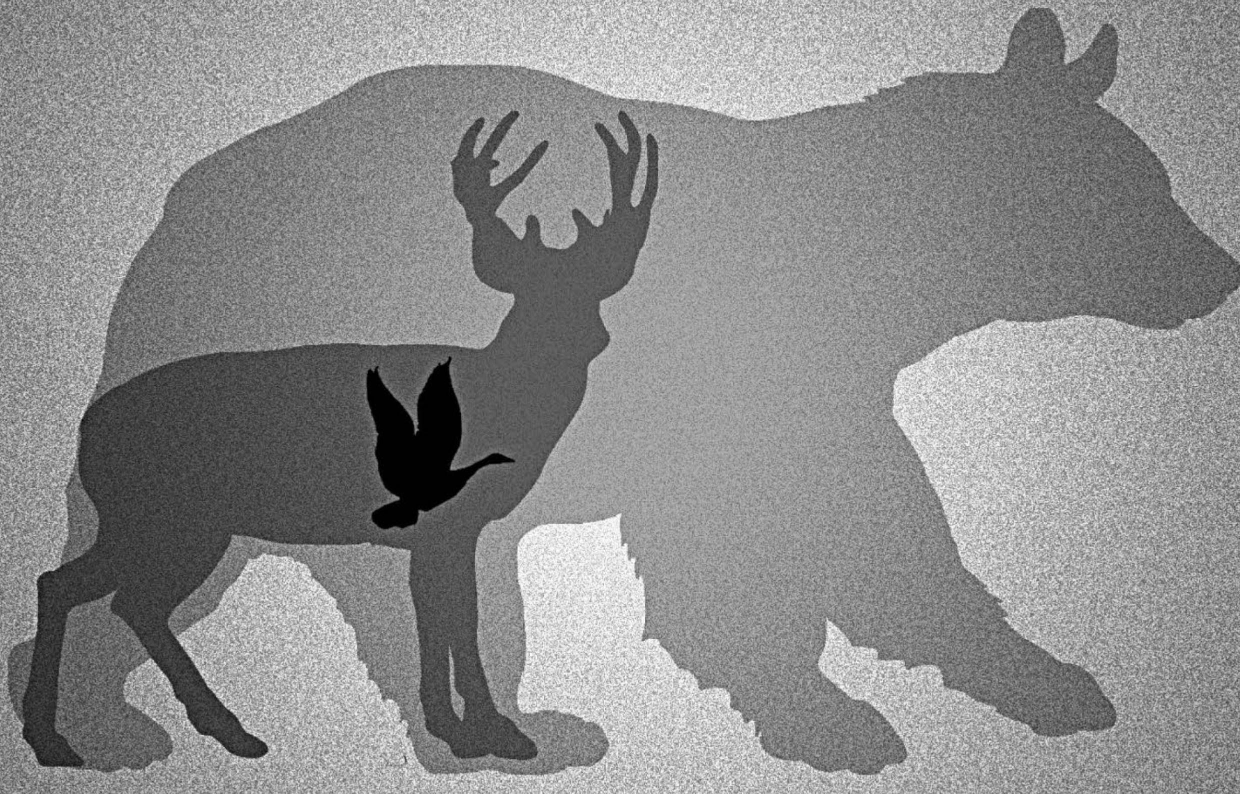

Status of Wildlife Populations

Fall 2017

Minnesota Department of Natural Resources
Division of Fish and Wildlife
St. Paul, Minnesota

DEPARTMENT OF NATURAL RESOURCES

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Status of Wildlife Populations, Fall 2017

(Including 2007-2017 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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Status of Wildlife Populations, Fall 2017

(Including 2007-2017 Hunting and Trapping Harvest Statistics)

This is the 41st 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.

Compiling and publishing this report was funded in part under the Federal Aid in Wildlife Restoration Act, Minnesota project W-69-S.

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FARMLAND WILDLIFE POPULATIONS

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DEPARTMENT OF NATURAL RESOURCES

2017 MINNESOTA AUGUST ROADSIDE SURVEY

Lindsey N. Messinger & Nicole M. Davros, Farmland Wildlife Populations and Research Group

SUMMARY OF FINDINGS

A decrease in grassland habitat acres (primarily Conservation Reserve Program (CRP) lands) is likely linked to a decrease in Minnesota's 2017 population indices for ring-necked pheasants and gray partridge. The 2017 range-wide pheasant index (38.1 birds/100 miles) was 26% below the 2016 index. Indices for pheasants and gray partridge were both below their 10-year and long-term averages. Range-wide indices for cottontail rabbits and white-tailed deer were similar to 2016. The white-tailed jackrabbit, mourning dove, and sandhill crane indices decreased in 2017 and mourning dove indices remained below their 10-year and long-term averages.

INTRODUCTION

This report summarizes the 2017 Minnesota August Roadside Survey (ARS). Since 1955, the ARS has been conducted annually during the first two weeks of August by Minnesota Department of Natural Resources (MN DNR) wildlife and enforcement personnel throughout Minnesota's farmland regions (Fig. 1). The 2017 ARS consisted of 171 25-mile routes (1-4 routes/county); 151 routes were located in the ring-necked pheasant range.

Observers drove each route during the early morning (starting at or near sunrise) at 15-20 miles/hour and recorded the number of pheasants, gray (Hungarian) partridge, cottontail rabbits, white-tailed jackrabbits, white-tailed deer, mourning doves, sandhill cranes, and other wildlife they observed including information on sex and age of these species. 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 that are used to monitor annual changes and long-term trends in regional and range-wide populations. Results are reported by agricultural region (Fig. 1) and range-wide; however, population indices for species with low detection rates (e.g., white-tailed jackrabbits) are imprecise and should be interpreted cautiously.

Habitat Conditions

In Minnesota's farmland region, total undisturbed grassland habitat decreased in 2017 after a slight increase in 2016. Statewide, 5,244 habitat acres were lost since 2016 (pheasant range: 8,637 acres lost; greater prairie-chicken range: 5,660 acres lost). Conservation Reserve Program (CRP) enrollment decreased by 26,327 acres overall. CRP losses occurred within both the pheasant range (25,428 acres lost) and prairie-chicken range (9,880 acres lost). Acres enrolled in the Conservation Reserve Enhancement Program (CREP) held nearly steady in 2017 while acres enrolled in Reinvest in Minnesota (RIM), Wetlands Reserve Program (WRP), and RIM-WRP increased statewide (5,731 acres, 1,059 acres, and 1,914 acres, respectively). Despite loss of privately-owned undisturbed grassland habitat, publically-owned grassland habitat within the farmland regions increased in 2017. Federally-owned Waterfowl Production Areas (WPA) and U.S. Fish and Wildlife Service (USFWS) refuges increased by 3,040 acres and state-owned Wildlife Management Areas (WMA) increased by 9,269 acres. More WMA acres were gained in the pheasant range (8,492 acres) than the prairie-chicken range (816 acres). The USFWS added 2,422 acres of habitat in the pheasant range and 1,424 acres in the prairie-chicken range. Similar to 2016, remaining protected habitat accounts for 6.1% of the landscape within the pheasant range (range:

3-10%; Table 1).

Grassland and wetland habitat conservation remains a priority concern for Minnesota. Private-land conservation programs, including CRP, continue to make up a large portion of protected grassland habitat in the state (Fig. 2) but approximately 686,800 acres of CRP have been lost since 2007. The 2012 version of the Farm Bill placed a cap of 24 million acres nationwide on CRP, leading to a steady decline of habitat acres in recent years. The Farm Bill is up for renewal in 2018 and many conservation groups are asking for the nationwide cap on CRP to be increased to 40 million acres. Funding from the Legacy Amendment[1] has helped partially offset habitat losses but the pace has not kept up with the rate of CRP losses. Minnesota's Prairie Conservation Plan and Pheasant Summit Action Plan both offer a blueprint for moving forward with grassland and wetland habitat conservation strategies in the farmland regions, thereby helping partners prioritize lands acquired with Legacy Amendment funding.

Started in 2012, Minnesota's Walk-in Access (WIA) program continues to provide public hunting opportunities on private land that is already enrolled in existing conservation programs or has high quality natural habitat. In 2015, the U.S. Department of Agriculture (USDA) awarded a 3-year, $1.67 million grant to assist in the continued funding of the WIA program. As of July 2017, 232 sites totaling 26,756 acres spread across the Farmland regions of Minnesota were enrolled in the program and open to public hunting September 1 – May 31 where boundary signs are present. Hunters must purchase a $3 WIA Validation to legally access WIA lands. For more information on the WIA program, including the code of conduct for WIA lands, a printable atlas of enrolled sites by county, aerial photos of each site, interactive maps, and Global Positioning System (GPS) downloads, visit the WIA program website. Minnesota DNR is still seeking permanent funding to continue the program into the future.

Weather Summary

Minnesota's winter 2016-2017 (1 December 2016 – 31 March 2017) was warmer across the state with average temperatures 3.4 - 4.0°F above thirty-year normals (Table 2; Minnesota Climatology Working Group [MCWG] 2017a, Climate Summary). Winter snow cover was variable across the farmland zone, but snow depths exceeding 6 inches lasted several weeks in the Northwest and West Central regions (MCWG 2017b, MCWG Climate Summary). By March, snow depths of less than 1.5 inches were recorded across the state except for the Northwest.

Spring (1 April – 31 May) temperatures were at or below thirty-year normals statewide and precipitation varied widely across the farmland regions. The Central and East Central regions experienced higher than normal rainfall (>1 inch departure from normal) with 8.1 and 8.4 inches of rain during spring 2017 respectively.

Summer (1 June – 31 July) was warm and dry across the state with temperatures 2.3 – 4.1 °F above thirty-year normal temperatures. Rainfall across the state was near or below average during June and July. Overall, the conditions for over-winter survival of wildlife were average to above average throughout the farmland zone. Although some localized areas received excessive snowfall during the winter months, these snow events were localized and outside the core pheasant range. Rainfall during May and June (the prime period for nesting birds) was above normal in some areas and normal- to cooler-than-normal temperatures may have impacted nest success and chick survival, especially early in the nesting season.

Survey Conditions

The survey period was extended (28 July – 19 August) to allow survey routes (n=171) to be

[1]Minnesota's Legacy Amendment, passed in 2008, is a 25-year constitutional amendment that increases the state sales tax by 3/8 of 1%. A large portion of the funding generated by this amendment is dedicated to protecting drinking water sources and protecting, enhancing, and restoring wetlands, prairies, and other wildlife habitat.

completed in 2017. Weather conditions during the survey ranged from excellent (calm winds, heavy dew, clear sky) to medium (light dew and overcast skies). Medium to heavy dew conditions were present at the start of 96% of the survey routes which was comparable to 2016 (97%) and slightly above the 10-year average (93%). Similar to 2016, clear skies (<30% cloud cover) were present at the start of 85% of routes. Wind speeds <7 mph were recorded for 97% of the routes.

Ring-Necked Pheasant

In 2017, the average number of pheasants observed range-wide (38.1 birds/100 mi) decreased 26% from 2016 and was 32% below the 10-year average and 62% below the long-term average (Table 3, Fig. 3A). Total pheasants observed per 100 mi ranged from 19.2 birds in the Southeast region to 54.6 birds in the South Central region (Table 4). The pheasant index showed substantial decreases in the Central (42%), East Central (61%) and Southwest (46%) regions. The best harvest opportunities will be in the West Central, Southwest, and South Central regions.

The range-wide hen index (5.8 hens/100 mi) decreased 26% from 2016 and was 34% below the 10-year average and 61% below the long-term average (Table 3). The hen index ranged from 2.3 hens/100 mi in the Southeast to 7.9 hens/100 mi in the South Central region. The 2017 hen index in all regions decreased since 2016 with the Southwest (-50.8%), East Central (-42.8%), and Central (-40.4%) regions showing the greatest percent change.

Across their range, the cock index (6.4 cocks/100 mi) increased 11% from 2016 but remained 8% below the 10-year average and 41% below the long-term average (Table 3). The cock index ranged from 1.7 cocks/100 mi in the Southeast to 8.6 cocks/100 mi in the South Central region. The 2017 indices increased in the Central (52.2%) and South Central (43.7%) regions while decreasing in the Southwest region (-29.8%). Indices were similar to 2016 in the West Central, East Central, and Southeast regions.

The 2017 hen:cock ratio (0.9) was less than the 2016 ratio (1.35) and was well below the average (1.40 ± 0.35) for the CRP years (1987-2017).

The 2017 range-wide brood index (5.7 broods/100 mi) decreased 34% from 2016 (Table 3). The index was 35% below the 10-year average and 57% below the long-term average. Regional brood indices ranged from 3.3 broods/100 mi in the Central region to 8.4 broods/100 mi in the Southwest. Brood indices decreased in all regions (range: -17.4% to -55.5%). The average brood size in 2017 (4.5 chicks/brood) was similar to 2016 and the 10-year average. However, the average brood size in 2017 was still 17% below the long-term average of 5.4 chicks/brood. The median estimated hatch date for pheasant broods across their range (8 June 2017, n = 217 broods) was slightly earlier than in 2016 (11 June) and the 10-year average (12 June; Table 3).

Although weather can drive year-to-year fluctuations in pheasant numbers, the amount of habitat on the landscape drives the longer term trends. Mild winters and breeding season weather conditions helped increase the pheasant indices over the past few years; however, the gradual but steady loss of habitat, especially CRP, has led to an overall decline in the pheasant population and harvest since the mid-2000s (Fig 2. & 3A).

Gray Partridge

The range-wide gray partridge index (1.3 birds/100 mi) decreased 63% from 2016 and was 60% and 90% below the 10-year and long-term averages, respectively (Table 3, Fig. 3B). No partridge were observed in the Northwest or West Central regions in 2017 (Table 4). Indices in regions where they were observed ranged from 0.5 birds/100 mi in the Central region to 5.1 birds/100 mi in the Southwest region. Intensified agricultural land use (e.g., corn and soybeans) has reduced the amount of suitable habitat for gray partridge in Minnesota. Additionally, gray partridge in their native range (southeastern Europe and northern Asia) are associated with arid climates and their reproductive success in the Midwest is limited except during successive dry years. Thus, gray partridge are more adversely affected by excessive rainfall during the breeding season compared to pheasants. The Southwest and Southeast regions will offer the best opportunities for harvesting gray partridge in 2017.

Cottontail Rabbit And White-Tailed Jackrabbit

Range-wide, the eastern cottontail rabbit index (7.7 rabbits/100 mi) increased 8% from 2016 and was 45% above the 10-year average and 28% above the long-term average (Table 3, Fig. 4A). Regionally, the cottontail rabbit index ranged from 1.3 rabbits/100 mi in the Northwest to 23.1 rabbits/100 mi in the East Central region (Table 4). Good harvest opportunities should exist in the Central, East Central, South Central, and Southeast regions.

At a historic low, the number of white-tailed jackrabbits observed range-wide (0.0 rabbits/100 mi) was 98% below the long-term average (1.7 rabbits/100 mi; Table 3, Fig. 4B). Minnesota's jackrabbit population peaked in the late 1950s, declined to low levels in the 1980s, and has continued to decline since then. The long-term decline in jackrabbits can primarily be attributed to loss of preferred habitats (i.e., pasture, hayfields, and small grains).

White-Tailed Deer

The white-tailed deer index (26.6 deer/100 mi) was similar to 2016 and was 52% above the 10-year average and 137% above the long-term average (Table 3, Fig. 5A). Regional roadside indices for deer ranged from 10.7 deer/100 mi in the South Central region to 55.2 deer/100 mi in the Northwest (Table 4).

Mourning Dove

The range-wide mourning dove index (138.9 doves/100 mi) was 6% lower than 2016, 28% below the 10-year average, and 46% below the long-term average (Table 3, Fig. 5B). Regional indices ranged from 60.3 doves/100 mi in the East Central region to 167.1 doves/100 mi in the South Central region (Table 4). The best opportunities for harvesting doves should be in the West Central, Southwest, and South Central regions.

Sandhill Crane

The 2017 roadside index of sandhill cranes was 11.9 total cranes/100 mi which decreased 23% from 2016 (Table 3). Regional indices ranged from 0.0 total cranes/100 mi in the Southeast and Southwest regions to 55.4 total cranes/100 mi in the East Central region (Table 4). The range-wide index of juveniles was 2.4 juvenile cranes/100 mi which increased slightly from 2016 (Table 3).

Other Species

Notable incidental sightings included: alder flycatcher (Polk County), American bittern (Todd County), badger (Swift County), black-billed magpie (Polk and Red Lake Counties), elk (Kittson County), greater prairie chicken (Clay County), green heron (Dodge County), mink (McLeod, Stearns, and Stevens Counties), pileated woodpecker (Red Lake County), red-headed woodpecker (Redwood and Renville Counties), sharp-tailed grouse (Kittson and Red Lake Counties), sora (Murray County), tiger salamander (Freeborn County), trumpeter swan (Kandiyohi County), and upland sandpiper (Pipestone County). American kestrels, American crow, bald eagles, Canada geese, coyotes, domestic cats, northern harrier, red fox, red-tailed hawks, and wild turkeys were also noted in multiple counties.

ACKNOWLEDGMENTS

We thank the many cooperators for their help in completing routes. This survey is simply not possible without their efforts. Tonya Klinkner was invaluable in providing logistical assistance and completing data entry. Tabor Hoek of the Minnesota Board of Water and Soil Resources provided enrollment data on cropland retirement programs in Minnesota, Kim Hennings (MN DNR) provided updated MN DNR land acquisition information, and Tamra Adams of the U.S. Fish and Wildlife Service provided federal land acquisition data. John Giudice reviewed an earlier draft of this report.

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Minnesota Climatology Working Group (MCWG). 2017a. MCWG Climate Summary Table. Accessed 9 August 2017.

Minnesota Climatology Working Group (MCWG). 2017b. MCWG Snow Depth and Snow Depth Ranking Maps. Accessed 9 August 2017.

Table 1. Abundance (total acres) and density (acres/mi2) of undisturbed grassland habitat within Minnesota's pheasant range, 2017, by agricultural region (AGREG).

	Cropland Retirement [a]					Public Lands			% of	Density
AGREG	CRP[b]	CREP	RIM	RIM-WRP	WRP	USFWS[c]	MNDNR[d]	Total	Landscape	ac/mi^2
WC[e]	246,470	37,755	22,975	14,275	20,124	197,750	110,747	650,096	10.0	61.0
SW	97,103	24,770	20,627	2,553	766	23,444	71,502	240,765	6.0	41.0
C	121,621	14,326	37,575	7,026	3,028	90,520	50,966	325,062	5.0	34.0
SC	86,665	27,633	13,585	10,703	8,981	9,494	36,310	193,371	5.0	31.0
SE	67,119	2,706	7,405	1,070	1,581	36,801	55,259	171,941	5.0	30.0
EC	2,949	0	1,131	0	4	4,993	91,829	100,906	3.0	20.0
Total	621,927	107,190	103,298	35,627	34,484	363,002	416,613	1,682,141	6.1	39.0

[a] Unpublished data, Tabor Hoek, BWSR, 16 August 2017.
[b] Acres reduced to account for estimated active CREP contracts reported within CREP column.
[c] Includes Waterfowl Production Areas (WPA) and USFWS refuges.
[d] MN DNR Wildlife Management Areas (WMA).
[e] Does not include Norman County.

Table 2. Average temperature, snow depth, and precipitation by season and agricultural region in Minnesota, 2017.

	Agricultural Region							
	NW	**WC**	**C**	**EC**	**SW**	**SC**	**SE**	**STATE**
Winter (December 1 - March 31)								
Temperature (average °F)	17.4	21.5	22.7	22.7	24.3	25.0	23.4	21.8
Departure from normal (°F)[a]	3.6	3.6	4.0	3.6	3.4	3.9	3.5	3.5
Snow Depth (average inches)	9.0[b]	2.9[b]	2.2	2.3	1.8	2.2	3.1	3.9
Spring (April 1 - May 31)								
Temperature (average °F)	48.9	50.7	50.8	50.0	51.4	52.8	50.5	49.8
Departure from normal (°F)[a]	0.1	-0.1	-0.3	-0.4	-0.4	0.5	-0.2	-0.2
Precipitation (total inches)	2.6	5.2	8.1	8.4	7.1	7.6	7.1	7.1
Departure from normal (inches)[a]	-0.8	0.1	1.1[c]	1.2[c]	0.4	0.2	0.6	0.6
Summer (June 1 - July 31)								
Temperature (average °F)	56.0	57.1	57.1	56.4	58.7	59.7	58.4	56.9
Departure from normal (°F)	4.1	2.7	2.4	2.3	2.8	3.4	3.2	2.8
Precipitation (total inches)	6.4	7.7	8.4	9.4	7.0	8.3	9.8	8.9
Departure from normal (inches)[a]	-0.3	-0.2	-0.2	0.1	-0.5	-0.5	0.1	0.0

[a] Departures calculated using thirty year NOAA average (1981-2010) over respective time period.
[b] At least one two-week period with snow depth exceeding 6 inches.
[c] Precipitation >1 inch above normal.

Table 3. Range-wide trends (% change) in number of wildlife observed per 100 miles driven, Minnesota August roadside survey, 1955-2017.

Species	**Change from 2016**[a]					**Change from 10-year average** [b]				**Change from long-term average (LTA)**[c]			
Subgroup	*n*	2016	2017	%	95% CI	*n*	2007-16	%	95% CI	*n*	LTA	%	95% CI
Ring-necked pheasant													
Total pheasants	152	51.4	38.1	-26	±18	148	52.3	-32	±13	149	94.6	-62	±9
Cocks	152	5.8	6.4	11	±25	148	6.9	-8	±17	149	10.7	-41	±13
Hens	152	7.8	5.8	-26	±20	148	8.1	-34	±15	149	13.7	-61	±10
Broods	152	8.6	5.7	-34	±16	148	8.2	-35	±12	149	12.5	-57	±9
Chicks per brood	217	4.4	4.5	4			4.6	-2			5.4	-17	
Broods per 100 hens	152	109.6	98.6	-10			101.1	-2			101.5	-3	
Median hatch date	217	11 J	8 June				12 June						
Gray partridge	171	3.6	1.3	-63	±65	167	3.4	-60	±43	149	14.4	-90	±17
Eastern cottontail	171	7.1	7.7	8	±22	167	5.3	45	±22	149	6.6	28	±22
White-tailed jackrabbit	171	0.1	0.0	-67	±93	167	0.2	-73	±51	149	1.7	-98	±14
White-tailed deer	171	27.2	26.6	-2	±17	167	17.7	52	±20	168	11.3	137	±32
Mourning dove	171	147.0	138.9	-6	±18	167	190.8	-28	±10	149	265.6	-46	±11
Sandhill crane[d]													
Total cranes	171	15.4	11.9	-23	±48								
Juveniles	171	2.1	2.4	10	±51								

[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 = long-term average during years 1955-2016, except for deer (1974-2016). 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.
[d] Cranes were added to the survey in 2009; thus, 10-year and long-term averages are not calculated.

Table 4. Regional trends (% change) in number of wildlife observed per 100 miles driven, Minnesota August roadside survey, 1955-2017.

Region	**Change from 2016**[a]					**Change from 10-year average**[b]				**Change from long-term average (LTA)**[c]			
Species	*n*	2016	2017	%	95% CI	*n*	2007-16	%	95% CI	*n*	LTA	%	95% CI
Northwest[d]													
Gray partridge	19	0.0	0.0			19	0.6	-100	±101	19	3.1	-100	±60
Eastern cottontail	19	2.1	1.3	-39	±117	19	0.6	116	±315	19	0.8	50	±197
White-tailed jackrabbit	19	0.0	0.2			19	0.2	-3	±225	19	0.6	-64	±92
White-tailed deer	19	69.0	55.2	-20	±37	19	44.4	24	±33	19	32.9	68	±35
Mourning dove	19	116.2	114.7	-1	±59	19	87.8	31	±82	19	118.3	-3	±64
Sandhill crane[e]	19	65.2	35.6	-45	±102								
West Central[f]													
Ring-necked pheasant	39	50.8	43.2	-15	±34	35	59.4	-45	±31	37	96.1	-64	±18
Gray partridge	39	0.0	0.0			35	0.8	-100	±97	37	9.2	-100	±21
Eastern cottontail	39	3.4	4.3	28	±65	35	2.6	66	±89	37	3.9	2	±59
White-tailed jackrabbit	39	0.3	0.0	-100	±114	35	0.2	-100	±66	37	2.2	-100	±19
White-tailed deer	39	31.5	26.7	-15	±35	35	18.1	55	±52	37	10.8	147	±82
Mourning dove	39	189.8	162.1	-15	±28	35	233.9	-31	±19	37	363.5	-55	±13
Sandhill crane	39	1.7	3.2	83	±204								
Central													
Ring-necked pheasant	30	42.7	24.7	-42	±46	30	43.3	-43	±31	29	71.2	-64	±20
Gray partridge	30	2.3	0.5	-77	±151	30	1.5	-63	±42	29	9.0	-94	±41
Eastern cottontail	30	6.7	7.2	8	±69	30	4.4	65	±66	29	6.2	16	±47
White-tailed jackrabbit	30	0.0	0.0			30	0.1	-100	±99	29	1.2	-100	±22
White-tailed deer	30	21.7	33.2	53	±42	30	12.7	161	±83	29	6.8	403	±186
Mourning dove	30	160.8	144.0	-11	±52	30	174.1	-17	±34	29	227.3	-35	±27
Sandhill crane	30	22.9	16.1	-30	±45								
East Central													
Ring-necked pheasant	13	54.1	20.9	-61	±53	13	50.9	-59	±24	13	84.5	-75	±22
Gray partridge	13	0.0	1.2			13	0.0			13	0.1		
Eastern cottontail	13	21.5	23.1	7	±53	13	11.7	97	±66	13	8.9	159	±82
White-tailed jackrabbit	13	0.0	0.0			13	0.0			13	0.2	-100	±64
White-tailed deer	13	30.1	24.6	-18	±43	13	19.2	28	±63	13	10.4	136	±99
Mourning dove	13	62.9	60.3	-4	±33	13	92.4	-35	±29	13	115.5	-48	±29
Sandhill crane	13	42.3	55.4	31	±63								

Table 4. Continued.

Region / Species	Change from 2016[a]					Change from 10-year average [b]				Change from long-term average (LTA)[c]			
	n	2016	2017	%	95% CI	*n*	2007-16	%	95% CI	*n*	LTA	%	95% CI
Southwest													
Ring-necked pheasant	19	96.0	51.7	-46	±44	19	95.8	-46	±24	19	113.6	-54	±21
Gray partridge	19	9.7	5.1	-48	±159	19	8.8	-42	±77	19	38.6	-87	±26
Eastern cottontail	19	6.1	5.1	-17	±80	19	5.6	-10	±47	19	8.0	-37	±41
White-tailed jackrabbit	19	0.4	0.2	-50	±185	19	0.6	-66	±103	19	3.6	-94	±21
White-tailed deer	19	27.8	16.6	-40	±46	19	18.6	-11	±35	19	10.2	63	±62
Mourning dove	19	182.1	165.9	-9	±28	19	272.0	-39	±15	19	307.5	-46	±19
Sandhill crane	19	0.0	0.0										
South Central													
Ring-necked pheasant	32	52.6	54.6	4	±35	32	51.1	7	±25	32	123.1	-56	±19
Gray partridge	32	7.5	0.9	-88	±85	32	6.6	-87	±57	32	17.9	-95	±21
Eastern cottontail	32	9.5	9.1	-4	±38	32	8.2	11	±33	32	7.7	18	±38
White-tailed jackrabbit	32	0.1	0.0	-100	±204	32	0.1	-100	±69	32	1.6	-100	±25
White-tailed deer	32	7.5	10.7	43	±63	32	6.1	76	±66	32	4.0	166	±104
Mourning dove	32	144.1	167.1	16	±62	32	249.5	-33	±19	32	254.4	-34	±38
Sandhill crane	32	2.1	1.0	-53	±107								
Southeast													
Ring-necked pheasant	19	17.9	19.2	7	±63	19	13.3	45	±83	19	67.2	-72	±32
Gray partridge	19	6.5	3.8	-42	±171	19	5.5	-31	±171	19	12.6	-70	±67
Eastern cottontail	19	7.5	11.3	50	±60	19	7.4	54	±47	19	7.7	46	±56
White-tailed jackrabbit	19	0.0	0.0			19	0.0			19	0.5	-100	±46
White-tailed deer	19	15.6	25.8	66	±94	19	15.6	65	±63	19	11.4	126	±88
Mourning dove	19	95.2	86.9	-9	±33	19	127.9	-32	±20	19	212.7	-59	±22
Sandhill crane	19	1.5	0.0	-100	±160								

[a] Based on routes (*n*) surveyed in both years.
[b] Based on routes (*n*) surveyed at least 9 of 10 years.
[c] LTA = long-term average during years 1955-2016, except for Northwest region (1982-2016) and white-tailed deer (1974-2016). Estimates based on routes (*n*) surveyed $\geq$40 years (1955-2016), except for Northwest ($\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.
[e] Cranes were added to the survey in 2009; thus, 10-year and long-term averages are not calculated.
[f] Two routes were added to the West Central region in 2014.

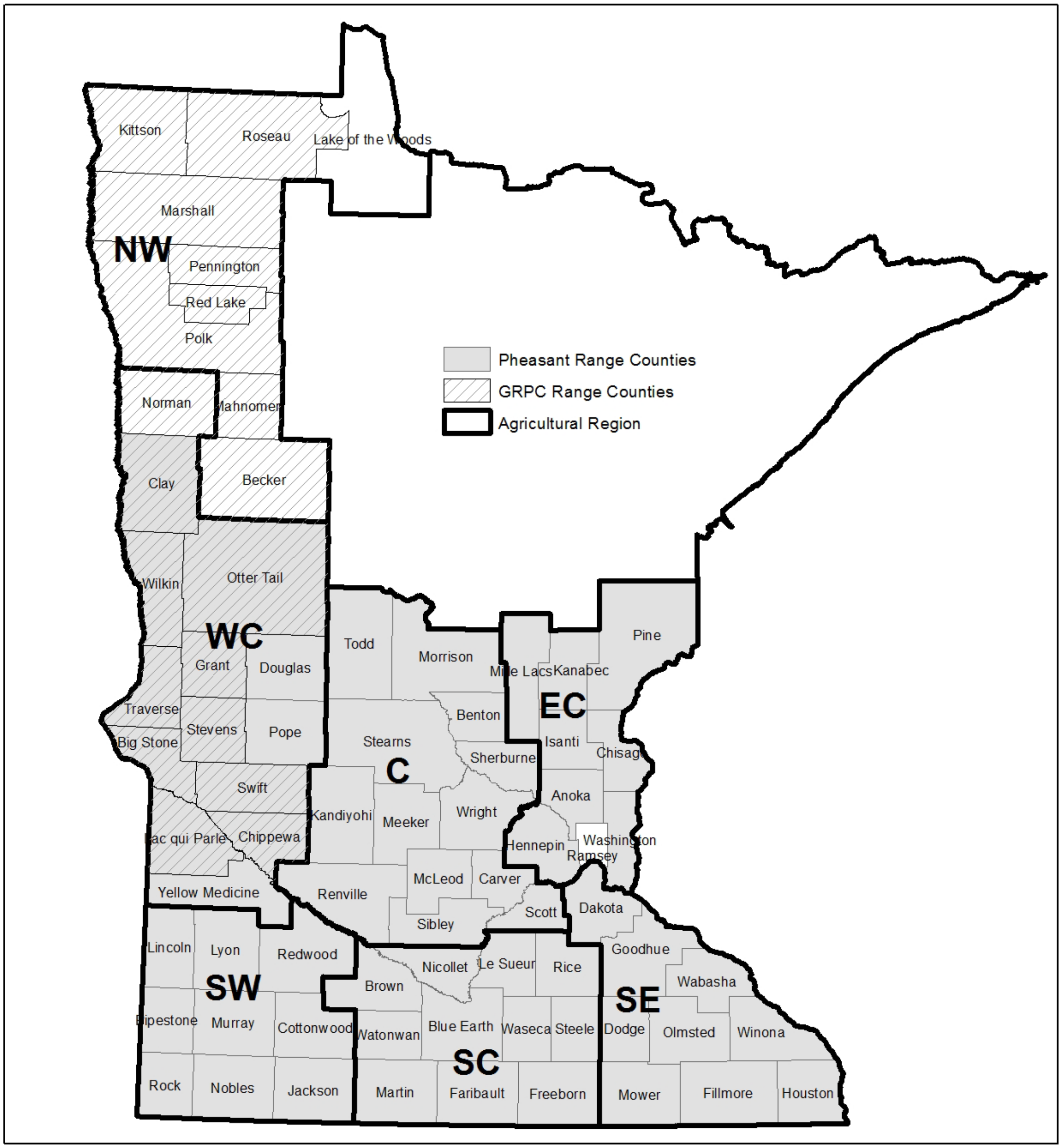


Figure 1. Survey regions, ring-necked pheasant range, and greater prairie-chicken (GRPC) range delineations for Minnesota's August roadside survey, 2017.

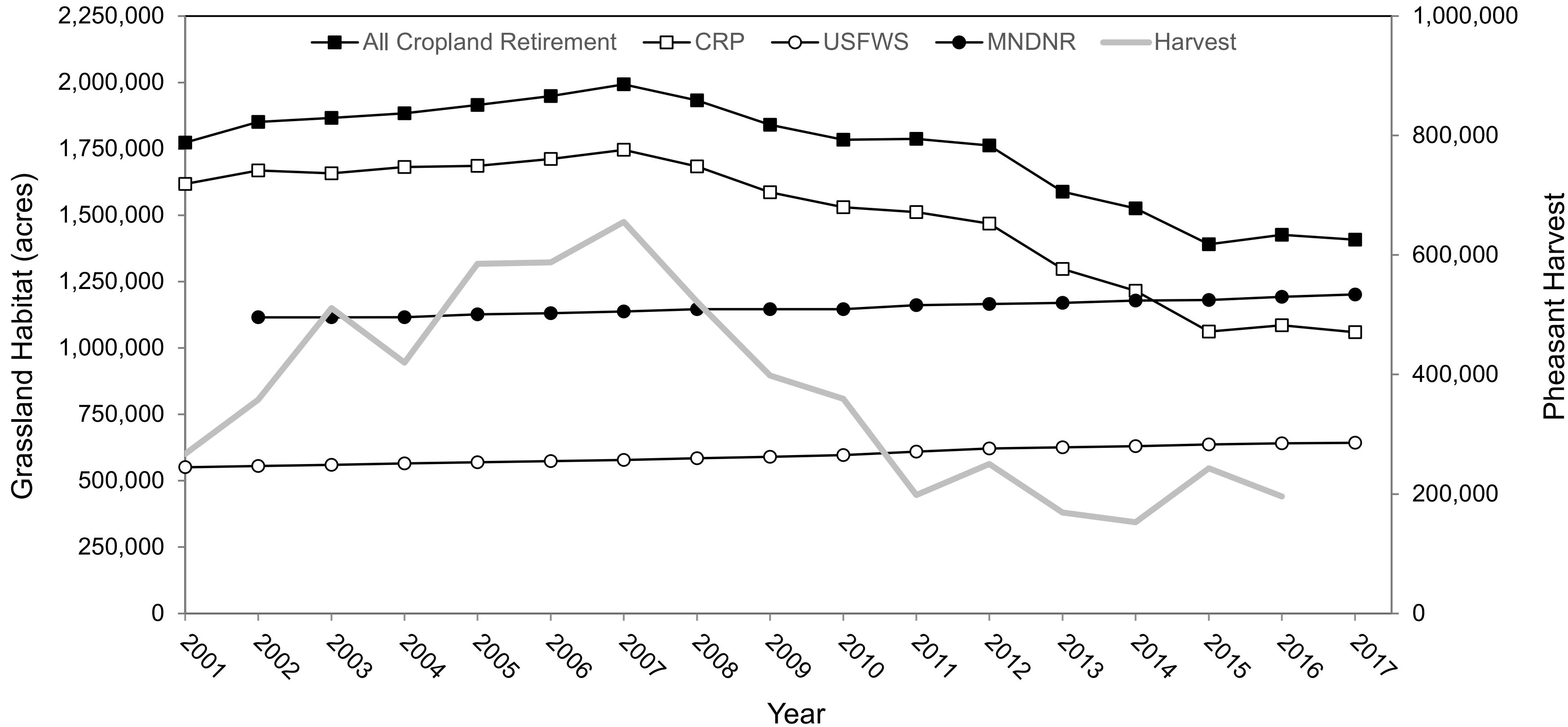


Figure 2. Acres enrolled in private (lines with open and solid squares) and public (lines with open and solid circles) land habitat conservation programs vs. ring-necked pheasant harvest trends (line with no markers) in Minnesota, 2001-2017. Acres represent STATEWIDE totals. All cropland retirement includes Conservation Reserve Program (CRP), Conservation Reserve Enhancement Program (CREP), Reinvest in Minnesota (RIM), Wetlands Reserve Program (WRP), and RIM-WRP.

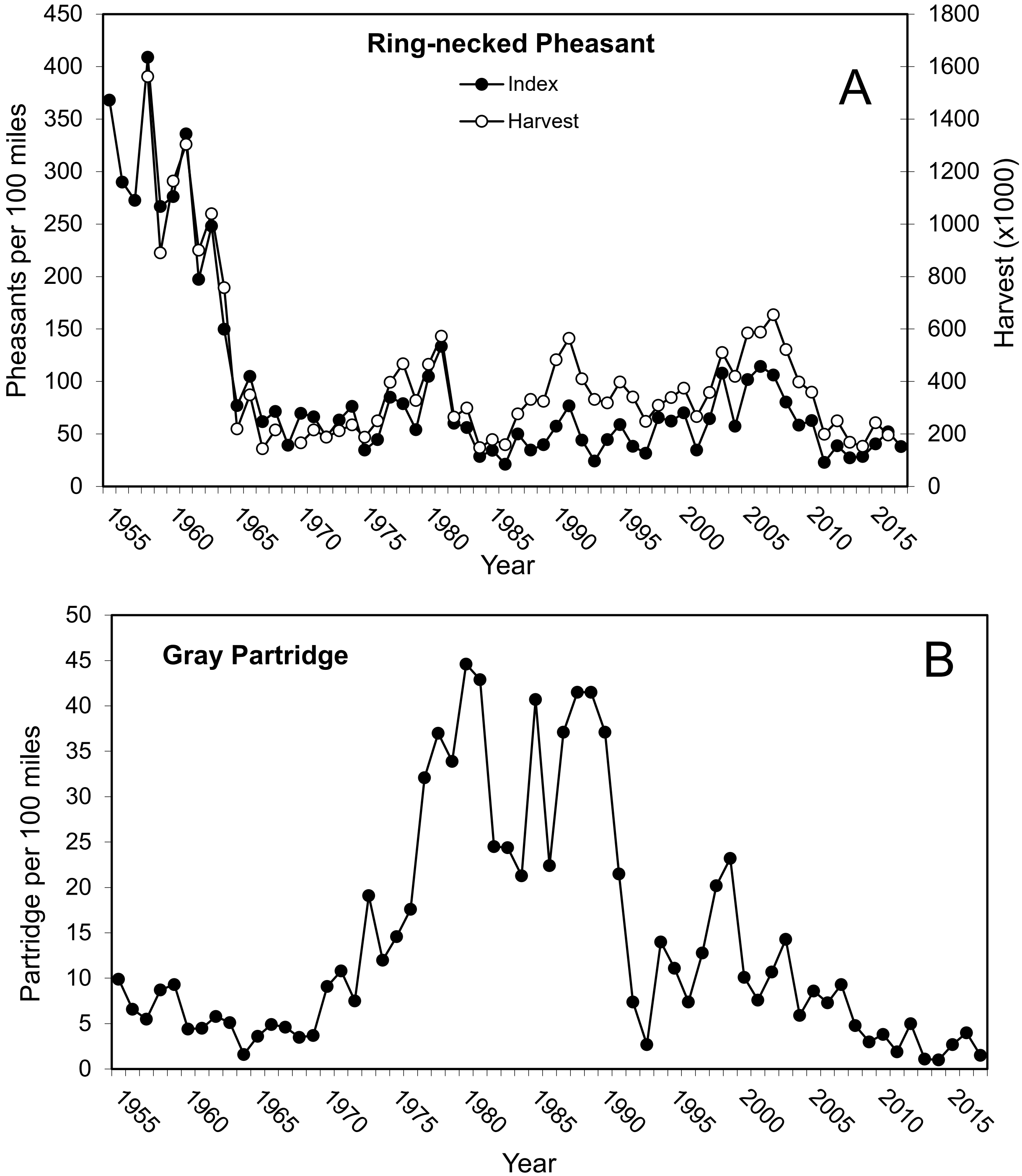


Figure 3. Range-wide index of ring-necked pheasants (A) and gray partridge (B) seen per 100 miles driven in Minnesota, 1955-2017. Does not include the Northwest region. Based on all survey routes completed.

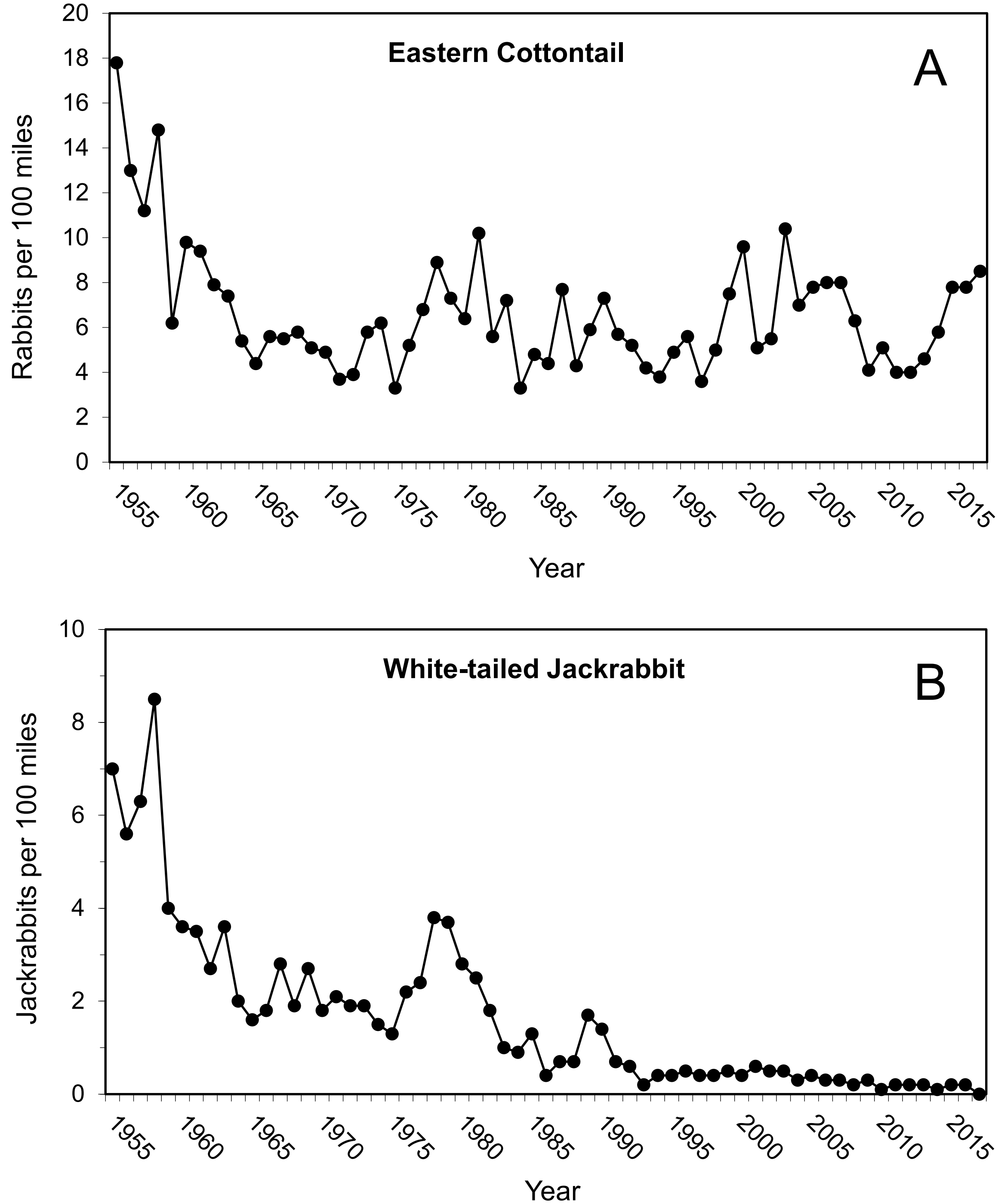
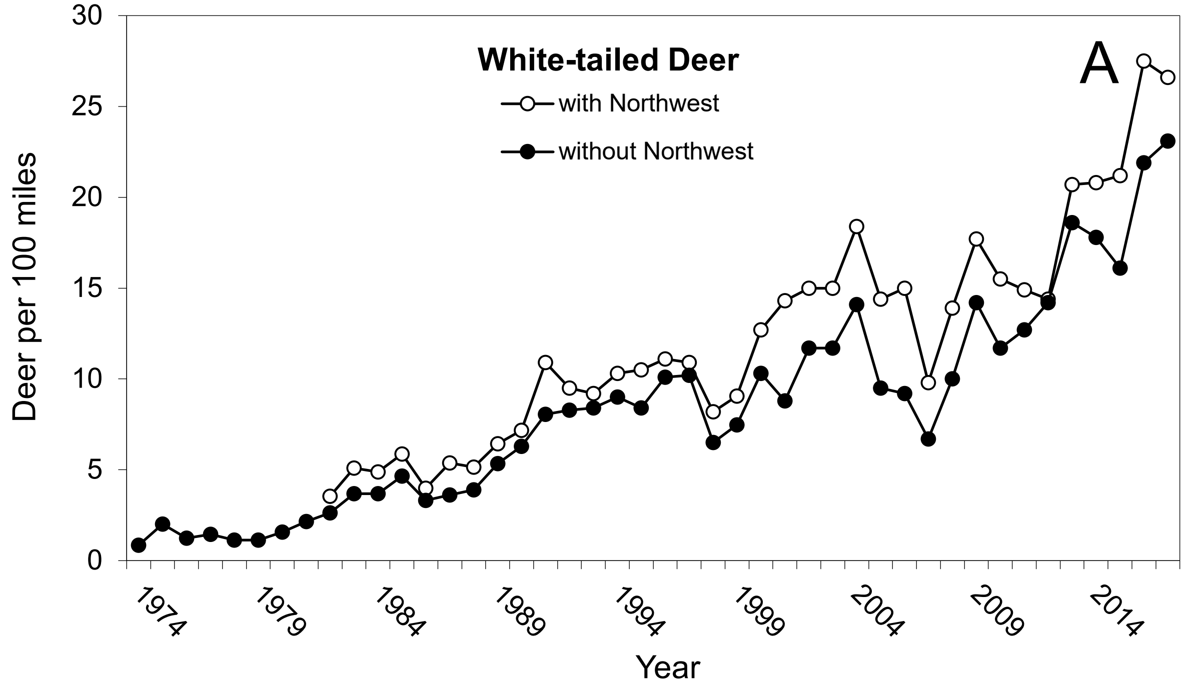


Figure 4. Range-wide index of eastern cottontail (A) and white-tailed jackrabbits (B) seen per 100 miles driven in Minnesota, 1955-2017. Does not include the Northwest region. Based on all survey routes completed.



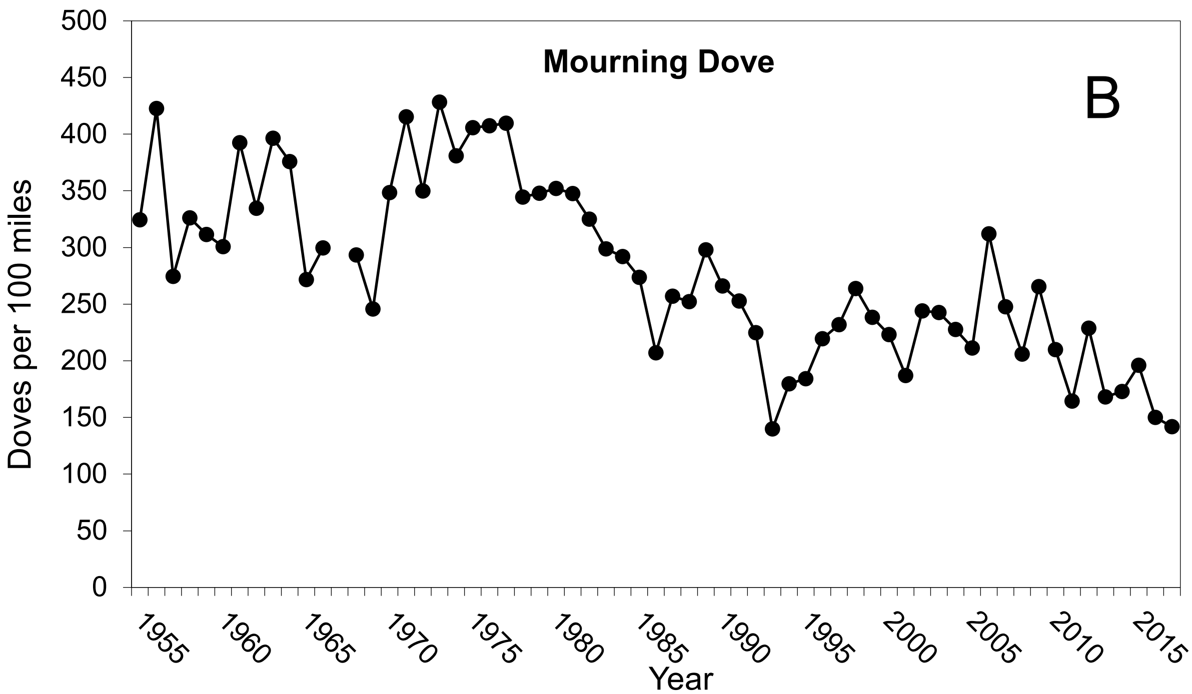


Figure 5. Range-wide index of: (A) white-tailed deer seen per 100 miles driven in Minnesota, 1974-2017, with and without the Northwest region included; and (B) mourning doves seen per 100 miles driven in Minnesota, 1955-2017. Doves were not counted in 1967 and the dove index does not include the Northwest region. Based on all survey routes completed.

DEPARTMENT OF NATURAL RESOURCES

MONITORING POPULATION TRENDS OF WHITE-TAILED DEER IN MINNESOTA - 2017

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INTRODUCTION

Hunting is the primary method used to manage white-tailed deer (*Odocoileus virginianus*) populations in Minnesota. Minnesota Department of Natural Resources (MNDNR) sets hunting regulations annually to adjust deer harvest to meet management goals. MNDNR wildlife researchers conduct simulation modeling of deer populations within deer permit areas (DPAs) to understand historical deer herd dynamics, predict population sizes, and to explore the impacts of various hunting regulations on populations. To aid in decision-making, the output from population modeling is considered along with deer harvest metrics, hunter success rates, surveys of hunter and landowner satisfaction with deer populations, and deer population goals set through a public process.

We used a stochastic population model to simulate annual variations in deer densities within individual DPAs. We defined ranges of values for fecundity and survival by sex- and age-classes of deer based on values from the primary literature and data from studies within Minnesota. This report summarizes the structure and parameters of the simulation model, and provides a description of recent trends in deer populations.

METHODS

Model Structure

We started each multi-year simulation in spring of the initial year before reproduction occurred (Figure 1). We specified an initial population density (see more about selection of initial population densities in Modeling Procedures section), and the model converted the initial population density into a total population size by multiplying the density by the total land area of the DPA. We set the proportion of adult deer by age- and sex-class in the initial population (adult females mean = 0.40 [SD = 0.02], adult males mean = 0.25 [SD = 0.02]).

Within each annual cycle, we applied age-specific fecundity rates to females to estimate reproduction. All age- and sex-classes were subjected to spring/summer mortality, and the result was the pre-hunt fall population. Deer that died as a result of hunting were subtracted from the pre-hunt population. Winter mortality rates were estimated by age-class relative to the severity of winter, and were applied to the post-hunt population. The remaining population represented the starting population size for the next stage of the simulation. We assumed that the effects of immigration and emigration on a population within a DPA were equal. In the following, we provide more detailed information about the selection of model parameters.

Reproduction

We used fecundity rates, from a range of values reported for Minnesota and Wisconsin (MNDNR unpublished data, Fuller 1990, McCaffery et al. 1998, DelGiudice et al. 2007, Dunbar 2007, Grund 2011, Wisconsin Department of Natural Resources 2014). Fecundity rates were partitioned by 2 age-classes of breeding females (i.e., <1 year old [yearling] when bred and ≥1 years old [adult] when bred) and were allowed to vary by 3 eco-geographic zones (northeast, farmland and transition areas, southeast) that reflected relative differences in climate and habitat quality. Fecundity rates were estimated to be lowest in the northeast (yearlings, mean = 0.06 [SD = 0.01]; adults, mean = 1.55 [SD = 0.03]), moderate in the farmland and transition zone (yearlings, mean = 0.10 [SD = 0.01]; adults, mean = 1.75 [SD = 0.03]), and greatest in the southeast (yearlings, mean = 0.15 [SD = 0.01]; adults, mean = 1.85 [SD = 0.03]). The sex ratio of fawns at birth in most deer populations is approximately 50:50, but may vary annually (Ditchkoff 2011). We allowed the proportion of male fawns at birth to vary between 0.48-0.52.

Spring/Summer Survival

Survival rates of deer during winter are dependent on the severity of winter conditions (Fuller 1990, DelGiudice et al. 2002). Likewise, the condition of breeding females following winter may directly influence survival of their newborn fawns (Verme 1977, Nixon et al. 1991, Carstensen et al. 2009). MNDNR calculates a winter severity index (WSI) in each DPA annually based on snow depth and minimum daily temperatures. WSI was calculated weekly by staff from Minnesota Information Technology Services at MNDNR. From 1 November through 31 May, 1 point was added to the WSI for each day with snow depths ≥ 15 in (38.1 cm). One point was also added to the WSI for each day when temperatures were $\leq 0^0$ F (-17.8^0 C). Therefore, the WSI accumulated 0, 1, or 2 points each day in a DPA. Winters were considered mild when the WSI was <100 and severe when WSI was ≥180.

We used estimates of spring/summer survival of fawns, from values reported in the primary literature for deer in Minnesota and populations in similar habitats (Huegel et al. 1985, Nelson and Mech 1986a, Nelson and Woolf 1987, Kunkel and Mech 1994, Brinkman et al. 2004, Vreeland et al. 2004, Rohm et al. 2007, Hiller et al. 2008, Carstensen et al. 2009). Fawn survival rates were adjusted to approximate the effects of winter severity on the condition of adult females during the previous winter. Mean spring/summer survival values for fawns were 0.80 (SD = 0.03), 0.65 (SD = 0.03), and 0.45 (SD = 0.03) following mild (WSI <100), moderate (100≤ WSI <180), and severe winters (WSI ≥180), respectively.

Spring/summer survival rates reported in the primary literature for adult deer ≥1 year old were relatively high and similar for both sexes (DeYoung 2011). We used default values for summer survival of adult deer from the population model previously used in Minnesota (Grund and Woolf 2004, Grund 2014) and allowed the values to vary stochastically (female = 0.97 [SD = 0.01], male = 0.98 [SD = 0.01]). These estimates overlapped values reported in the literature for Minnesota and populations in similar habitats (Nelson and Mech 1986a, Fuller 1990, Van Deelen et al. 1997, Whitlaw et al. 1998, Brinkman et al. 2004, Grund and Woolf 2004, Grund 2011, Grovenburg et al. 2011).

Fall Harvest and Survival

In most DPAs in Minnesota, hunter harvest represents the greatest source of mortality for deer populations in the fall (Fuller 1990, DelGiudice et al. 2006, Grovenburg et al. 2011).

We obtained harvest data from the MNDNR Electronic Licensing System. Hunters were required to register deer within 48 hours after harvest, indicate in which DPA the deer was harvested, and classify the deer as adult male, adult female, fawn male, or fawn female. We pooled harvest data for the archery, firearms, and muzzleloader seasons, special hunts, and harvest reported by Native American Tribes within DPAs.

We recognized that some deer were killed but not registered because hunters did not complete the registration process (Rupp et al. 2000), wounding loss occurred (i.e., deer was not recovered by the hunter and thus was not reported; Nixon et al. 2001), and deer were harvested illegally (Dusek et al. 1992). We applied a mean multiplier of 1.05 to the numerical harvest to account for non-registered deer.

Winter Survival

Winter severity, particularly snow depth, increases risk of deer mortality via starvation and predation, and fawns are more susceptible than adults (Nelson and Mech 1986b, DelGiudice et al. 2002). We estimated winter survival rates relative to winter severity based on studies conducted in Minnesota (Nelson and Mech 1986a, DelGiudice et al. 2002, Brinkman 2004, Grund and Woolf 2004, DelGiudice 2006, Grovenburg et al. 2011, Grund 2011). These studies reported survival rates similar to those observed in other deer populations in northern latitudes (Van Deelen et al. 1997, Whitlaw et al. 1998, DePerno et al. 2000, Dumont et al. 2000).

For adult deer, we set mean winter survival at 0.95 during mild winters. For moderate to severe winters, we used a linear equation to calculate survival as a function of winter severity (mean winter survival = $1 - [0.011 + 0.0015\ \text{WSI}]$) based on previous research in Minnesota. For fawns, we set the mean winter survival rate at 0.85 during mild winters. For moderate winters, the linear equation to calculate adult survival was used. However, an additional mortality rate of 0.05 was subtracted to simulate parallel but lower survival of fawns versus adults (mean winter survival = $(1 - [0.011 + 0.0015\ \text{WSI}]) - 0.05$). For severe winters, the equation was adjusted to simulate increased mortality reported for fawns in field studies (mean winter survival = $1 - [0.0054\ \text{WSI} - 0.33]$). For extremely severe winters (WSI >240), we set fawn survival at 0.033. We then allowed winter survival (for both fawns and adults) in any given model iteration to vary stochastically about the predicted mean using SD ≈ 0.02. Winter survival relationships were parameterized based on previous Minnesota research studies of radiocollared deer.

Modeling Procedures

To model each DPA, we tested several initial population densities including: 1) population estimates from field surveys when available for the starting year of the simulation (Haroldson 2014); 2) previous estimates from modeling (Grund 2014); or 3) a crude population estimate reconstructed from the reported harvest of adult males in the most recent deer season and given assumptions about the harvest rate of adult males, the proportion of adult males in the pre-hunt population, and the proportion of adults in the pre-hunt population.

To determine the most appropriate initial population density, we examined the modeled population trends relative to: 1) population estimates from field surveys when available within the years modeled; 2) the trend in reported deer harvest; and 3) the relationship between estimated population densities and adult male harvest success. To further refine the initial population density, we incrementally increased and decreased the density and re-examined the modeled trend relative to the aforementioned indices. In some cases, we also adjusted spring/summer survival of adult females ≤0.10 in conjunction with varying initial population densities.

We ran most model simulations for 8 years (2010-2017) with the final population estimate occurring pre-fawning for the spring following the most recent deer hunting season (i.e., spring 2017). All simulations were performed with the R programming language (ver. 3.3.2, R Core Team 2017). We used 500 Monte Carlo simulations (simulated draws from the stochastic distributions) until the most reasonable set of starting parameters was determined, and then used 5,000 simulations for the final run.

It is not logistically or financially feasible to conduct field studies on deer populations across all DPAs with regularity to estimate model input parameters. Population modeling requires researchers to make assumptions about these data based on prior studies (Hansen 2011). Because model input data rely on broad generalizations about herd demographics and survival rates, models simulating deer populations in small geographic areas would not be realistic. Grund and Woolf (2004) demonstrated that modeling small deer herds increased variability in model estimates, thus decreasing the ability to consider model outputs in making management decisions. Therefore, we did not model populations in DPAs that were small in area or where harvest data were limited.

RESULTS

Deer Population Trends and Management Recommendations

Although the parameters included in the model were derived from studies of deer in Minnesota or from studies in similar habitats and environmental conditions, uncertainty is inherent in modeling the dynamics of free-ranging deer populations. Our modeling allowed input parameters to vary stochastically to simulate uncertainty, and model outputs also included measures of uncertainty reflecting variation among model simulations. However, for ease of interpretation, we present mean pre-fawn deer densities in this document. We conducted simulation modeling in 121 of 130 DPAs in Minnesota to estimate deer densities before reproduction during spring 2017 (Table 1, Figure 2).

Following 3 deer seasons with relatively conservative management designations and 3 winters with mild conditions across most of the state, deer populations in most DPAs have increased. Fewer opportunities to harvest deer with either-sex permits in 2014, 2015, and 2016 protected female deer and fawn males from harvest. This allowed a carry-over of fawn males, which became antlered bucks legal for harvest during the 2015 and 2016 seasons. In 2016, buck harvest was more than 100,000 deer, which was >10% above the average for the previous 5 years. Consistent with this trend, substantial numbers of female deer were protected from harvest during 2014 to 2016, and population growth was accelerated.

Deer populations in most DPAs were approaching goal levels by spring 2016, and recommendations from MNDNR research for the 2016 deer season were aimed at identifying consistent regulations to begin to stabilize deer densities. Following another mild winter in 2016-2017, deer densities continued to increase across much of the state despite more liberal antlerless regulations in 2016. In terms of management intensity, the 2017 research recommendations would afford more antlerless deer harvest opportunities to hunters in approximately half of the DPAs versus the 2016 season. For most of the remaining DPAs, research recommendations in 2017 were the same as 2016, and only a few DPA recommendations afforded less antlerless harvest opportunity.

Farmland Zone

Deer populations in the majority of farmland DPAs were near goal levels. Antlerless harvest in the farmland zone was closely tied to the number of either-sex permits. We selected management designations to stabilize deer numbers with consistent regulations across years whenever possible. In most DPAs in the farmland region we recommended a lottery designation, with moderate to high allocations of either-sex permits. Less than 20% of the DPAs required Hunter Choice and Managed designations to stabilize deer numbers at appropriate levels.

Farmland-Forest Transition Zone

Deer populations in the Farmland-Forest Transition Zone are highly productive due to excellent habitat and generally milder winters as compared to the Forest Zone. Historical harvests and modeled population trends suggested that Lottery designations were not sufficient to stabilize deer numbers in most transition zone DPAs as evidenced by few DPAs with Lottery recommendations. For the 2017 season, we recommended Hunter Choice for one-third of DPAs and Managed for nearly half of DPAs. In 5 DPAs, Intensive designations will be necessary in

2017 to continue reducing deer densities toward goal level, 2 of which (DPA 346 and 349) we recommended additional antlerless seasons. In the metro area (DPA 601) and the chronic wasting disease management zone (DPA 603), unlimited antlerless opportunity will be available during the legal hunting seasons.

Forest Zone

Many deer populations in the Forest Zone with adequate habitat have recovered from the severe winter of 2013-14. For 2017, we recommended Bucks Only in 1 DPA, Lottery (with low to moderate allocation of either-sex permits) in nearly half of the DPAs, Hunter Choice in over one-third of DPAs, Managed in 4 DPAs, and Intensive in the DPA encompassing Duluth.

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Table 1. Estimated mean pre-fawn deer densities (deer/mi^2) derived from population model simulations in Minnesota deer permit areas, 2010-2017.

Deer Permit Area	Land area (mi^2)	Pre-fawn deer density[a]							
		2010	2011	2012	2013	2014	2015	2016	2017
101	496	8	7	8	9	8	9	11	13
103	1,820	4	3	4	4	3	3	4	5
105	740	13	12	13	14	10	10	13	15
108	1,651	7	6	7	7	5	5	7	8
110	529	18	16	17	15	11	11	14	16
111	1,438	3	2	3	3	2	2	3	3
114	116	-	-	-	-	-	-	-	-
117	927	-	-	-	-	-	-	-	-
118	1,220	5	5	5	5	4	4	4	5
119	770	9	7	8	8	5	6	7	8
126	942	5	4	4	5	3	3	3	3
130	746	7	5	5	5	3	3	4	5
131	899	5	4	4	4	2	2	2	2
132	482	10	8	8	7	4	5	6	7
133	352	18	14	14	13	7	8	9	11
152	61	12	12	12	13	11	13	16	20
155	593	16	16	17	18	15	17	21	26
156	825	16	16	16	16	10	10	13	15
157	673	21	20	20	20	20	21	23	26
159	571	17	16	16	17	12	13	16	19
169	1,124	14	12	14	13	9	10	13	15
171	701	12	12	12	12	10	12	14	16
172	687	20	20	21	22	19	21	26	32
173	584	10	10	11	11	8	8	10	12
176	921	12	10	11	11	7	8	10	12
177	480	20	17	17	17	11	11	14	16
178	1,195	16	14	13	13	8	8	11	13
179	862	20	18	18	18	11	11	13	14
181	629	18	15	13	14	8	9	12	15
182	267	-	-	-	-	-	-	-	-
183	663	14	14	15	16	11	12	15	19
184	1,229	21	20	22	20	16	17	21	25
197	955	13	12	13	12	9	10	12	15
199	148	9	9	10	10	7	8	10	13
201	161	10	9	10	12	9	11	13	15
203	118	12	13	16	27	28	24	32	40
208	379	5	5	5	5	4	5	7	8

[a] "-" indicates deer permit area was not modeled.

Deer Permit Area	Land area (mi^2)	Pre-fawn deer density[a]							
		2010	2011	2012	2013	2014	2015	2016	2017
209	640	9	8	8	9	7	7	9	10
210	615	13	11	11	10	8	8	9	10
213	1,057	15	13	14	15	16	18	20	23
214	554	24	24	26	27	25	27	29	32
215	701	16	16	18	19	18	20	22	24
218	884	9	9	10	11	11	12	13	15
219	391	11	12	12	13	13	14	16	18
221	642	14	14	15	15	13	14	16	19
222	413	17	17	18	17	14	15	17	20
223	376	12	13	13	15	14	16	18	20
224	47	16	16	16	18	18	21	25	31
225	618	18	18	18	19	16	18	20	22
227	472	18	19	20	20	18	20	21	24
229	284	7	8	8	9	10	12	14	18
230	452	3	4	3	3	3	3	4	4
232	377	5	5	5	5	6	6	8	9
233	385	5	4	5	5	5	5	6	6
234	636	-	-	2	2	2	2	3	3
235	34	-	-	-	-	-	-	-	-
236	370	17	17	17	18	16	18	20	23
237	728	-	-	3	3	2	3	3	3
238	95	-	-	-	-	-	-	-	-
239	919	14	12	13	12	12	12	13	14
240	643	21	20	21	22	20	22	24	26
241	996	28	28	29	31	26	27	29	32
242	214	24	24	24	24	20	20	24	27
246	840	17	17	17	17	16	18	22	27
247	228	19	19	20	20	17	19	21	23
248	214	20	19	20	19	15	15	16	17
249	502	17	16	16	18	16	16	19	23
250	713	-	-	3	3	3	3	3	4
251	55	-	-	-	-	-	-	-	-
252	715	3	3	3	3	3	3	4	4
253	974	3	3	3	3	3	3	4	4
254	929	4	4	4	4	4	4	4	5
255	774	4	4	5	5	5	6	6	7
256	654	6	6	6	7	7	7	8	10
257	412	8	8	8	9	8	8	10	12
258	343	23	20	23	21	18	20	22	25
259	490	24	23	22	21	16	19	22	26

[a] "-" indicates deer permit area was not modeled.

Deer Permit Area	Land area (mi^2)	Pre-fawn deer density[a]							
		2010	2011	2012	2013	2014	2015	2016	2017
260	1,249	3	3	3	4	3	4	5	6
261	795	2	2	2	3	3	4	5	6
262	677	3	2	3	3	3	3	4	4
263	512	8	7	9	10	8	10	13	16
264	669	10	10	11	13	12	14	17	20
265	494	8	7	8	9	9	10	12	15
266	617	5	4	5	5	5	6	7	9
267	472	4	4	4	5	4	5	6	7
268	228	10	9	9	10	8	9	11	13
269	650	3	3	3	3	3	3	4	4
270	748	2	2	2	2	3	3	3	4
271	632	3	2	2	2	3	3	3	4
272	531	3	2	2	2	2	3	3	4
273	571	-	6	6	6	6	7	8	9
274	354	-	5	5	5	6	6	7	8
275	764	-	4	4	4	4	4	4	5
276	542	8	7	8	8	9	10	11	13
277	812	12	11	11	12	13	14	15	16
278	402	-	7	6	6	6	6	7	8
279	344	-	5	5	5	4	4	4	5
280	675	3	3	3	3	3	3	3	3
281	575	5	5	5	6	7	8	9	11
282	778	2	1	2	2	2	2	3	3
283	613	-	3	3	4	4	4	4	5
284	838	-	-	4	3	3	3	3	4
285	549	5	4	4	5	5	6	6	8
286	446	-	-	5	5	5	5	6	7
287	46	-	-	-	-	-	-	-	-
288	625	-	-	6	5	5	5	5	6
289	815	2	2	2	2	2	3	3	4
290	662	5	5	5	5	5	6	6	7
291	800	6	6	6	6	6	7	8	9
292	479	8	7	8	9	10	12	14	17
293	511	8	7	7	8	8	9	11	12
294	686	-	4	4	4	4	5	5	6
295	839	-	-	4	4	4	5	5	6
296	667	3	3	3	3	3	4	5	5
297	438	3	3	3	3	3	3	4	5
298	618	10	8	10	10	9	11	14	18
299	386	5	5	5	5	5	6	6	7

[a] "-" indicates deer permit area was not modeled.

Deer Permit Area	Land area (mi^2)	Pre-fawn deer density[a]							
		2010	2011	2012	2013	2014	2015	2016	2017
338	454	5	5	6	6	6	7	8	10
339	394	6	6	6	7	7	7	8	9
341	612	16	15	15	15	15	15	16	17
342	349	17	17	17	17	17	18	19	21
343	663	13	13	13	13	13	13	13	14
344	190	20	20	20	21	20	19	19	20
345	323	12	12	13	15	15	17	19	21
346	318	29	32	32	34	34	33	31	29
347	434	9	10	10	11	11	11	12	13
348	332	18	18	19	20	20	21	24	24
349	490	24	25	26	27	28	27	25	24
601	1,625	-	-	-	-	-	-	-	-
603	372	-	-	-	-	-	-	-	-

[a] "-" indicates deer permit area was not modeled.

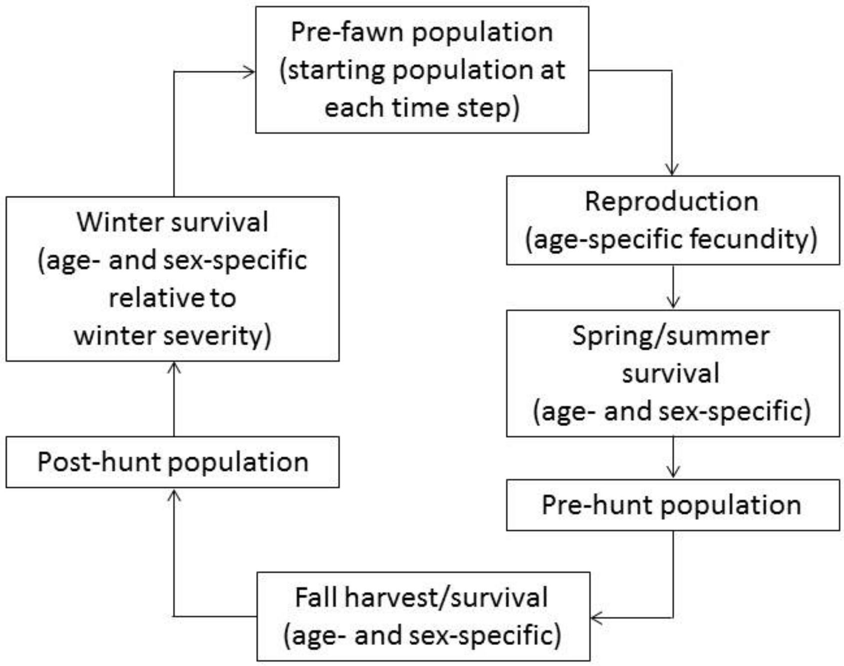

Figure 1. Model structure for simulations of white-tailed deer populations in Minnesota.

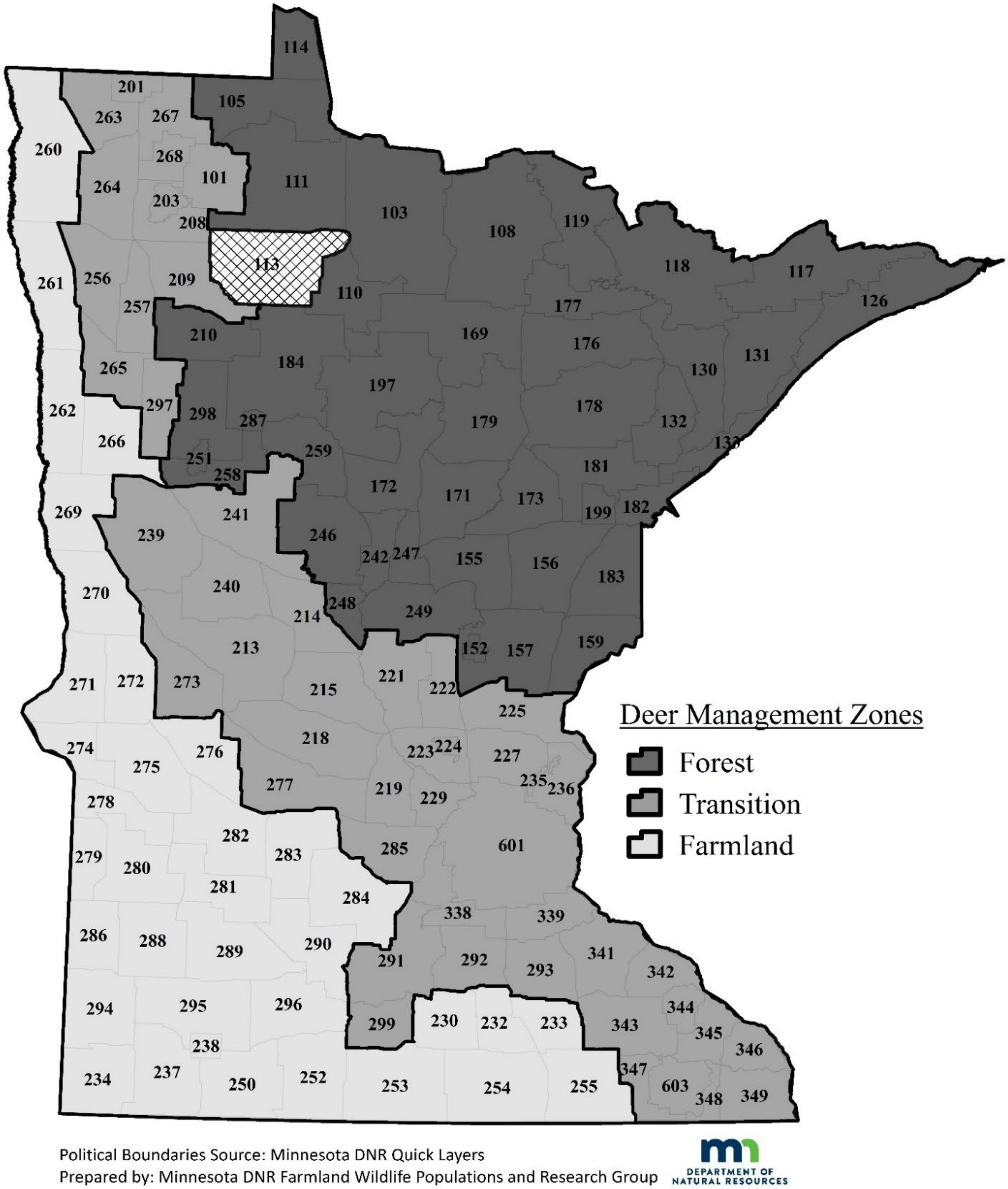

Figure 2. Deer permit areas (DPAs) in Minnesota and deer management zones used to describe deer population and harvest trends, 2017. DPAs were assigned to forest, transition, or farmland zones based on historical land cover and current woody cover. Generally, forested DPAs were composed of >60% woody cover, transition DPAs were composed of 6%-50% woody cover, and farmland DPAs were composed of <5% woody cover.

2017 WHITE-TAILED DEER SURVEYS

Brian S. Haroldson, Farmland Wildlife Populations and Research Group

John H. Giudice, Wildlife Biometrics Unit

INTRODUCTION

Management goals for animal populations are frequently expressed in terms of population size (Lancia et al. 1994). Accurate estimates of animal abundance allow for documentation of population trends, provide the basis for setting harvest quotas (Miller et al. 1997), and permit assessment of population and habitat management programs (Storm et al. 1992).

The Minnesota Department of Natural Resources (MNDNR) uses simulation modeling within 115 permit areas (PA) to estimate and track changes in white-tailed deer (*Odocoileus virginianus*) abundance and, subsequently, to aid in developing harvest recommendations to manage deer populations toward goal levels. In general, model inputs include estimates of initial population size, reported harvest, and spatial and temporal estimates of survival and reproduction for various age and sex cohorts. Because simulated population estimates are subject to drift as model input errors accumulate over time, it is recommended that managers collect additional data to develop ancillary indices of changes in deer populations or periodically recalibrate models with independent deer population estimates (Grund and Woolf 2004).

Our objective was to use aerial surveys by helicopter to provide independent estimates of deer abundance in select deer PAs, where the 90% confidence interval bound on each estimate was within 20% of the estimate (Lancia et al. 1994). Estimates within these bounds were used to recalibrate population models to improve population management.

METHODS

After the discovery of chronic wasting disease (CWD) in 3 hunter-killed white-tailed deer in southeast Minnesota during November-December 2016, a CWD survey area was created, incorporating portions of PA 343, 345, 347, and 348 (Figure 1). We estimated deer populations in the CWD area plus PA 348 using a quadrat-based, aerial survey design. Quadrat surveys have been used to estimate populations of caribou (*Rangifer tarandus*; Siniff and Skoog 1964), moose (*Alces alces*; Evans et al. 1966), and mule deer (*O. hemionus*; Bartmann et al. 1986) in a variety of habitat types. Within each area, quadrats were delineated by Public Land Survey (PLS) section (640 ac) boundaries. We used a stratified, spatially-balanced sampling design, with geographic subunits and woody cover as stratification variables. Geographic subunits included:

1. Core 1 – 12 PLS sections surrounding kill locations of first 2 CWD positive deer (Figure 1);
2. Core 2 – 9 PLS sections surrounding kill location of third CWD positive deer;
3. West – formerly part of PA 347;
4. Central – formerly part of PA 348;
5. North – formerly part of PAs 343 and 345;
6. East – residual part of PA 348;

We used regression trees (Fabrizi and Trivisano 2007, Fieberg and Lenarz 2012), the R programming language (R Core Team 2016), and R package 'stratification' (Baillargeon and Rivest 2016) to classify the PLS sections within each geographic subunit, excluding the 2 Core units, as "low" or "high" based upon past helicopter counts of deer and abundance of woody cover within each section. Woody cover data were derived from the 2006 National Land Cover Database (Fry et al. 2011). Thus, our design had 10 mutually exclusive strata. We used optimal allocation, R package 'spsurvey' (Kincaid and Olsen 2016), and a generalized random tessellation stratified procedure (GRTS; Stevens and Olsen 2004) to draw random samples among strata within each survey area.

During both surveys, we used an MD-500E helicopter, a new addition to the MNDNR fleet, and attempted to maintain flight altitude at 200 ft (60 m) above ground level and airspeed at 50-60 mph (80-97 km/hr). A pilot and 2 observers searched for deer along transects spaced at 0.17-mi (270-m) intervals until they were confident all "available" deer were observed. When animals fled the helicopter, direction of movement was noted to avoid double counting. We used a real-time, moving-map software program (DNRSurvey; Haroldson et al. 2015), coupled to a global positioning system receiver and a convertible tablet computer, to guide transect navigation and record deer locations, direction of movement, and aircraft flight paths directly to ArcGIS (Environmental Systems Research Institute, Redlands, CA) shapefiles. To maximize sightability, we completed surveys during winter when snow cover measured at least 6 in (15 cm) and we varied survey intensity as a function of cover and deer numbers (Gasaway et al. 1986).

We implemented double sampling (Eberhardt and Simmons 1987, Thompson 2002) on a subsample of quadrats within the combined survey areas to estimate sightability of deer from the helicopter. We sorted the sample of survey quadrats by woody cover abundance, excluded quadrats likely to contain no deer (e.g., quadrats where woody cover < 40 ac [0.17 km^2]), and selected a 4% systematic subsample of sightability quadrats. Immediately after completing the operational survey on each sightability quadrat, a second more intensive survey was flown at reduced speed (40-50 mph [64-80 km/hr) to identify animals that were missed (but assumed available) on the first survey (Gasaway et al. 1986). We used geo-referenced deer locations, group size, and movement information from DNRSurvey (Haroldson et al. 2015) to "mark" deer (groups) observed in the operational survey and help estimate the number of "new" (missed) animals detected in the sightability survey. We used a binary logistic model to estimate average detection probabilities (i.e., the conditional probability of detection given animals are present in the sampling unit and available for detection) for each PA.

We used the R package 'spsurvey' (Kincaid and Olsen 2016) to compute deer abundance and density (mean count per quadrat) indices within each stratum, where indices were expanded for sampling but not sightability. We used the local mean variance estimator (Kincaid and Olsen 2016) with a finite population correction to compute stratum-specific estimates of sampling variance. We summed stratum-specific estimates by management unit (simple domain analysis, where domains did not cross stratum boundaries; Cochran 1977:34) to compute deer abundance and density indices for PA 348 (composed of 6 strata) and the CWD survey area (composed of 8 strata). We used a Horvitz-Thompson estimator (Thompson 2002:53, Fieberg and Giudice 2008) to convert population indices to population estimates (adjusted for sightability), and the Delta method (Seber 1982:9) to compute the variance. We evaluated precision using coefficient of variation (CV), defined as standard deviation of the population estimate divided by the population estimate, and relative error, defined as the 90% confidence interval bound divided by the population estimate (Krebs 1999).

RESULTS AND DISCUSSION

Due to limited snow cover, we completed only 1 recalibration survey (PA 348) during winter 2016-2017 (Table 1). Results from the CWD survey are reported online. Within PA 348, the survey crew observed 2,069 deer on 78 quadrats for a mean density of 27 deer/quadrat (range = 0 to 115 deer/quadrat). Deer were observed in 91% of sample quadrats (Table 2). Mean density on quadrats with at least 1 deer detection was 29 deer/quadrat. In addition, mean group size was 4 and mean number of groups per "occupied" quadrat was 7.

We collected visibility data on 18 quadrats, with 16 of those quadrats containing deer (mean = 26 deer/quadrat; range = 2 to 56). The number of deer missed on the initial survey of each sightability quadrat ranged from 0 to 9 (mean = 4). Overall, mean estimated sightability was 0.85 (SE = 0.017), which was slightly higher than mean sightability for aerial deer surveys in adjoining PAs in the past (mean = 0.74). This may reflect increased observer visibility afforded by the new helicopter, but more visibility surveys must be conducted with this aircraft to validate this observation. Correcting for sightability increased relative variance (CV [%]) of population estimates by 3%, which was a reasonable tradeoff between decreased bias and increased variance, although costs associated with the sightability surveys are also important. However, we caution that our sightability estimates are conditional on animals being available for detection (Johnson 2008, Nichols et al. 2009). Unfortunately, like many other wildlife surveys, we have no estimates of availability or how it varies over space and time. Our approach also assumes that sightability is constant across animals and quadrats. Heterogeneity in detection probabilities can lead to biased estimates of abundance. Common methods for correcting for heterogeneous detection probabilities include distance sampling, mark-recapture methods, and logistic-regression sightability models (based on radio-marked animals). We did not have marked animals in our populations, and relatively high densities of deer in our survey areas would present logistical and statistical problems for distance sampling and double-observer methods (Nichols et al 2000, Bart et al 2004). Therefore, our double-sampling approach is a reasonable alternative to using unadjusted counts or applying more complicated methods whose assumptions are difficult to attain in practice. Nevertheless, our population estimates must still be viewed as approximations to the truth.

ACKNOWLEDGMENTS

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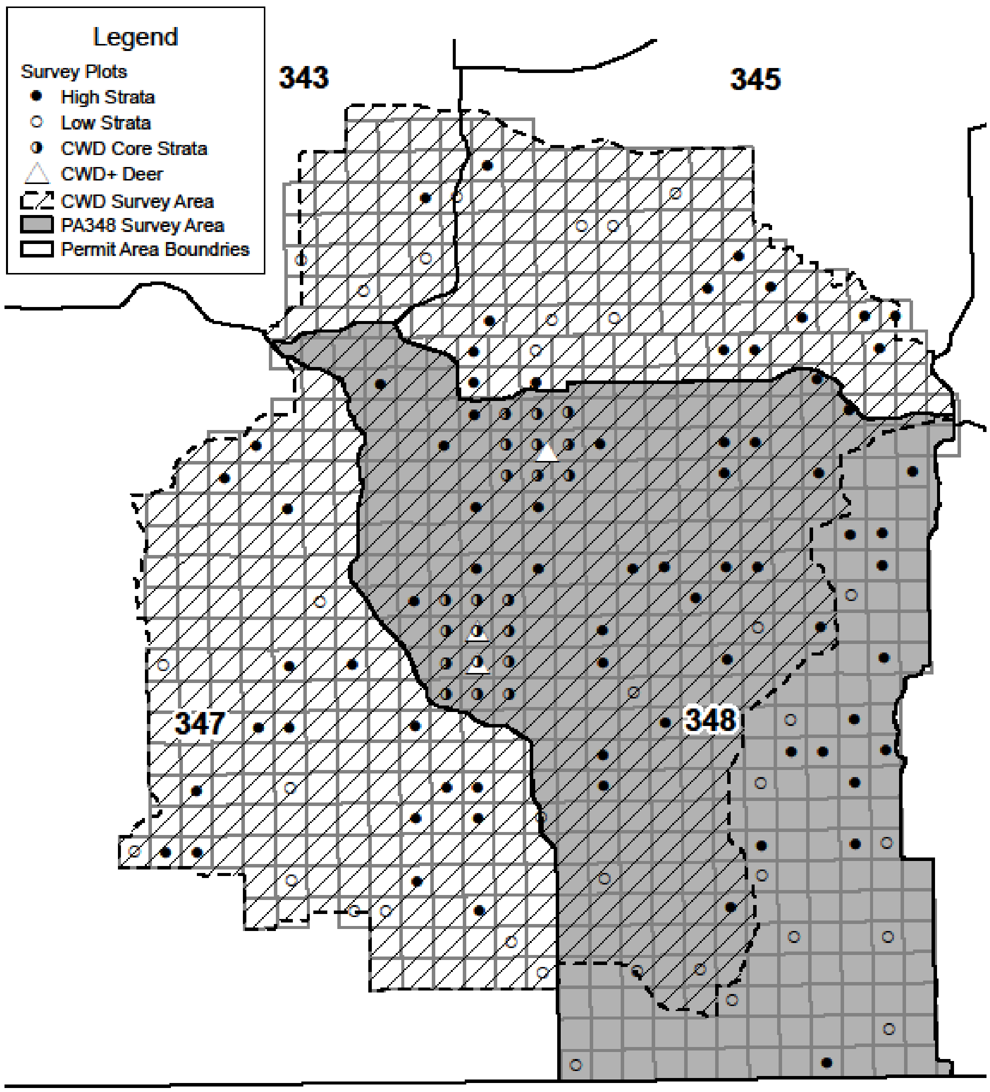

Figure 1. Survey areas flown during winter 2016-2017 in southeast Minnesota. Hatched area denotes chronic wasting disease survey area, incorporating portions of deer permit areas (PA) 343, 345, 347, and 348. Shaded area denotes PA 348 survey area.

Table 1. Deer population and density (deer/quadrat) estimates derived from aerial surveys in Minnesota, 2017.

Permit area	Domain	Sampling rate	Population estimate		CV (%)	Relative error (%)[a]	Density estimate	
			N	90% CI			Mean	90% CI
348	Central	0.26[b]	5,171	4,633 – 5,709	8.1	10.4	26	23 – 29
	East	0.20	3,459	2,649 – 4,269	18.3	23.4	28	21 – 35
	All	0.24	8,630	7,645 – 9,615	8.9	11.4	27	24 – 30

[a] Relative precision of population estimate. Calculated as 90% CI bound/*N*.
[b] Includes 'Core1' and 'Core2' geographic subunits.

Table 2. Sampling metrics from aerial deer surveys in Minnesota, 2017.

Permit area	Domain Quadrats in domain	Quadrats sampled	Quadrats occupied[a] Deer	Observed Deer	groups	observed	Groups / occupied quadrat		Group size / occupied quadrat		Maximum quadrat count
							mean	range	mean	range	
348	Central	202	53	47	1,395	341	7	1-18	4	1-23	97
	East	124	25	24	674	185	8	1-20	4	1-16	115
	All	326	78	71	2,069	526	7	1-20	4	1-23	115

[a] Number of quadrats with ≥1 deer observed.

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, 2016

John Erb, Forest Wildlife Research Group

INTRODUCTION

Monitoring the distribution and abundance of carnivores can be important for understanding 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 annually 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, Levi and Wilmers 2012).

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 41st year 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 tablet 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 (FO), transition (TR), and farmland (FA); Figure 1).

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 288 routes were completed this year. There were 2,653 operable scent stations examined on the 288 routes. Route density varied from 1 route per 506 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), in order of increasing magnitude, were opossum (5%), bobcats (8%), wolves (10%), domestic dogs (11%), domestic cats (28%), coyotes (29%), red foxes (30%), raccoons (33%), and skunks (42%). Regionally, route visitation rates were as follows: red fox – FA 11%, FO 34%; TR 37%; coyote – FO 22%, TR 31%, FA 47%; skunk – FA 37%, FO 42%, TR 45%; raccoon – FO 26%, TR 33%, FA 54%; domestic cat – FO 13%, TR 34%, FA 63%; domestic dog – FO 4%, FA 19%, TR 21%; opossum - FO 0%, TR 7%, FA 18%; wolf - FA 0%, TR 7%, FO 14%; and bobcat - FA 2%, TR 6%, FO 12%.

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 strictly on the presence/absence of confidence interval overlap, significant changes this year include a decline in red fox in the Farmland Zone (Figure 2) and increases in striped skunks and raccoons in the Forest Zone (Figure 4). The decline in bobcat indices in the Forest Zone also approached significance (Figure 2).

In the Farmland Zone (Figure 2), red fox indices were the lowest yet recorded since the survey began, continuing a steady decline since 1990. Conversely, the coyote index, while not a significant change from last year, was the highest ever, suggesting a continuing increase dating back to the survey's inception. Indices for most other species remain near or slightly above their long-term averages, with the exception of domestic dog detections which have recently been well below their long-term average.

In the Transition Zone (Figure 3), red fox indices have undergone a 'cyclic' fluctuation over the last 10 years but have remained below the long-term average for 15 years. Conversely, the Transition Zone coyote index has been above its long-term average for approximately 10 years. Indices for most other species are near their long-term average, though similar to the Farmland Zone, domestic dog indices have remained below their average for numerous years.

In the Forest Zone (Figures 4 and 5), significant increases were observed in skunk and raccoon indices, though both indices were within their historic bounds. Indices for red foxes and coyotes were near their long-term averages. After reaching peak levels in 2012, bobcat indices have now declined for 4 years but remain above their long-term average. Wolf indices, after reaching peak levels in 2011, have been near their long-term average for the past 4 years.

ACKNOWLEDGEMENTS

I wish to thank all of the cooperators who participated in the 2016 survey: DNR Division of Wildlife staff; Superior National Forest Aurora District; Agassiz, Rice Lake, Sherburne and Tamarac National Wildlife Refuges; Camp Ripley Military Reservation; 1854 Treaty Authority, White Earth, Red Lake, and Leech Lake Tribal Natural Resource Departments; Lori Schmidt and Vermillion Community College; Central Lakes Community College; Peter Jacobson and Faribault High School; Josh Tharaldson and Central High School (Marshall County); Steven Hogg and the Three Rivers Park District; and Andrew Erickson. This project was funded in part by the Wildlife Restoration Program (Pittman-Robertson).

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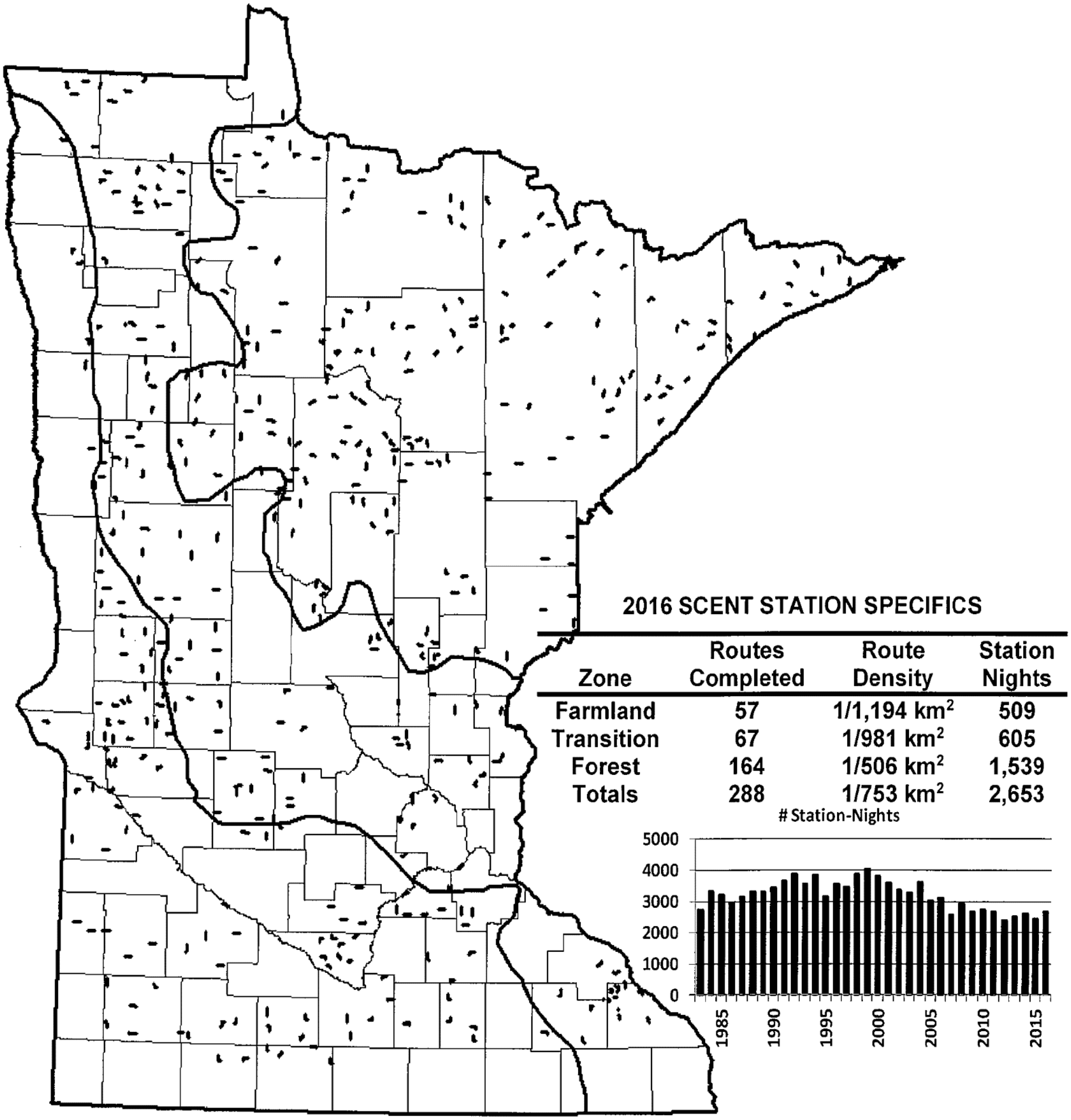

2016 SCENT STATION SPECIFICS

Zone	Routes Completed	Route Density	Station Nights
Farmland	57	1/1,194 km^2	509
Transition	67	1/981 km^2	605
Forest	164	1/506 km^2	1,539
Totals	288	1/753 km^2	2,653

Figure 1. Locations of existing scent station routes (not all completed every year). Insets show 2016 route specifics and the number of station-nights per year since 1983.

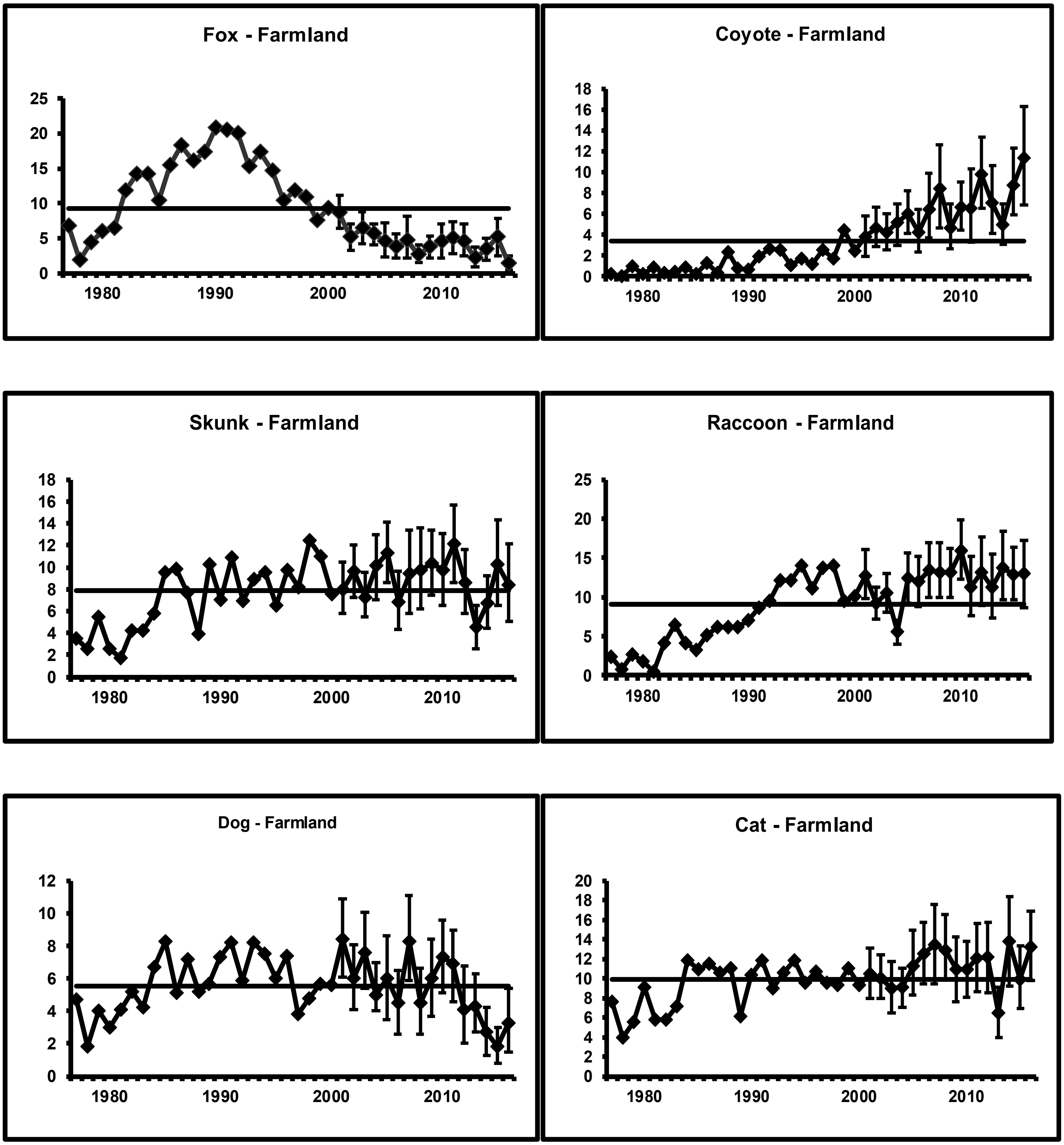

Figure 2. Percentage of scent stations visited by selected species in the Farmland Zone of Minnesota, 1977-2016. Horizontal line represents long-term mean.

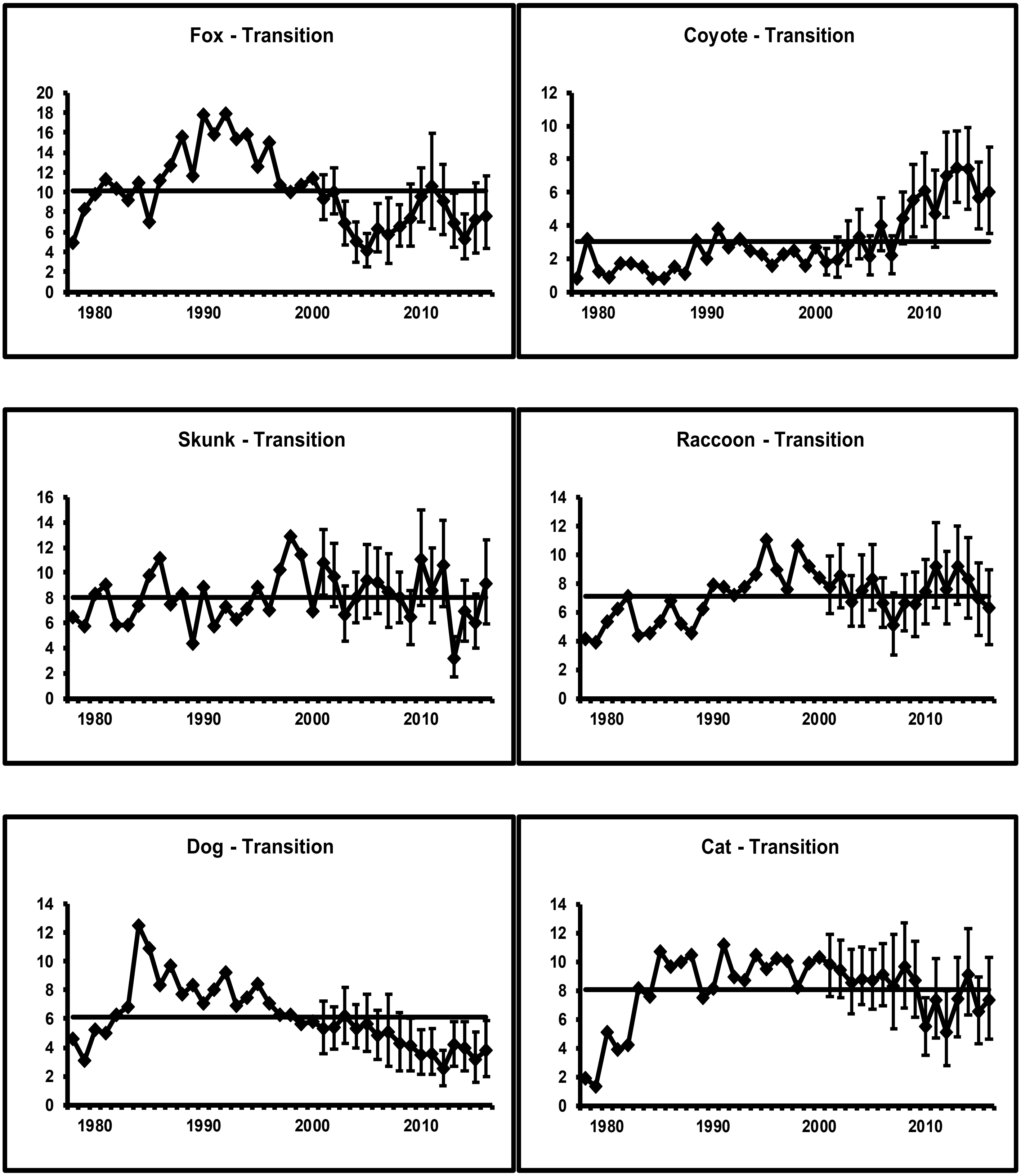

Figure 3. Percentage of scent stations visited by selected species in the Transition Zone of Minnesota, 1978-2016. Horizontal line represents long-term mean.

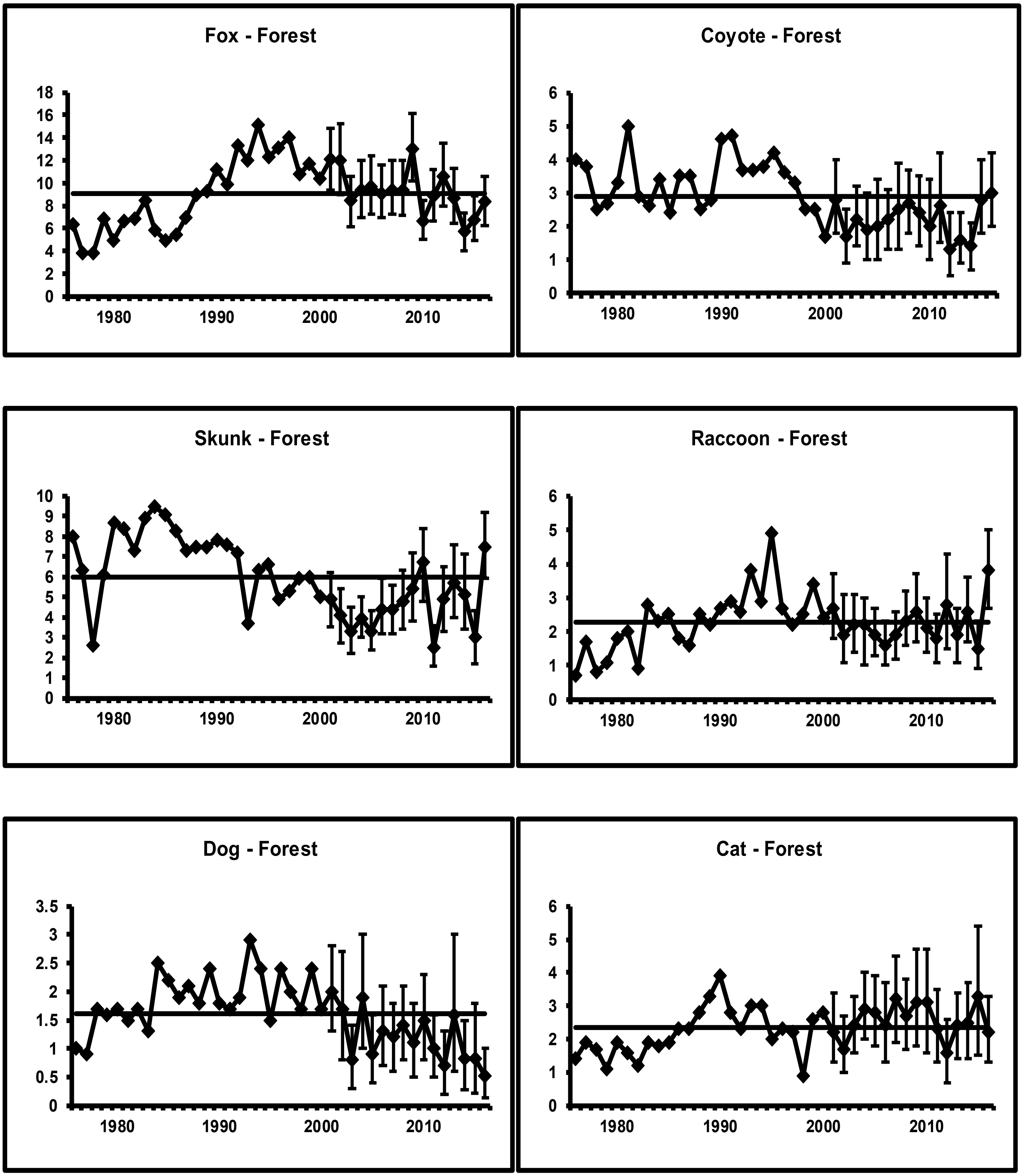

Figure 4. Percentage of scent stations visited by selected species in the Forest Zone of Minnesota, 1976-2016. Horizontal line represents long-term mean.

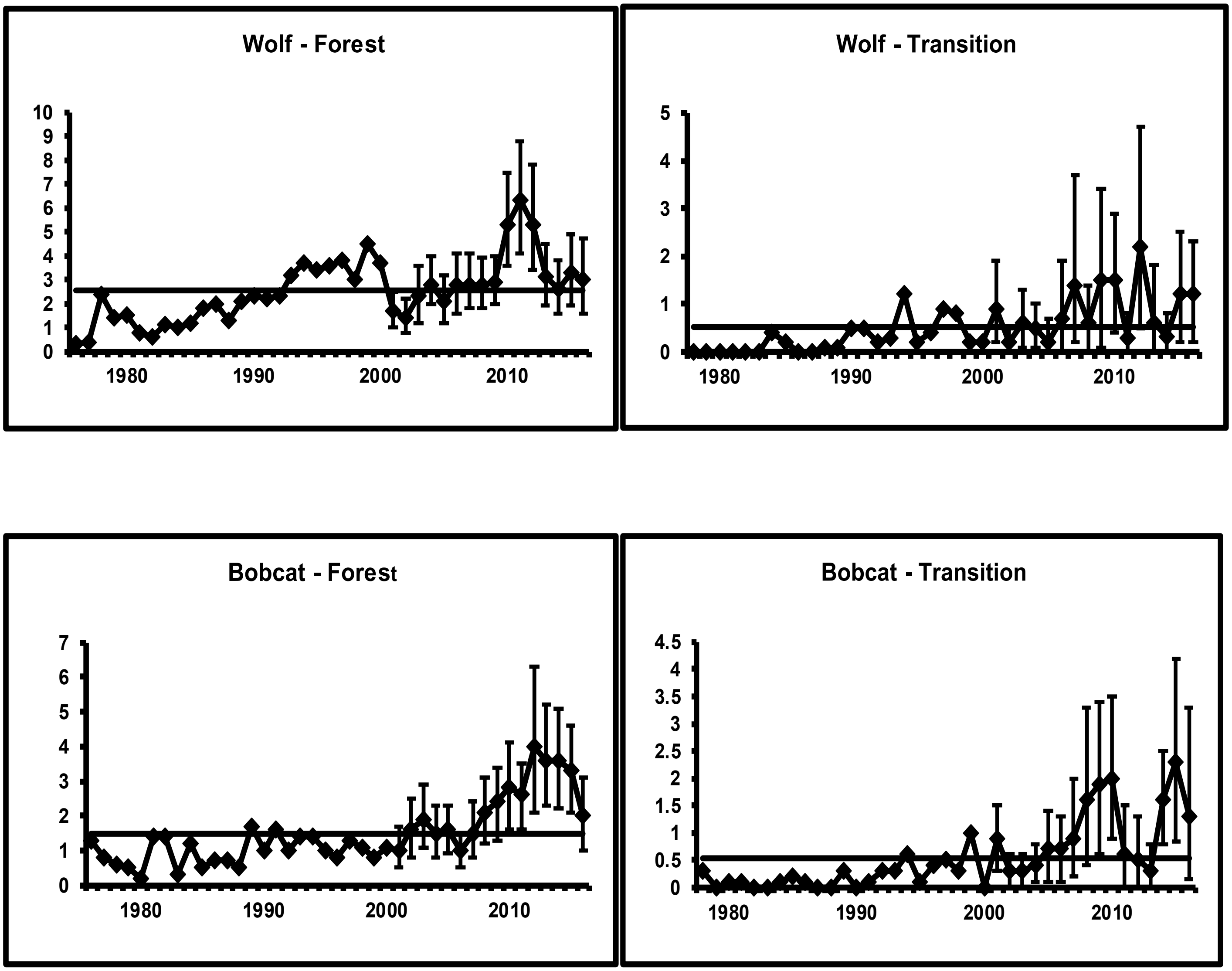

Figure 5. Percentage of scent stations visited by wolves and bobcat in the Forest and Transition Zones of Minnesota, 1976-2016. Horizontal lines represents long-term mean.

FURBEARER WINTER TRACK SURVEY SUMMARY, 2016

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 presumed to reflect 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*), two species for which no other survey data is available. Because sign of other carnivores is readily detectable in snow, participants also record tracks for other selected species. After three years of evaluating survey logistics, the survey became operational in 1994. Formal recording of gray fox detections did not commence until 2008.

METHODS

Presently, 57 track survey routes are operational 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. Though 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 hares (*Lepus americanus*) are recorded only as present or absent in the first 0.1 miles of each 0.5-mile segment. Although most routes are surveyed one day after the conclusion of a snowfall (ending by ~ 6:00 pm), thereby allowing one night for tracks to be left, a few routes are usually completed two nights following snowfall. In such cases, track counts on those routes are divided by the number of days post-snowfall.

Because most targeted species occur throughout the area where survey routes are located, calculated indices for all species prior to 2015 utilize data from all surveyed routes. Starting with the 2015 report, all past marten indices were re-calculated using only those routes that fall within a liberal delineation of marten range. However, in general there were minimal differences in temporal patterns observed in this subset versus the full sample of routes.

Currently, three summary statistics 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 two adjacent 0.5-mile segments along the road, and it was the only 'new' red fox (*Vulpes vulpes*) in the second segment, only one of the two 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 one 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 two indices (% segments occupied and # tracks per route) will often yield mathematically equivalent results; 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 still associate with previous offspring or start traveling as breeding pairs in winter, the approximate equivalence of these two 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 are by definition 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 this report.

In the second graph for each species, I illustrate the percentage of *routes* 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) 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 with replacement 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

This winter, 46 of the 57 routes were completed, the third most since the survey began (Figure 2). Survey routes took an average of 2.2 hours to complete. Total snow depths averaged 12" along completed routes, slightly above the long-term average (Figure 3). Mean overnight low temperature the night preceding the surveys was 0°F, below the long-term average (Figure 3). Survey routes were completed between December 8th and March 3rd, with a mean survey date of January 8th (Figure 3).

Based on presence or degree of overlap in confidence intervals, fisher indices (% segments with detection) exhibited a marginally significant increase from last year (Figure 4). However, there is no apparent trend over the last 5 years for fishers, and indices remain well below the long-term average. Gray fox indices exhibited a marginally significant decline; there were no significant changes in indices for other species (Figure 4).

Fishers were detected on approximately 5% of the route segments and along 54% of the routes (Figure 4). Numerous sources of information indicate that over the past decade fishers have expanded in distribution and abundance along the southern and western edge of their Minnesota range, an area currently with few or no track survey routes. Hence, fisher indices in this report are presumed indicative of population trends only in the previous 'core' of fisher range. In the core area, data indicates a longer-term decline; at their peak (2003/2004), fishers were detected on 14% of the segments and 78% of the survey routes.

Within the 'marten zone', martens were detected on approximately 6% of the route segments and 51% of the survey routes (Figure 4), virtually identical to last year. Similar to results for fishers, marten indices remain below their long-term average and have not exhibited any unidirectional trends over the last 5 or more years. However, marten fluctuations, particularly in recent years, show indications of 3-5 year cycles consistent in timing with cyclic fluctuations of some of their rodent prey species in Minnesota (e.g., Bogyo 2017).

Although there was no significant change from last year, bobcat indices had increased for approximately 15 years through 2014, and then declined to their long-term average the past two years. Bobcats were detected on 2.5% of the segments and 35% of the routes.

Wolf indices were near their long-term average, similar to the previous 3 winters. Wolves were detected on ~ 6.6% of the route segments and 72% of the survey routes (Figure 4). The average number of wolves detected per route was 1.8. Coyotes were detected on 3.8% of the route segments and 41% of the routes, and both metrics have, for the past 3 years, remained slightly above their long-term average. As with martens and weasels (see below), coyote indices appear to exhibit 3 to 5 year cycles consistent in timing with data for some rodent species in MN. Although red fox indices have been comparatively stable in recent years, indices have remained below the long-term average since 2006. They were detected on approximately 10% of the segments and 78% of the routes (Figure 4). Gray fox detections have only been formally recorded since 2008. Although it may be premature to characterize longer patterns in gray fox detections, data from the past 8 years suggests a possible 3-4 year cyclic fluctuation. However, gray fox peaks are inversely correlated with those in rodent and coyote indices, suggesting, as found in various studies, that coyote numbers may be partly responsible for fluctuations in gray foxes. There was a marginally significant decline in gray fox indices from last winter, with gray foxes being detected on 1% of the segments and 17% of the routes.

Weasel (*Mustela erminea* and *Mustela frenata*) indices did not change significantly from last year and their fluctuations have been characterized by 3 to 5 year cycles or 'irruptions' superimposed on a declining trend, at least through 2012 (Figure 4). No significant change was observed in winter snowshoe hare indices from last winter. Since the winter track survey began in 1994, hare indices had steadily increased, with some leveling off around 2012 (Figure 4). Although confidence intervals are not currently computed on the <u>spring</u> hare index, a large decline in the point estimate was observed in spring 2015 (Figure 4). Historic data (pre-1994; not presented here) for the spring index of snowshoe hares clearly exhibited 10-year cycles. Since then, only subtle 'hints' of a cycle are apparent in both surveys during the first few years of each decade; the large decline observed in the 2015 spring index, and the slower decline in winter indices the last 3 years, would nevertheless be consistent with the expected timing of 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, MacKenzie et al. 2004). Because this remains an untested assumption, caution is warranted when interpreting changes, particularly annual changes of low to moderate magnitude or short-term trends. Overall, the timing and average ambient conditions during this winter's survey suggest conditions slightly more 'extreme' than average (later in winter, with slightly more snow and colder temperatures than average); animal movements may have been reduced on nights prior to survey route completion. While this could negatively bias results, conditions were not 'severe' and other unknown factors can influence animal movement and detection rates. Hence, there is no clear indication that results were biased in either direction, and as always, inferences should largely be restricted to multi-year trends. Acknowledging this, collective data suggests that most carnivore populations in northern Minnesota remained largely unchanged from the previous winter.

ACKNOWLEDGMENTS

I wish to thank all those who participated in this year's survey, including staff with the Minnesota DNR, Superior National Forest (Cook, Ely, and Grand Marais offices), Mille Lacs, Leech Lake, Fond-du-Lac, Grand Portage, and Red Lake Bands of Ojibwe, and the 1854 Treaty Authority. This project was funded in part by the Wildlife Restoration Program (Pittman-Robertson).

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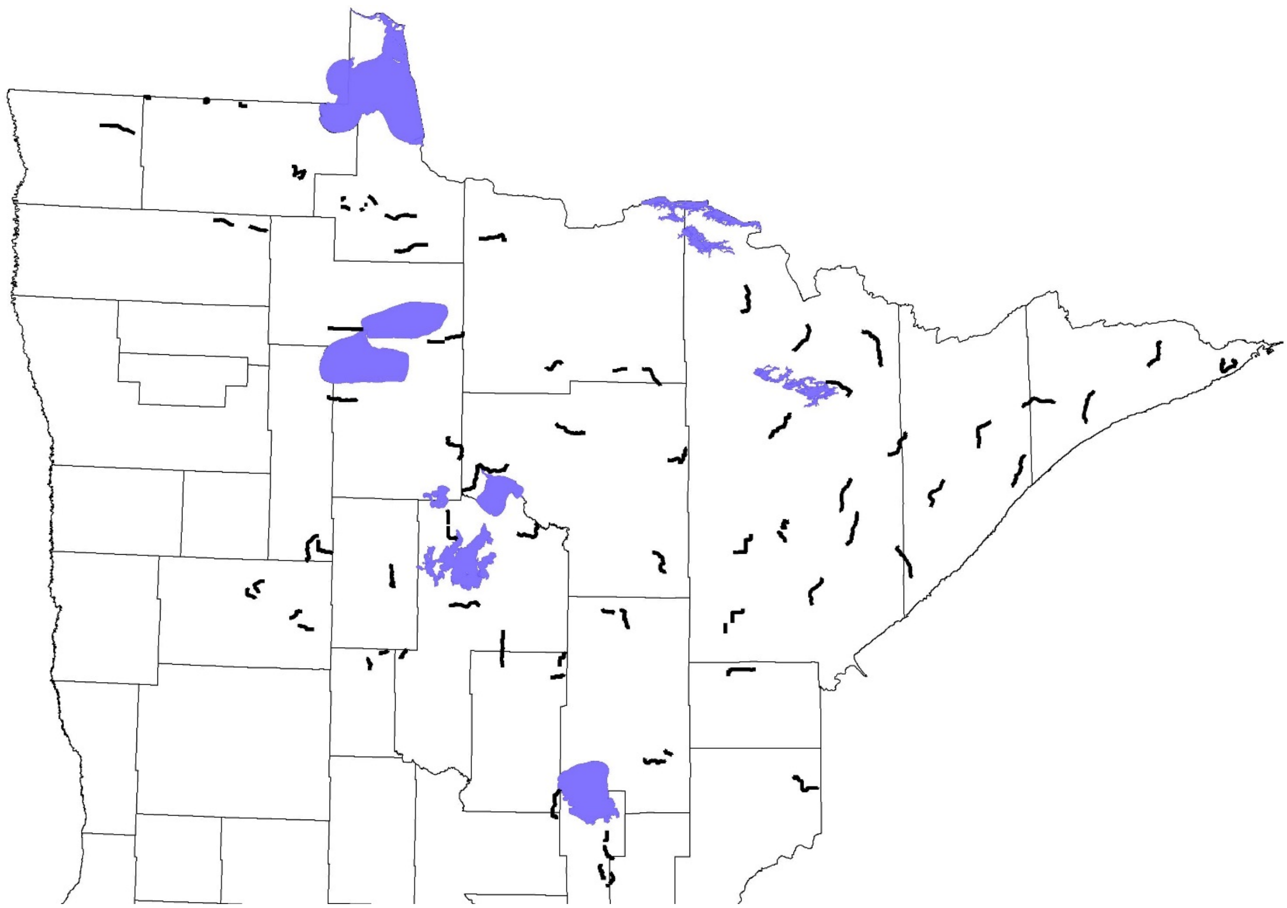

Figure 1. Locations of furbearer winter track survey routes in northern Minnesota.

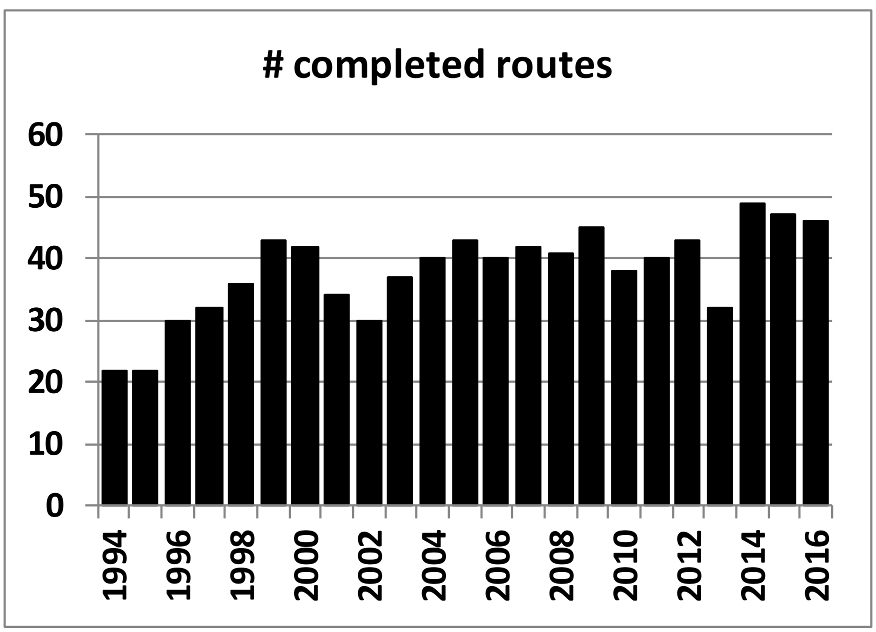

Figure 2. Number of snow track routes surveyed in Minnesota, 1994-2016.

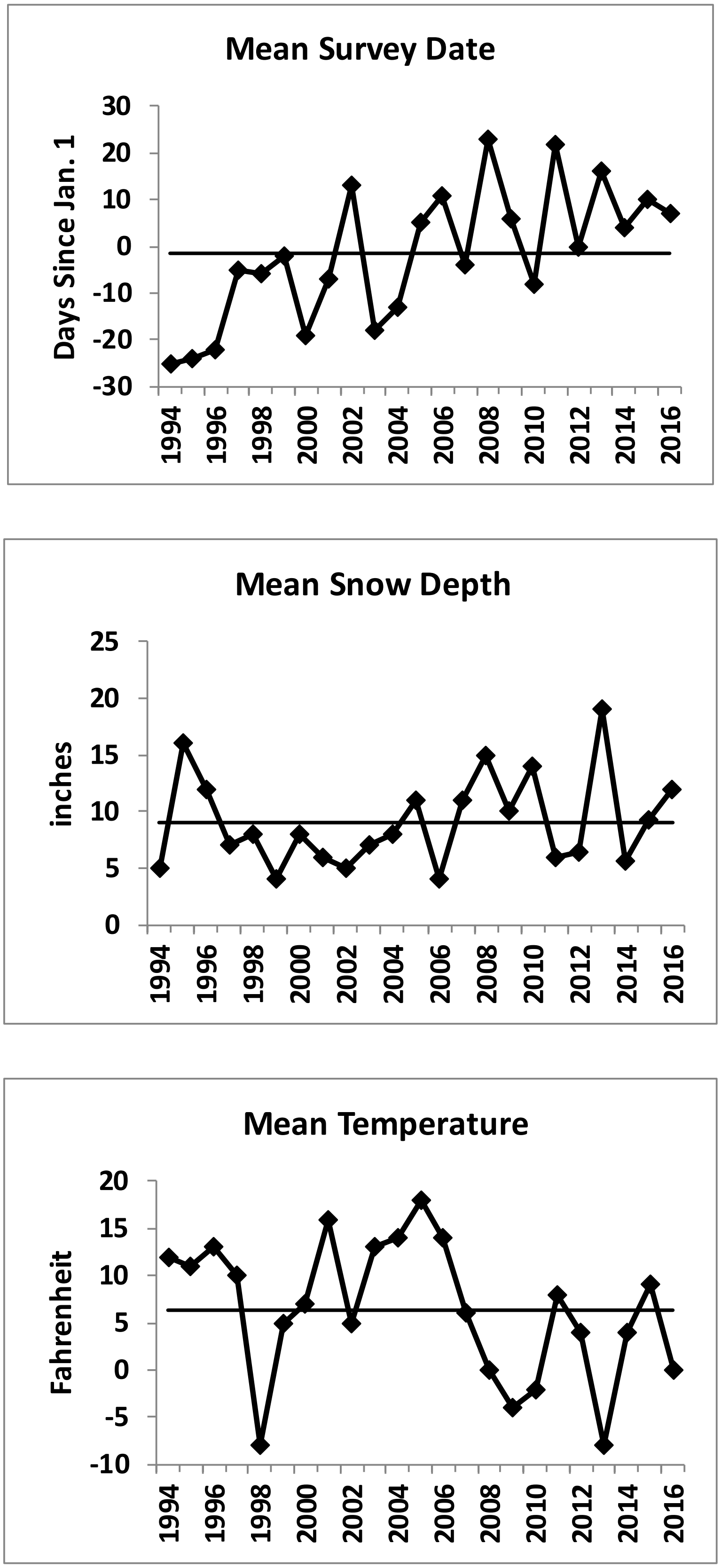

Figure 3. Average survey date, snow depth, and temperature for snow track routes completed in Minnesota, 1994-2016. Horizontal line represents long-term mean.

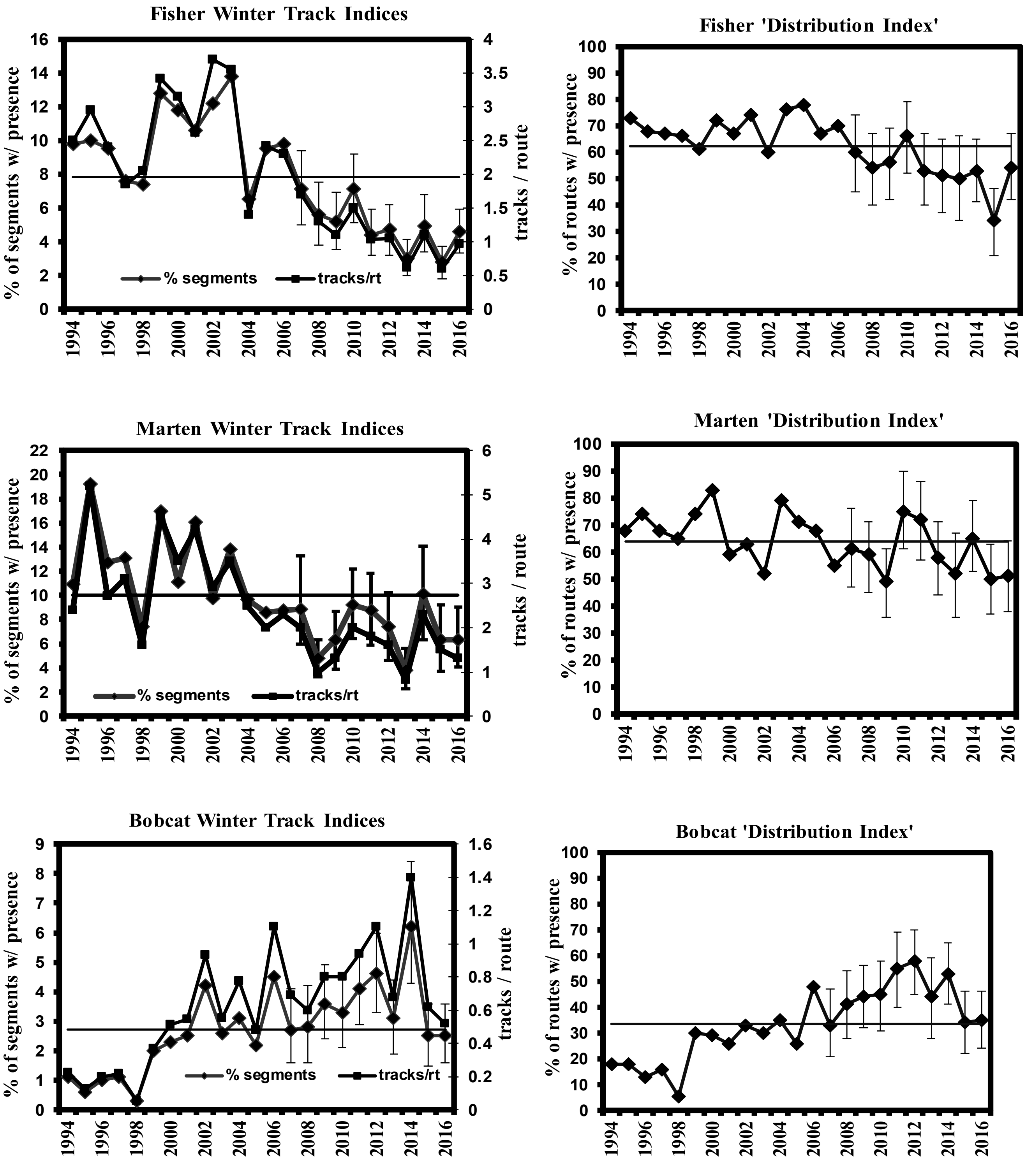

Figure 4. Winter track indices for selected species in Minnesota, 1994-2016. Confidence intervals are presented only for % segments and % routes with track presence; horizontal lines represent their long-term averages.

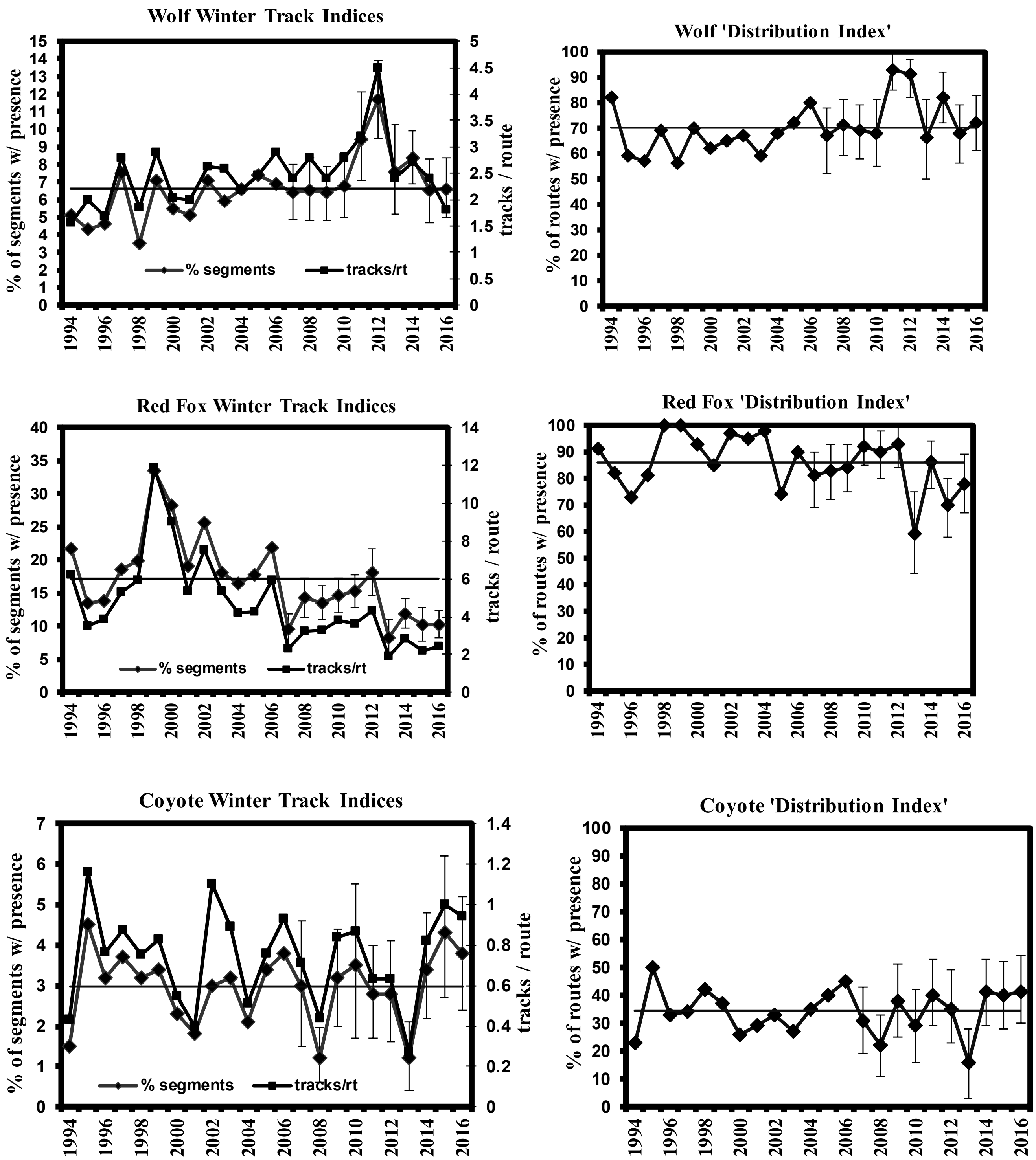

Figure 4 (continued). Winter track indices for selected species in Minnesota, 1994-2016.

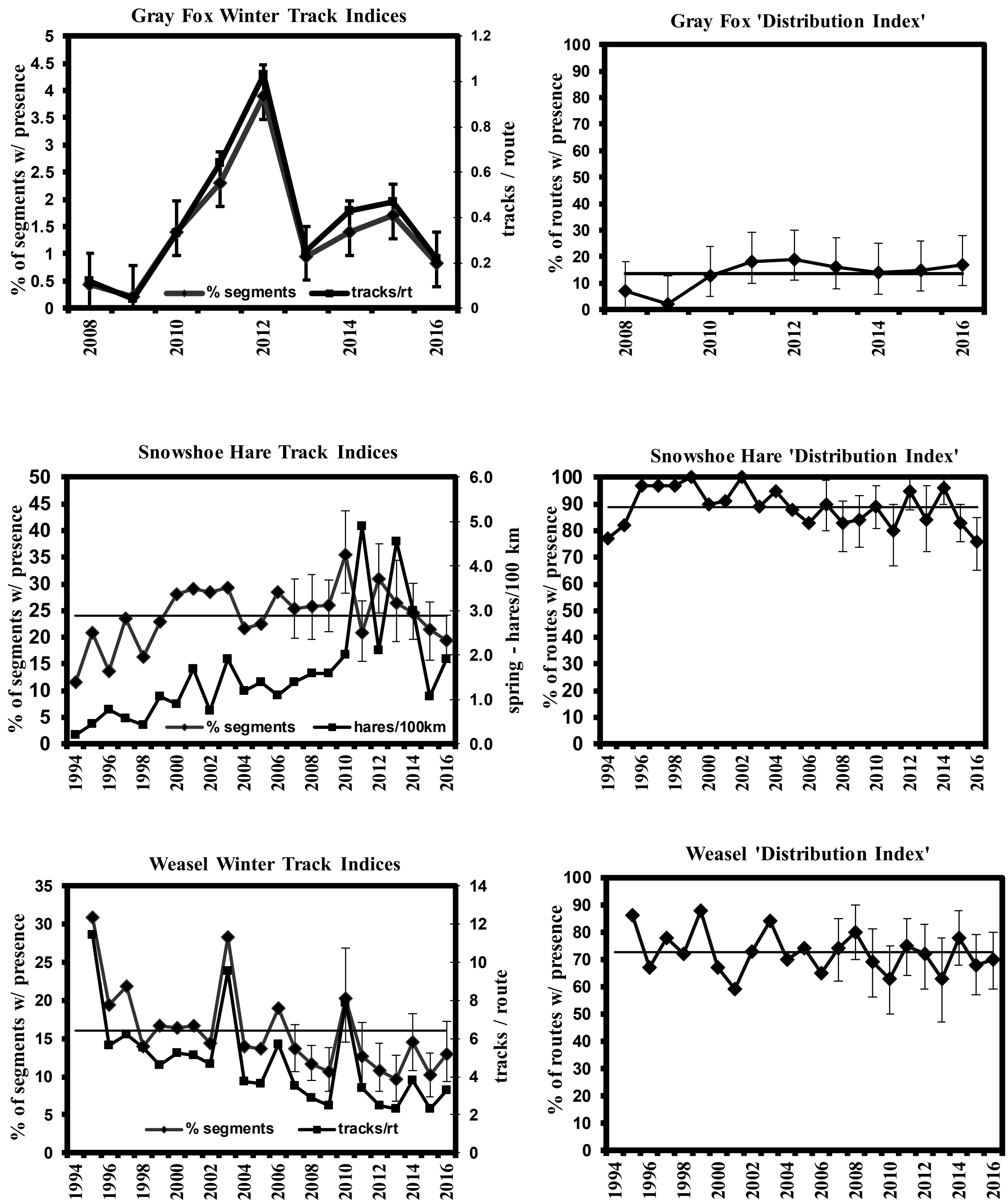

Figure 4 (continued). Winter track indices for selected species in Minnesota, 1994-2016.

FOREST WILDLIFE POPULATIONS

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2016 STATUS OF MINNESOTA BEAR POPULATION

David L. Garshelis, Forest Wildlife Populations and Research Group

INTRODUCTION

The size of the Minnesota bear population has been estimated in the past using a biomarker (tetracycline) and mark–recapture based on hunter-submitted samples (Garshelis and Visser 1997, Garshelis and Noyce (2006). The last estimate was produced in 2008, and the use of that biomarker may no longer be permitted. Since then, trends in the population have been assessed using various modelling approaches, based on composition (sex-age) of harvest data.

METHODS

Successful hunters must register their bears and submit a tooth sample, which is used to estimate age, and thus harvest age structure. Hunters also report the sex of their harvested bear; we adjust this for a known bias in hunter-reported sex (11% of female bears reported as males). Ages and sexes of harvested bears accumulated since 1980 were used to reconstruct minimum statewide population sizes through time (i.e., the size of the population that eventually died due to hunting) using a technique formulated by Downing (1980): each sex was estimated separately, and then summed. Age groups were collapsed to 1, 2, and 3+ years in order to estimate population size 3 years in the past (no more recent estimates can be obtained using this technique). This technique only estimates the size of the population that eventually dies due to hunting; to account for bears that die of other causes, the trend lines are scaled upward to attempt to match tetracycline-based estimates.

A second, independent assessment of population trend is obtained by investigating harvest rates (% of living bears harvested each year). A relatively low harvest rate would signify a population with more potential growth. Harvest rate is estimated from the inverse of the age at which the number of males and females in the harvest is equal, based on methodology of Fraser (1984).

RESULTS

Population trend

Ages of harvested bears accumulated since 1980 were used to reconstruct minimum statewide population sizes through time (i.e., the size of the population that eventually died due to hunting) using a technique formulated by Downing. This was scaled upwards (to include bears that died of other causes), using 4 statewide tetracycline mark–recapture estimates as a guide. Whereas both the tetracycline-based and reconstructed populations showed a “humped” trajectory, with an increase during the 1990s, followed by a decline during the 2000s, the shapes of the 2 trajectories differed somewhat (the reconstructed population curves were less steep). Therefore, it was not possible to exactly match the curve from the reconstruction to all 4 tet-based estimates.

Downing population reconstruction assumes equal harvest pressure through time: as harvest pressure is diminished, and fewer bears are killed (as has been the trend since 2003), ensuing population estimates will be biased low, so it is possible that the curve for the most recent years should be higher (Fig. 1).

Harvests were intentionally reduced in the quota zone when it was surmised (in the mid-2000s) that the population was declining. Since 2013, quotas were maintained at a low level, although harvests varied with food. Population reconstruction does not provide reliable estimates for the 2 most recent years, and since the model provides “pre-hunt” estimates, the most recent estimate shows only the effects of the 2013 harvest (and not the low harvest of 2014, or unexpectedly high harvest of 2016).

The no-quota zone has also shown a population decline during the 2000s, but at a slower rate than in the quota zone. Again, though, model results following the record no-quota harvest in 2016 are not yet available.

Trends in harvest rates

The sex ratio of harvested bears varies by age in accordance with the relative vulnerability of the sexes. With male bears being more vulnerable to harvest than females, males always predominate among harvested 1-year-olds (67–75%). They also predominate, but less strongly among 2 and 3-year-old harvested bears. However, older aged bears (≥7 years) are nearly always dominated by females, because, although old females continue to be less vulnerable, there are far more of them than old males. The age at which the line fitted to these proportions crosses the 50:50 sex ratio is approximately the inverse of the harvest rate. Segregating the data into time blocks showed harvest rates increasing from 1980–1999, then declining with reductions in hunter numbers (Fig. 1). Harvest rates since 2010 have been, on average, less than what they were in the early 1980s, when the population was increasing (Figs. 2, 3).

Figure. 1. Statewide bear population trend (pre-hunt) derived from Downing reconstruction using the harvest age structures. Curves were scaled (elevated to account for non-harvest mortality) to various degrees to attempt to match the tetracycline-based mark–recapture estimates. Estimates beyond 2014 are unreliable.

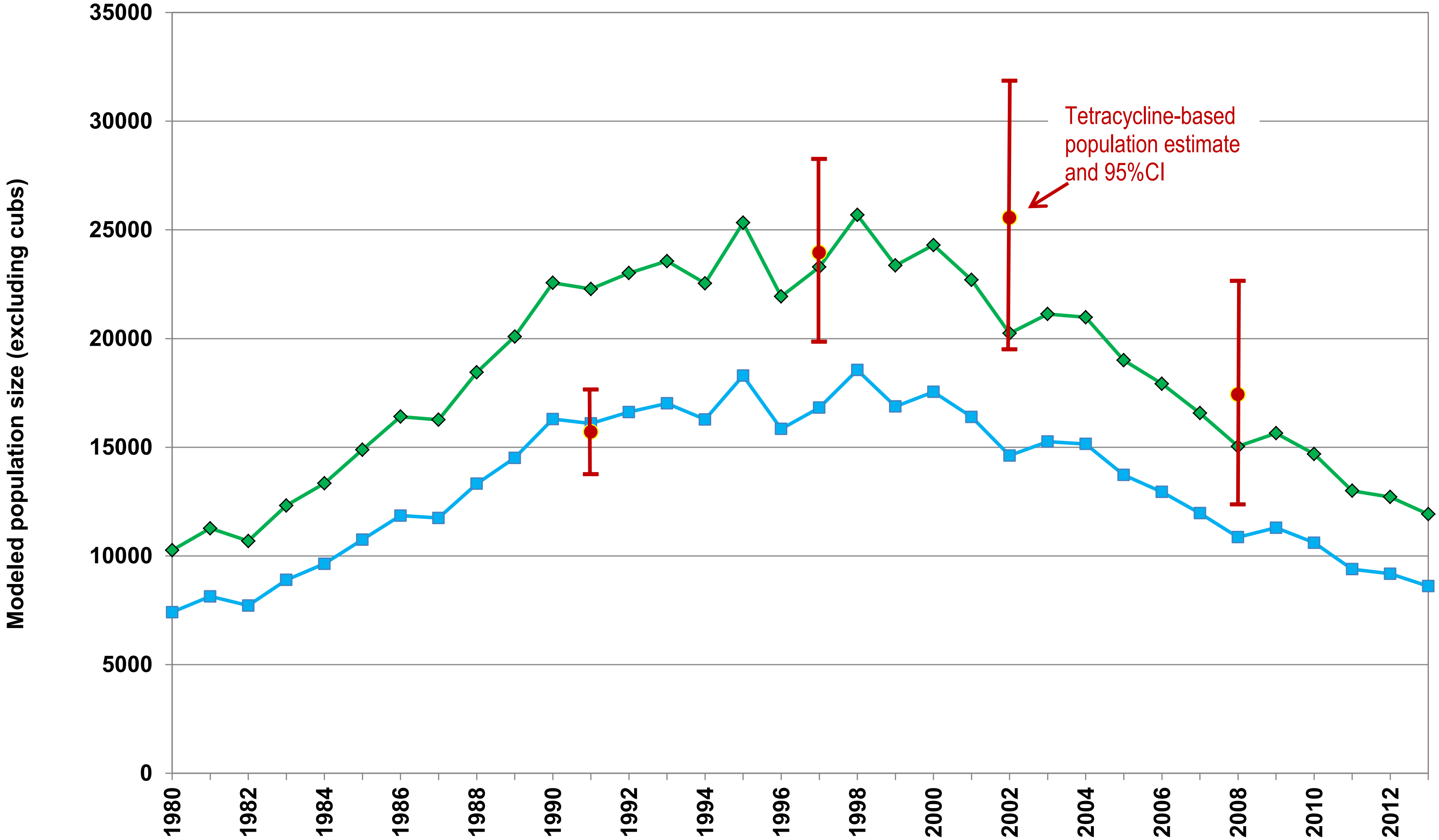


Figure 2. Population trends during 2000s derived from Downing reconstruction for quota and no-quota zones compared to respective harvests. Population curves were scaled (elevated to account for non-harvest mortality) using a multiplier midway between the two curves in Fig. 1 (i.e., the actual scale of the population estimates is not empirically-based).

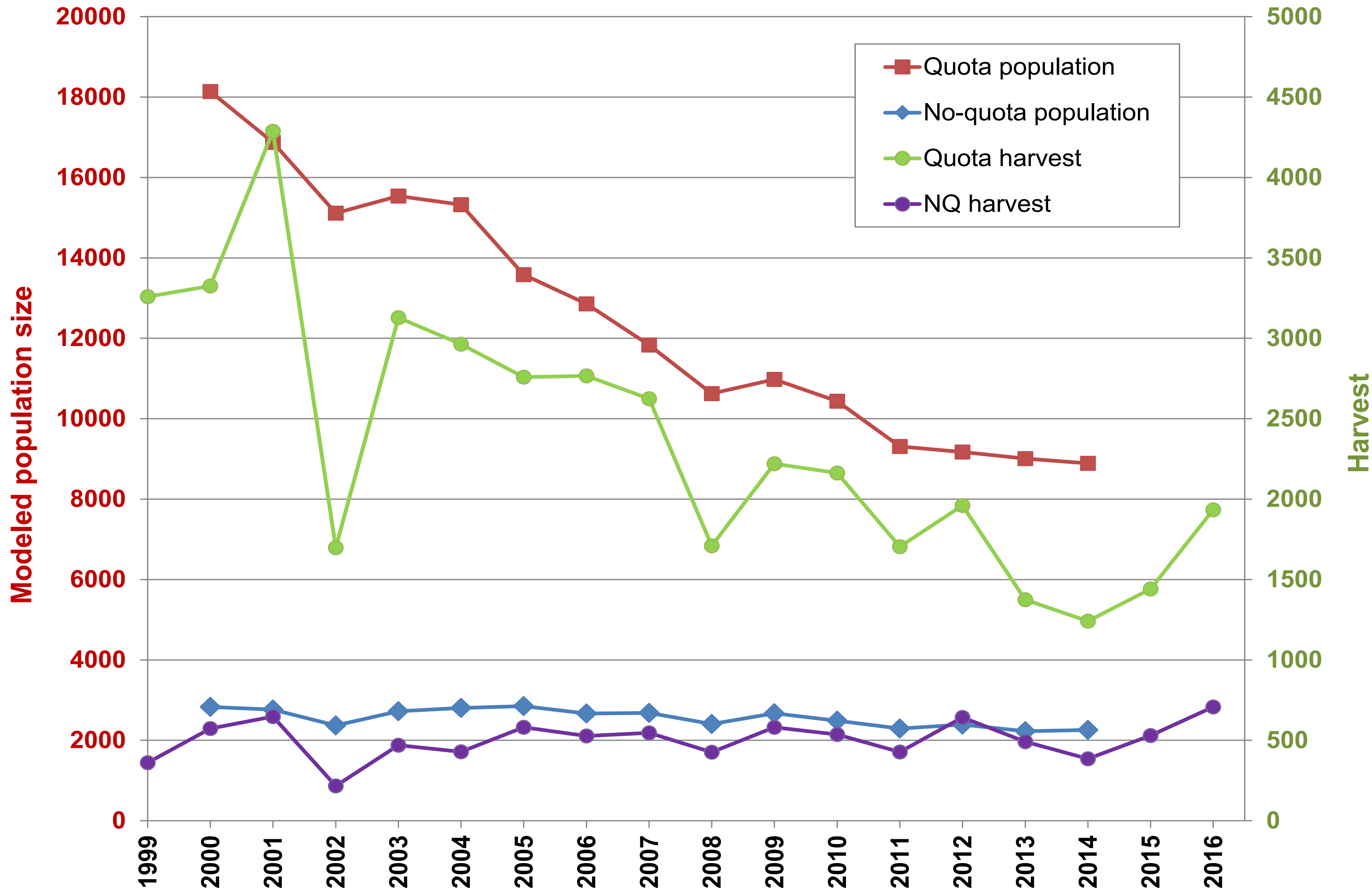
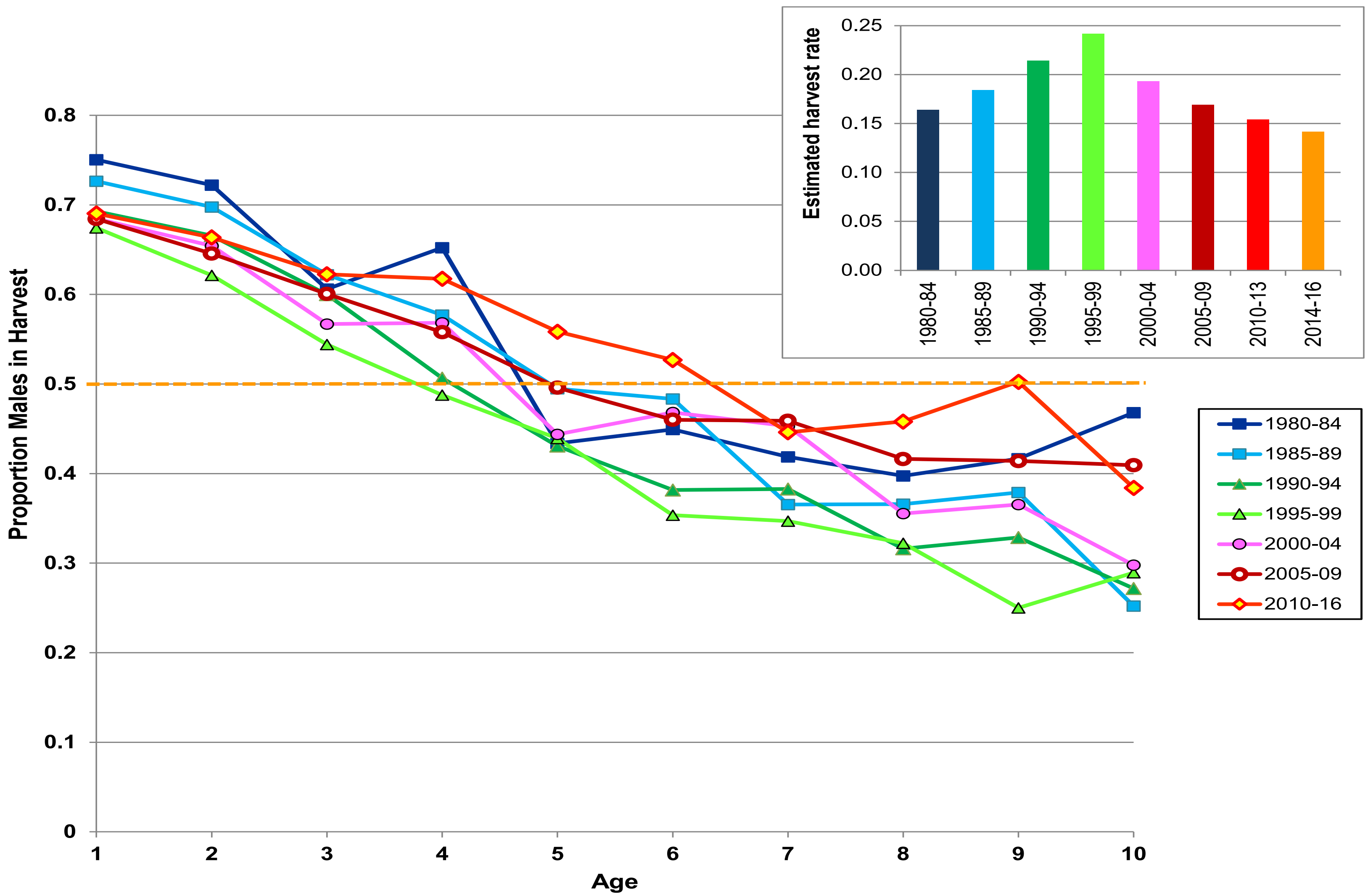


Figure 3. Trends in proportion of male bears in statewide harvest at each age, 1–10 years, grouped in 5-year time blocks, 1980–2016 (last interval is 7 years). Higher harvest rates result in steeper curves because males are reduced faster than females. Fitting a line to the data for each time block and predicting the age at which 50% of the harvest is male (dashed yellow line) yields approximately the inverse of the harvest rate (derived rates are shown in inset).



2017 MINNESOTA SPRING GROUSE SURVEYS

Charlotte Roy, Forest Wildlife Populations and Research Group

SUMMARY OF FINDINGS

The Minnesota DNR coordinates ruffed grouse (*Bonasa umbellus*) and sharp-tailed grouse (*Tympanuchus phasianellus*) surveys statewide each spring with the help of wildlife managers, cooperating agencies, and organizations (e.g., tribal agencies, U.S. Forest Service, counties). In 2017, ruffed grouse surveys were conducted between 7 April and 15 May. Mean ruffed grouse drums per stop (dps) were 2.1 statewide (95% confidence interval = 1.7–2.4) and increased (57%) from the previous year, as expected during the increasing phase of the 10-year population cycle. Statewide, the mean ruffed grouse drums per stop were as high as during the last peak in drumming in 2009, but in western portions of the survey area, means have not yet reached previous peak levels, which are expected to occur in the next few years.

Sharp-tailed grouse surveys were conducted between 26 March and 13 May 2017, with 1,756 birds (males and birds of unknown sex) observed at 181 leks. The mean numbers of sharp-tailed grouse/lek were 7.2 (5.8–8.6) in the East Central (EC) survey region, 10.4 (9.2–11.8) in the Northwest (NW) region, and 9.7 (8.7–10.8) statewide. Comparisons between leks observed in consecutive years (2016 and 2017) indicated a similar number of birds/lek statewide ($t = 0.5$, $P > 0.5$), in the NW region ($t = 0.4$, $P > 0.5$), and in the EC region ($t = 0.4$, $P > 0.05$).

INTRODUCTION

The ruffed grouse (*Bonasa umbellus*) is the most popular game bird in Minnesota, with an annual harvest averaging >500,000 birds (~150,000 to 1.4 million birds). Ruffed grouse hunter numbers have been as high as 92,000 during the last decade, although hunter numbers did not peak with the recent peak in grouse numbers, as they have traditionally. Sharp-tailed grouse (*Tympanuchus phasianellus*) are also popular among hunters, with an annual harvest of 6,000-22,000 birds since the early-1990s and 5,000–10,000 hunters in Minnesota.

The Minnesota DNR coordinates grouse surveys each year to monitor changes in grouse populations through time. These surveys provide a reasonable index to population trends, when the primary source of variation in counts among years is change in densities. However, weather, habitat conditions, observer ability, and grouse behavior, also vary over time and can influence survey counts. Thus, making inferences from survey data over short time periods (e.g., a few years) can be tenuous. Nevertheless, over longer time periods and when large changes in index values occur, these surveys can provide a reasonable index to long-term grouse population trends. Spring surveys, in combination with hunter harvest statistics, provide evidence that the ruffed grouse population cycles at approximately 10-year intervals.

The first surveys of ruffed grouse in Minnesota occurred in the mid-1930s, and the first spring survey routes were established along roadsides in 1949. By the mid-1950s, ~50 routes were established with ~70 more routes added during the late-1970s and early-1980s. Since that time, spring drumming counts have been conducted annually to survey ruffed grouse in the forested regions of the state where ruffed grouse habitat occurs. Drumming is a low sound produced by males as they beat their wings rapidly and in increasing frequency to signal the location of their territory. These drumming displays also attract females that are ready to begin nesting, so the frequency of drumming increases in the spring during the breeding season. The sound produced when male grouse drum is easy to hear and thus drumming counts are a convenient way to survey ruffed grouse populations in the spring.

Sharp-tailed grouse were first surveyed in Minnesota between the early-1940s and 1960. The current survey is based on counts at dancing grounds during the spring and was first conducted in 1976. Male sharp-tailed grouse display, or dance, together in open areas to attract females in the spring. This display consists of the males stomping their feet with out-stretched wings. Females visit the dancing grounds to select males for breeding. These dancing grounds, or leks, are reasonably stable in location from year to year, allowing surveyors to visit and count individuals each spring. Surveys are conducted in openland portions of the state where sharp-tailed grouse persist, although they were formerly much more widely distributed in Minnesota at the early part of the 20th century.

METHODS

Ruffed Grouse

Surveys for ruffed grouse were conducted along established routes throughout the state. Each route consisted of 10 listening stops at approximately 1.6-km (1-mile) intervals. The placement of routes on the landscape was determined from historical survey routes, which were originally placed near ruffed grouse habitat in low traffic areas. Annual sampling of these historical routes provides information about temporal changes along the routes, but may not be representative of the counties or regions where the routes occurred.

Survey observers were solicited from among state, federal, tribal, private, and student biologists. Each observer was provided a set of instructions and route location information. No formal survey training was conducted but all observers had a professional background in wildlife science, and most had previously participated in the survey. Participants were asked to conduct surveys at sunrise during peak drumming activity (in April or May) on days that had little wind and no precipitation. Each observer drove the survey route once and listened for drumming at each stop for 4 minutes. Observers recorded the number of drums heard at each stop (not necessarily the number of individual grouse), along with information about phenology and weather at the time of the survey.

The number of drums heard per stop (dps) was used as the survey index value. I determined the mean dps for each route, for each of 4 survey regions (Figure 1), and for the entire state. For each survey region, I calculated the mean of route-level means for all routes partially or entirely within the region. Routes that traversed regional boundaries were included in the means for both regions. Because the number of routes within regions was not related to any proportional characteristic, I used the weighted mean of index values for the 4 Ecological Classification Sections (ECS) in the Northeast region and the 7 ECS sections in the state. The geographic area of the section was used as the weight for each section mean (i.e., Lake Agassiz, Aspen Parklands = 11,761 km^2, Northern Minnesota and Ontario Peatlands = 21,468 km^2, Northern Superior Uplands = 24,160 km^2, Northern Minnesota Drift and Lake Plains = 33,955 km^2, Western Superior Uplands = 14,158 km^2, Minnesota and Northeast Iowa Morainal (MIM) = 20,886 km^2, and Paleozoic Plateau (PP) = 5,212 km^2). The area used to weight drum index means for the MIM and PP sections was reduced to reflect the portion of these areas within ruffed grouse range (~50%) using subsection boundaries. A 95% confidence interval (CI) was calculated to convey the uncertainty of each mean index value using 10,000 bootstrap samples of route-level means for survey regions and the whole state. Confidence interval boundaries were defined as the 2.5^{th} and 97.5^{th} percentiles of bootstrap frequency distributions.

Nine surveys from 2016 were received after the report was written last year, so the 2016 analysis was updated to include these late submissions.

Sharp-tailed Grouse

Wildlife Managers and volunteers surveyed known sharp-tailed grouse lek locations in their work areas in the Northwest (NW) and East Central (EC) portions of the state (Figure 2). The NW region consisted of Lake Agassiz & Aspen Parklands, Northern Minnesota & Ontario Peatlands, and Red River Valley ECS sections. The EC region consisted of selected subsections of the Northern Minnesota Drift & Lake Plains, Western Superior Uplands, and Southern Superior Uplands sections. Some leks may have been missed, but most managers believed that they included most of the leks in their work area. Given the uncertainty in the proportion of leks missed, especially those occurring outside traditional areas, the survey may not necessarily reflect sharp-tailed grouse numbers in larger areas such as counties or regions.

Each cooperator was provided with instructions and asked to conduct surveys on $\geq$1 day in an attempt to obtain a maximum count of male sharp-tailed grouse attendance at each lek. Observers were asked to conduct surveys within 2.5 hours of sunrise under clear skies and during low winds (<16 km/hr, or 10 mph) when lek attendance and ability to detect leks were expected to be greatest. Data recorded during each lek visit included the number of males, females, and birds of unknown sex.

The number of sharp-tailed grouse per dancing ground was used as the index value and was averaged for the NW region, the EC region, and statewide, using known males and birds of unknown sex. Observations of just 1 grouse were not included in the index. Data from former survey years were available for comparison, however, survey effort and success varied among years rendering comparisons of the full survey among years invalid. Therefore, to make valid comparisons between 2 consecutive years, only counts of birds from dancing grounds that were surveyed during both years were considered. Paired t-tests were used to test the significance of comparisons among years. Confidence intervals (95%) were calculated using 10,000 bootstrap samples of lek counts for each region and statewide.

RESULTS & DISCUSSION

Ruffed Grouse

Observers from 15 cooperating organizations surveyed 122 routes between 7 April and 15 May 2017. Most routes (95%) were surveyed between 12 April and 10 May, with a median survey date of May 3, which is a few days later than last year (April 29) and the median survey date for the most recent 10 years. Excellent (68%), Good (27%), and Fair (5%) survey conditions were reported for 115 routes reporting conditions.

Statewide counts of ruffed grouse drums averaged 2.1 dps (95% confidence interval = 1.7–2.4 dps) during 2017 (Figure 3). Drum counts were 2.5 (2.0–2.9) dps in the Northeast (n = 98 routes), 1.6 (0.8–2.4) dps in the Northwest (n = 8), 0.9 (0.4–1.4) dps in the Central Hardwoods (n = 13), and 0.8 (0.4–1.4) dps in the Southeast (n = 8) regions (Figure 4a-d). Statewide drum counts increased (57%) from last year. An increase was expected given that the ruffed grouse population is in the increasing phase of the 10-year cycle and expected to peak soon. In the Northeast, the index has reached its former peak in the last cycle, but in the Northwest and Central Hardwoods the index is still rising, whereas in the Southeast, cycling is very weak.

Sharp-tailed Grouse

A total of 1,756 male sharp-tailed grouse and grouse of unknown sex were counted at 181 leks (Table 1) during 16 March to 13 May 2017. The statewide index value of 9.7 (8.7–10.8) grouse/lek was centrally located among values observed since 1980 (Figure 5). In the EC survey region, 286 grouse were counted on 40 leks, and 1,470 grouse were counted on 141 leks in the NW survey region. The grouse/lek index was similar statewide and in both survey regions compared to 2016 (Table 1). Leks with $\geq$2 grouse were observed an average of 2.0 times. Counts at leks observed during both 2016 and 2017 were similar ($t = 0.4$, $P > 0.05$) statewide, in the NW region ($t = 0.4$, $P > 0.05$), and in the EC region ($t = 0.4$, $P > 0.05$; Table 2).

Sharp-tailed grouse population index values peaked with those for ruffed grouse in 2009, and appear to have troughed with them in 2013, but sharp-tailed grouse peaks can follow those of ruffed grouse by as much as 2 years. Ruffed grouse populations increased dramatically this year, but increases were not observed in the sharp-tailed grouse population index, nor in comparisons of leks surveyed both years in either region or statewide. The number of birds counted in the EC region was 59% higher this year than during 2016 and higher than the preceding 5 years when ~200 birds were counted. However, survey effort can strongly influence the number of leks surveyed and can explain this result. The additional leks and birds counted in the EC region this year were predominantly (9 leks, 94 birds) in the portion of the Aitkin work area where leks have been more stable in recent years. Survey effort in the Aitkin work area last year was focused on areas of perceived declines and included many traditional lek sites that no longer support leks. [Workloads do not permit exhaustive surveys in the Aitkin or Tower work areas.] This year, efforts in the Aitkin work area focused more broadly on surveying as many existing leks as time permitted. Thus, the number of birds and leks counted in the EC region was higher in 2017, but the grouse/lek index and comparisons of leks surveyed in 2016 and 2017 did not change. Comprehensive consideration of these data leads to the conclusion that the EC sharp-tailed grouse population remains unchanged from last year. Importantly, the multi-year declining population pattern observed in southern portions of the EC region (e.g., Pine and Kanabec counties) appear not to be an artifact of survey effort after considering similar evidence (see the 2016 Survey Report). Observed lek size can vary as a function of population changes, lek numbers, and the timing, effort, and conditions of surveys, so it is important to consider all these factors when interpreting the data.

In the NW region, the number of leks counted has been stable or increasing over the same period. In 2016 and 2017, the DNR allowed the capture and translocation of sharp-tailed grouse from the NW region to supplement a population of sharp-tailed grouse at Moquah Barrens in Wisconsin. Continued monitoring will document whether the NW population will continue to be a stronghold for sharp-tailed grouse in the state and the impact of potential management actions in response to declines in the EC region.

ACKNOWLEDGMENTS

The ruffed grouse survey was accomplished this year through the combined efforts of staff and volunteers at Chippewa and Superior National Forests (USDA Forest Service); Fond du Lac, Grand Portage, Leech Lake, Red Lake, and White Earth Reservations; 1854 Treaty Authority; Blandin Paper, Agassiz and Tamarac National Wildlife Refuges (U.S. Fish & Wildlife Service); Vermilion Community College; Beltrami County and Cass County Land Departments; and DNR staff at Aitkin, Baudette, Bemidji, Brainerd, Cambridge, Carlos Avery Wildlife Management Area (WMA), Cloquet, Crookston, Detroit Lakes, Fergus Falls, Grand Rapids, International Falls, Karlstad, Little Falls, Mille Lacs WMA, Park Rapids, Red Lake WMA, Rochester, Roseau River WMA, Sauk Rapids, Thief Lake WMA, Thief River Falls, Tower, Two Harbors, Whitewater WMA, and Winona work areas. I would like to thank DNR staff and volunteers at Aitkin, Baudette, Bemidji, Cambridge, Cloquet, Crookston, Karlstad, International Falls, Tower, Thief River Falls, and Thief Lake work areas, staff and volunteers at Red Lake and Roseau River WMAs, and partners at Agassiz National Wildlife Refuge for participating in sharp-tailed grouse surveys. N. Benson and R. Haindfield surveyed leks as part of a research project this year. Laura Gilbert helped enter ruffed grouse data. Gary Drotts, John Erb, and Rick Horton organized an effort to enter the ruffed grouse survey data for 1982–2004, and Doug Mailhot and another volunteer helped enter the data. I would also like to thank Mike Larson for making helpful comments on this report. This work was funded in part through the Federal Aid in Wildlife Restoration Act.

Table 1. Sharp-tailed grouse / lek (≥2 males) at all leks observed during spring surveys each year 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
2013	9.2	8.2 – 10.2	139	10.5	9.3 – 11.7	107	4.8	3.8 – 5.9	32
2014	9.8	8.8 – 10.9	181	10.9	9.8 – 12.1	144	5.4	4.5 – 6.4	37
2015	9.8	8.9 – 10.7	206	10.8	9.9 – 11.9	167	5.3	4.4 – 6.4	39
2016	9.5	8.6 – 10.5	182	10.2	9.2 – 11.4	152	6.0	4.9 – 7.3	30
2017	9.7	8.7 – 10.8	181	10.4	9.2 – 11.8	141	7.2	5.8 – 8.6	40

[a] Survey regions; see Figure 1.
[b] 95% CI = 95% confidence interval
[c] *n* = number of leks in the sample.

Table 2. Difference in the number of sharp-tailed grouse / lek observed during spring surveys of the same lek in consecutive years 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
2012 – 2013	-0.8	-2.0 – 0.4	140	0.4	-1.3 – 2.3	88	-2.9	-4.2 – -1.8	52
2013 – 2014	1.4	0.1 – 2.7	121	1.6	-0.3 – 3.5	79	1.1	-0.1 – 2.3	42
2014 – 2015	-0.2	-1.4 – 0.9	141	-0.3	-1.9 – 1.3	102	-0.1	-1.1 – 1.1	39
2015 – 2016	-1.3	-2.3 – -0.2	167	-1.6	-2.9 – -0.2	129	-0.2	-1.3 – 0.9	38
2016 – 2017	-0.3	-1.5 – 0.9	166	-0.3	-1.8 – 1.2	128	-0.2	-1.2 – 0.8	38

[a] Survey regions; see Figure 1.
[b] Consecutive years for which comparable leks were compared.
[c] 95% CI = 95% confidence interval
[d] *n* = number of leks in the sample. Here, a lek can have a 0 count in 1 of the 2 years and still be considered.

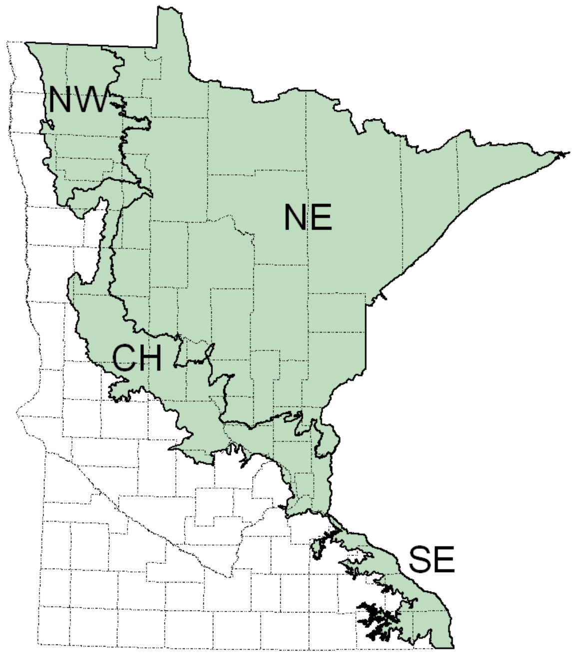


Figure 1. Survey regions for **ruffed grouse** in Minnesota. Northwest (NW), Northeast (NE), Central Hardwoods (CH), and Southeast (SE) survey regions are depicted relative to county boundaries (dashed lines) and influenced by the Ecological Classification System.

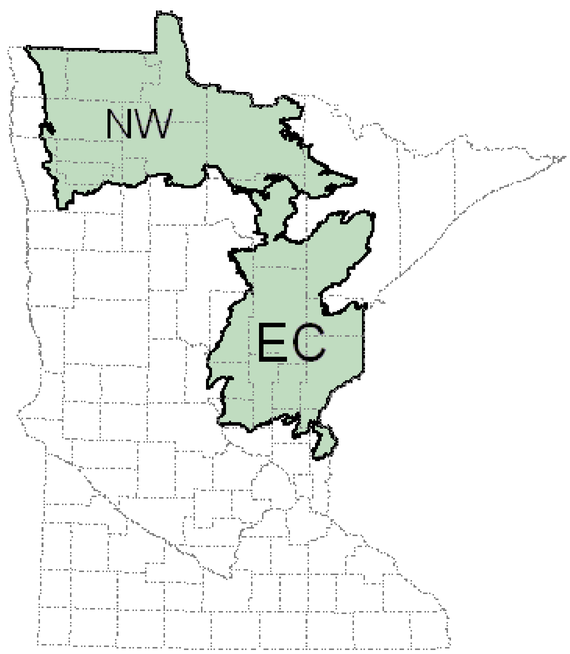


Figure 2. Survey regions for **sharp-tailed grouse** in Minnesota. Northwest (NW) and East Central (EC) survey regions are depicted relative to county boundaries (dashed lines) and influenced by Ecological Classification System Subsections boundaries.

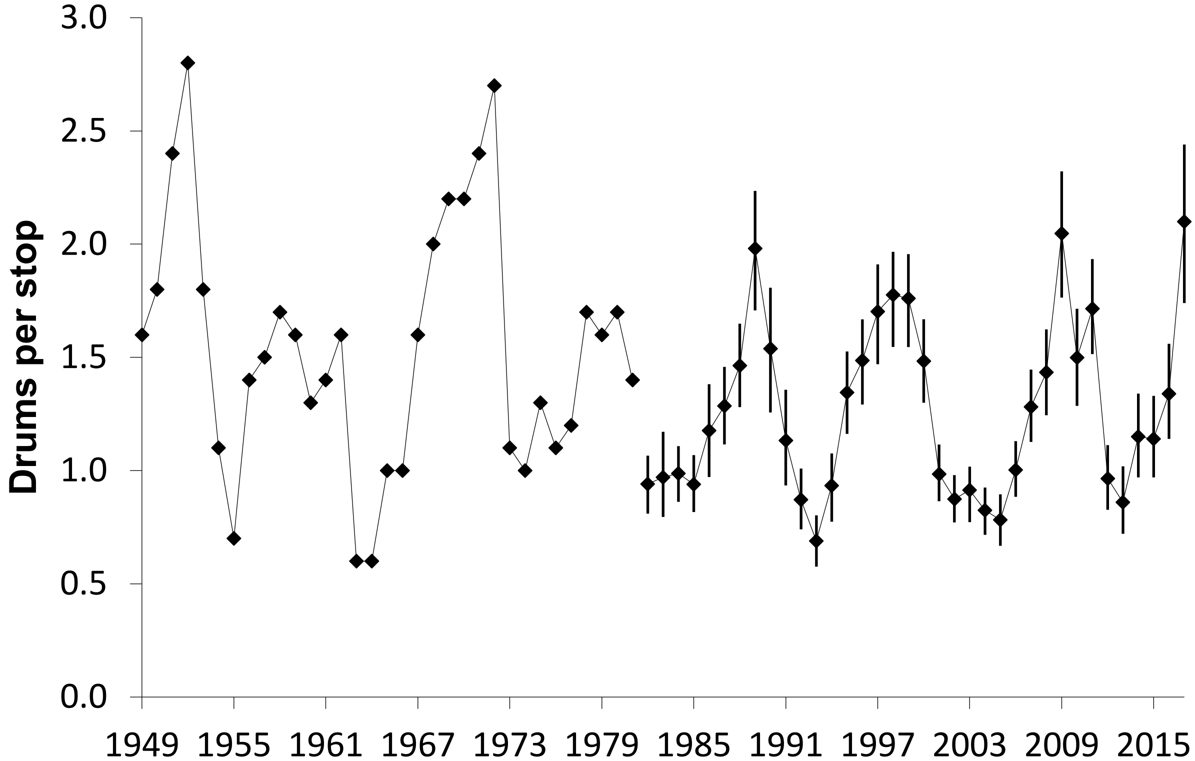
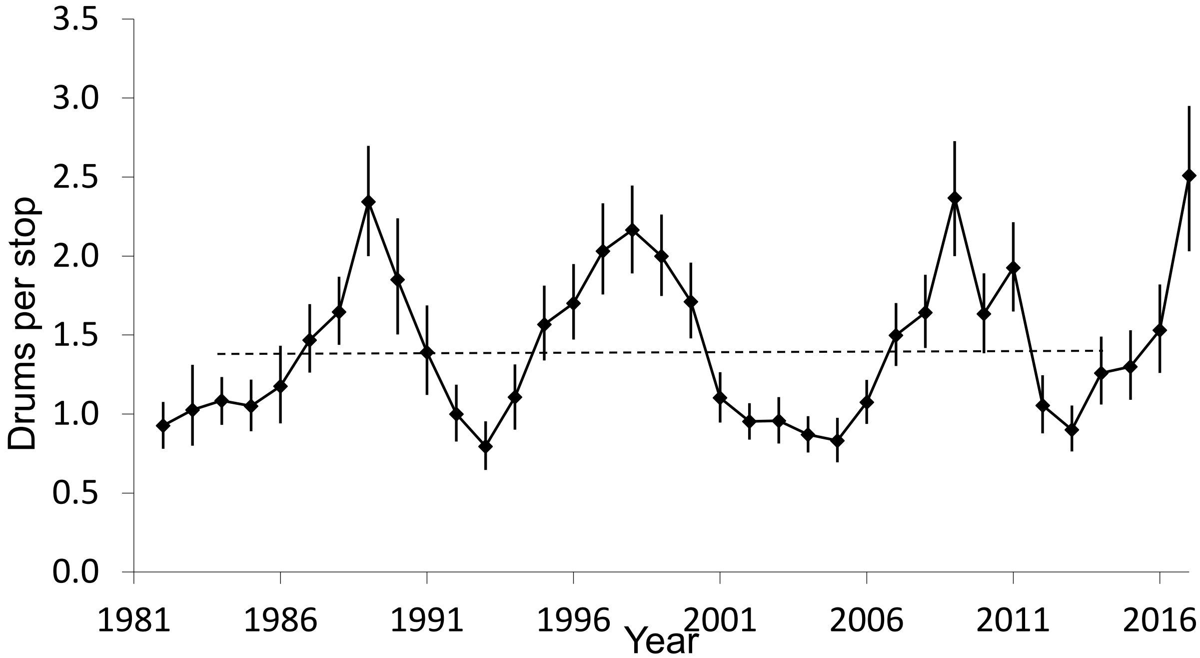
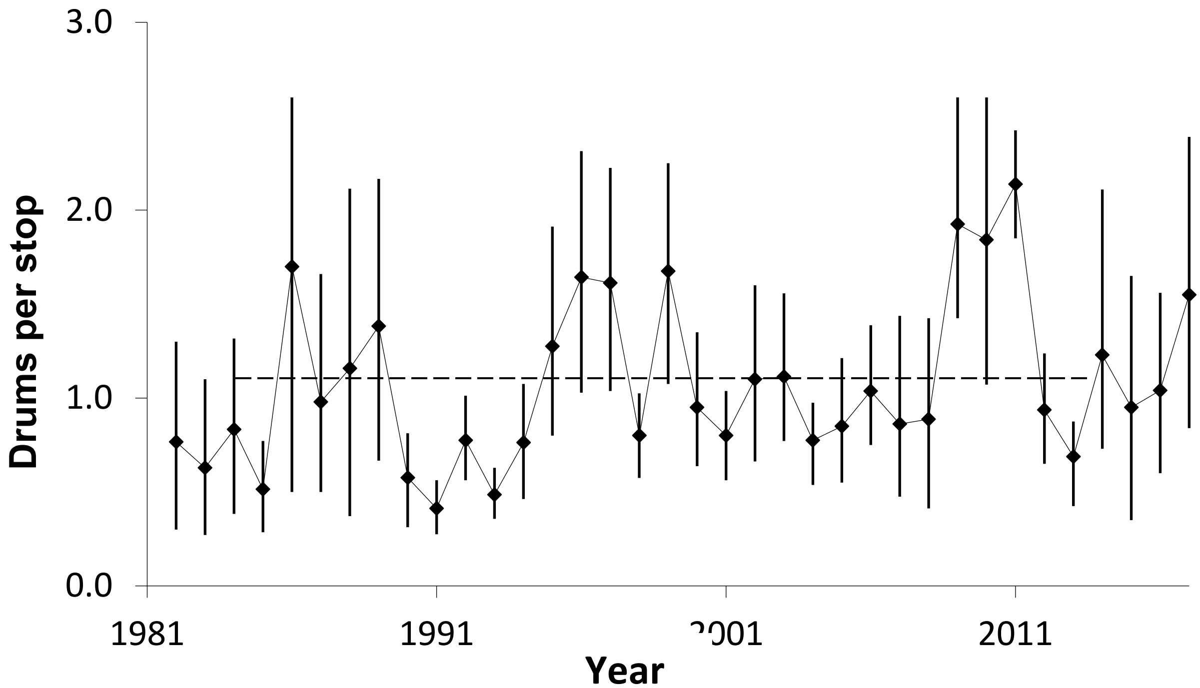


Figure 3. Statewide ruffed grouse population index values in Minnesota. Bootstrap (95%) confidence intervals (CI) are provided after 1981, but different analytical methods were used prior to this and thus CI are not available for earlier years. The difference between 1981 and 1982 is biological and not an artifact of the change in analysis methods.

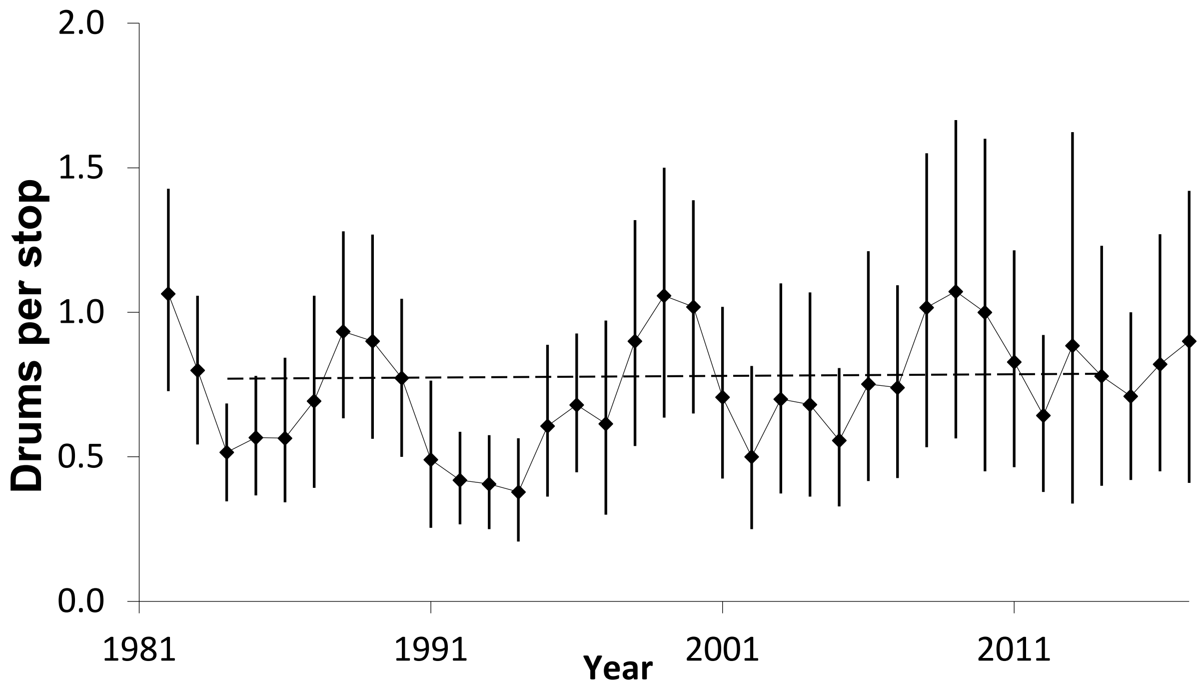
a.


3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Drums per stop
1981
1986
1991
1996
2001
2006
2011
2016
Year

b.


3.0
2.0
1.0
0.0
Drums per stop
1981
1991
2001
2011
Year

c.



d.

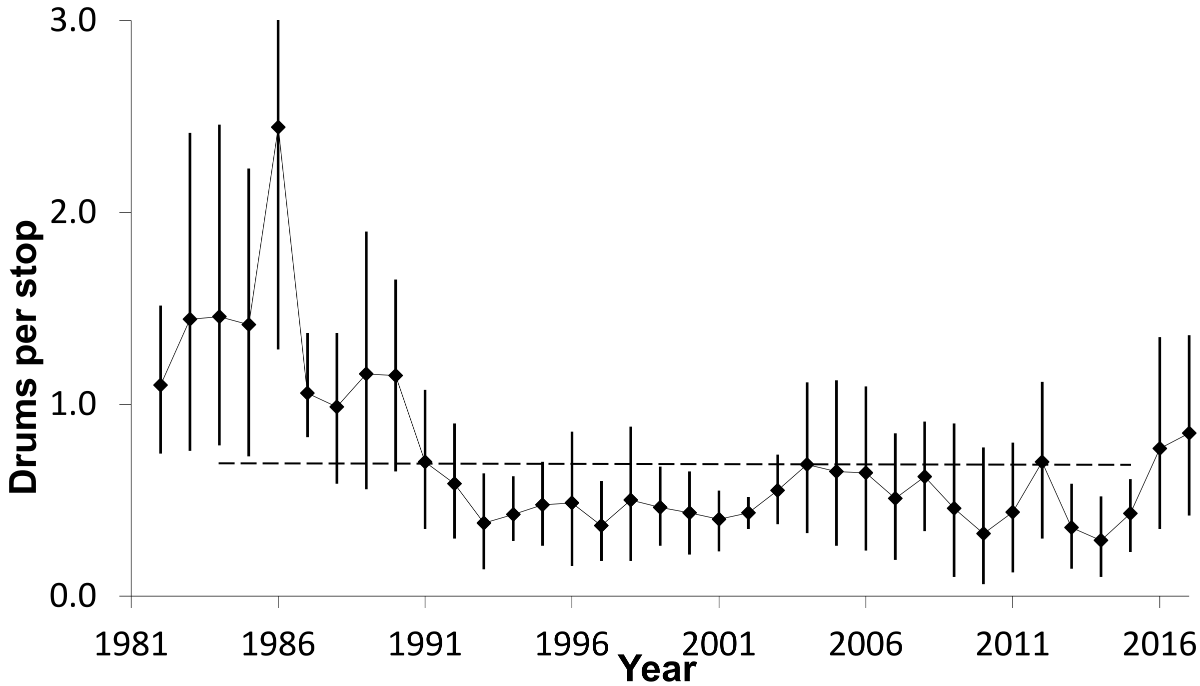


Figure 4a,b,c,d. Ruffed grouse population index values in the **Northeast** (a), **Northwest** (b), **Central Hardwoods** (c), and **Southeast** (d) survey regions of Minnesota. The mean for 1984-2014 is indicated by the dashed line. Bootstrap (95%) confidence intervals are provided for each mean. In the bottom panel, the CI for 1986 extends beyond area depicted in the figure.

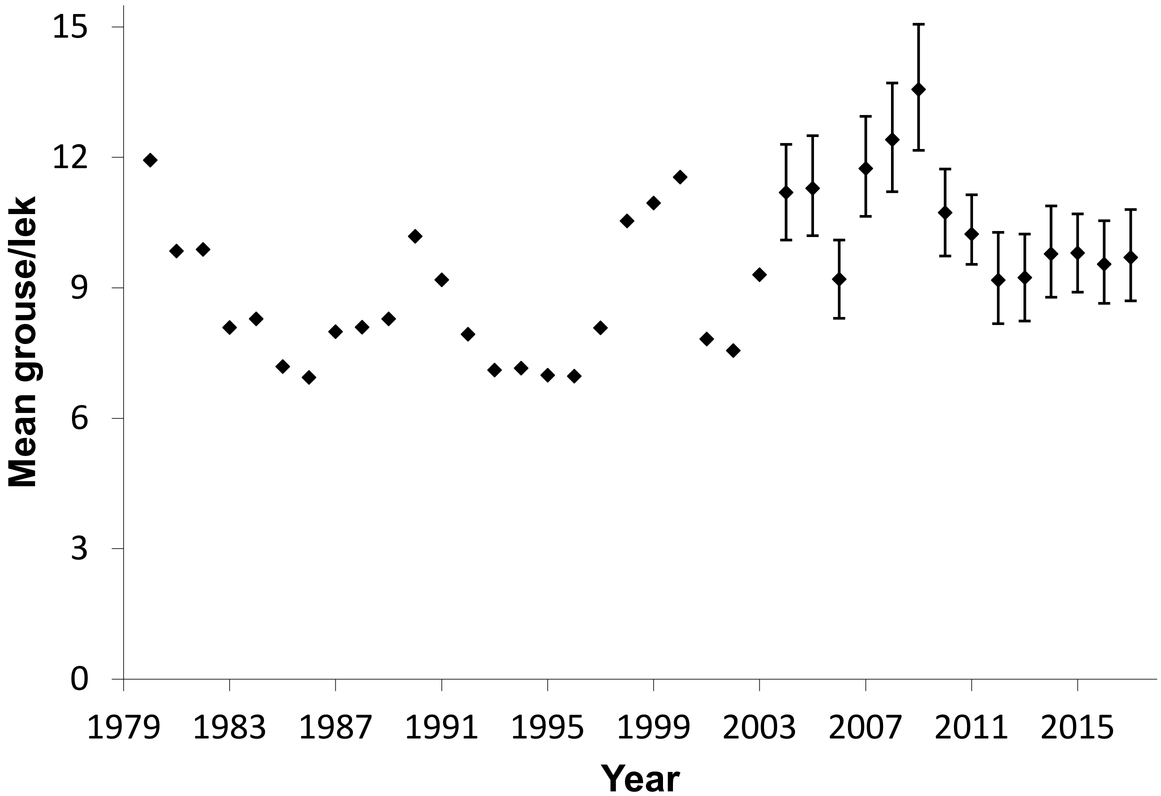


Figure 5. **Sharp-tailed grouse** counted in spring lek surveys statewide during 1980–2017. Bootstrap (95%) confidence intervals are provided for recent years. Annual means are not connected by lines because the same leks were not surveyed every year.

2017 MINNESOTA PRAIRIE-CHICKEN POPULATION SURVEY

Charlotte Roy, Forest Wildlife Populations and Research Group

SUMMARY OF FINDINGS

Greater prairie-chickens (*Tympanuchus cupido pinnatus*) were surveyed in all 17 survey blocks during the spring of 2017. Observers located 64 booming grounds and counted 663 males and birds of unknown sex in the survey blocks. They located 146 booming grounds,1,412 male prairie-chickens, and 159 birds of unknown sex throughout the prairie-chicken range. Estimated densities of 0.09 (0.07–0.11) booming grounds/km^2 and 10.4 (8.4–12.3) males/booming ground within the survey blocks were similar to densities during recent years and during the 10 years preceding modern hunting seasons (i.e., 1993–2002), but have declined since the standardized survey began in 2004. All population indices began to decline in 2008, but seem to have stabilized in recent years at a lower level.

INTRODUCTION

Historically, greater prairie-chicken (*Tympanuchus cupido pinnatus*) range in Minnesota was restricted to the southeastern portion of the state. However, dramatic changes in their range occurred in the 19th century as settlers expanded and modified the landscape with farming and forest removal, providing abundant food sources and access to new areas. However, as grass was lost from the landscape, prairie-chicken populations began to decline, their range contracted, and hunting seasons closed after 1942. In an attempt to bolster populations and expand prairie-chicken range, the Minnesota Department of Natural Resources (DNR) conducted a series of translocations in the Upper Minnesota River Valley during 1998-2006. Today, the beach ridges of glacial Lake Agassiz hold most of Minnesota's prairie-chickens, but their populations do extend southward (Figure 1). Hunting was re-opened using a limited-entry season in 2003, and approximately 120 prairie-chickens are now harvested annually.

With the opening of the new hunting season, the DNR had a greater interest in the monitoring of prairie-chicken populations, which the Minnesota Prairie-Chicken Society (MPCS) had been coordinating since 1974. The DNR, in collaboration with MPCS members, began coordinating prairie-chicken surveys and adopted a standardized survey design in 2004. These surveys are conducted at small open areas called leks, or booming grounds, where male prairie-chickens display for females in the spring and make a low-frequency booming vocalization that can be heard for miles.

Prairie-chickens continue to be surveyed to monitor changes in population densities over time. However, density estimates can be costly and difficult to obtain, so instead we count individuals and make the assumption that changes in density are the primary source of variation in counts among years. If true, counts should provide a reasonable index to long-term trends in prairie-chicken populations. However, counts are also influenced by weather, habitat conditions, observer ability, and bird behavior among other factors, which make it difficult to make inferences over short periods of time (e.g., a few annual surveys) or from small changes in index values. Nevertheless, over long time periods and when changes in index values are large, inferences from prairie-chicken surveys are more likely to be valid.

METHODS

Cooperating biologists and volunteers surveyed booming grounds in all 17 designated survey blocks in western Minnesota (Figure 2) during late-March through May. Each survey block was nonrandomly selected so that surveys would be conducted in areas where habitat was expected to be good (i.e., grassland was relatively abundant) and leks were known to occur. Each observer attempted to find and survey each booming ground repeatedly in his/her assigned block, which comprised 4 sections of the Public Land Survey (approximately 4,144 ha). Observers obtained multiple counts at each booming ground in the morning because male attendance at leks varies throughout the season and throughout the day.

During each survey, observers obtained visual counts of males, females, and birds of unknown sex from a distance with binoculars. Sex was determined through behavior; males display conspicuously, and females do not. If no birds were displaying during the survey period, then sex was recorded as unknown. When a reliable count could not be obtained visually because vegetation or topography prevented it, birds were flushed for counts and sex was recorded as unknown. Most birds for which sex was unknown were likely male because female attendance at leks is sporadic, and they are less conspicuous during lek attendance than displaying males.

In the analysis, I used counts of males and unknowns at each booming ground but not females. Leks were defined as having ≥2 males, so observations of single males were not counted as leks. Data were summarized by hunting permit area and spring survey block. The survey blocks were separated into a core group and a periphery group for analysis. The core group had a threshold density of approximately 1.0 male/km^2 during 2010, and was located proximally to other such blocks (Figure 2). I compared densities of leks and prairie-chickens to estimated densities from previous years.

I also encouraged observers to submit surveys of booming grounds outside the survey blocks because these observations may provide additional information that is helpful to prairie-chicken management. These data were included in estimates of minimum abundance of prairie-chickens. However, these data were not used in the analysis of lek and prairie-chicken densities because effort and methods may have differed from those used in the survey blocks.

RESULTS & DISCUSSION

Observers from DNR Division of Fish and Wildlife, the U.S. Fish & Wildlife Service, and The Nature Conservancy, as well as many unaffiliated volunteers counted prairie-chickens between 28 March and 20 May 2017. Observers located 146 booming grounds and observed 1,412 male prairie-chickens and 159 birds of unknown sex within and outside survey blocks (Table 1). These counts represent a minimum number of prairie-chickens in Minnesota during 2017, but because survey effort outside of survey blocks is not standardized among years, these counts should not be compared among years or permit areas.

Table 1. Minimum abundance of prairie-chickens within and outside hunting permit areas in Minnesota during spring 2017. Lek and bird counts are not comparable among permit areas or years.

Permit Area	Area (km^2)	Leks	Males	Unk[a]
803A	1,411	12	103	0
804A	435	2	15	0
805A	267	17	163	0
806A	747	10	65	18
807A	440	23	273	5
808A	417	21	349	0
809A	744	12	164	0
810A	505	8	68	17
811A	706	9	51	18
812A	914	8	42	21
813A	925	7	58	0
PA subtotal	7,511	129	1,351	79
Outside PAs[b]	NA[c]	17	61	80
Grand total	NA[c]	146	1,412	159

[a] Unk = prairie-chickens for which sex was unknown, but which were probably males.
[b] Counts done outside permit areas (PA).
[c] NA = not applicable because the area outside permit areas was not defined.

Within the standardized survey blocks, 663 males and birds of unknown sex were counted on 64 booming grounds during 2017 (Table 2). These counts are the second lowest—only lower in 2016—since the standardized survey began in 2004 and 1,566 males and 95 booming grounds were counted. This contrasts with the high count of 1,618 males and 114 booming grounds in 2007. Each lek was observed an average of 2.5 times (median = 2), with 31% of booming grounds observed just once. These counts should not be regarded as estimates of abundance because detection probabilities of leks and birds have not been estimated. However, if we assume that detection probabilities and effort are similar among years in the survey blocks, then population indices based on survey block data can be used to monitor changes in abundance among years.

Densities of prairie-chickens in the 10 core survey blocks were 0.10 (0.07–0.12) booming grounds/km^2 and 11.8 (9.1–14.5) males/booming ground (Table 2, Figure 2). In the 7 peripheral survey blocks, densities were 0.08 (0.04–0.11) booming grounds/km^2 and 7.6 (5.8–9.5) males/booming ground. The density of 0.09 (0.07–0.11) booming grounds/km^2 in all survey blocks during 2017 was similar to densities during recent years (Table 2, Figure 3) and the average of 0.08 (0.06–0.09) booming grounds/km^2 during the 10 years preceding recent hunting seasons (i.e., 1993–2002). Similarly, the density of 10.4 (8.4–12.3) males/booming ground in all survey blocks during 2017 was comparable to densities during recent years and similar to the average of 11.5 (10.1–12.9) males/booming ground observed during 1993–2002 (Table 2, Figure 3). However, these densities are lower than the years preceding 2008 when CRP enrollments in the counties containing the survey blocks were highest. Densities appear to have stabilized over the last several years at a new lower level. These changes in the population indices coincide with gains and losses in enrollments in the Conservation Reserve Program. More explicit examination of these patterns is underway in collaboration with researchers at the Cooperative Wildlife Research Unit at the University of Minnesota.

Table 2. Prairie-chicken counts within survey blocks in Minnesota.

			2017		Change from 2016[a]	
Range[b]	Survey Block	Area (km^2)	Booming grounds	Males[c]	Booming grounds	Males[c]
Core	Polk 1	41.2	6	57	0	-4
	Polk 2	42.0	4	45	-1	-13
	Norman 1	42.0	2	15	1	10
	Norman 2	42.2	6	43	3	9
	Norman 3	41.0	4	36	-1	-34
	Clay 1	46.0	7	100	0	16
	Clay 2	41.0	2	76	0	12
	Clay 3	42.0	4	61	-3	-10
	Clay 4	39.0	3	19	0	4
	Wilkin 1	40.0	4	43	1	4
	Core subtotal	415.0	42	495	0	-6
Periphery	Mahnomen	41.7	3	39	1	21
	Becker 1	41.4	6	51	2	23
	Becker 2	41.7	5	23	2	6
	Wilkin 2	41.7	1	5	-1	-9
	Wilkin 3	42.0	4	33	-1	-10
	Otter Tail 1	41.0	2	9	1	2
	Otter Tail 2	40.7	1	8	0	2
	Periphery subtotal	290.6	22	168	4	35
Grand total		705.5	64	663	4	29

[a] The 2016 count was subtracted from the 2017 count, so positive values indicate increases.

[b] Survey blocks were categorized as within the core or periphery of the Minnesota, prairie-chicken range based upon bird densities and geographic location.

[c] Includes birds recorded as being of unknown sex but excludes lone males.

ACKNOWLEDGMENTS

I would like to thank cooperators who conducted and helped coordinate the prairie-chicken survey. Cooperators within the DNR included Emily Hutchins, Brian Torgusson, Rob Baden, Michael Oehler, Becky Ekstein, Matt Morin, and Phil Doll; cooperators with The Nature Conservancy included Brian Winter, Travis Issendorf, and volunteers Pat Beauzay, Rick Julian, Matt Mecklenburg, Tyler Larson, Derek Savage, Tony Nelson, Dennis Thielen, and Lindsey Reinarz; cooperators with the US Fish and Wildlife Service included Shawn Papon, Chad Raitz, Cody Townsend, Ben Walker; and numerous additional volunteers participated, including Dan Svedarsky, Doug Wells, Tom Kucera, Jon Voz, Ross Hier, Tori Drake, and Kaly Adkins. Bemidji

State University faculty and students, Brian Hiller and Adam Maleski, also assisted with surveys this year. This survey was funded in part by the Wildlife Restoration (Pittman-Robertson) Program W-69-S-15 Project #14. Mike Larson provided assistance and comments which improved this report.

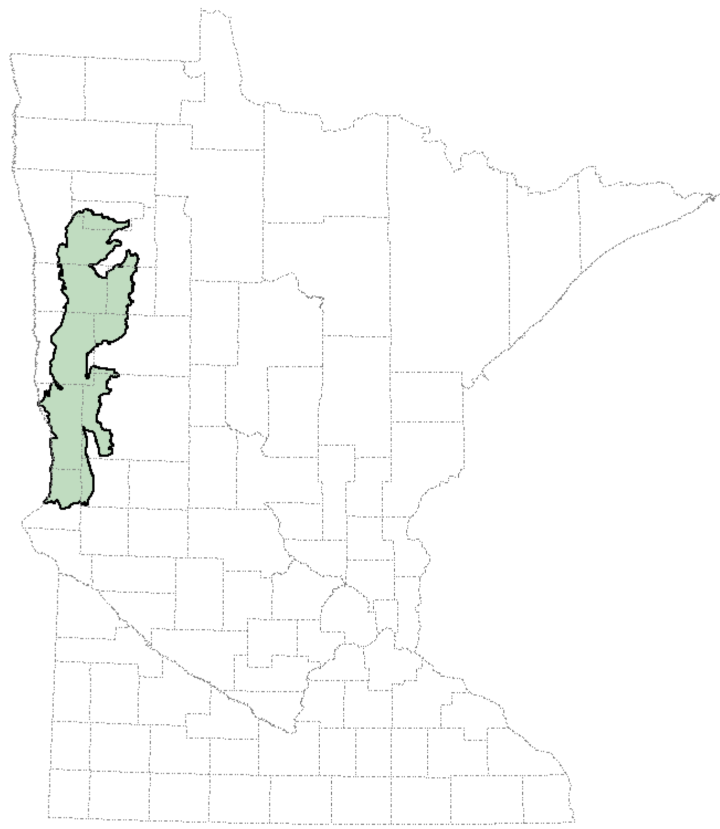


Figure 1. Primary greater prairie-chicken range in Minnesota (shaded area) relative to county boundaries. The range boundary was based on Ecological Classification System Land Type Associations and excludes some areas known to be occupied by prairie-chickens.

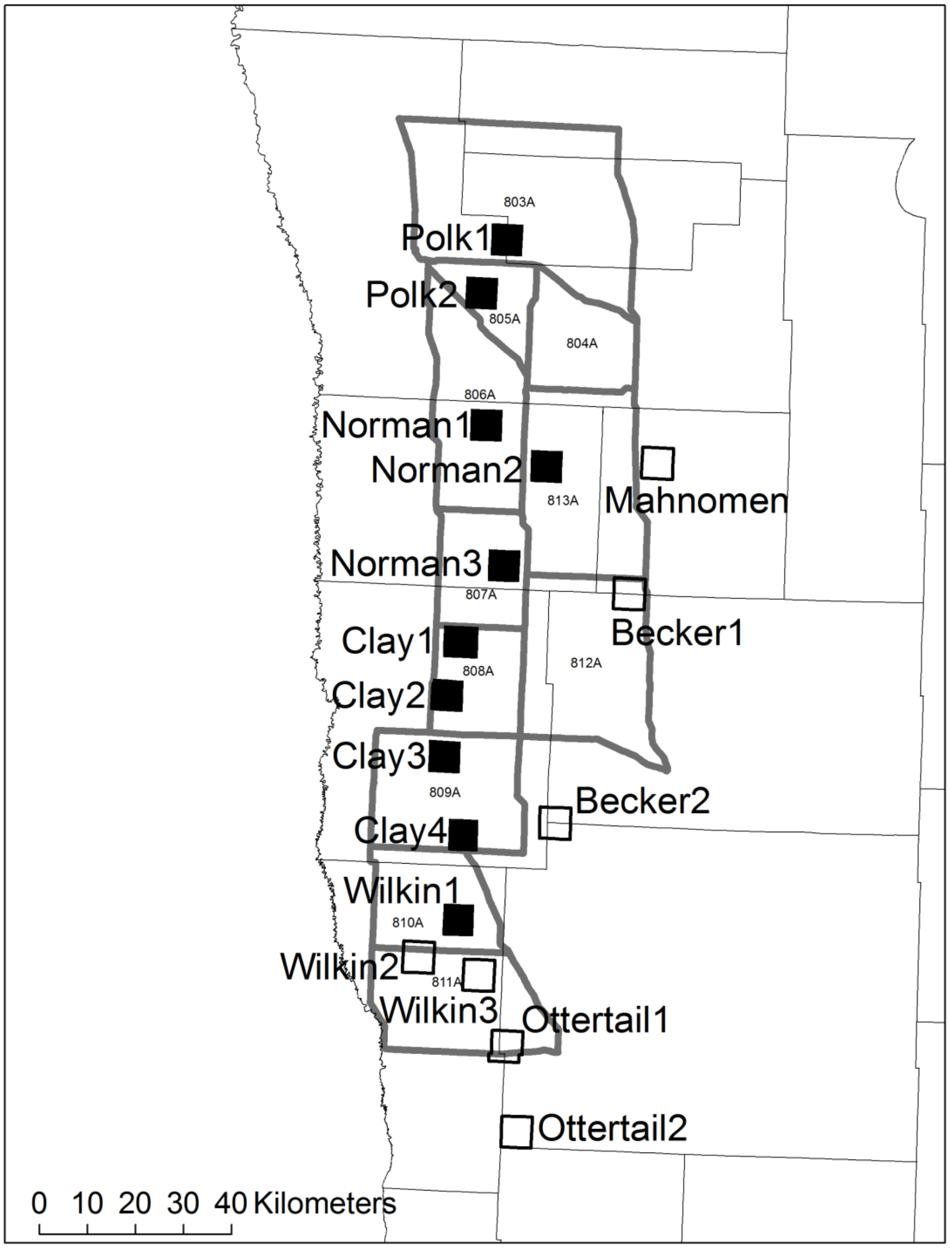


Figure 2. Prairie-chicken lek survey blocks (41 km^2, labeled squares) and hunting permit areas (thick grey lines) in western Minnesota. Survey blocks were either in the core (black) or periphery (white) of the range with a threshold of 1.0 male/km^2 in 2010, and were named after their respective counties (thin black lines). Permit areas were revised in 2013 to eliminate 801A and 802A, modify 803A, and add 812A and 813A. See previous reports for former permit area boundaries.

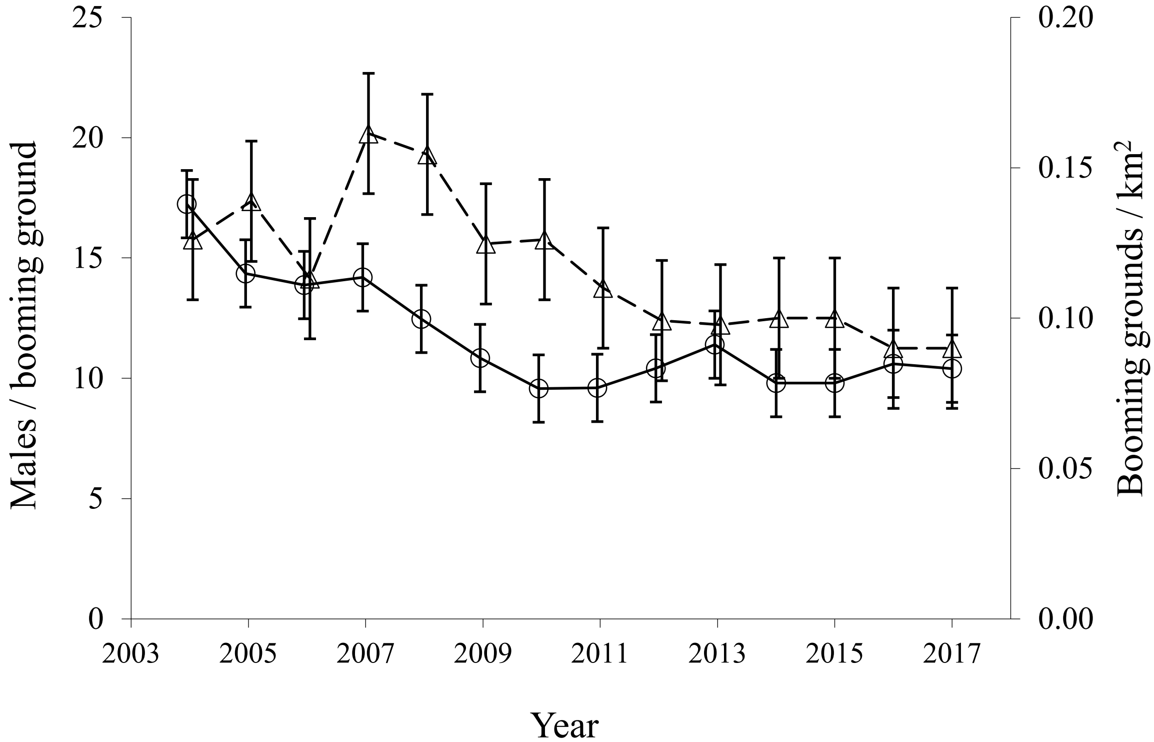


Figure 3. Mean prairie-chicken males/booming ground (circles connected by solid line) and booming grounds/km^2 (triangles connected by dashed line) in survey blocks in Minnesota with 95% confidence intervals.

2017 NW MN ELK SURVEYS

Doug Franke, Area Wildlife Manager, Thief River Falls

INTRODUCTION

This year we used only fixed-wing aircraft (Cessna 185) to conduct aerial elk surveys for the Lancaster, Caribou-Vita, and Grygla elk herds. The fixed-wing aircraft followed predetermined transects spaced 1/5 mile apart at an altitude of 300 to 400 feet and speeds of 80-85 mph. The pilot and two observers recorded elk location(s) and documented the sex and size class of bulls.

METHODS

The surveys started on February 1st and ended on February 21st, 2017. Snow depths and conditions were much better than the past two years for the Lancaster and Grygla survey blocks. Snow depths ranged from 10 to 15 inches throughout the elk range. Weather conditions were average for this time of the year with temperatures ranging from a low of -16°F to a high of 32°F and mostly sunny days. There were no major delays due to precipitation, wind, or temperatures.

We waited to complete the Caribou-Vita block this year since Manitoba Wildlife staff planned to survey elk on the Canadian side in late February. The surveys for both the Canadian and US border area were completed on February 21st, 2017 within a two hour period of each other. The entire region lost a lot of snow cover prior to the surveys, resulting in fair survey conditions.

RESULTS

Lancaster—Water Tower and Percy WMA herds

This survey started on February 1st and was completed on February 3rd, 2017. The area surveyed was the same 167 mi^2 area as last year and took 16.1 hours for the fixed-wing to complete (wheels up to wheels down). The fixed-wing recorded elk at 6 separate locations within the survey boundary. Total elk recorded was 61 and included: 45 Antlerless (cows/calves) and 16 bulls (5 mature, 9 raghorn, and 2 spike bulls. The Water Tower group had 30 antlerless elk with a majority of the Lancaster bulls located less than five miles to the east. We located the Percy WMA antlerless herd (15 animals) on the western edge of Beaches Lake WMA, just east of the Percy WMA this year. Four raghorn bulls were located within a mile of the antlerless herd.

Grygla herd

This survey started on February 8th and was completed on February 9th, 2017. The area surveyed was the same 133 mi^2 area as last year and took 10.6 hours for the fixed-wing to complete. The entire survey area received a fresh snowfall the day before and made for excellent survey conditions. The fixed-wing recorded elk at 3 separate locations within the survey boundary. Total elk observed was 17 and included: 7 antlerless (cows/calves) and 10 bulls (4 mature, 2 raghorn, and 4 spike bulls).

Caribou-Vita (a.k.a. border herd)

This survey started and was completed on February 21st, 2017. The area surveyed was the same 35.5 mi^2 area as last year and took 3.4 hours for the fixed-wing to complete. The fixed-wing only recorded a single elk (1 raghorn bull) within survey boundary. There were a lot of elk tracks near the Canadian border and we assumed a majority of this herd was north of the Minnesota border. This was later confirmed when we received results from the Manitoba aerial elk survey.

The MN DNR and Manitoba Wildlife staff successfully coordinated a joint aerial elk survey that was completed February 21st, 2017 for the survey areas close to the US/Canadian border. Manitoba completed the survey for the Vita area the next day on February 22nd, 2017. Manitoba Wildlife staff used a Jet Ranger helicopter to fly north/south transects within predetermined survey blocks that covered a broad area along the border. They recorded 108 elk near the US/Canadian border and another 55 elk slightly north of Vita. Table 2 details the age/sex breakdown for these two populations.

Table 1 on page three summarizes MN DNR elk observations during the past four years of NW MN aerial elk surveys. The last two pages are maps showing 2017 locations of elk within each survey block.

ACKNOWLEDGMENTS

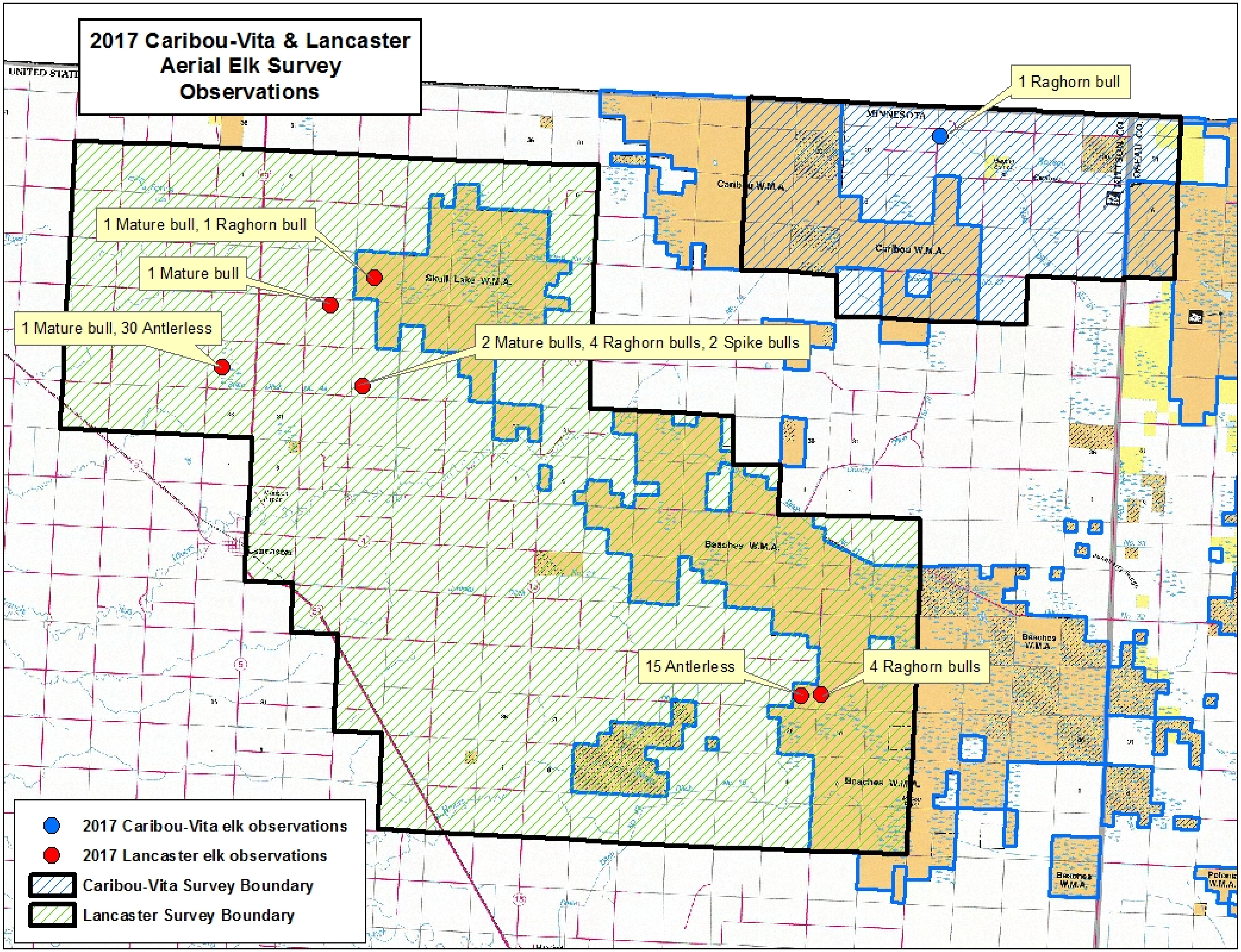
I would like to thank all those that helped with the survey this year, especially the fixed-wing pilots Chris Lofstuen, Bob Geving, and John Heineman who provided safe flying for all of us. This was Bob's first time flying the elk surveys and he did a great job! Observers this year included: Kyle Arola (Thief Lake Assistant Manager), Jason Wollin (Karlstad Assistant Area Wildlife Manager), Matt Morin (Thief River Falls Assistant Manager), and myself. Special thanks again to Brian Haroldson who put together all of the survey materials and computer used during the survey.

Table 1. Comparison of elk observations between 2014 and 2017 for the Lancaster, Caribou-Vita, and Grygla herds.

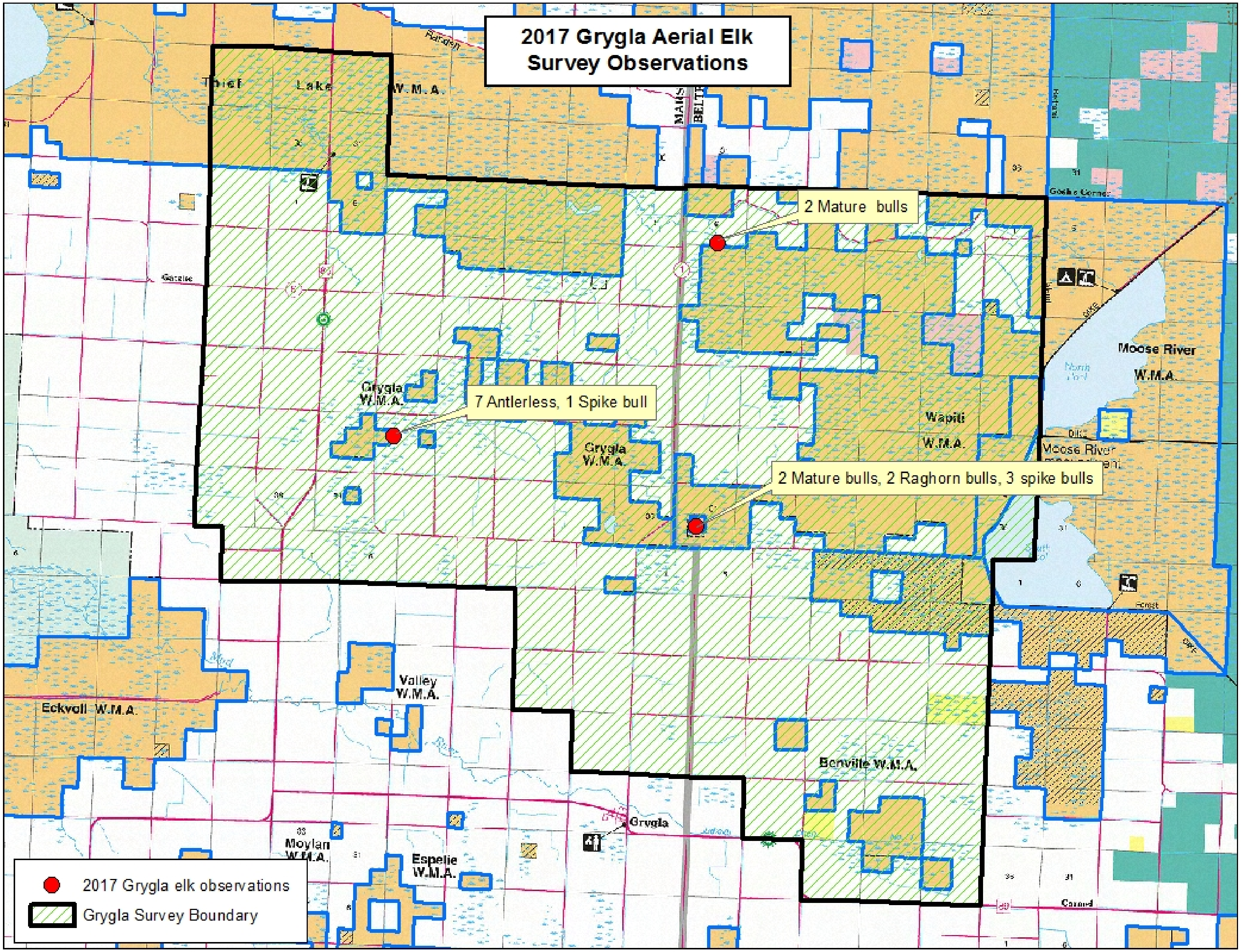
	Lancaster				**Caribou-Vita**				**Grygla**			
	2014	2015	2016	2017	2014	2015	2016	2017	2014	2015	2016	2017
Spike bull	3	2	6	2	10	5	0	0	2	3	2	4
Raghorn bull	7	8	2	9	5	9	4	1	1	5	5	2
Mature Bull	7	8	10	5	2	8	2	0	3	1	4	4
Total Bulls	**17**	**18**	**18**	**16**	**17**	**22**	**6**	**1**	**6**	**9**	**11**	**10**
Antlerless	**20**	**16**	**34**	**45**	**34**	**57**	**4**	**0**	**14**	**9**	**10**	**7**
Total Elk	**37**	**34**	**52**	**61**	**51**	**79**	**10**	**1**	**20**	**18**	**21**	**17**

Table 2. Elk observations recorded by Manitoba Wildlife staff during their aerial survey conducted February 21st and 22nd, 2017

	Border (Caribou)	**Vita**
Spike bull	2	4
Branch bull	17	7
Total Bulls	**19**	**11**
Cow	68	32
Calf	21	12
Total Antlerless	**89**	**44**
Total Elk	**108**	**55**



2017 Caribou-Vita & Lancaster
Aerial Elk Survey
Observations
1 Raghorn bull
1 Mature bull, 1 Raghorn bull
1 Mature bull
1 Mature bull, 30 Antlerless
2 Mature bulls, 4 Raghorn bulls, 2 Spike bulls
15 Antlerless
4 Raghorn bulls
Skull Lake W.M.A.
Caribou W.M.A.
Beaches W.M.A.
2017 Caribou-Vita elk observations
2017 Lancaster elk observations
Caribou-Vita Survey Boundary
Lancaster Survey Boundary


2017 Grygla Aerial Elk Survey Observations
2 Mature bulls
7 Antlerless, 1 Spike bull
2 Mature bulls, 2 Raghorn bulls, 3 spike bulls
Thief Lake W.M.A.
Grygla W.M.A.
Wapiti W.M.A.
Moose River W.M.A.
Valley W.M.A.
Eckvoll W.M.A.
Benville W.M.A.
Moylan W.M.A.
Espelie W.M.A.
Grygla
2017 Grygla elk observations
Grygla Survey Boundary

2017 AERIAL MOOSE SURVEY

Glenn D. DelGiudice, Forest Wildlife Populations and Research Group

INTRODUCTION

Each year we conduct an aerial survey in northeastern Minnesota to estimate the moose (*Alces americanus*) population and to monitor and assess changes in the overall status of the state's largest deer species. Specifically, the primary objectives of this annual survey are to estimate moose abundance, percent calves, and calf:cow and bull:cow ratios. These demographic data help us to 1) best determine and understand the population's long-term trend (decreasing, stable, or increasing), composition, and distribution; 2) set the harvest quota for the subsequent State hunting season (when applicable); 3) with research findings, improve our understanding of moose ecology; and 4) otherwise contribute to sound future management strategies.

METHODS

The survey area is approximately 5,985 mi^2 (almost 4 million acres, Lenarz 1998, Giudice et al. 2012). We estimate moose numbers, and age and sex ratios by flying transects within a stratified random sample of the 436 total survey plots that cover the full extent of moose range in northeastern Minnesota (Figure 1). To keep the stratification current, all survey plots are reviewed and re-stratified as low, medium, or high moose density about every 5 years based on past survey observations of moose, locations of recently harvested moose, and extensive field experience of moose managers and researchers. The most recent re-stratification was conducted in November 2013 for the 2014 Survey. In addition, individual plots are re-stratified after each annual survey if observations warrant. Survey plots are classified as low, medium, or high based on whether ≤ 2, 3–7, or $\geq$8 moose, respectively, would be expected to occur in a specific plot. Stratification is most important to optimizing precision of our survey estimates. In 2012, we added a 4th stratum represented by a series of 9 plots (referred to as "habitat plots") which have already undergone, or will undergo, significant disturbance by wildfire, prescribed burning, or timber harvest. These same 9 plots are surveyed each year in an effort to better understand moose use of disturbed areas and evaluate the effect of forest disturbance on moose density over time. In total, we surveyed 52 (43 randomly sampled and the 9 habitat plots) of the 436 plots this year.

All 436 survey plots in the grid (designed in 2005) are 13.9-mi^2 rectangles (5 x 2.77 mi), oriented east to west, with 8 flight-transects evenly spaced 0.3 mi apart. Minnesota Department of Natural Resources (MNDNR) Enforcement pilots flew the 2 helicopters used to conduct the survey—1 Bell Jet Ranger (OH-58) and 1 MD500E. We determined the sex of moose using the presence of antlers or the presence of a vulva patch (Mitchell 1970), nose coloration, and bell size and shape. We identified calves by size and behavior. We used the program DNRSurvey on tablet-style computers (Toughbook®) to record survey data (Wright et al. 2015). DNRSurvey allowed us to display transect lines superimposed on aerial photography, topographical maps, or other optional backgrounds to observe each aircraft's flight path over the selected background in *real time*, and to efficiently record data using a tablet pen with a menu-driven data-entry form. Two primary strengths of this aerial moose survey are the consistency and standardization of the methods since 2005 and the long-term consistency of the survey team's personnel, survey biometrician, and GIS specialists.

We accounted for visibility bias using a sightability model (Giudice et al. 2012). This model was developed between 2004 and 2007 using adult moose that were radiocollared as part of a study of survival and its impact on dynamics of the population (Lenarz et al. 2009, 2010). Logistic regression indicated that "visual obstruction" (VO) was the most important covariate in determining whether radiocollared moose were observed. We estimated VO within a 30-ft radius (roughly 4 moose lengths) of the observed moose. Estimated VO was the proportion of a circle where vegetation would prevent you from seeing a moose from an oblique angle when circling that spot in a helicopter. If we observed more than 1 moose (a group) at a location, VO was based on the first moose sighted. We used uncorrected estimates (no visibility bias [sightability] correction) of bulls, cows, and calves, adjusted for sampling, to calculate the bull:cow and calf:cow ratios at the population level (i.e., using the combined ratio estimator; Cochran 1977:165).

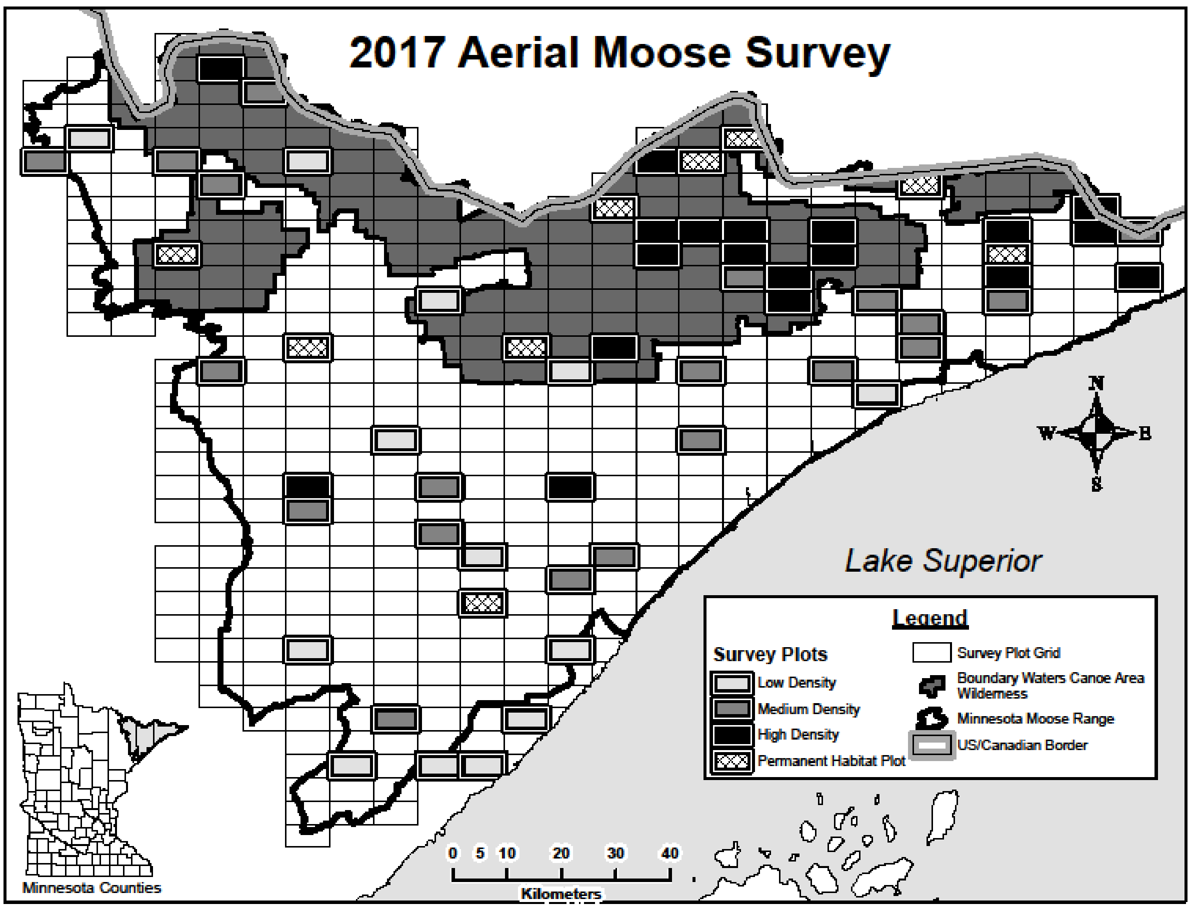


Figure 1. Moose survey area and 52 sample plots flown in the 2017 aerial moose survey.

RESULTS AND DISCUSSION

The survey was conducted from 5 to 14 January 2017. It consisted of 8 actual survey days, and as in 2014, 2015, and 2016, it included a sample of 52 survey plots. This year, based on optimal allocation analyses, we surveyed 10 low-, 17 medium-, and 16 high-density plots, and the 9 permanent or habitat plots (Giudice 2017). Generally, 8" of snow cover is our minimum threshold depth for conducting the survey. Snow depths were 8–16" and >16" on 27% and 73% of the sample plots, respectively. Overall, survey conditions were rated as good for 90% and fair for 10% of the plots when surveyed. Average survey intensity was 50 minutes/plot (13.9 mi^2) and ranged from 41 to 65 minutes/plot (Giudice 2017).

This year a total of 508 moose were observed on 47 (90%) of the 52 plots surveyed (a total 723 mi^2), almost identical to the 506 moose observed on 47 of 52 plots during the 2016 survey. Similarly, an average of 10.8 moose (range = 1–39) were observed per "occupied" plot. Plot occupancy during the past 13 years averaged 81% (range = 65–95%) with a mean 11.8 moose observed per occupied plot. This year's 508 observed moose included 206 bulls, 217 cows, 74 calves, and 11 unclassified adults. Overall, estimated VO averaged 34% (range = 0−90%) and average estimated detection probability was 0.63 (range = 0.20−0.85); both were comparable to those of previous years.

After adjusting for sampling and sightability, we estimated the population in northeastern Minnesota at 3,710 (3,010–4,710, 90% confidence interval [CI]) moose (Table 1, Figure 2). As can be noted from the 90% confidence intervals associated with the population point estimates, statistical uncertainty inherent in aerial wildlife surveys can be quite large, even when surveying large, dark, relatively conspicuous animals such as moose against a white background during winter. This is attributable to the varied (1) occurrence of dense vegetation, (2) habitat use by moose, (3) behavioral responses to aircraft, (4) effects of annual environmental conditions (e.g., snow depth, ambient temperature) on their movements, and (5) interaction of these and other factors. Consequently, year-to-year statistical comparisons of population estimates are *not* supported by these surveys. These data are best suited to establishing long-term trends; even short-term trends must be viewed cautiously.

Past aerial survey and research results have indicated that the long-term trend of the population in northeastern Minnesota has been declining since 2006 (Lenarz et al. 2010, DelGiudice 2016). The current population estimate is 58% less than the estimate in 2006 and the declining linear trend during the past decade remains statistically significant (r^2 = 0.80, P< 0.001, Figure 2). However, the leveling since 2012 persists, and a piecewise polynomial curve indicates that the trend from 2012 to 2017 is not declining (Figure 3). While this recent short-term trend is noteworthy, it applies only to the existing survey estimates, not the future trajectory of the population (Giudice 2017).

Table 1. Estimated moose abundance, 90% confidence intervals, calf:cow ratios, percent calves in the population, percent cows with twins, and bull:cow ratios estimated from aerial surveys in northeastern Minnesota, 2005–2017.

SURVEY	Estimate	90% CONFIDENCE INTERVAL	CALF: COW	% Calves	% Cows w/ twins	Bull: Cow
2005	8,160	6,090 – 11,410	0.52	19	9	1.04
2006	8,840	6,790 – 11,910	0.34	13	5	1.09
2007	6,860	5,320 – 9,100	0.29	13	3	0.89
2008	7,890	6,080 – 10,600	0.36	17	2	0.77
2009	7,840	6,270 – 10,040	0.32	14	2	0.94
2010	5,700	4,540 – 7,350	0.28	13	3	0.83
2011	4,900	3,870 – 6,380	0.24	13	1	0.64
2012	4,230	3,250 – 5,710	0.36	15	6	1.08

2013	2,760	2,160 – 3,650	0.33	13	3	1.23
2014	4,350	3,220 – 6,210	0.44	15	3	1.24
2015	3,450	2,610 – 4,770	0.29	13	3	0.99
2016	4,020	3,230 – 5,180	0.42	17	5	1.03
2017	3,710	3,010 – 4,710	0.36	15	4	0.91

The January 2017 calf:cow ratio of 0.36 is low but similar to the 12-year average since 2005 (0.35, Table 1, Figure 4). Calves were 14.5% of the total 508 moose actually observed and represented 15% of the estimated population (Table 1, Figure 4). Twin calves were observed with 9 of the 217 (4%) cow moose (Table 1). Overall, survey results indicate calf survival to January 2017 is low, but it is typical compared to most years since the population decline began following the 2006 survey. Findings of an ongoing moose calf study also indicate similar survival rates (0.442−0.485) in early winter in 2015−16 and 2016−17 (Severud et al., unpublished data; Obermoller et al., unpublished data). Annual recruitment of calves can have a significant influence on population performance of moose, but it is not actually determined until the next spring's calving season when calves observed during winter become yearlings. One study documented average survival of calves from January to April (2005−2011) in northeastern Minnesota at 59% (39.6−78.4, 90% CL; Schrage et al., unpublished data). This spring a helicopter calf survey targeting adult GPS-collared females that were known to be pregnant during the spring 2016 calving season will shed additional light on annual calf survival (recruitment). It also is important to note that adult moose survival has the greatest long-term impact on annual changes in the moose population (Lenarz et al. 2010). Consistent with the recent relative stability of the population trend, the annual survival rate of adult GPS-collared moose has changed little (85–88%) during the past 3 years (Carstensen et al. 2017, unpublished data), but it is slightly higher than the previous long-term (2002−2008) average of 81% (Lenarz et al. 2009).

The estimated bull:cow ratio (0.91, Table 1; Figure 5) is similar to the long-term mean of 0.98 during 2005–2016. However, there has been a great deal of annual variability associated with the bull:cow ratios, consequently, they exhibit no clear upward or downward long-term trend.

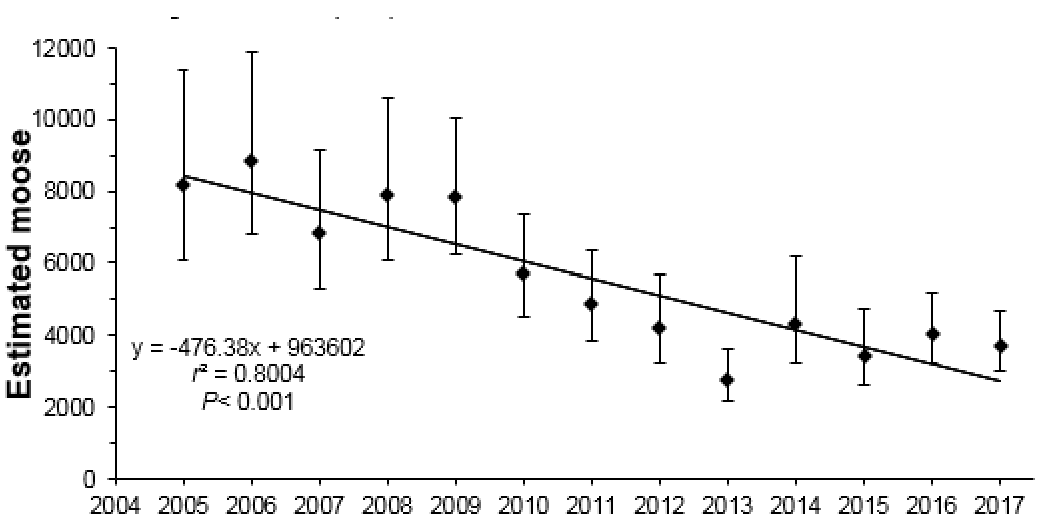


Figure 2. Point estimates, 90% confidence intervals, and a linear trend line of estimated moose abundance in northeastern Minnesota, 2005–2017. (Note: The 2005 survey was the first to be flown with helicopters and to include a sightability model and a uniform grid of east-west oriented rectangular 13.4-mi^2 plots).

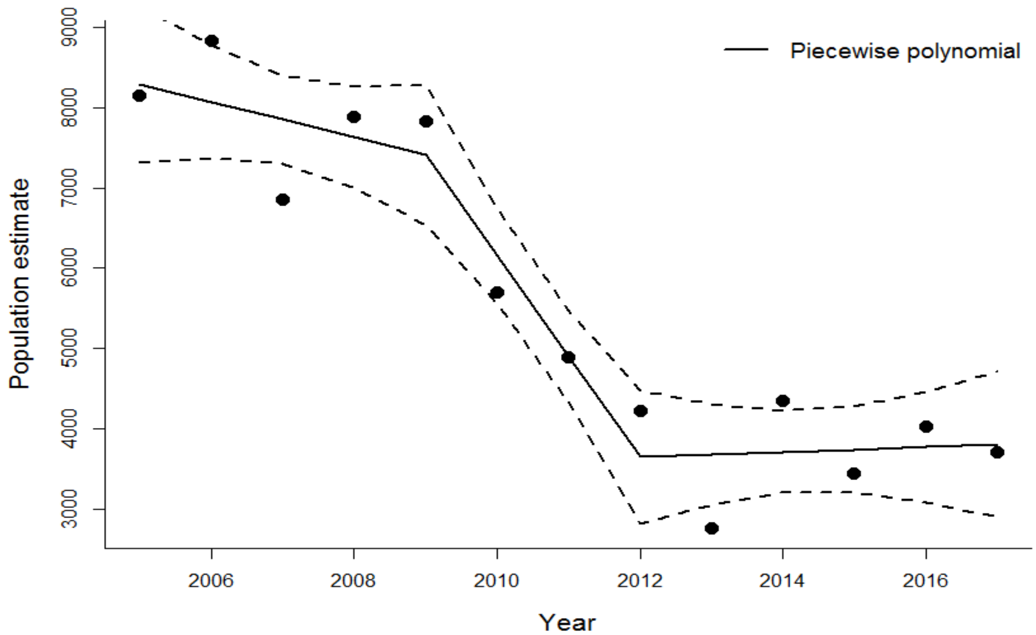


Figure 3. Point estimates, 90% confidence intervals, and a piecewise polynomial curve of moose abundance in northeastern Minnesota, 2005–2017. This curve shows a change in the short-term slope of the trend from 2012 to 2017 compared to 2009 to 2012.

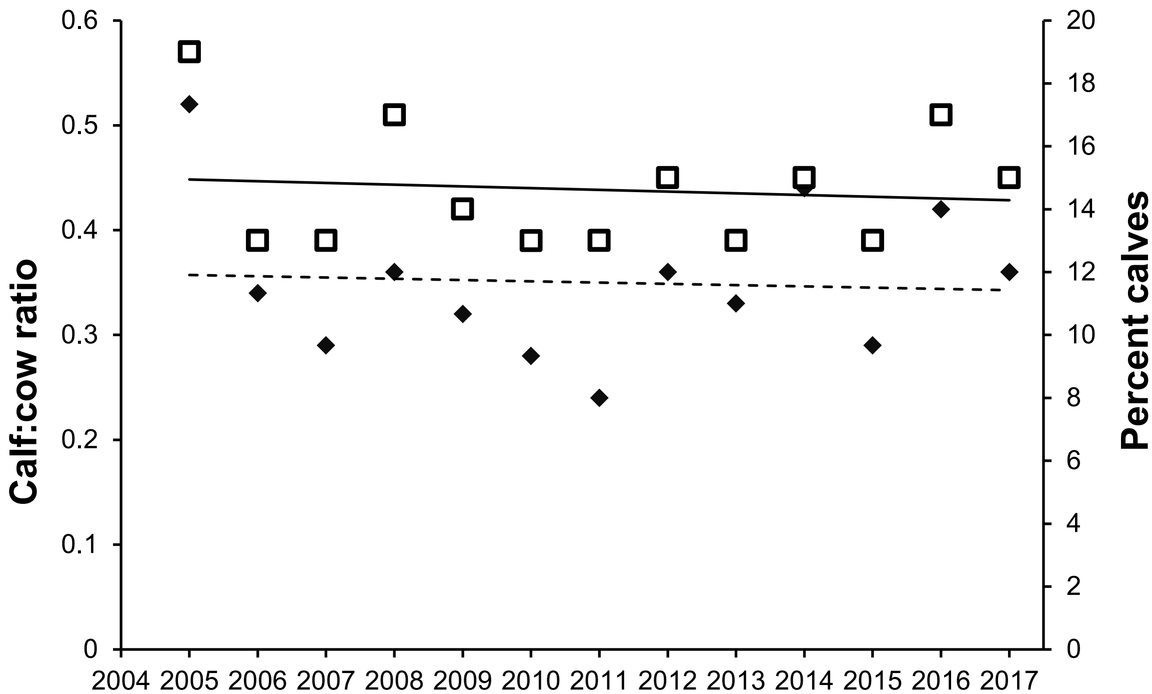


Figure 4. Estimated calf:cow ratios (solid diamonds, dashed trend line) and percent calves (open squares, solid trend line) of the population from aerial moose surveys in northeastern Minnesota, 2005–2017.

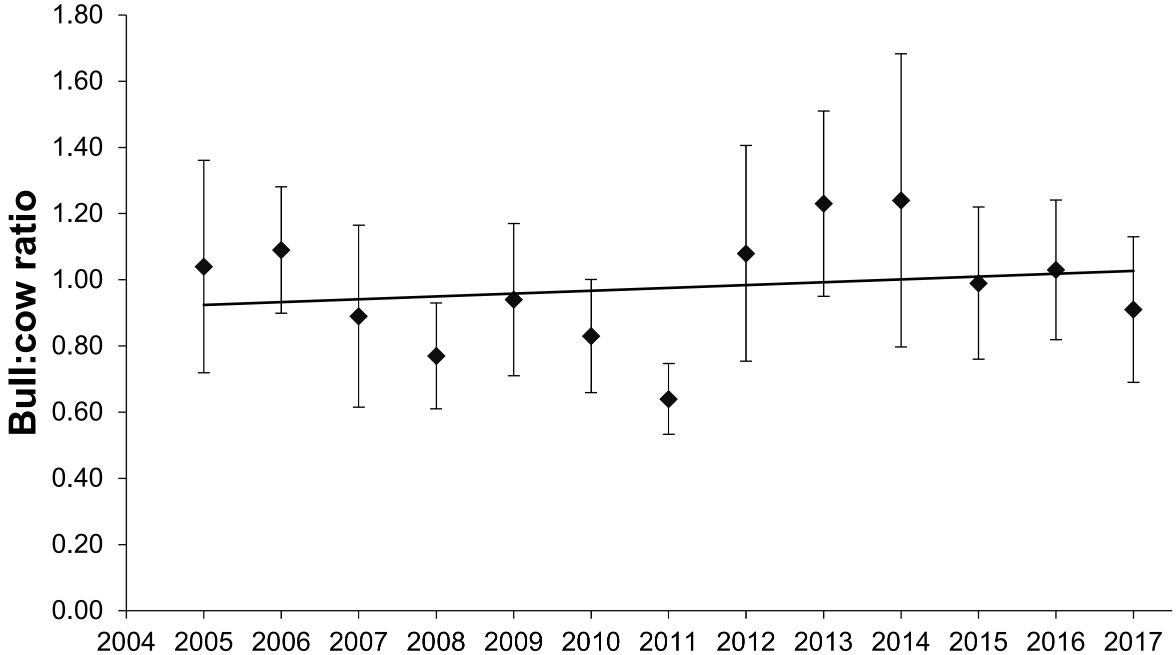


Figure 5. Estimated bull:cow ratios, 90% confidence intervals, and trend line from aerial moose surveys in northeastern Minnesota, 2005–2017.

ACKNOWLEDGMENTS

This survey is an excellent partnership between the Divisions of Enforcement and of Fish and Wildlife, the Fond du Lac Band of Lake Superior Chippewa, and the 1854 Treaty Authority. Specifically, thank you to Thomas Buker, Chief Pilot, 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. Enforcement pilots Brad Maas and John Heineman skillfully piloted the aircraft during the surveys, and Tom Rusch, Andy Edwards, Mike Schrage, Nancy Hansen, and Jeremy Maslowski flew as observers. The consistent annual efforts of these teams contribute to the rigor of this survey and the comparability of long-term results, and are greatly appreciated. Thank you to John Giudice who continues to provide critical statistical consultation and analyses, and to Barry Sampson for creating the process to generate the GIS survey maps and GPS coordinates for the transect lines and for his work on re-stratification of the survey plots. We gratefully acknowledge Bob Wright, Brian Haroldson, and Chris Pouliot for creating the program, DNRSurvey. Bob also modifies the software as needed and each year provides refresher training for survey observers using DNRSurvey. The efforts of all of these people contribute to survey improvements. This report has been reviewed by Paul Telander, Lou Cornicelli, Mike Larson, Mike Schrage, and Andy Edwards. This project was funded in part by the Wildlife Restoration (Pittman-Robertson) Program.

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MINNESOTA WOLF POPULATION UPDATE 2017

John Erb, Carolin Humpal, and Barry Sampson, Forest Wildlife Populations and Research Group

INTRODUCTION

Since the late 1970's, Minnesota has monitored its statewide wolf population using an approach that combines attributes of territory mapping with an *ad hoc* approach to determine the total area of the state occupied by wolf packs. The methods employed have changed only slightly during this time. Initially, surveys were conducted at approximately 10-year intervals (1978, 1988, 1997), thereafter at approximately 5-year intervals (2003, 2007, 2012). Results indicated a geographically and numerically expanding population through the 1997-98 survey, with little geographic expansion from 1998 to 2007 (Erb and DonCarlos 2009). These results were generally consistent with separate wolf population trend indicators (annual scent station survey, winter track survey, and number of verified depredations) in Minnesota.

In 2012, wolves in the Western Great Lakes Distinct Population Segment were removed as a listed species under the federal Endangered Species Act. The de-listing coincided with the normally scheduled (every 5th year) wolf survey as well as survey timeline specifications in the Minnesota Wolf Management Plan (i.e., first and fifth year after delisting; Minnesota Department of Natural Resources 2001). The 2012-13 survey (Erb and Sampson 2013) concluded that overall wolf range had expanded along its south and west edge, but with minimal change in the total amount of land occupied by wolf packs.

After federal de-listing in 2012, wolf harvest seasons were established and population surveys have been conducted annually to better inform annual management decisions. In the first three winters after de-listing, wolf population point estimates varied from approximately 2,200 to 2,400 (Erb et al. 2014). In December 2014, following the third consecutive wolf harvest season, wolves in Minnesota were returned to the list of federally threatened species as a result of a court ruling. Herein we provide an update of population status from the 2016-17 winter survey.

METHODS

The methodology used to estimate wolf population size in Minnesota utilizes three primary pieces of information: 1) an estimate of the total area of land occupied by wolf packs; 2) an estimate of average wolf pack territory size; and 3) an estimate of average mid-winter pack size. It is likely that occupied range changes on a comparatively slow timescale compared to fluctuations in average territory and pack size. As such, since the 2012-13 survey we have assumed that occupied range has remained unchanged (i.e., 70,579 km^2; Erb and Sampson 2013) and tentatively plan to re-evaluate occupied range at 5-year intervals.

To radio-collar wolves, we and various collaborators captured wolves using foothold traps (LPC # 4, LPC #4 EZ Grip, or LPC #7 EZ Grip) approved as part of research conducted under the Association of Fish and Wildlife Agencies Best Management Practices for trapping program. Twenty-five wolves have also been captured with the use of live-restraining neck snares, and a few by helicopter dart-gun. Wolves were typically immobilized using a mixture of either Ketamine:Xylazine or Telazol:Xylazine. After various project-specific wolf samples and measurements were obtained, the antagonist Yohimbine and an antibiotic were typically administered to all animals prior to release. Various models of radio-collars were deployed depending on study area and collar availability. Most GPS radio-collars were programmed to take 3-6 locations per day, while wolves fitted with VHF-only radio-collars were relocated at approximately 7- to 10-day intervals throughout the year, or in some cases primarily from early winter through spring.

To estimate average territory size, we delineated territories of radio-collared packs using minimum convex polygons (MCP) for consistency with previous surveys. Prior to delineating wolf pack territories, we removed 'outlier' radiolocations using the following guidelines, though subjective deviations were made in some cases as deemed biologically appropriate: 1) for wolves with approximately weekly VHF radiolocations only, locations > 5 km from other locations were excluded as extraterritorial forays (Fuller 1989); 2) for GPS collared wolves with temporally fine-scale movement information, we removed obvious movement paths if the animal did not travel to that area on multiple occasions and if use of the path would have resulted in inclusion of obviously unused areas in the MCP; and 3) for consistency with the way in which the data is used (i.e., to estimate number of packs), points that result in notable overlap with adjacent territories are removed.

In past surveys where all or the majority of territories were delineated using VHF radiolocations, raw territory sizes were increased 37% to account for the average amount of interstitial space between delineated wolf pack territories, as estimated from several Minnesota studies (Fuller et al. 1992:50) where the number of radiolocations per pack typically averaged 30-60. Interstitial spaces are a combination of small voids created by landscape geometry and wolf behavior, but can also be an artifact of territory underestimation when there are comparatively sparse radiolocations. Hence, for packs with < 100 radiolocations (n=7; mean number of radiolocations = 32), we multiplied each estimated territory size by 1.37 as in the past. For packs with > 100 radiolocations (n = 30; mean number of radiolocations = 2,013), territories were assumed to be fully delineated and were not re-scaled.

To estimate average mid-winter pack size, radio-marked wolves were repeatedly located via aircraft during winter to obtain visual counts of pack size. In cases where visual observations were insufficient, we also rely on any estimates of pack size based on tracks observed in the snow and trail camera images from within the pack's territory. If any reported count produced uncertain estimates (e.g., 4 to 5 wolves), we used the lower estimate. Overall, counts are assumed to represent minimum known mid-winter pack size.

The estimated number of packs within occupied wolf range is computed by dividing the area of occupied range by average scaled territory size. The estimated number of packs is then multiplied by average mid-winter pack size to produce an estimate of pack-associated wolves, which is then divided by 0.85 to account for an estimated 15% lone wolves in the population (Fuller et al. 1992:46, Fuller et al. 2003:170). Specifically,

$$N = ((\text{km}^2 \text{ of occupied range/mean scaled territory size})\text{*mean pack size})/0.85.$$

Using the accelerated bias-corrected method (Manly 1997), the population size confidence interval (90%) was generated from 9,999 bootstrapped re-samples of the pack and territory size data and does not incorporate uncertainty in estimates of occupied range or percent lone wolves.

RESULTS AND DISCUSSION

Pack and Territory Size

A total of 39 packs were monitored during all or part of the survey period (April 2016 to April 2017). We obtained territory and winter pack size data from 30 radio-marked wolf packs (Figure 1). Seven additional wolf packs had adequate radiolocation data to delineate territories, but we were unable to obtain mid-winter pack counts, and we obtained pack counts on 2 packs for which there was insufficient data to delineate a territory.

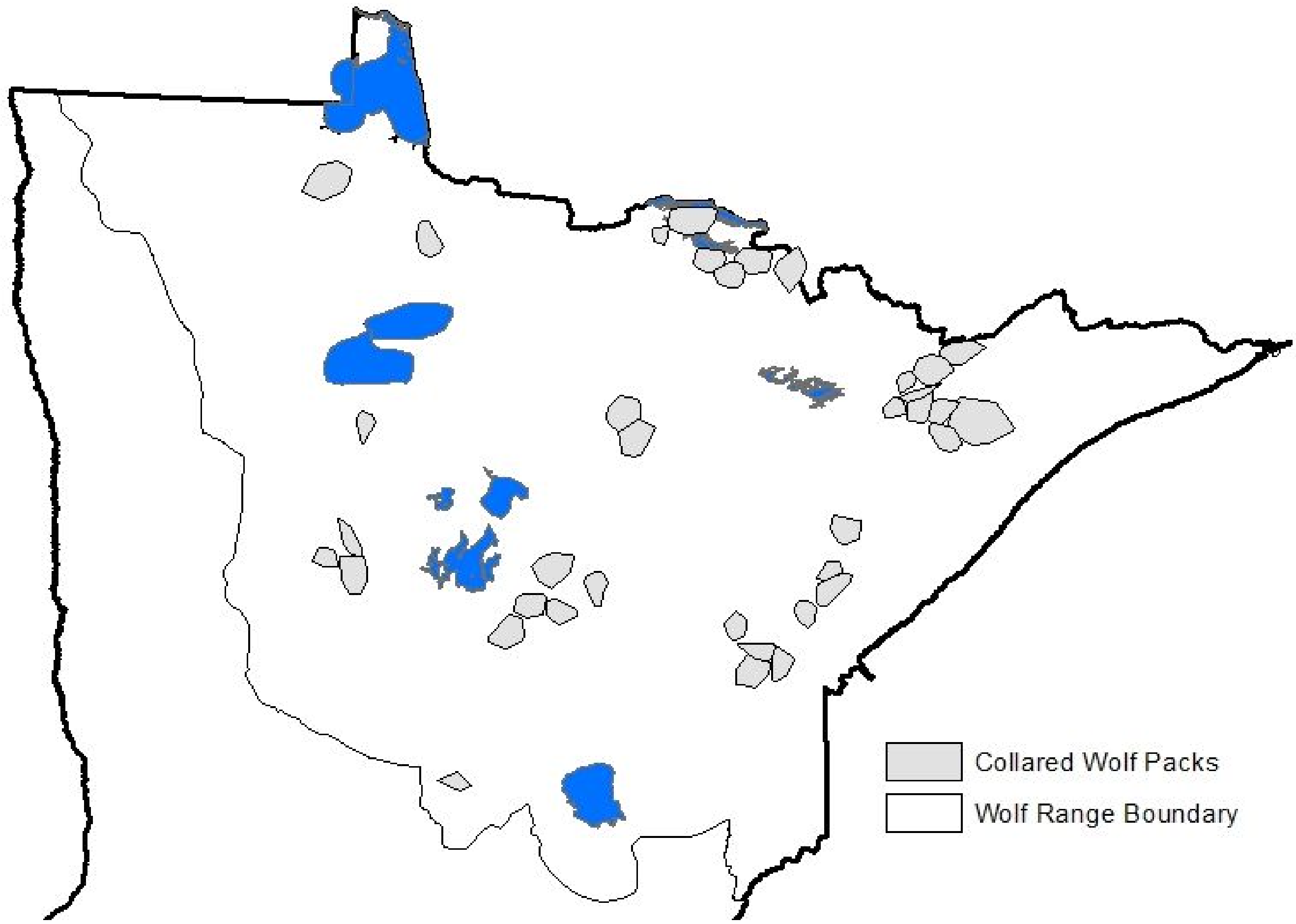

Figure 1. Location of radio-marked wolf packs during the 2016-17 survey.

Comparison of land cover type proportions within territories of collared packs with proportions throughout wolf range suggests that habitat within collared pack territories was representative of cover types throughout wolf range (Table 1; Chi-square $p = 0.7$; 8 df). Using spring 2016 deer density data (MNDNR, unpublished data) for deer hunting permit areas, weighted by number of radio-collared wolf packs in a permit area, we estimate an average of approximately 11 deer/mi^2 (pre-fawn) in territories of radio-marked packs at the beginning of the biological year in which the survey was conducted. In comparison, 2016 spring deer density for the entirety of occupied wolf range (weighted by permit area) in Minnesota was approximately 12 deer/mi^2. Considering both cover type and deer density, we believe that key conditions within marked pack territories last winter sufficiently approximated conditions within overall wolf range.

Table 1. Comparison of land cover[a] in territories of radio-collared wolf packs with land cover in all of occupied wolf range in Minnesota.

	Overall Occupied Wolf range	Radio-collared Wolf Territories
Land Cover Category	% Area	% Area
Woody Wetlands	32.6	29.0
Deciduous Forest	23.6	25.3
Emergent Herbaceous Wetlands	9.9	7.0
Mixed Forest	7.2	8.8
Evergreen Forest	7.0	11.5
Open Water	5.4	8.1
Shrub/Scrub	4.5	6.1
Pasture/Hay/Grassland/Crops	7.7	2.5
Developed, All	2.2	1.7

[a] Land cover data derived from the 2011 National Land Cover Database

The point estimate for average territory size this winter declined 14% from last winter and was the lowest since surveys began. However, with the exception of comparison to the 2014-15 estimate, average territory size this winter was not significantly different from estimates obtained after 1998 (Figure 2). After applying the territory scaling factors, average estimated territory size for radio-marked packs during the 2016-17 survey was 139 km^2 (range = 53 – 437 km^2).

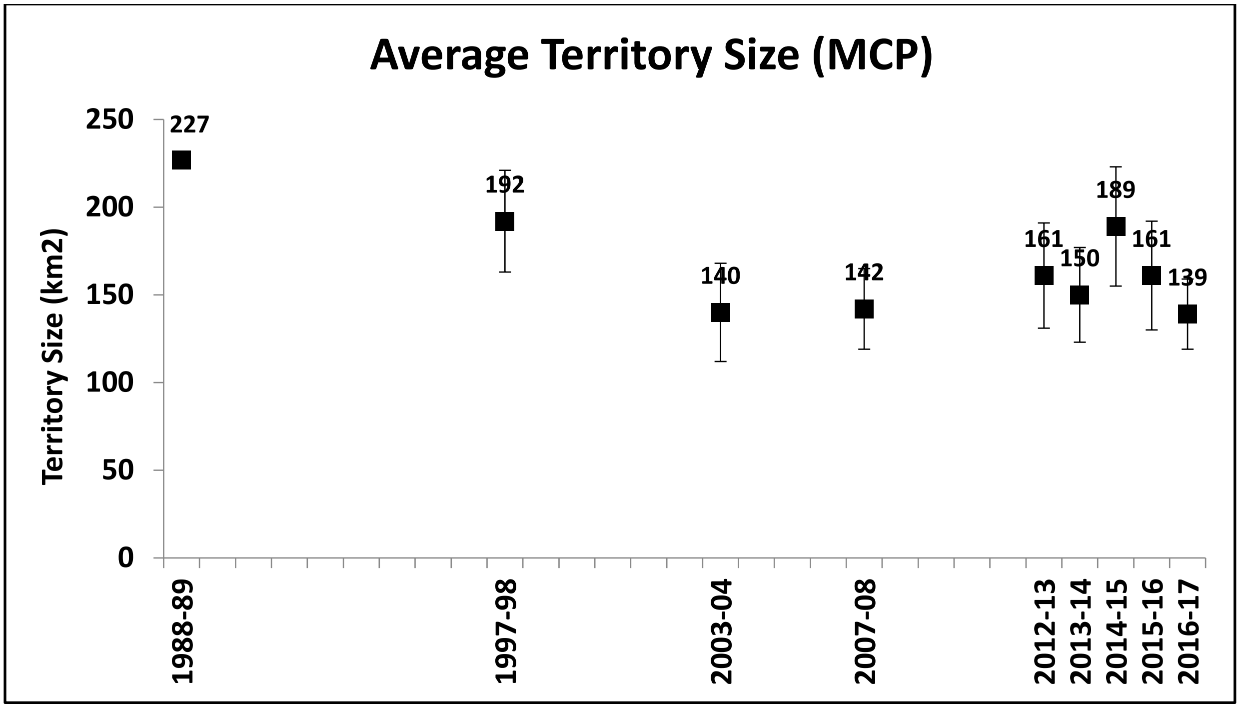

Figure 2. Average scaled territory size for radio-marked wolf packs in Minnesota from 1989 to 2017.

The point estimate for average winter pack size increased 9% from last winter, but the confidence interval widely overlaps those from the previous 5 surveys. Average winter pack size in 2016-17 was estimated to be 4.8 (range = 2 – 8, Figure 3).

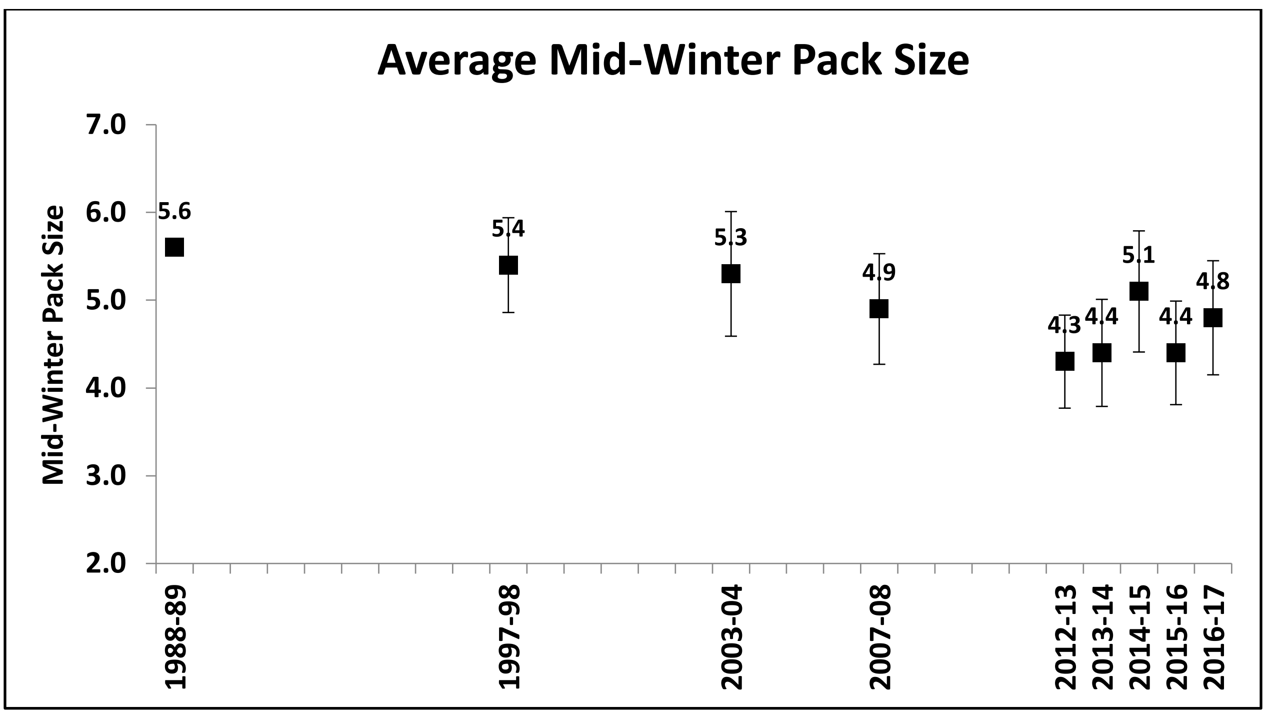

Figure 3. Average mid-winter pack size for radio-marked wolf packs in Minnesota from 1989 to 2017.

Wolf Numbers

Given an average territory size of approximately 139 km^2 and assuming occupied range has not changed since the 2012-13 survey (70,579 km^2; Erb and Sampson 2013), we estimated a total of 508 wolf packs in Minnesota during winter 2016-17. Although also influenced by the estimated amount of occupied range, trends in the estimated number of packs (Figure 4) are generally the inverse of trends in estimated territory size (Figure 2).

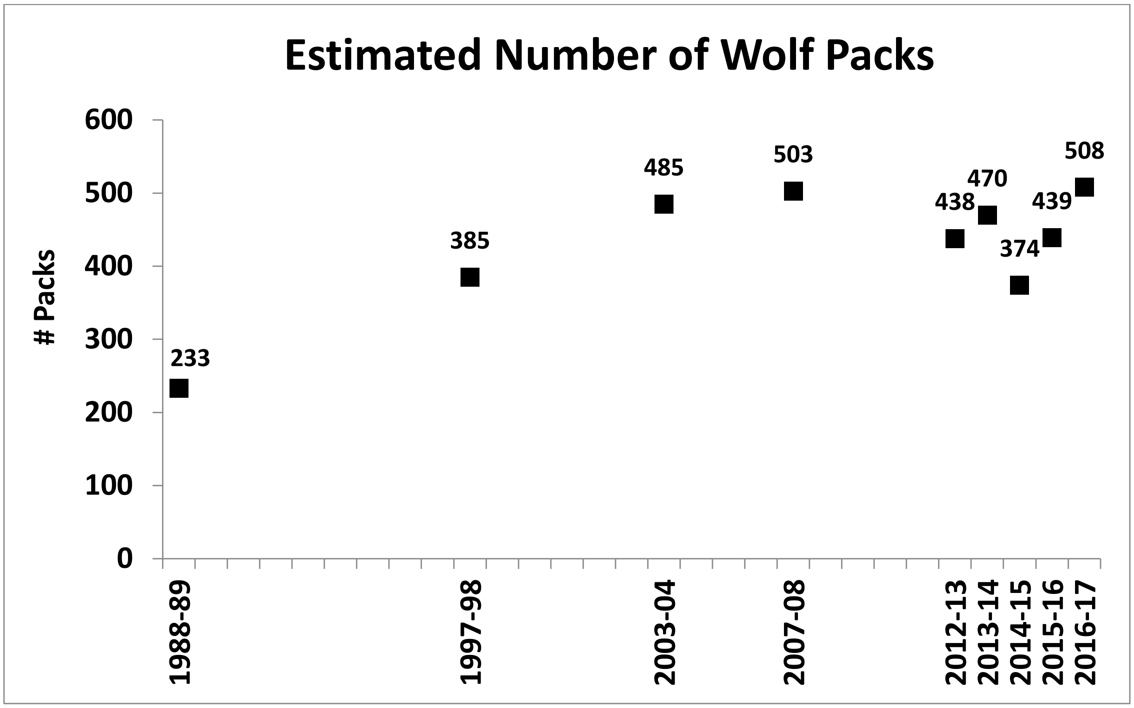

Figure 4. Estimated number of wolf packs in Minnesota at periodic intervals from 1989 to 2017

.After accounting for the assumed 15% lone wolves in the population, we estimated the 2016-17 mid-winter wolf population at 2,856 wolves, or 4.0 wolves per 100 km^2 of occupied range. The 90% confidence interval was approximately +/- 500 wolves, specifically 2,371 to 3,382. Comparison of point estimates from 2015-16 and 2016-17 suggests a 25% increase in the wolf population to levels similar to that estimated during the 2003 and 2007 surveys. Although there is some overlap with the 2015-16 confidence interval, a comparison of differences among the 2015-16 and 2016-17 bootstrap replicates results in 2016-17 population estimates being greater for 92% of the samples. We conclude that the 2016-17 statewide wolf population increased from the previous winter, consistent with expectations arising from a growing prey base over the past 2 years.

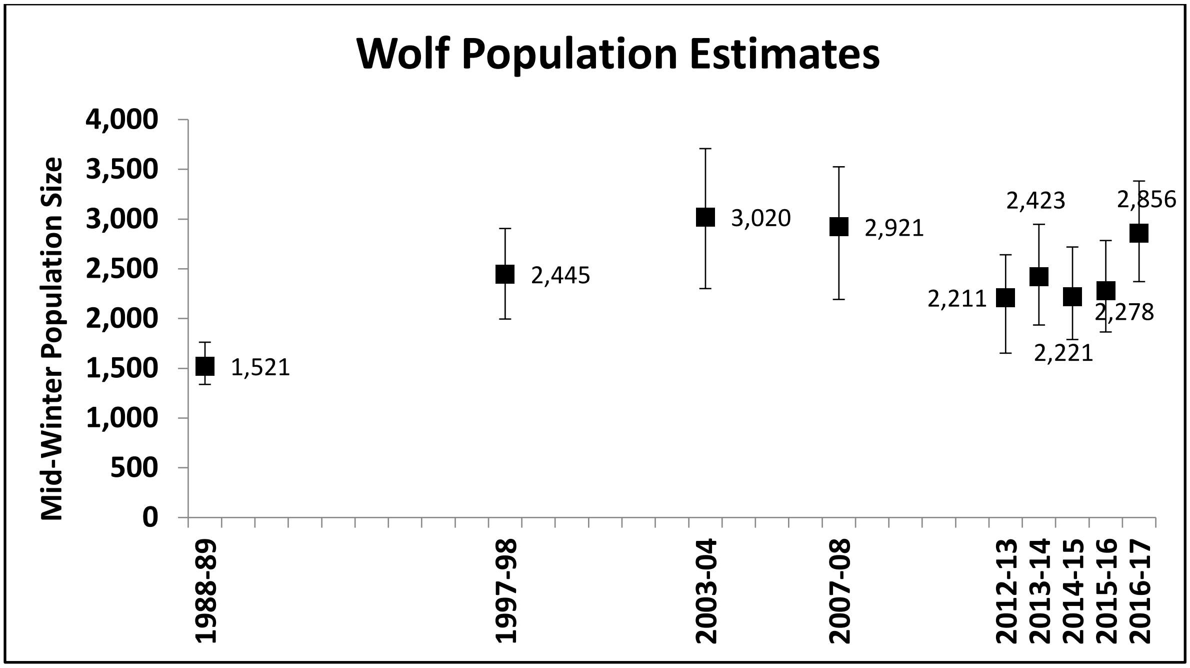

Figure 5. Wolf population estimates from periodic standardized surveys in Minnesota from 1989 to 2017.

From spring 2015 to spring 2016, deer density within wolf range is estimated to have increased approximately 22%, and the point estimate for mid-winter wolf density increased by approximately 25%. Over the past 5 years, wolf population estimates have been positively correlated with average deer density within wolf range (Figure 6).

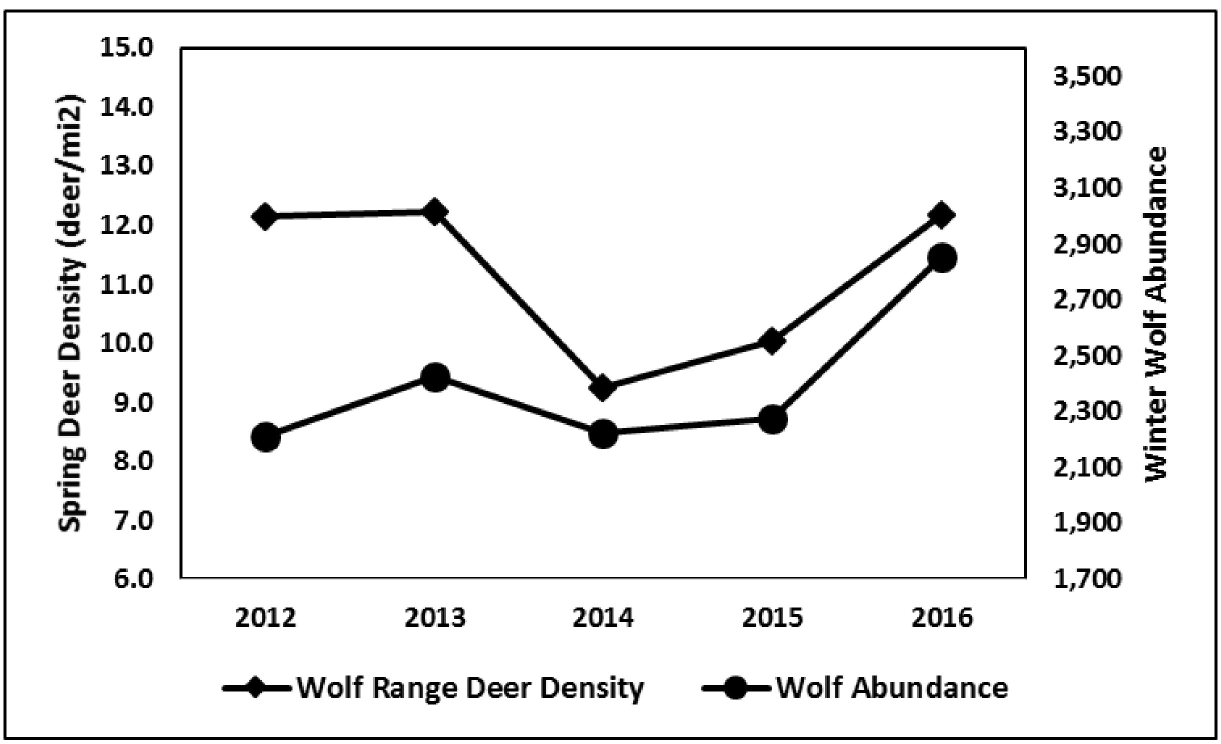

Figure 6. Comparison of estimated pre-fawn deer density and winter wolf abundance in Minnesota, 2012-2016.

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WETLAND WILDLIFE POPULATIONS

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2017 WATERFOWL BREEDING POPULATION SURVEY MINNESOTA

Steve Cordts, Minnesota DNR, Waterfowl Staff Specialist

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 2017 aerial survey portion was flown from May 2-11. Spring ice-out dates in the southern 2/3 of the state were near record early and ~3 weeks earlier than median dates. In the northern 1/3 of the state, ice out dates were about 1 week earlier than median dates. Temperatures were well above normal in February, near normal in March, above normal in April, and below normal in May. Precipitation was above normal in April and May. Overall, wetland numbers (Types II-V) were 20% higher than 2016 and near the 10-year (-6%) and long-term (5%) averages.

The 2017 estimated mallard breeding population was 214,000, which was 15% below last year's estimate of 250,000 mallards, but statistically unchanged (P=0.50). Mallard numbers were 16% below the 10-year average and 6% below the long-term average of 228,000 breeding mallards. The estimated blue-winged teal population was 159,000, which was 51% below last year's estimate of 324,000 blue-winged teal, but statistically unchanged (P=0.13). Blue-winged teal numbers were 1% below the 10-year average and 25% below the long-term average of 214,000 blue-winged teal. The combined population index of other ducks, excluding scaup, was 263,000 ducks, which was 23% higher than last year's estimate and 48% above the 10-year average and 48% above the long-term average of 178,000 other ducks.

The estimate of total duck abundance (636,000), which excludes scaup, was 19% below last year's estimate and 7% above the 10-year average and 3% above the long-term average of 620,000 ducks. The estimated number of Canada geese was 152,000 and 30% higher than last year and 1% above the 10-year average.

METHODS:

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

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

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

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

Areas with less than two basins per township are not surveyed. Strata boundaries were based upon "An Inventory of Minnesota Lakes" (Minnesota Conserv. Dept. 1968:12). Standard procedures for the survey follow those outlined in "Standard Operating Procedures for Aerial Waterfowl Breeding Ground Populations and Habitat Surveys in North America" (USFWS/CWS

1987). Changes in survey methodology were described in the 1989 Minnesota Waterfowl Breeding Population Survey report. Pond and waterfowl data for 1968-74 were calculated from Jessen (1969-72) and Maxson and Pace (1989).

All aerial transects in Strata I-III (Table 1) were flown using an American Champion Scout. 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; Table 2) 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 and transcribed by the observer 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 2016 and 2017 were compared using two-tailed Z-tests.

SURVEY CHRONOLOGY:

The 2017 aerial survey began on 2 May in southern Minnesota and concluded in northern Minnesota on 11 May. Transects were flown on 9 days (no flight May 8) and completed in 53 flight hours. Flights began near 7 AM and were completed by 12:00 PM each day. The median date for survey completion was May 6, which was 1 day earlier than last year.

WEATHER AND HABITAT CONDITIONS*:*

For the southern part of the state, ice out was extremely early with many lakes at or near their earliest dates on record and in general, about 3-4 weeks earlier than median ice out dates. In northern Minnesota, ice out dates were later but still about 1-2 weeks earlier than median dates. Temperatures in February averaged 9°F above normal statewide. Temperatures in March averaged 0.1°F above normal and precipitation was 0.4 inches below normal statewide. Temperatures in April averaged 1.4°F above normal and precipitation was 0.37 inches above normal statewide. Temperatures in May averaged 1.7°F below normal statewide and precipitation was 0.9 inches above normal statewide (http://climate.umn.edu). Precipitation during the period of time just prior to and during the survey showed above average precipitation in eastern MN and near average precipitation across the rest of the state (Appendix A).

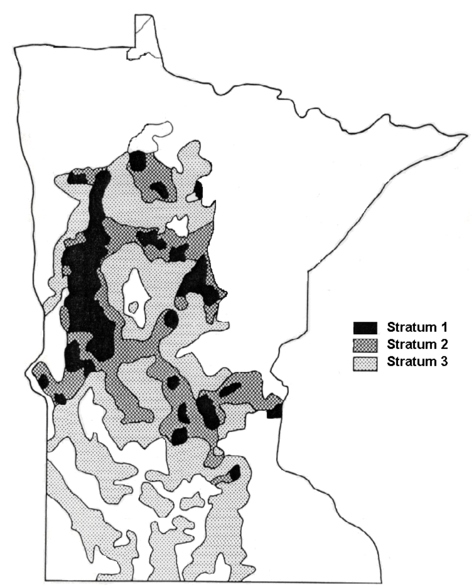

Figure 1. Location of waterfowl breeding population survey strata

Overall wetland conditions in spring 2017 were improved some from last year. In early May 2017, the U.S. drought monitor indicated 0% of the state was under any dryness designation compared to 9% of the state classed as abnormally dry last year. By late May, 95% of the state was under no drought designation and 5% of NW MN was classified as abnormally dry. On May 1, 2017 statewide topsoil moisture indices were rated as 0% very short, 1% short, 70% adequate and 29% surplus moisture. By May 30, statewide topsoil moisture indices were rated as 0% very short, 1% short, 76% adequate and 23% surplus moisture (http://droughtmonitor.unl.edu).

Wetland numbers (Types II-V) in 2017 were 265,000 ponds which was 20% above last year's estimate of 221,000 ponds. Wetland numbers were 6% below the 10-year average and 5% above the long-term average (Table 2; Fig. 2). The number of temporary (Type 1) sheet water wetlands was 55% higher than last year and 11% below the long-term average.

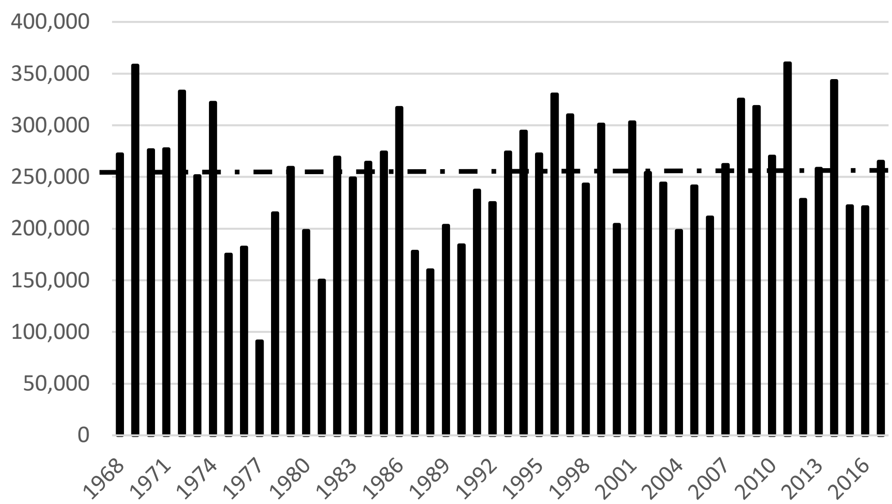

Figure 2. Number of May ponds (Type II-V) and long-term average (dashed line) in Minnesota, 1968-2017.

Planting dates for row crops were late in 2017. By May 1, about 12% of the corn acres had been planted which was 13 days behind last year and 9 days behind average. By May30th, about 14% of alfalfa hay had been cut, 9 days behind last year and 3 days behind average (Minnesota Agricultural Statistics Service Weekly Crop Weather Reports, (http://www.nass.usda.gov/mn/).

WATERFOWL POPULATIONS:

The number of ducks, Canada geese, coots, and swans, 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 2017 breeding population estimate of mallards was 213,644 (SE = 32,704), which was 15% lower than the 2016 estimate of 250,204 mallards, but statistically unchanged (Z = 0.68, P = 0.50) (Table 7, Fig. 3). Mallard numbers were 16% below the 10-year average and 6% below the long-term average of 228,000 mallards. In 2017, the mallard population was comprised of 73% lone or flocked males, 16% pairs, and 11% flocked mallards. The 5-year average is 71% lone or flocked males, 21% pairs, and 9% flocked mallards.

The estimated blue-winged teal population was 159,483 (SE = 55,100), which was 51% lower than the 2016 estimate of 323,916 blue-winged teal, but statistically unchanged (Z = 1.50, P = 0.13). Blue-winged teal numbers were 1% below the 10-year average and 25% below the long-term average (Table 7, Fig. 4). The blue-winged teal population was comprised of 7% lone males, 37% pairs, and 55% flocks. The long-term average is 10% lone males, 43% pairs, and 48% flocks.

The combined population estimate of other ducks (excluding scaup) was 262,867 which was 23% above last year's estimate of 212,967 other ducks and 48% above the 10-year average and 48% above the long-term average (Table 7, Fig. 5). Ring-necked ducks and wood ducks were the most abundant species of other ducks (Table 6). Scaup numbers (77,000) were 39% above last year's estimate and 27% above the long-term average.

The total duck population index, excluding scaup, was 636,000 ducks and was 19% below last year's index of 787,000 ducks and 7% above the 10-year average and 3% above the long-term average (Table 8, Fig. 6).

The population index for total ducks was 713,000 ducks, which was 15% above the 10-year average and 5% above the long-term average.

Visibility Correction Factors (VCFs) were lower for mallards, blue-winged teal, and other ducks in 2017 compared to 2016 (Table 7, Table 8). The mallard VCF (2.04) was 23% below the 10-year average. The blue-winged teal VCF (2.51) was 36% below the 10-year average. The VCF for other ducks (2.20) was 23% below the 10-year average. The VCF for Canada geese (2.16) was 9% above the 10-year average.

The population estimate of Canada geese (adjusted for visibility) was 152,000, which was 30% above last year's estimate and 1% above the 10-year average (Table 8, Fig. 7). A total of 43 Canada goose broods were observed, compared to 56 in 2016.

The estimated coot population, uncorrected for visibility, was 31,000 compared to 16,000 in 2016.

The estimated number of swans (likely trumpeters) was 17,230 swans compared to last year's estimate of 13,400 (Table 6; Fig. 8). Lone swans are not doubled and the estimate is expanded for area but not visibility, although visibility of swans is extremely high. Trumpeter swans continue to expand their range and dramatically increase in number.

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Data supplied by: Minnesota Department of Natural Resources (MNDNR) and U.S. Fish and Wildlife Service (USFWS)

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Pilot/Observer: Bob Geving, Conservation Officer Pilot, MNDNR, Division of Enforcement

Observer: Steve Cordts, Waterfowl Staff Specialist, MNDNR, Division of Wildlife

Ground Crew Leaders: Sean Kelly, Deputy Chief, Migratory Birds, USFWS, Region III, Twin Cities; Wayne Brininger, USFWS, Tamarac National Wildlife Refuge; Dan Hertel and Natalee Yates, USFWS, HAPET, Fergus Falls; Tom Cooper, Andy Forbes, and Jim Kelley, USFWS, Twin Cities; Jeff Lawrence, Minnesota DNR; Greg Dehmer, USFWS, Sherburne National Wildlife Refuge

Ground Crew Assistants: Jason Strege, Minnesota DNR; Gina Kemper and Ken Mattson, USFWS, Tamarac National Wildlife Refuge; Adam Weishair and Joseph Schmit, USFWS, HAPET, Fergus Falls; Kelly Van Beek and Beth Rigby, USFWS, Twin Cities; Kris Spaeth, USFWS, Sherburne National Wildlife Refuge

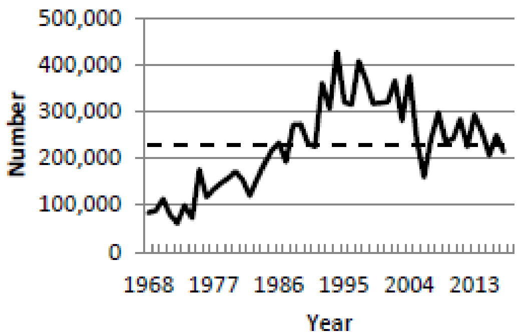

Figure 3. Mallard population estimates (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1968-2017.

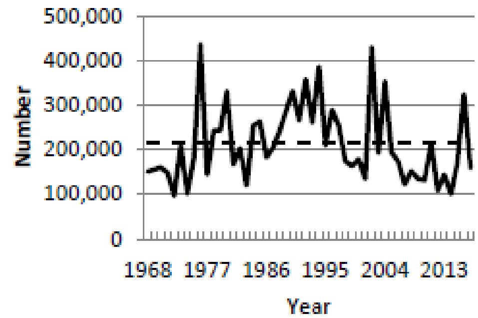

Figure 4. Blue-winged teal population estimates (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1968-2017.

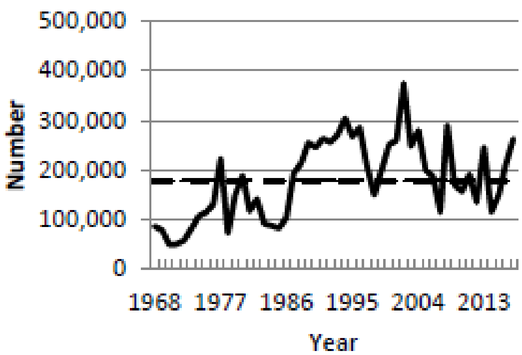

Figure 5. Other duck (excluding scaup) population estimates (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1968-2017.

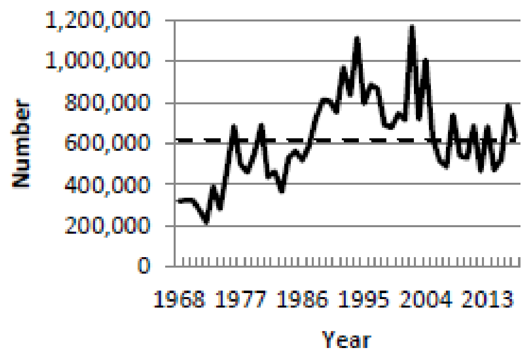

Figure 6. Total duck (excluding scaup) population estimates (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1968-2017.

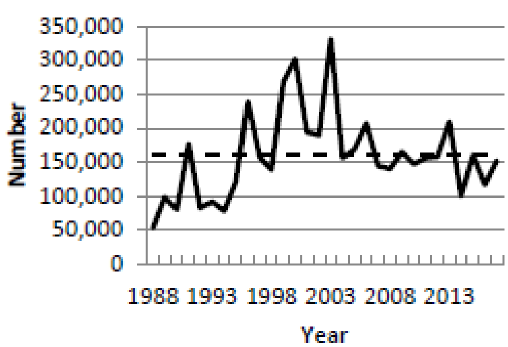

Figure 7. Canada goose population (adjusted for visibility bias) and long term average (dashed line) in Minnesota, 1988-2017.

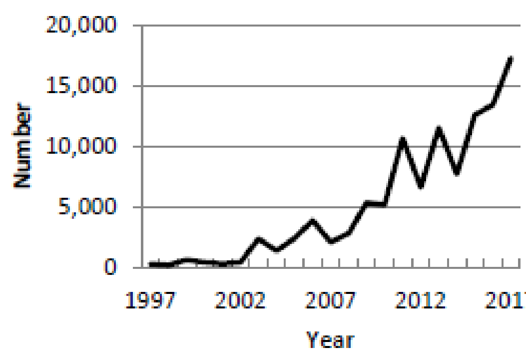

Figure 8. Trumpeter swan population in Minnesota, 1997-2017.

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Table 1. Survey design for Minnesota, May 2017.[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), 1968-2017.

Year	Number of Ponds[1]	Year	Type 1 wetlands	Number of Ponds[1]
1968	272,000	1991	82,862	237,000
1969	358,000	1992	10,019	225,000
1970	276,000	1993	199,870	274,000
1971	277,000	1994	123,958	294,000
1972	333,000	1995	140,432	272,000
1973	251,000	1996	147,859	330,000
1974	322,000	1997	30,751	310,000
1975	175,000	1998	20,560	243,000
1976	182,000	1999	152,747	301,000
1977	91,000	2000	5,090	204,000
1978	215,000	2001	66,444	303,000
1979	259,000	2002	30,602	254,000
1980	198,000	2003	34,005	244,000
1981	150,000	2004	9,494	198,000
1982	269,000	2005	30,764	241,000
1983	249,000	2006	56,798	211,000
1984	264,000	2007	32,415	262,000
1985	274,000	2008	69,734	325,000
1986	317,000	2009	39,078	318,000
1987	178,000	2010	26,880	270,000
1988	160,000	2011	89,218	360,000
1989	203,000	2012	30,910	228,000
1990	184,000	2013	9,813	258,000
		2014	54,300	343,000
		2015	22,056	222,000
		2016	34,487	221,000
		2017	53,576	265,000
	Averages:	10-year	41,000	281,000
		Long-term	60,000	253,000
	% change from:	2016	55%	20%
		10-year	31%	-6%
		Long-term	-11%	5%

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

Table 3. Minnesota waterfowl breeding populations by species for Stratum I (high wetland density), expanded for area but not visibility, 2000-2017.

	Year																	
Species	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Dabblers:																		
Mallard	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	21,161	19,522	19,633	26,020	21,688
Black Duck	0	0	0	0	0	56	0	0	0	0	0	0	0	333	167	222	0	56
Gadwall	833	1,333	944	1,250	2,111	1,166	1,444	889	1,166	1,055	1,000	167	1,389	722	555	1,083	1,000	2,138
American Wigeon	56	111	0	56	555	167	0	56	111	56	56	111	222	222	167	111	111	167
Green-winged Teal	278	56	278	222	444	56	56	167	278	167	56	56	56	0	0	56	111	278
Blue-winged Teal	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	4,193	3,388	4,360	6,998	8,609
Northern Shoveler	1,055	305	1,277	278	1,166	333	167	56	1,000	666	1,027	111	56	333	722	111	666	916
Northern Pintail	167	389	56	111	56	0	56	0	56	56	0	111	0	111	167	222	0	111
Wood Duck	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	3,249	2,527	2,222	5,610	4,971
Dabbler Subtotal	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	30,324	27,215	28,020	40,516	38,934
Divers:																		
Redhead	583	1,444	750	333	805	666	666	916	1,389	472	944	805	750	861	1,333	583	2,166	1,000
Canvasback	1,222	2,027	1,833	1,333	666	972	833	1,000	2,277	1,333	1,222	833	722	1,555	1,777	1,027	1,944	2,666
Scaup	7,415	5,832	2,444	2,055	5,971	4,110	111	555	6,276	8,553	2,777	2,222	1,055	1,000	1,250	5,526	10,969	7,359
Ring-necked Duck	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	3,582	4,554	3,110	8,220	12,608
Goldeneye	56	333	111	0	222	222	56	222	278	278	222	56	56	333	444	278	278	1,000
Bufflehead	56	111	222	111	389	167	222	56	1,611	833	389	278	56	611	56	278	500	2,444
Ruddy Duck	0	83	1,305	417	305	1,222	305	0	1,027	861	28	56	0	305	111	694	1,500	222
Hooded Merganser	500	722	555	333	278	333	555	111	666	944	555	500	555	333	666	1,000	1,222	1,222
Large Merganser	0	111	0	972	0	111	0	278	333	333	333	111	56	222	139	167	56	167
Diver Subtotal	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	8,802	10,330	12,663	26,855	28,688
Total Ducks	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	39,126	37,545	40,683	67,371	67,622
Other:																		
Coot	3,999	1,722	2,888	2,666	21,411	2,444	639	139	16,829	2,166	139	2,194	444	10,386	2,360	1,972	10,608	13,191
Canada Goose	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	23,771	18,578	23,077	17,995	18,273
Swan	0	0	111	1,000	305	417	861	389	694	500	694	1,611	1,277	2,944	1,944	2,472	3,693	4,054

Table 4. Minnesota waterfowl breeding populations by species for Stratum II (medium wetland density), expanded for area but not visibility, 2000-2017.

	Year																	
Species	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Dabblers:																		
Mallard	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	27,409	28,987	24,078	32,085	26,299
Black Duck	0	117	0	0	0	0	0	0	0	0	0	0	0	0	0	117	0	0
Gadwall	3,039	1,636	701	584	3,565	584	1,052	234	3,039	1,169	1,286	935	1,987	701	234	818	1,286	4,442
American Wigeon	468	0	0	0	2,513	117	0	0	351	0	351	0	117	234	0	234	234	1,052
Green-winged Teal	117	117	468	234	234	0	117	0	0	234	117	0	0	117	351	584	0	0
Blue-winged Teal	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	4,383	7,364	5,026	10,753	15,487
Northern Shoveler	4,675	1,052	2,221	1,403	1,753	234	584	351	468	701	2,513	1,052	0	351	935	877	935	3,857
Northern Pintail	117	117	0	117	0	0	0	234	0	0	0	234	0	0	117	0	0	0
Wood Duck	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	4,792	1,636	1,753	4,149	4,851
Dabbler subtotal	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	37,987	39,624	33,487	49,442	55,988
Divers:																		
Redhead	2,805	2,455	234	584	1,110	292	175	935	935	584	760	1,578	468	468	526	468	1,110	818
Canvasback	935	0	468	1,052	234	0	0	1,169	468	234	117	584	117	935	1,286	1,169	1,403	2,338
Scaup	6,779	3,039	5,961	2,279	7,188	2,981	468	643	3,097	2,104	0	1,929	935	2,045	2,396	4,909	5,318	5,260
Ring-necked Duck	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	6,253	5,143	4,325	4,792	9,292
Goldeneye	584	468	234	234	351	117	117	0	351	584	468	468	584	935	1,519	935	1,169	818
Bufflehead	0	0	1,169	117	468	351	117	117	1,403	818	643	1,403	468	0	818	0	234	2,279
Ruddy Duck	0	0	1,870	2,688	0	351	58	0	0	175	409	58	234	117	0	351	643	468
Hooded Merganser	935	1,403	701	701	234	234	351	234	584	701	117	2,221	1,636	701	234	1,169	2,455	3,448
Large Merganser	117	117	0	0	234	351	0	0	351	0	0	234	0	234	117	234	117	0
Diver subtotal	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	11,688	12,039	13,560	17,241	24,721
Total Ducks	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	49,675	51,663	47,047	66,683	80,709
Other:																		
Coot	1,110	468	4,909	1,519	8,007	584	292	409	23,961	0	117	292	292	2,571	877	0	0	6,370
Canada Goose	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	22,442	20,572	24,312	17,533	21,799
Swan	58	117	292	994	701	1,461	994	468	1,519	2,922	2,279	7,188	3,507	6,604	3,740	5,318	4,325	5,084

Table 5. Minnesota waterfowl breeding populations by species for Stratum III (low wetland density), expanded for area but not visibility, 2000-2017.

	Year																	
Species	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Dabblers:																		
Mallard	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	62,638	62,899	51,154	59,593	56,983
Black Duck	0	0	0	0	174	0	0	174	174	0	0	0	174	174	0	0	0	0
Gadwall	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	5,220	1,914	2,088	9,570	5,046
American Wigeon	522	174	1,218	174	1,566	1,044	174	348	348	174	348	1,044	174	348	174	1,566	870	174
Green-winged Teal	1,218	1,392	522	174	0	174	522	0	0	0	0	174	348	696	0	348	0	348
Blue-winged Teal	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	18,617	21,227	24,098	53,155	39,323
Northern Shoveler	20,444	10,701	6,264	870	3,828	348	522	870	4,002	2,088	6,873	2,088	8,265	6,786	522	1,914	4,959	3,219
Northern Pintail	696	522	0	174	348	174	174	348	174	0	174	0	174	174	0	174	522	174
Wood Duck	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	12,180	9,657	8,265	8,700	16,094
Dabbler subtotal	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	106,833	96,393	89,607	137,369	121,361
Divers:																		
Redhead	2,523	3,654	1,305	174	1,740	1,479	0	522	783	870	174	4,350	3,306	1,827	1,566	1,305	1,044	3,480
Canvasback	3,915	522	696	1,131	2,784	0	0	348	1,566	1,218	348	1,044	1,044	696	522	696	348	1,914
Scaup	18,182	6,873	4,611	783	17,747	5,307	1,392	696	5,481	1,914	522	5,133	696	8,874	2,871	435	3,915	22,271
Ring-necked Duck	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	6,960	5,568	3,480	4,089	18,095
Goldeneye	1,044	1,566	3,132	1,305	696	1,044	1,044	870	348	522	174	870	0	348	174	1,218	870	1,566
Bufflehead	0	0	1,218	783	2,088	0	174	696	1,218	870	174	2,871	174	3,915	4,698	522	2,523	1,740
Ruddy Duck	0	696	18,878	87	2,262	870	696	261	87	348	0	3,828	522	522	174	0	87	1,305
Hooded Merganser	957	174	2,175	174	1,740	1,218	870	174	696	348	1,218	1,044	1,044	348	348	522	1,392	1,653
Large Merganser	0	0	522	0	0	261	957	348	348	348	348	174	174	0	0	0	870	957
Diver subtotal	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	23,490	15,921	8,178	15,138	52,981
Total Ducks	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	130,323	112,314	97,785	152,507	174,342
Other:																		
Coot	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	27,578	15,746	7,917	5,829	10,962
Canada Goose	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	48,022	24,707	43,498	31,145	30,101
Swan	348	174	0	348	348	522	2,001	1,218	609	1,914	2,175	1,827	1,827	2,088	2,001	4,785	5,394	8,091

Table 6. Minnesota waterfowl breeding populations by species for Stratum I-III combined, expanded for area coverage but not for visibility, 2000-2017.

	Year																	
Species	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Dabblers:																		
Mallard	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	111,208	111,408	94,866	117,698	104,970
Black Duck	0	117	0	0	174	56	0	174	174	0	0	0	174	507	167	339	0	56
Gadwall	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	6,643	2,703	3,989	11,855	11,626
American Wigeon	1,045	285	1,218	230	4,634	1,327	174	404	810	230	754	1,155	513	804	341	1,911	1,215	1,393
Green-winged Teal	1,613	1,564	1,267	630	678	230	694	167	278	400	172	230	404	813	351	988	111	626
Blue-winged Teal	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	27,194	31,979	33,484	70,907	63,418
Northern Shoveler	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	7,470	2,179	2,902	6,560	7,992
Northern Pintail	979	1,028	56	402	404	174	230	582	230	56	174	345	174	285	284	396	522	285
Wood Duck	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	20,221	13,820	12,240	18,459	25,916
Dabbler subtotal	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	175,145	163,232	151,115	227,327	216,282
Divers:																		
Redhead	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	3,155	3,425	2,356	4,320	5,298
Canvasback	6,072	2,549	2,996	3,516	3,684	972	833	2,517	4,311	2,785	1,687	2,461	1,883	3,186	3,585	2,892	3,694	6,918
Scaup	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	11,919	6,517	10,870	20,202	34,890
Ring-necked Duck	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	16,795	15,265	10,915	17,101	39,995
Goldeneye	1,684	2,367	3,477	1,539	1,269	1,383	1,216	1,092	976	1,384	864	1,393	640	1,616	2,138	2,431	2,317	3,384
Bufflehead	56	111	2,609	1,011	2,944	517	513	868	4,231	2,521	1,206	4,551	697	4,526	5,572	800	3,257	6,463
Ruddy Duck	0	779	22,054	3,192	2,567	2,443	1,060	261	1,114	1,384	437	3,942	756	944	285	1,045	2,229	1,995
Hooded Merganser	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	1,383	1,248	2,691	5,068	6,323
Large Merganser	117	228	522	972	234	723	957	626	1,032	681	681	519	230	456	256	400	1,042	1,124
Diver subtotal	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	43,980	38,291	34,400	59,230	106,390
Total Ducks	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	219,125	201,523	185,515	286,557	322,672
Other:																		
Coot	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	40,535	18,984	9,888	16,437	30,523
Canada Goose	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	94,235	63,857	90,887	66,672	70,172
Swan	406	291	403	2,341	1,355	2,400	3,855	2,074	2,823	5,336	5,148	10,626	6,611	11,500	7,700	12,575	13,412	17,230

Table 7. Mallard, blue-winged teal, and other duck (excluding scaup) populations in Minnesota, 1968-2017.

	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

	Mallard				Blue-winged teal				Other ducks (exc. scaup)		
Year	Unad. PI	VCF	PI	SE	Unad. PI	VCF	PI	SE	Unad. PI	VCF	PI
1996	153,473	2.05	314,816	53,461	57,196	5.05	288,913	64,064	107,950	2.64	285,328
1997	160,629	2.54	407,413	65,771	45,496	5.57	253,408	67,526	76,095	2.72	207,316
1998	188,972	1.95	368,450	61,513	47,788	3.66	174,848	33,855	91,478	1.64	149,786
1999	169,213	1.87	316,394	51,651	36,106	4.53	163,499	36,124	80,459	2.49	200,570
2000	157,853	2.02	318,134	36,857	60,288	2.97	179,055	32,189	120,158	2.09	250,590
2001	146,034	2.20	320,560	39,541	37,706	3.60	135,742	19,631	91,152	2.85	260,051
2002	145,191	2.53	366,625	46,264	91,982	4.67	429,934	87,312	92,778	4.04	374,978
2003	115,974	2.42	280,517	34,556	46,759	4.13	193,269	36,176	46,796	5.30	248,019
2004	158,416	2.37	375,313	57,591	94,152	3.75	353,209	56,539	95,105	2.94	279,802
2005	82,472	2.89	238,500	28,595	48,394	4.01	194,125	37,358	46,797	4.26	199,355
2006	72,843	2.21	160,715	24,230	38,328	4.53	173,674	60,353	42,333	4.41	186,719
2007	76,979	3.15	242,481	30,020	29,407	4.20	123,588	20,055	30,963	3.73	115,390
2008	103,411	2.88	297,565	27,787	40,777	3.74	152,359	24,157	99,575	2.91	289,629
2009	78,368	3.02	236,436	36,539	37,286	3.63	135,262	32,155	62,725	2.70	169,568
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
2013	111,208	2.64	293,239	58,463	27,194	5.29	143,927	46,635	68,804	3.57	245,729
2014	111,408	2.31	256,996	55,366	31,979	3.18	101,640	24,089	51,619	2.24	115,751
2015	94,866	2.17	206,229	37,498	33,484	5.04	168,615	56,787	46,295	3.23	149,330
2016	117,698	2.13	250,204	42,850	70,907	4.57	323,916	94,952	77,750	2.74	212,967
2017	104,970	2.04	213,644	32,704	63,418	2.51	159,483	55,100	119,394	2.20	262,867
Averages: 10-year	97,355	2.64	253,333	41,737	41,533	3.93	160,376	44,695	63,278	2.86	178,057
Long-term	102,842	2.23	228,205	37,831	57,310	3.91	213,740	43,844	60,947	3.11	177,677
% change from 2016	-11%	-4%	-15%	-24%	-11%	-45%	-51%	-42%	54%	-20%	23%
10-year average	8%	-23%	-16%	-22%	53%	-36%	-1%	23%	89%	-23%	48%
Long-term average	2%	-8%	-6%	-14%	11%	-36%	-25%	26%	96%	-29%	48%

Table 8. Scaup, total ducks (excluding scaup), total ducks, and Canada goose populations in Minnesota, 1968-2017.

	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

	Scaup			Total Ducks (exc. Scaup)		Total Ducks		Canada geese		
Year	Unad. PI	VCF	PI	Unad. PI	PI	Unad. PI	PI	Unad. PI	VCF	PI
1998	28,416	1.64	46,528	328,238	693,084	356,654	739,612	79,147	1.75	138,507
1999	14,041	2.49	35,002	285,778	680,463	299,819	715,465	80,012	3.35	268,168
2000	32,376	2.09	67,520	338,299	747,779	370,675	815,299	105,932	2.84	301,298
2001	15,743	2.85	44,914	274,892	716,353	290,653	761,267	89,418	2.17	193,887
2002	13,016	4.04	52,606	327,951	1,171,537	340,967	1,224,143	78,200	2.42	189,353
2003	5,117	5.30	27,120	209,529	721,805	214,646	748,925	87,663	3.78	331,094
2004	30,906	2.94	90,926	347,673	1,008,324	378,579	1,099,250	98,339	1.58	155,859
2005	12,397	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	2.70	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
2013	11,919	3.57	42,568	207,206	682,895	219,125	725,463	94,235	2.22	208,825
2014	6,517	2.24	14,614	195,006	474,387	201,523	489,001	63,857	1.57	100,255
2015	10,870	3.23	35,062	174,645	524,174	185,515	559,236	90,887	1.77	160,427
2016	20,202	2.74	55,336	266,355	787,087	286,557	842,423	66,672	1.75	117,096
2017	34,890	2.20	76,817	287,782	635,994	322,672	712,811	70,172	2.16	151,740
Averages:										
10-year	9,410	2.86	26,941	202,200	592,471	211,575	619,412	76,563	1.98	149,542
Long-term	20,583	3.11	60,648	221,075	619,766	241,651	680,414	48,841	2.28	159,461
% change from										
2016	73%	-20%	39%	8%	-19%	13%	-15%	5%	23%	30%
10-year average	271%	-23%	185%	42%	7%	53%	15%	-8%	9%	1%
Long-term average	70%	-29%	27%	30%	3%	34%	5%	44%	-5%	-5%

Appendix A. Precipitation in selected regions of Minnesota, 11 April - 11 May 2017 (Source: Minnesota DNR; link to state climate data).

Region	Precipitation	Departure from normal
Northwest	1.39	-0.52
North Central	2.35	0.18
Northeast	3.50	0.92
West Central	2.24	-0.32
Central	4.13	1.07
East Central	4.13	1.01
Southwest	3.11	-0.09
South Central	3.54	-0.30
Southeast	4.45	0.70
Statewide	3.45	0.37

Waterfowl information is taken from the U.S. Fish and Wildlife Service report Waterfowl Population Status, 2017 by Joshua Dooley, Walt Rhodes, and Nathan Zimpfer. The entire report is available on the Division of Migratory Bird Management website (http://www.fws.gov/birds/surveys-and-data/reports-and-publications.php).

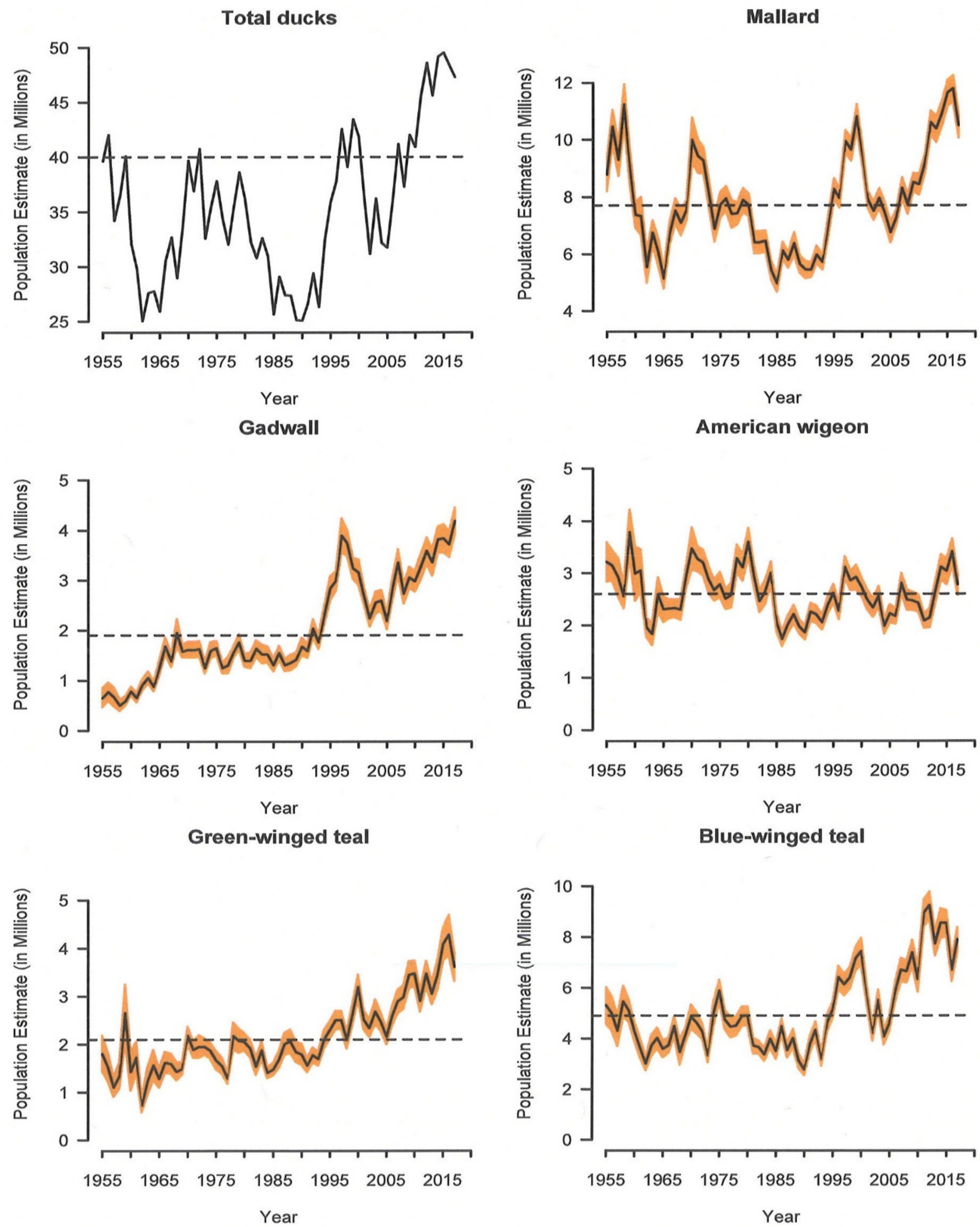

Figure 1 Estimates of North American breeding populations, 90% confidence intervals, and North American Waterfowl Management Plan population goal (dashed line) for selected species and number of water areas in May in Prairie Canada and Northcentral U.S (from: U.S. Fish and Wildlife Service 2016).

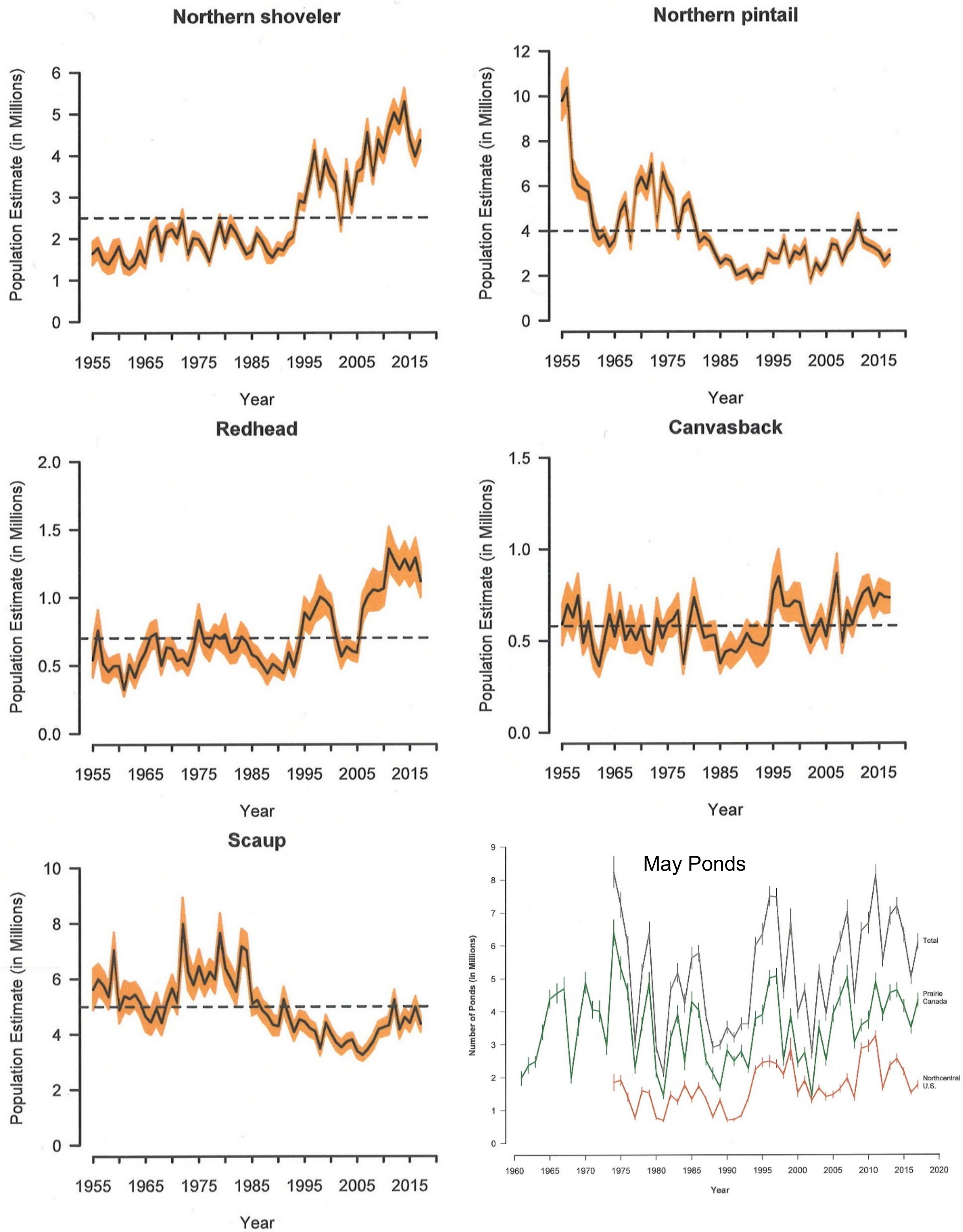

Figure 1 (continued).

2017 MINNESOTA SPRING CANADA GOOSE SURVEY

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INTRODUCTION

This report presents results from the seventeenth year of a spring helicopter survey of locally nesting Canada geese (*Branta canadensis*) in Minnesota. Minnesota Department of Natural Resources (MNDNR) personnel developed the survey per a request from the Mississippi Flyway Council to produce a statewide population estimate having 95% confidence intervals (CI) that are within ± 25% of the estimate for this bird species.

METHODS

MNDNR Wetland Group staff initiated surveys for resident Canada geese in 2001 (Maxson 2002). The state was divided into 3 ecoregions (Prairie, Transition, Forest) using boundaries of the Prairie Parkland, Eastern Broadleaf Forest, Tallgrass Aspen Parklands, and Laurentian Mixed Forest ecoprovinces (Aaseng et al. 2005). The Transition ecoregion comprises the Eastern Broadleaf Forest and Tallgrass Aspen Parklands, the Prairie ecoregion is equivalent to the Prairie Parkland ecozone, and the Forest ecoregion is equivalent to the Laurentian Mixed Forest ecoprovince. The 7-county Metro area was excluded from the Transition ecoregion, and Lake County, Cook County, and the Boundary Waters Canoe Wilderness Area were excluded from the Forest ecoregion. The remaining survey area was divided into quadrats (hereafter, plots) using PLS quarter-sections as the primary sampling unit.

From 2002-2007, double sampling was used to construct a stratified sample (Maxson 2002). Nine hundred plots were randomly selected from each ecoregion (Prairie, Transition, and Forest), and then various GIS datalayers (NWI, Circular 39, MNDNR 1:24000 lakes, airphotos) were used to quantify the potential nesting habitat on these plots based on 1) total acres of type 3, 4, and 5 wetlands; 2) total acres of type 3 wetlands; 3) total acres of 1:24,000 lakes, and; 4) total acres of riverine habitat. This information was used to form 3 habitat classes that reflected expected number of pairs of resident Canada geese: 1) no nesting habitat (on average, no geese were expected on such plots), 2) limited nesting habitat (habitat capable of supporting 1 or 2 pairs of geese), and 3) prime nesting habitat (habitat capable of supporting 3 or more pairs). The 3 ecoregions and 3 habitat classes were used to form 9 strata (P0, P12, P3+, T0, T12, T3+, F0, F12, F3+).

Strata with expected counts equal to zero (P0, T0, F0) were excluded from further consideration, and the F3+ stratum did not contain any plots. Thus, the final stratification scheme consisted of 5 strata: P12, P3+, T12, T3+, F12. Thirty 30 plots were randomly selected from each stratum each year, for an annual sample size of 150 plots.

In 2008, the entire sampling frame was stratified using GIS data and the same stratification criteria. Thus, double sampling was eliminated (Rave 2008). The sampling frame was also modified by removing Lake of the Woods and the Northwest Angle from the Forest ecoregion. Again, 30 plots were randomly selected from each of the 5 strata each year. In 2011, a proposed Intensive Harvest Zone (IHZ) was incorporated into the sampling frame, which permitted a domain analysis of total geese in the proposed IHZ (Rave 2011). Thirty plots were randomly selected from the IHZ and 130 plots from outside the zone, and plots were proportionally allocated to strata. The actual IHZ used from 2013-2015 to delineate boundaries for an August Canada goose conservation action and during the September Canada goose season was larger than the proposed zone (see Minnesota Waterfowl Hunting Regulations Booklet, 2013, 2014, 2015). However, we continued to use the proposed IHZ to monitor changes in goose numbers in a portion of the intensive harvest area. In 2017, we dropped the IHZ from the sampling frame, and we used a spatially balanced sampling design (Stevens and Olsen 2004) to draw 30 random plots from each of the 5 original strata.

Surveys were flown in a military surplus OH-58 or an Enstrom 480B. Plots were surveyed from an altitude that maximized visibility of Canada geese (approximately 20 - 80 meters AGL). Each plot was surveyed completely and typically wetland areas were circled 2-3 times to be confident that we did not miss any geese.

Canada geese observed within plot boundaries were recorded on paper datasheets (2001-2016) or digitally using DNRSurvey and a Toughbook computer (2017). From 2001-2011, goose observations were classified as singles with nest, singles (without nest), pairs with nest, pairs (without nest), and groups (>=3 birds).

From 2012-2016, goose observations were classified as singles, pairs, and groups, and nests were recorded separately as total nests/plot. In 2017, we reverted to the original observation classes. Our primary response metrics were indicated pairs (IP=singles + pairs), total geese (IPx2 + groups), and productive geese (2x[singles + pairs with nest]). By doubling single-goose observations we implicitly assumed the mate was present on the survey plot but was missed. As noted above, we did not survey the Twin Cities (7-county Metro area) where there is a significant number of nesting Canada geese; instead, we relied on estimates from Cooper (2004) to approximate the average contribution of the Metro area to the statewide population estimate.

RESULTS AND DISCUSSION

The 2017 survey was completed in 6 flight days from 17-29 April (Figure 2) by observer Patrick Hagen and DNR pilot John Heineman. The survey took 48.3 hours of helicopter time and 8.7 hours was spent on the 150 plots. Survey time per plot was 3.5 minutes in 2017 compared to 2.5 minutes in 2016.

The aerial crew counted 63 singles, 9 singles with nests, 84 pairs, 123 pairs with nests, and 42 Canada geese in groups. The 2017 population estimate (321,582±87,478) was the largest estimate since 2012 and 59% > 2016 (Table 2). This difference was non-significant. The point estimate was 9% > the long-term (2001-2016) average. Increased estimates were indicated in all 3 ecoregions (Table 2). The stratification worked well with occupancy being greater in the strata with predicted higher densities (Figure 3). There were few significant differences among years, but the tendency had been downward from 2012-2016. The 2017 estimate changed this trend. There have been shorter periods of increase or declines, but generally the population has been stable over the 17-year period (Figure 4).

We do not survey the Twin Cities Metro area, but use a constant estimate (17,500) from an earlier survey (Cooper 2004). The statewide estimate including the metro area is 339,082 (Table 2), above the state Canada goose population goal of 250,000. Last year (2016) was the only year population numbers have been below goal.

There was a low proportion of single geese and a high proportion of pairs observed during the 2017 survey (Table 3). This was a good production year and 132 nests were observed, including 9 singles and 123 pairs observed with nests. The previous high nest year was 2011, when there were 75 nests, but other years had 3-44 nests (Table 3). In most years, productive geese closely track the number of singles since they are believed to be indicated breeding pairs. However, in 2017, singles declined and the high productivity was indicated by large numbers of pairs observed with nests (Figure 5). Often when both members of a pair are observed together, they are not actively nesting. For example, in 2013 when a large proportion of pairs were observed, productivity was low (Figure 5) and few nests were observed (Table 3). It is possible some of this difference may be due to a new observer on the survey, but the pilot remained the same in most years. We do believe that this was a good production year as reflected in the number of productive geese, but future analyses should examine the value of this metric.

The average temperature was near to slightly above average in March and April 2017, although ice out dates were 2-3 weeks earlier than normal. Geese nested early in many areas and incubation was well underway during the survey. Precipitation was above normal in April and May, especially in areas in southern Minnesota.

Last year's Goose survey was expected to be the last (Weegman 2016); however, we decided to conduct the 2017 goose survey when we did not implement an expanded May Waterfowl Survey (Cordts 2016). Part of the reason for continuing the goose survey was the downward trend we had seen in point estimates the previous 4 years. This year's results changed that pattern. We will need to consider the importance of this survey in future years.

ACKNOWLEDGMENTS

John Heineman once again ably piloted the helicopter and served as the second observer. Chris Scharenbroich assisted in providing GPS coordinates of plots to the pilot and developing area maps. This project was funded in part by the Wildlife Restoration (Pittman-Robertson) Program.

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Table 1. Sampling frames used to conduct spring Canada goose surveys in Minnesota from 2001 – 2007 (*n*=2,700 plots) and 2008 – 2017 (*n* = 304,929 plots). Ecoregion is the combination of provinces across the state. Strata are determined by type and acres (ac) of wetlands and rivers per quarter section plot.

			N plots in sample frame by period	
Ecoregion	Strata	National Wetland Inventory Data	2001 – 2007[a]	2008 – 2017[b,c]
Prairie	0 pairs[d]	Type 3, 4, and 5 wetlands <0.5 ac and rivers <10.0 ac all water	476	61,597
	1-2 pairs	Type 4 and 5 wetlands >0.5 ac but type 3 <15.0 ac or type 3, 4, and 5 <0.5 ac and rivers >10.0 ac all water	344	30,751
	≥ 3 pairs	Type 3 >15.0 ac but plot not all water	80	9,533
Transition	0 pairs[d]	Type 3, 4, and 5 wetlands <1.0 ac and rivers <8.0 ac or plot all water	377	39,484
	1-2 pairs	Type 3, 4, and 5 wetlands 1.0–25.0 ac or >25.0 ac, but type 3 <15.0 ac or type 3, 4, and 5 <1.0 ac and rivers >8.0 ac	428	29,048
	≥ 3 pairs	Type 3, 4, and 5 wetlands >25.0 ac, but type 3 >15.0 ac and plot not all water	95	8,015
Forest	0 pairs[d]	Type 3, 4, and 5 wetlands <2.0 ac and rivers <2.0 ac or plot all water	510	75,835
	1-2 pairs	Type 3, 4, and 5 wetlands >2.0 ac but plot not all water or type 3, 4, and 5 <2.0 ac and rivers >2.0 ac	390	50,666
	≥ 3 pairs	None	0	0
Total			2,700	304,929

[a] From 2001-2007, double-sampling was used to estimate stratum weights and the survey plots were randomly drawn from a sample of 900 plots in each Ecoregion.

[b] The entire sampling frame was re-stratified in 2008 and Lake of the Woods and the NW Angle were removed from the sampling frame. The sampling frame was adjusted slightly in 2009 because of some processing errors in 2008. The population estimates for 2008–2016 are based on the updated sampling frame.

[c] From 2011-16, a portion of the potential survey plots were in the original proposed intensive harvest goose hunting zone (Fig. 1). These included 9,674 of the 1-2 pair plots and 3,400 of the >3 pair plots in the Prairie Ecoregion and 5,777 of the 1-2 pair plots and 1,479 of the > 3 pair plots in the Transition Ecoregion.

[d] The 0-pair strata were excluded from the random selection process.

Table 2. Population estimates of resident Canada geese for prairie transition, and forest ecoregions, ecoregions combined ±95% confidence interval (CI), the seven-county Twin cities metro area (see Figure 1), and state of Minnesota, 2001-2017 (*n*=150 plots 2001-2007 and 2017, *n*=160 plots 2008-2015, *n*=161 plots 2016).

Year	Prairie	Transition	Forest	Subtotal	95% CI	Metro	Statewide
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	271,373	69,055	17,500	288,872
2009	129,116	114,738	23,645	267,497	70,607	17,500	284,996
2010	83,911	151,903	57,422	293,235	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	104710	416,198	132,344	17,500	433,698
2013	104,907	91,652	54,044	250,602	73,122	17,500	268,102
2014	94,664	122,438	27,022	244,123	77,836	17,500	261,623
2015	97,847	114,986	37,156	249,988	61,291	17,500	267,488
2016	99,499	78,511	23,645	201,654	64,297	17,500	219,154
2017	139,365	145,062	37,155	321,582	87,478	17,500	339,082

*Prior to 2008, double-sampling was used to estimate stratum weights. The entire sampling frame was re-stratified in 2008 and Lake of the Woods and the NW Angle were removed from the sampling frame. The sampling frame was adjusted slightly in 2009 because of some processing errors in 2008. The population estimates for 2008–2016 are based on the updated sampling frame.

Table 3. Percent of Canada geese seen as singles, pairs, groups, nests, and productive geese, the number of nests, and the survey period during the Minnesota Spring Canada Goose Survey, 2001-2017.

Year	Singles[a]	Pairs[a]	Groups	Nests observed	Productive Geese[b]	Survey period
2001	27.0	63.9	9.1	22	36.4	4/14 to 5/02/2001
2002	30.7	52.0	17.2	31	41.5	4/26 to 5/11/2002
2003	27.9	58.2	13.9	11	29.3	4/22 to 5/01/2003
2004	26.5	57.5	16.0	44	35.5	4/22 to 5/04/2004
2005	33.0	50.2	16.8	43	40.7	4/20 to 5/03/2005
2006	43.5	45.9	10.6	30	50.3	4/24 to 5/05/2006
2007	31.0	51.5	17.5	17	36.2	4/23 to 4/28/2007
2008	38.4	55.4	6.2	22	42.6	4/23 to 5/05/2008
2009	41.8	50.7	7.5	31	45.2	4/21 to 5/01/2009
2010	42.5	48.2	9.3	36	46.6	4/15 to 4/20/2010
2011	50.3	47.2	2.6	75	55.7	4/21 to 4/29/2011
2012	30.0	49.6	20.4	41	35.1	4/16 to 4/23/2012
2013	27.1	67.8	5.1	6	29.8	5/06 to 5/14/2013
2014	39.3	55.1	5.6	12	44.0	4/21 to 5/04/2014
2015	38.5	56.4	5.1	8	41.6	4/20 to 4/28/2015
2016	37.1	48.2	14.7	3	37.1[c]	4/18 to 4/29/2016
2017	24.0	69.0	7.0	132	65.0	4/17 to 4/29/2017

[a] Singles and pairs were doubled before calculating proportions
[b] Productive Canada geese = singles + pairs with nests
[c] Productive Canada geese = singles

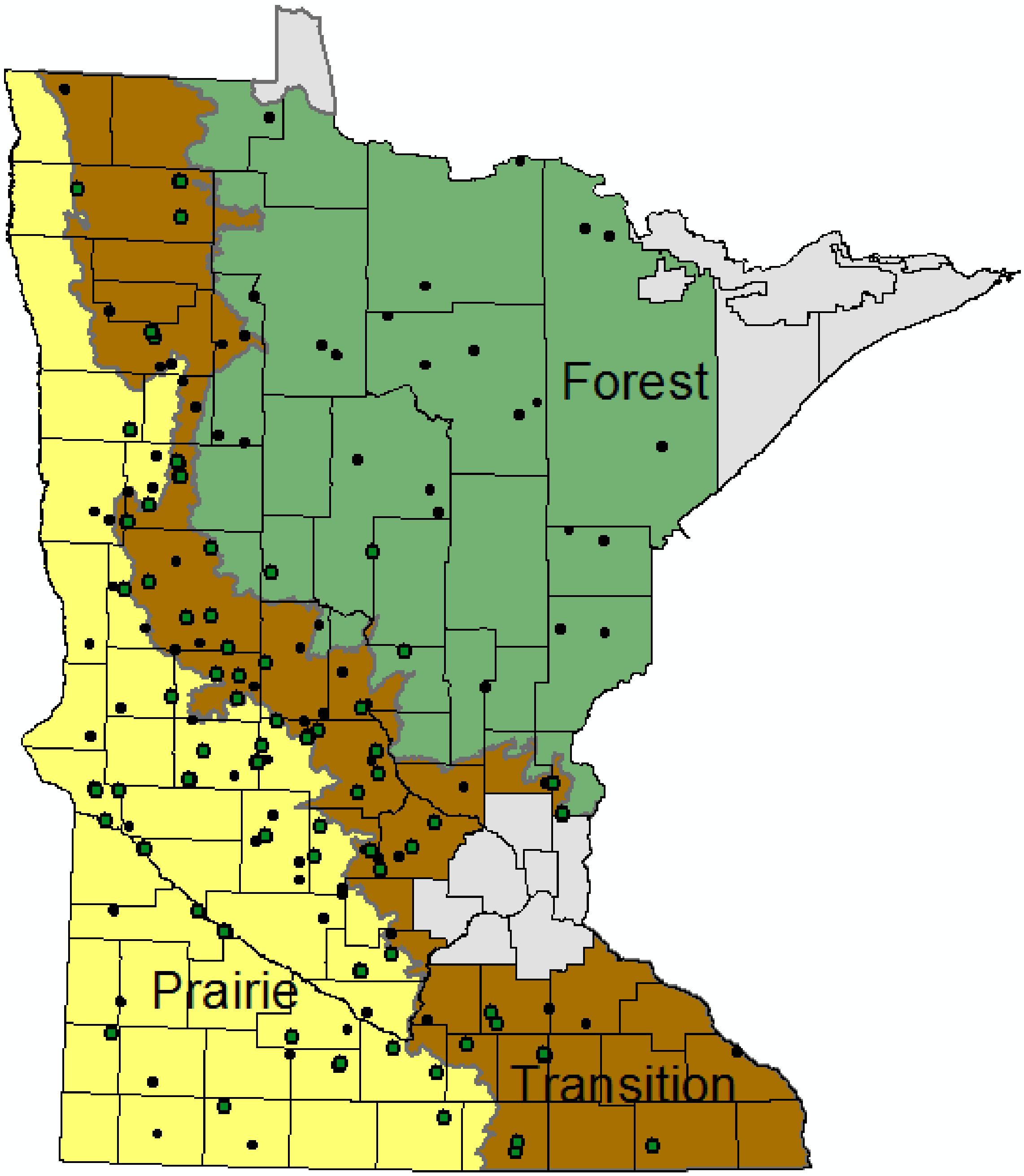

Figure 1. Location of 150 quarter-section plots surveyed during the 2017 spring Canada goose survey. Plots are distributed among the Prairie, Transition, and Forest ecoregions. Plots with geese present are indicated by dots with green centers. Grey areas were not included in the survey.

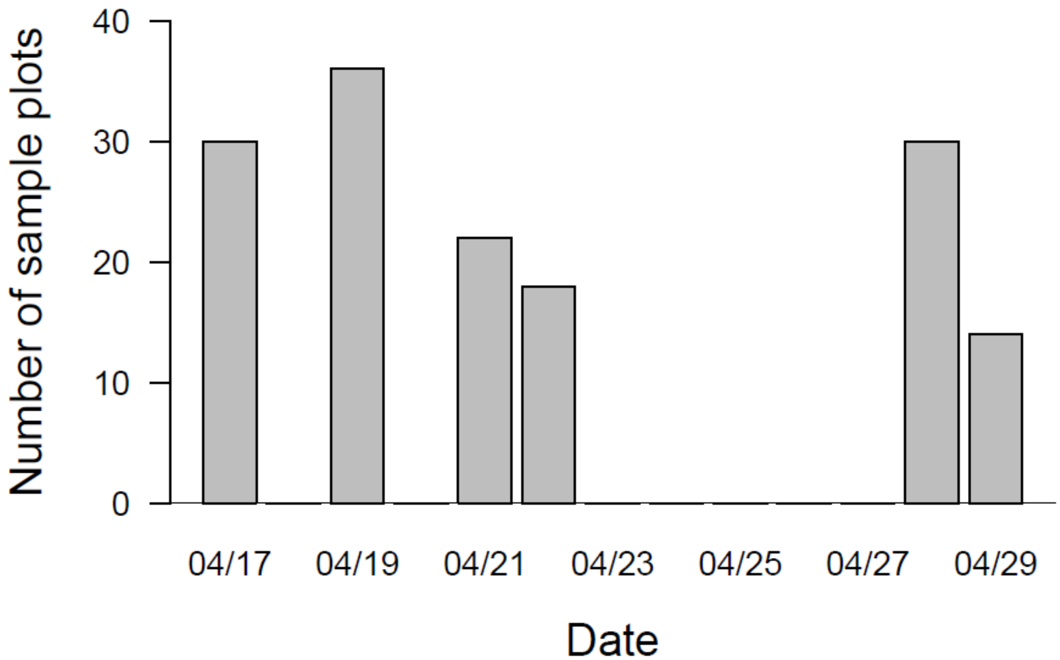

Figure 2. Number of sample plots surveyed by date during the 2017 Minnesota spring Canada goose survey.

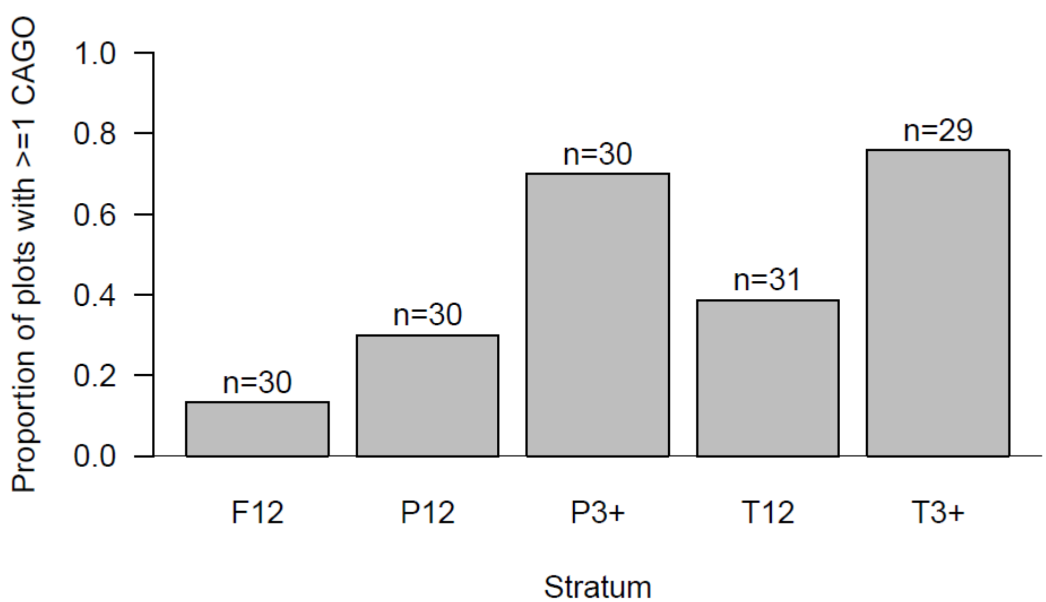

Figure 3. Proportion of plots (*n*/strata) by stratum with $\geq$ 1 goose observed, 2017 Minnesota spring Canada goose survey.

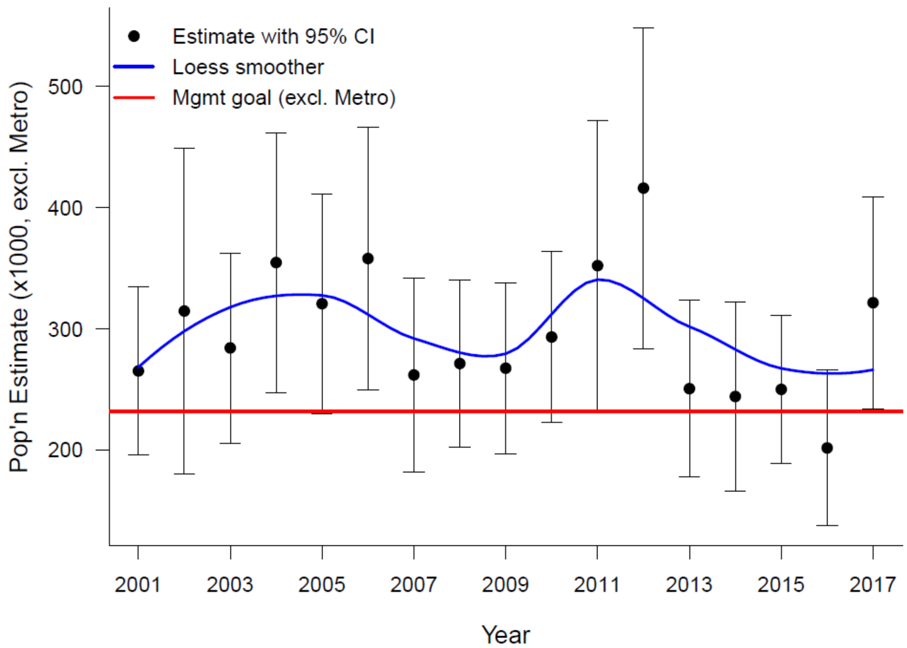

Figure 4. Population estimates and 95% confidence intervals for Canada geese in Minnesota, 2001-2017.

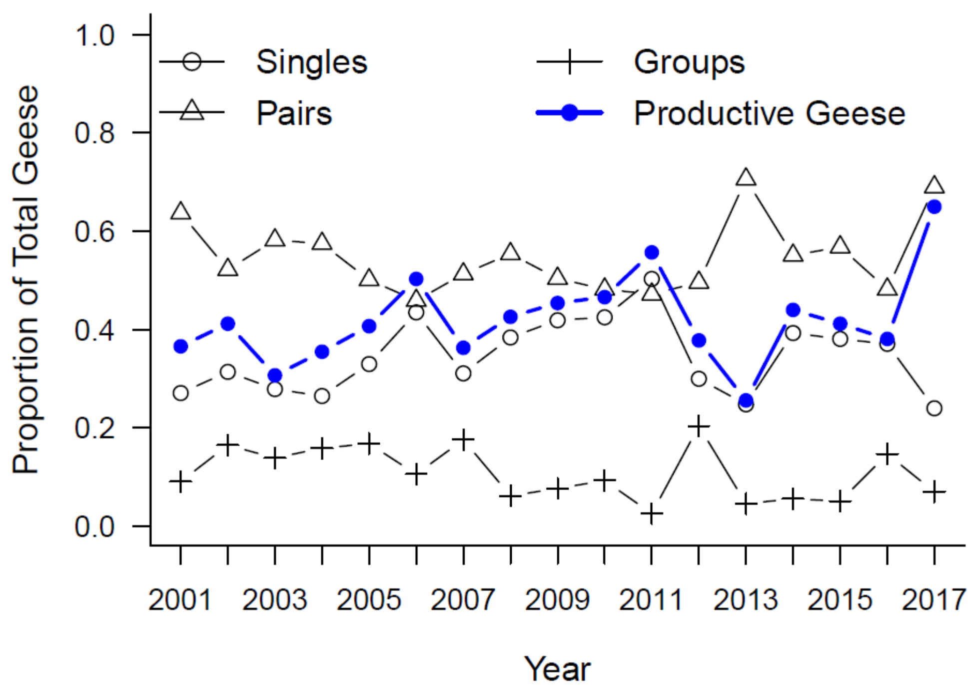

Figure 5. Social status trends from 2001 – 2017 for Canada geese in Minnnesota. Productive Canada geese determined using the proportion of single birds plus pairs with nests, except in 2016 when it is just proportion of single birds.

Mourning dove information is taken from the U.S. Fish and Wildlife Service report by Seamans, M.E. 2017. Mourning dove population status, 2017. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 22 pp. The entire report is available on the Division of Migratory Bird Management web site

(http://www.fws.gov/birds/surveys-and-data/reports-and-publications/population-status.php).

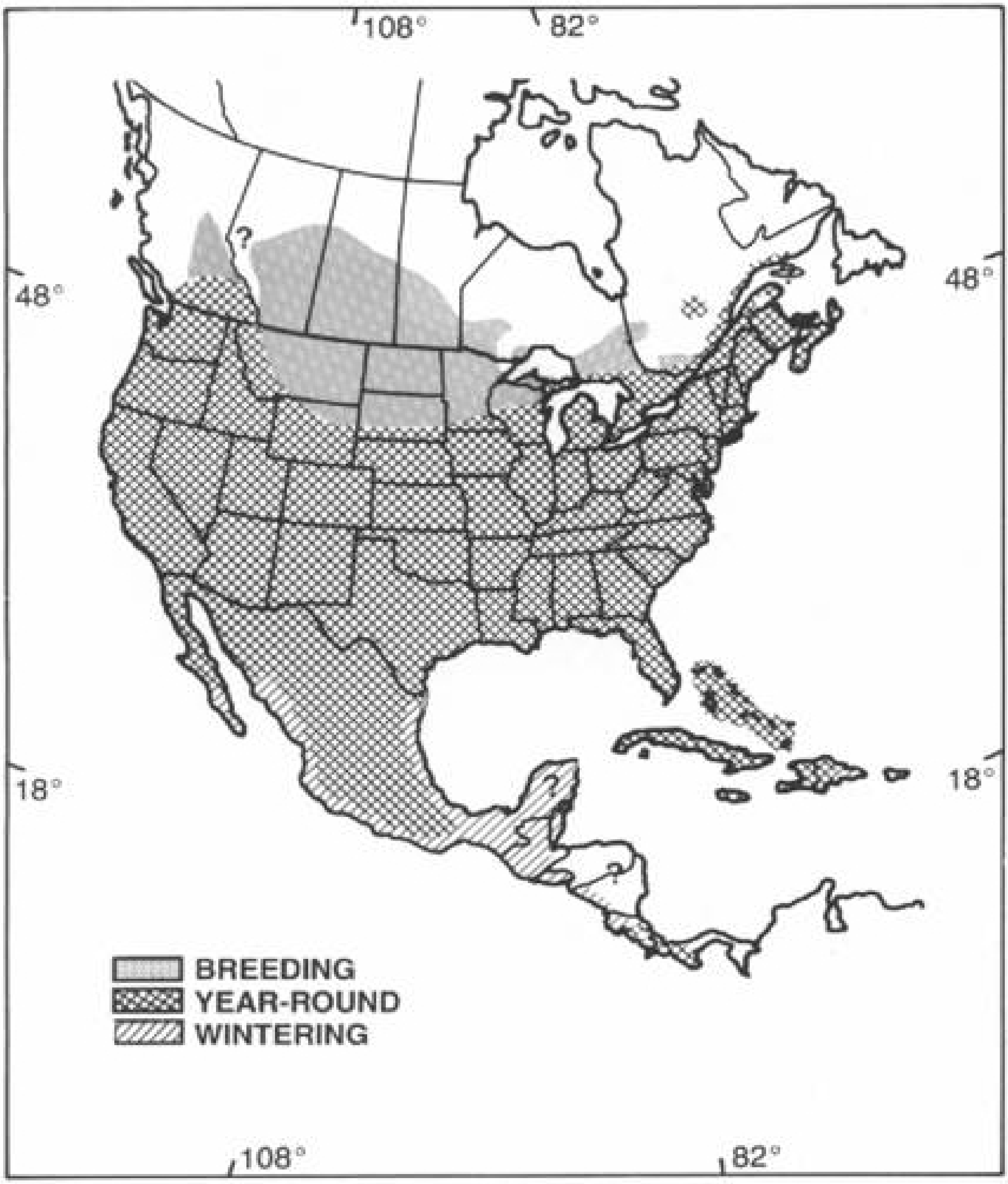

Figure 1. Breeding and wintering ranges of the mourning dove (adapted from Mirarchi and Baskett 1994). (From: Seamans, M.E. 2017. Mourning dove population status, 2017. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 22 pp.)

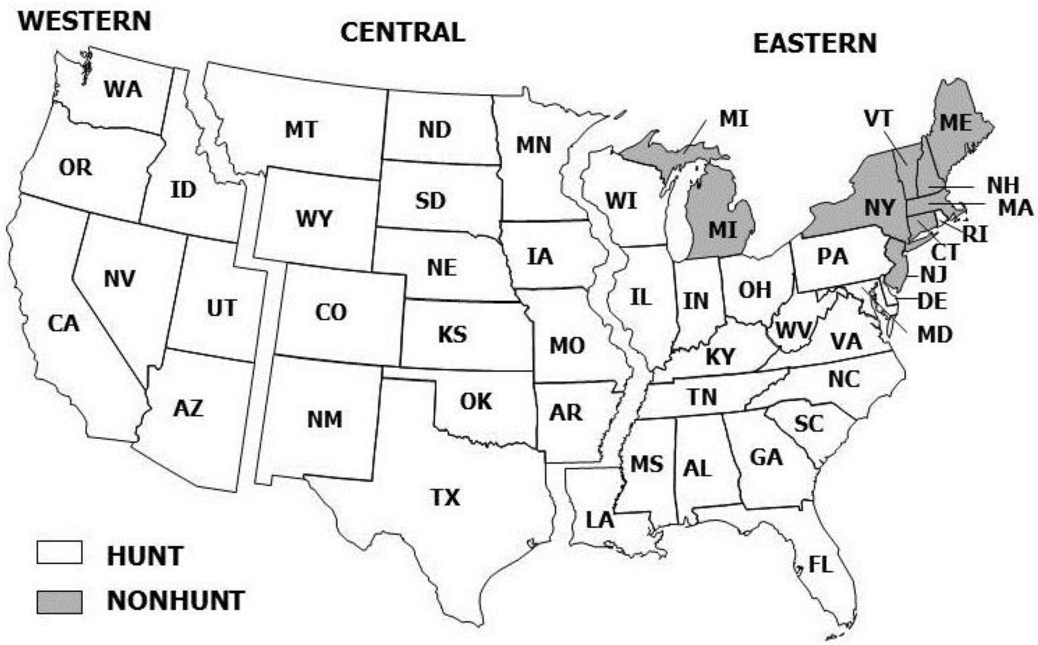

Figure 2. Mourning dove management units with 2016 -17 hunting and non-hunting states. (From: Seamans, M.E. 2017. Mourning dove population status, 2017. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 22 pp.)

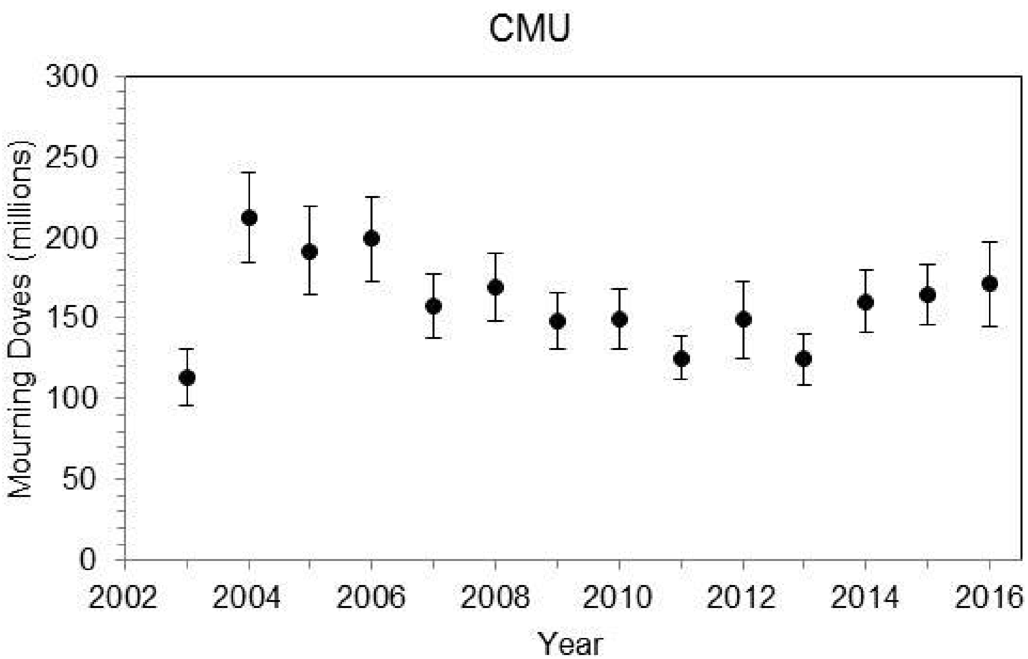

Figure 3. Estimates and 95% confidence intervals of mourning dove absolute abundance by in the Central Management Unit (CMU), 2003-16. Estimates based on band recovery and harvest data. (From: Seamans, M.E. 2017. Mourning dove population status, 2017. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 22 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 2014, 2015 and 2016 seasons [a]. (From: Seamans, M.E. 2017. Mourning dove population status, 2017. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 22 pp.)

Management unit / State	Active Hunters			Hunter Days Afield			Total Harvest		
	2014	2015	2016	2014	2015	2016	2014	2015	2016
CENTRAL	427,100 †	369,800 †	430,400 †	1,333,600 ± 9	1,235,000 ±10	1,344,400 ±13	7,654,700 ±10	7,180,300 ±9	7,334,600 ±14
AR	19,900 ±21	17,88 ±24	16,300 ±28	47,900 ±28	37,600 ±22	36,200 ±27	347,900 ±29	252,400 ±22	258,200 ±29
CO	14,400 ±14	14,200 ±15	13,100 ±18	27,800 ±16	38,900 ±23	29,700 ±19	173,100 ±19	204,500 ±22	141,200 ±20
IA	9,200 ±9	9,200 ±15	9,700 ±15	27,100 ±12	24,600 ±16	25,300 ±17	130,000 ±13	111,500 ±18	128,100 ±19
KS	26,200 ±10	28,600 ±13	28,600 ±12	70,700 ±14	86,400 ±18	77,200 ±17	485,300 ±18	558,200 ±20	427,600 ±18
MN	6,900 ±51	9,700 ±48	6,500 ±58	20,200 ±59	28,200 ±54	18,000 ±55	54,800 ±29	96,700 ±86	96,700 ±79
MO	24,100 ±12	22,500 ±14	25,200 ±14	62,200 ±15	54,300 ±17	65,100 ±21	374,000 ±17	307,400 ±24	321,600 ±20
MT	1,400 ±42	1,600 ±49	1,900 ±44	2,900 ±41	5,100 ±54	3,500 ±43	8,500 ±37	18,000 ±54	16,000 ±53
NE	9,700 ±12	9,000 ±17	9,700 ±19	26,700 ±13	25,500 ±18	24,500 ±18	172,900 ±15	160,600 ±17	132,000 ±22
NM	7,600 ±10	7,000 ±11	4,400 ±18	24,100 ±15	23,100 ±14	12,800 ±33	115,200 ±15	111,900 ±22	47,900 ±26
ND	3,900 ±25	4,200 ±23	5,300 ±24	11,900 ±30	12,800 ±25	15,800 ±35	47,600 ±23	73,500 ±25	76,900 ±30
OK	19,100 ±13	18,200 ±15	23,800 ±14	56,900 ±24	45,300 ±17	58,500 ±21	417,900 ±21	294,000 ±18	400,400 ±28
SD	6,400 ±21	5,300 ±15	5,600 ±22	17,500 ±24	16,000 ±25	17,100 ±33	106,800 ±25	84,500 ±30	112,400 ±46
TX	276,800 ±10	220,700 ±11	278,700 ±13	934,300 ±13	834,000 ±14	956,800 ±18	5,199,400 ±14	4,892,100 ±13	5,155,300 ±19
WY	1,500 ±26	1,700 ±23	1,700 ±27	3,400 ±23	3,300 ±30	3,700 ±36	21,100 ±25	14,900 ±28	20,100 ±40

[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.

American Woodcock information is taken from the U.S. Fish and Wildlife Service report American Woodcock Population Status, 2017. Seamans, M.E. and R.D. Rau. U.S. Fish and Wildlife Service, Laurel, MD. 20 pp.

The entire report is available on the Division of Migratory Bird Management home page (https://www.fws.gov/migratorybirds/pdf/surveys-and-data/Population-status/Woodcock/AmericanWoodcockStatusReport17.pdf)

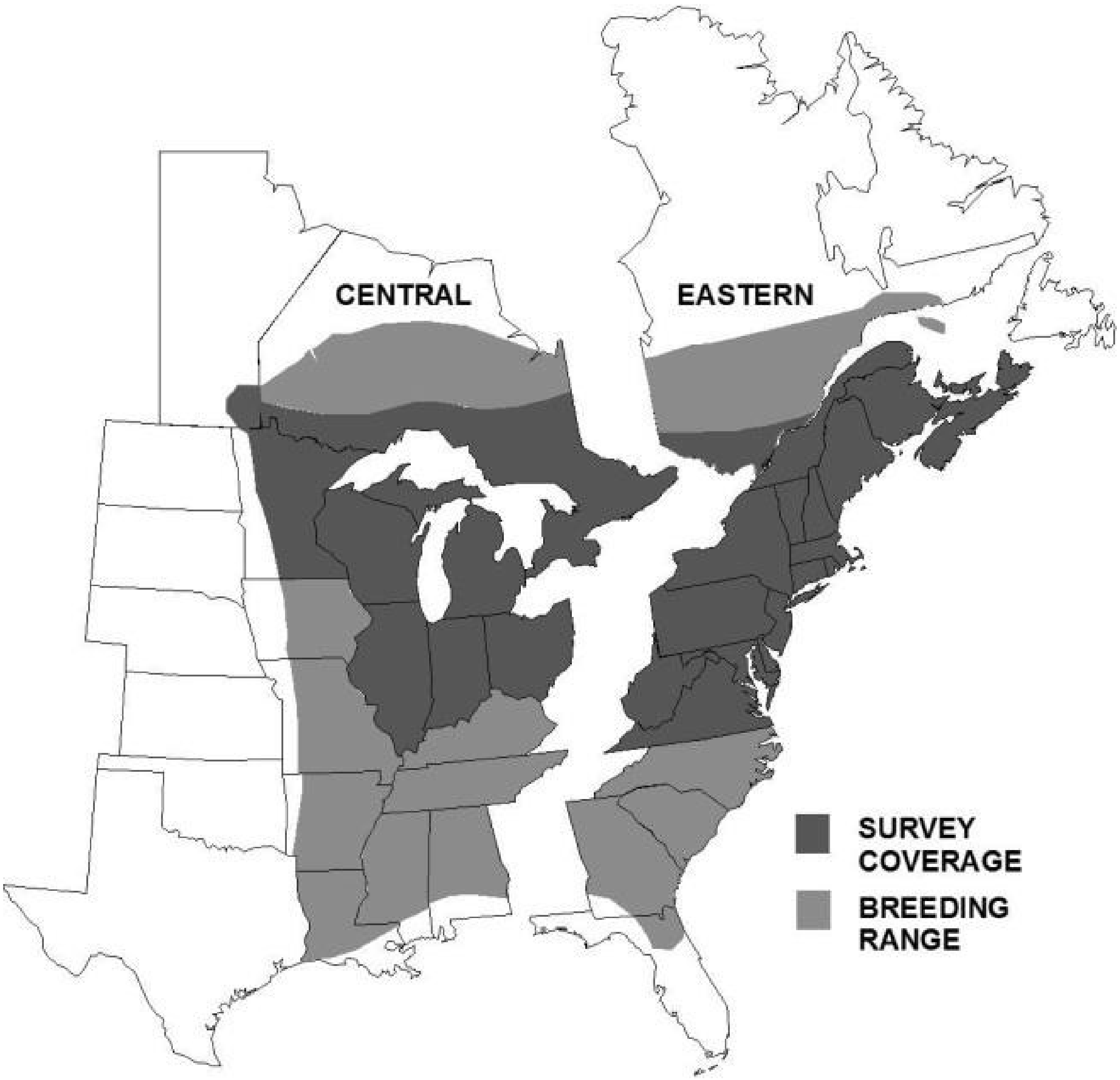

Figure 1. Woodcock management regions, breeding range, singing-ground survey coverage. (from: Seamans, M.E. and R.D. Rau. 2017. American woodcock population status, 2017. U.S. Fish and Wildlife Service, Laurel, MD. 20 pp.).

Table 1. Short term (2016 – 17), 10 –year (2007-2017), and long-term (1968-2017) 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: Seamans, M.E. and R.D. Rau. 2017. American woodcock population status, 2017. U.S. Fish and Wildlife Service, Laurel, MD. 20 pp.).

Management Unit/State	Number of Routes[b]	n[c]	2016-17			2007-17			1968-17		
			% Change	95% CI[d] lower	upper	% Change	95% CI[d] lower	upper	% Change	95% CI[d] lower	upper
CENTRAL	437	744	3.64	-3.50	11.37	- 0.44	-0.88	0.79	- 0.56	-0.79	-0.33
IL	14	47	21.11	-58.21	247.13	-1.63	-12.38	10.33	-0.89	-3.51	2.07
IN	11	62	-3.57	-43.05	62.19	-3.05	- 7.82	2.76	- 4.06	-5.30	-2.88
MB[e]	17	30	22.85	-7.70	71.45	2.56	- 0.95	6.87	0.48	-1.13	2.21
MI	119	155	1.30	-10.50	14.37	0.30	- 1.02	1.72	- 0.70	-1.06	-0.34
MN	74	122	1.76	-12.40	19.30	2.56	0.82	4.35	0.94	0.37	1.56
OH	33	73	-9.84	-32.61	13.74	-0.54	- 2.96	2.75	- 1.65	-2.42	-0.93
ON	92	163	1.60	-11.85	17.90	-2.12	- 3.88	-0.42	- 0.85	-1.29	-0.39
WI	77	122	15.70	-1.60	36.56	0.37	- 1.47	2.26	- 0.01	-0.49	0.50

[a] Median of route trends estimated used hierarchical modeling. To estimate the total percent change over several years, use: 100(% 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 2017 for which data were received by 30 June, 2017.

[c] Number of routes with at least one year of non-zero data between 1968 and 2017.

[d] 95% credible interval, if the interval overlaps zero, the trend is considered non-significant.

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

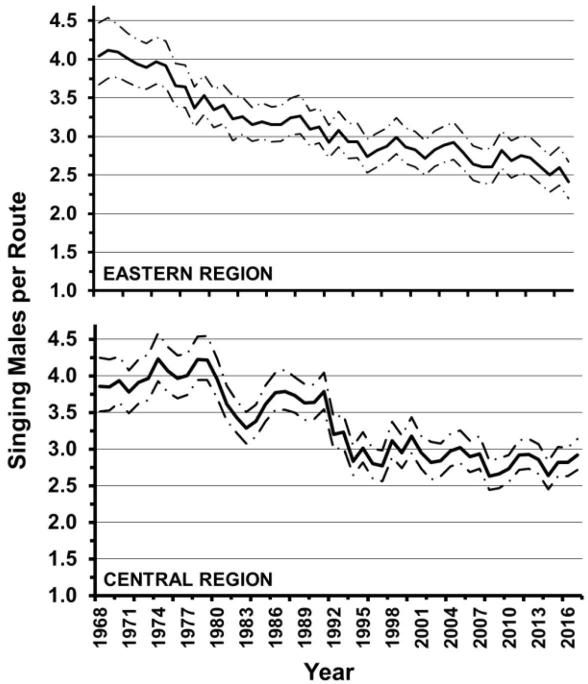

Figure 2. Annual indices of the number of woodcock heard on the Singing-ground Survey, 1968-2017. The dashed lines represent the 95th percentile credible interval. (from: Seamans, M.E. and R.D. Rau. 2017. American woodcock population status, 2017. U.S. Fish and Wildlife Service, Laurel, MD. 20 pp.).

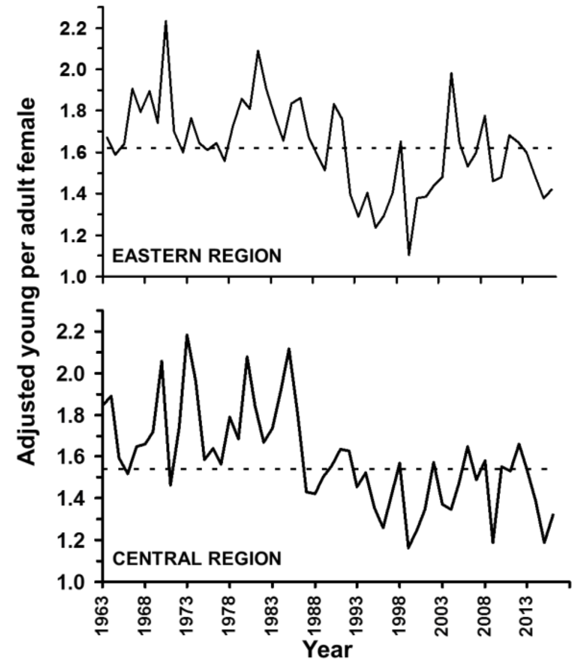

Figure 3. Weighted annual indices of American woodcock recruitment, 1963-2016. Dashed line is the 1963-2015 average. (from: Seamans, M.E. and R.D. Rau. 2017. American woodcock population status, 2017. U.S. Fish and Wildlife Service, Laurel, MD. 20 pp.).

Table 2. Preliminary estimates of woodcock hunter numbers, days afield, and harvest for selected states, from the 2013-14, 2014-15, 2015-16 and 2016-17 Harvest Information Program surveys. (from: Seamans, M.E. and R.D. Rau. 2017. American woodcock population status, 2017. U.S. Fish and Wildlife Service, Laurel, MD. 20 pp.).

Management Unit / State	Active woodcock hunters ([a])				Days afield ([a, c])				Harvest ([a, c])			
	2013-14	2014-15	2015-16	2016-17	2013-14	2014-15	2015-16	2016-17	2013-14	2014-15	2015-16	2016-17
Central Region	n.a. [b]	n.a. [b]	n.a. [b]	n.a. [b]	306,100 ± 20	227,600 ±13.6	284,200 ±16	300,200 ±32,500	180,600 ± 20	141,500 ± 23	145,700 ± 19	158,000 ±16,300
IL	1,600 ± 128	800 ± 169	1,000 ± 170	1,500 ±1,000	3,400 ± 119	2,600 ± 162	1,300 ± 133	13,200 ±11,000	1,000 ± 142	300 ± 132	200 ± 114	1,600 ±1,400
IN	700 ± 77	300 ± 99.7	400 ± 99	300 ±200	1,600 ± 58	900 ± 88.1	1,100 ± 83	1,300 ±500	1,400 ± 84	700 ± 43	600 ± 56	900 ±200
MI	30,000 ± 19	19,400 ± 21.1	26,000 ± 18	24,100 ±2,300	123,700 ± 24	87,500 ± 19.1	124,700 ± 21	107,100 ±11,600	79,300 ± 28	53,500 ± 29	63,200 ± 23	64,900 ±8,600
MN	10,900 ± 37	13,500 ±33.5	13,500 ±34	13,500 ±2,300	74,700 ± 62	47,500 ± 31.8	47,600 ± 40	46,000 ±8,200	18,600 ± 57	23,900 ± 45	25,600 ± 42	25,900 ±4,700
OH	3,000 ± 63	1,600 ± 85.4	1,900 ± 80	2,600 ±900	8,600 ± 64	4,500 ± 94.2	7,500 ± 95	8,200 ±3,700	8,600 ± 85	300 ± 90	2,100 ± 85	3,200 ±1,300
WI	14,500 ± 27	16,200 ± 25	14,700 ± 27	11,700 ±1700	60,000 ± 31	66,400 ± 26.9	66,600 ± 29	55,100 ±8,900	38,400 ± 24	49,300 ± 45	31,000 ± 25	35,100 ±4,400

[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.

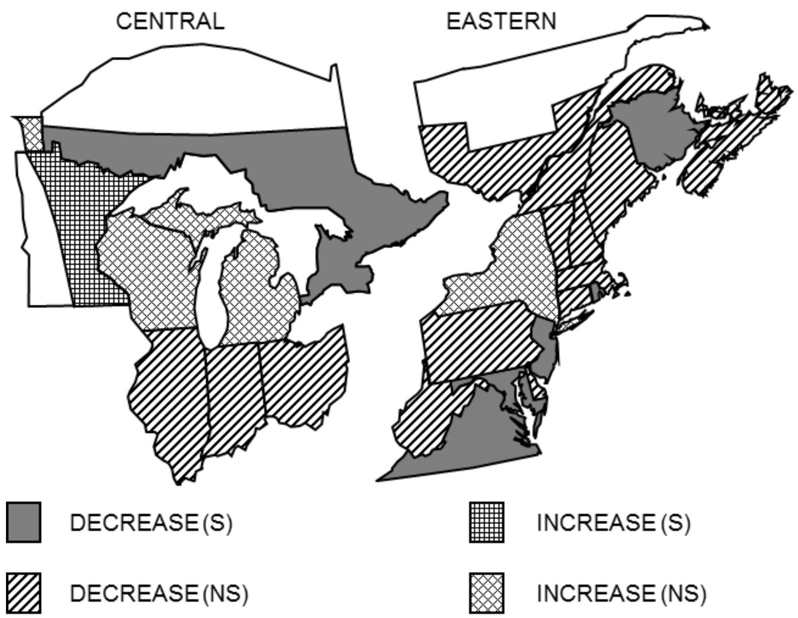

Figure 4. Ten-year trends in number of American woodcock heard on the Singing-ground Survey; 2007-17, as determined by the hierarchical modeling method. A significant trend (S) does not include zero in the 95% credible interval, while a non-significant (NS) trend does include zero. (from: Seamans, M.E. and R.D. Rau. 2017. American woodcock population status, 2017. U.S. Fish and Wildlife Service, Laurel, MD. 20 pp.).

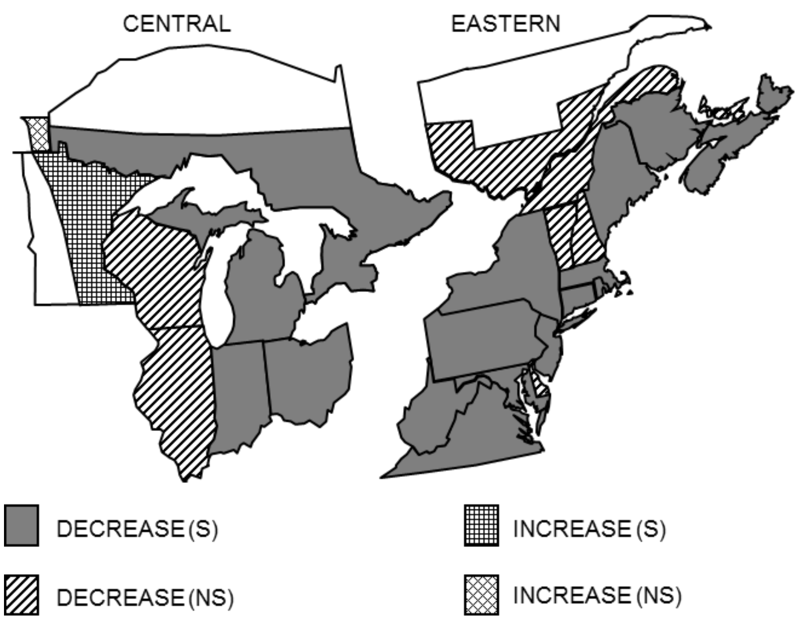

Figure 5. Long-term trends in number of American woodcock heard on the Singing-ground Survey; 1968-2017, as determined by the hierarchical modeling method. A significant trend (S) does not include zero in the 95% credible interval, while a non-significant (NS) trend does include zero. (from: Seamans, M.E. and R.D. Rau. 2017. American woodcock population status, 2017. U.S. Fish and Wildlife Service, Laurel, MD. 20 pp.).

HUNTING HARVEST STATISTICS

Division of Fish and Wildlife
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2016 SMALL GAME HUNTER MAIL SURVEY

Margaret Dexter, Wildlife Research Unit

INTRODUCTION

The Minnesota Department of Natural Resources (DNR), Division of Fish and Wildlife, Wildlife Research unit annually conducts a mail survey of small game hunters. The small game mail survey was initiated in 1976 as a means to gather small game harvest information, which is used to inform our constituency and guide decisions about hunting regulations and season structure.

METHODS

A postcard survey (Fig. 1) was mailed in early March and respondents who returned it within three weeks were eliminated from follow-up mailings. The sampling frame consisted of individuals who purchased a small game hunting license (any type) for the 2016-17 small game hunting season (N=252,358). A stratified random sample (n=7,000, 2.8%), allocated proportionally by license type, was drawn from the Minnesota DNR electronic database. Small game license types included the following: Resident Senior Citizen, Resident Youth, Resident Adult, Resident Individual Sport, Resident Combination Sport, Resident Lifetime, Resident Lifetime Sport, Nonresident Youth, and Nonresident Adult. For analysis, license types were pooled into “Resident” (N=245,657) and “Nonresident” (N=6,701) (Fig. 2). A free youth license was added to the sampling frame for 2010-13 but that license has since been discontinued. Estimates for those years have been recalculated without the youth license so that harvest estimates and license sales are comparable among years. The percent of respondents who said they hunted or did not hunt is reported in Table 1. License sales and survey response rate are shown in Figure 2.

Recipients were asked if they hunted small game in 2016-17 and if not, they were instructed to return the survey. Respondents who hunted were asked: (1) total number of days they hunted small game, (2) number bagged by species, (3) number of days hunted by species and (4) the county in which they hunted most for each species listed. Returned surveys were checked for completeness, consistency, and biological practicability. Dual key-entry and quality control checks were used to minimize transcription errors. Data was tabulated using Viking Data Entry VDE+ software and analyzed using R programming language (ver. 3.3.3; R Development Core Team [RDCT] 2017).

RESULTS

Of the 7,000 mailed surveys, 123 surveys were undeliverable; 3,371 surveys were returned for an adjusted response rate of 49%. Harvest trends for the top four small game species (ducks-all species, Canada geese, pheasants, and ruffed grouse) harvested in Minnesota for the past 15 years are shown in Figure 3. License sales declined 2% from the previous year (Fig. 2, Table 5). Estimated number of hunters increased slightly for ruffed grouse, gray squirrel, and cottontail rabbits but declined for most other species (Table 2). Estimated harvest per active hunter (Table 3) declined for mourning doves but remained relatively stable for all other species. Mean harvest for successful hunters and hunter success rates also showed no statistically significant changes (Table 4). License sales and estimated hunter harvest are presented in Table 5. Estimated ring-necked pheasant harvest declined from 243,176 roosters to 196,141, similar to 2011 levels. Ruffed grouse harvest increased slightly from 267,997 grouse in 2015 to 308,955 in 2016. There were fewer duck hunters in 2016 which lead to a decline in the duck harvest from 663,811 in 2015 to 606,458 but the take per active hunter was up slightly in 2016 (9.0 ducks/hunter compared to 8.7 ducks/hunter in 2015). Canada goose harvest edged up slightly to an estimated 204,825 geese harvested despite the decline in hunters from 45,938 in 2015 to 40,950 in 2016. Estimated take per hunter increased from 5.7 to 7.1 geese per successful hunters. Overall Nonresident license sales remained steady but participation increased for hunters of ducks, ruffed grouse, and pheasant (Table 6). Nonresident harvests for ducks increased slightly but decreased for grouse and pheasants.

This project was funded in part by the Wildlife Restoration Program.

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 2016-2017 small game hunting season **(March 2016-February 2017)**. We need information to estimate the season's harvest and to help set future small game seasons. Answer only for your Minnesota 2016 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

Lou Cornicelli, Wildlife Research Program Manager
Division of Fish and Wildlife
Department of Natural Resources

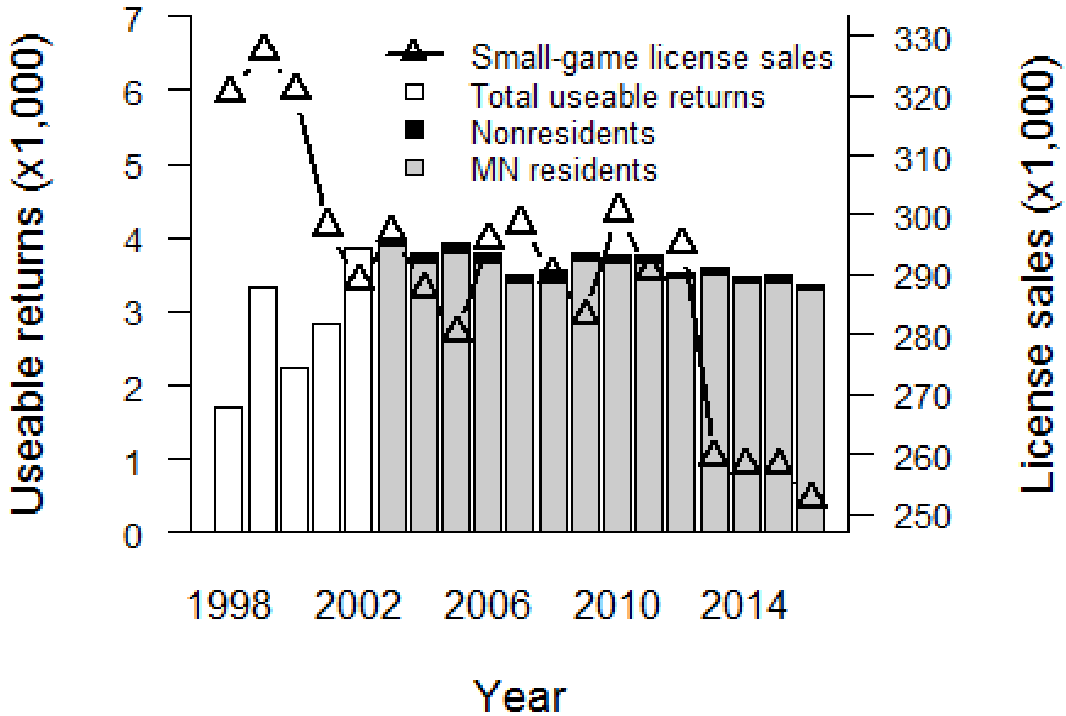
2016 Small Game Hunter Report

1. Did you hunt small game, listed below, in Minnesota this year (March 2016 - Feb 2017)? ☐ 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			

Figure 1. Sample of Small Game Hunter survey card.

Figure 2. Number of Minnesota small game licenses sold and usable returned surveys, 1990-2016. Includes resident and non-resident licenses, and excludes duplicate and free licenses.



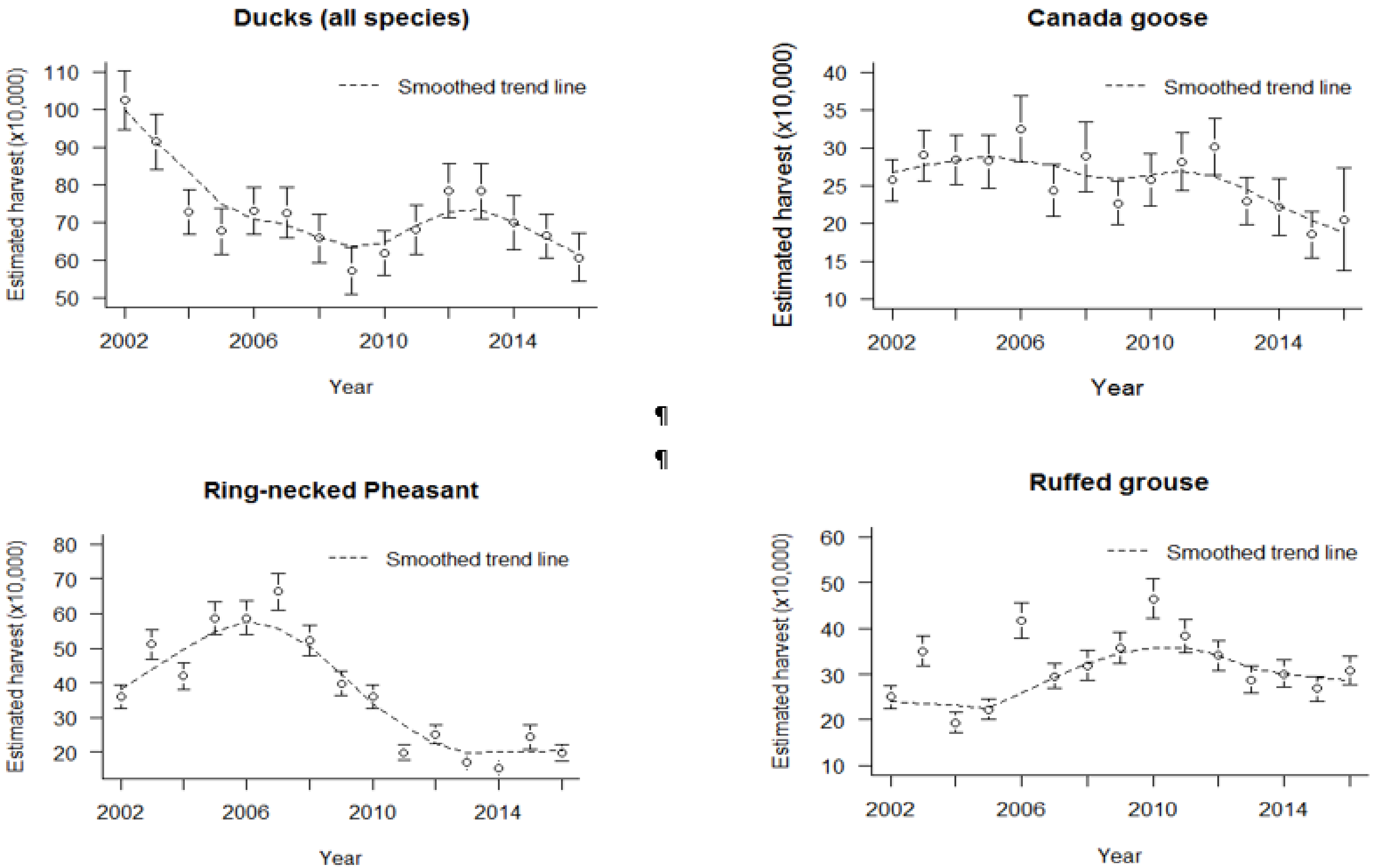


Figure 3. Harvest trends for top four small game species harvested in Minnesota, 2002-2016.

Table 1. Percent of respondents who hunted small game, 2005-06 through 2016-2017 [a].

		Returns from mail survey	Projections from license sales
2005-06	Hunted Did not hunt	3,035 (77%) 900 (23%) 3,935 (100.0%)	216,000 64,156 280,156
2006-07	Hunted Did not hunt	2,994 (79%) 795 (21%) 3,789 (100.0%)	233,759 62,139 295,898
2007-08	Hunted Did not hunt	2,894 (78%) 822 (22%) 3,716 (100.0%)	232,505 65,961 298,467
2008-09	Hunted Did not hunt	2,678 (75%) 873 (25%) 3,551 (100.0%)	218,753 71,311 290,064
2009-10	Hunted Did not hunt	2,850 (75%) 952 (25%) 3,802 (100.0%)	212,126 70,857 282,983
2010-11	Hunted Did not hunt	2,824 (75%) 953 (25%) 3,777 (100.0%)	210,129 70,911 281,040
2011-12	Hunted Did not hunt	2,761 (74%) 987 (26%) 3,748 (100.0%)	214,137 76,549 290,686
2012-13	Hunted Did not hunt	2,669 (76%) 851 (24%) 3,520 (100%)	223,808 71,360 295,168
2013-14	Hunted Did not hunt	2,586 (72%) 1,003 (28%) 3,589 (100%)	186,317 72,264 258,581
2014-15	Hunted Did not hunt	2,476 (72%) 975 (28%) 3,451 (100%)	185,186 72,923 258,109
2015-16	Hunted Did not hunt	2,505 (72%) 980 (28%) 3,485 (100%)	185,604 72,612 258,216
2016-17	Hunted Did not hunt	2,426 (72%) 945 (28%) 3,371 (100%)	181,614 70,744 252,358

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

Table 2. Estimated number of statewide hunters by species, 2006-07 through 2016-17.

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12$^{\beta}$	2012-13$^{\beta}$	2013-14	2014-15	2015-16	2016-17
Ducks	87,075	87,468	81,358	77,480	72,770	76,090	80,770	76,950	75,170	76,243	67,301
Canada goose	66,224	62,649	59,222	55,520	53,430	57,220	58,900	51,160	48,240	45,938	40,950
Other geese	4,529	3,695	4,411	3,280	3,650	2,710	3,830	2,810	2,770	2,520	2,321
American coot	4,529	3,454	4,166	4,090	4,610	3,480	3,990	3,820	4,410	3,261	3,519
Common snipe	2,187	1,928	1,797	1,340	1,340	1,160	1,160	1,370	820	667	899
Rails / gallinules	547	482	408	370	220	230	500	140	300	445	75
Crow *	10,777	8,514	10,047	10,640	9,380	10,360	11,480	8,570	7,400	7,410	7,412
American woodcock	13,510	10,843	12,171	11,760	10,790	9,430	13,310	12,030	9,650	12,596	12,877
Mourning dove $^{\gamma}$	12,886	13,172	11,599	10,500	10,640	8,970	9,230	10,380	9,950	8,966	7,636
Ring-necked pheasant	118,703	118,311	106,763	99,440	89,140	72,840	76,950	62,110	57,590	63,350	59,965
Ruffed grouse	91,682	90,600	86,505	87,230	92,490	88,620	91,260	81,130	83,020	79,058	82,348
Spruce grouse	9,840	10,602	8,332	9,750	8,860	10,210	7,400	10,810	10,320	8,225	9,658
Sharp-tailed grouse	6,560	6,827	6,616	5,510	7,140	6,190	6,570	6,700	5,460	5,113	6,214
Gray partridge	6,013	6,667	4,411	4,240	3,720	2,400	3,080	2,450	2,540	2,075	2,097
Gray squirrel	25,459	25,863	22,382	22,260	23,740	23,280	24,710	21,690	21,240	22,303	23,806
Fox squirrel	15,619	14,779	13,233	13,180	15,630	12,060	14,220	12,030	12,790	13,411	13,625
Eastern cottontail	20,070	19,598	17,644	16,300	15,030	12,300	16,390	14,550	13,160	11,633	16,096
White-tailed jackrabbit	2,577	2,891	2,451	1,790	2,230	2,320	1,750	1,220	1,350	890	1,423
Snowshoe hare	5,545	4,257	4,574	3,500	3,800	3,250	4,820	3,750	4,560	4,076	3,369
Raccoon (Sept - Feb)	8,747	9,558	7,433	7,300	8,260	8,040	8,570	7,640	6,880	5,632	5,840
Raccoon‡ (March -Aug)											
Red fox (Sept -Feb)	6,248	5,783	5,800	7,820	7,220	6,030	5,820	5,910	4,560	4,150	3,594
Red fox‡ (March -Aug)											
Gray fox	2,030	1,928	1,879	1,790	1,640	1,390	1,580	1,730	1,050	1,186	899
Coyote	17,024	16,064	19,278	19,280	19,420	17,940	21,050	17,650	17,580	18,302	15,871
Badger	859	482	490	370	600	310	330	500	80	297	375

*Crow season added in 1989. ‡ Raccoon and red fox season continuous May 1994 thru March 15, 2006. $^{\gamma}$ Mourning dove season added 2004. $^{\beta}$ Estimates from these years were recomputed without license type 99- free youth license to be consistent with other years of data.

Table 3. Estimated harvest per active hunter by species, 2006-07 through 2016-17.

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12[β]	2012-13[β]	2013-14	2014-15	2015-16	2016-17
Ducks	8.4	8.1	8.1	7.4	8.5	9.0	9.7	10.2	9.3	8.7	9.0
Canada geese	4.9	3.9	4.9	4.1	4.8	4.9	5.1	4.5	4.6	4.0	5.0
Other geese	1.5	2.1	3.2	1.9	1.1	1.8	2.3	2.5	2.4	1.8	3.1
American coot	5.6	4.6	5.7	3.6	5.7	3.0	4.2	4.0	3.9	4.9	6.1
Common snipe	1.9	2.0	1.2	1.1	1.4	1.2	1.2	1.7	0.6	0.3	2.2
Rails/gallinules	2.4	5.3	0.4	0.8	0.3	1.7	0.2	0.5	0.2	2.3	n.a.*
Crow*	6.4	6.4	5.2	5.3	6.1	7.9	7.9	7.9	7.6	7.8	6.6
American woodcock	3.2	2.6	2.4	3.0	2.8	2.6	2.3	2.7	2.7	3.0	3.6
Mourning dove[γ]	6.7	7.7	11.4	10.5	9.4	8.2	10.0	7.8	10.4	10.8	7.7
Ring-necked pheasant	4.9	5.5	4.9	4.0	4.0	2.7	3.3	2.7	2.7	3.8	3.3
Ruffed grouse	4.5	3.2	3.7	4.1	5.0	4.3	3.7	3.6	3.6	3.4	3.8
Spruce grouse	2.7	1.7	2.0	2.0	1.7	1.8	1.6	1.2	1.4	1.2	1.6
Sharp-tailed grouse	1.8	2.0	2.1	1.7	2.4	1.9	1.6	1.1	1.6	1.6	1.4
Gray partridge	1.9	1.6	2.2	1.9	2.5	1.6	1.7	1.0	1.4	1.5	1.8
Gray squirrel	5.5	5.2	5.4	4.9	5.9	5.0	5.1	3.9	4.3	4.3	4.0
Fox squirrel	4.2	3.2	3.9	4.1	3.9	4.0	3.5	2.8	3.2	3.5	2.9
Eastern cottontail	3.9	4.0	4.5	3.5	3.6	2.8	3.9	2.8	2.9	3.6	3.1
White-tailed jackrabbit	1.6	3.3	2.6	1.5	3.2	2.2	1.1	1.5	0.8	0.8	0.8
Snowshoe hare	3.0	1.4	2.5	1.5	1.8	2.6	3.5	1.7	1.7	1.6	1.8
Raccoon (Sept - Feb)	7.2	4.9	9.7	9.1	9.4	5.5	5.6	6.1	7.7	6.8	3.8
Raccoon[‡] (March -Aug)											
Red fox (Sept -Feb)	1.3	1.1	0.8	1.3	1.2	1.2	1.4	0.9	0.7	0.9	0.6
Red fox[‡] (March -Aug)											
Gray fox	1.8	0.3	1.3	1.0	1.5	0.8	0.2	0.2	0.6	0.7	0.2
Coyote	1.2	2.1	2.4	2.4	2.3	1.9	2.5	1.3	1.0	1.9	1.5
Badger	1.3	0.3	1.0	2.0	1.0	0.8	1.0	0.6	1.0	0.5	1.0

[*]Crow season added in 1989. [‡] Raccoon and red fox season continuous May 1994 thru March 15, 2006. [γ] Mourning dove season added 2004. [β] Estimates from these years were recomputed without license type 99- free youth license to be consistent with other years of data. * Only 1 respondent indicated they hunted rails and they reported 0 bagged.

Table 4. Mean harvest for successful hunters and hunter success rates (%), 2006-07 through 2016-17.

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12 β	2012-13 β	2013-14	2014-15	2015-16	2016-17
Ducks	9.9 (84)	9.5 (85)	9.8 (83)	9.2(80)	10.3 (83)	10.5 (85)	11.1 (87)	11.7 (87)	11.0 (85)	10.6 (82)	10.9 (83)
Canada geese	6.3 (78)	5.5 (71)	6.4 (77)	5.6 (73)	6.1 (80)	6.3 (78)	6.5 (78)	5.8 (77)	6.6 (69)	5.7 (71)	7.1 (70)
Other geese	2.7 (55)	4.2 (50)	6.3 (50)	3.5 (55)	2.6 (41)	3.4 (51)	4.4 (52)	5.5 (46)	4.3 (54)	4.0 (44)	8.0 (39)
American coot	7.2 (78)	6.3 (74)	6.9 (82)	5.5 (65)	7.2 (79)	4.4 (69)	5.2 (81)	5.2 (75)	5.0 (78)	6.7 (73)	7.6 (81)
Common snipe	2.6 (75)	2.9 (71)	1.7 (73)	1.8 (61)	2.2 (67)	1.6 (73)	2.1 (57)	2.1 (79)	1.4 (45)	1.0 (33)	3.2 (67)
Rails / gallinules	4.3 (57)	6.4 (83)	1.0 (40)	1.3 (60)	1.0 (33)	5.0 (33)	1.0 (17)	1.0 (50)	1.0 (25)	3.5 (67)	n.a.*
Crow	7.2 (89)	7.3 (88)	5.9 (88)	5.9 (90)	6.7 (91)	8.9 (88)	8.8 (90)	9.4 (84)	8.7 (87)	8.3 (94)	7.6 (86)
American woodcock	3.9 (83)	3.7 (69)	3.3 (74)	4.1 (73)	3.6 (76)	3.8 (70)	3.4 (68)	3.8 (70)	4.2 (64)	4.4 (67)	5.4 (67)
Mourning dove γ	8.2 (81)	9.8 (79)	13.2 (87)	11.4 (92)	11.1 (85)	10.5 (78)	12.5 (80)	9.2 (85)	12.5 (83)	13.3 (81)	10.3 (75)
Ring-necked pheasant	6.6 (75)	7.1 (78)	6.4 (77)	5.8 (69)	5.6 (72)	4.4 (63)	4.9 (67)	4.2 (64)	4.3 (61)	5.4 (71)	5.0 (65)
Ruffed grouse	5.9 (77)	4.7 (69)	5.0 (74)	5.5 (74)	6.6 (76)	5.9 (74)	5.2 (71)	5.2 (68)	5.1 (71)	4.9 (69)	5.3 (70)
Spruce grouse	3.8 (71)	3.1 (54)	3.0 (68)	3.1 (64)	2.4 (71)	3.0 (61)	2.8 (57)	2.4 (51)	2.5 (56)	2.4 (50)	2.7 (58)
Sharp-tailed grouse	3.3 (56)	4.4 (46)	3.2 (64)	3.0 (58)	3.5 (68)	3.1 (61)	3.4 (48)	3.2 (33)	3.8 (41)	3.1 (51)	2.9 (47)
Gray partridge	2.8 (69)	3.0 (55)	3.4 (65)	3.3 (58)	4.2 (58)	3.2 (52)	3.1 (54)	2.5 (38)	4.4 (32)	2.7 (57)	3.3 (54)
Gray squirrel	6.4 (87)	5.9 (88)	6.2 (88)	5.8 (86)	7.0 (84)	6.3 (78)	6.3 (80)	5.0 (77)	5.5 (78)	5.3 (81)	5.1 (79)
Fox squirrel	5.0 (85)	3.9 (83)	4.6 (83)	4.8 (85)	4.6 (86)	5.4 (74)	4.4 (80)	3.7 (75)	4.3 (75)	4.9 (71)	3.8 (76)
Eastern cottontail	4.6 (85)	4.8 (84)	5.3 (85)	4.3 (83)	4.4 (81)	4.1 (69)	5.5 (71)	3.5 (79)	4.1 (73)	5.0 (72)	4.0 (77)
White-tailed jackrabbit	2.5 (64)	4.5 (72)	3.8 (70)	2.1 (71)	4.6 (70)	3.5 (63)	2.3 (48)	5.2 (29)	1.8 (44)	2.0 (42)	1.9 (42)
Snowshoe hare	3.8 (80)	2.2 (62)	3.5 (71)	2.6 (60)	2.6 (69)	3.8 (69)	5.0 (69)	2.9 (58)	3.0 (57)	3.0 (53)	3.2 (56)
Raccoon (Sept -Feb)	7.7 (94)	5.4 (90)	10.6 (91)	9.6 (95)	10.0 (94)	6.1 (89)	6.1 (93)	6.9 (89)	8.5 (90)	7.7 (88)	4.1 (92)
Raccoon‡ (March -Aug)											
Red fox (Sept -Feb)	2.1 (60)	2.3 (46)	1.5 (49)	2.4 (54)	2.3 (54)	2.4 (49)	2.7 (50)	2.0 (44)	1.7 (41)	1.6 (57)	1.4 (44)
Red fox‡ (March -Aug)											
Gray fox	2.7 (65)	1.0 (29)	3.3 (39)	2.5 (42)	4.0 (36)	2.5 (33)	1.0 (16)	1.5 (17)	2.0 (29)	1.4 (50)	1.0 (25)
Coyote	2.4 (51)	4.4 (49)	4.4 (54)	4.6 (52)	4.0 (57)	4.0 (47)	5.1 (49)	2.7 (50)	2.4 (41)	3.4 (57)	3.1 (49)
Badger	1.6 (82)	1.0 (33)	1.2 (83)	2.5 (80)	1.0 (100)	1.5 (50)	1.0 (100)	1.0 (57)	1.0 (100)	1.0 (50)	1.2 (80)

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

β Estimates from these years were recomputed without license type 99- free youth license to be consistent with other years of data.

* Only 1 respondent indicated they hunted rails and they reported 0 bagged.

Table 5. Statewide (resident and non-resident) small game hunting license sales and estimated hunter harvest, 2006-07 through 2016-17.

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12 [β]	2012-13 [β]	2013-14	2014-15	2015-16	2016-17
Small game license sales[a]	295,898	298,467	290,064	282,983	282,227	271,768	264,063	258,581	258,109	258,208	252,358
State duck stamp sales	101,792	100,134	95,675	89,942	88,069	89,681	90,052	93,412	94,265	92,176	88,905
Pheasant stamp sales	129,546	129,315	123,270	110,456	104,286	86,868	90,541	77,597	74,295	77,750	76,920
Estimated harvest [b]											
Ducks	730,559	708,491	658,186	572,220	619,600	681,550	784,360	782,810	699,620	663,811	606,458
Canada geese	324,498	243,705	288,411	227,160	257,530	281,630	301,550	229,120	221,620	185,012	204,825
Other geese	6,658	7,723	13,895	6,250	3,940	4,800	8,820	7,130	6,510	4,448	7,188
American coot	24,909	16,061	23,871	14,810	26,340	10,520	16,720	15,130	17,050	15,861	21,564
Common snipe	4,221	3,933	2,210	1,490	1,940	1,390	1,420	2,310	520	223	1,948
Rails / gallinules	1,329	2,569	163	300	80	390	80	70	80	1,039	n.a.*
Crow	69,188	54,319	51,742	56,350	57,300	81,500	90,260	67,440	56,020	57,576	48,590
American woodcock	39,907	27,866	29,210	35,430	29,770	24,980	30,360	31,920	25,810	37,270	46,867
Mourning dove [d]	85,950	101,161	132,577	109,940	100,230	74,000	92,760	80,480	103,370	96,552	58,618
Ring-necked pheasant	587,580	655,443	522,071	398,130	359,400	198,500	250,140	169,100	152,800	243,176	196,141
Ruffed grouse	417,153	293,544	318,338	357,420	465,580	383,150	341,320	288,410	301,190	267,997	308,955
Spruce grouse	26,568	17,705	16,997	19,130	14,960	18,640	11,980	13,110	14,590	9,856	15,348
Sharp-tailed grouse	11,939	13,790	13,695	9,530	16,820	11,600	10,650	7,130	8,530	7,929	8,610
Gray partridge	11,545	11,000	9,660	8,040	9,150	3,950	5,160	2,380	3,590	3,187	3,745
Gray squirrel	140,788	133,194	121,534	109,790	138,920	115,840	126,110	84,010	91,250	96,400	95,374
Fox squirrel	66,068	47,736	51,079	53,970	61,690	48,100	49,750	33,940	40,840	46,383	39,603
Eastern cottontail	77,872	78,588	79,927	57,760	53,870	34,640	64,140	40,710	38,820	41,716	49,187
White-tailed jack rabbit	4,149	9,482	6,446	2,610	7,220	5,180	1,910	1,870	1,050	742	1,124
Snowshoe hare	16,801	5,789	11,343	5,360	6,770	8,430	16,800	6,200	7,860	6,374	5,990
Raccoon (Sept -Feb)	62,891	46,739	72,026	66,700	77,690	44,080	48,340	46,690	52,800	38,387	22,312
Raccoon [c] (Mar –Aug)											
Red fox (Sept –Feb)	7,872	6,188	4,408	10,270	8,780	7,120	7,990	5,190	3,220	3,780	2,247
Red fox [c] (Mar –Aug)											
Gray fox	3,593	559	2,443	1,860	2,380	1,160	250	430	600	816	225
Coyote	20,769	34,377	45,689	46,070	44,050	33,410	51,990	23,630	17,430	35,123	24,481
Badger	1,091	159	490	750	600	230	330	290	80	149	375

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 youth-free license was part of the sampling frame for the 2011-12 and 2012-13 seasons but was discontinued for 2013-14. The harvest statics for those years have been recomputed by removing the youth free license from both the sampling frame and the respondents' database. The estimates are now more comparable over time.

[a] Includes all types of Small game licenses. Duplicate and free 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.

* Only 1 respondent indicated they hunted rails and they reported 0 bagged.

Table 6. Mail survey results of nonresident small game hunters, 2006-07 through 2016-17.

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Nonresident licenses issued [a]	7,356	7,858	7,114	6,934	6,695	6,312	6,456	6,031	6,056	6,755	6,701
Questionnaires:											
Number mailed	185	185	226	196	163	169	166	162	165	169	190
Number not delivered	11	11	15	10	6	11	11	10	12	5	15
Number (percent) returned	115 (62)	101 (58)	89 (42)	105 (54)	107 (66)	91 (54)	71 (43)	81 (50)	70 (42)	73 (43)	78 (41)
Estimated nonresidents and (percent) of all licensed nonresidents hunting:											
Ducks	2,344 (32)	2,256 (29)	2,293 (32)	1,849 (27)	2,003 (29.9)	2,430 (38.5)	2,360 (36.6)	2,010 (33.3)	2,340 (38.6)	1,850 (27.4)	2,320 (34.6)
Canada goose	2,083 (28)	934 (12)	1,587(22)	726 (10)	1,314 (19.6)	1,620 (25.6)	1,360 (21.1)	1,270 (21.0)	1,300 (21.4)	650 (9.6)	770 (11.5)
Ruffed grouse	1,953 (26)	1,867 (24)	1,940 (27)	1,915 (28)	2,503 (37.4)	1,460 (23.1)	2,820 (43.7)	2,010 (33.3)	2,600 (42.9)	2,870 (42.5)	3,520 (52.6)
Ring-necked pheasant	3,776 (51)	2,645 (34)	3,116 (44)	1,519 (22)	2,003 (29.9)	1,780 (28.2)	1,910 (29.6)	1,420 (23.5)	1,380 (22.9)	1,480 (21.9)	1,550 (23.1)
Raccoon [b, c]	0 (0)	78 (1.0)	0 (0)	0 (0)	63 (0.9)	0 (0)	0 (0)	80 (1.2)	0 (0)	0 (0)	170 (2.6)
Estimated nonresident take:											
Ducks	12,173	22,718	15,463	11,755	17,055	13,840	20,380	20,410	13,060	16,863	17,701
Canada goose	3,580	3,501	5,762	3,698	6,334	4,050	2,270	3,650	2,680	1,484	1,462
Ruffed grouse	11,522	7,236	6,938	8,651	12,600	8,980	10,090	4,990	9,090	13,805	11,772
Ring-necked pheasant	16,079	17,661	10,642	6,274	8,076	4,860	6,820	3,430	3,720	6,581	4,040
Raccoon [b, c]	0	3,268	0	0	593	0	0	1,280	0	0	172

[a] Excludes duplicate licenses and nonresident shooting preserve licenses.

[b] In 2002, 2003, 2004, 2006, 2008, 2009, 2011, 2012, 2014, and 2015 no non-residents reported hunting/harvesting raccoons.

[c] In 2013 only one non-resident reported hunting/harvesting raccoons. The extrapolated estimate is not reliable.

The following information has been excerpted from: U.S. Fish and Wildlife Service. Migratory bird hunting activity and harvest during the 2015 - 2016 and 2016-17 hunting seasons. U.S. Fish and Wildlife Service, Laurel, Maryland, U.S.A. The entire report is available on-line at https://www.fws.gov/migratorybirds/pdf/surveys-and-data/HarvestSurveys/MBHActivityHarvest2015-16and2016-17.pdf

Table 1. Species composition of the Minnesota waterfowl harvest, 2015 and 2016. (from: Raftovich, R.V., S.C. Chandler, and K.K. Fleming. 2017. Migratory bird hunting activity and harvest during the 2015-16 and 2016-17 hunting seasons. U.S. Fish and Wildlife Service, Laurel, Maryland. USA August 2017. 71 pp).

	Minnesota Harvest					Mississippi Flyway Harvest		
Species	2015	% of Harvest	2016	% of Harvest	Percent change in Harvest 15-16	2015	2016	Percent change Harvest 15-16
Mallard	136,645	23.83	136,016	26.11	0	1,695,598	1,826,117	7
Domestic mallard	0	0	0	0.00		1,087	1,185	8
American black duck	0	0	0	0.00		16,254	25,956	37
Black x mallard	343	0.06	0	0.00	-100	1,692	1,664	-2
Gadwall	17,510	3.05	8,198	1.57	-53	559,674	662,282	15
American wigeon	8,927	1.56	13,788	2.65	54	63,988	91,897	30
Green-winged teal	41,199	7.19	37,637	7.22	-9	529,417	627,605	16
Blue-winged /cinnamon teal	76,562	13.35	73,039	14.02	-5	506,316	255,598	-98
Northern shoveler	8,240	1.44	6,335	1.22	-23	155,309	193,823	20
Northern pintail	8,240	1.44	9,316	1.79	13	95,746	101,514	6
Wood duck	130,465	22.75	115,520	22.17	-11	557,838	582,231	4
Redhead	16,480	2.87	13,788	2.65	-16	86,213	60,324	-43
Canvasback	12,703	2.22	7,080	1.36	-44	30,696	45,348	32
Greater scaup	2,060	0.36	373	0.07	-82	25,053	34,574	28
Lesser scaup	13,046	2.28	7,080	1.36	-46	118,419	67,223	-76
Ring-necked duck	64,546	11.26	62,232	11.94	-4	183,485	188,185	2
Goldeneye	3,777	0.66	4,099	0.79	9	25,123	33,269	24
Bufflehead	23,690	4.13	17,887	3.43	-24	73,064	55,768	-31
Ruddy duck	1,030	0.18	0	0.00	-100	4,805	15,500	69
Scoters	0	0	0	0.00		3,100	6,160	50
Hooded merganser	7,210	1.26	8,571	1.65	19	37,751	50,167	25
Other mergansers	343	0.06	0	0.00	-100	24,008	12,614	-90
Total Duck Harvest [a] (retrieved kill)	573,400 ±13%		521,000 ±14%		-9	4,822,700 ±6%	4,962,600 ±6%	3

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

Table 2. Top 10 states in number of **adult duck hunters**, 2016, and number of hunter-days and retrieved duck kill. (from: Raftovich, R.V., S.C. Chandler, and K.K. Fleming. 2017. Migratory Bird Hunting activity and harvest during the 2015-16 and 2016-17 hunting seasons. U.S. Fish and Wildlife Service, Laurel, Maryland. USA August 2017. 71 pp).

State	**Number of active duck hunters**	**Duck hunter days afield**	**Total duck harvest**	**Seasonal duck harvest per hunter**
Texas	79,900 ± 20%	385,800 ± 29%	1,162,400± 36%	14.5 ± 41%
Minnesota	60,600 ± 10%	336,600 ± 13%	521,000 ± 14%	8.6 ± 18%
Wisconsin	55,000 ± 14%	346,100 ± 14%	365,500 ± 12%	6.6 ± 18%
Arkansas	53,900 ± 10%	423,100 ± 12%	1,139,600 ± 13%	21.1 ± 17%
Louisiana	49,900 ± 12%	289,900 ± 17%	857,000 ± 20%	17.2 ± 24%
California	47,100 ± 13%	370,800 ± 12%	1,154,300 ± 14%	24.5 ± 19%
Michigan	38,200 ± 15%	248,800 ± 16%	361,300 ± 23%	9.5 ± 27%
North Dakota	33,500 ± 8%	159,500 ± 8%	437,300 ± 9%	13.1 ± 12%
North Carolina	31,500 ± 19%	242,100 ± 34%	472,600 ± 36%	15.0 ± 41%
Missouri	30,800 ± 13%	220,200 ± 22%	452,400 ± 32%	14.7 ±35%
Mississippi Flyway		2,647,700 ± 5%	4,962,600 ± 6%	
United States		5,557,400 ± 4%	11,607,400 ± 5%	

Table 3. Top 10 states in number of **adult goose hunters**, 2016, and number of hunter-days and retrieved goose kill. (from: Raftovich, R.V., S.C. Chandler, and K.K. Fleming. 2017. Migratory Bird Hunting activity and harvest during the 2015-16 and 2016-17 hunting seasons. U.S. Fish and Wildlife Service, Laurel, Maryland. USA August 2017. 71 pp).

State	Number of active goose hunters	Goose hunter days afield	Total goose harvest	Seasonal goose harvest per hunter
Texas	45,700 ± 18%	143,500 ± 27%	197,300 ± 26%	4.3 ± 32%
Wisconsin	44,400 ± 12%	328,700 ± 20%	96,400 ± 20%	2.2 ± 23%
Minnesota	42,000 ± 11%	214,900 ± 15%	177,700 ± 25%	4.2 ± 27%
Michigan	39,700 ± 14%	263,400 ± 20%	167,800 ± 19%	4.2 ± 24%
California [b]	30,900 ± 12%	194,000 ± 14%	145,200 ± 20%	4.5 ± 24%
Maryland [b]	25,800 ± 6%	131,900 ± 10%	157,800 ± 13%	6.1 ± 14%
North Dakota	25,000 ± 7%	125,200 ± 12%	179,800 ± 15%	7.2 ± 17%
Pennsylvania	23,600 ± 17%	115,700 ± 23%	104,100 ± 23%	4.4 ± 28%
North Carolina	22,900 ± 24%	79,100 ± 31%	53,500 ± 31%	2.3 ± 39%
Illinois	22,600 ± 13%	161,300 ± 16%	113,400 ± 25%	5.0 ± 29%
Mississippi Flyway		1,734,700 ± 7%	1,178,200 ± 9%	
United States [b]		3,621,300 ± 4%	3,266,900 ± 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 HARVEST DURING THE SEPTEMBER 2016 EARLY GOOSE HUNT IN MINNESOTA

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Minnesota held its first September Canada goose season in the Twin Cities Metro area in 1987. Zones were added and seasons expanded in subsequent years until the September Canada goose season was held statewide beginning in 1999. In addition, the State provided an August Canada goose Conservation Action from 2013-2015, but did not continue that season in 2016. September seasons were specific to Canada geese from 1987-2015. However, the federal frameworks for goose hunting were changed in 2016 so that both dark and light geese were legal to take during the September portion of the goose season. Functionally, the September season still targets Canada geese because none of the other goose species are present in significant numbers in Minnesota that time of year.

In 1999, Minnesota began an experiment to extend the season one week (until 22 September) beyond the September 15 end date for early Canada goose seasons in the Mississippi Flyway (Maxson et al. 2002). The full extension was used from 1999-2015, except when the regular waterfowl season opened earlier than 23 September (2012 and 2013) and then the Minnesota Department of Natural Resources (DNR) closed the September goose season the day before the regular waterfowl season opener. In 2016, the DNR closed the season 6 days before the regular waterfowl opener (18 September).

September goose seasons in Minnesota were 3-18 September 2016 and the bag limit 5 dark geese (Canada, white-fronted, and brant) and 20 light (snow, blue, and Ross's) geese per day. Shooting hours were 1/2 hour before sunrise to sunset. Taking geese was prohibited on or within 100 yards of all surface waters in the Northwest Goose and Sandhill Crane Zone, in the Carlos Avery Wildlife Management Area (Anoka, Chisago County), the Swan Lake Area (Nicollet County), and Ocheda Lake Game Refuge (Nobles County). Goose hunters were required to obtain a $4.00 permit to participate in the September portion of the season. This report documents results of the 2016 September goose hunter mail questionnaire.

METHODS

Permittees were randomly selected to receive a post-season hunter survey. Questionnaires were sent to 3,100 permit holders following the September 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 (Appendix A) asked permittees the number of days hunted, number of geese shot and retrieved, and number of geese knocked down and not retrieved during the September goose season. Hunters were asked to indicate the number of days they shot and retrieved a limit of 5 geese, if they hunted the last weekend of the season, and which closing date they preferred. We also asked whether they participated in the August Canada Goose Conservation Action in 2015 and if they supported reinstating that hunt. Finally, we asked hunters questions to gauge their satisfaction with the goose hunting experience, harvest, regulations, and the number of geese seen.

While other species of geese were legal game for the first time during the 2016 September Goose Season in Minnesota, all responses were directed at Canada geese because essentially no other migrant geese were typically present in September.

We used the R programming language (ver. 2.9.2; R Development Core Team 2017) to summarize responses to the survey.

RESULTS

The DNR License Bureau reported that 26,096 Fall Special Goose Permits were sold through 18 September 2016. Response rate to the survey was 48%, slightly higher than the past two years (Table 1). A slightly higher percentage of respondents hunted in September 2016 (70.8%) than August and September 2015 (65.3%). In 2015, when the August conservation action was offered, 8.3% hunted only during August, 42.2% hunted only in September, 14.8% hunted both seasons, and 34.7% did not hunt. Results from the 2013-2015 August Conservation Actions (Cordts et al. 2017) are presented for comparison (Table 2).

We estimated 18,484 active hunters during the September portion of the season, similar to September 2014 but greater than in 2013 or 2015 (Table 1, Figure 1). However, the total number of early season hunters was less than 2 of the 3 years when the August and September seasons were held (18,570, 20,290 and 21,743 in 2013, 2014, and 2015, respectively). Hunters shot and retrieved an estimated 66,282 Canada geese in the September 2016 season, less than the combined August/September take in 2013-15 (Table 3). Geese/hunter was less than any year since 2009 (Table 3), although the August Conservation Action added to the individual hunter take from 2013-15.

We asked hunters how satisfied they were (1=very low to 7=very high) relative to overall hunting experience, number of geese bagged, number of geese seen, and regulations. Results in 2016 were similar to the September season two previous years: mean satisfaction with the overall experience was 5.1, 4.7, and 4.9 in 2014, 2015, and 2016, respectively; geese bagged was 4.2, 3.8, and 4.0; regulations was 5.0, 4.9, and 4.9; and number of geese seen was 4.4, 3.9, and 4.3. Mean satisfaction for each of these items was slightly lower in the August portion of the season in 2014 and 2015 (Cordts et al. 2015, 2017).

Hunters reported taking the full 5-bird bag limit on 17.6% of the days they hunted. Individual hunters reported getting 5 geese up to 8 days during the season, but most took 5 on 1 (10%) or 2 (5%) days.

Forty percent (40.8%) of active hunters reported hunting on the last weekend of the season, 17-18 September. The largest proportion (0.47) of respondents had no preference on the closing date of the season. Of the individuals with an opinion, 26% favored continuing the season until September 22 and 26% favored ending the season on September 18 (the 2016 option). Slightly more individuals who hunted the last weekend had an opinion, with 30% favoring 18 September, 34% favoring 22 September, and 36% having no opinion.

A quarter (24.4%) of the respondents reported hunting in the 2015 August Conservation Action; however, 10% of the individuals who did not hunt in September this year did not answer the question vs. <1% of the active September hunters. The majority (60.1%) of individuals who participated in the 2015 August Conservation Action favored reinstating the hunt, while 27.8%

did not support the hunt and 12.1% had no opinion. For hunters who did not participate in the 2015 Conservation Action, 30.4% supported reinstating the hunt, 34.6% opposed it, and 35.0% had no opinion.

DISCUSSION

Permit sales declined from 45,277 to 34,311 in the 13-year period from 2000 to 2012, then declined 6,533 between 2012 and 2013. 2013 was the first year of the August Goose Conservation Action, but we have no data to indicate that change influenced the decline. Permit sales in 2016 were the lowest over this period and were 1,072 less than the previous year. September hunter numbers followed a similar pattern, but even though permit sales went down this year, the number of active September hunters increased slightly (Figure 1). September harvest also increased this year (Figure 1), but was 11.5% less than the combined August/September harvest in 2015. Harvest in 2016 was still lower than most years since 2000.

In 2016, Mississippi Flyway goose season frameworks changed to: “States may select seasons for Canada geese not to exceed 107 days with a 5-bird daily bag limit September 1-30 (except in the Intensive Harvest Zone in Minnesota, which may have up to a 10-bird daily bag limit) and a 3-bird daily bag limit for the remainder of the season. Seasons may be held between September 1 and February 15 and may be split into 4 segments.” (81 Federal Register (FR) 17301, 03/28/2016). Thus, Minnesota could hold the early portion of the season anytime starting September 1 and continuing through September 30, or functionally until the opening of the regular waterfowl season in Minnesota, which was 24 September 2016. The previous year (2015) federal frameworks stated: “September Canada goose seasons could be 15 days from September 1-15 in most of the Mississippi Flyway, except Minnesota, where the season could be up to 22 days from September 1-22” (80 FR 51089, 08/21/2015). Minnesota was granted the longer season based upon a 3-year experiment we conducted (Maxson et al. 2002).

Under the September season frameworks in place through 2015, we likely would have closed the 2016 early season on Thursday, 22 September, and opened the regular waterfowl season on Saturday, 24 September. We did this in 2011 when we had similar options. However, given the continuous goose season framework available in 2016, it did not make sense to close the September portion of the season on Thursday, 22 September 2016 and have a 1-day split before the opening of the regular waterfowl season. The logical options were to close the September segment on Sunday, 18 September 2016, or continue the season until Friday, 23 September 2016, the day before the regular waterfowl season opener. In 2012 and 2013, the DNR chose to have continuous September and regular season when the regular season opened earlier than September 24. However, in 2016 the DNR made a different decision and chose to close the September goose season on Sunday, September 18 and have a 5-day split before the waterfowl season opener.

In the questionnaire, we asked respondents if they would have preferred the season closing on Sunday, 18 September (used in 2016) or Thursday, 22 September (used most previous years). Twenty-six percent of the respondents and 34% of those that hunted the last weekend of the season favored the later closing date (Thursday, 22 September). It is likely similar proportions would have favored continuing the season one-more day (close Friday, 23 September) rather than having a one-day split between the early Canada goose and regular waterfowl seasons. In 2011, we asked a sample of Minnesota waterfowl stamp purchasers (not just September goose season hunters) whether they would prefer the next year’s (2012) early season continuing until the Friday before regular waterfowl season opened (close Friday, 21 September 2012) or close 5 days before the regular season (on Sunday, 16 September 2012). A slight majority (37.2%) had no preference, 33.6% favored the continuous season, and 29.4% favored the split between seasons (Schroder et al. 2012). It is interesting that a larger proportion of fall goose permit purchasers had no opinion (47%) compared to regular waterfowl stamp purchasers (37%).

Since 2002, the opening framework date for the regular waterfowl season has been a week earlier (Saturday nearest September 24) than the Saturday nearest 1 October date that was in effect most years from 1979-2001. Minnesota selected the earlier opening date in 2003-2004 and 2011-2016. Opening dates for the regular waterfowl season will range from 21-27 September with the earlier framework date. If we continue to close the September season the Sunday before the regular waterfowl opener, closing dates for the early segment will range from 15-21 September.

Results from this survey provide a more detailed understanding of hunter activity, harvest, and preferences during the September portion of the goose season. There was no preference by hunters for either proposed closing date, so the DNR Section of Wildlife should consider other factors when developing recommendations for future September season closing dates.

Funding is provided by participants through the $4 Fall Special Goose Permit and in part by the Wildlife Restoration (Pittman-Robertson) Program. We recommend continuing the survey.

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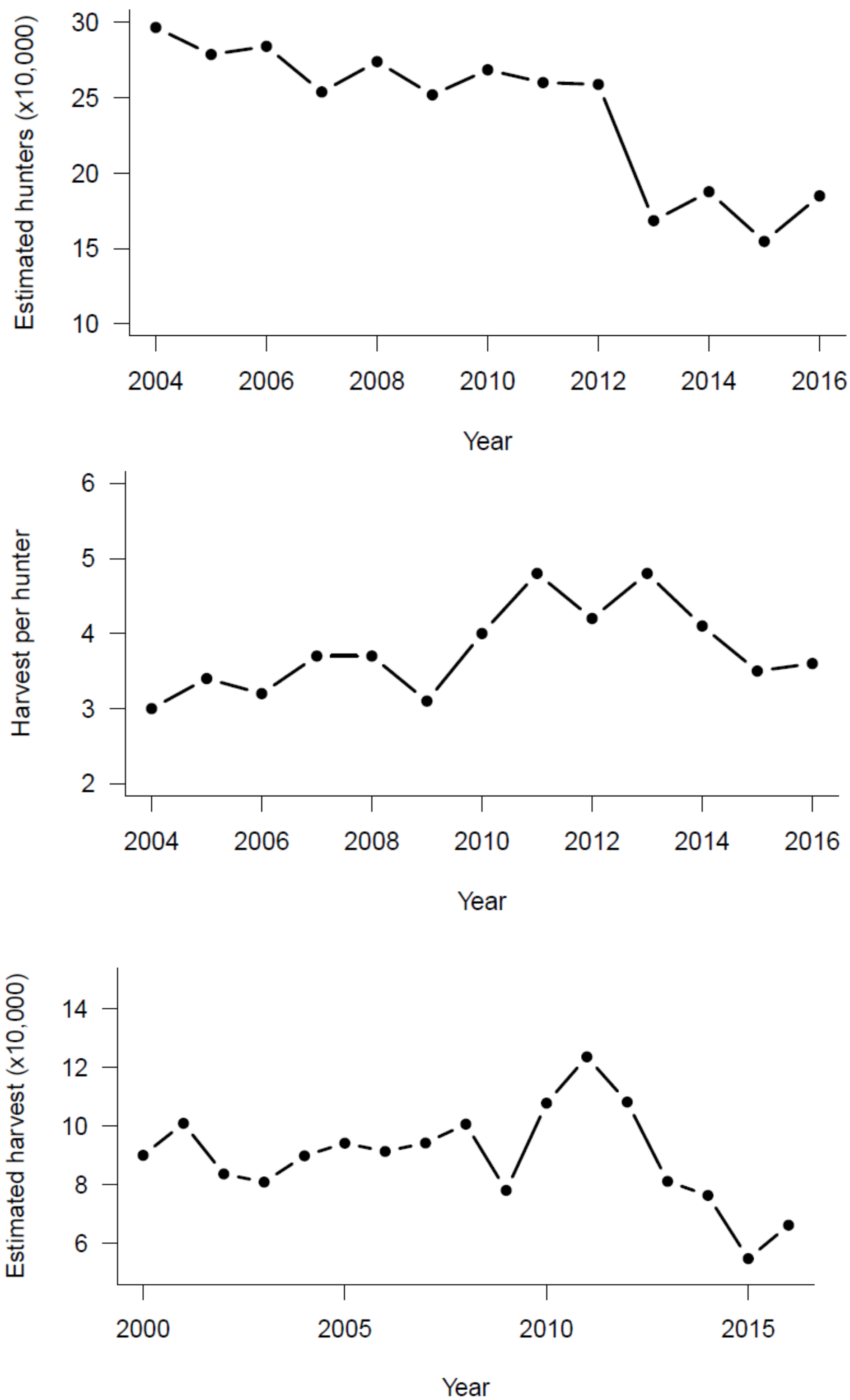


Figure 1. Hunter numbers and harvest/hunter, 2004-2016, and estimated harvest, 2000-2016, in Minnesota's September Canada goose seasons.

Table 1. Permit sales, hunter activity, and harvest during the September Goose season in Minnesota, 2013-2016.

Parameter	2013	2014	2015	2016
Total permits sold	27,778	29,603	27,168	26,096
Questionnaires delivered	3,100	3,039	3,036	3,035
Useable questionnaires returned	1,400	1,335	1,307	1,457
% responding	46.0	43.9	43.1	48.0
Days hunted per active hunter	3.9	3.3	3.6	3.3
Geese shot and retrieved per active hunter	4.8	4.1	3.5	3.6
Unretrieved harvest per active hunter	0.4	0.4	0.3	0.3
% unretrieved harvest	8.4	8.4	7.9	8.7
EXPANDED:				
Active hunters	16,840	18,760	15,465	18,484
Hunter days	64,970	61,620	56,414	60,746
Retrieved harvest	81,230	76,440	54,876	66,282
Est. unretrieved harvest	7,440	7,070	4,719	6,306
Total estimated take	88,670	83,510	59,595	72,588

Table 2. Permit sales, hunter activity, and harvest during the August Canada Goose Conservation Action in Minnesota, 2013-2015.

Parameter	2013	2014	2015
Total permits sold (through August season)	13,740	11,065	10,818
Questionnaires delivered	3,045	3,039	3,036
Useable questionnaires returned	1,400	1,335	1,307
% responding	46.0	43.9	43.1
Days hunted per active hunter	3.1	2.9	3.3
Geese shot and retrieved per active hunter	3.5	3.9	3.2
Unretrieved harvest per active hunter	0.5	1.0	0.4
% unretrieved harvest	12.8	20.4	11.1
EXPANDED:			
Active hunters	6,810	5,500	6,278
Hunter days	21,230	15,870	20,927
Retrieved harvest	23,570	21,280	20,010
Est. unretrieved harvest	3,490	1,430	2,507
Total estimated take	27,060	22,710	22,517

Table 3. Retrieved harvest estimates (by zone 2000-2009) during the September Canada Goose season in Minnesota, 2000-2012 and 2016. Total retrieved harvest during the August and September Canada Goose Seasons, combined, in Minnesota, 2013-15.

Year	NW	West	SE	Twin Cities Metro	Remainder	Total Geese Harvested	Number Active Hunters	Geese/ Hunter day	Geese/ Hunter	Permits Sold
2000	2,750	18,909	1,183	15,594	51,685	**90,121**	33,202	0.63	2.71	45,277
2001	2,047	27,663	538	8,164	62,608	**101,021**	28,265	0.82	3.57	40,127
2002	1,568	22,075	848	8,504	50,769	**83,764**	26,089	0.68	3.20	40,002
2003	2,805	17,779	2,357	9,890	48,157	**80,988**	30,415	0.74	2.66	42,009
2004	4,326	16,843	1,197	11,090	56,480	**89,936**	29,657	0.80	3.03	42,235
2005	4,888	15,304	1,717	11,139	61,218	**94,266**	27,865	0.89	3.38	38,051
2006	6,826	17,987	1,461	11,844	53,321	**91,439**	28,405	0.86	3.22	39,534
2007	7,948	14,952	1,469	11,702	58,243	**94,314**	25,379	0.91	3.72	37,050
2008	5,530	16,168	2,580	13,656	62,827	**100,748**	27,392	0.98	3.73	37,252
2009	4,442	10,294	2,023	12,794	48,609	**78,151**	25,189	0.85	3.10	35,418
2010						**107,907**	26,848	0.98	4.00	35,817
2011						**123,700**	26,000	1.21	4.80	34,271
2012						**108,300**	25,900	0.98	4.20	34,311
2013						**104,800**	18,570	1.25	5.64	27,778
2014						**97,720**	20,290	1.26	4.82	29,603
2015						**74,886**	17,731	0.97	4.22	27,168
2016						**66,282**	18,484	1.09	3.66	26,096

APPENDIX A.

MNDNR

2016 September Goose Season Hunter Survey

You are being asked to provide information to help us evaluate the harvest of geese in Minnesota during the September 3-18, 2016 season. Your cooperation is important. Please return this survey form even if you did not hunt geese. THANK YOU! Lou Cornicelli, Wildlife Research Manager, Division of Fish and Wildlife, MN DNR.

1. Did you hunt in Minnesota during the **September** 3-18 Goose season?
   __ Yes __ No (Please check one.)
   If YES, please continue to question 2. If NO, proceed to question 6.
2. Indicate the number of days you hunted and the total number of Canada geese you **personally** shot and retrieved in Minnesota (do not include information from other members in your party).

Number of days hunted during September 3-18, 2016	Total Canada geese personally shot and retrieved	Total Canada geese personally knocked down but not retrieved

3. If you hunted geese during the 2016 Minnesota **September** Canada goose season, how satisfied or dissatisfied were you with the following? (*Please circle one response for each.*)

	Very dissatisfied	Moderately dissatisfied	Slightly Dissatisfied	Neither	Slightly Satisfied	Moderately satisfied	Very satisfied
Goose hunting experience	1	2	3	4	5	6	7
Goose hunting harvest	1	2	3	4	5	6	7
Goose hunting regulations	1	2	3	4	5	6	7
Number of geese seen	1	2	3	4	5	6	7

4. On the days you hunted during the September goose season (Sept. 3-18), how many days did you personally shoot and retrieve the daily limit of 5 geese: _______ day(s).

5. This year, the September goose season closed on Sunday, Sept. 18, instead of Sept. 22 as it has in most recent years. There were 5 closed days between the September goose season and the Sept. 24 duck/goose season opener.

   a. Did you hunt geese during the last weekend (Sep 17-18) of the September goose season in Minnesota?
   ______Yes ______No
   b. What closing date would you have preferred (Check one)?
   - ☐ Sunday, September 18, 2016
   - ☐ Thursday, September 22, 2016
   - ☐ No preference

6. Minnesota did **not** offer the August Canada Goose Conservation Action (season) in the Intensive harvest zone this year (2016).
   a. Did you hunt during the August 8-23 Canada goose season last year (2015) in Minnesota?
   ______Yes ______No
   b. Do you support reinstating the August goose hunt?
   ______Yes ______No _____ Don't know

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:**

2017 LIGHT GOOSE CONSERVATION ORDER HARVEST IN MINNESOTA

Steve Cordts, Wildlife Populations and Regulations Unit

Margaret Dexter, Wildlife Populations and Research Unit

INTRODUCTION

This report documents results of the 2017 Light Goose Conservation Order hunter mail questionnaire survey.

METHODS

Minnesota held a light goose Conservation Order harvest from 1 March - 30 April 2017. 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.

RESULTS AND DISCUSSION

A total of 974 permits were issued and 393 responses (41 %) to the questionnaire were obtained (Table 1). In calculating harvest estimates, we assumed that the 581 non-respondents participated in the conservation action and took light geese in the same manner as respondents. Four hundred seventy one people attempted to take light geese during the 61-day conservation order period. Active participants pursued light geese for 1,966 days and 1,713 light geese were shot and retrieved. This was an average retrieved take of 4 geese per active participant. Another 298 light geese were estimated wounded and not retrieved.

ACKNOWLEDGMENTS

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

This project was funded in part by the Wildlife Restoration (Pittman-Robertson) Program.

Figure 1. Light Goose Conservation Order hunter mail questionnaire, 2017.

MINNESOTA 2017 LIGHT GOOSE HARVEST SURVEY

For the Period of March 1 - April 30, 2017 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, 2017. 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 2017 hunting experience.**
THANK YOU! Lou Cornicelli, Wildlife Research Program Manager, Division of Fish and Wildlife, MN DNR.

1. Did you hunt light geese in Minnesota during March 1 - April 30, 2017? 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, 2017? __________

3. How many light geese did you personally shoot and retrieve in Minnesota? __________________

4. How many light geese did you personally shoot, but were UNABLE to retrieve? ________________

Table 1. Summary of Light Goose Conservation Order harvest in Minnesota, 2006 – 2017.

	Year											
Statistic	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total permits sold	1,363	1,292	1,406	1,670	952	994	1,048	1,405	1,278	1,141	1,143	974
Useable returns	955	921	910	1,057	671	659	675	810	759	520	491	393
Response rate (%)	70.0	71.0	65.0	63.0	72.3	67.1	65.3	58.3	60.0	46	43	41
Active hunters (%)	37.3	39.8	54.9	66.0	40.8	45.7	56.9	54.9	44.0	50	47	48
Estimated total hunters	516	514	773	1,103	389	455	600	770	560	569	534	471
Estimated hunter days	2,665	2,302	3,404	4,647	1,475	1,830	2,270	3,070	2,580	2,434	2,605	1,966
Mean days/hunter	5.2	4.5	4.4	4.2	3.8	4.0	3.8	4.0	4.6	4	5	4
Estimated harvest (shot & retrieved)	1,360	1,786	2,409	4,366	559	1,554	2,620	2,430	2,880	3,266	2,121	1,713
Mean harvest/hunter	2.6	3.5	3.1	4.0	1.4	3.4	4.4	3.2	5.1	6	4	4
Estimated crippling losses	163	172	302	640	70	145	210	370	210	349	215	298
Percent using unplugged guns	42.3	43.6	46.7	46.8	44.9	44.2	43.0	49.4	48.8	NA	NA	NA
Est. number hunters using unplugged guns	215	224	361	516	175	201	260	380	270	NA	NA	NA
Est. number geese **shot** with unplugged guns	689	1,032	1,275	2,413	348	742	1,510	1,670	2,060	NA	NA	NA
Est. harvest with shell 4-5-6	287	277	339	822	131	311	460	620	770	NA	NA	NA
Percent using electronic calls	14.4	17.1	19.1	23.5	25.9	21.3	22.2	24.5	27.8	NA	NA	NA
Est. number hunters using e-calls	73	88	148	260	101	97	130	190	160	NA	NA	NA
Est. harvest while using e-calls	280	329	566	1,171	192	531	460	620	1,710	NA	NA	NA
Percent hunting 1/2-hr after sunset	43.9	38.3	42.3	43.1	39.7	39.7	42.4	33.4	36.2	NA	NA	NA
Est. number hunting after 1/2-hr sunset	223	197	326	475	154	180	250	260	200	NA	NA	NA
Est. harvest 1/2-hr after sunset	246	209	511	713	87	238	240	260	550	NA	NA	NA

DEPARTMENT OF NATURAL RESOURCES

MINNESOTA'S WILD TURKEY HARVEST – FALL 2016, SPRING 2017

Lindsey N. Messinger, Farmland Wildlife Populations and Research Group

SUMMARY OF SEASON STRUCTURE

This report summarizes the fall 2016 and spring 2017 Minnesota wild turkey harvest. The fall turkey season was 30 days in length (October 3- November 1) and allowed for an unlimited number of hunters to take one wild turkey of either sex in one of 12 pre-selected permit areas (501-512, Figure 1). Permits for archery and youth hunters were valid statewide (i.e., no restrictions on permit area).

Although significant changes were made to the spring turkey season structure in 2016, there were no major changes for the 2017 season. The spring turkey season was 49 days in length (12 April – 30 May) and allowed hunters to take one bearded wild turkey (tom, jake, or bearded hen). The spring turkey season was divided into six time periods with permits valid during a specified time period (A-F) and permit area (501-512; Figure 1). A restricted number of permits were available through a lottery system in each permit area during time periods A and B (A: April 12-18, and B: April 19-25). Permits not sold during the lottery process were available for over-the-counter surplus sales. Permits for the remaining time periods (C: April 26 – May 2, D: May 3-9, E: May 10-16, F: May 17-30) were available over-the-counter in unlimited quantities in each permit area. Hunters possessing a permit unfilled during time periods A-E were permitted to hunt during the final time period (F) in their respective permit area. Permits for archery and youth hunters were valid the entire season and statewide (i.e., no time period or permit area restrictions).

FALL 2016 SEASON

Permits Issued

Permits issued to hunters increased slightly from 8,210 permits in 2015 to 8,562 in 2016 (Table 1, Figure 2). Youth permit sales accounted for 23.4% of total license sales during the fall 2016 season which increased from 14.5% in fall 2015. This may reflect recent regulation changes which permit youth to hunt statewide (i.e., no permit area restrictions).

Harvest

There were 1,111 harvested turkeys registered during the fall 2016 season which was a 1% decrease from 2015 (Table 1). Hunter success rates declined slightly (-0.7%) to 13.0% in 2016 from 2015 and remained below the 5-year average (13.9%). The greatest number of permits were issued in permit areas 507 and 508 and this effort was reflected in harvest with these two permit areas also registering the highest harvest numbers (Table 2). Statewide, females represented 54.4% of the total harvest while juvenile males (jakes) and mature males (toms) represented 15.7% and 30.0% of the total harvest respectively (Table 2).

SPRING 2017 SEASON

Permits Issued

There were 49,919 permits issued during the spring 2017 season, including 10,324 general lottery and landowner permits, 11,355 youth permits, 11,249 archery permits, and 16,991 surplus over-the-counter permits (Table 3). The total number of permits purchased remained relatively steady (<1% decrease) in 2017 (Table 4). Youth permit sales composed 22.7% of total permit sales in 2017, a slight decrease (<1%) from 2016 (Table 4). Archery permits accounted for 22.5% of total permit sales (Table 3). Archery permits issued increased 8.8% in 2017 (Table 4); this follows a 105% increase in spring 2016 after regulation changes expanded opportunity, allowing archery hunters to hunt statewide during any time period. Purchase of lottery permits declined by 8.9% from 2016, continuing a declining trend whereas purchase of surplus gun permits remained steady in 2017.

Harvest

Hunters registered 11,854 turkeys (Tables 3, 4, 5, & 7), which was above the 5-year average (11,548 turkeys, Figure 3) and the best consecutive 5-year harvest average (11,610 turkeys during the 2008-2012 seasons). Although harvest remained the highest in the core turkey range in permit areas 507 (3,098 turkeys) and 501 (2,622 turkeys), harvest in permit area 508 (1,632 turkeys) surpassed 503 (1,373 turkeys) for the first time. Youth harvest (2,168 turkeys) declined 3.5% from 2016 whereas archery harvest (1,665 turkeys) increased 12% from 2016 (Table 3). The winter of 2016-2017 was again mild, and likely was not a significant factor beyond normal winter mortality for turkeys. Spring weather was variable, but generally warm and spring “green-up” was earlier than normal. Periods of rain during the A and B time periods may have impacted hunter participation and effort and could account for lower harvest rates during those periods in 2017.

Table 1. Permits available, number of applicants, permits issued, registered harvest, and hunter success rates for fall wild turkey seasons in Minnesota, 1990-2016.

Year	Permits available	Applicants	Permits issued	Registered harvest	Hunter success (%)[a]
1990	1,000	4,522	951	326	34.3
1991	2,200	2,990	2,020	552	27.3
1992	2,200	2,782	2,028	588	29.0
1993	2,400	3,186	2,094	605	28.9
1994	2,500	3,124	2,106	601	28.5
1995	2,500	3,685	2,125	648	30.5
1996	2,500	4,453	2,289	685	29.9
1997	2,580	4,574	2,378	698	29.4
1998	2,710	4,526	2,483	828	33.3
1999	2,890	5,354	2,644	865	32.7
2000	3,090	5,263	2,484	735	29.6
2001	2,870	4,501	2,262	629	27.8
2002	3,790	5,180	2,945	594	20.2
2003	3,870	5,264	2,977	889	29.9
2004	4,380	5,878	3,277	758	23.1
2005	4,410	4,542	2,978	681	22.9
2006	4,290	4,167	2,802	618	22.1
2007	4,490	4,464	2,837	695	24.5
2008	7,560	5,834	4,981	1,187	23.8
2009	9,330	7,738	5,019	1,163	23.2
2010	10,430	6,869	6,607	1,353	20.5
2011	10,430	3,538	5,382	953	17.7
2012	Unlimited	N/A	10,779	1,753	16.3
2013	Unlimited	N/A	8,193	1,078	13.2

Year	Permits available	Applicants	Permits issued	Registered harvest	Hunter success (%)[a]
2014	Unlimited	N/A	8,339	1,137	13.6
2015	Unlimited	N/A	8,210	1,124	13.7
2016	Unlimited	N/A	8,562	1,111	13.0

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

Table 2. Permits issued, registered harvest by sex, total registered harvest, regular gun harvest, and hunter success rates during the 2016 fall wild turkey season in Minnesota.

Permit Area	Regular permits issued[a]	Toms[b]	Jakes[b]	Hens[b]	Total registered harvest[b]	Regular gun harvest[c]	Regular gun success rates (%)
501	1,068	52	20	95	167	143	13.4
502	100	3	2	9	14	10	10.0
503	675	33	9	64	106	83	12.3
504	226	8	6	11	25	22	9.7
505	417	23	9	25	57	47	11.3
506	226	8	6	21	35	30	13.3
507	1,635	89	52	154	295	245	15.0
508	1,242	72	50	131	253	214	17.2
509	130	13	5	17	35	30	23.1
510	696	27	13	72	112	72	10.3
511	62	1	1	0	2	2	3.2
512	82	4	1	5	10	7	8.5
TOTAL	6,559	333	174	604	1,111	905	13.8

[a] Archery and youth permits were not included (valid in all permit areas).
[b] Total harvest for all license types.
[c] All firearm harvest, excluding harvest from youth and archery license holders.

Table 3. Total permits sold, harvest, and success rate by type of permit during the spring 2017 wild turkey season in Minnesota.

	Total permits sold	Harvest	Success (%)[a]
Lottery	10,324	3,836[b]	37.1
Surplus	16,991	4,185	24.6
Youth	11,355	2,168	19.1
Archery	11,249	1,665	14.8
Total	49,919	11,854	23.7

[a] Success rates not adjusted for non-participation.
[b] Includes military and military disabled veteran permit types.

Table 4. Permits available, permits issued, registered harvest, and relative success rates from 1978-2017 for all spring wild turkey hunting seasons in Minnesota.

		Permits		Harvest	
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	30.0
2007[b]	33,976	28,320	83.4	9,412	33.2

		Permits		Harvest	
Year	Available	Issued	Issued (%)	Registered harvest	Success (%)[a]
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	28.9
2011[b]	Unlimited	43,521[c]	N/A	10,055	23.1
2012[b]	Unlimited	38,906[c]	N/A	11,325	29.1
2013[b]	Unlimited	34,281[c]	N/A	10,390	30.3
2014[b]	Unlimited	43,305[c]	N/A	11,447	26.4
2015[b]	Unlimited	41,623[c]	N/A	11,734	28.2
2016[b]	Unlimited	39,648[c]	N/A	12,313	31.1
2017[b]	Unlimited	38,670 [c]	N/A	11,854	30.7

[a] Success rates not adjusted for non-participation.
[b] Youth hunt data included.
[c] Permits issued to archery hunters were not included. There were 2,462, 3,911, 4,550, 4,899, 5,052, 10,343, and 11,249 permits issued to archers in 2011, 2012, 2013, 2014, 2015, 2016, and 2017, respectively.

Table 5. Permits issued, registered harvest, and hunter success during the 2017 spring wild turkey season in Minnesota.

Permit area	Regular permits issued[a]	Total registered harvest[b]	Regular gun harvest[c]	Regular gun success rates (%)
501	6,667	2,622	2,037	30.6
502	620	177	131	21.1
503	3,235	1,373	964	29.8
504	725	311	181	25.0
505	2,217	904	671	30.3
506	1,033	426	267	25.8
507	6,586	3,098	2,002	30.4
508	3,770	1,632	1,044	27.7
509	332	204	106	31.9
510	1,922	1,014	577	30.0
511	103	53	20	19.4
512	105	40	21	20.0
TOTAL	27,315	11,854	8,021	29.4

[a] Permits issued for the Camp Ripley disabled veterans hunt, archery, and youth permits were not included.
[b] Total harvest for all license types.
[c] All lottery, military, and surplus permit harvest, excluding youth and archery licenses.

Table 6. Permits available and issued by license type (resident and non-resident) and time period for the spring 2017 wild turkey season in Minnesota.

Time period	Permits available	General lottery[a]	Surplus	Youth	Archery
A: Apr. 12-18	7,010	5,802	358	Not applicable – Youth and archery permits were valid during all time periods.	
B: Apr. 19-25	7,010	4,504	1,873		
C: Apr. 26-May 2	Unlimited	5	7,215		
D: May 3-9	Unlimited	4	4,359		
E: May 10-16	Unlimited	5	2,012		
F: May 17-30	Unlimited	4	1,174[b]		
Total[a]	**Unlimited**	**10,324**	**16,991**	**11,355**	**11,249**

[a] Includes landowner licenses.
[b] Number of surplus licenses sold for this time period. Actual number of hunters in unknown because all unsuccessful hunters from previous time periods were permitted to hunt in the final (F) season.

Table 7. Total harvest by time period during the spring 2017 wild turkey season in Minnesota.

Time period	Total harvest	Harvest (%)
A	3,793	32.0
B	2,815	23.7
C	2,041	17.2
D	1,383	11.7
E	665	5.6
F	1,157	9.8
Total	**11,854**	**100**

Wild Turkey Permit Areas

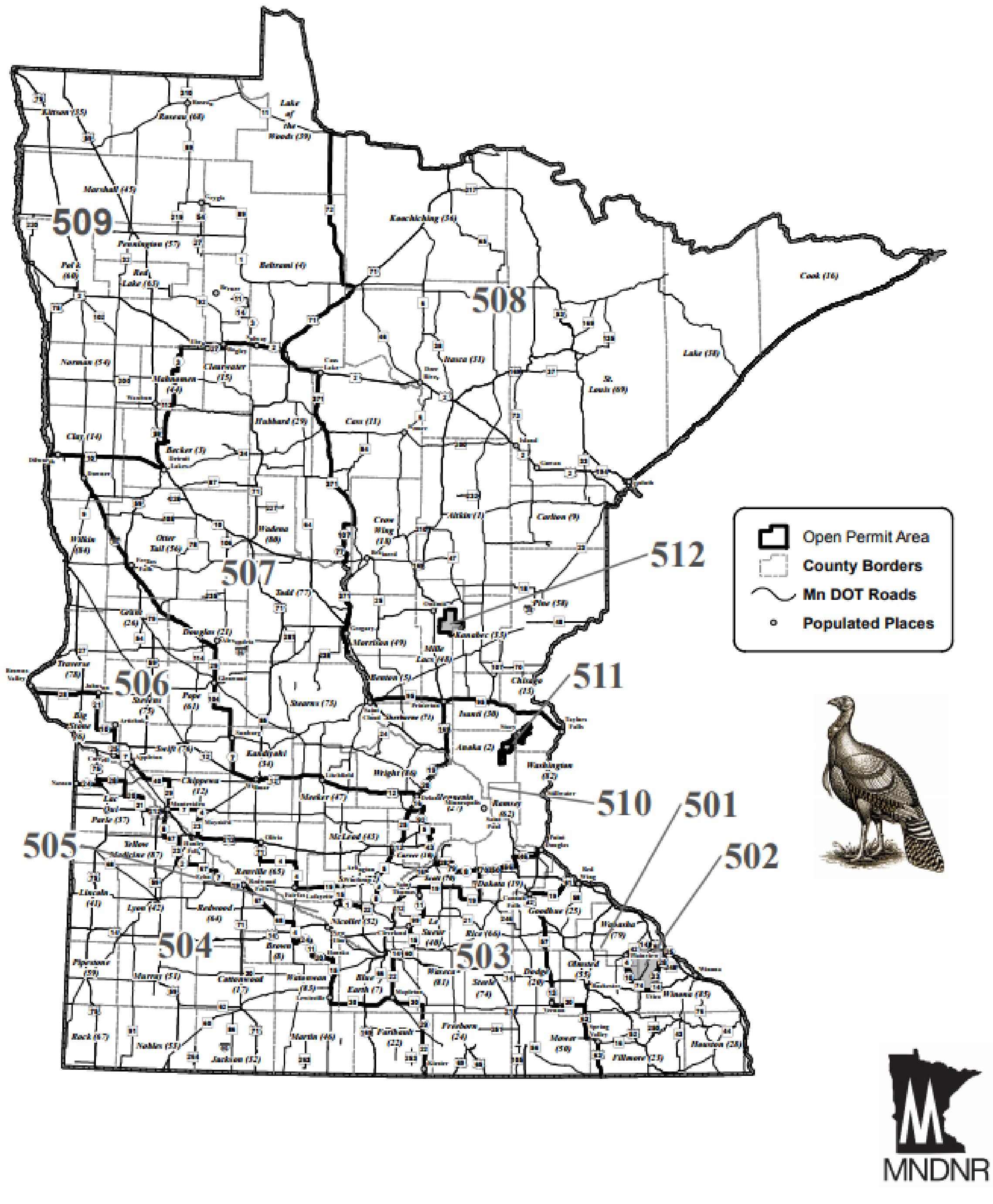


Figure 1. Permit areas open for hunting, fall 2016 and spring 2017 wild turkey seasons in Minnesota.

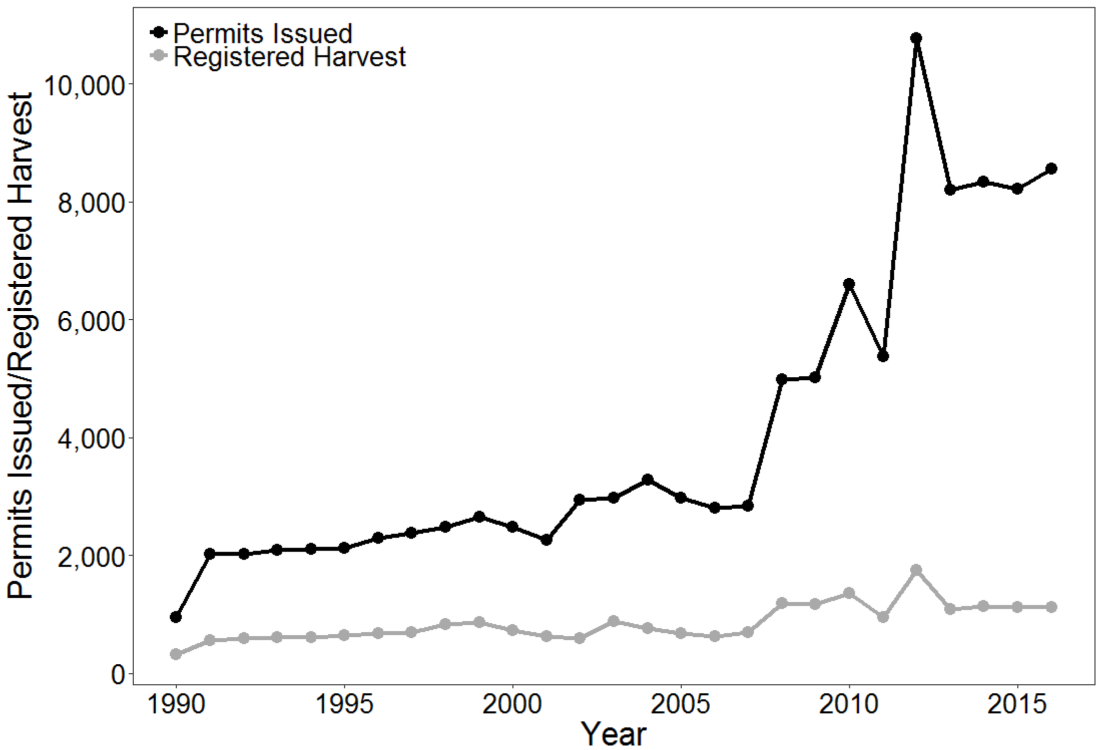


Figure 2. Permits issued and registered harvest for fall wild turkey seasons in Minnesota, 1990-2017.

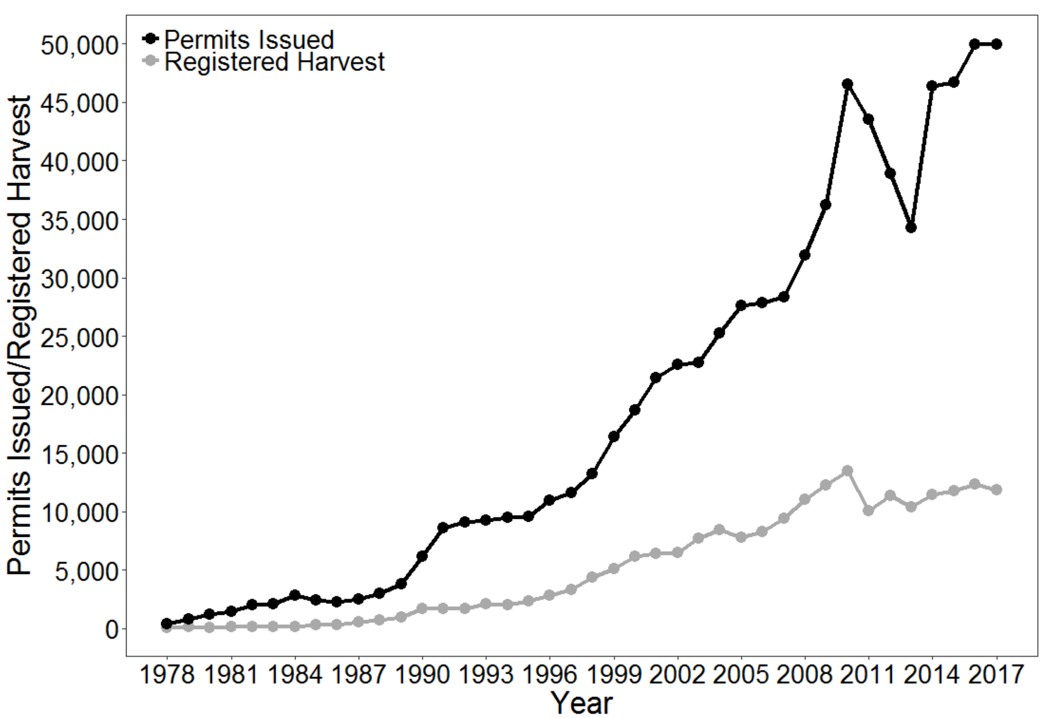


Figure 3. Permits issued and registered harvest for spring wild turkey seasons in Minnesota, 1978-2017.

2016 MINNESOTA PRAIRIE-CHICKEN HARVEST SURVEY

Charlotte Roy, Forest Wildlife Populations and Research Group

SUMMARY OF FINDINGS

The Minnesota DNR conducts a postcard survey of Greater Prairie-chicken (*Tympanuchus cupido pinnatus*) hunters each year to estimate hunter numbers and harvest, and to evaluate hunter success and satisfaction. In 2016, 111 hunters were estimated to have gone afield and harvested 102 prairie-chickens and 35 sharp-tailed grouse (*Tympanuchus phasianellus*) during prairie-chicken hunts. Hunter success (0.58) and satisfaction (3.7 on a scale of 1-5) were similar to recent years and consistent with improvement following changes to the permit areas and season (i.e., longer length and earlier dates) in 2013.

INTRODUCTION

Prairie-chicken (*Tympanuchus cupido pinnatus*) hunting in Minnesota was closed in 1943 because of population declines resulting from habitat loss. However, hunting was reopened in 2003 because prairie-chicken populations were considered robust enough to allow a limited season. During 2003-2005, a limited-entry 5-day hunting season was opened in 7 permit areas in western Minnesota. Permits were awarded through a lottery system, with a bag and season limit of 2 prairie-chickens. In 2006, 4 new permit areas were added and the number of permits was increased in some areas. Surplus licenses were offered for sale after the lottery for the first time in 2011, and in 2013, the permit areas were revised again. These most recent changes eliminated 801A and 802A, modified 803A to include portions of the former 802A and 803A, and added 812A and 813A to expand hunting eastward (Figures 1 and 2). The number of available permits was also reduced in some permit areas to more closely reflect opportunities to harvest prairie-chickens in each permit area. The season was lengthened from 5 days to 9 days to provide hunting opportunity on >1 weekend and was moved from mid-October to open in late-September. The earlier season was an attempt to improve hunter success and satisfaction by providing hunting opportunities before pheasant season opened (to reduce hunter interference and flushing distance). These changes were based on hunter comments received by DNR Wildlife Managers during prior years and input received during a public input survey during March 2013. Responses of surveyed prairie-chicken hunters in 2015 provided additional evidence that the earlier season is preferred by most, although hunter preferences were clearly divided. In 2016, the prairie-chicken season opened 24 September and closed 2 October.

Prairie-chicken hunting in Minnesota is a privilege that is only available to residents. Landowners or tenants of ≥40 acres of grassland within a permit area are eligible to apply for a landowner lottery that awards ≤20% of the available permits in a permit area. Extra landowner permits are then included with the regular lottery. Any landowner not receiving a permit through the landowner lottery can participate in the regular lottery. The lottery gives preference to persons that have applied for a permit unsuccessfully for the most years. Upon selection, lottery winners must purchase a prairie-chicken hunting permit before hunting. Although sharp-tailed grouse (*Tympanuchus phasianellus*) hunting is closed south of U.S. Highway 2 (i.e., in permit areas 804A–813A), licensed prairie-chicken hunters may also take sharp-tailed grouse while hunting prairie-chickens. Harvest is documented each year in this annual report.

METHODS

Lottery applicants, winners, and permit purchasers were recorded by the Electronic Licensing System (ELS). Registration of harvested birds has not been mandatory except during 2003-2006, so I determined harvest through a postcard survey. I sent a postcard to each lottery winner the week before hunting season. Three weeks later I sent another postcard to people who had not yet responded. Postcards contained 6 questions: did you purchase a permit, did you hunt, and if so, for how many days, how many prairie-chickens did you harvest, how many sharp-tailed grouse did you harvest during prairie-chicken hunts, and how satisfied were you (on a scale of 1-5)?

Only responses from lottery winners who purchased a hunting permit were considered in the analysis. I compared responses from the first mailing to responses from the second mailing to examine possible nonresponse bias. Corrections were made to account for harvest of non-respondents, based on the answers of respondents. I estimated the number of hunters, birds harvested, birds per harvester, and hunter success for each permit area. Average hunter satisfaction was determined for both successful and unsuccessful hunters, as well as a combined mean. Responses received prior to 21 December were included in this report.

RESULTS & DISCUSSION

The combined quota for the 11 permit areas during 2016 was 126 permits, and 304 individuals applied in the lottery (Table 1). Of the 128 lottery winners, 110—including 7 landowners—later purchased a permit. Only 1 permit area (813A) had fewer applicants than permits available, and all 4 surplus permits were purchased by lottery applicants that did not win in other permit areas, for a total of 114 permit purchasers. The hunters who purchased surplus permits were not included in the survey sample.

Ninety-one permit purchasers (83%, n = 110) responded to the survey; 72 (65%) responded to the first mailing and 19 (17%) to the second mailing. This response rate is slightly lower than survey response rates during 2011 (90%) and 2012 (95%), but similar to 2010 (84%), 2013 (83%), and 2014 (87%). In contrast to 2013, we did not detect a strong response bias between the first and second mailings. Respondents to the first mailing were as likely as respondents to the second mailing to have hunted (96% vs. 100% of respondents), they hunted a similar number of days (2.8 vs. 2.3), reported harvesting prairie-chickens at similar rates (58% vs. 47%), reported harvesting a similar number of chickens (0.9 vs. 0.8 birds per hunter), but more sharp-tailed grouse (0.4 vs. 0.1 birds per hunter), and reported similar satisfaction (mean 3.8 vs. 3.6, median 4 vs. 4), with 84% and 79% of respondents reporting satisfaction scores $\geq$3, respectively. Thus, I combined responses from both mailings this year for the analysis.

Eighty-seven respondents reported that they hunted prairie-chickens (Table 2). I estimated the total number of hunters to be 111 (i.e., purchasers who went afield) after accounting for hunting by non-respondents. Hunters reported harvesting 77 prairie-chickens and total harvest after accounting for non-respondents was estimated as 102 prairie-chickens. An estimated 64 hunters bagged $\geq$1 chicken. Survey respondents reported harvesting 32 sharp-tailed grouse while hunting prairie-chickens from permit areas 803A, 804A, 805A, and 807A (Figure 1). Although successful hunters reported higher average satisfaction (4.5) than respondents that were not successful (2.8), satisfaction of prairie-chicken hunters was high overall.

Prairie-chicken hunter success and satisfaction during 2016 was similar to 2013, 2014, and 2015 and was consistent with improvements following season changes (Table 3). Regulations were changed in 2013 in an attempt to improve hunter success and satisfaction, and survey responses indicated that this was achieved. Write-in comments about the longer (9-day) season with 2 weekends were favorable. Write-in comments about the timing of the season in

2014 included numerous comments indicating a preference for the former, later season (15% of respondents including non-purchasers), compared to 1% of respondents that commented that they preferred the earlier season. Although the 2013 Wildlife Public Input Survey asked specifically whether a season opening on the last Saturday in September was preferred to the opener on the Saturday nearest Oct. 20, and the majority of respondents indicated a preference for the earlier season (64% respondents who expressed an opinion supported the earlier season), preferences of prairie-chicken hunters might change over time. So in 2015, we again asked hunters about their preferences for the timing of the season. In reply, 56% of respondents indicated a preference for the earlier season, and 44% preferred a later season. Supporters of the early season indicated that the birds were less wary early in the season and pheasant hunting did not affect the hunt. Reasons provided in support of a later season included cooler weather for hunters and dogs, better plumage on birds, fewer standing crops, opportunity to harvest pheasants while hunting chickens, and no conflict with the waterfowl opener. Clearly, the survey indicates that prairie-chicken hunters are split in their preferences for season timing, but that the current season meets the timing preferences of the majority of responding prairie-chicken hunters.

ACKNOWLEDGMENTS

I would like to thank Laura Gilbert for preparing and mailing the postcards and entering data. I would also like to thank Mike Larson for commenting on the report. I would also like to thank the hunters that submitted samples for the genetics and pesticide studies.

Table 1. Prairie-chicken hunt lottery applicants, winners, and hunting permit purchasers in Minnesota during 2016.

Permit area	Permits available	No. of applicants	Lottery winners		Permit purchasers[a]		Surplus purchasers[c]
			No.[b]	Proportion	No.	Proportion	
803A	10	22	10	0.45	10	1.00	0
804A	12	17	12	0.71	9	0.75	0
805A	12	73	12	0.16	12	1.00	0
806A	12	24	14	0.58	8	0.57	0
807A	20	43	20	0.47	18	0.90	0
808A	15	29	17	0.59	15	0.88	0
809A	15	32	15	0.47	13	0.87	0
810A	15	27	17	0.63	15	0.88	0
811A	5	8	5	0.63	4	0.80	0
812A	5	28	5	0.18	5	1.00	0
813A	5	1	1	1.00	1	1.00	4
All	126	304	128	0.42	110	0.86	4

[a] Lottery winners who purchased a hunting permit.
[b] The number of permits may exceed the quota when the last applicant selected in the lottery belongs to a hunting party.
[c] Number of people purchasing a surplus permit after the lottery because the permit quota was not met during the lottery.

Table 2. Prairie-chicken harvest in Minnesota during 2016.

Permit area	No. of hunters[a]		Birds harvested		Birds per harvester[b]	Success rate[c]
	Self-reported	Estimated	Self-reported	Estimated		
803A	10	10	8	8	1.3	0.60
804A	6	7	7	8	1.3	0.86
805A	9	11	3	4	2.0	0.18
806A	5	8	8	13	2.2	0.75
807A	13	18	14	19	1.4	0.78
808A	11	15	13	18	1.6	0.73
809A	10	13	6	8	2.0	0.31
810A	14	15	12	13	1.9	0.47
811A	4	4	2	2	2.0	0.25
812A	4	5	3	4	2.0	0.40
813A	1	5	1	5	1.0	1.00
All	87	111[d]	77	102[d]	1.6[d]	0.58[d]

[a] Permit purchasers who hunted.
[b] Estimated number of birds harvested per successful hunter.
[c] Proportion of estimated hunters harvesting ≥1 prairie-chicken.
[d] Assumed that non-respondents were represented by respondents.

Table 3. Summary of prairie-chicken hunting in Minnesota during 2003–2016.

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
2012	186	298	158	86	0.39	3.4
2013	126	277	93[f]	96[f]	0.60[f]	3.7[f]
2014	126	305	102	95	0.54	3.7
2015	126	271	112	103	0.55	3.6
2016	126	304	111	102	0.58	3.7

[a] Estimated number who went hunting, not permit purchasers.
[b] Proportion of hunters harvesting ≥1 prairie-chicken.
[c] Mean on a scale of 1–5.
[d] A hunter survey was not conducted during 2007; results are from the Electronic Licensing System, which documented 150 permit purchasers.
[e] One hunter reported harvesting 10 prairie-chickens in 2010.
[f] Assumed that non-respondents were represented by respondents in the second mailing in 2013.

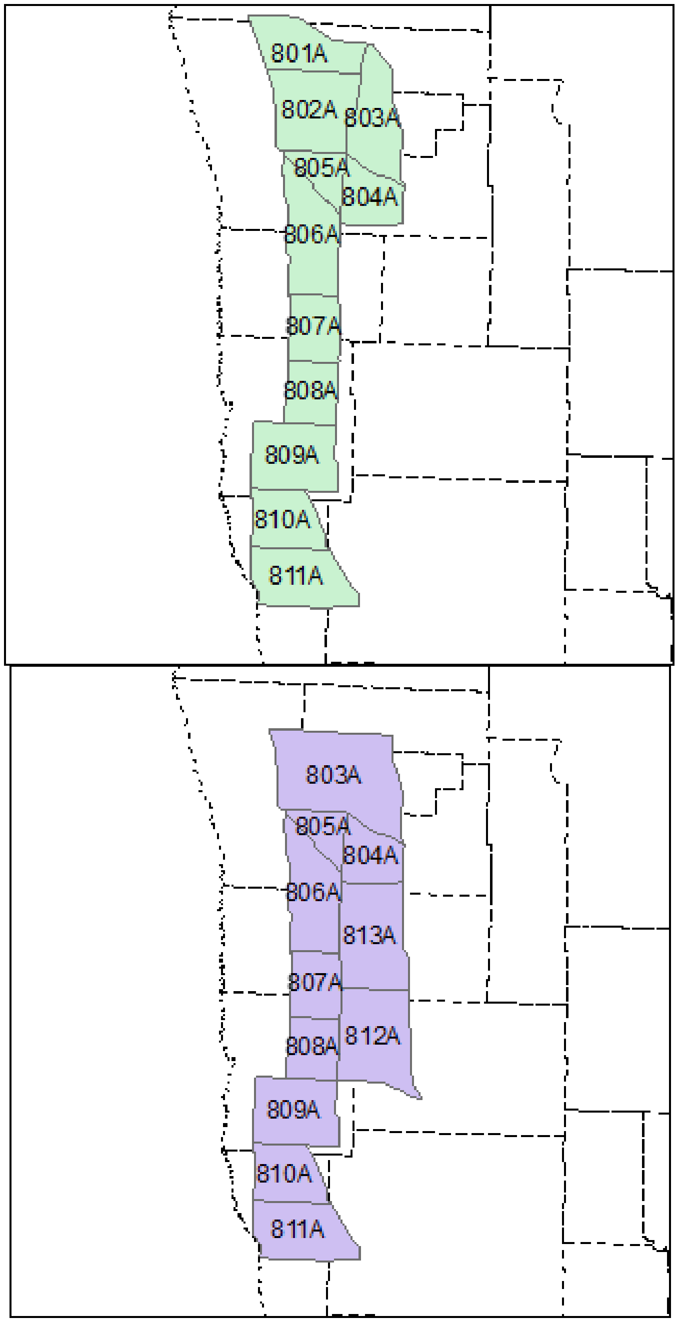


Figure 1. Prairie-chicken hunting permit area boundaries in northwestern Minnesota during 2013 - 2016 (top) compared to 2012 (bottom). County boundaries are indicated by dashed lines. Permit areas 812A and 813A were added, 801A was eliminated, and 802A and portions of 803A were combined into a revised permit area 803A.

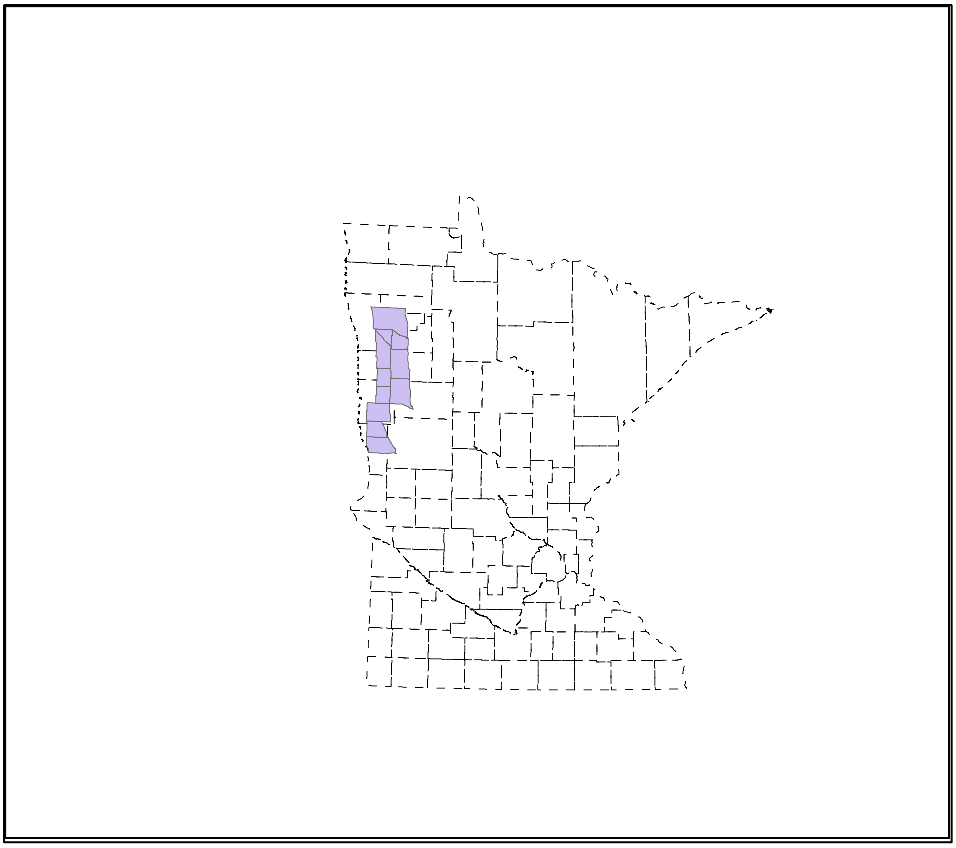


Figure 2. Northwestern location of prairie-chicken hunting permit areas within the state relative to county boundaries (dashed lines).

2016 STATUS OF MINNESOTA BLACK BEARS

Dave Garshelis and Andy Tri, Forest Wildlife Populations and Research Group

INTRODUCTION

The Minnesota bear range has historically been divided into 11 bear management units (BMU). Each has a separate quota on hunting licenses, and hunters must enter hunters must enter a lottery (based on preference points) to obtain a license. Outside the primary bear range, where bear depredation to crops is a primary concern, license sales are unlimited (no-quota area), and hunters can purchase licenses right up to and through the season, over the counter. 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 bear hunting and harvests.

METHODS

Successful hunters must register their bears, in person at designated registration stations or electronically by internet or phone. Stations are not staffed by DNR personnel. Harvest data are a simple tally of these registrations. Hunters also are required to submit a tooth from harvested bears, which is used to estimate age, and thus harvest age structure. Tooth envelopes must be acquired at registration stations.

RESULTS

Permits, licenses, harvest, and success rates

Permit applications for bear licenses increased to nearly 20,000 (Table 1), the highest in 14 years. Permit availability has remained fairly constant for the past 4 years. The low permit availability has driven up sales of no-quota licenses, which were the highest on record in 2016, comprising 46% of total licenses purchased. The higher number of hunters combined with an unusually high success rate resulted in the highest statewide harvest in 6 years. Hunting success is affected by numbers of hunters (i.e., competition) (Fig. 1), food supply (affecting bears' attraction to baits), and density of bears.

Quota zone permits and licenses

In 2016, Bear Management Unit (BMUs, see Fig. 2) 26 was divided into 27 and 28, and BMU 44 was split into 46 and 47 (BMUs 28 and 47 comprise the Leech Lake Reservation). The number of available quota zone permits remained the same or declined slightly for all BMUs except BMUs 45 and 51 (Table 2), which were increased in response to a perceived increasing trend in bear numbers. This was the 6th year of a system whereby licenses for the quota zone that were not purchased by permittees selected in the lottery could be purchased later as surplus. All surplus licenses were purchased (Table 3).

Quota zone lottery

The low permit availability over the past 4 years has made it more difficult to draw a permit in the lottery (Table 4). In 2011, some 1st-year applicants (preference level 1) were drawn in all but 3 BMUs. But since 2014, 1st-year applicants were drawn only in BMU 22 (BWCAW). In

2016, preference level 2 hunters were drawn only in BMUs 22, 13, and 25. Drawing a permit in BMUs 28, 46 and 45 required a preference level of 4 or higher.

Harvest by BMU

In 2016, most BMUs had higher harvests than in 2015 (Table 5). BMU 45 had an especially high harvest. A record high harvest occurred in the no-quota zone. The percent of the total statewide harvest contained within the no-quota zone has increased with reduction of quota zone permits (Fig. 3). 2015 was notable for a record high male-biased harvest sex ratio; in 2016, the sex ratio was more normal, except BMUs 25 and 26 (now 27/28), which had record high percent males, versus BMU 41, which had a female-dominated harvest.

Hunting success by BMU

Hunters in the quota zone had a record high (50%) success in 2016 (Table 6). All quota zone BMUs (except 22, where unattended baiting is not allowed) had record high or near record high success. Success rate was more normal in the no-quota zone. However, estimating success in the 3 no-quota BMUs (Fig. 2) remains difficult, as it is based on where hunters indicated they planned to hunt when they purchased their license, and many of these hunters (>100) chose places within the quota zone (but most likely did not hunt there, as only 9 killed a bear in the quota zone with a no-quota license).

Harvest by date

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). The distribution of the harvest by date followed this normal pattern in 2016, despite being a year with low abundance of fall foods (very unlike 2015, which also had low fall food abundance).

Predictions of harvest

The 2016 statewide harvest was close to what was expected, based on regression of harvest as a function of hunter numbers and the fall food productivity index (Fig 4). This regression is particularly strong (and has accurately predicted previous harvests) when only the past 15 years are considered.

Harvest sex ratios

Sex ratios of harvested bears reflect both the sex ratio of the living population (which varies with harvest pressure) as well as the relative vulnerability of the sexes to hunters (which varies with natural food conditions and hunter density). In general, harvest sex ratios favoring males (the more vulnerable sex, and hence the minority sex in the living population) provide more resilience to the population. Harvest sex ratios within BMUs varied considerably year-to-year over the past 2 decades (Fig. 5). Three BMUs have shown a generally increasing trend in percent males in the harvest: BMU 25, 26, and 51.

Harvest ages

Median age of harvested females increased in nearly all BMUs, and statewide, in 2016 (Fig. 6). A long-term declining trend in median age of harvested females continues to be evident in BMU 25 (Fig. 7). Statewide, the proportion of the female harvest composed of 1–2 year-olds declined and 4–10 year-olds increased (Fig. 8). Median ages of harvested males have been relatively stable for 2 decades.

Submission of bear teeth for aging

Ages of harvested bears are now used as the principal means of monitoring population trends. Although hunters are required to submit a tooth from their harvested bear, historically >25% did not comply. “Violation notices” were sent to non-compliant hunters each year since 2014, which spurred a higher initial compliance in 2015 and 2016 (>80%), and a compliance after the reminder notice of ~90% (Fig. 9). Since 2013, hunters could register by phone or internet, and pick up a tooth submission envelope later: tooth submission compliance by these hunters is less than for hunters who register their bear in person and pick up a tooth envelope at that time. No-quota zone hunters (BMUs 11, 10, 52) have the poorest rate of tooth submission (Fig. 10).

Note: All data contained herein are subject to revision, due to updated information, improved analysis techniques, and/or regrouping of data for analysis.

Table 1. Bear permits, licenses, hunters, harvests, and success rates, 1996–2016.

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Permit applications	30405	27353	30245	29384	29275	26824	21886	16431	16466	16153	15725	16345	17362[a]	17571[a]	18647[a]	19184[a]	18103[a]	18107[a]	18885[a]	18422[a]	19958[a]
Permits available	12030	11370	18210	20840	20710	20710	20610	20110	16450	15950	14850	13200	11850	10000	9500	7050[b]	6000	3750	3750	3700	3850
Licenses purchased (total)	12414	11440	16737	18355	19304	16510	14639	14409	13669	13199	13164	11936	10404	9892	9689	9555	8986	6589	6620	6962	7177
Quota zone [c]	10592	9655	14941	16563	17021	13632	12350	9833	10063	9340	9169	8905	7842	7342	7086	5684	4951	3188	3177	3257	3420
Quota surplus/military [c]						235	209	2554	1356	1591	1561	526	233	77	83	1385	1070	578	583	446	441
No-quota zone [c]	1822	1785	1796	1792	2283	2643	2080	2022	2238	2268	2434	2505	2329	2473	2520	2486	2965	2823	2860	3259	3316 [h]
% Licenses bought																					
Of permits available [d]	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	100	100	100	100	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	82.7	85.0	84.7	87.9	88.7
Estimated no. hunters [e]	11500	10300	14500	15900	16800	15500	13800	13600	12900	12500	12500	11300	9900	9400	9200	9100	8600	6300	6300	6600	6800
Harvest	1874	3212	4110	3620	3898	4936	1915	3598	3391	3340	3290	3172	2135	2801	2699	2131	2604	1866	1627	1971	2641
Harvest sex ratio (%M) [f]	62	55	55	53	58	56	61	58	57	59	58	57	62	59	59	61	59	62	62	66 [i]	61
Success rate (%)																					
Total harvest/hunters [g]	16	31	28	23	23	29	14	26	26	26	26	28	21	30	29	23	30	30	26	30	39
Quota harvest/licenses	15	29	25	20	20	28	14	25	26	25	25	28	21	30	30	24	33	37	33	39 [j]	50 [j]

[a] Includes area 99, a designation to increase preference but not to obtain a license (2008 = 528, 2009 = 835; 2010 = 1194; 2011 = 1626; 2012 = 1907; 2013 = 2129; 2014=2377; 2015=2455; 2016=2641).

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

[c] Quota zone established in 1982. No-quota zone 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 August 1. Free licenses for 10 and 11 year-olds were available beginning 2009.

[d] Quota licenses bought (including surplus)/permits available, or licenses bought (prior to surplus)/permits issued. 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 2011–16, all unpurchased licenses were put up for sale and 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 2011–16 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 2001–2012 were calculated as number of successful hunters/total hunters, rather than bears killed/total hunters, because no-quota hunters could take 2 bears. After 2012, hunters could take 2 bears only if they bought 2 licenses (1 quota + 1 no-quota). In 2016, 5 hunters killed 2 bears.

[h] Record high number of no-quota zone licenses purchased (46% of total licenses purchased).

[i] Record high % males in statewide harvest.

[j] 2016: record high success rate. 2015: highest success rate since very poor food year of 1995.

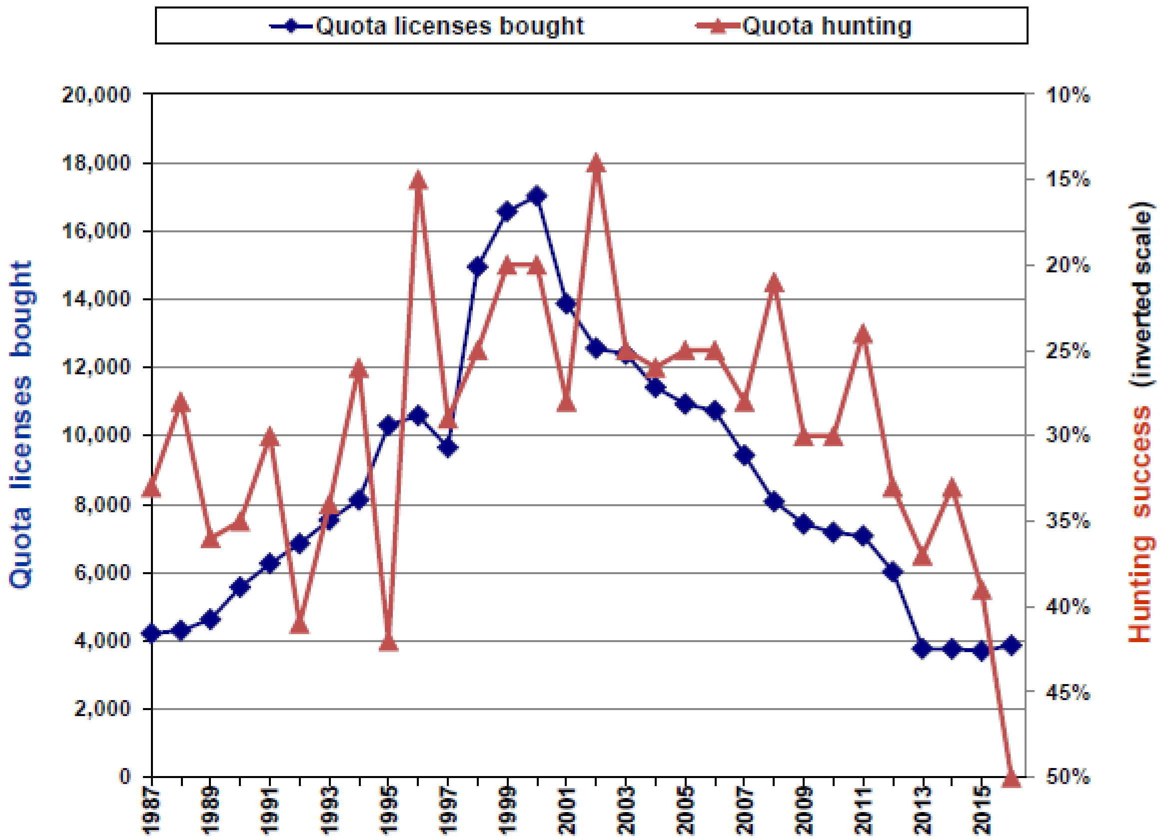


Figure 1. Relationship between licenses sold and hunting success (note inverted scale) in quota zone, 1987–2016 (no-quota zone first partitioned out in 1987). Number of licenses explains 42% of variation in hunting success during this period (P = 0.0001). Large variation in hunting success is also attributable to food conditions.

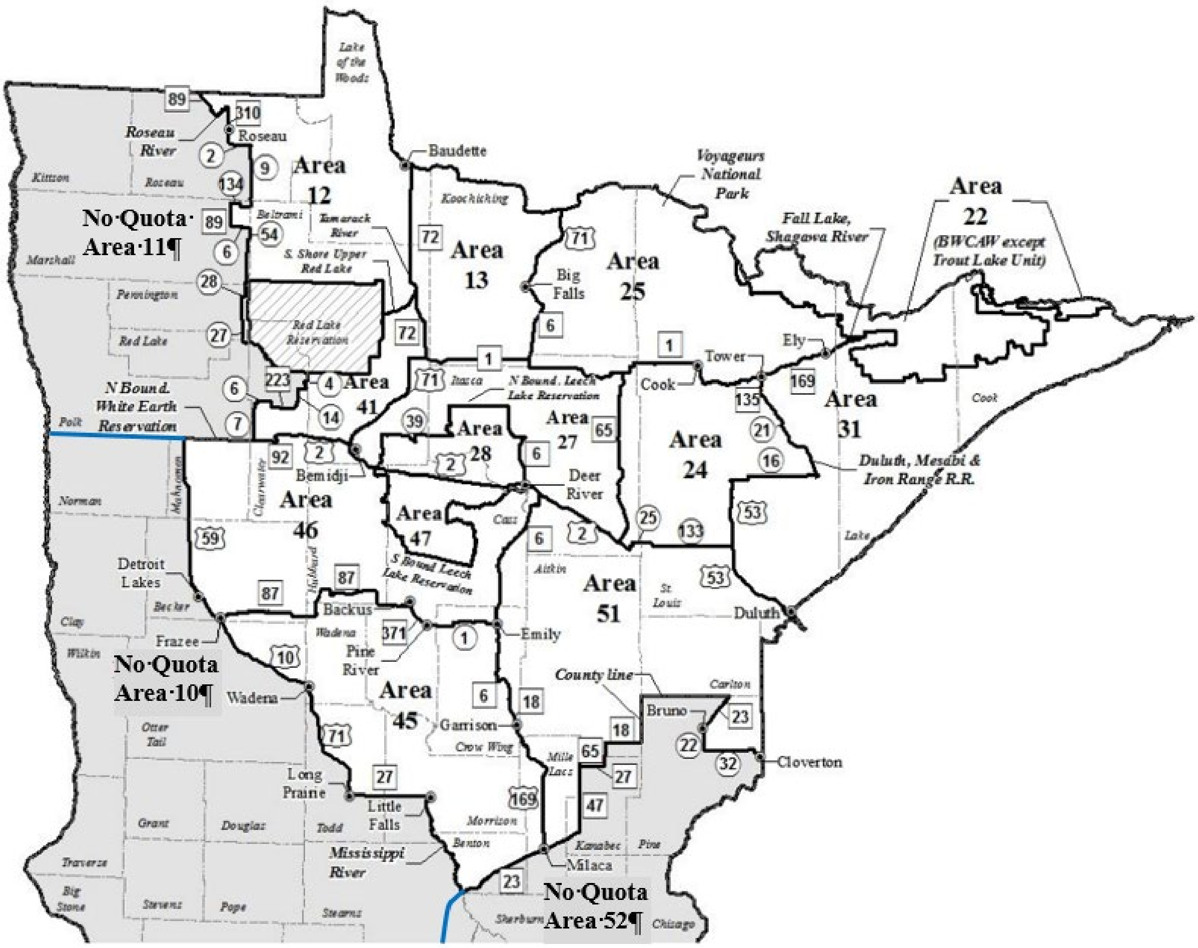


Figure. 2. Bear management units (BMUs) within quota (white) and no-quota (gray) zones. Hunters in the quota zone are restricted to a single BMU, whereas no-quota hunters can hunt anywhere within that zone. In 2016, BMU 26 was divided into 27 and 28, and BMU 44 was split into 46 and 47 (BMUs 28 and 47 comprise the Leech Lake Reservation).

Table 2. Number of bear hunting quota area permits available, 2011–2016. Highlighted values show a change from the previous year. BMUs 26 and 44 were divided into 27/28 and 46/47, respectively, in 2016.

BMU		2011		2012	2013	2014	2015	2016	
		Before reduction	After reduction[a]					Before BMU split [b]	After BMU split
12		450	350	300	200	200	150	150	150
13		600	450	400	250	250	250	250	250
22		125	100	100	50	50	50	50	50
24		500	350	300	200	200	200	200	200
25		1200	900	850	500	500	500	500	500
26		900	650	550	350	350	350	325	
	27								250
	28								75
31		1300	1000	900	550	550	550	550	550
41		400	300	250	150	150	150	125	125
44		1100	850	700	450	450	450	450	
	46								400
	47								50
45		400	250	200	150	150	150	250	250
51		2500	1850	1450	900	900	900	1000	1000
Total		9475	7050	6000	3750	3750	3700	3850	3850

[a] Beginning in 2011, 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. All subsequent allocations were based on the assumption that the quota would be filled (Table 3).

[b] In 2016, the Leech Lake Reservation was split from BMUs 26 and 44 to form BMUs 28 (north) and 47 (south), with the remaining area of BMU 26 renamed BMU 28 and remaining area of BMU 44 renamed BMU 46. The column shows permit allocation before the split in order to compare with previous years.

Table 3. Number of quota BMU permit applicants (Apps), licenses bought (after permits drawn) and surplus licenses bought, 2011–2016[a]. Shaded values indicate undersubscribed areas (applications < permits available).

BMU	2011			2012			2013			2014			2015			2016		
	Apps	Bought license	Surplus bought	Apps	Bought license	Surplus bought	Apps	Bought license	Surplus bought	Apps	Bought license	Surplus bought	Apps	Bought license	Surplus bought	Apps	Bought license	Surplus bought
12	834	267	84	813	244	60	707	160	44	661	164	36	612	130	20	624	133	17
13	751	366	84	719	325	76	664	213	37	703	218	32	692	210	40	716	221	29
22	90	71	31	83	56	43	55	36	14	65	33	17	48	36	9[b]	52	37	13
24	918	294	56	888	253	47	763	170	30	875	174	26	771	171	29	884	173	27
25	1763	712	190	1625	713	137	1575	432	69	1533	424	76	1396	433	67	1443	440	60
26	1894	512	139	1666	458	92	1695	303	47	1696	298	52	1650	309	42			
27																1224	219	31
28																325	72	3
31	2505	826	174	2406	758	146	2261	478	72	2257	468	82	2021	488	62	2180	489	62
41	688	253	47	592	208	42	575	135	15	561	129	21	570	129	21	618	114	11
44	3010	697	154	2619	612	88	2682	386	65	2751	393	57	2626	402	48			
46																2690	370	30
47																194	45	5
45	1019	208	42	1135	170	30	1205	141	9	1403	127	23	1703	139	11	2046	227	23
51	4086	1478	372	3650	1154	296	3796	734	166	4003	748	152	3878	810	90	4321	880	121
Total[c]	17558	5684	1373	16196	4951	1057	15978	3188	568	16508	3176	574	15967	3257	439	17317	3420	432

[a] Beginning in 2011, all licenses not purchased by permittees were sold as "surplus". In all cases but one (see footnote b), all of the surplus licenses were purchased. Surplus = Permits available (Table 2) minus Bought license (±4 to account for groups applying together).

[b] Even after purchase of surplus licenses, this BMU remained undersubscribed.

[c] 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 the total number of applications (unlike Table 1, where they are included).

Table 4. Percentage of quota BMU lottery applicants with preference level 1 (1st-year applicants), 2, 3, and 4 who were drawn for a bear permit, 2011–2016. Blank spaces signify 100% of applicants drawn. All preference level 2 applicants were drawn, except where 0 preference level 1 applicants were drawn. Likewise, all preference level 3 applicants were drawn, except where 0 preference level 2 applicants were drawn[a].

	2011		2012		2013			2014			2015				2016			
BMU	Pref 1	Pref 2	Pref 1	Pref 2	Pref 1	Pref 2	Pref 3	Pref 1	Pref 2	Pref 3	Pref 1	Pref 2	Pref 3	Pref 4	Pref 1	Pref 2	Pref 3	Pref 4
12	2		0	80	0	49		0	40		0	17			0	0	98	
13	51		33		4			0	72		0	56			0	38	100	
22	100		100		89			72			100				98	100		
24	14		0	75	0	41		0	13		0	2			0	0	86	
25	35		28		0	81		0	57		0	44			0	42	100	
26[b]	0	77	0	49	0	7		0	0	80	0	0	51					
27															0	0	30	
28															0	0	0	99
31	11		0	84	0	45		0	15		0	0	87		0	0	75	
41	6		0	86	0	43		0	19		0	0	99		0	0	77	
44[b]	0	55	0	28	0	0	68	0	0	41	0	0	18					
46															0	0	0	85
47															0	0	10	
45	0	67	0	29	0	0	75	0	0	30	0	0	0	81	0	0	0	63
51	25		1		0	53		0	22		0	0	89		0	0	72	

[a] As an example: In BMU 12: in 2011, 2% of preference level 1 applicants were drawn and 100% of preference 2 applicants were drawn for a permit; by 2016, no preference 1 or 2 applicants were drawn, 98% of preference 3 and 100% of preference 4 (and above) were drawn. In BMU 45: in 2016, no preference 1–3 applicants were drawn, 63% of preference 3 were drawn, and 100% of 4 (and above) were drawn.

[b] BMU 26 was split into 27/28 and BMU 44 was split into 46/47 in 2016.

Table 5. Minnesota bear harvest tally for 2016 by Bear Management Unit (BMU)[a] and sex[b] compared to harvests during 2011–2015 and record high and low harvests (since establishment of each BMU).

BMU	2016				2015	2014	2013	2012	2011	5-year mean	Record low harvest (yr)	Record high harvest (yr)
	M	(%M)	F	Total								
Quota												
12	54	(69)	24	78	60	38[d]	62	82	106	70	38 (14)	263 (01)
13	94	(64)	53	147	72[e]	91	95	112	119	98	71 (88)	258 (95)
22	3	(60)	2	5	7	5	9	8	11	8	3 (03)	41 (89)
24	64	(67)	32	96	97	50[f]	76	108	122	91	50 (14)	288 (95)
25	186	(65)[m]	101	287	227	168[g]	197	254	317	233	149 (96)	584 (01)
26	[127]	(74)[m]	[44]	[171]	121	117[h]	121	238	167	153	117 (14)	513 (95)
27	98	(75)	33	131								
28	29	(73)	11	40								
31	201	(64)	111	312	307	221	197	363	358	289	157 (88)	697 (01)
41	25	(44)[n]	32	57	35[i]	36	40	70	54	47	35 (15)	201 (01)
44	[114]	(53)	[101]	[215]	158	170	181	188	130	165	130 (11)	643 (95)
46	100	(53)	90	190								
47	14	(56)	11	25								
45	51	(50)	51	102[p]	55	54	48	67	32	51	32 (11)	178 (01)
51	268	(58)	194	463[c]	302	291	349	471	288	340	247 (91)	895 (01)
Total	1187	(61)	745	1933[c]	1441	1241[j]	1375	1961	1704	1544	1192 (88)	4288 (01)
No-Quota[b]												
11	196	(67)	95	291	195	77[k]	136	224	219	170	38 (87)	351 (05)
10	9	(60)	6	15[q]	11	8	9	14	3	9		14 (12)
52	231	(57)	171	402	324	301	346	405	205	316	105 (02)	405 (12)
Total	436	(62)	272	708[q]	530	386	491	643	427	495	198 (87)	678 (95)
State	1623	(61)	1017	**2641**[c]	1971	1627[j]	1866	2604	2131	2040		4956 (95)

[a] Some tooth envelopes were received from hunters who did not register their bear. These were added to the harvest tally: 2011:13; 2012:7; 2013:6; 2014:3; 2015:6; 2016:7.
Some hunters with no-quota licenses hunted in the quota zone, and their kills were assigned to the BMU where they apparently hunted: 2011:14; 2012:8; 2013:11; 2014:4; 2015:12; 2016:9.
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 (presuming most were misreported kill locations).

[b] Sex recorded on tooth envelopes may differ from the registered sex. Sex shown on table is the registered sex because normally only ~70% of tooth envelopes are submitted.

[c] Total includes 1 bear of unknown sex.

Notable harvests 2011–2015:
[d] Record low harvest since this area was established in 1987.
[e] Lowest harvest since 1988.
[f] Record low harvest since this area was established in 1989.
[g] Lowest harvest since 1996.
[h] Record low harvest since this area was established in 1991. [i] Record low harvest since this area was established in 1990. [j] Lowest harvest since 1988 (quota—no-quota split in 1987). [k] Lowest harvest since 1999.

Notable harvests 2016:
[m] Record (or tie record) high % males.
[n] Second lowest % males (42% in 2014).
[p] Highest harvest since 2007.
[q] Record high harvest.

Figure 3. Trends in statewide bear harvest and proportions of harvest in the no-quota zones, 1987–2016.

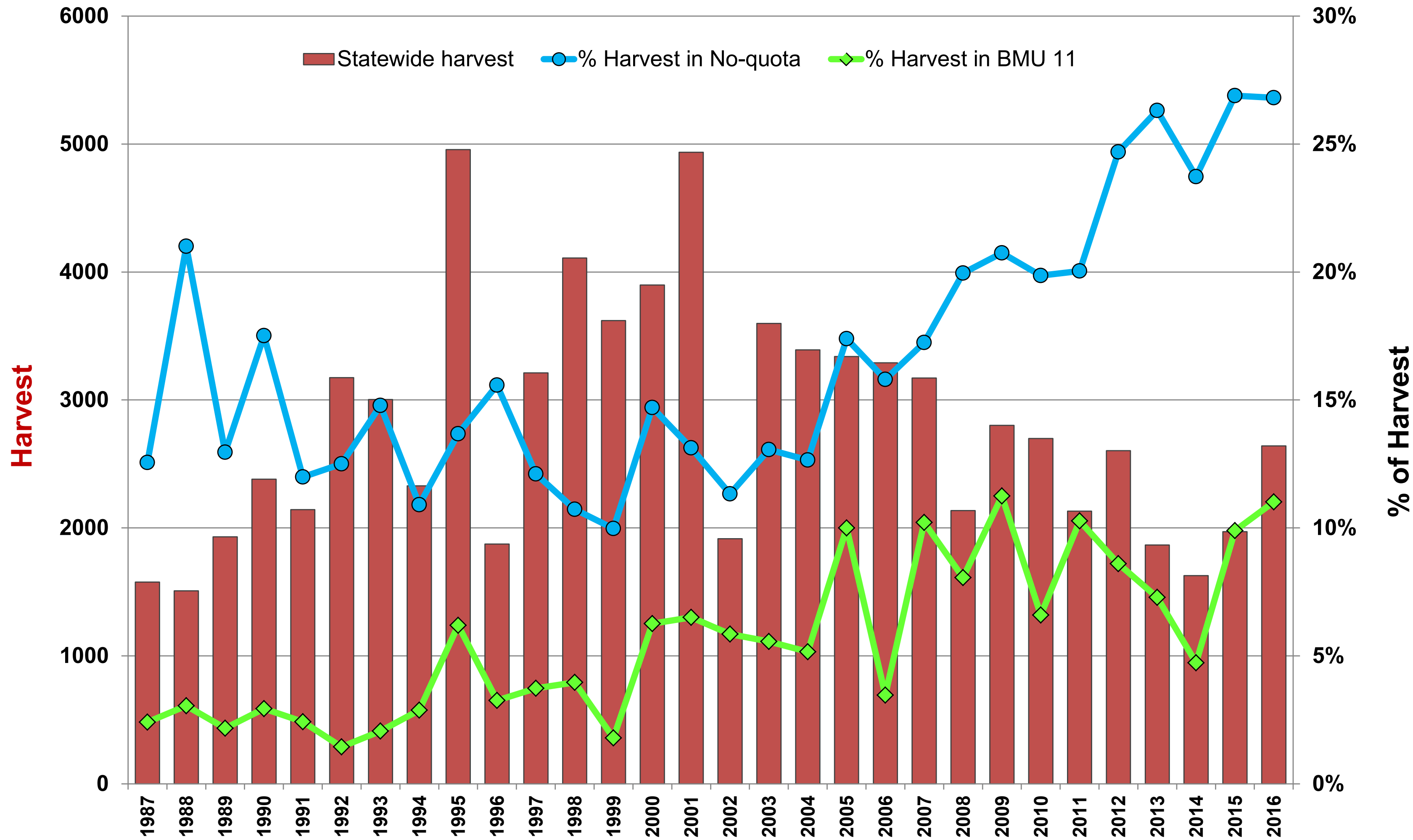


Table 6. Bear hunting success (%) by BMU, measured as the registered harvest divided by the number of licenses sold[a], 2011–2016.

BMU	Max success prior to 2016	(yr)	Mean success 2011-2015	2016	2015	2014	2013	2012	2011
12	49	(95)	29	52[b]	40	19[d]	30	27	30
13	59	(95)	31	59[b]	29	36	38[c]	28	26
22	21	(92)	12	10	13	10	18[c]	8	11
24	45	(92)	36	48[b]	48[b]	25	38	36	35
25	47	(92)	36	57[b]	45	34	39	30	35
26	59	(95)	34	52[c]	34	33	34	43	26
27				52					
28				53					
31	55	(92)	42	56[b]	56[c]	40	36	40	36
41	50	(95)	24	46[c]	23	24	26	28	18
44	43	(95)	31	48[b]	35	38	40	27	15[f]
46				47					
47				50					
45	36	(14, 15)	30	40[b]	36[c]	36[c]	32	33	13
51	39	(13)	31	46[b]	33	32	39c	32	16
Quota	42	(95)	33	50[b]	39	33	37	33	24
11e				28	20	9	15		
10e				9	7	7	12		
52e				19	15	16	19		
No Quota	32	(95)	16	21	16	13	17	20	15[f]
Statewide	40	(95)	26	37	28	25	28	28	22

[a] Registered 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] Record high (or tied record high) success.

[c] Second highest success.

[d] Tied record lowest success.

[e] Since 2013, an attempt was made to differentiate the number of no-quota (NQ) hunters by BMU in order to estimate success rates. When no-quota hunters bought licenses, they recorded the deer block where they anticipated hunting. A significant number chose blocks in the quota zone; those who did not harvest a bear in the quota zone were divided up into NQ-BMUs in proportion to those who chose blocks in or adjacent to NQ-BMUs. A few chose BMU 60 (SE Minnesota) but so far none have killed a bear there. Table shows % indicating where they planned to hunt:

BMU	2013	2014	2015	2016	
11	30.0	28.5	29.3	30.3	
10	2.6	4.1	4.4	4.9	
52	62.6	64.7	63.9	61.2	
60 (n)	0.4 (10)	0.6 (17)	0.2 (8)	0.4	(12)
Quota zone (n)	4.5 (127)	2.1 (60)	3.1 (101)	3.2	(105)

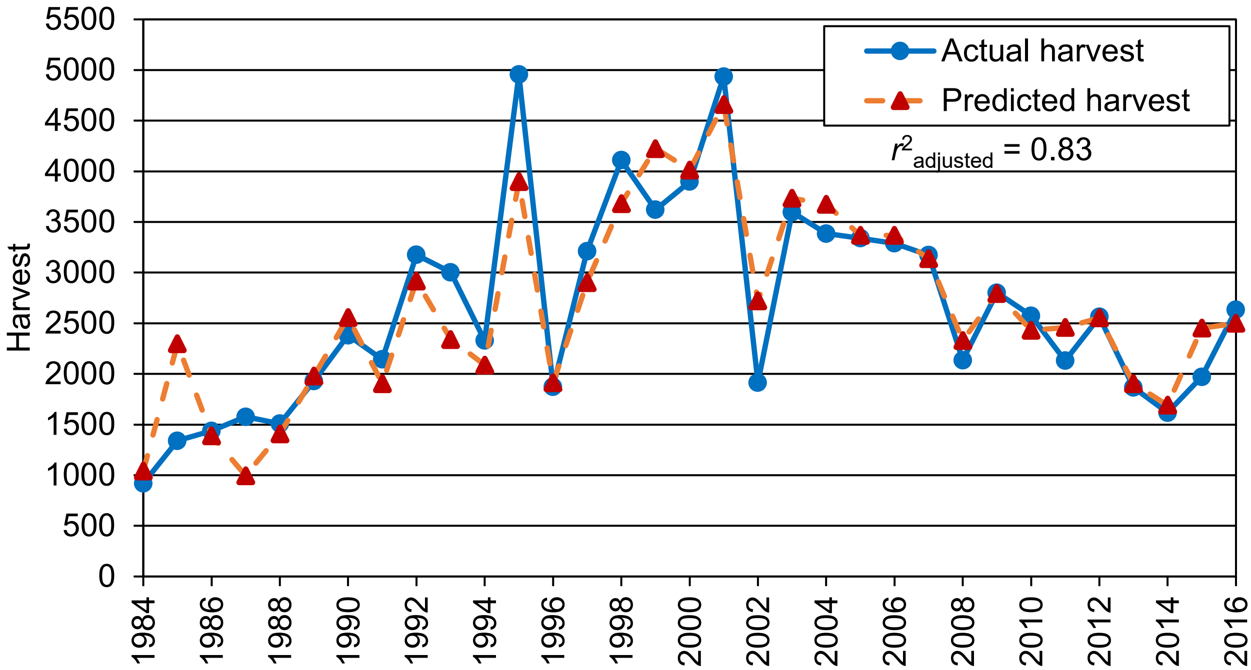
Table 7. Cumulative bear harvest (% of total harvest) by date, 1996–2016.

Year	Day of week for opener	Aug 22/23 – Aug 31	Sept 1 – Sept 7	Sept 1 – Sept 14	Sept 1 – Sept 30
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[a]	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[a]	92
2009	Tue		74	86	96
2010	Wed		69	84	96
2011	Thu		65	78	93
2012	Sat		68	83	96
2013	Sun		61	76	94
2014	Mon		60	75	92
2015	Tue		58[b]	75	91
2016	Thu		68	83	95

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

[b] The slow start the first week was likely due to especially warm weather.

Figure 4. Number of bears harvested vs. number predicted to be harvested based on fall food production and the number of hunters statewide: top: 1984–2016; bottom: 2002–2016.



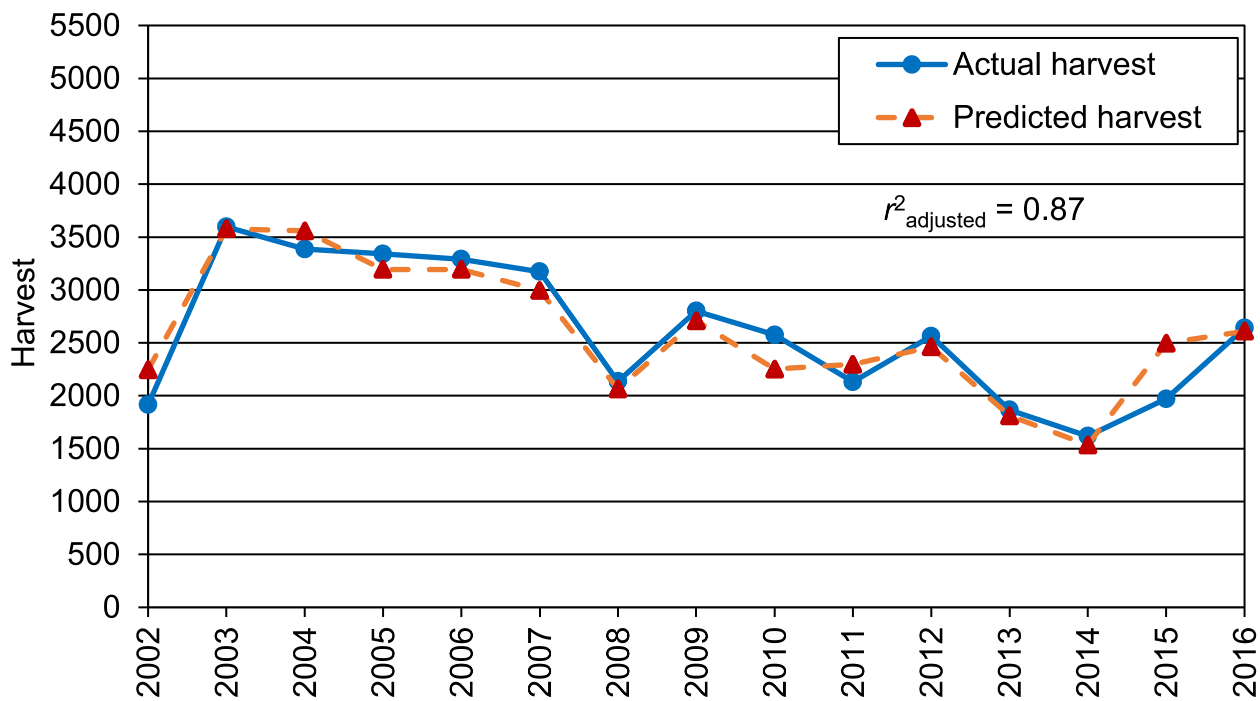
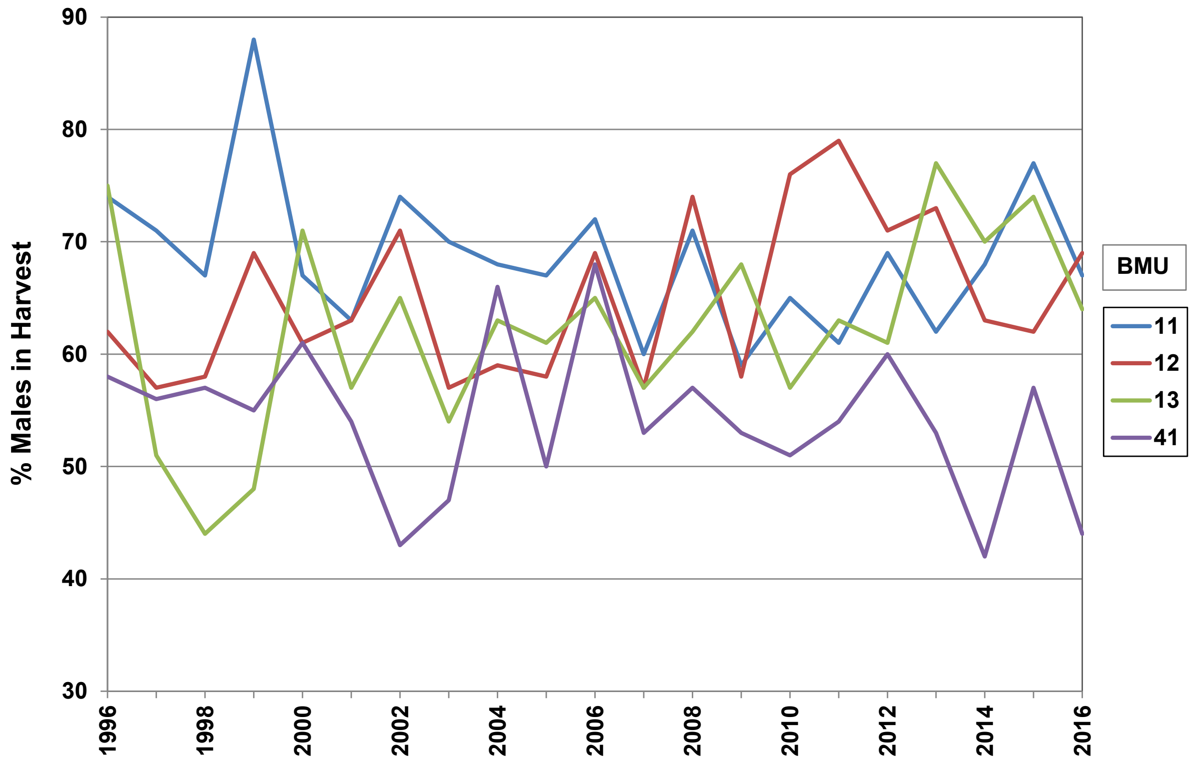
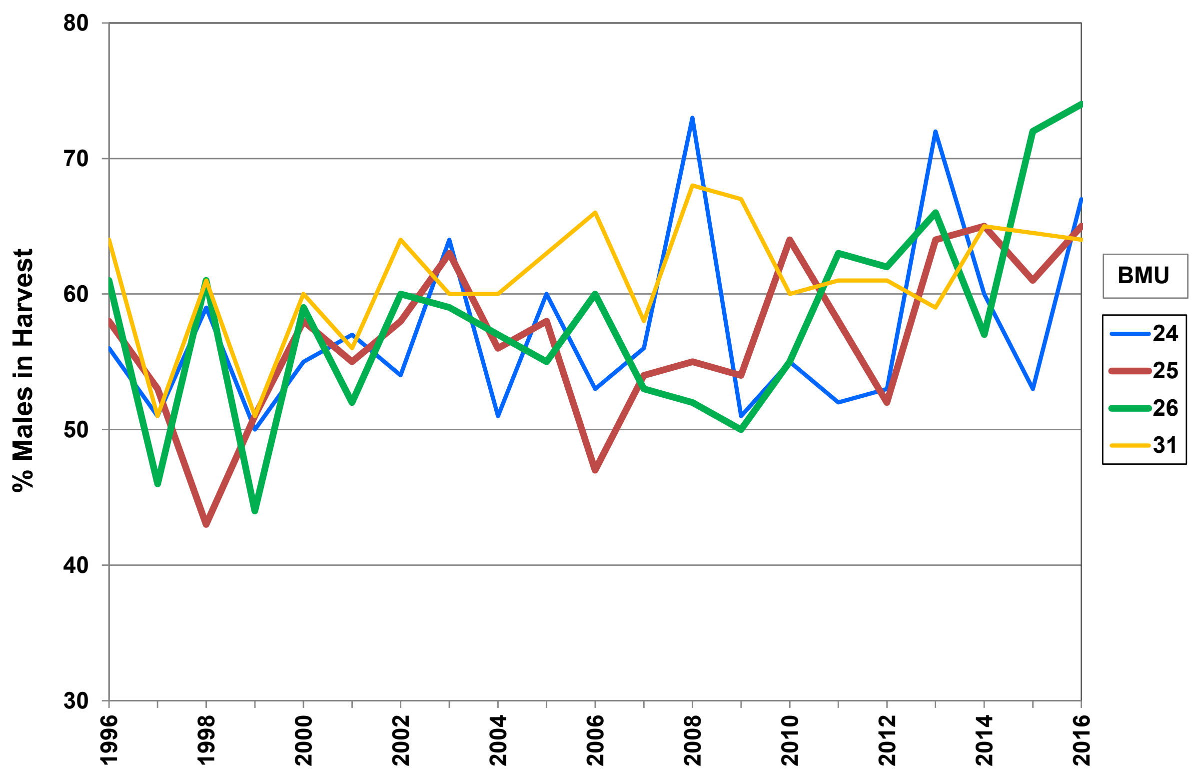
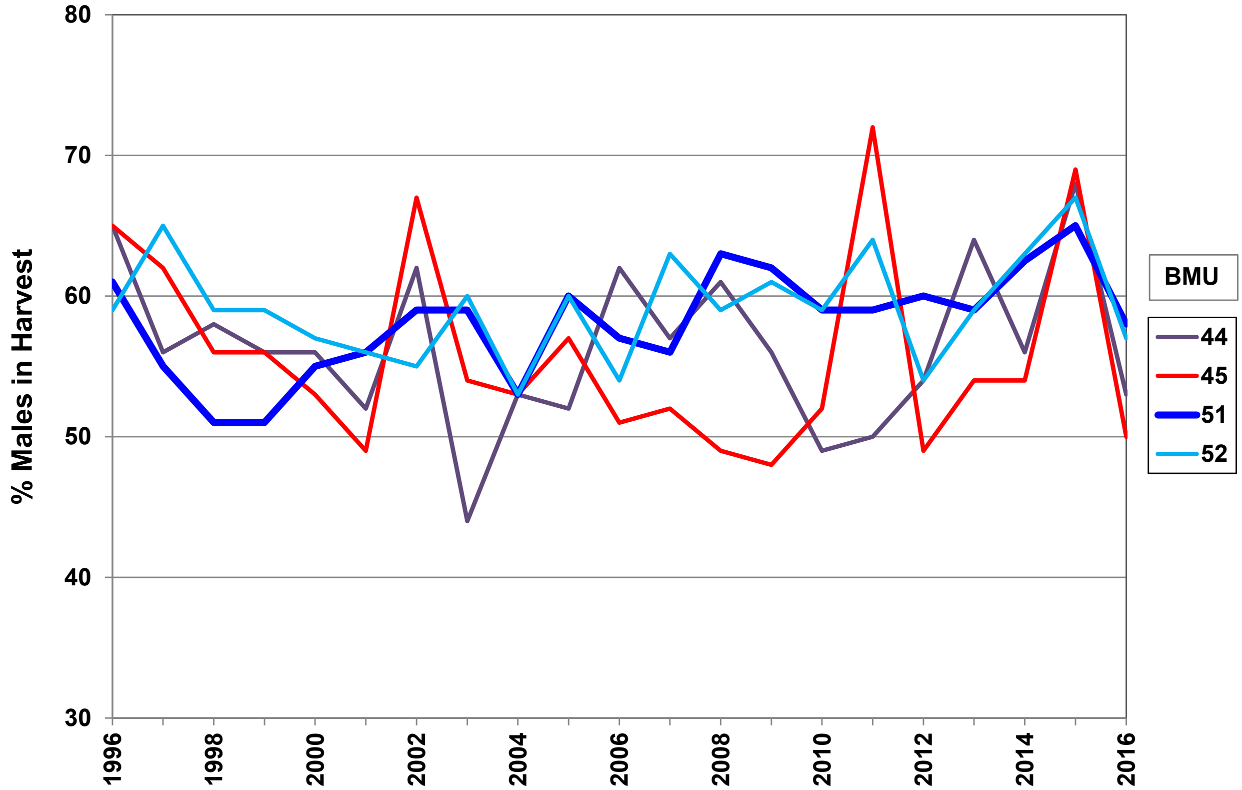


Figure 5. Sex ratios of harvested bears by BMU, 1996–2016.
Thick lines show increasing trends.

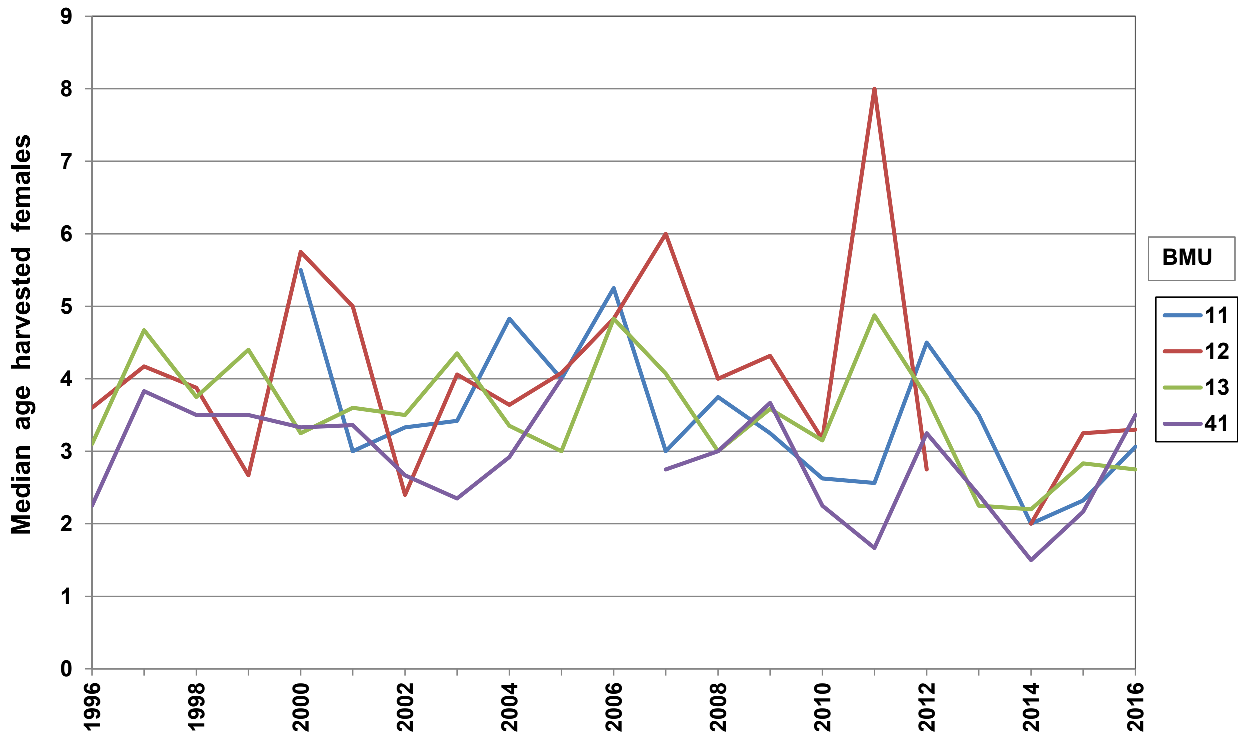


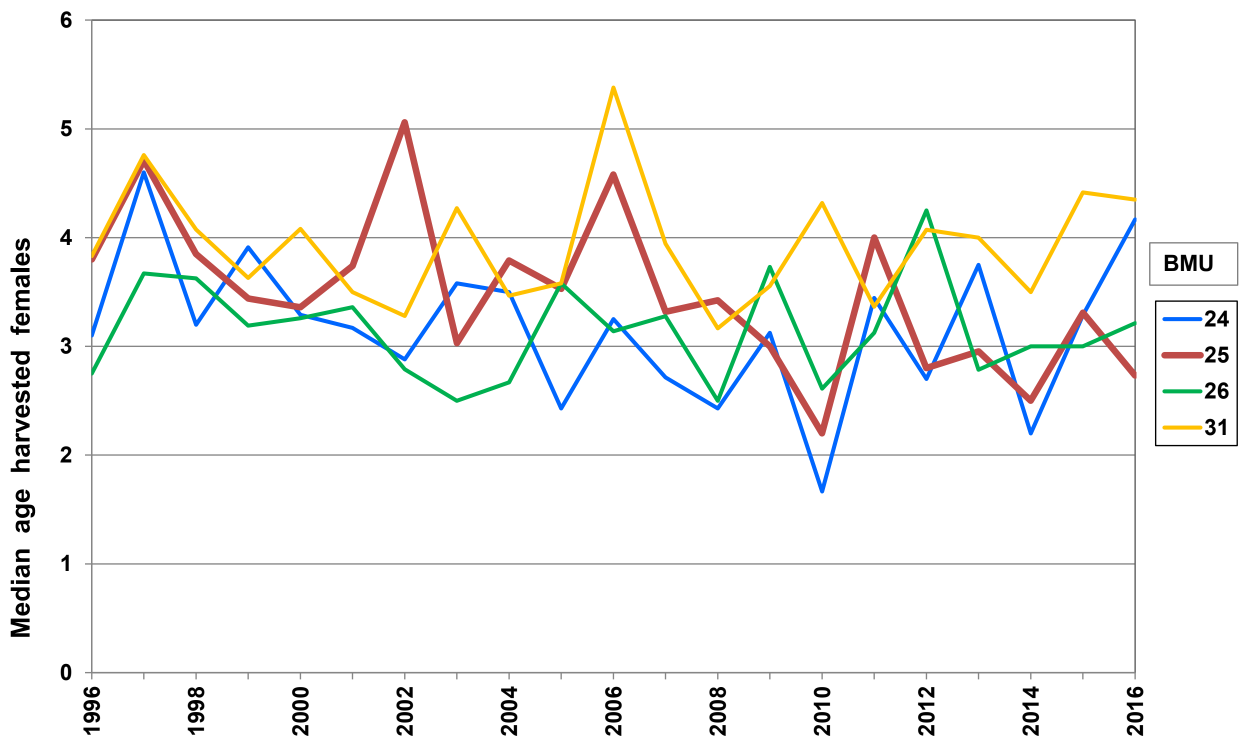




80
70
60
50
40
30
% Males in Harvest
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
BMU
44
45
51
52

Figure 6. Median ages of harvested female bears by BMU, 1996–2016.
Thick lines show declining trends.





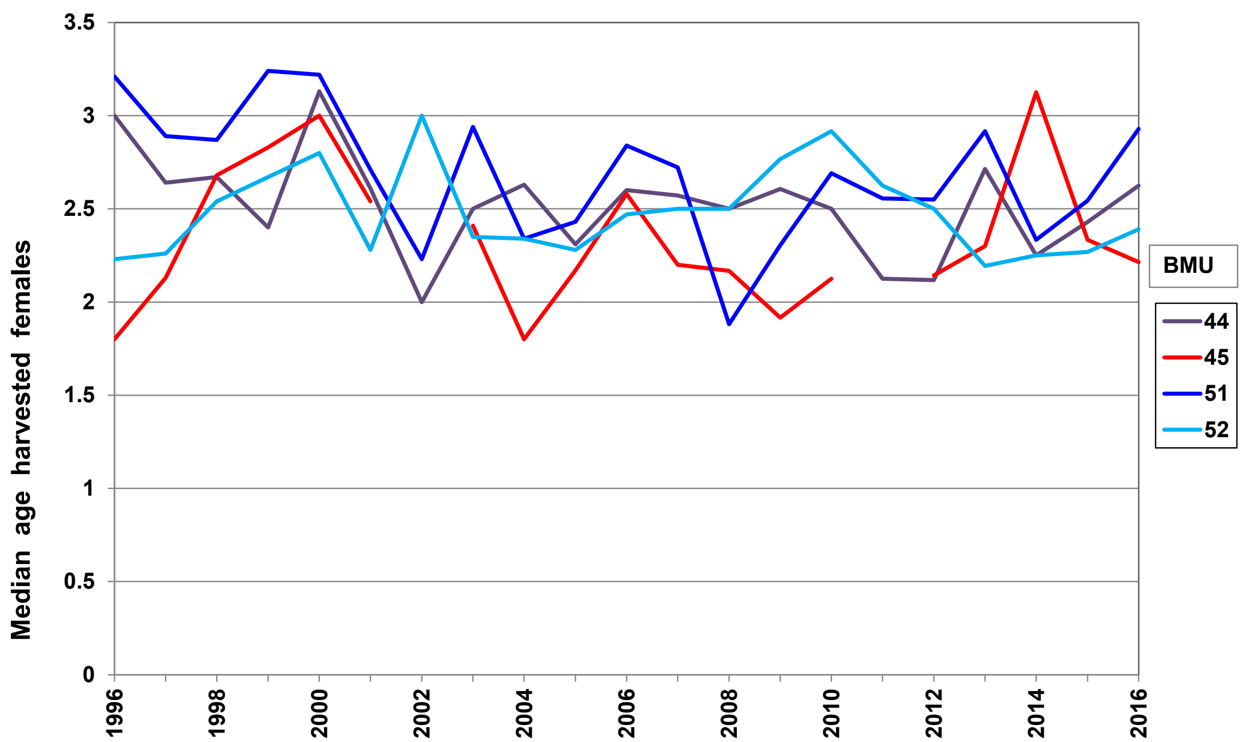

Median age harvested females
3.5
3
2.5
2
1.5
1
0.5
0
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
BMU
44
45
51
52

Figure 7. Statewide median ages (yrs) of harvested bears by sex, 1982–2016.

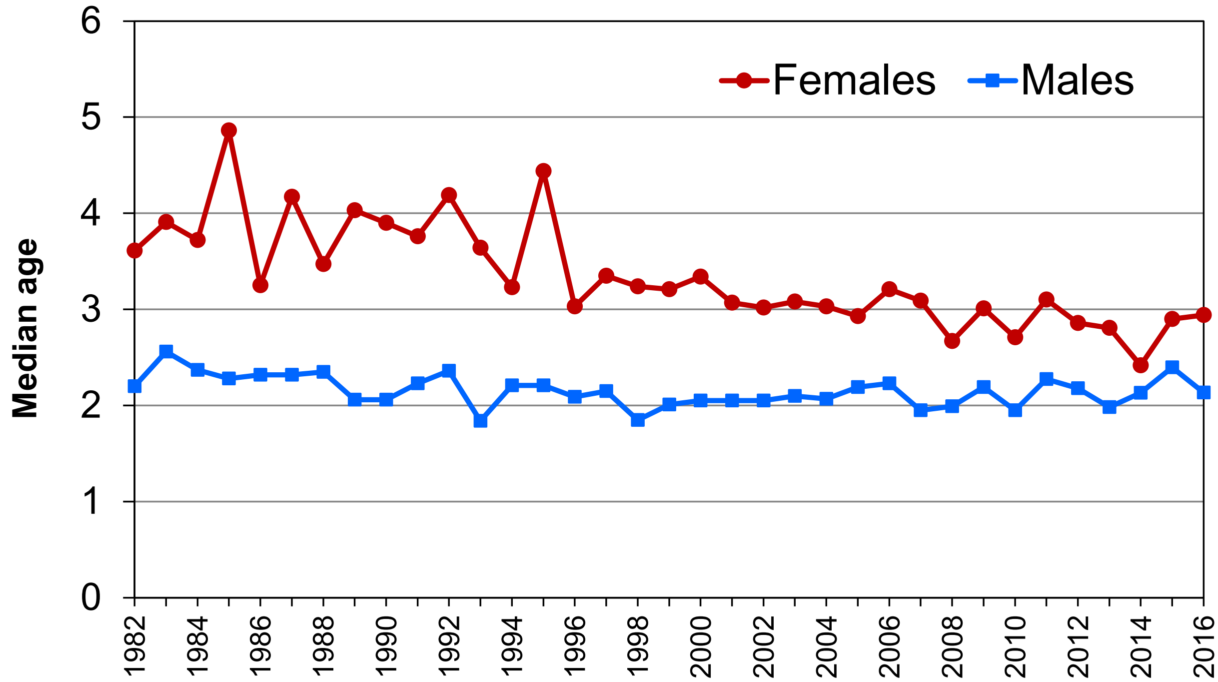


Figure 8. Statewide harvest structure: proportion of each sex in age category, 1982–2016. Trend lines are significant.

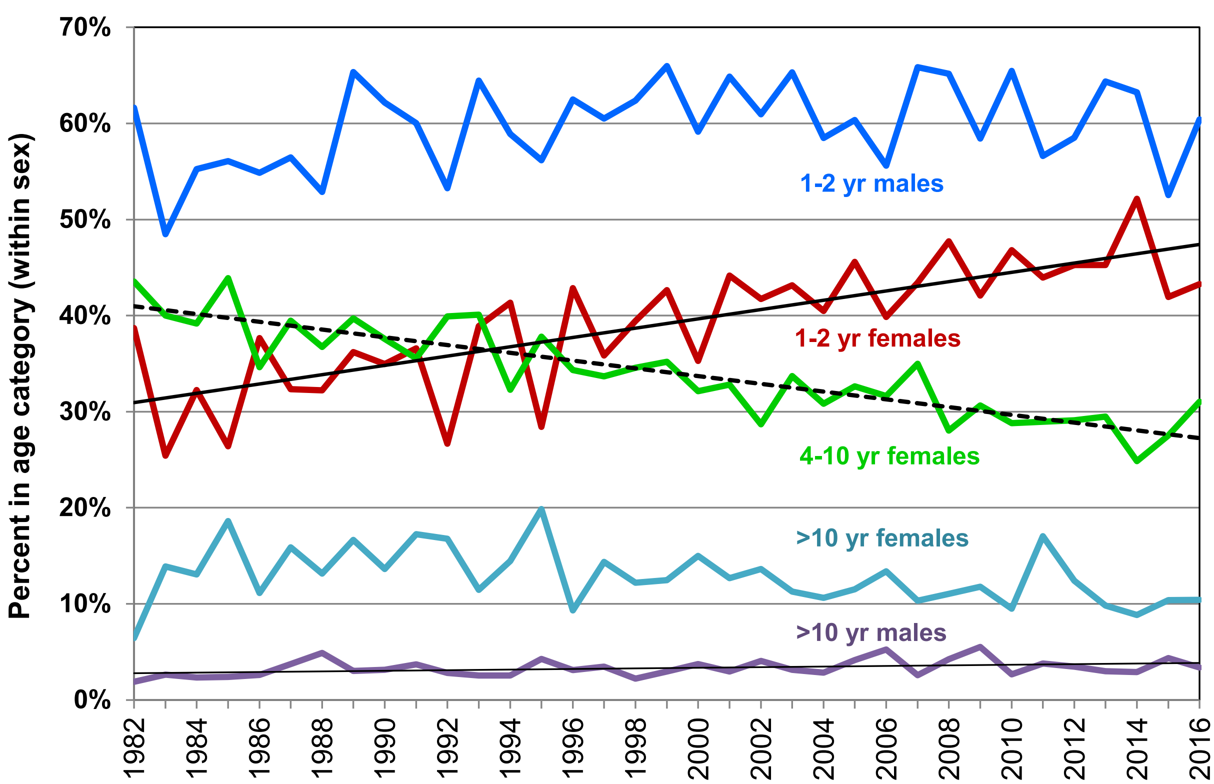


Figure 9. Percent of hunters submitting useable bear teeth for aging (now vital for population monitoring,). Cooperation levels exceeded 80% when registration stations were paid to extract teeth (this practice ended in 1993) and ~90% when non-compliant hunters were sent a reminder letter in December or January (2015 and 2016).

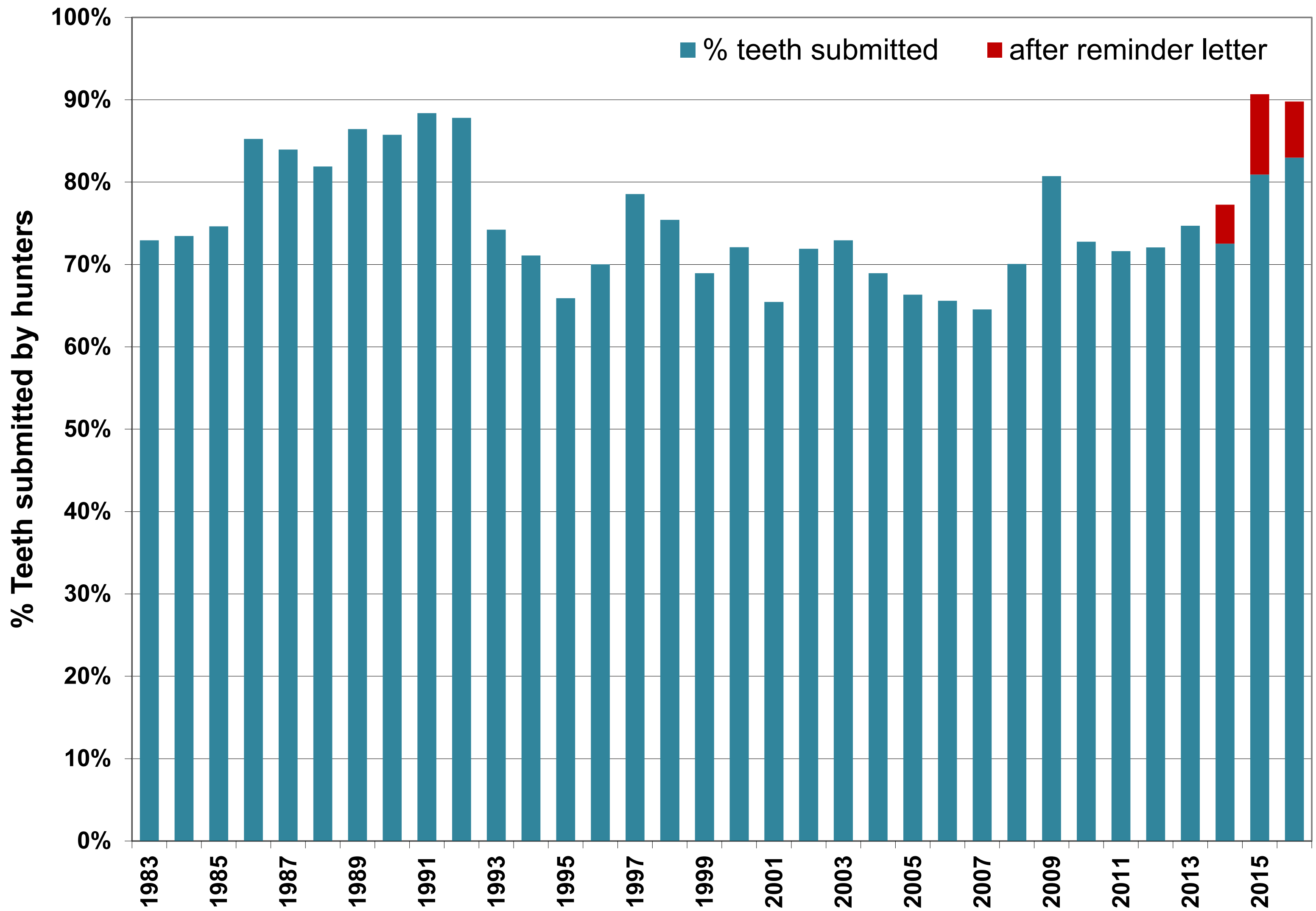
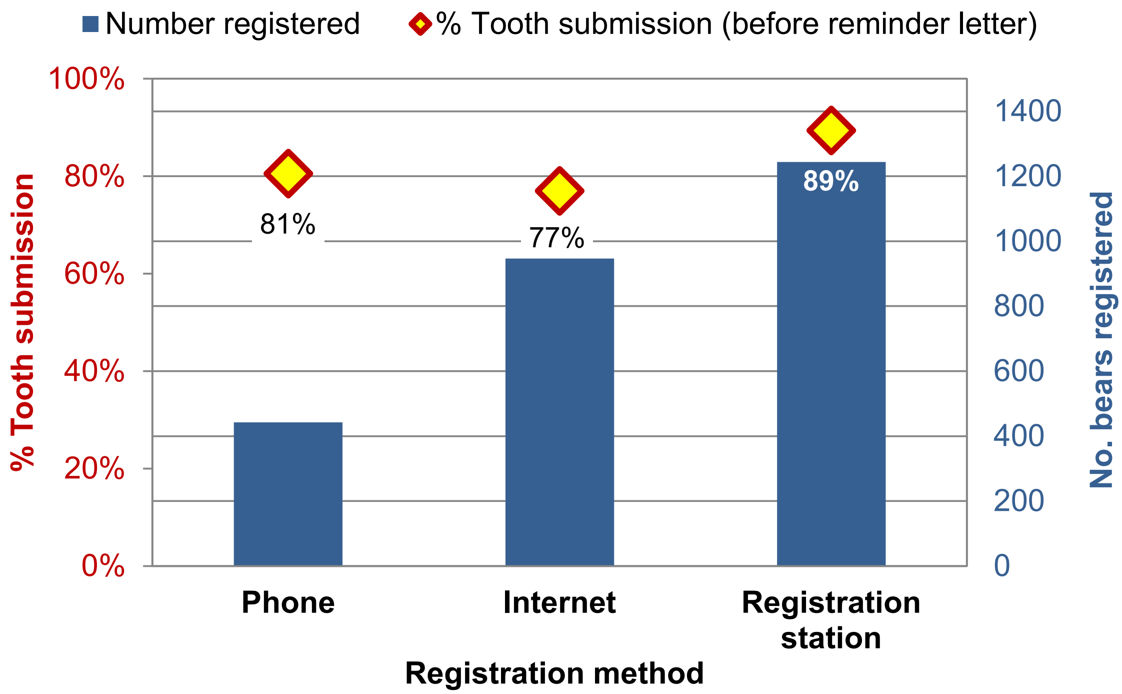
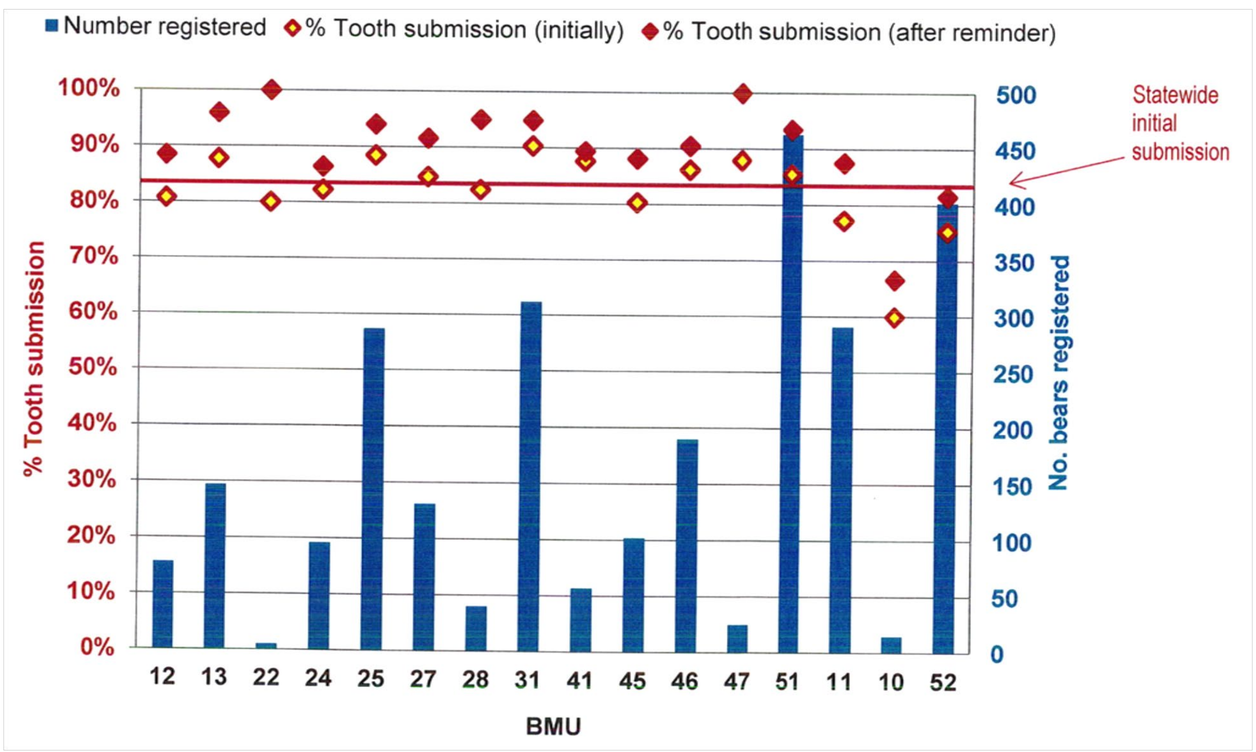


Figure 10. Percent of hunters who submitted a bear tooth in 2016 by method of registration (top panel) and by BMU (bottom panel; before and after reminder letter). Beginning in 2013, hunters could register their bear by phone or internet.





2016 MINNESOTA DEER HARVEST REPORT

Adam Murkowski, Big Game Program Leader, Division of Fish and Wildlife

INTRODUCTION

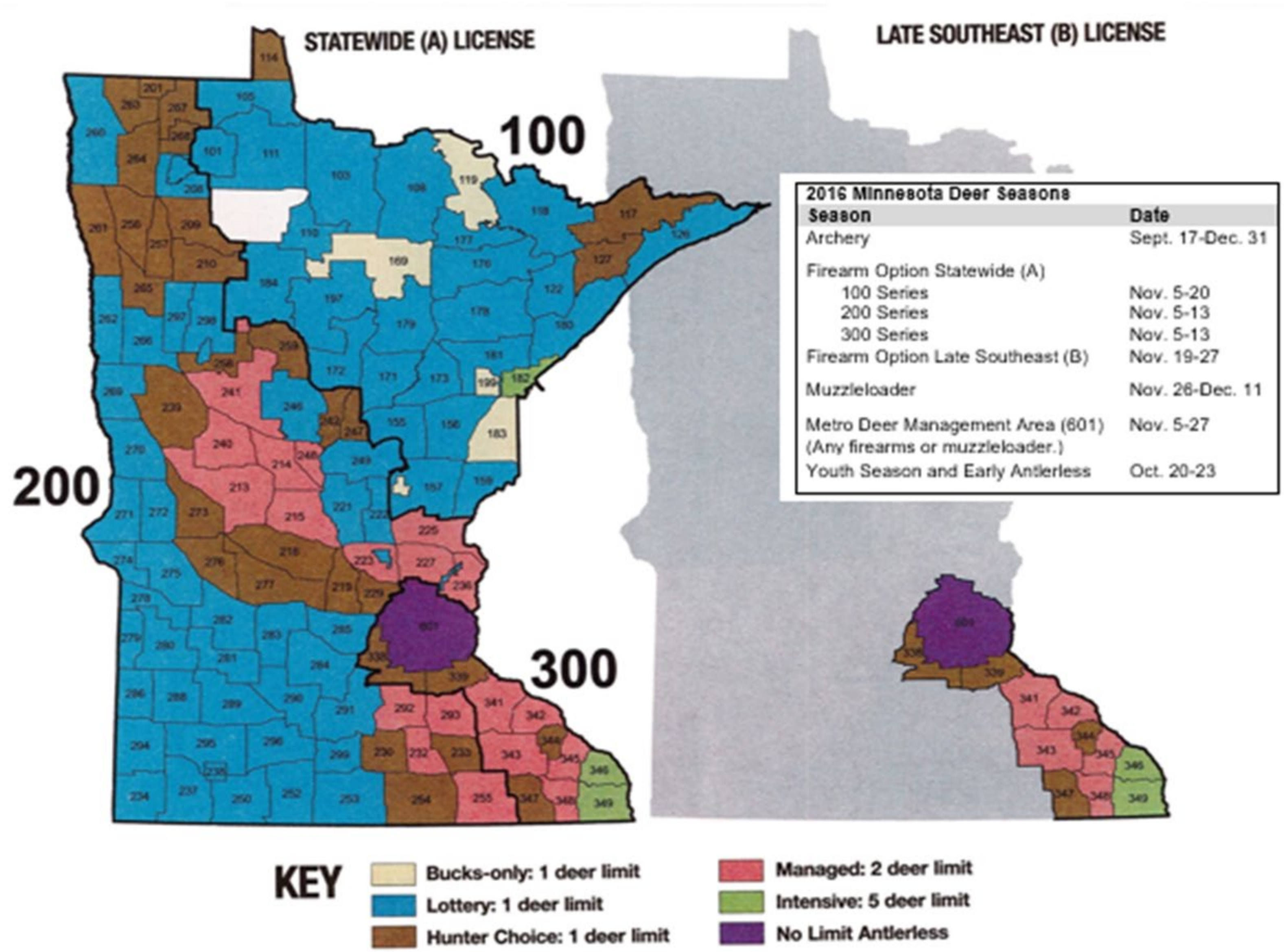
The white-tailed deer may be considered Minnesota's most popular wildlife species. In 2016, nearly 450,000 hunters participated in the season. 2016 was a conservative season designed to rebuild deer numbers across much of the state. During the archery, firearms and muzzleloader seasons, hunters registered 173,213 deer.

METHODS

Every deer taken by hunting in Minnesota must be registered. In 2016, carcass import restrictions were instituted to help prevent the spread of Chronic Wasting Disease (CWD). 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 also be registered using the internet and telephone except in areas under Disease Management tag restrictions. 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

Outcomes of the 2016 deer harvest are presented in the following tables.



2016 Minnesota Deer Seasons	
Season	**Date**
Archery	Sept. 17-Dec. 31
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 firearms or muzzleloader.)	Nov. 5-27
Youth Season and Early Antlerless	Oct. 20-23

Figure 1. 2016 Firearms and Archery Deer Seasons.

Table 1. Statewide Firearms, Archery, and Muzzleloader Harvest, License Sales, and Success Rates, 2005-2016.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
REGULAR FIREARMS												
Resident License Sales	291,298	299,774	285,286	376,006	377,077	379,866	382,668	391,822	391,967	374,314	371,612	372,645
Non-Resident License Sales	12,523	12,520	12,520	11,883	11,759	11,908	11,955	12,483	12,496	11,674	13,501	12,540
Bonus Permit Sales	184,566	167,343	145,522	190,156	140,920	143,763	142,049	89,750	97,402	29,642	31,065	44,365
Multi-Zone Buck License Sales	28,233	15,984	15,051	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Youth License Sales	50,501	49,599	49,242	50,397	56,678	59,726	60,943	62,949	64,748	62,488	62,333	61,138
All Season Deer License Sales	59,090	75,511	76,385	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total License Sales	626,211	620,731	584,006	628,442	586,434	595,263	597,615	557,004	566,613	478,118	448,007	446,323
Registered Buck Harvest[1]	95,594	95,695	97,528	85,646	83,820	88,027	76,003	84,729	70,627	70,627	83,939	87,855
Antlerless Permits Offered	28,830	18,925	18,830	32,325	60,100	60,083	15,525	32,854	36,816	26,332	31,065	39,646
Antlerless Permits Issued	25,656	18,925	18,830	32,325	60,100	60,083	15,525	32,854	36,816	26,332	31,065	39,646
Antlerless Permits App.	31,403	31,403	31,403	31,403	90,882	86,783	21,071	67,308	68,811	96,580	95,656	97,056
Registered AL Harvest[1]	119,363	135,981	118,860	98,147	78,525	86,077	88,197	71,140	67,885	46,030	48,758	52,338
Registered Total Harvest[1]	214,957	231,676	216,388	183,793	162,345	174,104	164,200	155,869	145,449	116,657	132,697	144,470
Registered % Successful[2]	34.3	37.3	41.7	34.8	33.8	35.9	32.9	32.0	29.7	25.3	29.6	32.4
ARCHERY												
Resident License Sales	50,293	49,595	52,780	87,872	88,707	91,156	90,252	95,259	92,717	92,301	93,462	92,076
Non-Resident License Sales	1,207	1,286	1,509	1,509	1,610	1,638	1,718	1,814	1,952	1,946	2,032	2,062
Youth Archery Sales	7,489	7,688	7,663	9,005	9,157	9,577	10,306	11,276	12,212	11,965	11,905	10,846
Mgmt Permit License Sales	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total License Sales	58,989	58,569	61,952	99,033	99,474	102,371	102,276	108,349	106,881	106,212	107,399	104,984
Total Harvest - All-Season License	4,563	8,284	6,900	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Archery Harvest	23,538	25,360	24,161	22,632	20,629	22,057	20,444	21,605	19,388	17,119	20,074	20,360
Registered % Successful[2]	24.6	24.8	24.3	18.5	17.5	17.8	17.0	18.8	14.5	15.3	18.7	19.4
MUZZLELOADER												
Total Muzzleloader License Sales	9,226	10,781	9,867	64,673	63,282	55,640	59,384	58,363	51,092	43,946	50,176	53,097
Estimated All-Season Hunters	23,293	23,293	26,813	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Muzzleloader Harvest	15,421	13,507	12,138	9,572	7,929	9,023	7,416	7,779	7,045	5,814	6,572	8,383
Registered % Successful[2]	47.4	39.6	28.2	13.4	11.3	14.4	11.6	12.4	12.7	12.7	7.6	6.3
Antlerless Permits Offered						5,792	1,997	1,626	2,144	1,593	1,434	1,352
Antlerless Permits App.						7,260	2,615	3,743	3,544	4,588	3,393	2,930
TOTAL Registered Harvest	255,736	270,778	260,434	221,837	194,186	207,313	192,331	186,634	172,781	139,442	159,343	173,213

[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, 2016.

Season	Hunters	Harvest			Overall Success
		Bucks	Antlerless	Total	
1A	160,998	32,192	10,075	42,267	26.3%
2A	243,010	48,995	34,578	83,573	34.4%
3A	29,621	4,975	4,077	9,052	30.6%
3B	12,694	1,062	3,032	4,094	32.3%
Metro Firearm	N/A	631	576	1,207	N/A
Youth	N/A	671	546	1,217	N/A
Depredation[1]	N/A	0	11	11	N/A
Early Antlerless[1]	N/A		483	483	N/A
Free Landowner[1]	N/A		1,310	1,310	N/A
900 Series[1]	4,995	394	1,195	1,589	31.8%
Muzzleloader	53,097	3,092	5,001	8,093	15.2%
Archery	104,984	8,741	10,708	19,449	18.5%
CWD	N/A	168	700	868	
Total[2]	**609,399**	**100,921**	**72,292**	**173,213**	

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

Table 3. Firearms Harvest and Harvest per Square Mile by Permit Area, 2016. Includes all firearm licenses.

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	487	54	13	10	564	496	0.98	0.16	1.14
103	1A	798	128	23	6	955	1,824	0.44	0.09	0.52
105	1A	975	187	32	19	1,213	932	1.05	0.26	1.30
108	1A	1171	133	31	17	1,352	1,701	0.69	0.11	0.79
110	1A	1057	202	38	23	1,320	530	1.99	0.50	2.49
111	1A	557	48	12	10	627	1,440	0.39	0.05	0.44
114	1A	38	6	2	1	47	412	0.09	0.02	0.11
117	1A	20	4	1	1	26	1,129	0.02	0.01	0.02
118	1A	629	59	9	5	702	1,445	0.44	0.05	0.49
119	1A	450	5	2	1	458	946	0.48	0.01	0.48
122	1A	232	79	21	5	337	622	0.37	0.17	0.54
126	1A	301	72	12	4	389	979	0.31	0.09	0.40
127	1A	55	29	2	6	92	587	0.09	0.06	0.16
152	1A	85	9	1	1	96	62	1.38	0.18	1.56
155	1A	1304	571	142	102	2,119	639	2.04	1.28	3.32
156	1A	1568	254	55	51	1,928	834	1.88	0.43	2.31
157	1A	2495	698	220	128	3,541	904	2.76	1.16	3.92
159	1A	1272	254	75	48	1,649	575	2.21	0.66	2.87
169	1A	1594	15	6	3	1,618	1,202	1.33	0.02	1.35
171	1A	1169	457	128	78	1,832	729	1.60	0.91	2.51
172	1A	1882	612	164	113	2,771	786	2.39	1.13	3.52
173	1A	781	157	44	30	1,012	617	1.27	0.37	1.64
176	1A	1440	226	52	26	1,744	1,150	1.25	0.26	1.52
177	1A	700	224	49	27	1,000	553	1.27	0.54	1.81
178	1A	1713	270	66	37	2,086	1,325	1.29	0.28	1.57
179	1A	1717	512	121	85	2,435	939	1.83	0.76	2.59
180	1A	752	222	44	22	1,040	999	0.75	0.29	1.04
181	1A	1038	176	27	24	1,265	746	1.39	0.30	1.70
182	1A	397	244	82	46	769	280	1.42	1.33	2.75
183	1A	1323	13	4	3	1,343	675	1.96	0.03	1.99
184	1A	2939	1017	286	207	4,449	1,318	2.23	1.15	3.37
197	1A	1140	166	41	31	1,378	1,343	0.85	0.18	1.03
199	1A	113	1	0	0	114	152	0.74	0.01	0.75
201	2A	124	63	10	6	203	169	0.73	0.47	1.20
203	2A	60	6	3	1	70	132	0.46	0.08	0.53
208	2A	257	66	7	3	333	379	0.68	0.20	0.88
209	2A	549	214	55	51	869	641	0.86	0.50	1.36
210	2A	860	353	92	60	1,365	635	1.35	0.79	2.15
213	2A	2320	1355	476	343	4,494	1,161	2.00	1.87	3.87
214	2A	1617	1121	436	341	3,515	566	2.86	3.35	6.21
215	2A	1363	893	347	277	2,880	730	1.87	2.08	3.94
218	2A	1060	516	213	152	1,941	912	1.16	0.97	2.13
219	2A	580	298	99	63	1,040	427	1.36	1.08	2.44
221	2A	1337	413	165	112	2,027	647	2.07	1.07	3.13
222	2A	916	311	136	78	1,441	413	2.22	1.27	3.49
223	2A	642	403	157	110	1,312	385	1.67	1.74	3.41
224	2A	111	47	13	11	182	49	2.26	1.45	3.71
225	2A	1460	849	298	206	2,813	635	2.30	2.13	4.43

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
227	2A	940	461	181	108	1,690	491	1.91	1.53	3.44
229	2A	239	108	31	23	401	313	0.76	0.52	1.28
230	2A	228	135	38	32	433	464	0.49	0.44	0.93
232	2A	264	153	43	25	485	380	0.69	0.58	1.28
233	2A	241	64	17	11	333	386	0.62	0.24	0.86
234	2A	171	38	11	6	226	637	0.27	0.09	0.35
235	2A	53	19	5	4	81	37	1.44	0.76	2.20
236	2A	603	303	113	51	1,070	404	1.49	1.16	2.65
237	2A	246	40	21	5	312	737	0.33	0.09	0.42
238	2A	84	18	2	3	107	98	0.86	0.24	1.10
239	2A	1523	726	247	183	2,679	1,110	1.37	1.04	2.41
240	2A	1797	1160	330	313	3,600	694	2.59	2.60	5.19
241	2A	3431	2360	742	561	7,094	1,047	3.28	3.50	6.78
242	2A	641	354	102	74	1,171	307	2.09	1.73	3.81
246	2A	2283	879	271	201	3,634	860	2.66	1.57	4.23
247	2A	730	457	160	89	1,436	263	2.77	2.68	5.45
248	2A	374	257	89	64	784	229	1.64	1.79	3.43
249	2A	1206	489	163	89	1,947	729	1.65	1.02	2.67
250	2A	320	88	12	8	428	730	0.44	0.15	0.59
251	2A	80	31	7	8	126	68	1.17	0.68	1.85
252	2A	256	95	14	14	379	735	0.35	0.17	0.52
253	2A	390	83	21	13	507	987	0.40	0.12	0.51
254	2A	506	208	54	35	803	946	0.53	0.31	0.85
255	2A	497	262	74	49	882	774	0.64	0.50	1.14
256	2A	584	216	74	42	916	654	0.89	0.51	1.40
257	2A	439	185	57	38	719	426	1.03	0.66	1.69
258	2A	872	455	200	115	1,642	381	2.29	2.02	4.31
259	2A	1437	846	286	203	2,772	546	2.63	2.45	5.08
260	2A	409	132	21	17	579	1,252	0.33	0.14	0.46
261	2A	223	92	12	8	335	796	0.28	0.14	0.42
262	2A	221	48	9	7	285	677	0.33	0.09	0.42
263	2A	453	146	39	25	663	513	0.88	0.41	1.29
264	2A	732	308	85	44	1,169	672	1.09	0.65	1.74
265	2A	500	252	72	38	862	495	1.01	0.73	1.74
266	2A	394	128	25	24	571	625	0.63	0.28	0.91
267	2A	269	93	35	11	408	472	0.57	0.29	0.86
268	2A	353	146	24	22	545	239	1.48	0.80	2.28
269	2A	269	43	11	11	334	652	0.41	0.10	0.51
270	2A	244	33	14	6	297	758	0.32	0.07	0.39
271	2A	245	65	17	8	335	646	0.38	0.14	0.52
272	2A	223	38	2	8	271	544	0.41	0.09	0.50
273	2A	498	234	54	31	817	634	0.79	0.50	1.29
274	2A	217	95	23	13	348	381	0.57	0.34	0.91
275	2A	355	96	25	9	485	777	0.46	0.17	0.62
276	2A	571	275	73	50	969	575	0.99	0.69	1.68
277	2A	1432	703	176	127	2,438	876	1.63	1.15	2.78
278	2A	318	75	16	11	420	422	0.75	0.24	1.00
279	2A	134	114	19	13	280	346	0.39	0.42	0.81
280	2A	191	87	16	7	301	676	0.28	0.16	0.45

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
281	2A	491	164	38	21	714	579	0.85	0.39	1.23
282	2A	147	19	5	4	175	780	0.19	0.04	0.22
283	2A	268	68	11	5	352	640	0.42	0.13	0.55
284	2A	308	119	14	12	453	853	0.36	0.17	0.53
285	2A	371	86	17	11	485	580	0.64	0.20	0.84
286	2A	267	72	21	9	369	458	0.58	0.22	0.81
287	2A	102	66	29	10	207	51	2.01	2.07	4.09
288	2A	308	179	29	24	540	630	0.49	0.37	0.86
289	2A	214	88	13	8	323	820	0.26	0.13	0.39
290	2A	455	152	33	17	657	666	0.68	0.30	0.99
291	2A	718	218	50	33	1,019	832	0.86	0.36	1.23
292	2A	542	310	110	55	1,017	517	1.05	0.92	1.97
293	2A	624	297	119	72	1,112	512	1.22	0.95	2.17
294	2A	308	159	41	20	528	689	0.45	0.32	0.77
295	2A	453	116	19	12	600	855	0.53	0.17	0.70
296	2A	275	102	15	9	401	675	0.41	0.19	0.59
297	2A	197	23	9	3	232	449	0.44	0.08	0.52
298	2A	714	135	44	28	921	677	1.05	0.31	1.36
299	2A	280	104	23	17	424	389	0.72	0.37	1.09
338	3A	208	116	31	15	370	472	0.44	0.34	0.78
338	3B	31	50	13	8	102	472	0.07	0.15	0.22
339	3A	159	81	31	18	289	406	0.39	0.32	0.71
339	3B	23	52	11	8	94	406	0.06	0.18	0.23
341	3A	614	337	108	79	1,138	626	0.98	0.84	1.82
341	3B	136	257	92	56	541	626	0.22	0.65	0.86
342	3A	516	289	59	52	916	374	1.38	1.07	2.45
342	3B	103	218	70	44	435	374	0.28	0.89	1.16
343	3A	466	297	93	51	907	664	0.70	0.66	1.37
343	3B	84	152	56	50	342	664	0.13	0.39	0.52
344	3A	248	168	43	30	489	190	1.31	1.27	2.58
344	3B	40	99	24	21	184	190	0.21	0.76	0.97
345	3A	345	197	54	40	636	335	1.03	0.87	1.90
345	3B	82	154	44	29	309	335	0.24	0.68	0.92
346	3A	655	428	132	81	1,296	328	2.00	1.96	3.95
346	3B	176	313	95	96	680	328	0.54	1.54	2.07
347	3A	353	105	28	20	506	434	0.81	0.35	1.17
347	3B	77	114	43	18	252	434	0.18	0.40	0.58
348	3A	510	330	70	66	976	332	1.53	1.40	2.94
348	3B	85	167	59	32	343	332	0.26	0.78	1.03
349	3A	901	523	114	92	1,630	499	1.81	1.46	3.27
349	3B	225	485	106	132	948	499	0.45	1.45	1.90
601	Metro	631	381	116	82	1,210	1,756	0.36	0.33	0.69
TOTAL		**87,844**	**35,495**	**10,577**	**7,331**	**141,247**	**83,586**	**1.05**	**0.64**	**1.69**

Area size = Total land area (not water) within the DPA, area estimates were recalculated in 2014.

Table 4. Firearm Harvest using Bonus Permits, 2016.

Managed Permit Areas.

Permit Area	Zone	Adult Female	Fawn Male	Fawn Female	Total
213	2A	643	184	166	993
214	2A	574	188	160	922
215	2A	418	158	144	720
223	2A	195	67	55	317
225	2A	384	134	93	611
227	2A	257	90	56	403
232	2A	76	13	14	103
236	2A	167	57	28	252
240	2A	577	155	164	896
241	2A	1,275	354	295	1,924
248	2A	118	38	27	183
255	2A	132	43	22	197
287	2A	41	17	8	66
292	2A	128	46	19	193
293	2A	159	57	34	250
341A	3A	217	58	43	318
341B	3B	133	41	25	199
342A	3A	189	26	33	248
342B	3B	105	25	25	155
343A	3A	200	60	35	295
343B	3B	65	33	26	124
345A	3A	107	25	21	153
345B	3B	69	20	13	102
348A	3A	197	37	33	267
348B	3B	72	24	17	113
Total		**6,498**	**1,950**	**1,556**	**10,004**

Intensive Permit Areas

Permit Area	Zone	Adult Female	Fawn Male	Fawn Female	Total
346	3A	334	107	68	509
346	3B	191	67	57	315
349	3A	385	76	70	531
349	3B	307	55	81	443
Total		**1,217**	**305**	**276**	**1,798**

Table 5. Early Antlerless Season Harvest by Permit Area, 2016.

Permit Area	Adult Female	Fawn Male	Fawn Female	Total
346	120	44	46	210
349	125	41	42	208
Total	**245**	**85**	**88**	**418**

Table 6. Summary of Firearms Special Hunts, 2016. Includes regular, youth, and bonus permits.

Area	Dates	Permits Issued	Harvest Adult Male	Adult Female	Fawn Male	Fawn Female	Total
900 Cascade River State Park	11/5-11/20	100*	0	11	0	0	11
901 -Rice Lake NWR	11/12-11/20	40*	4	5	1	3	13
902 -Saint Croix State Park	11/17-11/20	350*	37	43	11	9	100
903 -Lake Louise State Park	11/5-11/6	25***	6	13	3	5	27
904 -Gooseberry Falls State Park	11/5-11/20	30*	4	6	3	2	15
905 -Split Rock Lighthouse State Park	11/5-11/20	30*	5	3	0	0	8
906 -Tettegouche State Park	11/5-11/20	125*	4	7	1	1	13
907 -Scenic State Park	11/5-11/20	30*	1	2	1	0	4
908 -Hayes Lake State Park	11/5-11/20	50***	3	4	5	3	15
909 -Lake Bemidji State Park	11/5-11/8	30***	0	5	0	2	7
910 -Zippel Bay State Park	11/5-11/20	55***	6	16	6	4	32
911 -Judge CR Magney State Park	11/5-11/20	75*	3	3	1	1	8
912 -Schoolcraft State Park	11/5-11/20	NA†*	1	4	0	1	6
913 -Lake Carlos State Park	11/5-11/6	18**	0	5	1	4	10
914 -William O'Brien State Park	11/5-11/16	50*	11	11	4	3	29
915 -Lake Bronson State Park	11/5-11/13	30***	6	14	6	2	28
916 -Maplewood State Park	11/5-11/8	100*	31	12	5	4	52
919 -Glacial Lakes State Park	11/10-11/13	30**	1	5	3	3	12
920 -Zumbro Falls SNA	11/5-11/13	12**	0	3	2	3	8
921 -Minneopa SP	12/3-12/4, 12/10-12/11	10**	0	6	0	1	7
923 -Zumbro Falls SNA	11/19-11/27	12**	0	4	5	3	12
925A -Vermillion Highlands Research (A or B)	11/5-11/18	20*	2	4	1	0	7
927 -Whitewater State Park	11/12-11/13	140*	24	30	5	10	69
928 -Wild River SP	11/12-11/13	75*	13	20	4	1	38
929 -Frontenac State Park	11/19-11/20	55*	5	19	6	4	34
931 -City of Grand Rapids	11/5-11/20	NA†*	15	11	11	6	43
934 -Whitewater State Game Refuge	11/19-11/27	75**	0	14	2	3	19
962-Great Rivers Bluff SP	11/19-11/20	50*	1	2	0	0	3
Total			**183**	**282**	**87**	**78**	**630**

†Unlimited permits *Either sex **Antlerless Only *** Earn-A-Buck

Table 7. Free Landowner Firearms Harvest by Permit Area, 2016.

Permit Area	Adult Female	Fawn Male	Fawn Female	Total
201	2	0	1	3
209	15	4	4	23
210	14	4	3	21
213	62	17	9	88
214	71	21	20	112
215	35	15	19	69
218	10	2	2	14
219	3	1	1	5
223	4	1	0	5
225	11	4	8	23
227	6	1	0	7
229	1	0	0	1
230	3	0	1	4
232	3	1	1	5
233	3	0	1	4
236	2	1	0	3
239	27	6	13	46
240	53	16	8	77
241	84	27	19	130
242	0	0	1	1
247	4	0	1	5
248	7	1	0	8
254	1	0	0	1
255	10	2	0	12
256	8	8	6	22
257	14	9	1	24
258	4	2	2	8
259	11	1	0	12
261	3	1	0	4
263	2	2	2	6
264	17	5	2	24
265	13	2	1	16
267	9	0	0	9
268	5	1	0	6
273	1	0	0	1
276	3	0	0	3
277	6	1	1	8
287	0	0	0	0
292	7	2	0	9
293	4	1	1	6
338	1	0	1	2
338	0	0	0	0
339	5	1	1	7
339	1	0	0	1
341A	6	1	3	10
341B	13	4	5	22
342A	3	3	1	7
342B	19	4	3	26
343A	5	0	2	7
343B	8	1	2	11
344A	1	2	0	3
344B	9	2	2	13
345A	3	0	2	5
345B	5	5	0	10
346A	10	3	3	16
346B	7	4	4	15
347A	7	0	1	8
347B	3	1	0	4
348A	7	5	1	13
348B	14	1	0	15
349A	15	6	2	23
349B	13	4	2	19
601	2	1	0	3
Total	**665**	**200**	**160**	**1,025**

Table 8. Archery Harvest by Permit Area, 2016. Includes Regular, Youth, and Bonus Permits. Does not include most 900-series hunts.

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
101	7	3	0	0	10
103	10	9	1	0	20
105	18	25	3	0	46
108	21	36	4	0	61
110	29	16	1	7	53
111	6	3	0	0	9
114	3	4	0	0	7
117	0	0	0	0	0
118	17	27	0	0	44
119	2	2	0	0	4
122	4	6	1	0	11
126	6	16	0	0	22
127	0	1	1	0	2
152	4	2	0	0	6
155	57	40	8	2	107
156	70	57	10	4	141
157	124	97	15	16	252
159	61	48	9	9	127
169	41	1	0	1	43
171	31	44	7	4	86
172	103	90	11	15	219
173	26	28	5	2	61
176	45	37	5	1	88
177	17	21	1	2	41
178	58	59	9	4	130
179	99	96	15	6	216
180	43	36	3	2	84
181	48	33	6	2	89
182	97	188	36	31	352
183	44	1	1	2	48
184	144	89	24	13	270
197	26	25	3	2	56
199	6	0	0	0	6
201	6	2	0	0	8
203	1	1	0	0	2
208	8	4	1	1	14
209	34	15	5	3	57
210	26	13	5	3	47
213	169	270	44	35	518

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
250	38	27	2	0	67
251	4	5	3	0	12
252	37	28	4	1	70
253	64	47	5	3	119
254	76	37	10	4	127
255	101	121	19	7	248
256	21	14	1	4	40
257	12	11	0	2	25
258	44	30	2	12	88
259	54	41	6	2	103
260	13	11	0	0	24
261	26	11	1	0	38
262	27	23	3	0	53
263	11	6	0	1	18
264	30	16	1	2	49
265	32	23	1	6	62
266	18	12	2	2	34
267	7	5	1	2	15
268	13	7	1	0	21
269	42	11	0	2	55
270	21	16	0	2	39
271	37	11	0	2	50
272	26	1	0	1	28
273	67	35	4	3	109
274	30	16	3	4	53
275	29	36	3	1	69
276	74	38	6	3	121
277	210	173	28	13	424
278	41	31	6	3	81
279	16	12	0	2	30
280	20	14	1	1	36
281	70	53	4	1	128
282	23	9	3	1	36
283	53	32	1	2	88
284	47	16	2	3	68
285	85	47	1	4	137
286	16	27	3	0	46
287	7	2	3	0	12
288	67	61	8	3	139

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
214	138	205	31	29	403
215	238	319	45	49	651
218	161	104	25	21	311
219	118	59	14	11	202
221	122	77	15	14	228
222	69	36	8	4	117
223	175	235	47	30	487
224	23	21	5	0	49
225	171	210	51	24	456
227	237	261	54	42	594
229	79	34	3	7	123
230	46	20	2	3	71
232	49	35	5	4	93
233	55	18	6	5	84
234	37	18	1	2	58
235	11	7	2	0	20
236	194	207	42	19	462
237	18	17	0	1	36
238	8	9	0	0	17
239	105	54	10	13	182
240	124	168	32	15	339
241	251	387	55	60	753
242	89	79	12	7	187
246	102	71	13	13	199
247	72	77	16	6	171
248	37	68	8	8	121
249	73	59	17	12	161

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
289	34	22	2	2	60
290	61	26	5	5	97
291	164	71	13	7	255
292	77	90	9	14	190
293	122	112	19	21	274
294	27	22	9	1	59
295	53	35	5	13	106
296	41	24	5	4	74
297	13	3	0	0	16
298	15	9	1	1	26
299	57	56	7	3	123
338	64	30	7	3	104
339	70	42	6	4	122
341	187	202	36	18	443
342	126	119	27	17	289
343	257	325	55	28	665
344	54	16	2	3	75
345	82	72	14	9	177
346	163	234	39	39	475
347	95	32	2	3	132
348	117	121	14	16	268
349	204	265	41	45	555
601	736	950	219	154	2,059
970	27	8	1	0	36
971	60	11	1	6	78
Total	**8,828**	**8,313**	**1,430**	**1,081**	**19,652**

970 = Camp Ripley First Hunt

971 = Camp Ripley Second Hunt

Table 9. Archery Harvest using Bonus Permits by Permit Area, 2016.

Permit Area	Adult Female	Fawn Male	Fawn Female	Total
182	157	32	22	211
213	202	30	30	262
214	152	23	23	198
215	261	33	33	327
223	164	28	28	220
225	152	31	31	214
227	194	37	38	269
232	21	1	1	23
236	146	29	29	204
240	119	19	17	155
241	286	34	33	353
248	46	7	7	60
255	92	13	13	118
287	0	0	0	0
292	58	8	8	74
293	89	13	13	115
341	163	20	20	203
342	85	22	22	129
343	261	40	39	340
345	62	10	10	82
346	214	30	27	271
348	110	8	8	126
349	240	34	33	307
601	831	186	185	1202
Total	**4,105**	**688**	**670**	**5,463**

Table 10. Summary of Archery Special Hunts, 2016. Includes Regular, Youth, and Bonus Permits.

Area	Permits Issued	Dates	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
970 - Camp Ripley 1	2000*	10/20-10/21	27	8	1	0	36
971 - Camp Ripley 2	2000*	10/29-10/30	60	11	1	6	78
972 - Carleton Game Refuge	40***	11/24-12/31	2	5	0	2	9
975 - Vermillion Highlands WMA	60*	9/17-10/28, 12/12-12/31	0	6	1	0	7
976 - City of New Ulm	56***	10/15-12/31	3	39	14	11	67
977 - City of Red Wing	NA†**	9/17-12/31	6	32	4	5	47
978 - City of Redwood Falls	20*	9/17-12/31	0	12	1	0	13
979 - City of Fergus Falls	15*	9/17-12/31	0	4	0	0	4
980 - City of Duluth	400***	9/17-12/31	48	144	38	46	276
981 - City of Mankato	40***	9/17-12/31	2	4	1	0	7
982 - City of Granite Falls	10**	9/17-12/31	0	2	0	0	2
983 - City of Ortonville	30***	9/17-12/31	2	16	2	2	22
984 - City of Canby	20*	9/17-12/31	0	3	1	0	4
985 - City of Bemidji (NE)	45*	9/17-12/32	3	14	2	4	23
986 - City of Bemidji (Airport)	25*	9/17-12/33	5	9	1	1	16
988 - City of Tower & Lake Vermillion - Soudan Underground State Park	10**	11/26-12/31	1	1	0	0	2
989 - City of Hoyt Lakes	25*	9/17-12/31	3	30	2	3	38
990 - City of Owatonna	28***	11/1-12/20	2	4	5	5	16
991 - East Minnesota River Refuge	NA†**	9/17-12/31	10	16	0	2	28
992 - City of Minneota	10**	9/17-12/31	0	2	0	0	2
993 - City of Cook	25*	9/17-12/31	1	12	3	3	19

Area	Permits Issued	Dates	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
995- City of Grand Rapids	NA†*	9/17-12/32	5	37	10	5	57
997 - River Bend Nature Center	30***	11/1-11/14	8	23	6	7	44
998 - City of Red Lake Falls	10**	9/17-10/31	0	2	0	0	2
Total			**188**	**436**	**93**	**102**	**819**

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

NA† Unlimited Permits *Either sex ** Antlerless only *** Earn-A-Buck

Table 11. Free Landowner Archery Harvest by Permit Area, 2016.

Permit Area	Adult Female	Fawn Male	Fawn Female	Total
155	1	0	0	1
209	0	0	1	1
213	6	0	4	10
214	1	0	1	2
215	5	2	0	7
218	2	0	0	2
230	0	0	1	1
240	5	0	0	5
241	9	2	0	11
248	1	0	0	1
255	1	0	0	1
256	1	0	0	1
264	1	0	0	1
267	0	1	0	1
277	3	1	0	4
292	3	0	0	3
293	2	1	0	3
338	0	1	0	1
339	1	0	2	3
341	3	0	0	3
342	1	0	0	1
343	2	1	0	3
345	3	0	0	3
346	1	2	0	3
347	5	0	1	6
348	0	0	1	1
349	6	0	0	6
Total	63	11	11	85

Table 12. Muzzleloader Harvest by Permit Area, 2016.

Includes Regular, Muzzleloader, Youth, and Bonus permits. Does not include Park hunts.

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
101	15	3	0	0	18
103	7	0	0	0	7
105	16	9	1	1	27
108	14	2	0	0	16
110	11	1	0	0	12
111	3	0	0	0	3
114	0	1	0	0	1
117	0	0	0	0	0
118	10	7	0	1	18
119	6	0	0	0	6
122	1	1	0	0	2
126	3	0	0	0	3
127	0	1	0	1	2
152	2	0	0	0	2
155	11	14	3	3	31
156	14	6	2	0	22
157	27	16	4	2	49
159	7	5	1	0	13
169	18	1	0	0	19
171	11	13	0	1	25
172	24	22	6	5	57
173	6	3	0	0	9
176	18	3	0	0	21
177	13	3	0	0	16
178	12	3	2	1	18
179	24	15	5	2	46
180	8	7	3	0	18
181	14	4	0	0	18
182	12	21	3	1	37
183	5	0	0	0	5
184	43	29	3	3	78
197	12	3	3	0	18
199	1	0	0	0	1
201	9	9	1	1	20

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
249	26	28	10	5	69
250	23	20	1	1	45
251	2	2	0	0	4
252	22	13	1	0	36
253	42	19	5	2	68
254	36	53	10	6	105
255	24	52	11	5	92
256	25	10	2	3	40
257	19	15	3	2	39
258	18	32	3	10	63
259	37	57	11	8	113
260	26	4	0	0	30
261	22	17	2	0	41
262	15	3	1	0	19
263	23	17	0	1	41
264	31	32	10	2	75
265	23	44	5	1	73
266	19	10	3	3	35
267	20	14	1	0	35
268	13	16	3	0	32
269	30	7	1	0	38
270	19	1	0	0	20
271	29	6	1	0	36
272	11	3	0	0	14
273	31	35	2	3	71
274	24	23	3	3	53
275	32	10	0	1	43
276	61	67	8	6	142
277	113	159	20	14	306
278	45	17	3	2	67
279	26	29	2	2	59
280	25	11	0	0	36
281	26	24	3	4	57
282	15	6	0	0	21

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
203	1	0	0	0	1
208	14	3	0	3	20
209	34	17	3	4	58
210	32	22	2	4	60
213	120	215	46	41	422
214	48	131	40	38	257
215	73	147	45	36	301
218	64	104	23	18	209
219	33	78	12	13	136
221	29	31	11	6	77
222	21	27	5	3	56
223	44	83	16	13	156
224	1	1	0	0	2
225	30	83	19	23	155
227	39	76	20	18	153
229	14	23	3	1	41
230	10	14	7	4	35
232	17	33	12	4	66
233	14	23	4	3	44
234	14	5	0	0	19
235	5	1	0	1	7
236	24	42	9	6	81
237	19	5	0	0	24
238	2	0	0	1	3
239	58	68	14	6	146
240	59	130	28	29	246
241	97	239	43	47	426
242	16	24	6	4	50
246	50	28	7	7	92
247	21	40	6	8	75
248	31	42	8	5	86

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
283	19	10	0	1	30
284	26	13	3	2	44
285	11	4	3	0	18
286	25	9	4	0	38
287	4	7	2	1	14
288	32	32	3	0	67
289	26	14	3	2	45
290	38	18	11	4	71
291	44	25	6	3	78
292	25	53	15	9	102
293	29	49	11	7	96
294	34	25	2	1	62
295	67	16	3	2	88
296	35	18	4	3	60
297	6	0	0	0	6
298	10	4	0	1	15
299	16	8	1	2	27
338	14	19	7	5	45
339	12	11	2	2	27
341	23	81	17	10	131
342	25	72	19	19	135
343	29	71	13	10	123
344	12	29	3	4	48
345	24	58	9	5	96
346	37	107	26	22	192
347	19	23	6	4	52
348	14	54	10	11	89
349	54	126	27	25	232
601	18	24	5	2	49
TOTAL	**3,092**	**3,773**	**766**	**609**	**8,240**

Table 13. Muzzleloader Harvest using Bonus Permits by Permit Area, 2016.

Permit Area	Adult Female	Fawn Male	Fawn Female	Total
182	11	0	0	11
213	128	22	19	169
214	74	17	20	111
215	74	28	24	126
223	36	7	5	48
225	38	7	10	55
227	52	7	8	67
232	16	8	2	26
236	23	5	4	32
240	70	17	12	99
241	119	21	28	168
248	26	6	5	37
255	32	7	2	41
287	3	2	0	5
292	23	9	1	33
293	29	3	3	35
341	49	10	6	65
342	45	5	13	63
343	47	9	8	64
344	2	0	0	2
345	35	5	4	44
346	79	16	15	110
347	0	0	0	0
348	34	5	7	46
349	90	23	16	129
601	16	4	2	22
TOTAL	**1,151**	**243**	**214**	**1,608**

Table 14. Summary of Muzzleloader Special Hunts, 2016. Includes Regular, Youth, and Bonus Permits.

Area	Dates	Permits Issued	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
921 - Minneopa SP	12/3-12/4, 12/10-12/11	10**	0	6	0	1	7
935 - Jay Cook SP[1]	12/3-12/7	75*	7	10	0	1	18
936 - Crow Wing SP	12/3-12/4	25*	4	7	1	1	13
937 - Soudan Mine and Lake Vermilion SP[1]	11/26-12/11	20*	0	4	1	0	5
938 - City of Tower	11/26-12/11	20*	1	8	1	0	10
941 - Nerstrand Big Woods SP[1]	12/3-12/4	50***	1	7	2	2	12
942 - Sibley State Park[1]	11/26 - 11/27	60**	0	11	2	3	16
943 - Rice Lake State Park[1]	12/3 - 12/4	20**	0	15	3	1	19
944 - Vermillion Highlands WMA[1]	11/26-12/11	20†*	0	2	0	0	2
946 -City of Grand Rapids[1]	11/26-12/11	NA*	2	1	0	1	4
947 -Lake Bemidji State Park[1]	12/2-12/4	30*	4	4	2	1	11
948 - Savanna Portage SP	12/3-12/4	30**	0	1	0	1	2
949 - St. Croix SP	12/1-12/4	100*	2	12	3	1	18
992 - Sakatah Lake SP	12/3-12/4	15**	0	2	0	0	2
Total			**21**	**90**	**15**	**13**	**139**

[1] Bonus permits available　　**Antlerless Only　　NA† Unlimited Permits

*Either Sex　　***Earn-A-Buck

Table 15. Free Landowner Muzzleloader Harvest by Permit Area, 2016.

Permit Area	Adult Female	Fawn Male	Fawn Female	Total		Permit Area	Adult Female	Fawn Male	Fawn Female	Total
114	0	0	0	0		264	1	3	1	5
117	0	0	0	0		265	3	0	0	0
127	0	0	0	0		267	0	0	0	0
182	0	0	0	0		268	0	0	0	0
201	0	0	0	0		273	0	0	0	0
209	1	0	1	2		276	1	0	0	3
210	1	0	0	1		277	3	1	1	0
213	11	1	1	13		287	0	0	0	0
214	4	2	1	7		292	2	0	1	0
215	6	4	1	11		293	1	1	0	1
218	5	1	0	6		338A	1	0	0	5
219	2	1	0	3		338B	1	0	0	0
223	0	0	0	0		339A	1	0	0	3
225	2	0	2	4		339B	1	0	0	2
227	0	0	0	0		341A	8	1	1	1
229	2	0	0	2		341B	8	1	1	1
230	0	0	0	0		342A	0	1	0	1
232	0	0	0	0		342B	0	1	0	1
233	0	0	0	0		343A	1	0	0	10
236	0	0	0	0		343B	1	0	0	10
239	1	0	1	2		344A	2	0	0	1
240	6	0	1	7		344B	2	0	0	1
241	17	2	4	23		345A	4	0	0	1
242	0	0	0	0		345B	4	0	0	1
247	0	0	1	1		346A	3	0	2	2
248	0	0	0	0		346B	3	0	2	2
254	0	0	0	0		347A	2	0	0	4
255	0	0	0	0		347B	2	0	0	4
256	0	0	0	0		348A	3	1	1	5
257	1	0	0	1		348B	3	1	1	5
258	1	0	0	1		349A	9	0	3	2
259	0	0	0	0		349B	9	0	3	2
261	0	0	0	0		601	0	0	0	5
263	0	0	0	0		**Total**	**139**	**22**	**30**	**162**

Table 16. Summary of mentored* and youth seasons, 2016.

Permit Area	Dates	Permits Issued	Harvest Adult Male	Adult Female	Fawn Male	Fawn Female	Total
950 - Camp Ripley Archery (Youth)	10/8-10/9	175	2	0	0	0	2
951 - Afton SP	11/5-11/6	25	7	5	0	4	16
952 - Sibley State Park	10/29 - 10/30	10	6	1	0	0	7
953 - Zipple Bay SP	10/22-10/23	20	2	1	1	0	4
954 - Lake Bemidji SP	10/21-10/23	20	1	4	2	2	9
955 - Lake Alexander Preserve	10/8 - 10/9	20	0	1	0	0	1
956 - St. Croix SP (Youth)	10/29-10/30	90	5	0	3	0	8
957 - Rydell NWR	10/22-10/23	15	0	0	0	0	0
958 - Savanna Portage SP	10/29-10/30	25	2	3	0	1	6
959 - Buffalo River SP	11/5-11/6	14	0	0	0	0	0
960 - Tettegouche SP	10/29-10/30	10	1	0	0	0	1
961 - Itasca SP	10/15-10/16	75	0	0	1	0	1
963 - Kilen Woods State Park	10/22 - 10/23	6	1	2	0	1	4
965 - Banning SP	10/29-10/30	6	1	0	0	0	1
966 - Blue Mounds SP	11/19-11/20	10	2	1	0	1	4
967 - Camden SP	10/29-10/30	15	2	6	0	1	9
968 - Lake Shetek SP	11/19-11/20	12	2	5	1	1	9
159 - St Croix SP Adult	10/31-11/1	13	1	0	0	0	1
Total		**561**	**35**	**29**	**8**	**11**	**83**

* Includes special youth and adult mentored hunts

Youth Deer Season - October 20 - 23, unlimited permits.

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
101	13	10	2	2	27
105	61	48	6	6	121
111	12	15	1	1	29
114	0	0	0	0	0
201	9	2	2	0	13
203	1	2	0	1	4
208	18	13	0	2	33
209	20	17	4	2	43
256	25	11	2	5	43
257	24	9	4	2	39
260	23	23	4	4	54
263	25	18	4	1	48
264	57	29	8	4	98
267	21	13	4	0	38
268	14	19	4	2	39
338	5	4	1	0	10
339	9	5	3	1	18
341	40	14	9	4	67
342	34	12	7	6	59
343	40	9	2	4	55
344	25	2	6	9	42
345	27	12	5	3	47
346	40	7	4	5	56
347	29	10	2	3	44
348	15	12	6	4	37
349	37	9	1	1	48
601	12	5	2	1	20
Total	**636**	**330**	**93**	**73**	**1132**

Table 17. Total Deer Harvest by Permit Area, 2016. Includes all license types, permits, and special hunts.

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
101	522	70	15	12	619
103	816	137	24	6	983
105	1,072	270	42	26	1,410
108	1,206	171	35	17	1,429
110	1,097	219	39	30	1,385
111	578	66	13	11	668
114	41	11	2	1	55
117	20	4	1	1	26
118	656	93	9	6	764
119	458	7	2	1	468
122	238	86	22	5	351
126	310	88	12	4	414
127	55	31	3	7	96
152	91	11	1	1	104
155	1,372	625	153	107	2,257
156	1,652	325	70	55	2,102
157	2,646	811	239	146	3,842
159	1,341	307	85	57	1,790
169	1,654	17	6	4	1,681
171	1,212	514	135	83	1,944
172	2,009	724	182	133	3,048
173	813	188	49	32	1,082
176	1,504	266	57	27	1,854
177	730	248	50	30	1,058
178	1,783	332	77	43	2,235
179	1,840	623	141	93	2,697
180	803	265	50	24	1,142
181	1,100	213	33	26	1,372
182	506	453	121	78	1,158
183	1,372	14	5	5	1,396
184	3,130	1,137	314	224	4,805
197	1,178	195	47	33	1,453
199	120	1	0	0	121
289	274	124	18	12	428
290	554	196	49	26	825
291	926	314	69	43	1,352
292	644	453	134	78	1,309
293	775	458	149	100	1,482
294	369	206	52	22	649
295	573	167	27	27	794
296	351	144	24	16	535
297	216	26	9	3	254
298	739	148	45	30	962
299	353	168	31	22	574
338	322	219	60	31	632
339	273	192	53	34	552
341	1,000	901	263	167	2,331
342	804	724	184	139	1,851
343	876	864	222	146	2,108
344	379	315	78	67	839
345	560	497	127	87	1,271
346	1,071	1,209	340	289	2,909
347	573	285	81	48	987
348	741	691	162	129	1,723
349	1,421	1,533	330	337	3,621
601	1,397	1,360	342	239	3,338
603	168	429	144	127	868
900	0	11	0	0	11
901	4	5	1	3	13
902	37	43	11	9	100
903	6	13	3	5	27
904	4	6	3	2	15
905	5	3	0	0	8
906	4	7	1	1	13
907	1	2	1	0	4
908	3	4	5	3	15

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
201	148	76	13	7	244
203	63	9	3	2	77
208	297	86	8	9	400
209	637	263	67	60	1,027
210	919	388	99	68	1,474
213	2,609	1,840	566	419	5,434
214	1,803	1,457	507	408	4,175
215	1,674	1,359	437	362	3,832
218	1,285	724	261	191	2,461
219	731	435	125	87	1,378
221	1,488	521	191	132	2,332
222	1,006	374	149	85	1,614
223	861	721	220	153	1,955
224	135	69	18	11	233
225	1,661	1,142	368	253	3,424
227	1,216	798	255	168	2,437
229	332	165	37	31	565
230	284	169	47	39	539
232	330	221	60	33	644
233	310	105	27	19	461
234	222	61	12	8	303
235	69	27	7	5	108
236	821	552	164	76	1,613
237	283	62	21	6	372
238	94	27	2	4	127
239	1,686	848	271	202	3,007
240	1,980	1,458	390	357	4,185
241	3,779	2,986	840	668	8,273
242	746	457	120	85	1,408
246	2,435	978	291	221	3,925
247	823	574	182	103	1,682
248	442	367	105	77	991
249	1,305	576	190	106	2,177
250	381	135	15	9	540
251	86	38	10	8	142

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
909	0	5	0	2	7
910	6	16	6	4	32
911	3	3	1	1	8
912	1	4	0	1	6
913	0	5	1	4	10
914	11	11	4	3	29
915	6	14	6	2	28
916	31	12	5	4	52
919	1	5	3	3	12
920	0	3	2	3	8
921	0	6	0	1	7
923	0	4	5	3	12
925	2	4	1	0	7
927	24	30	5	10	69
928	13	20	4	1	38
929	5	19	6	4	34
931	15	11	11	6	43
934	0	14	2	3	19
935	7	10	0	1	18
936	4	7	1	1	13
937	0	4	1	0	5
938	1	8	1	0	10
939	0	3	2	1	6
941	1	7	2	2	12
942	0	11	2	3	16
943	0	15	3	1	19
944	0	2	0	0	2
946	2	1	0	1	4
947	4	4	2	1	11
948	0	1	0	1	2
949	2	12	3	1	18
950	2	0	0	0	2
951	7	5	0	4	16
952	6	1	0	0	7
953	2	1	1	0	4

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
252	315	136	19	15	485
253	496	149	31	18	694
254	618	298	74	45	1,035
255	622	435	104	61	1,222
256	655	251	79	54	1,039
257	494	220	64	44	822
258	934	517	205	137	1,793
259	1,528	944	303	213	2,988
260	471	170	25	21	687
261	271	120	15	8	414
262	263	74	13	7	357
263	512	187	43	28	770
264	850	385	104	52	1,391
265	555	319	78	45	997
266	431	150	30	29	640
267	317	125	41	13	496
268	393	188	32	24	637
269	341	61	12	13	427
270	284	50	14	8	356
271	311	82	18	10	421
272	260	42	2	9	313
273	596	304	60	37	997
274	271	134	29	20	454
275	416	142	28	11	597
276	706	380	87	59	1,232
277	1,755	1,035	224	154	3,168
278	404	123	25	16	568
279	176	155	21	17	369
280	236	112	17	8	373
281	587	241	45	26	899
282	185	34	8	5	232
283	340	110	12	8	470
284	381	148	19	17	565
285	467	137	21	15	640
286	308	108	28	9	453

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
954	1	4	2	2	9
955	0	1	0	0	1
956	5	0	3	0	8
957	0	0	0	0	0
958	2	3	0	1	6
959	0	0	0	0	0
960	1	0	0	0	1
961	0	0	1	0	1
962	1	2	0	0	3
963	1	2	0	1	4
965	1	0	0	0	1
966	2	1	0	1	4
967	2	6	0	1	9
968	2	5	1	1	9
970	27	8	1	0	36
971	60	11	1	6	78
972	2	5	0	2	9
975	0	6	1	0	7
976	3	39	14	11	67
977	6	32	4	5	47
978	0	12	1	0	13
979	0	4	0	0	4
980	48	144	38	46	276
981	2	4	1	0	7
982	0	2	0	0	2
983	2	16	2	2	22
984	0	3	1	0	4
985	3	14	2	4	23
986	5	9	1	1	16
987	0	0	0	0	0
988	1	1	0	0	2
989	3	30	2	3	38
990	2	4	5	5	16
991	10	16	0	2	28
992	0	2	0	0	2

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
287	113	75	34	11	233
288	407	272	40	27	746

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
993	1	12	3	3	19
995	5	37	10	5	57
997	8	23	6	7	44
998	0	2	0	0	2
999	0	2	1	1	4
TOTAL	**100,920**	**49,460**	**13,315**	**9,518**	**173,213**

Table 18. Estimated firearm hunter numbers, density, and harvest by Permit Area, 2016. Excludes data from all 900-series hunts.

Permit Area	Firearm Hunters	Area Size (sq mi)	Hunters/ mile^2	Harvest/ mile^2
101	2,075	496	4.2	1.2
103	2,926	1,820	1.6	0.5
105	3,980	740	5.4	1.9
108	4,524	1,651	2.7	0.9
110	4,050	528	7.7	2.6
111	2,348	1,438	1.6	0.5
114	178	116	1.5	0.5
117	132	927	0.1	0.0
118	2,945	1,220	2.4	0.6
119	2,334	770	3.0	0.6
122	1,986	603	3.3	0.6
126	1,625	941	1.7	0.4
127	518	564	0.9	0.2
152	601	61	9.8	1.7
155	7,690	593	13.0	3.8
156	8,478	825	10.3	2.5
157	12,480	673	18.6	5.7
159	7,022	571	12.3	3.1
169	6,351	1,124	5.6	1.5
171	6,493	701	9.3	2.8
172	10,442	687	15.2	4.4
173	4,677	584	8.0	1.9
176	7,092	1,113	6.4	1.7
177	3,699	480	7.7	2.2
178	8,696	1,280	6.8	1.7
179	9,537	862	11.1	3.1
180	4,592	977	4.7	1.2
181	5,523	708	7.8	1.9
182	2,555	267	9.6	4.3
183	5,889	663	8.9	2.1
184	13,507	1,229	11.0	3.9
197	5,607	954	5.9	1.5
199	446	148	3.0	0.8
201	550	161	3.4	1.5
221	5,749	642	0.3	3.6
222	4,890	413	11.8	3.9
223	3,538	375	9.4	5.2
224	819	47	17.3	4.9
225	7,514	618	12.2	5.5
227	4,674	472	9.9	5.2
229	1,495	284	5.3	2.0
230	1,478	452	3.3	1.2
232	1,360	377	3.6	1.7
233	958	385	2.5	1.2
234	759	636	1.2	0.5
235	329	34	9.8	3.2
236	3,212	370	8.7	4.4
237	1,169	728	1.6	0.5
238	360	95	3.8	1.3
239	7,814	919	8.5	3.3
240	7,773	643	12.1	6.5
241	14,462	996	14.5	8.3
242	2,833	214	13.2	6.6
246	11,265	840	13.4	4.7
247	3,788	228	16.6	7.4
248	2,102	214	9.8	4.6
249	6,173	715	8.6	3.0
250	1,506	713	2.1	0.8
251	567	55	10.3	2.6
252	1,362	715	1.9	0.7
253	2,039	974	2.1	0.7
254	2,585	929	2.8	1.1
255	2,038	774	2.6	1.6
256	2,262	654	3.5	1.6
257	2,065	412	5.0	2.0
258	4,377	343	12.8	5.2
259	7,374	490	15.1	6.1
260	1,910	1,249	1.5	0.6

Permit Area	Firearm Hunters	Area Size (sq mi)	Hunters/ mile^2	Harvest/ mile^2
203	257	83	3.1	0.9
208	1,130	414	2.7	1.0
209	2,611	639	4.1	1.6
210	4,211	615	6.8	2.4
213	10,082	1,057	9.5	5.1
214	7,386	554	13.3	7.5
215	7,002	701	10.0	5.5
218	5,834	884	6.6	2.8
219	3,661	391	9.4	3.5

Permit Area	Firearm Hunters	Area Size (sq mi)	Hunters/ mile^2	Harvest/ mile^2
261	1,016	795	1.3	0.5
262	955	677	1.4	0.5
263	1,840	512	3.6	1.5
264	3,613	669	5.4	2.1
265	2,171	494	4.4	2.0
266	1,969	617	3.2	1.0
267	1,190	472	2.5	1.1
268	1,455	228	6.4	2.8
269	1,365	650	2.1	0.7

Table 18. Continued.

Permit Area	Firearm Hunters	Area Size (sq mi)	Hunters/ $mile^2$	Harvest/ $mile^2$
270	1,056	747	1.4	0.5
271	1,130	632	1.8	0.7
272	1,130	531	2.1	0.6
273	2,803	571	4.9	1.7
274	1,208	354	3.4	1.3
275	1,980	764	2.6	0.8
276	3,246	542	6.0	2.3
277	6,844	812	8.4	3.9
278	1,929	402	4.8	1.4
279	1,247	344	3.6	1.1
280	1,401	675	2.1	0.6
281	2,493	575	4.3	1.6
282	887	778	1.1	0.3
283	1,523	613	2.5	0.8
284	1,757	837	2.1	0.7
285	2,370	549	4.3	1.2
286	1,397	446	3.1	1.0
287	1,076	46	23.5	5.1
288	1,943	625	3.1	1.2
289	1,158	815	1.4	0.5
290	2,296	662	3.5	1.2
291	3,917	800	4.9	1.7
292	3,082	479	6.4	2.7
293	2,610	511	5.1	2.9
294	1,447	686	2.1	0.9
295	2,208	839	2.6	0.9
296	1,834	667	2.8	0.8
297	1,036	438	2.4	0.6
298	3,551	618	5.7	1.6
299	1,554	386	4.0	1.5
338	2,129	454	4.7	1.4
339	1,715	393	4.4	1.4
341	5,027	612	8.2	3.8
342	3,859	349	11.1	5.3
343	4,308	663	6.5	3.2
344	2,915	189	15.4	4.4

Permit Area	Firearm Hunters	Area Size (sq mi)	Hunters/ $mile^2$	Harvest/ $mile^2$
345	2,936	322	9.1	3.9
346	4,331	318	13.6	9.2
347	2,792	434	6.4	2.3
348	3,387	332	10.2	5.2
349	6,055	490	12.3	7.4
601	2,861	1,625	1.8	2.1
Total	**446,323**	**78,855**	**5.7**	**2.2**

Note: This table excludes harvest data from all 900-series special hunts.

Area Size = Total land area (not water) within the DPA, area estimates were recalculated in 2014

Table 19. Deer harvest per square mile by season, 2016.

Permit Area	Area Size/ mi^2	Archery Harvest/ mi^2	Firearm Harvest/ mi^2	Muzzleloader Harvest/mi^2	EA Harvest /mi^2	Youth Harvest/ mi^2	Total Harvest/ mi^2	Rank
101	496	0.02	1.14	0.04	0.00	0.05	1.25	84
103	1,820	0.01	0.52	0.00	0.00	0.00	0.54	117
105	740	0.06	1.64	0.04	0.00	0.16	1.90	62
108	1,651	0.04	0.82	0.01	0.00	0.00	0.87	101
110	528	0.10	2.50	0.02	0.00	0.00	2.62	46
111	1,438	0.01	0.44	0.00	0.00	0.02	0.46	124
114	116	0.06	0.41	0.01	0.00	0.00	0.47	122
117	927	0.00	0.03	0.00	0.00	0.00	0.03	128
118	1,220	0.00	0.58	0.01	0.00	0.00	0.59	114
119	770	0.06	0.59	0.01	0.00	0.00	0.66	108
122	603	0.01	0.56	0.00	0.00	0.00	0.57	115
126	941	0.01	0.41	0.00	0.00	0.00	0.43	125
127	564	0.04	0.16	0.00	0.00	0.00	0.21	127
152	61	0.03	1.57	0.03	0.00	0.00	1.64	67
155	593	0.01	3.57	0.05	0.00	0.00	3.64	31
156	825	0.13	2.34	0.03	0.00	0.00	2.49	49
157	673	0.21	5.27	0.07	0.00	0.00	5.55	10
159	571	0.44	2.89	0.02	0.00	0.00	3.35	35
169	1,124	0.11	1.44	0.02	0.00	0.00	1.57	71
171	701	0.06	2.61	0.04	0.00	0.00	2.71	45
172	687	0.13	4.04	0.08	0.00	0.00	4.24	23
173	584	0.37	1.73	0.02	0.00	0.00	2.12	55
176	1,113	0.05	1.57	0.02	0.00	0.00	1.64	66
177	480	0.18	2.09	0.03	0.00	0.00	2.30	51
178	1,280	0.03	1.63	0.01	0.00	0.00	1.68	64
179	862	0.15	2.83	0.05	0.00	0.00	3.03	41
180	977	0.22	1.06	0.02	0.00	0.00	1.30	83
181	708	0.12	1.79	0.03	0.00	0.00	1.93	60
182	267	0.33	2.88	0.14	0.00	0.00	3.35	36
183	663	0.53	2.03	0.01	0.00	0.00	2.56	47
184	1,229	0.04	3.62	0.06	0.00	0.00	3.72	29
197	954	0.28	1.44	0.02	0.00	0.00	1.75	63

Permit Area	Area Size/ mi²	Archery Harvest/ mi²	Firearm Harvest/ mi²	Muzzleloader Harvest/mi²	EA Harvest /mi²	Youth Harvest/ mi²	Total Harvest/ mi²	Rank
199	148	0.38	0.77	0.01	0.00	0.00	1.16	89
201	161	0.04	1.26	0.12	0.00	0.08	1.50	74
203	83	0.10	0.85	0.01	0.00	0.05	1.01	98
208	414	0.00	0.80	0.05	0.00	0.08	0.94	99
209	639	0.02	1.36	0.09	0.00	0.07	1.54	72
210	615	0.09	2.22	0.10	0.00	0.00	2.41	50
213	1,057	0.04	4.25	0.40	0.00	0.00	4.70	19
214	554	0.93	6.34	0.46	0.00	0.00	7.74	5
215	701	0.57	4.11	0.43	0.00	0.00	5.11	13
218	884	0.74	2.20	0.24	0.00	0.00	3.17	37
219	391	0.79	2.66	0.35	0.00	0.00	3.80	27
221	642	0.31	3.16	0.12	0.00	0.00	3.59	32
222	413	0.55	3.49	0.14	0.00	0.00	4.17	25
223	375	0.31	3.49	0.42	0.00	0.00	4.22	24
224	47	10.29	3.85	0.04	0.00	0.00	14.18	1
225	618	0.08	4.55	0.25	0.00	0.00	4.88	15
227	472	0.97	3.58	0.32	0.00	0.00	4.87	16
229	284	2.09	1.41	0.14	0.00	0.00	3.64	30
230	452	0.27	0.96	0.08	0.00	0.00	1.31	82
232	377	0.19	1.29	0.18	0.00	0.00	1.65	65
233	385	0.24	0.87	0.11	0.00	0.00	1.22	86
234	636	0.13	0.36	0.03	0.00	0.00	0.52	118
235	34	1.72	2.40	0.21	0.00	0.00	4.33	22
236	370	0.05	2.89	0.22	0.00	0.00	3.17	38
237	728	0.63	0.43	0.03	0.00	0.00	1.10	93
238	95	0.38	1.13	0.03	0.00	0.00	1.54	73
239	919	0.02	2.92	0.16	0.00	0.00	3.09	40
240	643	0.28	5.60	0.38	0.00	0.00	6.27	8
241	996	0.34	7.12	0.43	0.00	0.00	7.89	4
242	214	3.52	5.47	0.23	0.00	0.00	9.23	2
246	840	0.22	4.33	0.11	0.00	0.00	4.66	20
247	228	0.87	6.29	0.33	0.00	0.00	7.49	6
248	214	0.80	3.66	0.40	0.00	0.00	4.86	17

Permit Area	Area Size/ mi²	Archery Harvest/ mi²	Firearm Harvest/ mi²	Muzzleloader Harvest/mi²	EA Harvest /mi²	Youth Harvest/ mi²	Total Harvest/ mi²	Rank
249	715	0.17	2.72	0.10	0.00	0.00	2.99	42
250	713	0.23	0.60	0.06	0.00	0.00	0.89	100
251	55	1.22	2.29	0.07	0.00	0.00	3.58	33
252	715	0.02	0.53	0.05	0.00	0.00	0.60	113
253	974	0.07	0.52	0.07	0.00	0.00	0.66	107
254	929	0.13	0.86	0.11	0.00	0.00	1.11	92
255	774	0.16	1.14	0.12	0.00	0.00	1.42	77
256	654	0.38	1.40	0.06	0.00	0.07	1.91	61
257	412	0.10	1.74	0.09	0.00	0.09	2.03	58
258	343	0.07	4.79	0.18	0.00	0.00	5.05	14
259	490	0.18	5.66	0.23	0.00	0.00	6.07	9
260	1,249	0.08	0.46	0.02	0.00	0.04	0.61	111
261	795	0.03	0.42	0.05	0.00	0.00	0.50	120
262	677	0.06	0.42	0.03	0.00	0.00	0.50	119
263	512	0.10	1.29	0.08	0.00	0.09	1.57	70
264	669	0.03	1.75	0.11	0.00	0.15	2.03	57
265	494	0.10	1.74	0.15	0.00	0.00	1.99	59
266	617	0.10	0.93	0.06	0.00	0.00	1.08	95
267	472	0.07	0.86	0.07	0.00	0.08	1.09	94
268	228	0.07	2.39	0.14	0.00	0.17	2.76	44
269	650	0.03	0.51	0.06	0.00	0.00	0.60	112
270	747	0.07	0.40	0.03	0.00	0.00	0.50	121
271	632	0.06	0.53	0.06	0.00	0.00	0.65	109
272	531	0.09	0.51	0.03	0.00	0.00	0.63	110
273	571	0.05	1.43	0.12	0.00	0.00	1.60	69
274	354	0.31	0.98	0.15	0.00	0.00	1.44	76
275	764	0.07	0.63	0.06	0.00	0.00	0.76	104
276	542	0.13	1.79	0.26	0.00	0.00	2.18	54
277	812	0.15	3.00	0.38	0.00	0.00	3.53	34
278	402	1.06	1.05	0.17	0.00	0.00	2.27	53
279	344	0.24	0.81	0.17	0.00	0.00	1.22	85
280	675	0.04	0.45	0.05	0.00	0.00	0.54	116
281	575	0.06	1.24	0.10	0.00	0.00	1.40	78

Permit Area	Area Size/ mi²	Archery Harvest/ mi²	Firearm Harvest/ mi²	Muzzleloader Harvest/mi²	EA Harvest /mi²	Youth Harvest/ mi²	Total Harvest/ mi²	Rank
282	778	0.16	0.22	0.03	0.00	0.00	0.42	126
283	613	0.06	0.57	0.05	0.00	0.00	0.68	106
284	837	0.11	0.54	0.05	0.00	0.00	0.70	105
285	549	0.12	0.88	0.03	0.00	0.00	1.04	97
286	446	0.31	0.83	0.09	0.00	0.00	1.22	87
287	46	0.00	4.53	0.31	0.00	0.00	4.83	18
288	625	0.07	0.86	0.11	0.00	0.00	1.05	96
289	815	0.01	0.40	0.06	0.00	0.00	0.47	123
290	662	0.21	0.99	0.11	0.00	0.00	1.31	81
291	800	0.07	1.27	0.10	0.00	0.00	1.45	75
292	479	0.20	2.12	0.21	0.00	0.00	2.54	48
293	511	0.50	2.17	0.19	0.00	0.00	2.86	43
294	686	0.28	0.77	0.09	0.00	0.00	1.14	91
295	839	0.33	0.72	0.10	0.00	0.00	1.15	90
296	667	0.09	0.60	0.09	0.00	0.00	0.78	103
297	438	0.24	0.53	0.01	0.00	0.00	0.78	102
298	618	0.12	1.49	0.02	0.00	0.00	1.64	68
299	386	0.04	1.10	0.07	0.00	0.00	1.21	88
338	454	0.23	1.04	0.10	0.00	0.02	1.39	80
339	393	0.31	0.97	0.07	0.00	0.05	1.40	79
341	612	0.72	2.74	0.21	0.00	0.11	3.79	28
342	349	0.83	3.87	0.39	0.00	0.17	5.25	11
343	663	1.00	1.88	0.19	0.00	0.08	3.16	39
344	189	0.40	3.55	0.25	0.00	0.22	4.42	21
345	322	0.55	2.93	0.30	0.00	0.15	3.92	26
346	318	1.49	6.22	0.60	0.66	0.18	9.15	3
347	434	0.30	1.75	0.12	0.00	0.10	2.27	52
348	332	0.81	3.98	0.27	0.00	0.11	5.16	12
349	490	1.13	5.26	0.47	0.42	0.10	7.38	7
601	1,625	1.27	0.74	0.03	0.00	0.01	2.05	56
Total	**78,855**	**0.25**	**1.79**	**0.10**	**0.01**	**0.01**	**2.16**	

Note: This table excludes harvest data from all 900- series special hunts

Area Size = Total land area (not water) within the DPA, area estimates were recalculated in 2014

EA harvest is reported based on total permit area; in some scenarios may be sub-unit designation.

Table 20. Harvest using Depredation Permits, by Permit Area, 2016.

Permit Area	Adult Female	Fawn Male	Fawn Female	Total
156	8	3	0	11
TOTAL	**8**	**3**	**0**	**11**

Table 21. 2016 Firearm Lottery Distribution Report.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
101	1	162	3	162	0	**297**
	2	162	0	102	60	
	3	143	1	0	143	
	4	93	0	0	93	
	6	1	0	0	1	
		561	**4**	**264**	**297**	
105	1	424	5	424	0	**494**
	2	374	2	374	0	
	3	433	2	224	209	
	4	284	1	0	284	
	9	1	0	0	1	
		1516	**10**	**1022**	**494**	
108	1	448	0	448	0	**99**
	2	285	1	285	0	
	3	209	1	209	0	
	4	221	1	221	0	
	5	167	0	126	41	
	6	58	1	0	58	
		1388	**4**	**1289**	**99**	
110	1	565	2	565	0	**347**
	2	661	6	661	0	
	3	647	1	303	344	
	4	3	0	0	3	
		1876	**9**	**1529**	**347**	
111	1	249	1	249	0	**99**
	2	234	0	234	0	
	3	231	0	161	70	
	4	29	0	0	29	
		743	**1**	**644**	**99**	
118	1	333	1	333	0	**98**
	2	236	0	236	0	
	3	222	0	222	0	
	4	183	0	109	74	
	5	23	0	0	23	
	6	1	0	0	1	

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
		998	**1**	**900**	**98**	
122	1	382	0	243	139	**497**
	2	293	2	0	293	
	3	60	0	0	60	
	4	3	0	0	3	
	5	1	0	0	1	
	9	1	0	0	1	
		740	**2**	**243**	**497**	
126	1	421	0	0	308	**393**
	2	83	0	0	83	
	3	2	0	0	2	
		506	**0**	**0**	**393**	
155	1	1527	1	1527	0	**1972**
	2	1278	1	265	1013	
	3	954	14	0	954	
	4	5	0	0	5	
		3764	**16**	**1792**	**1972**	
156	1	971	5	971	0	**296**
	2	1063	2	1063	0	
	3	1238	6	944	294	
	5	1	0	0	1	
	9	1	0	0	1	
		3274	**13**	**2978**	**296**	
157	1	2686	9	2465	221	**2460**
	2	2178	8	0	2178	
	3	52	0	0	52	
	4	6	0	0	6	
	9	3	0	0	3	
		4925	**17**	**2465**	**2460**	
159	1	930	5	930	0	**493**
	2	944	2	944	0	
	3	731	5	239	492	
	4	1	0	0	1	
		2606	**12**	**2113**	**493**	
171	1	819	0	819	0	**1481**
	2	929	7	929	0	

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
	3	1195	5	181	1014	
	4	466	1	0	466	
	5	1	0	0	1	
		3410	**13**	**1929**	**1481**	
172	1	1672	4	1672	0	**1965**
	2	1415	4	1415	0	
	3	1901	5	604	1297	
	4	667	5	0	667	
	7	1	0	0	1	
		5656	**18**	**3691**	**1965**	
173	1	616	4	616	0	**296**
	2	720	10	720	0	
	3	738	4	448	290	
	4	6	0	0	6	
		2080	**18**	**1784**	**296**	
176	1	1643	6	1643	0	**495**
	2	1159	2	947	212	
	3	266	1	0	266	
	4	16	0	0	16	
	9	1	0	0	1	
		3085	**9**	**2590**	**495**	
177	1	974	5	855	119	**888**
	2	669	4	0	669	
	3	71	1	0	71	
	4	18	0	0	18	
	5	10	0	0	10	
	6	1	0	0	1	
		1743	**10**	**855**	**888**	
178	1	3089	11	3058	31	**495**
	2	354	0	0	354	
	3	91	0	0	91	
	4	16	0	0	16	
	5	1	0	0	1	
	9	2	0	0	2	
		3553	**11**	**3058**	**495**	
179	1	1256	2	1256	0	**1484**
	2	1350	4	1309	41	

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	**Rejected**			
	3	1441	4	0	1441	
	4	2	2	0	2	
		4049	**12**	**2565**	**1484**	
180	1	1123	6	10	1113	**1475**
	2	340	2	0	340	
	3	20	0	0	20	
	4	1	0	0	1	
	9	1	0	0	1	
		1485	**8**	**10**	**1475**	
181	1	1658	6	1608	50	**296**
	2	195	0	0	195	
	3	46	0	0	46	
	4	5	0	0	5	
		1904	**6**	**1608**	**296**	
184	1	2917	11	2022	895	**4932**
	2	3099	14	0	3099	
	3	931	8	0	931	
	4	5	0	0	5	
	9	2	0	0	2	
		6954	**33**	**2022**	**4932**	
197	1	669	1	669	0	**495**
	2	694	4	694	0	
	3	988	8	733	255	
	4	240	1	0	240	
		2591	**14**	**2096**	**495**	
203	1	38	0	38	0	**25**
	2	46	0	30	16	
	3	8	0	0	8	
		92	**0**	**68**	**24**	
208	1	149	4	49	100	**292**
	2	135	2	0	135	
	3	57	3	0	57	
		341	**9**	**49**	**292**	
221	1	1149	5	1230	259	**1462**
	2	1176	3	0	1176	
	3	25	0	0	25	
	4	2	0	0	2	

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
		2352	**8**	**1230**	**1462**	
222	1	1640	3	682	958	**1464**
	2	488	3	0	488	
	3	16	0	0	16	
	4	2	0	0	2	
		2146	**6**	**682**	**1464**	
224	1	185	0	116	69	**149**
	2	78	0	0	78	
	3	2	0	0	2	
		265	**0**	**116**	**149**	
234	1	238	1	169	69	**93**
	2	24	0	0	24	
		262	**1**	**169**	**93**	
235	1	76	0	30	46	**125**
	2	12	0	0	12	
	3	3	0	0	3	
	4	1	0	0	1	
		92	0	30	62	
		184	**0**	**60**	**124**	
237	1	187	0	187	0	**48**
	2	135	2	96	39	
	3	9	1	0	9	
		331	**3**	**283**	**48**	
238	1	56	0	56	0	**49**
	2	68	1	21	47	
	3	2	0	0	2	
		126	**1**	**77**	**49**	
246	1	1918	2	1918	0	**2943**
	2	1806	12	1000	806	
	3	2128	7	0	2128	
	4	4	0	0	4	
	5	3	0	0	3	
	6	1	0	0	1	
	9	1	0	0	1	
		5861	**21**	**2918**	**2943**	
249	1	1913	6	1576	337	**1479**
	2	1117	8	0	1117	

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
	3	21	0	0	21	
	4	4	0	0	4	
		3055	**14**	**1576**	**1479**	
250	1	307	1	307	0	**277**
	2	296	2	78	218	
	3	58	0	0	58	
	4	1	0	0	1	
		662	**3**	**385**	**277**	
251	1	116	0	88	28	**196**
	2	119	1	0	119	
	3	48	0	0	48	
	4	1	0	0	1	
		284	**1**	**88**	**196**	
252	1	363	0	217	146	**361**
	2	207	0	0	207	
	3	8	0	0	8	
		578	**0**	**217**	**361**	
253	1	359	0	359	0	**263**
	2	356	3	258	98	
	3	164	0	0	164	
	4	1	0	0	1	
		880	**3**	**617**	**263**	
260	1	203	1	0	203	**574**
	2	173	1	0	173	
	3	187	1	0	187	
	4	1	0	0	1	
		564	**3**	**0**	**564**	
262	1	193	1	193	0	**141**
	2	142	0	35	107	
	3	34	0	0	34	
		369	**1**	**228**	**141**	
266	1	280	1	280	0	**477**
	2	266	0	15	251	
	3	225	0	0	225	
	4	1	0	0	1	
		772	**1**	**295**	**477**	
269	1	255	0	255	0	**136**

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
	2	251	2	159	92	**136**
	3	43	4	0	43	
	5	1	0	0	1	
		550	**6**	**414**	**136**	
270	1	143	0	143	0	**23**
	2	131	0	131	0	
	3	104	0	81	23	
		378	**0**	**355**	**23**	
271	1	262	6	209	53	**228**
	2	170	3	0	170	
	3	5	0	0	5	
		437	**9**	**209**	**228**	
272	1	262	2	169	0	**97**
	2	165	0	165	0	
	3	135	3	40	95	
	4	1	0	0	1	
	9	1	0	0	1	
		471	**5**	**374**	**97**	
274	1	276	1	276	0	**307**
	2	237	0	6	231	
	3	75	0	0	75	
	4	1	0	0	1	
		589	**1**	**282**	**307**	
275	1	314	1	314	0	**233**
	2	447	1	313	134	
	3	96	1	0	96	
	4	3	0	0	3	
		860	**3**	**627**	**233**	
278	1	278	1	278	0	**179**
	2	293	1	293	0	
	3	314	2	147	167	
	4	12	1	0	12	
	6	0	2	0	0	
		897	**7**	**718**	**179**	
279	1	491	1	117	374	**520**
	2	138	0	0	138	
	3	8	0	0	8	

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
		637	**1**	**117**	**520**	
280	1	272	0	272	0	**188**
280	2	288	2	133	155	**188**
	3	29	0	0	29	
	4	3	0	0	3	
	9	1	0	0	1	
		593	**2**	**405**	**188**	
281	1	230	1	435	95	**628**
	2	365	0	0	365	
	3	161	0	0	161	
	4	5	1	0	5	
	9	2	0	0	2	
		1063	**2**	**435**	**628**	
282	1	84	0	84	0	**24**
	2	70	0	70	0	
	3	37	0	34	3	
	4	21	0	0	21	
		212	**0**	**188**	**24**	
283	1	245	1	245	0	**188**
	2	245	2	217	28	
	3	159	0	0	159	
	4	1	1	0	1	
		650	**4**	**462**	**188**	
284	1	329	2	329	0	**284**
	2	350	2	212	138	
	3	142	0	0	142	
	4	2	0	0	2	
	5	2	0	0	2	
		825	**4**	**541**	**284**	
285	1	448	6	448	0	**279**
	2	717	0	453	264	
	3	15	0	0	15	
	4	0	1	0	0	
		1180	**7**	**901**	**279**	
286	1	340	2	340	0	**93**
	2	148	0	66	82	
	3	11	0	0	11	

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
		499	**2**	**406**	**93**	
288	1	496	1	402	94	**462**
	2	349	2	0	349	
	3	16	0	0	16	
	4	3	0	0	3	
		864	**3**	**402**	**462**	
289	1	237	1	99	138	**407**
	2	237	1	0	237	
	3	30	0	0	30	
	4	2	0	0	2	
		506	**2**	**99**	**407**	
290	1	433	1	397	0	**358**
	2	465	5	0	68	
	3	287	2	0	287	
	4	2	1	0	2	
	9	1	0	0	1	
		1188	**9**	**397**	**358**	
291	1	852	1	852	0	**725**
	2	821	2	342	479	
	3	245	2	0	245	
	5	1	0	0	1	
		1919	**5**	**1194**	**725**	
294	1	431	1	147	284	**453**
	2	164	0	0	164	
	3	5	1	0	5	
		600	**2**	**147**	**453**	
295	1	360	0	360	0	**266**
	2	341	1	290	51	
	3	215	2	0	215	
		916	**3**	**650**	**266**	
296	1	323	0	323	0	**265**
	2	283	2	224	59	
	3	205	1	0	205	
	5	1	0	0	1	
		812	**3**	**547**	**265**	
297	1	133	1	133	0	**98**
	2	120	0	73	47	

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
	3	51	1	0	51	
		304	**2**	**206**	**98**	
298	1	382	2	382	0	**586**
	2	364	1	350	14	
	3	442	2	0	442	
	4	129	0	0	129	
	9	1	0	0	1	
		1318	**5**	**732**	**586**	
299	1	368	0	368	0	**354**
	2	362	3	23	339	
	3	13	2	0	13	
	4	2	0	0	2	
		745	**5**	**391**	**354**	
TOTAL		**97,056**	**406**	**57,298**	**39,552**	**39,646**

Table 22. 2016 Muzzleloader Lottery Distribution Report.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
101	1	3	0	3	0	**3**
	2	2	0	0	2	
	3	1	0	0	1	
		6	0	**3**	**3**	
103	1	6	0	6	0	**3**
	2	3	0	3	0	
	3	6	0	3	3	
		15	0	**12**	**3**	
105	1	8	0	8	0	**6**
	2	7	0	3	4	
	3	2	0	0	2	
		17	0	**11**	**6**	
108	1	10	0	10	0	**1**
	2	2	0	2	0	
	3	2	0	2	0	
	4	3	0	2	1	
		17	0	**16**	**1**	
110	1	7	0	7	0	**3**
	2	2	0	2	0	
	3	5	0	2	3	
		14	0	**11**	**3**	
111	1	2	0	2	0	**1**
	2	2	0	1	1	
		4	0	**3**	**1**	
118	1	12	0	12	0	**2**
	2	2	0	2	0	
	3	1	0	1	0	
	4	2	0	0	2	
		17	0	**15**	**2**	
122	1	4	0	1	3	**3**
		14	0	**1**	**3**	
126	1	9	0	2	7	**7**
		9	0	**2**	**7**	
155	1	34	0	25	9	**28**
	2	13	0	0	13	
	3	6	0	0	6	

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
		53	0	**25**	**28**	
157	1	59	0	39	20	**40**
	2	16	0	0	16	
	3	4	0	0	4	
		79	0	**39**	**40**	
159	1	22	0	22	0	**7**
	2	11	0	8	3	
	3	4	0	0	4	
		37	0	**30**	**7**	
172	1	47	0	47	0	**35**
	2	29	0	16	13	
	3	20	0	0	20	
	4	2	0	0	2	
		98	0	**63**	**35**	
173	1	11	0	11	0	**4**
	2	10	0	10	0	
	3	4	0	0	4	
		25	0	**21**	**4**	
176	1	22	0	22	0	**5**
	2	7	0	2	5	
		29	0	**24**	**5**	
177	1	17	0	12	5	**12**
	2	5	0	0	5	
	3	1	0	0	1	
	4	1	0	0	1	
		24	0	**12**	**12**	
179	1	28	0	27	1	**16**
	2	11	0	0	11	
	3	4	0	0	4	
		43	0	**27**	**16**	
180	1	21	0	0	21	**25**
	2	4	0	0	4	
		25	0	**0**	**25**	
180	1	22	0	22	0	**4**
	2	6	0	2	4	
		28	0	**24**	**4**	
184	1	48	0	27	21	**68**
	2	42	0	0	42	

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
	3	5	0	0	5	
		95	0	**27**	**68**	
197	1	9	0	9	0	**5**
	2	5	0	5	0	
	3	10	0	5	5	
		24	0	**19**	**5**	
203	1	2	0	2	0	**1**
	2	1	0	0	1	
		3	0	**2**	**1**	
208	1	7	0	1	6	**8**
	2	2	0	0	2	
		9	0	**1**	**8**	
221	1	49	0	31	18	**38**
	2	20	0	0	20	
		69	0	**31**	**38**	
222	1	43	0	15	28	**36**
	2	8	0	0	8	
		51	0	**15**	**36**	
224	1	2	0	1	1	**1**
		2	0	**1**	**1**	
234	1	17	0	11	6	**7**
	2	1	0	0	1	
		18	0	**11**	**7**	
235	1	14	0	3	11	**13**
	2	1	0	0	1	
	3	1	0	0	1	
		16	0	**3**	**13**	
237	1	11	0	11	0	**2**
	2	5	0	3	2	
		16	0	**14**	**2**	
238	1	1	0	1	0	**1**
	2	1	0	0	1	
		2	0	**1**	**1**	
246	1	66	0	63	3	**66**
	2	49	0	0	49	
	3	14	0	0	14	
		129	0	**63**	**66**	
249	1	33	0	22	11	**21**

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
	2	10	0	0	10	
		43	0	**22**	**21**	
250	1	26	0	26	0	**23**
	2	23	0	2	21	
	3	2	0	0	2	
		51	0	**28**	**23**	
251	1	4	0	2	2	**4**
	2	2	0	0	2	
		6	0	**2**	**4**	
252	1	42	0	18	24	**39**
	2	15	0	0	15	
		57	0	**18**	**39**	
253	1	61	0	61	0	**37**
	2	38	0	11	27	
	3	10	0	0	10	
		109	0	**72**	**37**	
260	1	12	0	0	12	**26**
	2	7	0	0	7	
	3	5	0	0	5	
		24	0	**0**	**24**	
262	1	8	0	8	0	**9**
	2	12	0	4	8	
	3	1	0	0	1	
		21	0	**12**	**9**	
266	1	18	0	12	6	**23**
	2	13	0	0	13	
	3	4	0	0	4	
		35	0	**12**	**23**	
269	1	33	0	33	0	**14**
	2	18	0	4	14	
		51	0	**37**	**14**	
270	1	15	0	15	0	**2**
	2	10	0	10	0	
	3	9	0	7	2	
		34	0	**32**	**2**	
271	1	25	0	17	8	**22**
	2	14	0	0	14	
		39	0	**17**	**22**	

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
272	1	9	0	9	0	**3**
	2	5	0	4	1	
	3	2	0	0	2	
		16	0	**13**	**3**	
274	1	40	0	29	11	**43**
	2	32	0	0	32	
		72	0	**29**	**43**	
275	1	28	0	28	0	**17**
	2	29	0	14	15	
	3	2	0	0	2	
		59	0	**42**	**17**	
278	1	35	0	35	0	**21**
	2	39	0	39	0	
	3	21	0	0	21	
		95	0	**74**	**21**	
278	1	79	0	5	74	**80**
	2	6	0	0	6	
		85	0	**5**	**80**	
280	1	24	0	24	0	**12**
	2	12	0	0	12	
		36	0	**24**	**12**	
281	1	63	0	37	26	**72**
	2	43	0	0	43	
	3	2	0	0	2	
	9	1	0	0	1	
		109	0	**37**	**72**	
282	1	5	0	5	0	**1**
	2	2	0	2	0	
	3	1	0	1	0	
	4	1	0	1	0	
	5	1	0	0	1	
		10	**0**	**9**	**1**	
283	1	19	0	19	0	**12**
	2	13	0	9	4	
	3	8	0	0	8	
		40	0	**28**	**12**	
284	1	21	0	21	0	**16**
	2	18	0	6	12	

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
	3	4	0	0	4	
		43	0	**27**	**16**	
285	1	48	0	48	0	**21**
	2	34	0	14	20	
	3	1	0	0	1	
		83	0	**62**	**21**	
286	1	30	0	29	1	**7**
	2	6	0	0	6	
		36	0	**29**	**7**	
288	1	43	0	28	15	**38**
	2	23	0	0	23	
		66	0	**28**	**38**	
289	1	28	0	5	23	**43**
	2	18	0	0	18	
	3	2	0	0	2	
		48	0	**5**	**43**	
290	1	59	0	59	0	**42**
	2	50	0	24	26	
	3	16	0	0	16	
		125	0	**83**	**42**	
291	1	96	0	96	0	**75**
	2	72	0	8	64	
	3	11	0	0	11	
		179	0	**104**	**75**	
294	1	43	0	9	34	**47**
	2	12	0	0	12	
	4	1	0	0	1	
		56	0	**9**	**47**	
295	1	47	0	47	0	**34**
	2	35	0	23	12	
	3	22	0	0	22	
		104	0	**70**	**34**	
296	1	49	0	49	0	**35**
	2	38	0	12	26	
	3	9	0	0	9	
		96	0	**61**	**35**	
297	1	5	0	4	1	**2**
	3	1	0	0	1	

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
		6	0	**4**	**2**	
298	1	11	0	11	0	**14**
	2	13	0	6	7	
	3	7	0	0	7	
		31	0	**17**	**14**	
299	1	53	0	40	13	**46**
	2	33	0	0	33	
		86	0	**40**	**46**	
TOTAL		**2,930**	**0**	**1,577**	**1,343**	**1,352**

Table 23. 2016 Special Permit Areas for Firearms Hunters.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
900 - Cascade River SP	1	8	5	0	8	**8**
		8	**0**	**0**	**8**	
901 - Rice Lake NWR	1	40	23	28	12	**40**
	2	25	14	0	25	
	3	3	1	0	3	
		68	**38**	28	**40**	
902 - St. Croix SP	1	405	184	236	169	**350**
	2	173	86	0	173	
	3	8	6	0	8	
	9	1	1	0	1	
		587	**277**	**236**	**351**	
903 - Lake Louise SP	1	44	21	44	0	**25**
	2	15	11	15	0	
	3	26	11	1	25	
		85	**43**	**60**	**25**	
904 - Gooseberry Falls SP	1	35	0	11	24	**30**
	2	6	0	0	6	
		41	**0**	**0**	**30**	
905 - Split Rock Lighthouse SP	1	31	0	7	24	**30**
	2	6	0	0	6	
		37	**0**	**0**	**30**	
906 - Tettegouche SP	1	83	0	0	83	**125**
	2	3	0	0	3	
		86	**0**	**0**	**86**	
907 - Scenic SP	1	36	0	12	24	**30**
	2	5	0	0	5	
	3	1	0	0	1	
		42	**0**	**0**	**30**	
908 - Hayes Lake SP	1	44	41	0	44	**50**
	2	4	4	0	4	
		48	**45**	**0**	**48**	
909 - Lake Bemidji SP	1	32	0	8	24	**30**
	2	4	0	0	4	
	3	2	0	0	2	
		38	**0**	**8**	**30**	

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
910 - Zippel Bay SP	1	63	0	16	47	**55**
	2	6	0	0	6	
	3	2	0	0	2	
		71	**0**	**16**	**55**	
911 - Judge CR Magney SP	1	5	0	0	5	**75**
	2	1	0	0	1	
		6	**0**	**0**	**6**	
913 - Lake Carlos SP	1	23	0	4	19	**18**
	2	2	0	0	2	
		25	**0**	**4**	**21**	
914 - William O'Brien SP	1	82	0	82	0	**50**
	2	29	0	2	27	
	3	25	0	0	25	
		136	**0**	**84**	**52**	
915 - Lake Bronson SP	1	47	35	35	12	**30**
	2	18	15	0	18	
	3	3	3	0	3	
		68	**53**	**35**	**33**	
916 - Maplewood SP	1	168	0	168	0	**100**
	2	113	0	113	0	
	3	77	0	13	64	
	4	34	0	0	34	
	9	2	0	0	2	
		394	**0**	**294**	**100**	
919 - Glacial Lakes SP	1	34	0	5	29	**30**
	2	4	0	0	4	
		38	**0**	**5**	**33**	
920 - Zumbro Falls SNA	1	16	0	10	6	**12**
	2	6	0	0	6	
		22	**0**	**10**	**12**	
923 - Zumbro Falls SNA	1	9	0	0	9	**9**
		9	**0**	**0**	**9**	
925 - Vermillion Highlands WMA	1	53	0	53	0	**20**
	2	33	0	33	0	
	3	17	0	0	17	

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
	4	2	0	0	2	
	9	1	0	0	1	
		106	**0**	**0**	**20**	
927A - Elm Creek Park Reserve	1	261	0	0		**137**
	2	207	0	261	69	
	3	65	0	138	65	
	4	4	0	0	4	
	9	1	0	0	1	
		538	**0**	**399**	**139**	
927B - Elm Creek Park Reserve	1	7	0	7	0	**3**
	2	2	0	0	2	
	4	1	0	0	1	
		10	**0**	**7**	**3**	
928 - Wild River SP	1	247	0	247	0	**75**
	2	96	0	57	39	
	3	33	0	0	33	
	4	3	0	0	3	
		379	**0**	**304**	**75**	
929 - Frontenac SP	1	86	0	69	17	**55**
	2	35	0	0	35	
	3	3	0	0	3	
		124	**0**	**69**	**55**	
931 - City of Grand Rapids	1	62	0	0	62	**74**
	2	11	0	0	11	
	4	1	0	0	1	
		74	**0**	**0**	**74**	

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
934 - Whitewater State Game Refuge	1	116	0	62	54	**75**
	2	21	0	0	21	
		137	**0**	**62**	**75**	
962- Great Rivers Bluff SP	1	70	0	41	29	**50**
	2	16	0	0	16	
	3	6	0	0	6	
		92	**0**	**41**	**51**	
TOTAL		**3,269**	**456**	**1,662**	**1,491**	**1,586**

Table 24. 2016 Special Permit Areas for Muzzleloader Hunts.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
921 - Minneopa SP	1	16	0	15	1	**10**
	2	5	0	0	5	
	3	4	0	0	4	
		25	0	**15**	**10**	
935 - Jay Cook SP	1	78	0	78	0	**75**
	2	84	0	10	74	
	3	2	0	0	2	
		164	**0**	**88**	**76**	
936 - Crow Wing SP	1	30	0	30	0	**25**
	2	17	0	7	10	
	3	15	0	0	15	
	9	1	0	0	1	
		63	**0**	**37**	**26**	
937 - Lake Vermillion SP	1	23	0	19	4	**20**
	2	16	0	0	16	
		39	**0**	**19**	**20**	
938 - City of Tower	1	11	0	0	11	**20**
	2	2	0	0	2	
	3	1	0	0	1	
		14	0	**0**	**14**	
941 - Nestrand Big Woods SP	1	95	0	95	0	**50**
	2	68	0	68	0	
	3	48	0	6	42	
	4	9	0	0	9	
	5	1	0	0	1	
		221	**0**	**169**	**52**	
942 - Sibley SP	1	98	0	89	9	**60**
	2	44	0	0	44	
	3	8	0	0	8	
	4	1	0	0	1	
		151	**0**	**89**	**62**	
943 - Rice Lake SP	1	39	0	39	0	**20**

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
	2	31	0	16	15	
	3	4	0	0	4	
	9	1	0	0	1	
		75	**0**	**55**	**20**	
944 - Vermillion Highlands WMA	1	28	0	28	0	**20**
	2	23	0	5	18	
	3	5	0	0	5	
		56	**0**	**33**	**23**	
946 - City of Grand Rapids	1	12	0	0	12	**14**
	2	2	0	0	2	
		14	**0**	**0**	**14**	
947 - Lake Bemidji SP	1	19	0	0	19	**30**
	2	3	0	0	3	
		22	**0**	**0**	**22**	
948 - Savanna Portage	1	11	0	0	11	**30**
	2	17	0	0	17	
		28	**0**	**0**	**28**	
949 - St. Croix SP	1	81	0	4	77	**100**
	2	19	0	0	19	
	3	4	0	0	4	
		104	**0**	**4**	**100**	
992 - Sakatah Lake SP	1	21	0	18	3	**15**
	2	8	0	0	8	
	3	6	0	0	6	
		35	**0**	**18**	**17**	
TOTAL		**1,011**	**0**	**527**	**484**	**489**

GRAND TOTAL		**104,266**	**862**	**61,064**	**42,840**	**43,073**

2016 MINNESOTA ELK HARVEST REPORT

Adam Murkowski, Big Game Program Leader

Ruth Anne Franke, Area Wildlife Supervisor (Karlstad)

Jason Wollin, Asst. Area Wildlife Manager (Karlstad)

Joel Huener, Wildlife Area Supervisor (Thief Lake)

INTRODUCTION

A limited number of licenses are offered to Minnesota residents to hunt elk. In 2016, there were two established zones: 1) Zone 20 - Kittson County Central and 2) Zone 30 - Kittson County Northeast (Figure 1). Zone 10, near Grygla, Minnesota, has been closed since 2013 because the population is below goal (Figure 2). In 2016, there was one regular season hunt (September 10-18) held in both zones. The hunt was structured to fall within the breeding season when bull elk are most vulnerable and elk can be located by vocalizations.

METHODS

All elk hunters are required to attend a mandatory orientation session the day before the hunt begins. At this session, DNR staff also provide hunters with their license, and a kit to collect biological samples from their harvested animal. Field samples collected by the hunter include whole blood, hair with skin, ticks (if found), and the whole liver. Hunters must register their animal in person at the local DNR office. DNR staff map the harvest location, provide a possession tag, and take the hunter-collected biological samples. DNR staff also collect lymph nodes, the obex (brain stem), and a tooth so an accurate age can be determined at a later date. DNR staff submit all biological samples to Wildlife Health for disease testing and other monitoring projects.

RESULTS

A total of 7 licenses were available and 1,827 individuals or parties applied for the opportunity to hunt elk (Table 1). A first random drawing was held for landowners who applied for the one landowner license available in Zone 20. All remaining landowners were then placed into the general drawing for remaining elk licenses. Licenses were distributed through a second random drawing conducted per Zone. In 2016, a total of 5 elk were harvested in the zones (Table 2).

Long-term elk harvest for the zones are depicted in Tables 3 and 4.

Table 1. License allocation and application numbers for two elk hunting zones, 2016.

Zone	Either-Sex	Antlerless	Bull-only	Total	Total Applicants
20 – Kittson C	0	0	5	5	1,152
30 – Kittson NE	0	0	2	2	675
Total	**0**	**0**	**7**	**7**	**1,827**

Table 2. Distribution of the 2016 Minnesota elk harvest.

Kittson County Central Hunt Zone (20)

Season	Bulls-only Licenses	Antlerless Licenses	Bulls taken	Antlerless taken	Total elk taken
September 10 - 18	5	0	3	0	3
Total	**5**	**0**	**3**	**0**	**3**

Kittson County Northeast Hunt Zone (30)

Season	Bull-only Licenses	Bulls taken	Total elk taken
September 10 - 18	2	2	2
Total	**2**	**2**	**2**

Table 3. Grygla elk harvests, 1987-2016

	Grygla Elk Harvests			
	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		6	6
2008	2	2	10	6
2009	2	3*	12	11
2010	2	1	5	3
2011	2	2	3	0
2012	2	1	3	0
2013	Closed	0	Closed	0
2014	Closed	0	Closed	0
2015	Closed	0	Closed	0
2016	Closed	0	Closed	0
Total	**27**	**18**	**67**	**39**

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

Table 4. Kittson County elk harvests, 2008-2016.

	Kittson County (combined)			
	Bulls (or Either-Sex)		**Antlerless**	
Year	**Permits**	**Harvest**	**Permits**	**Harvest**
2008	1	1	10	10
2009	12	9[a]	4	5
2010	1	1	3	3
2011	2	3[b]	8[c]	4
2012	5	4[d]	13	3
2013	8	6	15	6
2014	9	6	0	0
2015	7	5	0	0
2016	7	5	0	0
Total	**52**	**38**	**53**	**31**

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

[b] One bull was a male calf and was legally tagged as an antlerless animal.

[c] Three 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.

[d] One bull was a sub-legal spike and was confiscated.

Figure 1. Kittson County Elk Hunt Zones.

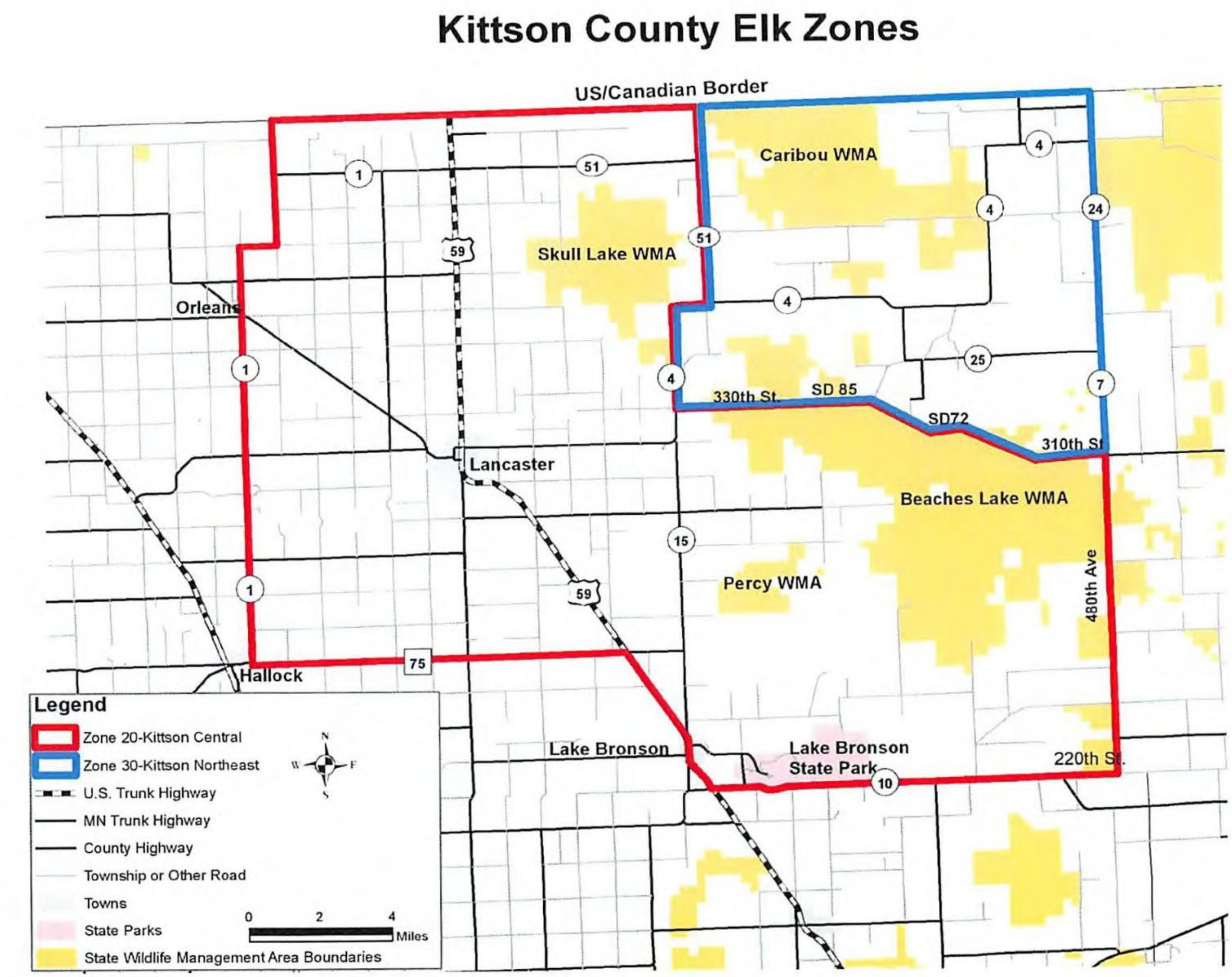
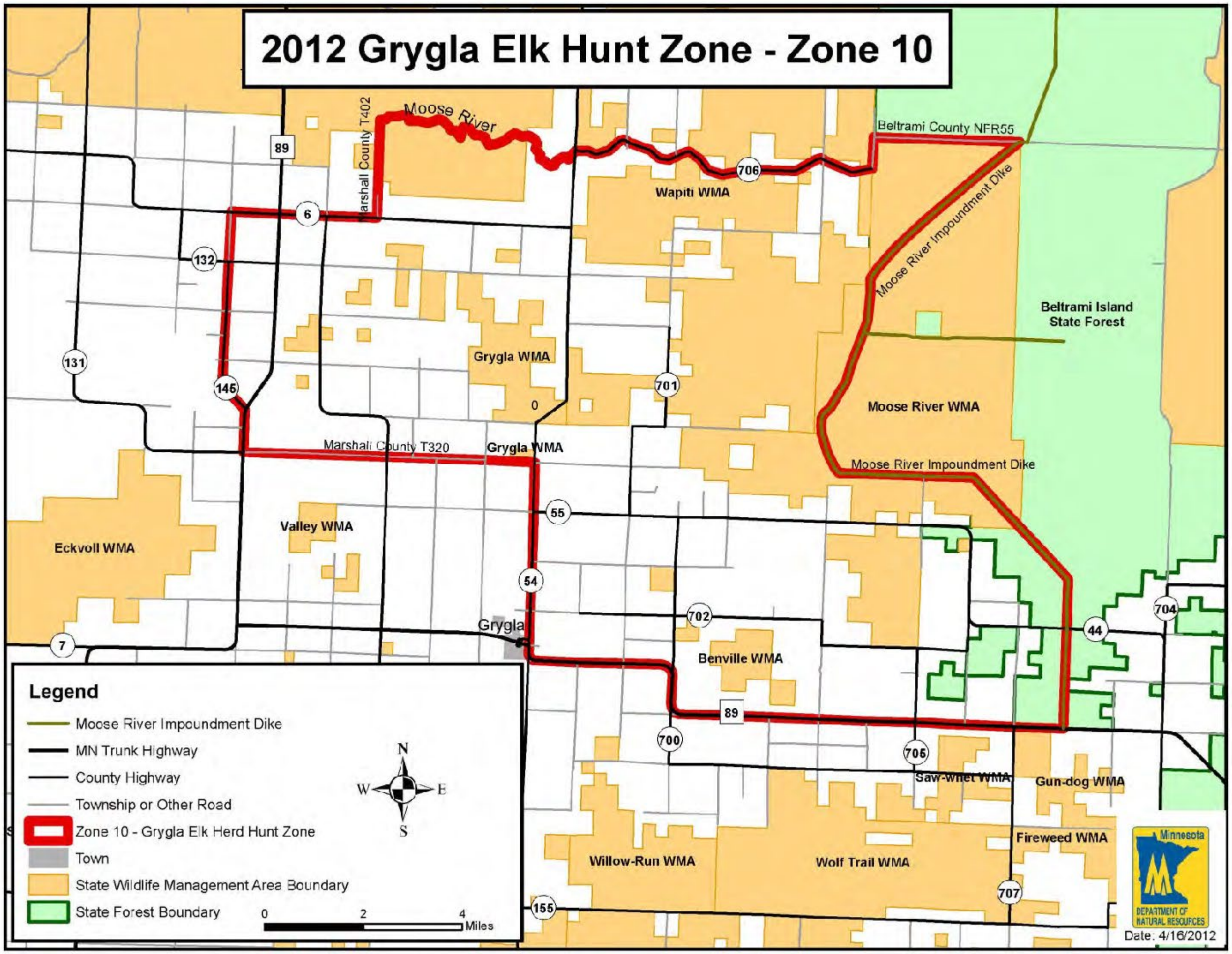


Figure 2. Grygla Elk Hunt Zone.



MINNESOTA SANDHILL CRANE HARVEST REPORT, 2016

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 for the first two years with a daily limit of 2 and a possession limit of 4 (Table 1). In 2012 the season was shifted to a week later but the limits remained the same. The possession limit increased from 4 to 6 in 2013. In 2014 limits were reduce to 1 daily and 3 in possession. There were no changes to the 2016 season. 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 2).

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.

Dubovsky, J.A. 2016. 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. 15pp.) http://www.fws.gov/migratorybirds/NewReportsPublications/PopulationStatus.html

Table 1. Sandhill Crane season dates and limits in Minnesota, 2010 – 2016.

Year	Dates	Daily limit	Possession limit
2010	4 Sept – 10 Oct	2	4
2011	3 Sept – 9 Oct	2	4
2012	15 Sept – 21 Oct	2	4
2013	14 Sept – 20 Oct	2	6
2014	13 Sept – 19 Oct	1	3
2015	12 Sept – 18 Oct	1	3
2016	10 Sept – 16 Oct	1	3

Table 2. Sandhill crane permit sales, estimated number of active hunters and harvest for NW Minnesota, 2010-2016. (Kruse, K.L. et al. 2015).

Year	Number of Permits	Active Hunters	Harvest
2010	1,954	964	830
2011	1,342	643	765
2012	1,032	410	407
2013	1,086	485	378
2014	1,216	401	247
2015	1,199	424	212
2016	1,139	471	287

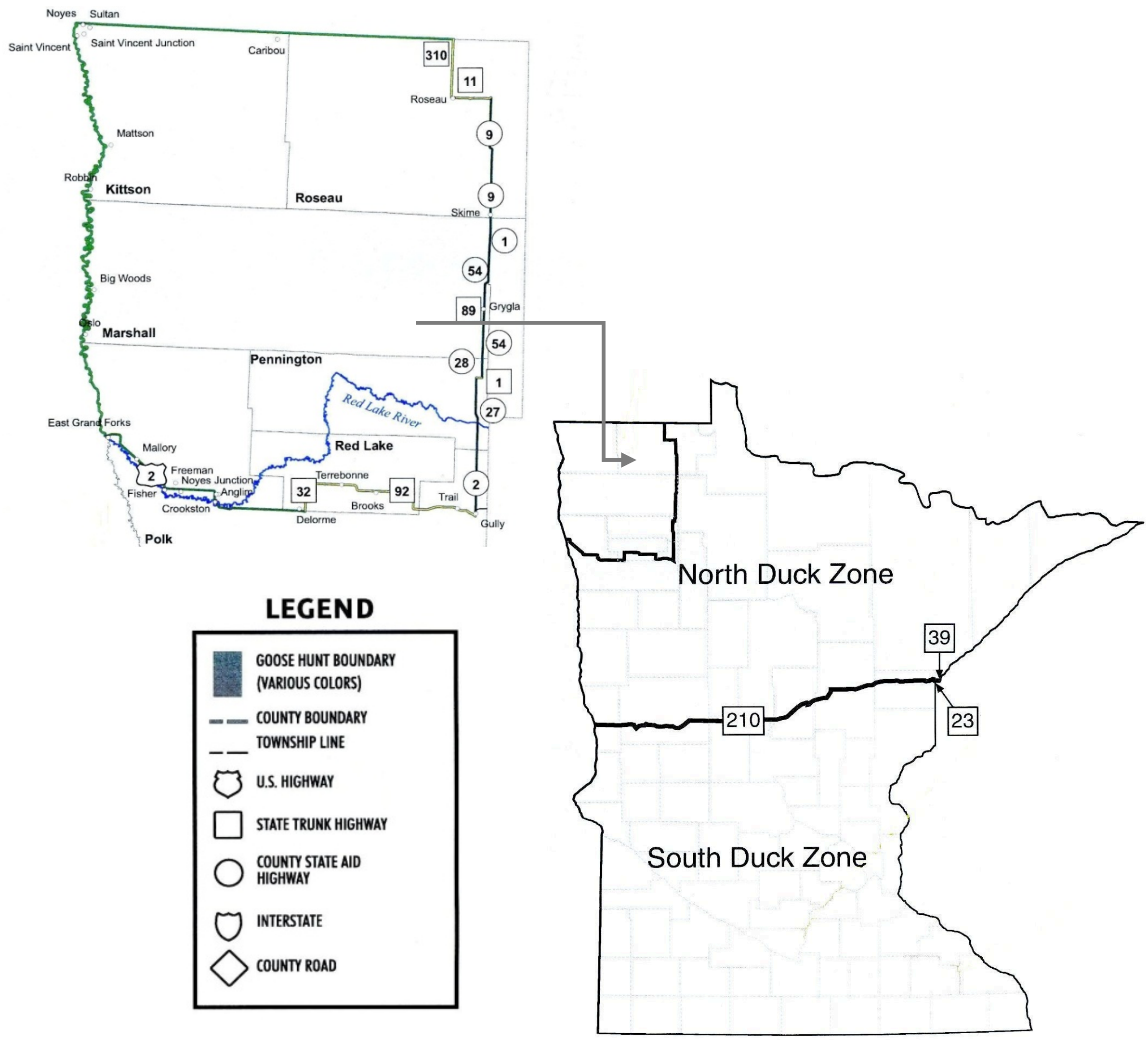


Figure 1. Sandhill crane hunting zone in Minnesota, 2010-2016.

TRAPPING HARVEST STATISTICS

Division of Fish and Wildlife
500 Lafayette Road, Box 20
Saint Paul, MN 55155-4020
(651) 259-5207

2016 TRAPPER HARVEST SURVEY

Margaret Dexter, Wildlife Research Unit

INTRODUCTION

The Minnesota Department of Natural Resources (MNDNR) annually conducts a mail survey of licensed trappers. Annual harvest estimates from the survey data are used to help assess and set trapping regulations and season structure. Beginning in 2000, survey cards were sent to all trappers with a valid mailing address. Information concerning registered harvest (fisher, marten, bobcat, and otter) is obtained from mandatory registration of these animals. Details regarding methods and results can be found in the Registered Furbearer Harvest report on the DNR website.

METHODS

The sampling frame consisted of all individuals with active MNDNR trapping licenses (all types) listed in the Electronic License System (ELS) database in late February 2017. There were 7,044 active trapping licenses in the ELS database, which consisted of 5,138 Resident Regular Trappers, 287 Resident Junior Trappers, 1,064 Resident Senior Trappers, 543 "active" Lifetime Trappers, and 12 Nonresident (MN landowners) license holders. License type was reclassified as "adult" (regular, lifetime, and non-resident) or "youth" for analysis purposes.

The MNDNR Trapper Harvest Survey is a census but the response rate is <100% (mean = 70%, range: 56–79%). Thus, uncertainty in harvest estimates is strictly a function of non-response (missing data) rather than random sampling. However, if non-response (unit and item) is completely random then data from respondents can be treated as a random sample, which is how the Trapper Harvest Survey has been analyzed historically. The critical assumption is that non-response is completely random (e.g., if you repeated the survey, non-respondents would be a random subset of licensed trappers). For consistency with previous analyses, the response data was treated as a random sample.

A postcard survey (Figure 1) was sent to all trapping license holders with a valid mailing address at the close of the license year. Trappers that returned the survey questionnaire within three weeks were marked returned and eliminated from follow-up mailings. A single follow-up mailing was sent to non-respondents. 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. Duel key-entry and quality control checks were used to minimize transcription errors. Data was tabulated using Viking Data Entry VDE+ software and statistically analyzed using R programming language (R version 3.4.1; R Development Core Team 2017) to summarize responses.

RESULTS

We mailed out 7,044 surveys, 104 surveys were undeliverable and 4,016 were returned for an adjusted response rate of 57.9%. Sixty four percent of respondents (adults = 63%, youth =

74%) reported setting traps for at least one species (Table 1, Figure 2). Historic trapper estimates are presented in Table 2, Table 3, and Table 4.

ACKNOWLEDGMENTS

This project was funded in part by the Wildlife Restoration Program. Special thanks to John Giudice for continued statistical support and critical review.

DEPARTMENT OF NATURAL RESOURCES
500 Lafayette Road Box 20
St Paul MN 55155

RETURN SERVICE REQUESTED

Presorted
First-Class Mail
US Postage
PAID
Twin Cities MN
Permit No 171

2016 Trapper Report

1. Did you set traps / snares in Minnesota during the 2016-2017 trapping season?
   ☐ No ☐ Yes (Please check one)
2. Indicate your harvest, the number of days you trapped for each species, the average number of traps you checked PER DAY for each species, and the county in which you trapped **most** for each species. Report only animals **YOU personally** trapped in Minnesota. Animals taken by hunting should **NOT** be reported here.

Species Trapped		*Number YOU Trapped All Season*	*# Days Trapped All Season*	*Average # Traps/Snares Checked Per Day*	*County You Trapped In Most*
Muskrat	80				
Mink	32				
Gray Fox	96				
Striped skunk	34				
Coyote (brush wolf)	97				
Beaver (Mar-May '16)	81				
Beaver (Oct '16-Feb '17)	82				
Pine marten	37				
Otter	38				
Fisher	36				
Badger	35				
Long-tailed weasel	31				
Short-tailed weasel	30				
Opossum	10				
Bobcat	98				
Raccoon	94				
Red Fox	95				

Figure 1. Trapper survey card 2016.

Dear Trapper:

You are being asked as a trapping license buyer to assist us in evaluating the 2016-2017 trapping season **(March 2016-February 2017)**. For Spring Beaver, please report only animals taken between March 2016 and May 15, 2016. We need this information to estimate the season's harvest and to help set future furbearer trapping seasons. Similar to past years we are also asking for the **average number of traps you checked per day** for each species. If a trap is set for multiple species, count the trap for both species when answering the question. For example, if you ran 20 mink/coon traps each day, enter 20 traps/day for both mink and coon.

YOUR RESPONSE IS NEEDED
EVEN IF YOU DID NOT SET TRAPS THIS YEAR.

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

Lou Cornicelli, Wildlife Research Program Manager
Division of Fish and Wildlife
Department of Natural Resources

DEPARTMENT OF NATURAL RESOURCES
500 Lafayette Road Box 20
St Paul MN 55155

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY MAIL
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POSTAGE WILL BE PAID BY ADDRESSEE

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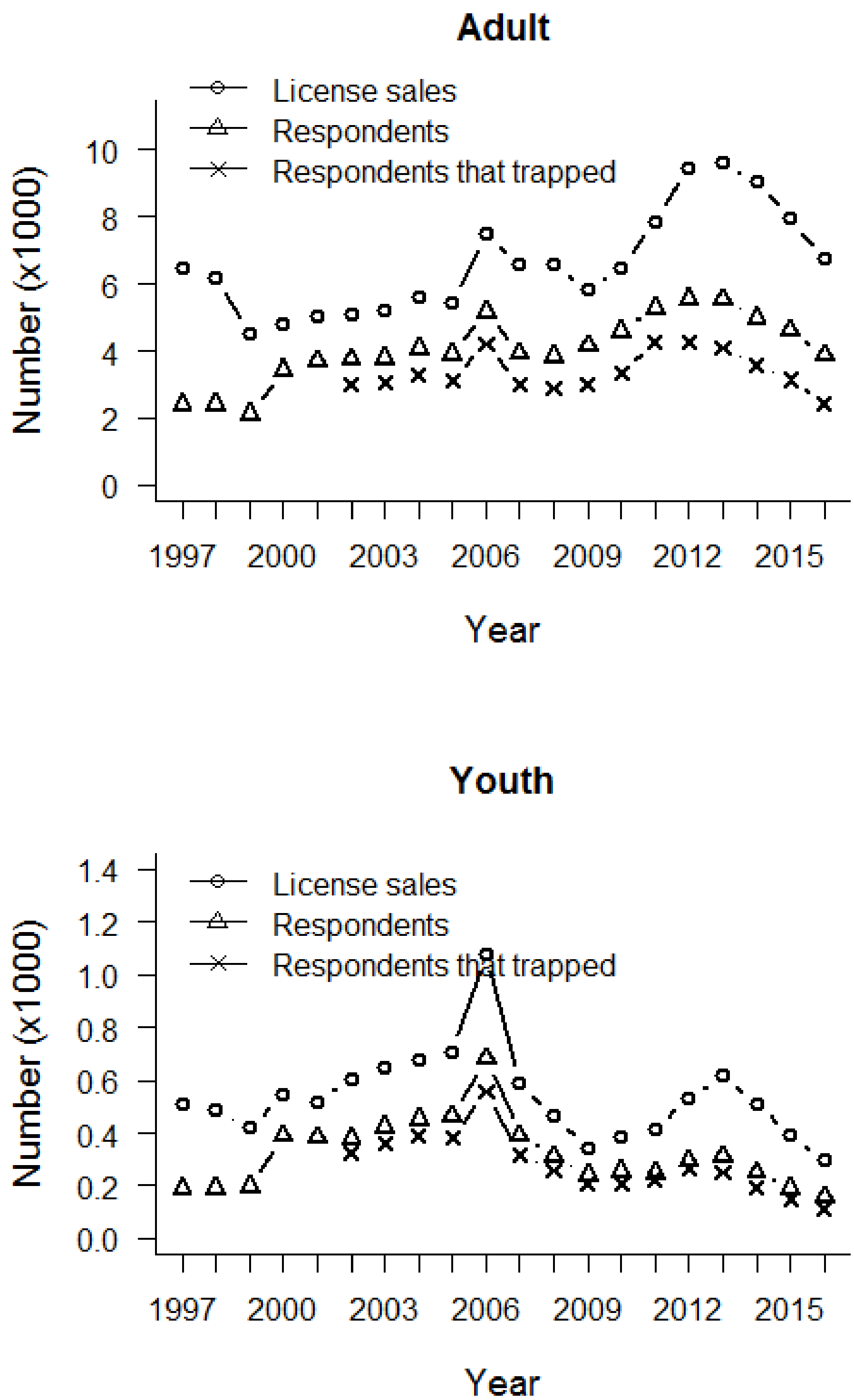

Figure 2. Trapper license sales and mail survey response by age class (Adult vs Youth), 1997-98 through 2016-17.

Table 1. Use of trapper licenses, 2004-05 through 2016-17.

Year		Returns from mail survey	Projections from license sales
2004-05	Trapped Did not trap	3,697 (81.9%) 815 (18.1%) 4,512 (100.0%)	5,136 1,135 6,271[a]
2005-06	Trapped Did not trap	3,495 (80.0%) 875 (20.0%) 4,370 (100.0%)	4,930 1,233 6,163[a]
2006-07	Trapped Did not trap	4,782 (81.9%) 1,053 (18.1%) 5,835 (100.0%)	7,008 1,549 8,557[a]
2007-08	Trapped Did not trap	3,322 (77.2%) 980 (22.8%) 4,302 (100.0%)	5,533 1,634 7,167[a]
2008-09	Trapped Did not trap	3,154 (75.7%) 1,012 (24.3%) 4,166 (100.0%)	5,319 1,708 7,027[a]
2009-10	Trapped Did not trap	3,202 (72.7%) 1,202 (27.3%) 4,404 (100.0%)	4,467 1,677 6,144[a]
2010-11	Trapped Did not trap	3,546 (73.2%) 1,298 (26.8%) 4,844 (100.0%)	5,032 1,843 6,875[a]
2011-12	Trapped Did not trap	4,498 (81.5%) 1,019 (18.5%) 5,517 (100.0%)	6,748 1,532 8,280[a]
2012-13	Trapped Did not trap	4,537 (77.6%) 1,307 (22.4%) 5,844 (100.0%)	7,747 2,236 9,983[a]
2013-14	Trapped Did not trap	4,342 (74.6%) 1,480 (25.4%) 5,822 (100.0%)	7,627 2,597 10,224[a]
2014-15	Trapped Did not trap	3,786 (72.2%) 1,459 (27.8%) 5,245 (100.0%)	6,888 2,652 9,540[a]
2015-16	Trapped Did not trap	3,296 (68.8%) 1,496 (31.2%) 4,792 (100.0%)	5,734 2,600 8,334[a]
2016-17	Trapped Did not trap	2,558 (63.7%) 1,458 (36.3%) 4,016 (100.0%)	4,487 2,557 7,044[a]

[a] excludes duplicates.

Table 2. Estimated number of trappers of various furbearers, 2004-05 through 2016-17.

	Estimated number of trappers												
	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Muskrat	2269	2351	4228	2371	2393	2088	2760	4,320	4,110	3,410	2,902	2,218	1,797
Mink	2085	1864	3033	2168	2044	1541	1847	2,470	3,110	2,780	2,158	1,587	1,049
Short-tailed weasel	470	349	864	595	511	417	546	800	690	510	666	289	195
Long-tailed weasel	299	211	694	434	345	254	333	560	540	480	519	265	174
Raccoon (Sept -Feb)	2505	2315	3766	3189	3150	2320	2567	4,060	4,680	4,660	4,182	2,781	2,032
Raccoon (Mar -Aug)[a]	406	322											
Striped skunk	1161	1023	1644	1485	1488	949	1130	1,800	1,940	1,610	1,541	1,234	907
Eastern spotted skunk	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
Badger	310	219	347	330	293	206	229	310	360	390	284	247	193
Opossum	1037	957	1511	1392	1169	701	645	830	1,100	1,110	575	463	469
Red fox (Sept -Feb)	1179	991	1608	1320	1232	1006	1068	1,900	2,240	2,080	2,012	1,434	1,048
Red fox (Mar -Aug)[a]	110	85											
Gray fox	451	407	806	654	657	529	555	970	1,180	1,060	1,035	684	446
Coyote	826	857	1379	1203	1141	888	998	1,720	2,360	2,200	2,396	1,981	1,479
Beaver (Oct - Feb)	2171	1965	2659	2008	1877	1650	1722	2,360	2,620	2,710	2,189	1,894	1,642
Beaver (previous Spring)	1449	1455	1710	1408	1257	1260	1367	1,510	1,810	1,150	1,305	1,145	1,130

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

Note: Estimates prior to 2009 may differ from values published in previous reports because of rounding and more recent estimates were recomputed using a standardized historic dataset (vs. being carried forward from previous reports).

Table 3. Estimated take per trapper of various furbearers, 2004-05 through 2016-2017.

	Estimated take per successful trapper reporting that species												
	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Muskrat	32	39	58	32	34	48	66	82	59	36	39	51	49
Mink	11	10	9	9	9	9	8	7	6	6	5	5	6
Short-tailed weasel	6	7	10	7	7	8	10	10	7	5	8	4	5
Long-tailed weasel	4	4	6	5	3	4	6	6	4	3	5	3	3
Raccoon (Sept -Feb)	23	22	21	24	23	20	23	25	18	16	15	11	12
Raccoon (Mar Aug)[a]	13	12											
Striped skunk	8	7	7	8	7	7	8	7	7	6	6	6	7
Eastern spotted skunk	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
Badger	2	2	2	2	2	2	2	2	2	2	2	2	2
Opossum	14	13	14	13	10	8	7	6	7	7	7	4	5
Red fox (Sept -Feb)	4	4	5	4	3	3	4	4	4	3	4	3	3
Red fox (Mar -Aug)[a]	4	3											
Gray fox	2	2	3	3	3	3	2	3	3	2	2	2	2
Coyote	5	5	4	5	4	5	5	6	5	5	5	6	5
Beaver (Oct –Feb)	14	14	13	11	12	12	10	12	10	9	8	8	8
Beaver (previous Spring)	27	25	25	19	23	20	22	20	20	9	16	14	17

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

Note: Estimates may differ from values published in previous reports because of rounding and they were recomputed using a ratio of estimated totals (estimated harvest / estimated trappers), which were computed from the standardized, historic harvest dataset.

Table 4. Minnesota trapper license sales and estimated annual harvest, 2003-04 through 2016-2017[a]

	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Trapper license sales [b]	5,841	6,271	6,163	8,557	7,167	7,027	6,158	6,885	8,280	9,998	10,224	9,540	8,334	7,044
Estimated harvest [c]														
Muskrat	69,131	72,079	91,271	243,360	75,439	80,157	98,524	180,505	352,030	242,120	120,500	111,998	112,219	87,958
Mink	16,716	21,478	18,048	26,084	18,626	16,647	13,207	13,853	15,770	18,460	14,710	10,211	7,745	5,439
Short-tailed weasel	3,519	2,679	2,223	8,145	4,155	3,515	3,128	4,914	7,300	4,500	2,360	4,806	1,083	930
Long-tailed weasel	1,781	1,007	651	3,494	2,013	1,118	838	1,732	3,020	2,030	1,410	2,568	734	466
Raccoon (Oct - Feb)	53,534	56,848	48,966	78,571	73,498	71,893	45,118	57,245	98,240	79,800	70,380	58,868	29,963	22,874
Raccoon (Mar -Aug)[f]	4,933	4,940	3,594											
Striped skunk	8,474	8,704	6,881	10,773	10,811	10,354	6,194	8,023	12,250	12,620	9,430	7,956	6,349	5,458
Eastern spotted skunk [g]	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
Badger	552	455	339	461	499	424	316	344	490	570	600	347	376	286
Opossum	11,251	14,313	11,754	20,442	17	11,296	4,963	4,193	4,400	6,780	6,720	3,524	1,814	2,124
Red fox (Oct - Feb)	6,721	4,684	3,528	6,783	4,060	3,500	2,984	3,311	7,250	7,540	5,710	6,040	4,061	2,707
Red fox (Mar -Aug)[f]	635	334	222											
Gray fox	915	898	797	1,703	1,360	1,320	1,084	1,110	2,100	2,550	1,940	1,902	1,161	715
Coyote	3,805	3,607	3,915	5,315	5,355	4,532	3,797	4,292	8,780	11,130	9,010	11,703	10,084	7,308
Beaver (Oct- Feb)	22,801	28,716	26,029	33,966	21,813	21,075	18,178	17,048	26,620	24,590	23,220	15,671	14,181	13,070
Beaver (previous Spring)	26,363	37,861	35,252	41,652	26,286	27,815	25,008	29,118	29,500	34,600	10,110	20,820	15,966	19,004
Registered harvest [d]														
Otter	2,766	3,450	2,846	2,720	1,861	1,938	1,544	1,814	2,294	3,171	2,824	2,148	1,955	1195
Lynx [g]	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
Bobcat [e]	483	631	590	890	702	853	884	1,012	1,711	1,875	1,038	1,380	766	485
Fisher	2,517	2,552	2,388	3,251	1,682	1,712	1,259	903	1,473	1,293	1,146	919	756	399
Marten	3,214	3,241	2,653	3,788	2,221	1,823	2,073	1,842	2,525	1,472	1,014	1,055	877	551

[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, 2017 - 7,044 trapping licenses were sold in 2016: 287 (4.1%) were junior licenses, 5,138 (72.9%) were Regular adult licenses, 1,064 (15.1%) were Senior licenses, 543 (7.7%) were Lifetime licenses, and 12 (<1%) were Nonresident (MN Landowner) licenses. Duplicate licenses excluded.

[c] Based upon trappers' responses to mail surveys. [d.] Registered harvest information as reported from annual, mandatory registration.

[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 2016-2017 HUNTING AND TRAPPING SEASON

Jason Abraham, Season Setting/Furbearer Specialist
Margaret Dexter, 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 September 2017, questionnaires were mailed to the 38 licensed fur buyers in Minnesota. The survey asked them to report the number and type of fur purchased from Minnesota trappers and hunters in 2016-17 and the "average price" paid to those hunters and trappers based on all fur purchased. A total of 29 usable surveys were received, for a return rate of 76 percent.

Calculations of average pelt price for each species 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 2016-17 was $283,280, an 18 percent decrease from the previous season.

Table 1. Minnesota fur prices as reported by licensed fur dealers, 2016-17.

Species	Number Pelts	Minimum Price	Maximum Price	Weighted Mean
Muskrat	22958	1.50	3.50	2.65
Mink Female	955	3.00	10.00	6.20
Mink male	817	3.00	10.00	7.47
Raccoon	7133	0.00	7.25	4.92
Red Fox	804	3.00	23.00	10.52
Gray Fox	134	8.00	15.00	10.33
Coyote	2853	7.70	22.00	17.39
Bobcat	148	25.00	75.00	35.88
River Otter	152	10.00	30.00	21.05
Beaver 10-12	2533	5.00	10.00	8.14
Beaver 3-4	4949	5.00	10.00	7.33
L.T. Weasel	0	0.00	0.00	0.00
S.T. Weasel	123	1.00	1.65	1.41
Striped Skunk	52	1.00	7.00	4.00
Badger	69	3.00	15.00	7.86

Species	Number Pelts	Minimum Price	Maximum Price	Weighted Mean
Opossum	77	0.00	1.53	1.32
Fisher Male	33	25.00	40.00	28.00
Fisher Female	55	30.00	40.00	37.07
Marten Male	81	18.00	40.00	29.94
Marten Female	73	18.00	40.00	30.41
Deer Hides	10969	2.50	6.00	4.00
Bear Hides	32	25.00	50.00	32.97

Table 2. Average price per pelt paid to hunters and trappers in Minnesota, 2006-07 through 2016-17

	Average pelt prices paid hunters and trappers in Minnesota (dollars)										
Species	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Muskrat	5.79	2.96	1.85	4.43	5.33	5.86	7.91	8.72	4.85	2.28	2.65
Mink (female)	13.18	9.05	7.45	8.02	9.33	11.54	17.53	13.72	7.45	4.99	6.20
Mink (male)	18.04	12.32	9.14	9.37	13.66	14.68	18.27	18.11	10.50	6.18	7.47
S.T. Weasel	3.58	3.18	3.57	3.02	1.50	2.10	2.51	0.00	2.00	1.41	0.00
L.T. Weasel	4.35	5	2.21	3.12	2.87	4.02	4.10	2.35	1.78	1.46	1.41
Raccoon	11.92	14.32	9.34	9.18	10.87	12.57	16.60	16.58	8.64	5.11	4.92
Striped Skunk	4.46	5.27	2.56	3.66	3.29	3.55	5.00	4.14	3.86	3.65	4.00
Badger	15.71	13.92	7.70	8.81	10.43	13.47	14.54	13.72	9.52	9.57	7.86
Opossum	1.52	1.76	1.21	1.30	2.64	5.80	1.52	1.52	1.17	1.98	1.32
Red Fox	17.68	14.69	11.79	10.85	13.35	22.87	33.52	30.90	20.41	11.86	10.52
Gray Fox	22.36	30.09	14.08	11.55	14.64	15.11	19.20	21.27	14.17	10.64	10.33
Coyote	17.76	13.51	7.12	8.62	9.47	17.99	22.04	21.30	25.10	21.48	17.39
Bobcat	101.07	93.41	74.74	42.77	71.44	98.18	144.79	88.63	66.67	57.46	35.88
Beaver (fall-winter)	18.35	14.6	14.63	12.49	11.95	14.29	18.47	16.52	12.40	8.77	8.14
Beaver (spring)	14.81	17.77	9.36	14.47	14.50	19.96	12.80	14.77	10.69	8.24	7.33
Otter	42.85	29.49	24.33	35.65	34.53	51.40	72.12	61.32	34.57	30.03	21.05
Fisher (male)	76.33	63.09	22.27	34.45	38.19	47.69	62.38	61.32	41.76	34.88	28.00
Fisher (female)	67.82	48.24	37.22	34.90	37.31	39.59	63.02	67.73	50.87	34.39	37.07
Marten (male)	74.04	58.72	30.61	26.76	39.80	42.32	56.57	74.10	38.92	30.83	29.94
Marten (female)	66.09	50.05	28.19	29.95	36.57	39.49	54.29	70.94	32.20	28.89	30.41
Deer Hides	4.51	3.92	3.53	4.44	4.41	3.95	5.18	6.09	5.59	5.62	4.00
Bear Hides	43.03	36.57	29.81	43.00	33.38	28.79	30.28	42.63	32.94	46.03	32.97

REGISTERED FURBEARER HARVEST STATISTICS

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REGISTERED FURBEARER HARVEST STATISTICS 2016-17

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

INTRODUCTION

Monitoring harvest is an important component of population management for some wildlife populations. For many species, harvest represents a large proportion of overall mortality. Obtaining harvest information can be useful for documenting changes in the distribution and abundance of animals, as well as the effects of changes in harvest seasons, harvest techniques, and habitat. The level of detail or accuracy necessary in harvest information may vary across species, depending on such factors as population density, harvest pressure, habitat 'sensitivity' of the species, and reproductive potential.

In Minnesota, detailed harvest information is collected on 4 carnivores – fishers, martens, bobcats, and river otters. These species have lower reproductive potential, naturally occur at low to moderate densities, have comparatively restricted distributions, or may be more influenced by habitat change. Hence, detailed harvest information is desirable to help ensure sustainable populations. For the past 40 years, detailed harvest data has been collected for these species.

METHODS

Fur-harvesters are required to bring pelts from harvested animals (fishers, martens, bobcats, and otters) in to fur registration stations usually within 48 hours of the close of the season. Upon registration, information is collected on the sex, date, method of take, and harvest location (township), and the pelt is tagged to verify it has been registered.

RESULTS

Currently, harvest of fishers, martens, and bobcats is allowed in approximately the northern 60% of the state, while otter harvest is allowed statewide (Figure 1). There were no changes to season structures this year compared to the 2015 season. All harvest summaries are provided in the following tables and graphs. Data for years prior to those presented in this report is available (back to 1977) by contacting the Minnesota DNR.

ACKNOWLEDGMENTS

I thank the many individuals from the Minnesota Department of Natural Resources for their assistance with collection of data contained in this report. This project was funded in part by the Wildlife Restoration Program (Pittman-Robertson).

NOTE: THIS REPORT DOES NOT INCLUDE TRIBAL HARVESTS, OR ANY CONFISCATIONS.

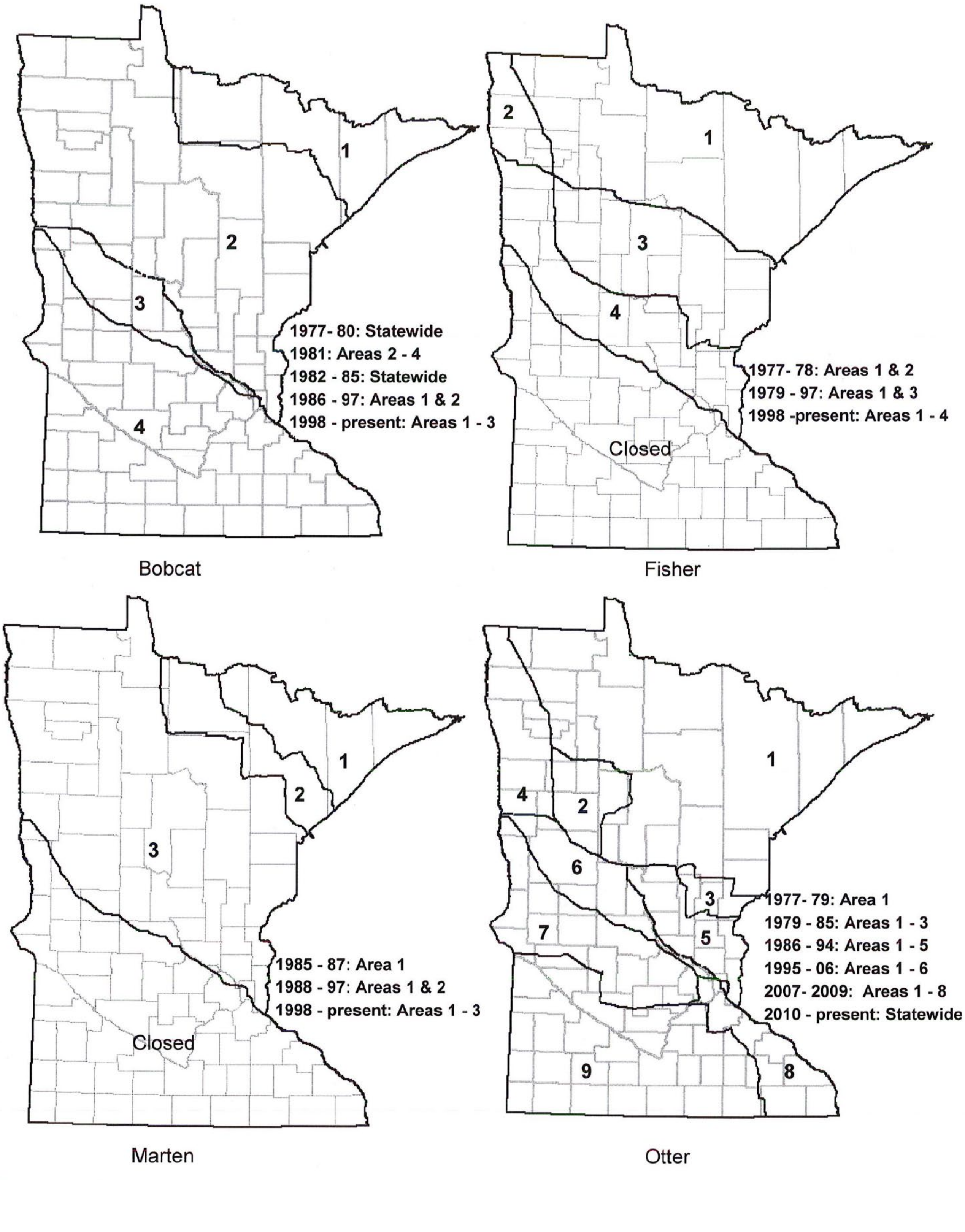

Figure 1. Open trapping areas for fisher, marten, bobcat, and otter, 1977 - present.

Table 1. Registered furbearer seasons and harvests, 1986-2016.

	Bobcat				Fisher				Marten				Otter			
Year	Season	Days	Limit	Harvest	Season	Days	Limit[a]	Harvest	Season	Days	Limit[a]	Harvest	Season[b]	Days	Limit[c]	Harvest
1986-87	11/29 -1/3	36	5	160	11/29-12/14	16	1	1067	11/29-12/14	16	1	798	11/1-11/30	30	3	777
1987-88	11/28-1/3	37	5	212	11/28-12/13	16	1	1641	11/28-12/13	16	1	1363	10/24-11/29	37	3	1386
1988-89	11/26-1/1	37	5	141	11/26-12/11	16	1	1025	11/26-12/11	16	2	2072	10/29-11/27	30	3	922
1989-90	12/2-1/7	37	5	129	12/2-12/17	16	1	1243	12/2-12/17	16	2	2119	10/28-12/17	51	3	1294
1990-91	12/1-1/6	37	5	84	12/1-12/16	16	1	746	12/1-12/16	16	2	1349	10/27-1/6	71	3	888
1991-92	11/30-1/5	37	5	106	11/30-12/15	16	1	528	11/30-12/15	16	1	686	10/26-1/5	71	3	855
1992-93	11/28-1/3	37	5	168	11/28-12/13	16	1	778	11/28-12/13	16	2	1602	10/24-1/3	71	4	1368
1993-94	12/4-1/9	37	5	201	12/4-12/19	16	2	1159	12/4-12/19	16	2	1438	10/23-1/9	78	4	1459
1994-95	12/3-1/8	37	5	238	12/3-12/18	16	2	1772	12/3-12/18	16	2	1527	10/29-1/8	71	4	2445
1995-96	12/2-1/7	37	5	134	12/2-12/17	16	2	942	12/2-12/17	16	2	1500	10/28-1/7	71	4	1435
1996-97	11/30 -1/5	37	5	223	11/30-12/15	16	2	1773	11/30-12/15	16	2	1625	10/26-1/5	71	4	2219
1997-98	11/29-1/4	37	5	359	11/29-12/14	16	2	2761	11/29-12/14	16	2	2261	10/25-1/4	71	4	2145
1998-99	11/28-12/13	16	5	103	11/28-12/13	16	2	2695	11/28-12/13	16	2	2299	10/24-1/3	71	4	1946
1999-00	12/4-1/9	37	5	206	12/4-12/19	16	2	1725	12/4-12/19	16	4	2423	10/23-1/9	78	4	1635
2000-01	12/2-1/7	37	5	231	12/2-12/17	16	4	1674	12/2-12/17	16	4	1629	10/28-1/7	71	4	1578
2001-02	11/24-1/6	44	5	250	11/24-12/9	16	4	2119	11/24-12/9	16	4	1928	10/27-1/6	71	4	2301
2002-03	11/30-1/5	37	5	544	11/30-12/15	16	5	2660	11/30-12/15	16	5	2839	10/26-1/5	71	4	2145
2003-04	11/29-1/4	37	5	483	11/29-12/14	16	5	2521	11/29-12/14	16	5	3214	10/25-1/4	71	4	2766
2004-05	11/27-1/9	44	5	631	11/27-12/12	16	5	2552	11/27-12/12	16	5	3241	10/23-1/9	78	4	3450
2005-06	11/26-1/8	44	5	590	11/26-12/11	16	5	2388	11/26-12/11	16	5	2653	10/29-1/8	71	4	2846
2006-07	11/25-1/7	44	5	890	11/25-12/10	16	5	3251	11/25-12/10	16	5	3788	10/28-1/7	71	4	2720
2007-08	11/24-1/6	44	5	702	11/24-12/2	9	5	1682	11/24-12/2	9	5	2221	10/27-1/6	71	2/4	1861
2008-09	11/29-1/4	37	5	853	11/29-12/7	9	5	1712	11/29-12/7	9	5	1823	10/25-1/4	71	2/4	1938
2009-10	11/28-1/3	37	5	884	11/28-12/6	9	5	1259	11/28-12/6	9	5	2073	10/24-1/3	71	2/4	1544
2010-11	11/27-1/9	44	5	1012	11/27-12/5	9	2	903	11/27-12/5	9	5	1842	10/23-1/9	78	4	1814
2011-12	11/26-1/8	44	5	1711	11/26-12/4	9	2	1473	11/26-12/4	9	5	2525	10/22-1/8	78	4	2294
2012-13	11/24-1/6	44	5	1875	11/24-11/29	6	2	1293	11/24-11/29	6	5	1472	10/27-1/6	71	4	3171
2013-14	11/30-1/5	37	5	1038	11/30-12/5	6	2	1146	11/30-12/5	6	2	1014	10/26-1/5	71	4	2824
2014-15	11/29-1/4	37	5	1384	11/29-12/4	6	2	943	11/29-12/4	6	2	1059	10/25-1/4	71	4	2154
2015-16	11/28-1/3	37	5	766	11/28-12/3	6	2	756	11/28-12/3	6	2	877	10/24-1/3	71	4	1955
2016-17	11/26-1/8	44	5	485	11/26-12/1	6	2	399	11/26-12/1	6	2	551	10/29-1/8	78	4	1195

[a] Starting in 1997, the limit on fisher/marten became a combined limit. In years after, the combined limit for a given year is the higher of the 2 reported above (if different).

[b] In some years, otter season opens 1 week earlier in a north zone as compared to a south zone. Otter season dates in this table reflect the start of the north zone.

[c] From 2007-2009, otter limits differ between a southeast zone (limit=2; Area 8, Fig. 1) and the remainder of the open area (limit=4).

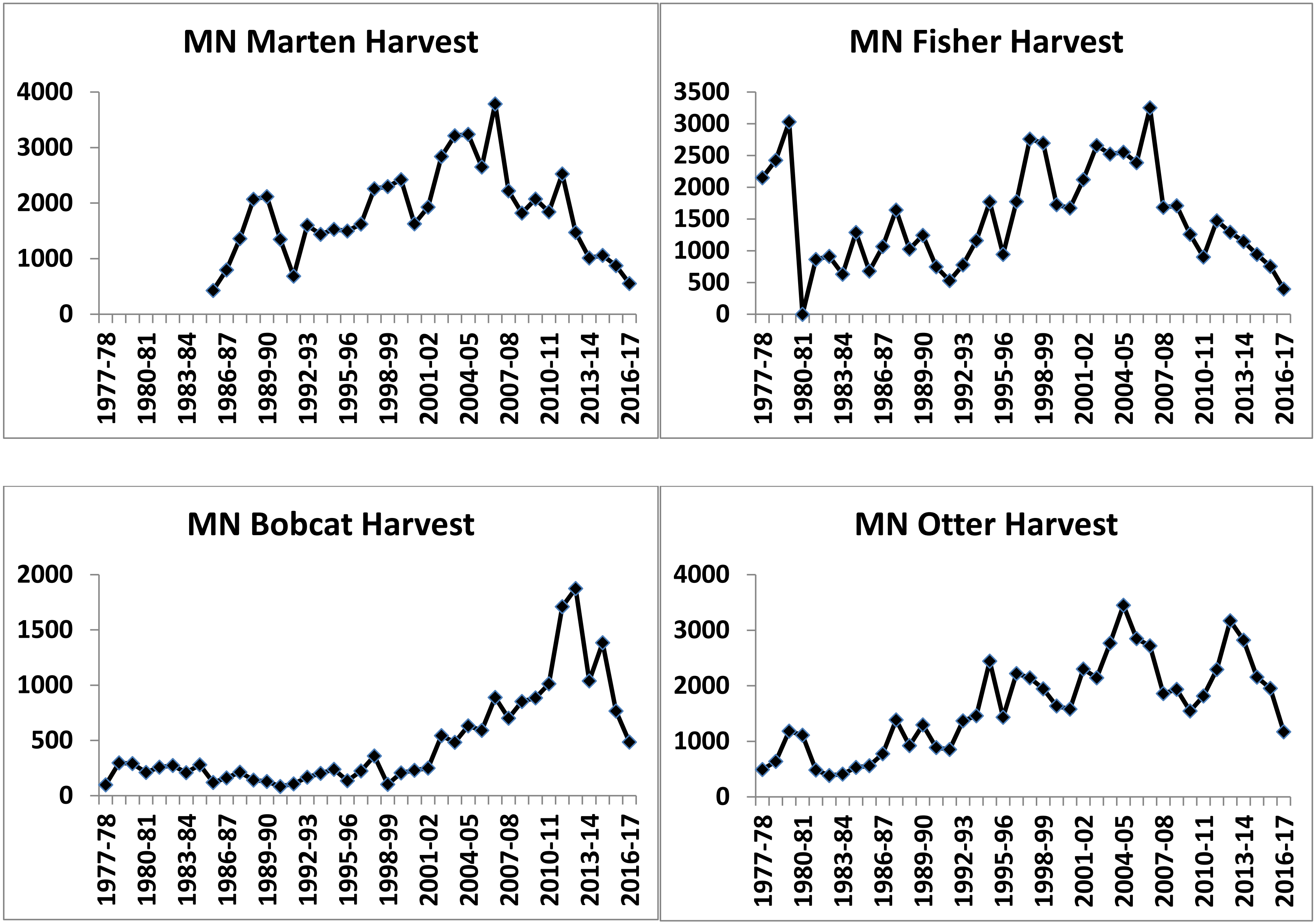

Figure 2. Harvest of registered furbearers in Minnesota, 1977-present.

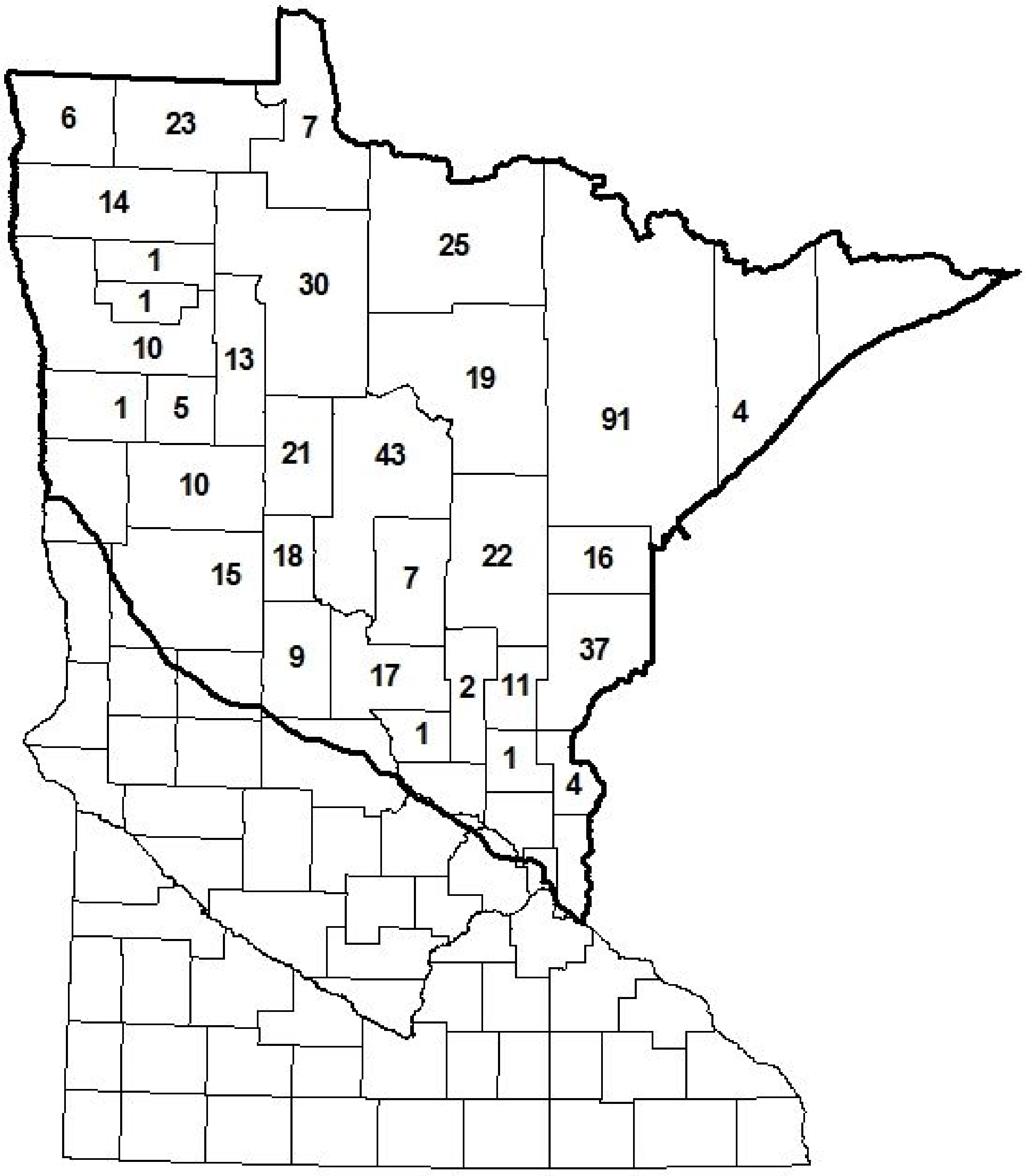

Figure 3. Bobcat harvest by county, 2016-17.

Table 2. Bobcat harvest by county and sex, 2016-17.

County	Sex*			Total	Harvest/ 100 Mile^2
	Male	Female	Unknown		
Aitkin	7	15		22	1.10
Anoka	0	0		0	0.00
Becker	2	8		10	0.69
Beltrami	20	10		30	0.98
Benton	1	0		1	0.24
Carlton	12	4		16	1.83
Cass	14	30		44	1.82
Chisago	2	2		4	0.90
Clay	0	0		0	0.00
Clearwater	10	3		13	1.26
Cook	0	0		0	0.00
Crow Wing	3	4		7	0.61
Douglas	0	0		0	0.00
Hubbard	14	7		21	2.10
Isanti	0	1		1	0.22
Itasca	8	11		19	0.65
Kanabec	7	4		11	2.06
Kittson	4	2		6	0.54
Koochiching	9	16		25	0.79
Lake	2	2		4	0.17
Lake of the Woods	2	5		7	0.39
Mahnomen	1	4		5	0.86
Marshall	6	8		14	0.77
Mille Lacs	0	2		2	0.29
Morrison	6	11		17	1.47
Norman	1	0		1	0.11
Otter Tail	5	10		15	0.67
Pennington	0	1		1	0.16
Pine	25	12		37	2.58
Polk	4	6		10	0.50
Red Lake	1	0		1	0.23
Roseau	9	14		23	1.37
Sherburne	0	0		0	0.00
St. Louis	33	58		91	1.35
Stearns	0	0		0	0.00
Todd	3	6		9	0.92
Wadena	4	14		18	3.31
Unknown	0	0		0	
Total	214	270	0	484	

* Trapper/hunter reported sex ratios in this table are **NOT** adjusted according to results from DNR carcass analyses

Table 3. Comparison of bobcat harvest by county, 2006-2016.

County	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Aitkin	46	56	64	82	73	121	142	65	105	39	22
Anoka	0	0	0	0	0	1	0	0	1	0	0
Becker	46	24	37	25	39	70	58	36	48	36	10
Beltrami	90	33	49	70	108	139	139	59	73	49	30
Benton	0	1	5	2	0	4	3	3	0	0	1
Carlton	34	25	45	44	37	94	63	42	88	25	16
Cass	137	50	98	115	117	164	150	76	126	73	44
Chisago	0	3	0	0	1	0	3	1	1	3	4
Clay	0	0	0	1	3	1	3	2	3	1	0
Clearwater	42	25	43	27	30	58	40	19	29	15	13
Cook	0	0	1	0	1	3	3	9	17	1	0
Crow Wing	27	21	36	38	29	64	65	19	32	21	7
Douglas	0	0	0	0	0	0	1	1	0	0	0
Hubbard	69	40	49	81	59	129	105	51	50	45	21
Isanti	0	0	0	0	0	0	0	1	0	1	1
Itasca	113	86	72	106	132	186	194	93	110	50	19
Kanabec	14	16	23	11	16	21	46	16	46	12	11
Kittson	5	4	9	4	9	10	7	5	5	7	6
Koochiching	16	37	31	25	54	66	82	50	40	22	25
Lake	1	0	1	2	7	15	21	13	15	8	4
Lake of the Woods	2	9	12	16	10	28	13	20	26	10	7
Mahnomen	7	8	0	4	2	9	7	4	4	3	5
Marshall	19	32	18	15	31	42	44	15	21	19	14
Mille Lacs	8	13	11	10	10	13	23	7	14	5	2
Morrison	17	23	28	13	23	25	35	15	25	16	17
Norman	1	0	0	1	0	3	6	3	8	4	1
Otter Tail	7	9	7	7	14	21	38	18	17	16	15
Pennington	2	11	9	6	5	4	13	7	3	4	1
Pine	59	87	101	49	50	94	135	54	87	56	37
Polk	3	0	4	9	9	17	20	10	16	15	10
Red Lake	1	0	0	7	16	20	25	6	11	3	1
Roseau	36	32	18	19	26	46	60	38	27	20	23
Sherburne	0	0	0	1	0	3	0	0	0	0	0
St. Louis	45	39	58	56	81	202	283	255	307	156	91
Stearns	0	1	0	0	0	0	0	2	0	1	0
Todd	12	6	14	10	9	14	16	5	8	8	9
Wadena	16	9	7	21	9	17	23	18	18	10	18
Unknown	15	2	3	7	2	7	9	0	3	12	0
Total	890	702	853	884	1012	1711	1875	1038	1384	766	484

Table 4. Bobcat harvest by sex and week, 2016-17 season.

Date	Sex*			Total	% of Total	Cumulative %
	Male	Female	Unknown			
Nov.26 - Dec.2	33	39		72	14.85	14.85
Dec.3 - Dec.9	30	34		64	13.20	28.04
Dec.10 - Dec.16	31	38		69	14.23	42.27
Dec.17 - Dec.23	54	60		114	23.51	65.77
Dec.24 - Dec.30	31	39		70	14.43	80.21
Dec.31 - Jan.8**	36	60		96	19.79	100.00
Unknown	0	0		0	0.00	100%
Total	215	270	0	485	100%	

* Trapper/hunter reported sex ratios in this table are **NOT** adjusted according to results from DNR carcass analyses

** 9-day interval

Table 5. Distribution of bobcat harvest* among takers, 1991-2016.

Number (%) of Takers	Number Taken					
	1	2	3	4	5	Total Takers
1991-92	42 (64)	15 (23)	4 (6)	3 (5)	2 (3)	66
1992-93	69 (64)	21 (20)	9 (9)	5 (5)	2 (2)	106
1993-94	90 (70)	17 (13)	13 (10)	7 (5)	2 (2)	201
1994-95	103 (68)	25 (17)	12 (8)	6 (4)	5 (3)	151
1995-96	67 (74)	13 (14)	5 (6)	4 (4)	2 (2)	91
1996-97	115 (73)	28 (18)	85 (5)	2 (1)	4 (3)	157
1997-98	129 (61)	43 (20)	17 (8)	12 (6)	9 (5)	210
1998-99	59 (77)	11 (14)	2 (3)	3 (4)	1 (2)	76
1999-00	113 (76)	21 (14)	10 (6)	4 (3)	1(1)	149
2000-01	99 (69)	23 (16)	7 (5)	5 (4)	9 (6)	143
2001-02	101 (71)	23 (16)	12 (8)	1 (1)	5 (4)	142
2002-03	185 (60)	64 (21)	33 (10)	15 (5)	12 (4)	309
2003-04	171 (64)	40 (15)	25 (10)	20 (7)	11 (4)	267
2004-05	193 (59)	55 (17)	32 (10)	25 (7)	24 (7)	329
2005-06	198 (60)	67 (20)	33 (10)	15 (5)	18 (5)	331
2006-07	265 (57)	90 (19)	44 (9)	25 (5)	42 (9)	466
2007-08	212 (58)	71 (19)	30 (8)	16 (4)	38 (10)	367
2008-09	236 (55)	88 (21)	43 (10)	25 (6)	37 (9)	429
2009-10	223 (53)	80 (19)	40 (9)	30 (7)	51 (12)	424
2010-11	242 (50)	103 (21)	58 (12)	35 (7)	49 (10)	487
2011-12	351 (47)	126 (17)	86 (12)	62 (8)	118 (16)	743
2012-13	380 (45)	167 (20)	108 (13)	82 (10)	100 (12)	837
2013-14	350 (60)	112 (19)	51 (9)	44 (8)	26 (4)	583
2014-15	383 (54)	131 (19)	84 (12)	49 (7)	58 (8)	705
2015-16	248 (59)	87 (21)	33 (8)	29 (7)	25 (6)	422
2016-17	126 (58)	47 (22)	26 (12)	6 (3)	11 (5)	216

* Product of categories above may not equal total harvest due to some missing names/license numbers

Table 6. Bobcat harvest by method of take, 1989-2016.

	Total	Trapping					Hunting				
Year	Harvest[a]	Harvest	% of Total	# Takers	Ave. Take	% Males[b]	Harvest	% of Total	# Takers	Ave. Take	% Males[b]
1989-90	129	90	70	49	1.8		39	30	28	1.4	
1990-91	83	61	73	43	1.4		22	27	17	1.3	
1991-92	102	59	58	31	1.9		43	42	33	1.3	
1992-93	168	133	79	85	1.6		35	21	23	1.5	
1993-94	201	147	73	88	1.7		54	27	41	1.3	
1994-95	238	189	79	120	1.6		49	21	31	1.6	
1995-96	134	73	54	53	1.4		61	46	38	1.6	
1996-97	203	133	66	91	1.5		70	34	53	1.3	
1997-98	357	313	88	176	1.8		44	12	34	1.3	
1998-99	103	95	92	67	1.4		8	8	8	1.0	
1999-00	206	155	75	114	1.4		51	25	36	1.4	
2000-01	231	140	61	85	1.6		91	39	58	1.6	
2001-02	250	208	83	116	1.8	41	42	17	27	1.6	68
2002-03	544	500	92	279	1.8	38	44	8	32	1.4	57
2003-04	483	415	86	230	1.8	46	68	14	40	1.7	65
2004-05	631	542	86	279	1.9	43	89	14	53	1.7	60
2005-06	583	435	75	250	1.7	37	148	25	85	1.7	65
2006-07	890	779	88	391	2.0	45	111	12	81	1.4	57
2007-08	702	524	75	266	2.0	40	178	25	110	1.6	48
2008-09	853	689	81	334	2.1	42	164	19	99	1.7	59
2009-10	884	736	83	340	2.2	43	148	17	91	1.6	58
2010-11	1012	817	81	372	2.2	40	195	19	123	1.6	50
2011-12	1708	1606	94	670	2.4	47	102	6	74	1.4	60
2012-13	1875	1681	90	721	2.3	46	194	10	130	1.5	52
2013-14	1038	879	85	490	1.8	40	159	15	107	1.5	55
2014-15	1384	1260	91	622	2.0	44	124	9	86	1.4	56
2015-16	766	657	86	355	1.9	49	109	14	68	1.6	70
2016-17	485	377	78	215	1.8	41	108	22	69	1.6	54

[a] Total harvest reported here may not be equal to total harvest in other tables due to incomplete method-of-take data.

[b] Trapper/hunter reported sex ratios in this table are **NOT** adjusted according to results from DNR carcass analyses

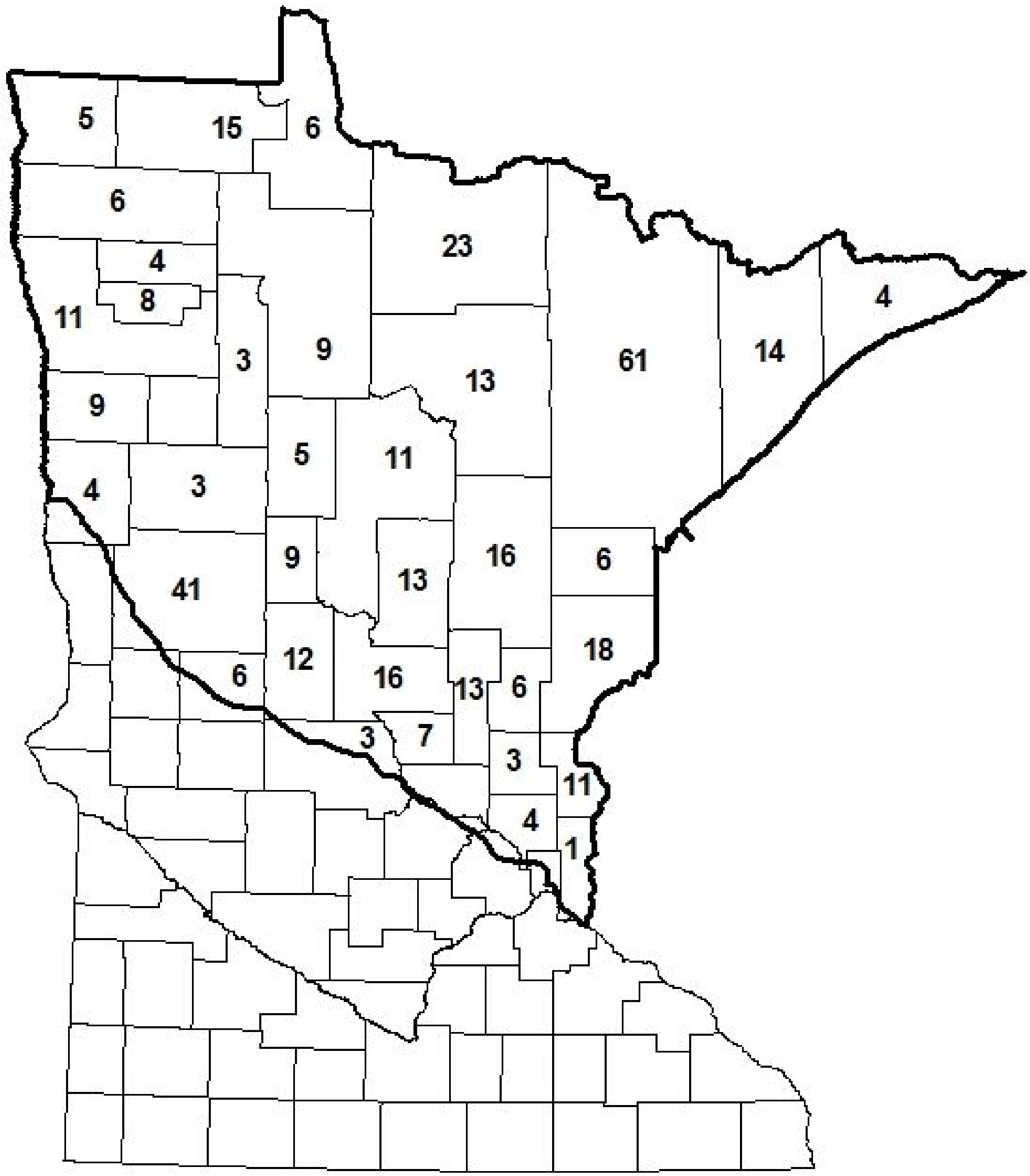

Figure 4. Fisher harvest by county, 2016.

Table 7. Fisher harvest by county and sex, 2016 season.

County	Sex			Total	Harvest/
	Male	Female	Unknown		100 Mile^2
Aitkin	9	7		16	0.80
Anoka	2	2		4	0.90
Becker	2	1		3	0.21
Beltrami	3	6		9	0.29
Benton	4	3		7	1.70
Carlton	2	4		6	0.69
Cass	7	4		11	0.46
Chisago	5	6		11	2.49
Clay	3	1		4	0.38
Clearwater	3	0		3	0.29
Cook	1	3		4	0.25
Crow Wing	8	5		13	1.12
Douglas	2	4		6	0.83
Grant	0	0		0	0.00
Hubbard	4	1		5	0.50
Isanti	1	2		3	0.66
Itasca	5	8		13	0.44
Kanabec	3	3		6	1.13
Kittson	3	2		5	0.45
Koochiching	14	9		23	0.73
Lake	7	7		14	0.61
Lake of the Woods	5	1		6	0.34
Mahnomen	0	0		0	0.00
Marshall	3	3		6	0.33
Mille Lacs	9	4		13	1.91
Morrison	5	11		16	1.39
Norman	6	3		9	1.03
Otter Tail	18	23		41	1.84
Pennington	2	2		4	0.65
Pine	9	9		18	1.26
Polk	4	7		11	0.55
Red Lake	7	1		8	1.85
Roseau	9	6		15	0.89
Sherburne	0	0		0	0.00
St. Louis	30	31		61	0.91
Stearns	1	2		3	0.22
Todd	5	7		12	1.23
Wadena	4	5		9	1.66
Washington	1	0		1	0.24
Wilkin	0	0		0	0.00
Unknown	0	0		0	
Total	206	193	0	399	

Table 8. Comparison of fisher harvest by county, 2005-2016.

County	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Aitkin	97	156	67	75	50	35	55	52	47	24	38	16
Anoka	0	0	0	2	0	0	1	2	1	2	7	4
Becker	49	87	57	36	44	30	32	45	38	21	23	3
Beltrami	47	54	40	15	22	10	25	21	17	4	8	9
Benton	1	1	0	3	2	0	5	5	2	4	3	7
Carlton	35	49	13	19	15	12	12	14	8	14	13	6
Cass	149	209	80	77	57	43	41	37	23	30	24	11
Chisago	2	18	7	4	10	6	10	3	4	16	18	11
Clay	0	1	0	3	0	6	10	6	5	6	4	4
Clearwater	35	54	19	37	13	6	8	5	12	3	2	3
Cook	40	35	29	10	11	17	28	11	13	11	5	4
Crow Wing	79	140	81	116	42	48	64	55	51	34	31	13
Douglas	3	6	2	5	2	6	15	24	8	20	12	6
Grant	0	0	0	0	0	1	0	0	0	0	0	0
Hubbard	20	51	20	38	18	13	10	11	10	8	6	5
Isanti	3	5	1	5	9	1	4	6	11	11	12	3
Itasca	320	405	195	195	166	88	142	105	116	78	47	13
Kanabec	15	26	11	26	20	13	21	27	30	9	10	6
Kittson	7	2	5	8	5	7	5	9	11	2	3	5
Koochiching	209	221	105	115	96	51	116	80	51	67	45	23
Lake	85	87	49	54	49	45	56	53	35	28	14	14
Lake of the Woods	63	74	17	42	21	9	33	21	13	12	15	6
Mahnomen	9	27	25	6	3	0	3	0	4	2	0	0
Marshall	18	26	19	26	6	7	13	14	17	22	22	6
Mille Lacs	16	20	15	17	18	18	17	20	17	12	6	13
Morrison	5	23	21	14	10	8	10	24	25	23	15	16
Norman	6	4	9	12	7	4	10	19	21	12	5	9
Otter Tail	60	158	110	152	67	100	138	121	117	102	77	41
Pennington	22	22	16	8	2	4	8	8	11	19	11	4
Pine	42	82	39	74	30	26	22	42	46	44	35	18
Polk	38	72	61	49	31	25	54	58	45	32	22	11
Red Lake	34	32	29	23	23	10	17	16	24	18	6	8
Roseau	110	127	84	89	58	20	79	61	42	32	26	15
Sherburne	0	0	0	0	3	1	6	2	2	2	2	0
St. Louis	688	898	407	283	296	186	350	233	220	171	125	61
Stearns	0	0	0	1	1	0	4	1	4	2	3	3
Todd	23	21	13	33	22	18	15	29	22	15	19	12
Wadena	40	44	27	37	23	23	31	25	23	21	26	9
Washington	0	0	1	0	0	0	1	1	0	2	2	1
Wilkin	0	0	0	0	0	0	1	0	0	0	0	0
Unknown	18	14	8	3	7	6	1	27	0	8	14	0
Total	2,388	3,251	1,682	1,712	1,259	903	1,473	1,293	1,146	943	756	399

Table 9. Fisher harvest by date and sex, 2016 season.

Date	Sex			Total	% of Known Total	Cumulative %
	Male	Female	Unknown			
Nov. 26	2	4		6	1.50	1.50
Nov. 27	46	37		83	20.80	22.31
Nov. 28	52	57		109	27.32	49.62
Nov. 29	38	42		80	20.05	69.67
Nov. 30	41	26		67	16.79	86.47
Dec. 1	26	27		53	13.28	99.75
Unknown	1	0		1	0.25	100%
Total	206	193	0	399	100%	

Table 10. Distribution of fisher harvest* among trappers, 1993-2015.

Number (%) of Takers	Number Taken						
	1	2	3	4	5	Total Takers	Ave. Take
1993	239 (34)	460 (66)	----	----	----	699	1.7
1994	321 (31)	725 (69)	----	----	----	1046	1.7
1995	232 (40)	355 (60)	----	----	----	587	1.6
1996	321 (31)	726 (69)	----	----	----	1047	1.7
1997	351 (23)	1205 (77)	----	----	----	1556	1.8
1998	443 (28)	1141 (72)	----	----	----	1584	1.7
1999	397 (37)	664 (63)	----	----	----	1061	1.6
2000	301(38)	251 (31)	129 (16)	121 (15)	----	802	2.1
2001	294 (33)	271 (31)	146 (17)	168 (19)	----	879	2.2
2002	336 (35)	234 (25)	138 (15)	117 (12)	123 (13)	948	1.8
2003	403 (39)	249 (24)	150 (15)	107 (11)	115 (11)	1024	1.7
2004	390 (37)	260 (25)	184 (17)	95 (9)	132 (12)	1061	1.7
2005	407 (40)	251 (24)	150 (15)	102 (10)	118 (11)	1028	1.7
2006	510 (37)	328 (24)	208 (15)	150 (11)	171 (13)	1367	1.7
2007	416 (50)	193 (23)	104 (12)	68 (8)	57 (7)	838	1.7
2008	382 (48)	182 (23)	91 (11)	65 (8)	79 (10)	799	1.6
2009	372 (55)	156 (23)	69 (10)	42 (6)	38 (6)	677	1.6
2010	330 (54)	279 (46)	----	----	----	609	1.5
2011	553 (55)	451 (45)	----	----	----	1004	1.4
2012	453 (52)	415 (48)	----	----	----	868	1.5
2013	501 (61)	316 (39)	----	----	----	817	1.4
2014	434 (63)	254 (37)	----	----	----	688	1.4
2015	346 (63)	203 (37)	----	----	----	549	1.4
2016	177 (61)	111 (39)	----	----	----	288	1.4

* Product of categories above may not equal total harvest due to some missing name/license numbers

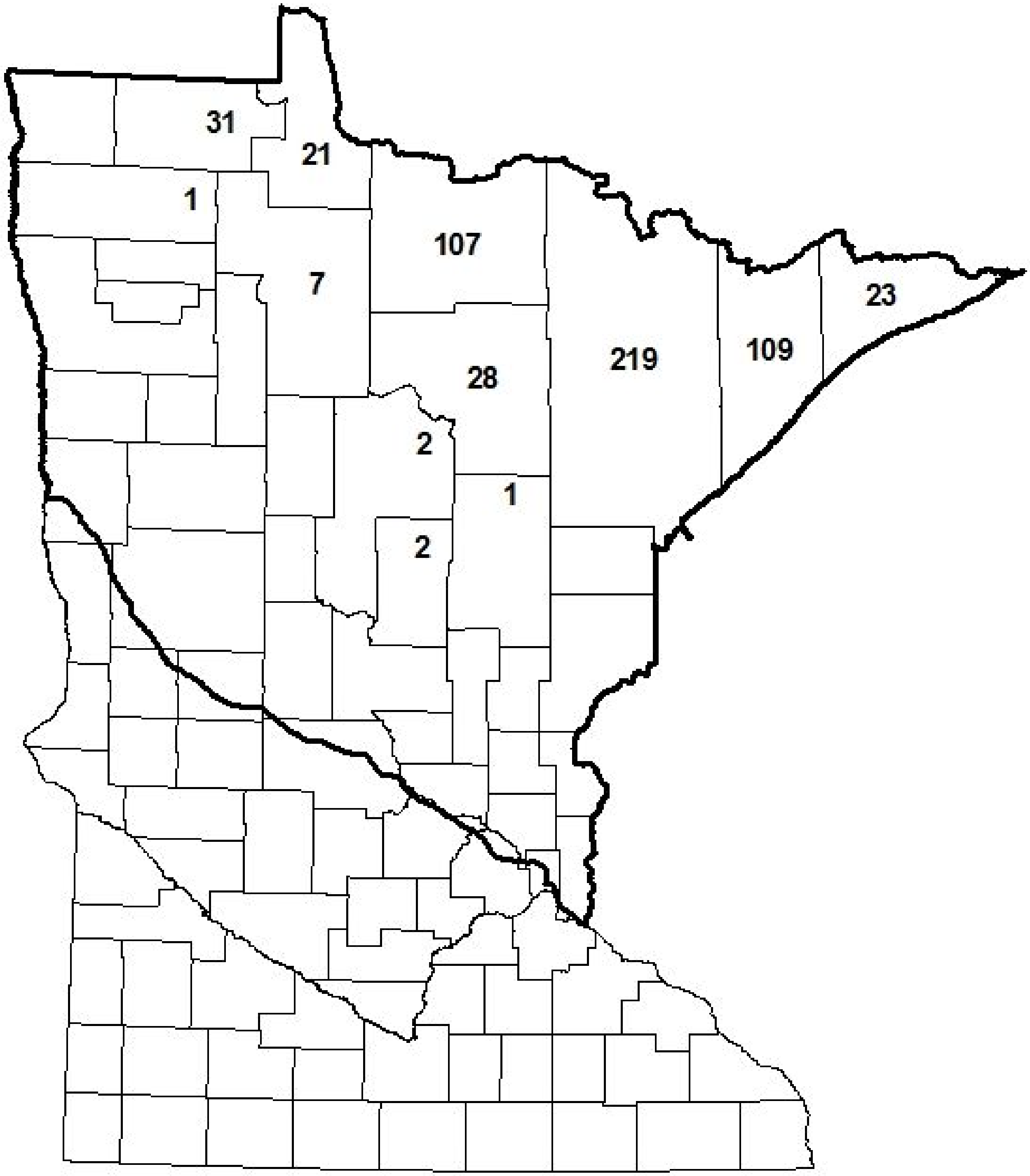

Figure 5. Marten harvest by county, 2016.

Table 11. Marten harvest by county and sex, 2016 season.

County	Sex			Total	Harvest/
	Male	Female	Unknown		100 Mile^2
Aitkin	0	1		1	0.05
Becker	0	0		0	0.00
Beltrami	6	1		7	0.23
Carlton	0	0		0	0.00
Cass	1	1		2	0.08
Clearwater	0	0		0	0.00
Cook	19	4		23	1.43
Crow Wing	2	0		2	0.17
Hubbard	0	0		0	0.00
Itasca	16	12		28	0.96
Kanabec	0	0		0	0.00
Kittson	0	0		0	0.00
Koochiching	66	41		107	3.39
Lake	71	38		109	4.76
Lake of the Woods	16	5		21	1.18
Mahnomen	0	0		0	0.00
Marshall	1	0		1	0.06
Otter Tail	0	0		0	0.00
Pennington	0	0		0	0.00
Pine	0	0		0	0.00
Red Lake	0	0		0	0.00
Roseau	17	14		31	1.85
St. Louis	145	74		219	3.25
Unknown	0	0		0	
Total	360	191	0	551	

Table 12. Comparison of marten harvest by county in Minnesota, 2005-2016.

County	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Aitkin	6	13	4	12	5	4	13	10	8	12	4	1
Becker	0	0	0	0	0	0	0	0	0	0	1	0
Beltrami	17	19	8	6	10	2	11	20	15	7	15	7
Carlton	10	6	1	4	8	5	6	3	1	1	0	0
Cass	1	4	0	1	2	1	2	0	0	3	2	2
Clearwater	0	0	0	0	0	0	0	0	0	0	0	0
Cook	369	446	269	151	244	191	205	148	78	43	39	23
Crow Wing	0	0	0	0	1	0	1	0	0	1	0	2
Hubbard	0	0	0	0	0	0	0	0	0	0	1	0
Itasca	98	155	74	72	91	73	118	46	62	79	64	28
Kanabec	0	2	0	0	0	0	0	0	0	0	0	0
Kittson	0	0	0	0	0	1	0	4	0	1	0	0
Koochiching	418	592	348	300	354	336	516	276	218	265	169	107
Lake	536	892	520	438	496	491	577	290	185	149	138	109
Lake of the Woods	54	46	31	17	17	13	49	32	18	23	25	21
Mahnomen	0	0	0	0	0	0	0	0	0	0	0	0
Marshall	3	0	1	0	4	0	3	3	5	5	3	1
Otter Tail	0	0	0	0	0	0	0	0	0	1	0	0
Pennington	0	0	1	0	0	0	0	0	0	0	1	0
Pine	1	1	1	0	0	1	0	0	0	1	0	0
Red Lake	0	0	0	0	0	0	0	1	1	0	0	0
Roseau	51	31	69	46	32	13	98	77	37	40	33	31
St. Louis	1,065	1,579	885	769	803	709	926	562	386	421	377	219
Unknown	24	2	9	7	6	2	0	0	0	7	5	0
Total	2,653	3,788	2,221	1,823	2,073	1,842	2,525	1,472	1,014	1,059	877	551

Table 13. Marten harvest by date and sex, 2016 season.

Date	Sex			Total	% of Known	Cumulative
	Male	Female	Unknown		Total	%
Nov. 26	4	3		7	1.27	1.27
Nov. 27	115	60		175	31.76	33.03
Nov. 28	89	36		125	22.69	55.72
Nov. 29	74	43		117	21.23	76.95
Nov. 30	43	31		74	13.43	90.38
Dec. 1	33	17		50	9.07	99.46
Unknown	2	1		3	0.54	100%
Total	360	191	0	551	100%	

Table 14. Distribution of marten harvest* among trappers, 1993-2016.

Number (%) of Takers	Number Taken						
	1	2	3	4	5	Total Takers	Ave. Take
1993	76 (10)	681 (90)	----	----	----	757	1.9
1994	165 (20)	681 (80)	----	----	----	846	1.8
1995	78 (10)	711 (90)	----	----	----	789	1.9
1996	157 (18)	734 (82)	----	----	----	891	1.8
1997	161 (13)	1050 (87)	----	----	----	1211	1.9
1998	187 (15)	1056 (85)	----	----	----	1243	1.8
1999	164 (17)	318 (34)	213 (23)	246 (26)	----	941	2.6
2000	188 (28)	190 (28)	123 (18)	173 (26)	----	674	2.4
2001	147 (23)	175 (27)	138 (21)	187 (29)	----	647	2.6
2002	149 (21)	138 (19)	147 (21)	123 (17)	160 (22)	717	1.9
2003	126 (15)	135 (16)	159 (19)	170 (20)	265 (31)	855	1.8
2004	165 (17)	153 (16)	171 (18)	164 (18)	282 (30)	935	1.8
2005	191 (22)	158 (18)	139 (16)	156 (18)	215 (25)	859	1.8
2006	206 (18)	201 (17)	226 (19)	203 (17)	335 (29)	1171	1.8
2007	176 (23)	160 (21)	147 (19)	141 (18)	142 (19)	766	2.0
2008	153 (24)	139 (22)	108 (17)	110 (17)	122 (19)	632	1.9
2009	121 (19)	105 (16)	106 (17)	134 (21)	173 (27)	639	1.9
2010	95 (17)	77 (14)	120 (22)	92 (17)	170 (31)	554	1.8
2011	154 (19)	131 (16)	179 (22)	166 (20)	181 (22)	811	2.0
2012	198 (33)	134 (22)	131 (22)	73 (12)	64 (11)	600	1.9
2013	341 (51)	332 (49)	----	----	----	673	1.5
2014	307 (45)	376 (55)	----	----	----	683	1.6
2015	247 (44)	309 (56)	----	----	----	556	1.6
2016	142 (41)	202 (59)	----	----	----	344	1.6

* Product of categories above may not equal total harvest due to some unknown name/license numbers

Table 15. Number of trappers with different fisher/marten combinations, 2016.
(Combined limit = 2)

Number of Takers		Number of Marten					
		0	1	2	3	4	5
Number of Fisher	0		94	202			
	1	128	49				
	2	111					
	3						
	4						
	5				Total takers of at least 1 fisher or marten		584

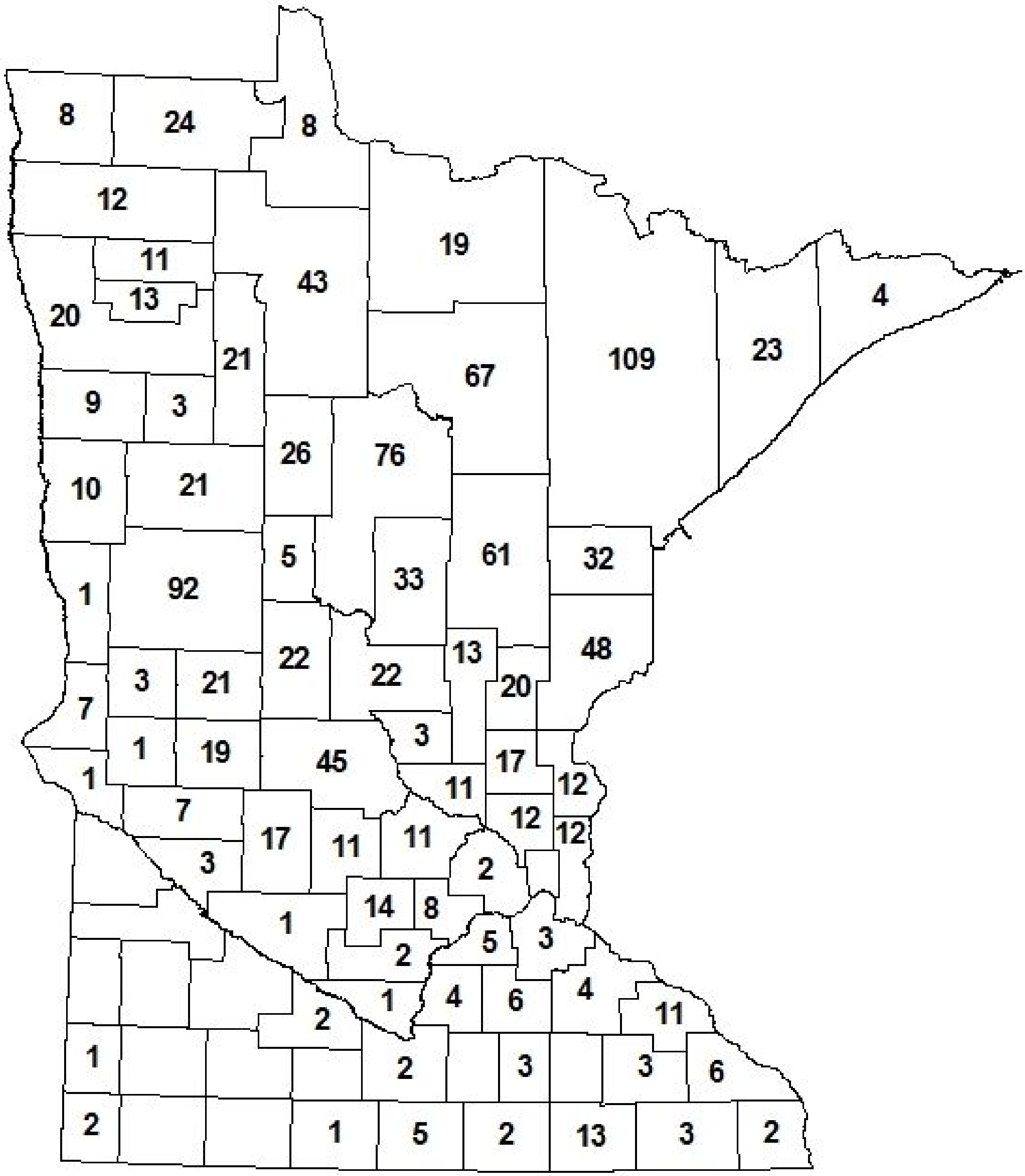

Figure 6. Otter harvest by county, 2016-17.

Table 16. Otter harvest by county and sex, 2016-17 season.

County	Sex: Male	Sex: Female	Sex: Unknown	Total	Harvest/ 100 Mile^2
Aitkin	32	29		61	3.06
Anoka	10	2		12	2.69
Becker	16	5		21	1.45
Beltrami	24	19		43	1.41
Benton	2	1		3	0.73
Big Stone	0	1		1	0.19
Blue Earth	0	3		3	0.39
Brown	2	0		2	0.32
Carlton	18	14		32	3.66
Carver	5	3		8	2.13
Cass	38	36		74	3.07
Chippewa	2	1		3	0.51
Chisago	8	4		12	2.71
Clay	5	5		10	0.95
Clearwater	12	9		21	2.04
Cook	2	2		4	0.25
Crow Wing	21	14		35	3.03
Dakota	3	0		3	0.51
Dodge	0	0		0	0.00
Douglas	14	7		21	2.92
Faribault	3	2		5	0.69
Fillmore	2	1		3	0.35
Freeborn	1	1		2	0.28
Goodhue	3	1		4	0.51
Grant	2	1		3	0.52
Hennepin	1	1		2	0.33
Houston	1	1		2	0.35
Hubbard	19	7		26	2.60
Isanti	12	5		17	3.77
Itasca	33	34		67	2.29
Jackson	0	0		0	0.00
Kanabec	15	5		20	3.75
Kandiyohi	11	2	4	17	1.97
Kittson	6	2		8	0.72
Koochiching	13	6		19	0.60
Lac Qui Parle	0	0		0	0.00
Lake	12	11		23	1.01
Lake of the Woods	5	3		8	0.45
Le Sueur	3	1		4	0.84
Lincoln	0	0		0	0.00
Mahnomen	3	0		3	0.51
Marshall	6	6		12	0.66
Martin	1	0		1	0.14
McLeod	9	5		14	2.77
Meeker	5	6		11	1.71
Mille Lacs	9	4		13	1.91
Morrison	10	12		22	1.91
Mower	7	6		13	1.83
Murray	0	0		0	0.00
Nicollet	0	0		0	0.00
Nobles	0	0		0	0.00
Norman	5	4		9	1.03
Olmsted	1	2		3	0.46
Otter Tail	56	36		92	4.13
Pennington	6	5		11	1.78
Pine	34	14		48	3.35

Table 16 (continued). Otter harvest by county and sex, 2016-17 season.

County	Sex			Total	Harvest/
	Male	Female	Unknown		100 Mile^2
Pipestone	1	0		1	0.21
Polk	14	6		20	1.00
Pope	9	10		19	2.65
Ramsey	0	0		0	0.00
Red Lake	11	2		13	3.00
Redwood	0	0		0	0.00
Renville	1	0		1	0.10
Rice	3	3		6	1.16
Rock	0	2		2	0.41
Roseau	17	7		24	1.43
Scott	3	2		5	1.36
Sherburne	7	4		11	2.44
Sibley	1	1		2	0.33
St. Louis	69	39	1	109	1.62
Stearns	33	12		45	3.24
Steele	0	3		3	0.69
Stevens	0	1		1	0.17
Swift	2	4	1	7	0.93
Todd	14	6	2	22	2.25
Traverse	3	4		7	1.19
Wabasha	7	4		11	2.00
Wadena	4	1		5	0.92
Waseca	0	0		0	0.00
Washington	7	5		12	2.83
Watonwan	0	0		0	0.00
Wilkin	0	1		1	0.13
Winona	4	2		6	0.94
Wright	7	4		11	1.54
Yellow Medicine	0	0		0	0.00
Unknown	0	0		0	
Total	725	462	8	1,195	

Table 17. Comparison of otter harvest by county, 2005-2016.

County	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Aitkin	132	124	53	65	54	59	107	111	90	67	74	61
Anoka	22	16	26	18	26	8	13	31	25	23	20	12
Becker	107	117	54	55	39	53	95	127	87	77	83	21
Beltrami	170	154	105	80	74	77	112	120	98	74	76	43
Benton	14	16	9	11	3	13	13	21	17	8	1	3
Big Stone	0	0	0	2	1	0	3	3	9	8	3	1
Blue Earth	0	0	0	0	0	0	2	3	1	2	1	3
Brown	0	0	0	0	0	0	0	0	0	0	2	2
Carlton	36	39	36	29	30	35	29	38	37	26	42	32
Carver	0	0	2	5	6	5	15	8	9	17	11	8
Cass	231	236	124	160	90	135	140	183	161	193	172	74
Chippewa	0	0	0	0	0	5	7	8	12	6	4	3
Chisago	28	33	16	15	18	23	19	24	32	26	20	12
Clay	18	35	8	14	7	23	42	23	16	14	18	10
Clearwater	48	41	39	35	19	38	41	46	47	23	38	21
Cook	46	39	13	12	16	19	36	55	57	28	9	4
Crow Wing	102	111	63	99	76	66	107	117	96	83	59	35
Dakota	0	0	0	5	7	1	0	11	10	6	13	3
Dodge	0	0	0	0	0	3	1	1	3	4	2	0
Douglas	16	30	18	28	11	14	34	37	23	33	22	21
Faribault	0	0	0	0	0	0	1	12	3	1	3	5
Fillmore	0	0	6	1	1	5	5	10	6	13	3	3
Freeborn	0	0	0	0	0	5	10	10	1	7	6	2
Goodhue	0	0	3	3	7	11	7	18	2	2	11	4
Grant	0	0	3	3	6	1	8	12	6	13	4	3
Hennepin	0	0	1	3	6	2	3	4	5	6	3	2
Houston	0	0	9	15	11	11	10	26	22	14	9	2
Hubbard	80	72	59	72	41	52	42	67	61	36	32	26
Isanti	38	30	30	17	18	14	9	18	28	23	13	17
Itasca	362	334	205	201	191	247	281	346	345	184	159	67
Jackson	0	0	0	0	0	0	0	0	0	0	1	0
Kanabec	79	62	44	29	23	17	22	52	45	34	26	20
Kandiyohi	0	0	2	6	6	8	8	10	20	20	23	17
Kittson	3	5	11	2	3	8	2	9	7	4	0	8
Koochiching	131	118	70	95	61	81	62	127	115	55	68	19
Lac Qui Parle	0	0	0	0	0	2	6	15	6	1	7	0
Lake	65	60	35	34	45	28	36	66	67	45	26	23
Lake of the Woods	34	24	30	17	8	15	27	27	27	31	31	8
Le Sueur	0	0	0	0	0	3	0	9	5	2	2	4

Table 17 (continued). Comparison of otter harvest by county, 2005-2016.

County	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Lincoln	0	0	0	0	0	0	0	4	0	0	0	0
Mahnomen	29	26	24	7	7	9	20	15	25	7	6	3
Marshall	18	7	6	2	0	13	13	15	15	4	9	12
Martin	0	0	0	0	0	0	0	1	0	0	1	1
McLeod	0	0	6	6	8	12	18	19	22	18	16	14
Meeker	0	0	13	13	16	12	28	19	32	35	23	11
Mille Lacs	51	21	33	26	28	19	15	30	39	28	16	13
Morrison	77	60	45	43	31	29	29	52	52	50	31	22
Mower	0	0	0	0	0	8	20	14	9	8	2	13
Murray	0	0	0	0	0	0	0	0	0	0	1	0
Nicollet	0	0	0	0	0	2	1	5	7	1	0	0
Nobles	0	0	0	0	0	0	0	0	0	4	0	0
Norman	17	11	9	17	11	12	21	45	27	19	13	9
Olmsted	0	0	0	2	3	2	3	0	7	7	5	3
Otter Tail	85	81	50	82	32	65	109	173	154	97	87	92
Pennington	33	15	9	0	1	4	2	12	5	8	8	11
Pine	51	111	50	74	37	38	44	66	98	59	86	48
Pipestone	0	0	0	0	0	0	0	0	0	0	0	1
Polk	45	47	32	25	19	36	49	83	71	47	37	20
Pope	0	0	11	12	12	11	20	22	14	19	8	19
Ramsey	0	0	0	0	0	0	0	3	1	1	1	0
Red Lake	26	30	19	8	20	22	19	26	11	10	14	13
Redwood	0	0	0	0	0	0	2	4	6	8	3	0
Renville	0	0	0	0	0	0	1	6	0	3	1	1
Rice	0	0	0	0	0	1	9	4	8	1	2	6
Rock	0	0	0	0	0	0	0	2	0	0	0	2
Roseau	60	53	32	53	23	32	33	64	48	44	23	24
Scott	0	0	3	3	1	4	2	4	3	2	4	5
Sherburne	15	29	26	10	17	7	19	12	9	10	10	11
Sibley	0	0	0	0	0	6	6	6	3	2	3	2
St. Louis	428	344	290	251	233	253	239	363	293	258	260	109
Stearns	21	33	9	38	24	13	41	53	53	41	50	45
Steele	0	0	0	0	0	1	0	3	1	0	1	3
Stevens	0	0	1	3	1	6	1	3	12	4	2	1
Swift	0	0	9	4	5	2	11	10	10	9	3	7
Todd	63	81	35	37	32	41	63	55	55	19	28	22
Traverse	0	0	1	0	2	0	1	4	1	0	3	7
Wabasha	0	0	15	7	18	7	8	20	21	19	9	11
Wadena	38	32	15	19	15	16	20	43	30	30	19	5

Table 17 (continued). Comparison of otter harvest by county, 2005-2016.

County	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Waseca	0	0	0	0	0	0	0	0	0	2	2	0
Washington	11	16	18	19	11	16	18	12	24	27	9	12
Watonwan	0	0	0	0	0	0	0	0	1	0	0	0
Wilkin	0	0	2	0	0	0	0	3	2	0	3	1
Winona	0	0	11	19	13	15	20	21	17	5	17	6
Wright	2	5	7	9	8	11	17	23	26	21	21	11
Yellow Medicine	0	0	0	0	0	0	0	7	9	0	3	0
Unknown	14	22	6	18	12	2	17	40	2	18	18	0
	2,846	2,720	1,861	1,938	1,544	1,814	2,294	3,171	2,824	2,154	1,955	1,195

Table 18. Otter harvest by sex and week, 2016-17 season.

Date	Sex			Total Harvest	% of Total	Cumulative %
	Male	Female	Unknown			
Oct.29 - Nov.4	126	81		207	17.32	17.32
Nov.5 - Nov.11	104	59	2	165	13.81	31.13
Nov.12 - Nov.18	104	73		177	14.81	45.94
Nov.19 - Nov.25	95	48		143	11.97	57.91
Nov.26 - Dec.2	105	69	1	175	14.64	72.55
Dec.3 - Dec.9	64	39	1	104	8.70	81.26
Dec.10 - Dec.16	49	28	3	80	6.69	87.95
Dec.17 - Dec.23	25	26		51	4.27	92.22
Dec.24 - Dec.30	33	25	1	59	4.94	97.15
Dec.31 - Jan.8*	20	14		34	2.85	100.00
Unknown	0	0		0	0.00	100.00
Total	725	462	8	1,195	100%	

* 9-day interval.

Table 19. Distribution of otter harvest* among trappers, 1993-2016.

Number (%) of Takers	Number Taken					
	1	2	3	4	Total Takers	Ave. Take
1993-94	193 (33)	115 (19)	100 (17)	184 (31)	592	2.5
1994-95	250 (27)	185 (20)	143 (15)	349 (38)	927	2.6
1995-96	183 (31)	134 (23)	88 (15)	180 (31)	585	2.5
1996-97	257 (29)	205 (23)	140 (16)	283 (32)	885	2.5
1997-98	304 (33)	235 (26)	117 (13)	255 (28)	911	2.4
1998-99	263 (32)	183 (23)	139 (17)	226 (28)	811	2.4
1999-00	222 (33)	124 (19)	99 (15)	217 (33)	662	2.5
2000-01	206 (32)	122 (19)	108 (17)	201 (32)	637	2.5
2001-02	147 (23)	175 (27)	138 (21)	187 (29)	647	2.6
2002-03	253 (33)	147 (19)	122 (16)	241 (32)	763	2.5
2003-04	269 (27)	201 (20)	152 (16)	361 (37)	983	2.6
2004-05	302 (25)	235 (19)	182 (15)	498 (41)	1217	2.7
2005-06	291 (27)	213 (20)	186 (17)	386 (36)	1076	2.6
2006-07	372 (34)	216 (19)	194 (17)	328 (30)	1110	2.4
2007-08	308 (39)	153 (19)	119 (15)	207 (26)	787	2.3
2008-09	293 (37)	157 (20)	121 (15)	216 (27)	787	2.3
2009-10	237 (38)	131 (21)	93 (15)	171 (27)	632	2.3
2010-11	263 (34)	166 (22)	130 (17)	206 (27)	765	2.4
2011-12	438 (42)	227 (22)	149 (14)	236 (22)	1050	2.2
2012-13	468 (35)	330 (24)	175 (13)	376 (28)	1349	2.3
2013-14	561 (43)	291 (22)	196 (15)	271 (21)	1319	2.1
2014-15	424 (42)	231 (23)	154 (15)	200 (20)	1009	2.1
2015-16	337 (39)	183 (21)	142 (16)	203 (23)	865	2.2
2016-17	270 (46)	135 (23)	80 (14)	101 (17)	586	2.0

* Product of categories above may not equal total harvest due to some unknown name/license numbers