wildlife Service, Laurel, MD. 16 pp.).

Table 1. Short term (2011 – 12), 10 –year (2002-2012), and long-term (1968-2012) trends (% change per year [a]) in the number of American woodcock heard during the Singing-ground Survey as determined by using the hierarchical log-linear modeling technique (Sauer et al. 2008) (from: Cooper, T.R. and R.D. Rau. 2012. American woodcock population status, 2012. U.S. Fish and Wildlife Service, Laurel, MD. 16 pp.).

Management Unit/State	Number of Routes[b]	n[c]	(2011-12) % Change	(2002-12) % Change	(1968-12) % Change
CENTRAL	439	721	1.28	0.20	- 0.77
IL	39	45	- 38.68	- 7.59	- 1.20
IN	16	60	- 3.16	- 3.06	- 4.32
MB[d]	13	30	- 6.30	3.73	- 0.10
MI	99	151	1.75	- 0.09	- 0.86
MN	77	120	- 2.03	2.16	0.25
OH	34	72	- 1.42	- 0.54	- 1.68
ON	88	155	0.59	- 1.29	- 0.08
WI	73	118	9.34	2.96	- 0.22

[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 2012 for which data were received by 6 June, 2012.

[c] Number of routes with at least one year of non-zero data between 1968 and 2012.

[d] Manitoba began participating in the Singing-ground survey in 1992.

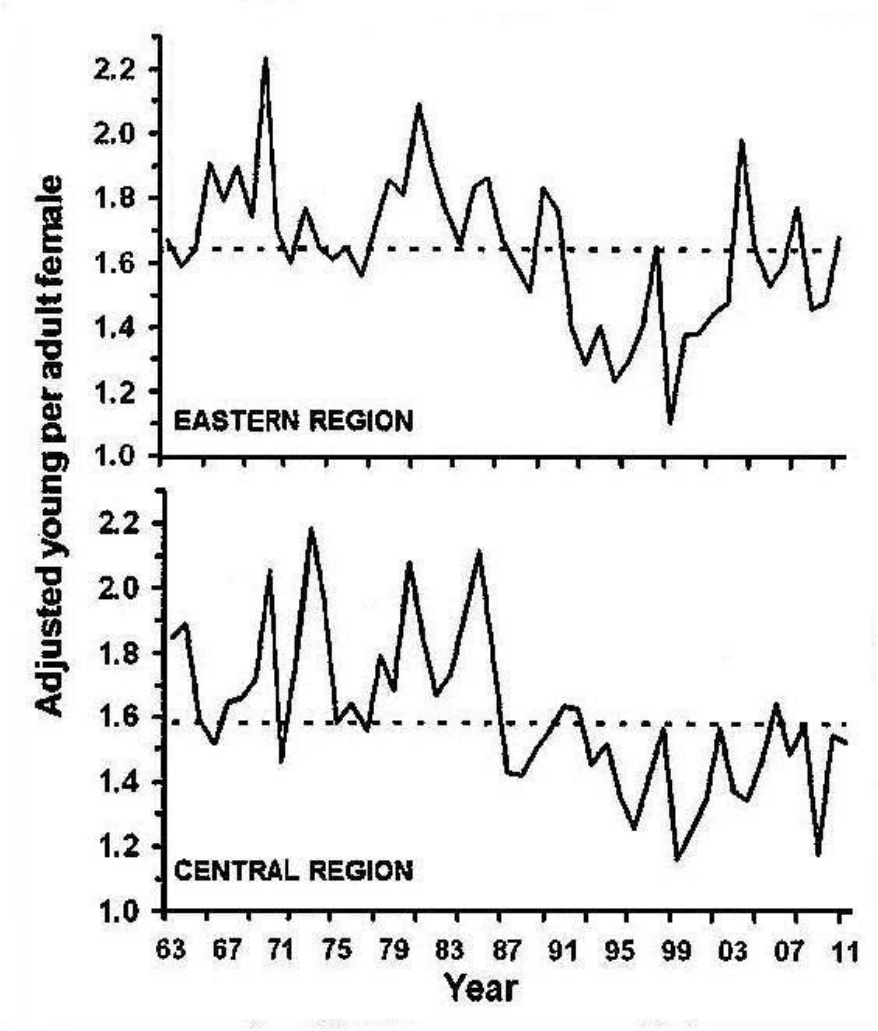

Figure 2. Weighted annual indices of American woodcock recruitment, 1963-2010. Dashed line is the 1963-2009 average. (from: Cooper, T.R. and R.D. Rau. 2012. American woodcock population status, 2012. U.S. Fish and Wildlife Service, Laurel, MD. 16 pp.).

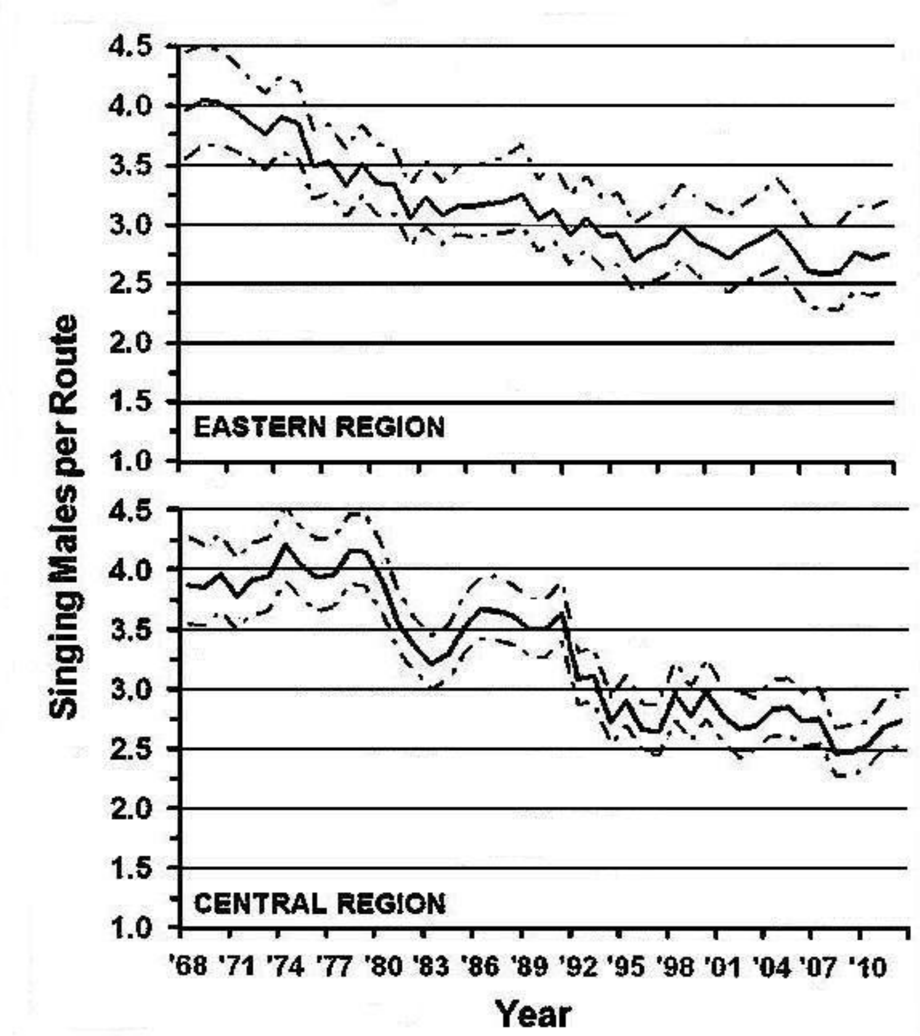

Figure 3. Annual indices of the number of woodcock heard on the Singing-ground Survey, 1968-2011. The dashed lines represent the 95th percentile credible interval. (from: Cooper, T.R. and R.D. Rau. 2012. American woodcock population status, 2012. U.S. Fish and Wildlife Service, Laurel, MD. 16 pp.).

Table 2. Preliminary estimates of woodcock hunter numbers, days afield, and harvest for selected states, from the 2007-08, 2008-09, 2009-10 and 2010-11 Harvest Information Program surveys. Note: beginning 2008-09 all estimates rounded to the nearest 100 for harvest, hunters, and days afield. (from: Cooper, T.R. and R.D. Rau. 2012. American woodcock population status, 2012. U.S. Fish and Wildlife Service, Laurel, MD. 16 pp.).

Management Unit / State	Active woodcock hunters ([a])				Days afield ([a, c])				Harvest ([a, c])			
	2008-09	2009-10	2010-11	2011-12	2008-09	2009-10	2010-11	2011-12	2008-09	2009-10	2010-11	2011-12
Central Region	n.a. [b]	n.a. [b]	n.a. [b]	n.a. [b]	369,800 ± 16%	322,300 ± 14	392,400 ± 20	350,500 ± 16	174,300 ± 16%	175,100 ± 17	233,100 ± 20	231,700 ± 20
IL	2,100 ± 90%	1,800 ± 98	800 ± 171	2,900 ± 108	6,100 ± 103%	6,200 ± 91	1,200 ± 123	8,800 ± 131	4,300 ± 100%	5,300 ± 142	900 ± 106	3,700 ± 195
IN	900 ± 69%	1,100 ± 63	1,000 ± 66	1,100 ± 79	2,400 ± 63%	4,000 ± 80	3,900 ± 89	4,100 ± 86	800 ± 31%	1,700 ±79	3,000 ± 134	1,800 ± 102
MI	34,600 ± 13%	26,400 ± 15	31,100 ± 14	28,400 ± 15	156,000 ± 17%	146,200 ± 21	159,200 ± 19	144,000 ± 18	78,900 ± 17%	80,900 ± 22	93,200 ± 21	106,900 ± 28
MN	8,700 ± 37%	9,700 ± 37	13,900 ± 32	17,000 ± 29	37,900 ± 43%	38,300 ± 44	55,400 ± 33	76,900 ± 46	19,900 ± 67%	16,00 ± 48	34,800 ± 39	44,200 ± 42
OH	2,900 ± 69%	1,600 ± 82	1,800 ± 98	3,100 ± 98	10,300 ± 70%	7,200 ± 94	4,300 ± 70	10,200 ± 96	2,300 ± 68%	1,200 ± 63	1,700 ± 93	2,300 ± 74
WI	14,200 ± 24%	19,400 ± 22	14,600 ± 25	15,200 ±25	65,400 ± 35%	77,100 ±24	65,700 ± 40	69,000 ± 30	36,000 ± 27%	29,200 ± 24	42,300 ± 22	42,600 ± 31

[a] All 95% Confidence Intervals are expressed as a % of the point estimate.

[b]. 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.

[c]. Days afield and Harvest estimates are for the entire 18 state Central Region.

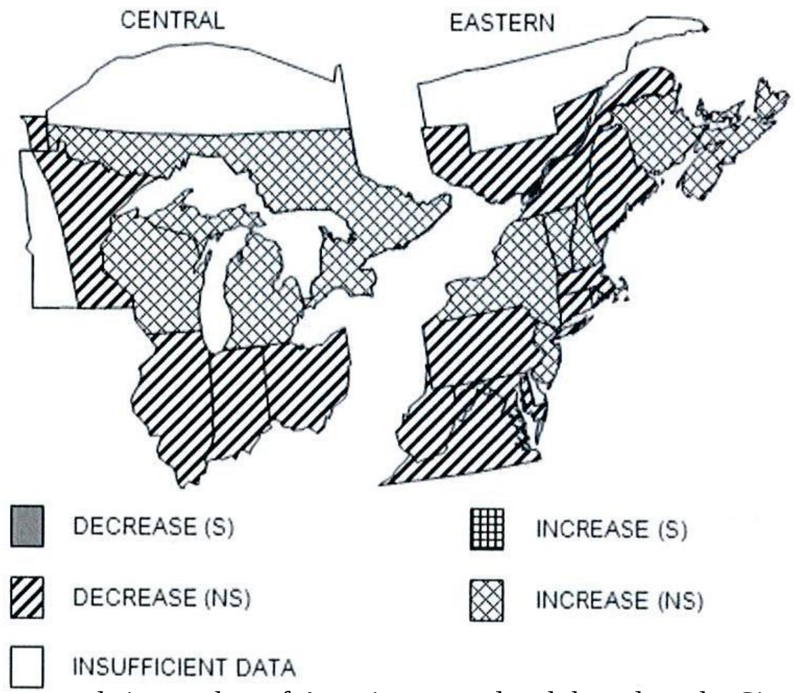

Figure 4. Short-term trends in number of American woodcock heard on the Singing-ground Survey; 2010-11, as determined by the hierarchical modeling method. A significant trend (S) does not include zero in the 95% credible interval, while a non-significant (NS) trend does include zero. (from: Cooper, T.R. and R.D. Rau. 2012. American woodcock population status, 2012. U.S. Fish and Wildlife Service, Laurel, MD. 16 pp.).

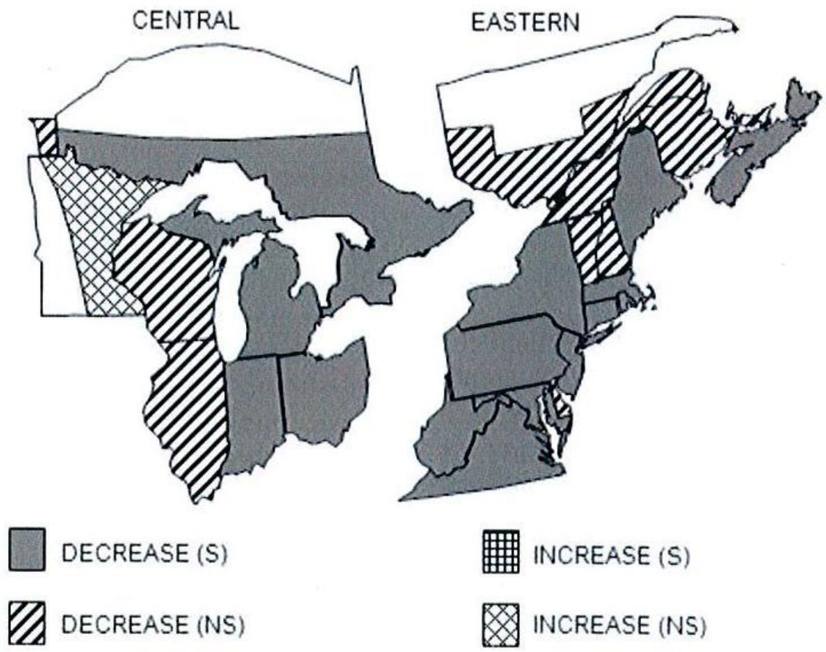

Figure 5. Long-term trends in number of American woodcock heard on the Singing-ground Survey; 1968-2011, as determined by the hierarchical modeling method. A significant trend (S) does not include zero in the 95% credible interval, while a non-significant (NS) trend does include zero. (from: Cooper, T.R. and R.D. Rau. 2012. American woodcock population status, 2012. U.S. Fish and Wildlife Service, Laurel, MD. 16 pp.).

2012 RING-NECKED DUCK BREEDING PAIR SURVEY

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John H. Giudice, Wildlife Biometrics Unit, and Erik C. Hildebrand, Wildlife Health Unit

SUMMARY OF FINDINGS

Since 2006, we have estimated numbers of ring-necked ducks in 3 Ecological Classification System (ECS) subsections containing potential ring-necked duck breeding habitat. We used helicopters to survey 234 plots, including 49 resurvey plots, in 2012. The survey was flown from 4-8 June, somewhat earlier than previous years, but well-timed based on ring-necked duck lone male to indicated breeding pair (IBP) ratios. There were an estimated 11,620 IBP (SE = 1,830) and 24,200 ring-necked ducks (SE = 3,700) in the survey area, which was similar to previous estimates, except in 2010, when the population estimate was only 11,840 breeding birds (SE = 2,520). The majority of ring-necked duck observations were in the Northern Minnesota Drift and Lake Plains ECS Section.

INTRODUCTION

Ring-necked ducks are important breeding waterfowl species in portions of Minnesota. Continental populations of ring-necked ducks have increased since the 1950s (U.S. Fish and Wildlife Service, unpublished data); however, a survey of 14 important ring-necked duck breeding lakes in north central Minnesota indicated a decline in numbers since the early 1970s (Zicus et al. 2004). This led to concern about the status of breeding ring-necked ducks in the state. Minnesota Department of Natural Resources initiated a survey in 2004 to estimate the number and distribution of breeding ring-necked ducks in Minnesota (Zicus et al. 2008). Ring-necked ducks are also important to Minnesota's waterfowl hunters and often rank 3rd most abundant duck in the annual waterfowl harvest (U.S. Fish and Wildlife Service, unpublished data).

Ring-necked ducks have been consistently surveyed in 3 Ecological Classification System (ECS) sections of Minnesota since 2006. The current survey was developed based on a pilot survey conducted in 2004-2005 (Zicus et al. 2008). Our objective was to estimate breeding pair numbers and monitor population trends for ring-necked ducks in northern Minnesota.

METHODS

We used Public Land Survey (PLS) sections (~2.6-km^2 plots, range = 1.2 – 3.0 km^2) as primary sampling units (Zicus et al. 2008). Our sampling frame consisted of PLS sections that contained any potential ring-necked duck nesting cover, which Zicus et al. (2008) defined as Minnesota GAP (MNGAP) level 4 land cover data that was either:

- Class 10 = lowlands with <10% tree crown cover and >33% cover of low-growing deciduous woody plants such as alders and willows,
- Class 14 = wetlands with <10% tree crown cover that is dominated by emergent herbaceous vegetation such as fine-leaf sedges, or
- Class 15 = wetlands with <10% tree crown cover that is dominated by emergent herbaceous vegetation such as broad-leaf sedges and/or cattails,

and was within 250 m of and adjacent to:

- Class 12 = lakes, streams, and open-water wetlands, or
- Class 13 = water bodies whose surface is covered by floating vegetation.

MNGAP class 10, 14, and 15 cover associated with lakes having a General or Recreational Development classification under the Minnesota Shoreland Zoning ordinance was excluded, because pilot surveys indicated that breeding ring-necked ducks seldom used this habitat. Plots that meet the criteria were assigned to Habitat Class 1 if they contained > median amount of this cover; otherwise they were Habitat Class 2 (Figure 1A).

Beginning in 2011, we used a generalized random tessellation stratified (GRTS) design to obtain a spatially balanced sample of plots (Stevens and Olsen 2004) instead of stratifying based upon ECS Section. The GRTS design ensures that sampling units are dispersed across the sampling frame. We used a domain analysis (Cochran 1977:34) to estimate number of IBPs and breeding ducks in each of the 3 ECS sections to compare results with previous years.

Our sample included 235 plots (96 Habitat Class 1, 90 Habitat Class 2, and 49 resample plots). This was 10 more plots than in 2011 because we inadvertently surveyed all 10 alternate plots (5 each in Habitat Class 1 and Habitat Class 2). Resample plots were randomly selected in 2010 from plots sampled in 2009 to represent a range of ring-necked duck counts and IBP (Herwig 2010). The 49 plots have been consistently surveyed since 2009 and were treated as a third stratum (sampling rate = 1).

We surveyed plots from a DNR Division of Enforcement helicopter (Bell OH-58 [Jet Ranger] or Enstrom 480B) flying ~30–45 meters above ground level (agl) and ~75–130 km/h. A 2-person survey crew (pilot + 1 observer) recorded ring-necked duck observations by sex and social status (Zicus et al. 2008). We considered pairs, lone males, and flocked males (2–5) to indicate breeding pairs (Zicus et al. 2008). The breeding population in the survey area was considered to be twice the Indicated Breeding Pairs (IBP) plus the number of unpaired females and birds in groups. We used the R libraries survey (Lumley 2009, R Development Core Team 2009) and spsurvey (Kincaid and Olsen 2011) to estimate IBP and the total breeding population. In 2008, we stopped surveying plots in 4 ECS Sections (Southern, Western, and Northern Superior Uplands, Northern Minnesota and Ontario Peatlands) and PLS sections that were expected to have low densities or no breeding ring-necked ducks (Habitat Classes 3 and 4). Population estimates from 2006 and 2007 were re-calculated to reflect the reduced sampling frame (Sousa et al. 2009).

From 2007 through 2011, observations were recorded on aerial photos and transcribed to data sheets following the survey. In 2012, observations were recorded in digital voice files, each associated with a UTM location, on a tablet computer using the DNRSurvey software program developed by Minnesota DNR Wildlife and GIS staff (Wright et al. 2011). Data were transcribed and proofed following the survey.

RESULTS

We surveyed approximately 2% of the survey plots in the Northern Minnesota Drift and Lake Plains section and Minnesota and Northeast Iowa Morainal section, and 4.2-4.8% of the Lake Agassiz, Aspen Parklands section (Table 1, Figure 1B). Ten of the 15 plots in the Lake Agassiz, Aspen Parklands section were resurvey plots.

We flew the survey on 4-8 June with the primary crew (pilot John Heineman and observer Erik Hildebrand) flying 5 days and the secondary crew (pilot Tom Pfingsten and observer Jeff Lawrence) flying 2 days (4-5 June). The survey was completed in 49.8 hours of flight time. We flew a total of 234 plots. One plot (Habitat Class 2) located in Camp Ripley was not flown due to training activity on the military base. The survey was completed earlier than other years since we began surveying plots in only 3 ECS sections (Figure 2). Survey start dates have ranged from 4-9 June, yet weather and other factors have resulted in end dates ranging from 11-17 June (9–17 June 2008, 5–12 June 2009, 7–16 June 2010, and 6–11 June 2011).

A total of 381 ring-necked ducks were detected on 70 (30%) of the 234 sample plots (Table 2). The habitat class stratification implemented by Zicus et al. (2008) continues to be effective as twice as many class 1 plots were occupied compared to class 2 plots (Figure 3). Ring-necked duck counts on occupied plots ranged from 1 to 39 birds (median = 4, mean = 5.4), but varied slightly by strata (Figure 3). Indicated breeding pairs per occupied plot ranged from 0 to 23 pairs, with average IBP/plot being highest in the "High" stratum (Figure 3). The proportion of pairs was approximately 50% of all IBP (Figure 4).

We estimated 11,620 IBP (SE = 1,830) and 24,200 ring-necked ducks (SE = 3,700) in the survey area (Table 3). These estimates were similar to previous years except 2010 (Figure 5). As in previous years, the majority of the birds were located in the Northern Minnesota Drift and Lake Plains ECS Section (Figure 6). The number of birds observed on the 49 resurvey plots was similar to previous years (Figure 7).

DISCUSSION

The population of ring-necked ducks breeding in Minnesota has remained stable for the past 7 years, with the exception of 2010. Herwig and Giudice (2011) discuss the potential reasons for the low estimate in 2010 and note that counts on the 49 resurvey plots remained relatively stable even though the population estimate declined by 50%. The timing of the survey in 2012 was good because the proportion of pairs was approximately 50% of all IBP (U.S. Fish and Wildlife Service and Canadian Wildlife Service 1987).

We have used the same habitat classification to select survey plots since 2006, but we reduced the scope of the survey in 2008 (Sousa et al. 2009). We stopped surveying portions of 4 northeastern Minnesota ECS sections (Southern, Western, and Northern Superior Uplands, Northern Minnesota and Ontario Peatlands) that accounted for about 31-33% of the population estimate in 2006 and 2007. We also stopped surveying habitat classes 3 and 4, which accounted for 9% of the population estimate in 2006 and 2007. Thus, 40% of the total Minnesota breeding ring-necked duck population in 2006-2007 was from areas we did not survey in 2008-2012. If distribution of ducks has remained similar to 2006 and 2007, the actual ring-necked duck breeding ground population in northern Minnesota may be approximately 40,000 ducks.

The core breeding range for ring-necked ducks in Minnesota is the Northern Minnesota Drift and Lake Plains ECS section. This area contains large amounts of potential ring-necked duck breeding habitat (Figure 1A) and breeding ring-necked ducks are well distributed throughout the ECS section (Figure 8). In contrast, while the Minnesota and Northeast Iowa Moranial section has substantial potential breeding habitat (Figure 1A), breeding ring-necked ducks mostly occur in the northern portion of this ECS section. The Lake Agassiz, Aspen Parklands ECS section has limited potential breeding habitat (Figure 1A), but ring-necked ducks are relatively abundant in the limited habitat. Much of the habitat is located on large tracts of public land, such as Agassiz National Wildlife Refuge and Thief Lake and Roseau River wildlife management areas. Of the 4 ECS sections we no longer survey, the Northern Superior Uplands was the most important ring-necked duck breeding area (Sousa et al. 2009).

Resample plots may provide more reliable information on population trends because the same plots are surveyed each year (i.e., sampling variation is minimized). For example, ring-necked duck counts on resample plots have been relatively stable during 2009-2012 (Figure 7), whereas the population estimate (based on all plots) for 2010 was substantially lower than previous and subsequent estimates (Figure 5). This suggests that the 2010 population estimate may have been, at least partly, an artifact of the random sample (i.e., on average a sample-based estimated will be unbiased -- but we only have 1 realization of the sampling process each year and that realization can be biased). On the other hand, only 30% of the 49 resample plots had ring-necked duck observations in any given year. Furthermore, only 39% of the resample plots were "occupied" in >1 year, and only 6% were occupied in all 4 years. Thus, the resample-plot dataset contains many zeros. Future analyses may want to consider exploring model-based approaches that utilize information from both resampled and random plots to provide more efficient estimators of population sizes and trends (e.g., Fong 1990, Bokalo et al. 1996).

This survey has provided important information to increase our understanding and allow us to properly manage ring-necked ducks in Minnesota. The ring-necked duck is the 4th most abundant breeding duck in Minnesota, following mallards, blue-winged teal, and wood ducks (Cordts 2012, this survey). When we began the pilot survey in 2004, we discussed whether population size, trend or distribution was the most important parameter to monitor the population. The original design allowed us to determine population size, thus trend, and the stratification into 6 ECS sections ensured that plots were distributed across the landscape. While it is possible the breeding ring-necked duck population was larger in Minnesota during the 1970s and 1980s as indicated by the 14-lake survey, the helicopter survey indicates that ring-necked duck breeding populations are currently stable in Minnesota. The 14 lakes ring-necked duck survey has also been relatively stable since 2006, ranging from 72-91 indicated breeding pairs (Lawrence 2011, unpublished data). We recommend continuing the aerial survey at least one more year and then decide on the role of this survey in context with other breeding waterfowl surveys in Minnesota.

ACKNOWLEDGMENTS

David Rave (2004-2007) and Christine Herwig (2008-2012) coordinated and were the lead observers for previous surveys. Pilots John Heineman and Tom Pfingsten helped with survey planning and flew the helicopters. Bob Wright set up the DNRSurvey program and Chris Scharenbroich created the navigation maps.

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Table 1. Sampling rate by Ecological Classification System section and habitat class (1 and 2) for Minnesota's ring-necked duck breeding-pair survey, June 2006–2012.

	No. of plots surveyed (Sampling rate [%])															
	N Minnesota Drift & Lake Plains				Minnesota & NE Iowa Morainal				Lake Agassiz, Aspen Parklands				All			
	1		2		1		2		1		2		1		2	
Year	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
2006-07	41	1.1	36	1.1	15	0.9	17	0.9	5	2.3	3	2.4	61	1.1	56	1.0
2008	83	2.2	25	0.8	31	1.9	22	1.1	9	4.2	4	3.2	123	2.2	51	1.0
2009[a]	56	1.5	47	1.4	24	1.5	27	1.4	10	4.6	10	8.1	90	1.6	84	1.6
2010[a]	67	1.8	59	1.8	32	2.0	34	1.8	15	6.9	15	12.1	114	2.0	108	2.0
2011[a]	76	2.0	64	1.9	32	2.0	38	2.0	8	3.7	7	5.6	116	2.0	109	2.0
2012[a]	75	2.0	68	2.1	37	2.3	39	2.0	9	4.2	6	4.8	121	2.1	113	2.1
N[b]	3,828		3,317		1,638		1,923		216		124		5682		5364	

[a]includes resample plots: N. MN Drift & Lake Plains = 12 class 1 and 12 class 2; MN & NE Iowa Morainal = 8 class 1 and 7 class 2;
Lake Agassiz, Aspen parklands, 5 class 1 and 5 class 2

[b]Number of Public Land Survey sections by ECS section and habitat class.

Table 2. Plot occupancy, number and density of ring-necked duck observations and indicated breeding pairs in 3 Ecological Classification System sections in Minnesota, June 2006-2012.

		Plots with birds		Birds[a]			IBP[b]		
Year	No. of plots surveyed	*n*	%	Total	Per plot	Per occupied plot	Total	Per plot	Per occupied plot
2006	117	27	23	201	1.72	7.44	120	1.03	4.44
2007	117	33	28	174	1.49	5.27	101	0.86	3.06
2008	174	58	33	296	1.70	5.10	173	0.99	2.98
2009	174	57	33	273	1.57	4.79	173	0.99	3.04
2010	222	56	25	230	1.04	4.11	147	0.66	2.63
2011	225	73	32	338	1.50	4.63	220	0.98	3.01
2012	234	70	30	381	1.63	5.44	229	0.98	3.27

[a]Total number of ring-necked ducks counted during the survey.

[b]The number of indicated breeding pairs (IBP) is the sum of the pairs, lone males, and males in flocks of 2–5 birds.

Table 3. Breeding ground population and indicated breeding pair (IBP) estimates for ring-necked ducks in 3 Ecological Classification System sections in Minnesota, June 2006-2012.

	n		Breeding Population				IBP			
Year	sample plots	Sampling rate	N	SE	CI	Relative precision	N	SE	CI	Relative precision
2006	117	0.011	22,040	5,060	8,380	38.0	9,850	2,350	3,900	39.5
2007	117	0.011	18,530	3,470	5,750	31.0	8,700	1,730	2,870	32.9
2008	174	0.016	20,130	3,340	5,520	27.4	9,440	1,580	2,620	27.7
2009	174	0.016	22,990	3,450	5,700	24.8	10,950	1,560	2,590	23.6
2010	222	0.020	11,840	2,520	4,170	35.2	5,340	1,080	1,790	33.5
2011	225	0.020	22,730	2,760	4,540	19.9	10,400	1,330	2,180	20.9
2012	234	0.021	24,200	3,700	6,090	25.2	11,620	1,830	3,010	26.0

A

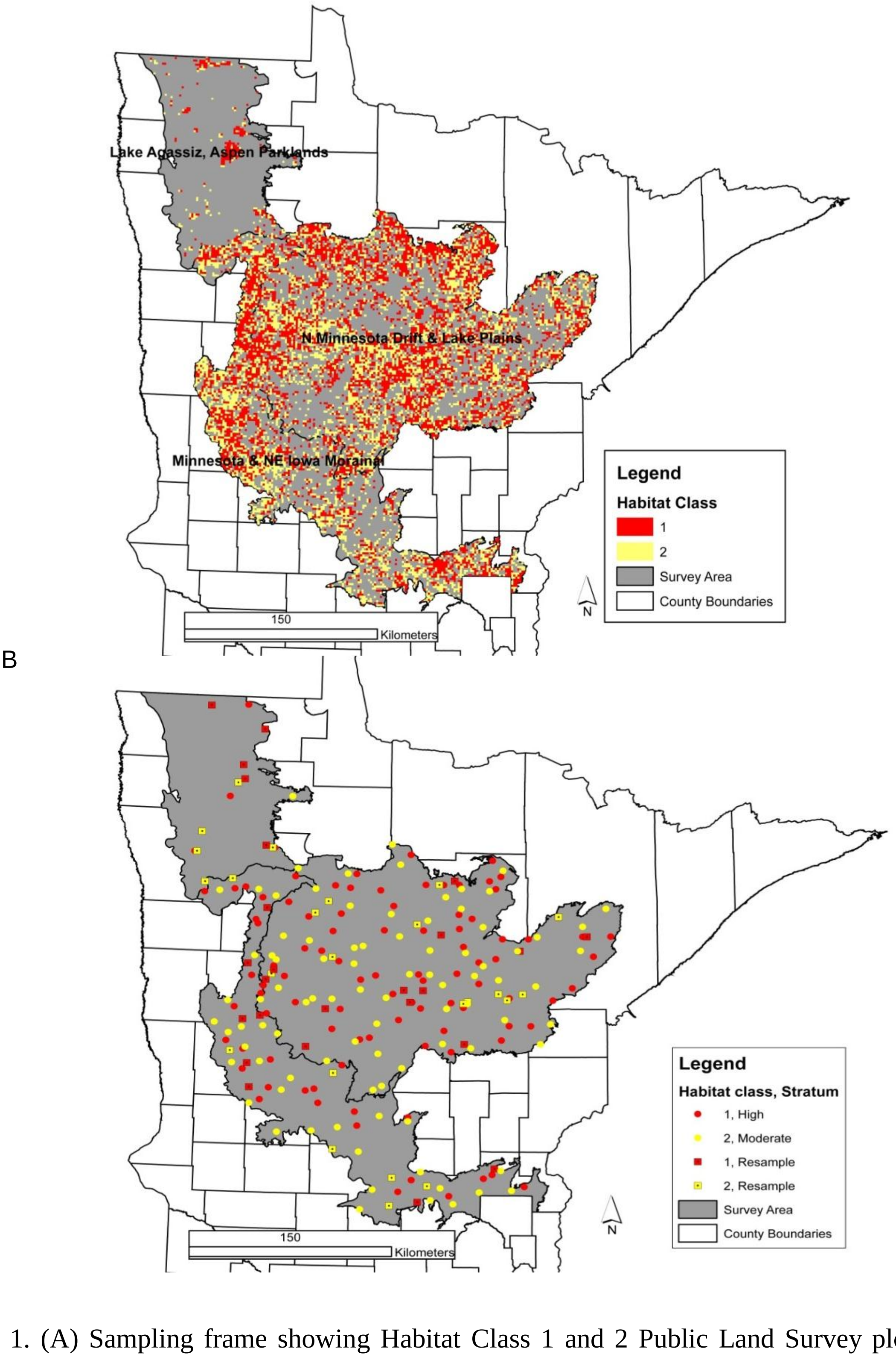

Figure 1. (A) Sampling frame showing Habitat Class 1 and 2 Public Land Survey plots for the ring-necked duck breeding population survey, 2006-2012, and (B) standard and resample plots surveyed in 2012 (enlarged for visibility) by Habitat Class.

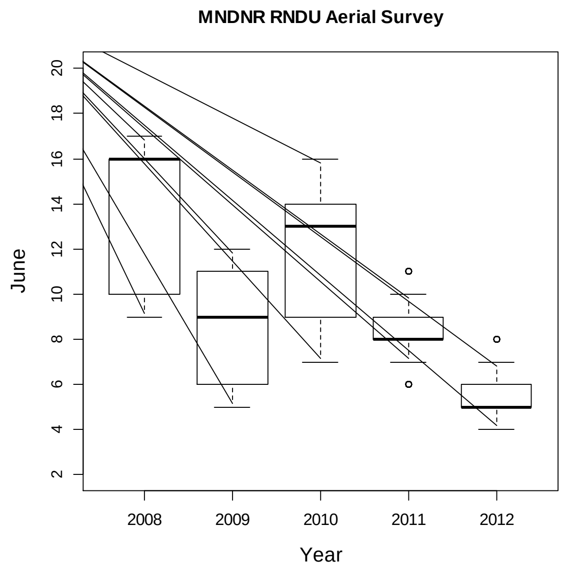

Figure 2. Box plot showing dates ring-necked duck breeding population survey plots were completed, 2008-2012.

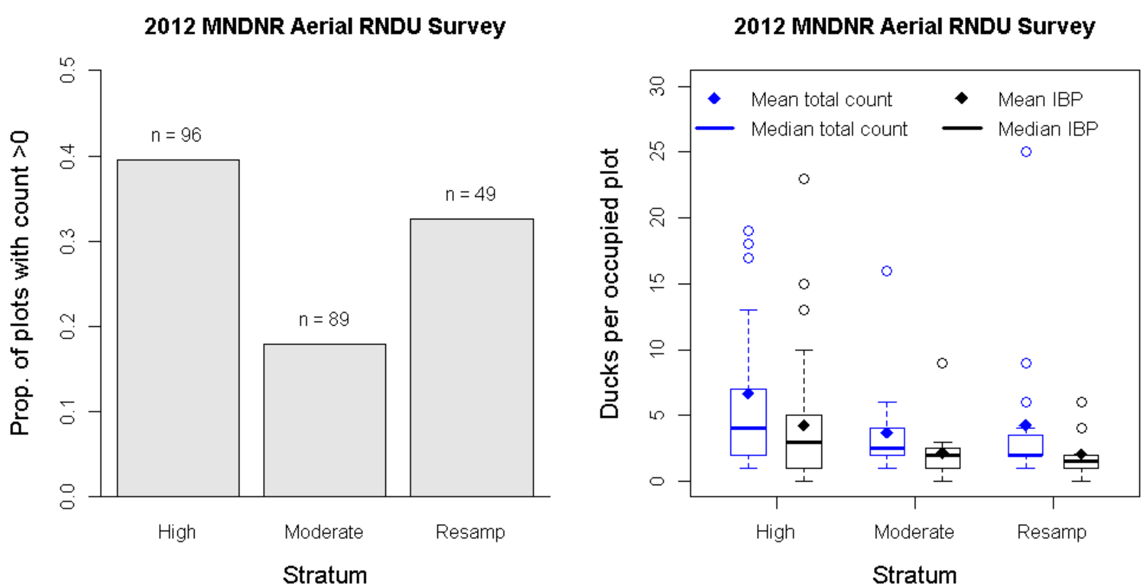

Figure 3. Proportion of occupied plots by stratum (left panel) and number of ducks per occupied plot (right panel, total count and indicated breeding pairs) during the 2012 ring-necked duck breeding population survey.

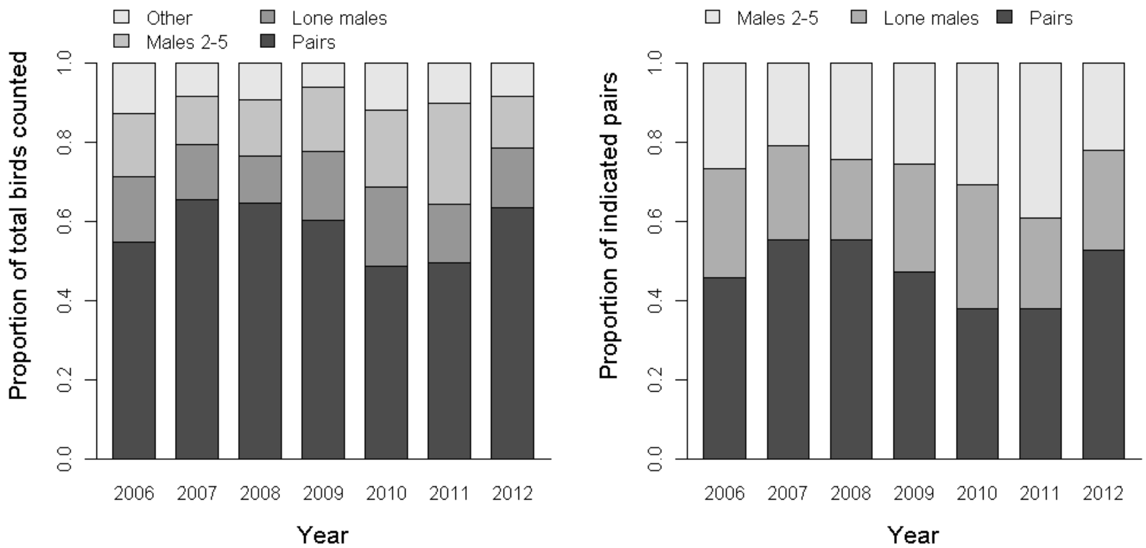

Figure 4. Social grouping of ring-necked ducks counted on the 2012 ring-necked duck breeding population survey for all ducks counted (left panel) and indicated breeding pairs (right panel).

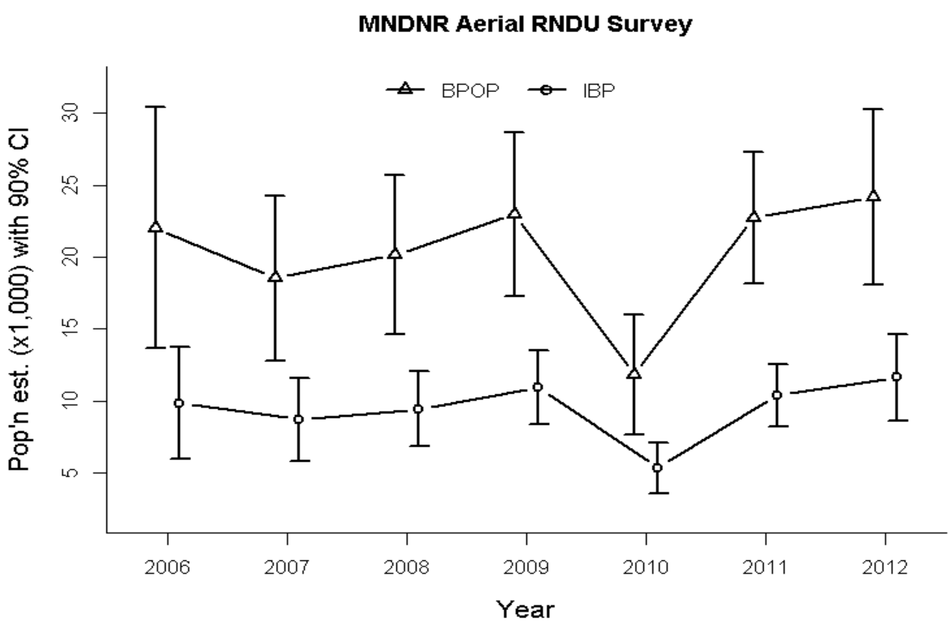

Figure 5. Estimated indicated breeding pairs (IBP) and breeding birds (BPOP) with SE bars for the habitat class 1 and 2 strata in the Minnesota ring-necked duck breeding pair survey area, June 2006–2012.

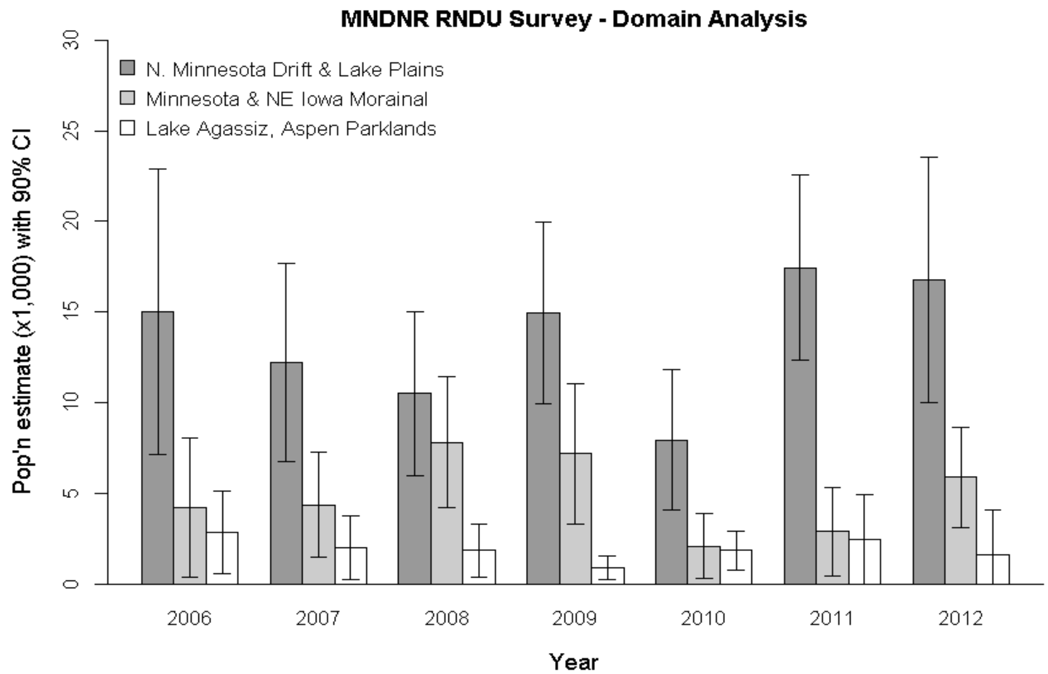

Figure 6. Distribution of Minnesota ring-necked duck breeding population by Ecological Classification System section, 2006-2012.

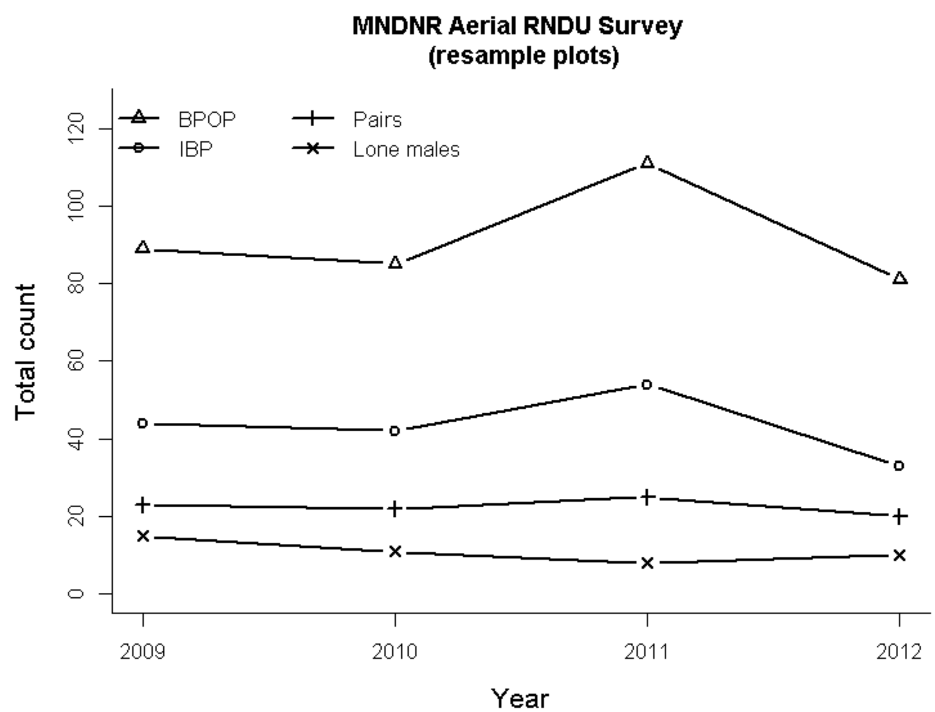

Figure 7. Number of ring-necked ducks by social grouping (breeding population [BPOP], indicated breeding pairs [IBP], lone males [LM], and pairs) for the 49 resurvey plots, 2009-2012.

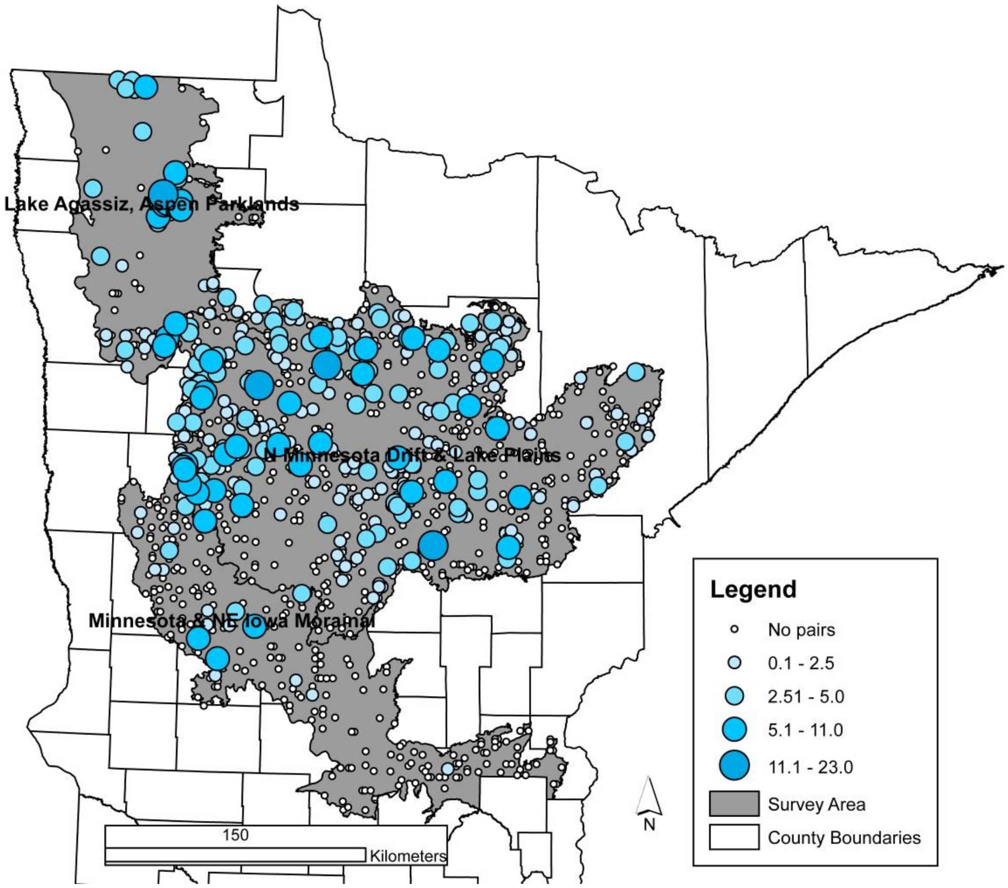

Figure 8. Sample plot locations and number of indicated breeding pairs observed/plot on the Minnesota ring-necked duck breeding pair survey, June 2006-2012. Value is IBP/year for plots surveyed > 1 year. White circles indicate plots where no indicated pairs were seen.

ESTIMATING NUMBERS OF BREEDING SANDHILL CRANES IN NORTHWEST MINNESOTA - 2012

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SUMMARY

A sandhill crane (*Grus canadensis*) hunting season was opened in northwest Minnesota in 2010. Following the initiation of the hunting season, there was some concern about the status of cranes that bred in this portion of Minnesota. Thus, it was important to determine the size of the crane population during the breeding season in the hunting zone.

We used a GIS to construct grid-based sampling frame consisting of 4-km^2 plots. We used remote-sensed land-cover data to stratify the sampling frame based on the amount of potential crane nesting habitat in each plot. We also classified plots according to ecological subsection. We used a generalized random-tessellation stratified (GRTS) design to select a spatially balanced sample of 90 plots. We also surveyed one 100-km^2 plot to evaluate questions related to plot size and crane distribution. We surveyed each sample plot once during 7-15 May 2012 using a Bell OH-58 helicopter with a 2-person crew. We counted and classified all crane observations in each plot based on their social status (individuals, pairs, groups) and evidence of breeding status (e.g., nest, colts, territorial behavior).

We estimated there were 7,210 sandhill cranes (SACR) in the survey area that included the Northwest Goose-Crane Hunting Zone (NWGCZ) and adjoining Aspen Parkland habitat. This included 1,450 breeding birds, 3,010 birds in groups, and 2,750 cranes whose breeding status was unknown (i.e., singles or pairs observed without a nest or young and not exhibiting territorial or defense behavior). Most (96%) crane observations were in plots with potential SACR nesting habitat, which closely aligned with the Aspen Parkland. We will use data obtained in 2012 to improve survey stratification and design in 2013 and 2014.

INTRODUCTION

In 2010, Minnesota held its first SACR hunting season since the passage of the Migratory Bird Treaty Act in 1918. Although Midcontinent Population (MCP) SACR are hunted in several Central Flyway states (Central Flyway Webless Migratory Bird Technical Committee 2006), the season in Minnesota was unique within the United States because hunting occurs within their breeding range. MCP cranes are hunted in other areas where they breed (e.g., southeast and central Manitoba, Alaska); but, the vast majority of harvest occurs on migration, staging, and wintering areas (Krapu et al. 2011). Krapu et al. (2011) suggested that reestablishment of breeding SACR populations in the U.S. portion of the Prairie Pothole Region, where historical records indicate cranes once bred, may have been limited by crane hunting in this region.

SACR that breed in Minnesota are the greater subspecies (*G. c. tabida*). In the 1970s, SACRs bred in two distinct regions of Minnesota: MCP cranes in northwest Minnesota and Eastern Population (EP) cranes in east-central Minnesota (Henderson 1978). SACRs have since expanded their range, and currently have been reported breeding in 53 of Minnesota's 87 counties (Minnesota Ornithological Union 2011). The breeding range is now continuous between these two areas; thus, the delineation between MCP and EP cranes is unknown.

There was some concern on the potential effect of a SACR hunting season on Minnesota breeding cranes (Lawrence et al. 2011). Retrieved harvest the first 2 years of the season ranged from 765-830 cranes annually, greater than the <500 expected annual harvest. Stable isotope analysis of harvested cranes suggested that the proportion of Minnesota breeding cranes in the harvest was greater than expected, but these results need further interpretation (K. Hobson and G. Knutsen, unpublished data). In addition, crane counts in NW Minnesota from the August Roadside Survey declined following the 2010 hunting season, while they continued to increase in east-central Minnesota. While none of these pieces of information were major causes of concern, they did highlight the need to determine the size of the crane population in the SACR hunting zone.

There was no template for a large-scale, aerial survey specifically designed for breeding SACRs. Thus, we proposed conducting a pilot survey for three years to provide sufficient information for making intelligent survey-design choices, including developing and evaluating a stratification scheme (e.g., Zicus et al. 2008), answering questions about bias-precision-cost tradeoffs (e.g., Giudice et al. 2010), and identifying important sources of variation in estimates of abundance and population trends (Thompson et al. 1998:149).

The first year of the pilot study allowed us to evaluate survey-design considerations (e.g., stratification options and effectiveness, estimated variances, spatial correlation in counts, bias-variance-cost tradeoffs) and sampling techniques, which will be used in the second and third years to obtain a precise estimate (CI ±25%) of the number of MCP cranes breeding in northwestern Minnesota. The survey was designed to provide an estimate of the number of breeding cranes in northwest Minnesota that was within ±25% of the true population size with 90% certainty (i.e., if we could replicate the sample survey many times, 90% of the population estimates will be within ±25% of the true population size).

The breeding population size estimates obtained from this survey, combined with data on crane harvest, harvest derivation, and other parameters will allow us to better manage hunting of cranes in northwest Minnesota and may provide insights to hunting cranes in other portions of their breeding range. The survey design will also provide the potential to monitor breeding crane populations in other areas, e.g. east-central Minnesota.

STUDY AREA

We selected the NW Goose-Crane Hunting Zone (NWGCZ) and portions of the Aspen Parklands ecological subsection that extended beyond the NWGCZ as our primary sampling frame (Figure 1). This included the Aspen Parklands ecological subsection, northwestern portions of the Red River Prairie Subsection, and a small portion of the Agassiz Lowlands subsection.

METHODS

Sampling frame

We used ArcGIS 9.3 (Environmental Systems Research Institute, Redlands, CA) to develop an overlay grid of 4-km^2 plots for the northwestern Minnesota study area (Figure 1). The grid was rotated approximately 2.5 degrees east to orient it with Public Land Survey (PLS)-

based features such as roads and property boundaries. We treated 4-km^2 plots as the primary sampling unit (PSU) and excluded any PSUs not located entirely within the boundary of the SACR survey area (Figure 1). We also non-randomly selected a 100- km^2 plot, approximately overlaying Espelie township (EspTwp) in eastern Marshall County, based on previous crane work by DNR staff (S. Maxson, unpublished DNR files).

Sampling design

We used descriptions of crane nesting habitat in northwest Minnesota (DiMatteo 1991, Provost et al. 1992, Maxson et al. 2008), and land cover data layers contained in Minnesota Gap Analysis Project (GAP) (Drotts and Heinzen 2007) and National Land Cover Data (NLCD) (Fry et al. 2011) to identify potential nesting cover. Both the GAP and NLCD land cover layers have a cell resolution of 30 meters. We considered 3 preliminary classification scenarios: GAP1 – nesting cover defined as GAP level-4 habitat types 14 (sedge meadow) and 15 (broadleaf sedge/cattail); GAP2 – similar to to GAP1 but nesting cover also included habitat type 10 (lowland deciduous shrub); and NLCD - nesting cover defined as cover type 95 (emergent herbaceous wetland). We visually compared data layers associated with crane nest locations from the DNR Rare Natural Features database to decide which GIS data layers to use for stratification (Figure 2). We decided to use the 2006 NLCD to stratify the survey plots for the pilot year and then examine relationships of crane sightings and GIS layers to consider better stratifications in future years.

We used NLCD to quantify the amount (m^2) of potential SACR habitat in each 4-km^2 plot and 1-km^2 subplot. NLCD is a Landsat-based, 30-meter resolution, land cover database created by the Multi-Resolution Land Characteristics (MRLC) Consortium, a partnership of Federal agencies led by the U.S. Geological Survey (http://pubs.usgs.gov/fs/2012/3020/). For the purposes of the pilot study, we defined "SACR nesting habitat" as NLCD cover class 95 (emergent herbaceous wetland) and "other SACR habitat" as NLCD cover classes 11 (open water) and 90 (woody wetlands). We then classified each 4-km^2 plot into 4 categories:

NLCD-1: $\geq$ median amount of nesting habitat,
NLCD-2: $0 <$ m^2 of nesting habitat $<$ median,
NLCD-3: nesting habitat = 0 but other SACR habitat > 0,
NLCD-4: no SACR habitat.

NLCD plot classifications were strongly correlated with ecological subsections (Figure 1). Therefore, we stratified the sampling frame (4-km^2 plots) into 4 strata:

1. NLCD12 plots – Stratum 1 and 2 plots; 71% of sampling frame; mostly associated with Aspen Parklands and Agassiz Lowlands.
2. NLCD3 plots – 11% of sampling frame; mostly associated with Red River Prairie.
3. NLCD4 plots – 18% of sampling frame; mostly associated with Red River Prairie.
4. Espelie Township (EspTwp) – 100-km^2 survey block in Aspen Parklands and in close proximity to previous SACR research sites. Consisted of 24 NLCD-1 plots and 1 NLCD-2 plot.

We assumed that SACR density in the NLCD4 stratum was very low (approaching zero). Therefore, given time and budget constraints, we did not sample stratum NLCD4. However, we recorded UTM locations of all SACR observations, which will allow us to examine NLCD habitat associations at finer scales (e.g., 1-km^2 subplot) and explore the utility of using other land-cover data sources to stratify the sampling frame. Likewise, we expected SACR density to be low (but > 0) in the NLCD3 stratum. For NLCD12 and NLCD3 strata, we drew a spatially-balanced, Generalized Random-Tessellation Stratified (GRTS) sample (Stevens and Olsen 2004) with n = 60 (sampling rate = 2.2%) and 30 (sampling rate = 7.3%), respectively. We sampled the NLCD3 stratum at a higher rate to ensure we had a sufficient sample size to evaluate the feasibility of estimating SACR numbers in this low-density stratum. We surveyed 100% of the EspTwp stratum (n = 25 4-km^2 plots). Thus, the total sample size in 2012 was 115 4-km^2 plots (Table 2, Figure 3).

Target population(s)

Ideally, we wanted estimates of total cranes and total breeding cranes located within the SACR survey area and, possibly, separate estimates for ecological subsections and the NW Goose-Crane Zone (i.e., a domain analysis). Obtaining geographically relevant estimates was reasonably straightforward; although, in some cases, estimates were imprecise. Conversely, separating breeding and non-breeding components of the population was problematic. We recorded crane observations as singles, pairs, and groups. Groups of SACR likely contain mostly non-breeders (subadults, non-territorial adult birds, and, possibly, failed breeders), whereas the breeding status of singles and pairs is more difficult to determine (Hayes and Barzen 2006). Therefore, for the purposes of this survey, we classified crane observations as follows:

1. *Breeding birds* = singles or pairs that were observed with a nest or young, or birds that were suspected of having a nest or young (but it was not detected) based on their behavior (reluctance to fly or leave the area, broken-wing displays, etc.).
2. *Groups* = flocks of $\geq$3 cranes.
3. *Status unknown* = singles or pairs whose breeding status could not be determined (e.g., nest or young was not detected, and did not exhibit any territorial or defense behavior).

For population estimates, we considered doubling observations of single ‘breeding’ birds (e.g., similar to indicated pairs in waterfowl surveys), but this could result in a positive bias for the estimate of breeding birds. For example, if single breeding birds were truly paired and their mate was missed (not detected) because it was located off the survey plot, then the missed mate is accounted for when we expand the counts for sampling (i.e., it is not necessary to double the observed count). Conversely, if the mate was on the plot but was not detected, then doubling the observed count is equivalent to applying a sightability correction factor = 2 for single crane observations. In reality, both cases likely occurred and we could not distinguish between them. Therefore, we used a conservative approach when estimating population size by taking observations of single birds at their face value (i.e., count = 1) regardless of their breeding status.

Visibility bias (non-response)

To our knowledge, there is no information available on non-response rates (detection probabilities) in aerial surveys of breeding cranes. We attempted to evaluate the potential magnitude of visibility bias by using a double-sampling technique. We randomly selected a 1-km^2 subplot (that contained >0 m^2 of potential SACR nesting habitat) within each NLCD-12 4-km^2 sample plot and resurveyed these subplots immediately after completing the survey of the larger plot. We also considered line-transect and double-observer methods, but we concluded these methods were not practical given our aircraft/crew setup and survey protocols (e.g., the need to be flexible with respect to speed, altitude, flight pattern, and time [intensity] devoted to surveying different cover types).

Survey Procedures

The survey was conducted during mid-May, which is the peak incubation period for cranes in northwest Minnesota (DiMatteo 1991, Provost et al. 1992, Maxson et al. 2008). All plots were surveyed using Bell OH-58 [Jet Ranger] containing a pilot and one observer, except the first survey day when a second observer was in the helicopter. Surveys were flown at 5-45 meters above ground level and from 10-100 km/hr, depending upon the cover. Observations were recorded in digital voice files, each associated with a UTM location, on a tablet computer using the DNRSurvey software program developed by Minnesota DNR Wildlife and GIS staff (Wright et al. 2011).

RESULTS

Survey effort

The survey was conducted over 7 days (7-11 May, 14-15 May), averaging 16 plots/day (range: 4-28) and 6 hr/day (range: 1.5-9.2 hr/day, including refueling stops). The survey team (DNR pilot John Heineman and observer Jeff Lawrence) spent an average of 9.8 min surveying a plot (range: 3-28 min), but it varied slightly by strata (Table 1). The EspTwp stratum consisted of mostly high-quality plots (> median amount of potential SACR nesting cover) and, thus, required more survey time/plot. Total transit time averaged 6 min/plot, but this included the EspTwp block where inter-plot transit time was zero and a nearby refueling truck was utilized. Refueling time averaged 36 min/stop (including an estimate of 30 minutes for end-of-day refueling) with typically 3 stops required for a full day of surveys. Average total time (survey + transit + refueling) per plot was 21 min (including EspTwp) and 22 min for NLCD-123 plots only. The survey team also conducted 27 visibility surveys. On average, visibility surveys required 4 min to complete (range: 1-7 min). Forty-five percent of total survey effort (total minutes; all activities) in 2012 was associated with surveying plots, 27% with transit time, 23% with refueling stops, and 4% with visibility surveys.

Sampling statistics

We detected SACR on 51 (44%) of the 115 sample plots (Table 2). The average count per occupied plot was 4.7 birds (SD = 6.5, range: 1 to 43). Naïve estimates of plot occupancy varied by strata (range: 13% in NLCD3 to 64% in EspTwp), but the distribution of counts per occupied plot was similar among strata (Table 2). The exception was one plot that contained 43 birds (3 groups of 7, 9 and 21 birds, 2 pairs; and 2 singles), which was an NLCD-12 plot located outside the NWGCZ.

We counted 240 SACR on sample plots, of which 48% were pairs, 15% were singles, and 37% were groups (Table 3). We observed 11 groups, which ranged in size from 3 to 21 birds. Thirty-five percent of observed pairs and singles exhibited some evidence of being breeding birds (44% of pairs and 22% of singles; Table 3). We detected 22 nests (including 1 detected during the re-survey), and eggs or young were observed at 18 nests (the status of the other 4 nests could not be determined). In addition, we observed 3 pairs with young but no nest. The spatial distribution of crane detections (including nests and incidental observations) is shown in Figure 3.

Population estimates

The estimated total number of cranes in the survey area was 7,210 (90% CI: 4,200–10,200). This is a minimum estimate because we did not adjust for detection probabilities (which are likely <1, at least for singles and pairs in dense cover). If our sample of singles and pairs exhibiting breeding behavior was representative of the relative abundance of breeding birds in the target population, then we estimated there were a minimum of 1,450 (90% CI: 1,010–1,880) breeding birds in the survey area, and another 2,750 (90% CI: 2,070–3,430) whose breeding status was uncertain (Table 4).

Approximately 96% of the estimated total birds were associated with the NLCD-12 and EspTwp strata (Table 5), which essentially represents the Aspen Parkland ecological zone. The estimated number of cranes in the NLCD-3 stratum (~Red River Valley ecological zone) was only 290 (90% CI: 50–530). The bound on the estimated total (all strata) was greater (CV = 25% and relative bound = 41%) than the usual target level for an MNDNR wildlife survey (i.e., CV = 15% and relative bound = 25%), which partly reflects the influence of 1 extremely large plot count (43 birds) on the estimated population variance. The estimated CV for breeding birds and status-unknown birds was reasonably good (<18%; Table 4). This large plot count was located outside the NWGCZ hunting zone, which resulted in an imprecise population estimate in a domain analysis of NWGCZ (n = 106 plots, pop.est = 5,060, SE = 1,150) vs. non-NWGCZ (n = 9 plots, pop.est = 2,160, SE = 1,930). Consequently, we do not have sufficient information to estimate with reasonable precision the number of SACRs in Aspen Parkland habitats located outside the NWGCZ.

Habitat associations

There were only weak relationships between plot counts (total birds) and amount of potential nesting cover as defined by NLCD and GAP cover data (Figure 4).

DISCUSSION

Survey Effort and Design Considerations

Generally, we believe the pilot year of this survey went extremely well. We had proposed to survey 125 high-quality plots (NLCD-12) and 50 low-quality plots (NLCD-34) during the first year of the pilot study (Lawrence et al. 2011). However, during the design phase we decided to scale back to 115 plots, which allowed us to evaluate the feasibility of using double-sampling to estimate visibility bias. We planned for 35 hours of helicopter time but flew 37 hours to complete the 115 plots. We were able to survey 21-28 plots on days when we flew the entire day. In 2013, we will not resurvey the 1 km^2 plots, saving approximately 1.8 hours of survey time. In addition, we may not survey in the Red River Valley, which would allow us to survey more plots in the Aspen Parkland.

We planned to begin the survey on 14 May 2012 based upon chronology of nest incubation documented in northwest Minnesota (Provost et al. 1992, Maxson et al. 2008, although DiMatteo 1991 indicated earlier nesting on Agassiz National Wildlife Refuge). Given the advanced phenology of 2012, we decided to begin the survey 1 week earlier, on 7 May 2012. Even then, some nests had already hatched based upon colts observed during the survey (Figure 5) and anecdotal reports of other colts. Therefore, we anticipate we will begin the 2013 survey no later than approximately 7 May.

Conditions in northwest Minnesota were abnormally dry when the survey was conducted in May (http://droughtmonitor.unl.edu/archive.html) and much of the potential nesting cover was dry. Typically, SACRs nest in emergent vegetation in shallow water (Figure 5, DiMatteo 1991, Provost et al. 1992, Maxson et al. 2008); although we did observe some crane nests in cover that appeared mostly dry. We do not know if cranes forgo nesting if conditions are not favorable; but in a wet year there would be additional potential nesting habitat in NW MN. Some crane nests were located in relatively small pieces of nesting cover (Figure 6).

Population Estimate

We allocated 73% of our survey effort to NLCD-12 plots, which reflected our primary objective of estimating the abundance of breeding SACR (or birds associated with reproductive habitats) in the northwest survey area. Thus, it is not surprising that population estimates for the NLCD-12 stratum and for potential breeding birds (singles and pairs) associated with nesting habitats were more precise than for estimates of grouped birds or birds associated with NLCD-3 plots. In the case of groups, many of these birds were observed in non-reproductive cover types, including agricultural fields. Thus, their distribution among plots is more difficult to predict. For example, the plot with the greatest number of birds in groups (n = 37, 42% of all birds observed in groups) was in an area on Glacial Ridge National Wildlife Refuge that was recently burned and had greened up. These areas are especially attractive to nonbreeding cranes. In the likely scenario that we do not have recently burned areas on one of the survey plots in future years, number of birds in groups will probably decline.

Most of the unknown-status pairs were likely nonbreeders, although a portion of the unknown-status singles likely had a mate on an undetected nest. Seven of the 8 singles recorded as breeders were observed on a nest; it is likely that these birds had an undetected mate in the vicinity. Three of the 8 breeding singles had possible mates (other singles) on the plot, but their behavior did not suggest we count them as pairs.

We surveyed the 100-km^2 block to evaluate how nesting cranes were spread over the landscape. The number of likely reproductively-active singles/pairs ranged from 0-2 per 4-m^2 plot, but only 1 active nest was observed on each plot (Fig 7).

Evaluation of sampling design

Post-hoc stratification analyses of plot counts suggested that NLCD or GAP data by themselves were not very effective stratification variables. Additional cover attributes may be needed to increase stratification effectiveness. For example, many crane observations were in or adjacent to agricultural fields (e.g., feeding sites) and many patches of potential nesting cover (emergent vegetation) were dry. Thus, developing an effective stratification scheme for the SACR survey may require a more sophisticated suite of habitat metrics. Our work on this aspect of the survey is just beginning. For example, we collected UTM locations for all SACR observations (including nests) and plan to examine habitat associations using various cover attributes and data layers this fall.

Estimated total birds in stratum NLCD-3 was only 290 (90% CI: 50–530) and only 4 of the 30 sample plots had counts >0. As noted previously, stratification in the pilot survey was closely associated with ecological subsections. Thus, the NLCD-3 stratum essentially reflected the sample characteristics of the Red River Prairie portion of the survey area (Figure 1). Given cost-bias-precision tradeoffs, dropping the Red River Prairie from future sampling frames is a legitimate consideration, especially if it resulted in a corresponding increase in effort (plots) in the Aspen-Parkland region (~NLCD-12 stratum). Likewise, as noted above, we will be exploring more effective stratification schemes for the Aspen Parkland region. For example, post-hoc stratification analysis suggested that, at the very least, using a cut point (for abundance of potential nesting habitats) of 102 ha to form 2 strata (NLCD-1, NLCD-2) and sampling at a higher rate in NLCD-1 (potential nesting habitat > 102 ha) would likely improve the precision of population estimates. We will further evaluate the habitat associated with crane observations and consider other options for improving the survey prior to next year. We plan to fly the survey again in May 2013.

The 4-km^2 plot size appears to be a reasonable choice based on naïve occupancy rates, survey time requirements, and bird behavior (i.e., flushing distances and flight patterns). Smaller plots (e.g., 1 km^2) would require less survey time, but total transit time would increase and the sample dataset would probably contain more "zero" counts. Conversely, the 100-km^2 EspTwp block was reasonably efficient to survey, but there are potential problems with double counting and observer fatigue. However, retaining the EspTwp block in future surveys may be beneficial for other reasons (e.g., anecdotal information on population trends from repeated surveys of the same area).

Resurveying 1-km^2 subplots was not an effective method for evaluating the potential magnitude of visibility bias in aerial survey of SACRs. Of the 37 visibility surveys, only 1 survey resulted in a "new" detection (in this case, a missed nest). Based on bird behavior noted during the survey, one could argue that detection probability p is very high ($p \rightarrow 1$) for grouped birds and birds (of any social class) feeding in open agricultural fields, whereas p for breeding cranes in emergent cover is unknown but certainly <1. Thus, the crux of the visibility issue in this case is to estimate p for breeding cranes (especially those with a nest or young). Unfortunately, it is not an easy problem to solve. Visibility bias remains an issue of interest to us, although for this case study, a conservative estimate of SACR numbers (not adjusted for visibility bias) is sufficient for planning purposes. Nevertheless, we will continue to explore the feasibility of using alternative methods to estimate detection probabilities (e.g., repeated counts, logistic model approach based on known nest locations and an independent survey team, other?).

ACKNOWLEDGEMENTS

This project was funded by a grant from the U.S. Fish and Wildlife Service Webless Migratory Bird Program and the Minnesota Department of Natural Resources. Special thanks to pilot John Heineman, who did an exceptional job flying the helicopter. We also appreciate the assistance of Pam Murphy, who drove the fuel truck, and Doug Franke, who arranged the fuel truck, from the DNR Thief River Falls Wildlife office.

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Table 1. Summary of survey effort (total minutes) by activity for an aerial survey of sandhill cranes in Minnesota, May 2012.

	Survey time			Transit time				Refueling stops				Total time (excl. visibility)		Visbility surveys		
Stratum	Total minutes	Plots	Min/ plot	Total minutes	Number transits	Min/ transit	Min/ plot	Total minutes	Number stops	Min/ stop	Min /plot	Total minutes	Min/plot	Total minutes	Number surveys	Min/ survey
NLCD-123	822	90	9.1	663	104	6.4	7.4	482	13	37.1	5.4	1,967	21.9	102	27	3.8
EspTwp	310	25	12.4	16	6	2.7	0.6	97	3	32.3	3.9	423	16.9	0	0	0
All	1,132	115	9.8	679	110	6.2	5.9	579	16	36.2	5.0	2,390	20.8	102	27	3.8

Table 2. Sampling statistics[a] for an aerial survey of sandhill cranes in northwestern Minnesota, May 2012.

							Counts/occupied plot				
Stratum	nh	Nh	wh	srate	n.occ	p.occ	min	max	med	mean	SD
EspTwp	25	25	0.006	1.000	16	0.640	1	11	4	4.2	2.6
NLCD12	60	2,724	0.707	0.022	31	0.517	1	43	2	4.8	8.0
NLCD3	30	411	0.107	0.073	4	0.133	2	11	4	5.2	4.3
NLCD4	0	691	0.179	0.000							
All	115	3,851	1.000	0.030	51	0.443	1	43	2	4.7	6.5

[a]nh = sample size (4-km^2 plots), Nh = stratum size, wh = stratum weight, srate = sampling rate, n.occ = number of “occupied” plots (>1 sandhill crane detected), p.occ = proportion of plots with >1 crane detected, and count statistics for “occupied” plots.

Table 3. Social and breeding classification of sandhill crane observations.

Social class[a]	Count	Percent of total	Percent of pairs or singles
Pairs (x2)	114	47.5	
Breeding birds	50	(20.8)	43.9
Status unknown	64	(26.7)	56.1
Singles	37	15.4	
Breeding birds	8	(3.3)	21.6
Status unknown	29	(12.1)	78.4
Groups	89	37.1	
Total	240	100	

[a]- Breeding birds = singles or pairs that were observed with a nest or young, or birds that were suspected of having a nest or young (but it was not detected) based on their behavior (reluctance to fly or leave the area, broken-wing displays, etc.); Groups = flocks of >3 cranes; or status unknown = singles or pairs whose breeding status could not be determined (e.g., nest or young was not detected, and did not exhibit any territorial or defense behavior).

Table 4. Population estimates (Nhat) by indicated breeding status for sandhill cranes in northwestern Minnesota, May 2012.

Status	nh	Nh	n.occ	min.ct	max.ct	sig.hat	xbar.4km	SE.xbar	Nhat	SE.Nhat	LCB90Pct	UCB90Pct	cv.pct
Breeding birds[a]	115	3,160	28	1	4	0.87	0.5	0.08	1,450	260	1,010	1,880	17.9
Groups	115	3,160	9	3	37	4.59	1.0	0.49	3,010	1,550	470	5,550	51.5
Unknown[b]	115	3,160	40	1	6	1.42	0.9	0.13	2,750	420	2,070	3,430	15.3
Total	115	3,160	51	1	43	5.64	2.3	0.58	7,210	1,820	4,220	10,200	25.2

[a]Singles and pairs (x2) with a nest or young, or exhibiting some type of breeding or territorial behavior.

[b]Singles and pairs (x2) without a nest or young, and no behavioral evidence that they were breeding birds.

Table 5. Population estimates (Nhat) by stratum for sandhill cranes in northwest Minnesota, May 2012.

stratum	nh	Nh	n.occ	min.ct	max.ct	sig.hat	xbar.4km	SE.xbar	Nhat	SE.Nhat	LCB90Pct	UCB90Pct	cv.pct
EspTwp	25	25	16	1	11	2.88	2.7	0	70	0			
NLCD12	60	2,724	31	1	43	6.17	2.5	0.67	6,860	1,810	3,870	9,840	26.4
NLCD3	30	411	4	2	11	2.24	0.7	0.36	290	150	50	530	51.7
All	115	3,160	51	1	43	5.64	2.3	0.58	7,210	1,820	4,220	10,200	25.2

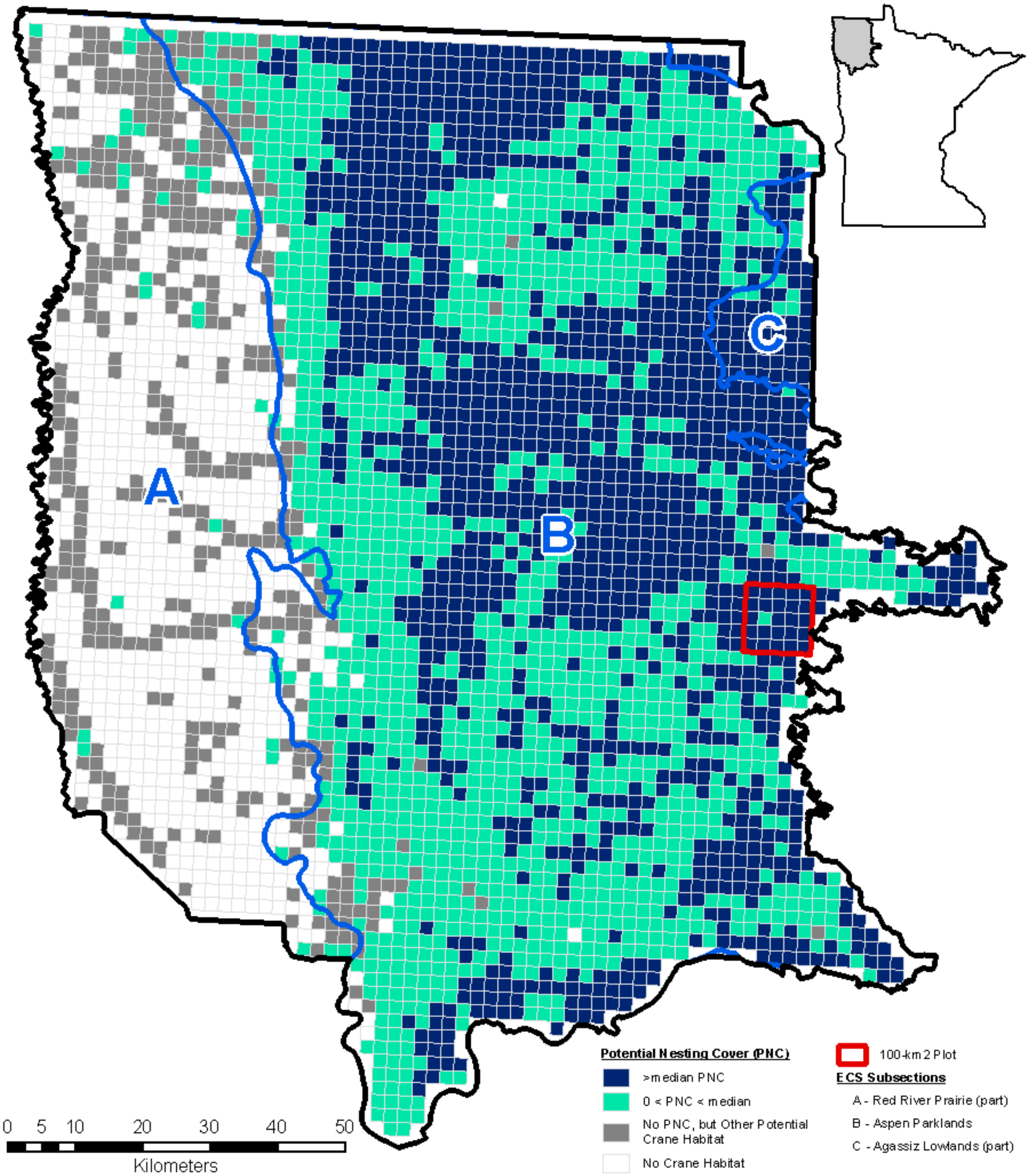

Figure 1. Sampling frame for the 2012 MNDNR spring aerial survey of sandhill cranes, northwestern Minnesota. The primary sampling unit was 4-km^2 plots. Colored squares denote plots by strata as defined by National Land Cover Data: dark blue = NLCD-1 (>median amount of potential crane nesting cover), turquoise = NLCD-2 (0 < potential nesting cover < median), gray = NLCD-3 (no nesting cover but other potential crane cover), white = NLCD-4 (no crane habitat). Black lines denote the boundaries of the survey area and blue lines note boundaries of ecological subsections.

Figure 2. Comparison of land cover GIS layers with a known 1991 sandhill crane nest (blue dot), Section 16, Poplar Grove Township, Marshall County, MN. (left: GAP land cover, middle: 2010 color aerial photo, right: 2006 National Land Cover Data).

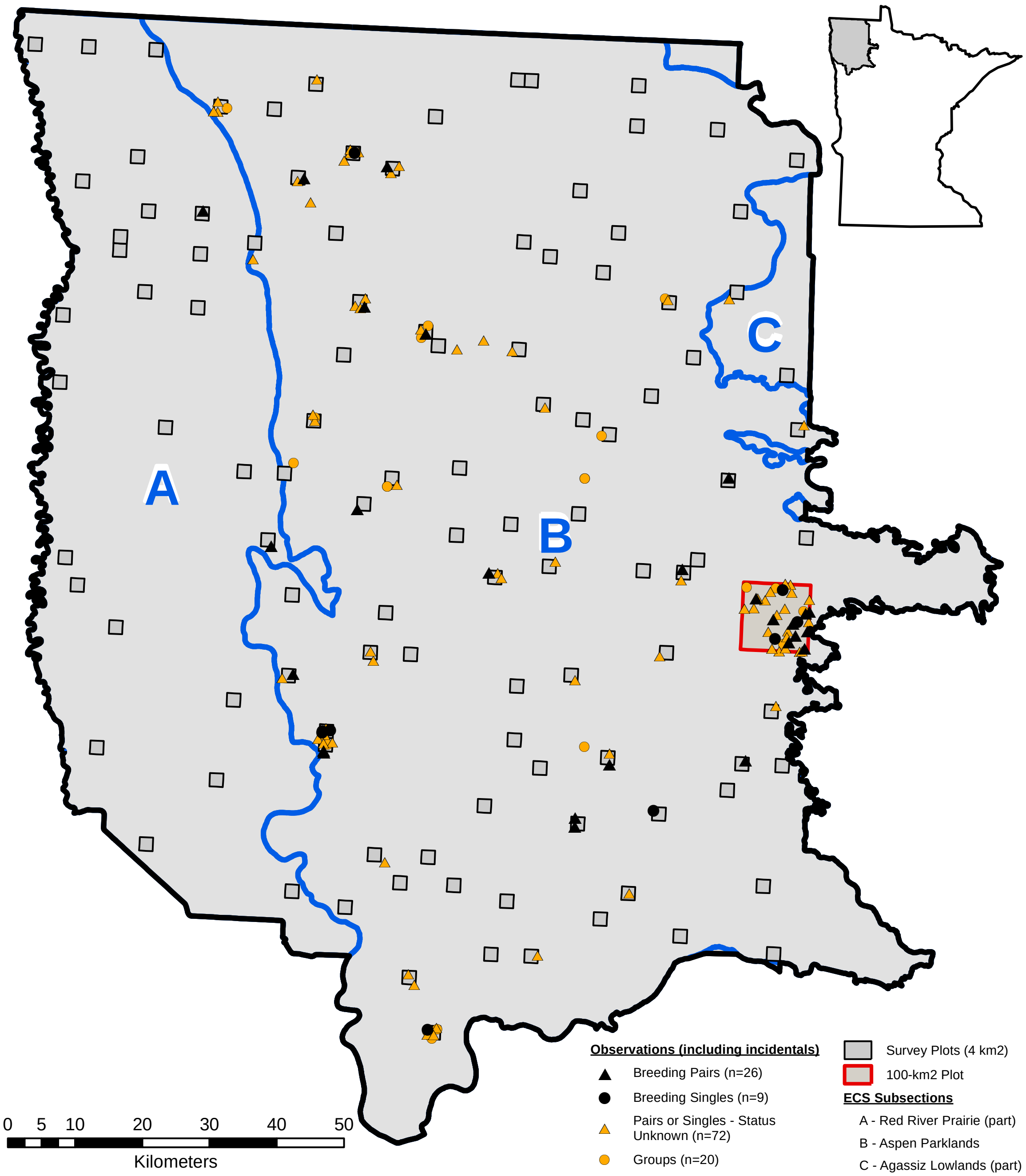

Figure 3. Distribution of sample plots (n = 115) and sandhill crane observations by type (including incidental sightings) in the 2012 MNDNR spring aerial survey, northwestern Minnesota. Each sample plot was 4 km^2 and the SACR survey area was 16,350 km^2.

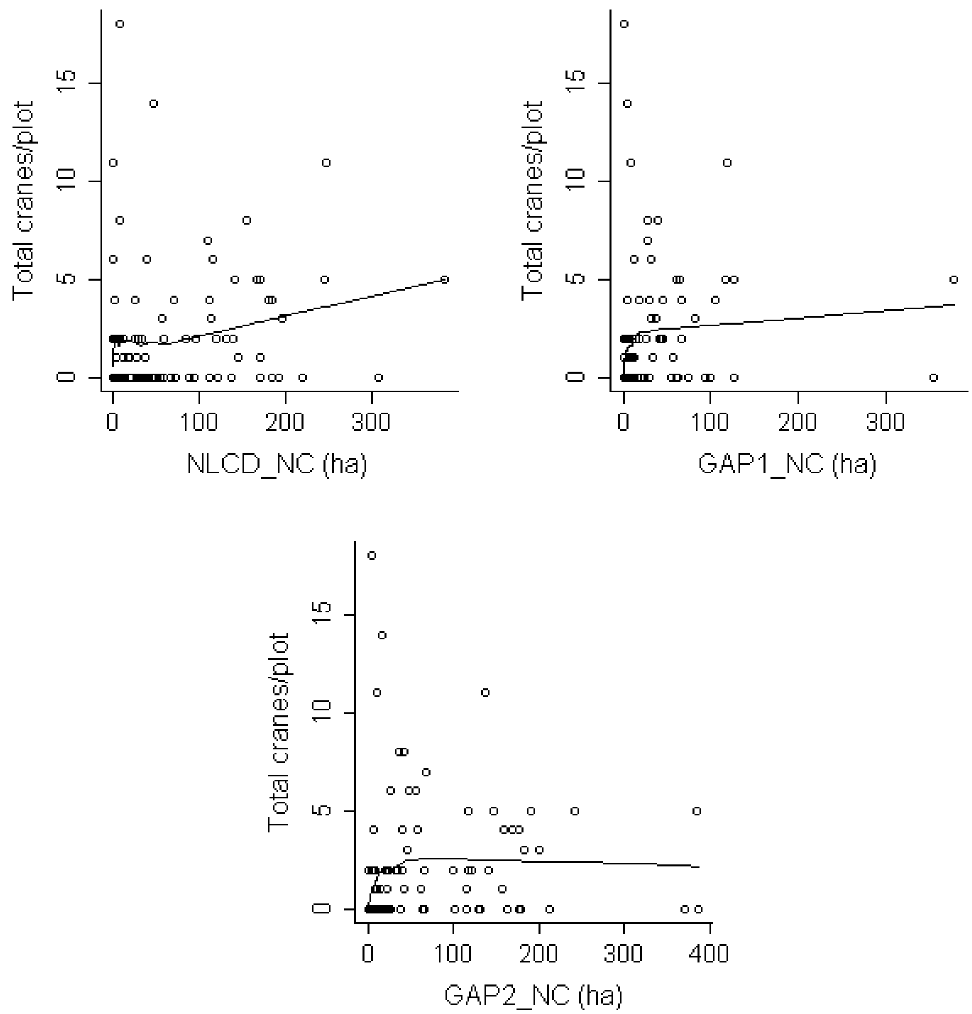

Figure 4. Relationships between sandhill crane observations and habitat abundance (as defined by NLCD and GAP classification schemes) based on 114 4-km2 plots surveyed in May 2012, northwest Minnesota. The graphs do not show 1 plot with 43 cranes, which contained 73, 129, and 149 ha of NLCD_NC, GAP1_NC, and GAP2_NC habitats, respectively.

Figure 5. Crane nest and colt in northwestern Minnesota, May, 2012.

Figure 6. A sandhill crane nest was located near the arrow in the wetland, Northwest Minnesota, May 2012.

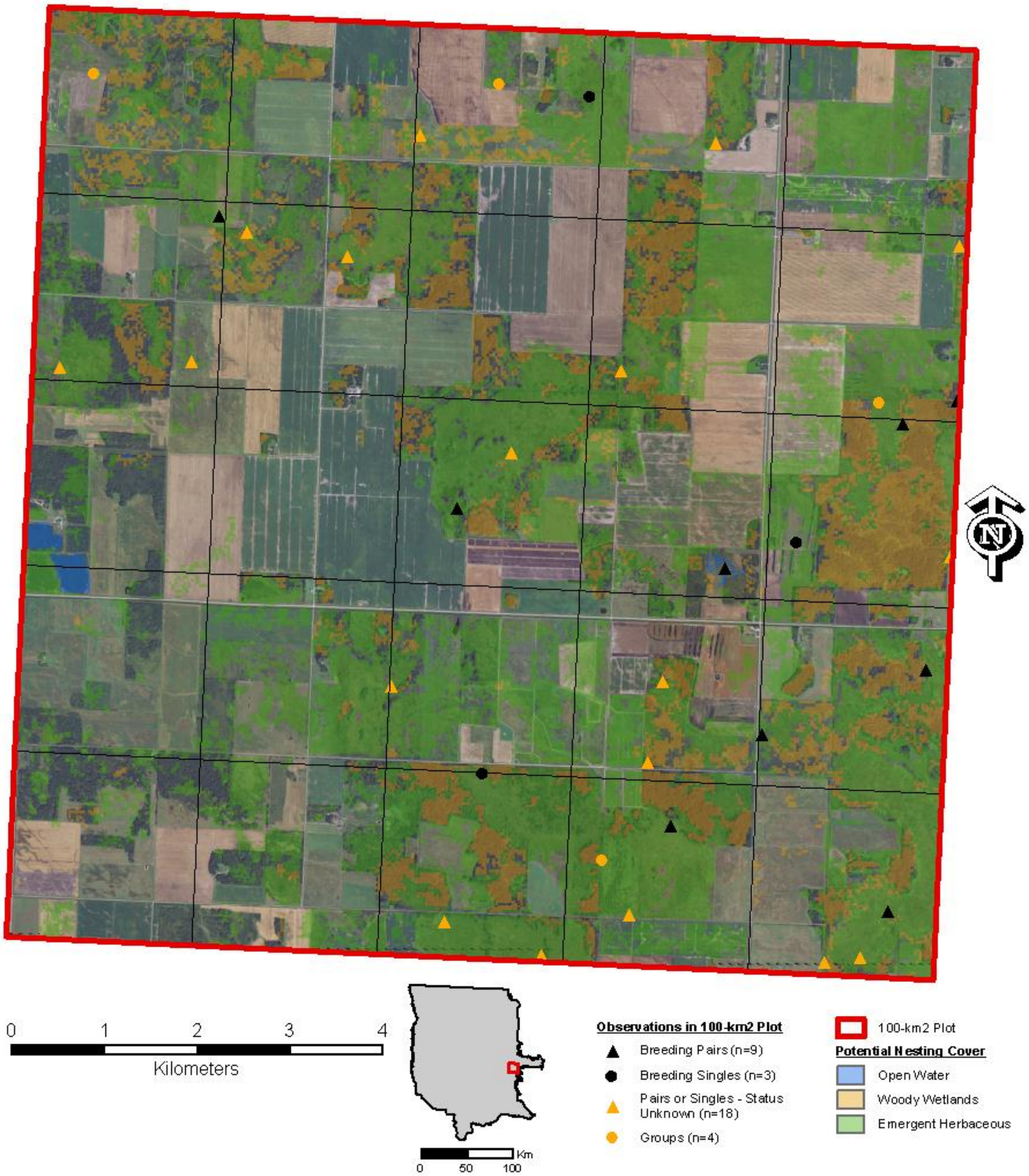

Figure 7. Location of sandhill crane observations, by social status, in a 100 km^2 plot overlaying Espelie Township, Marshall County, Minnesota, May 2012.

HUNTING HARVEST STATISTICS

Division of Fish and Wildlife
500 Lafayette Road, Box 20
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2011 SMALL GAME HUNTER MAIL SURVEY

Margaret Dexter, Wildlife Research Unit

INTRODUCTION

The Minnesota Department of Natural Resources, Division of Fish and Wildlife, Wildlife Research unit annually conducts a survey of small game hunters. Annual harvest estimates from survey data provide guidance for future hunting regulations and season structure.

METHODS

The Wildlife Research unit requested a random sample be drawn from the Electronic License System database in late February, 2011 to ensure that each license holder had an equal chance of being in the survey sample. The sample consisted of 6,500 (approximately 2%) Small Game License holders, drawn proportionately from each of the nine Small Game license types available: Resident Senior Citizen, Resident Youth Small Game, Resident (Adult) Small Game, Resident Individual sports, Resident Combination Sports, Resident Lifetime Small Game, Resident Lifetime sports, Nonresident Youth, and Nonresident (Adult) Small Game.

Hunters that returned the survey questionnaire within three weeks were marked returned and eliminated from follow-up mailings. Follow-up mailings were sent to non-respondents at three week intervals. There were two follow-up mailings to non-respondents.

Completed and returned questionnaires were checked for completeness, consistency, and biological practicability. Cards were marked with numeric county codes corresponding to the hunter's written information. Data from each usable card was converted to an electronic database. Data were checked for errors, duplicate responses, and /or missing data. The following is a list of assumptions made in data coding:

1) If an individual checked the box indicating (s)he did not hunt, but harvest information was provided, it was assumed that the individual did hunt.
2) If a range was given for "number of days hunted" or "number of animals harvested", the median of the range, rounded to the nearest even integer was recorded.
3) If a hunter indicated spending time hunting for a species, but left "number bagged" blank, the # bagged was entered as missing data.
4) If a small game hunter indicated bagging a species, but left "number of days hunted" blank, then "number of days hunted" was recorded as missing data.
5) If more than one county was indicated for "county hunted in most", the first county listed was recorded. However, if the several counties listed were indicated to apply to all species hunted, then counties were recorded in sequential order in relation to species hunted.
6) If "county hunted in most" was left unanswered or not legible, the county was recorded as missing data.

Data from all usable cards were tabulated and statistically analyzed by the St. Paul staff, using SAS statistical analysis software programs.

RESULTS

License sales declined a bit from the previous year as did pheasant stamp sales but duck stamp sales showed some increase. Estimated number of hunters showed some increase for ducks, Canada geese, crows, spruce grouse and gray squirrels but some decline for pheasants, fox squirrels, and cottontail rabbits (Table 3). Success rates increased for hunters pursuing ducks and snowshoe hares (Table 5). Total estimated harvests (Table 6) increased for ducks, Canada geese, other geese, rails and gallinules, crows, spruce grouse and snowshoe hare. Estimated harvests declined for coots, woodcock, pheasant, mourning dove, ruffed grouse, sharp-tailed grouse, gray partridge, gray squirrel, fox squirrel, cottontail rabbit, jack rabbit, raccoon, red fox, gray fox, and coyote. Note that all estimates were based on a survey of approximately 2% of all small game license holders. Data in this report may change as a result of future verification and more comprehensive analysis.

Attached are survey results. All estimates were statewide unless otherwise indicated. Tables 1-7 are historic tables of small game harvest for the previous 10 years.

Table 1. Small game hunter response to mail surveys, 1982 - 83 through 2011 - 12.

Year	Number mailed	Number not delivered	Delivered questionnaires completed and returned	
			Number	Percent
1982 - 83	5,963	266	4,792	84.1
1983 - 84	4,551	269	3,325	77.7
1984 - 85	4,096	127	3,280	82.6
1985 - 86	3,370	157	2,574	80.1
1986 - 87	4,668	208	3,623	81.2
1987 - 88	5,513	248	4,191	79.6
1988 - 89	15,388	857	11,431	78.7
1989 - 90[a]	10,893	735	7,790	76.7
1990 - 91[a]	5,000	394	3,467	75.3
1991 - 92[a]	5,050	387	3,541	75.9
1992 - 93[a]	5,000	288	3,625	76.9
1993 - 94[a]	5,011	282	3,320	70.2
1994 - 95[a]	5,000	387	3,353	72.7
1995 - 96[a]	5,000	321	3,293	70.4
1996 - 97[a]	5,000	170	3,334	69.0
1997 - 98[a]	5,000	198	3,234	67.3
1998 - 99[a]	5,000	200	3,153	65.7
1999 - 00[a]	5,001	180	3,349	69.5
2000 - 01[a]	5,000	184	3,001	62.3
2001 - 02 [a]	6,000	225	3,667	64.0
2002 - 03 [a]	6,000	363	3,862	68.5
2003 - 04[a]	6,400	381	3,972	66.0
2004 - 05[a]	6,000	356	3,823	68.0
2005 – 06[a]	6,280	142	3,946	64.3
2006 – 07[a]	6,000	151	3,810	65.1
2007 – 08[a]	6,000	113	3,736	65.5
2008 – 09[a]	5,996	183	3,551	61.1
2009 - 10[a]	5,999	88	3,828	63.8
2010 - 11[a]	6,000	100	3,777	63.0
2011- 12[a]	6,500	129	3,748	58.6

[a] Includes resident and non-resident licenses, and excludes duplicate licenses.

Table 2. Use of small game hunter licenses, 2002-03 through 2011-2012.

		Returns from mail survey	Projections from license sales
2002-03	Hunted	2,962 (76.7%)	221,455
	Did not hunt	900 (23.3%)	67,274
		3,862 (100.0%)	288,729
2003-04	Hunted	3,085 (78.2%)	232,206
	Did not hunt	862 (21.8%)	64,733
		3,947 (100.0%)	296,939
2004-05	Hunted	2,934 (77.6%)	223,275
	Did not hunt	847 (22.4%)	64,450
		3,781 (100.0%)	287,725
2005-06	Hunted	3,035 (77.1%)	216,000
	Did not hunt	900 (22.9%)	64,156
		3,935 (100.0%)	280,156
2006-07	Hunted	2,994 (79.0%)	233,759
	Did not hunt	795 (21.0%)	62,139
		3,789 (100.0%)	295,898
2007-08	Hunted	2,894 (77.9%)	232,505
	Did not hunt	822 (22.1%)	65,961
		3,716 (100.0%)	298,467
2008-09	Hunted	2,678 (75.4%)	218,753
	Did not hunt	873 (24.6%)	71,311
		3,551 (100.0%)	290,064
2009-10	Hunted	2,850 (75.0%)	212,126
	Did not hunt	952 (25.0%)	70,857
		3,802 (100.0%)	282,983
2010-11	Hunted	2,824 (74.8%)	210,129
	Did not hunt	953 (25.2%)	70,911
		3,777 (100.0%)	281,040
2011-12	Hunted	2,761 (73.7%)	214,137
	Did not hunt	987 (26.3%)	76,549
		3,748 (100.0%)	290,686

Includes resident and non-resident information. Excludes duplicates and free licenses (youth under 16, active-duty military and disabled veterans).

2011 Small Game Hunter Report

1. Did you hunt small game, listed below, in Minnesota this year (March 2011 - Feb 2012)? ☐No ☐Yes (Please check box)
2. Indicate the **total number of days** spent hunting small game of all species listed below, in Minnesota. ________
3. For the species you hunted indicate your harvest, number of days hunted, and county in which you hunted most for each species, even if **None** were bagged. Report only game **you personally** bagged and retrieved in Minnesota. **Do not** include birds taken on shooting preserves or game farms.

		Number You bagged	Days Hunted	County
Ducks (all species)	01			
Coots (mud hens)	50			
Canada geese	40			
Other geese	41			
Snipe (jacksnipe)	51			
Rails and gallinules	52			
Crows	53			
Woodcock	60			
Mourning Dove	65			
Pheasants	70			
Ruffed grouse (Forest partridge)	71			
Spruce grouse	72			
Sharp-tailed grouse	73			
Hungarian (Gray) partridge	74			
Fox squirrel	89			
Gray squirrel	90			
Cottontail rabbit	91			
Jackrabbit	92			
Snowshoe hare	93			
Badger	35			
Coyote (brush wolf)	97			
Gray fox	96			
Raccoon	94			
Red fox	95			

Dear Small Game Hunter:

You have been selected at random from among Minnesota's small game hunting license buyers to assist us in evaluating the 2011-2012 small game hunting season **(March 2011-February 2012)**. We need information to estimate the season's harvest and to help set future small game seasons. Answer only for your Minnesota 2010 hunting experience.

YOUR RESPONSE IS NEEDED
EVEN IF YOU DID NOT HUNT OR HARVEST SMALL GAME

Please fill out the attached questionnaire and mail as soon as possible. A reminder will be sent to individuals not returning the questionnaire within three weeks. No envelope or stamp is necessary; just tear along the perforation and drop into a mailbox.

THANK YOU FOR YOUR COOPERATION

Ed Boggess, Director
Division of Fish and Wildlife
Department of Natural Resources

Figure 1. Sample of Small Game Hunter survey card

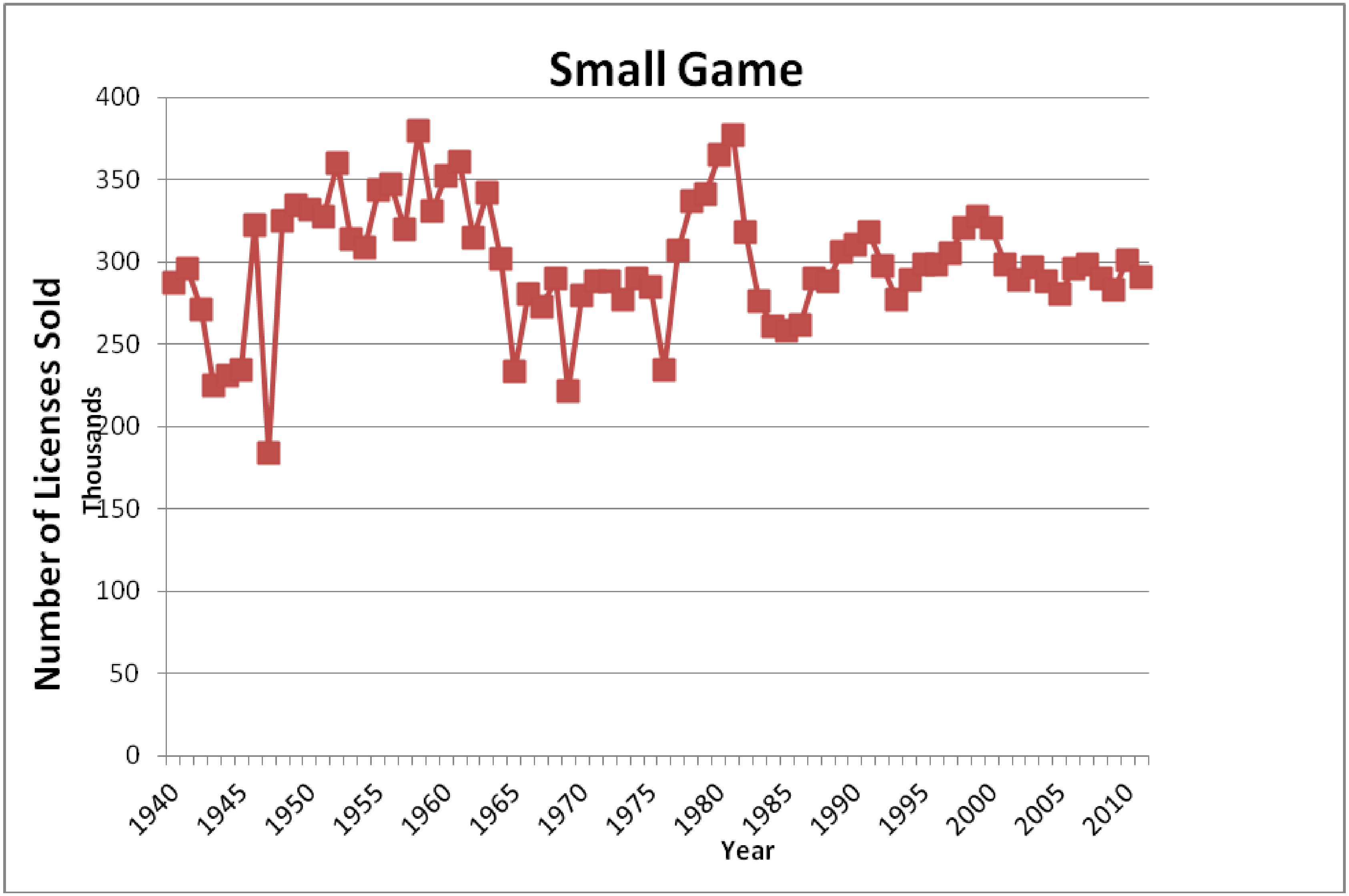

Figure 2. Number of Minnesota small game licenses sold, 1940–2011.

Table 3. Estimated number of hunters for various species, 1999-00 through 2011-12.

	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Ducks	121,718	109,008	109,241	111,619	101,487	104,634	92,634	87,075	87,468	81,358	77,705	72,772	83,450
Canada goose	80,458	76,518	76,322	78,574	74,855	74,728	69,416	66,224	62,649	59,222	55,599	53,426	61,190
Other geese	5,403	6,834	6,502	5,981	7,373	5,327	4,628	4,529	3,695	4,411	3,275	3,647	3,020
American coot	6,189	3,809	3,901	4,411	3,912	5,099	4,129	4,529	3,454	4,166	4,094	4,614	4,580
Common snipe	1,768	2,241	1,382	2,243	1,429	1,902	1,210	2,187	1,928	1,797	1,340	1,340	1,240
Rails / gallinules	491	336	406	673	150	228	0	547	482	408	372	224	230
Crow [*]	13,557	14,004	11,542	12,859	12,263	12,404	11,890	10,777	8,514	10,047	10,643	9,376	11,170
American woodcock	19,353	15,909	11,542	11,962	12,789	12,023	11,035	13,510	10,843	12,171	11,834	10,790	10,080
Mourning dove [γ]						15,524	11,107	12,886	13,172	11,599	10,495	10,641	10,000
Ring-necked pheasant	92,836	100,045	84,694	91,284	105,023	104,406	110,852	118,703	118,311	106,763	99,811	89,142	77,640
Ruffed grouse	138,812	120,547	101,194	90,686	93,513	79,141	76,037	91,682	90,600	86,505	87,530	92,490	93,840
Spruce grouse	10,806	9,411	8,778	7,327	8,727	7,305	7,048	9,840	10,602	8,332	9,825	8,855	10,860
Sharp-tailed grouse	8,350	9,747	8,372	6,355	6,921	6,164	4,913	6,560	6,827	6,616	5,582	7,144	6,590
Gray partridge	9,922	7,842	6,828	6,579	7,975	5,327	6,265	6,013	6,667	4,411	4,243	3,721	2,480
Gray squirrel	30,749	26,664	26,010	25,494	29,190	23,438	24,563	25,459	25,863	22,382	22,255	23,737	26,680
Fox squirrel	20,139	16,693	15,281	14,878	19,936	15,372	15,094	15,619	14,779	13,233	13,174	15,626	13,810
Eastern cottontail	18,174	19,830	17,150	15,700	21,441	18,644	20,148	20,070	19,598	17,644	16,300	15,031	13,730
White-tailed jackrabbit	3,242	2,465	3,251	2,467	3,009	3,044	2,065	2,577	2,891	2,451	1,786	2,233	2,640
Snowshoe hare	6,680	5,154	6,502	5,682	5,567	4,338	3,346	5,545	4,257	4,574	3,498	3,795	3,650
Raccoon (Sept - Feb)	5,993	6,498	6,340	5,981	5,868	6,316	4,841	8,747	9,558	7,433	7,294	8,260	8,920
Raccoon[‡] (March -Aug)	2,554	4,593	4,145	3,589	4,589	3,348	2,705						
Red fox (Sept -Feb)	7,761	10,083	5,608	7,476	7,222	5,783	5,980	6,248	5,783	5,800	7,815	7,218	6,130
Red fox[‡] (March -Aug)	1,867	1,905	2,682	2,243	2,182	1,370	1,282						
Gray fox	1,965	1,344	1,544	1,271	1,505	1,674	997	2,030	1,928	1,879	1,786	1,637	1,400
Coyote	10,806	15,797	10,648	12,261	15,122	16,133	18,653	17,024	16,064	19,278	19,426	19,421	19,240
Badger	786	672	406	748	451	533	783	859	482	490	372	596	390

[*] Crow season added in 1989. [‡] Raccoon and red fox season continuous May 1994 thru March 15, 2006. [γ] Mourning dove season added 2004.

Table 4. Estimated take per hunter, for respondents reporting that they hunted a particular species, 1999-00 through 2011-12.

	Estimated take per hunter												
	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Ducks	8.4	8.9	9.1	9.2	9.0	6.9	7.3	8.4	8.1	8.1	7.4	8.5	8.8
Canada geese	3.5	3.9	4.0	3.3	3.9	3.8	4.1	4.9	3.9	4.9	4.1	4.8	4.8
Other geese	1.2	2.2	1.2	1.9	1.7	1.5	1.9	1.5	2.1	3.2	1.9	1.1	2.2
American coot	4.0	2.7	4.5	4.6	2.8	4.0	3.9	5.6	4.6	5.7	3.6	5.7	3.2
Common snipe	1.6	1.3	1.3	1.5	1.8	1.1	4.4	1.9	2.0	1.2	1.1	1.4	1.2
Rails/gallinules	0.2	3.7	0.6	2.6	0.5	0.3	0	2.4	5.3	0.4	0.8	0.3	1.7
Crow *	4.4	6.9	7.7	5.6	6.7	5.8	7.8	6.4	6.4	5.2	5.3	6.1	7.4
American woodcock	2.8	2.8	2.3	2.4	2.4	3.5	2.5	3.2	2.6	2.4	3.0	2.8	2.6
Mourning dove $^{\gamma}$						6.2	7	6.7	7.7	11.4	10.5	9.4	7.8
Ring-necked pheasant	3.7	3.7	3.2	3.9	4.9	4.0	5.3	4.9	5.5	4.9	4.0	4.0	2.6
Ruffed grouse	4.9	5.1	3.3	2.8	3.8	2.5	2.9	4.5	3.2	3.7	4.1	5.0	4.3
Spruce grouse	1.8	2.5	1.1	1.6	2.1	1.3	1.4	2.7	1.7	2.0	1.9	1.7	1.8
Sharp-tailed grouse	1.6	1.6	1.2	1.3	1.7	1.7	1.3	1.8	2.0	2.1	1.7	2.4	1.8
Gray partridge	1.9	2.1	1.5	1.7	2.8	2.4	2.6	1.9	1.6	2.2	1.9	2.5	1.7
Gray squirrel	4.3	5.3	5.6	5.2	6.0	5.7	5.0	5.5	5.2	5.4	4.9	5.9	4.9
Fox squirrel	3.5	3.9	4.1	4.5	4.2	4.1	4.1	4.2	3.2	3.9	4.1	3.9	3.7
Eastern cottontail	3.2	3.9	3.6	3.3	4.3	4.6	4.5	3.9	4.0	4.5	3.5	3.6	2.8
White-tailed jackrabbit	1.9	2.8	2.6	1.6	2.4	2.3	2.7	1.6	3.3	2.6	1.5	3.2	2.1
Snowshoe hare	3.1	5.2	3.3	1.9	2.2	1.8	3.1	3.0	1.4	2.5	1.5	1.8	2.7
Raccoon (Sept - Feb)	10.9	7.6	9.4	10.0	8.5	9.0	6.0	7.2	4.9	9.7	9.1	9.4	6.0
Raccoon‡ (March -Aug)	6.4	7.8	4.4	5.4	4.7	6.1	2.7						
Red fox (Sept -Feb)	1.2	1.9	1.2	1.5	1.8	1.1	1.7	1.3	1.1	0.8	1.3	1.2	1.2
Red fox‡ (March -Aug)	0.6	0.9	1.5	1.7	0.6	0.6	0.9						
Gray fox	0.9	0.7	0.4	0.4	0.4	1.1	0.9	1.8	0.3	1.3	1.0	1.5	0.8
Coyote	1.3	1.8	1.1	1.2	1.3	1.1	2.1	1.2	2.1	2.4	2.4	2.3	1.8
Badger	1.1	0.8	0.6	1.7	0.7	1.0	1.2	1.3	0.3	1.0	2.0	1.0	0.8

*Crow season added in 1989. ‡ Raccoon and red fox season continuous May 1994 thru March 15, 2006. $^{\gamma}$ Mourning dove season added 2004.

Table 5. Mean harvest for successful hunters and hunter success rates (%), 2002-03 through 2011-12.

	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Ducks	10.6 (86.7)	10.4 (86.7)	8.6 (81.1)	8.9 (82.5)	9.9 (84.4)	9.5 (85.4)	9.8 (82.8)	9.2(80.5)	10.3 (82.7)	10.3 (84.6)
Canada geese	4.6 (72.0)	5.1 (76.0)	5.2 (72.8)	5.5 (73.7)	6.3 (78.4)	5.5 (71.4)	6.4 (76.6)	5.6 (72.8)	6.1 (79.5)	6.3 (77.3)
Other geese	4.4 (42.5)	2.7 (65.3)	3.3 (45.7)	4.5 (43.1)	2.7 (55.2)	4.2 (50.0)	6.3 (50.0)	3.5 (54.5)	2.7 (40.8)	4.3 (51.3)
American coot	6.4 (71.2)	3.7 (76.9)	5.5 (73.1)	5.1 (75.9)	7.2 (77.6)	6.3 (74.4)	6.9 (82.4)	5.5 (65.5)	7.2 (79.0)	4.3 (74.6)
Common snipe	2.6 (60.0)	2.3 (78.9)	1.6 (68.0)	4.7 (94.1)	2.6 (75.0)	2.9 (70.8)	1.7 (72.7)	1.8 (61.1)	2.2 (66.7)	1.6 (75.0)
Rails / gallinules	3.8 (66.7)	1.0 (50.0)	1.0 (33.3)	0.0 (0.0) *	4.3 (57.1)	6.4 (83.3)	1.0 (40.0)	1.3 (60.0)	1.0 (33.3)	5.0 (33.3)
Crow	6.3 (89.0)	7.9 (85.3)	6.4 (90.8)	9.1 (85.6)	7.2 (89.1)	7.3 (87.7)	5.9 (87.8)	5.9 (89.5)	6.7 (91.3)	8.6 (86.1)
American woodcock	3.6 (65.6)	3.3 (71.8)	5.3 (64.6)	3.6 (70.3)	3.9 (82.7)	3.7 (68.9)	3.3 (73.8)	4.1 (72.3)	3.6 (75.9)	3.6 (71.5)
Mourning dove $^{\gamma}$			7.9 (78.9)	8.7 (80.1)	8.2 (81.2)	9.8 (78.7)	13.2 (86.6)	11.4 (92.2)	11.1 (84.6)	10.0 (77.5)
Ring-necked pheasant	5.5 (71.7)	6.3 (77.2)	5.7 (70.0)	7.0 (75.9)	6.6 (75.3)	7.1 (78.1)	6.4 (76.7)	5.8 (68.7)	5.6 (71.5)	4.3 (61.8)
Ruffed grouse	4.3 (63.8)	5.1 (73.5)	3.9 (63.3)	4.4 (67.5)	5.9 (77.4)	4.7 (69.4)	5.0 (73.7)	5.5 (74.5)	6.6 (76.3)	5.8 (73.6)
Spruce grouse	3.4 (48.0)	3.3 (62.9)	2.3 (54.2)	2.4 (60.6)	3.8 (70.6)	3.1 (53.8)	3.0 (67.6)	3.1 (63.6)	2.4 (70.6)	2.9 (62.9)
Sharp-tailed grouse	3.5 (38.8)	3.3 (52.2)	3.1 (54.3)	2.4 (55.1)	3.3 (56.0)	4.4 (45.9)	3.2 (64.2)	3.0 (57.3)	3.5 (67.7)	3.0 (60.0)
Gray partridge	2.8 (59.1)	4.1 (68.9)	3.6 (65.7)	5.0 (52.3)	2.8 (68.8)	3.0 (55.4)	3.4 (64.8)	3.3 (57.9)	4.2 (58.0)	3.1 (53.1)
Gray squirrel	6.1 (86.2)	7.0 (85.3)	6.9 (82.5)	5.8 (86.1)	6.4 (87.1)	5.9 (87.6)	6.2 (87.6)	5.8 (85.6)	7.0 (84.0)	6.3 (77.6)
Fox squirrel	5.9 (76.4)	5.1 (82.6)	4.8 (85.1)	5.0 (82.5)	5.0 (84.5)	3.9 (82.6)	4.6 (83.3)	4.8 (84.7)	4.6 (85.7)	4.9 (75.8)
Eastern cottontail	4.7 (70.5)	5.2 (84.2)	5.8 (79.6)	5.4 (83.4)	4.6 (84.8)	4.8 (84.0)	5.3 (85.2)	4.3 (82.6)	4.4 (81.2)	4.1 (69.5)
White-tailed jackrabbit	2.7 (60.6)	3.3 (72.5)	3.0 (75.0)	3.2 (82.8)	2.5 (63.6)	4.5 (72.2)	3.8 (70.0)	2.1 (70.8)	4.6 (70.0)	3.3 (61.8)
Snowshoe hare	2.9 (67.1)	3.5 (60.8)	3.0 (61.4)	4.6 (68.1)	3.8 (80.3)	2.2 (62.3)	3.5 (71.4)	2.6 (59.6)	2.6 (68.6)	3.7 (72.3)
Raccoon (Sept -Feb)	11.6 (86.3)	9.6 (88.5)	9.9 (91.6)	6.5 (92.6)	7.7 (93.8)	5.4 (89.9)	10.6 (91.2)	9.6 (94.9)	10.0 (93.7)	6.7 (89.6)
Raccoon‡ (March -Aug)	5.9 (91.7)	5.6 (85.2)	6.7 (90.9)	3.1 (86.8)						
Red fox (Sept -Feb)	3.1 (49.0)	3.5 (51.0)	2.8 (38.2)	3.7 (46.4)	2.1 (60.0)	2.3 (45.8)	1.5 (49.3)	2.4 (54.3)	2.3 (53.6)	2.4 (48.1)
Red fox‡ (March -Aug)	3.6 (46.7)	1.1 (51.7)	1.4 (44.4)	1.6 (55.6)						
Gray fox	1.8 (23.5)	1.3 (30.0)	2.6 (40.9)	1.9 (50.0)	2.7 (65.4)	1.0 (29.2)	3.3 (39.1)	2.5 (41.7)	4.0 (36.4)	2.5 (33.3)
Coyote	3.2 (36.6)	2.7 (48.8)	2.5 (45.3)	4.11 (50.4)	2.4 (50.5)	4.4 (49.0)	4.4 (53.8)	4.6 (51.7)	4.0 (57.1)	3.9 (44.8)
Badger	2.8 (60.0)	1.0 (66.7)	1.2 (85.7)	1.2 (100.0)	1.6 (81.8)	1.0 (33.3)	1.2 (83.3)	2.5 (80.0)	1.0 (100.0)	1.3 (60.0)

‡ Raccoon and red fox season continuous May 1994 thru March 15, 2006. $^{\gamma}$ Mourning dove season added 2004. * No hunters surveyed reported Rails/Gallinules in bag.

Table 6. Statewide (resident and non-resident) small game hunting license sales and estimated hunter harvest, 2000-01 through 2011-12.

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Small game license sales[a]	320,862	298,055	288,729	296,939	287,725	280,156	295,898	298,467	290,064	282,983	300,624	290,686
State duck stamp sales	121,709	118,590	119,677	118,757	114,003	102,143	101,792	100,134	95,675	89,942	88,069	89,681
Pheasant stamp sales	114,440	97,665	102,097	121,456	114,653	117,301	129,546	129,315	123,270	110,456	104,286	86,868
Estimated harvest[b]												
Ducks	969,081	989,723	1,024,662	914,398	727,206	676,741	730,559	708,491	658,186	576,571	619,604	730,370
Canada geese	301,481	308,341	256,937	289,689	284,714	281,829	324,498	243,705	288,411	229,068	257,532	296,040
Other geese	14,761	7,867	11,125	12,755	8,150	9,025	6,658	7,723	13,895	6,255	3,945	6,750
American coot	10,437	17,554	20,114	10,993	20,345	15,938	24,909	16,061	23,871	14,820	26,345	14,740
Common snipe	2,801	1,783	3,432	2,558	2,130	5,336	4,221	3,933	2,210	1,487	1,936	1,470
Rails / gallinules	1,233	244	1,723	75	75	0	1,329	2,569	163	298	75	390
Crow	96,347	84,412	71,753	82,285	71,943	92,742	69,188	54,319	51,742	56,301	57,298	82,990
American woodcock	45,341	26,662	28,230	30,438	41,479	27,919	39,907	27,866	29,210	35,384	29,766	25,980
Mourning dove[d]					96,559	77,749	85,950	101,161	132,577	109,988	100,234	77,790
Ring-necked pheasant	375,169	266,786	357,833	511,462	419,712	585,299	587,580	655,443	522,071	400,242	359,396	204,440
Ruffed grouse	619,612	331,916	249,386	350,674	194,687	224,309	417,153	293,544	318,338	357,998	465,576	401,280
Spruce grouse	23,151	9,480	11,943	18,327	9,204	10,079	26,568	17,705	16,997	19,159	14,957	19,470
Sharp-tailed grouse	15,888	9,795	8,516	11,835	10,417	6,387	11,939	13,790	13,695	9,545	16,819	12,020
Gray partridge	16,782	10,174	10,921	22,250	12,572	16,289	11,545	11,000	9,660	8,019	9,154	4,110
Gray squirrel	140,253	145,916	133,589	174,848	132,659	122,078	140,788	133,194	121,534	109,717	138,925	129,600
Fox squirrel	65,103	62,958	67,100	84,529	62,410	62,187	66,068	47,736	51,079	54,013	61,686	51,580
Eastern cottontail	78,328	62,426	51,967	93,054	86,508	90,062	77,872	78,588	79,927	57,702	53,874	38,780
White-tailed jack rabbit	6,803	8,453	4,046	7,161	6,940	5,493	4,149	9,482	6,446	2,608	7,221	5,430
Snowshoe hare	26,904	21,717	10,909	11,969	7,895	10,406	16,801	5,789	11,343	5,352	6,772	9,700
Raccoon (Sept -Feb)	3,785	59,279	60,049	49,878	56,970	29,191	62,891	46,739	72,026	66,667	77,689	53,910
Raccoon [c] (Mar –Aug)	35,733	18,362	19,524	21,752	20,456	7,331						
Red fox (Sept –Feb)	19,460	6,842	11,438	13,000	6,072	10,166	7,872	6,188	4,408	10,238	8,781	7,140
Red fox [c] (Mar –Aug)	1,676	4,077	3,746	1,287	836	1,141						
Gray fox	900	571	521	602	1,758	927	3,593	559	2,443	1,857	2,382	1,160
Coyote	28,908	12,032	14,223	19,961	18,230	38,612	20,769	34,377	45,689	46,234	44,051	33,820
Badger	558	244	1,272	302	533	924	1,091	159	490	744	596	310

Harvest estimates in this table, and the number of hunters and mean take per hunter in Table 5, are calculated from different questions on the survey form. The sample used in calculations differs from one estimator to the next. This is because some respondents give specific answers to one question but not to a related one. A formula is used to calculate the total estimated take for each species that appear in this table. In most years the formula produces results rather close to those obtained by multiplying the average take per hunter times the number of hunters. However, in other years (e.g., 1985) results of the two methods are quite divergent, perhaps as a result of an unusual sample. This is being investigated further, and as a result, numbers may change somewhat in future reports. The most current report of survey findings will have the best data available at that time.

[a] Includes all types of Small game licenses. Duplicate licenses not included.
[b] Estimates based upon response of hunters to questionnaires.
[c] Raccoon and red fox seasons were year round from May, 1994 through March 16, 2006.
[d.] Mourning dove season added 2004.

Table 7. Mail survey results of nonresident small game hunters, 1999-00 through 2010-11.

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Nonresident licenses issued[a]	7001	5,843	5,852	6,291	6,385	5,897	7,356	7,858	7,114	6,934	6,695	6,312
Questionnaires:												
Number mailed	98	124	130	123	182	210	185	185	226	196	163	169
Number not delivered	6	9	9	17	13	10	11	11	15	10	6	11
Number (percent) returned	56 (61)	77 (67)	75 (66)	68 (64)	114 (67)	134 (67)	115 (62)	101 (58)	89 (42)	105 (54)	107 (66)	91 (54)
Estimated nonresidents and (percent) of all nonresidents hunting:												
Ducks	2,375 (34)	2,727 (47)	2,263 (39)	2,498 (40)	2,394 (37)	2,040 (35)	2,344 (32)	2,256 (29)	2,293 (32)	1,849 (27)	2,003 (29.9)	2,430 (38.5)
Canada goose	1,500 (21)	1,169 (20)	1,092 (19)	1,388 (24)	1,368 (21)	1,818 (31)	2,083 (28)	934 (12)	1,587(22)	726 (10)	1,314 (19.6)	1,620 (25.6)
Ruffed grouse	3,000 (43)	1,169 (20)	2,029 (35)	2,313 (40)	1,824 (29)	1,774 (30)	1,953 (26)	1,867 (24)	1,940 (27)	1,915 (28)	2,503 (37.4)	1,460 (23.1)
Ring-necked pheasant	625 (9)	935 (16)	1,404 (24)	2,128 (36)	2,679 (42)	2,572 (44)	3,776 (51)	2,645 (34)	3,116 (44)	1,519 (22)	2,003 (29.9)	1,780 (28.2)
Raccoon	250 (4)	0 (0)	0 (0)	0 (0)	0 (0)	44 (0.7)	0 (0)	78 (1.0)	0 (0)	0 (0)	63 (0.9)	0 (0)
Estimated nonresident take:												
Ducks	18,253	42,225	17,556	17,855	19,269	12,149	12,173	22,718	15,463	11,755	17,055	13,840
Canada goose	5,001	13,400	5,852	5,736	6,214	3,946	3,580	3,501	5,762	3,698	6,334	4,050
Ruffed grouse	24,003	6,622	9,207	9,437	7,924	6,429	11,522	7,236	6,938	8,651	12,600	8,980
Ring-necked pheasant	4,001	3,740	7,647	9,344	11,174	13,656	16,079	17,661	10,642	6,274	8,076	4,860
Raccoon [b]	3,375	0	0	0	0	887	0	3,268	0	0	593	0

[a] Excludes duplicate licenses and nonresident shooting preserve licenses.
[b] In 2001, 2002, 2003, 2004, 2006, 2008, 2009 and 2011 no non-residents reported hunting/harvesting raccoons.

Raccoon take per hunter			
Year	Resident	Non-resident	Number of Non-resident raccoon licenses
2002 [b]	11	0	46
2003 [b]	10	0	44
2004 [b]	8	0	46
2005	6	20	44
2006 [b]	8	0	53
2007	5	42	45
2008 [b]	10	0	40
2009 [b]	10	0	33
2010	9.4	9.4	42
2011	6.7	0	34

The following information has been excerpted from: U.S. Fish and Wildlife Service. Migratory bird hunting activity and harvest during the 2010 and 2011 hunting seasons: preliminary estimates. U.S. Department of the Interior, Washington, D.C. U.S.A. The entire report is available on-line at http://www.fws.gov/migratorybirds/reports/reports.html

Table 1. Species composition of the Minnesota waterfowl harvest, 2010 and 2011. (from: Raftovich, R.V., K.A. Wilkins, S.S. Williams, and H.L. Spriggs. 2012. Migratory Bird Hunting activity and harvest during the 2010 and 2011 hunting seasons: Preliminary estimates. U.S. Fish and Wildlife Service, Laurel, Maryland. USA July 2012. 63 pp).**Note:** All hunter activity and harvest estimates are preliminary, pending final counts of the number of migratory bird hunters in each state and complete audits of all survey response data.

	Minnesota Harvest					Mississippi Flyway Harvest		
Species	2010	% of Harvest	2011	% of Harvest	Percent change in Harvest 10-11	2010	2011	Percent change Harvest 10-11
Mallard	138,167	26.37	180,515	29.07	+ 23	2,228,872	2,240,248	+ 1
Domestic mallard	0	0	0	0	0	1,482	3,398	+ 56
American black duck	1,421	0.27	491	0.08	- 189	27,073	21,992	- 23
Black x mallard	284	0.05	491	0.08	+ 42	4,522	5,068	+ 11
Gadwall	25,871	4.94	8,339	1.34	- 210	1,098,694	1,474,405	+ 25
American wigeon	9,382	1.79	5,396	0.87	- 74	129,962	136,779	+ 5
Green-winged teal	36,674	7.00	36,790	5.92	0	1,052,784	1,001,902	- 5
Blue-winged /cinnamon teal	36,958	7.05	89,767	14.45	+ 59	633,448	704,647	+ 10
Northern shoveler	19,332	3.69	15,697	2.53	- 23	475,080	375,918	- 26
Northern pintail	11,087	2.12	7,848	1.26	- 41	196,185	212,499	+ 8
Wood duck	77,897	14.87	150,593	24.25	+ 48	919,239	928,178	+ 1
Redhead	18,479	3.53	18,640	3.00	+ 1	109,003	155,227	+ 30
Canvasback	13,362	2.55	9,811	1.58	- 96	72,703	68,358	- 6
Greater scaup	1,421	0.27	1,962	0.32	+ 28	23,692	33,680	+ 30
Lesser scaup	14,783	2.82	5,396	0.87	- 174	157,275	114,903	- 37
Ring-necked duck	88,984	16.98	63,278	10.19	- 41	268,411	260,061	- 3
Goldeneye	7,051	0.92	9,320	1.50	+ 48	33,578	39,306	+ 15
Bufflehead	12,607	3.26	7,358	1.18	- 132	79,652	78,145	- 2
Ruddy duck	1,421	0.27	1,962	0.32	+ 28	8,196	21,717	+ 62
Scoters	284	0.05	0	0	- 100	3,136	6,014	+ 48
Hooded merganser	6,254	1.19	6,377	1.03	+ 2	45,988	53,766	+ 14
Other mergansers	0	0.00	981	0.16	+ 100	5,256	13,368	+ 61
Total Duck Harvest (retrieved kill)	524,000 ±13%		621,000 ±11%		+ 16	7,647,000 ±6%	8,000,100 ±6%	+ 4

[a] Sum of all species does not equal total because of rounding error.

Table 2. Top 10 states in number of **adult duck hunters**, 2011, and number of hunter-days and retrieved duck kill, in (from: Raftovich, R.V., K.A. Wilkins, S.S. Williams, and H.L. Spriggs. 2012. Migratory Bird Hunting activity and harvest during the 2010 and 2011 hunting seasons: Preliminary estimates. U.S. Fish and Wildlife Service, Laurel, Maryland. USA July 2012. 63 pp).**Note:** All hunter activity and harvest estimates are preliminary, pending final counts of the number of migratory bird hunters in each state and complete audits of all survey response data.

State	**Number of active duck hunters**	**Duck hunter days afield**	**Total duck harvest**	**Seasonal duck harvest per hunter**
Louisiana	97,500 ± 5%	857,100 ± 9%	2,818,800 ± 10%	28.9 ±12%
Minnesota	76,800 ± 9%	401,100 ± 11%	621,000 ± 11%	8.1 ± 15%
Texas	74,700 ± 21%	480,100 ± 45%	1,390,400± 46%	18.6 ± 50%
Arkansas	58,800 ± 9%	476,000 ± 13%	1,358,400 ± 13%	23.1 ± 16%
Wisconsin	58,300 ± 11%	424,700 ± 15%	445,700 ± 12%	7.6 ± 16%
California	49,100 ± 10%	468,500 ± 13%	1,489,100 ± 16%	30.3 ± 19%
Illinois	34,100 ± 10%	311,000 ± 13%	507,000 ± 17%	14.9 ± 20%
North Dakota	32,000 ± 6%	162,600 ± 10%	460,600 ± 8%	14.4 ± 10%
Michigan	31,500 ± 11%	191,000 ± 12%	287,500 ±16%	9.1 ± 19%
Missouri	29,600 ± 12%	230,300 ± 20%	493,200 ± 26%	16.7 ± 29%
Mississippi Flyway		3,637,200 ± 5%	8,000,100 ± 6%	
United States		7,073,700 ± 4%	15,931,200 ± 6%	

Table 3. Top 10 states in number of **adult goose hunters**, 2011, and number of hunter-days and retrieved goose kill, in (from: Raftovich, R.V., K.A. Wilkins, S.S. Williams, and H.L. Spriggs. 2012. Migratory Bird Hunting activity and harvest during the 2010 and 2011 hunting seasons: Preliminary estimates. U.S. Fish and Wildlife Service, Laurel, Maryland. USA July 2012. 63 pp).**Note:** All hunter activity and harvest estimates are preliminary, pending final counts of the number of migratory bird hunters in each state and complete audits of all survey response data.

State	Number of active goose hunters	Goose hunter days afield	Total goose harvest	Seasonal goose harvest per hunter
Minnesota	54,700 ± 11%	309,600 ± 15%	248,300 ± 22%	4.5 ± 25%
Texas	42,300 ± 23%	192,800 ± 56%	236,200 ± 41%	5.6 ± 47%
Wisconsin	40,800 ± 12%	271,000 ± 16%	93,500 ± 19%	2.3 ± 22%
California	33,900 ± 11%	219,100 ± 13%	166,700 ± 19%	4.9 ± 22%
Michigan	28,400 ± 12%	166,900 ± 15%	125,400 ± 18%	4.4 ± 21%
Ohio	28,400 ±20%	204,200 ±23%	111,600 ±30%	3.9 ±36%
Pennsylvania	27,900 ± 15%	130,500 ± 19%	96,800 ± 25%	3.5 ± 29%
Illinois	21,200 ± 14%	171,700 ± 16%	114,900 ± 28%	5.4 ± 31%
Maryland	25,000 ±10%	131,200 ± 13%	117,600 ± 16%	4.7 ± 19%
North Dakota	24,500 ± 7%	109,300 ± 9%	147,800 ± 13%	6.0 ± 15%
Arkansas	18,400 ±16%	97,000 ±26%	89,000 ±31%	4.8 ±34%
Mississippi Flyway		1,667,300 ± 7%	1,082,500 ± 9%	
United States [b]		3,573,800 ± 5%	2,879,900 ± 5%	

[b]. Goose hunter statistics do not include brant hunter statistics for coastal states with brant seasons: Connecticut, Delaware, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Rhode Island, Virginia, California, Oregon, Washington, and Alaska.

HUNTER ACTIVITY AND GOOSE HARVEST DURING THE SEPTEMBER 2011 CANADA GOOSE HUNT IN MINNESOTA

David P. Rave, Wetland Wildlife Populations and Research
Margaret H. Dexter, Wildlife Policy and Research Unit
John Giudice, Biometrics Unit

The September Canada goose season in Minnesota was 3 - 22 September 2011 (20 days). Beginning in 2007 and continuing through 2009, a 7-day (16 - 22 Sep) experimental season was added in the Northwest Goose Zone (Fig. 1). The U.S. Fish and Wildlife Service had approved the 7-day season extension in other goose zones in Minnesota after a 3-year experimental season from 1999-2001 (Maxson et al. 2003). In 2010 and 2011, this season extension was operational statewide.

During the September season the daily bag limit was 5 Canada geese per day statewide. Shooting hours were 1/2 hour before sunrise to sunset. Taking of Canada geese was prohibited on or within 100 yards of all surface waters in the Northwest Goose Zone, in the Carlos Avery Wildlife Management Area and in the Swan Lake Area. Within the Twin Cities Metro Zone, and goose refuges open to goose hunting, hunting was not permitted from public road right-of-ways. Goose hunters were required to obtain a $4.00 permit to participate in the September season. This report documents results of the 2011 September goose hunter mail questionnaire survey (Appendix A).

METHODS

Permittees were randomly selected to receive a post-season hunter survey. Questionnaires were sent to 3,100 permit holders following the season. Questionnaires were individually numbered, and up to 3 questionnaires were mailed to individuals who had not responded. Completed questionnaires were double key-punched to reduce data-entry errors.

The questionnaire asked hunters the number of days hunted, and, number of geese shot and retrieved, number of geese knocked down and not retrieved, and the county they hunted in the most. Hunters were asked to indicate the number of days during the September season that they hunted over water, and not over water, and the number of geese they shot under each scenario. Finally, the questionnaire asked hunters a series of questions to gauge their satisfaction with the September Canada goose hunting season.

We used the R programming language (ver. 2.9.2; R Development Core Team [RDCT] 2009) to summarize responses to the survey.

RESULTS AND DISCUSSION

The DNR License Bureau reported that 34,271 Special Canada Goose Season permits were sold prior to 23 September, 2011. Response rate to the survey was 55%. Among those respondents, 76% indicated that they hunted during the September season. Active hunters were afield an average of 3.9 days and retrieved 4.8 geese. Overall, the success rate for active hunters was 73% (Table 1).

The survey estimates that 26,000 active hunters shot and retrieved 123,700 Canada geese during the 2011 September season (Table 2). Prior to the implementation of the Harvest Information Program, the U.S. Fish and Wildlife Service adjusted their mail survey statistics by a memory and prestige response bias factor of 0.848 for geese bagged in the Mississippi Flyway (Voelzer et al. 1982:56). Multiplying September Canada goose harvest by the adjustment factor would indicate a 2011 retrieved harvest of 104,900 geese.

We asked hunters how many days they hunted overwater and how many days they hunted away from water. A total of 37% of hunters statewide hunted over water, and 26% of all days spent hunting during the September season were overwater. The survey indicates that 20 % (SE = 0.79) of the geese harvested in the early season (25,200 total geese) were harvested by hunters overwater. We asked hunters if they favored eliminating overwater hunting statewide during the September season. Twenty-one percent of active hunters favored, 60% were opposed, and 19% had no preference for eliminating overwater hunting.

We asked hunters about whether or not they had harvested a limit of 5 geese, or had harvested zero geese, during the September goose season. Nineteen percent of September goose hunters reported bagging a limit of geese $\geq$1 time during the September season. Seventy percent of hunters reported a zero harvest on at least one day during the September season.

Fifty-two percent of all geese in the September season were harvested in the first week of the season, followed by 32% in the second week, and 16% harvested the third. When asked about their preference for season dates for the September season: 51% of active hunters wanted to maximize the number of days, 24% wanted a split between the end of the early goose season and start of the regular waterfowl season, and 25% had no preference. Sixty-eight percent of the hunters that hunted during the September goose season also hunted on the regular waterfowl opener.

Landowners and managers in the west central portion of Minnesota are still reporting numerous goose depredation issues. If these issues continue, there may be justification for a new September goose zone (Fig. 2) to attempt to address these issues. To determine how many September goose hunters hunt in the area where the new zone would be located, we asked hunters which county they hunted in the most during the September Canada goose season (Appendix B). Seventeen percent of September goose hunters (4,300) hunted most within counties at least partially within the new zone, and those hunters harvested 15% (18,300) of the geese harvested during the 2011 September Canada goose season, although it is unknown how many of those geese were actually harvested within the new zone.

We asked hunters how satisfied they were (1=very low ,…, 7=very high) relative to overall hunting experience, number of geese bagged, number of geese seen, and regulations. Mean satisfaction was: overall experience 5.6, geese bagged 4.4, number of geese seen 5.0, and regulations 5.4.

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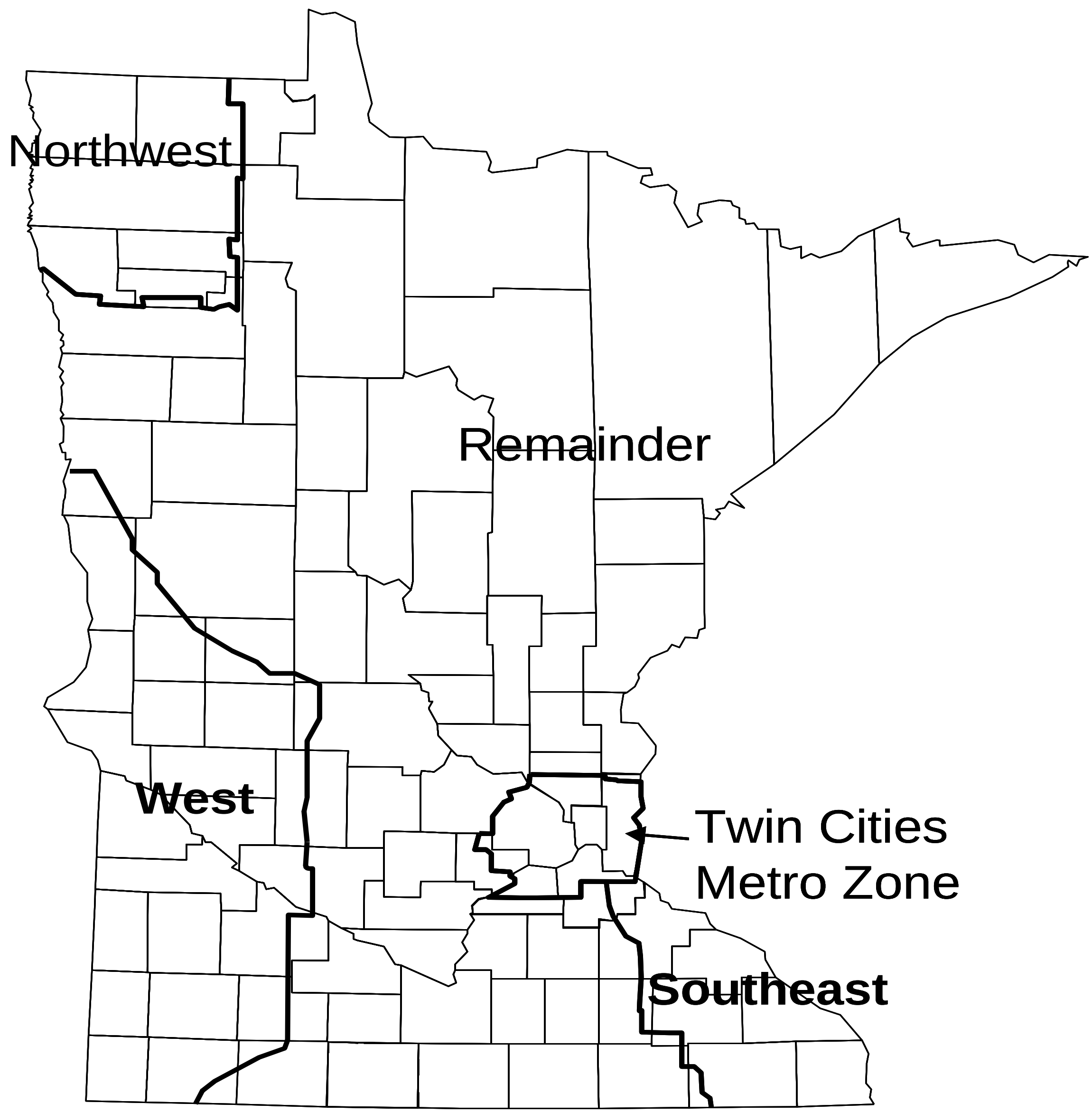

Figure 1. Traditional September season Goose Zones in Minnesota. The West, Twin Cities Metro and Southeast zones are now included in the Remainder zone during the September season.

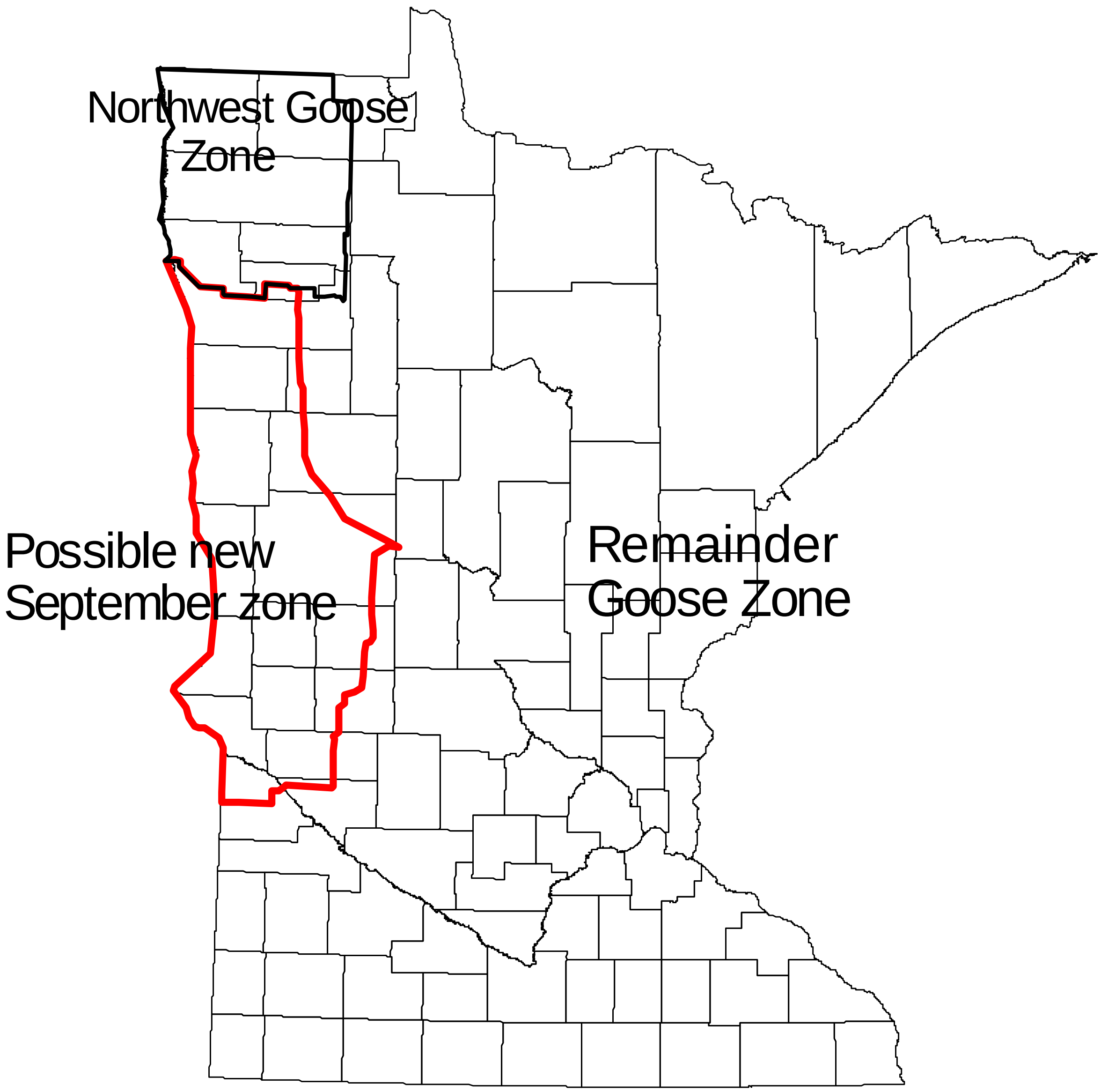

Figure 2. Location of a possible new September Canada goose zone in comparison to the current Northwest goose zone, and the Remainder of State Goose zone.

Table 1. Permit sales, hunter activity, and harvest[a] during the September Canada Goose season (3 – 22 September) in Minnesota, 2011.

Parameter	Total
Total permits sold	34,271
Questionnaires delivered	3,100
Useable questionnaires returned	1,674
% responding	55.1
Active hunters	1,270
% active hunters	76.0
% hunters that were successful	73
Days hunted per active hunter	3.9
Geese shot and retrieved per active hunter	4.8
Unretrieved harvest per active hunter	0.5
% unretrieved harvest	0.092
EXPANDED:	
Active hunters	26,000
Hunter days	102,500
Retrieved harvest	**123,700**
Est. unretrieved harvest	12,900
Total harvest	140,500

[a]Harvest estimates not adjusted for memory/exaggeration bias.

Table 2. Retrieved harvest estimates by zone during the September Canada Goose season in Minnesota, 2000 – 2009. Total retrieved harvest estimates during the September Canada Goose season in Minnesota, 2010-2011.

Year	Northwest	West	Southeast	Twin Cities Metro	Remainder	Total Geese Harvested	Number of Hunters	Geese/ Day/ Hunter	Total Geese/ Hunter
2000	2,750	18,909	1,183	15,594	51,685	**90,121**	33,202	0.63	2.71
2001	2,047	27,663	538	8,164	62,608	**101,021**	28,265	0.82	3.57
2002	1,568	22,075	848	8,504	50,769	**83,764**	26,089	0.68	3.20
2003	2,805	17,779	2,357	9,890	48,157	**80,988**	30,415	0.74	2.66
2004	4,326	16,843	1,197	11,090	56,480	**89,936**	29,657	0.80	3.03
2005	4,888	15,304	1,717	11,139	61,218	**94,266**	27,865	0.89	3.38
2006	6,826	17,987	1,461	11,844	53,321	**91,439**	28,405	0.86	3.22
2007	7,948	14,952	1,469	11,702	58,243	**94,314**	25,379	0.91	3.72
2008	5,530	16,168	2,580	13,656	62,827	**100,748**	27,392	0.98	3.73
2009	4,442	10,294	2,023	12,794	48,609	**78,151**	25,189	0.85	3.10
2010						**107,907**	26,848	0.98	4.00
2011						**123,700**	26,000	1.21	4.80

Appendix A. Questions asked on the 2011 September Special Canada Goose Season Hunter Survey.

1. Did you hunt during the September 3-22, 2011 September Canada goose season? (Check One)

    __ YES
    __ NO→ If NO, PLEASE SKIP TO→ **QUESTION 6**.

2. Please indicate the number of days hunted, total harvest of geese, and the County you hunted most during the 2011 September Canada goose season.

    _________________ Number of days you hunted
    _________________ Total geese personally shot and retrieved
    _________________ Total geese personally knocked down but <u>not</u> retrieved
    _________________ County hunted most

3. Did you personally hunt geese overwater (for example with decoys floating in or along the shore of a wetland or pass shooting next to a wetland) during the September 2011 Canada goose season?

    ______NO →IF NO PLEASE SKIP TO→ **QUESTION 4**
    ______YES

    If Yes:
    How many <u>days</u> did you personally hunt overwater? ______DAYS
    How many <u>geese</u> did you personally shoot while hunting overwater? ______GEESE

4. During the 2011 September Canada goose season, about <u>how many days</u> that you hunted geese….

    ..did you shoot your daily bag limit of geese (5)?_____________ DAYS
    ..did you shoot 0 geese? _____________ DAYS

5. During the 2011 September Canada goose season, <u>how many geese</u> did you personally harvest during each of the following periods:

    First week (Saturday, Sept. 3 – Friday, Sept. 9)? ___________
    Second week (Saturday, Sept. 10 – Friday, Sept. 16)? ___________
    Last week (Saturday, Sept. 17 – Thursday, Sept. 22)? ___________

6. In 2012, the Regular waterfowl season may open on Saturday, September 22. Please place an **X** next to the option for the September goose season that you would favor. Option 1 would maximize days during the September goose season. Option 2 would allow a one week delay between the September goose season and Regular waterfowl seasons.

    _____Option 1: Saturday, September 1 to Friday, September 21
    _____Option 2: Saturday, September 1 to Sunday, September 16
    _____Option 3: No Preference

7. Do you favor eliminating over-water hunting statewide during the September Canada goose season? (CHECK ONLY ONE BELOW).

    ___YES
    ___NO
    ___NO PREFERENCE

8. During the 2011 September Canada goose season, how satisfied or dissatisfied were you with the following? (*Please circle one response for each. If you did not hunt geese please circle "9" in the far right column.*)

	Very dissatisfied	**Moderately dissatisfied**	**Slightly Dissatisfied**	**Neither**	**Slightly Satisfied**	**Moderately satisfied**	**Very satisfied**	**Did not hunt**
hunting experience	1	2	3	4	5	6	7	9
hunting geese bagged	1	2	3	4	5	6	7	9
hunting regulations	1	2	3	4	5	6	7	9
number of geese seen	1	2	3	4	5	6	7	9

9. Did you hunt waterfowl on opening weekend of the regular waterfowl season in Minnesota this year (Sept. 24-25)?

___ Yes ___ No (Please check one.)

If you have general comments you may write them here (continue on back if necessary). If you have questions and desire a specific response, please contact your local DNR Wildlife Office or the DNR Information Center (Minnesota DNR, 500 Lafayette Road, St. Paul, MN 55155-4020, 1-888-646-6367). Thank you.

Comments:

Appendix B. Number and percent of September Canada goose hunters in the survey in each county in Minnesota, 2011. Counties in bold are at least partially within a proposed new early season Canada goose zone.

County	Hunters		County	Hunters		County	Hunters	
	N	%		N	%		N	%
AITKIN	17	0.014	LOW	13	0.011	TODD	14	0.012
ANOKA	22	0.019	LE SUEUR	15	0.013	**TRAVERSE**	4	0.003
BECKER	23	0.020	LINCOLN	6	0.005	WABASHA	6	0.005
BELTRAMI	12	0.010	LYON	7	0.006	WADENA	8	0.007
BENTON	13	0.011	MAHNOMEN	11	0.009	WASECA	9	0.008
BIG STONE	17	0.014	MARSHALL	14	0.012	WASHINGTON	21	0.018
BLUE EARTH	17	0.014	MARTIN	12	0.010	WATONWAN	4	0.003
BROWN	11	0.009	McLEOD	33	0.028	**WILKIN**	3	0.003
CARLTON	5	0.004	MEEKER	28	0.024	WINONA	6	0.005
CARVER	28	0.024	MILLE LACS	10	0.008	WRIGHT	54	0.046
CASS	17	0.014	MORRISON	14	0.012	YELLOW MEDICINE	7	0.006
CHIPPEWA	7	0.006	MOWER	3	0.003			
CHISAGO	12	0.010	MURRAY	8	0.007			
CLAY	16	0.014	NICOLLET	12	0.010			
CLEARWATER	6	0.005	NOBLES	7	0.006			
COOK	0	0.000	**NORMAN**	2	0.002			
COTTONWOOD	12	0.010	OLMSTEAD	5	0.004			
CROW WING	17	0.014	**OTTERTAIL**	51	0.043			
DAKOTA	20	0.017	PENNINGTON	2	0.002			
DODGE	1	0.001	PINE	17	0.014			
DOUGLAS	47	0.040	PIPESTONE	3	0.003			
FARIBAULT	13	0.011	POLK	16	0.014			
FILLMORE	2	0.002	**POPE**	23	0.020			
FREEBORN	18	0.015	RAMSEY	2	0.002			
GOODHUE	5	0.004	RED LAKE	0	0.000			
GRANT	8	0.007	REDWOOD	3	0.003			
HENNEPIN	23	0.020	RENVILLE	6	0.005			
HOUSTON	1	0.001	RICE	20	0.017			
HUBBARD	7	0.006	ROCK	2	0.002			
ISANTI	18	0.015	ROSEAU	14	0.012			
ITASCA	19	0.016	SCOTT	37	0.031			
JACKSON	18	0.015	SHERBURNE	27	0.023			
KANABEC	11	0.009	SIBLEY	9	0.008			
KANDIYOHI	25	0.021	ST. LOUIS	27	0.023			
KITTSON	5	0.004	STEARNS	53	0.045			
KOOCHICHING	5	0.004	STEELE	8	0.007			
LAC QUI PARLE	10	0.008	**STEVENS**	5	0.004			
LAKE	0	0.000	**SWIFT**	14	0.012			

2012 LIGHT GOOSE CONSERVATION ORDER HARVEST IN MINNESOTA

David Rave, Wetland Wildlife and Populations Research Group
Margaret Dexter, Wildlife Populations and Research Unit

INTRODUCTION

This report documents results of the 2012 Light Goose Conservation Order hunter mail questionnaire survey.

METHODS

Minnesota held a light goose Conservation Order harvest from 1 March - 30 April 2012. Participants were required to obtain a $3.50 permit. No other license, stamp or permit was required. Shooting hours were 1/2 hour before sunrise to 1/2 hour after sunset. There were no daily or possession limits. Use of electronic calls and unplugged shotguns was allowed.

All permit holders were sent a questionnaire after the season. Survey questions are listed in Figure 1. Second and third mailings were sent to non-respondents after one month had elapsed.

RESULTS AND DISCUSSION

A total of 1,048 permits was issued and 675 responses (65 %) to the questionnaire were obtained (Table 1). In calculating harvest estimates, we assumed that the 373 non-respondents participated in the conservation action and took light geese in the same manner as respondents (i.e., tallies were expanded by 1.55). Light geese were present in Minnesota for more days, and were hunted by more hunters during spring 2012 than in spring 2011, resulting in higher harvest in 2012 than in 2011. Harvest was again concentrated in the southwest portion of the state with some also being taken in west-central Minnesota. Six hundred people attempted to take light geese during the 61-day conservation order period. Active participants pursued light geese for 2,270 days and 2,620 light geese were shot and retrieved. This was an average retrieved take of 4.4 geese per active participant. Another 210 light geese were estimated wounded and not retrieved.

Unplugged shotguns were used by 260 (43.3%) individuals to take 1,510 (57.6%) geese, of which 460 (17.6%) were taken with the 4th, 5th, or 6th shell. Electronic calls were used by 130 (21.7%) participants to take 930 (35.5%) light geese. During the 1/2 hour after sunset period, 240 (9.2%) geese were harvested by 250 (41.7%) active hunters.

The method used for hunting white geese was 38.1% over decoys, 33.9% pass shooting, and 28.0 % sneaking geese. Most hunters used steel shot (93.5%) versus other non-toxic shot (6.5%) to hunt light geese, and shot size varied among hunters with 57.9% using BB or larger shot, 38.0% using shot size 1 or 2, and 4.1% using shot size smaller than 2.

ACKNOWLEDGMENTS

J. Giudice, MNDNR Biometrics Unit analyzed all data for this report.

Figure 1. Light Goose Conservation Order hunter mail questionnaire, 2012.

MINNESOTA 2012 LIGHT GOOSE HARVEST SURVEY

For the Period of March 1 - April 30, 2012 ONLY

You are being asked to provide information to help us evaluate the harvest of light geese (snow, blue, and Ross' geese) in Minnesota during March 1 - April 30, 2012. Your cooperation is important. Please return this survey card even if you did not hunt light geese. Please answer the following questions to the best of your ability. **Answer only for your Minnesota 2012 hunting experience.**
THANK YOU! Ed Boggess, Director, Division of Fish and Wildlife, MN DNR.

1. Did you hunt light geese in Minnesota during March 1 - April 30, 2012? Yes / No

If NO, please disregard all remaining questions and return this survey card.

2. How many days did you hunt light geese in Minnesota during March 1 - April 30, 2012? ________
3. In what county did you hunt light geese most often during March 1 - April 30, 2012? ________
4. How many light geese did you personally shoot and retrieve in Minnesota? ________
5. How many light geese did you personally shoot, but were UNABLE to retrieve? ________
6. Did you hunt light geese in Minnesota with a gun(s) that was holding more than 3 shells? Yes / No
7. If yes, how many light geese did you shoot with a gun holding more than 3 shells? ________
8. How many light geese did you shoot and retrieve with the 4th, 5th, or 6th shell? ________
9. Did you hunt light geese in Minnesota with the aid of an electronic caller? Yes / No
10. If yes, how many light geese did you shoot and retrieve with the aid of an electronic caller? ________
11. Did you hunt light geese in Minnesota during the ½ hour after sunset period? Yes / No
12. If yes, how many light geese did you shoot and retrieve during the ½ hour after sunset period? ____
13. What method of hunting did you use most often? Check one
    ☐ hunt over decoys ☐ pass shoot ☐ Sneak
14. What type of shotgun shells did you use most often?
    ☐ Steel shot ☐ Other (Hevi-shot, bismuth, tungsten-matrix, etc.)
15. What size shot did you use most often? ☐ BBs or larger ☐ 1s or 2s ☐ Smaller than 2s

Table 1. Summary of Light Goose Conservation Order harvest in Minnesota, 2001 - 2012

	Year										
Statistic	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Total permits sold	1,997	1,438	1,424	1,383	1,363	1,292	1,406	1,670	952	994	1,048
Useable returns	1,375	1,071	1,095	998	955	921	910	1,057	671	659	675
Response rate (%)	69.0	74.0	77.0	72.0	70.0	71.0	65.0	63.0	72.3	67.1	65.3
Active hunters (%)	60.5	38.5	48.5	44.7	37.3	39.8	54.9	66.0	40.8	45.7	56.9
Estimated total hunters	1,209	553	690	618	516	514	773	1,103	389	455	600
Estimated hunter days	5,517	2,600	3,372	2,643	2,665	2,302	3,404	4,647	1,475	1,830	2,270
Mean days/hunter	4.6	4.7	4.9	4.3	5.2	4.5	4.4	4.2	3.8	4.0	3.8
Estimated harvest (shot & retrieved)	3,516	2,005	2,735	1,395	1,360	1,786	2,409	4,366	559	1,554	2,620
Mean harvest/hunter	2.9	3.6	4.0	2.3	2.6	3.5	3.1	4.0	1.4	3.4	4.4
Estimated crippling losses	637	253	315	150	163	172	302	640	70	145	210
Percent using unplugged guns	46.4	50.6	48.2	44.0	42.3	43.6	46.7	46.8	44.9	44.2	43.0
Est. number hunters using uplugged guns	560	280	333	272	215	224	361	516	175	201	260
Est. number geese **shot** with unplugged guns	2,137	996	1,385	777	689	1,032	1,275	2,413	348	742	1,510
Est. harvest with shell 4-5-6	615	401	491	269	287	277	339	822	131	311	460
Percent using electronic calls	11.8	15.7	19.3	17.8	14.4	17.1	19.1	23.5	25.9	21.3	22.2
Est. number hunters using e-calls	142	87	133	110	73	88	148	260	101	97	130
Est. harvest while using e-calls	512	474	326	268	280	329	566	1,171	192	531	460
Percent hunting 1/2-hr after sunset	45.5	41.2	38.4	42.7	43.9	38.3	42.3	43.1	39.7	39.7	42.4
Est. number hunting after 1/2-hr sunset	550	228	265	264	223	197	326	475	154	180	250
Est. harvest 1/2-hr after sunset	841	267	311	242	246	209	511	713	87	238	240

2011 FALL WILD TURKEY HARVEST REPORT

Kurt Haroldson, Farmland Wildlife Populations and Research Group

Minnesota's fall turkey hunting season is managed with a quota system similar to the spring turkey hunting season. Permits are allocated across 67 permit areas (PAs; Figure 1). In 2011, the fall season was 30 days in length (October 1-30) and allowed permit holders to take one wild turkey of either sex.

Four types of permits were available to hunters: (1) general lottery permits in which applicants or parties of up to 4 hunters applied for a specific PA, (2) landowner permits in which up to 20% of permits for each PA were reserved for landowners or tenants who lived on 40 acres or more of land within the PA, (3) surplus permits which were offered in under-subscribed PAs, and (4) youth permits which were offered over the counter to all youth age 17 and younger on October 1, 2011. General lottery and landowner permits were made available based on a system of preference, which was determined by the number of years applicants submitted a valid, but unsuccessful application since last receiving a permit. Surplus permits could be purchased on a first-come, first-served basis. Youth permits were available without quota or preference for the first time in 2011.

Fall turkey hunting opportunity has increased significantly since 2007 with the addition of 5,940 available permits (132% increase), 35 new permit areas, and the extension of the season from two 5-day time periods to one 30-day time period. In 2011, 5,382 permits were issued (a 19% decrease from 2010), and hunters registered 953 turkeys, a 30% decrease from the 2010 season (Table 1; Figure 2). Hunter success averaged 18%, below the 5-year average (23%), and success varied among PAs from 0% in PAs 447, 457, and 458 to 42% in PA 183 (Table 2). The majority of permits issued were general lottery (47%), followed by surplus permits (39%), youth (13%), and landowner (2%; Table 3). Compared to 2009, the proportion of general lottery permits issued has declined dramatically (from 94% to 47%) while the number of surplus permits issued increased by a similar amount (from 1% to 39%), indicating that some hunters are opting to purchase a surplus permit rather than apply for a permit through the general lottery system.

Overall weather conditions for the 2011 fall wild turkey season were favorable across much of the turkey range, although the first week was unseasonably warm. Much of October received little or no precipitation (Minnesota Climatology Working Group 2011), and regional mean temperatures for October were generally 4 to 6° F above average (Minnesota Climatology Working Group 2011). Despite generally favorable weather conditions, hunter participation declined 19% from 2010, and harvest was 30% below that from 2010. Both the spring turkey harvest and the fall turkey harvest were lower than expected, which might reflect a smaller wild turkey population following the severe winter of 2010-11, during which hen survival was likely reduced. Further, the cold, wet spring of 2011, which likely reduced nest and poult survival, would also reduce fall turkey numbers. Reduced hunter participation may be a response to the expected smaller turkey population and a smaller proportion of hunters making their fall turkey hunting plans in July by applying for a permit through the lottery system. Participation in fall turkey hunting has declined nearly 30% over the past 5 years in Wisconsin, so it is also possible that some hunters try out the sport but lack sufficient interest to continue participation.

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Table 1. Permits available and issued, applicants, registered harvest, and hunter success rates for fall wild turkey seasons 1990 – 2011, Minnesota.

Year	Permits available	Applicants	Permits issued	Registered harvest	Hunter success (%)[a]
1990	1,000	4,522	951	326	34
1991	2,200	2,990	2,020	552	27
1992	2,200	2,782	2,028	588	29
1993	2,400	3,186	2,094	605	29
1994	2,500	3,124	2,106	601	29
1995	2,500	3,685	2,125	648	30
1996	2,500	4,453	2,289	685	30
1997	2,580	4,574	2,378	698	29
1998	2,710	4,526	2,483	828	33
1999	2,890	5,354	2,644	865	33
2000	3,090	5,263	2,484	735	30
2001	2,870	4,501	2,262	629	28
2002	3,790	5,180	2,945	594	20
2003	3,870	5,264	2,977	889	30
2004	4,380	5,878	3,277	758	23
2005	4,410	4,542	2,978	681	23
2006	4,290	4,167	2,802	618	22
2007	4,490	4,464	2,837	695	24
2008	7,560	5,834	4,981	1,187	24
2009	9,330	7,738	5,019	1,163	23
2010	10,430	6,869	6,607	1,353	20
2011	10,430	3,538	5,382	953	18

[a] Success rates not adjusted for non-participation.

Table 2. Permits available and issued, registered harvest, and current and historic success by permit area for the 2011 fall wild turkey season, Minnesota.

Permit area	Permits: Available	Permits: Issued	2011: Registered harvest	2011: Success (%)[a]	Historic mean[b]: Success (%)	Historic mean[b]: *n*
156	20	21	7	33	21	3
157	100	89	18	20	22	4
159	20	18	1	6	7	3
183	10	12	5	42	19	3
213	200	136	30	22	18	4
214	200	103	22	21	25	4
215	300	145	25	17	23	4
218	200	168	25	15	22	3
219	100	97	16	16	17	3
221	200	79	10	13	20	4
222	200	52	11	21	21	4
223	200	147	28	19	17	4
225	200	98	12	12	14	3
227	300	180	28	16	21	5
229	50	41	5	12	17	4
235	20	18	2	11	9	3
236	300	192	32	17	23	9
239	300	195	38	19	25	4
240	200	95	24	25	28	4
241	20	20	2	10	22	3
243	20	26	8	31	30	3
244	40	39	11	28	35	3
248	100	47	10	21	24	4
249	100	86	10	12	19	4
262	40	8	1	13	28	4
338	200	158	28	18	24	9
339	200	134	14	10	18	9
341	500	304	70	23	25	9
342	350	145	21	14	22	9
343	300	216	42	19	26	9
344	200	82	6	7	19	9
345	200	58	6	10	16	9
346	300	113	16	14	22	9
347	200	122	25	20	23	9

Table 2. Continued.

Permit area	Permits: Available	Permits: Issued	2011: Registered harvest	2011: Success (%)[a]	Historic mean[b]: Success (%)	Historic mean[b]: *n*
348	250	130	16	12	23	9
349	450	105	21	20	22	9
412	40	37	5	14	25	4
416	20	20	5	25	22	3
417	30	29	8	28	30	3
420	40	12	3	25	30	6
422	50	46	5	11	31	6
425	40	32	10	31	26	6
427	20	19	3	16	20	3
428	30	29	6	21	26	4
431	20	18	5	28	33	6
433	20	24	4	17	18	6
440	20	21	2	10	28	4
442	250	177	29	16	25	9
443	100	65	9	14	17	9
446	20	10	1	10	20	6
447	20	7	0	0	14	6
448	30	12	3	25	22	9
449	30	16	3	19	27	8
450	20	3	1	33	15	6
451	20	7	2	29	19	3
454	20	21	3	14	25	3
457	20	13	0	0	3	3
458	20	3	0	0	0	3
459	20	12	2	17	7	4
461	250	198	41	21	28	9
462	240	129	28	22	24	9
463	30	31	7	23	22	4
464	80	47	12	26	24	9
465	80	38	8	21	22	9
466	160	106	19	18	26	9
467	100	109	22	20	21	9
601	2000	412	61	15	19	9
Total	10430	5382	953	18	-	-

[a] Success rates not adjusted for non-participation.

[b] Mean success rates (%) over all fall turkey seasons (*n*) between 2003 – 2011 or since a permit area opened for fall turkey hunting.

Table 3. Permits available and issued by type, registered harvest, and success by permit area for the 2011 fall wild turkey season, Minnesota.

Permit area	Permits available	Permits issued by type: General lottery	Landowner	Surplus	Youth	Total	Registered harvest	Success (%)[a]
156	20	16	1	0	4	21	7	33
157	100	49	1	31	8	89	18	20
159	20	14	0	3	1	18	1	6
183	10	10	0	0	2	12	5	42
213	200	52	4	60	20	136	30	22
214	200	37	1	52	13	103	22	21
215	300	47	2	72	24	145	25	17
218	200	76	3	60	29	168	25	15
219	100	58	2	22	15	97	16	16
221	200	24	2	43	10	79	10	13
222	200	12	1	32	7	52	11	21
223	200	64	0	64	19	147	28	19
225	200	36	2	43	17	98	12	12
227	300	66	2	88	24	180	28	16
229	50	12	0	23	6	41	5	12
235	20	12	0	4	2	18	2	11
236	300	89	1	75	27	192	32	17
239	300	79	0	94	22	195	38	19
240	200	42	0	38	15	95	24	25
241	20	6	0	10	4	20	2	10
243	20	15	1	0	10	26	8	31
244	40	30	3	0	6	39	11	28
248	100	13	2	28	4	47	10	21
249	100	41	1	35	9	86	10	12
262	40	4	0	3	1	8	1	13
338	200	65	4	76	13	158	28	18
339	200	37	1	66	30	134	14	10
341	500	130	4	130	40	304	70	23
342	350	81	4	47	13	145	21	14
343	300	126	4	65	21	216	42	19
344	200	44	0	35	3	82	6	7
345	200	23	2	27	6	58	6	10
346	300	61	4	36	12	113	16	14
347	200	59	1	43	19	122	25	20

Table 3. Continued.

Permit area	Permits available	Permits issued by type: General lottery	Landowner	Surplus	Youth	Total	Registered harvest	Success (%)[a]
348	250	69	1	50	10	130	16	12
349	450	53	1	40	11	105	21	20
412	40	14	3	14	6	37	5	14
416	20	9	0	6	5	20	5	25
417	30	24	3	0	2	29	8	28
420	40	3	1	6	2	12	3	25
422	50	30	0	8	8	46	5	11
425	40	28	2	0	2	32	10	31
427	20	10	0	7	2	19	3	16
428	30	21	3	1	4	29	6	21
431	20	5	0	9	4	18	5	28
433	20	12	0	8	4	24	4	17
440	20	18	0	0	3	21	2	10
442	250	120	6	40	11	177	29	16
443	100	35	0	18	12	65	9	14
446	20	5	0	5	0	10	1	10
447	20	3	0	4	0	7	0	0
448	30	8	0	2	2	12	3	25
449	30	11	0	5	0	16	3	19
450	20	1	0	2	0	3	1	33
451	20	4	0	2	1	7	2	29
454	20	9	0	11	1	21	3	14
457	20	9	0	3	1	13	0	0
458	20	0	0	3	0	3	0	0
459	20	7	0	2	3	12	2	17
461	250	99	4	71	24	198	41	21
462	240	76	5	40	8	129	28	22
463	30	24	1	1	5	31	7	23
464	80	15	0	21	11	47	12	26
465	80	20	0	12	6	38	8	21
466	160	41	1	53	11	106	19	18
467	100	50	0	39	20	109	22	20
601	2,000	147	0	195	70	412	61	15
Total	10,430	2,510	84	2,083	705	5,382	953	18

[a] Success rates not adjusted for non-participation

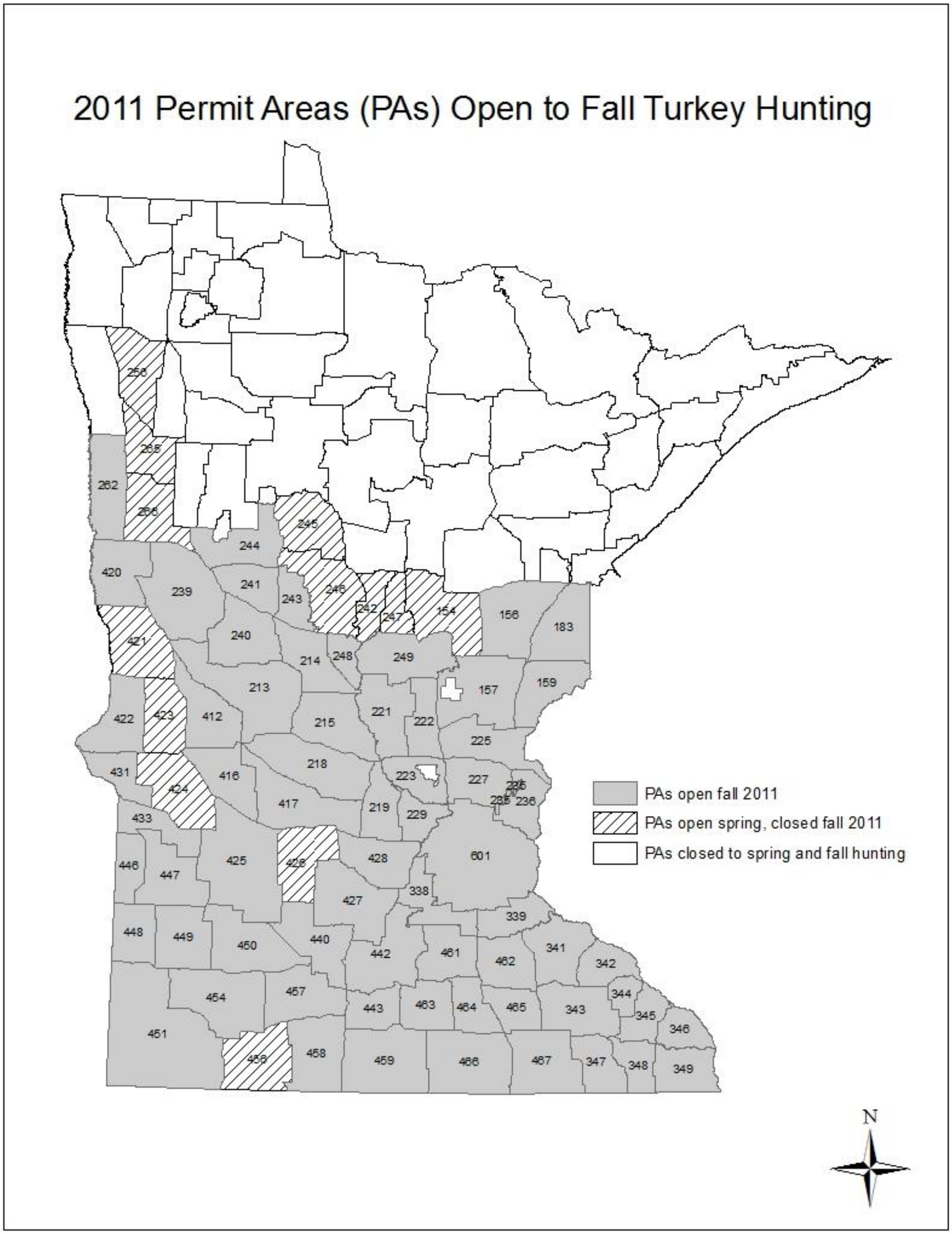

Figure 1. Permit areas (PAs) open for the 2011 fall wild turkey hunting season, Minnesota.

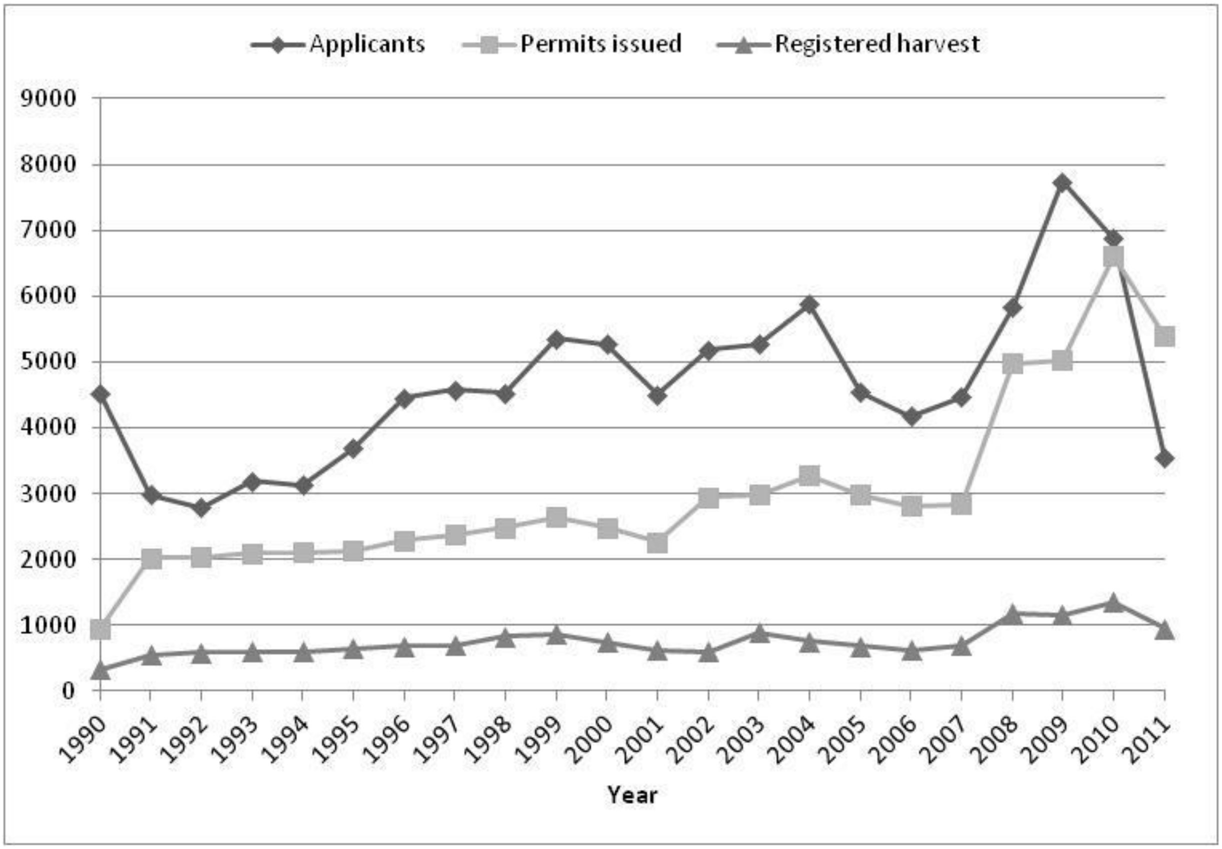

Figure 2. Applicants, permits issued, and registered harvest for fall wild turkey seasons 1990 – 2011, Minnesota.

SPRING 2012 WILD TURKEY HARVEST REPORT

Eric Walberg and Marrett Grund, Farmland Wildlife Populations and Research Group

In Minnesota, the spring wild turkey hunting season is designed to regulate harvest and distribute hunting pressure by allocating permits across 12 permit areas (PAs, Figure 1) and 8 time periods using a quota system. Although youth hunters could purchase a permit over-the-counter, adult hunters interested in pursuing wild turkeys were required to apply for a permit through a lottery system. Preference for this lottery system was determined by the number of years a valid but unsuccessful application has been submitted since last receiving a permit. Hunters could apply individually or in a group of up to 4 hunters. Successful applicants were notified through U.S. mail, and unsuccessful applicants were awarded a preference point. The goal of this system was to provide quality turkey hunting opportunities by minimizing hunter interference rates, conservatively harvesting turkeys in permit areas where the turkey range was expanding, yet allowing a substantial harvest in the remainder of the state.

There were two notable regulation changes for the 2012 spring hunting season: the last 4 time periods (E, F, G and H) had an unlimited number of permits available and the number of PAs was reduced from 81 to 12 PAs by pooling smaller PAs into larger ones. Permits for time periods E through H and all surplus licenses remaining after the drawing were offered over-the-counter in mid-March on a first-come, first-served basis.

Seven types of hunting licenses were available to resident turkey hunters: (1) general lottery permit in which an applicant or a group of up to 4 hunters applied for a specific PA and time period; (2) landowner permit in which up to 20% of permits for each PA and time period were reserved for landowners or tenants who lived on 40 acres or more of land within the PA; (3) youth permit for residents age 17 or less on opening day of the turkey hunting season; (4) archery permit which could be purchased for the last 4 time periods; (5) youth archery; (6) surplus permits; and (7) military permit. Five types of hunting licenses were available to nonresident turkey hunters: (1) general lottery permit; (2) youth permit; (3) archery permit; (4) youth archery permit; and (5) surplus permit.

During 2012, 42,817 permits were issued (Table 1, Figure 2), including 17,944 general lottery permits, 1,346 landowner permits, 8,664 youth permits, 3,911 archery permits, and 10,952 surplus permits. There were 187 permits issued for the Camp Ripley disabled veterans hunt. Hunters registered 11,325 turkeys, an increase of 13% from 2011 (Table 1, Figure 2). Hunter success averaged 29% (Table 1), which was comparable to the 5-year average of 30%. Hunter success by PA ranged from 15% (PA 511) to 45% (PA 509; Table 2). Hunter success varied by license type from 13% (archery) to 32% (general lottery and landowner), 24% (youth), and 23% (surplus). The number of general lottery licenses (including landowner) issued averaged 4,818 permits in time periods A – D, whereas the number of surplus licenses issued averaged 209 permits over the same time periods (Table 3). The average number of surplus licenses issued in the last four time periods increased to an average of 2,530 surplus permits because there were an unlimited number of surplus permits available and no general lottery permit quota was offered. The number of youth permits issued averaged 1,872 permits in time periods A – D and the average number of permits issued in the last four time periods declined to

285 youth permits (Table 3), which indicates youth hunters took advantage of hunting turkeys earlier in the spring. The 8,940 permits issued to resident and non-resident youth hunters (general lottery, surplus, and archery) in 2012 was a 3% increase over the 8,693 youth permits issued in 2011. Approximately 18% (2,380) of harvested turkeys were registered using the phone registration system, 30% (4,002) through the internet, and 52% (4,943) at a registration station.

Numeric changes in annual turkey harvests can be influenced by turkey population size, hunter effort, and weather. As of 2010, Minnesota's wild turkey population appeared to be stable or growing modestly throughout most of the range, with more rapid growth in the northern PAs (Giudice et al. 2011). The effect of the mild winter of 2011-12 on turkey abundance is unknown, but survival rates may have been above average due to above average temperatures and below average precipitation (Minnesota Climatology Working Group 2012). Weather conditions in April and May were relatively warm and wet across much of Minnesota, with above average temperatures and above average precipitation (Minnesota Climatology Working Group 2012). Precipitation during the 2012 spring turkey harvest was similar to the last two spring turkey harvests for the month of April, but more precipitation occurred in May (Minnesota Climatology Working Group 2012). Although hunting opportunities increased in 2012 due to a larger portion of Minnesota being open for turkey harvest and an unlimited number of permits available for time periods E through H, hunter effort was reduced, with over 4,600 fewer permits issued in 2012 than in 2011. Fewer permits issued from 2011 to 2012 may have been caused, at least in part, by time periods E and F switching to unlimited permit availability and the poor weather that occurred during the month of May. The increase in success rate that occurred from 2011 to 2012 was likely a function of above average temperature during the 2012 spring turkey hunting season, which likely increased hunter effort for those hunters who participated. Improved weather conditions increased the spring 2012 turkey harvest in Wisconsin, Iowa, and South Dakota from 2011 as well. Consequently, the increased harvest in 2012 was likely the result of warmer weather and possibly increased turkey abundance due to increased winter survival rates compared to 2011.

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Table 1. Permits available, permits issued, and registered harvest from 1978 – 2012 for all spring wild turkey hunting seasons in Minnesota.

	Permits				
Year	Available	Issued	Issued (%)	Registered harvest	Success (%)[a]
1978	420	411	97.9	94	22.9
1979	840	827	98.5	116	14.0
1980	1,200	1,191	99.3	98	8.2
1981	1,500	1,437	95.8	113	7.9
1982	2,000	1,992	99.6	106	5.3
1983	2,100	2,079	99.0	116	5.6
1984	3,000	2,837	94.6	178	6.3
1985	2,750	2,449	89.1	323	13.2
1986	2,500	2,251	90.0	333	14.8
1987	2,700	2,520	93.3	520	20.6
1988	3,000	2,994	99.8	674	22.5
1989	4,000	3,821	95.5	930	24.3
1990	6,600	6,126	92.8	1,709	27.9
1991	9,170	8,607	93.9	1,724	20.0
1992	9,310	9,051	97.2	1,691	18.7
1993	9,625	9,265	96.3	2,082	22.5
1994	9,940	9,479	95.4	1,975	20.8
1995	9,975	9,550	95.7	2,339	24.5
1996	12,131	10,983	90.5	2,841	25.9
1997	12,530	11,610	92.7	3,302	28.4
1998	14,035	13,229	94.3	4,361	33.0
1999	18,360	16,387	89.3	5,132	31.3
2000	20,160	18,661	92.6	6,154	33.0
2001	22,936	21,404	93.3	6,383	29.8
2002	24,136	22,607	93.7	6,516	28.8
2003	25,016	22,770	91.0	7,666	33.7
2004	27,600	25,261	91.5	8,434	33.4
2005	31,748	27,638	87.1	7,800	28.2
2006	32,624	27,876	85.4	8,241	29.6
2007[b]	33,976	28,320	83.4	9,412	33.2
2008[b]	37,992	31,942	84.1	10,994	34.4
2009[b]	42,328	36,193	85.5	12,210	33.7
2010[b]	55,982	46,548[c]	83.0	13,467	29.0
2011[b]	Unlimited	43,521[c]	N/A	10,055	23.1
2012[b]	Unlimited	38,906[c]	N/A	11,325	29.1

[a] Success rates not adjusted for non-participation
[b] Youth hunt data included
[c] Permits issued to archery hunters were not included in this Table. There were 2,462 permits issued to archers in 2011 and 3,911 permits issued to archers in 2012.

Table 2. Permits issued, registered harvest, and hunter success during the 2012 Minnesota spring wild turkey season.

Permit Area	Permits Issued[a]	Harvest[b]	Success (%)[c]
501	9,943	2741	28
502	857	181	21
503	4,645	1499	32
504	958	291	30
505	3,627	1019	28
506	1,438	401	28
507	9,522	2883	30
508	4,021	1156	29
509	244	111	45
510	3,262	957	29
511	154	23	15
512	48	17	35

[a] Permits issued for the Camp Ripley disabled veterans hunt (187) and archery permits (3,911) were not included in this Table.
[b] There were 45 turkeys registered from the Camp Ripley disabled veterans hunt and were not included in this Table.
[c] Success rates were not adjusted for non-participation.

Table 3. Permits available and issued by license type (resident and non-resident) and time period for the spring 2012 wild turkey season, Minnesota.

		Permits issued			
Time period[a]	Permits available	General lottery	Landowner	Surplus	Youth[c]
A	5,705	4,410	675	17	3,705
B	5,705	4,587	293	93	460
C	5,705	4,656	273	93	2,184
D	5,705	4,272	105	631	1,137
E	Unlimited	9	0	5,202	376
F	Unlimited	4	0	1,296	146
G	Unlimited	2	0	2,632	399
H	Unlimited	4	0	988	220
Total[b]	Unlimited	17,944	1,346	10,952	8,664

[a] A = April 18-22, B = April 23-27, C = April 28–May 2, D = May 3-7, E = May 8-12, F = May 13-17, G = May 18-24, H = May 25-31
[b] Total includes 187 issued for the Camp Ripley disabled veterans hunt (4 general lottery and 183 surplus), but excludes archery permit sales.
[c] Total excludes 276 youth archery licenses.

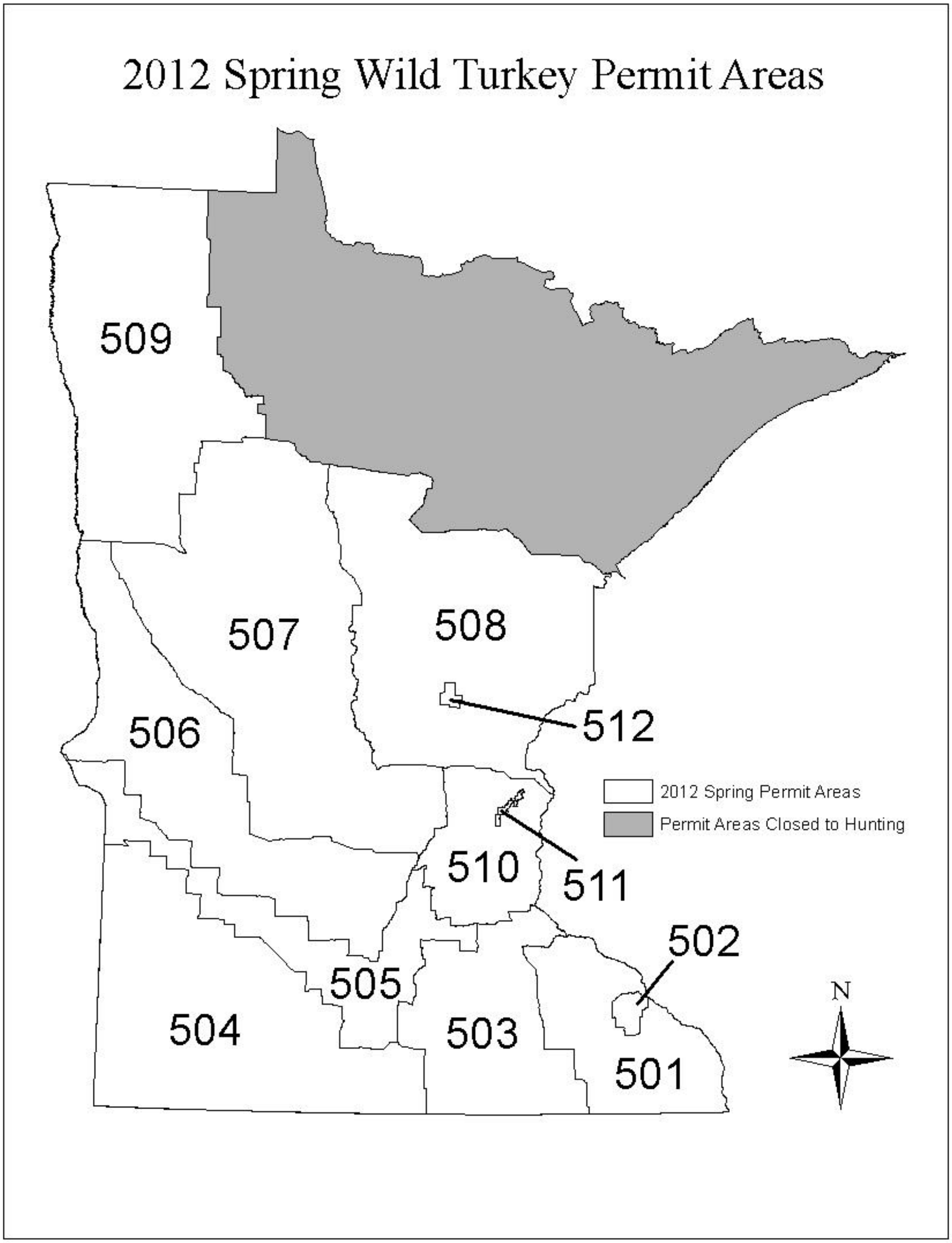

Figure 1. Permit areas open for hunting during the 2012 spring turkey hunting season, Minnesota.

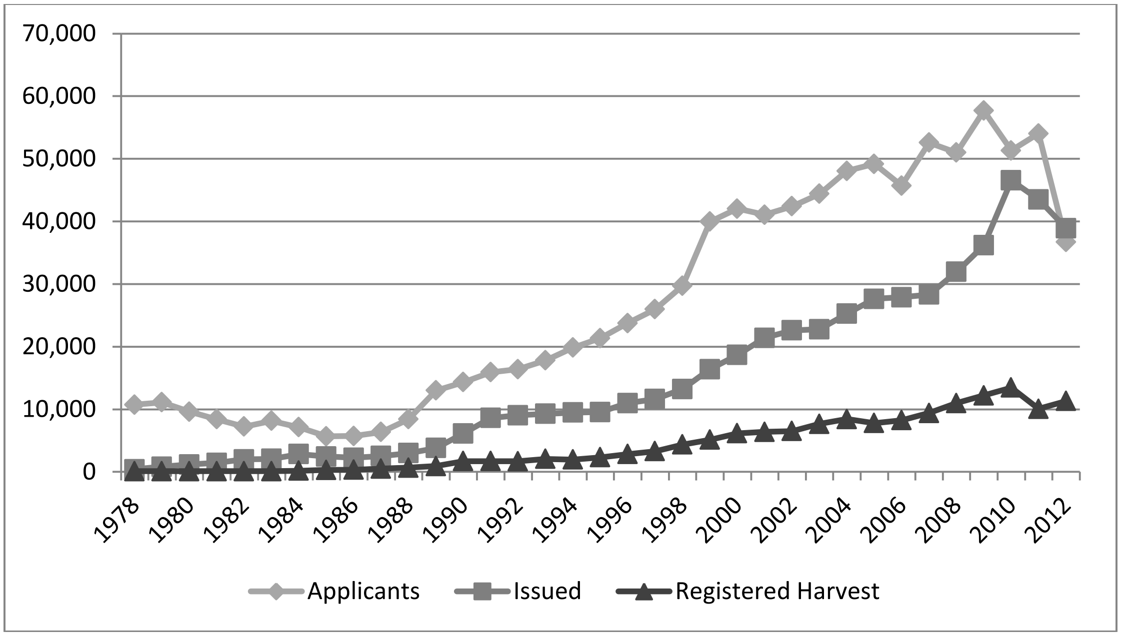

Figure 2. Applicants, permits issued, and registered harvest for the spring wild turkey seasons 1978-2012, Minnesota. Number of permits issued does not include archery permits in 2010-212.

PRAIRIE-CHICKEN HARVEST IN MINNESOTA DURING 2011

Michael A. Larson, Forest Wildlife Populations and Research Group

INTRODUCTION

Hunting seasons for greater prairie-chickens (*Tympanuchus cupido pinnatus*) in Minnesota were closed from 1943 through 2002. During October 2003 a limited-entry, 5-day hunting season for prairie-chickens was held within 7 contiguous permit areas in western Minnesota. Opportunities to purchase a hunting permit were awarded through a lottery system, and each licensed hunter could harvest a maximum of 2 prairie-chickens. The same format for prairie-chicken hunting seasons has been implemented annually since 2003. The only changes that have occurred were adding 4 new permit areas in 2006 (Figure 1), increasing the quota of hunters in some permit areas, and selling surplus licenses after the lottery beginning in 2011.

Only residents of the state are eligible to hunt prairie-chickens in Minnesota. Residents who are an owner or tenant of ≥40 acres of grassland within a permit area may apply to the lottery as a "landowner." Twenty percent of the available permits in a permit area are awarded in a lottery consisting of only landowner applicants. Any permits not awarded in the landowner lottery are then included with the other 80% of available permits to be awarded in a subsequent lottery for regular applicants. Any landowners who are unsuccessful in the landowner lottery are also included in the subsequent lottery. The permits within each permit area are awarded first to people who have applied the greatest number of years since last winning a permit.

Lottery winners must purchase a prairie-chicken hunting permit (i.e., license) before they hunt prairie-chickens. Permit areas 804A–811A (i.e., those south of U.S. Highway 2) are in an area of the state that is closed to the hunting of sharp-tailed grouse (*Tympanuchus phasianellus*). Licensed prairie-chicken hunters in those permit areas, however, are allowed to take a regular bag limit of sharp-tailed grouse while hunting prairie-chickens.

The objective of the hunter survey described below is to document results of prairie-chicken hunting seasons.

METHODS

The Electronic Licensing System (ELS) automatically recorded all lottery applications, lottery results, and purchases of permits. Prairie-chicken hunters are not required to register their harvested birds in the ELS, so during the week before the hunting season I sent a postcard survey by mail to all people who were successful in the lottery. Approximately 3 weeks later I sent the postcard survey a second time to people who had not responded to the first mailing. The survey consisted of the following 5 questions: did you hunt, how many days did you hunt, how many prairie-chickens did you bag, how many sharp-tailed grouse did you bag while hunting for prairie-chickens, and how satisfied were you with the hunt?

To summarize hunting results for this report I used only responses from lottery winners who purchased a hunting permit. I checked to ensure that responses from people who replied to the first mailing were similar to responses from people who replied to the second mailing. Then, to estimate the numbers of hunters and birds harvested, I assumed that nonrespondents would have had the same average response as all those who responded to either mailing of the survey.

I recalculated estimates of the total number of hunters, total number of prairie-chickens harvested, and hunter success rates for all previous years (i.e., 2003–2010). I did this because (1) during 2008–2010 the estimates of harvest and success rate were incorrectly based upon the number of purchasers who did not respond to the survey, not the slightly smaller number of nonrespondents who likely went hunting, as they are now; (2) during 2003–2006 the estimates were taken directly from ELS registration data (i.e., not corrected for hunters who did not register their harvested birds, which was mandatory at that time) rather than being based upon data from the hunter survey; and (3) additional survey responses may have been received since completion of the hunting season report for a given year.

RESULTS & DISCUSSION

One hundred eighty-six prairie-chicken hunting permits were available during 2011. There were 169 lottery winners (Table 1), and 7 of them were landowners. There were fewer applicants than there were permits available in 5 of the 11 permit areas. One hundred thirty-four lottery winners purchased permits, and 10 others purchased surplus permits. Six lottery winners reported hunting but did not purchase a permit, so for the purposes of this summary I considered there to be 150 permit purchasers in 2011. One hundred thirty-two permit purchasers (88%) responded to the first mailing of the survey, and 3 (2%) responded to the second mailing, so the response rate of purchasers was 90% (i.e., 135 of 150).

Twelve purchasers who responded to the survey reported that they did not hunt (9%), and 123 respondents reported hunting, so there were an estimated 138 hunters (i.e., purchasers who went afield; Table 2). Hunters hunted an average of 2.2 days during the 5-day season (22–26 October 2011). Hunters reported harvesting 92 prairie-chickens, and the estimated total harvest was 103 prairie-chickens (Table 2). I estimated that 62 hunters bagged at least 1 prairie-chicken (45%, Table 2). The average rating for hunter satisfaction on a 1–5 scale was 3.4 (median = 4), and 73% of the 123 respondents to this question reported a satisfaction level of 3 or greater.

As anticipated, the corrected estimates of the total number of prairie-chickens harvested and hunter success rates for 2008–2010 were slightly less than previously reported (Table 3). This was despite a slightly higher estimate of the total number of hunters in 2009–2010 due to receiving additional survey responses since the original report. New estimates of the total number of prairie-chickens harvested and hunter success rates for 2003–2006 (Table 3) were greater than previously reported because the ELS registration data from which the previous values were taken were incomplete; the hunter survey data did not change. There was no change in the estimated number of hunters for 2003–2008.

The prairie-chicken harvest and hunter success rate during 2011 were greater than during 2010 but slightly less than during 2007–2009 (Table 3). This is consistent with relatively poor weather during the hunting season of 2010 and a declining trend in spring survey counts since 2007. As I reported last year, there was a moderate degree of correlation between the total number of males observed in survey blocks during spring and total harvest during the fall (Kendall's $\tau = 0.6$, $n = 5$ years [2006–2010]). The correlation coefficient (τ) is on a 0–1 scale and is not closer to 1 because (1) survey counts are not a perfect reflection of spring bird densities, (2) reproductive success (i.e., the number of juvenile birds in the fall population per adult in the spring population) varies from year to year, and (3) factors other than bird density contribute to annual variation in hunter success (e.g., weather conditions during the hunting season).

Prairie-chicken hunters reported bagging 15 sharp-tailed grouse while hunting prairie-chickens during 2011. The reported sharp-tailed grouse were harvested from permit areas 803A, 805A, and 806A (Figure 1).

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Table 1. Results of the lottery for prairie-chicken hunting permits in Minnesota during 2011.

Permit area	Permits available	No. of applicants	Lottery winners		Permit purchasers[a]		Surplus purchasers[c]
			No.[b]	Proportion	No.	Proportion	
801A	10	1	1	1.00	1	1.00	1
802A	10	13	11	0.85	9	0.82	0
803A	10	6	6	1.00	5	0.83	3
804A	17	15	15	1.00	11	0.73	2
805A	20	54	20	0.37	15	0.75	0
806A	17	23	17	0.74	11	0.65	0
807A	25	39	25	0.64	24	0.96	0
808A	20	17	17	1.00	13	0.76	3
809A	20	37	20	0.54	15	0.75	0
810A	27	50	28	0.56	23	0.82	0
811A	10	9	9	1.00	7	0.78	1
All	186	264	169	0.64	134	0.79	10

[a] Number and proportion of lottery winners who purchased a permit.
[b] More permits than were available may be awarded in a permit area when the last applicant selected in the lottery applied as a member of a hunting party.
[c] Number of people who purchased a surplus permit after the lottery because there were fewer applicants than there were permits available.

Table 2. Hunter harvest of prairie-chickens in Minnesota during 2011.

Permit area	No. of hunters[a]		Birds harvested		Birds per harvester[b]	Success rate[c]
	Self-reported	Estimated	Self-reported	Estimated		
801A	1	1	0	0	NA	0.00
802A	7	8	5	6	2.0	0.38
803A	8	8	7	7	1.8	0.50
804A	11	13	1	1	1.0	0.08
805A	17	17	10	10	1.4	0.41
806A	9	11	9	11	1.6	0.64
807A	18	23	15	19	1.6	0.52
808A	12	13	21	23	1.9	0.92
809A	9	11	6	7	1.4	0.45
810A	23	24	8	8	2.0	0.17
811A	8	9	10	11	1.6	0.78
All	123	138	92	103	1.7	0.45

[a] Number of permit purchasers who actually went hunting.
[b] Estimated number of prairie-chickens harvested per successful hunter.
[c] Proportion of estimated hunters who harvested ≥1 prairie-chicken.

Table 3. Annual summary of prairie-chicken hunting results in Minnesota during 2003–2011.

Year	Permits available	Applicants	Hunters[a]	Birds harvested	Success rate[b]	Hunter satisfaction[c]
2003	100	853	92	130	0.75	4.4
2004	101	759	87	58	0.45	3.6
2005	110	500	86	94	0.63	4.0
2006	182	512	149	109	0.49	3.6
2007[d]	187	519		122	0.53	
2008	186	535	137	133	0.58	3.9
2009	186	512	143	118	0.52	3.4
2010	186	421	136	78[e]	0.32	3.0
2011	186	264	138	103	0.45	3.4

[a] Estimated number of people who went hunting, not the number of permit purchasers.
[b] Proportion of hunters who harvested ≥1 prairie-chicken.
[c] Average on a 1–5 scale.
[d] No hunter survey was conducted for the 2007 season; results are from the Electronic Licensing System only, which had 150 permit purchasers.
[e] One hunter reported harvesting 10 prairie-chickens, which may be questionable.

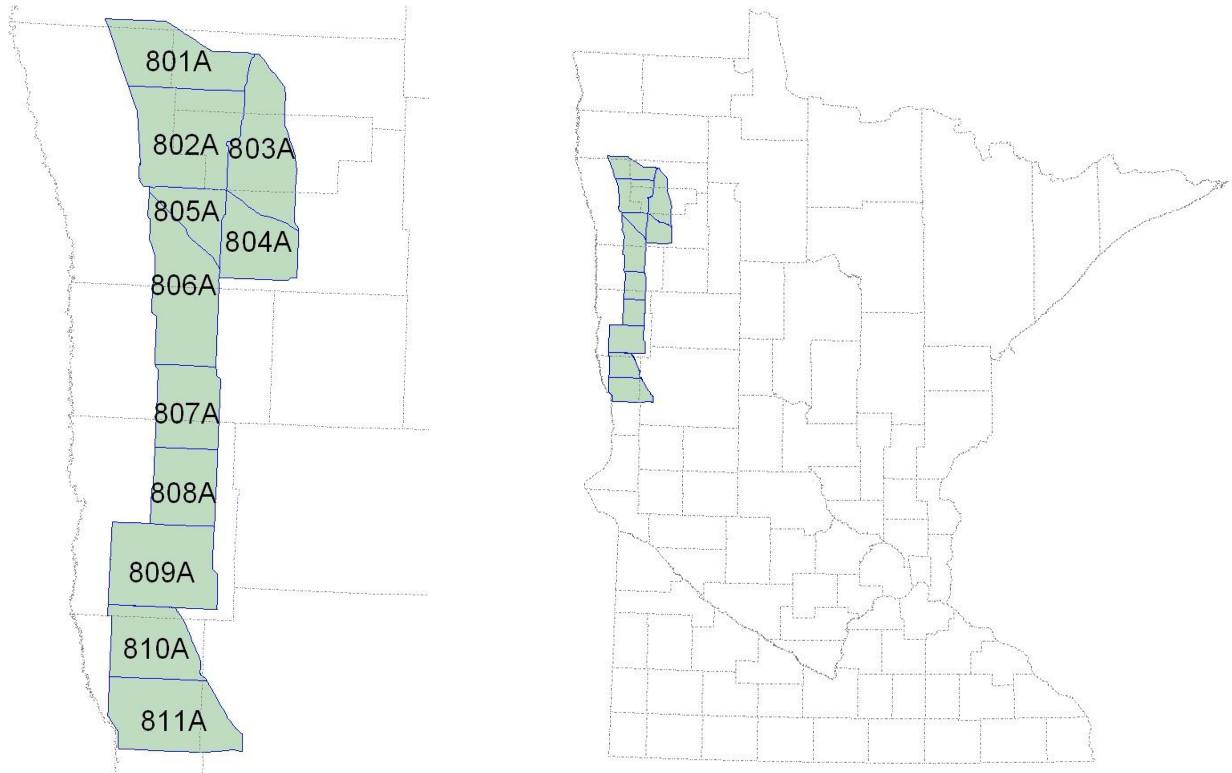


Figure 1. Map of permit areas for prairie-chicken hunting in Minnesota (top) and their location relative to counties within the state (bottom).

2011 MINNESOTA BEAR HARVEST REPORT

David Garshelis and Karen Noyce, Forest Wildlife Populations and Research Group

INTRODUCTION

The Minnesota bear range is divided into 11 bear management units (BMUs; Fig. 1). Each has a separate quota on hunting licenses. Outside the primary bear range, where bear depredation to crops is a primary concern, license sales are unlimited (no-quota area). Hunters in this area can harvest two bears, and beginning in 2005 hunters could purchase both a quota and no-quota license. In all areas the season runs from September 1 through mid-October. About 80% of hunters use bait. This report summarizes status and trends in harvests and population size and structure.

METHODS

Successful hunters must register their bears at designated registration stations. Stations are not staffed by DNR personnel. Harvest data are a simple tally of these registrations, which for the most part are done electronically. Hunters also are required to submit a tooth from harvested bears (compliance ≈ 70%), which is used to estimate age, and thus harvest age structure. We used harvest age structure accumulated since 1980 to reconstruct minimum population size (Downing population reconstruction) and thereby assess population trend.

RESULTS

Permit applications for bear licenses in 2011 increased to the highest level in 9 years (Table 1). This may have been in response to the diminished number of permits available. The estimated number of hunters in the field (9,100) was equal to that of 1994, and not much different than 2010 (9,200). However, the total harvest (2,131) was lower because success rate (23%) was low. Success rate is generally higher with reduced numbers of hunters (Fig. 2), but declines with abundant natural foods. Harvest sex ratios of >60% male (the case this year) tend to be indicative of abundant natural foods.

Normally, >25% of quota area licenses are not purchased, and this is factored into the allocation of permits. However, a new procedure was established this year to ensure that all licenses that were not purchased by permittees would be available for purchase by unsuccessful lottery applicants. Accordingly, permits were reduced in all areas by about 25% so the number of hunters would remain about the same (Table 2). Prior to this reduction, permits were reduced in only one area (BMU 24).

Only BMU 22 (BWCAW) was undersubscribed (Table 3). However, all quota areas had unpurchased licenses, which went on sale Aug 4. All (1,373) were purchased within a few minutes. As permit allocations were significantly reduced in all BMUs over the past 5 years, the percentage of applicants drawn in the lottery diminished (Table 4). In 2011, >50% of 1st-year applicants were selected in only 2 BMUs (13, 22). Three BMUs (26, 44, 45) required a drawing among 2nd-year applicants (55–77% were selected).

Harvests were equivalent to the previous 5-year average in 3 BMUs (11, 12, 22) and lower than average in all other BMUs (Table 5). Especially low harvests occurred in the southern BMUs: 44 & 45 (lowest since these were established in 1994), 51 (lowest since 1991), and 52 (lowest since 2002).

Hunting success was much higher in the northern parts of the bear range than in the southern parts of the range (Table 6). Success rates <20% occurred in BMUs 41, 44, 45 & 51, whereas success ≥30% occurred in BMUs 12, 24, 25 & 31. BMU 24 had the highest hunter success since 1992. Conversely, BMUs 44 and 51 had the lowest success since 2002. Hunting success varies geographically and year-to-year with abundance of natural foods, hunter density, and bear density.

During years of normal fall food abundance, about 70% of the harvest occurs during the 1st week of the bear season, and ~83% occurs by the end of the 2nd week (Table 7). These percentages tend to be lower during years with more abundant fall foods. In 2011, 65% and 78% of the harvest occurred after weeks 1 and 2, respectively.

A combination of two key factors, fall food abundance and number of hunters, accounts for 84% of the yearly variation in the bear harvest since 1984 and 95% of the variation in harvest since 2000 (Fig. 3). These regression models predicted a slightly higher harvest in 2011 than actually occurred.

Statewide, ages of harvested females declined dramatically during the 1980s–90s, as evidenced by a declining median age (Fig. 4) and increasing proportion of the harvest composed of 1–2 year-olds (Fig. 5). However, the trend during the past decade has been equivocal: median age of harvested females has remained at about 3.0 years old (3.1 in 2011) and the proportion of the female harvest composed of 1–2 year olds has remained near 44% (44% in 2011). Male harvest ages have been younger (~60% were 1–2 years old) and less variable. Female harvest ages have been youngest and least variable in the southern BMUs (44, 45, 51, 52).

Ages of harvested bears accumulated over 32 years were used to reconstruct minimum statewide population sizes through time (i.e., the size of the population that eventually died due to hunting). This was scaled upwards (to include bears that died of other causes), using tetracycline mark–recapture estimates as a guide (Fig. 6). Whereas both the tetracycline and reconstructed populations showed an increase during the 1990s, followed by a decline during the 2000s, the shapes of the 2 trajectories differed. Therefore, it was impossible to match the curve from the reconstruction to all 4 tet-based estimates, so several curves were scaled to differing degrees to intersect different sets of tet-estimates. Both the tetracycline and age-reconstructed estimates showed a population decline of ~30% from 2001 to 2008. Recent data (2009) shows a possible population increase (due to reduced harvests), but this is uncertain. Reconstructed populations rely on several years of age data, so population estimates for 2010 and 2011 are not yet available.

DISCUSSION

Harvests of bears remained consistently high during 2003–2007 (Table 1), masking an apparent decline in the population. These high harvests (>3000 bears) were due to consistently high hunting success. A reduction in permits, and thus number of hunters, reduced the harvest during the next few years, and likely enabled the population to grow.

The population is being managed at a level that provides good hunting opportunities but also socially tolerable nuisance activity. There is no target population number, but rather a range that meets these criteria. In fact, the target population is likely to fluctuate. With a smaller population size during the 1980s, nuisance activity was often intolerable (during poor food years, at least). Since 2002, nuisance complaints have been consistently low, reflecting consistently good natural food supplies as well as a change in behavior of people (better at removing attractants, such as garbage and birdseed, and also less apt to complain about bears). Thus, it is possible that the population could grow to a higher level (e.g., 25,000) and still be publicly acceptable.

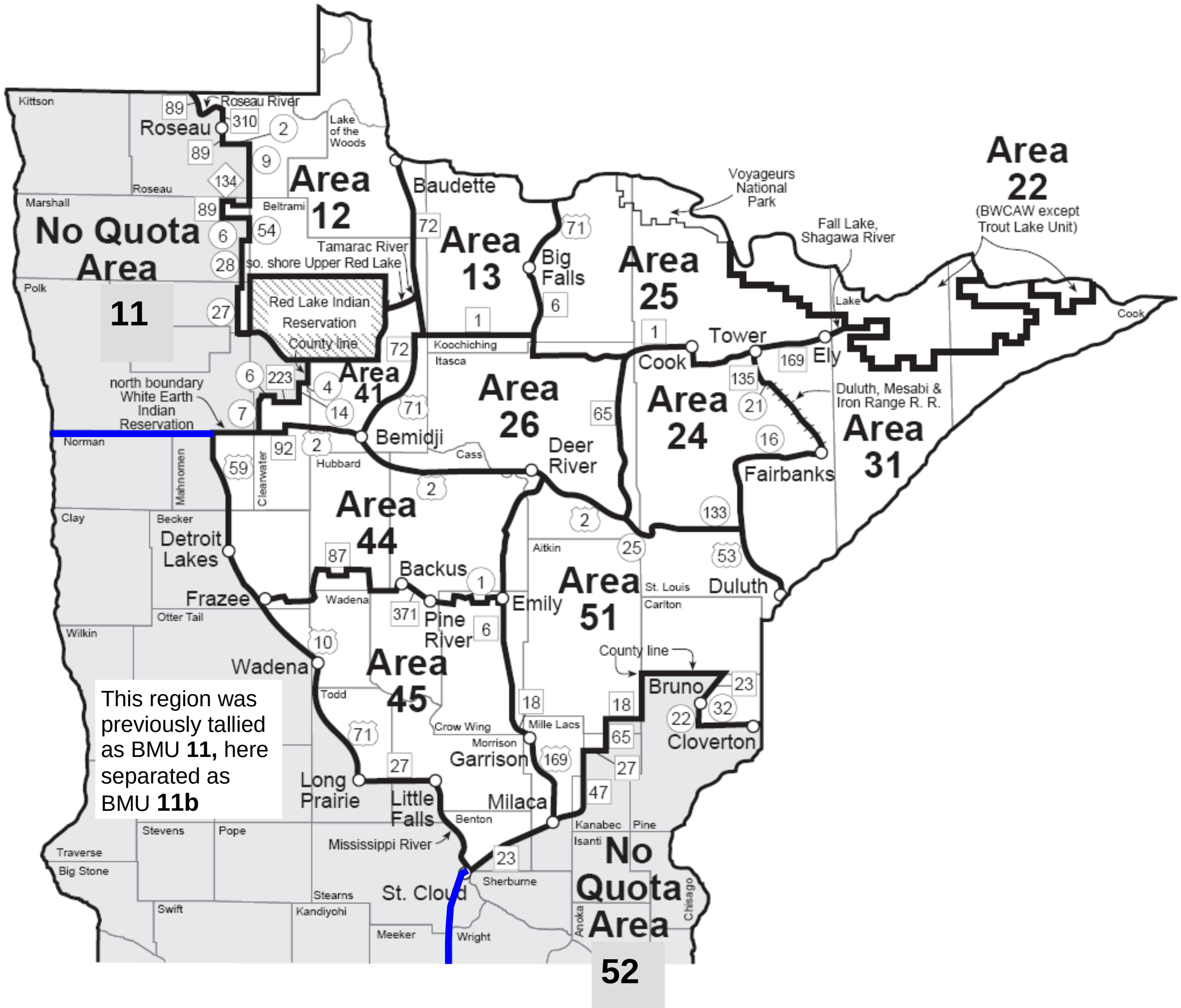


Figure 1. Bear management units (BMUs) within quota (white) and no-quota (gray) zones. Hunters in the quota zone are restricted to a single BMU, whereas no-quota hunters can hunt anywhere within that zone.

Table 1. Bear permits, licenses, hunters, harvests, and success rates, 1991–2011.

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Permit applications	25890	26428	27365	30127	29922	30405	27353	30245	29384	29275	26824	21886	16431	16466	16153	15725	16345	17362[a]	17571[a]	18647[a]	19184[a]
Permits available	7140	7920	8630	9400	11950	12030	11370	18210	20840	20710	20710	20610	20110	16450	15950	14850	13200	11850	10000	9500	7050[b]
Licenses purchased (total)	7757	8485	9224	9826	12448	12414	11440	16737	18355	19304	16510	14639	14409	13669	13199	13164	11936	10404	9892	9689	9555
Quota area [c]	6257	6845	7528	8125	10304	10592	9655	14941	16563	17021	13632	12350	9833	10063	9340	9169	8905	7842	7342	7086	5684
Quota surplus/military [c]											235	209	2554	1356	1591	1561	526	233	77[c]	83[c]	1385
No-quota area [c]	1500	1640	1696	1701	2144	1822	1785	1796	1792	2283	2643	2080	2022	2238	2268	2434	2505	2329	2473	2520	2486
% Licenses bought																					
Of permits available [d]	87.6	86.4	87.2	86.4	86.2	88.0	84.9	82.0	79.5	82.2	67.0	60.9	61.6	69.4	68.5	72.3	71.4	67.7	73.4	74.6	100
Of permits issued [d]								84.4	87.2	83.9	69.8	66.3	65.7	68.3	67.1	68.9	70.0	67.2	73.8	74.5	80.7
Estimated no. hunters [e]	7200	7900	8600	9100	11600	11500	10300	14500	15900	16800	15500	13800	13600	12900	12500	12500	11300	9900	9400	9200	9100
Harvest	2143	3175	3003	2329	4956	1874	3212	4110	3620	3898	4936	1915	3598	3391	3340	3290	3172	2135	2801	2699	2131
Harvest sex ratio (%M) [f]	59	50	56	62	47	62	55	55	53	58	56	61	58	57	59	58	57	62	59	59	61
Success rate (%)																					
Total harvest/hunters [g]	30	40	35	26	43	16	31	28	23	23	29	14	26	26	26	26	28	21	30	29	23
Quota harvest/licenses	30	41	34	26	42	15	29	25	20	20	28	14	25	26	25	25	28	21	30	30	24

[a] Includes area 99, a designation to increase preference but not to obtain a license (2008 = 528, 2009 = 835; 2010 = 1194; 2011 = 1626).

[b] Permits reduced because of a new procedure in 2011 that ensures that all available licenses are purchased (see Table 2).

[c] Quota area established in 1982. No-quota area established in 1987. Surplus licenses from undersubscribed quota areas sold beginning in 2000; originally open only to unsuccessful permit applicants, but beginning in 2003, open to all. In 2011, surplus licenses offered for all lottery licenses not purchased by July 31. Free licenses for 10 and 11 year-olds were available beginning 2009 (2009 = 45; 2010 = 86; 2011 = 72 [including surplus youth]). Youth licenses included here with surplus and military licenses. Total licenses = quota + quota surplus + no-quota + military (no permit needed) + youth.

[d] Quota licenses bought (including surplus)/permits available, or licenses bought (prior to surplus)/permits issued (permits issued more relevant for years when some areas were undersubscribed; see Table 3). Beginning in 2008, some permits were issued for area 99; these are no-hunt permits, just to increase preference, and are not included in this calculation. In 2011, all unpurchased licenses were put up for sale, and all were bought.

[e] Number of licensed hunters x percent of license-holders hunting. Percent hunting is based on data from bear hunter surveys conducted during 1981–91, 1998 (86.8%), 2001(93.9%) and 2009 (95.3%). The estimated no. of hunters in 2011 may be under-estimated because a large no. of people bought surplus licenses 1 month before the season, so they were more apt to hunt.

[f] Sex ratio as reported by hunters; hunters classify about 10% of female bears as males, so the actual harvest has a lower %M than shown here. In good food years, the harvest is more male-biased.

[g] Success rates in 2001–2011 were calculated as number of successful hunters/total hunters, rather than bears killed/total hunters, because hunters could take 2 bears. In 2011, 52 hunters took >1 bear (49 took 2 bears on NQ license, 2 hunters took 1 bear on NQ + 1 on quota license, 2 took 2 bears on NQ and 1 on quota license): thus, the 2131 bears were taken by 2078 different hunters, so success = 2078/9100 = 23%.

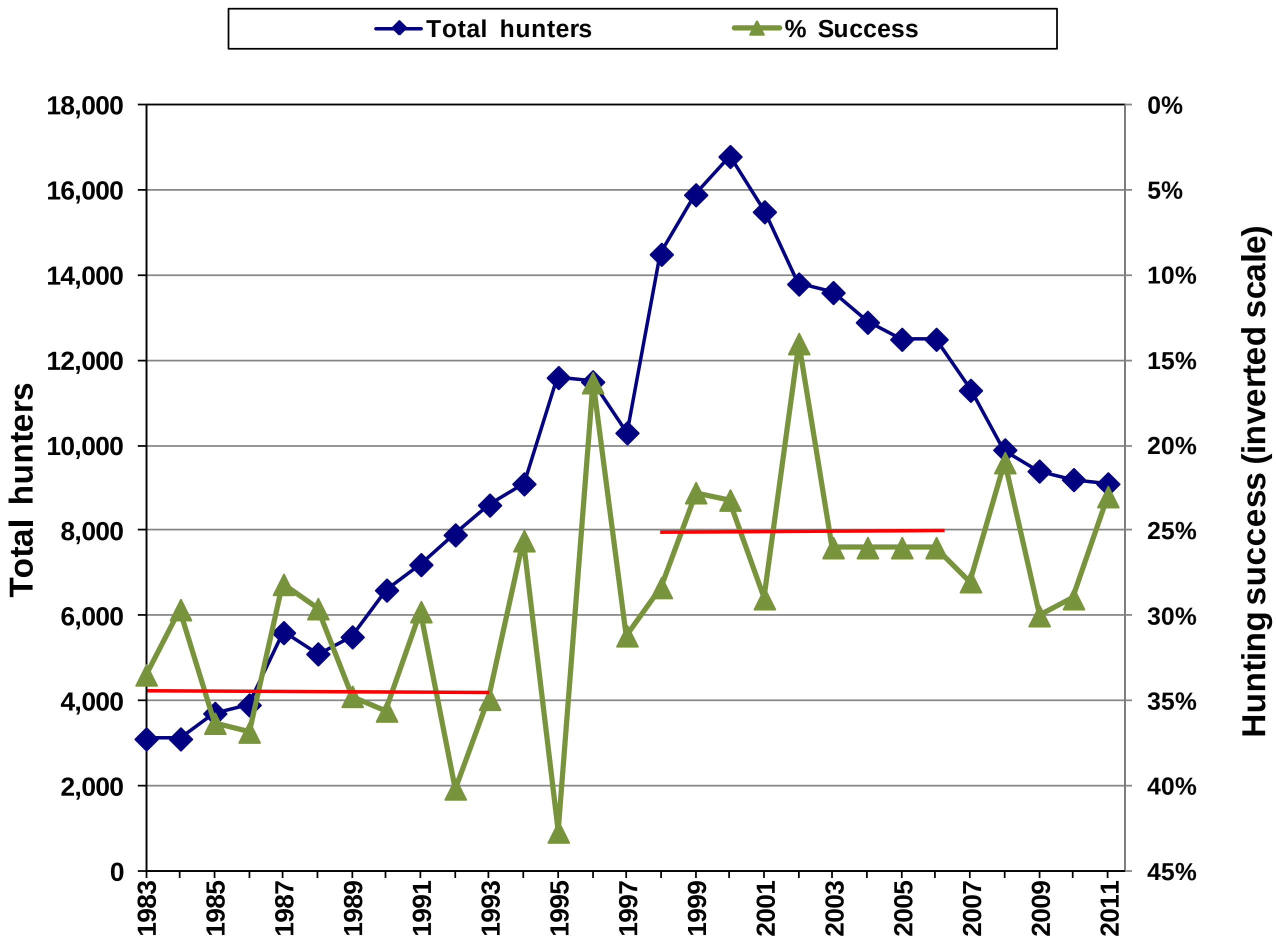


Figure 2. Relationship between hunter numbers and hunting success (note inverted scale), 1983–2011. Red horizontal lines show mean hunting success for periods with <9000 hunters vs >12,000 hunters. Large variation in hunting success is also attributable to food conditions.

Table 2. Number of bear hunting quota area permits available, 2007–2011 (aligned with permit applications in Table 3 below; highlighted values show drop from previous year).

BMU	2011		2010	2009	2008	2007
	After reduct.[a]	Before reduct.				
12	350	450	450	450	450	500
13	450	600	600	600	650	700
22	100	125	100	150	150	150
24	350	500	550	650	750	900
25	900	1200	1200	1250	1550	1700
26	650	900	900	1000	1150	1250
31	1000	1300	1300	1300	1700	1900
41	300	400	400	400	400	400
44	850	1100	1100	1100	1350	1500
45	250	400	400	600	1000	1200
51	1850	2500	2500	2500	2700	3000
Total	7050	9475	9500	10000	11850	13200

[a] Prior to 2011, <75% of permittees purchased a license (Table 1). This was factored into the allocation of permits. In 2011, under a new procedure, all licenses not purchased by permittees were sold (Table 3). In order not to increase the number of hunters, 2011 permit allocations were reduced by the mean percentage of licenses that were purchased in each BMU in 2009–2010. The table shows the permit allocation before and after this reduction.

Table 3. Number of bear hunting permit applicants and surplus licenses bought, 2007–2011[a]. Shaded values indicate undersubscribed areas.

BMU	2011[b]			2010		2009		2008			2007		
	Apps	Bought license	Surplus bought	Apps	Surplus	Apps	Surplus	Apps	Surplus	bought	Apps	Surplus	bought
12	834	267	84	903	5[c]	876		857			811		
13	751	366	84	753		700		709			745		
22	90	71	31	114		91	0[d]	85	50	77%	87	51	81%
24	918	294	56	971		843		825			742	159	100%
25	1763	712	190	1811	5[c]	1694		1793	4[c]		1799		
26	1894	512	139	1959		1874		1999	2[c]		2028		
31	2505	826	174	2414		2423		2388	3[c]		2383		
41	688	253	47	718		685		656			577		
44	3010	697	154	2923		2787		2821			2669		
45	1019	208	42	937		941		873	128	100%	936	266	100%
51	4086	1478	372	3950	1[c]	3822		3828			3568		
Total	17558[e]	5684	1373	17453[e]		16736[e]		16834[e]	178	92%	16345	476	98%

[a] Surplus licenses available beginning in 2001. This was discontinued in 2009 and replaced by 2nd choice lottery applicants.
[b] In 2011, all licenses not purchased by permittees were sold as "surplus". Surplus = Permits available (Table 2) minus Bought license (±2 to account for groups applying together).
[c] Courtesy licenses issued by Commissioner, not actual surplus.
[d] No 2nd choice applicants bought a license for BMU 22, so it remained undersubscribed.
[e] Beginning in 2008, applicants could apply for area 99 in order to increase future preference, but not buy a license; these are not included in this total.

Table 4. Percentage of lottery applicants with preference level 1 (1st-year applicant) that were drawn for a bear permit, 2007–2011. All preference level 2 applicants were drawn, except where 0 preference level 1 applicants were drawn, in which case the success of preference level 2 applicants is shown parenthetically.

BMU	2011	2010	2009	2008	2007
12	2	23	29	37	46
13	51	77	84	92	94
22	100	88	100	100	100
24	14	49	75	91	100
25	35	60	72	86	94
26	0 (77)	15	32	43	53
31	11	35	43	68	79
41	6	31	37	47	59
44	0 (55)	0 (90)	3	26	38
45	0 (67)	24	61	100	100
51	25	52	58	67	84

Table 5. Minnesota bear harvest tally[a] for 2011 by Bear Management Unit (BMU) and sex compared to harvests during 2006–2010 and record high harvests.

BMU	2011 M	2011 (%M)	2011 F	2011 U	2011 Total	2010	2009	2008	2007	2006	5 year mean	Record high harvest (yr)
Quota												
12	84	(79)[c]	22	0	106	95	140	101	124	70	106	263 (01)
13	75	(63)	44	0	119	155	149	129	163	151	149	258 (95)
22	9	(82)	2	0	11	9	7	7	15	15	11	41 (89)
24	64	(52)	58	0	122	124	151	100	134	194	141	288 (95)
25	185	(58)	132	0	317	307	344	298	369	421	348	584 (01)
26	105	(63)	62	0	167	232	228	137	315	314	245	513 (95)
31	219	(61)	139	0	358	363	384	248	398	482	375	697 (01)
41	29	(54)	25	0	54	71	104	77	104	40	79	201 (01)
44	65	(50)	65	0	130[d]	248	255	196	333	192	245	643 (95)
45	23	(72)[c]	9	0	32[d]	58	42	72	113	118	81	178 (01)
51	171	(59)	117	0	288[e]	501	416	344	557	721	508	895 (01)
Total	1029	(60)	675	0	1704[f]	2163	2220	1709	2625	2718	2287	4288 (01)
No Quota[b]												
11	134	(61)	85	0	219	178	315	172	324	114	221	351[h] (05)
11b	1		2	0	3	11	9	3	4	6		
52	131	(64)	74	0	205[g]	347	257	251	219	400	295	400 (06)
Total	266	(63)	161	0	427	536	581	426	547	520	522	678 (95)
State	1295	(61)	836	0	**2131**	2699	2801	2135	3172	3290[h]	2819	4956 (95)

[a] Hunters receive tooth envelopes at registration stations, but the sex recorded on tooth envelopes sometimes differs from the registered sex (2011: 1450 [97%] unchanged; 12 $M_{(reg)} \rightarrow F_{(tooth)}$; 38 F→M). Sex shown on table is the registered sex because only ~70% of tooth envelopes are submitted (2011: 1535 of 2131 = 72%). Also, some tooth envelopes had no corresponding registration data. These were added to the harvest tally:

Year	Quota area	No-quota area
2006	63	15
2007	27	9
2008	23	4
2009	19	14
2010	20	8
2011	11	2

[b] Some hunters with no-quota licenses hunted in the quota area, and their kills were assigned to the BMU where they apparently hunted (n = 28 in 2006, 27 in 2007, 14 in 2008, 3 in 2009, 14 in 2010, 14 in 2011). Some quota area hunters also apparently hunted in the wrong BMU, based on the block where they said they killed a bear, but these were recorded in the BMU where they were assigned, not the BMU of the indicated harvest block, presuming most were misreported kill locations.

[c] Record high sex ratio (%M).

[d] Lowest harvest since BMU was established in 1994.
[e] Lowest harvest since 1991.
[f] Lowest harvest since 1996.
[g] Lowest harvest since 2002.

[h] The estimated registered harvest, including those in which registration data were lost and no tooth envelope was received. Value does not match column total because BMU data were uncorrected for lost registration data.

Table 6. Bear hunting success (%) by BMU, measured as the registered harvest (excluding second bear) divided by the number of licenses sold[a], 2006–2011.

BMU	Mean success 2006-2010	2011		2010		2009		2008		2007		2006	
		% Success	% 2 bears[b]	% Success	% 2 bears[b]	% Success	% 2 bears[b]	% Success	% 2 bears[b]	% Success	% 2 bears[b]	% Success	% 2 bears[b]
Quota	27												
12	31	30		30		39		32		36		19	
13	30	26		34[c]		32		28		31		24	
22	13	11		14		16[c]		8		14		14	
24	25	35[e]		29		31[d]		20		20		25	
25	32	35		34		36		28[f]		31		30	
26	30	26		34		31		17[f]		36		30	
31	31	36		36		38[c]		21[f]		28		33	
41	27	18		25		34		27		35		13	
44	25	15[f]		28		30		21		30		16	
45	14	13		21[d]		11[f]		11[f]		14		14	
51	25	16[f]		27		23		19		27		28	
No Quota	20												
Statewide	25												

[a] Harvest/licenses instead of harvest/hunters because BMU-year-specific estimates for the proportion of license-holders that hunted are unreliable. Statewide estimates of harvest/hunters are presented in Table 1.

[b] Percent of successful hunters that shot 2 bears; 2nd bear is not included in the calculation of hunting success. The taking of 2 bears was legal only in the no-quota area since 2002.

[c] Highest success since 1997 (until this year).

[d] Highest success since 1995 (until this year).

[e] Highest success since 1992.

[f] Lowest success since 2002 (until this year).

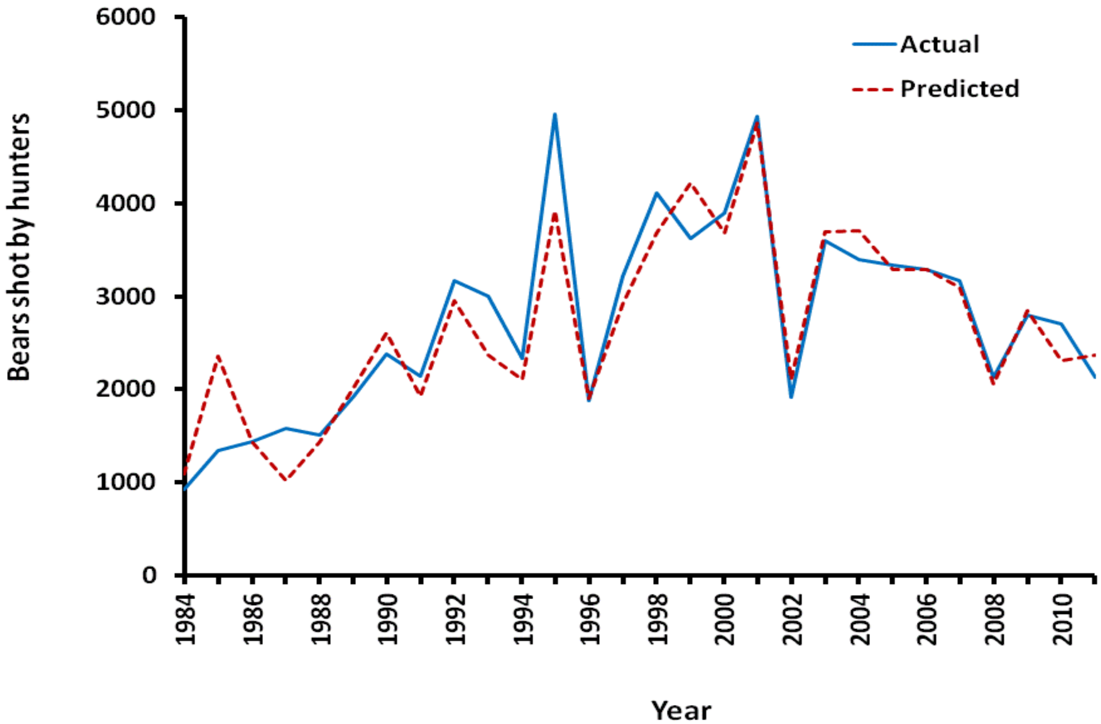
[g] Of the no-quota hunters in 2011, 30 took 2 bears in BMU 11 and 20 took 2 bears in BMU 52.

[h] Success rates in different parts of the no-quota area (Fig. 1) are not distinguishable from harvest records because the number of people that hunted in each BMU is unknown. However, a hunter survey conducted following the 2009 hunting season indicated the following success rates: BMU 11 – 42%; BMU 11b – 17%; BMU 52 – 19%. These values are not directly comparable to values tabulated here due to a non-response bias in the survey (non-successful hunters are less likely to respond; respondents indicated overall success rate of 31% vs 22% calculated from harvest/licenses); nevertheless, they reflect differences in success rates among these BMUs that year (notably a year when harvest was high in BMU 11).

Table 7. Cumulative bear harvest (% of total harvest) by date, 1990–2011.

Year	Day of week for opener	Aug 22/23 – Aug 31	Sep 1 – Sep 7	Sep 1 – Sep 14	Sep 1 – Sep 30
1990	Sat		69	82	96
1991	Sun		64	76	93
1992	Tue		72	86	96
1993	Wed		67	80	94
1994	Thu		67	78	92
1995	Fri		72	87	97
1996	Sun		56[a]	70	87
1997	Mon		76	88	97
1998	Tue		76	87	96
1999	Wed		69	81	95
2000	Wed	57	72	82	96
2001	Wed	67	82	88	98
2002	Sun		57[a]	69	90
2003	Mon		72	84	96
2004	Wed		68	82	95
2005	Thu		72	81	94
2006	Fri		69	83	96
2007	Sat		69	82	96
2008	Mon		58[a]	71	92
2009	Tue		74	86	96
2010	Wed		69	84	96
2011	Thu		65	78	93

[a] The low proportion of total harvest taken during the opening week (<60%) reflects a high abundance of natural foods



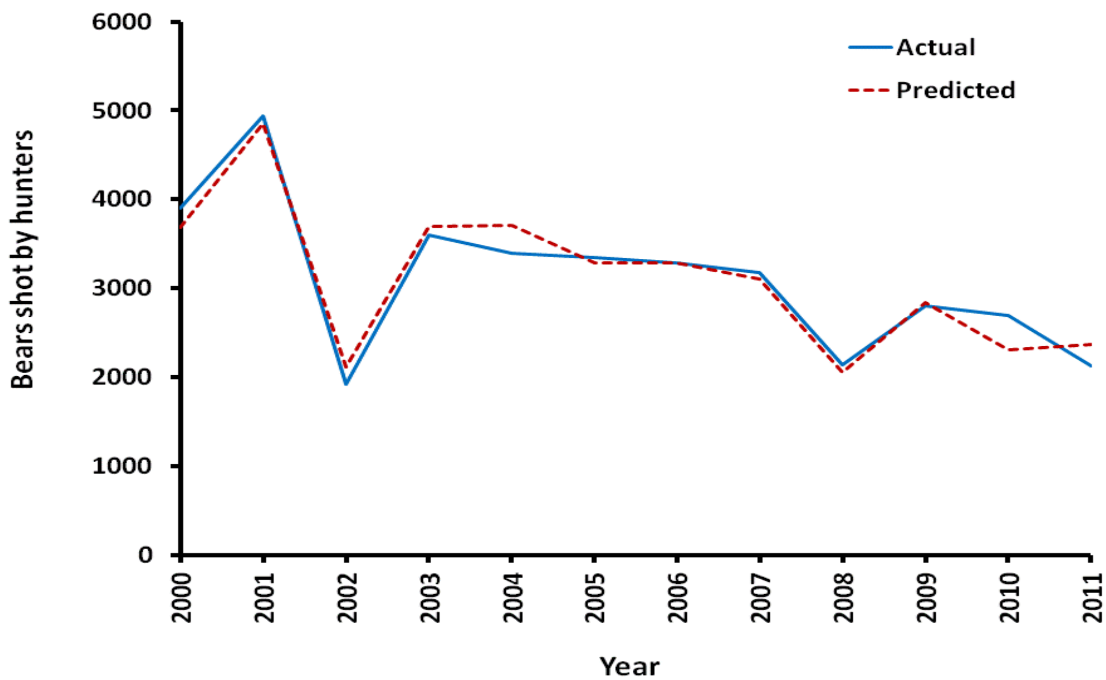


Figure 3. Number of bears harvested vs. number predicted based on fall food abundance and the number of hunters: (top graph) 1984–2011 (R^2=0.84); (bottom graph) 2000–2011 (R^2=0.95).

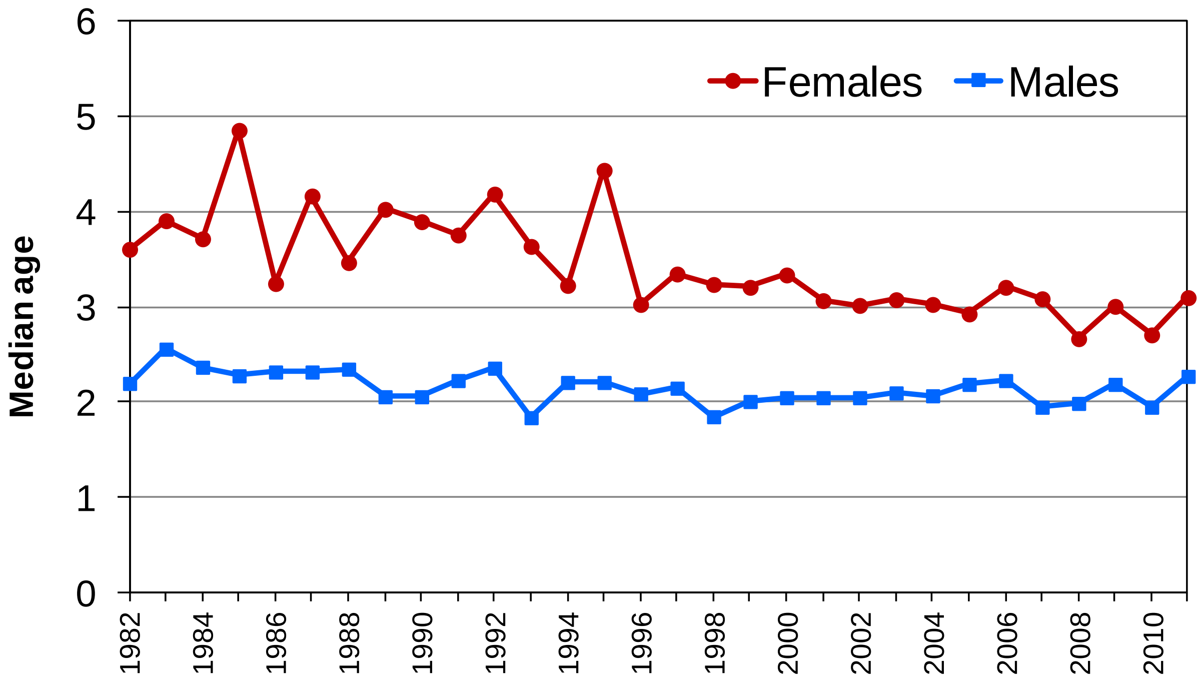


Figure 4. Statewide harvest structure: median ages (yrs) by sex, 1982–2011.

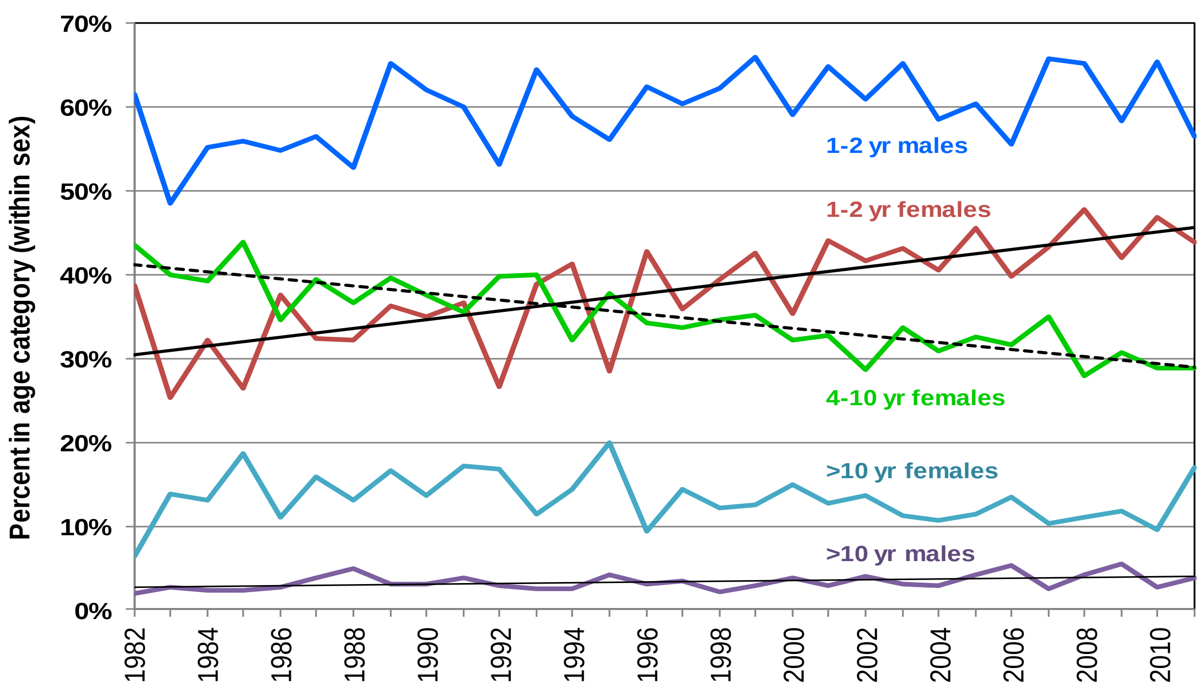


Figure 5. Statewide harvest structure: proportion of each sex in age category, 1982–2011. Trend lines are significant.

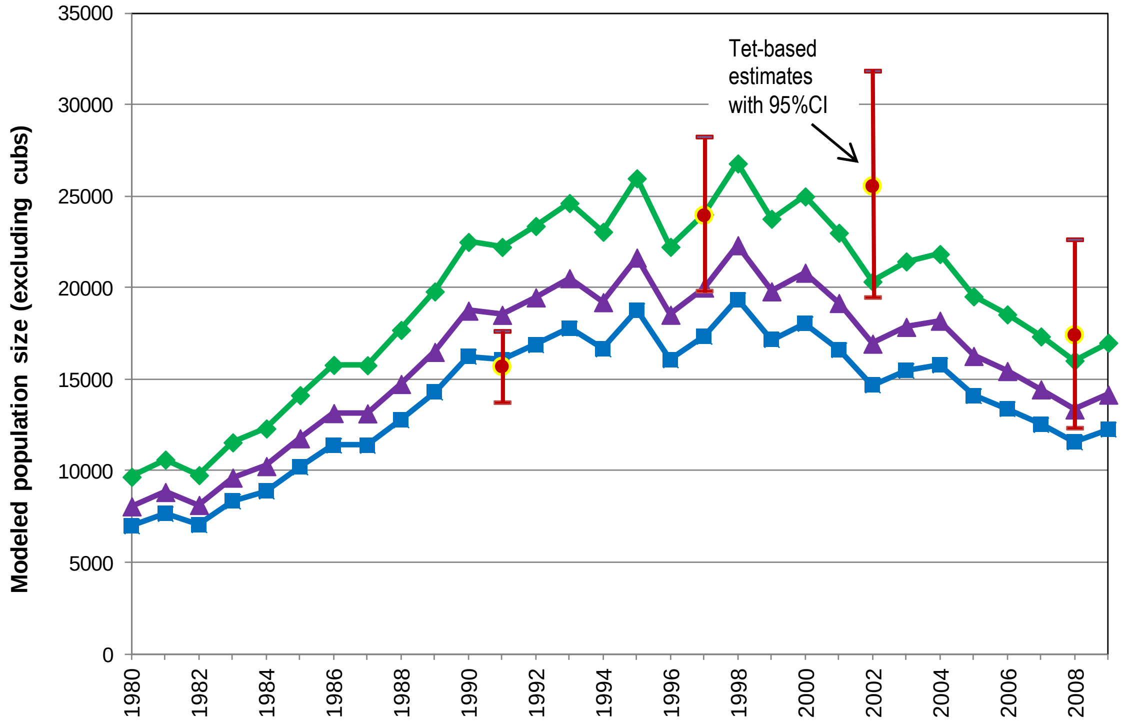


Figure 6. Statewide population trend derived from Downing reconstruction using the harvest age structure. Curves were scaled (elevated) to various degrees to match the tetracycline-based mark–recapture estimates (3 curves shown match different sets of tetracycline estimates).

2011 MINNESOTA DEER HARVEST REPORT

Lou Cornicelli, Big Game / Season Program Consultant, Division of Fish and Wildlife

INTRODUCTION

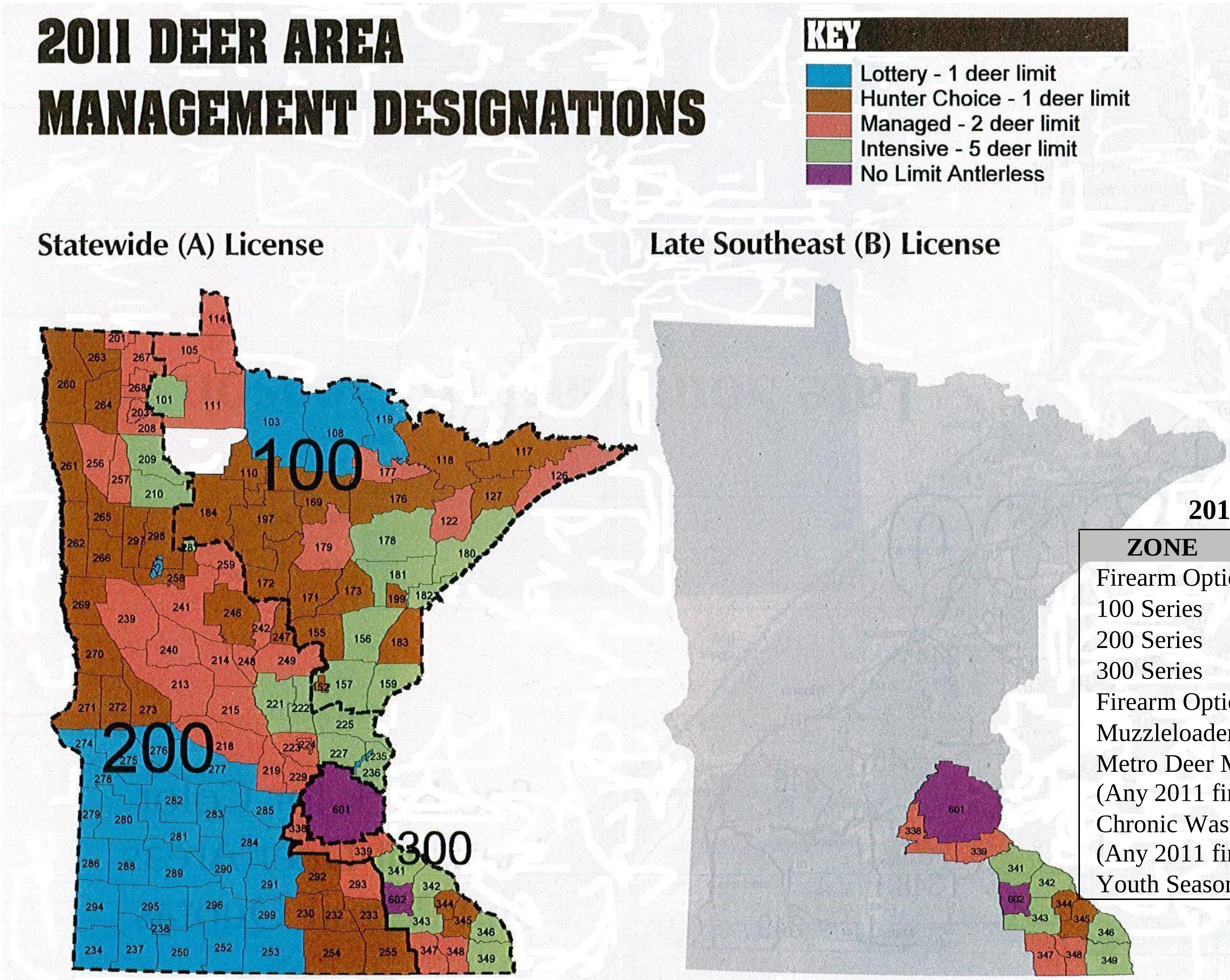
The white-tailed deer may be considered Minnesota's most popular wildlife species. Each year 500,000 hunters harvest over 190,000. In 2010, hunters registered 192,331 deer

METHODS

Every deer taken by hunting in Minnesota must be registered within 24 hours of the close of the season under which the deer was taken. Deer may be registered at any of the 825 to nearly 900 “Big Game Registration” stations available throughout the state. Starting in 2011, deer could be registered using the internet and telephone except in areas with Disease Management tag restrictions (101 and 602). Implementation of electronic licensing (ELS) has improved the efficiency and accuracy of deer harvest estimates and provides a more timely release of harvest information. Registered deer are recorded as adult buck, fawn buck, adult doe, or fawn doe. Additional information gathered at time of registration includes date of kill, deer permit area, and season.

RESULTS

Outcome of the 2011 deer harvest are presented in the following tables.



2011 Minnesota Firearms Deer Seasons

ZONE	DATES
Firearm Option Statewide (A)*	
100 Series	Nov. 5-20
200 Series	Nov. 5-13
300 Series	Nov. 5-13
Firearm Option Late Southeast (B)**	Nov. 19-27
Muzzleloader****	Nov. 26-Dec. 11
Metro Deer Management Area (601)***	
(Any 2011 firearms or muzzleloader.)	Nov. 5-27
Chronic Wasting Disease Area (602)***	
(Any 2011 firearms or muzzleloader.)	Nov. 5-27
Youth Season	Oct. 20-23

Figure 1. 2011 Firearms and Archery Deer Seasons.

2011 Minnesota Archery Deer Season Dates: September 17-December 31.
Antlerless deer and legal bucks may be taken by archery, except only legal bucks may be taken in permit areas that have no either-sex permits or have youth-only either-sex permits.

Table 1. Statewide Firearms, Archery, and Muzzleloader Harvest, License Sales, and Success Rates, 2000-2011.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
REGULAR FIREARMS												
Resident License Sales	400,814	401,005	367,964	344,875	309,698	291,298	299,774	285,286	376,006	377,077	379,866	382,668
Non-Resident License Sales	10,595	10,972	10,835	11,334	12,036	12,523	12,520	12,520	11,883	11,759	11,908	11,955
Bonus Permit Sales	34,802	59,013	105,699	194,201	183,186	184,566	167,343	145,522	190,156	140,920	143,763	142,049
Multi-Zone Buck License Sales	42,669	41,921	35,658	32,929	32,359	28,233	15,984	15,051	N/A	N/A	N/A	N/A
Youth License Sales	3,215	4,011	2,884	34,463	51,347	50,501	49,599	49,242	50,397	56,678	59,726	60,943
All Season Deer License Sales	2,384	3,986	22,125	30,998	46,008	59,090	75,511	76,385	N/A	N/A	N/A	N/A
Total License Sales	495,289	519,601	545,165	648,800	634,634	626,211	620,731	584,006	628,442	586,434	595,263	597,615
Registered Buck Harvest[1]	102,961	98,894	101,333	110,440	116,612	95,594	95,695	97,528	85,646	83,820	88,027	76,003
Antlerless Permits Offered	232,595	286,540	365,667	31,625	30,760	28,830	18,925	18,830	32,325	60,100	60,083	15,252
Antlerless Permits Issued	180,490	196,603	192,907	25,386	24,111	25,656	18,925	18,830	32,325	60,100	60,083	60,083
Antlerless Permits App.	237,571	225,341	202,086	30,253	28,454	31,403	31,403	31,403	31,403	90,882	86,783	86,783
Registered AL Harvest[1]	88,492	98,169	102,280	147,420	123,278	119,363	135,981	118,860	98,147	78,525	78,525	88,197
Registered Total Harvest[1]	191,453	197,063	203,613	257,860	239,890	214,957	231,676	216,388	183,793	162,345	174,104	164,200
Registered % Successful[2]	38.6	37.9	37.3	39.7	37.8	34.3	37.3	37.1	35.1	32.1	35.6	32.9
	414,624	415,988	381,683	390,672	373,081	354,322	361,893	347,048	438,286	445,514	451,500	455,566
ARCHERY												
Resident License Sales	68,947	69,608	57,532	59,339	50,601	50,293	49,595	52,780	87,872	88,707	91,156	90,252
Non-Resident License Sales	1,271	1,288	1,275	1,428	1,144	1,207	1,286	1,509	1,509	1,610	1,638	1,718
Youth Archery Sales	N/A	N/A	N/A	3,748	7,261	7,489	7,688	7,663	9,005	9,157	9,577	10,306
Mgmt Permit License Sales	20,393	22,141	18,126	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total License Sales	90,611	93,037	76,933	60,767	59,006	58,989	58,569	61,952	99,033	99,474	102,371	102,276
Total Harvest - All-Season License				2,356	3,489	4,563	8,284	6,900	N/A	N/A	N/A	N/A
Total Archery Harvest	15,776	15,884	14,744	21,691	20,726	23,538	25,360	24,161	22,632	20,629	22,057	20,444
Registered % Successful[2]	17.4	17.1	19.2	22.3	29.2	24.6	24.8	24.3	18.5	17.5	17.8	17.0
MUZZLELOADER												
Total Muzzleloader License Sales	11,972	13,043	11,764	9,142	10,512	9,226	10,781	9,867	64,673	63,282	55,640	59,384
Estimated All-Season Hunters	--	--	--	12,020	14,168	23,293	23,293	26,813	N/A	N/A	N/A	N/A
Total Muzzleloader Harvest	4,548	4,494	3,505	9,466	9,289	15,421	13,507	12,138	9,572	7,929	9,023	7,416
Registered % Successful[2]	38.0	34.5	29.8	44.7	37.6	47.4	39.6	28.2	13.4	11.3	16.2	12.4
Antlerless Permits Offered											5,792	1,997
Antlerless Permits App.											7,260	2,615
TOTAL Registered Harvest	211,777	217,452	222,050	290,525	260,604	255,736	270,778	260,434	221,837	194,186	207,313	192,331

[1] Does not include free landowner licenses

[2] Based on total license sales - does not include all-season deer

Table 2. Deer Harvest by License Type and Zone, 2011.

Firearms/Zone	Hunters	Harvest			Overall Success
		Bucks	Antlerless	Total	
1	176,551	30,481	33,176	63,657	33.0%
2	234,353	39,358	44,244	83,602	33.1%
3A	24,051	4,053	4,796	8,849	31.9%
3B	13,617	886	3,553	4,439	27.9%
CWD	1,769	451	709	1,160	49.7%
Free Landowner[1]	3,631	0	1,084	1,084	29.9%
Muzzleloader[2]	55,640	2,222	5,194	7,416	12.4%
Archery[3]	102,276	6,987	13,457	20,444	17.0%
TOTAL[4]	**497,995**	**85,549**	**106,782**	**192,331**	34.9%

[1] Includes deer taken during regular firearms, muzzleloader, and archery seasons.

[2] Total number of people who bought only a muzzleloader license was 6,989.

[3] Includes Camp Ripley. Total number of people who bought only an archery license was 32,495.

[4] Due to the fact that a hunter can buy multiple licenses, hunter numbers and success rates are calculated using unique MNDNR numbers.

Table 3. Firearms Harvest and Harvest per Square Mile by Permit Area, 2011. Includes all firearm licenses but does not include early antlerless harvest.

Permit Area	Zone	Adult Male	Fawn Male	Adult Female	Fawn Female	Total	Area Size (sq.mi.)	Bucks/ Sq. Mile	Antlerless/ Sq. Mile	Total/ Sq. Mile
101	1A	211	65	227	57	560	496	0.43	0.70	1.13
103	1A	570	36	205	36	847	1,824	0.31	0.15	0.46
105	1A	512	123	532	97	1,264	932	0.55	0.81	1.36
108	1A	837	27	145	17	1,026	1,701	0.49	0.11	0.60
110	1A	773	124	558	103	1,558	530	1.46	1.48	2.94
111	1A	329	82	248	41	700	1,440	0.23	0.26	0.49
114	1A	44	5	23	3	75	412	0.11	0.08	0.18
117	1A	22	2	13	0	37	1,129	0.02	0.01	0.03
118	1A	572	56	319	37	984	1,445	0.40	0.29	0.68
119	1A	612	19	172	21	824	946	0.65	0.22	0.87
122	1A	463	52	279	41	835	622	0.74	0.60	1.34
126	1A	362	32	250	40	684	979	0.37	0.33	0.70
127	1A	77	3	35	5	120	587	0.13	0.07	0.20
152	1A	103	21	60	16	200	62	1.67	1.57	3.25
155	1A	1439	277	968	179	2,863	639	2.25	2.23	4.48
156	1A	1638	495	1589	362	4,084	834	1.96	2.93	4.89
157	1A	2393	680	1995	560	5,628	904	2.65	3.58	6.23
159	1A	1141	297	972	211	2,621	575	1.98	2.57	4.55
169	1A	1179	243	942	198	2,562	1,202	0.98	1.15	2.13
171	1A	1149	211	748	143	2,251	729	1.58	1.51	3.09
172	1A	1679	390	1231	260	3,560	786	2.14	2.39	4.53
173	1A	787	117	581	92	1,577	617	1.27	1.28	2.55
176	1A	1345	176	779	130	2,430	1,150	1.17	0.94	2.11
177	1A	737	168	706	140	1,751	553	1.33	1.83	3.17
178	1A	2085	494	2045	468	5,092	1,325	1.57	2.27	3.84
179	1A	1699	431	1583	377	4,090	939	1.81	2.55	4.36
180	1A	1134	169	760	145	2,208	999	1.14	1.08	2.21
181	1A	1408	355	1240	251	3,254	746	1.89	2.47	4.36
182	1A	427	88	278	45	838	280	1.53	1.47	2.99
183	1A	1268	198	819	132	2,417	675	1.88	1.70	3.58
184	1A	2420	437	1595	321	4,773	1,318	1.84	1.78	3.62
197	1A	969	146	545	111	1,771	1,343	0.72	0.60	1.32
199	1A	97	11	60	5	173	152	0.64	0.50	1.14
201	2A	70	19	75	11	175	169	0.41	0.62	1.03
203	2A	51	14	53	8	126	132	0.39	0.57	0.96
208	2A	142	52	178	33	405	379	0.38	0.69	1.07
209	2A	402	152	496	111	1,161	641	0.63	1.18	1.81
210	2A	711	265	812	226	2,014	635	1.12	2.05	3.17
213	2A	1480	493	1197	370	3,540	1,161	1.27	1.77	3.05
214	2A	1337	467	1004	360	3,168	566	2.36	3.24	5.60
215	2A	1013	361	744	287	2,405	730	1.39	1.91	3.29
218	2A	844	285	696	187	2,012	912	0.93	1.28	2.21
219	2A	514	147	371	111	1,143	427	1.20	1.47	2.68
221	2A	918	391	704	298	2,311	647	1.42	2.15	3.57
222	2A	900	266	616	202	1,984	413	2.18	2.63	4.81
223	2A	537	122	343	113	1,115	385	1.39	1.50	2.90
224	2A	95	34	77	15	221	49	1.94	2.57	4.51
225	2A	1261	369	872	326	2,828	635	1.99	2.47	4.45
227	2A	800	239	566	175	1,780	491	1.63	1.99	3.62

Table 3. (Continued)

Permit Area	Zone	Adult Male	Fawn Male	Adult Female	Fawn Female	Total	Area Size (sq.mi.)	Bucks/ Sq. Mile	Antlerless/ Sq. Mile	Total/ Sq. Mile
229	2A	204	52	124	35	415	313	0.65	0.67	1.32
230	2A	194	56	143	32	425	464	0.42	0.50	0.92
232	2A	232	42	134	18	426	380	0.61	0.51	1.12
233	2A	154	25	65	10	254	386	0.40	0.26	0.66
234	2A	160	33	100	26	319	637	0.25	0.25	0.50
235	2A	51	4	19	7	81	37	1.39	0.82	2.20
236	2A	572	126	340	100	1,138	404	1.42	1.40	2.82
237	2A	209	22	92	15	338	737	0.28	0.17	0.46
238	2A	67	5	30	4	106	98	0.69	0.40	1.09
239	2A	1231	329	964	293	2,817	1,110	1.11	1.43	2.54
240	2A	1499	469	1104	375	3,447	694	2.16	2.81	4.97
241	2A	2606	856	2150	664	6,276	1,047	2.49	3.51	5.99
242	2A	589	155	504	134	1,382	307	1.92	2.58	4.50
246	2A	2079	448	1405	330	4,262	860	2.42	2.54	4.96
247	2A	715	152	498	121	1,486	263	2.72	2.93	5.64
248	2A	404	109	265	60	838	229	1.77	1.90	3.67
249	2A	1137	332	850	284	2,603	729	1.56	2.01	3.57
250	2A	254	24	126	19	423	730	0.35	0.23	0.58
251	2A	55	10	29	7	101	68	0.81	0.68	1.48
252	2A	271	31	98	18	418	735	0.37	0.20	0.57
253	2A	363	35	152	23	573	987	0.37	0.21	0.58
254	2A	434	66	243	51	794	946	0.46	0.38	0.84
255	2A	378	61	160	38	637	774	0.49	0.33	0.82
256	2A	317	86	322	81	806	654	0.48	0.75	1.23
257	2A	299	76	264	68	707	426	0.70	0.96	1.66
258	2A	722	200	494	146	1,562	381	1.90	2.20	4.10
259	2A	1360	409	1370	342	3,481	546	2.49	3.89	6.38
260	2A	254	41	167	36	498	1,252	0.20	0.19	0.40
261	2A	114	9	60	12	195	796	0.14	0.10	0.24
262	2A	159	39	128	24	350	677	0.23	0.28	0.52
263	2A	255	42	165	32	494	513	0.50	0.47	0.96
264	2A	450	98	330	61	939	672	0.67	0.73	1.40
265	2A	317	74	218	54	663	495	0.64	0.70	1.34
266	2A	268	43	207	50	568	625	0.43	0.48	0.91
267	2A	138	47	152	28	365	472	0.29	0.48	0.77
268	2A	193	53	166	38	450	239	0.81	1.07	1.88
269	2A	153	39	120	14	326	652	0.23	0.27	0.50
270	2A	154	18	82	14	268	758	0.20	0.15	0.35
271	2A	216	37	149	28	430	646	0.33	0.33	0.67
272	2A	169	33	113	10	325	544	0.31	0.29	0.60
273	2A	396	75	226	57	754	634	0.63	0.57	1.19
274	2A	225	10	100	9	344	381	0.59	0.31	0.90
275	2A	321	28	132	24	505	777	0.41	0.24	0.65
276	2A	420	73	242	33	768	575	0.73	0.60	1.33
277	2A	1049	122	525	87	1,783	876	1.20	0.84	2.04
278	2A	346	27	166	28	567	422	0.82	0.52	1.34
279	2A	181	17	98	23	319	346	0.52	0.40	0.92

Table 3. (Continued)

Permit Area	Zone	Adult Male	Fawn Male	Adult Female	Fawn Female	Total	Area Size (sq.mi.)	Bucks/ Sq. Mile	Antlerless/ Sq. Mile	Total/ Sq. Mile
280	2A	214	20	128	18	380	676	0.32	0.25	0.56
281	2A	367	48	176	30	621	579	0.63	0.44	1.07
282	2A	112	4	35	3	154	780	0.14	0.05	0.20
283	2A	257	20	97	13	387	640	0.40	0.20	0.61
284	2A	274	23	111	19	427	853	0.32	0.18	0.50
285	2A	362	49	156	37	604	580	0.62	0.42	1.04
286	2A	243	18	98	15	374	458	0.53	0.29	0.82
287	2A	74	45	110	27	256	51	1.46	3.59	5.05
288	2A	288	24	90	18	420	630	0.46	0.21	0.67
289	2A	156	9	44	17	226	820	0.19	0.09	0.28
290	2A	363	36	223	31	653	666	0.55	0.44	0.98
291	2A	557	78	266	50	951	832	0.67	0.47	1.14
292	2A	437	68	250	53	808	517	0.84	0.72	1.56
293	2A	531	104	307	58	1,000	512	1.04	0.92	1.95
294	2A	238	24	123	20	405	689	0.35	0.24	0.59
295	2A	357	26	142	23	548	855	0.42	0.22	0.64
296	2A	231	24	96	11	362	675	0.34	0.19	0.54
297	2A	132	17	67	20	236	449	0.29	0.23	0.53
298	2A	511	100	298	70	979	677	0.76	0.69	1.45
299	2A	245	36	106	10	397	389	0.63	0.39	1.02
338	3A	131	27	133	27	318	472	0.28	0.40	0.67
338	3B	28	21	71	17	137	472	0.06	0.23	0.29
339	3A	176	32	137	34	379	406	0.43	0.50	0.93
339	3B	26	20	51	14	111	406	0.06	0.21	0.27
341	3A	419	101	336	105	961	483	0.87	1.12	1.99
341	3B	110	88	250	71	519	483	0.23	0.85	1.07
342	3A	386	117	346	96	945	374	1.03	1.49	2.53
342	3B	98	97	253	82	530	374	0.26	1.15	1.42
343	3A	296	103	277	66	742	486	0.61	0.92	1.53
343	3B	53	56	142	37	288	486	0.11	0.48	0.59
344	3A	271	51	226	53	601	190	1.43	1.74	3.17
344	3B	48	37	150	34	269	190	0.25	1.16	1.42
345	3A	258	40	115	36	449	335	0.77	0.57	1.34
345	3B	69	54	153	43	319	335	0.21	0.75	0.95
346	3A	658	115	467	102	1,342	328	2.01	2.09	4.09
346	3B	139	94	295	91	619	328	0.42	1.46	1.89
347	3A	286	65	232	35	618	434	0.66	0.77	1.42
347	3B	66	50	183	40	339	434	0.15	0.63	0.78
348	3A	395	72	351	67	885	332	1.19	1.47	2.66
348	3B	56	57	181	40	334	332	0.17	0.84	1.00
349	3A	777	108	615	109	1,609	499	1.56	1.67	3.22
349	3B	193	146	525	110	974	499	0.39	1.57	1.95

Table 3. (Continued)

Permit Area	Zone	Adult Male	Fawn Male	Adult Female	Fawn Female	Total	Area Size (sq.mi.)	Bucks/ Sq. Mile	Antlerless /Sq. Mile	Total/ Sq. Mile
601	Metro	611	136	428	120	1,295	1,756	0.35	0.39	0.74
602	CWD	451	192	401	116	1,160	304	1.48	2.33	3.82
900	Park	1	0	4	1	6				
901	Park	4	1	1	0	6				
902	Park	47	38	79	24	188				
903	Park	1	0	0	0	1				
904	Park	3	3	6	1	13				
905	Park	3	0	1	2	6				
906	Park	7	1	1	1	10				
907	Park	1	0	1	0	2				
908	Park	1	0	0	0	1				
909	Park	1	1	2	0	4				
910	Park	0	4	6	2	12				
913	Park	0	1	7	2	10				
914	Park	10	3	15	1	29				
915	Park	3	1	0	1	5				
916	Park	29	6	22	1	58				
917	Park	0	1	2	0	3				
918	Park	1	1	3	3	8				
919	Park	0	1	5	4	10				
920	Park	0	4	3	3	10				
921	Park	13	9	23	2	47				
922	Park	3	3	14	5	25				
923	Park	0	0	2	4	6				
924	Park	0	4	14	1	19				
925	Park	5	2	1	1	9				
926	Park	5	3	13	3	24				
927	Park	3	1	3	0	7				
928	Park	19	8	27	13	67				
929	Park	3	5	9	3	20				
TOTAL		**76,003**	**17,597**	**56,402**	**13,606**	**163,608**	**83,265**	0.91	1.05	1.96

Table 4. Firearm Harvest using Bonus and Disease Management Permits, 2011.
Managed Permit Areas.

Permit Area	Zone	Fawn Male	Adult Female	Fawn Female	Total
105	1A	71	316	60	447
111	1A	42	131	21	194
114	1A	2	13	1	16
122	1A	23	119	26	168
126	1A	16	131	25	172
177	1A	80	369	74	523
179	1A	231	859	232	1,322
201	2A	10	54	11	75
203	2A	9	27	6	42
208	2A	26	97	20	143
213	2A	207	552	190	949
214	2A	238	495	185	918
215	2A	159	349	131	639
218	2A	117	303	84	504
219	2A	70	212	55	337
223	2A	58	180	52	290
224	2A	16	42	11	69
229	2A	24	75	12	111
239	2A	154	477	165	796
240	2A	258	610	206	1,074
241	2A	454	1,240	375	2,069
242	2A	79	262	69	410
248	2A	47	134	33	214
249	2A	136	419	147	702
256	2A	39	184	39	262
257	2A	47	142	41	230
259	2A	205	682	164	1,051
267	2A	25	86	17	128
268	2A	30	108	22	160
293	2A	51	167	34	252
338	3A	15	75	14	104
338	3B	8	33	11	52
339	3A	19	83	19	121
339	3B	13	29	5	47
347	3A	39	167	24	230
347	3B	28	85	14	127
348	3A	42	234	47	323
348	3B	22	73	20	115
Total		3,110	9,614	2,662	15,386

Intensive Permit Areas

Permit Area	Zone	Fawn Male	Adult Female	Fawn Female	Total
101	1A	49	168	46	263
156	1A	283	972	245	1,500
157	1A	394	1171	368	1,933
159	1A	187	569	135	891
178	1A	336	1274	329	1,939
180	1A	104	492	103	699
181	1A	254	800	180	1,234
182	1A	56	176	29	261
209	2A	113	354	80	547
210	2A	192	531	168	891
221	2A	251	431	206	888
222	2A	163	360	132	655
225	2A	210	534	201	945
227	2A	169	388	114	671
236	2A	90	206	68	364
287	2A	32	79	24	135
341	3A	77	245	81	403
341	3B	49	138	51	238
342	3A	81	268	67	416
342	3B	62	132	52	246
343	3A	76	200	48	324
343	3B	34	87	26	147
346	3A	83	362	76	521
346	3B	40	155	60	255
349	3A	65	460	82	607
349	3B	87	299	76	462
601	Metro	97	316	101	514
602	CWD	161	350	108	619
Total		3,795	11,517	3,256	18,568

Table 5. Summary of Firearms Special Hunts, 2011. Includes regular, youth, and bonus permits.

Area	Dates	Permits Issued	Harvest Adult Male	Harvest Fawn Male	Harvest Adult Female	Harvest Fawn Female	Harvest Total
900 - Lake Vermilion State Park[1]	11/5-11/20	50*	1	0	4	1	6
901 - Rice Lake Nat. Wildlife Refuge	11/12-11/20	40***	4	1	1	0	6
902 - St. Croix State Park[1]	11/11-11/14	400**	47	39	79	24	189
903 - Savanna Portage State Park	11/12-11/16	15***	1	0	0	0	1
904 - Gooseberry Falls State Park[1]	11/5-11/20	30*	3	3	7	1	14
905 - Split Rock Lighthouse State Park[1]	11/5-11/20	30*	3	0	1	2	6
906 - Tettegouche State Park[1]	11/5-11/20	125*	7	1	1	1	10
907 - Scenic State Park[1]	11/5-11/20	30*	1	0	1	0	2
908 - Hayes Lake State Park[1]	11/5-11/20	75*	1	0	0	0	1
909 - Lake Bemidji State Park[1]	11/5-11/8	30**	1	1	2	0	4
910 - Zippel Bay State Park[1]	11/5-11/20	55#	0	4	7	2	13
911 - Judge CR Magney SP[1]	11/5-11/20	N/A*	0	0	0	0	0
912 - Schoolcraft State Park[1]	11/5-11/20	N/A*	0	0	0	0	0
913 - Lake Carlos State Park[1]	11/5-11/8	20#	0	1	7	2	10
914 - William O'Brien State Park[1]	11/5-11/6	70*	10	3	15	1	29
915 - Lake Bronson State Park	11/5-11/13	30*	3	1	0	1	5
916 - Maplewood State Park[1]	11/5-11/8	100*	29	6	22	1	58
917 - Rydell NWR	11/5-11/13	5#	0	1	2	0	3
918 - Lake Alexander SNA[1]	11/5-11/13	40*	1	1	3	3	8
919 - Glacial Lakes State Park	11/10-11/13	30#	0	1	5	4	10
920 - Zumbro Falls SNA - A[1]	11/5-11/13	12#	0	4	3	3	10
921 - Frontenac State Park - A[1]	11/7-11/9	60***	13	9	23	2	47
922 - Whitewater State Park[1]	11/19-11/20	50***	3	3	14	5	25
923 - Zumbro Falls SNA - B[1]	11/19-11/27	12#	0	0	2	4	6
924 - Whitewater State Game Refuge	11/19-11/27	75**	0	4	14	1	19
925 - Vermillion Highlands WMA[1]	11/5-11/18	25*	5	2	1	1	9
926 - Carver Park Reserve[1]	11/19-11/20	105*	5	3	13	3	24
927 - Lake Rebecca Park Reserve[1]	11/26-11/27	80*	3	1	3	0	7
928 - Wild River State Park[1]	11/5-11/8	100**	19	8	27	13	67
929 - Frontenac State Park - B[1]	11/19-11/20	60***	3	5	10	3	21
TOTAL			163	102	267	78	610

1 Bonus permits available *Either sex ** Earn-A-Buck

***Antler Point Restriction #Antlerless Only

Table 6. Free Landowner Firearms Harvest by Permit Area, 2011.

Permit Area	Fawn Male	Adult Female	Fawn Female	Total
101	0	2	0	2
105	0	5	3	8
111	1	1	2	4
114	0	1	0	1
156	3	9	3	15
157	19	20	9	48
159	0	4	0	4
177	3	6	2	11
178	2	9	1	12
179	4	6	1	11
180	1	1	0	2
181	0	3	1	4
182	1	3	0	4
208	0	5	0	5
209	3	13	2	18
210	4	16	7	27
213	12	40	11	63
214	18	65	16	99
215	17	23	11	51
218	3	8	2	13
219	2	0	0	2
221	5	22	9	36
222	3	5	0	8
223	0	2	0	2
225	6	9	4	19
227	1	3	2	6
229	0	1	0	1
236	1	5	1	7
239	8	17	4	29
240	13	36	9	58
241	27	45	14	86
242	1	1	1	3
248	4	5	1	10
249	8	20	11	39
256	2	8	1	11
257	4	9	2	15
259	1	10	4	15
267	4	2	0	6
268	0	4	2	6
293	0	2	0	2
338	1	3	0	4
339	1	2	1	4
341	5	16	3	24
342	5	22	7	34
343	0	7	3	10
346	8	19	6	33
347	2	6	2	10
348	2	11	3	16
349	7	45	8	60
601	1	2	0	3
602	1	3	2	6
TOTAL	214	582	171	967

Table 7. Archery Harvest by Permit Area, 2011.
Includes Regular, Youth, All-Season, and Bonus Permits.

Permit Area	Adult Male	Fawn Male	Adult Female	Fawn Female	Total
101	3	3	13	2	21
103	3	0	8	0	11
105	13	5	24	4	46
108	20	4	24	1	49
110	18	0	18	3	39
111	3	3	9	2	17
114	10	1	1	0	12
117	0	0	1	0	1
118	7	1	19	1	28
119	8	1	11	0	20
122	8	2	14	2	26
126	11	4	28	2	45
127	2	0	1	0	3
152	2	1	4	2	9
155	41	3	51	0	95
156	72	24	224	29	349
157	116	47	256	39	458
159	62	15	136	20	233
169	19	6	24	7	56
171	25	5	23	1	54
172	54	11	52	5	122
173	30	4	14	2	50
176	28	5	22	6	61
177	15	6	53	6	80
178	74	34	211	21	340
179	93	22	185	26	326
180	68	17	155	18	258
181	84	34	182	28	328
182	222	107	524	111	964
183	34	5	23	4	66
184	105	10	81	9	205
197	17	5	18	1	41
199	3	1	4	1	9
201	3	2	6	1	12
203	1	0	2	0	3
208	4	1	16	0	21
209	21	10	58	8	97
210	44	22	123	9	198
213	196	47	207	26	476
214	84	28	103	12	227
215	115	33	140	25	313
218	120	28	169	21	338
219	101	28	148	16	293
221	93	59	255	50	457
222	75	32	154	28	289
223	151	38	150	21	360
224	14	1	17	2	34
225	99	55	193	38	385
227	198	87	310	50	645
229	62	13	67	7	149
230	39	2	23	1	65
232	15	2	17	2	36
288	33	2	28	2	65
289	23	1	12	0	36
290	47	7	41	7	102
291	136	13	82	2	233
292	71	3	36	2	112
293	91	20	94	11	216
294	21	2	15	1	39
295	30	7	33	3	73
296	20	1	12	1	34
297	6	0	3	0	9
298	8	1	8	1	18
299	62	3	27	2	94
233	38	2	20	2	62
234	18	2	13	4	37
235	11	1	14	4	30
236	205	84	284	57	630
237	18	1	10	1	30
238	5	0	5	0	10
239	78	20	129	13	240
240	64	30	163	11	268
241	140	47	291	38	516
242	80	31	179	22	312
246	73	15	77	7	172
247	52	9	38	5	104
248	27	7	54	5	93
249	88	22	97	17	224
250	36	5	15	1	57
251	2	0	0	1	3
252	29	2	19	3	53
253	45	5	36	0	86
254	64	4	34	4	106
255	71	4	35	8	118
256	6	3	11	0	20
257	7	6	36	2	51
258	30	0	18	6	54
259	60	17	107	18	202
260	14	1	8	0	23
261	7	2	8	0	17
262	25	2	15	1	43
263	9	1	3	1	14
264	17	3	6	1	27
265	12	0	3	0	15

Table 7. (Continued)

Permit Area	Adult Male	Fawn Male	Adult Female	Fawn Female	Total
266	24	0	6	0	30
267	4	0	9	0	13
268	8	1	16	2	27
269	16	1	9	0	26
270	12	3	3	0	18
271	23	3	15	0	41
272	9	0	3	0	12
273	13	2	15	1	31
274	12	2	10	3	27
275	30	0	13	2	45
276	42	7	32	2	83
277	115	14	87	10	226
278	33	7	24	2	66
279	16	2	6	0	24
280	19	3	14	0	36
281	37	3	25	4	69
282	15	1	6	1	23
283	37	2	21	2	62
284	34	1	18	2	55

Permit Area	Adult Male	Fawn Male	Adult Female	Fawn Female	Total
285	71	8	33	6	118
286	21	4	14	1	40
287	0	0	1	0	1
338	39	15	73	7	134
339	53	14	54	14	135
341	120	44	239	44	447
342	97	29	170	25	321
343	143	57	296	51	547
344	35	5	17	4	61
345	61	8	18	5	92
346	139	34	219	46	438
347	64	11	84	14	173
348	81	11	96	13	201
349	125	23	252	31	431
601	649	243	1106	230	2,228
602	57	33	154	32	276
970*	94	34	133	26	287
971**	55	20	51	6	132
Total	**6,987**	**1,905**	**10,032**	**1,520**	**20,444**

*Camp Ripley First Hunt
**Camp Ripley Second Hunt

Table 8. Archery Harvest using Bonus and Disease Management Permits by Permit Area, 2011.

Permit Area	Fawn Male	Adult Female	Fawn Female	Total
101	2	13	1	16
105	1	13	1	15
111	1	6	1	8
114	1	0	0	1
122	1	10	2	13
126	2	17	2	21
156	16	185	25	226
157	36	205	33	274
159	12	110	17	139
177	2	36	4	42
178	25	162	14	201
179	13	136	16	165
180	13	130	16	159
181	29	147	25	201
182	102	482	107	691
201	2	6	1	9
203	0	1	0	1
208	1	12	0	13
209	7	49	8	64
210	19	115	8	142
213	27	145	19	191
214	23	88	9	120
215	23	113	17	153
218	20	124	16	160
219	20	113	12	145
221	51	235	41	327
222	30	131	24	185
223	21	117	15	153
224	0	12	2	14

Permit Area	Fawn Male	Adult Female	Fawn Female	Total
225	47	173	32	252
227	79	274	44	397
229	8	52	3	63
236	76	250	50	376
239	17	106	10	133
240	17	130	5	152
241	38	243	33	314
242	22	142	14	178
248	2	43	1	46
249	15	74	12	101
256	1	10	0	11
257	5	28	2	35
259	10	78	12	100
267	0	8	0	8
268	1	12	2	15
287	0	1	0	1
293	19	80	11	110
338	11	56	6	73
339	14	47	13	74
341	35	221	39	295
342	28	157	23	208
343	51	273	49	373
346	28	206	43	277
347	8	71	11	90
348	7	79	11	97
349	20	231	27	278
601	227	1010	206	1443
602	32	149	31	212
TOTAL	**1,318**	**7,117**	**1,126**	**9,561**

Table 9. Summary of Archery Special Hunts, 2011. Includes Regular, Youth, and Bonus Permits.

Area	Dates	Permits Issued	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
970 - Camp Ripley	10/20 - 10/21	2,500	94	133	34	26	287
971 - Camp Ripley	10/29 - 10/30	2,500	55	51	20	6	132
972 - Crow-Hassan Park Reserve	11/11- 11/13	130	0	2	2	0	4
973 - Murphy-Hanrehan Park Reserve	11/11- 11/13	180	0	0	0	0	0
974 - Cleary Lake Regional Park	11/11 - 11/13	55	0	0	0	0	0
975 - Vermillion Highlands WMA	9/17-10/30	60	3	3	0	0	6
976 - City of New Ulm	10/15 - 12/31	50	0	1	0	0	1
977 - City of Red Wing	9/17 - 12/31	Unl.	0	0	0	0	0
978 - City of Sandstone	9/17 - 12/31	Unl.	0	0	0	0	0
979 - City of St. Cloud	9/17 - 12/31	70	3	6	5	1	15
980 - City of Taylors Falls	9/17 - 12/31	Unl.	0	0	0	0	0
981 - City of Mankato	10/15 - 12/31	40	0	22	2	1	25
982 - City of Granite Falls	9/17 - 12/31	10	0	1	0	0	1
983 - City of Ortonville	9/17 - 12/31	30	1	7	2	0	10
984 - City of Canby	9/17 - 12/31	20	1	2	0	0	3
985 - City of Bemidji	9/17 - 12/31	40	0	12	2	5	19
986 - Bemidji Airport	9/17 - 12/31	30	2	13	0	4	19
987 - Greenleaf State SRA	9/17 - 12/31	Unl.	1	0	0	0	1
988 - Kellogg Weaver Dunes SNA	9/17 - 12/31	10	0	0	0	0	0
989 - Cedar Mountain SNA	9/17 - 12/31	Unl.	0	0	0	0	0
990 - City of Warroad	9/17 - 12/31	10	0	4	0	3	7
Total			160	257	67	46	530

*In many cases, city archery harvest is under-reported because individuals do not use the applicable number when registering their deer.

Table 10. Free Landowner Archery Harvest by Permit Area, 2011.

Permit Area	Fawn Male	Adult Female	Fawn Female	Total		Permit Area	Fawn Male	Adult Female	Fawn Female	Total
157	0	1	0	1		240	0	3	0	3
177	0	1	0	1		241	1	3	1	5
179	0	1	0	1		248	1	0	1	2
213	2	1	0	3		249	1	2	0	3
214	0	1	1	2		293	0	1	0	1
215	0	4	0	4		338	0	1	0	1
221	0	1	0	1		341	0	1	0	1
222	0	1	0	1		342	1	1	0	2
225	1	0	0	1		346	0	2	0	2
229	0	2	0	2		347	0	3	0	3
236	0	1	0	1		348	0	1	0	1
239	0	2	0	2		349	0	2	1	3
						TOTAL	7	36	4	47

Table 11. Muzzleloader Harvest by Permit Area, 2011.
Includes Regular, Muzzleloader, Youth, and Bonus permits. Does not include Park hunts.

Permit Area	Adult Male	Fawn Male	Adult Female	Fawn Female	Total	Permit Area	Adult Male	Fawn Male	Adult Female	Fawn Female	Total
101	2	1	7	2	12	223	23	11	24	6	64
103	4	0	2	0	6	224	2	0	0	0	2
105	7	3	13	1	24	225	22	26	55	14	117
108	9	0	2	0	11	227	41	23	76	22	162
110	6	0	12	0	18	229	7	6	18	3	34
111	4	0	8	1	13	230	10	4	20	0	34
117	0	0	2	0	2	232	16	1	27	2	46
118	20	0	21	0	41	233	15	5	28	3	51
119	12	0	5	0	17	234	14	0	10	0	24
122	8	1	3	0	12	235	1	0	2	0	3
126	11	2	22	2	37	236	31	15	54	12	112
127	2	0	1	0	3	237	21	3	6	0	30
152	1	0	1	0	2	238	2	0	1	0	3
155	7	4	11	5	27	239	31	19	59	11	120
156	11	4	31	7	53	240	25	13	63	7	108
157	27	18	77	25	147	241	55	30	132	24	241
159	9	7	28	4	48	242	12	5	21	2	40
169	10	5	23	3	41	246	24	6	38	6	74
171	9	0	12	3	24	247	13	4	24	4	45
172	10	3	25	5	43	248	13	9	15	6	43
173	5	1	10	0	16	249	17	14	40	13	84
176	20	3	18	3	44	250	13	0	21	3	37
177	8	6	23	3	40	251	1	0	4	0	5
178	15	6	57	4	82	252	17	2	15	3	37
179	14	12	48	11	85	253	35	3	23	5	66
180	22	0	35	5	62	254	29	9	45	5	88
181	10	9	42	8	69	255	27	9	35	7	78
182	4	0	17	2	23	256	16	4	19	3	42
183	4	1	16	0	21	257	10	4	20	2	36
184	28	4	38	13	83	258	15	2	15	2	34
197	8	2	8	1	19	259	16	9	47	12	84
199	1	0	1	0	2	260	19	1	15	2	37
201	4	1	5	0	10	261	8	2	11	0	21
203	1	0	7	2	10	262	17	2	15	0	34
208	12	1	12	1	26	263	12	2	7	0	21
209	24	5	34	11	74	264	27	1	26	4	58
210	14	10	33	4	61	265	17	8	17	2	44
213	51	20	85	12	168	266	15	2	16	2	35
214	15	15	41	19	90	267	9	0	6	1	16
215	28	24	72	21	145	268	8	2	9	0	19
218	38	22	87	14	161	269	33	2	13	3	51
219	31	14	55	19	119	270	12	2	13	1	28
221	15	17	63	17	112	271	19	3	9	2	33
222	15	20	32	12	79	272	14	3	11	0	28

Table 11. (Continued).

Permit Area	Adult Male	Fawn Male	Adult Female	Fawn Female	Total
273	19	0	27	0	46
274	12	1	7	1	21
275	22	3	15	1	41
276	28	4	23	2	57
277	60	8	44	8	120
278	41	6	32	2	81
279	17	4	15	0	36
280	14	1	5	0	20
281	36	3	27	1	67
282	7	0	1	0	8
283	10	0	6	0	16
284	24	4	9	1	38
285	21	5	12	1	39
286	25	2	8	1	36
287	0	0	2	0	2
288	43	1	10	0	54
289	17	1	6	0	24
290	28	7	31	6	72
291	43	11	41	5	100
292	27	11	34	7	79
293	35	19	68	5	127
294	20	4	15	2	41
295	38	1	21	0	60
296	15	2	15	1	33
297	5	0	7	2	14
298	10	2	11	2	25
299	21	4	19	1	45
338	9	2	32	7	50
339	9	4	22	1	36
341	20	20	83	14	137
342	37	19	124	22	202
343	24	16	92	17	149
344	14	4	39	8	65
345	14	2	13	1	30
346	37	26	133	23	219
347	16	8	52	15	91
348	9	8	56	10	83
349	30	15	133	21	199
601	17	11	52	10	90
602	8	0	7	1	16
TOTAL	**2,222**	**746**	**3,619**	**633**	**7,220**

Table 12. Muzzleloader Harvest using Bonus and Disease Management Permits by Permit Area, 2011.

Permit Area	Fawn Male	Adult Female	Fawn Female	Total
101	1	3	1	5
105	2	6	1	9
111	0	3	1	4
122	1	1	0	2
126	1	15	2	18
156	2	16	3	21
157	13	50	19	82
159	4	18	1	23
177	3	9	2	14
178	2	30	2	34
179	7	20	5	32
180	0	25	2	27
181	6	21	6	33
182	0	11	1	12
201	1	1	0	2
203	0	5	2	7
208	1	4	1	6
209	4	22	8	34
210	4	23	2	29
213	12	44	7	63
214	5	24	12	41
215	12	41	13	66
218	9	48	8	65
219	4	35	9	48
221	10	36	12	58
222	16	18	5	39
223	5	13	3	21
225	17	34	11	62
227	17	48	15	80
229	5	6	1	12
236	7	34	7	48
239	14	21	6	41
240	11	31	3	45
241	18	80	14	112
242	3	7	1	11
248	6	5	2	13
249	5	20	10	35
256	3	11	1	15
257	2	8	1	11
259	6	27	5	38
267	0	4	1	5
268	1	6	0	7
287	0	1	0	1
293	7	35	5	47
338	1	17	3	21
339	3	12	0	15
341	14	60	7	81
342	15	85	18	118
343	10	64	10	84
346	17	89	15	121
347	3	25	7	35
348	6	35	7	48
349	10	92	17	119
601	7	38	5	50
602	0	3	0	3
TOTAL	**333**	**1,440**	**300**	**2,073**

Table 13. Summary of Muzzleloader Special Hunts, 2011.
Includes Regular, Youth, All-Season, and Bonus Permits.

Area	Dates	Permits Issued	Adult Male	Fawn Male	Adult Female	Fawn Female	Total
935 - Jay Cooke SP[1]	12/3-12/7	120*	13	6	21	3	43
936 - Crow Wing SP[1]	12/2-12/4	40***	2	6	5	4	17
937 - Soudan SP[1]	11/26-12/11	30*	2	1	4	1	8
938 - City of Tower[1]	11/26-12/11	20*	0	1	0	0	1
939 - Lake Shetek SP[1]	12/3-12/4	15**	0	1	7	5	13
940 - Lake Maria SP[1]	12/3-12/5	25***	1	4	8	4	17
941 - Nerstrand Big Woods SP[1]	11/26-11/27	50***	0	7	16	6	29
942 - Sibley SP	11/26-11/27	50**	2	1	17	1	21
943 - Myre-Big Island SP	11/26-11/28	40**	0	3	18	1	22
944 - Vermilion Highlands WMA[1]	11/26-12/11	25*	1	0	1	0	2
945 - Big Stone SP[1]	12/3 - 12/4	10**	0	1	6	1	8
946 - Murphy-Hanrehan Park Res.[1]	12/3 - 12/4	90*	0	1	7	0	8
947 - Itasca State Park[1]	11/26 - 12/4	125	2	1	4	0	7
TOTAL			23	33	114	26	196

[1] Bonus permits available *Either Sex **Antlerless Only ***Earn-A-Buck

Table 14. Free Landowner Muzzleloader Harvest by Permit Area, 2011.

Permit Area	Fawn Male	Adult Female	Fawn Female	Total
105	0	2	0	2
111	0	1	0	1
157	0	0	1	1
179	1	1	0	2
213	2	1	1	4
214	2	1	0	3
215	0	2	1	3
219	0	1	0	1
221	0	1	1	2
225	0	2	0	2
239	0	1	0	1
240	1	3	1	5
241	1	6	1	8
256	0	2	0	2
257	0	1	0	1
293	0	3	0	3
338	0	1	0	1
341	0	1	1	2
342	0	2	1	3
346	2	3	0	5
347	0	4	0	4
348	0	4	1	5
349	1	7	1	9
Total	**10**	**50**	**10**	**70**

Table 15. Summary of Youth Firearm Hunts and NW Youth Season, 2011.

Area	Dates	Permits Issued	Harvest Adult Male	Adult Female	Fawn Male	Fawn Female	Total
950 - Camp Ripley Archery	10/7-10/9	175	1	4	0	1	6
954 - Lake Bemidji SP	10/15-10/16	20	1	0	0	0	1
955 - Lake Alexander TNC	10/7-10/9	20	0	0	0	0	0
956 - St. Croix SP	10/29-10/30	90	5	5	3	0	13
957 - Rydell NWR	10/22-10/23	20	0	1	0	1	2
958 - Savanna Portage SP	10/29-10/30	10	3	0	0	1	4
959 - Buffalo River SP - A	10/22-10/23	10	1	1	0	0	2
960 - Tettegouche SP	10/15-10/16	10	0	1	0	0	1
961 - Itasca SP	10/15-10/16	75	3	2	3	0	8
965 - Banning SP	10/29-10/30	6	1	0	0	0	1
969 - Buffalo River SP - B	10/29-10/30	10	1	0	0	0	1
999 - Afton SP	11/5-11/6	15	4	10	2	1	17
Total		461	20	24	8	4	56

Youth Deer Season - October 20 - 24, unlimited permits

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
101	0	0	0	2	2
105	22	22	2	5	51
111	6	6	1	0	13
114	0	2	0	0	2
201	4	4	1	1	10
203	1	0	1	0	2
208	7	7	3	2	19
209	17	17	4	5	43
256	14	10	4	4	32
257	7	10	1	3	21
260	4	13	3	8	28
263	5	9	0	2	16
264	8	17	3	3	31
267	5	11	0	1	17
268	1	9	2	0	12
338	7	10	1	1	19
339	7	2	3	0	12
341	26	12	7	9	54
342	16	8	7	2	33
343	14	11	5	2	32
344	12	6	4	4	26
345	7	3	1	1	12
346	14	16	7	3	40
347	19	11	2	3	35
348	9	3	5	4	21
349	26	18	5	7	56
601	9	5	5	4	23
602	11	3	0	0	14
Total	278	245	77	76	676

Table 16. Total Deer Harvest by Permit Area, 2011.
Includes all license types, permits, and special hunts.

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
101	216	247	69	63	595
103	577	215	36	36	864
105	554	591	133	107	1,385
108	866	171	31	18	1,086
110	797	588	124	106	1,615
111	342	271	86	44	743
114	54	26	6	3	89
117	22	16	2	0	40
118	599	359	57	38	1,053
119	632	188	20	21	861
122	479	296	55	43	873
126	384	300	38	44	766
127	81	37	3	5	126
152	106	65	22	18	211
155	1487	1030	284	184	2,985
156	1721	1844	523	398	4,486
157	2536	2328	745	624	6,233
159	1212	1136	319	235	2,902
169	1208	989	254	208	2,659
171	1183	783	216	147	2,329
172	1743	1308	404	270	3,725
173	822	605	122	94	1,643
176	1393	819	184	139	2,535
177	760	782	180	149	1,871
178	2174	2313	534	493	5,514
179	1806	1816	465	414	4,501
180	1224	950	186	168	2,528
181	1502	1464	398	287	3,651
182	653	819	195	158	1,825
183	1306	858	204	136	2,504
184	2553	1714	451	343	5,061
197	994	571	153	113	1,831
199	101	65	12	6	184
201	81	90	23	13	207
203	54	62	15	10	141
208	165	213	57	36	471
209	464	605	171	135	1,375
210	770	968	297	239	2,274
213	1727	1489	560	408	4,184
214	1436	1148	510	391	3,485
215	1156	956	418	333	2,863
218	1002	952	335	222	2,511
219	646	574	189	146	1,555
221	1026	1022	467	365	2,880
222	990	802	318	242	2,352
223	711	517	171	140	1,539
224	111	94	35	17	257
225	1382	1120	450	378	3,330
227	1039	952	349	247	2,587
229	273	209	71	45	598
230	243	186	62	33	524
232	263	178	45	22	508
233	207	113	32	15	367
234	192	123	35	30	380
235	64	37	6	11	118
236	808	678	225	169	1,880
237	248	108	26	16	398
238	74	36	5	4	119
239	1340	1152	368	317	3,177
240	1588	1330	512	393	3,823
241	2801	2573	933	726	7,033
242	681	704	191	158	1,734
246	2176	1520	469	343	4,508
247	780	560	165	130	1,635
248	447	341	126	71	985
249	1242	987	368	314	2,911
250	303	162	29	23	517
251	58	33	10	8	109
252	317	132	35	24	508
253	443	211	43	28	725
254	527	322	79	60	988
255	476	230	74	53	833
256	353	362	97	88	900
257	323	330	87	75	815
258	767	527	202	154	1,650
259	1436	1524	435	372	3,767
260	291	203	46	46	586
261	129	79	13	12	233
262	201	158	43	25	427
263	281	184	45	35	545
264	502	379	105	69	1,055
265	346	238	82	56	722
266	307	229	45	52	633
267	156	178	47	30	411
268	210	200	58	40	508
269	202	142	42	17	403
270	178	98	23	15	314
271	258	173	43	30	504
272	192	127	36	10	365
273	428	268	77	58	831
274	249	117	13	13	392
275	373	160	31	27	591
276	490	297	84	37	908
277	1224	656	144	105	2,129
278	421	222	40	32	715
279	214	119	23	23	379
280	247	147	24	18	436
281	440	228	54	35	757

Table 16. (Continued).

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
282	134	42	5	4	185
283	304	124	22	15	465
284	332	138	28	22	520
285	454	201	62	44	761
286	289	120	24	17	450
287	74	113	45	27	259
288	364	128	27	20	539
289	196	62	11	17	286
290	438	295	50	44	827
291	736	389	102	57	1,284
292	535	320	82	62	999
293	657	469	143	74	1,343
294	279	153	30	23	485
295	425	196	34	26	681
296	266	123	27	13	429
297	143	77	17	22	259
298	529	317	103	73	1,022
299	328	152	43	13	536
338	214	319	66	59	658
339	271	266	73	63	673
341	695	920	260	243	2,118
342	634	901	269	227	2,031
343	530	818	237	173	1,758
344	380	438	101	103	1,022
345	409	302	105	86	902
346	987	1130	276	265	2,658
347	451	562	136	107	1,256
348	550	687	153	134	1,524
349	1151	1543	297	278	3,269
601	1286	1591	395	364	3,636
602	527	565	225	149	1,466
900	1	4	0	1	6
901	4	1	1	0	6
902	47	79	39	24	189
903	1	0	0	0	1
904	3	7	3	1	14
905	3	1	0	2	6
906	7	1	1	1	10
907	1	1	0	0	2
908	1	0	0	0	1
909	1	2	1	0	4
910	0	7	4	2	13
913	0	7	1	2	10
914	10	15	3	1	29
915	3	0	1	1	5
916	29	22	6	1	58
917	0	2	1	0	3
918	1	3	1	3	8
919	0	5	1	4	10
920	0	3	4	3	10
921	13	23	9	2	47
922	3	14	3	5	25
923	0	2	0	4	6
924	0	14	4	1	19
925	5	1	2	1	9
926	5	13	3	3	24
927	3	3	1	0	7
928	19	27	8	13	67
929	3	10	5	3	21
935	13	21	6	3	43
936	2	5	6	4	17
937	2	4	1	1	8
938	0	0	1	0	1
939	0	7	1	5	13
940	1	8	4	4	17
941	0	16	7	6	29
942	2	17	1	1	21
943	0	18	3	1	22
944	1	1	0	0	2
945	0	6	1	1	8
946	0	7	1	0	8
947	2	4	1	0	7
950	1	4	0	1	6
954	1	0	0	0	1
956	5	5	3	0	13
957	0	1	0	1	2
958	3	0	0	1	4
959	1	1	0	0	2
960	0	1	0	0	1
961	3	2	3	0	8
965	1	0	0	0	1
969	1	0	0	0	1
970	94	133	34	26	287
971	55	51	20	6	132
972	0	2	2	0	4
975	3	3	0	0	6
976	0	1	0	0	1
979	3	6	5	1	15
981	0	22	2	1	25
982	0	1	0	0	1
983	1	7	2	0	10
984	0	2	0	0	2
985	0	12	2	5	19
986	2	13	0	4	19
987	1	0	0	0	1
990	0	4	0	3	7
999	4	10	2	1	17
TOTAL	**85,549**	**70,521**	**20,382**	**15,879**	**192,331**

Table 17. Estimated firearm hunter numbers, density, and harvest by Permit Area, 2011.

Permit Area	Firearm Hunters	Area Size (sq mi)	Hunters/ mile^2	Harvest/ mile^2
101	1,827	496	3.7	1.1
103	3,293	1,824	1.8	0.5
105	3,702	932	4.0	1.4
108	4,966	1,701	2.9	0.6
110	4,289	530	8.1	2.9
111	2,926	1,440	2.0	0.5
114	278	412	0.7	0.2
117	219	1,129	0.2	0.03
118	3,610	1,445	2.5	0.7
119	3,802	946	4.0	0.9
122	2,336	622	3.8	1.3
126	2,034	979	2.1	0.7
127	564	587	1.0	0.2
152	946	62	15.4	3.2
155	7,353	639	11.5	4.5
156	9,390	834	11.3	4.9
157	13,244	904	14.6	6.2
159	7,232	575	12.6	4.6
169	8,980	1,202	7.5	2.1
171	6,478	729	8.9	3.1
172	10,318	786	13.1	4.5
173	4,555	617	7.4	2.6
176	7,316	1,150	6.4	2.1
177	3,905	553	7.1	3.2
178	10,465	1,325	7.9	3.8
179	9,735	939	10.4	4.4
180	6,131	999	6.1	2.2
181	7,002	746	9.4	4.4
182	2,092	280	7.5	3.0
183	7,504	675	11.1	3.6
184	13,776	1,318	10.4	3.6
197	5,750	1,343	4.3	1.3
199	533	152	3.5	1.1
201	477	169	2.8	1.0
203	352	132	2.7	1.0
208	1,234	379	3.3	1.1
209	2,587	641	4.0	1.8
210	4,592	635	7.2	3.2
213	8,512	1,161	7.3	3.0
214	7,186	566	12.7	5.6
215	6,423	730	8.8	3.3
218	5,234	912	5.7	2.2
219	3,370	427	7.9	2.7
221	5,022	647	7.8	3.6
222	4,683	413	11.3	4.8
223	2,998	385	7.8	2.9
224	766	49	15.6	4.5
225	6,580	635	10.4	4.5
227	4,675	491	9.5	3.6
229	1,512	313	4.8	1.3
230	1,539	464	3.3	0.9
232	1,265	380	3.3	1.1
233	1,086	386	2.8	0.7
234	835	637	1.3	0.5
235	392	37	10.7	2.2
236	3,117	404	7.7	2.8
237	1,028	737	1.4	0.5
238	307	98	3.1	1.1
239	7,562	1,110	6.8	2.5
240	7,431	694	10.7	5.0
241	12,753	1,047	12.2	6.0
242	2,830	307	9.2	4.5
246	11,350	860	13.2	5.0
247	3,549	263	13.5	5.6
248	2,125	229	9.3	3.7
249	5,759	729	7.9	3.6
250	1,514	730	2.1	0.6
251	543	68	8.0	1.5
252	1,423	735	1.9	0.6
253	2,096	987	2.1	0.6
254	2,672	946	2.8	0.8
255	1,783	774	2.3	0.8
256	2,444	654	3.7	1.2
257	1,887	426	4.4	1.7
258	4,205	381	11.0	4.1
259	7,952	546	14.6	6.4
260	1,824	1,252	1.5	0.4
261	863	796	1.1	0.2
262	1,047	677	1.5	0.5
263	1,920	513	3.7	1.0
264	3,466	672	5.2	1.4
265	2,059	495	4.2	1.3

Table 17. (Continued).

Permit Area	Firearm Hunters	Area Size (sq mi)	Hunters/ mile^2	Harvest/ mile^2
266	2,169	625	3.5	0.9
267	1,106	472	2.3	0.8
268	1,303	239	5.4	1.9
269	1,405	652	2.2	0.5
270	977	758	1.3	0.4
271	1,088	646	1.7	0.7
272	1,171	544	2.2	0.6
273	2,705	634	4.3	1.2
274	924	381	2.4	0.9
275	1,991	777	2.6	0.7
276	3,064	575	5.3	1.3
277	5,991	876	6.8	2.0
278	2,044	422	4.8	1.3
279	1,142	346	3.3	0.9
280	1,544	676	2.3	0.6
281	2,412	579	4.2	1.1
282	778	780	1.0	0.2
283	1,540	640	2.4	0.6
284	1,448	853	1.7	0.5
285	2,441	580	4.2	1.0
286	1,280	458	2.8	0.8
287	658	51	13.0	5.1
288	1,619	630	2.6	0.7
289	1,001	820	1.2	0.3
290	2,359	666	3.5	1.0
291	3,657	832	4.4	1.1
292	2,829	517	5.5	1.6
293	2,667	512	5.2	2.0
294	1,159	689	1.7	0.6
295	2,039	855	2.4	0.6
296	1,608	675	2.4	0.5
297	1,216	449	2.7	0.5
298	3,776	677	5.6	1.4
299	1,528	389	3.9	1.0
338	2,097	472	4.4	1.0
339	1,775	406	4.4	1.2
341	4,292	483	8.9	3.1
342	3,934	374	10.5	3.9
343	3,260	486	6.7	2.1
344	3,045	190	16.0	4.6
345	2,672	335	8.0	2.3
346	4,143	328	12.6	6.0
347	3,064	434	7.1	2.2
348	3,638	332	10.9	3.7
349	5,748	499	11.5	5.2
601	2,885	1,756	1.6	0.7
602	1,769	304	5.8	3.8
Total	**448,572**	**83,265**	**5.4**	**1.9**

Table 18. Deer harvest per square mile by season, 2011.

Permit Area	Area Size (sq mi)	Archery Harvest/mi^2	Firearm Harvest/mi^2	Muzz. Harvest/mi^2	EA Harvest/mi^2	Total Harvest/mi^2
101	496	0.04	1.13	0.02		1.20
103	1,824	0.01	0.46	0.00		0.47
105	932	0.05	1.36	0.03		1.43
108	1,701	0.03	0.60	0.01		0.64
110	530	0.07	2.94	0.03		3.04
111	1,440	0.01	0.49	0.01		0.51
114	412	0.03	0.18	0.00		0.21
117	1,129	0.00	0.03	0.00		0.04
118	1,445	0.02	0.68	0.03		0.73
119	946	0.02	0.87	0.02		0.91
122	622	0.04	1.34	0.02		1.40
126	979	0.05	0.70	0.04		0.78
127	587	0.01	0.20	0.01		0.21
152	62	0.15	3.25	0.03		3.42
155	639	0.15	4.48	0.04		4.67
156	834	0.42	4.89	0.06		5.38
157	904	0.51	6.23	0.16		6.89
159	575	0.40	4.55	0.08		5.04
169	1,202	0.05	2.13	0.03		2.21
171	729	0.07	3.09	0.03		3.19
172	786	0.16	4.53	0.05		4.74
173	617	0.08	2.55	0.03		2.66
176	1,150	0.05	2.11	0.04		2.20
177	553	0.14	3.17	0.07		3.39
178	1,325	0.26	3.84	0.06		4.16
179	939	0.35	4.36	0.09		4.79
180	999	0.26	2.21	0.06		2.53
181	746	0.44	4.36	0.09		4.89
182	280	3.44	2.99	0.08		6.52
183	675	0.10	3.58	0.03		3.71
184	1,318	0.16	3.62	0.06		3.84
197	1,343	0.03	1.32	0.01		1.36
199	152	0.06	1.14	0.01		1.21
201	169	0.07	1.03	0.06		1.16
203	132	0.02	0.96	0.08		1.06
208	379	0.06	1.07	0.07		1.19
209	641	0.15	1.81	0.12		2.08
210	635	0.31	3.17	0.10		3.58
213	1,161	0.41	3.05	0.14		3.60
214	566	0.40	5.60	0.16		6.16
215	730	0.43	3.29	0.20		3.92
218	912	0.37	2.21	0.18		2.75
219	427	0.69	2.68	0.28		3.64
221	647	0.71	3.57	0.17		4.45
222	413	0.70	4.81	0.19		5.70
223	385	0.93	2.90	0.17		4.00
224	49	0.69	4.51	0.04		5.24
225	635	0.61	4.45	0.18		5.24
227	491	1.31	3.62	0.33		5.26

Table 18. (Continued).

Permit Area	Area Size (sq mi)	Archery Harvest/mi^2	Firearm Harvest/mi^2	Muzz. Harvest/mi^2	EA Harvest/mi^2	Total Harvest/mi^2
229	313	0.48	1.32	0.11		1.91
230	464	0.14	0.92	0.07		1.13
232	380	0.09	1.12	0.12		1.34
233	386	0.16	0.66	0.13		0.95
234	637	0.06	0.50	0.04		0.60
235	37	0.82	2.20	0.08		3.10
236	404	1.56	2.82	0.28		4.66
237	737	0.04	0.46	0.04		0.54
238	98	0.10	1.09	0.03		1.22
239	1,110	0.22	2.54	0.11		2.86
240	694	0.39	4.97	0.16		5.51
241	1,047	0.49	5.99	0.23		6.72
242	307	1.02	4.50	0.13		5.65
246	860	0.20	4.96	0.09		5.24
247	263	0.39	5.64	0.17		6.21
248	229	0.41	3.67	0.19		4.26
249	729	0.31	3.57	0.12		3.99
250	730	0.08	0.58	0.05		0.71
251	68	0.04	1.48	0.07		1.60
252	735	0.07	0.57	0.05		0.69
253	987	0.09	0.58	0.07		0.73
254	946	0.11	0.84	0.09		1.04
255	774	0.15	0.82	0.10		1.08
256	654	0.03	1.23	0.06		1.33
257	426	0.12	1.66	0.08		1.86
258	381	0.14	4.10	0.09		4.33
259	546	0.37	6.38	0.15		6.90
260	1,252	0.02	0.40	0.03		0.45
261	796	0.02	0.24	0.03		0.29
262	677	0.06	0.52	0.05		0.63
263	513	0.03	0.96	0.04		1.03
264	672	0.04	1.40	0.09		1.52
265	495	0.03	1.34	0.09		1.46
266	625	0.05	0.91	0.06		1.01
267	472	0.03	0.77	0.03		0.83
268	239	0.11	1.88	0.08		2.07
269	652	0.04	0.50	0.08		0.62
270	758	0.02	0.35	0.04		0.41
271	646	0.06	0.67	0.05		0.78
272	544	0.02	0.60	0.05		0.67
273	634	0.05	1.19	0.07		1.31

Table 18. (Continued).

Permit Area	Area Size (sq mi)	Archery Harvest/mi²	Firearm Harvest/mi²	Muzz. Harvest/mi²	EA Harvest/mi²	Total Harvest/mi²
274	381	0.07	0.90	0.06		1.03
275	777	0.06	0.65	0.05		0.76
276	575	0.14	1.33	0.10		1.58
277	876	0.26	2.04	0.14		2.43
278	422	0.16	1.34	0.19		1.69
279	346	0.07	0.92	0.10		1.10
280	676	0.05	0.56	0.03		0.64
281	579	0.12	1.07	0.12		1.31
282	780	0.03	0.20	0.01		0.24
283	640	0.10	0.61	0.03		0.73
284	853	0.06	0.50	0.04		0.61
285	580	0.20	1.04	0.07		1.31
286	458	0.09	0.82	0.08		0.98
287	51	0.02	5.05	0.04		5.11
288	630	0.10	0.67	0.09		0.86
289	820	0.04	0.28	0.03		0.35
290	666	0.15	0.98	0.11		1.24
291	832	0.28	1.14	0.12		1.54
292	517	0.22	1.56	0.15		1.93
293	512	0.42	1.95	0.25		2.62
294	689	0.06	0.59	0.06		0.70
295	855	0.09	0.64	0.07		0.80
296	675	0.05	0.54	0.05		0.64
297	449	0.02	0.53	0.03		0.58
298	677	0.03	1.45	0.04		1.51
299	389	0.24	1.02	0.12		1.38
338	472	0.28	0.96	0.11		1.35
339	406	0.33	1.21	0.09		1.63
341	483	0.93	3.06	0.28		4.27
342	374	0.86	3.94	0.54		5.34
343	486	1.13	2.12	0.31		3.55
344	190	0.32	4.58	0.34		5.25
345	335	0.27	2.29	0.09		2.65
346	328	1.34	5.98	0.67		7.98
347	434	0.40	2.21	0.21		2.82
348	332	0.60	3.67	0.25		4.52
349	499	0.86	5.18	0.40		6.44
601	1,756	1.27	0.74	0.05		2.06
602	304	0.91	3.82	0.05		4.78
Total	83,265	0.24	1.96	0.09		2.28

Table 19. 2011 Antlerless Lottery Distribution Report.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available	% Under-Subscribed
		Total	Rejected				
103	1	1,291	0	446	845	**967**	**0.0%**
	2	91	0	0	91		
	3	31	0	0	31		
		1,413	**0**	**446**	**967**		
108	1	424	1	424	0	**97**	**0.0%**
	2	495	0	495	0		
	3	593	0	496	97		
		1,512	**1**	**1,415**	**97**		
119	1	907	1	907	0	**475**	**0.0%**
	2	683	0	254	429		
	3	45	0	0	45		
	9	1	0	0	1		
		1,636	**1**	**1,161**	**475**		
234	1	179	1	0	179	**369**	**33.6%**
	2	59	0	0	59		
	3	6	0	0	6		
	4	1	0	0	1		
		245	**1**	**0**	**245**		
235	1	43	0	38	5	**60**	**0.0%**
	2	39	0	0	39		
	3	15	0	0	15		
	4	1	0	0	1		
		98	**0**	**38**	**60**		
237	1	154	2	121	33	**182**	**0.0%**
	2	105	0	0	105		
	3	40	0	0	40		
	4	3	0	0	3		
	7	1	0	0	1		
		303	**2**	**121**	**182**		
238	1	40	0	17	23	**96**	**0.0%**
	2	49	0	0	49		
	3	24	0	0	24		
		113	**0**	**17**	**96**		
250	1	390	0	196	194	**433**	**0.0%**
	2	189	0	0	189		
	3	48	0	0	48		
	4	1	0	0	1		
	5	1	1	0	1		
		629	**1**	**196**	**433**		
251	1	211	0	0	164	**185**	**0.0%**
	2	21	0	0	21		
		232	**0**	**0**	**185**		

Table 19. (Continued).

Permit Area Number	Preference Level	Applications Total	Applications Rejected	Unsuccessful	Winners	Permits Available	% Under-Subscribed
252	1	262	2	262	0	**258**	**0.0%**
	2	149	0	12	137		
	3	117	0	0	117		
	4	3	0	0	3		
	5	1	0	0	1		
		532	**2**	**274**	**258**		
253	1	312	0	312	0	**423**	**0.0%**
	2	281	1	27	254		
	3	167	0	0	167		
	4	2	0	0	2		
		762	**1**	**339**	**423**		
274	1	139	0	139	0	**226**	**0.0%**
	2	93	0	2	91		
	3	73	0	0	73		
	4	60	0	0	60		
	5	2	0	0	2		
		367	**0**	**141**	**226**		
275	1	204	0	204	0	**362**	**0.0%**
	2	189	0	93	96		
	3	123	0	0	123		
	4	126	0	0	126		
	5	16	0	0	16		
	6	1	0	0	1		
		659	**0**	**297**	**362**		
276	1	559	0	238	321	**1,084**	**0.0%**
	2	415	0	0	415		
	3	339	0	0	339		
	4	8	0	0	8		
	5	1	0	0	1		
		1,322	**0**	**238**	**1,084**		
277	1	1,602	0	708	894	**2,146**	**0.0%**
	2	1,031	0	0	1,031		
	3	209	0	0	209		
	4	8	0	0	8		
	5	4	0	0	4		
		2,854	**0**	**708**	**2,146**		
278	1	426	3	365	61	**635**	**0.0%**
	2	259	0	0	259		
	3	295	0	0	295		
	4	18	0	0	18		
	5	1	0	0	1		
	6	1	0	0	1		
		1,000	**3**	**365**	**635**		

Table 19. (Continued).

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available	% Under-Subscribed
		Total	Rejected				
279	1	212	0	178	34	**310**	**0.0%**
	2	154	0	0	154		
	3	118	0	0	118		
	4	1	0	0	1		
	5	2	0	0	2		
	6	1	0	0	1		
		488	**0**	**178**	**310**		
280	1	236	0	144	92	**360**	**0.0%**
	2	117	0	0	117		
	3	132	0	0	132		
	4	18	0	0	18		
	5	1	0	0	1		
		504	**0**	**144**	**360**		
281	1	365	1	230	135	**644**	**0.0%**
	2	291	0	0	291		
	3	188	0	0	188		
	4	29	1	0	29		
	7	1	0	0	1		
		874	**2**	**230**	**644**		
282	1	56	0	56	0	**46**	**0.0%**
	2	36	0	24	12		
	3	26	0	0	26		
	4	7	0	0	7		
	6	1	0	0	1		
		126	**0**	**80**	**46**		
283	1	186	0	186	0	**224**	**0.0%**
	2	139	0	111	28		
	3	107	0	0	107		
	4	89	0	0	89		
		521	**0**	**297**	**224**		
284	1	212	1	212	0	**183**	**0.0%**
	2	179	0	179	0		
	3	112	0	34	78		
	4	70	0	0	70		
	5	30	0	0	30		
	6	3	0	0	3		
	7	2	0	0	2		
		608	**1**	**425**	**183**		
285	1	717	0	302	415	**818**	**0.0%**
	2	379	0	0	379		
	3	13	0	0	13		
	4	8	1	0	8		
	5	1	0	0	1		
	6	2	0	0	2		
		1,120	**1**	**302**	**818**		

Table 19. (Continued).

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available	% Under-Subscribed
		Total	Rejected				
286	1	171	2	171	0	**181**	**0.0%**
	2	170	0	115	55		
	3	101	0	0	101		
	4	23	0	0	23		
	5	2	0	0	2		
		467	**2**	**286**	**181**		
288	1	171	0	171	0	**178**	**0.0%**
	2	174	1	174	0		
	3	138	0	4	134		
	4	39	0	0	39		
	5	4	0	0	4		
	9	1	0	0	1		
		527	**1**	**349**	**178**		
289	1	85	0	85	0	**89**	**0.0%**
	2	79	0	79	0		
	3	53	0	11	42		
	4	39	0	0	39		
	5	8	0	0	8		
		264	**0**	**175**	**89**		
290	1	402	0	402	0	**623**	**0.0%**
	2	345	0	59	286		
	3	293	1	0	293		
	4	44	0	0	44		
		1,084	**1**	**461**	**623**		
291	1	826	1	826	0	**834**	**0.0%**
	2	585	0	67	518		
	3	311	0	0	311		
	4	4	0	0	4		
	5	1	0	0	1		
		1,727	**1**	**893**	**834**		
294	1	123	1	105	18	**268**	**0.0%**
	2	122	0	0	122		
	3	100	0	0	100		
	4	27	0	0	27		
	5	1	0	0	1		
		373	**1**	**105**	**268**		
295	1	299	1	299	0	**428**	**0.0%**
	2	222	1	108	114		
	3	239	0	0	239		
	4	73	0	0	73		
	5	2	0	0	2		
		835	**2**	**407**	**428**		

Table 19. (Continued).

Permit Area Number	Preference Level	Applications Total	Applications Rejected	Unsuccessful	Winners	Permits Available	% Under-Subscribed
296	1	297	0	297	0	**260**	**0.0%**
	2	167	0	141	26		
	3	179	1	0	179		
	4	54	0	0	54		
	5	1	0	0	1		
		698	**1**	**438**	**260**		
299	1	264	0	264	0	**332**	**0.0%**
	2	253	0	73	180		
	3	150	0	0	150		
	4	2	0	0	2		
		669	**0**	**337**	**332**		
TOTAL		**21,071**	**18**	**9,568**	**11,456**	**13,776**	

Table 20. 2011 Muzzleloader Lottery Distribution Report.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available	% Under-Subscribed
		Total	Rejected				
103	1	45	0	14	31	**33**	**0.0%**
	2	2	0	0	2		
		47	**0**	**14**	**33**		
108	1	17	0	17	0	**3**	**0.0%**
	2	7	0	7	0		
	3	3	0	0	3		
		27	**0**	**24**	**3**		
119	1	49	0	49	0	**25**	**0.0%**
	2	32	0	7	25		
		81	**0**	**56**	**25**		
234	1	24	0	0	24	**25**	**0.0%**
	2	1	0	0	1		
		25	**0**	**0**	**25**		
235	1	12	0	4	8	**15**	**0.0%**
	2	6	0	0	6		
	3	1	0	0	1		
		19	**0**	**4**	**15**		
237	1	23	0	9	14	**18**	**0.0%**
	2	4	0	0	4		
		27	**0**	**9**	**18**		
238	1	3	0	0	3	**4**	**0.0%**
	2	1	0	0	1		
		4	**0**	**0**	**4**		
250	1	62	0	17	45	**67**	**0.0%**
	2	21	0	0	21		
	3	1	0	0	1		
		84	**0**	**17**	**67**		
251	1	17	0	2	15	**15**	**0.0%**
		17	**0**	**2**	**15**		
252	1	46	0	32	14	**42**	**0.0%**
	2	26	0	0	26		
	3	2	0	0	2		
		74	**0**	**32**	**42**		
253	1	71	0	41	30	**77**	**0.0%**
	2	47	0	0	47		
		118	**0**	**41**	**77**		
274	1	22	0	11	11	**24**	**0.0%**
	2	13	0	0	13		
		35	**0**	**11**	**24**		
275	1	37	0	25	12	**38**	**0.0%**
	2	24	0	0	24		
	3	2	0	0	2		
		63	**0**	**25**	**38**		
276	1	83	0	12	71	**116**	**0.0%**
	2	44	0	0	44		
	3	1	0	0	1		
		128	**0**	**12**	**116**		

Table 20. (Continued).

Permit Area Number	Preference Level	Applications Total	Applications Rejected	Unsuccessful	Winners	Permits Available	% Under-Subscribed
277	1	223	0	48	175	**254**	**0.0%**
	2	77	0	0	77		
	3	2	0	0	2		
		302	**0**	**48**	**254**		
278	1	96	0	38	58	**115**	**0.0%**
	2	57	0	0	57		
		153	**0**	**38**	**115**		
279	1	40	0	16	24	**40**	**0.0%**
	2	16	0	0	16		
		56	**0**	**16**	**40**		
280	1	32	0	10	22	**40**	**0.0%**
	2	17	0	0	17		
	3	1	0	0	1		
		50	**0**	**10**	**40**		
281	1	79	0	18	61	**106**	**0.0%**
	2	41	0	0	41		
	3	4	0	0	4		
		124	**0**	**18**	**106**		
282	1	8	0	7	1	**4**	**0.0%**
	2	3	0	0	3		
		11	**0**	**7**	**4**		
283	1	29	0	29	0	**26**	**0.0%**
	2	24	0	0	24		
	3	2	0	0	2		
		55	**0**	**29**	**26**		
284	1	44	0	36	8	**17**	**0.0%**
	2	8	0	0	8		
	4	1	0	0	1		
		53	**0**	**36**	**17**		
285	1	76	0	20	56	**82**	**0.0%**
	2	25	0	0	25		
	3	1	0	0	1		
		102	**0**	**20**	**82**		
286	1	32	0	26	6	**19**	**0.0%**
	2	12	0	0	12		
	3	1	0	0	1		
		45	**0**	**26**	**19**		
288	1	44	0	35	9	**22**	**0.0%**
	2	10	0	0	10		
	3	3	0	0	3		
		57	**0**	**35**	**22**		
289	1	21	0	19	2	**11**	**0.0%**
	2	9	0	0	9		
		30	**0**	**19**	**11**		

Table 20. (Continued).

Permit Area Number	Preference Level	Applications Total	Applications Rejected	Unsuccessful	Winners	Permits Available	% Under-Subscribed
290	1	111	0	57	54	**127**	**0.0%**
	2	70	0	0	70		
	3	3	0	0	3		
		184	**0**	**57**	**127**		
291	1	186	0	120	66	**166**	**0.0%**
	2	94	0	0	94		
	3	5	0	0	5		
	9	1	0	0	1		
		286	**0**	**120**	**166**		
294	1	24	0	8	16	**32**	**0.0%**
	2	15	0	0	15		
	3	1	0	0	1		
		40	**0**	**8**	**32**		
295	1	65	0	49	16	**72**	**0.0%**
	2	51	0	0	51		
	3	5	0	0	5		
		121	**0**	**49**	**72**		
296	1	62	0	52	10	**40**	**0.0%**
	2	25	0	0	25		
	3	5	0	0	5		
		92	**0**	**52**	**40**		
299	1	71	0	46	25	**68**	**0.0%**
	2	41	0	0	41		
	3	2	0	0	2		
		114	**0**	**46**	**68**		
TOTAL		**2,180**	**0**	**761**	**1,419**	**1,743**	

Table 21. 2011 Special Permit Areas for Firearms Hunters.

Special Hunt	Preference Level	Applications Total	Applications Rejected	Unsuccessful	Winners	Permits Available
900 - Lake Vermilion State Park	1	7	0	0	7	**50**
	2	1	0	0	1	
		8	**0**	**0**	**8**	
901 - Rice Lake NWR	1	35	0	20	15	**40**
	2	25	0	0	25	
	3	2	0	0	2	
		62	**0**	**20**	**42**	
902 - Saint Croix State Park	1	429	0	224	205	**400**
	2	191	0	0	191	
	3	4	0	0	4	
		624	**0**	**224**	**400**	
903 - Savanna Portage State Park	1	29	0	13	16	**15**
	2	2	0	0	2	
		31	**0**	**13**	**18**	
904 - Gooseberry Falls State Park	1	34	0	18	16	**30**
	2	13	0	0	13	
	3	1	0	0	1	
		48	**0**	**18**	**30**	
905 - Split Rock Lighthouse State Park	1	22	0	0	22	**30**
	2	1	0	0	1	
		23	**0**	**0**	**23**	
906 - Tettegouche State Park	1	72	0	0	72	**125**
	2	5	0	0	5	
	3	1	0	0	1	
		78	**0**	**0**	**78**	
907 - Scenic State Park	1	32	0	3	29	**30**
	2	1	0	0	1	
	3	1	0	0	1	
		34	**0**	**3**	**31**	
908 - Hayes Lake State Park	1	21	0	0	21	**75**
		21	**0**	**0**	**21**	
909 - Lake Bemidji State Park	1	39	0	14	25	**30**
	2	5	0	0	5	
		44	**0**	**14**	**30**	
910 - Zippel Bay State Park	1	50	0	0	50	**55**
	2	1	0	0	1	
		51	**0**	**0**	**51**	
913 - Lake Carlos State Park	1	30	0	27	3	**20**
	2	19	0	0	19	
		49	**0**	**27**	**22**	
914 - William O'Brien State Park	1	82	0	49	33	**70**
	2	38	0	0	38	
		120	**0**	**49**	**71**	
915 - Lake Bronson State Park	1	3	0	0	3	**30**
		3	**0**	**0**	**3**	

Table 21. (Continued).

Special Hunt	Preference Level	Applications Total	Applications Rejected	Unsuccessful	Winners	Permits Available
916 - Maplewood State Park	1	156	0	156	0	**100**
	2	132	0	132	0	
	3	101	0	38	63	
	4	37	0	0	37	
		426	**0**	**326**	**100**	
917 - Rydell NWR	1	4	0	0		**5**
	2	1	0	0		
		5	**0**	**0**		
918 - Lake Alexander Woods SNA	1	34	0	2	32	**40**
	2	8	0	0	8	
		42	**0**	**2**	**40**	
919 - Glacial Lakes State Park	1	16	0	0	16	**30**
	2	10	0	0	10	
		26	**0**	**0**	**26**	
920 - Zumbro Falls SNA	1	21	0	19	2	**12**
	2	10	0	0	10	
		31	**0**	**19**	**12**	
921 - Frontenac State Park - A	1	58	0	31	27	**60**
	2	33	0	0	33	
		91	**0**	**31**	**60**	
922 - Whitewater State Park	1	67	0	67	0	**50**
	2	50	0	3	47	
	3	4	0	0	4	
		121	**0**	**70**	**51**	
923 - Zumbro Falls SNA	1	8	0	0	8	**12**
	2	2	0	0	2	
		10	**0**	**0**	**10**	
924 - Whitewater State Game Refuge	1	63	0	0	63	**75**
	2	11	0	0	11	
		74	**0**	**0**	**74**	
925 - Vermillion Highlands Research, Recr	1	62	0	62	0	**25**
	2	36	0	21	15	
	3	9	0	0	9	
		107	**0**	**83**	**24**	
926 - Carver Park Reserve	1	191	0	191	0	**95**
	2	128	0	36	92	
	3	1	0	0	1	
	4	1	0	0	1	
	6	1	0	0	1	
		322	**0**	**227**	**95**	
927 - Lake Rebecca Park Reserve	1	116	0	80	36	**72**
	2	34	0	0	34	
	3	3	0	0	3	
		153	**0**	**80**	**73**	

Table 21. (Continued).

Special Hunt	Preference Level	Applications Total	Applications Rejected	Unsuccessful	Winners	Permits Available
928 - Wild River SP	1	170	0	167	3	**100**
	2	90	0	0	90	
	3	7	0	0	7	
		267	**0**	**167**	**100**	
929 - Frontenac State Park - B	1	42	0	0	42	**60**
	2	17	0	0	17	
		59	**0**	**0**	**59**	
		2,930	**0**	**909**	**1,281**	**1,736**

Table 22. 2011 Special Permit Areas for Muzzleloader Hunters.

Permit Area Number	Preference Level	Applications Total	Applications Rejected	Unsuccessful	Winners	Permits Available
935 - Jay Cooke SP	1	94	0	94	0	**120**
	2	111	0	1	110	
	3	10	0	0	10	
		215	**0**	**95**	**120**	
936 - Crow Wing SP	1	86	0	86	0	**40**
	2	73	0	73	0	
	3	57	0	21	36	
	4	7	0	0	7	
		223	**0**	**180**	**43**	
937 - Soudan SP	1	13	0	0	13	**20**
	2	4	0	0	4	
		17	**0**	**0**	**17**	
938 - City of Tower	1	9	0	0	9	**15**
	2	2	0	0	2	
		11	**0**	**0**	**11**	
939 - Lake Shetek SP	1	27	0	27	0	**15**
	2	13	0	9	4	
	3	11	0	0	11	
		51	**0**	**36**	**15**	
940 - Lake Maria SP	1	79	0	79	0	**25**
	2	42	0	25	17	
	3	7	0	0	7	
	4	1	0	0	1	
		129	**0**	**104**	**25**	
941 - Nerstrand Big Woods SP	1	72	0	72	0	**50**
	2	61	0	41	20	
	3	31	0	0	31	
	4	1	0	0	1	
		165	**0**	**113**	**52**	
942 - Sibley SP	1	51	0	39	12	**50**
	2	36	0	0	36	
	3	2	0	0	2	
		89	**0**	**39**	**50**	
943 - Myre-Big Island SP	1	51	0	48	3	**40**
	2	36	0	0	36	
	3	2	0	0	2	
		89	**0**	**48**	**41**	
944 - Vermilion Highlands WMA	1	29	0	28	1	**25**
	2	23	0	0	23	
	3	1	0	0	1	
		53	**0**	**28**	**25**	
945 - Big Stone Lake SP	1	11	0	11	0	**10**
	2	11	0	4	7	
	3	3	0	0	3	
		25	**0**	**15**	**10**	
946 - Murphy-Hanrehan Park Reserve	1	165	0	104	61	**90**
	2	28	0	0	28	
	3	3	0	0	3	
		196	**0**	**104**	**92**	

Table 22. (Continued).

Permit Area Number	Preference Level	Applications Total	Applications Rejected	Unsuccessful	Winners	Permits Available
947 - Itasca State Park	1	51	0	0	51	**125**
	2	7	0	0	7	
		58	**0**	**0**	**58**	
TOTAL		**1,268**	**0**	**734**	**534**	**625**
GRAND TOTAL		**27,884**	**18**	**12,106**	**14,991**	**18,134**

2011 MINNESOTA ELK HARVEST REPORT

Erik Thorson, Acting Big Game Program Coordinator
Joel Huener, Assistant Wildlife Area Manager
Christine Reisz, Acting Area Wildlife Supervisor

INTRODUCTION

A limited number of licenses are offered to Minnesota residents to hunt elk. In 2011, there were 2 established zones; 1) near Grygla, Minnesota, and 2) Kittson County (Figures 1 and 2). Within those 2 zones, there were two regular hunts in each. The early hunt is structured so that it falls within the breeding season when bull elk are most vulnerable and elk can be located by vocalizations. The late season is primarily used as a mechanism to harvest antlerless elk because patterns are more predictable, elk are in larger groups, and snow cover, when present, can aid in locating and tracking animals. In 2011, unsuccessful hunters from the September and December seasons were authorized to hunt in a special January 14-22, 2012 antlerless-only extended season in the Kittson County zone.

METHODS

All elk hunters are required to attend a mandatory orientation and if successful, they must register their animal through the local DNR office. Kill locations are mapped and various data are collected, including age/sex as well as biological samples for disease testing and other monitoring projects.

RESULTS

A total of 13 licenses were available and 687 individuals or parties applied for the opportunity to hunt elk (Table 1). As the number of either-sex licenses is limited, DNR receives an application for the area only. After winners are selected, the time period and license type is distributed through a second random drawing. In 2011, a total of 9 elk were harvested in the both zones (Table 2). Long-term elk harvest for the 2 zones is depicted in Table 3 on pages 3 and 4.

Table 1. License allocation and applications numbers for 2 Minnesota elk hunting zones, 2011.

Zone	Either-Sex	Antlerless	Total	Total Applicants
10 – Grygla	3	2	5	433
20 – Kittson County	2	6	8	254
Total	**5**	**8**	**13**	**687**

Table 2. Distribution of the 2011 Minnesota elk harvest. License allocation totals represent the actual number sold, not the number authorized through rule.

Grygla Hunt Zone

Season	Either-Sex Licenses	Antlerless Licenses	Bulls taken	Antlerless taken	Total elk taken
September 17 - 25	2	0	1 (6x7)	0	1
December 3 - 11	1	2	1 (7x8)	0	1
Total	**3**	**2**	**2**	**0**	**2**

Kittson County Hunt Zone

Season	Either-Sex Licenses	Antlerless Licenses	Bulls taken	Antlerless taken	Total elk taken
September 17 – 25	1	3	1 (7x7)	2	3
December 3- 11	1	3	1 (6x7)	0	1
January 14-22 (extended season)	0	5*	1 (calf)	2	3
Total	**2**	**11**	**3**	**4**	**7**

*7 hunters were invited back for a special extended season hunt, 4 with unfilled tags from previous Kittson County hunts and 3 were hunters with unfilled tags from September & December from the Grygla hunt zone, however only 5 parties actually participated in this hunt, of which two were from Grygla and three were from Kittson County.

Table 3. Grygla and Kittson County elk harvests, 1987-2011.

Grygla

	Bulls (or Either-Sex)		Antlerless	
Year	**Permits**	**Harvest**	**Permits**	**Harvest**
1987	2	1	2	1
1996	2	2	7 (1 alternate)	6
1997	5 (2 alternate)	1	5 (2 alternate)	2
1998	4 (2 alternate)	2	0	0
2004	1	1	4	2
2005	1	0	4	0
2006	2	2	6	2
2007	0	0	6	6
2008	2	2	10	6
2009	2	3*	12	11
2010	2	1	5	3
2011	3	2	2	0
Total	26	17	63	39

*One bull was a sub-legal spike and was legally tagged as an antlerless animal.

Kittson County (Combined)

	Bulls (or Either-Sex)		Antlerless	
Year	**Permits**	**Harvest**	**Permits**	**Harvest**
2008	1	1	10	10
2009	12	9*	4	5
2010	1	1	3	3
2011	2	3**	8***	4
Total	16	14*	25	22

*One additional bull (6x7) was wounded but not retrieved in 2009. It was found dead later and is counted in the total.

**One bull was a male calf and was legally tagged as an antlerless animal.

***3 unsuccessful hunters from the Grygla zone were invited to participate in the January extended season in Kittson County, however only 2 participated and were included in the number of antlerless permits issued.

Figure 1. Grygla Hunt Zone.

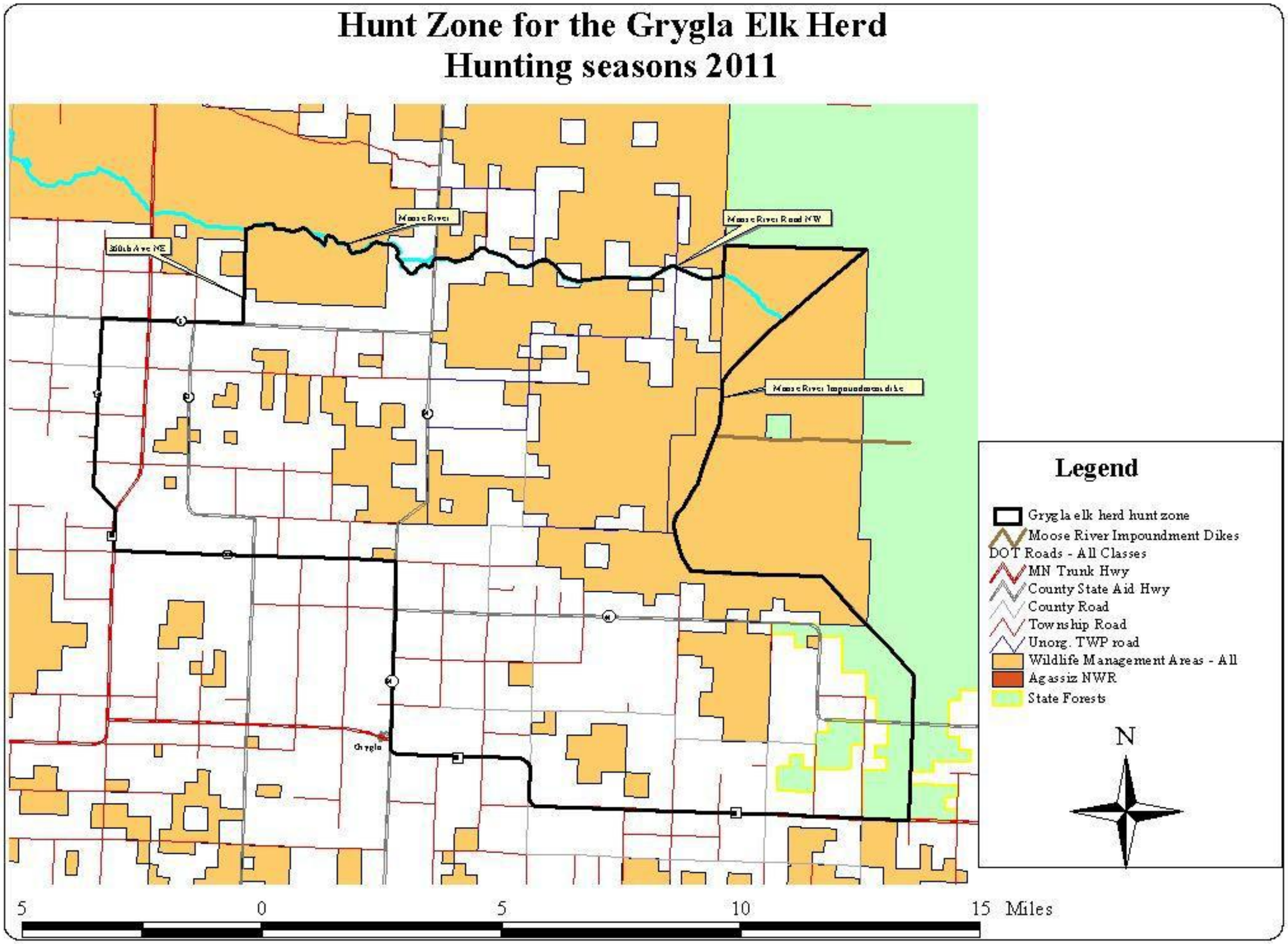
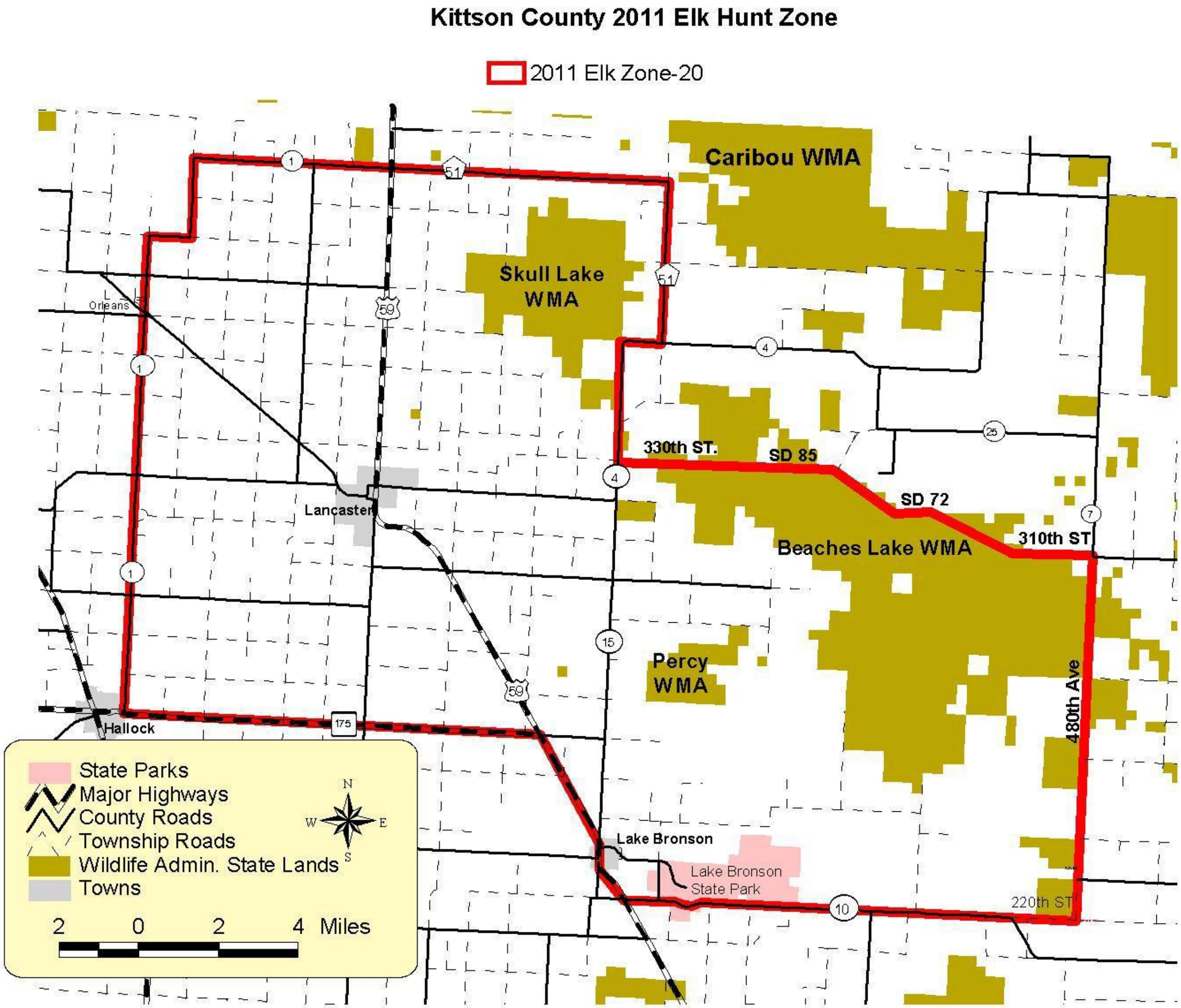


Figure 2. Kittson County Hunt Zone.



2011 MINNESOTA MOOSE HARVEST

Mark S. Lenarz, Forest Wildlife Populations and Research Group

INTRODUCTION

Each year, a limited number of permits are issued that allow Minnesota residents to hunt moose. The following report is intended to document the number of hunters applying for permits, the number of permits issued, a hunting party's chance of receiving a permit, hunter success rate, and a breakdown of the harvest by hunting zone. Information on permit numbers and moose harvested by members of the 1854 Treaty Authority or Fond du Lac band of Lake Superior Chippewa within the 1854 Ceded Territory is also provided.

METHODS

All successful State hunters are required to register their moose at one of 9 registration stations and provide information on the location where they killed their moose and date of kill. Hunters are also requested to collect biological samples from the moose harvested and these are submitted at the registration station.

RESULTS

In 2011, State hunters harvested 53 moose in northeastern Minnesota (Figure 1). No season was held in northwestern Minnesota. Of the 1,963 parties that applied for this year's moose hunt, 105 (5%) were drawn, and 103 purchased licenses (Table 1). Access to portions of hunting zones 20, 22, 23, 24, 25, 26, 61, 62, 63, 64, 77 and 80 were restricted beginning in September because of an ongoing wild fire (Pagami Creek fire) and hunters in these zones were offered the option of returning their license for a refund. Subsequently, 11 hunting parties returned their license. Table 1 also lists the number of permits offered by hunting zone, chance of being selected for a permit, and hunter success. The 1854 Treaty Authority issued 59 permits and band members killed 10 moose (10 bulls and 0 cows). The Fond du Lac band issued 65 permits and the preliminary harvest (as of 10/28/2011) was 17 moose (13 bulls and 4 cows). The Fond du Lac season closes 12/31/2011.

DISCUSSION

The success rate of State hunters in 2011 was 58%, an increase of 7% over 2010 (Tables 1 and 2). This was the fifth year of hunting for bulls only. The success rate for members of the 1854 Treaty Authority was 17%, down 4% from last year. The preliminary success rate for the Fond du Lac band was 26%, as of 10/26/2011, down 6%.

Table 1. Moose harvested, licenses offered and sold, application rate, and party success, in 2011 moose hunt by State hunters in northeastern Minnesota

Zone	Bulls	Licenses Offered	Licenses Sold*	Party Applications**	Chances for Permit	% Success‡
20	1	4	2	50	8%	50%
21	2	3	3	64	5%	67%
22	0	2	1	22	9%	0%
23	0	1	1	15	7%	0%
24	1	2	1	86	2%	100%
25	1	2	1	103	2%	100%
26	1	2	2	18	11%	50%
27	3	4	4	24	17%	75%
28	0	2	2	31	6%	0%
29	4	4	4	109	4%	100%
30	3	5	5	131	4%	60%
31	3	6	6	283	2%	50%
32	2	4	4	18	22%	50%
33	1	2	2	41	5%	50%
34	0	2	2	38	5%	0%
36	2	5	5	24	21%	40%
37	2	2	2	11	18%	100%
60	2	3	3	28	11%	67%
61	2	5	5	57	9%	40%
62	3	10	5	176	6%	60%
63	2	4	4	31	13%	50%
64	1	8	5	50	16%	20%
70	4	4	4	104	4%	100%
72	4	4	4	111	4%	100%
73	1	2	2	44	5%	50%
74	1	2	2	55	4%	50%
76	1	3	3	63	5%	33%
77	2	2	2	51	4%	100%
79	2	2	2	31	6%	100%
80	2	4	4	94	4%	50%
Total	53	105	92	1963	5%	58%

* 11 Parties returned their license prior to the hunt because of access restrictions caused by Pagami Creek fire.

** Number of 2, 3, or 4 person parties minus rejected applications.

‡ Success based on licenses sold.

Table 2. Applicants, permit numbers, moose harvested, and success rates of State moose hunters in northeastern Minnesota since 1993.

Year	Party Applicants*	Permits	Licenses Purchased**	Moose Harvested	Party Success
1993	2,934	315	315	264	84%
1994	3,022	189	189	155	82%
1995	3,181	188	188	156	83%
1996	3,830	207	207	156	75%
1997	3,958	198	198	152	77%
1998	4,157	182	182	125	69%
1999	3,919	189	189	136	72%
2000			No Season		
2001	3,164	182	176	125	71%
2002	2,580	208	202	141	70%
2003	2,328	224	217	144	66%
2004	3,062	246	240	151	63%
2005	3,060	284	276	164	59%
2006	2,952	279	269	161	60%
2007	2,566	233	229	115	50%
2008	2,706	247	245	110	45%
2009	2,746	225	223	103	46%
2010	2,415	213	212	109	51%
2011	1,963	105	92	53	58%

* Number of 2, 3, or 4 person parties minus rejected applications.
** In 2011 - 11 parties returned their licenses because access to portions of their hunting zone was restricted.

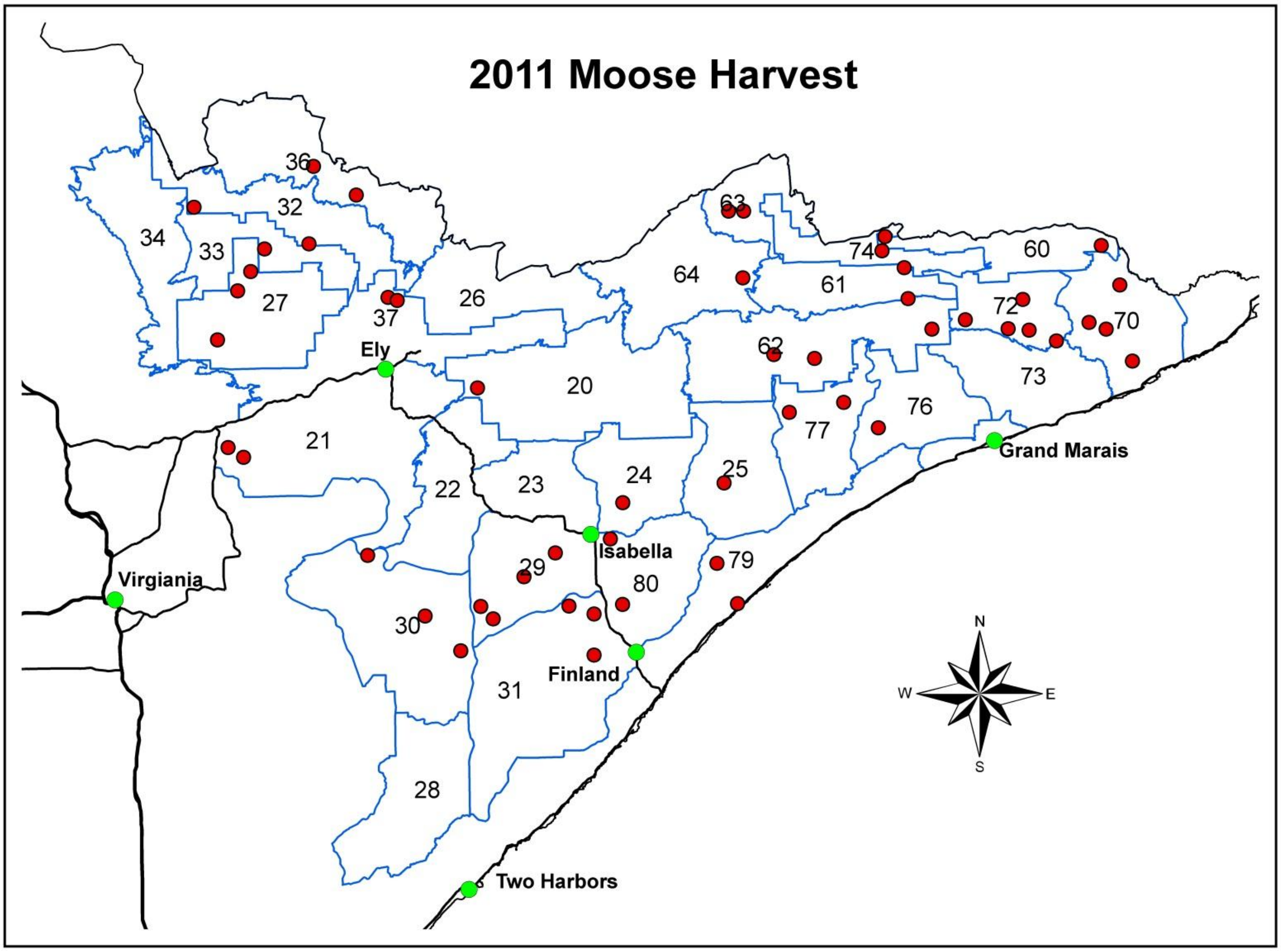


Figure 1. Moose harvest by permit area, 2011

MINNESOTA SANDHILL CRANE HARVEST REPORT, 2011

Margaret Dexter, Wildlife Research Unit

Two distinct populations of sandhill cranes (*Grus Canadensis*) occur in Minnesota. Sandhill cranes that breed and stage during fall in NW Minnesota are part of the Mid-continent population whereas sandhill cranes in the remainder of the state are part of the Eastern population. The Mid-continent population, including cranes in NW Minnesota is managed via a cooperative management plan with the U.S. Fish and Wildlife Service, Mississippi, Central, and Pacific Flyway Councils.

A limited season for Mid-continent sandhill cranes was opened in Minnesota's Northwest Goose Zone (Figure 1) beginning in 2010. The season was open from the first Saturday in September through the second Sunday in October (4 Sep – 10 Oct 2010 and 3 Sep – 9 Oct 2011). The bag limit was 2 per day and 4 in possession. Hunters were required to purchase a $3.00 sandhill crane permit. A sample of sandhill crane permit holders were selected to receive a harvest survey from the U.S. Fish and Wildlife Service after the season. This survey is used to monitor harvest levels and hunting activity (Table 1).

LITERATURE CITED

Central Flyway Webless Migratory Bird Technical Committee. 2006. Management Guidelines for the Mid-Continent Population of Sandhill Cranes. Special Report in files of the Central Flyway Representative. Denver, Colorado.

Kruse, K.L., J.A. Dubovsky, and T.R. Cooper. 2012. Status and harvests of sandhill cranes:Mid-Continent, Rocky Mountain, Lower Colorado River Valley and Eastern Populations. Administrative Report, U.S. Fish and Wildlife Service, Denver, Colorado. 14pp.) http://www.fws.gov/migratorybirds/NewReportsPublications/PopulationStatus.html

Table 1. Sandhill crane permit sales, estimated number of active hunters and harvest for NW Minnesota, 2010-2011. (Kruse, K.L. et al. 2012).

Year	Number of Permits	Active Hunters	Harvest
2010	1,962	964	830
2011	1,342	643	765

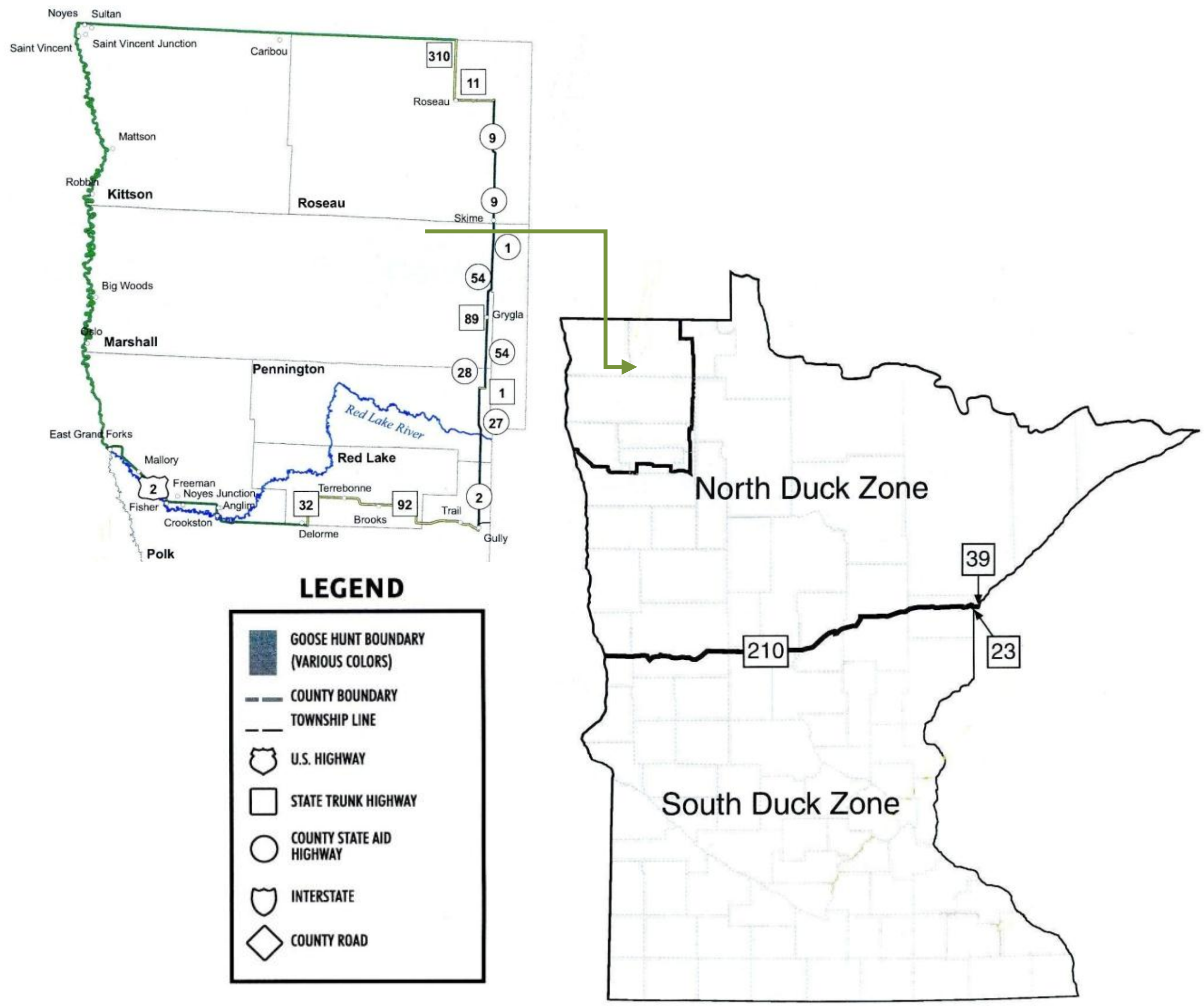


Figure 1. Sandhill crane hunting zone in Minnesota, 2010-2011.

TRAPPING HARVEST STATISTICS

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2011 TRAPPER HARVEST SURVEY

Margaret Dexter, Wildlife Research Unit

INTRODUCTION

The Minnesota Department of Natural Resources, Research Surveys and Statistics unit annually conduct a survey of trapper license holders to assess annual harvest rates. Annual harvest estimates from survey data provide the basis for future trapping regulations and season structure. Beginning with the 1999-2000 season survey cards were sent to all trappers with a valid mailing address.

METHODS

The Research Surveys and Statistics unit requests a list of all active trapper license holders from the Electronic License System database in late February. The sample consists of all valid Regular, Junior and Non-resident Trapper License holders. For the 2011-12 trapping season there were 6,525 Resident Regular Trappers, 387 Resident Junior Trappers, 1.021 Resident Senior Trappers, 322 "active" Lifetime Trappers (20 youth), and 7 Nonresident (MN landowners) Trapper license holders. Of the 8,280 valid licenses, 8,262 had usable addresses for purposes of the survey. The survey sample is in essence a census but the response rate is < 100%. If non-response (including undeliverable surveys) is completely random, then respondents can be treated as a random sample and results expanded to the entire sampling frame for all licensed trappers. For consistency with previous analyses, the response data was treated as a random sample.

Trappers that returned the survey questionnaire within three weeks were marked returned and eliminated from follow-up mailings. Follow-up mailings were sent to non-respondents at intervals of three weeks. There were two follow-up mailings to non-respondents.

Completed and returned questionnaires were checked for completeness, consistency, and biological practicability. Cards were marked with numeric county codes corresponding to the trapper's written information. Data from each usable card was converted to an electronic database. Data were checked for errors, duplicate responses, and /or missing data. The following is a list of assumptions made in data coding:

1) If an individual checked the box indicating (s)he did not trap, but harvest information was provided, it was assumed that the individual did trap.
2) If a range was given for "number of days trapped" or "number of animals harvested", the median of the range, rounded to the nearest even integer was recorded.
3) If a trapper indicated spending time trapping for a species, but left "number trapped" blank, the # trapped was entered as missing data.
4) If a trapper indicated taking a species, but left "number of days trapped" blank, then "number of days trapped" was recorded as missing data.
5) If more than one county was indicated for "county trapped in most", the first county listed was recorded. However, if the several counties listed were indicated to apply to all species trapped, then counties were recorded in sequential order in relation to species hunted.

6) If “county trapped in most” was left unanswered or not legible, the county was recorded as missing data.

Data from all usable cards were tabulated and statistically analyzed by the St. Paul staff, using SAS statistical analysis software programs.

RESULTS

Attached are the survey results for Harvest Statewide and by License type, in tabular form (Tables 1 – 5).

Table 1. Trapper response to mail surveys, 1989-90 through 2011-12.

Year	Number mailed	Number not delivered	Delivered questionnaires completed and returned	
			Number	Percent
1989-90	3,302	120	2,804	88.1
1990-91	2,294	102	1,875	85.5
1991-92	2,643	149	2,062	82.7
1992-93	2,080	76	1,681	83.9
1993-94	2,828	100	2,194	80.4
1994-95	2,382	76	1,876	81.5
1995-96	3,244	118	2,467	80.3
1996-97	4,071	132	3,017	76.6
1997-98	3,500	96	2,629	77.2
1998-99	3,900	117	2,878	76.4
1999-00	3,110	74	2,313	76.2
2000-01	5,262	146	3,941	77.0
2001-02	5,482	127	4,132	78.6
2002-03	5,655	210	4,148	76.0
2003-04	5,812	197	4,234	75.4
2004-05	6,267	235	4,547	75.4
2005-06	6,060	88	4,396	73.6
2006-07	8,508	139	5,835	69.9
2007-08	6,342	104	4,326	69.9
2008-09	6,203	86	4,166	68.1
2009-10	6,144	70	4,425	71.7
2010-11	6,875	94	4,844	71.4
2011-12	8,262	110	5,517	67.7

Table 2. Use of trapper licenses, 2000-01 through 2011-12.

		Return from mail survey	Projections from license sales
2000-01	Trapped	2,897 (75.9%)	4,051
	Did not trap	920 (24.1%)	1,286
		3,817 (100.0%)	5,337[a]
2001-02	Trapped	3,332 (81.5%)	4,510
	Did not trap	754 (18.5%)	1,024
		4,086 (100.0%)	5,534[a]
2002-03	Trapped	3,344 (80.6%)	4,615
	Did not trap	804 (19.4%)	1,111
		4,148 (100.0%)	5,726[a]
2003-04	Trapped	3,412 (81.1%)	4,737
	Did not trap	793 (18.9%)	1,104
		4,205 (100.0%)	5,841[a]
2004-05	Trapped	3,697 (81.9%)	5,136
	Did not trap	815 (18.1%)	1,135
		4,512 (100.0%)	6,271[a]
2005-06	Trapped	3,495 (80.0%)	4,930
	Did not trap	875 (20.0%)	1,233
		4,370 (100.0%)	6,163[a]
2006-07	Trapped	4,782 (81.9%)	7,008
	Did not trap	1,053 (18.1%)	1,549
		5,835 (100.0%)	8,557[a]
2007-08	Trapped	3,322 (77.2%)	5,533
	Did not trap	980 (22.8%)	1,634
		4,302 (100.0%)	7,167[a]
2008-09	Trapped	3,154 (75.7%)	5,319
	Did not trap	1,012 (24.3%)	1,708
		4,166 (100.0%)	7,027[a]
2009-10	Trapped	3,202 (72.7%)	4,467
	Did not trap	1,202 (27.3%)	1,677
		4,404 (100.0%)	6,144[a]
2010-11	Trapped	3,546 (73.2%)	5,032
	Did not trap	1,298 (26.8%)	1,843
		4,844 (100.0%)	6,875[a]
2011-12	Trapped	4,498 (81.5%)	6,748
	Did not trap	1,019 (18.5%)	1,532
		5,517 (100.0%)	8,280[a]

[a] excludes duplicates.

Table 3. Estimated number of trappers of various furbearers, 1998-99 through 2011-12.

	Estimated number of trappers													
	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Muskrat	3121	2137	2052	2419	2137	2117	2269	2351	4228	2371	2393	2088	2760	4,320
Mink	2772	1919	1867	2117	1945	1917	2085	1864	3033	2168	2044	1541	1847	2,470
Short-tailed weasel	366	383	318	411	408	473	470	349	864	595	511	417	546	800
Long-tailed weasel	347	330	272	313	312	374	299	211	694	434	345	254	333	560
Raccoon (Sept -Feb)	2769	1880	1599	2249	2427	2384	2505	2315	3766	3189	3150	2320	2567	4,060
Raccoon (Mar -Aug)[a]	463	315	343	334	354	338	406	322						
Striped skunk	994	681	563	955	1052	1102	1161	1023	1644	1485	1488	949	1130	1,800
Eastern spotted skunk	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
Badger	234	178	135	250	237	292	310	219	347	330	293	206	229	310
Opossum	643	458	484	610	754	934	1037	957	1511	1392	1169	701	645	830
Red fox (Sept -Feb)	1186	1033	986	1093	1319	1290	1179	991	1608	1320	1232	1006	1068	1,900
Red fox (Mar -Aug)[a]	137	107	89	91	111	113	110	85						
Gray fox	386	308	468	277	421	441	451	407	806	654	657	529	555	970
Coyote	576	552	491	606	813	812	826	857	1379	1203	1141	888	998	1,720
Beaver (Oct 11- Feb 12)	2483	1891	1695	2054	1844	1883	2171	1965	2659	2008	1877	1650	1722	2,360
Beaver (Mar 11- Apr 11)	1907	1320	1425	1345	1296	1233	1449	1455	1710	1408	1257	1260	1367	1,510

[a] Raccoon and red fox season continuous May 1994 thru March 15, 2006.

Table 4. Estimated take per trapper of various furbearers, 1997-98 through 2011-2012.

	Estimated take per successful trapper reporting that species														
	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Muskrat	58	42	46	42	42	35	33	32	39	58	32	34	47	65	81.4
Mink	11	13	14	12	14	10	9	10	10	9	9	8	9	8	6
Short-tailed weasel	10	7	5	8	10	7	7	6	6	9	7	7	8	9	9
Long-tailed weasel	5	5	5	5	7	4	5	3	3	5	5	3	3	5	5
Raccoon (Sept -Feb)	24	23	20	20	27	25	22	23	21	21	23	23	19	22	24
Raccoon (Mar Aug)[a]	14	15	14	11	19	12	15	12	11						
Striped skunk	10	9	8	8	8	8	8	8	7	7	7	7	7	7	7
Eastern spotted skunk	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
Badger	2	2	2	2	2	2	2	1	2	1	2	1	2	2	2
Opossum	9	11	13	11	8	11	12	14	12	14	12	10	7	7	5
Red fox (Sept -Feb)	7	5	6	6	6	6	5	4	4	4	3	3	3	3	4
Red fox (Mar -Aug)[a]	4	3	4	4	5	5	6	3	3						
Gray fox	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2
Coyote	3	3	4	4	4	4	5	4	5	4	4	4	4	4	5
Beaver (Oct 11-Feb 12)	16	16	16	15	18	13	12	13	13	13	11	11	11	10	11
Beaver (Mar 11 - Apr 11)	32	29	27	26	31	26	21	26	24	24	19	22	20	21	20

[a] Raccoon and red fox season continuous May 1994 thru March 15, 2006.

Table 5. Minnesota trapper license sales and estimated annual harvest, 1996-97 through 2011-2012[a]

	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Trapper license sales [b]	6,996	6,652	4,936	5,337	5,534	5,725	5,841	6,271	6,163	8,557	7,167	7,027	6,158	6,885	8,280
Estimated harvest [c]															
Muskrat	188,189	131,439	97,333	85,555	100,819	75,190	69,131	72,079	91,271	243,360	75,439	80,157	98,524	180,505	352,030
Mink	32,449	36,152	26,808	22,590	28,684	19,894	16,716	21,478	18,048	26,084	18,626	16,647	13,207	13,853	15,770
Short-tailed weasel	6,401	2,400	1,763	2,586	4,160	2,895	3,519	2,679	2,223	8,145	4,155	3,515	3,128	4,914	7,300
Long-tailed weasel	3,880	1,863	1,619	1,354	2,243	1,138	1,781	1,007	651	3,494	2,013	1,118	838	1,732	3,020
Raccoon (Oct - Feb)	71,705	63,680	37,435	32,460	60,292	61,221	53,534	56,848	48,966	78,571	73,498	71,893	45,118	57,245	98,240
Raccoon (Mar -Aug)[f]	8,986	6,849	4,263	3,702	6,468	4,137	4,933	4,940	3,594						
Striped skunk	10,027	9,181	5,266	4,580	7,168	7,901	8,474	8,704	6,881	10,773	10,811	10,354	6,194	8,023	12,250
Eastern spotted skunk [g]	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
Badger	446	400	319	205	407	358	552	455	339	461	499	424	316	344	490
Opossum	5,201	6,916	5,907	5,351	5,127	8,491	11,251	14,313	11,754	20,442	17	11,296	4,963	4,193	4,400
Red fox (Oct - Feb)	9,995	6,347	6,508	6,165	6,870	7,851	6,721	4,684	3,528	6,783	4,060	3,500	2,984	3,311	7,250
Red fox (Mar -Aug)[f]	680	458	379	357	447	612	635	334	222						
Gray fox	1,163	976	743	468	525	892	915	898	797	1,703	1,360	1,320	1,084	1,110	2,100
Coyote	2,720	1,637	2,372	2,112	2,369	3,641	3,805	3,607	3,915	5,315	5,355	4,532	3,797	4,292	8,780
Beaver (Oct 11- Feb 12)	47,370	38,720	30,564	24,802	35,963	23,592	22,801	28,716	26,029	33,966	21,813	21,075	18,178	17,048	26,620
Beaver (Mar 11-Apr 11)	65,472	55,262	36,189	37,455	41,829	33,721	26,363	37,861	35,252	41,652	26,286	27,815	25,008	29,118	29,500
Registered harvest															
Otter	2,145	1,946	1,635	1,578	2,301	2,145	2,766	3,450	2,846	2,720	1,861	1,938	1,544	1,814	2,294
Lynx [g]	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
Bobcat [e]	359	103	206	231	250	544	483	631	590	890	702	853	884	1,012	1,711
Fisher	2,761	2,695	1,725	1,674	2,119	2,660	2,517	2,552	2,388	3,251	1,682	1,712	1,259	903	1,473
Marten	2,261	2,299	2,423	1,629	1,928	2,839	3,214	3,241	2,653	3,788	2,221	1,823	2,073	1,842	2,525

[a] Includes data for all seasons from October through April of years indicated.
[b] Separate licenses were issued for juveniles (13-17 years old) and adults (18 and older), beginning in 1982. Nonresident (MN Landowner) licenses started in 2004. Senior trapping licenses were first issued in 2007. Lifetime Licenses became available for free when renewing lifetime sports or small game licenses in 2007. As of April, 2012 - 8,285 trapping licenses were sold in 2011 387 (4.7%) were juvenile licenses, 6,525 (78.8%) were Regular adult licenses, 1,021 (12.3%) were Senior licenses, 322 (3.9%) were Lifetime licenses, and 7 (<1%) were Nonresident (MN Landowner) licenses. Duplicate licenses excluded.
[c] Based upon trappers' responses to mail surveys.
[e] Registered harvest for bobcat includes animals taken by hunting. [f] Raccoon and red fox season continuous May 1994 thru March 15, 2006.
[g] Lynx (1984) and Eastern spotted skunk (1996) listed as Special Concern and threatened species (respectively) and are fully protected.

MINNESOTA FUR BUYERS SURVEY FOR THE 2011-2012 HUNTING AND TRAPPING SEASON

Jason Abraham, Wildlife Furbearer Program Coordinator
Margaret Dexter, Wildlife Policy and Research Unit

INTRODUCTION

Fur buyers are individuals licensed by the State of Minnesota to buy and sell raw fur. They are required to keep complete records of all transactions and activities related to buying, selling, and disposing of raw furs. Each year buyers are sent a questionnaire asking them to submit information regarding the "average" price they paid to trappers for various furbearers the previous season.

METHODS

In August 2012, questionnaires were mailed to the 41 licensed fur buyers in Minnesota. The survey asked them to report the number and type of fur purchased from Minnesota trappers and hunters in 2011-12 and the "average price" paid to those hunters and trappers based on all furs purchased. A total of 32 usable surveys were received, for a return rate of 82 percent.

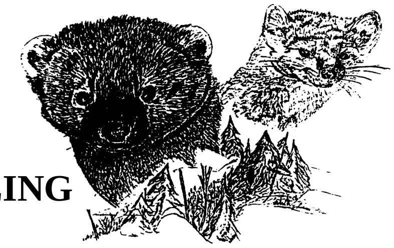
Calculations of average pelt price for each species (Table 1) were weighted according to the number of pelts purchased by each buyer. Average pelt prices for the past 15 years are summarized in Table 2. Total estimated value of the furbearer harvest to trappers and hunters in 2011-12 was $1,970,338.77, a 220 percent increase from 2010-2011.

Table 1. Minnesota fur prices as reported by licensed fur dealers, 2011-12.

Species	Number Pelts	Minimum Price	Maximum Price	Weighted Mean
Muskrat	114,523	4.89	7.50	5.86
Mink Female	3,172	6.00	15.75	11.54
Mink male	3,467	8.89	20.00	14.68
Raccoon	42,408	7.00	15.00	12.57
Red Fox	1,692	13.00	30.00	22.87
Gray Fox	437	10.00	20.00	15.11
Coyote	2,570	8.00	30.00	17.99
Bobcat	435	25.00	120.00	98.18
River Otter	733	12.00	75.00	51.40
Beaver (Fall-Winter)	8,431	0.00	23.00	14.29
Beaver (Spring)	11,379	5.00	27.00	19.96
L.T. Weasel	92	2.00	5.00	2.10
S.T. Weasel	1,671	1.00	30.00	4.02
Striped Skunk	360	1.00	6.00	3.55
Badger	174	8.00	45.00	13.47
Opossum	151	0.65	45.00	5.80
Fisher Male	357	30.00	60.00	47.69
Fisher Female	193	30.00	50.00	39.59
Marten Male	192	36.60	50.00	42.32
Marten Female	137	40.00	50.00	39.49
Deer Hides	27,589	2.25	6.00	3.95
Bear Hides	29	17.50	50.00	28.79

Table 2. Average price per pelt paid to hunters and trappers in Minnesota, 2002-03 through 2011-12.

	Average pelt prices paid hunters and trappers in Minnesota (dollars)									
Species	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Muskrat	2.11	2.05	1.9	2.81	$5.79	2.96	1.85	4.43	5.33	5.86
Mink (female)	6.52	7.23	10.22	10.23	$13.18	9.05	7.45	8.02	9.33	11.54
Mink (male)	9.55	11.41	11.34	14.29	$18.04	12.32	9.14	9.37	13.66	14.68
S.T. Weasel	2.63	2.53	2.52	2.6	$3.58	3.18	3.57	3.02	1.50	4.02
L.T. Weasel	1.94	3.34	3.05	2.56	$4.35	5	2.21	3.12	2.87	2.10
Raccoon	10.33	11.45	10.49	9.61	$11.92	14.32	9.34	9.18	10.87	12.57
Striped Skunk	5.81	4.66	3.95	3.77	$4.46	5.27	7.12	8.62	9.47	3.55
Badger	13.18	14.23	12.94	13.4	$15.71	13.92	7.70	8.81	10.43	13.47
Opossum	1.22	1.23	1.51	1.4	$1.52	1.76	1.21	1.30	2.64	5.80
Red Fox	22.08	20.02	17.28	16.96	$17.68	14.69	11.79	10.85	13.35	22.87
Gray Fox	9.05	13.64	12.58	15	$22.36	30.09	14.08	11.55	14.64	15.11
Coyote	16.12	18.37	15.24	13.57	$17.76	13.51	7.12	8.62	9.47	17.99
Bobcat	71.54	95.9	98.99	95.74	$101.07	93.41	74.74	42.77	71.44	98.18
Beaver (fall-winter)	10.05	12.57	13.62	14.48	$18.35	14.6	14.63	12.49	11.95	14.29
Beaver (spring)	9.99	11.09	13.8	16.49	$14.81	17.77	9.36	14.47	14.50	19.96
Otter	61.16	85.33	87.23	88.89	$42.85	29.49	24.33	35.65	34.53	51.40
Fisher (male)	26.7	27.15	30.02	36.03	$76.33	63.09	22.27	34.45	38.19	47.69
Fisher (female)	25.44	25.71	27.47	31.46	$67.82	48.24	37.22	34.90	37.31	39.59
Marten (male)	28	30.09	30.65	37.47	$74.04	58.72	30.61	26.76	39.80	42.32
Marten (female)	27.3	26.7	27.42	31.53	$66.09	50.05	28.19	29.95	36.57	39.49
Deer Hides	3.48	5.41	3.95	4.14	$4.51	3.92	3.53	4.44	4.41	3.95
Bear Hides	40.56	41.55	46.61	39.3	$43.03	36.57	29.81	43.00	33.38	28.79



REGISTERED FURBEARER POPULATION MODELING
2012 Report

Drawing by Gilbert Proulx

John Erb, Forest Wildlife Populations and Research Group

INTRODUCTION

For populations of secretive carnivores, obtaining field-based estimates of population size remains a challenging task (Hochachka et al. 2000; Wilson and Delehay 2001; Conn et al. 2004). This is particularly true when one is interested in annual estimates, multiple species, or large areas. Nevertheless, population estimates are desirable to assist in making management or harvest decisions. Population modeling is a valuable tool for synthesizing our knowledge of population demography, predicting outcomes of management decisions, and approximating population size.

In the late 1970s, Minnesota developed population models for 4 species of carnivores (fisher, marten, bobcat, and otter) to help 'estimate' population size and track population changes. All are deterministic accounting models that do not currently incorporate density-dependence. However, juvenile survival adjustments are made for bobcats and fisher during cyclic lows in hare abundance and following severe winters, particularly those where northern deer populations decline. For juvenile marten, survival is adjusted downward during apparent lows in small mammal abundance. Modeling projections are interpreted in conjunction with harvest data and results from any annual field-based track surveys.

METHODS

Primary model inputs include the estimated 1977 'starting' population size, estimates of age-specific survival and reproduction, and sex- and age-specific harvest data. Reproductive inputs are based largely on carcass data collected in the early 1980s, and for bobcats, additional data collected in 1992 and from 2003-present. Initial survival inputs were based on a review of published estimates in the literature, but are periodically adjusted as noted above. In some cases, parameter adjustments for previous years are delayed until additional data on prey abundance trends is available. Hence, population estimates reported in previous reports may not always match those reported in current reports. Obtaining updated Minnesota-specific survival and reproductive estimates is the goal of ongoing research.

Harvest data is obtained through mandatory furbearer registration. A detailed summary of 2011 harvest information is available in a separate report. Bobcat, marten, and fisher age data is obtained via x-ray examination of pulp cavity width or microscopic counts of cementum annuli from teeth of harvested animals. Although the population models only utilize data for the 3 age-classes (juvenile, yearling, adult), cementum annuli counts have periodically been collected for all non-juveniles either to examine age-specific reproductive output (bobcats) or to obtain periodic information on year-class distribution for selected species. In years where age data is not obtained for a given species, harvest age proportions are approximated using averages computed from the most recent period when data was collected.

For comparison to model projections, field-based track survey indices are presented in this report as running 3-year (t-1, t, t+1) averages of the observed track index, with the most recent year's average computed as (2/3*current index + 1/3*previous index). More detailed descriptions of scent post and winter track survey methods and results are available in separate reports.

RESULTS AND DISCUSSION

Bobcat. The 2011 registered DNR trapping and hunting harvest reached a new record level (1,711), exceeding last year's record harvest by 70% (Table 1). Total modeled harvest, which includes reported tribal take, was 1,898. The juvenile to adult female ratio in the harvest (0.8; Table 1) was below both the long-term average (1.5) and the recent 10-year average (1.1). A total of 1,626 bobcat carcasses were examined (Table 1), with a mean age of 3.0 for females. Approximately 10% of the harvested female bobcats were ≥ 6.5 years old (Figure 1).

Based on examination of reproductive tracts, 13% of yearling females produced a litter in 2011, the lowest since data collection resumed in 2003 (Figure 2). Average litter size for pregnant yearlings was 2.5, slightly above the previous 8-year average of 2.2. Pregnancy rate for 2+ year olds was 73%, similar to the previous 8-year mean (74%). Mean litter size for pregnant adults was 2.8 (8-year mean = 2.8). For both yearlings and adults, pregnancy rates appear to fluctuate more than average litter size, though neither has shown significant variability or trend since data collection resumed in 2003.

Based on the recently recalibrated bobcat population model, 35% of the 2011 fall population was harvested. As a result of the record harvest, population modeling projects a 12% decline in the bobcat population (Figure 3), with an estimated 2012 spring population size of ~ 3,400 (Figure 3). Both track indices remain at record levels (Figure 3).

Fisher. For the past 4 years, the fisher harvest season was reduced from 16 days to 9 days. In addition, the fisher limit was reduced the past 2 seasons from 5 to 2. Fisher harvest this year under the DNR framework increased 63% to 1,473 (Table 2). Modeled harvest, which includes reported tribal take, was 1,651.

Fisher carcass collections were resumed in 2010 to collect current information on age distribution. A total of 1,314 carcasses were collected in 2011 (Table 2). The juvenile:adult female ratio was 3.0, below last year's estimate of 4.3, and well below the 1977-1994 average of 6.6 (Table 2). Average age of harvested males and females was 1.4 and 1.8, respectively. Very few fishers over the age of 2.5 were harvested (Figures 4 and 5).

Based on projections from the fisher population model, 21% of the fall fisher population was harvested during the 2011 season. Although the conservative seasons in recent years appeared to have stabilized the previous decline, this year's harvest may have exceeded current sustainable levels, and the 3-year-averaged winter track index for fisher once again declined, though not significantly (Figure 6). Modeling projects a 7% decrease in the population, with an estimated 2012 spring population size of ~ 6,000 fishers (Figure 6).

Marten. As with fisher, the marten harvest season the last 4 years was shortened from 16 days to 9 days, though the marten limit has remained unchanged. Harvest this year under the

DNR framework was 2,525, up 37% from last year (Table 3). Modeled harvest, which includes reported tribal take, was 2,744. Age-class information was obtained from a sample of 70% of the carcasses collected this year. Juveniles comprised 39% of the total harvest, slightly below the recent 10-year average (46%), and well below the longer-term average of 55% (Table 3; Figure 7). The juvenile:adult female ratio (2.6) in the harvest was below both the recent 10-year average (4.6) and the longer-term average (7.6; Table 3).

Based on projections from the marten population model, 22% of the fall marten population was harvested. After declining for ~ 8 years, the 3-year-averaged winter track index has been rebounding after implementing more conservative harvest seasons. However, the higher than expected harvest this year appears to have dampened the recovery (Figure 8). Modeling projects a 6% decline in the population from last year (Figure 3), with an estimated 2012 spring population size of ~ 9,000 martens.

Otter. From 1977 - 2007, otter harvest was only allowed in the northern part of the state. From 2007-2009, otter harvest was allowed in 2 separate zones with differing limits (4 otter in the north zone, 2 in the southeast zone). Beginning in 2010, otter harvest was allowed statewide, with a consistent limit of 4 otter per trapper. Statewide harvest in 2011 under the DNR framework increased 26% to 2,294 (Table 4), of which approximately 50 (2%) were taken in the former southeast zone and 90 (4%) in the recently opened SC/SW portion of the state.

Modeled statewide otter harvest, which includes tribal take, was 2,490 (Table 4). An estimated 17% of the fall population was harvested. Carcass collections ended in 1986, so no age or reproductive data are available. After the population declined for several years as a result of high fur prices (harvests) and then rebounded to previous levels as fur prices (harvests) declined, modeling indicates that this year's harvest had a stabilizing effect on the population (Figure 7). The 2012 spring population is estimated to be ~ 12,300, essentially unchanged from last year.

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Table 1. Bobcat harvest data, 1982 to 2011.

Year	DNR Harvest	Modeled Harvest[1]	% Autumn Pop. Taken[2]	Carcasses Examined	% juveniles	% yearlings	% adults	Juv: Ad. Female ratio	% male juveniles	% male yearlings	% male adults	Overall % males	Mean Pelt Price[3]
1982	274	320	15	261	35	15	50	1.3	47	49	47	48	$66
1983	208	212	10	205	37	26	37	1.5	54	53	30	45	$61
1984	280	288	15	288	37	13	50	1.4	52	66	44	51	$76
1985	119	121	6	99	33	19	48	1.2	41	41	43	42	$70
1986	160	160	8	132	26	17	57	0.9	53	32	51	51	$120
1987	214	229	12	163	33	16	51	1.4	44	52	48	48	$101
1988	140	143	7	114	40	18	42	1.7	58	62	46	54	$68
1989	129	129	6	119	39	17	44	2	49	53	56	53	$48
1990	84	87	4	62	20	34	46	0.8	58	80	44	59	$43
1991	106	110	5	93	35	33	32	3.6	59	55	70	61	$37
1992	167	167	7	151	28	22	50	1.2	55	45	53	53	$28
1993	201	210	8	161	32	20	48	1.4	51	45	52	50	$43
1994	238	270	11	187	26	16	58	0.8	64	43	45	50	$36
1995	134	152	6	96	31	15	54	2.7	57	71	79	71	$32
1996	223	250	10	164	35	20	45	1.5	51	30	49	46	$33
1997	364	401	17	270	35	16	49	1.2	60	37	43	48	$30
1998	103	107	5	77	29	26	45	1.6	59	60	60	60	$28
1999	206	228	8	163	18	24	58	0.8	55	59	62	60	$24
2000	231	250	8	183	31	26	43	1.5	54	59	50	53	$33
2001	259	278	9	213	30	21	49	1.3	52	51	53	52	$46
2002	544	621	16	475	27	25	48	1	66	49	46	52	$72
2003	483	518	14	425	25	13	62	0.9	61	46	53	54	$96
2004	631	709	16	524	28	34	38	1.6	51	40	54	49	$99
2005	590	638	14	485	25	13	62	0.8	51	48	46	48	$96
2006	890	983	20	813	26	17	57	1.1	61	50	58	57	$101
2007	702	758	16	633	34	14	52	1.2	55	60	47	52	$93
2008	853	928	18	714	26	25	49	1.1	56	52	51	52	$75
2009	884	942	18	844	23	22	55	0.9	57	46	54	53	$43
2010	1012	1042	19	955	38	16	46	1.4	62	55	43	52	$71
2011	1711	1898	35	1626	23	21	56	0.8	61	73	47	56	$98

[1] Includes DNR and Tribal harvests

[2] Estimated from population model; includes estimated non-reported harvest of 10%.

[3] Average pelt price based on a survey of in-state fur buyers only.

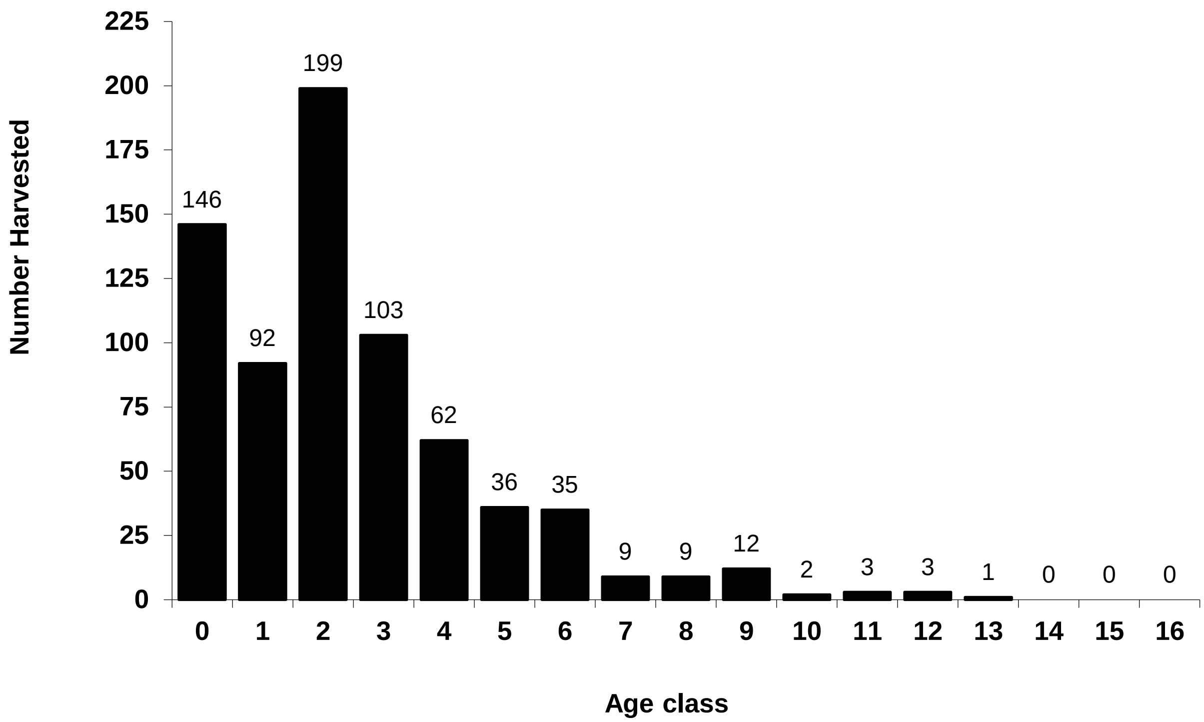

Figure 1. Age structure of female bobcats in the 2011-12 harvest.

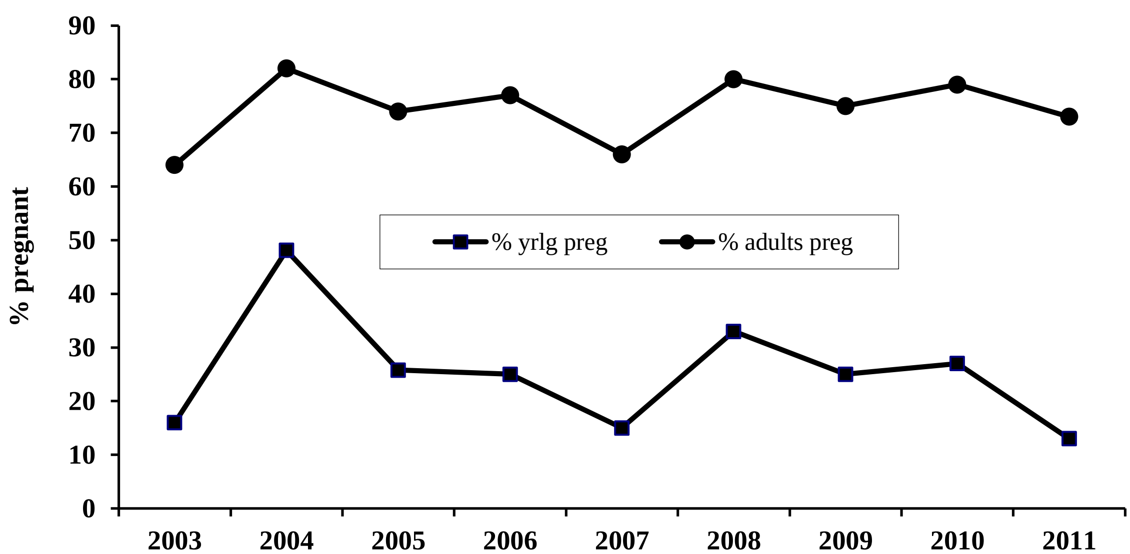

Figure 2. Pregnancy rates for yearling and adult bobcats in Minnesota, 2003-2011.

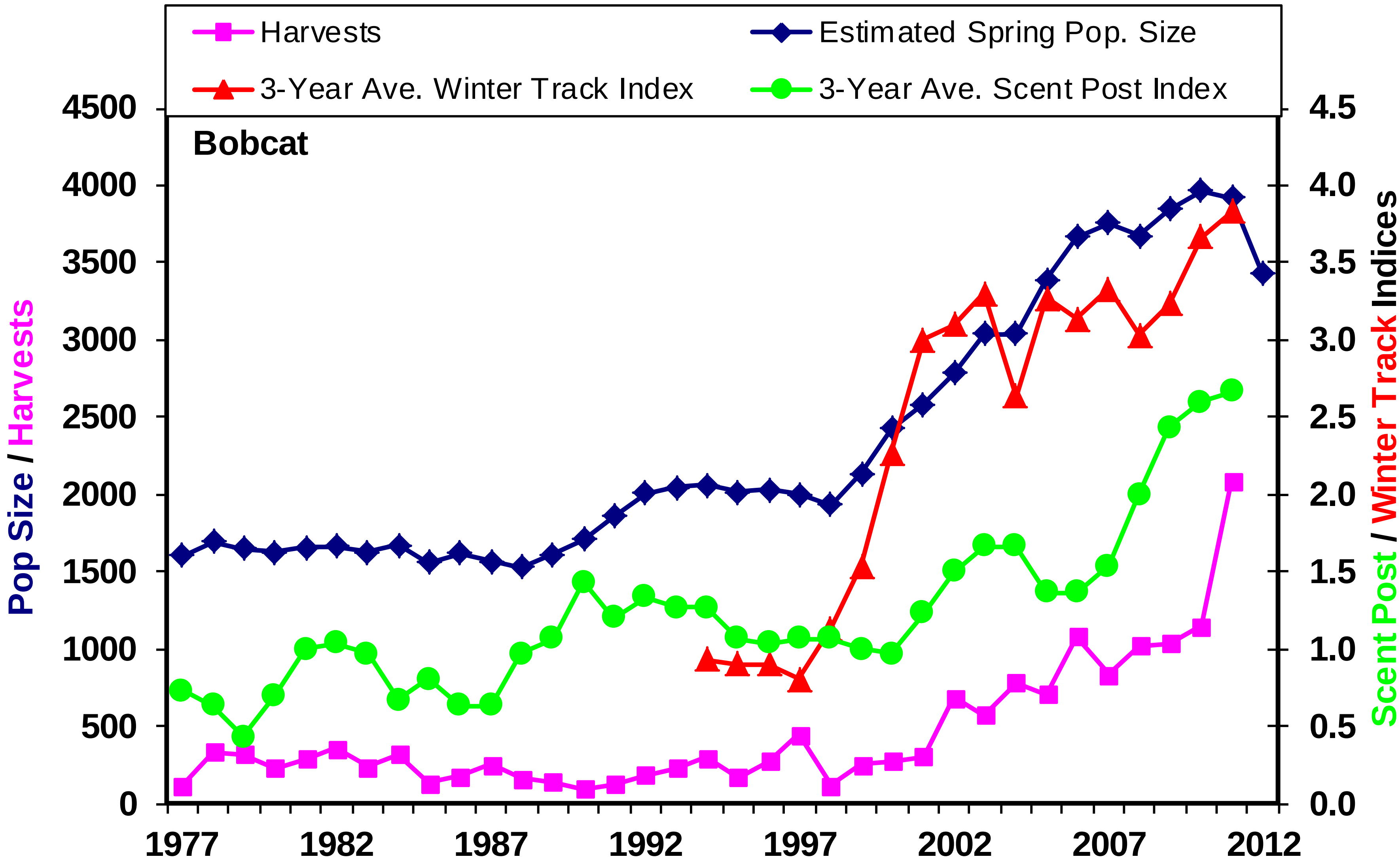

Figure 3. Bobcat populations, harvests, and survey indices, 1977-2012. Harvests include an estimate of non-reported take.

Table 2. Fisher harvest data, 1982 to 2011.

Year	DNR harvest	Modeled Harvest[1]	% Autumn Pop. Harvested[2]	Carcasses examined	% juveniles	% yearlings	% adults	Juv: Ad. Female ratio	% male juveniles	% male yearlings	% male adults	% males overall	Pelt price Males[3]	Pelt price Females[3]
1982	912	1073	16	1073	66	19	15	9.4	46	41	52	46	$70	$99
1983	631	735	11	662	69	18	13	8.8	45	40	40	44	$71	$121
1984	1285	1332	18	1270	63	20	17	7.2	52	45	45	49	$70	$122
1985	678	735	10	712	63	20	18	5.4	46	40	34	43	$74	$130
1986	1068	1186	16	1186	59	24	18	5.3	48	50	37	46	$84	$162
1987	1642	1749	23	1534	63	15	22	4.7	46	40	37	43	$84	$170
1988	1025	1050	15	805	70	15	15	6.8	48	45	33	45	$54	$100
1989	1243	1243	17	1024	64	19	17	5.8	47	47	36	45	$26	$53
1990	746	756	10	592	65	14	21	4.5	44	55	30	43	$35	$46
1991	528	528	6	410	66	21	13	7.8	50	52	35	48	$21	$48
1992	778	782	8	629	58	21	21	4.9	42	55	45	46	$16	$29
1993	1159	1192	11	937	59	22	19	5.3	47	37	42	44	$14	$28
1994	1771	1932	16	1360	56	18	26	4	47	54	44	48	$19	$30
1995	942	1060	9	-	-	-	-	-	-	-	-	45	$16	$25
1996	1773	2000	15	-	-	-	-	-	-	-	-	45	$25	$34
1997	2761	2974	22	-	-	-	-	-	-	-	-	45	$31	$34
1998	2695	2987	23	-	-	-	-	-	-	-	-	45	$19	$22
1999	1725	1880	16	-	-	-	-	-	-	-	-	45	$19	$20
2000	1674	1900	15	-	-	-	-	-	-	-	-	45	$20	$19
2001	2145	2362	19	-	-	-	-	-	-	-	-	54	$23	$23
2002	2660	3028	24	-	-	-	-	-	-	-	-	54	$27	$25
2003	2521	2728	22	-	-	-	-	-	-	-	-	55	$27	$26
2004	2552	2753	23	-	-	-	-	-	-	-	-	52	$30	$27
2005	2388	2454	22	-	-	-	-	-	-	-	-	52	$36	$31
2006	3250	3500	33	-	-	-	-	-	-	-	-	51	$76	$68
2007	1682	1811	21	-	-	-	-	-	-	-	-	51	$63	$48
2008	1712	1828	22	-	-	-	-	-	-	-	-	52	$22	$37
2009	1259	1323	17	-	-	-	-	-	-	-	-	53	$35	$34
2010	903	951	12	759	52	25	23	4.3	54	53	49	52	$38	$37
2011	1473	1651	21	1314	46	28	26	3	56	50	39	50	$48	$40

[1] Includes DNR and Tribal harvests

[2] Estimated from population model, includes estimated non-reported harvest of 22% 1977-1992, and 10% from 1993-present.

[3] Average pelt price based on a survey of in-state fur buyers only.

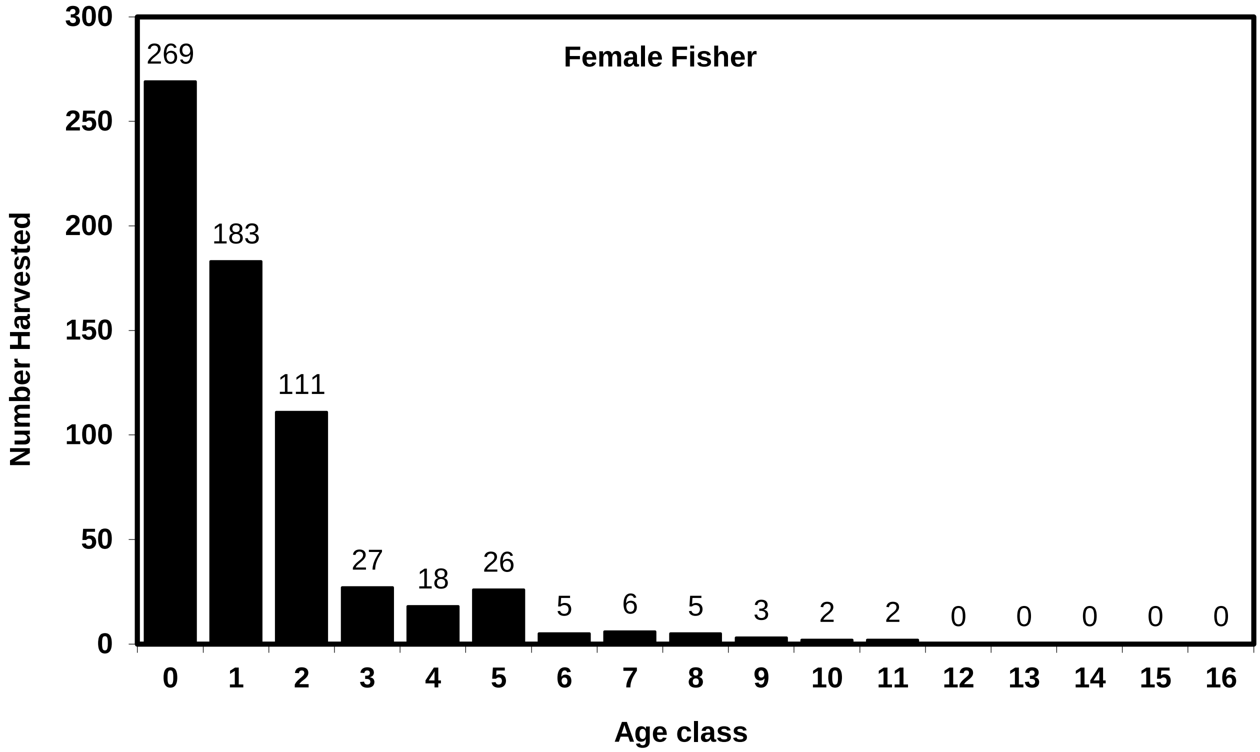

Figure 4. Age structure of female fishers in the 2011 harvest.

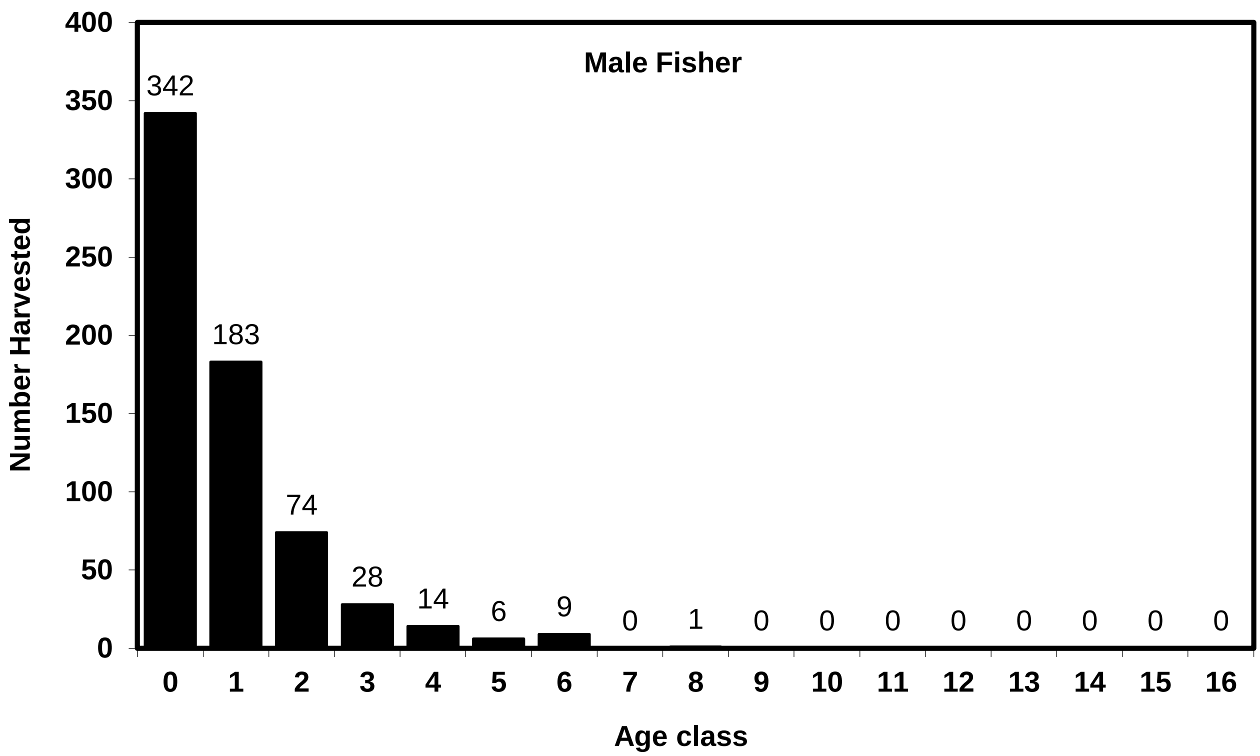

Figure 5. Age structure of male fishers in the 2011 harvest.

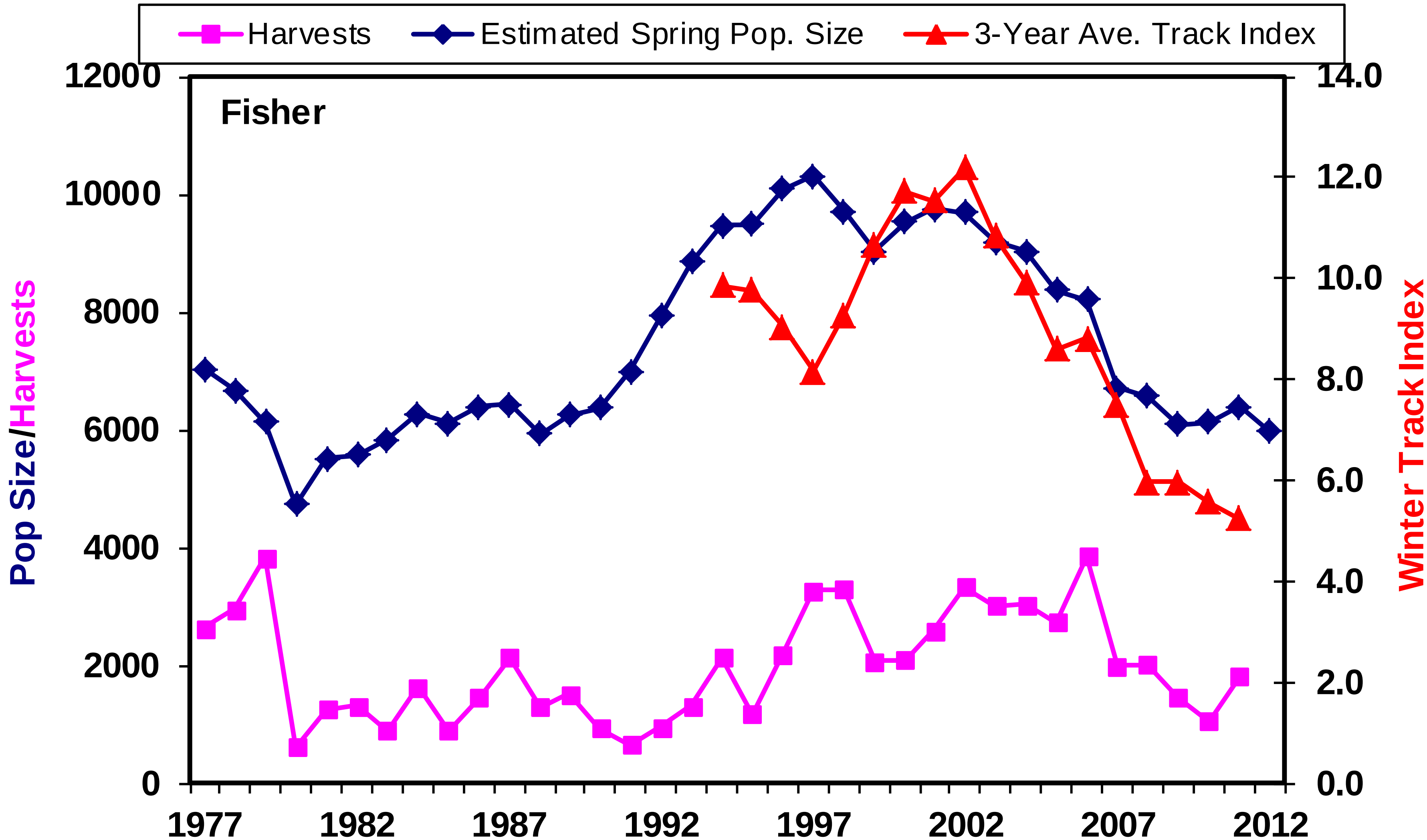

Figure 6. Fisher populations, harvests, and survey indices, 1977-2012. Harvests include an estimate of non-reported take.

Table 3. Marten harvest data, 1985 to 2011.

Year	DNR harvest	Modeled Harvest[1]	% Autumn Pop. Harvested[2]	Carcasses Examined[3]	% juveniles	% yearlings	% adults	Juv: Ad. Female ratio	% male juveniles	% male yearlings	% male adults	% males overall	Pelt price Males[4]	Pelt price Females[4]
1985	430	430	5	507	73	18	9	17.2	69	68	82	70	$30	$28
1986	798	798	9	884	64	21	15	12.3	65	71	81	69	$36	$27
1987	1363	1363	13	1754	66	18	16	11.2	65	67	75	67	$43	$39
1988	2072	2072	17	1977	66	11	23	8.6	58	50	66	59	$50	$43
1989	2119	2119	17	1014	68	12	20	9.7	57	63	65	59	$48	$47
1990	1349	1447	12	1375	48	18	34	3.6	59	54	61	59	$44	$41
1991	686	1000	9	716	74	9	17	16.1	69	71	72	70	$40	$27
1992	1602	1802	13	1661	65	18	17	15.1	63	70	75	66	$28	$25
1993	1438	1828	13	1396	57	20	23	7.5	61	71	67	64	$36	$30
1994	1527	1846	13	1452	58	15	27	6.4	62	76	67	66	$34	$28
1995	1500	1774	12	1393	60	18	22	8.2	63	68	66	65	$28	$21
1996	1625	2000	13	1372	48	22	30	4.8	62	69	67	65	$34	$29
1997	2261	2762	18	2238	61	13	26	6.2	60	60	63	61	$28	$22
1998	2299	2795	18	1577	57	18	25	6.6	62	66	65	63	$20	$16
1999	2423	3000	18	2013	67	12	21	9.8	65	66	67	66	$25	$21
2000	1629	2050	12	1598	56	25	19	8.9	62	69	66	64	$28	$21
2001	1940	2250	12	1895	62	15	23	11	66	73	75	69	$24	$23
2002	2839	3192	18	2451	39	30	31	3.1	57	63	61	60	$28	$27
2003	3214	3548	20	2391	48	17	35	4	57	65	66	62	$30	$27
2004	3241	3592	22	2776	26	28	46	1.3	52	64	57	58	$31	$27
2005	2653	2873	19	1992	53	16	31	4.9	64	63	65	64	$37	$32
2006	3788	4120	28	1914	64	17	20	9.2	66	67	65	66	$74	$66
2007	2221	2481	20	1355	30	29	41	1.5	56	64	50	56	$59	$50
2008	1823	1953	16	1095	40	21	39	2.1	58	60	53	56	$31	$28
2009	2073	2250	18	1252	55	16	29	4.9	65	46	61	61	$27	$30
2010	1842	1977	16	1202	47	29	25	4.1	69	54	60	63	$40	$37
2011	2525	2744	22	1615	39	25	36	2.6	63	63	59	62	$42	$39

[1] Includes DNR and Tribal harvests

[2] Estimated from population model; includes estimated non-reported harvest of 40% in 1985-1987 and 1991, 20% in 1988-1990 and 1992-1998, and 10% from 1999-present.

[3] Starting in 2005, the number of carcasses examined represents a random sample of ~ 70% of the carcasses collected in each year.

[4] Average pelt price based on a survey of in-state fur buyers only

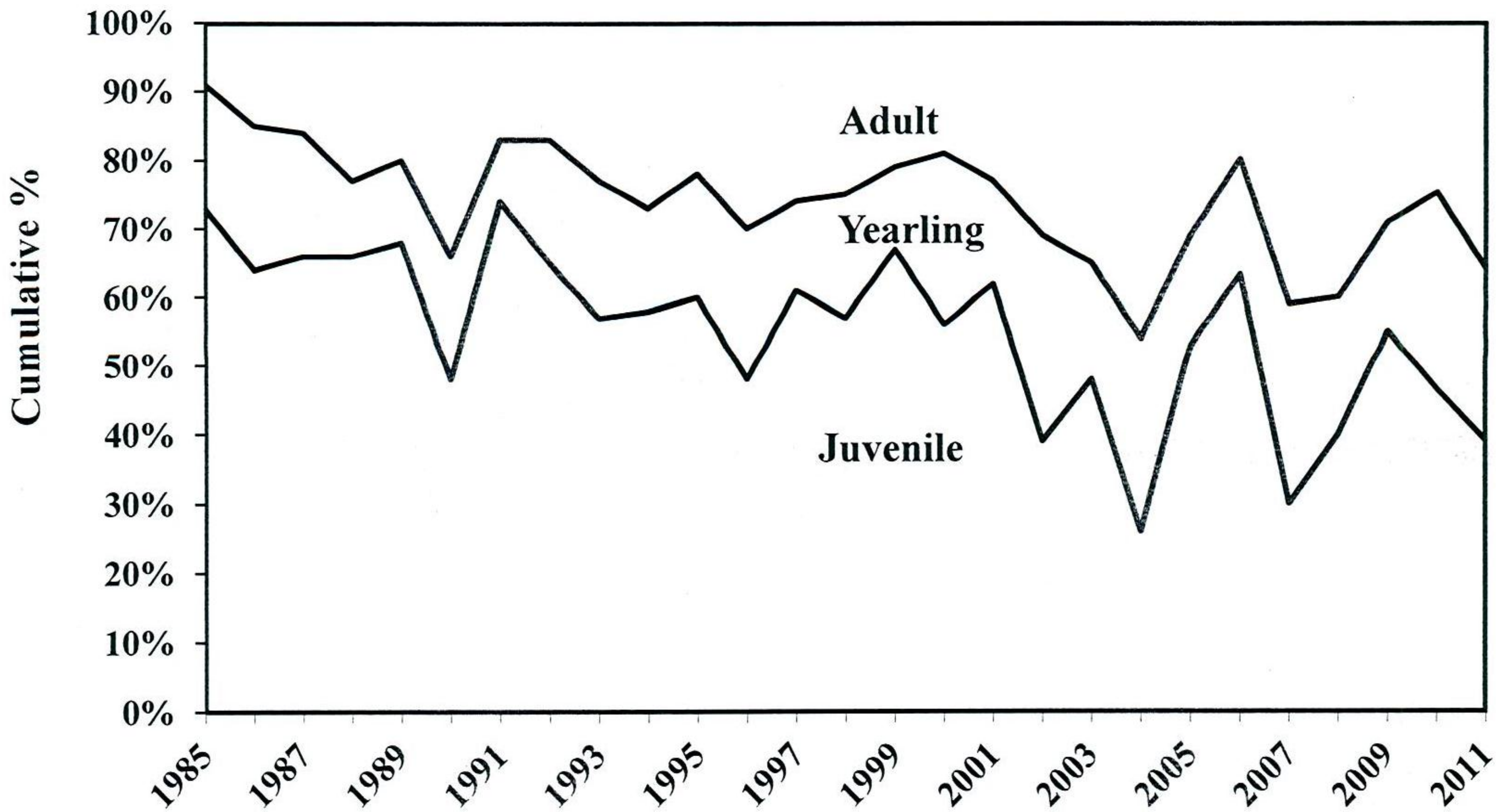

Figure 7. Marten harvest age-class proportions, 1985-2011.

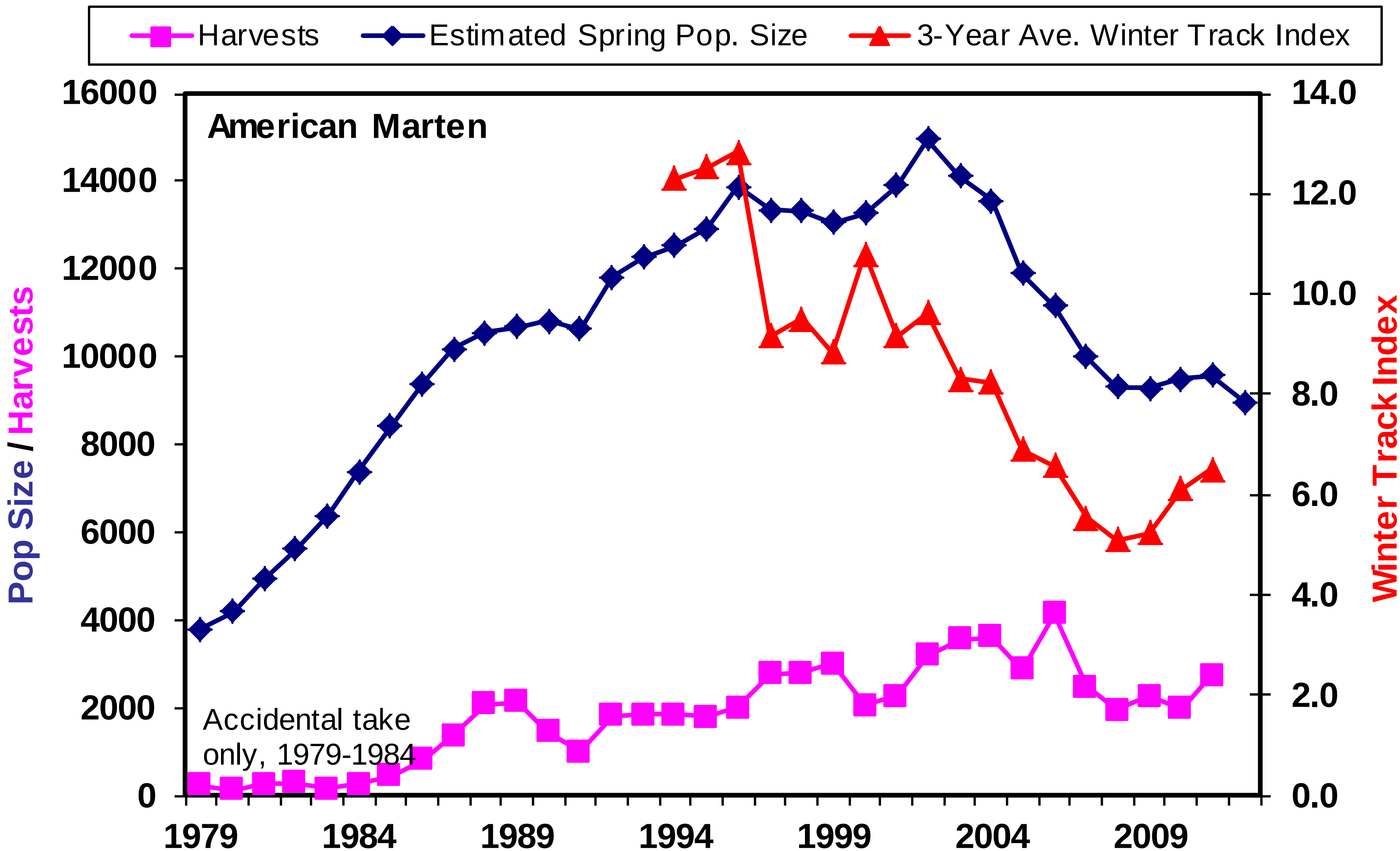

Figure 8. American marten populations, harvests, and survey indices, 1979-2012. Harvests include an estimate of non-reported take.

Table 4. Otter harvest data[1], 1982 to 2011. Carcasses were only collected from 1980-86.

Year	DNR harvest	Modeled Harvest[1]	% Autumn Pop. Harvested[2]	Carcasses examined	% juveniles	% yearlings	% adults	Juv:ad. females	% male juveniles	% male yearlings	% male adults	% males overall	Pelt price Otter[3]	Pelt price Beaver[3]
1982	385	625	9	389	51	26	23	6	57	65	65	60	$26	$11
1983	408	604	8	433	42	31	27	3.7	56	57	57	56	$25	$12
1984	529	561	7	549	48	23	29	3.2	47	50	49	49	$22	$12
1985	559	572	7	572	43	23	34	2.2	53	50	43	51	$21	$15
1986	777	777	8	745	45	23	32	2.7	45	48	46	47	$24	$20
1987	1386	1484	15	-	-	-	-	-	-	-	-	52	$23	$17
1988	922	922	9	-	-	-	-	-	-	-	-	52	$22	$14
1989	1294	1294	12	-	-	-	-	-	-	-	-	52	$22	$12
1990	888	903	8	-	-	-	-	-	-	-	-	52	$24	$9
1991	855	925	8	-	-	-	-	-	-	-	-	51	$25	$9
1992	1368	1365	10	-	-	-	-	-	-	-	-	52	$30	$7
1993	1459	1368	10	-	-	-	-	-	-	-	-	52	$43	$10
1994	2445	2708	19	-	-	-	-	-	-	-	-	52	$48	$14
1995	1435	1646	12	-	-	-	-	-	-	-	-	52	$39	$12
1996	2219	2500	18	-	-	-	-	-	-	-	-	52	$39	$19
1997	2145	2313	17	-	-	-	-	-	-	-	-	52	$40	$17
1998	1946	2139	16	-	-	-	-	-	-	-	-	52	$34	$13
1999	1635	1717	13	-	-	-	-	-	-	-	-	52	$41	$11
2000	1578	1750	13	-	-	-	-	-	-	-	-	52	$51	$14
2001	2301	2531	18	-	-	-	-	-	-	-	-	57	$46	$13
2002	2145	2390	16	-	-	-	-	-	-	-	-	59	$61	$10
2003	2766	2966	20	-	-	-	-	-	-	-	-	57	$85	$12
2004	3450	3700	25	-	-	-	-	-	-	-	-	56	$87	$14
2005	2846	3018	22	-	-	-	-	-	-	-	-	58	$89	$15
2006	2720	2873	22	-	-	-	-	-	-	-	-	56	$43	$17
2007	1861	1911	15	-	-	-	-	-	-	-	-	55	$29	$16
2008	1938	1983	15	-	-	-	-	-	-	-	-	59	$24	$12
2009	1544	1578	12	-	-	-	-	-	-	-	-	59	$36	$13
2010	1814	1830	13	-	-	-	-	-	-	-	-	57	$35	$13
2011	2294	2490	17	-	-	-	-	-	-	-	-	58	$51	$17

[1] Includes DNR and Tribal harvests

[2] Estimated from population model. Incl. estimated non-reported harvest of 30% to 1991, 22% from 1992-2001, and 10% from 2002-present.

[3] Weighted average of spring (beaver only) and fall prices based on a survey of in-state fur buyers.

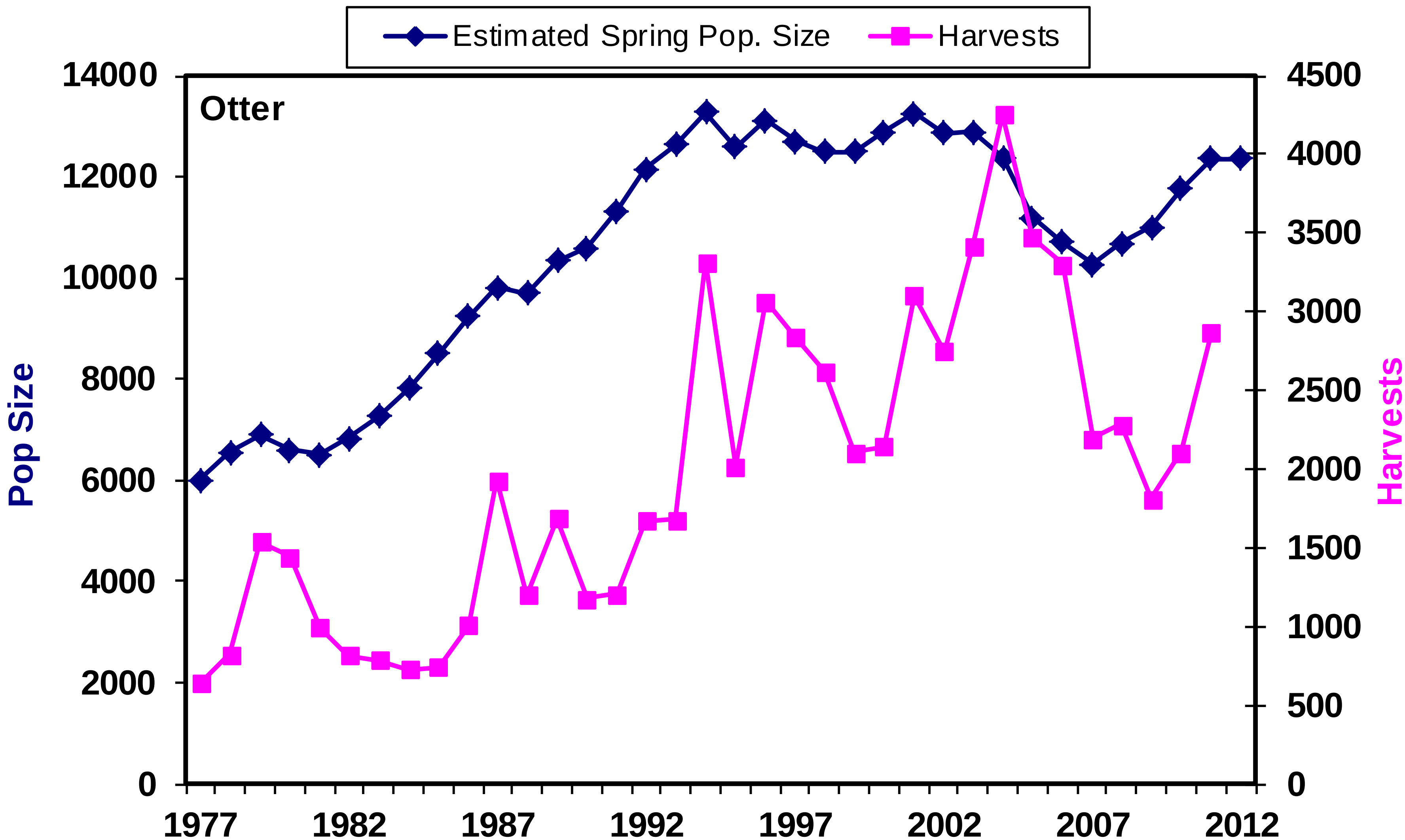

Figure 9. Otter populations and harvests, 1977-2012. Harvests include an estimate of non-reported take.