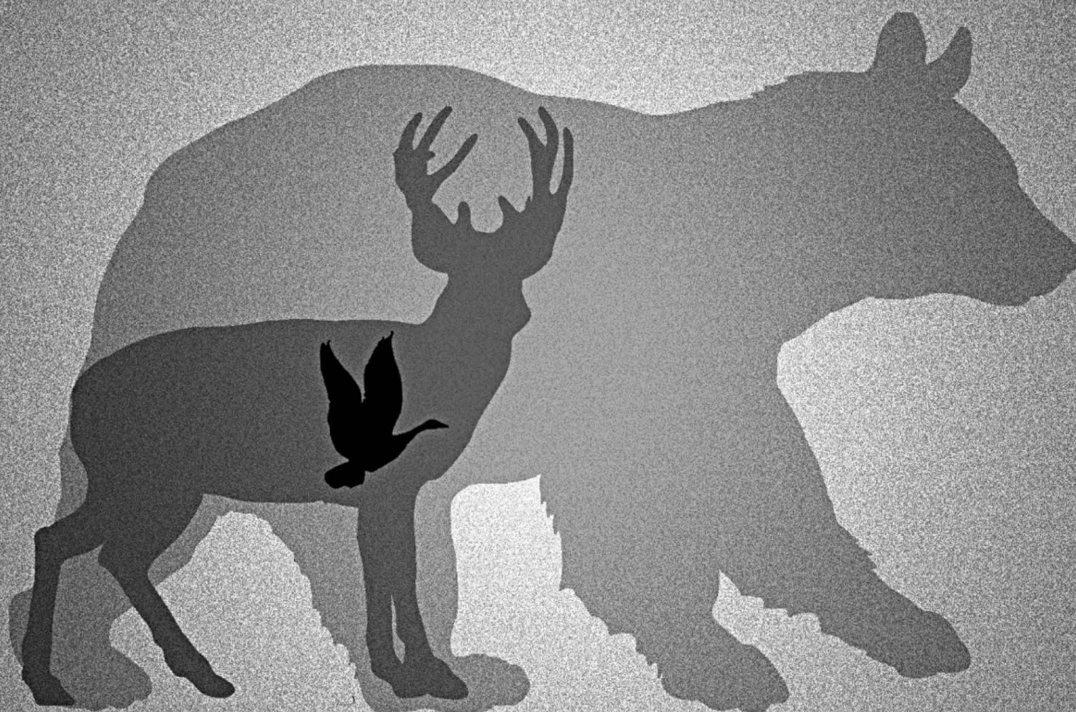

Status of Wildlife Populations

Fall 2016

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

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Status of Wildlife Populations, Fall 2016

(Including 2006-2016 Hunting and Trapping Harvest Statistics)

MNDNR

edited by
Margaret H. Dexter

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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 2016

(Including 2006-2016 Hunting and Trapping Harvest Statistics)

This is the 40th year that the DNR has compiled this booklet; it is primarily an administrative document intended for DNR personnel. Since 1984 we have also generated a companion volume, *Summaries of Wildlife Research Findings*, containing annual summaries of activities and findings from ongoing research projects in the Wildlife Policy and Research Unit. This publication will be posted on the DNR website and available in other formats upon request. In the on-line format links are available to the U.S. Fish and Wildlife Service Division of Migratory Bird Management to access their reports for Waterfowl Population Status; Migratory Bird Harvest Information Preliminary Estimates; American Woodcock Population Status; and Mourning Dove Population Status.

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

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

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WILDLIFE RESTORATION

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FARMLAND WILDLIFE POPULATIONS

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2016 MINNESOTA AUGUST ROADSIDE SURVEY

Nicole M. Davros, Farmland Wildlife Populations and Research Group

SUMMARY OF FINDINGS

An increase in grassland habitat acres combined with another relatively mild winter and favorable breeding season conditions led to increases in Minnesota's 2016 population indices for ring-necked pheasants and gray partridge. However, indices for both species remain below their long-term averages. Range-wide indices for cottontail rabbits and sandhill cranes were similar to 2015 but the index for juvenile cranes increased. The mourning dove index decreased in 2016 and remained below the long-term average. The white-tailed deer index increased and remains well above the long-term average.

For the first time since 2011, total acres of undisturbed grassland habitat increased across Minnesota's farmland region. Overall, 54,495 acres were gained statewide since 2015, including 24,307 acres of Conservation Reserve Program (CRP) habitat. Acres either held nearly steady or increased in all other private land conservation programs. Publically-owned grassland habitat also increased in 2016. Net habitat gains occurred in the pheasant range (61,525 acres) whereas the prairie chicken range (mostly represented by the Northwest region) lost 957 acres. The winter of 2015-16 was the second consecutive mild winter, and most regions had minimal snow during March. Spring and early summer temperatures varied widely but, on average, temperatures were at or above normal from April-June. Several regions were drier than normal but many areas in the southern regions had above-normal rainfall in May and June. Overall, weather conditions led to good overwinter survival and good nesting and brood-rearing conditions.

The 2016 range-wide pheasant index (52.1 birds/100 mi) increased 29% from 2015 but was 14% below the 10-year average and 48% below the long-term average. Although Minnesota's pheasant population has been declining since the mid-2000s in conjunction with a loss of CRP acres, this year marks the third consecutive year with an increase in the overall index. This increase can be attributed to the back-to-back mild winters, good nesting season conditions, and the gain in acres of habitat. The hen index (7.9 hens/100 mi) increased 31% from 2015 but was 16% below the 10-year average. The cock index (5.9 cocks/100 mi) increased 21% from 2015 but was 21% below the 10-year average. The hen:cock ratio (1.35) was greater than 2015 (1.27) and closer to the 1.42 average ratio for the CRP years (1987-2015). The pheasant brood index (8.7 broods/100 mi) increased 39% from last year but remained 7% below the 10-year average and 34% below the long-term average. Average brood size in 2016 (4.4 chicks/brood) was down slightly from the 2015 index and the 10-year average (both indices = 4.7 chicks/brood) and was 20% below the long-term average (5.5 chicks/brood). The range-wide median estimated hatch date for pheasants was 11 June 2016 but, notably, the median estimated hatch dates were later in the South Central (17 June) and Southwest (22 June) regions where rainfall early in the season may have interrupted nesting. Good harvest opportunities should be available in all regions except the Southeast.

The gray partridge index (3.7 birds/100 mi) increased 62% in 2016 and was similar to the 10-year average but 72% below the long-term average. Partridge observations were highest in the Southwest, South Central, and Southeast regions. The eastern cottontail rabbit index (7.2 rabbits/100 mi) was similar to 2015 and was above the 10-year and long-term averages (34% and 18%, respectively). Cottontail rabbit indices were highest in the East Central, South Central, and Southeast regions. The white-tailed jackrabbit index (0.1 rabbits/100 mi) did not change from last year and was 90% below the long-term average. The jackrabbit population declined to low levels in

the 1980s due to changes in agricultural land use and has not recovered. The white-tailed deer index (27.5 deer/100 mi) increased 30% from 2015 and was well above the 10-year and long-term averages (67% and 149%, respectively). The mourning dove index (144.1 doves/100 mi) decreased 22% from 2015 and was 29% below the 10-year average and 44% below the long-term average. Mourning dove counts were highest in the West Central, Southwest, Central, and South Central regions. Range-wide, the total sandhill crane index (15.7 total cranes/100 mi) was similar and the juvenile index (2.2 juvenile cranes/100 mi) increased 62% from 2015.

INTRODUCTION

This report summarizes the 2016 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 2016 ARS consisted of 172 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 at 15-20 miles/hour and recorded the number of pheasants, gray (Hungarian) partridge, cottontail rabbits, white-tailed jackrabbits, and other wildlife they observed. 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 are imprecise and ***should be interpreted cautiously***.

HABITAT CONDITIONS[1]

In Minnesota's farmland region, total undisturbed grassland habitat acres increased last year for the first time since 2011. Statewide, 54,495 habitat acres were gained (pheasant range: 61,525 net acres; prairie chicken range: -957 net acres). Conservation Reserve Program (CRP) enrollment increased by 24,307 acres overall. Gains in CRP occurred within the pheasant range (37,263 acres) whereas losses of CRP occurred in the prairie chicken range (-8,331 acres, primarily in the Northwest region). Acres enrolled in the Conservation Reserve Enhancement Program (CREP) held nearly steady in 2016 while acres enrolled in Reinvest in Minnesota (RIM), Wetlands Reserve Program (WRP), and RIM-WRP increased statewide (7,765 acres, 1,029 acres, and 2,356 acres, respectively). Publically-owned acres also increased in 2016. Federally-owned Waterfowl Production Areas (WPA) and U.S. Fish and Wildlife Service (USFWS) refuges increased by 7,384 acres and state-owned Wildlife Management Areas (WMA) increased by 11,673 acres overall. More WMA acres were gained in the pheasant range (10,104 acres) than the prairie chicken range (1,536 acres). The USFWS added 6,219 acres of habitat in the pheasant range and 2,593 acres in the prairie chicken range. Similar to 2015, remaining protected habitat accounts for 6.1% of the landscape within the pheasant range (range: 3.1-9.8%; Table 1).

Grassland and wetland habitat conservation remains a priority concern for Minnesota. Private-land conservation programs, including CRP, continue to make up the largest portion of protected grassland habitat in the state (Fig. 2) but approximately 393,000 acres of CRP are set to expire by

[1] An active CREP acreage report could not be obtained from the Farm Service Agency (FSA). Therefore, total statewide CRP acres reported for 2016 were reduced by 70,778 acres to avoid double-counting with CREP acres for which there are still active contracts.

2018. Recent low corn and soybean prices have increased landowner interest in farmland retirement programs; however, the current federal Farm Bill limits the number of acres that can be enrolled in CRP and the most recent CRP-sign up resulted in a low acceptance rate in Minnesota (i.e., only 9% of acres offered were accepted). Funding from the Legacy Amendment[2] 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 help continue funding of the WIA program. As of August 2016, 216 sites are enrolled in the program for a total of 21,436 acres of private land that are open to public hunting. Sites are spread across the Southwest, South Central, West Central, Central, and Northwest regions of Minnesota. Walk-in Access sites are open for public hunting from 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 2015-2016 was generally mild with warmer than normal temperatures and near normal precipitation amounts. Monthly temperatures averaged 6.0° F above normal (range: 1.7° F to 9.7° F) across all farmland regions from December through March (Minnesota Climatology Working Group [MCWG], Climate Summary Table). Although snow cover was fairly continuous from late December through February throughout the farmland zone, snow depths exceeding 6 inches were intermittent across regions (MCWG, MCWG Climate Summary, Weekly snow depth maps). All regions except the Northwest were nearly snow-free for most of March.

Spring temperatures and precipitation varied widely across the farmland regions. On average, temperatures were at or above normal for May and June. The Northwest, West Central, and East Central regions were drier than normal during May and June whereas localized areas in the Southwest region were wetter than normal. July had near-normal temperatures but was wetter than normal. Averaged across all regions, July rainfall amounts were 2.69 inches above normal (range: 1.36 inches to 3.52 inches).

Overall, the conditions for over-winter survival of wildlife were above average throughout the farmland zone for the second year in a row. Although some localized areas received excessive rainfall during May and June (the prime period for nesting birds), temperatures were above average which would have been beneficial for chick survival and brood-rearing. Additionally, hens had plenty of time to re-nest if they lost their early-season nest attempts due to flooding.

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[2] 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.

SURVEY CONDITIONS

The survey period was extended (28 July – 17 August) to allow all survey routes (n=172) to be completed in 2016. 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 97% of the survey routes which was comparable to 2015 (98%) and slightly above the 10-year average (93%). Similar to 2015, clear skies (<30% cloud cover) were present at the start of 82% of routes. Wind speeds <7 mph were recorded for 94% of the routes which was less favorable than 2015 (100%). Notably, several observers reported flooded road right-of-ways due to rainfall events before and during the survey period which may have reduced detectability of some species, particularly pheasants, partridge, and cottontail rabbits.

RING-NECKED PHEASANT

In 2016, the average number of pheasants observed (52.1 birds/100 mi) increased 29% from 2015 but was 14% below the 10-year average (Table 2, Fig. 3A) and 48% below the long-term average. Total pheasants observed per 100 mi ranged from 17.9 birds in the Southeast region to 96.0 birds in the Southwest region (Table 3). The pheasant index showed substantial increases in the Central (72%) and South Central (70%) regions. Regional indices also increased in the East Central (27%), Southwest (25%), and West Central (10%) regions. Good harvest opportunities should exist in all regions with the exception of the Southeast where the index declined 31% compared to 2015.

The range-wide hen index (7.9 hens/100 mi) increased 31% from 2015 but was 16% below the 10-year average and 45% below the long-term average (Table 2). The hen index ranged from 2.9 hens/100 mi in the Southeast to 13.7 hens/100 mi in the Southwest. The 2016 hen index in the East Central region was similar to 2015 but increased in the West Central (19%), Southwest (20%), South Central (65%), and Central (77%) regions. The hen index declined 22% in the Southeast region.

Across their range, the cock index (5.9 cocks/100 mi) increased 21% from 2015 but remained 21% below the 10-year average and 47% below the long-term average (Table 2). The cock index ranged from 0.6 cocks/100 mi in the Southeast to 9.9 cocks/100 mi in the Southwest. The 2016 indices increased in the South Central (26%), Southwest (47%), and East Central (83%) regions and remained similar to 2015 in the West Central, Central, and Southeast regions.

The 2016 hen:cock ratio (1.35) was greater than the 2015 ratio (1.27) and closer to the average (1.42 ± 0.35) for the CRP years (1987-2015).

The 2016 range-wide brood index (8.7 broods/100 mi) increased 39% from last year (Table 2). The index was 7% below the 10-year average and 34% below the long-term average. Regional brood indices ranged from 3.6 broods/100 mi in the Southeast to 15.6 broods/100 mi in the Southwest. Brood indices increased in all regions (range: 14% to 103%) except the Southeast which remained similar to 2015's index. The average brood size in 2016 (4.4 chicks/brood) was down slightly from the 2015 index and the 10-year average (both indices = 4.7 chicks/brood) and was 20% below the long-term average (5.5 chicks/brood). The median estimated hatch date for pheasant broods across their range was 11 June 2016 (n = 330 broods), which was similar to the 10-year average (12 June; Table 2). Notably, the median estimated hatch dates were later in the South Central (17 June) and Southwest (22 June) regions where rainfall may have disrupted early-season nest attempts.

The pheasant population has declined since the mid-2000s in conjunction with the loss of CRP acres (Fig. 2 & 3A) but 2016 represents the third consecutive year with an increase in the overall index. This increase can be mostly attributed to back-to-back mild winters combined with good weather conditions for nesting and brood-rearing but the gain in grassland habitat acres is also important. Winter conditions for pheasants are considered severe when the temperature is ≤0° F and snow depths exceed 6 inches. Heavier rains in some regions during May and June might have forced hens to re-nest but the above-normal temperatures were beneficial to brood-rearing and chick survival. One exception is the Southeast region, which has been hampered in consecutive years by late-season snowstorms and/or heavy rain events during the nesting season. The Southeast region also has the second lowest total of undisturbed grassland habitat acres within Minnesota's pheasant range (Table 1). The combination of poor weather conditions and lack of abundant habitat combine to make it difficult for the pheasant population to increase in this region of the state.

GRAY PARTRIDGE

The range-wide gray partridge index (3.7 birds/100 mi) increased 62% from 2015 and was similar to the 10-year average but remained 72% below the long-term average (Table 2, Fig. 3B). No partridge were observed in the Northwest, West Central, or East Central regions. Indices in regions where they were observed ranged from 2.5 birds/100 mi in the Central region to 9.7 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, South Central, and Southeast regions will offer the best opportunities for harvesting gray partridge in 2016.

COTTONTAIL RABBIT AND WHITE-TAILED JACKRABBIT

The range-wide eastern cottontail rabbit index (7.2 rabbits/100 mi) was similar to 2015 and was 34% above the 10-year average and 18% above the long-term average (Table 2, Fig. 4A). The cottontail rabbit index ranged from 2.1 rabbits/100 mi in the Northwest to 21.5 rabbits/100 mi in the East Central region (Table 3). Good harvest opportunities should exist in the East Central, South Central, and Southeast regions.

Remaining at a historic low, the number of white-tailed jackrabbits observed (0.1 rabbits/100 mi) was 90% below the long-term average (1.7 rabbits/100 mi; Table 2, 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 is due to the loss of their preferred habitats (i.e., pasture, hayfields, and small grains). The greatest potential for white-tailed jackrabbit hunting will be in the Southwest or West Central regions (Table 3).

WHITE-TAILED DEER

The white-tailed deer index (27.5 deer/100 mi) increased 30% from 2015 and was 67% above the 10-year average and 149% above the long-term average (Table 2, Fig. 5A). Roadside indices for deer ranged from 7.5 deer/100 mi in the South Central region to 69.0 deer/100 mi in the Northwest (Table 3).

MOURNING DOVE

The index for mourning doves (144.1 doves/100 mi) was 22% lower than 2015, 29% below the 10-year average, and 44% below the long-term average (Table 2, Fig. 5B). The index ranged from 62.9 doves/100 mi in the East Central region to 189.8 doves/100 mi in the West Central region. The best opportunities for harvesting doves should be in the West Central, Southwest, Central, and South Central regions.

SANDHILL CRANE

The 2016 range-wide index of sandhill cranes was 15.7 total cranes/100 mi which was similar to 2015 (Table 2). Regional indices ranged from 0.0 total cranes/100 mi in the Southwest to 65.2 total cranes/100 mi in the Northwest (Table 3). The range-wide index of juveniles was 2.2 juvenile cranes/100 mi which was 62% greater than 2015 (1.3 juvenile cranes/100 mi; Table 2). Juvenile cranes were observed in all regions except the Southwest.

OTHER SPECIES

Notable incidental sightings included: badger (Watonwan County), black bear (Todd County), beaver (Nobles County), black-billed magpie (Polk and Red Lake Counties), fisher (Todd County), merlin (Polk County), mink (Chippewa and Waseca Counties), northern harrier (Martin, Nobles, Polk, and Red Lake Counties), osprey (Wright County), pileated woodpecker (Stearns County), common raven (Red Lake County), red-headed woodpecker (Faribault and Redwood Counties), striped skunk (Becker, Faribault, Grant, and Red Lake Counties), and upland sandpiper (Cottonwood County). American kestrels, Canada geese, coyotes, domestic cats, red fox, red-tailed hawks, and wild turkeys were also noted in multiple counties.

ACKNOWLEDGEMENTS

I thank the many cooperators for their help in completing routes this year. This survey is simply not possible without their efforts. Tonya Klinkner was invaluable in providing logistical assistance and completing data entry. Jessica Petersen helped proof data and created the hunting prospects map. 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 data, and Tamra Adams of the U.S. Fish and Wildlife Service provided federal land acquisition data. Gino D'Angelo, Lou Cornicelli, and John Giudice reviewed an earlier draft of this report. This work was funded in part through the Federal Aid in Wildlife Restoration Act.

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Minnesota Climatology Working Group (MCWG). 2016. MCWG Climate Summary Table. Accessed on August 19, 2016.

Table 1. Abundance (total acres) and density (acres/mi2) of undisturbed grassland habitat within Minnesota's pheasant range, 2016[a], by agricultural region (AGREG).

	Cropland Retirement								% of	Density
AGREG	CRP[b]	CREP	RIM	RIM-WRP	WRP	USFWS[c]	MNDNR[d]	Total	Landscape	ac/mi2
WC[e]	263,694	37,688	22,695	14,275	20,255	196,148	110,294	665,049	9.8	62.7
SW	98,585	24,764	19,809	2,556	766	23,090	69,508	239,078	6.3	40.3
C	126,050	14,326	34,370	6,591	3,339	90,100	49,726	324,502	5.4	34.6
SC	88,050	27,633	13,327	10,288	8,785	9,494	34,238	191,815	4.7	30.1
SE	67,622	2,706	7,360	1,070	985	36,754	53,158	169,655	4.6	29.4
EC	3,354	0	1,131	0	4	4,994	91,197	100,680	3.1	19.8
Total	647,355	107,117	98,692	34,780	34,133	360,580	408,121	1,690,778	6.1	39.0

[a] Unpublished data, Tabor Hoek, BWSR, 16 August 2016.

[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. Range-wide trends (% change) in number of wildlife observed per 100 miles driven, Minnesota August roadside survey, 1955-2016.

Species	**Change from 2015**[a]					**Change from 10-year average**[b]				**Change from long-term average**[c]			
Subgroup	*n*	2015	2016	%	95% CI	*n*	2006-15	%	95% CI	*n*	LTA	%	95% CI
Ring-necked pheasant													
Total pheasants	149	40.7	52.1	29	±21	148	58.4	-14	±13	149	95.3	-48	±10
Cocks	149	4.9	5.9	21	±23	148	7.3	-21	±14	149	10.8	-47	±12
Hens	149	6.1	7.9	31	±24	148	9.0	-16	±14	149	13.8	-45	±11
Broods	149	6.3	8.7	39	±26	148	9.1	-7	±14	149	12.6	-34	±12
Chicks per brood	330	4.7	4.4	-7			4.7	-7			5.5	-20	
Broods per 100 hens	149	103.0	109.6	7			100.2	9			101.4	8	
Median hatch date	330	9 June	11 June				12 June						
Gray partridge	168	2.3	3.7	62	±89	167	3.6	2	±58	149	14.7	-72	±19
Eastern cottontail	168	7.1	7.2	1	±24	167	5.4	34	±24	149	6.6	18	±22
White-tailed jackrabbit	168	0.1	0.1	51	±140	167	0.2	-23	±66	149	1.7	-90	±14
White-tailed deer	168	21.2	27.5	30	±23	167	16.5	67	±26	168	10.9	149	±40
Mourning dove	168	184.2	144.1	-22	±16	167	203.2	-29	±11	149	267.2	-44	±8
Sandhill crane[d]													
Total cranes	168	16.0	15.7	-2	±26								
Juveniles	168	1.3	2.2	62	±57								

[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 1955-2015, except for deer (1974-2015). 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 3. Regional trends (% change) in number of wildlife observed per 100 miles driven, Minnesota August roadside survey, 1955-2016.

Region	**Change from 2015**[a]					**Change from 10-year average**[b]				**Change from long-term average**[c]			
Species	*n*	2015	2016	%	95% CI	*n*	2006-15	%	95% CI	*n*	LTA	%	95% CI
Northwest[d]													
Gray partridge	19	0.8	0.0	-100	±144	19	0.6	-100	±101	19	3.2	-100	±66
Eastern cottontail	19	1.3	2.1	64	±153	19	0.5	277	±315	19	0.8	155	±199
White-tailed jackrabbit	19	0.2	0.0	-100	±210	19	0.3	-100	±64	19	0.6	-100	±42
White-tailed deer	19	58.7	69.0	18	±53	19	43.4	59	±67	19	32.2	114	±80
Mourning dove	19	85.3	116.2	36	±52	19	89.7	30	±54	19	118.4	-2	±38
Sandhill crane[e]	19	65.7	65.2	-1	±37								
West Central[f]													
Ring-necked pheasant	39	46.3	50.8	10	±38	35	67.5	-30	±22	37	96.9	-54	±15
Gray partridge	39	0.2	0.0	-100	±202	35	0.8	-100	±96	37	9.4	-100	±21
Eastern cottontail	39	2.6	3.4	32	±67	35	2.6	31	±56	37	3.9	-18	±32
White-tailed jackrabbit	39	0.1	0.3	200	±405	35	0.2	97	±209	37	2.2	-85	±26
White-tailed deer	39	17.4	31.5	81	±58	35	15.9	110	±58	37	10.4	205	±104
Mourning dove	39	281.4	189.8	-33	±23	35	245.6	-22	±18	37	366.5	-48	±13
Sandhill crane	39	3.7	1.7	-53	±92								
Central													
Ring-necked pheasant	27	26.7	45.8	72	±74	29	48.3	-11	±39	28	70.9	-39	±26
Gray partridge	27	0.0	2.5			29	1.3	87	±297	28	9.1	-73	±47
Eastern cottontail	27	4.6	7.3	58	±78	29	4.7	46	±85	28	6.2	15	±62
White-tailed jackrabbit	27	0.0	0.0			29	0.1	-100	±97	28	1.1	-100	±23
White-tailed deer	27	20.4	23.3	14	±39	29	11.5	94	±60	28	6.2	260	±132
Mourning dove	27	123.1	145.1	18	±67	29	176.6	-16	±37	28	227.6	-33	±31
Sandhill crane	27	20.3	25.5	25	±64								
East Central													
Ring-necked pheasant	13	46.2	54.1	27	±56	13	53.8	1	±52	13	85.0	-36	±42
Gray partridge	13	0.0	0.0			13	0.0			13	0.1	-100	±147
Eastern cottontail	13	8.8	21.5	143	±103	13	10.3	109	±80	13	8.7	148	±102
White-tailed jackrabbit	13	0.0	0.0			13	0.0			13	0.2	-100	±64
White-tailed deer	13	22.4	30.1	34	±41	13	17.3	74	±67	13	10.1	198	±116
Mourning dove	13	75.2	62.9	-16	±41	13	101.3	-38	±20	13	116.4	-46	±27
Sandhill crane	13	54.6	42.3	-23	±66								

Table 3. Continued.

Region / Species	Change from 2015 n	2015	2016	%	95% CI	Change from 10-year average n	2006-15	%	95% CI	Change from long-term average n	LTA	%	95% CI
Southwest													
Ring-necked pheasant	19	76.4	96.0	26	±55	19	110.4	-13	±31	19	113.8	-16	±33
Gray partridge	19	1.9	9.7	411	±732	19	10.7	-9	±140	19	39.1	-75	±36
Eastern cottontail	19	10.7	6.1	-43	±61	19	6.1	0	±69	19	8.0	-24	±51
White-tailed jackrabbit	19	0.4	0.4	0	±153	19	0.7	-41	±106	19	3.6	-88	±20
White-tailed deer	19	18.5	27.8	50	±73	19	17.1	62	±64	19	10.1	176	±110
Mourning dove	19	263.8	182.1	-31	±37	19	307.2	-41	±18	19	309.7	-41	±21
Sandhill crane	19	0.0	0.0										
South Central													
Ring-necked pheasant	32	31.0	52.6	70	±48	32	56.2	-6	±25	32	124.3	-58	±17
Gray partridge	32	6.1	7.5	22	±83	32	7.0	7	±72	32	18.1	-59	±39
Eastern cottontail	32	11.6	9.5	-18	±39	32	8.1	18	±38	32	7.7	24	±36
White-tailed jackrabbit	32	0.0	0.1			32	0.1	0	±224	32	1.6	-92	±27
White-tailed deer	32	6.1	7.5	22	±66	32	5.8	29	±59	32	3.9	94	±87
Mourning dove	32	199.9	144.1	-28	±44	32	264.1	-45	±27	32	256.4	-44	±8
Sandhill crane	32	0.9	2.1	143	±165								
Southeast													
Ring-necked pheasant	19	26.0	17.9	-31	±64	20	14.3	19	±67	20	69.1	-75	±35
Gray partridge	19	6.5	6.5	0	±106	20	5.2	20	±156	20	13.2	-53	±58
Eastern cottontail	19	13.4	7.5	-44	±45	20	7.5	0	±42	20	7.8	-6	±50
White-tailed jackrabbit	19	0.0	0.0			20	0.0			20	0.6	-100	±42
White-tailed deer	19	19.1	14.9	-22	±67	20	15.3	0	±52	20	10.9	42	±56
Mourning dove	19	133.1	94.3	-29	±34	20	145.9	-37	±17	20	214.1	-57	±18
Sandhill crane	19	0.4	1.5	246	±365								

[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 1955-2015, except for Northwest region (1982-2015) and white-tailed deer (1974-2015). Estimates based on routes (*n*) surveyed ≥40 years (1955-2015), except for Northwest (≥20 years) and white-tailed deer (≥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.

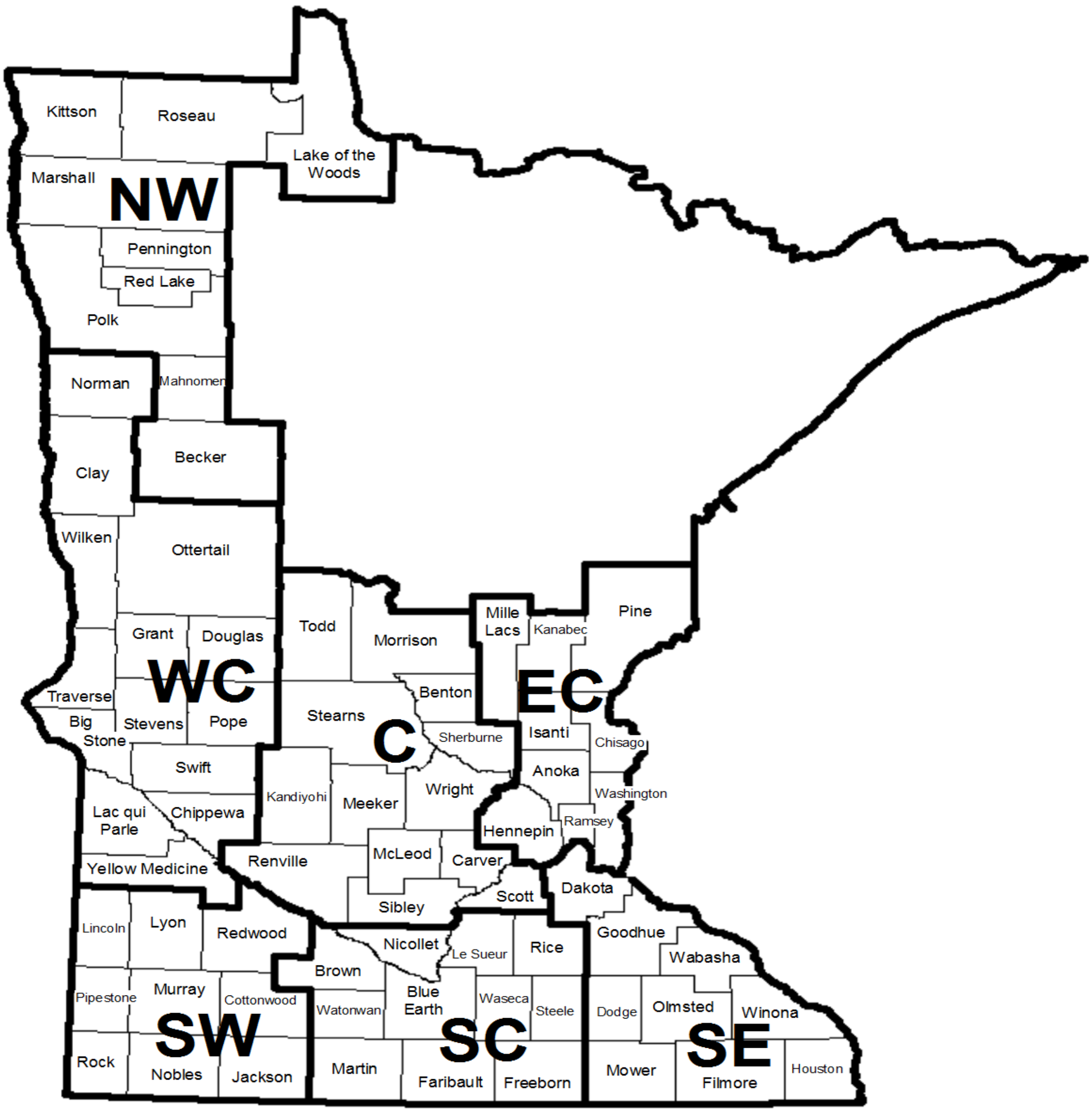


Figure 1. Survey regions for Minnesota's August roadside survey, 2016.

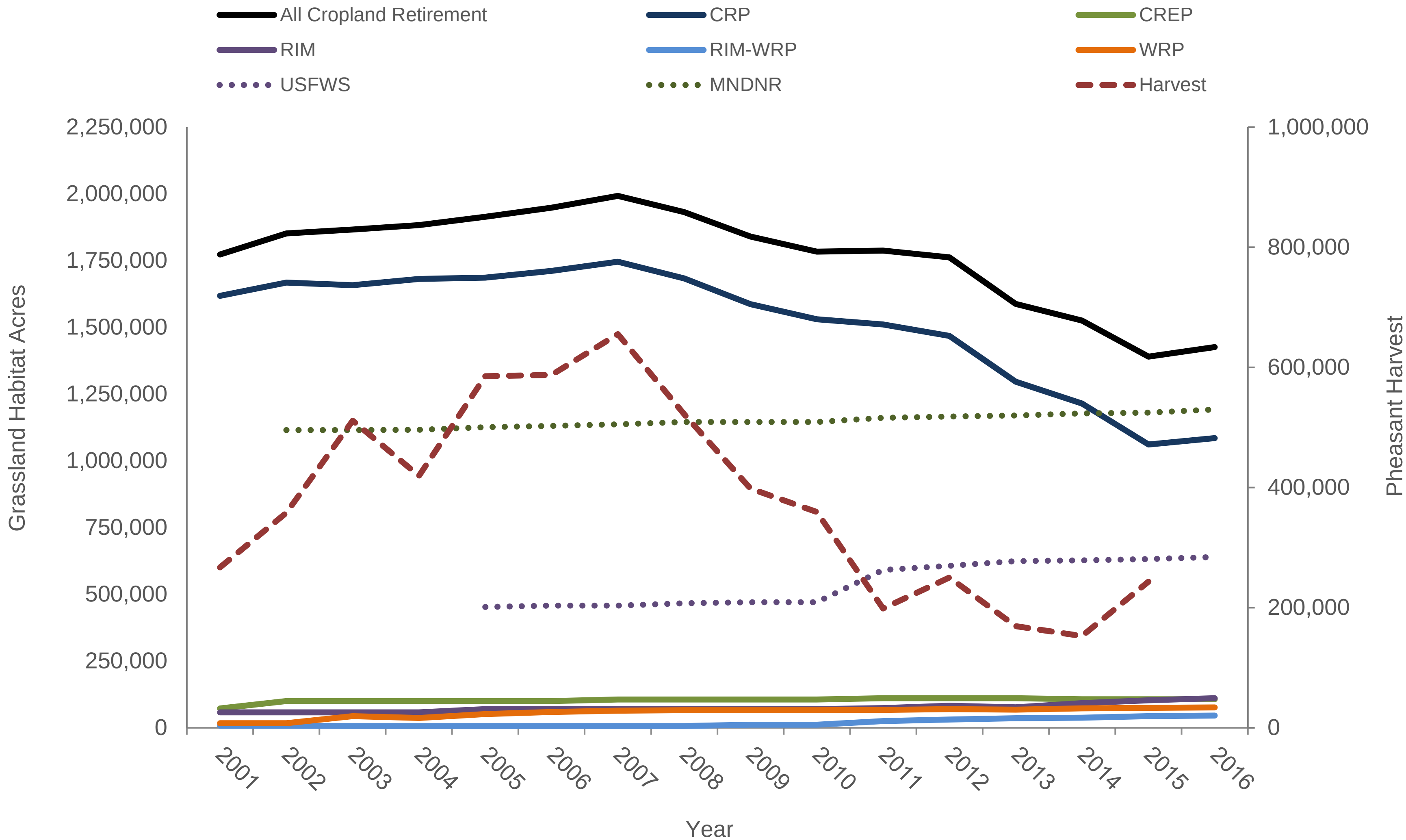
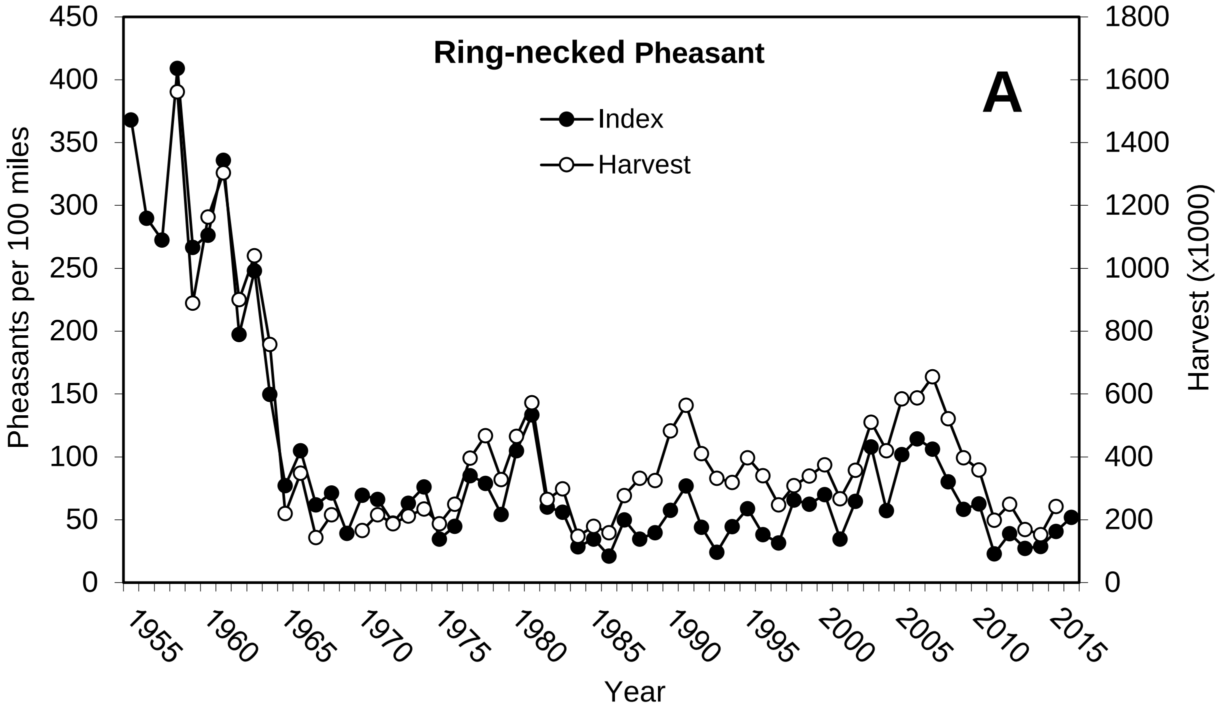


Figure 2. Acres enrolled in private and public land habitat conservation programs vs. ring-necked pheasant harvest trends in Minnesota, 2001-2016. Acres are calculated for the **entire state**.



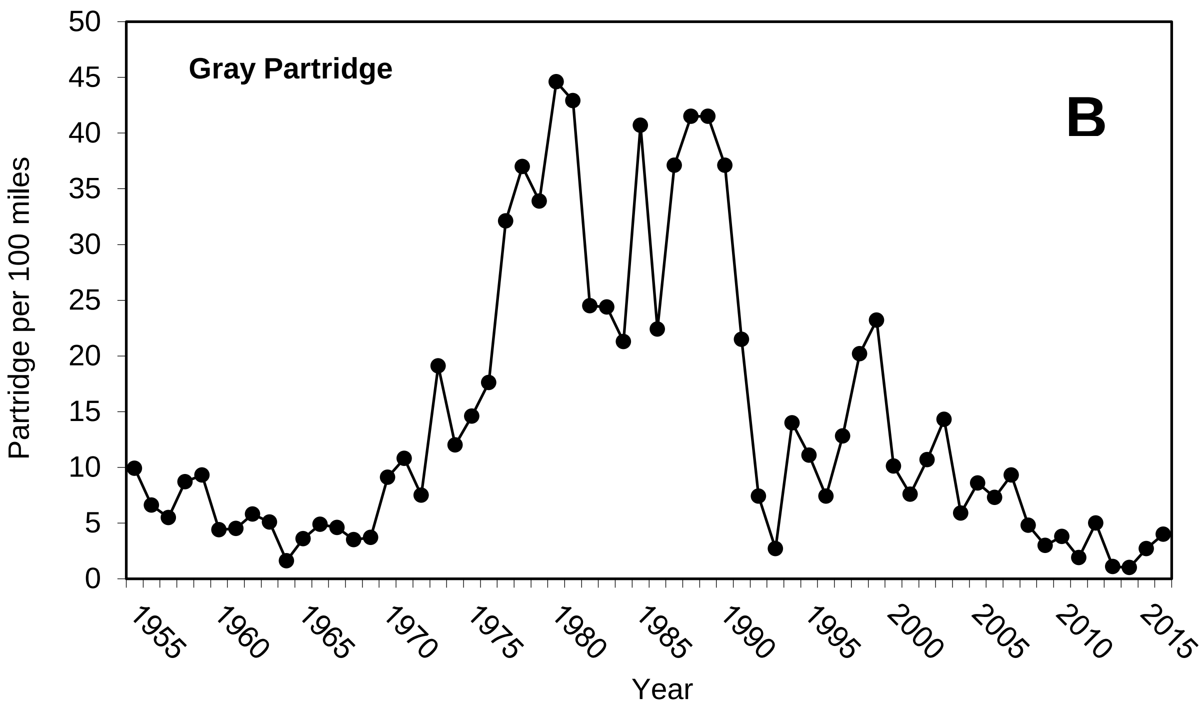
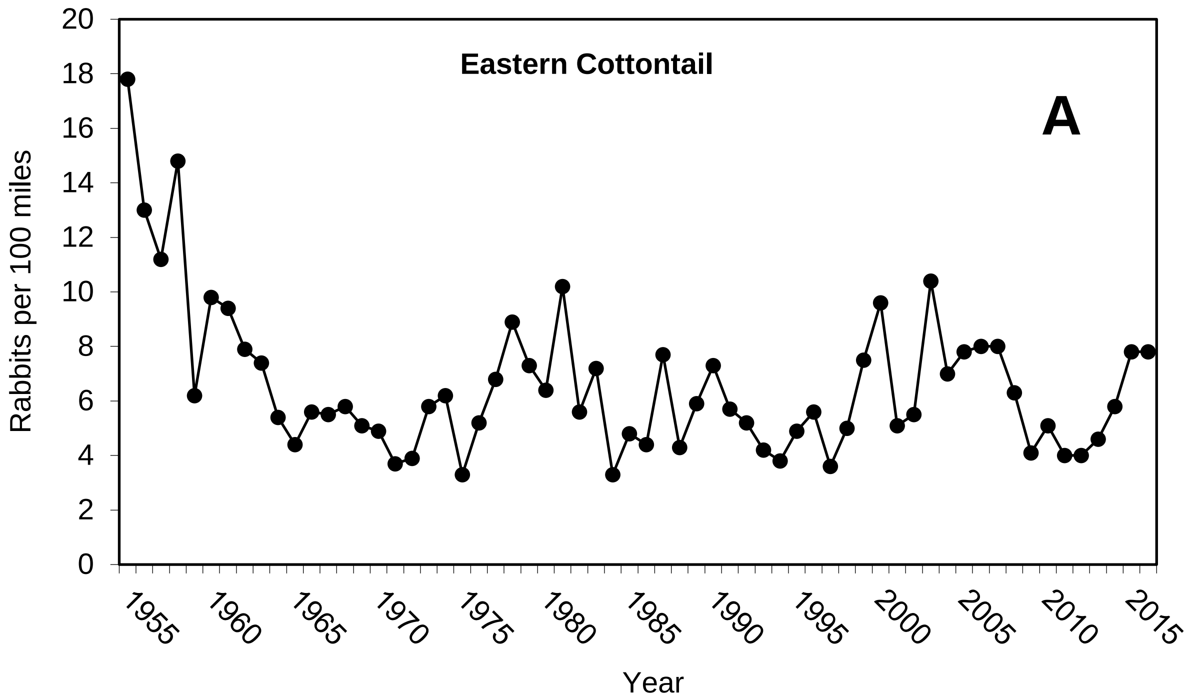


Figure 3. Range-wide index of ring-necked pheasants (**A**) and gray partridge (**B**) seen per 100 miles driven in Minnesota, 1955-2016. Does not include the Northwest region. Based on all survey routes completed.



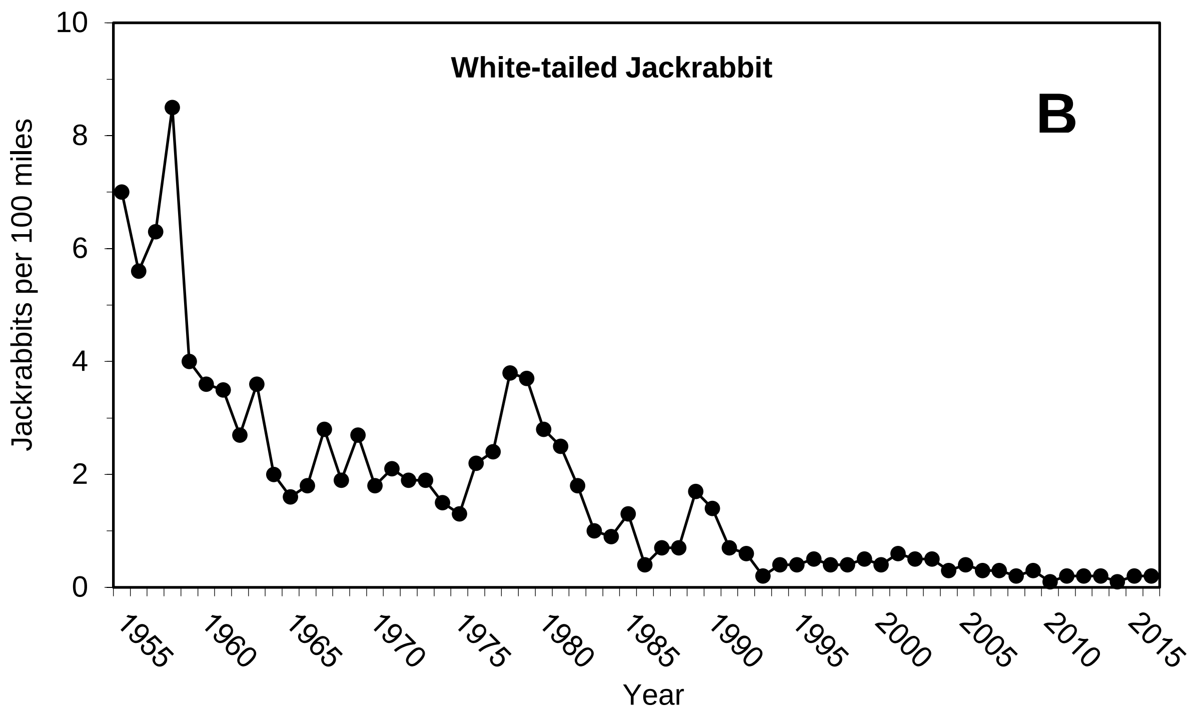
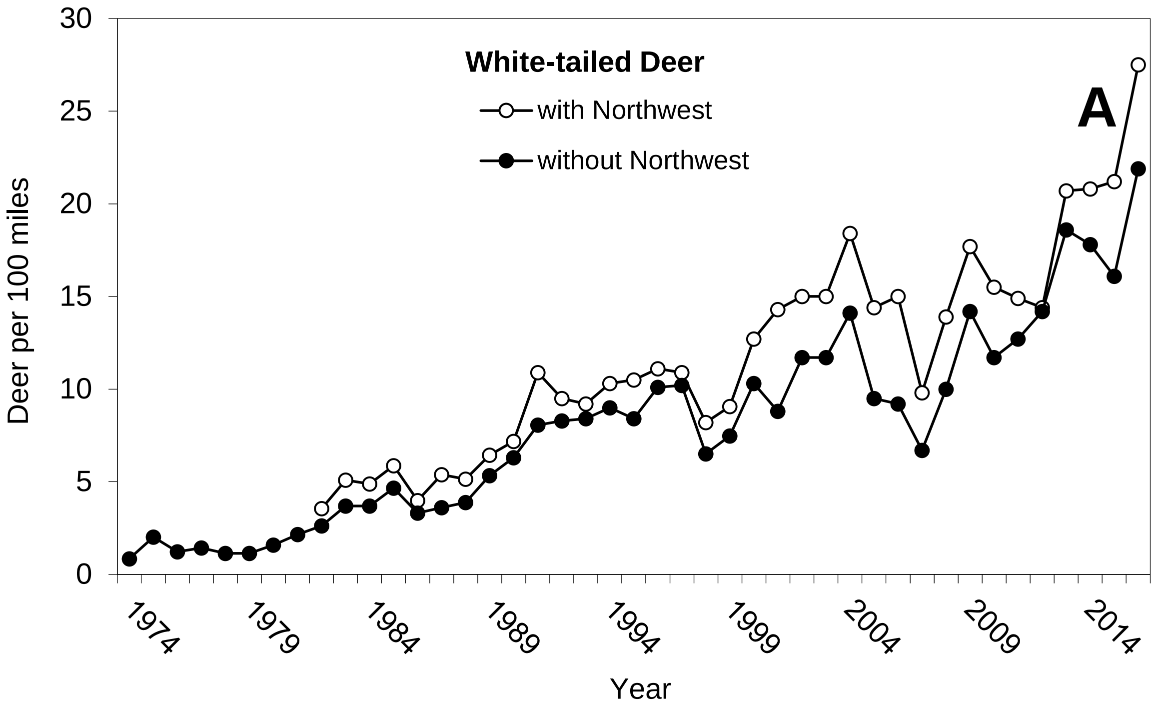


Figure 4. Range-wide index of eastern cottontail (A) and white-tailed jackrabbits (B) seen per 100 miles driven in Minnesota, 1955-2016. Does not include the Northwest region. Based on all survey routes completed.



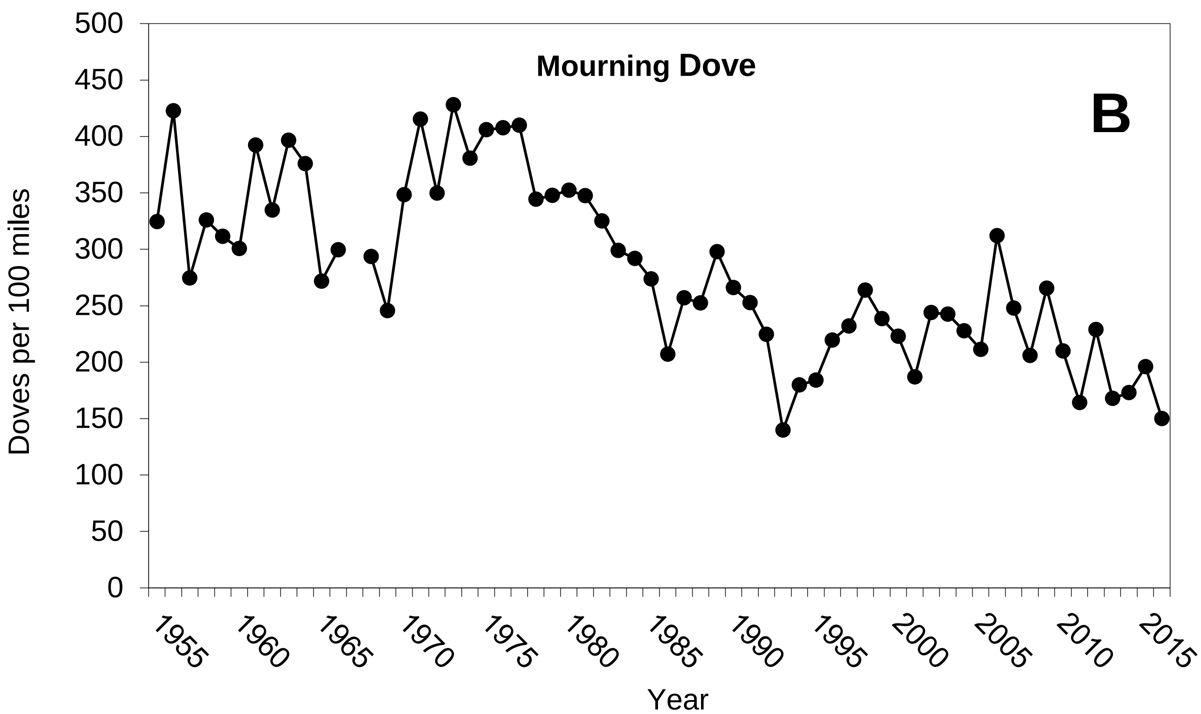


Figure 5. Range-wide index of: **(A)** white-tailed deer seen per 100 miles driven in Minnesota, 1974-2016, with and without the Northwest region included; and **(B)** mourning doves seen per 100 miles driven in Minnesota, 1955-2016. Doves were not counted in 1967 and the dove index does not include the Northwest region. Based on all survey routes completed.

MONITORING POPULATION TRENDS OF WHITE-TAILED DEER IN MINNESOTA - 2016

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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 utilized 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 harvested 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, which were within 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., yearlings <1.0

years old when bred and adults ≥1.0 years old when bred) and were allowed to vary by 3 eco-geographic zones (northeast, farmland-forest transition areas, southeast) that reflected relative differences in 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-forest 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 ≤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 winters had a WSI ≥180.

We used estimates of spring/summer survival of fawns, which spanned 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 (WSI ≥100 and <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, the model used a linear equation to calculate survival as a function of winter severity (mean winter survival = 1 − [0.011 + 0.0015 WSI]). For fawns, we set the mean winter survival rate at 0.85 during mild winters. For fawn survival in 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 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 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.

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. 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 each model simulation for 7 years (2010-2016) with the final population estimate occurring pre-fawning for the spring following the most recent deer hunting season (i.e., spring 2016). All simulations were performed with the R programming language (ver. 3.1.2, R Core Team 2015). 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). Since 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 112 of 128 DPAs in Minnesota to estimate deer densities before reproduction during spring 2016 (Table 1, Figure 2).

Following 2 deer seasons with relatively conservative management designations and 2 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 protected female deer and fawn males from harvest. This allowed a carry-over of fawn males, which were antlered bucks legal for harvest during the 2015 season. In 2015, buck harvest was more than 98,000 deer, which was >5% above the average for the previous 5 years. Consistent with this trend, substantial numbers of female deer were protected from harvest during 2014 and 2015, 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 stabilize deer densities. In terms of management intensity, the 2016 research recommendations would afford approximately 14% more antlerless deer harvest opportunities to hunters versus the 2015 season.

Farmland Zone

Deer populations in the majority of farmland DPAs were near goal levels. Antlerless harvest in the farmland 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. Two-thirds of DPAs in the farmland region were recommended for moderate to high allocations of either-sex permits. In the southeastern farmland, Hunters Choice and Managed designations were required 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. For the 2016 season, 50% of transition zone DPAs were recommended for Hunters Choice and another 25% were recommended for Managed. In DPAs 346 and 349, Intensive designations with DPA-wide early antlerless seasons will be necessary in 2016 to continue reducing deer densities toward goal levels.

Forest Zone

Many deer populations in the Forest Zone were still recovering from the severe winter of 2013-14. Five DPAs were recommended for Bucks Only in 2016, and one-third were recommended for a low allocation of either-sex permits. Four DPAs in the moose range were recommended for Hunters Choice. With relatively low hunter numbers in DPAs 117, 127, and 126, it is necessary to provide hunters with sufficient opportunities to harvest antlerless deer to maintain deer densities near goal levels over time. Most DPAs in the southern Forest Zone were recommended for moderate Lottery levels to begin stabilizing deer populations.

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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, 2010-2016.

		Pre-fawn deer density[a]						
Deer Permit Area	Land area (mi^2)	2010	2011	2012	2013	2014	2015	2016
101	496	-	-	-	-	-	-	-
103	1820	4	4	4	4	3	3	4
105	740	15	14	17	17	13	14	17
108	1651	6	6	7	7	5	5	7
110	529	18	16	17	15	11	11	14
111	1438	3	3	3	3	2	3	3
114	116	-	-	-	-	-	-	-
117	927	-	-	-	-	-	-	-
118	1220	5	5	5	5	4	4	4
119	770	8	7	8	8	5	5	7
122	603	6	5	5	5	3	4	5
126	942	4	4	4	5	3	3	3
127	564	-	-	-	-	-	-	-
152	61	-	-	-	-	-	-	-
155	593	17	17	18	19	16	18	23
156	825	16	16	16	15	10	10	12
157	673	21	21	21	22	23	24	28
159	571	17	16	16	17	12	14	16
169	1124	13	12	14	13	9	10	12
171	701	12	12	13	13	11	12	15
172	687	20	21	21	23	20	23	28

[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
173	584	10	10	11	11	8	8	10
176	1113	13	12	14	14	9	10	13
177	480	22	19	20	20	13	14	17
178	1280	16	13	13	13	8	8	10
179	862	20	18	18	18	11	11	13
180	977	12	9	10	10	5	6	7
181	708	18	15	14	14	9	10	13
182	267	-	-	-	-	-	-	-
183	663	14	14	15	16	11	11	15
184	1229	22	21	23	22	17	19	23
197	955	13	12	13	12	9	10	12
199	148	-	-	-	-	-	-	-
201	161	-	-	-	-	-	-	-
203	83	-	-	-	-	-	-	-
208	414	6	6	6	6	6	7	9
209	640	9	9	9	9	7	8	9
210	615	15	13	14	13	10	11	13
213	1057	15	14	15	17	18	20	25
214	554	22	23	26	27	25	26	30
215	701	15	16	18	19	19	20	22
218	884	8	9	9	10	10	11	13
219	391	11	12	12	14	15	17	19
221	642	14	14	15	16	14	14	18

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

Deer Permit Area	Land area (mi²)	Pre-fawn deer density[a]						
		2010	2011	2012	2013	2014	2015	2016
222	413	16	16	17	17	15	15	18
223	376	11	12	13	15	15	16	18
224	47	-	-	-	-	-	-	-
225	618	18	18	19	21	19	20	24
227	472	17	18	19	20	18	20	22
229	284	7	7	8	9	10	12	15
230	452	4	4	4	4	4	4	4
232	377	6	5	6	6	6	7	8
233	385	5	4	4	5	5	5	5
234	636	2	2	2	3	3	3	3
235	34	-	-	-	-	-	-	-
236	370	16	16	16	17	16	17	19
237	728	2	2	3	3	3	3	3
238	95	-	-	-	-	-	-	-
239	919	14	14	15	16	16	18	21
240	643	21	21	23	25	25	26	31
241	996	33	33	36	40	35	38	44
242	214	22	21	21	19	15	14	15
246	840	16	17	17	17	16	18	22
247	228	18	19	20	20	18	19	23
248	214	19	19	20	19	16	16	18
249	502	17	16	17	18	16	16	20
250	713	3	3	3	4	4	5	6

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

Deer Permit Area	Land area (mi²)	Pre-fawn deer density[a]						
		2010	2011	2012	2013	2014	2015	2016
251	55	-	-	-	-	-	-	-
252	715	3	3	4	4	5	5	7
253	974	3	3	4	4	5	6	7
254	929	4	4	4	4	4	5	5
255	774	4	4	5	5	5	6	7
256	654	7	7	7	8	8	9	10
257	412	9	9	10	11	10	11	13
258	343	23	22	25	26	23	26	34
259	490	28	27	29	28	23	27	34
260	1249	3	3	4	4	4	5	6
261	795	2	2	3	3	4	4	6
262	677	2	2	2	3	3	3	4
263	512	9	9	11	12	11	13	17
264	669	11	11	13	15	14	16	21
265	494	8	8	9	11	11	13	16
266	617	5	5	5	6	7	8	10
267	472	6	6	7	9	7	9	12
268	228	12	11	13	15	13	15	19
269	650	3	3	3	3	3	4	5
270	748	2	2	2	2	2	3	4
271	632	3	3	3	3	4	5	7
272	531	2	2	2	3	3	4	5
273	571	6	6	6	6	7	9	11

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

		Pre-fawn deer density[a]						
Deer Permit Area	Land area (mi^2)	2010	2011	2012	2013	2014	2015	2016
274	354	5	4	5	6	7	8	10
275	764	4	3	3	4	4	5	6
276	542	8	7	8	9	9	10	12
277	812	12	11	12	15	17	21	25
278	402	6	6	6	8	9	11	15
279	344	4	4	4	5	5	5	6
280	675	2	2	2	3	3	3	4
281	575	6	5	5	6	7	8	9
282	778	2	2	2	2	2	3	4
283	613	4	3	4	4	5	5	7
284	838	3	3	3	4	5	5	7
285	549	5	5	5	6	6	6	
286	446	5	5	5	6	6	7	8
287	46	-	-	-	-	-	-	-
288	625	6	6	6	6	6	6	7
289	815	2	2	2	3	3	4	4
290	662	5	5	5	5	6	6	7
291	800	6	6	6	7	7	8	9
292	479	8	8	8	10	11	13	16
293	511	9	8	8	9	9	9	10
294	686	3	3	4	4	5	5	6
295	839	4	4	4	5	6	7	8
296	667	4	4	4	5	5	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
297	438	3	3	4	4	4	5	6
298	618	10	9	10	10	9	12	15
299	386	5	5	6	6	7	8	8
338	454	5	6	6	6	6	7	7
339	394	6	6	7	7	8	8	9
341	612	13	13	13	14	14	16	18
342	349	16	17	17	17	17	19	20
343	663	12	12	13	14	14	14	14
344	190	-	-	-	-	-	-	-
345	323	11	12	13	15	15	16	18
346	318	28	31	32	34	34	32	29
347	434	9	10	11	11	11	11	12
348	332	16	16	17	17	16	16	17
349	490	23	25	25	26	26	24	20
601	1625	-	-	-	-	-	-	-

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

Figure 1. Model structure for simulations of white-tailed deer populations in Minnesota, 2015.

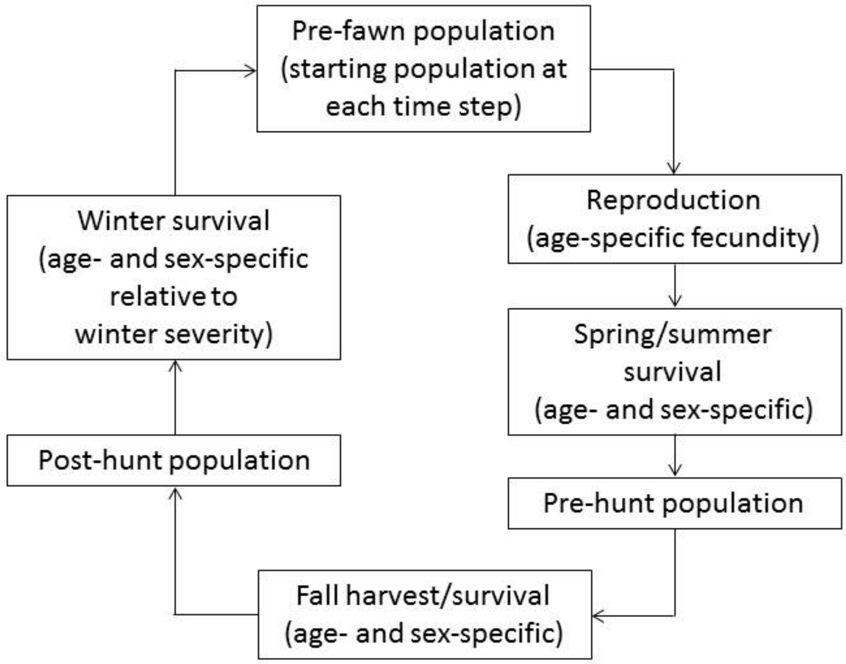
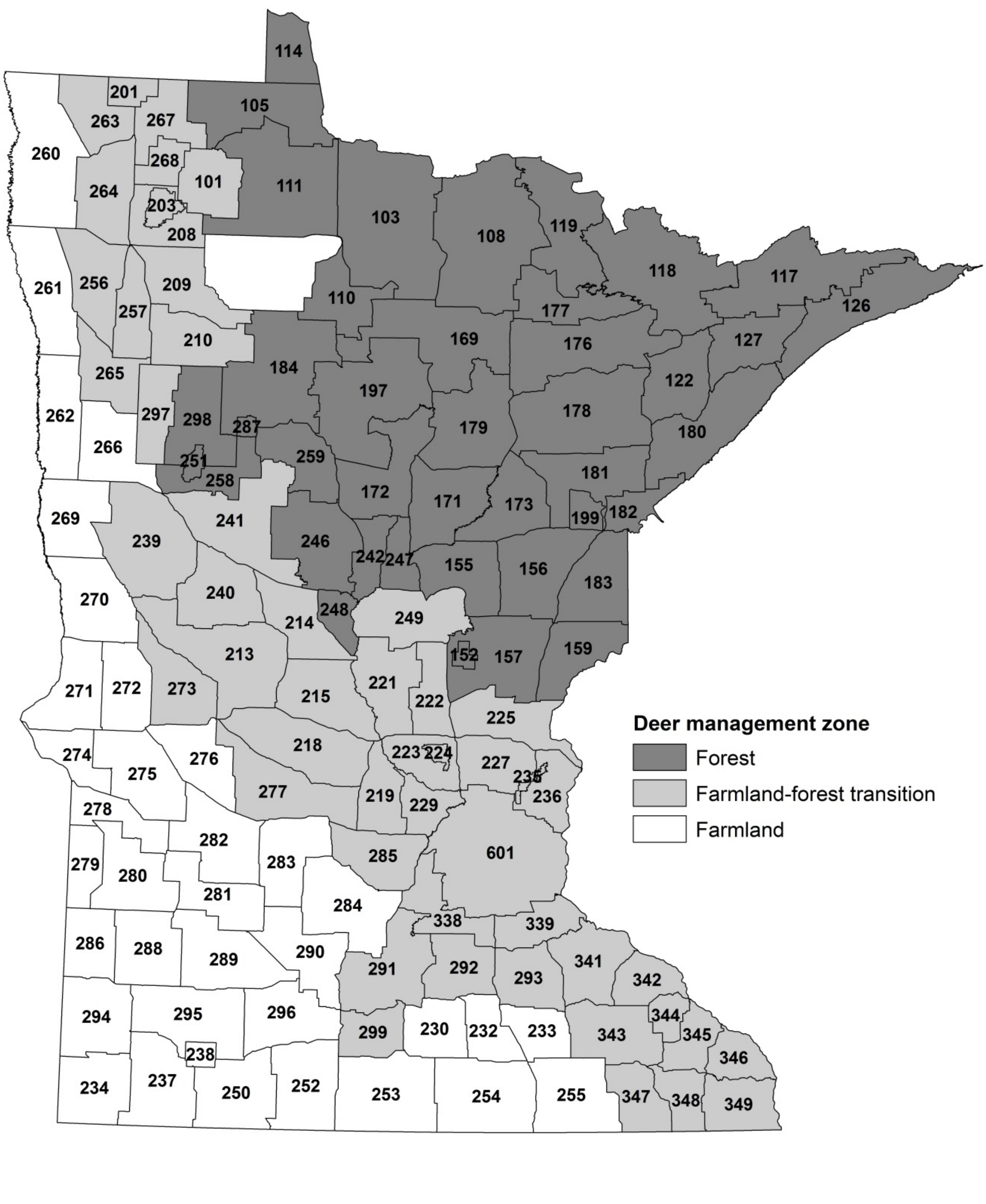


Figure 2. Deer permit areas (DPAs) in Minnesota and deer management zones used to describe deer population and harvest trends, 2016. DPAs were assigned to forest, farmland-forest transition, or farmland zones based on historical land cover and current woody cover. Generally, forested DPAs were composed of >60% woody cover, farmland-forest transition DPAs were composed of 6%-50% woody cover, and farmland DPAs were composed of <5% woody cover.



2016 WHITE-TAILED DEER SURVEYS

Brian S. Haroldson, Farmland Wildlife Populations and Research Group

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 112 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, 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 that were within 20% of the true population size with 90% confidence (Lancia et al. 1994). Estimates within these bounds were used to recalibrate population models to improve population management.

METHODS

We estimated deer populations in selected PAs 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. heimonus*; Bartmann et al. 1986) in a variety of habitat types. Within each PA, quadrats were delineated by Public Land Survey section boundaries. In PAs with woody cover distributed uniformly across the landscape, we used a simple random sampling frame. In PAs with abundant woody cover and past survey data, we used regression trees (Fabrizi and Trivisano 2007, Fieberg and Lenarz 2012), the R programming language (R Core Team 2012), and R package 'stratification' (Baillargeon and Rivest 2012) to stratify the sampling frame into 2 categories (low, high) based upon past helicopter counts of deer and abundance of woody cover within each quadrat. Woody cover data were derived from the 2006 National Land Cover database (Fry et al. 2011). In some PAs, an additional stratum was constructed to encompass State Park boundaries where applicable. We used optimal allocation, R package 'spsurvey' (Kincaid and Olsen 2012), and a generalized random tessellation stratified procedure (GRTS; Stevens and Olsen 2004) to draw spatially balanced simple or stratified random samples within each PA.

During all surveys, we used Bell OH-58 helicopters and attempted to maintain flight altitude at 60 m above ground level and airspeed at 64-80 km/hr. A pilot and 2 observers searched for deer along transects spaced at 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 minimize visibility bias, we completed surveys during winter (January-February) when snow cover measured at least 15 cm and we varied survey intensity as a function of cover and deer numbers (Gasaway et al. 1986). We estimated deer abundance using R package 'spsurvey' (Kincaid and Olsen 2012). 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).

We implemented double sampling (Eberhardt and Simmons 1987, Thompson 2002) on a subsample of quadrats in each PA to estimate sightability of deer from the helicopter. For each PA, we sorted the sample of survey quadrats by woody cover abundance, excluded quadrats likely to contain no deer (e.g., low stratum quadrats or quadrats where woody cover < 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 (48-64 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 computed population estimates adjusted for both sampling and sightability.

RESULTS AND DISCUSSION

We completed 5 surveys during 2016 (Table 1). We utilized a simple random sample in PA 248 after stratifying by ownership (e.g., Camp Ripley Military Reservation, other), whereas PAs 341, 343, 345, and 347 were stratified using the relationship between woody cover abundance per quadrat and historic deer density. In PAs 248, 343, and 347, sampling rate exceeded 20% to incorporate additional quadrats within Camp Ripley Military Reservation, Chester Woods County Park, and Forestville State Park, respectively. Deer density estimates ranged from 11-18 deer/mi^2 throughout all PAs and, except for PA 345, all estimates met precision goals (relative error $\leq$ 20%). Deer were observed in 59-82% of sample quadrats in the 5 surveyed areas, with greater occupancy generally occurring in PAs with more woody cover (Table 2). In addition, mean group size and mean number of groups per "occupied" quadrat was similar across all areas.

Estimates of sightability ranged from 0.697 (SE = 0.026) in PA 248 to 0.800 (SE = 0.019) in PA 347 and averaged 0.734 (SE = 0.048), which were similar to sightability estimates during 2009-2014 (range = 0.633-0.909). Correcting for sightability increased relative variance (CV [%]) of population estimates by 3.9-8.0%, 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 serious logistical and statistical problems for distance-sampling and double-observer methods. Therefore, our double-sampling approach is a reasonable alternative to using unadjusted counts or applying more complicated methods whose assumptions are tenuous. Nevertheless, our "adjusted" population estimates must still be viewed as approximations to the truth.

ACKNOWLEDGEMENTS

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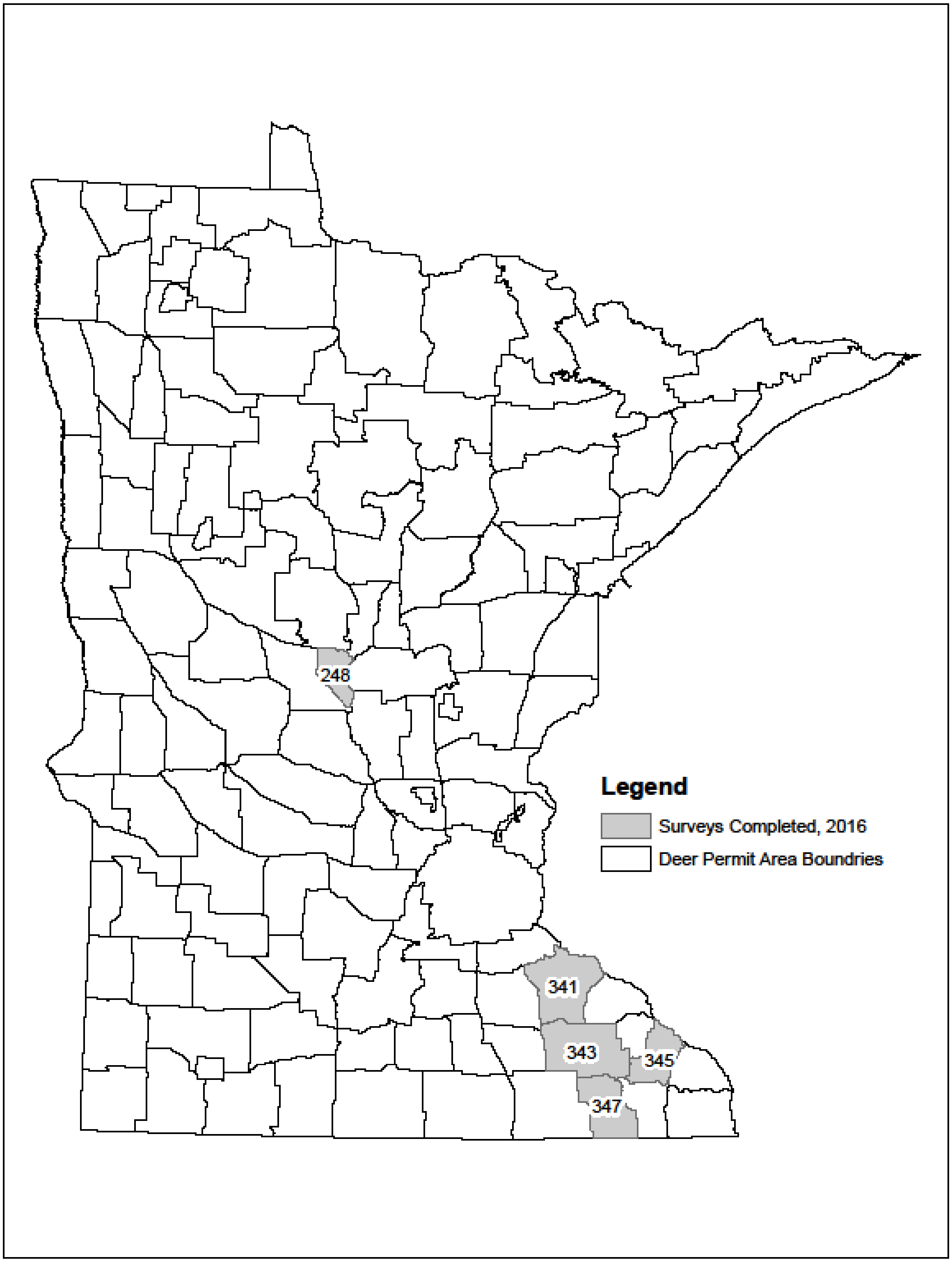

Figure 1. Aerial deer surveys completed in Minnesota, 2016

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Table 1. Deer population and density (deer/mi^2) estimates derived from aerial surveys in Minnesota, 2016.

Permit area	Sampling rate	Detection rate	Population estimate		CV (%)	Relative error (%)[a]	Density estimate	
			N	90% CI			Mean	90% CI
248	0.23[b]	0.697	3,709	3,093 – 4,325	10.1	16.6	17	14 – 20
341	0.20	0.751	11,503	10,475 – 12,531	5.4	8.9	18	17 – 20
343	0.22[c]	0.717	9,268	8,170 – 10,366	7.2	11.8	15	13 – 17
345	0.20	0.703	6,162	4,806 – 7,518	13.4	22.0	18	14 – 22
347	0.24[d]	0.800	4,596	3,949 – 5,243	8.6	14.1	11	9 – 12

[a]Relative precision of population estimate. Calculated as 90% CI bound/*N*.

[b]Includes a 29% sampling rate within Camp Ripley Military Reservation.

[c]Includes Chester Woods County Park.

[d]Includes Forestville State Park.

Table 2. Sampling metrics from aerial deer surveys in Minnesota, 2016.

Permit area	Quadrats in permit area	Quadrats sampled	Quadrats occupied[a]	Deer observed	Deer groups observed	Groups / occupied quadrat		Group size / occupied quadrat		Maximum quadrat count
						mean	range	mean	range	
248	218	51	42	604	183	4	1-14	3	1-11	57
341	626	126	98	2,366	702	7	1-22	3	1-20	94
343	627	137	84	2,334	460	5	1-18	5	1-32	114
345	338	68	40	1,004	236	6	1-20	4	1-21	102
347	433	102	63	1,373	307	5	1-14	4	1-38	70

[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, 2015

John Erb, Minnesota, Forest Wildlife and Populations 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 39th 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 268 routes were completed this year. There were 2,449 operable scent stations examined on the 268 routes. Route density varied from 1 route per 564 km^2 in the Forest Zone to 1 route per 1,216 km^2 in the Farmland Zone (Figure 1).

Statewide, route visitation rates (% of routes with detection), in order of increasing magnitude, were opossum (3%), domestic dogs (10%), wolves (10%), bobcats (13%), domestic cats (27%), skunks (29%), coyotes (30%), raccoons (30%), and red foxes (31%). Regionally, route visitation rates were as follows: red fox – FA 27%, FO 31%; TR 35%; coyote – FO 19%, TR 40%, FA 46%; skunk – FO 18%, TR 38%, FA 45%; raccoon – FO 12%, TR 42%, FA 66%; domestic cat – FO 12%, TR 40%, FA 52%; domestic dog – FO 5%, FA 14%, TR 20%; opossum - FO 0%, TR 3%, FA 9%; wolf - FA 0%, TR 6%, FO 16%; and bobcat - FA 0%, TR 11%, FO 19%.

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, there were no significant changes in indices compared to last year. However, several changes approached significance, including coyote increases in both the Farmland and Forest Zones and declines in skunk and raccoon indices in the Forest Zone (Figures 2 and 4).

In the Farmland Zone (Figure 2), red fox indices remain well below the long-term average, whereas raccoon and coyote indices remain above average. Indices for most other species remain near their long-term averages. The index for domestic dog detections in the Farmland Zone has recently undergone a decline to a record low.

In the Transition Zone (Figure 3), red fox indices have undergone a 'cyclic' fluctuation over the last 10 years but remain below the long-term average. Conversely, the Transition Zone coyote index remains above the long-term average. Indices for most other species are near their long-term average, though similar to the Farmland Zone, domestic dog detections are currently near a low point.

In the Forest Zone (Figures 4 and 5), most indices this year were near or moderately below their long-term averages. The primary exception is the bobcat index which remains well above its long-term average. Overall, there have been no long-term trends in forest indices except for the long-term increase in wolf indices and the recent 10-year increase in bobcat indices.

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I wish to thank all of the cooperators who participated in the 2015 survey: DNR Division of Wildlife staff; Superior National Forest Aurora District; Rydell, Sherberne and Tamarac National Wildlife Refuges; Camp Ripley; 1854 Treaty Authority, White Earth, Red Lake, and Leech Lake Tribal Natural Resource Departments; Lori Schmidt and Vermillion Community College; Bill Faber and Central Lakes Community College; Peter Jacobson and Faribault High School; Steven Hogg and the Three Rivers Park District; and Richard Nelles, Tom Stuber, and Matthew Detjen. This project was funded in part by the Wildlife Restoration Program (Pittman-Robertson).

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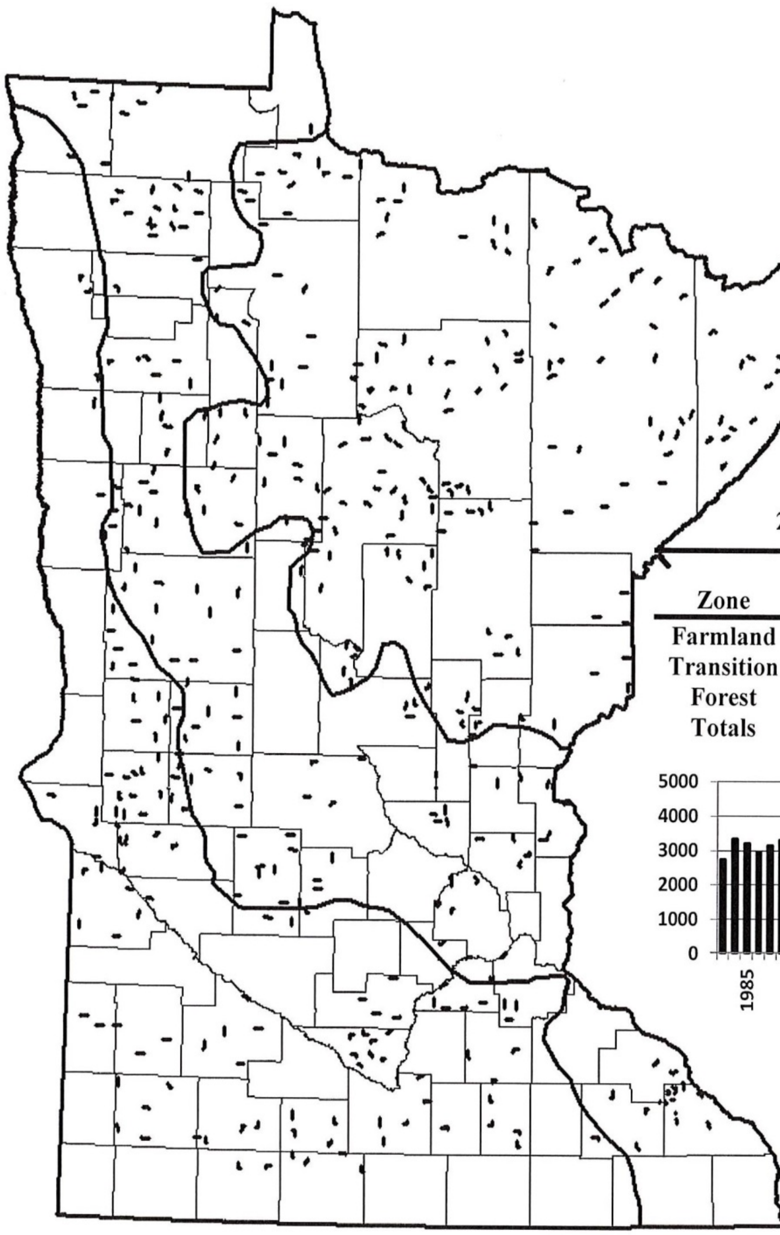

2015 Scent Station Specifics

Zone	Routes Completed	Route Density	Station Nights
Farmland	56	1/1,216 km^2	507
Transition	65	1/1,011 km^2	597
Forest	147	1/564 km^2	1,345
Totals	268	1/809 km^2	2,449

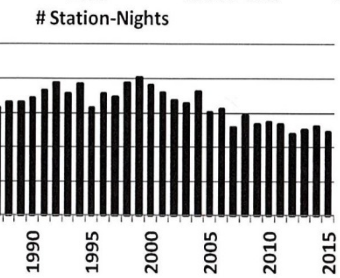

Figure 1. Locations of existing scent station routes (not all completed every year). Insets show 2015 route specifics and the number of station-nights per year since 1983.

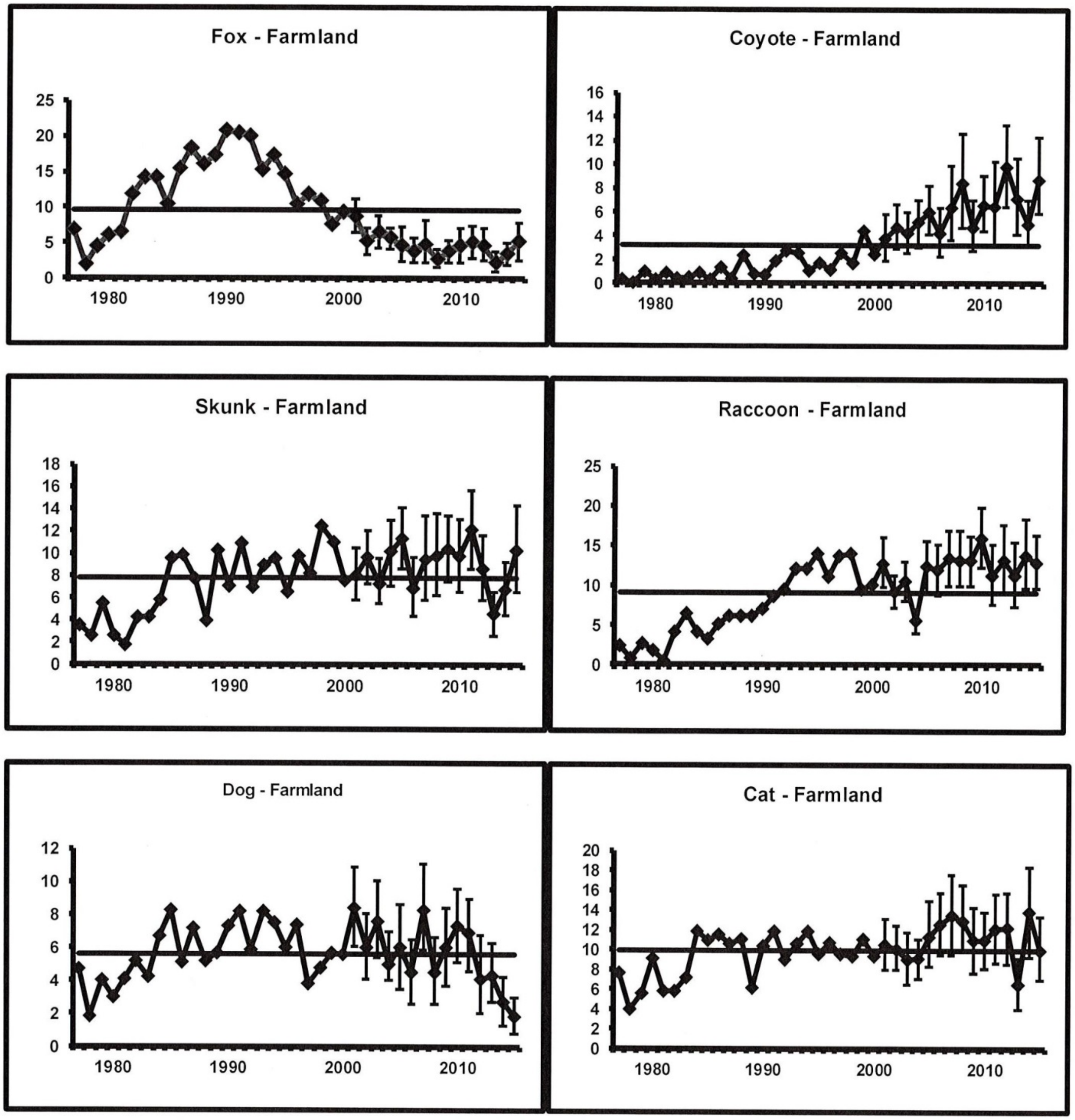

Figure 2. Percentage of scent stations visited by selected species in the Farmland Zone of Minnesota, 1977-2015. Horizontal line represents long-term mean.

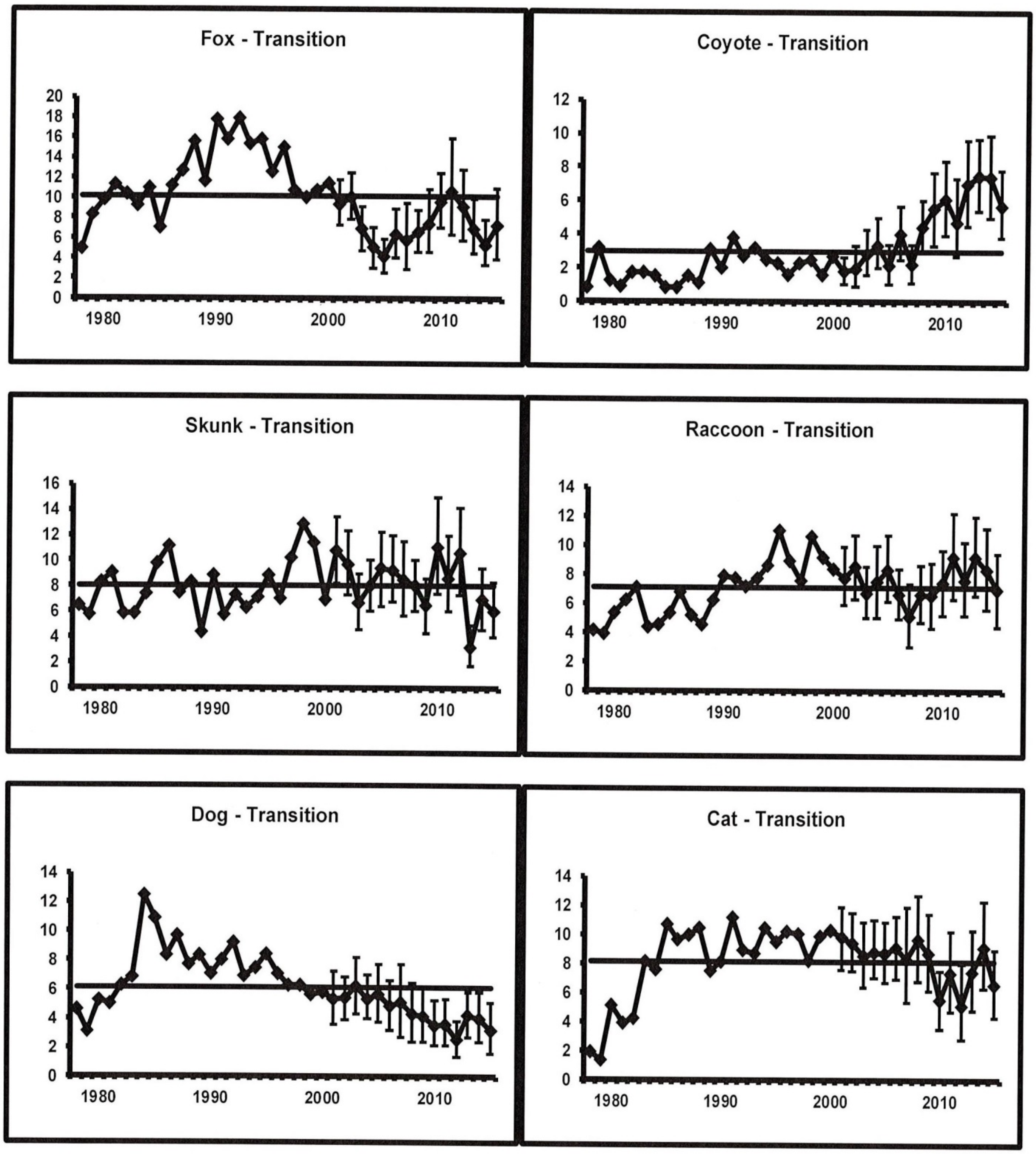

Figure 3. Percentage of scent stations visited by selected species in the Transition Zone of Minnesota, 1978-2015. Horizontal line represents long-term mean.

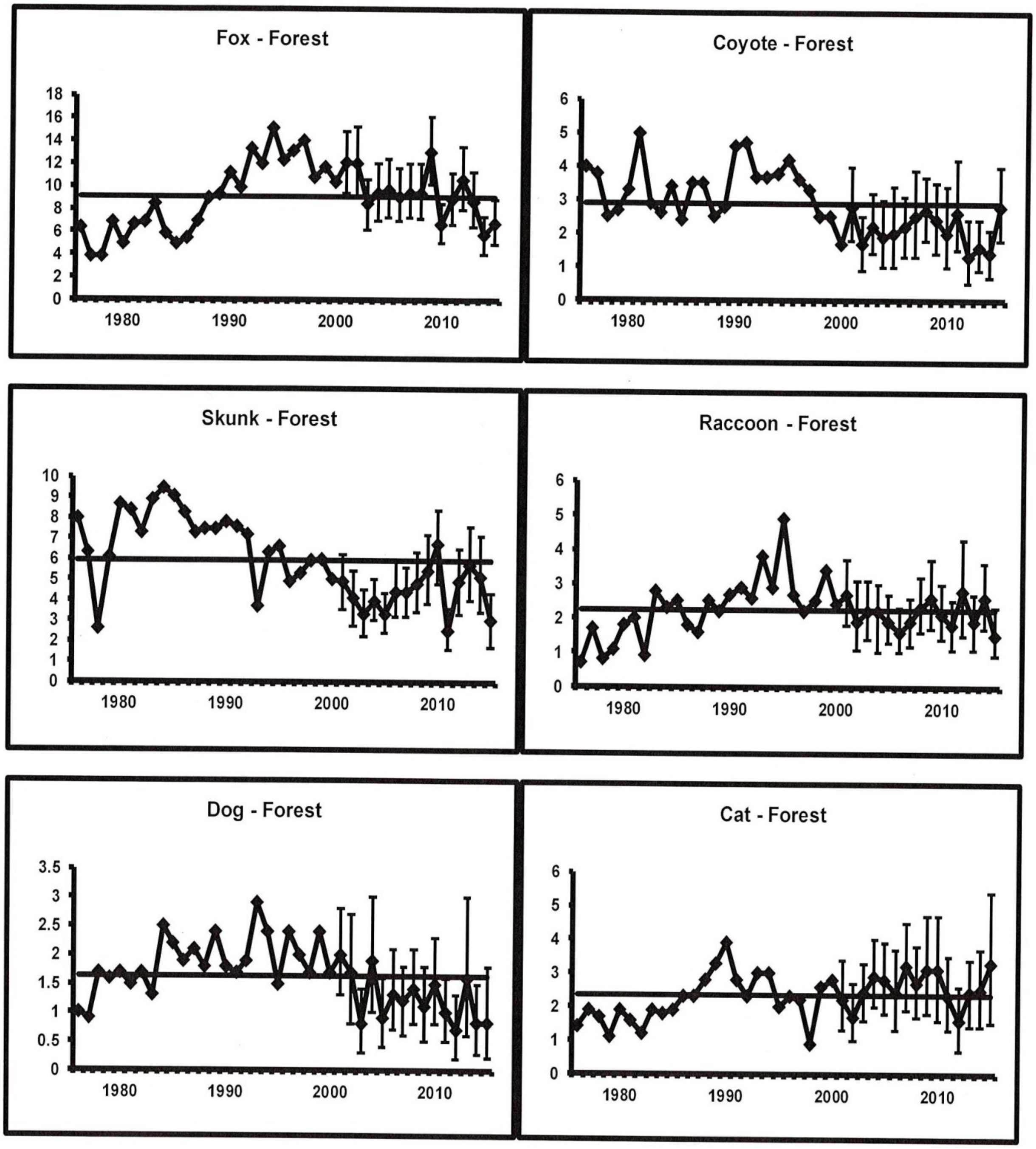

Figure 4. Percentage of scent stations visited by selected species in the Forest Zone of Minnesota, 1976-2015. Horizontal line represents long-term mean.

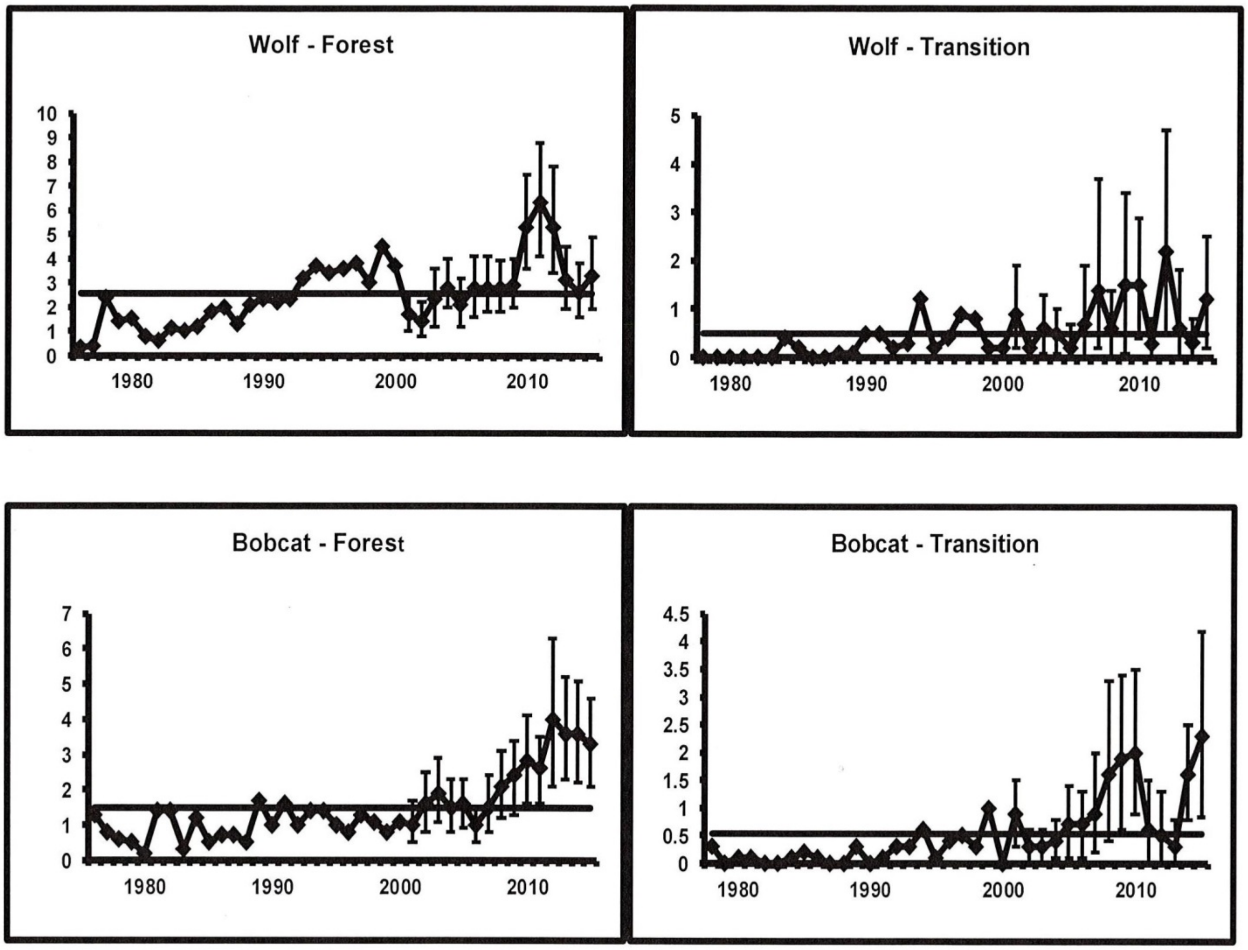

Figure 5. Percentage of scent stations visited by wolves and bobcat in the Forest and Transition Zones of Minnesota, 1976-2015. Horizontal line represents long-term mean.

FURBEARER WINTER TRACK SURVEY SUMMARY, 2015

John Erb, Minnesota, Forest Wildlife and Populations 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.

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 this 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, 47 of the 57 routes were completed, the second most since the survey began (Figure 2). Survey routes took an average of 2.1 hours to complete. Total snow depths averaged 9.3" along completed routes, very close to the long-term average (Figure 3). Mean overnight low temperature the night preceding the surveys was 9°F, slightly above the long-term average (Figure 3). Survey routes were completed between December 2nd and February 24th, with a mean survey date of January 11th (Figure 3).

Considering presence or degree of confidence interval overlap, fisher and bobcat indices (% segments with detection) exhibited significant declines from last year (Figure 4). However, there is no apparent trend over the last 4 years for fishers, though indices remain well below the long-term average. The decline in the bobcat index is the first significant annual decline since confidence intervals have been generated, but the current bobcat index is near the long-term average (Figure 4). Both marten and weasel indices exhibited marginally significant declines and remain below their long-term averages. There were no significant changes in indices for red foxes, coyotes, wolves, or the winter index for snowshoe hares (Figure 4).

Fishers were detected on ~ 6% of the route segments and along 33% of the routes (Figure 4), the latter being the lowest since the survey began. 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 fisher population trends only in the previous 'core' of fisher range. This year's decline, particularly in the percentage of routes where they were detected, suggests that fisher detections have become patchier in the previous core areas of their range. At their peak (2004), fishers were detected on 78% of the survey routes.

Within the 'marten zone', martens were detected on 3.5% of the route segments and 50% of the survey routes (Figure 4). The latter is the second lowest point estimate since the survey began, suggesting as with fisher that marten distribution is reduced or patchier compared to the peak year (1999) when they were detected on 83% of the 'marten zone' routes. Marten fluctuations, particularly in recent years, show indications of 4-5 year cycles consistent in timing with data for some rodent species in MN.

Wolf indices were near their long-term average, largely unchanged from last winter. Wolves were detected on ~ 6.5% of the route segments and 67% of the survey routes (Figure 4). The average number of wolves detected per route was 2.3. Coyotes were detected on 4.4% of the route segments and 44% of the routes. Although there was no significant change in coyote indices from last year, the point estimate for the percentage of segments with a detection was near an all-time high. However, like with marten and weasels (see below), coyote indices appear to exhibit 4 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 ~ 11% of the segments and 73% of the routes.

Weasel (*Mustela erminea* and *Mustela frenata*) indices did not change significantly from last year and their fluctuations continue to be characterized by 3 to 5 year cycles or 'irruptions' superimposed on a declining trend (Figure 4). No significant change was observed in winter snowshoe hare indices. Since the winter track survey began in 1994, hare indices have steadily increased, with some leveling off in the past 4 years (Figure 4). Although confidence intervals are not currently computed on the spring 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. In recent times, only faint 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 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 were near their post-1994 averages, suggesting that there were no obvious conditions that might bias track counts low or high compared to previous years. Nevertheless, other factors can influence animal movement and detection rates and results must be interpreted cautiously. Acknowledging this caveat, indices for fishers and bobcats, and to lesser degree martens and weasels, all declined; no significant changes were observed for other species. Fisher, marten, red fox, and weasel indices all remain below their long-term averages, whereas wolf, bobcat, and hare indices are near their long-term averages. Only the coyote index was above its long-term average in 2015.

ACKNOWLEDGEMENTS

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), 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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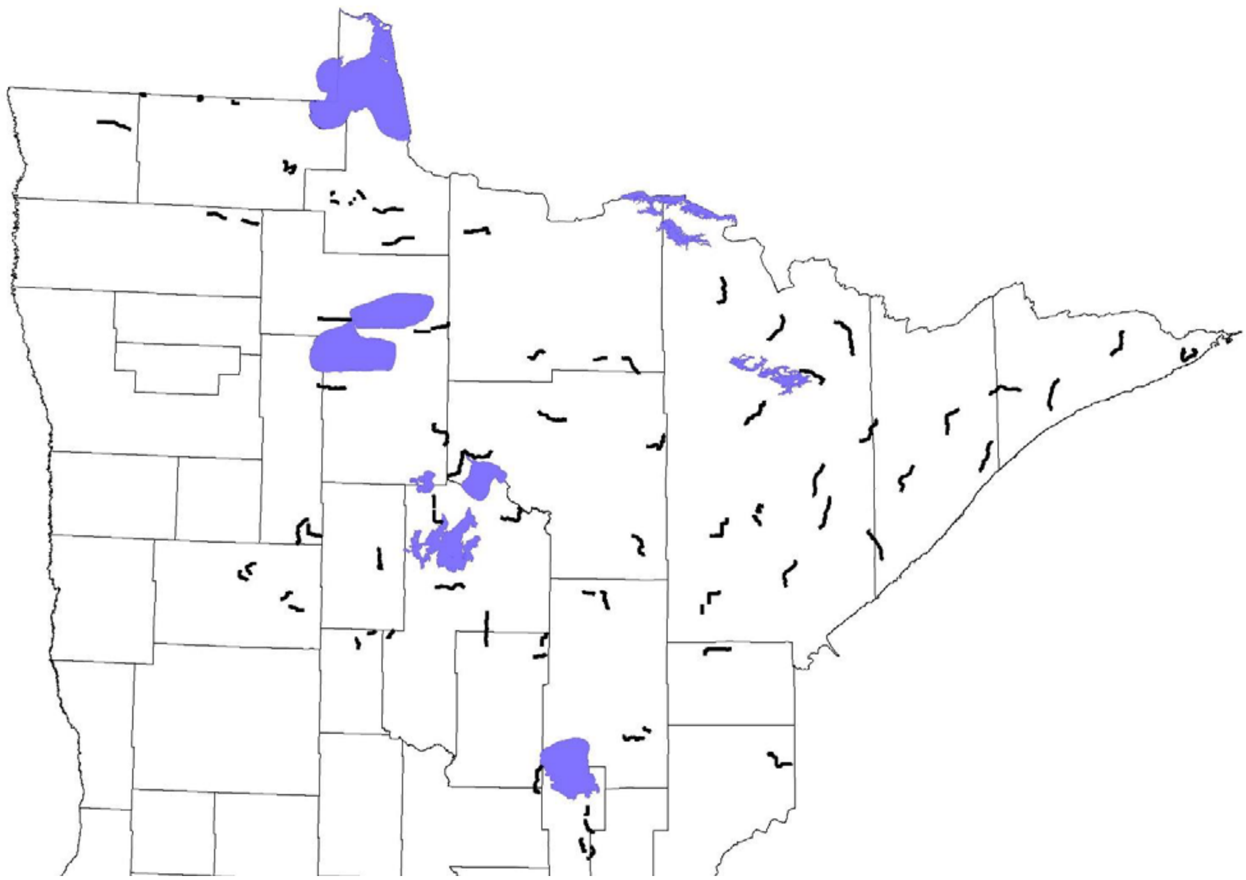

Figure 1. Locations of furbearer winter track survey routes in northern Minnesota.

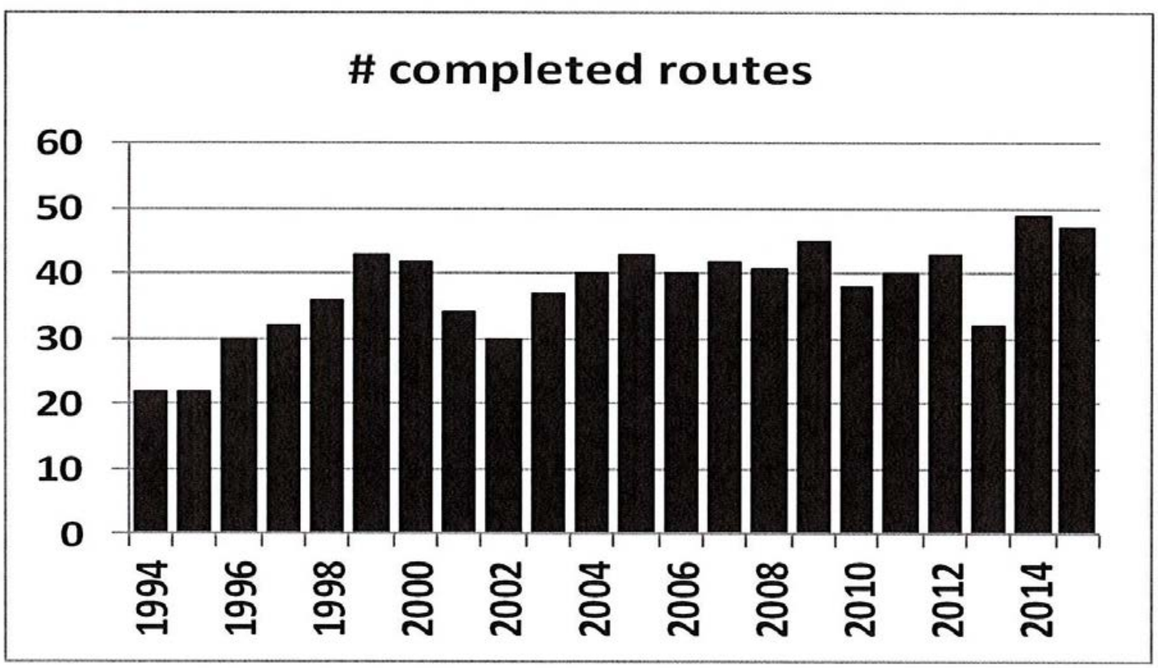

Figure 2. Number of snow track routes surveyed in Minnesota, 1994-2015.

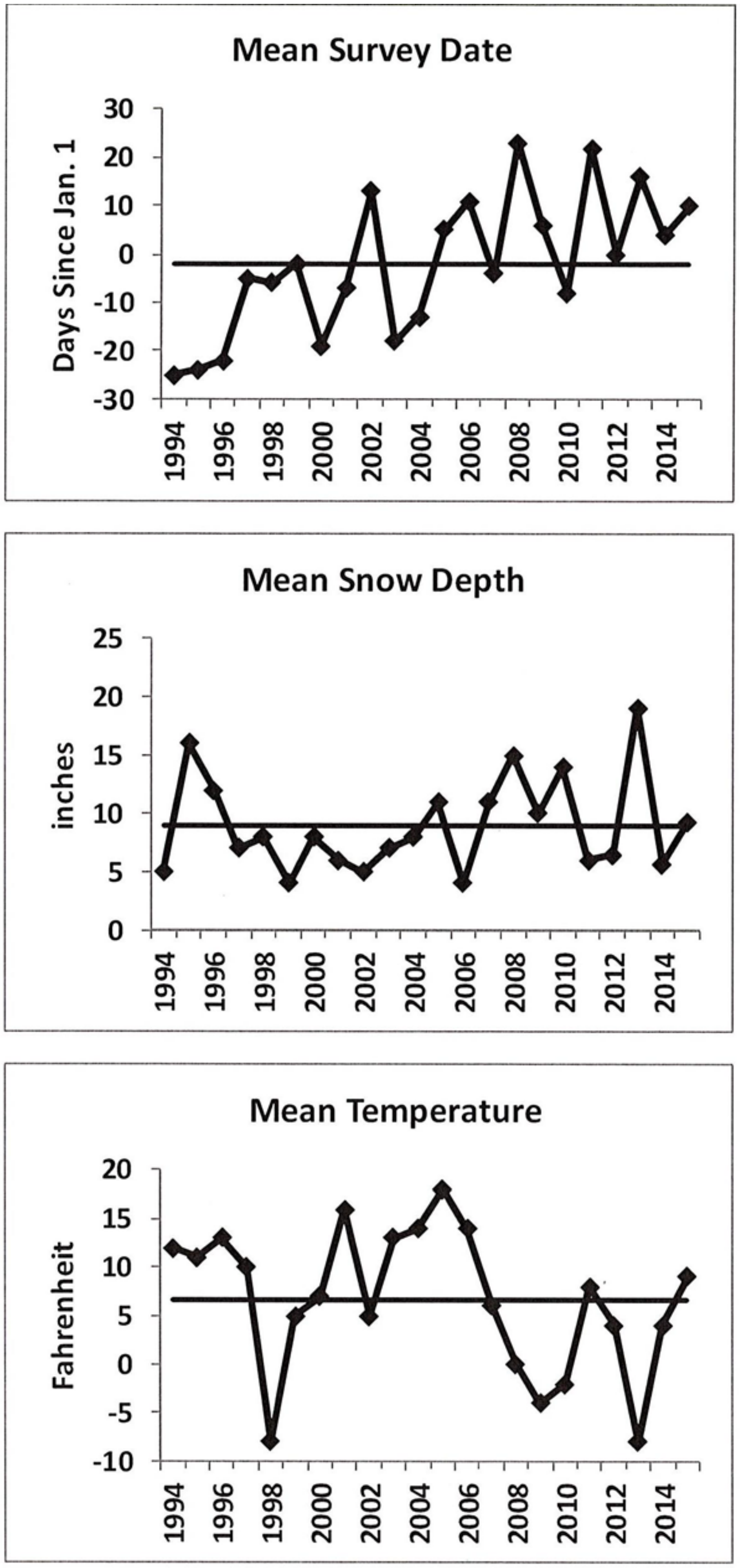

Figure 3. Average survey date, snow depth, and temperature for snow track routes completed in Minnesota, 1994-2015. Horizontal line represents long-tern mean.

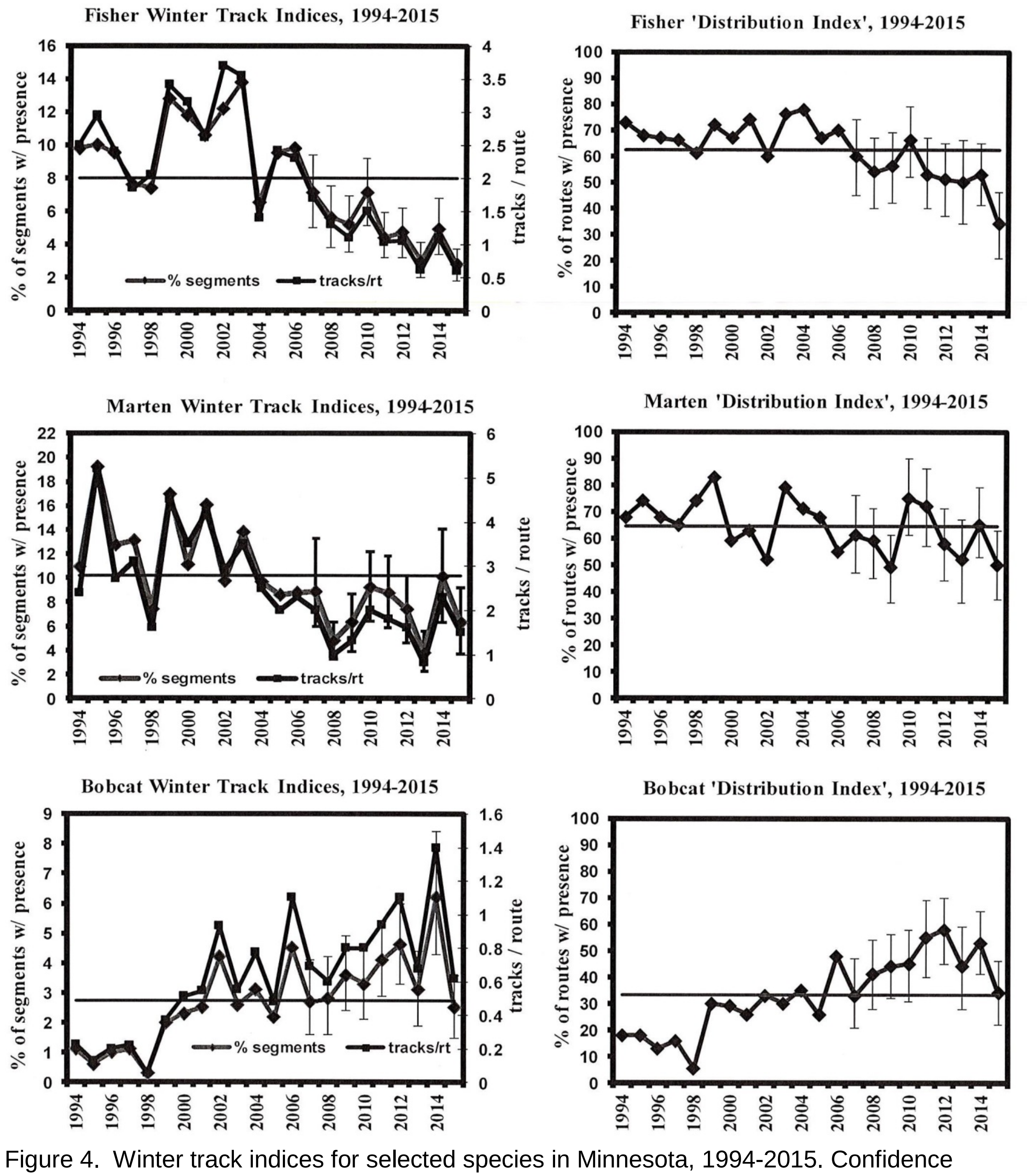

Figure 4. Winter track indices for selected species in Minnesota, 1994-2015. Confidence intervals are presented only for % segments and % routes with track presence; horizontal lines represent their long-term averages.

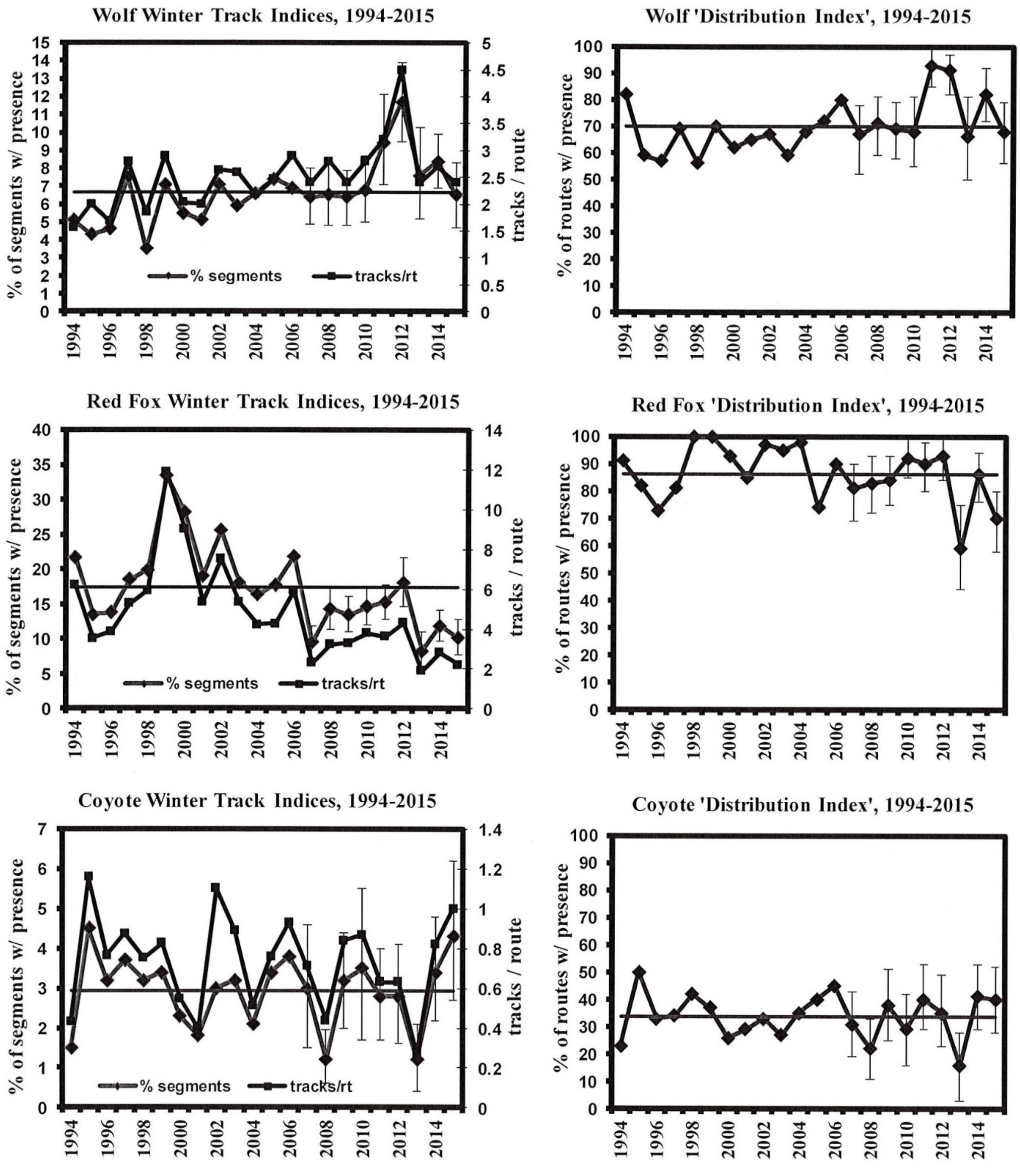

Figure 4 (continued).

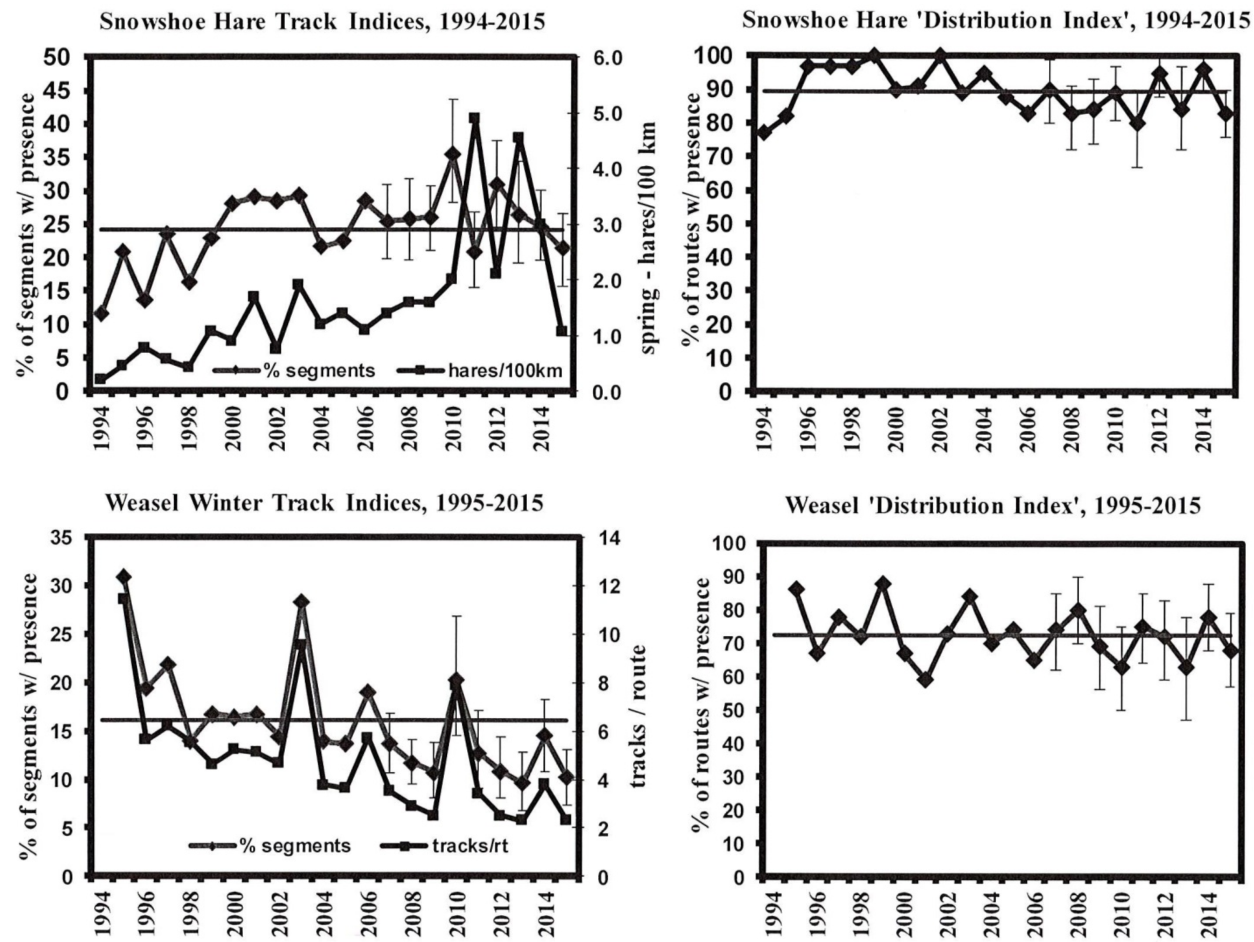

Figure 4 (continued).

FOREST WILDLIFE POPULATIONS

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2015 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

Both the tetracycline-based and Downing reconstructed populations showed an increase during the 1990s, followed by a decline during the 2000s (Fig. 1); however, 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 tetracycline-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, and population estimates will tend to follow changes in harvests (instead of population size). Hence, population trends showed a decline in the 2000s in the quota zone (Fig. 2), with reduced harvests there (which were designed to increase population size). Conversely, population trends appear stable in the no-quota zone, where harvests have been stable.

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. 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 (Fig. 3). Segregating the harvest age data into 5-year intervals showed harvest rates increasing from 1980–1999, then declining with reductions in hunter numbers. Harvest rates during 2010–2015 were, on average, less than what they were in 1980–84, when the population was increasing (Fig. 1, 3).

Fig. 1. Statewide bear population trend (pre-hunt) derived from Downing reconstruction using the harvest age structures from 1980−2013. 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 2013 (when harvests were reduced) are unreliable.

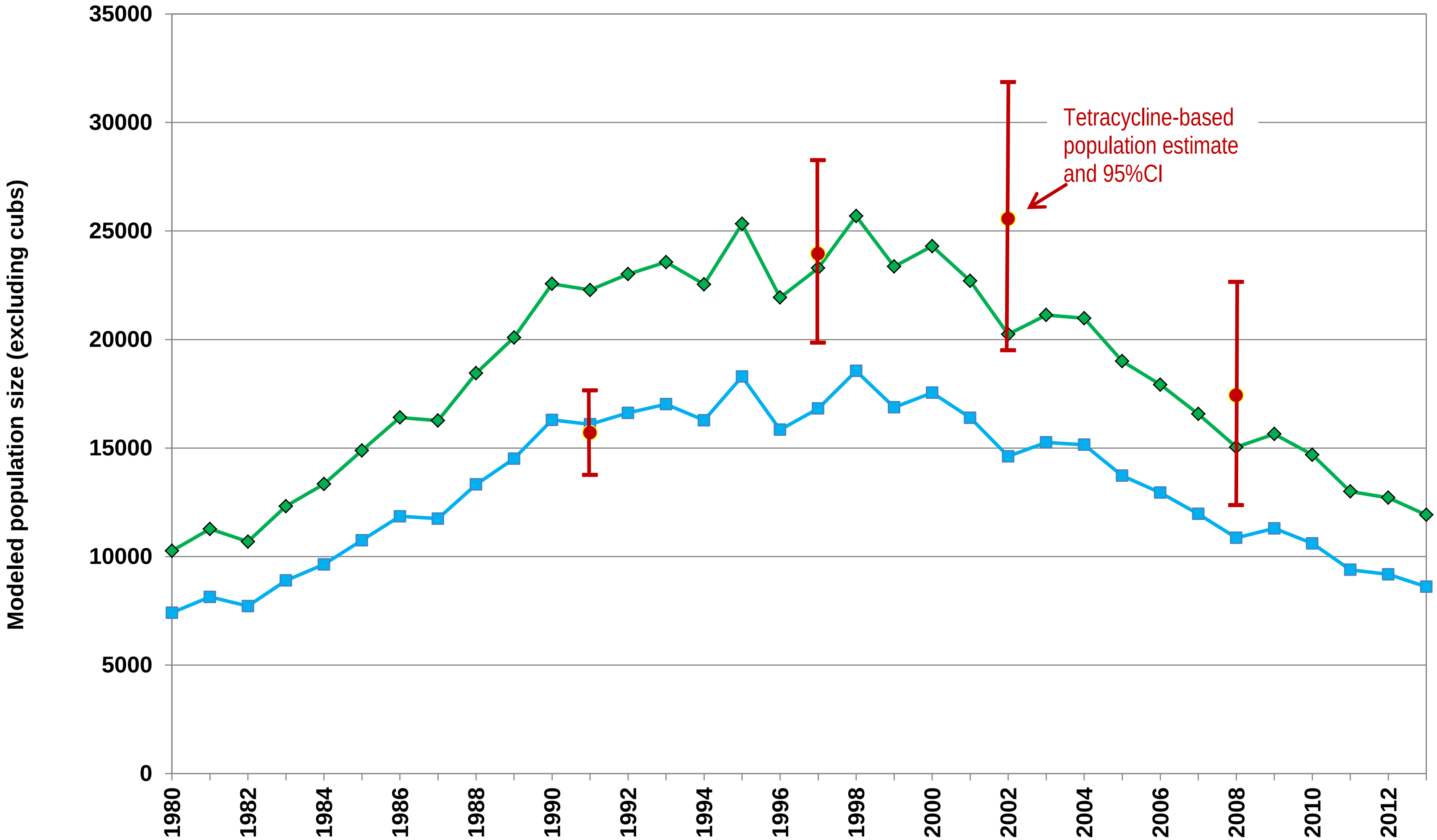


Fig. 2. Population trends during 2000s derived from Downing reconstruction for quota and no-quota zones compared to respective harvests. Population curves were scaled (elevated to account for non-harvest mortality) using a multiplier midway between the two curves in Fig. 12 (i.e., the actual scale of the population estimates is not empirically-based).

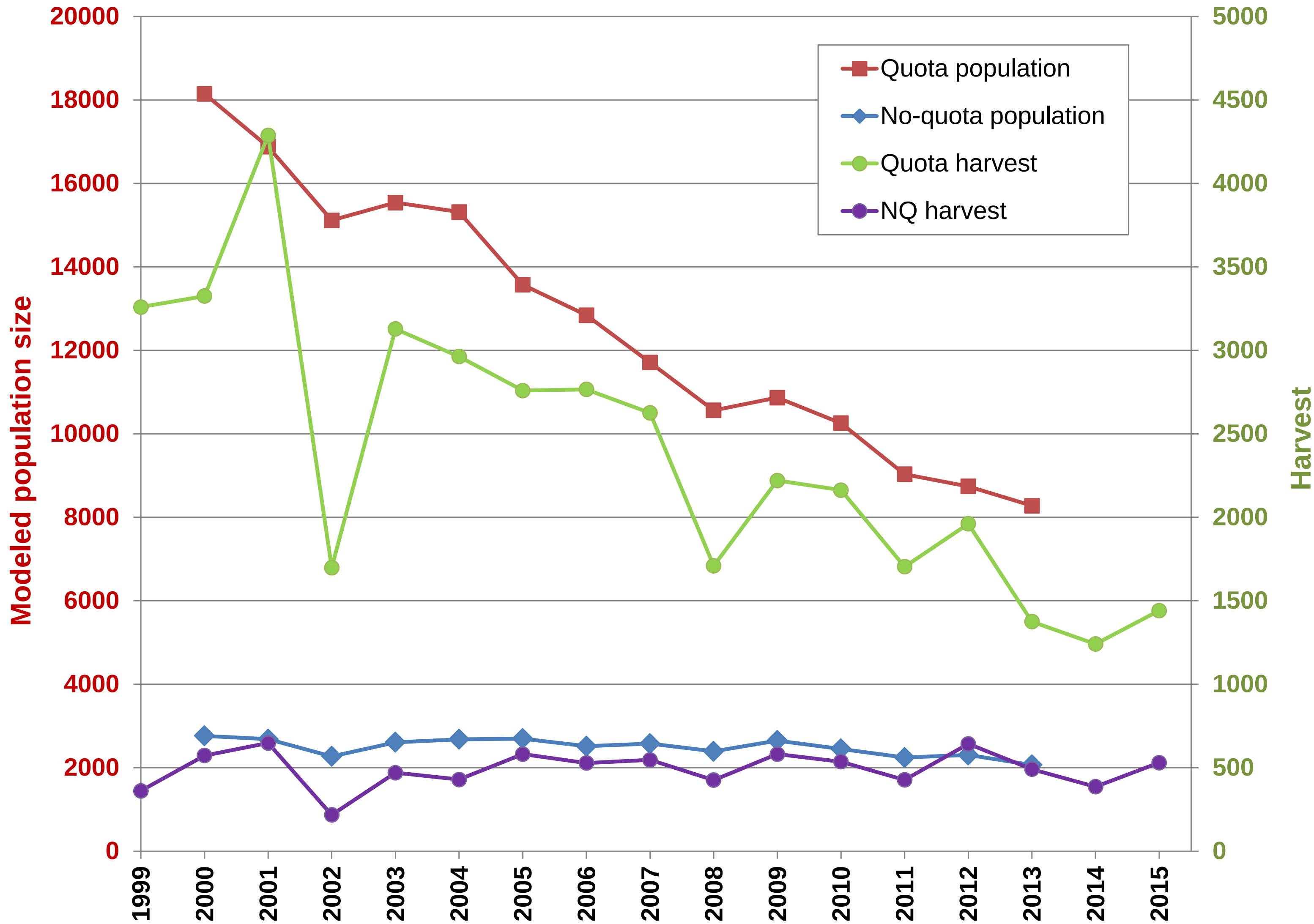
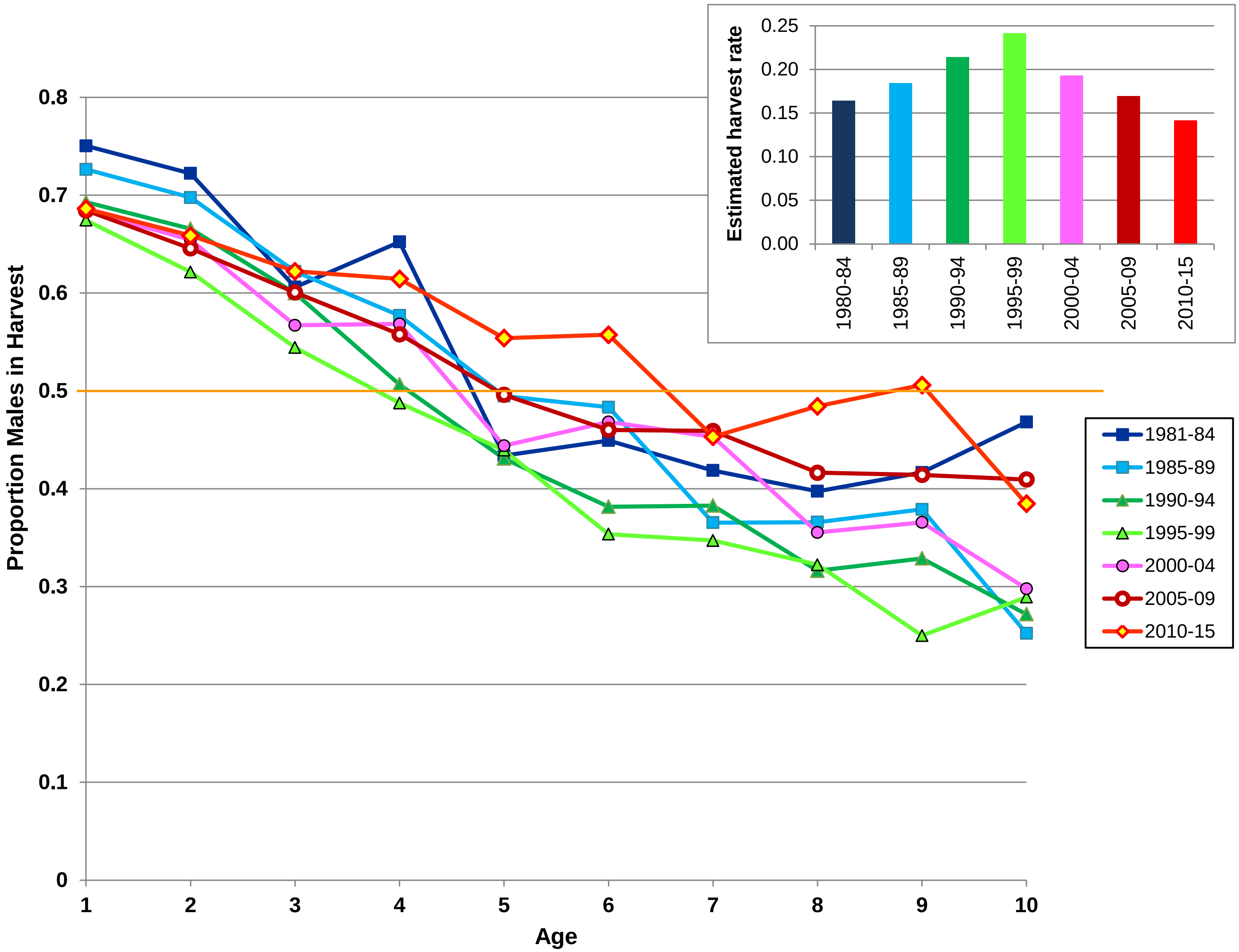


Fig. 3. Trends in proportion of male bears in statewide harvest at each age, 1–10 years, grouped in 5-year time blocks, 1981–2015. Higher harvest rates result in steeper curves. Fitting a line to the data for each time block and predicting the age at which 50% of the harvest is male yields approximately the inverse of the harvest rate (derived rates shown in inset).



2016 MINNESOTA SPRING GROUSE SURVEYS

Charlotte Roy, Forest Wildlife Populations and Research Group

SUMMARY OF FINDINGS

Each spring, the Minnesota DNR coordinates statewide ruffed grouse (*Bonasa umbellus*) and sharp-tailed grouse (*Tympanuchus phasianellus*) surveys with the help of wildlife managers, cooperating agencies, and organizations (e.g., tribal agencies, U.S. Forest Service, college wildlife clubs). In 2016, ruffed grouse surveys were conducted between 4 April and 13 May. Mean ruffed grouse drums per stop (dps) were 1.3 statewide (95% confidence interval = 1.1–1.6) and increased (18%) from the previous year, as expected during the increasing phase of the 10-year population cycle.

Sharp-tailed grouse surveys were conducted between 14 March and 3 May 2016, with 1,737 birds (males and birds of unknown sex) observed at 182 leks. The mean numbers of sharp-tailed grouse/lek were 6.0 (4.9-7.3) in the East Central (EC) survey region, 10.2 (9.2–11.4) in the Northwest (NW) region, and 9.5 (8.6–10.5) statewide. Comparisons between leks observed in consecutive years (2015 and 2016) indicated fewer birds/lek statewide ($t = 2.2$, $P = 0.02$), and in the NW region ($t = 2.2$, $P = 0.03$), but the EC region remained statistically unchanged ($t = 0.4$, $P > 0.05$). Nevertheless, fewer leks have been reported in the EC region in recent years despite similar average lek size, likely indicating that birds are combining into fewer leks.

INTRODUCTION

The ruffed grouse (*Bonasa umbellus*) is the most popular game bird in Minnesota, with an annual harvest averaging >500,000 birds (~150,000 -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.

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 AND DISCUSSION

Ruffed Grouse

Observers from 14 cooperating organizations surveyed routes between 4 April and 13 May 2016. Most routes (96%) were surveyed between 12 April and 10 May, with a median survey date of April 29, which is the same median date as last year and the median survey date for the most recent 10 years. Excellent (58%), Good (34%), and Fair (8%) survey conditions were reported for 106 routes reporting conditions.

Statewide counts of ruffed grouse drums averaged 1.3 dps (95% confidence interval = 1.1 – 1.6 dps) during 2016 (Figure 3). Drum counts were 1.5 (1.2 – 1.8) dps in the Northeast (n = 93 routes), 1.1 (0.6 – 1.6) dps in the Northwest (n = 8), 0.8 (0.5 – 1.3) dps in the Central Hardwoods (n = 16), and 0.8 (0.4 – 1.4) dps in the Southeast (n = 6) regions (Figure 4a-d). Statewide drum counts increased (18%) from last year. An increase was expected given that the ruffed grouse population is in the increasing phase of the 10-year cycle.

Sharp-tailed Grouse

A total of 1,737 male sharp-tailed grouse and grouse of unknown sex were counted at 182 leks (Table 1) during 14 March - 3 May 2016. The statewide index value of 9.5 (8.6–10.5) grouse/lek was centrally located among values observed since 1980 (Figure 5). In the EC survey region, 180 grouse were counted on 30 leks, and 1,557 grouse were counted on 152 leks in the NW survey region. The index value was similar statewide and in both survey regions compared to 2015 (Table 1). Counts at leks observed during both 2015 and 2016 were lower ($t = 2.2$, $P = 0.03$) statewide and in the NW region ($t = 2.2$, $P = 0.02$), but counts were statistically unchanged in the EC region (t = 0.4, $P > 0.05$; Table 2). Leks with ≥2 grouse were observed an average of 2.2 times, but fewer leks (13%) were observed in 2016 than during 2015.

Ruffed grouse populations increased this year, but similar increases were not observed in the sharp-tailed grouse population. 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. Although the index grouse/lek remained unchanged in both regions, fewer leks were observed in the EC region than have been observed in >30 years. Likewise, the number of birds counted in the EC region has been ~200 birds for the last 4 years, and counts have not been this low for >30 years. Although survey effort is a large factor in the number of leks surveyed, the declining patterns observed in the EC region appear not to be an artifact of survey effort. Survey effort (as indicated by number of lek sites visited, including historic leks where grouse have not been observed in recent years) was below the 10-year average of 102 leks in 2013 (84 leks); 2014 (82 leks); and 2015 (93 leks), but survey effort in 2016 (109 leks) exceeded the 10 year average and was the highest since the last peak in 2009. Likewise, the average number of surveys per lek in the EC region was up this year to 2.2 surveys/lek, the highest observed in the last 10 years (Roy and Larson, unpubl. data). Thus, declines in the EC region are indicated by the counts, after considering survey effort. 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 increasing over the same period. In 2016, 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. Trapping occurred at 7 leks in Kittson, Marshall, and Roseau counties with 104 birds captured and 29 birds moved (13 females and 16 males) to 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.

ACKNOWLEDGEMENTS

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. 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 his assistance in the transition coordinating the surveys and 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

[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

[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.

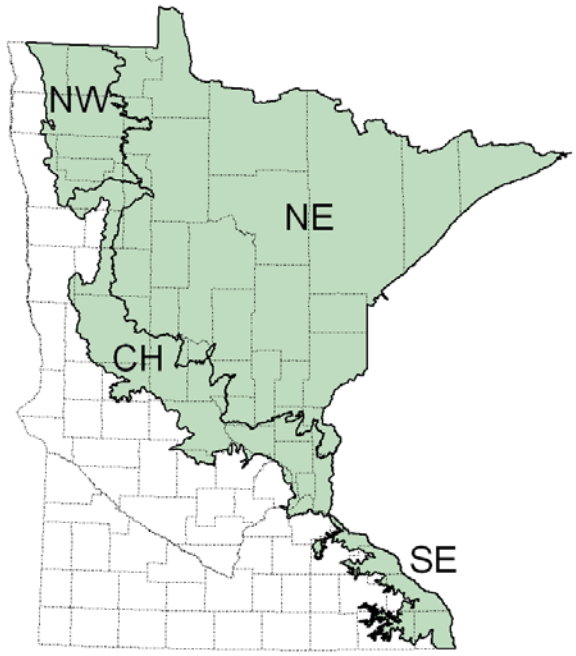


Figure 1. Survey regions for **ruffed grouse** in Minnesota. Northwest (NW), Northeast (NE), Central Hardwoods (CH), and Southeast (SE) survey regions are depicted relative to county boundaries (dashed lines) and influenced by the Ecological Classification System.

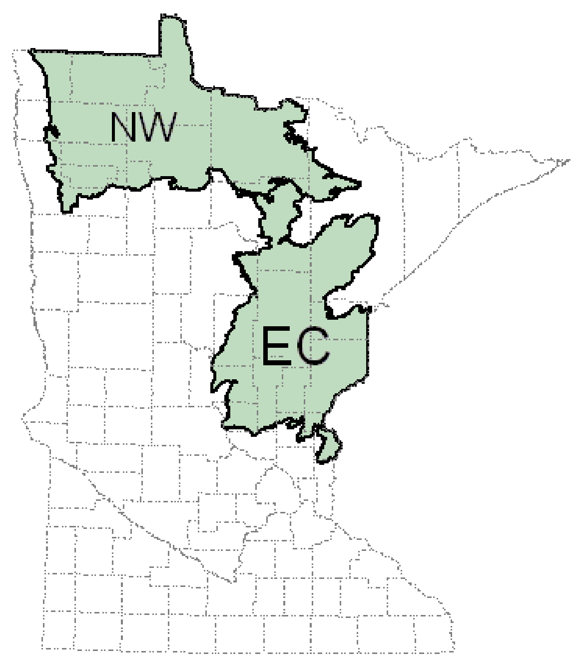


Figure 2. Survey regions for **sharp-tailed grouse** in Minnesota. Northwest (NW) and East Central (EC) survey regions are depicted relative to county boundaries (dashed lines) and influenced by Ecological Classification System Subsections boundaries.

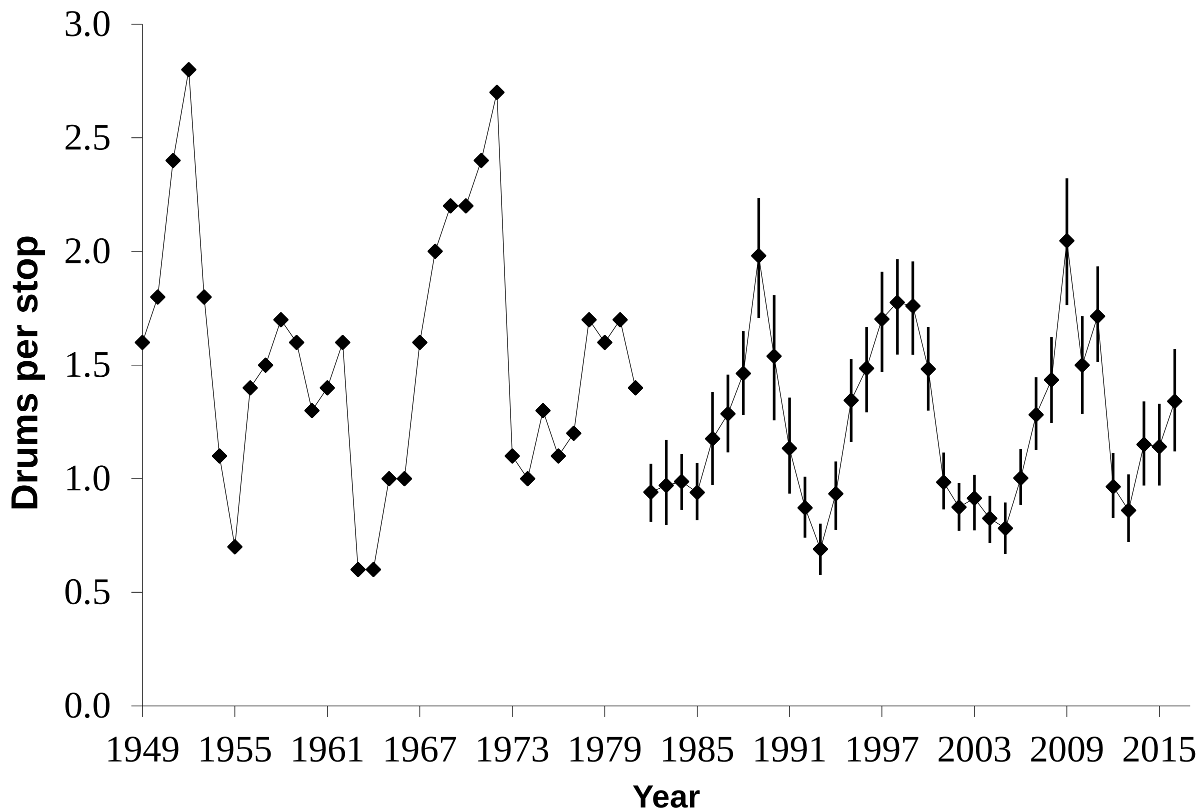
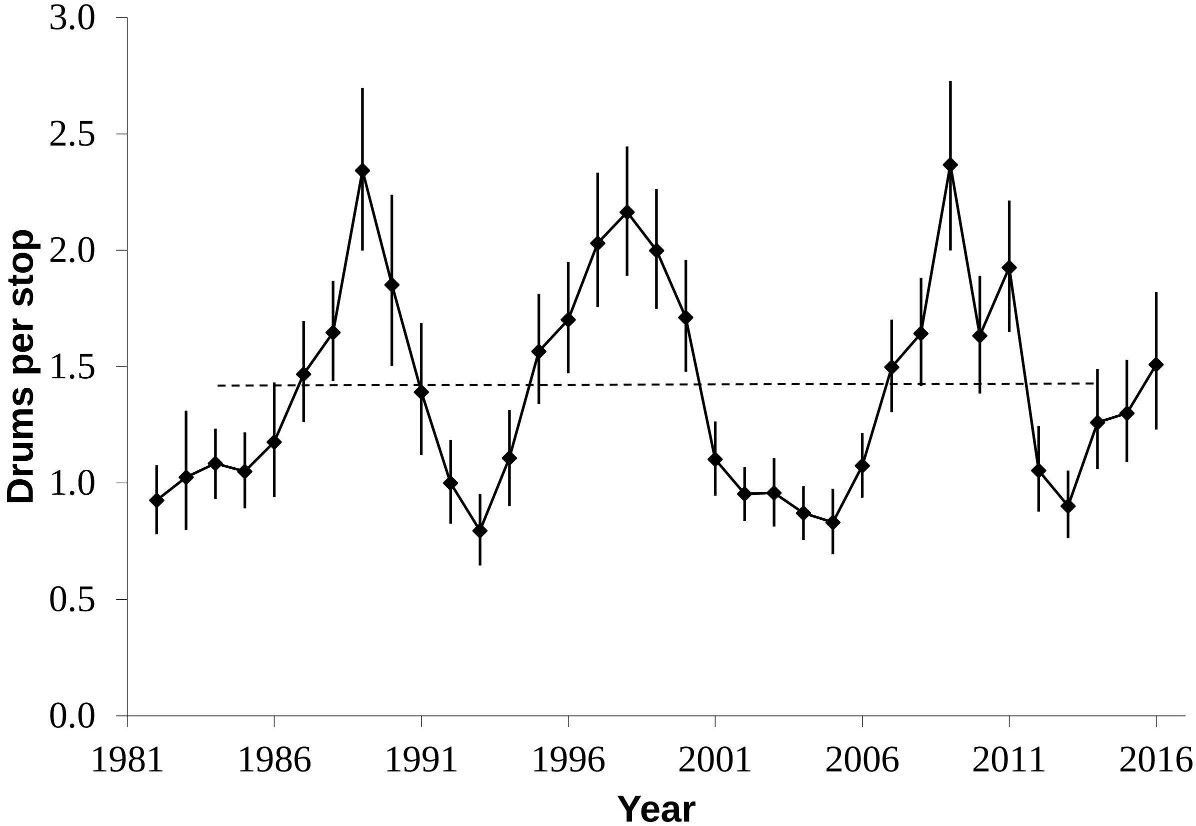
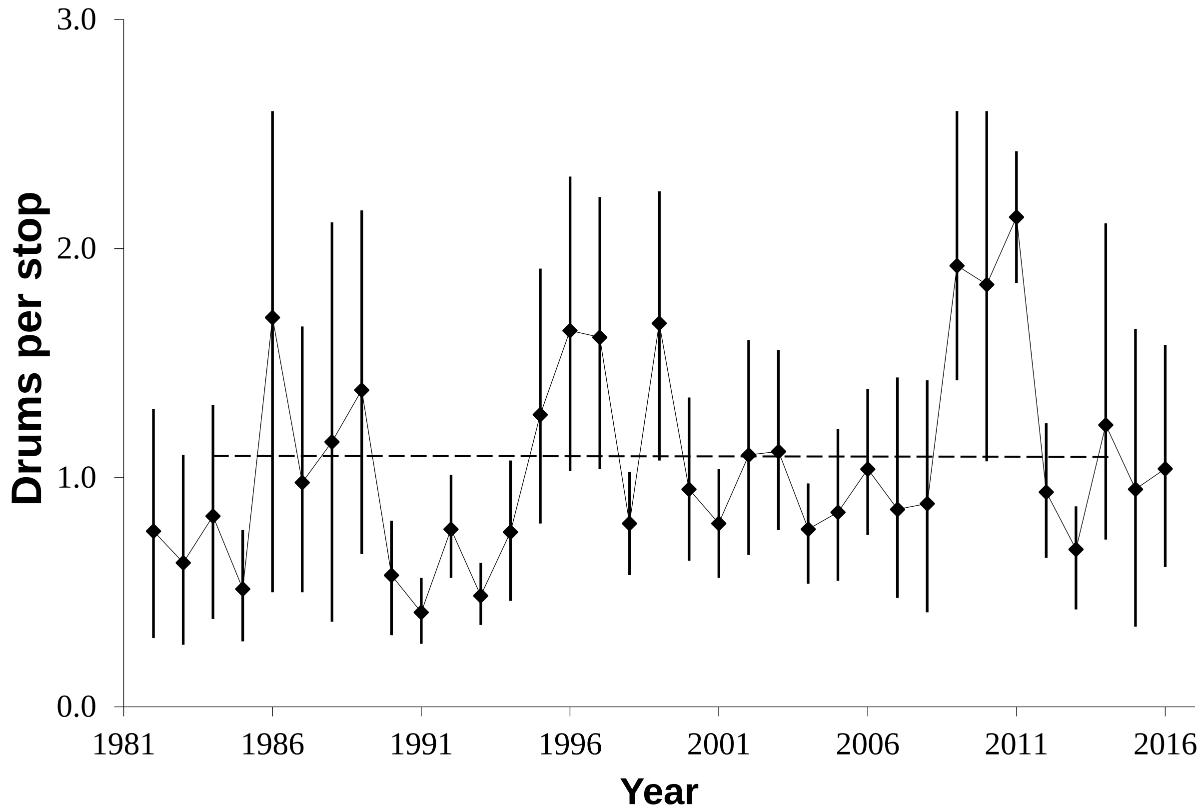


Figure 3. Statewide ruffed grouse population index values in Minnesota. Bootstrap (95%) confidence intervals (CI) are provided after 1981, but different analytical methods were used prior to this and thus CI are not available for earlier years. The difference between 1981 and 1982 is biological and not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

a.

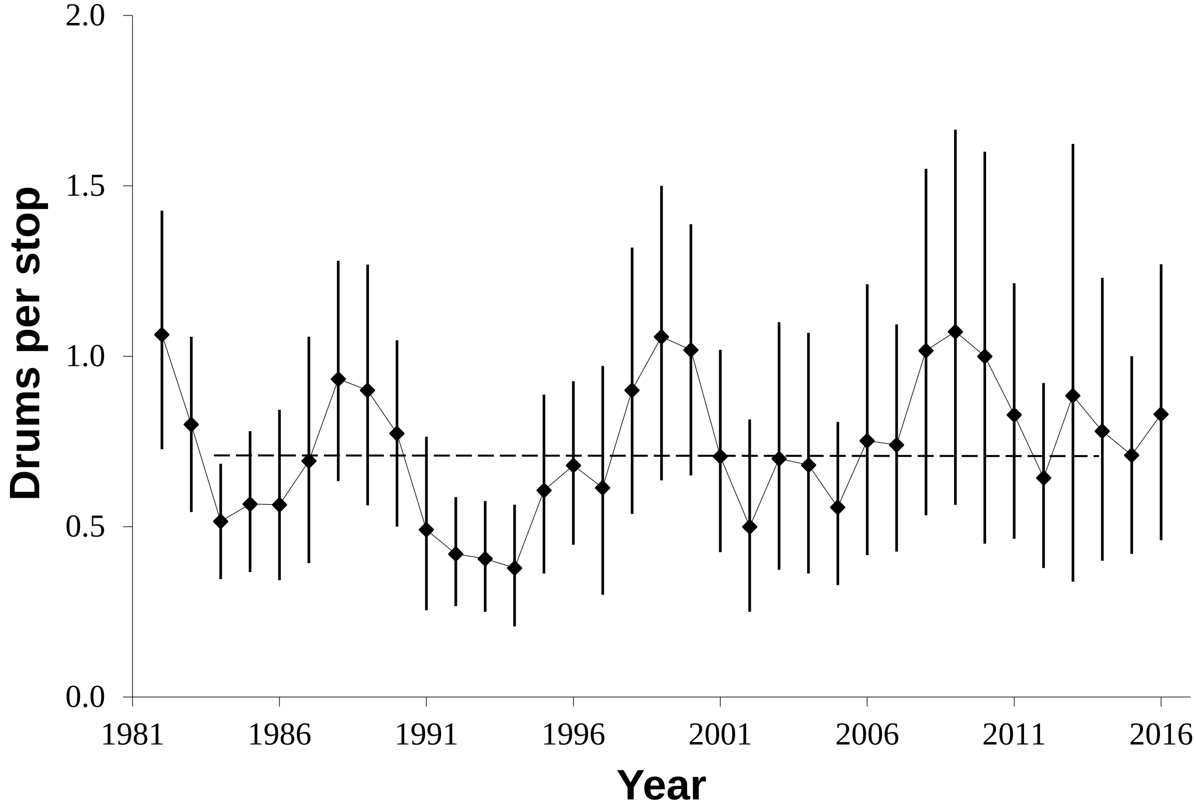

Drums per stop
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1981
1986
1991
1996
2001
2006
2011
2016
Year

b.



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

c.



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

d.

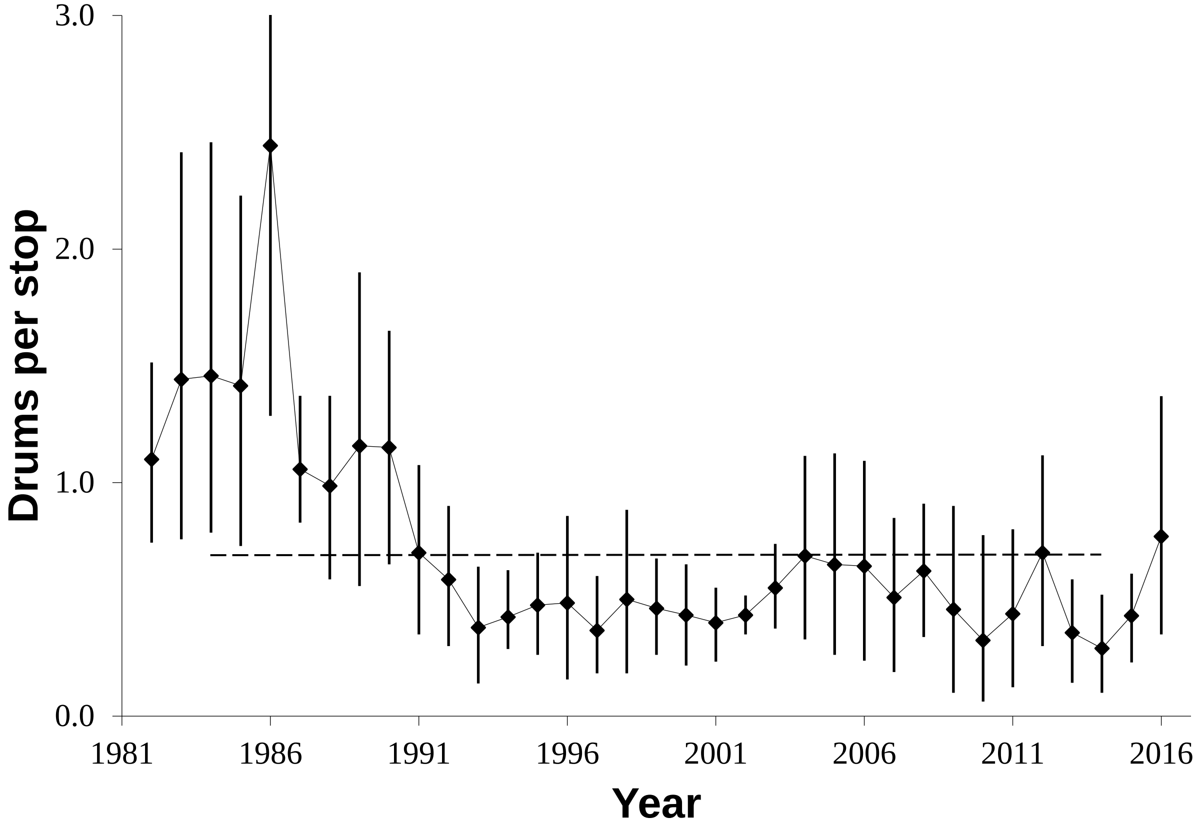


Figure 4a,b,c,d. Ruffed grouse population index values in the **Northeast** (a), **Northwest** (b), **Central Hardwoods** (c), and **Southeast** (d) survey regions of Minnesota. The mean for 1984-2014 is indicated by the dashed line. Bootstrap (95%) confidence intervals are provided for each mean. In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

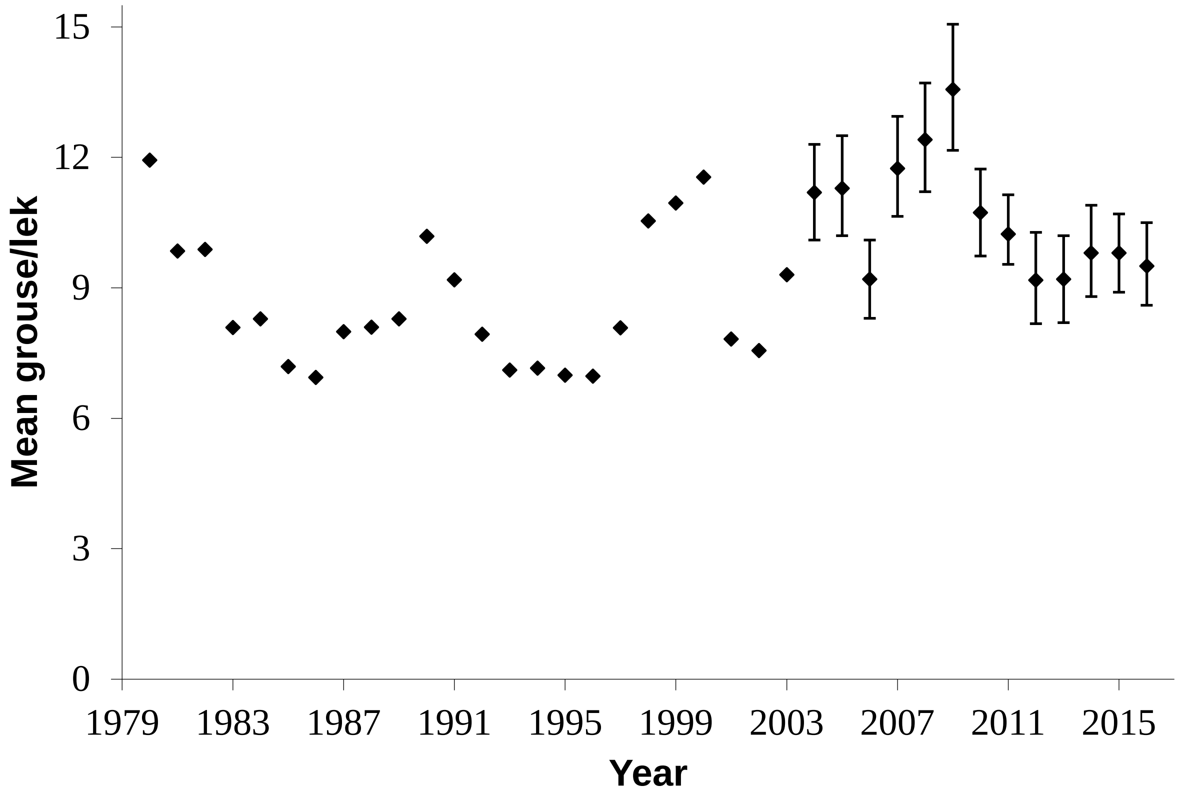


Figure 5. **Sharp-tailed grouse** counted in spring lek surveys statewide during 1980–2016. Bootstrap (95%) confidence intervals are provided for recent years. Annual means are not connected by lines because the same leks were not surveyed every year.

2016 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 2016. Observers located 60 booming grounds and counted 634 males and birds of unknown sex in the survey blocks. They located 130 booming grounds,1,280 male prairie-chickens, and 142 birds of unknown sex throughout the prairie-chicken range. Estimated densities of 0.09 (0.06–0.11) booming grounds/km^2 and 10.6 (8.7–12.5) 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 surveyor attempted to find and observe each booming ground repeatedly in his/her assigned block, which comprised 4 sections of the Public Land Survey (approximately 4,144 ha). We 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 surveyors to submit observations 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 24 March and 24 May 2016. Observers located 130 booming grounds and observed 1,280 male prairie-chickens and 142 birds of unknown sex within and outside survey blocks (Table 1). These counts represent a minimum number of prairie-chickens in Minnesota during 2016, but because survey effort outside of survey blocks is not standardized among years, these counts should not be compared among years or permit areas.

Within the standardized survey blocks, 634 males and birds of unknown sex were counted on 60 booming grounds during 2016 (Table 2). These are the lowest counts since the standardized survey began in 2004, when 1,566 males and 95 booming grounds were counted, and 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 36% 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.

Table 1. Minimum abundance of prairie-chickens within and outside hunting permit areas in Minnesota during spring 2016. Lek and bird counts are not comparable among permit areas or years.

Permit Area	Area (km^2)	Leks	Males	Unk[a]
803A	1,411	18	148	0
804A	435	2	15	17
805A	267	19	195	20
806A	747	8	65	5
807A	440	17	182	30
808A	417	18	286	0
809A	744	15	143	0
810A	505	4	68	0
811A	706	11	65	45
812A	914	4	8	20
813A	925	4	46	0
PA subtotal	7,511	120	1,221	137
Outside PAs[b]	NA[c]	10	59	5
Grand total	NA[c]	130	1,280	142

[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.

Densities of prairie-chickens in the 10 core survey blocks were 0.10 (0.07–0.13) booming grounds/km^2 and 11.9 (9.4–14.4) males/booming ground (Table 2, Figure 2). In the 7 peripheral survey blocks, densities were 0.06 (0.04–0.09) booming grounds/km^2 and 7.4 (5.5–9.3) males/booming ground. The density of 0.09 (0.06–0.11) booming grounds/km^2 in all survey blocks during 2016 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 10.6 (8.7–12.5) males/booming ground in all survey blocks during 2016 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.

			2016		Change from 2015[a]	
Range[b]	Survey Block	Area (km^2)	Booming grounds	Males[c]	Booming grounds	Males[c]
Core	Polk 1	41.2	6	61	-3	-25
	Polk 2	42.0	5	58	0	-25
	Norman 1	42.0	1	5	0	-7
	Norman 2	42.2	3	34	-1	-19
	Norman 3	41.0	5	70	-1	12
	Clay 1	46.0	7	84	-1	7
	Clay 2	41.0	2	64	0	12
	Clay 3	42.0	7	71	2	14
	Clay 4	39.0	3	15	0	-7
	Wilkin 1	40.0	3	39	-2	-28
	Core subtotal	415.0	42	501	-6	-66
Periphery	Mahnomen	41.7	2	18	-2	-11
	Becker 1	41.4	4	28	2	6
	Becker 2	41.7	3	17	0	-8
	Wilkin 2	41.7	2	14	-1	-4
	Wilkin 3	42.0	5	43	2	17
	Otter Tail 1	41.0	1	7	-1	-7
	Otter Tail 2	40.7	1	6	-2	-13
	Periphery subtotal	290.6	18	133	-2	-20
Grand total		705.5	60	634	-8	-86

[a] The 2015 count was subtracted from the 2016 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.

ACKNOWLEDGEMENTS

I would like to thank cooperators who conducted and helped coordinate the prairie-chicken survey. Cooperators within the DNR included Ross Hier, Emily Hutchins, Brian Torgusson, Rob Baden, Michael Oehler, 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, and Tony Nelson; cooperators with the US Fish and Wildlife Service included Maria Fosado, Shawn Papon, Chad Raitz, Ben Walker, Gregg Knutsen; and numerous additional volunteers participated, including Dan Svedarsky, Doug Wells, Terry Wolfe, Alexandra Wardwell, and Tom Kucera. Bemidji State University faculty and students, Brian Hiller, Adam Maleski, and Irain Adams also assisted with surveys this year. This survey was funded in part by the Wildlife Restoration (Pittman-Robertson) Program W-69-S-13 Project #16. Mike Larson provided assistance and comments which improved this report.

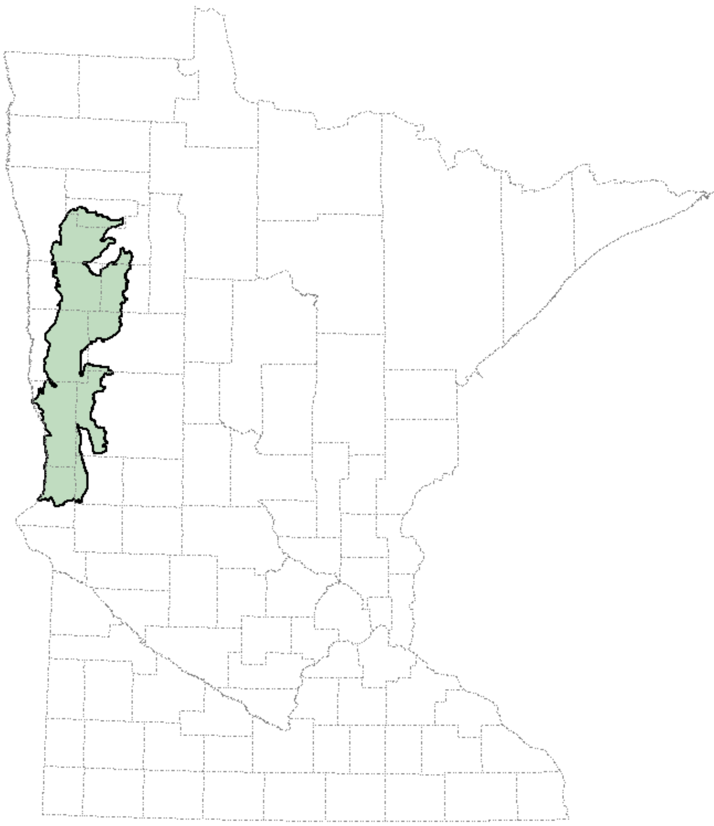


Figure 1. Primary greater prairie-chicken range in Minnesota (shaded area) relative to county boundaries. The range boundary was based on Ecological Classification System Land Type Associations and excludes some areas known to be occupied by prairie-chickens.

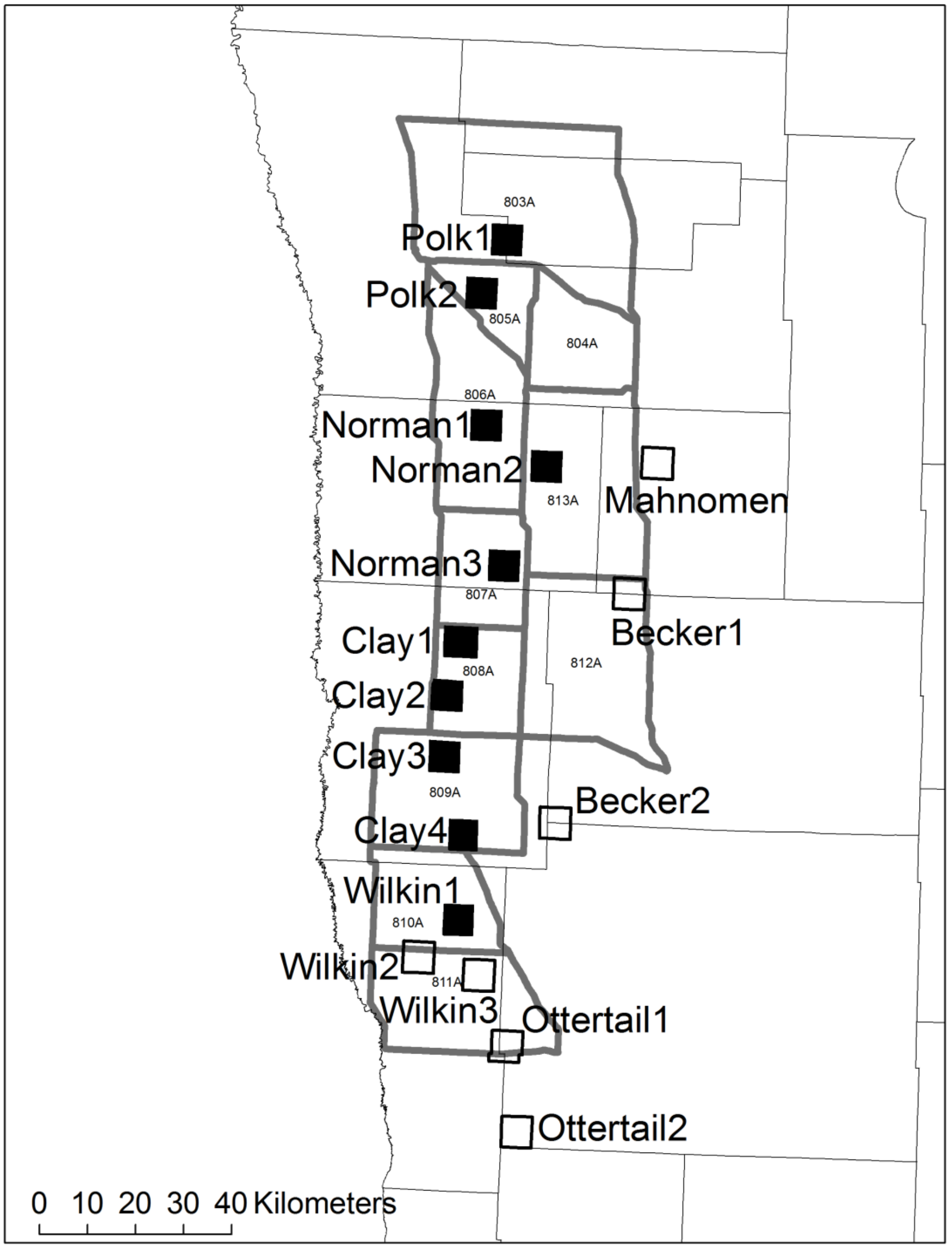


Figure 2. Prairie-chicken lek survey blocks (41 km^2, labeled squares) and hunting permit areas (thick grey lines) in western Minnesota. Survey blocks were either in the core (black) or periphery (white) of the range with a threshold of 1.0 male/km^2 in 2010, and were named after their respective counties (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.

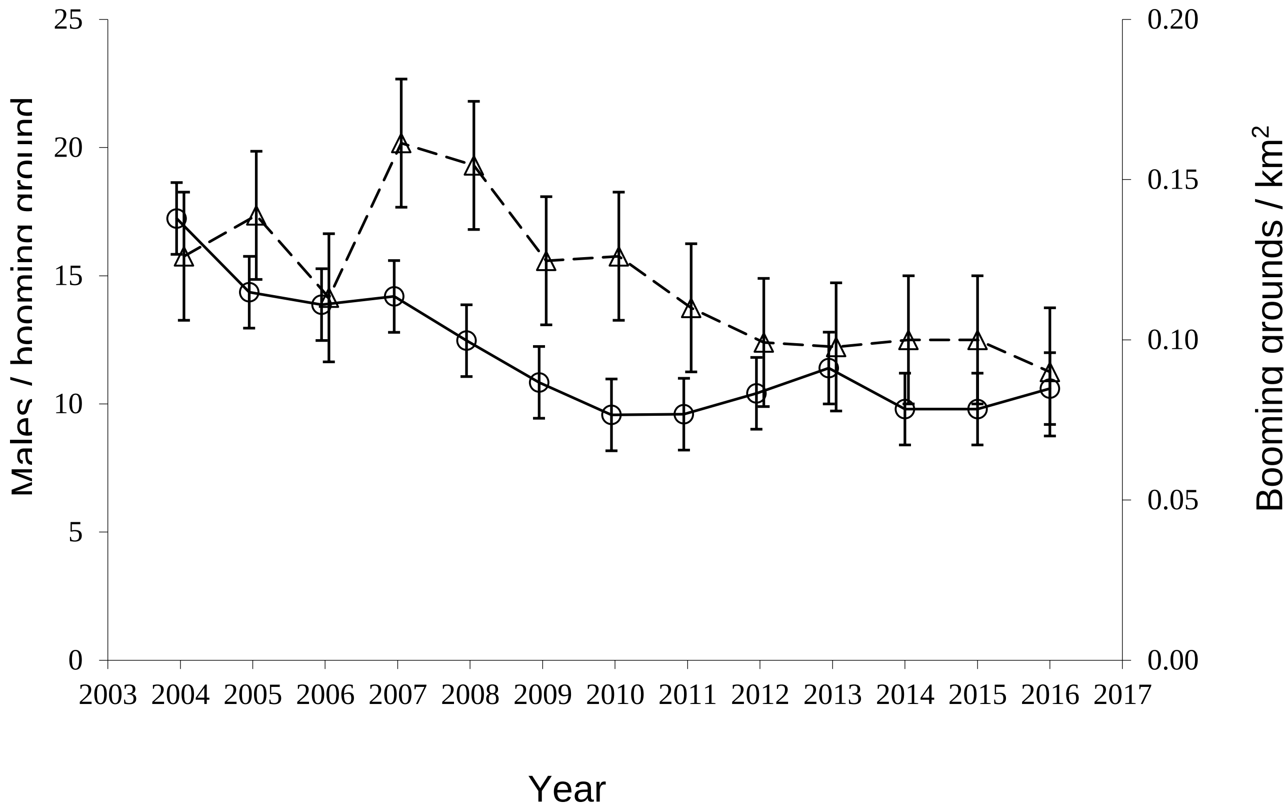


Figure 3. Mean prairie-chicken males/booming ground (circles connected by solid line) and booming grounds/km^2 (triangles connected by dashed line) in survey blocks in Minnesota with 95% confidence intervals.

MNDNR

2016 NW MN ELK SURVEYS

Doug Franke, Area Wildlife Manager, Thief River Falls

This was the fourth year using a combination of a fixed wing (Cessna 185) and helicopter (Enstrom) to conduct aerial elk surveys for the Lancaster, Caribou, and Grygla elk herds. The fixed-wing aircraft follows predetermined transects spaced 1/5 mile apart at an altitude of 300 to 500 feet and speeds of 70 mph. The pilot and two observers record elk location(s) and document the sex and size class of bulls as best they can. Once the fixed-wing crew records elk locations, the helicopter crew (pilot and two observers) verifies their data by resurveying the square mile with elk and all the square miles that border it (yielding 9 mi^2 for each elk observation). The helicopter flies lower and slower (200 feet and 50 mph) to maximize observations. This protocol has been used to determine if using a fixed-wing aircraft is efficient enough for counting and determining sex and bull size class for the annual elk survey.

The surveys started on January 28th and ended on February 5th, 2016. Similar to last year, snow depths ranged from 5 to 7 inches throughout the elk range. Grass cover was standing vertical due to the lack of snow cover and fresh snow had not fallen for a couple weeks, making for fair observation conditions. Weather conditions were fairly mild with temperatures ranging from a low of 7°F to a high of 34°F with most days overcast—which made for good visibility.

GRYGLA HERD

This survey started on January 28th and was completed on February 1st, 2016. The area surveyed was the same 133 mi^2 area as last year and took 11.7 hours for the fixed-wing to complete. The fixed-wing recorded elk at six (6) separate locations within the survey boundary. The helicopter crew resurveyed the area immediately after and verified all the fixed-wing observations, but also found a seventh location of two spike bulls about 1.0 mile SE of the cow herd. Total elk observed was 21 and included: 10 antlerless (cows/calves) and 11 bulls (4 mature, 5 raghorn, and 2 spike bulls).

CARIBOU (A.K.A. VITA OR BORDER HERD)

This survey started and was completed on February 2nd, 2016. The area surveyed was the same 35.5 mi^2 area as last year and took 3.5 hours for the fixed-wing to complete. The fixed-wing recorded elk at four (4) separate locations within the survey boundary. The helicopter crew resurveyed the area immediately after and verified the four locations of elk located by the fixed-wing and located single animals at two (2) additional locations. Total elk observed was 10 and included: 4 antlerless (cows/calves) and 6 bulls (2 mature and 4 raghorn). We did fly a single transect at a higher altitude down the center of the next two miles south and one mile west of the survey block, but did not see any sign of a larger group of antlerless elk. 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.

LANCASTER—WATER TOWER AND PERCY WMA HERDS

This survey started on February 3rd and was completed on February 5th, 2016. The area surveyed was the same 167 mi^2 area as last year and took 15.7 hours for the fixed-wing to complete. The fixed-wing recorded elk at four (4) separate locations within the survey boundary. The helicopter crew resurveyed the area immediately after and verified all the fixed- wing observations, but counted two fewer animals. Total elk observed was 52 and included: 34 Antlerless (cows/calves) and 18 bulls (10 mature, 2 raghorn, and 6 spike bulls. We did locate the antlerless herd west of the Percy WMA area this year, but most of the bulls were located about seven miles north and closer to the Water Tower antlerless herd.

I have provided a table on the following page that lists a breakdown of elk observations by survey block for the past three years. Also, attached are maps showing locations of elk within each survey block in 2016.

I would like to thank all those that helped with the survey this year, especially the pilots Chris Lofstuen and Luke Ettl (fixed-wing) and Brad Maas (helicopter) that provided safe flying for all of us. This was both Chris's and Luke's first time flying the elk surveys and they did a great job! Observers this year included: Becky Ekstein and Matt Morin (Thief River Falls Assistant Managers), Kyle Arola (Thief Lake Assistant Manager), Jason Wollin (Karlstad Assistant Area Wildlife Manager), and Doug Franke. Special thanks again to Brian Haroldson who put together all of the survey materials and computers used during the survey.

Figure 1. Elk survey crew, 2016. Left to right: Jason Wollin, Becky Ekstein, Brad Maas, Kyle Arola, Doug Franke, Chris Lofstuen

Table 1. Comparison of elk observations between 2014 and 2016 for the Caribou, Lancaster, and Grygla herds.

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

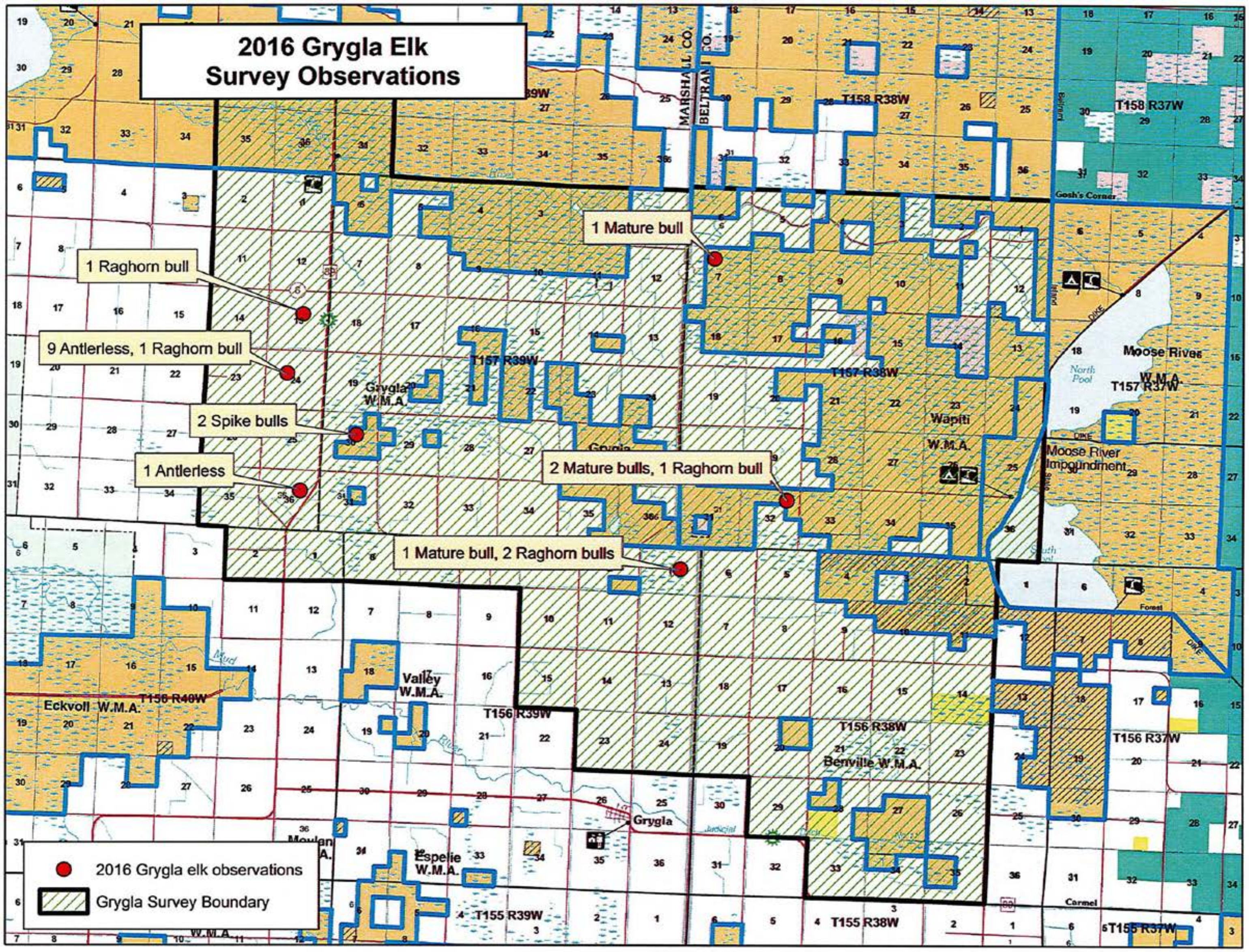


Figure 2. Survey observations of Elk near Grygla, MN, 2016.

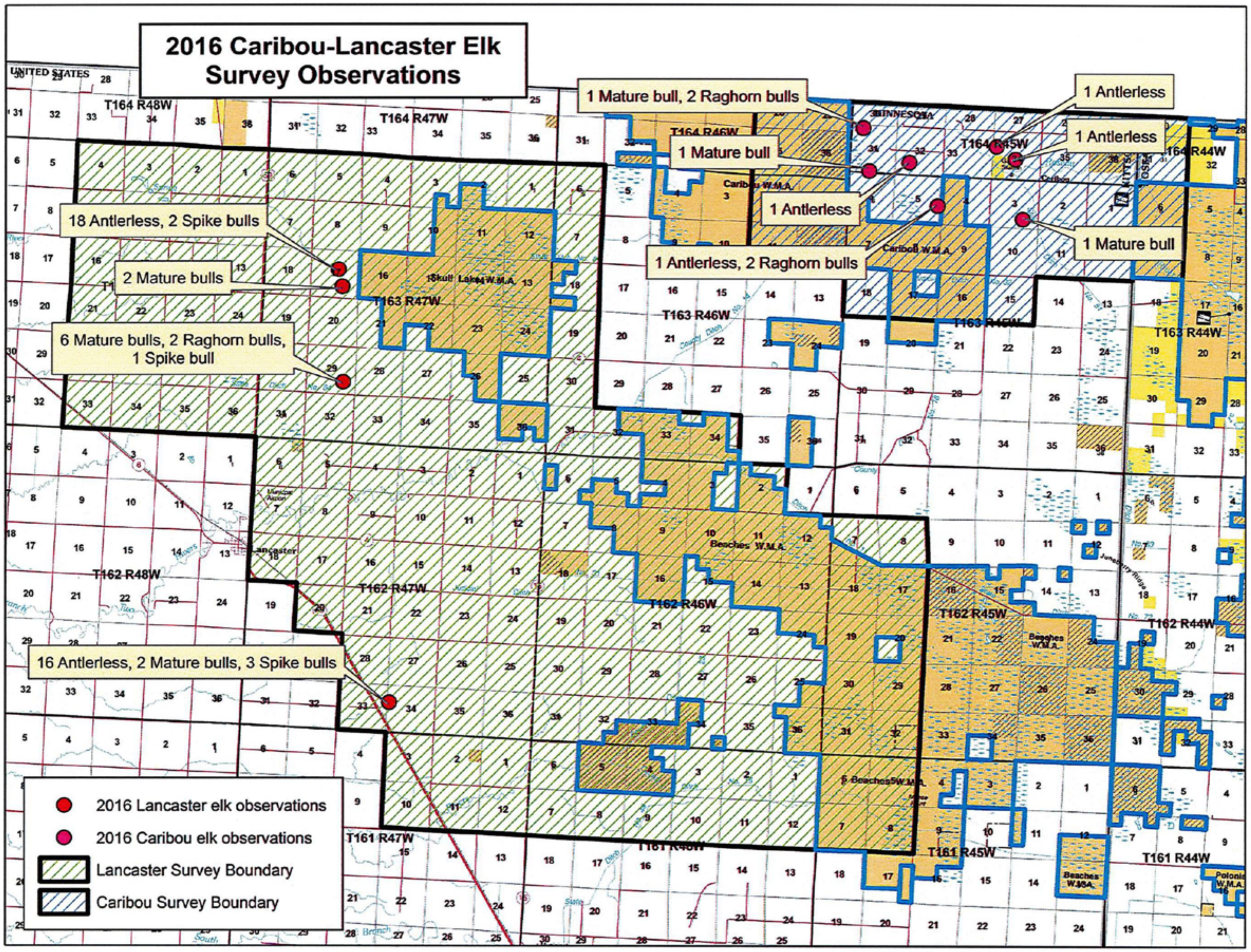


Figure 3. Survey observations of Caribou- Lancaster Elk herds, 2016.

2016 AERIAL MOOSE SURVEY

Glenn D. DelGiudice, Forest Wildlife Populations and Research Group

INTRODUCTION

Each year, we conduct an aerial survey in northeastern Minnesota to monitor moose (*Alces americanus*) numbers and fluctuations in the overall status of the state's largest deer species. The primary objectives of this annual survey are to estimate moose numbers, 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) and composition, 2) set the harvest quota for the subsequent hunting season (when applicable), 3) 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 (Fig. 1). 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. Survey plots were classified as low, medium, or high based on whether ≤ 2, 3–7, or ≥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. Each year since, these same 9 plots are surveyed in an effort to evaluate the effect of disturbance on moose density over time. In total, we surveyed 52 of the 436 plots this year.

All 436 survey plots in the grid (designed in 2005) are 13.4-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 and Forestry pilots flew the 2 Bell Jet Ranger (OH-58) helicopters used to conduct the survey. We determined the sex of moose using the presence of antlers or the presence of a vulval patch (Mitchell 1970), nose coloration, and bell size and shape. We identified calves on the basis of 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 this background in *real time*, and to efficiently record data using a tablet pen with a menu-driven data entry form. Two of the 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 the covariate "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. VO was the proportion of vegetation that 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 correction) of bulls, cows, and calves, adjusted for sampling, to calculate the bull:cow and calf:cow ratios (i.e., using the combined ratio estimator; Cochran 1977:165).

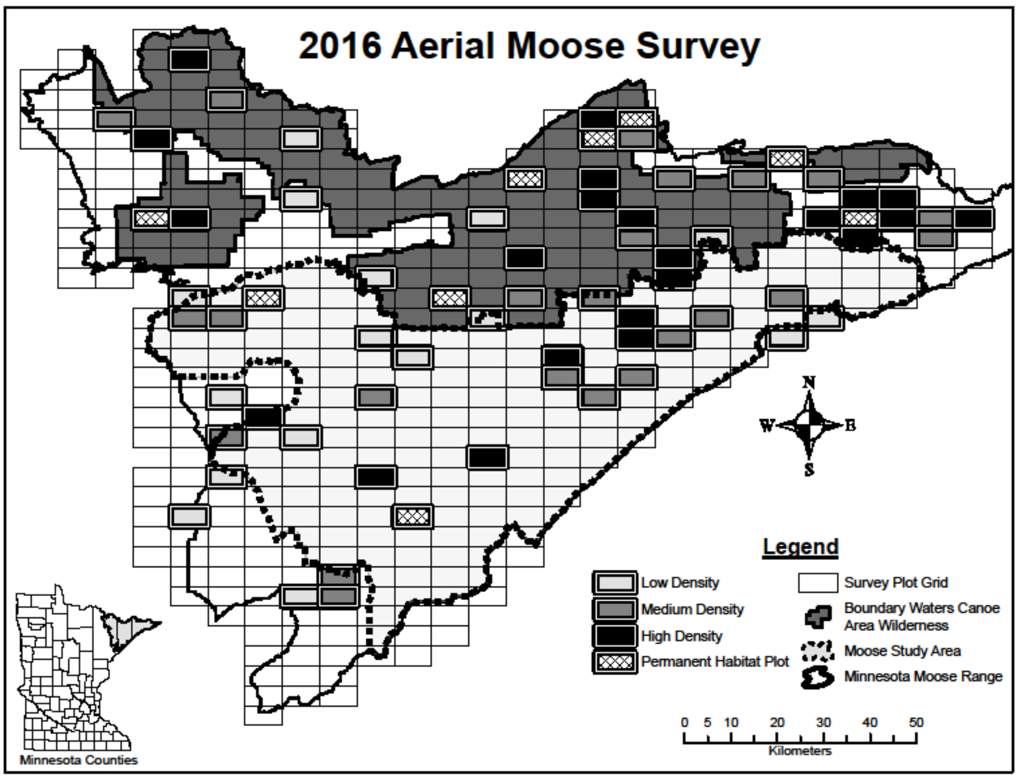


Figure 1. Moose survey area and 52 sample plots flown in the 2016 aerial moose survey. The study area for ongoing MNDNR moose research also is shown.

RESULTS AND DISCUSSION

The survey was conducted from 4 to 15 January 2016. It consisted of 9 actual survey days, and as in 2014 and 2015, 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 2016). Generally, 8" of snow cover is our minimum threshold depth for conducting the survey. Snow depths were marginal (less than 8") on 10% of the survey plots, but 8–16" and >16" on 62% and 29% of the sample plots, respectively. Overall, survey conditions were good for 79% and fair for 21% of the plots when surveyed.

Average survey intensity was 49 minutes/plot (13.4 mi^2) and ranged from 40 to 65 minutes/plot (Giudice 2016).

This year a total of 506 moose were observed on 47 (90%) of the 52 plots surveyed (a total 697 mi^2). An average of 10.8 moose (range = 1–38) were observed per occupied plot. This is a notable difference from the 392 moose observed on 34 of 52 plots (65%) in the 2015 survey. Plot occupancy during the past 12 years averaged 81% (range = 65–95%) with a mean 11.9 moose per occupied plot. This year's 506 observed moose included 208 bulls, 206 cows, 87 calves, and 5 unclassified.

After adjusting for sampling and sightability, we estimated the population in northeastern Minnesota at 4,020 (3,230–5,180, 90% confidence interval) moose (Table 1, Fig. 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. Rather, these data are best suited to establishing long-term trends.

Past aerial survey and research results have indicated that the trend of the population in northeastern Minnesota has been declining since 2006 (Lenarz et al. 2010, DelGiudice 2015). The current population estimate is 55% less than the estimate in 2006 and the declining linear trend during the past decade is still significant ($r^2 = 0.79$, $P < 0.001$, Fig. 2). However, there appears to be a leveling since 2012, and a piecewise polynomial curve indicates that the trend from 2012 to 2016 is not declining (Fig. 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 2016).

Table 1. Estimated moose numbers, 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, 2005–2016.

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

The January 2016 calf:cow ratio of 0.42 is 24% higher than the 11-year average since 2005 (0.34, Table 1, Fig. 4), and is the third highest since 2005. Calves were 17% of the total 506 moose actually observed and represented 17% of the estimated population (Table 1, Fig. 4). Twin calves were observed with 5% of the 206 cow moose, which is elevated slightly relative to most years since 2005 (Table 1). Overall, survey results indicate calf survival to January 2016 is higher than in most years since the population decline began following the 2006 survey. This is consistent with results of a separate helicopter survey which documented the number of adult GPS-collared cows that had calved in spring 2015 that were still accompanied by calves in early November–early December 2015 (Severud and DelGiudice, unpublished data). Annual recruitment of calves can have a significant influence on the population performance of moose, but it is not actually determined until the next spring's calving season when calves observed during winter become yearlings. Little is known about survival of moose calves during the period between the annual winter survey and subsequent spring calving. 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). Somewhat consistent with the recent (2012–2016) apparent relative stability of the population trend, the annual survival rate of adult GPS-collared moose has been 85–88% during the past 2 years, slightly higher than in 2013 (81%, Carstensen et al., unpublished data) and the previous long-term average of 81% (Lenarz et al. 2009).

The estimated bull:cow ratio (1.03, Table 1; Fig. 5) is similar to the long-term mean of 0.98 during 2005–2015. 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.

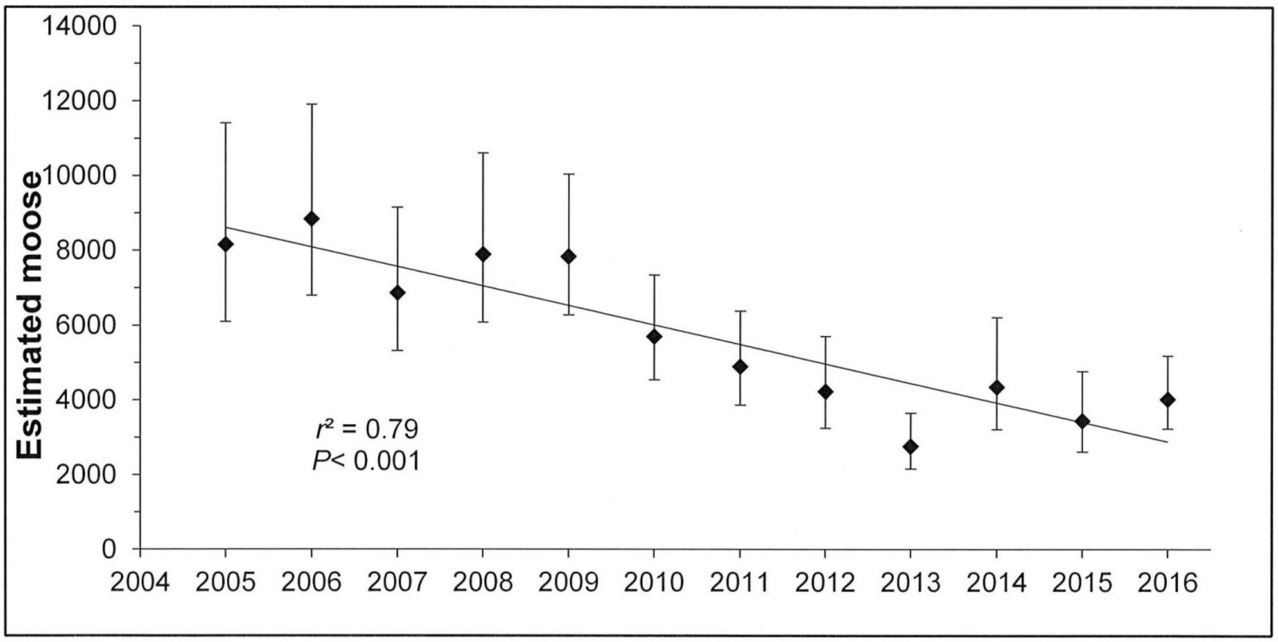


Figure 2. Point estimates, 90% confidence intervals, and a linear trend line of estimated moose numbers in northeastern Minnesota, 2005–2016. (Note: The 2005 survey was the first to be flown with helicopters and to include a sightability model and a uniform grid of east-west oriented rectangular 13.4-mi^2 plots).

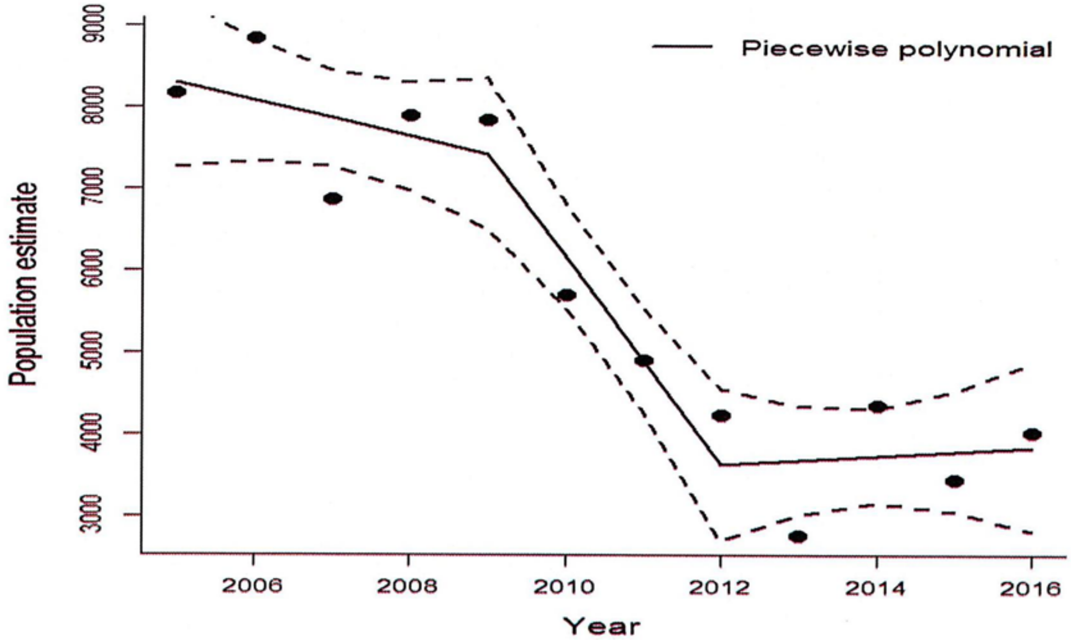


Figure 3. Point estimates of moose, 90% confidence intervals, and a piecewise polynomial curve of moose numbers in northeastern Minnesota, 2005–2016. This curve shows a change in the short-term slope of the trend from 2012 to 2016 compared to 2009 to 2012.

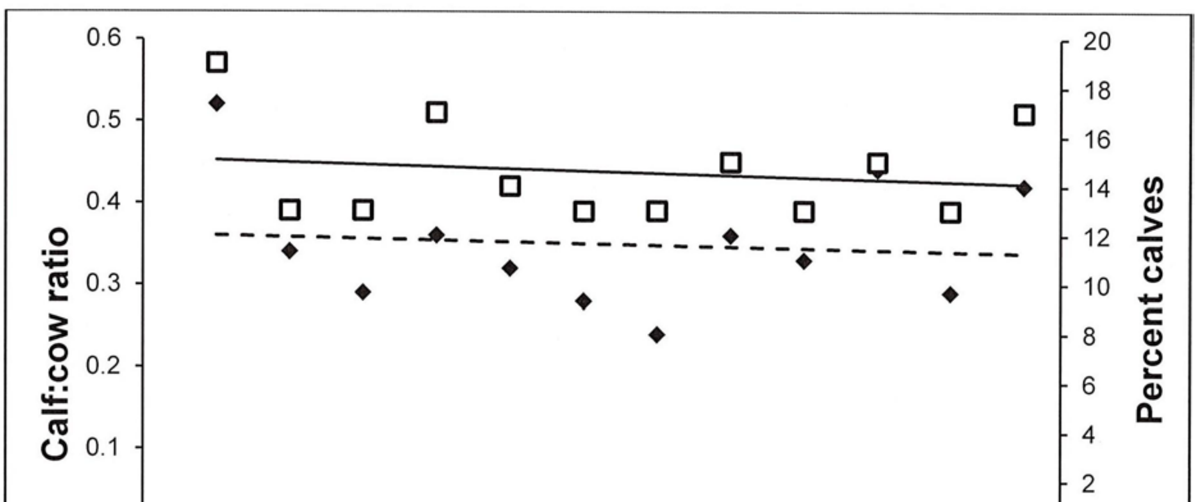


Figure 4. Estimated calf:cow ratios (solid diamonds, dashed trend line) and percent calves (open squares, solid trend line) of the population from aerial moose surveys in northeastern Minnesota, 2005–2016.

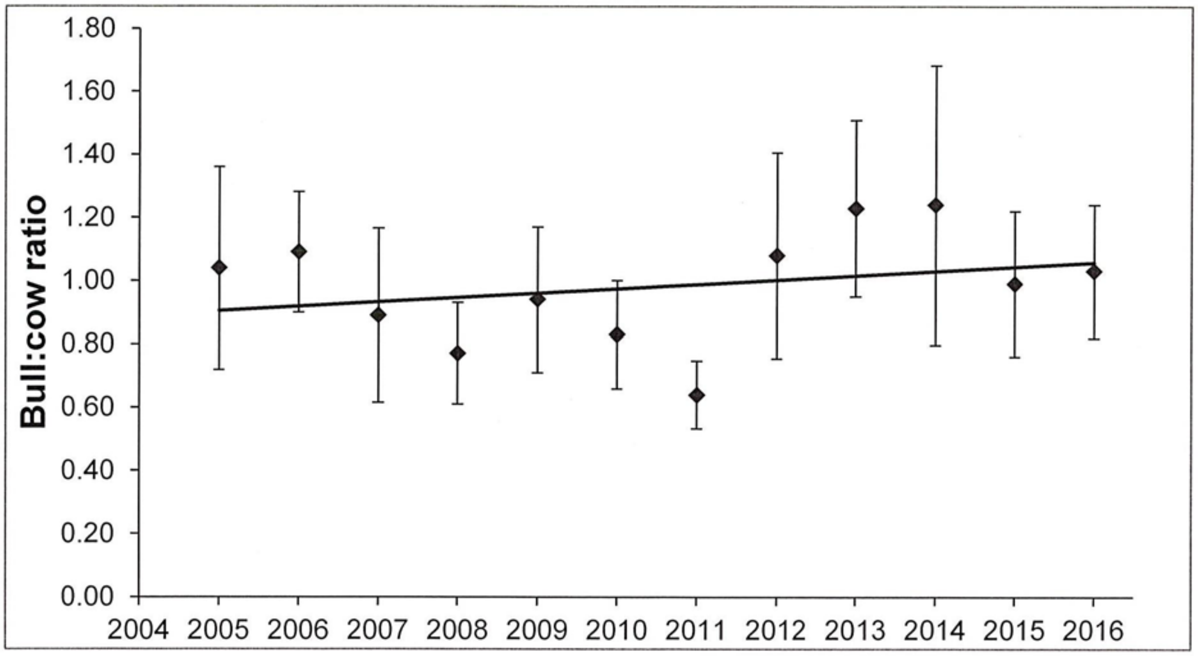


Figure 5. Estimated bull:cow ratios, 90% confidence intervals, and trend line from aerial moose surveys in northeastern Minnesota, 2005–2016.

ACKNOWLEDGEMENTS

This survey is an excellent partnership between the Division of Enforcement, the Division of Fish and Wildlife, the Fond du Lac Band of Lake Superior Chippewa, and the 1854 Treaty Authority. In particular, I would like to thank 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, and Forestry pilot, Luke Ettl, skillfully piloted the aircraft during the surveys, and Tom Rusch, Andy Edwards, Mike Schrage, Nancy Hansen, Jessica VanDuyn, Bailey Petersen, 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 Lou Cornicelli, Mike Larson, Michelle Carstensen, Mike Schrage, Andy Edwards, and Ron Moen.

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MINNESOTA WOLF POPULATION UPDATE 2016

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. Hence, no public harvest season took place during winter 2015-16 and this report provides an update of population status approximately one year since the last public harvest.

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 are much more likely to be an artifact of territory underestimation when there are comparatively sparse radiolocations. Hence, for packs with < 100 radiolocations (n=8; mean number of radiolocations = 35), we multiplied each estimated territory size by 1.37 as in the past. For packs with > 100 radiolocations (n = 34; mean number of radiolocations = 2,107), 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 = ((km^2 of occupied range/mean scaled territory size)*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

We obtained territory and winter pack size data from 37 radio-marked wolf packs (Figure 1). Five additional wolf packs had adequate radiolocation data to delineate territories, but we were unable to obtain mid-winter pack counts. Using scaled territory sizes for all packs combined, radio-collared pack territories represented approximately 10% of occupied wolf range.

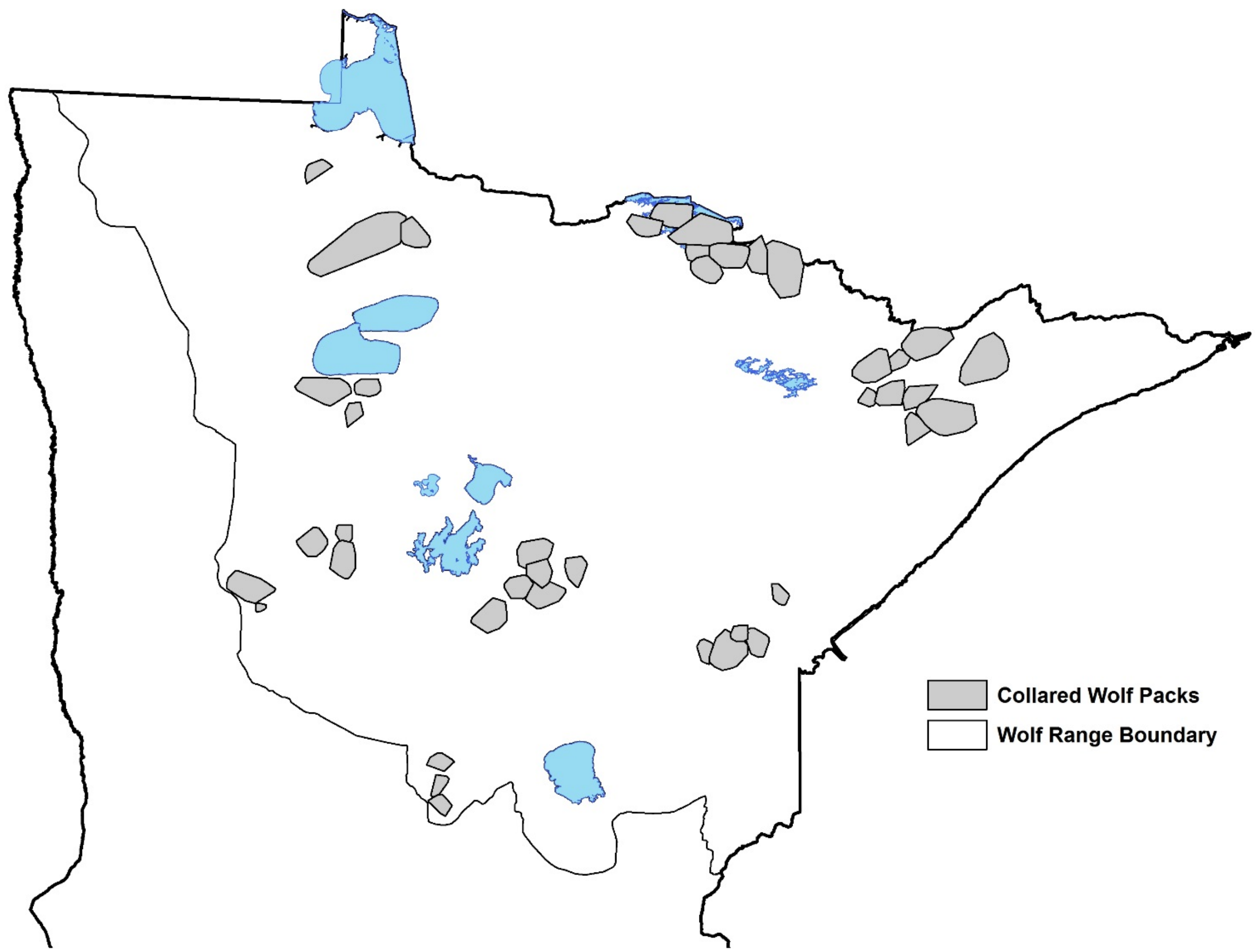

Figure 1. Location of radio-marked wolf packs during the 2015-16 survey.

Comparison of land cover type proportions within territories of collared packs with proportions throughout wolf range suggests differences (Table 1; Chi-square $p = 0.03$; 8 df) consistent with collaring activities often occurring on forested public land with abundant lakes and less agriculture or human developments. Nevertheless, the 3 cover types contributing most to the significant difference account for less than 20% of overall wolf range. Using spring 2015 deer density data (MNDNR, unpublished data) for deer hunting permit areas, weighted by number of wolf packs in a permit area, we estimate an average of approximately 9.4 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, 2015 spring deer density for the entirety of occupied wolf range (weighted by permit area) in Minnesota was approximately 10.3 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	33	36
Deciduous Forest	24	33
Emergent Herbaceous Wetlands	10	5
Mixed Forest	7	3
Evergreen Forest	7	6
Open Water	5	14
Shrub/Scrub	4	1
Pasture/Hay/Grassland/Crops	8	1
Developed, All	2	1

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

After a marginally significant increase in territory size last year, territory size this winter was similar to the 2012-13 and 2013-14 averages (Figure 2). After applying the territory scaling factors, average estimated territory size for radio-marked packs during the 2015-16 survey was 161 km^2 (range = 15 – 666 km^2).

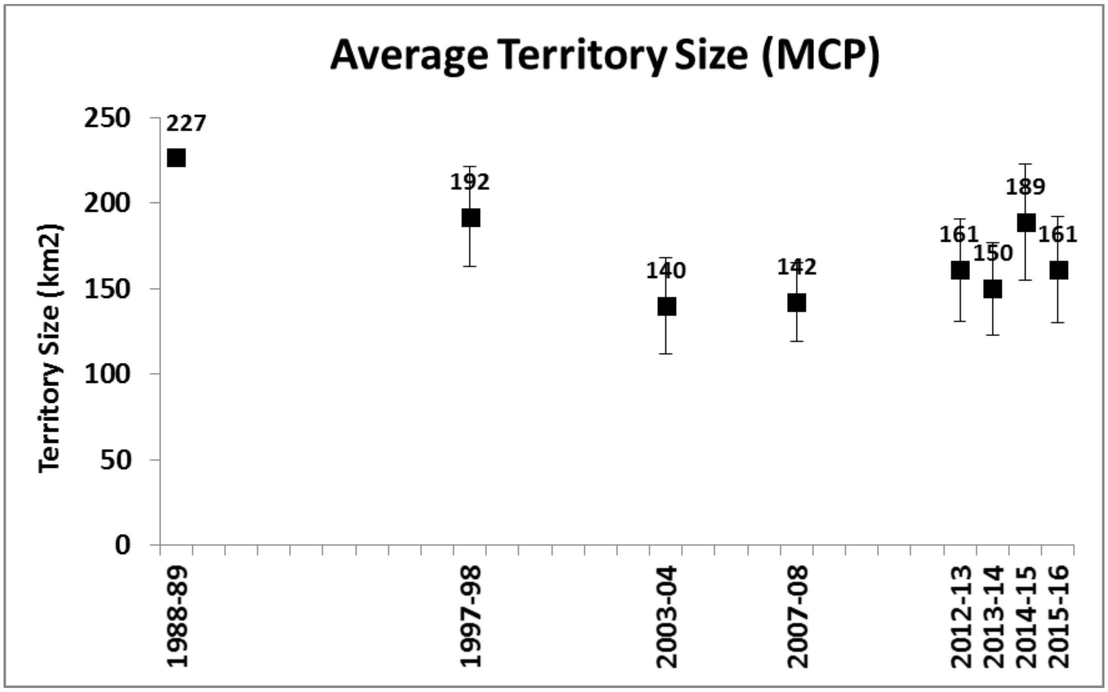

Figure 2. Average scaled territory size for radio-marked wolf packs in Minnesota from 1989 to 2016.

Similar to territory size, after a marginally significant increase in average pack size during winter 2014-15, average pack size in 2015-16 (4.4; range = 2 – 10, Figure 3) was similar to that observed during the 2012-13 and 2013-14 surveys.

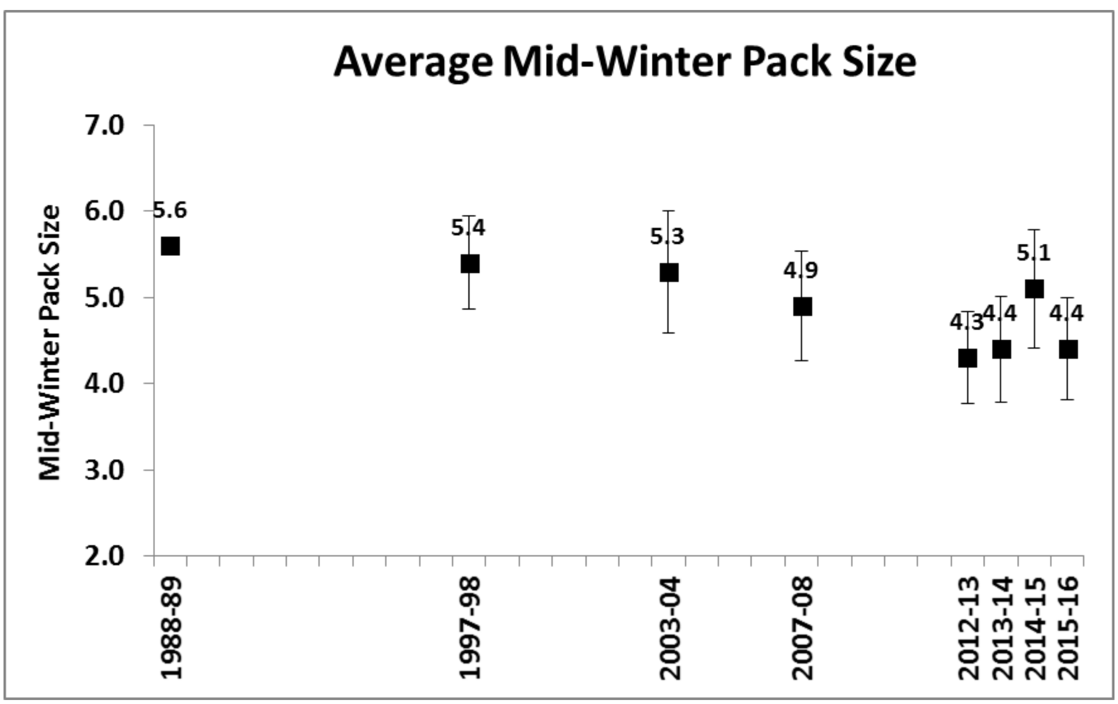

Figure 3. Average mid-winter pack size for radio-marked wolf packs in Minnesota from 1989 to 2016.

Wolf Numbers

Given an average territory size of approximately 161 km^2 and assuming occupied range has not changed since 2013 (70,579 km^2; Erb and Sampson 2013), we estimated a total of 439 wolf packs in Minnesota during winter 2015-16. 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).

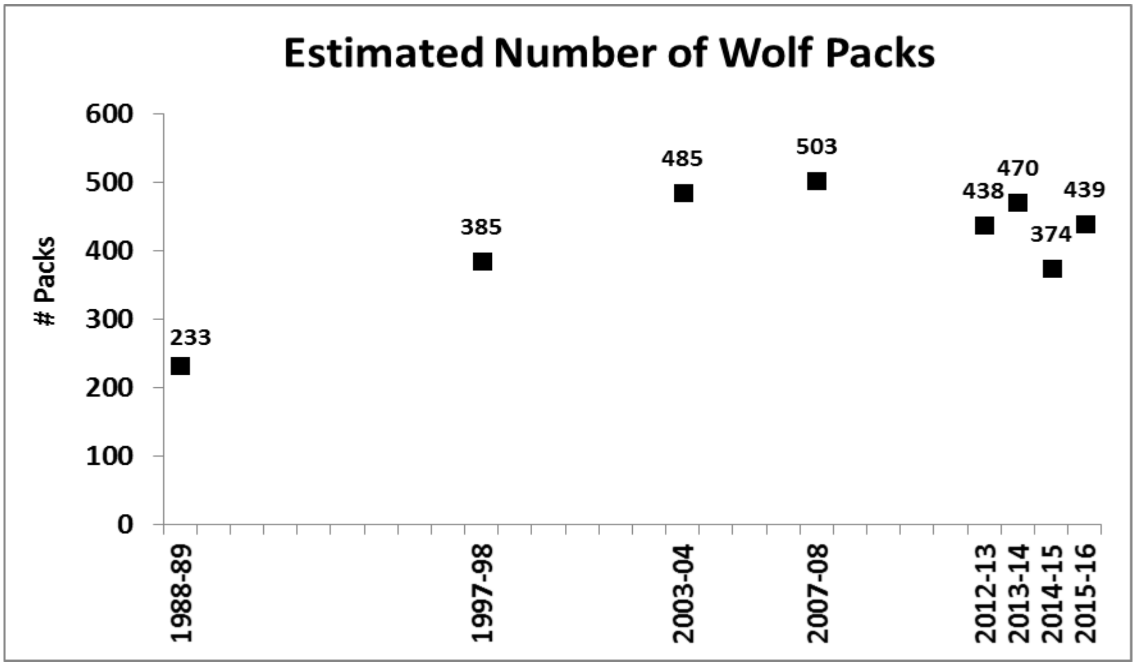

Figure 4. Estimated number of wolf packs in Minnesota at periodic intervals from 1989 to 2016.

After accounting for the assumed 15% lone wolves in the population, we estimated the 2015-16 mid-winter wolf population at 2,278 wolves, or 3.2 wolves per 100 km^2 of occupied range. The 90% confidence interval was approximately +/- 450 wolves, specifically 1,865 to 2,784. Given the very small changes in recent population estimates and substantial overlap in their confidence intervals, we conclude there has been no biologically or statistically significant change in the size of the statewide mid-winter wolf population over the past 4 years.

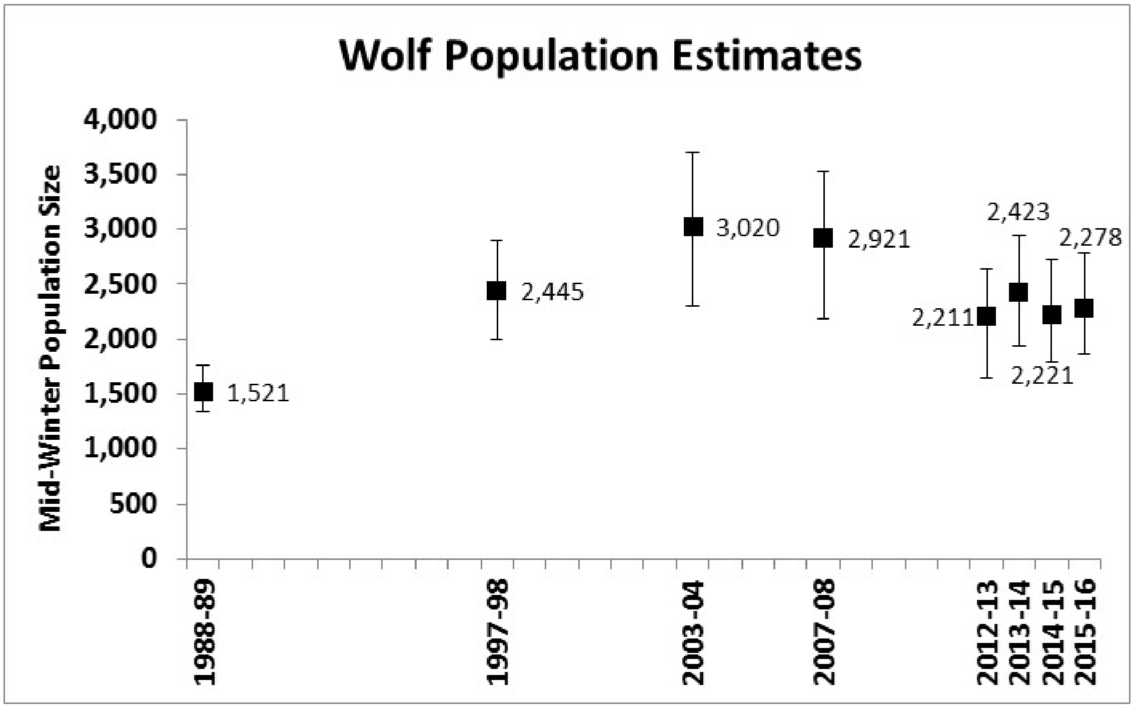

Figure 5. Wolf population estimates from periodic standardized surveys in Minnesota from 1989 to 2016.

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WETLAND WILDLIFE POPULATIONS

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2016 WATERFOWL BREEDING POPULATION SURVEY MINNESOTA

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ABSTRACT

The number of breeding waterfowl in a portion of Minnesota has been estimated each year since 1968 as a part of the overall inventory of North American breeding waterfowl. The survey consists of aerial observations in addition to more intensive ground counts on selected routes to determine the proportion of birds counted by the aerial crew. Procedures used are similar to those used elsewhere across the waterfowl breeding grounds. The 2016 aerial survey portion was flown from May 2 to May 16. 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 states, ice out dates were about 1 week earlier than median dates. Temperatures were well above normal in March and near normal in April and May. Precipitation was below normal in April and May except for portions of southwest Minnesota. Overall, wetland numbers (Types II-V) were unchanged from 2015 but 21% below the 10-year average and 13% below the long-term average.

The 2016 estimated mallard breeding population was 243,000, which was 18% higher than last year's estimate of 206,000 mallards, but statistically unchanged (P=0.51). Mallard numbers were unchanged from the 10-year average and 7% above the long-term average of 228,000 breeding mallards. The estimated blue-winged teal population was 317,000, which was 88% higher than last year's estimate of 169,000 blue-winged teal, but statistically unchanged (P=0.17). Blue-winged teal numbers were 50% above the long-term average of 211,000 blue-winged teal. The combined population index of other ducks, excluding scaup, was 208,000 ducks, which was 39% higher than last year's estimate and 18% above the 10-year average and 17% above the long-term average of 177,000 other ducks.

The estimate of total duck abundance (768,000), which excludes scaup, was 47% higher than last year's estimate of 524,000 ducks and was 36% above the 10-year average and 25% above the long-term average of 616,000 ducks. The estimated number of Canada geese was 108,000 and 33% lower than last year and 32% below the 10-year average.

METHODS

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

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

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

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

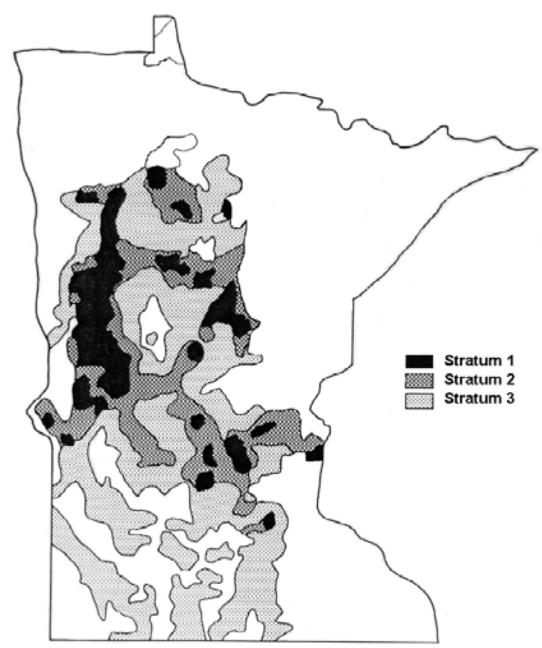

Figure 1. Location of waterfowl breeding population survey strata in Minnesota.

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

All aerial transects in Strata I-III (Table 1) were flown using 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 2015 and 2016 were compared using two-tailed Z-tests.

SURVEY CHRONOLOGY

The 2016 aerial survey began on 2 May in southern Minnesota and concluded in northern Minnesota on 16 May. Transects were flown on 10 days, May 2-9 and May 15-16 and completed in 54 flight hours. Flights began near 7 AM and were completed by 12:00 PM each day. The median date for survey completion was May 7, which was 2 weeks earlier than last year.

WEATHER AND HABITAT CONDITIONS

For the southern 2/3 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 week earlier than median dates. Temperatures in March averaged 7.6°F above normal and precipitation was 0.8 inches above normal statewide. Temperatures in April averaged 0.2°F below normal and precipitation was 0.3 inches below normal statewide. Temperatures in May averaged 1.0°F above normal statewide and precipitation was 0.5 inches below normal statewide (http://climate.umn.edu). Precipitation during the period of time just prior to and during the survey showed above average precipitation only in southwest MN and below average precipitation across the rest of the state (Appendix A).

Overall wetland conditions in spring 2016 were dry but similar to last year. In early May 2016, 91% of the state was under no drought designation and 9% of the state was classified as abnormally dry. By early June 2016, 57% of the state was under no drought designation and 43% was classified as abnormally dry. In early May 2016, statewide topsoil moisture indices were rated as 1% very short, 6% short, 80% adequate and 13% surplus moisture. By early June 2016, statewide topsoil moisture indices were rated as 2% very short, 9% short, 77% adequate and 12% surplus moisture (http://droughtmonitor.unl.edu).

Wetland (Types II-V) numbers in 2016 were 221,000 ponds and unchanged from last year's estimate of 222,000 ponds. This was 21% below the 10-year average and 13% below the long-term average (Table 2; Figure 2). The number of temporary (Type 1) sheet water wetlands was 43% below the long-term average and very few sheet water wetlands were observed except in southwest Minnesota.

Planting dates for row crops were extremely early in 2016. By May 1, about 59% of the corn acres had been planted statewide compared to 27% for the previous 5-year average. By May 29th, about 38% of alfalfa hay had been cut, 12 days ahead of last year and average (Minnesota Agricultural Statistics Service Weekly Crop Weather Reports, (http://www.nass.usda.gov/mn/).

Due to the early spring, leaf-out dates and wetland vegetation growth was about 2-3 weeks earlier than average and visibility was poor during the entire survey.

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 2016 breeding population estimate of mallards was 243,189 (SE = 42,502), which was 18% higher than the 2015 estimate of 206,229 mallards, but statistically unchanged (Z = 0.65, P = 0.51) (Table 7, Figure 3). Mallard numbers were similar to the 10-year average and 7% above the long-term average of 228,000 mallards. In 2016, the mallard population was comprised of 80% lone or flocked males, 15% pairs, and 5% flocked mallards. The 5-year average is 71% lone or flocked males, 21% pairs, and 8% flocked mallards.

The estimated blue-winged teal population was 317,464 (SE = 92,149), which was 88% higher than the 2015 estimate of 168,615 blue-winged teal, but statistically unchanged (Z = 1.38, P = 0.17). Blue-winged teal numbers were 118% above the 10-year average and 50% above the long-term average (Table 7, Figure 4). The blue-winged teal population was comprised of 7% lone males, 43% pairs, and 49% flocks. The long-term average is 16% lone males, 53% pairs, and 31% flocks. A number of fairly large flocks of teal were observed early in the survey in southwest Minnesota that influenced both the estimate and the standard error.

The combined population estimate of other ducks (excluding scaup) was 207,593 which was 39% above last year's estimate of 149,330 other ducks and 18% above the 10-year average and 17% above the long-term average (Table 7, Figure 5). Scaup, ring-necked ducks and wood ducks were the most abundant species of other ducks (Table 6). Scaup numbers (54,000) were 54% above last year's estimate but 11% below the long-term average.

The total duck population index, excluding scaup, was 768,000 ducks and was 47% above last year's index of 524,000 ducks and 36% above the 10-year average and 25% above the long-term average (Table 8, Figure 6).

The population index for total ducks was 822,000 ducks, which was 40% above the 10-year average and 21% above the long-term average.

Visibility Correction Factors (VCFs) were lower for mallards, blue-winged teal, other ducks, and Canada geese in 2016 compared to 2015 (Table 7, Table 8). The mallard VCF (2.07) was 22% below the 10-year average. The blue-winged teal VCF (4.48) was 14% above the 10-year average. The VCF for other ducks (2.67) was 12% below the 10-year average. The VCF for Canada geese (1.62) was 22% below the 10-year average.

The population estimate of Canada geese (adjusted for visibility) was 108,000, which was 33% below last year's estimate and 32% below the 10-year average (Table 8, Figure 7). A total of 56 Canada goose broods were observed, compared to 23 in 2015.

The estimated coot population, uncorrected for visibility, was 16,000 compared to 10,000 in 2015.

The estimated number of swans (likely trumpeters) was 13,400 swans compared to last year's estimate of 12,600 (Table 6). 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); U.S. Fish and Wildlife Service (USFWS)

Air Crew:

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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 Fred Oslund, USFWS, HAPET, Fergus Falls; Tom Cooper, Andy Forbes, Paul Richert, and Jim Kelley, USFWS, Twin Cities; Bruce Davis, Minnesota DNR; Tony Hewitt and Sally Zodrow, USFWS, Sherburne National Wildlife Refuge

Ground Crew Assistants: Rich Olsen, Minnesota DNR; Gina Kemper and J. Wormbold, USFWS, Tamarac National Wildlife Refuge; Tyler Zimmerman and Joe Schmit, USFWS, HAPET, Fergus Falls; Greg Dehmer and Kris Spaeth, USFWS, Sherburne National Wildlife Refuge

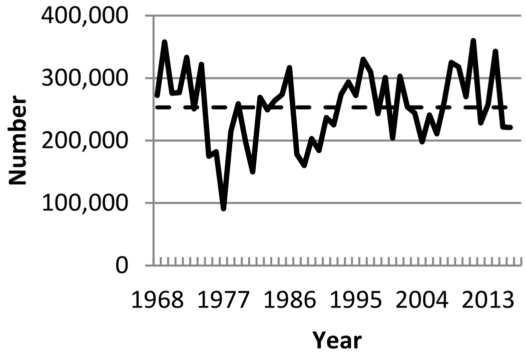

Figure 2. Number of May ponds (Types II-V) and long-term average (dashed line) in Minnesota, 1968-2016.

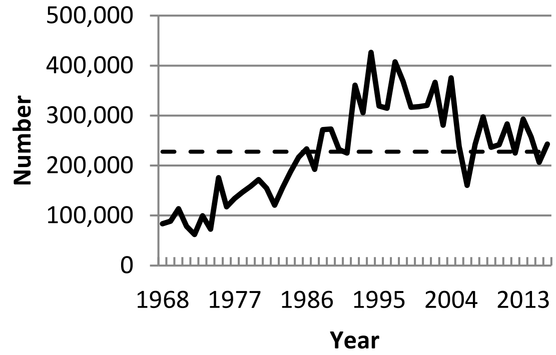

Figure 3. Mallard population estimates (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1968-2016.

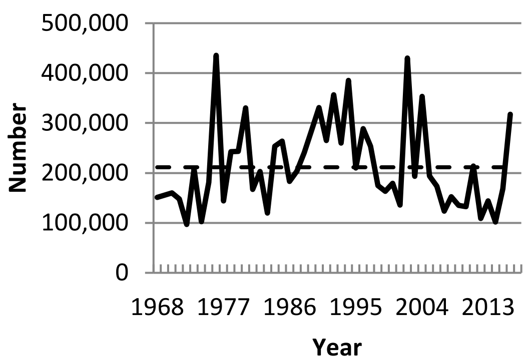

Figure 4. Blue-winged teal population estimates (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1968-2016.

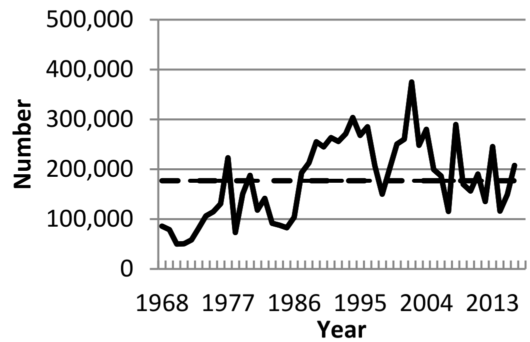

Figure 5. Other duck (excluding scaup) population estimates (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1968-2016

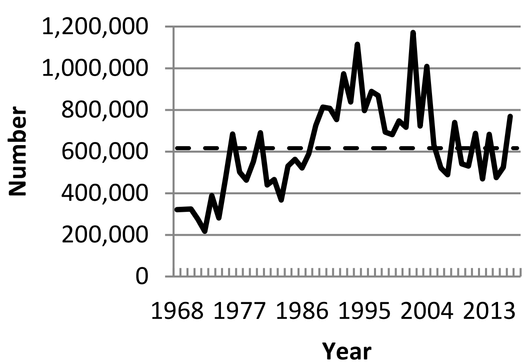

Figure 6. Total duck (excluding scaup) population estimates (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1968-2016

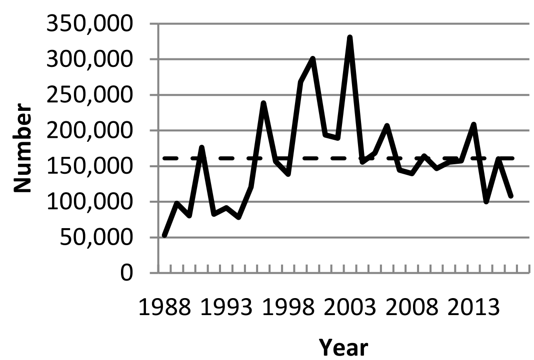

Figure 7. Canada goose population (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1988-2016.

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Table 1. Survey design for Minnesota, May 2016.[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), 1968-2016.

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
		Averages:	10-year	43,120	279,700
			Long-term	60,666	253,833
		% change from:	2015	56%	0%
			10-year	-20%	-21%
			Long-term	-43%	-13%

[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, 1998-2016.

	Year																		
Species	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Dabblers:																			
Mallard	33,157	26,576	26,604	28,742	29,297	25,937	29,381	19,050	16,829	16,357	25,104	19,467	18,439	19,856	18,911	21,161	19,522	19,633	26,020
Black Duck	0	0	0	0	0	0	0	56	0	0	0	0	0	0	0	333	167	222	0
Gadwall	1,111	1,777	833	1,333	944	1,250	2,111	1,166	1,444	889	1,166	1,055	1,000	167	1,389	722	555	1,083	1,000
American Wigeon	56	56	56	111	0	56	555	167	0	56	111	56	56	111	222	222	167	111	111
Green-winged Teal	333	0	278	56	278	222	444	56	56	167	278	167	56	56	56	0	0	56	111
Blue-winged Teal	8,220	6,998	11,247	7,387	14,218	9,664	23,771	9,303	5,665	5,332	9,942	5,998	7,304	4,665	5,110	4,193	3,388	4,360	6,998
Northern Shoveler	500	555	1,055	305	1,277	278	1,166	333	167	56	1,000	666	1,027	111	56	333	722	111	666
Northern Pintail	111	167	167	389	56	111	56	0	56	0	56	56	0	111	0	111	167	222	0
Wood Duck	12,302	5,582	10,219	6,720	2,888	4,499	8,081	5,498	3,555	2,666	6,665	4,277	3,999	3,416	4,138	3,249	2,527	2,222	5,610
Dabbler Subtotal	55,790	41,711	50,459	45,043	48,958	42,017	65,565	35,629	27,772	25,523	44,322	31,742	31,881	28,493	29,882	30,324	27,215	28,020	40,516
Divers:																			
Redhead	944	500	583	1,444	750	333	805	666	666	916	1,389	472	944	805	750	861	1,333	583	2,166
Canvasback	1,777	2,971	1,222	2,027	1,833	1,333	666	972	833	1,000	2,277	1,333	1,222	833	722	1,555	1,777	1,027	1,944
Scaup	9,247	1,750	7,415	5,832	2,444	2,055	5,971	4,110	111	555	6,276	8,553	2,777	2,222	1,055	1,000	1,250	5,526	10,969
Ring-necked Duck	2,749	2,360	4,776	2,444	2,777	1,361	5,165	1,722	2,055	1,555	21,494	6,859	3,138	4,804	2,666	3,582	4,554	3,110	8,220
Goldeneye	111	56	56	333	111	0	222	222	56	222	278	278	222	56	56	333	444	278	278
Bufflehead	56	111	56	111	222	111	389	167	222	56	1,611	833	389	278	56	611	56	278	500
Ruddy Duck	11,052	972	0	83	1,305	417	305	1,222	305	0	1,027	861	28	56	0	305	111	694	1,500
Hooded Merganser	389	722	500	722	555	333	278	333	555	111	666	944	555	500	555	333	666	1,000	1,222
Large Merganser	0	0	0	111	0	972	0	111	0	278	333	333	333	111	56	222	139	167	56
Diver Subtotal	26,325	9,442	14,608	13,107	9,997	6,915	13,801	9,525	4,803	4,693	35,351	20,466	9,608	9,665	5,916	8,802	10,330	12,663	26,855
Total Ducks	82,115	51,153	65,067	58,150	58,955	48,932	79,366	45,154	32,575	30,216	79,673	52,208	41,489	38,158	35,798	39,126	37,545	40,683	67,371
Other:																			
Coot	555	83	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
Canada Goose	16,967	19,495	22,160	24,882	24,104	22,160	23,160	22,938	21,633	29,797	18,717	16,523	16,440	13,691	26,437	23,771	18,578	23,077	17,995
Swan	56	139	0	0	111	1,000	305	417	861	389	694	500	694	1,611	1,277	2,944	1,944	2,472	3,693

Table 4. Minnesota waterfowl breeding populations by species for Stratum II (medium wetland density), expanded for area but not visibility, 1998-2016.

	Year																		
Species	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Dabblers:																			
Mallard	53,942	52,247	49,559	44,650	43,773	34,715	44,474	26,883	25,130	24,779	27,935	23,494	21,507	30,974	29,689	27,409	28,987	24,078	32,085
Black Duck	0	0	0	117	0	0	0	0	0	0	0	0	0	0	0	0	0	117	0
Gadwall	584	1,519	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
American Wigeon	818	0	468	0	0	0	2,513	117	0	0	351	0	351	0	117	234	0	234	234
Green-winged Teal	351	117	117	117	468	234	234	0	117	0	0	234	117	0	0	117	351	584	0
Blue-winged Teal	13,208	10,578	19,637	9,701	21,390	15,955	30,624	11,513	9,000	8,416	12,740	11,104	8,474	12,390	9,000	4,383	7,364	5,026	10,753
Northern Shoveler	701	2,104	4,675	1,052	2,221	1,403	1,753	234	584	351	468	701	2,513	1,052	0	351	935	877	935
Northern Pintail	468	117	117	117	0	117	0	0	0	234	0	0	0	234	0	0	117	0	0
Wood Duck	10,520	19,753	13,792	7,831	5,143	4,558	8,766	3,273	1,753	2,221	6,546	5,260	6,312	6,955	5,143	4,792	1,636	1,753	4,149
Dabbler subtotal	80,592	86,435	91,404	65,221	73,696	57,566	91,929	42,604	37,636	36,235	51,079	41,962	40,560	52,540	45,936	37,987	39,624	33,487	49,442
Divers:																			
Redhead	935	1,636	2,805	2,455	234	584	1,110	292	175	935	935	584	760	1,578	468	468	526	468	1,110
Canvasback	117	117	935	0	468	1,052	234	0	0	1,169	468	234	117	584	117	935	1,286	1,169	1,403
Scaup	4,032	3,331	6,779	3,039	5,961	2,279	7,188	2,981	468	643	3,097	2,104	0	1,929	935	2,045	2,396	4,909	5,318
Ring-necked Duck	2,279	2,221	5,610	3,799	6,370	2,455	5,377	1,929	3,331	1,578	13,149	9,117	2,396	11,455	1,695	6,253	5,143	4,325	4,792
Goldeneye	234	935	584	468	234	234	351	117	117	0	351	584	468	468	584	935	1,519	935	1,169
Bufflehead	0	0	0	0	1,169	117	468	351	117	117	1,403	818	643	1,403	468	0	818	0	234
Ruddy Duck	0	468	0	0	1,870	2,688	0	351	58	0	0	175	409	58	234	117	0	351	643
Hooded Merganser	117	701	935	1,403	701	701	234	234	351	234	584	701	117	2,221	1,636	701	234	1,169	2,455
Large Merganser	0	0	117	117	0	0	234	351	0	0	351	0	0	234	0	234	117	234	117
Diver subtotal	7,714	9,409	17,765	11,281	17,007	10,110	15,196	6,606	4,617	4,676	20,338	14,317	4,910	19,930	6,137	11,688	12,039	13,560	17,241
Total Ducks	88,306	95,844	109,169	76,502	90,703	67,676	107,125	49,210	42,253	40,911	71,417	56,279	45,470	72,470	52,073	49,675	51,663	47,047	66,683
Other:																			
Coot	643	234	1,110	468	4,909	1,519	8,007	584	292	409	23,961	0	117	292	292	2,571	877	0	0
Canada Goose	19,812	18,585	25,831	24,604	20,688	22,091	28,461	20,688	26,825	25,890	19,753	22,675	18,935	14,201	23,260	22,442	20,572	24,312	17,533
Swan	117	117	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

Table 5. Minnesota waterfowl breeding populations by species for Stratum III (low wetland density), expanded for area but not visibility, 1998-2016.

	Year																		
Species	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Dabblers:																			
Mallard	101,873	90,390	81,690	72,642	72,121	55,156	84,561	36,539	30,884	35,843	50,371	35,408	40,976	51,415	47,848	62,638	62,899	51,154	59,593
Black Duck	0	0	0	0	0	0	174	0	0	174	174	0	0	0	174	174	0	0	0
Gadwall	3,045	2,436	2,610	10,701	3,306	1,566	6,960	2,001	5,568	4,176	870	1,392	1,392	4,089	1,566	5,220	1,914	2,088	9,570
American Wigeon	696	0	522	174	1,218	174	1,566	1,044	174	348	348	174	348	1,044	174	348	174	1,566	870
Green-winged Teal	174	0	1,218	1,392	522	174	0	174	522	0	0	0	0	174	348	696	0	348	0
Blue-winged Teal	26,360	18,530	29,405	20,618	56,374	21,140	39,758	27,578	23,663	15,659	18,095	20,183	16,964	44,716	35,669	18,617	21,227	24,098	53,155
Northern Shoveler	4,176	4,002	20,444	10,701	6,264	870	3,828	348	522	870	4,002	2,088	6,873	2,088	8,265	6,786	522	1,914	4,959
Northern Pintail	870	870	696	522	0	174	348	174	174	348	174	0	174	0	174	174	0	174	522
Wood Duck	23,837	20,531	25,055	17,225	13,572	12,702	20,705	7,482	7,308	5,394	14,442	10,266	12,354	13,659	10,962	12,180	9,657	8,265	8,700
Dabbler subtotal	161,031	136,759	161,640	133,975	153,377	91,956	157,900	75,340	68,815	62,812	88,476	69,511	79,081	117,185	105,180	106,833	96,393	89,607	137,369
Divers:																			
Redhead	2,001	3,480	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
Canvasback	3,306	174	3,915	522	696	1,131	2,784	0	0	348	1,566	1,218	348	1,044	1,044	696	522	696	348
Scaup	15,137	8,961	18,182	6,873	4,611	783	17,747	5,307	1,392	696	5,481	1,914	522	5,133	696	8,874	2,871	435	3,915
Ring-necked Duck	2,958	1,479	8,178	8,526	7,395	1,479	5,133	10,179	6,699	1,392	8,526	6,525	3,045	6,264	9,135	6,960	5,568	3,480	4,089
Goldeneye	696	696	1,044	1,566	3,132	1,305	696	1,044	1,044	870	348	522	174	870	0	348	174	1,218	870
Bufflehead	348	0	0	0	1,218	783	2,088	0	174	696	1,218	870	174	2,871	174	3,915	4,698	522	2,523
Ruddy Duck	0	174	0	696	18,878	87	2,262	870	696	261	87	348	0	3,828	522	522	174	0	87
Hooded Merganser	696	1,218	957	174	2,175	174	1,740	1,218	870	174	696	348	1,218	1,044	1,044	348	348	522	1,392
Large Merganser	0	0	0	0	522	0	0	261	957	348	348	348	348	174	174	0	0	0	870
Diver subtotal	25,142	16,182	34,799	22,011	39,932	5,916	34,190	20,358	11,832	5,307	19,053	12,963	6,003	25,578	16,095	23,490	15,921	8,178	15,138
Total Ducks	186,173	152,941	196,439	155,986	193,309	97,872	192,090	95,698	80,647	68,119	107,529	82,474	85,084	142,763	121,275	130,323	112,314	97,785	152,507
Other:																			
Coot	5,133	14,702	67,684	3,132	14,007	7,134	77,427	8,613	14,702	5,742	15,137	7,047	435	1,479	25,664	27,578	15,746	7,917	5,829
Canada Goose	42,368	41,933	57,940	39,932	33,407	43,412	46,717	39,758	27,230	42,629	31,841	28,274	30,710	32,711	37,496	48,022	24,707	43,498	31,145
Swan	0	348	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

Table 6. Minnesota waterfowl breeding populations by species for Stratum I-III combined, expanded for area coverage but not for visibility, 1998-2016.

	Year																		
Species	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Dabblers:																			
Mallard	188,972	169,213	157,853	146,034	145,191	115,974	158,416	82,472	72,843	76,979	103,411	78,368	80,922	102,245	96,448	111,208	111,408	94,866	117,698
Black Duck	0	0	0	117	0	0	174	56	0	174	174	0	0	0	174	507	167	339	0
Gadwall	4,740	5,733	6,482	13,670	4,951	3,400	12,635	3,752	8,064	5,298	5,075	3,616	3,677	5,191	4,941	6,643	2,703	3,989	11,855
American Wigeon	1,570	56	1,045	285	1,218	230	4,634	1,327	174	404	810	230	754	1,155	513	804	341	1,911	1,215
Green-winged Teal	858	117	1,613	1,564	1,267	630	678	230	694	167	278	400	172	230	404	813	351	988	111
Blue-winged Teal	47,788	36,106	60,288	37,706	91,982	46,759	94,152	48,394	38,328	29,407	40,777	37,286	32,742	61,772	49,779	27,194	31,979	33,484	70,907
Northern Shoveler	5,377	6,661	26,175	12,058	9,762	2,550	6,747	915	1,273	1,276	5,469	3,456	10,413	3,251	8,320	7,470	2,179	2,902	6,560
Northern Pintail	1,449	1,153	979	1,028	56	402	404	174	230	582	230	56	174	345	174	285	284	396	522
Wood Duck	46,659	45,866	49,067	31,777	21,603	21,759	37,553	16,253	12,616	10,281	27,652	19,802	22,664	24,029	20,242	20,221	13,820	12,240	18,459
Dabbler subtotal	297,413	264,905	303,502	244,239	276,030	191,704	315,393	153,573	134,222	124,568	183,876	143,214	151,518	198,218	180,995	175,145	163,232	151,115	227,327
Divers:																			
Redhead	3,880	5,616	5,911	7,552	2,289	1,092	3,656	2,438	842	2,373	3,107	1,926	1,878	6,733	4,523	3,155	3,425	2,356	4,320
Canvasback	5,200	3,262	6,072	2,549	2,996	3,516	3,684	972	833	2,517	4,311	2,785	1,687	2,461	1,883	3,186	3,585	2,892	3,694
Scaup	28,416	14,041	32,376	15,743	13,016	5,117	30,906	12,397	1,971	1,894	14,854	12,571	3,299	9,283	2,686	11,919	6,517	10,870	20,202
Ring-necked Duck	7,986	6,060	18,565	14,768	16,542	5,294	15,675	13,829	12,085	4,525	43,169	22,501	8,579	22,523	13,495	16,795	15,265	10,915	17,101
Goldeneye	1,041	1,687	1,684	2,367	3,477	1,539	1,269	1,383	1,216	1,092	976	1,384	864	1,393	640	1,616	2,138	2,431	2,317
Bufflehead	404	111	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
Ruddy Duck	11,052	1,613	0	779	22,054	3,192	2,567	2,443	1,060	261	1,114	1,384	437	3,942	756	944	285	1,045	2,229
Hooded Merganser	1,202	2,641	2,392	2,299	3,432	1,209	2,251	1,785	1,776	519	1,947	1,993	1,890	3,765	3,236	1,383	1,248	2,691	5,068
Large Merganser	0	0	117	228	522	972	234	723	957	626	1,032	681	681	519	230	456	256	400	1,042
Diver subtotal	59,181	35,031	67,173	46,396	66,937	22,942	63,186	36,487	21,253	14,675	74,741	47,746	20,521	55,170	28,146	43,980	38,291	34,400	59,230
Total Ducks	356,594	299,936	370,675	290,635	342,967	214,646	378,579	190,060	155,475	139,243	258,617	190,960	172,039	253,388	209,141	219,125	201,523	185,515	286,557
Other:																			
Coot	6,331	15,020	72,793	5,321	21,804	11,319	106,845	11,641	15,633	6,290	55,927	9,213	691	3,965	26,401	40,535	18,984	9,888	16,437
Canada Goose	79,147	80,012	105,932	89,418	78,200	87,663	98,339	83,384	75,688	98,316	70,311	67,473	66,085	60,603	87,193	94,235	63,857	90,887	66,672
Swan	172	604	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

Table 7. Mallard, blue-winged teal, and other duck (excluding scaup) populations in Minnesota, 1968-2016.

	Mallard				Blue-winged teal				Other ducks (exc. scaup)		
Year	Unad. PI	VCF	PI	SE	Unad. PI	VCF	PI	SE	Unad. PI	VCF	PI
1968	41,030	2.04	83,701		61,493	2.44	151,141		41,419	2.08	86,152
1969	53,167	1.67	88,789		45,180	3.45	155,871		34,605	2.27	78,553
1970	67,463	1.69	113,945		31,682	5.06	160,343		30,822	1.62	49,932
1971	47,702	1.65	78,470		42,445	3.49	148,218		29,520	1.71	50,450
1972	49,137	1.27	62,158		49,386	1.96	96,895		34,405	1.69	58,127
1973	56,607	1.76	99,832		53,095	3.92	208,292		33,155	2.45	81,362
1974	44,866	1.62	72,826		39,402	2.59	102,169		38,266	2.79	106,609
1975	55,093	3.19	175,774		45,948	3.95	181,375		34,585	3.31	114,459
1976	69,844	1.69	117,806		89,370	4.87	435,607		39,022	3.35	130,669
1977	60,617	2.21	134,164		37,391	3.86	144,187		18,633	11.95	222,748
1978	56,152	2.61	146,781		28,491	8.53	242,923		22,034	3.30	72,798
1979	61,743	2.57	158,704	28,668	46,708	5.21	243,167	62,226	39,749	3.79	150,545
1980	83,775	2.05	171,957	22,312	50,966	6.49	330,616	40,571	47,322	3.97	188,020
1981	79,562	1.95	154,844	16,402	64,546	2.59	167,258	23,835	30,947	3.80	117,667
1982	51,655	2.33	120,527	17,078	42,772	4.75	203,167	34,503	32,726	4.32	141,501
1983	73,424	2.12	155,762	15,419	42,728	2.81	119,980	20,809	32,240	2.84	91,400
1984	94,514	1.99	188,149	24,065	89,896	2.82	253,821	33,286	40,326	2.18	87,709
1985	96,045	2.26	216,908	32,935	90,453	2.91	263,607	33,369	35,018	2.35	82,383
1986	108,328	2.16	233,598	30,384	68,235	2.69	183,338	28,204	38,900	2.67	103,851
1987	165,881	1.16	192,289	23,500	102,480	1.99	203,718	32,289	76,746	2.51	192,947
1988	155,543	1.75	271,718	38,675	101,183	2.38	240,532	39,512	81,514	2.61	212,988
1989	124,362	2.19	272,968	26,508	90,300	3.16	285,760	39,834	88,109	2.89	254,887
1990	140,879	1.65	232,059	26,316	107,177	3.09	330,659	44,455	124,531	1.97	245,152
1991	128,315	1.75	224,953	28,832	91,496	2.90	265,138	42,057	93,784	2.81	263,619
1992	144,126	2.50	360,870	43,621	93,107	3.83	356,679	53,619	109,779	2.33	255,774
1993	123,771	2.47	305,838	31,103	64,670	4.02	260,070	36,307	82,612	3.28	271,263
1994	138,482	3.08	426,455	66,240	70,324	5.48	385,256	82,580	85,671	3.55	303,847
1995	142,557	2.24	319,433	48,124	47,737	4.40	210,043	40,531	66,096	4.05	267,668
1996	153,473	2.05	314,816	53,461	57,196	5.05	288,913	64,064	107,950	2.64	285,328
1997	160,629	2.54	407,413	65,771	45,496	5.57	253,408	67,526	76,095	2.72	207,316
1998	188,972	1.95	368,450	61,513	47,788	3.66	174,848	33,855	91,478	1.64	149,786

	Mallard				Blue-winged teal				Other ducks (exc. scaup)		
Year	Unad. PI	VCF	PI	SE	Unad. PI	VCF	PI	SE	Unad. PI	VCF	PI
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	2.07	243,189	42,502	70,907	4.48	317,464	92,149	77,750	2.67	207,593
Averages:											
10-year	92,870	2.65	244,384	39,875	38,275	3.93	145,352	41,235	59,736	3.03	175,432
Long-term	102,533	2.23	227,747	37,695	57,027	3.89	211,445	42,463	60,597	3.12	176,942
% change from											
2015	24%	-5%	18%	13%	112%	-11%	88%	62%	68%	-17%	39%
10-year average	27%	-22%	0%	7%	85%	14%	118%	123%	30%	-12%	18%
Long-term average	15%	-7%	7%	13%	24%	15%	50%	117%	28%	-14%	17%

Table 8. Scaup, total ducks (excluding scaup), total ducks, and Canada goose populations in Minnesota, 1968-2016.

	Scaup			Total Ducks (exc. scaup)		Total ducks		Canada geese		
Year	Unad. PI	VCF	PI	Unad. PI	PI	Unad. PI	PI	Unad. PI	VCF	PI
1968	22,834	2.08	47,495	144,392	320,994	167,226	368,488			
1969	9,719	2.27	22,062	132,952	323,213	142,671	345,275			
1970	12,105	1.62	19,610	129,967	324,219	142,072	343,829			
1971	5,713	1.71	9,764	119,667	277,137	125,380	286,901			
1972	12,062	1.69	20,379	132,928	217,181	144,990	237,560	366		
1973	10,633	2.45	26,093	142,857	389,486	153,490	415,580	1,965		
1974	18,378	2.79	51,201	122,534	281,605	140,912	332,806	8,835		
1975	9,563	3.31	31,649	135,626	471,608	145,189	503,257	5,997		
1976	22,494	3.35	75,323	198,236	684,082	220,730	759,405	5,409		
1977	2,971	11.95	35,517	116,641	501,099	119,612	536,616	7,279		
1978	14,774	3.35	48,812	106,677	462,502	121,451	511,314	7,865		
1979	92,134	3.79	348,948	148,200	552,416	240,334	901,364	4,843		
1980	12,602	3.97	50,070	182,063	690,593	194,665	740,663	6,307		
1981	19,844	3.88	75,451	175,055	439,769	194,899	515,220	10,156		
1982	21,556	4.32	93,204	127,153	465,195	148,709	558,399	6,600		
1983	9,551	2.84	27,077	148,392	367,142	157,943	394,219	11,081		
1984	15,683	2.18	34,111	224,736	529,679	240,419	563,790	14,051		
1985	7,409	2.35	17,430	221,516	562,898	228,925	580,328	16,658		
1986	6,247	2.67	16,678	215,463	520,787	221,710	537,465	19,599		
1987	10,306	2.51	25,910	345,107	588,954	355,413	614,864	29,960		
1988	10,545	2.61	27,553	338,240	725,238	348,785	752,791	39,057	1.36	53,004
1989	71,898	2.89	207,991	302,771	813,615	374,669	1,021,606	51,946	1.88	97,898
1990	40,075	1.97	78,892	372,587	807,870	412,662	886,761	58,425	1.37	80,147
1991	40,727	2.81	114,480	313,595	753,710	354,322	868,191	42,231	4.18	176,465
1992	66,071	2.33	153,939	347,012	973,323	413,083	1,127,262	33,965	2.43	82,486
1993	11,801	3.28	38,750	271,053	837,172	282,854	875,921	43,858	2.08	91,369
1994	57,670	3.55	204,536	294,477	1,115,558	352,147	1,320,095	48,595	1.68	77,878
1995	28,421	4.05	115,096	256,390	797,144	284,811	912,241	58,065	2.08	120,775
1996	65,585	2.64	173,351	318,619	889,057	384,204	1,062,408	60,870	3.92	238,708
1997	31,138	2.72	84,834	282,220	868,137	313,358	952,971	60,449	2.59	156,817
1998	28,416	1.64	46,528	328,238	693,084	356,654	739,612	79,147	1.75	138,507
1999	14,041	2.49	35,002	285,778	680,463	299,819	715,465	80,012	3.35	268,168

	Scaup			Total Ducks (exc. scaup)		Total ducks		Canada geese		
Year	Unad. PI	VCF	PI	Unad. PI	PI	Unad. PI	PI	Unad. PI	VCF	PI
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	2.67	53,939	266,355	768,246	286,557	822,185	66,672	1.62	108,009
Averages:										
10-year	7,586	3.03	22,277	190,915	565,873	198,467	588,150	77,465	2.08	158,508
Long-term	20,591	3.12	60,758	220,131	616,280	240,716	677,038	48,436	2.30	160,974
% change from										
2015	86%	-17%	54%	53%	47%	54%	47%	-27%	-8%	-33%
10-year average	166%	-12%	142%	40%	36%	44%	40%	-14%	-22%	-32%
Long-term average	-2%	-14%	-11%	21%	25%	19%	21%	38%	-29%	-33%

APPENDIX A.

Precipitation in selected regions of Minnesota, 20 April - 20 May 2016 (Source: Minnesota DNR; http://www.dnr.state.mn.us/climate/historical/summary.html).

Region	Precipitation	Departure from normal
Northwest	1.47	-1.08
North Central	1.71	-0.98
Northeast	1.65	-1.14
West Central	2.44	-0.28
Central	3.00	-0.39
East Central	3.17	-0.02
Southwest	4.47	1.20
South Central	4.12	-0.14
Southeast	2.80	-0.43
Statewide	2.80	-0.43

Waterfowl information is taken from the U.S. Fish and Wildlife Service report Waterfowl Population Status, 2016 by Joshua Dooley, Pamela Garrettson, 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**).

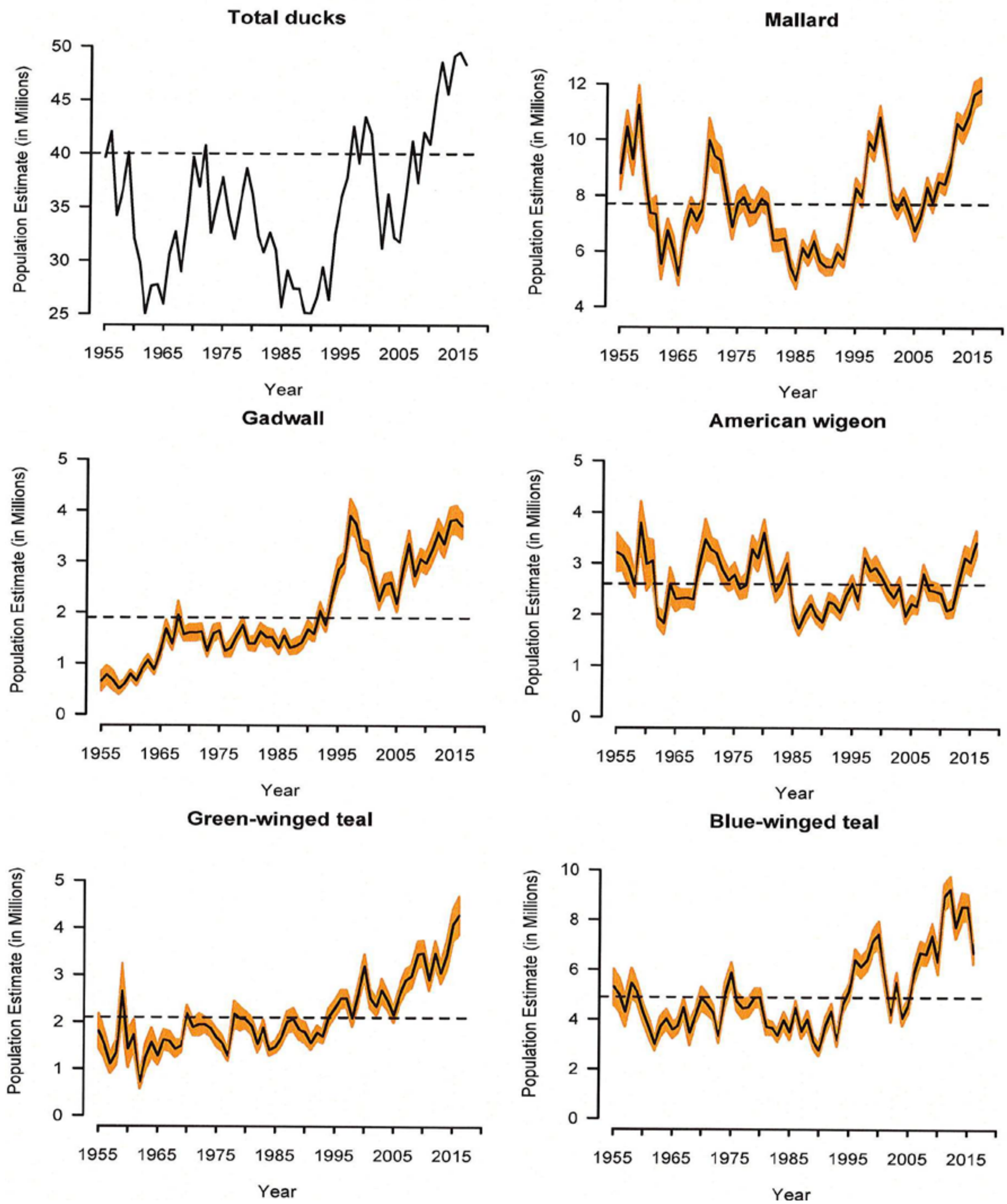

Figure 1 Estimates of North American breeding populations, 90% confidence intervals, and North American Waterfowl Management Plan population goal (dashed line) for selected species and number of water areas in May in Prairie Canada and Northcentral U.S (from: U.S. Fish and Wildlife Service 2015).

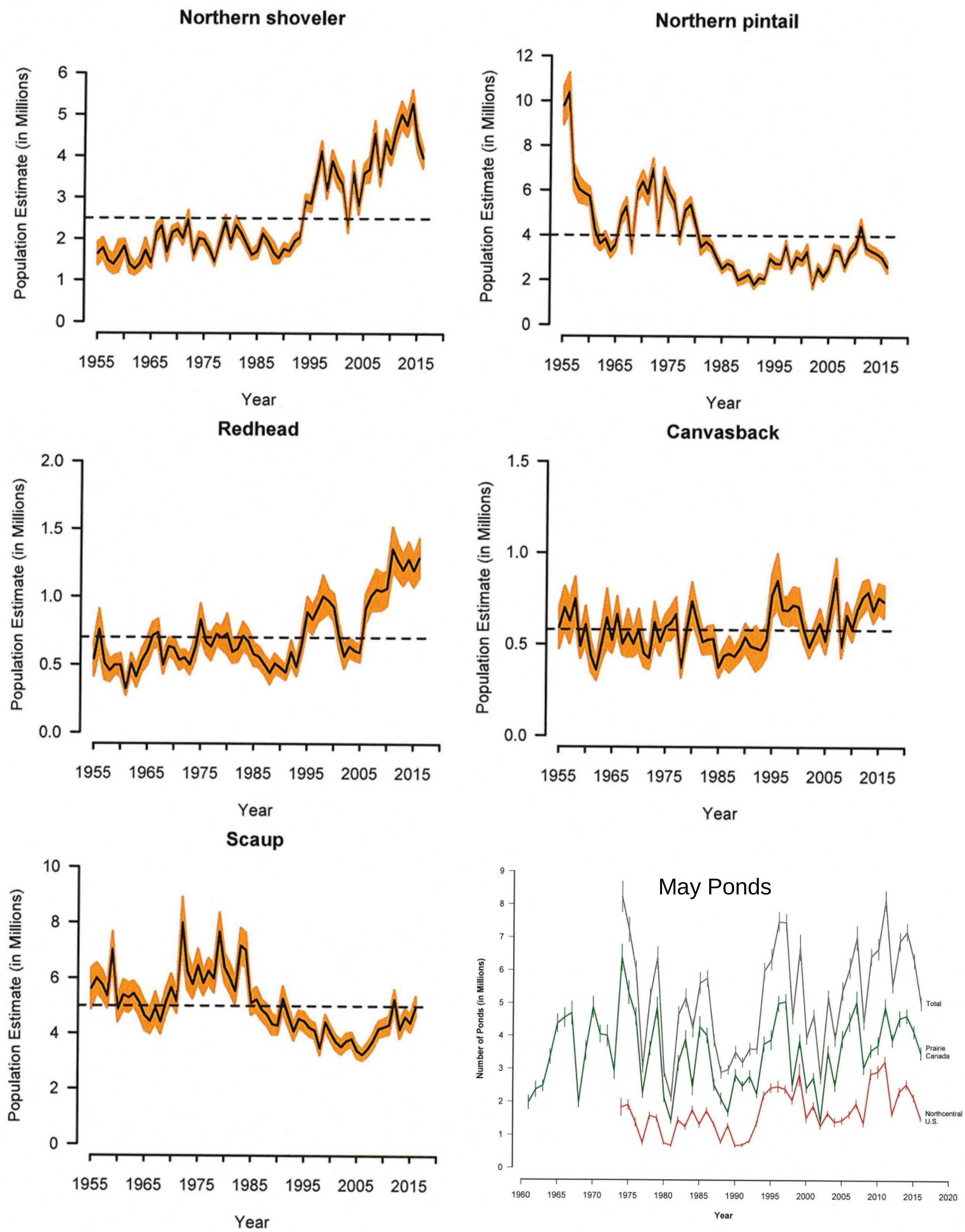

Figure 1 (continued).

2016 MINNESOTA SPRING CANADA GOOSE SURVEY

Matt Weegman, Wetland Wildlife Populations and Research Group

INTRODUCTION

This report presents results from the sixteenth 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). Using the boundaries of the Prairie Parkland, Eastern Broadleaf Forest, Tallgrass Aspen Parklands, and Laurentian Mixed Forest provinces, they divided the state into 3 ecoregions (Aaseng et al. 2005). They combined the Eastern Broadleaf Forest and Tallgrass Aspen Parklands provinces to create the Transition ecoregion, renamed the Prairie Parkland province the Prairie ecoregion, and renamed the Laurentian Mixed Forest province the Forest ecoregion (Figure 1). Maxson (2002) excluded the 7-county Metro area from the Transition ecoregion and Lake County, Cook County, and Boundary Waters Canoe Area from the Forest ecoregion. Using Public Land Survey quarter section boundaries and ArcView, Maxson (2002) assigned quarter sections of the remaining counties to the appropriate ecoregion, which yielded 304,929 quarter section plots (hereafter plots).

From 2002–2007, they used a double sampling design. First, Maxson (2002) randomly selected 900 plots within each ecoregion (prairie, transition, and forest), which yielded a sampling frame of 2,700 total plots (Table 1). Maxson (2002) used National Wetland Inventory Circular 39 data and DNR 1:24,000 lakes GIS layers to stratify plots by habitat quality using the following classification variables: 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 sampling design yielded 9 strata (Table 1) defined by the ecoregion and the expected number of pairs of resident Canada geese: 1) no nesting habitat – expect no geese, 2) limited nesting habitat – habitat capable of supporting 1 or 2 pairs of geese (e.g. F12 is Forest ecoregion habitat capable of supporting 1 or 2 pairs of geese), 3) prime nesting habitat – habitat capable of supporting 3 or more pairs (e.g., prime nesting habitat in the prairie is identified as P3). They did not survey plots in the "0 pairs" strata and the Forest ecoregion ≥3 pairs habitat-quality stratum did not contain any plots (Table 1). They implemented the second part of the double sampling design by randomly selecting 30 plots from the remaining 5 strata to survey each year, for a sample size of 150 plots.

Rave (2008) eliminated the double sampling design and randomly selected 30 plots per strata from the entire sampling frame excluding the "0" pairs strata (n = 128,031 plots; Table 1). He also excluded Lake of the Woods and the Northwest Angle from the Forest ecoregion. They used the same stratification criteria and field protocols to survey resident Canada geese for all years. Thus, results should be comparable among years.

Rave (2011) further modified the sampling frame to include a binary stratification variable, which permitted a domain analysis of total geese in a proposed intensive harvest goose hunting zone (Figure 1). Using proportional allocation per strata, they randomly selected 30 plots in the proposed hunting zone and 130 plots from outside the zone for a total of 160 plots (Figure 1). The Intensive Harvest Zone that was used from 2012-2015 to delineate boundaries for an August Canada goose conservation action and an increase in daily bag limit (10 geese daily) during the September Canada goose season was larger than the proposed zone used here (see Minnesota Waterfowl Hunting Regulations Booklet, 2013, 2014, 2015). However, we continue to use the proposed zone to monitor changes in goose numbers in a portion of the intensive harvest area.

I used the methods that were established by Rave (2011) and randomly selected survey plots from each of the 9 strata using the AlaskaPak Version 3.0 toolkit in ArcGIS 10.2, using the Select Random Features tool (Sarwas 2011). I randomly selected the following plots; 5 plots in P3_Aug; 26 plots in P3; 14 plots in P12_Aug; 20 plots in P12; 9 plots in T12_Aug; 26 plots in T12; 30 plots in F12; 2 plots in T3_Aug, and 29 plots in T3 for a total of 161 plots.

Minnesota DNR Natural Resource Pilot John Heineman and I began the survey on 18 April and finished on 29 April (Figure 2), approximately 2 days earlier than the average start and end date. Surveys were flown in a military surplus OH-58 or an Enstrom 480B. While surveying a plot we flew at an altitude that allowed for best visibility of Canada geese (approximately 20 – 80 meters AGL (Figure 9). We surveyed each plot completely and typically flew 2 – 3 circles around each wetland basin in the plot to be confident that we did not miss any geese. All geese observed within a plot were recorded on a data sheet developed by Rave (2011) and subsequently entered into Microsoft Excel.

We recorded Canada geese seen within plot boundaries as singles, pairs, or groups (≥ 3 geese together; Figure 2). We doubled the number of singles and pairs prior to estimating population size. We did not survey the Twin Cities where there is a significant number of nesting Canada geese, but have used an earlier estimate (Cooper 2004) to approximate the number of geese in Minnesota.

We used statistical software Program R, version 3.2.4 and RStudio, version 0.99.896 to perform exploratory data analysis (EDA; R Core Team 2016; see Figures 2 - 5) prior to running the population estimate code to generate Figure 6.

RESULTS AND DISCUSSION

Total time spent surveying plots was approximately 399 minutes, or on average 2.47 minutes per plot. Our total flight time from 8 days of surveys was 42.3 hours. Approximately 15.7% of the time in the air was spent surveying plots while 84.2% of the time was spent enroute.

We counted a total of 100 pairs, 77 singles, and 61 birds in groups to yield a population estimate (± 95% CI) of 201,654 (± 64,297) resident Canada geese for the sampling frame (Table 2). The 2016 resident Canada goose population estimate was comparable to estimates calculated for 2014 and 2015. Relative error (95% CI half-width) was 31.9% of the estimate. The large annual confidence intervals do not indicate differences between any years, but a general pattern indicates an increase in population size from 2001 to 2006 and then again from 2007 to 2012, with population declines in 2007, 2013, and 2016 (Figure 6). The population size was lower from 2013-2015 and declined in 2016 to the lowest point estimate since surveys began in 2001. Canada goose population estimates were similar to 2015 in the Prairie

Ecoregion, but were the lowest on record in the Transition and Forest ecoregions (same as 2009 in Forest; Table 2).

We added 17,500 geese for the Twin Cities metro area (Cooper 2004), which yielded a statewide population estimate of 219,154 resident Canada geese (Table 2). The 2016 statewide population estimate represents the first year that this estimate has been below the state Canada goose population goal of 250,000 resident Canada geese.

Of the total number of Canada geese we detected, 37.1% were singles, 48.2% pairs, and 14.7% were in groups (Table 3; Figure 7). We used single birds to develop an index to nesting effort and used it to calculate a productivity estimate of 37.1% (Table 3). The proportion of productive Canada geese for 2016 was slightly less than but comparable to the estimates for 2014 and 2015 (Table 3).

All nine stratum had geese occupy a proportion of the plots. The stratification generally worked well, with >60% of the plots occupied in the ≥3 Canada goose density plots and generally <35% of the 1-2 geese/plot strata occupied (except T3 = 60% occupancy, *n*=8) having ≥ 1 Canada goose (Figure 3). The lowest proportion of plots with ≥ 1 Canada goose occurred in the forest (F12, *n*=30 plots) with only 20% of plots having at least one Canada goose.

The total number of geese was comparable across strata (Figure 4). There were two outliers in strata P3 (after doubling the singles and pairs) with approximately 49 geese in one plot and 25 in another. Aside from the outliers, the number of geese per Eco-province was fairly consistent throughout (Figure 5).

Weather conditions from March – May were likely important factors affecting Canada goose productivity. The average temperature in Minnesota from October 2015 to March 2016 was the second warmest on record and approximately 4.5°C warmer than the 20th Century average for the same time period (National Oceanic and Atmospheric Administration 2016). Median lake ice-out dates for 2016 varied across the state. Some lakes in southern Minnesota opened up after much warmer than average days during the first week of March. On Lake Minnetonka, ice-out was March 17 which was the earliest ice-out in 139 years (Minnesota Department of Natural Resources 2016). Ice-out for Mille Lacs Lake was April 5, approximately 20 days earlier than median ice-out. Lower Red lake lost its ice on and 19 April, approximately 9 days earlier than the median. Rainy Lake lost its ice on April 30, approximately 4 days earlier than the median ice out.

This is the last consecutive spring helicopter goose survey. We plan to use a redesigned May waterfowl survey (Cordts 2016) to estimate goose numbers next year. The May waterfowl survey population estimate for geese tends to be lower (see Figure 8) using current methods because the survey only covers 39% of the State. In addition, when the geese first hatch, they hide making them difficult for both aerial and ground crews used in the May survey to observe. The redesigned May survey will cover the majority of the State and will use a helicopter, which should reduce at least some of the problems. Our goal was to survey plots during mid-incubation. The above average temperature and early lake ice out suggests many pairs should have been in the incubation stage of the nesting cycle when we conducted the survey.

ACKNOWLEDGEMENTS

John Heineman piloted the helicopter and served as the second observer. Chris Scharenbroich assisted in providing GPS coordinates of plots to the pilot and making area maps. Dave Rave and Jeff Lawrence provided guidance on conducting surveys and historical context for the surveys. John Giudice provided statistical support. 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 – 2016 (*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 – 2016 [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 2011-15, 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, 2001-2015 (*n*=150 plots 2001-2007, *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

*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, and productive geese on the Minnesota Spring Canada Goose Survey, 2001-2016.

Year	Singles[a]	Pairs[b]	Groups	Productive Geese[b]	Survey period
2001	27	63.9	9.1	36.4	4/14 to 5/02/2001
2002	30.7	52	17.2	41.5	4/26 to 5/11/2002
2003	27.9	58.2	13.9	29.3	4/22 to 5/01/2003
2004	26.5	57.5	16	35.5	4/22 to 5/04/2004
2005	33	50.2	16.8	40.7	4/20 to 5/03/2005
2006	43.5	45.9	10.6	50.3	4/24 to 5/05/2006
2007	31	51.5	17.5	36.2	4/23 to 4/28/2007
2008	38.4	55.4	6.2	42.6	4/23 to 5/05/2008
2009	41.8	50.7	7.5	45.2	4/21 to 5/01/2009
2010	42.5	48.2	9.3	46.6	4/15 to 4/20/2010
2011	50.3	47.2	2.6	55.7	4/21 to 4/29/2011
2012	30	49.6	20.4	35.1	4/16 to 4/23/2012
2013	27.1	67.8	5.1	29.8	5/06 to 5/14/2013
2014	39.3	55.1	5.6	44	4/21 to 5/04/2014
2015	38.5	56.4	5.1	41.6	4/20 to 4/28/2015
2016	37.1	48.2	14.7	37.1[c]	4/18 to 4/29/2016

[a] Singles and pairs were doubled before calculating proportions

[b] Productive Canada geese = singles + pairs with nests

[c] Productive Canada geese = singles

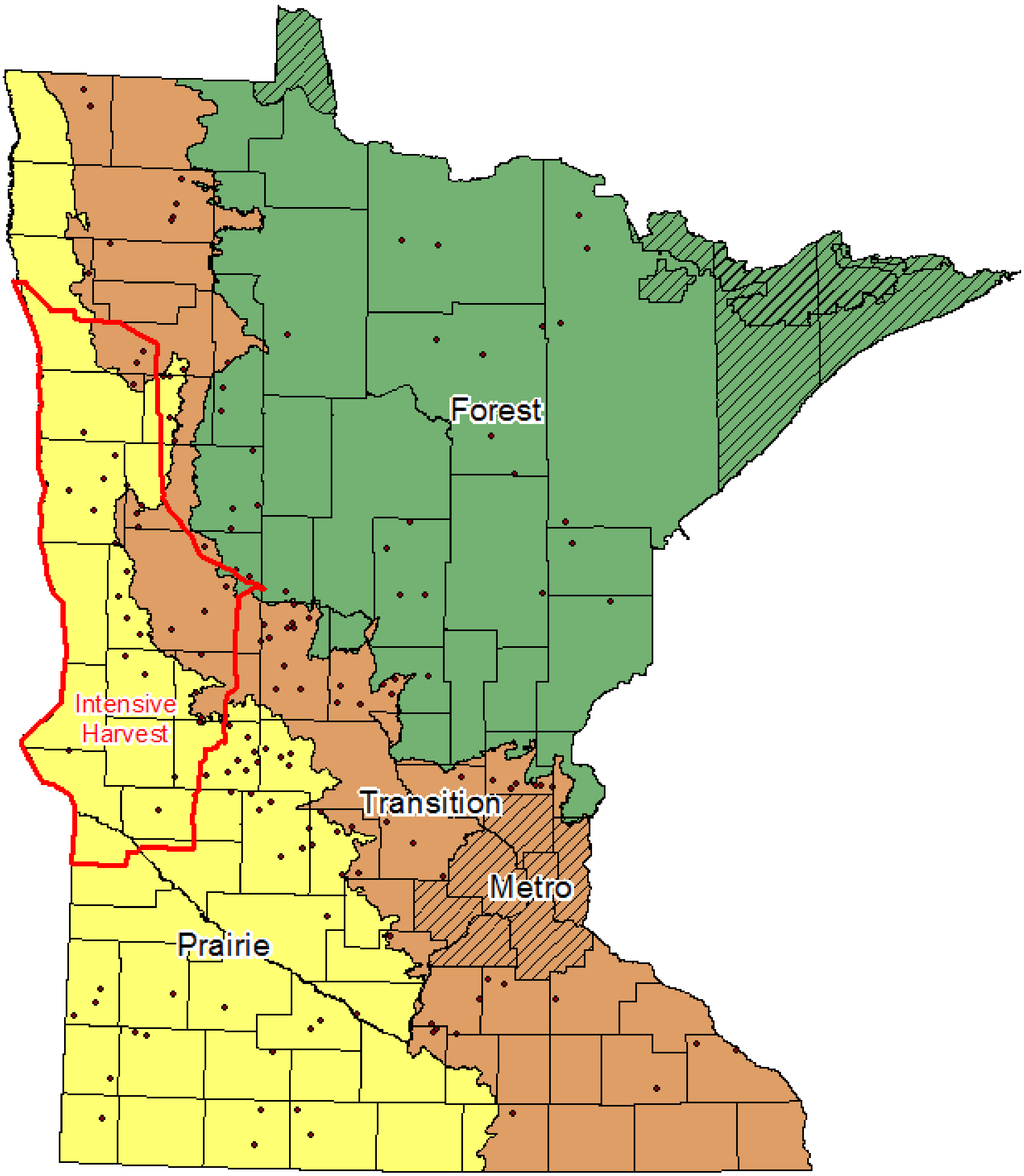

Figure 1. Location of 161 quarter section plots surveyed during the 2016 spring Canada goose survey. Plots are distributed among the Prairie, Transition, and Forest ecoregions. Cross-hatched areas were not included in the survey. The polygon delineated in red designates a portion of the Intensive goose harvest zone.

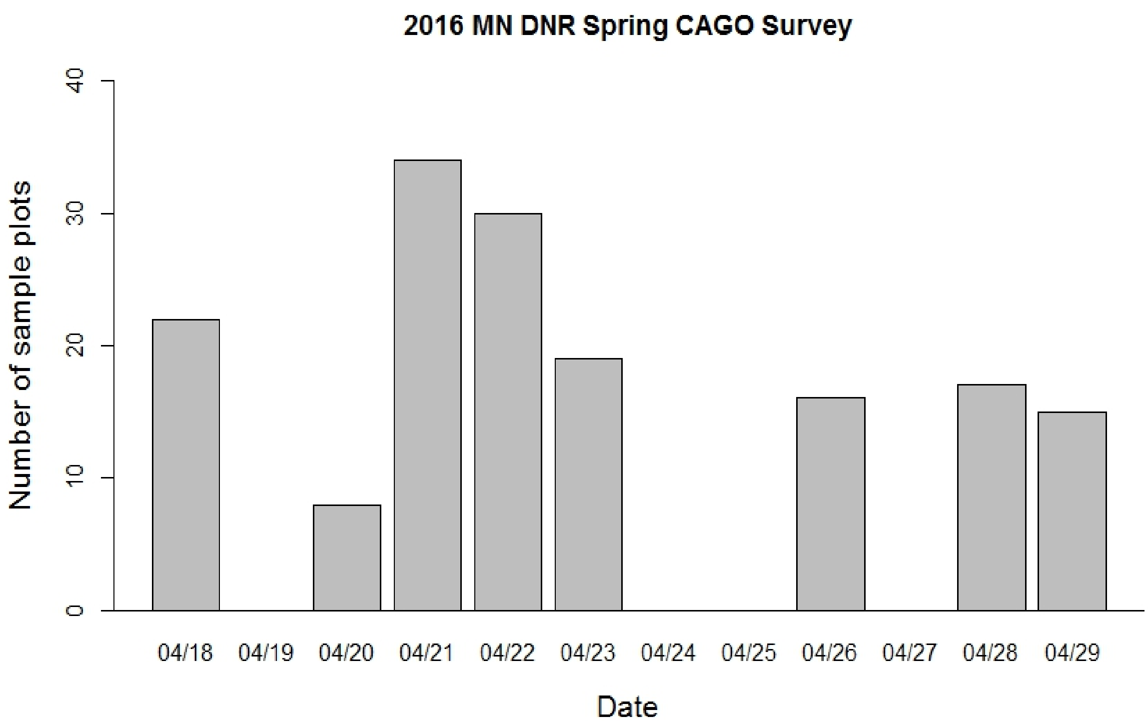

Figure 2. Number of sample plots surveyed by date. Dates without data indicate that surveys were not flown that day.

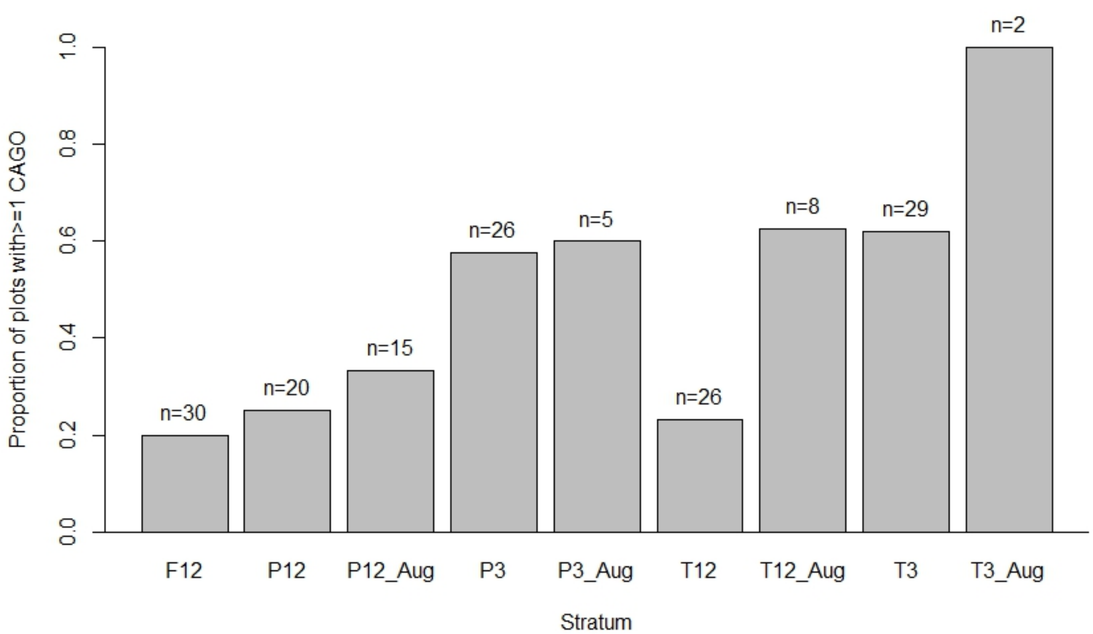

Figure 3. Percent of plots by stratum with ≥ 1 Canada goose counted (*n*=number of plots in each strata).

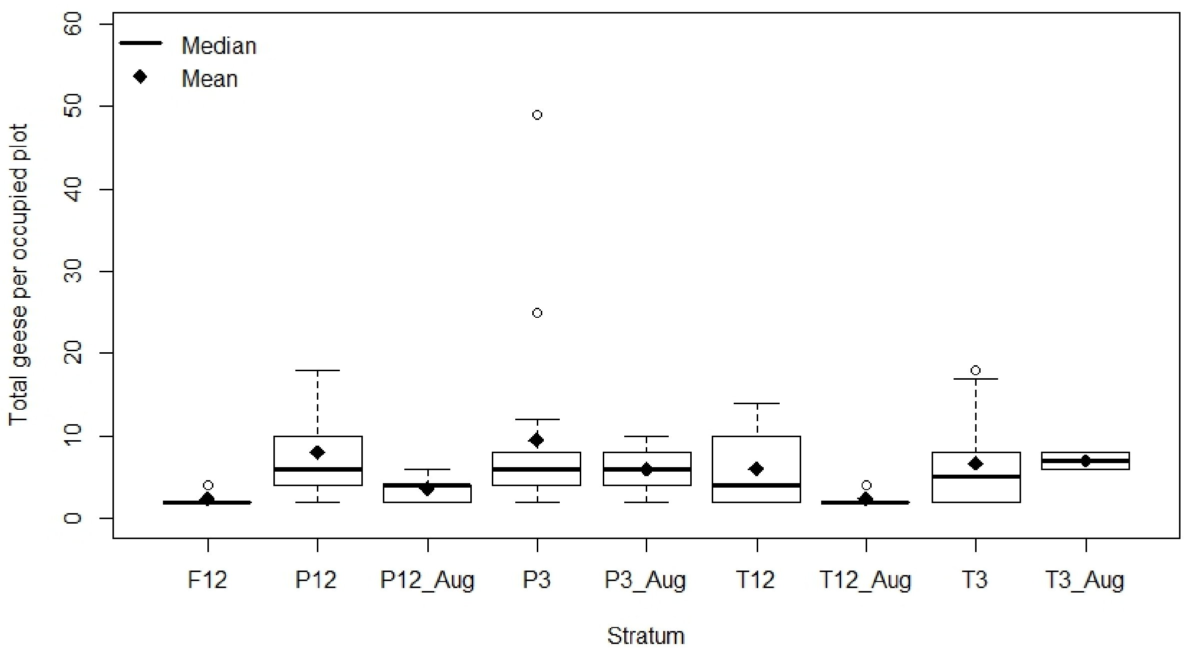

Figure 4. Mean and median number of geese per occupied plot in each strata.

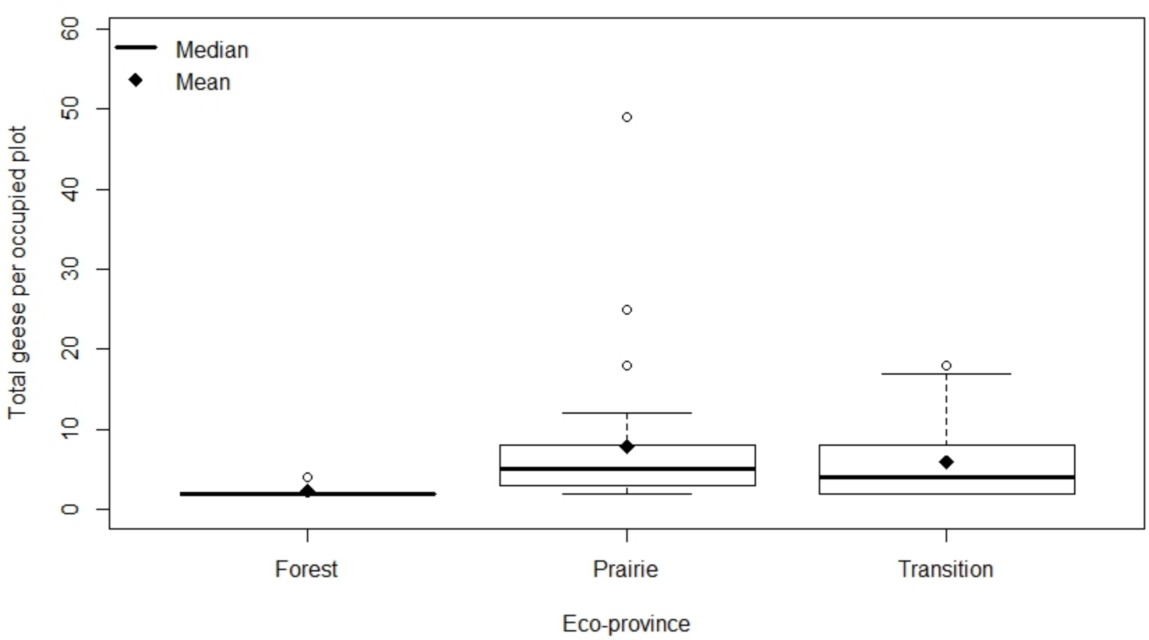

Figure 5. Mean and median number of geese per occupied plot per Eco-province.

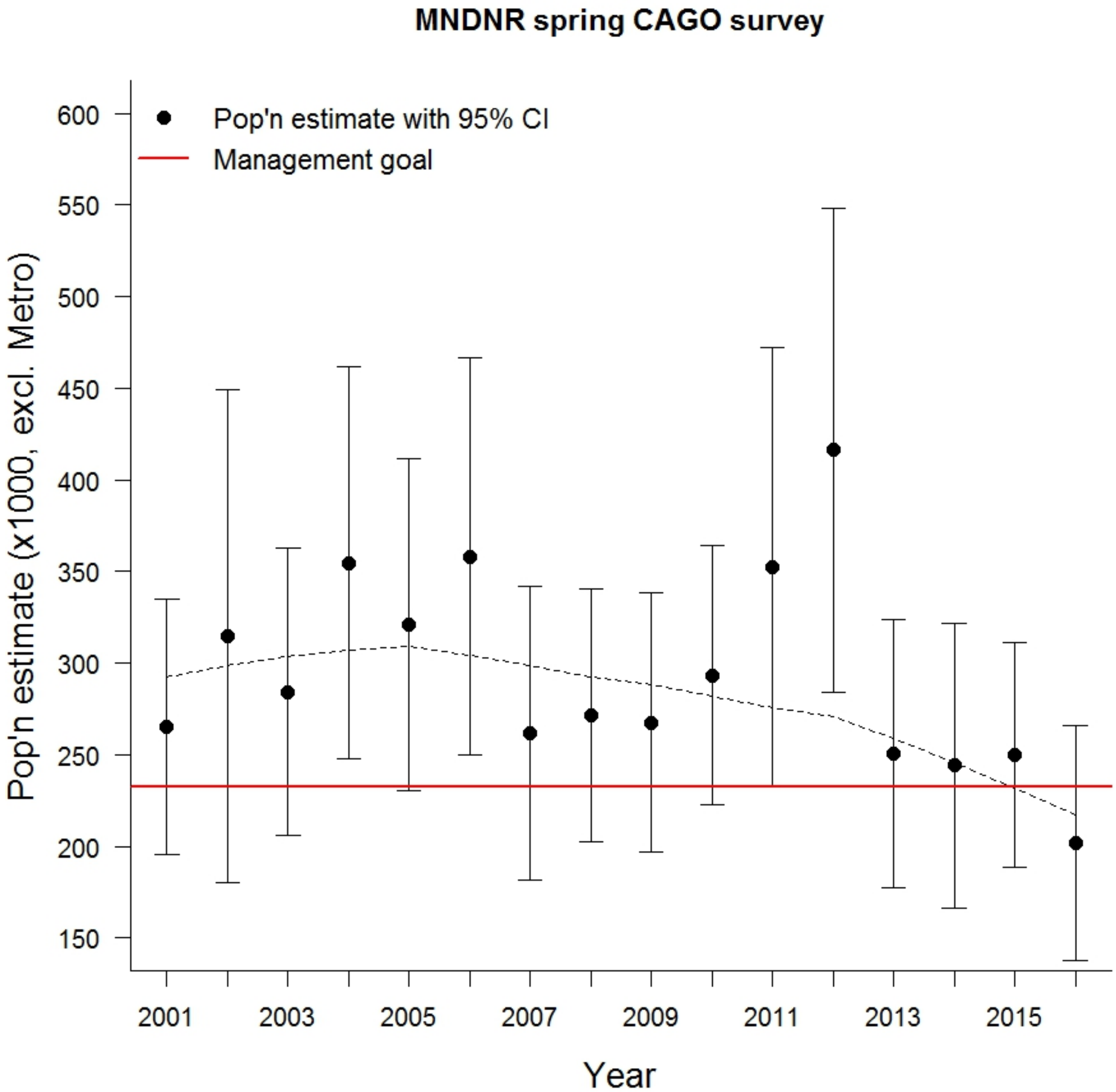

Figure 6. Resident Canada goose population estimates (± 95% CI) in Minnesota (excluding Metro), 2001–2016. The management goal is 250,000 Canada geese (250,000 – 17,500 Metro geese = 232,500).

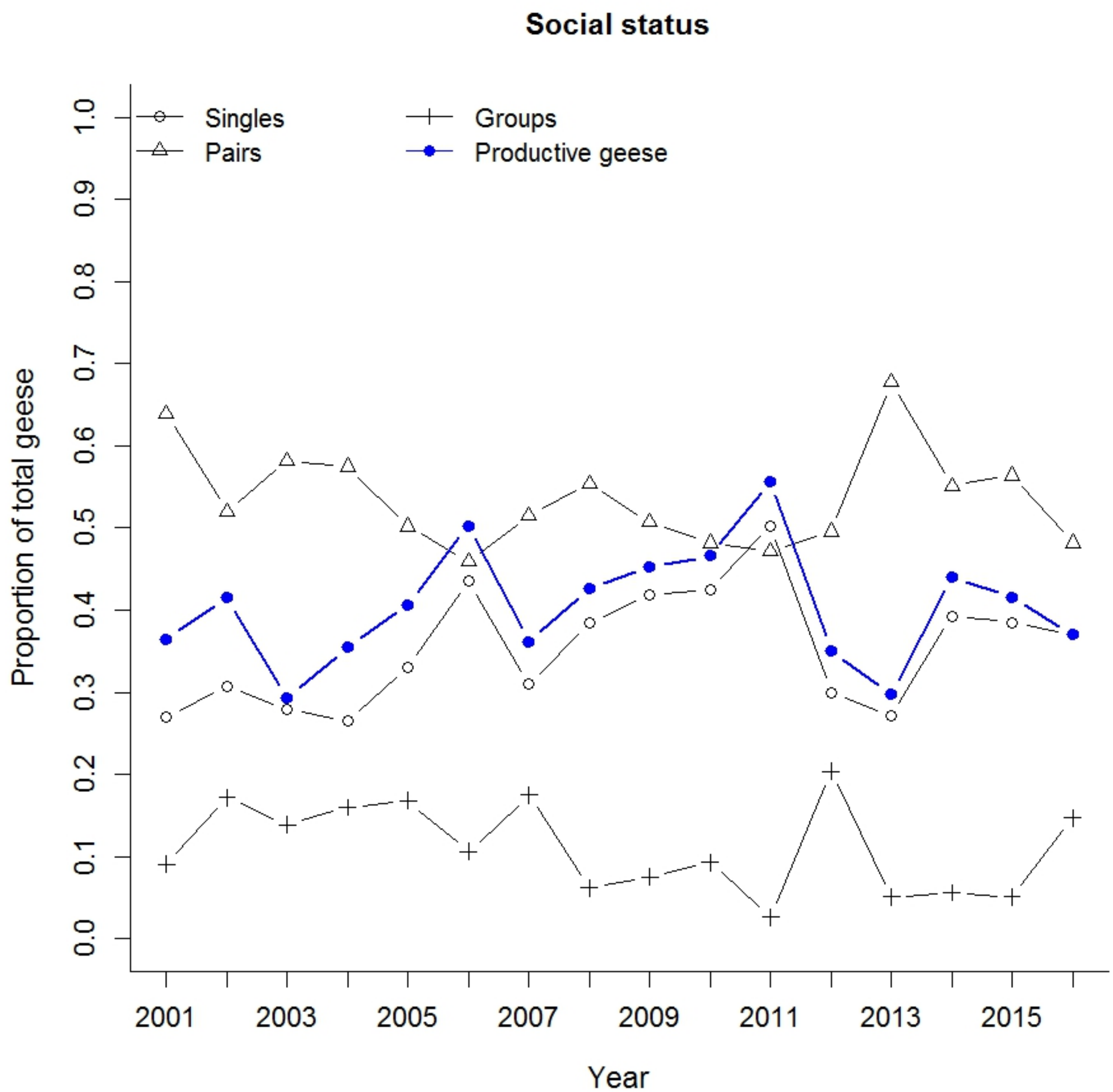

Figure 7. Social status trends from 2001 – 2016 for Canada geese in Minnnesota. The blue line represents productive Canada geese which was determined using the proportion of single birds plus pairs with nests, except in 2016 when it is just proportion of single birds.

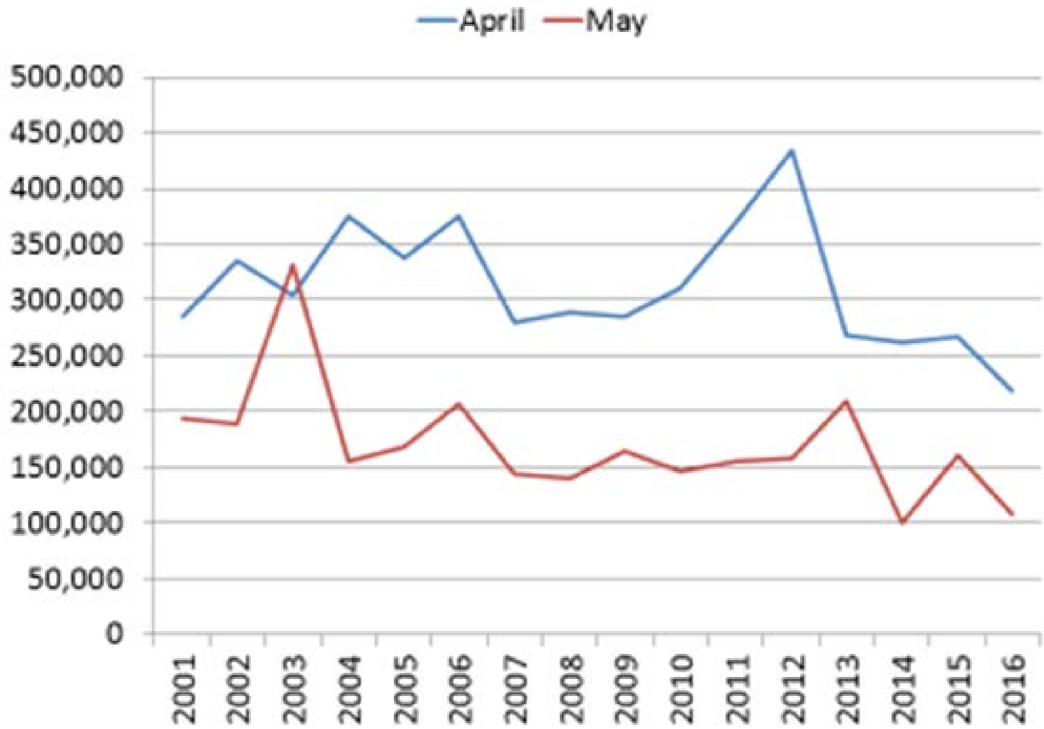

Figure 8. Comparison of Minnesota Canada goose population estimates from this survey and transect-based May fixed wing waterfowl survey (Cordts 2016).

Figure 9. Surveying a plot in the Upper Mississippi National Wildlife and Fish Refuge (Winona County).

Figure 10. Looking north towards Chen Bay Wildlife Management Area (Lincoln County). A portion of the wetland in the center (~160 acres) was randomly selected as part of the goose survey.

Mourning dove information is taken from the U.S. Fish and Wildlife Service report by Seamans, M.E. 2016. Mourning dove population status, 2016. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 20 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).

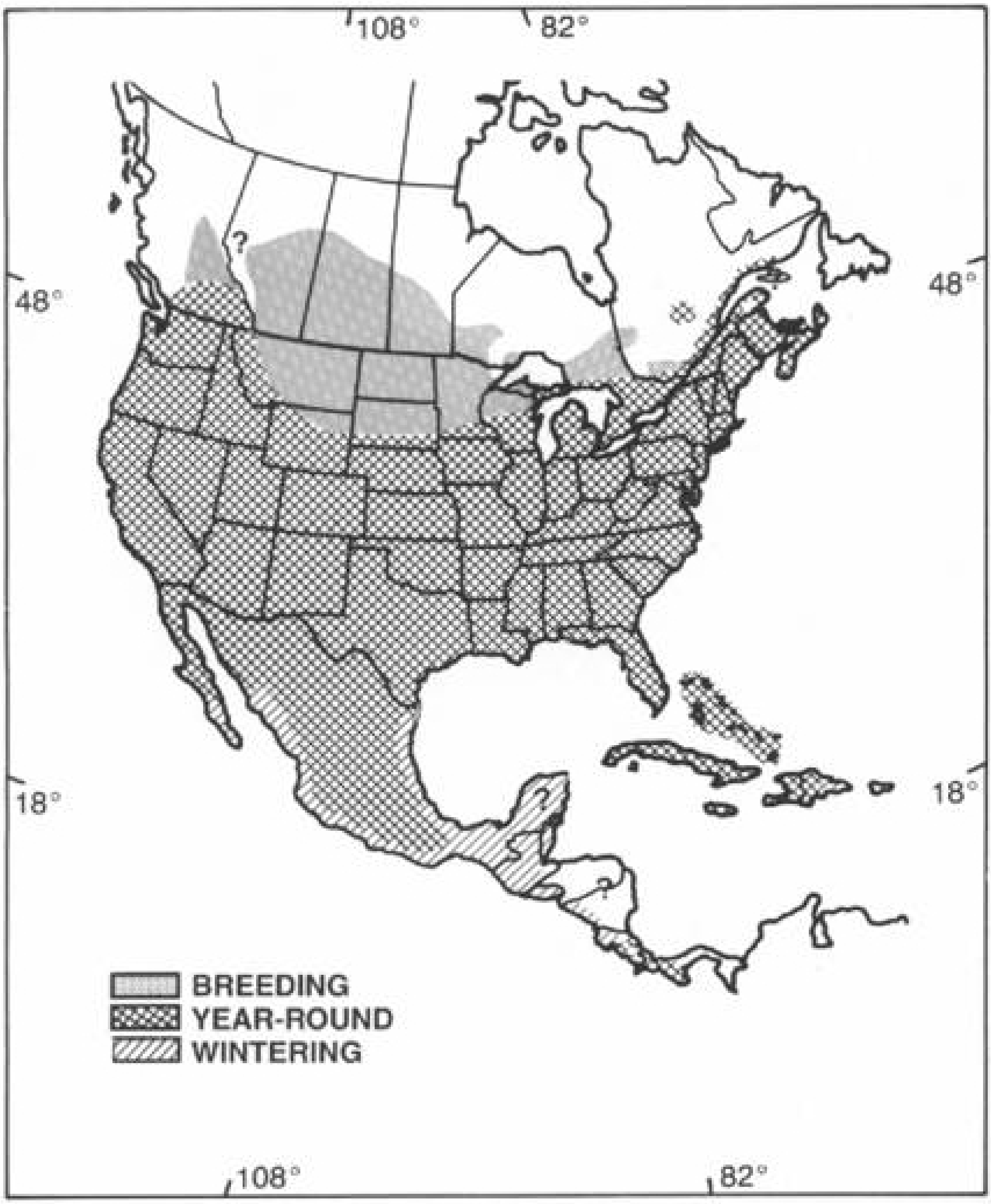

Figure 1. Breeding and wintering ranges of the mourning dove (adapted from Mirarchi and Baskett 1994). (From: Seamans, M.E. 2016. Mourning dove population status, 2016. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 20 pp.)

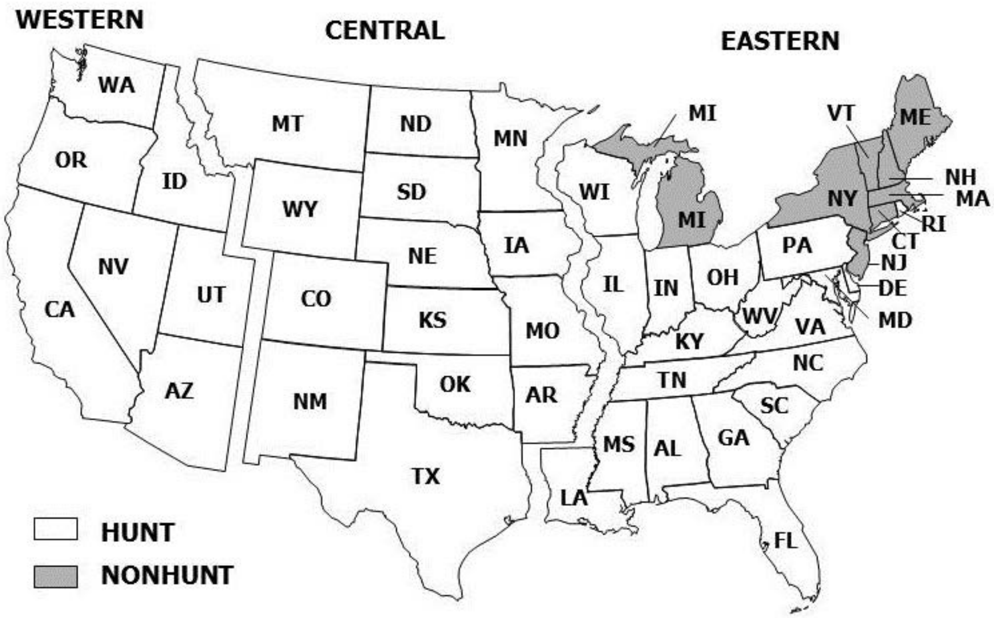

Figure 2. Mourning dove management units with 2015 hunting and non-hunting states. (From: Seamans, M.E. 2016. Mourning dove population status, 2016. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 20 pp.)

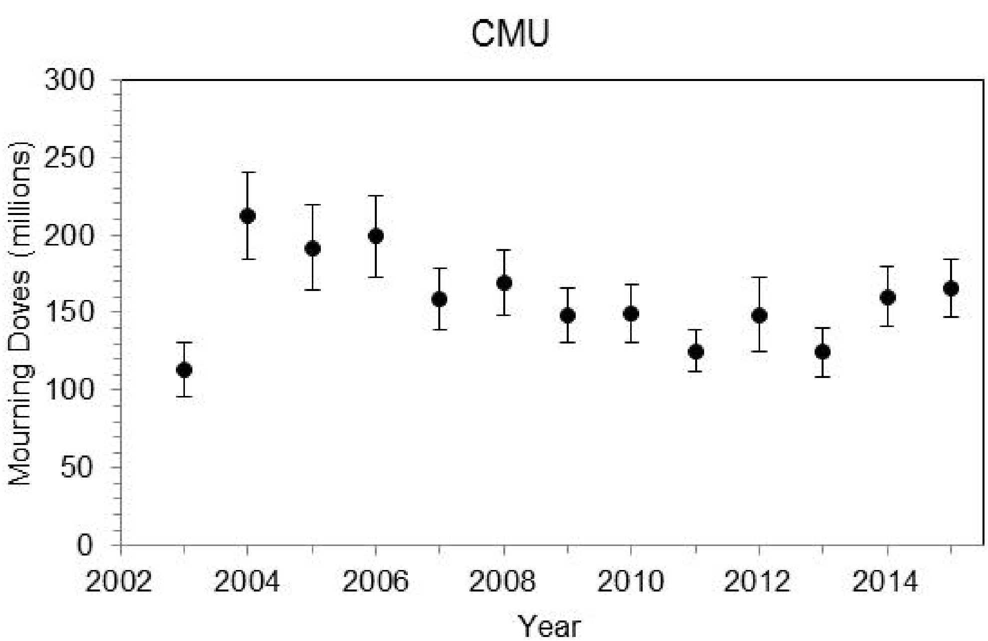

Figure 3. Estimates and 95% confidence intervals of mourning dove absolute abundance by in the Central Management Unit (CMU), 2003-15. Estimates based on band recovery and harvest data. (From: Seamans, M.E. 2016. Mourning dove population status, 2016. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 20 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 2013, 2014 and 2015 seasons [a]. (From: Seamans, M.E. 2016. Mourning dove population status, 2016. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 20 pp.)

Management unit / State	Active Hunters			Hunter Days Afield			Total Harvest		
	2013	2014	2015	2013	2014	2015	2013	2014	2015
CENTRAL	353,000 †	427,100 †	369,800 †	1,185,300±10	1,333,600 ± 9	1,235,000 ±10	6,236,000 ±11	7,654,700 ±10	7,180,300 ±9
AR	8,900 ±42	19,900 ±21	17,88 ±24	30,100 ±57	47,900 ±28	37,600 ±22	155,900 ±46	347,900 ±29	252,400 ±22
CO	15,600 ±15	14,400 ±14	14,200 ±15	36,900 ±19	27,800 ±16	38,900 ±23	176,900 ±25	173,100 ±19	204,500 ±22
IA	12,900 ±9	9,200 ±9	9,200 ±15	49,400 ±14	27,100 ±12	24,600 ±16	214, 300 ±16	130,000 ±13	111,500 ±18
KS	31,900 ±12	26,200 ±10	28,600 ±13	93,000 ±16	70,700 ±14	86,400 ±18	504,400 ±18	485,300 ±18	558,200 ±20
MN	7,700 ±53	6,900 ±51	9,700 ±48	17,000 ±39	20,200 ±59	28,200 ±54	53,500 ±30	54,800 ±29	96,700 ±86
MO	36,400 ±11	24,100 ±12	22,500 ±14	104,500 ±18	62,200 ±15	54,300 ±17	587,600 ±28	374,000 ±17	307,400 ±24
MT	1,700 ±46	1,400 ±42	1,600 ±49	2,900 ±41	2,900 ±41	5,100 ±54	12,000 ± 41	8,500 ±37	18,000 ±54
NE	13,500 ±16	9,700 ±12	9,000 ±17	39,300 ±19	26,700 ±13	25,500 ±18	239,800 ±24	172,900 ±15	160,600 ±17
NM	6,500 ±9	7,600 ±10	7,000 ±11	23,700 ±13	24,100 ±15	23,100 ±14	123,000 ±15	115,200 ±15	111,900 ±22
ND	6,300 ±28	3,900 ±25	4,200 ±23	16,400 ±29	11,900 ±30	12,800 ±25	88,200 ±37	47,600 ±23	73,500 ±25
OK	23,300 ±13	19,100 ±13	18,200 ±15	69,400 ±24	56,900 ±24	45,300 ±17	421,200 ±25	417,900 ±21	294,000 ±18
SD	6,200 ±22	6,400 ±21	5,300 ±15	17,500 ±26	17,500 ±24	16,000 ±25	118,300 ±31	106,800 ±25	84,500 ±30
TX	178,900 ±13	276,800 ±10	220,700 ±11	677,900 ±16	934,300 ±13	834,000 ±14	3,506,700 ±18	5,199,400 ±14	4,892,100 ±13
WY	3,100 ±19	1,500 ±26	1,700 ±23	7,200 ±19	3,400 ±23	3,300 ±30	34,200 ±19	21,100 ±25	14,900 ±28

[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, 2016. Seamans, M.E. and R.D. Rau. U.S. Fish and Wildlife Service, Laurel, MD. 17 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/AmericanWoodcockStatusReport16.pdf)

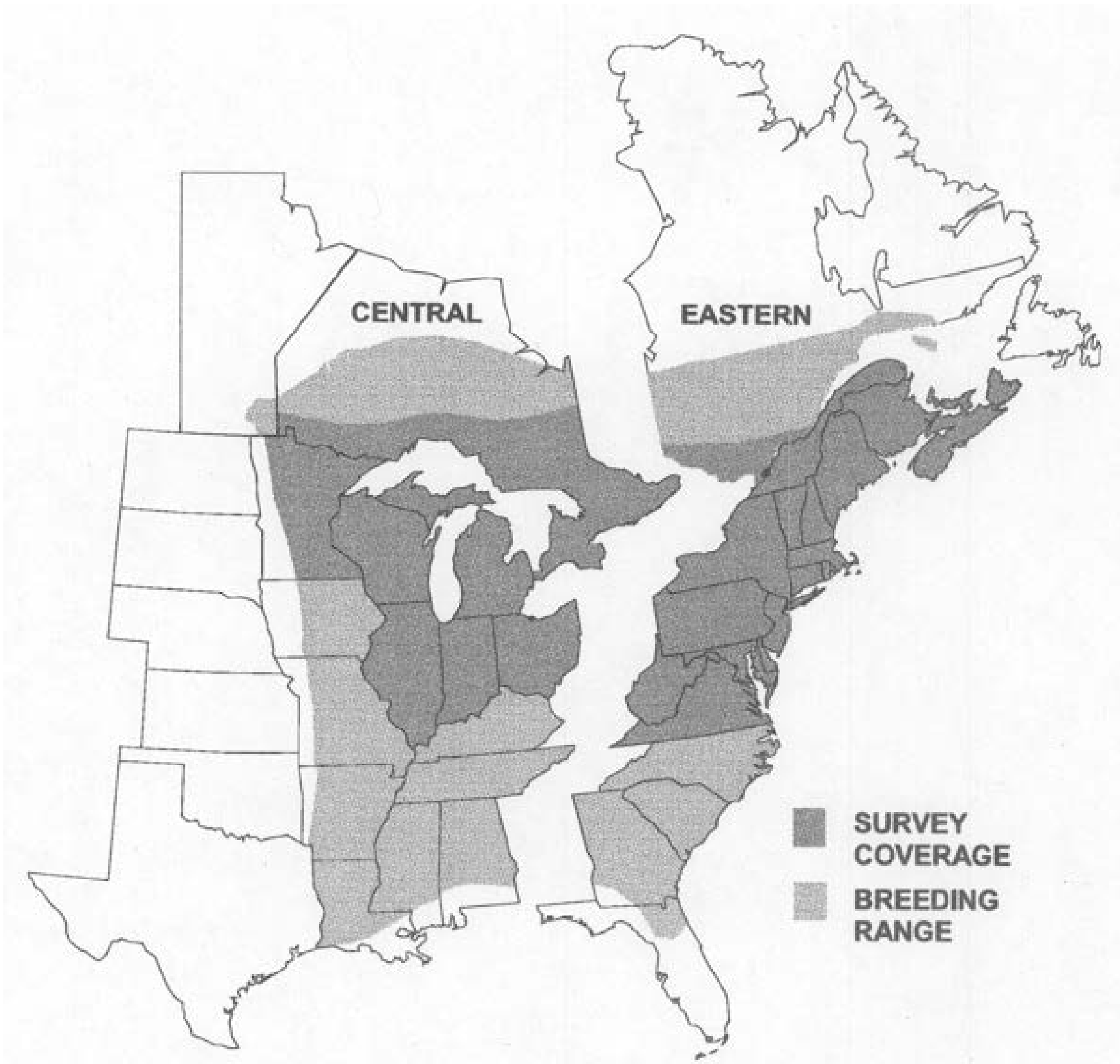

Figure 1. Woodcock management regions, breeding range, singing-ground survey coverage. (from: Seamans, M.E. and R.D. Rau. 2016. American woodcock population status, 2016. U.S. Fish and Wildlife Service, Laurel, MD. 17 pp.).

Table 1. Short term (2015 – 16), 10 –year (2006-2016), and long-term (1968-2016) 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. 2016. American woodcock population status, 2016. U.S. Fish and Wildlife Service, Laurel, MD. 17 pp.).

Management Unit/State	Number of Routes[b]	n[c]	2015-16			2006-16			1968-16		
			% Change	95% CI[d] lower	95% CI[d] upper	% Change	95% CI[d] lower	95% CI[d] upper	% Change	95% CI[d] lower	95% CI[d] upper
CENTRAL	455	740	0.82	-6.18	8.24	- 0.25	-1.10	0.57	- 0.68	-0.93	-0.44
IL	29	46	-45.24	-80.98	50.60	-10.54	-20.16	-1.03	-1.17	-3.86	1.75
IN	11	62	1.27	-38.08	77.46	- 3.03	- 7.66	2.81	- 4.07	-5.28	-2.92
MB[e]	19	30	-7.89	-33.67	23.96	0.86	- 2.54	4.78	- 0.15	-1.92	1.56
MI	115	155	-3.79	-14.71	8.77	0.11	- 1.24	1.53	- 0.75	-1.11	-0.37
MN	73	122	16.42	-0.92	36.94	2.43	0.67	4.27	0.80	0.23	1.44
OH	40	73	-6.27	-27.09	17.58	- 1.56	- 4.15	1.04	- 1.50	-2.20	-0.77
ON	89	161	-0.75	-14.66	15.32	- 1.85	- 3.59	-0.10	- 0.93	-1.39	-0.47
WI	79	121	1.17	-14.01	19.09	0.43	- 1.37	2.30	- 0.35	-0.84	0.14

[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 2015 for which data were received by 5 June, 2015.

[c] Number of routes with at least one year of non-zero data between 1968 and 2015.

[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.

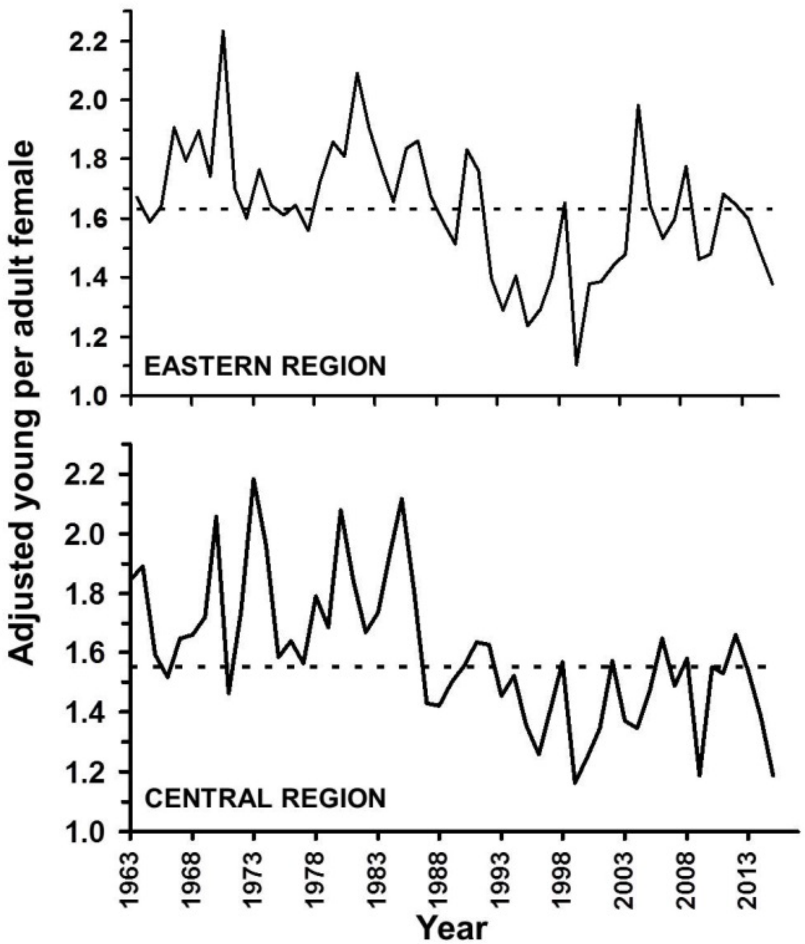

Figure 2. Weighted annual indices of American woodcock recruitment, 1963-2015. Dashed line is the 1963-2014 average. (from: Seamans, M.E. and R.D. Rau. 2016. American woodcock population status, 2016. U.S. Fish and Wildlife Service, Laurel, MD. 17 pp.).

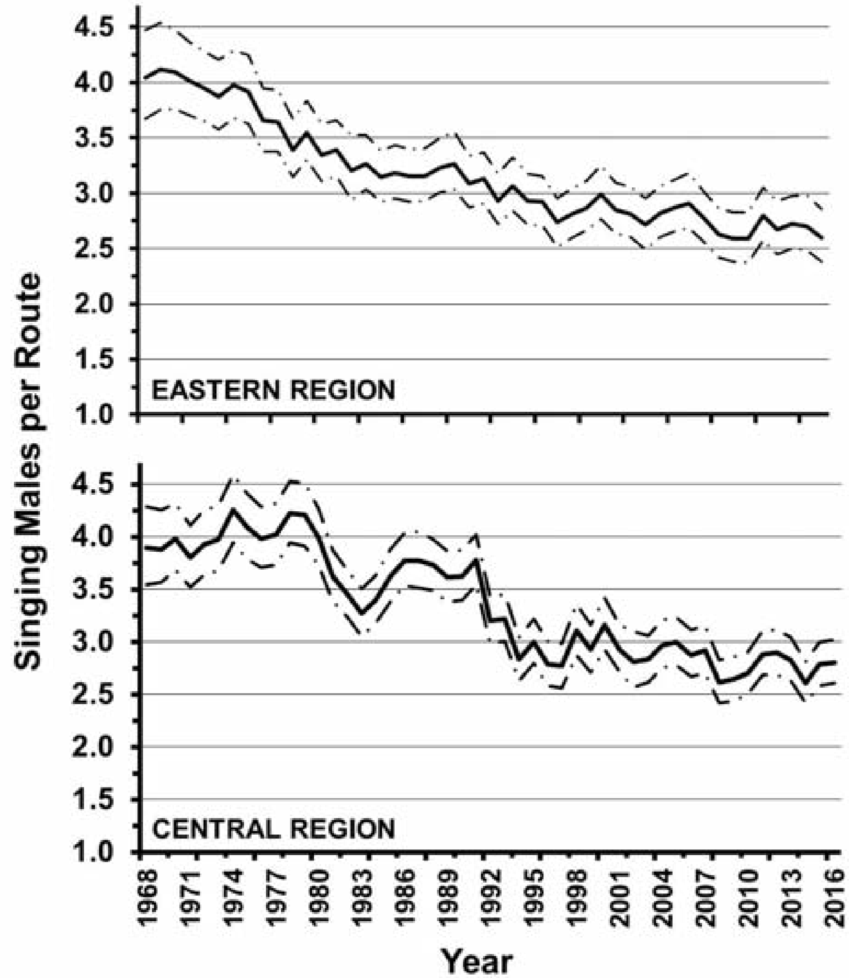

Figure 3. Annual indices of the number of woodcock heard on the Singing-ground Survey, 1968-2016. The dashed lines represent the 95th percentile credible interval. (from: Seamans, M.E. and R.D. Rau. 2016. American woodcock population status, 2016. U.S. Fish and Wildlife Service, Laurel, MD. 17 pp.).

Table 2. Preliminary estimates of woodcock hunter numbers, days afield, and harvest for selected states, from the 2012-13, 2013-14, 2014-15 and 2015-16 Harvest Information Program surveys. (from: Seamans, M.E. and R.D. Rau. 2016. American woodcock population status, 2016. U.S. Fish and Wildlife Service, Laurel, MD. 17 pp.).

Management Unit / State	Active woodcock hunters ([a])				Days afield ([a, c])				Harvest ([a, c])			
	2012-13	2013-14	2014-15	2015-16	2012-13	2013-14	2014-15	2015-16	2012-13	2013-14	2014-15	2015-16
Central Region	n.a. [b]	n.a. [b]	n.a. [b]	n.a. [b]	276,900 ± 16	306,100 ± 20	227,600 ±13.6	284,200 ±16	193,100 ± 23	180,600 ± 20	141,500 ± 23	145,700 ± 19
IL	900 ± 175	1,600 ± 128	800 ± 169	1,000 ± 170	3,500 ± 172	3,400 ± 119	2,600 ± 162	1,300 ± 133	1,900 ± 160	1,000 ± 142	300 ± 132	200 ± 114
IN	400 ± 119	700 ± 77	300 ± 99.7	400 ± 99	1,500 ± 122	1,600 ± 58	900 ± 88.1	1,100 ± 83	600 ± 84	1,400 ± 84	700 ± 43	600 ± 56
MI	25,700 ± 17	30,000 ± 19	19,400 ± 21.1	26,000 ± 18	121,400 ± 22	123,700 ± 24	87,500 ± 19.1	124,700 ± 21	74,100 ± 28	79,300 ± 28	53,500 ± 29	63,200 ± 23
MN	11,200 ± 36	10,900 ± 37	13,500 ±33.5	13,500 ±34	40,400 ± 34	74,700 ± 62	47,500 ± 31.8	47,600 ± 40	31,000 ± 59	18,600 ± 57	23,900 ± 45	25,600 ± 42
OH	600 ± 115	3,000 ± 63	1,600 ± 85.4	1,900 ± 80	2,600 ± 83	8,600 ± 64	4,500 ± 94.2	7,500 ± 95	1,500 ± 80	8,600 ± 85	300 ± 90	2,100 ± 85
WI	13,700 ± 28	14,500 ± 27	16,200 ± 25	14,700 ± 27	58,000 ± 33	60,000 ± 31	66,400 ± 26.9	66,600 ± 29	40,400 ± 37	38,400 ± 24	49,300 ± 45	31,000 ± 25

[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.

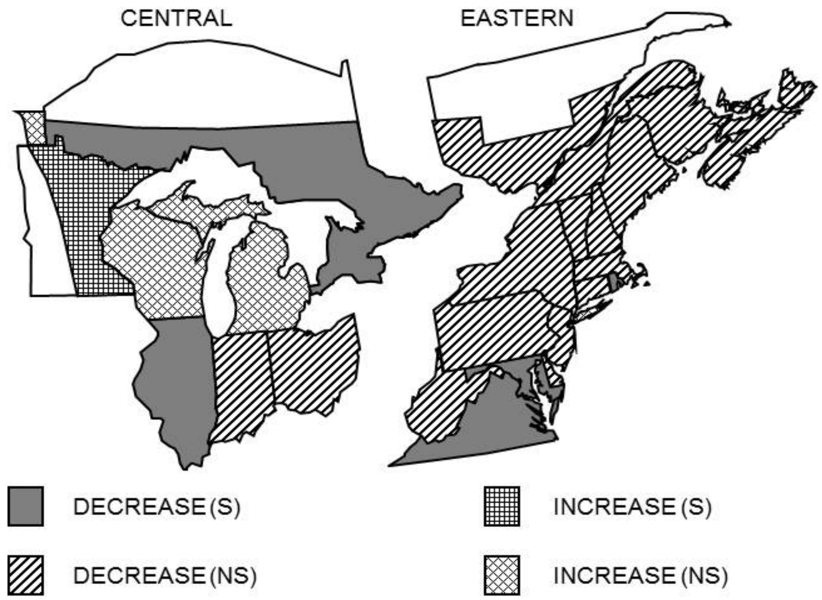

Figure 4. Ten-year trends in number of American woodcock heard on the Singing-ground Survey; 2006-16, as determined by the hierarchical modeling method. A significant trend (S) does not include zero in the 95% credible interval, while a non-significant (NS) trend does include zero. (from: Seamans, M.E. and R.D. Rau. 2016. American woodcock population status, 2016. U.S. Fish and Wildlife Service, Laurel, MD. 17 pp.).

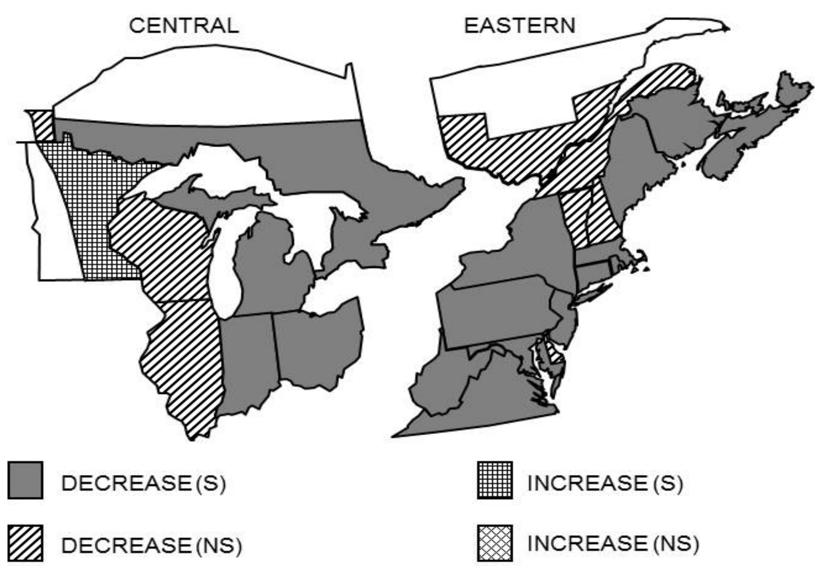

Figure 5. Long-term trends in number of American woodcock heard on the Singing-ground Survey; 1968-2016, as determined by the hierarchical modeling method. A significant trend (S) does not include zero in the 95% credible interval, while a non-significant (NS) trend does include zero. (from: Seamans, M.E. and R.D. Rau. 2016. American woodcock population status, 2016. U.S. Fish and Wildlife Service, Laurel, MD. 17 pp.).

2016 NORTHWEST MINNESOTA SANDHILL CRANE BREEDING GROUND SURVEY

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SUMMARY

We conducted an annual sandhill crane (SACR, *Grus canadensis*) breeding population survey in northwest Minnesota during 2012-2016. After the first year of the survey, we excluded the portion of the Red River Prairie Ecological Classification System (ECS) Subsection from the survey area due to low crane numbers in the agricultural landscape. We used 4 km^2 plots as the primary sampling unit. In 2015 and 2016, we used a split-panel design and surveyed 129 plots: 69 plots that we surveyed in 2012 were revisited and a spatially balanced sample of 60 new plots selected using a generalized random-tessellation stratified (GRTS) design. We surveyed each sample plot once during May using a MD500E helicopter with a 2-person crew. We counted and classified all crane observations in each plot based on their social status (individuals, pairs, groups) and evidence of breeding status (e.g., nest, colts, territorial behavior).

We estimated that there were 4,469, 3,235, 1,952, 4,106, and 2,723 single and paired SACR in 2012-2016, respectively, in the area of Aspen Parklands and some adjacent areas within the Northwest Goose and Crane Zone (NWGCZ) that was consistently surveyed in all years. In 2016, conditions were dry at the beginning of the survey, but the area did receive some moisture during the survey and habitat conditions were generally good. Habitat conditions were dry in 2012 and wet by the end of the survey in 2013-2016. Habitat was very dry at the beginning of the survey in 2013 and 2015, but major precipitation events resulted in very wet conditions for the majority of the survey. We believe that wetland conditions, timing of the survey and arrival of nonbreeding cranes on the breeding grounds may influence the counts in some years.

INTRODUCTION

SACR in northwest Minnesota are part of the Mid-Continent Population (MCP), which is hunted in Canada and several Central Flyway states (Central Flyway Webless Migratory Bird Technical Committee 2006). In 2010, Minnesota began a hunting season on SACR in the NWGCZ (Figure 1). The majority of MCP SACR harvest in other states and provinces occurs on migration, staging, and wintering areas (Krapu et al. 2011); however, in northwestern Minnesota, harvest is comprised of locally-breeding cranes and likely migrant cranes from other MCP breeding areas. We previously reviewed the history and status of SACR and the hunting season (Lawrence et al. 2012). There were some indications that harvest of Minnesota-breeding SACR was greater than expected (Lawrence et al. 2011); thus, in 2012, we initiated a pilot survey of breeding SACR in northwestern Minnesota. The survey was designed to provide an estimate of the number of breeding cranes in northwest Minnesota that was within ±25% of the true population size with 90% certainty (i.e., if we could replicate the sample survey many times, 90% of the population estimates will be within ±25% of the true population size).

The breeding population size estimates obtained from this survey, combined with data on crane harvest, harvest derivation, and other parameters will allow us to better manage harvest of cranes in northwest Minnesota and may provide insights to hunting cranes in other portions of their breeding range. Here, we describe the survey sampling scheme used in 2012-2016, present population estimates for the 5 years, and discuss future survey plans.

STUDY AREA

In 2012, we selected the NWGCZ and portions of the Aspen Parklands ecological subsection that extended beyond the NWGCZ as our primary sampling frame (Figure 2). This included the Aspen Parklands ecological subsection, northwestern portions of the Red River Prairie subsection, and a small portion of the Agassiz Lowlands subsection.

Beginning in 2013, we reduced the size of the survey area to only include plots in the Aspen Parkland ECS subsection and the small area of Agassiz Lowland subsection that was within the NWGCZ. We did not survey any plots in the Red River Prairie ECS subsection because the likelihood of finding nesting cranes in this area was low (Lawrence et al. 2013).

METHODS

Sampling frame

We used ArcGIS 10.2 (Environmental Systems Research Institute, Redlands, CA) to develop an overlay grid of 4-km^2 plots for the northwestern Minnesota study area (Figure 2). The grid was rotated approximately 2.5 degrees to orient it with Public Land Survey (PLS) based features such as roads and property boundaries. We treated 4-km^2 plots as the primary sampling unit (PSU) and in 2012 excluded any PSUs not located entirely within the boundary of the SACR survey area (Figure 2). In 2012, we also non-randomly selected a 100-km^2 plot, approximately overlaying Espelie Township (EspTwp) in eastern Marshall County, based on previous crane work by DNR staff (S. Maxson, unpublished DNR files).

Beginning in 2013, we excluded the Red River Prairie survey area because first year results indicated that few breeding cranes used this area in May (Figure 3). We also included any PSUs on the border of the survey area where >50% of the plot was located within the boundary of the survey area rather than just PSUs that were located entirely within the survey area.

Sampling design

Details of sampling design for previous years are contained in previous reports (Lawrence et al. 2012, 2013, 2014, 2015). We used descriptions of crane nesting habitat in northwest Minnesota (DiMatteo 1991, Provost et al. 1992, Maxson et al. 2008) and National Land Cover Data (NLCD; Fry et al. 2011) to identify potential crane habitat. We used NLCD (30 m cell resolution) to quantify the amount (m^2) of potential SACR habitat in each 4-km^2 plot. We defined "SACR nesting habitat" as NLCD cover class 95 (emergent herbaceous wetland) and "other SACR habitat" as NLCD cover classes 11 (open water) and 90 (woody wetlands).

In 2012, we classified each 4-km2 plot into one of 4 categories:

- Stratum 1 (NLCD-1): > median amount of nesting habitat,
- Stratum 2 (NLCD-2): 0 < m2 of nesting habitat < median,
- Stratum 3 (NLCD-3): nesting habitat = 0 but other SACR habitat > 0, or
- Stratum 4 (NLCD-4): no SACR habitat.

We selected 60 plots from Stratum 1 and 2 combined and 30 plots from Stratum 3. We assumed that breeding SACR density in the NLCD4 stratum was very low (approaching zero) and did not sample Stratum 4. We also surveyed a 100 km^2 plot (25 plots) generally overlaying Espelie Township to better understand distribution of cranes within good nesting habitat.

In 2013 and 2014, we used the GRTS design to select 115 plots from all plots with potential crane habitat with no stratification (i.e. Strata 1, 2, and 3 combined). We also recalculated the 2012 estimates based upon the 2013 sample frame.

In 2015 and 2016, we modified the sampling design to provide a more powerful measure of change. Specifically, we employed a split-panel sampling design (Warren 1994, Urquhart and Kincaid 1999) that consisted of 69 "revisit" plots and 60 "new" plots (Figure 3). Revisit plots were originally selected and surveyed in 2012, and consisted of 58 stratum 1-2 plots, 6 stratum 3 plots, and 5 randomly-selected plots of the original 25 Espelie Township plots. The "new" plots were drawn from the remaining 2,884 stratum 1, 2, and 3 plots in the reduced sampling frame using a spatially balanced simple random sampling design. We treated the 2 panels as strata, with inclusion probabilities = 1 for plots in the revisit stratum, and used the GRTS design-based estimator (Kincaid and Olsen 2013) to compute sampling statistics and estimates of population size. We also used a mixed-model framework to generate model-assisted estimates of total, singles+pairs, and breeding SACR abundance during 2012 to 2016. We used plot counts as our response variable and, at least initially, a fixed temporal slope parameter (year–2011) and random effects for year (categorical) and observation unit (plot ID). We fit the model using the lme4 package (Bates et al. 2014) in R (R Core Team 2014). We weighted the predicted mean count for each stratum and year by stratum weights and multiplied by N (sampling frame size) to obtain model-assisted population estimates. In all cases, there was little evidence to support a temporal trend (fixed slope parameter); therefore, we refit the data with an intercept-only model. We computed approximate 90% CI for the model-assisted population estimates by bootstrapping the residuals (with replacement; B=500), adding them to the fitted values, refitting the model, and predicting stratified means and expanded population estimates. Plot occupancy for revisit plots was calculated using a mixed model that accounted for repeated measurements on the same plot over years.

Target population(s)

In all years, separating breeding and non-breeding components of the population was problematic. We recorded crane observations as singles, pairs, and groups. Groups of SACR likely contain mostly non-breeders (subadults, non-territorial adult birds, and, possibly, failed breeders), whereas the breeding status of singles and pairs is more difficult to determine (Hayes and Barzen 2006). Therefore, for the purposes of this survey, we classified crane observations as follows:

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

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

Survey procedures

The survey was conducted during early to mid-May, which is the peak incubation period for cranes in northwest Minnesota (DiMatteo 1991, Provost et al. 1992, Maxson et al. 2008). Plots were surveyed by a pilot and one observer with a OH-58 helicopter in 2012-2015 and a MD500E helicopter in 2016. Plots were surveyed 5-45 meters above ground level at 10-100 km/hr, depending upon the land cover. In 2016, we used DNRSurvey ver. 2.11, an ArcGIS add-in developed by Minnesota DNR Wildlife and MN.IT Services GIS staff (www.dnr.state.mn.us/mis/gis/DNRSurvey/DNRSurvey.html) to record crane locations (waypoints) and aid in survey logistics.

RESULTS

Survey effort

The 2016 survey was conducted on 8 days (5, 6, 9, 11, 12, 13, 16 and 17 May) during a 13-day period. Delays in the survey were due to weather and helicopter maintenance. We averaged 16 plots/day (range: 7-25). We started the survey early in May and the survey was completed prior to the late surveys in 2013 and 2015 (Figure 4). The survey team (DNR pilot Brad Maas and observer Jeff Lawrence) spent an average of 9 min surveying each plot (range: 3–20 min), similar to 2012 and 2015 and 2.5 minutes longer that in 2013-14 (Table 1).

Sampling statistics

We detected SACR on 55 (43%) of the 129 sample plots in 2016 compared to 32-50% in 2012-15 (Table 2). Cranes were observed on 40% of the 60 randomly-selected plots in 2016 compared to 58% in 2015. The average count per 'occupied' plot (>=1 SACR observed) was 6.4, higher than any previous year (Table 2). This was mostly due to 85 flocked birds observed on 1 plot. In 2016, we counted 241 SACR on sample plots, of which 39% were pairs, 17% were singles, and 44% were in groups (Table 3). We observed 6 groups on sample plots, which ranged in size from 3 to 85 birds. We saw relatively more grouped SACR in 2012, 2013, and 2016 (37-44% of cranes observed) than in 2014-2015 (15% and 13%, respectively; Table 3, Figure 5). The proportion of singles and pairs that exhibited evidence of being breeding birds was within the range of previous years (Table 3). In 2016 we detected 22 nests, similar to the 17-20 nests annually in 2012-2015.

Population estimates and distribution

The estimated total number of cranes in the survey area in 2016 was 7,536 (90% CI: 1,355-13,717). This is a minimum estimate because we did not adjust for detection probabilities (which are likely <1, at least for singles and pairs in dense cover). The estimate of total cranes in 2016 was the least precise of any year and the coefficient of variation was 50% due to large variability in the group estimate (mostly due to 1 group of 85 SACR). If our sample of singles and pairs exhibiting breeding behavior was representative, then the estimated total number of breeding SACR in the survey area in 2016 was 747 (90% CI: 440-1,054), which was similar to other years. The estimated mean annual rate of change for model-assisted estimates was -9%/yr for IBB (P = 0.14) and <-1%/yr for singles and pairs (P=0.98). A model-assisted analysis of the survey data suggested population estimates from 2014 were likely biased low (Figure 6).

A more powerful metric of change is a comparison of the 69 plots surveyed in 2012, 2015, and 2016 (i.e., revisit plots). The number of single cranes observed on these plots was similar in 2012 (n = 24), 2015 (24), and 2016 (25), but the number of pairs declined from 43 in 2012 to 22 and 27 in 2015 and 2016, respectively, and the number of birds in groups declined from 73 to 8 and 7. Plot occupancy was 53% (90% CI: 37-66), 39% (25-50), and 43% (31-55) in 2012, 2015, and 2016. Twenty-four percent of the 69 plots were occupied all 3 years, 26% were not occupied any of the years, and 33% and 16% were occupied 1 or 2 of the 3 years, respectively. Numbers of SACR on individual plots often changed between years but not in any consistent pattern (Figure 7). We observed 13, 8, and 15 active nests on these plots in 2012, 2015, and 2016; but also observed 3 pairs with colts and 7 pairs or singles that were recorded as suspected breeders in 2012. More pairs and birds in groups were observed on the revisit plots in 2012 than other years, but all the birds in groups and a portion of the pairs (63, 82, and 59% of pairs in 2012, 2015, and 2016, respectively) were either nonbreeders or failed breeders.

Habitat associations

The probability of observing >=1 SACR was positively associated with the amount of nesting cover in the plot (Figure 8).

DISCUSSION

Survey effort and design considerations

In 2016, conditions were relatively dry early in the survey, but then we had several days of rain. However, we did not observe the flooded basins and standing water in fields that was common in 2013 and 2015, 2 other years that started dry followed by May rains. Spring phenology has varied each year. In 2016, very warm conditions were recorded in March, but temperatures moderated in April and phenology was close to normal by May. We had record early spring phenology in 2012, very late phenology in 2013 and 2014, and closer to average phenology in 2015. We have tried to time the survey for peak crane nest incubation, but these annual changes have made this difficult. Timing of the SACR survey may be critical to getting consistent results.

Population estimate

The number of IBB and total cranes were higher (non-significant) in 2012 than other years, but there were no significant trends over the 5-year period. Linear trends are likely not good predictors when strongly influenced by a single high or low estimate at the beginning/end of a survey period. Some of the variability in estimates may be due to factors such as survey timing and habitat conditions. The number of breeders and unknown cranes (singles and pairs) ranged from 1,952 to approximately 4,469 during the 5 years of this survey. The model-assisted estimate suggests that the 2014 count was biased low, but additional years of data would be necessary to better understand this annual variation.

The most powerful measure of change was the number of cranes observed on same plots between 2012 and 2015-2016. Cranes have strong philopatry to their nesting territories (Krapu et al. 2011, Gerber et al. 2014), and we would expect similar numbers of IBB on the same plots if populations were stable. However, other factors influencing recruitment may influence the number of cranes seen on these plots. We recorded similar numbers of singles on these plots. Singles were either observed with a nest (16-21% of singles) or are assumed to have a nesting mate nearby that was either undetected on the plot or off plot. Pairs could be either breeding or nonbreeding. The number of pairs on revisit plots in 2015 (n=22) and 2016 (n=27) was 51-62% of the number in 2012 (n=43). We observed few pairs with nests (4 nests) in 2015; but, the number of pairs with nests or colts was similar in 2012 (11) and 2016 (11). Many of the pairs we observed had likely not started breeding yet, so they may be variable in return date to the breeding grounds. Cranes in groups have been included in our population estimates, yet the uneven distribution of groups makes them difficult to survey using the plot based design. We saw 73 cranes in groups on these 69 plots in 2012, yet only 7 or 8 in 2015-16. Given there were more cranes in groups on these plots in 2012, there may have been more nonbreeding pairs on the plots that year too. In addition to the inherent difficulty of counting clumped animals (groups) with a plot survey, our plot selection method was based on presence of presumed nesting habitat. Non-breeding cranes may use plots with only agricultural fields that were not included in the sample.

We report the total breeding population including groups, yet the breeding ground surveys conducted to date suggest that return dates or distribution of the nonbreeding component of the crane population may be highly variable. Similar variability in timing and distribution of sandhill cranes along the Platte River, Nebraska influenced the proportion of cranes available to be counted in the spring (Pearse et. al. 2015). Cranes in groups, some cranes in pairs, and likely a few singles would comprise the nonbreeding component of the population. We recommended that while the number of nonbreeding pairs returning in May maybe variable, the total number of cranes observed as singles and pairs should provide the most reliable measure of the crane population in Northwest Minnesota (Lawrence et al. 2015). However, the number of singles and pairs had greater variability that the model-based estimates of either IBB or total cranes and it may not be the most reliable metric.

We do not plan to conduct the crane survey in 2017. We had originally planned to conduct the survey for 3 years (2012-14), but extended the survey following the low counts in 2014. The helicopter survey was expensive to conduct and harvest of cranes in the NWGCZ has been low the past few years (range 247-407 in 2012-14). While we had a higher population estimate in 2012, the first year of the survey, generally populations have been stable the last 4 years. Ideally, a longer series of annual surveys would provide a better understanding of variability in the counts. However, we do not have comparable numbers prior to the opening of the SACR hunting season in 2010. The August roadside survey (e.g. Davros 2015) has variable counts and did not track results from the 2012-16 aerial survey (Figure 9) but may be used as a general guidance of sandhill crane status in NW Minnesota. A large decline in the August roadside index would indicate the need to repeat the helicopter survey. In addition, it may be prudent to repeat the helicopter survey in 3-5 years to ensure that the population in NW Minnesota remains at a level similar to the 2012-2016 surveys. This population size has been acceptable to hunters, wildlife watchers, and wildlife managers that value cranes in this portion of Minnesota.

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Table 1. Survey effort for an aerial survey of sandhill cranes in Minnesota, May 2012-2016.

			Survey Duration						
			Start	End	Calendar	Survey	Total	Plots/	Minutes/
Year	Design[a]	*n* plots	date	date	days	days	flight hrs	day	plot
2012	GRTS-ST3	115	7-May	15-May	9	7	30	16.3	9.8
2013	GRTS-SRS	115	17-May	23-May	7	3	23	38.0	6.7
2014	GRTS-SRS	115	9-May	16-May	8	4	26	28.8	6.7
2015	SP12-GRTS	129	5-May	21-May	17	5	34	25.8	8.7
2016	SP12-GRTS	129	5-May	17-May	13	8	37	16.1	9.2

[a]-GRTS-ST3: generalized random-tessellation stratified with 3 strata; GRST-SRS: generalized random-tessellation stratified, simple random sample, SP12-GRTS: repeat 2012 Aspen Parkland plots, generalized random-tessellatior stratified, simple random sample for remainder of plots

Table 2. Sampling statistics[a] for an aerial survey of sandhill cranes in northwestern Minnesota, May 2012-2016.

								Counts/occupied plot				
		Sampling										
Year	Strata	allocation[b]	n	N	srate	n.occ	p.occ	min	max	med	mean	SE
2012	3	OPT	115	3,160	0.036	51	0.47	1	43	2	4.9	1.27
2013	1	SRS	115	2,953	0.039	49	0.43	1	46	3	4.4	1.06
2014	1	SRS	115	2,953	0.039	37	0.32	1	10	2	2.4	0.31
2015	2	SP-SRS	129	2,953	0.044	64	0.50	1	14	2	2.8	0.45
2016	2	SP-SRS	129	2,953	0.044	55	0.43	1	94	2	6.4	3.74

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

[b]OPT = Optimal, SRS = simple random sample, SP-SRS=Split plot-simple random sample.

Table 3. Social and breeding classification of sandhill crane observations, 2012-2016.

Social Class[a]	*n* by year					Proportion by year					Proportion of singles of pairs				
	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016
Pairs (x2)	114	92	38	104	94	0.48	0.43	0.43	0.59	0.39					
Breeding birds	50	28	12	24	32	0.21	0.13	0.14	0.14	0.13	0.44	0.30	0.32	0.23	0.34
Status unknown	64	64	26	80	62	0.27	0.3	0.29	0.46	0.26	0.56	0.70	0.68	0.77	0.66
Singles	37	34	38	48	40	0.15	0.16	0.43	0.27	0.17					
Breeding birds	8	9	11	10	9	0.03	0.04	0.12	0.06	0.04	0.22	0.26	0.29	0.21	0.23
Status unknown	29	25	27	38	31	0.12	0.12	0.3	0.22	0.13	0.78	0.74	0.71	0.79	0.78
Groups	89	90	13	23	107	0.37	0.42	0.15	0.13	0.44					
Total	240	216	89	175	241										

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

Table 4. Population estimates (N) by indicated breeding status for sandhill cranes in northwestern Minnesota, May 2012-2016.

Year		Status[b]	Plots surveyed	Total plots	n plots with cranes	Minimum cranes/plot	Maximum cranes/plot	Avg. birds/plot	SE birds/plot	$\hat{N}$	SE	LCB (90%)	UCB (90%)	CV %
2012	With Red River Valley	Breeding birds	115	3,160	28	1	4	0.5	0.08	1,447	264	1,014	1,881	18
		Status unknown	115	3,160	40	1	6	0.9	0.13	2,751	415	2,069	3,433	15
		Singles + Pairs	115	3,160	50	1	8	1.3	0.18	4,198	556	3,283	5,113	13
		Groups	115	3,160	9	3	37	1	0.49	3,013	1,545	472	5,554	51
		Total	115	3,160	51	1	43	2.3	0.58	7,211	1,818	4,220	10,202	25
2012[a]	Without Red River Valley	Breeding birds		2,953						1,416	268	975	1,857	19
		Status unknown		2,953						2,749	424	2,052	3,446	15
		Singles + Pairs		2,953						4,469	590	3,499	5,439	13
		Groups		2,953						3,100	1,606	458	5,742	52
		Total		2,953						7,264	1,885	4,163	10,365	26
2013	Without Red River Valley	Breeding birds	115	2,953	22	1	2	0.3	0.05	950	158	691	1,210	17
		Status unknown	115	2,953	36	1	6	0.8	0.11	2,285	318	1,763	2,808	14
		Singles + Pairs	115	2,953	48	1	7	1.1	0.12	3,235	363	2,639	3,832	11
		Groups	115	2,953	6	3	43	0.8	0.38	2,311	1,122	466	4,157	49
		Total	115	2,953	49	1	46	1.9	0.4	5,547	1,194	3,582	7,511	22
2014	Without Red River Valley	Breeding birds	115	2,953	15	1	4	0.2	0.05	591	135	368	813	23
		Status unknown	115	2,953	26	1	9	0.5	0.09	1,361	276	907	1,815	20
		Singles + Pairs	115	2,953	36	1	10	0.7	0.11	1,952	314	1,435	2,469	16
		Groups	115	2,953	3	3	6	0.1	0.05	334	162	68	600	49
		Total	115	2,953	37	1	10	0.8	0.12	2,285	346	1,716	2,855	15
2015	Without Red River Valley	Breeding birds	129	2,953	21	1	3	0.4	0.08	1,069	240	674	1,465	22
		Status unknown	129	2,953	52	1	9	1	0.16	3,036	481	2,245	3,827	16
		Singles + Pairs	129	2,953	63	1	11	1.4	0.2	4,106	597	3,124	5,087	15
		Groups	129	2,953	5	3	8	0.2	0.13	729	398	75	1,383	55
		Total	129	2,953	64	1	14	1.6	0.27	4,835	801	3,516	6,153	17
2016	Without Red River Valley	Breeding birds	129	2,953	22	1	5	0.3	0.06	747	186	440	1,054	25
		Status unknown	129	2,953	41	1	9	0.7	0.15	1,976	430	1,269	2,682	22
		Singles + Pairs	129	2,953	54	1	9	0.9	0.92	2,723	496	1,907	3,538	18
		Groups	129	2,953	6	3	85	1.6	1.16	4,814	3,436	107	10,466	71
		Total	129	2,953	55	1	94	2.6	1.27	7,536	3,758	1,355	13,717	50

[a] 2012 data adjusted to reflect 2013-14 sampling frame.

[b] Breeding birds = singles and pairs (x2) with a nest or young, or exhibiting some type of breeding or territorial behavior; Status unknown=Singles and pairs (x2) without a nest or young, and no behavioral evidence that they were breeding birds; Singles+Pairs=breeding birds+Status unknown.

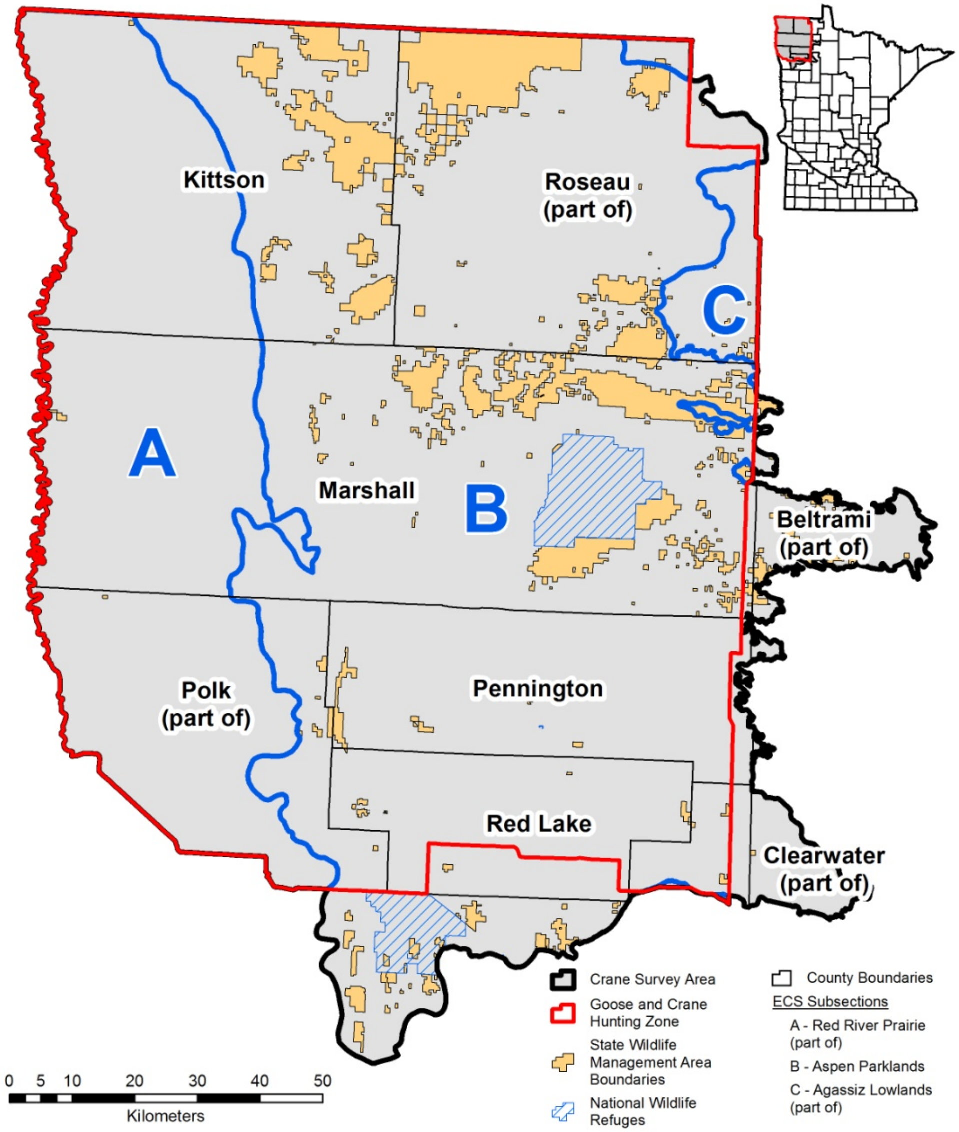

Figure 1 Location of the Northwest Goose and Sandhill Crane Hunting Zone in Minnesota and the sandhill crane survey area. ECS subsection A (portion of Red River Prairie) was surveyed in 2012 but not in 2013-2015.

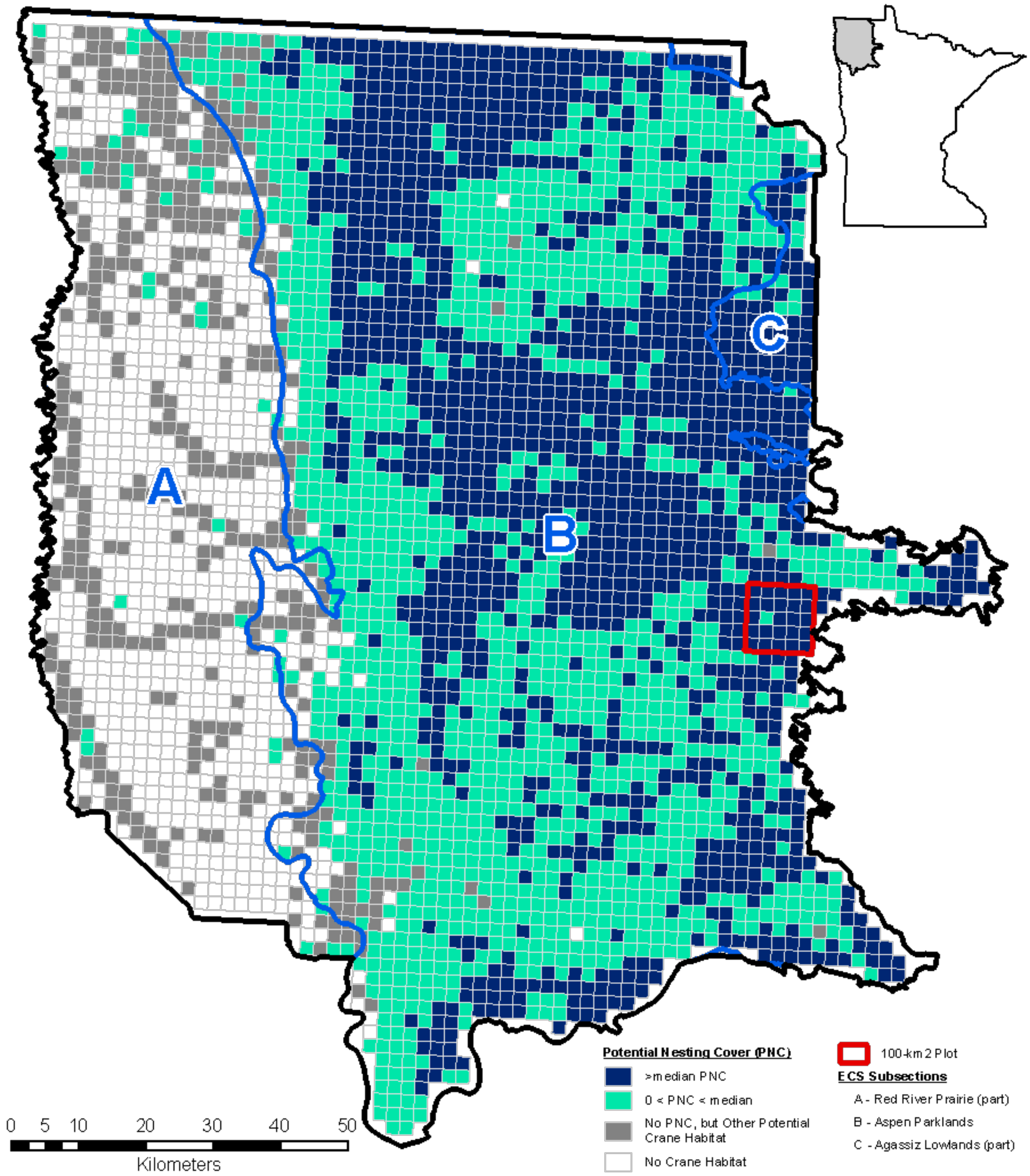

Figure 2. Sampling frame for the spring aerial survey of sandhill cranes, northwestern Minnesota. The primary sampling unit was 4-km^2 plots. Colored squares denote plots by strata as defined by National Land Cover Data: dark blue = NLCD-1 (>median amount of potential crane nesting cover [PNC]), turquoise = NLCD-2 (0 < potential nesting cover < median), gray = NLCD-3 (no nesting cover but other potential crane cover), white = NLCD-4 (no crane habitat). Black lines denote the boundaries of the survey area and blue lines note boundaries of ecological subsections. In 2012, we selected plots from strata 1-3 in the 3 subsections above (see text). After 2012, we excluded plots in the Red River Prairie ECS subsection (A above) and did not survey the 100-km^2 plot. Also, note there were additional plots on the edge of the survey area after 2012.

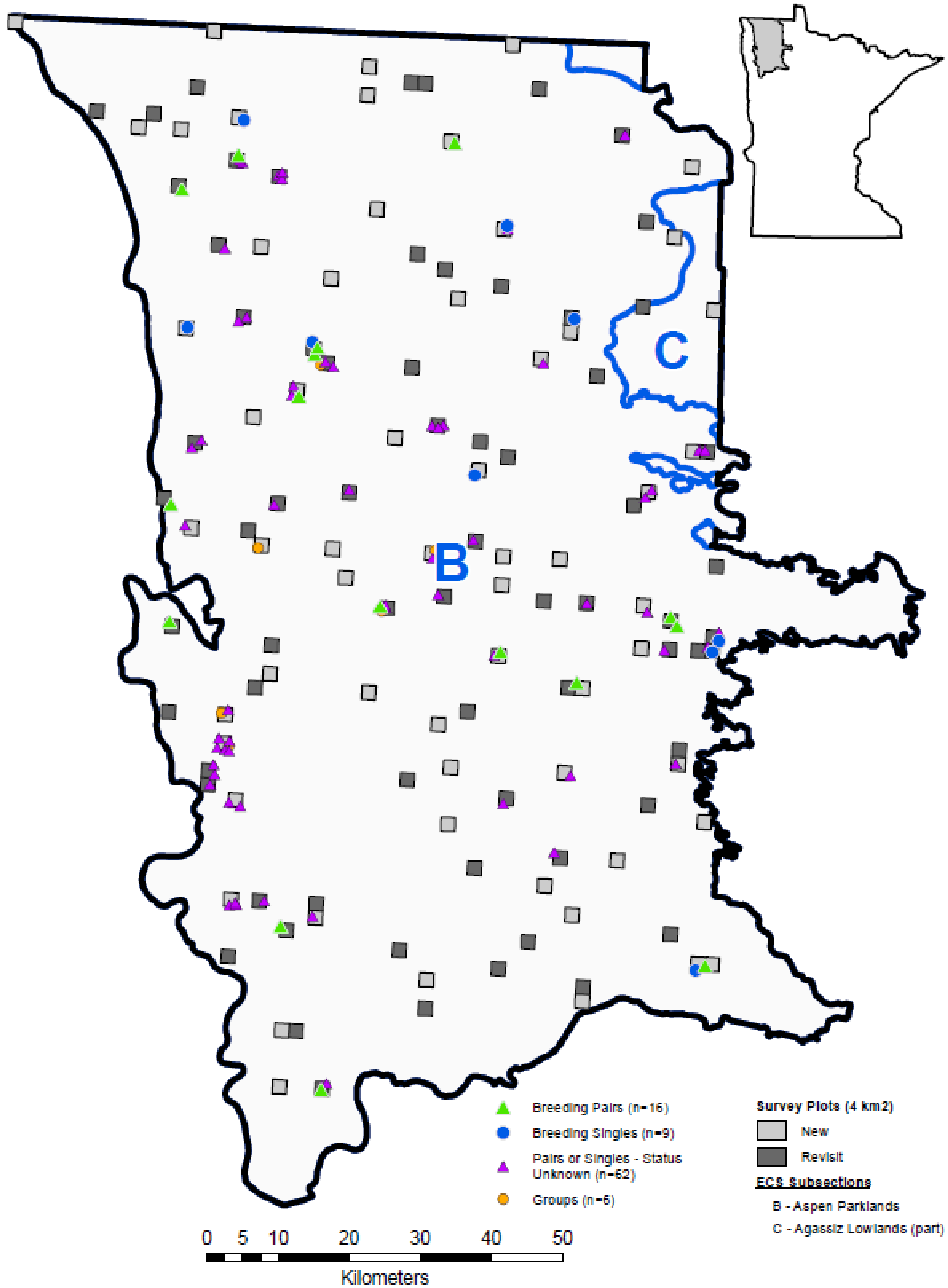

Figure 3. Distribution of sample plots (n = 129) and sandhill crane observations by type in the 2016 MNDNR spring aerial survey, northwestern Minnesota. Each sample plot was 4 km2 and the SACR survey area was 11,812 km2.

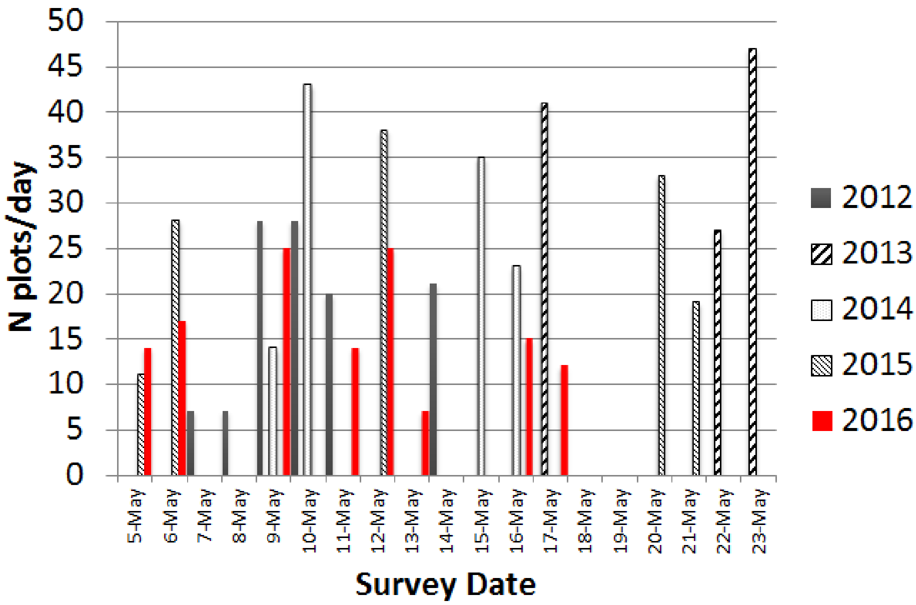

Figure 4. Number of plots surveyed by calendar date during the Northwestern Minnesota Sandhill Crane breeding population survey, 2012-2016. 115 plots were flown each year from 2012 to 2014 and 129 were flown in 2015 and 2016.

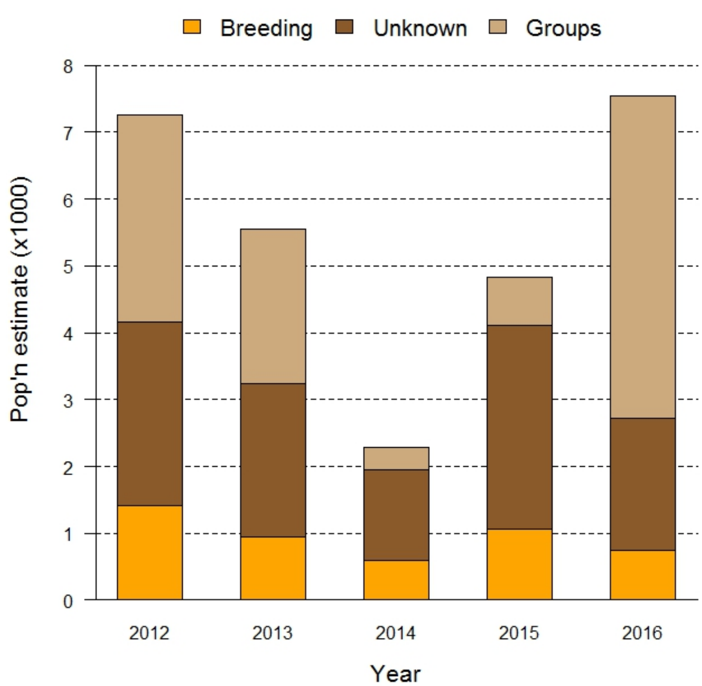

Figure 5. Number of cranes by social grouping in the Aspen Parklands survey area of northwestern Minnesota, 2012-2016.

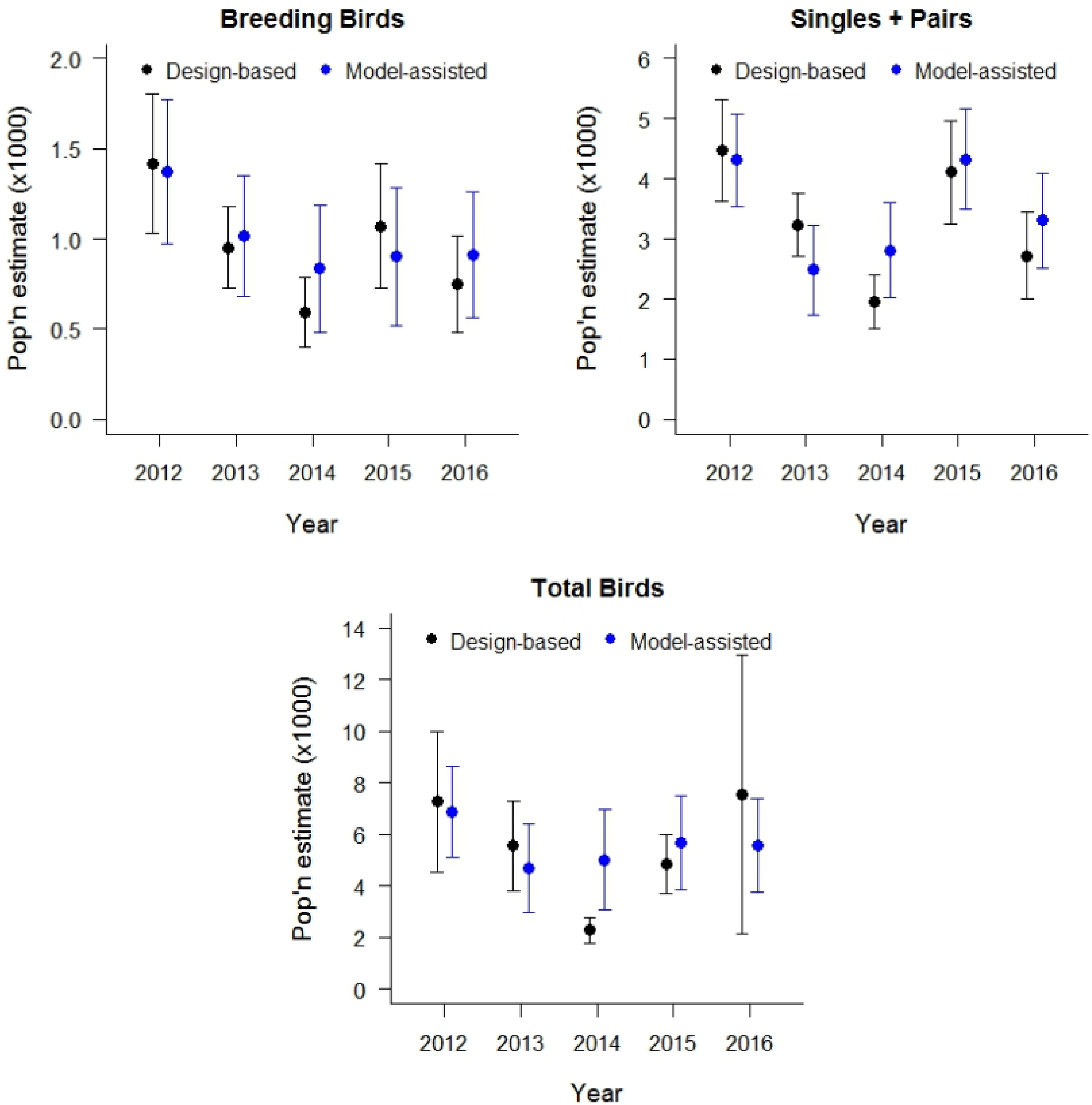

Figure 6. Design-based and model-assisted estimates of breeding sandhill cranes (SACR) and total breeding ground population in the Aspen Parklands survey area of northwestern Minnesota, 2012-2016. See text for explanation of the methods.

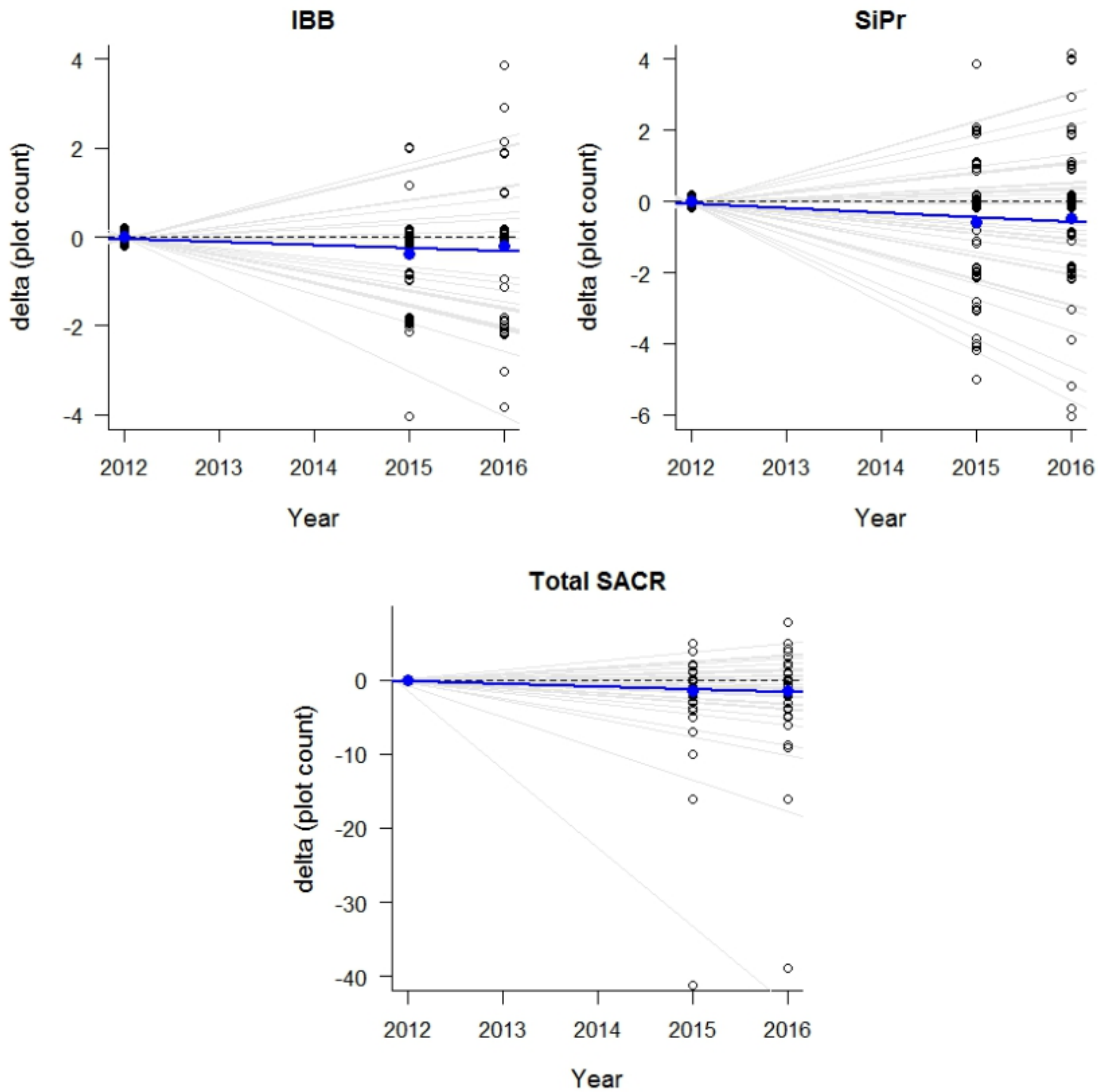

Figure 7. Change in plot counts on individual plots for Indicated Breeding Birds (IBB), singles and pairs (SiPr), and Total SACR in the Aspen Parklands survey area of northwestern Minnesota, 2012, 2015, and 2016. The blue lines denote mean relative population-level changes in plot counts (from 2012), whereas gray lines denote plot-level changes.

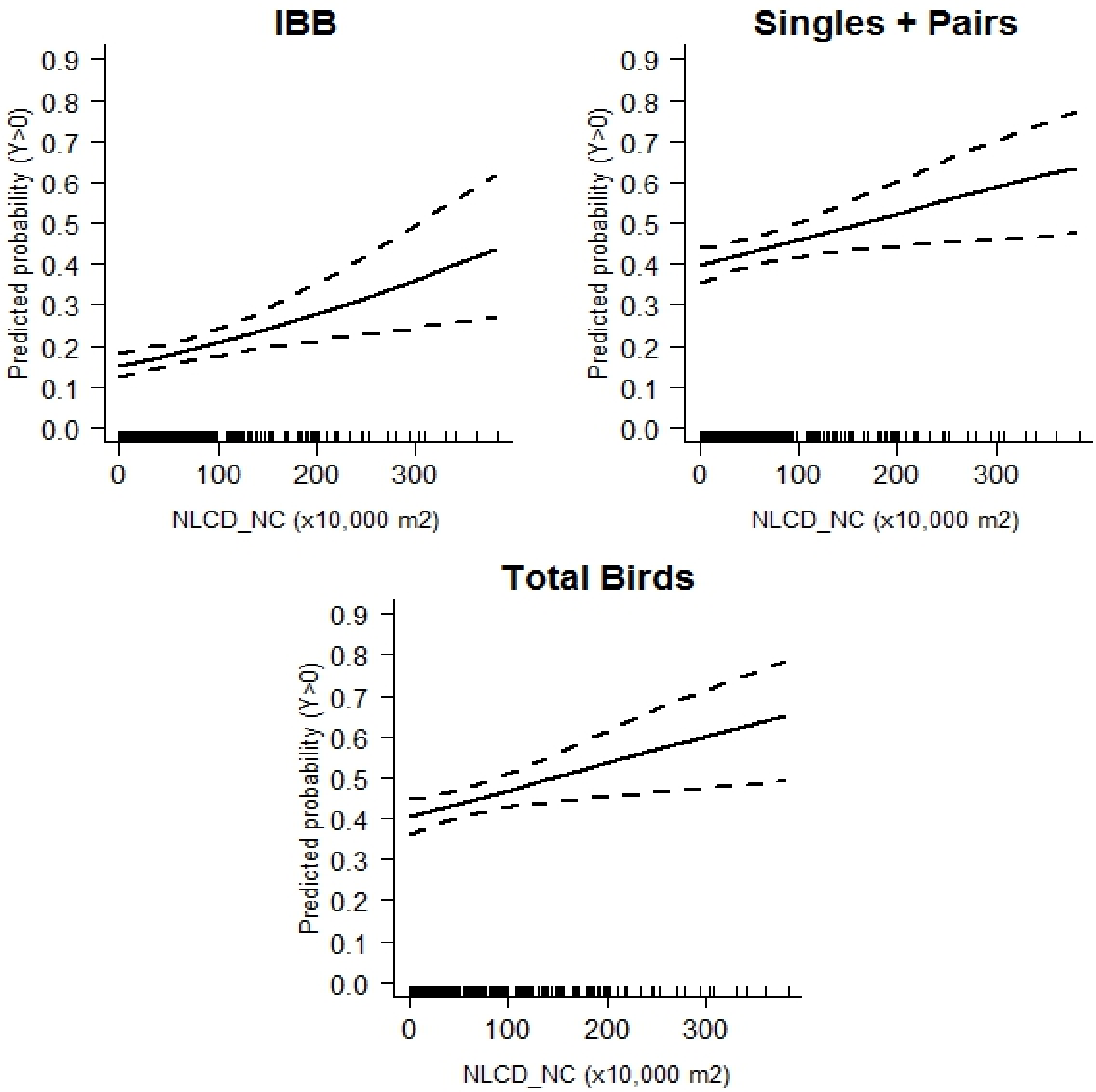

Figure 8. Relationship between sandhill crane occurrence (Indicated Breeding Birds [IBB], total singles and pairs, and total SACR) and habitat abundance (as defined by NLCD classification schemes [see text]) based on 578 4-km2 plots surveyed in northwest Minnesota, 2102-2016.

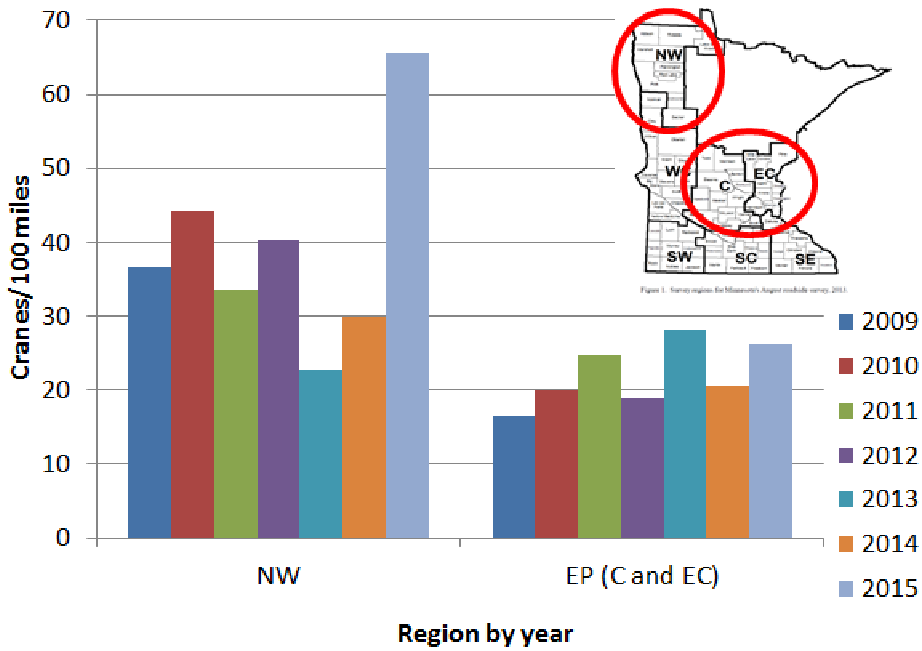

Figure 9. Number of sandhill cranes observed per 100 miles driven in northwest and Eastern Population (central and east-central regions combined), August roadside survey, 2009-2015 (data from 2009-2015 Minnesota August Roadside survey reports, in Status of wildlife population reports, Fall 2009-2015, Division of Fish and Wildlife, Minnesota Department of Natural Resources).

HUNTING HARVEST STATISTICS

Division of Fish and Wildlife
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2015 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 2015-16 small game hunting season (N=258,216). A stratified random sample (n=7,000, 2.7%), 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= 251,453) and “Nonresident” (N= 6,763) (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 2015-16 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. 3.1.2 (2014-10-31); R Development Core Team [RDCT] 2014).

RESULTS

Of the 7,000 mailed surveys, 174 surveys were undeliverable; 3,485 surveys were returned for an adjusted response rate of 51%. Summaries of the top four small game species (ducks- all species, Canada geese, pheasants, and ruffed grouse) harvested in Minnesota are shown in Figure 3. License sales were fairly similar to the previous year (Fig. 2, Table 5). Estimated number of hunters increased slightly for woodcock and pheasant but declined for most other species (Table 2). Estimated harvest per active hunter (Table 3) remained relatively stable for all 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 showed an increase to 243,176 birds, similar to 2012 levels. Ruffed grouse harvest decreased from 301,190 in 2014 to 267,997 in 2015. Duck harvest declined from 699,620 in 2014 to 663,811 in 2015 with hunters taking 8.7 ducks/active hunter compared to 9.3 in 2014. Canada goose harvest continued its downward slide to an estimated 185,012 birds harvested. Although nonresident license sales increased, the number of non-resident duck and goose hunters declined last year (Table 6). However, the harvests for ducks, grouse and pheasants were up. Once again, no nonresident hunters reported hunting or harvesting raccoons.

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

Figure 1. Sample of Small Game Hunter survey card.

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 2015-2016 small game hunting season **(March 2015-February 2016).** We need information to estimate the season's harvest and to help set future small game seasons. Answer only for your Minnesota 2015 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

2015 Small Game Hunter Report

1. Did you hunt small game, listed below, in Minnesota this year (March 2015 - Feb 2016)? ☐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. Number of Minnesota small game licenses sold and usable returned surveys, 1998-2015. Includes resident and non-resident licenses, and excludes duplicate and free licenses.

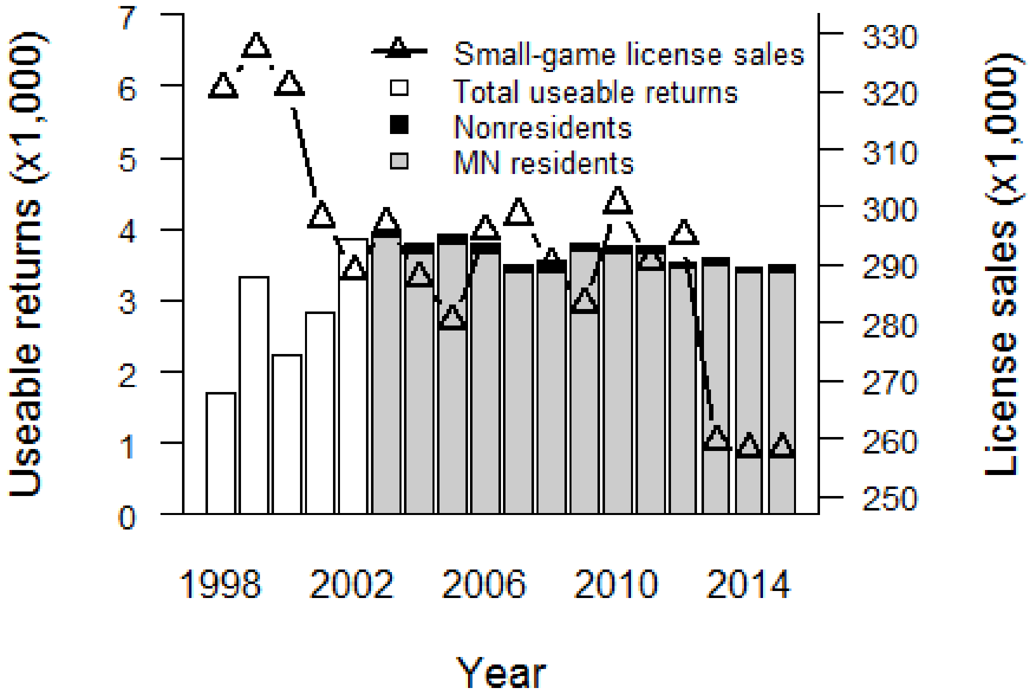

Figure 2. Summary of top four small game species harvested in Minnesota, 2002-2015.

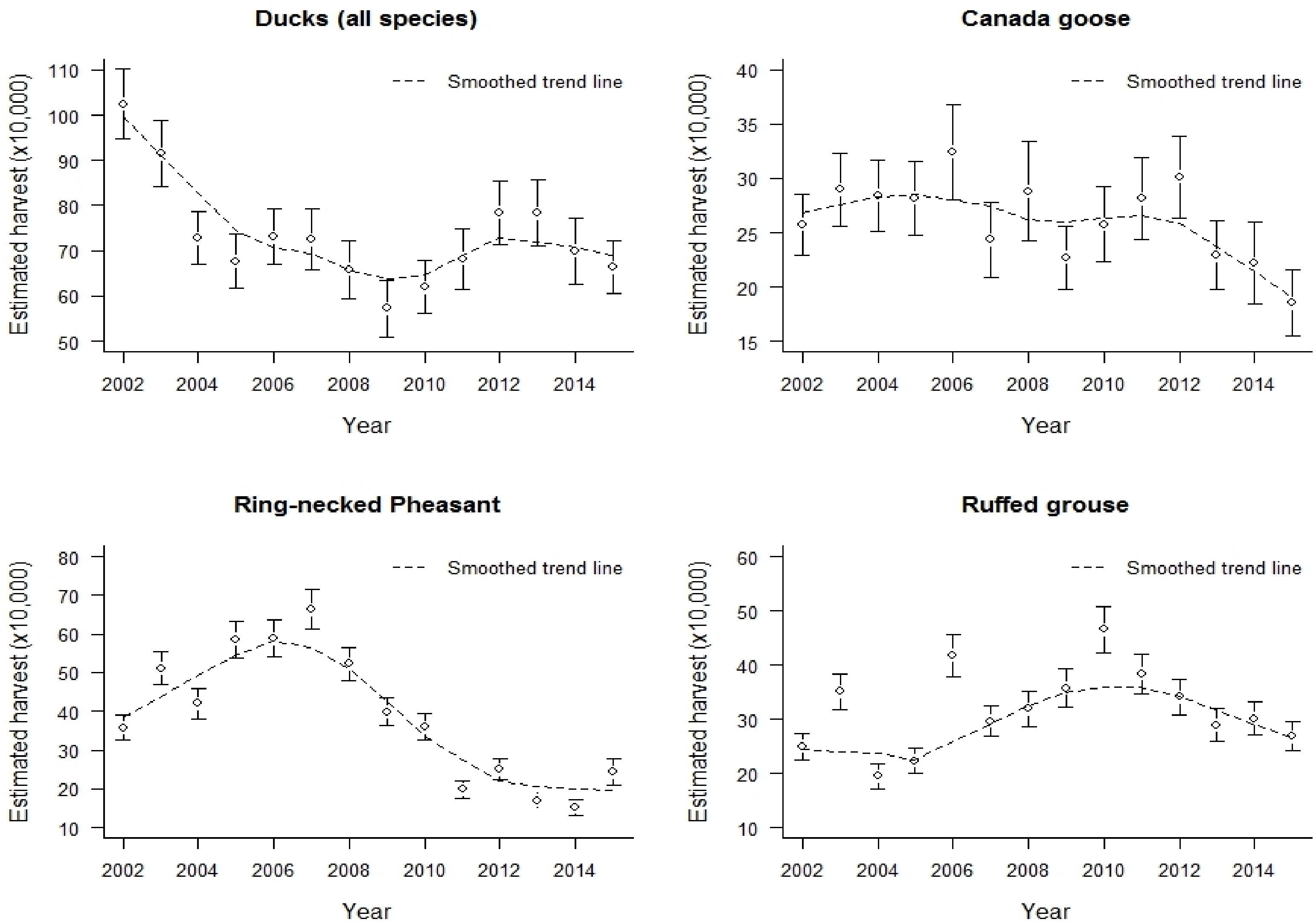

Table 1. Percent of respondents who hunted small game, 2005-06 through 2015-2016 [a].

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

[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, 2005-06 through 2015-16.

	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12[β]	2012-13[β]	2013-14	2014-15	2015-16
Ducks	92,634	87,075	87,468	81,358	77,480	72,770	76,090	80,770	76,950	75,170	76,243
Canada goose	69,416	66,224	62,649	59,222	55,520	53,430	57,220	58,900	51,160	48,240	45,938
Other geese	4,628	4,529	3,695	4,411	3,280	3,650	2,710	3,830	2,810	2,770	2,520
American coot	4,129	4,529	3,454	4,166	4,090	4,610	3,480	3,990	3,820	4,410	3,261
Common snipe	1,210	2,187	1,928	1,797	1,340	1,340	1,160	1,160	1,370	820	667
Rails / gallinules	0	547	482	408	370	220	230	500	140	300	445
Crow [*]	11,890	10,777	8,514	10,047	10,640	9,380	10,360	11,480	8,570	7,400	7,410
American woodcock	11,035	13,510	10,843	12,171	11,760	10,790	9,430	13,310	12,030	9,650	12,596
Mourning dove [γ]	11,107	12,886	13,172	11,599	10,500	10,640	8,970	9,230	10,380	9,950	8,966
Ring-necked pheasant	110,852	118,703	118,311	106,763	99,440	89,140	72,840	76,950	62,110	57,590	63,350
Ruffed grouse	76,037	91,682	90,600	86,505	87,230	92,490	88,620	91,260	81,130	83,020	79,058
Spruce grouse	7,048	9,840	10,602	8,332	9,750	8,860	10,210	7,400	10,810	10,320	8,225
Sharp-tailed grouse	4,913	6,560	6,827	6,616	5,510	7,140	6,190	6,570	6,700	5,460	5,113
Gray partridge	6,265	6,013	6,667	4,411	4,240	3,720	2,400	3,080	2,450	2,540	2,075
Gray squirrel	24,563	25,459	25,863	22,382	22,260	23,740	23,280	24,710	21,690	21,240	22,303
Fox squirrel	15,094	15,619	14,779	13,233	13,180	15,630	12,060	14,220	12,030	12,790	13,411
Eastern cottontail	20,148	20,070	19,598	17,644	16,300	15,030	12,300	16,390	14,550	13,160	11,633
White-tailed jackrabbit	2,065	2,577	2,891	2,451	1,790	2,230	2,320	1,750	1,220	1,350	890
Snowshoe hare	3,346	5,545	4,257	4,574	3,500	3,800	3,250	4,820	3,750	4,560	4,076
Raccoon (Sept - Feb)	4,841	8,747	9,558	7,433	7,300	8,260	8,040	8,570	7,640	6,880	5,632
Raccoon[‡] (March -Aug)	2,705										
Red fox (Sept -Feb)	5,980	6,248	5,783	5,800	7,820	7,220	6,030	5,820	5,910	4,560	4,150
Red fox[‡] (March -Aug)	1,282										
Gray fox	997	2,030	1,928	1,879	1,790	1,640	1,390	1,580	1,730	1,050	1,186
Coyote	18,653	17,024	16,064	19,278	19,280	19,420	17,940	21,050	17,650	17,580	18,302
Badger	783	859	482	490	370	600	310	330	500	80	297

[*]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.

Table 3. Estimated harvest per active hunter by species, 2005-06 through 2015-16.

	Estimated harvest per hunter										
	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12[β]	2012-13[β]	2013-14	2014-15	2015-16
Ducks	7.3	8.4	8.1	8.1	7.4	8.5	9.0	9.7	10.2	9.3	8.7
Canada geese	4.1	4.9	3.9	4.9	4.1	4.8	4.9	5.1	4.5	4.6	4.0
Other geese	1.9	1.5	2.1	3.2	1.9	1.1	1.8	2.3	2.5	2.4	1.8
American coot	3.9	5.6	4.6	5.7	3.6	5.7	3.0	4.2	4.0	3.9	4.9
Common snipe	4.4	1.9	2.0	1.2	1.1	1.4	1.2	1.2	1.7	0.6	0.3
Rails/gallinules	0	2.4	5.3	0.4	0.8	0.3	1.7	0.2	0.5	0.2	2.3
Crow*	7.8	6.4	6.4	5.2	5.3	6.1	7.9	7.9	7.9	7.6	7.8
American woodcock	2.5	3.2	2.6	2.4	3.0	2.8	2.6	2.3	2.7	2.7	3.0
Mourning dove[γ]	7	6.7	7.7	11.4	10.5	9.4	8.2	10.0	7.8	10.4	10.8
Ring-necked pheasant	5.3	4.9	5.5	4.9	4.0	4.0	2.7	3.3	2.7	2.7	3.8
Ruffed grouse	2.9	4.5	3.2	3.7	4.1	5.0	4.3	3.7	3.6	3.6	3.4
Spruce grouse	1.4	2.7	1.7	2.0	2.0	1.7	1.8	1.6	1.2	1.4	1.2
Sharp-tailed grouse	1.3	1.8	2.0	2.1	1.7	2.4	1.9	1.6	1.1	1.6	1.6
Gray partridge	2.6	1.9	1.6	2.2	1.9	2.5	1.6	1.7	1.0	1.4	1.5
Gray squirrel	5.0	5.5	5.2	5.4	4.9	5.9	5.0	5.1	3.9	4.3	4.3
Fox squirrel	4.1	4.2	3.2	3.9	4.1	3.9	4.0	3.5	2.8	3.2	3.5
Eastern cottontail	4.5	3.9	4.0	4.5	3.5	3.6	2.8	3.9	2.8	2.9	3.6
White-tailed jackrabbit	2.7	1.6	3.3	2.6	1.5	3.2	2.2	1.1	1.5	0.8	0.8
Snowshoe hare	3.1	3.0	1.4	2.5	1.5	1.8	2.6	3.5	1.7	1.7	1.6
Raccoon (Sept - Feb)	6.0	7.2	4.9	9.7	9.1	9.4	5.5	5.6	6.1	7.7	6.8
Raccoon[‡] (March -Aug)	2.7										
Red fox (Sept -Feb)	1.7	1.3	1.1	0.8	1.3	1.2	1.2	1.4	0.9	0.7	0.9
Red fox[‡] (March -Aug)	0.9										
Gray fox	0.9	1.8	0.3	1.3	1.0	1.5	0.8	0.2	0.2	0.6	0.7
Coyote	2.1	1.2	2.1	2.4	2.4	2.3	1.9	2.5	1.3	1.0	1.9
Badger	1.2	1.3	0.3	1.0	2.0	1.0	0.8	1.0	0.6	1.0	0.5

[*]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.

Table 4. Mean harvest for successful hunters and hunter success rates (%), 2005-06 through 2015-16.

	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12 $^{\beta}$	2012-13 $^{\beta}$	2013-14	2014-15	2015-16
Ducks	8.9 (83)	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)
Canada geese	5.5 (74)	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)
Other geese	4.5 (43)	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)
American coot	5.1 (76)	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)
Common snipe	4.7 (94)	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)
Rails / gallinules	0.0 (0)*	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)
Crow	9.1 (86)	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)
American woodcock	3.6 (70)	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)
Mourning dove $^{\gamma}$	8.7 (80)	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)
Ring-necked pheasant	7.0 (76)	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)
Ruffed grouse	4.4 (68)	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)
Spruce grouse	2.4 (61)	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)
Sharp-tailed grouse	2.4 (55)	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)
Gray partridge	5.0 (52)	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)
Gray squirrel	5.8 (86)	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)
Fox squirrel	5.0 (83)	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)
Eastern cottontail	5.4 (83)	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)
White-tailed jackrabbit	3.2 (83)	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)
Snowshoe hare	4.6 (68)	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)
Raccoon (Sept -Feb)	6.5 (93)	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)
Raccoon‡ (March -Aug)	3.1 (87)										
Red fox (Sept -Feb)	3.7 (46)	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)
Red fox‡ (March -Aug)	1.6 (56)										
Gray fox	1.9 (50)	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)
Coyote	4.1 (50)	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)
Badger	1.2 (100)	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)

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

$^{\beta}$ Estimates from these years were recomputed without license type 99- free youth license to be consistent with other years of data.

Table 5. Statewide (resident and non-resident) small game hunting license sales and estimated hunter harvest, 2005-06 through 2015-16.

	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12 [β]	2012-13 [β]	2013-14	2014-15	2015-16
Small game license sales[a]	280,156	295,898	298,467	290,064	282,983	282,227	271,768	264,063	258,581	258,109	258,208
State duck stamp sales	102,143	101,792	100,134	95,675	89,942	88,069	89,681	90,052	93,412	94,265	92,176
Pheasant stamp sales	117,301	129,546	129,315	123,270	110,456	104,286	86,868	90,541	77,597	74,295	77,750
Estimated harvest [b]											
Ducks	676,741	730,559	708,491	658,186	572,220	619,600	681,550	784,360	782,810	699,620	663,811
Canada geese	281,829	324,498	243,705	288,411	227,160	257,530	281,630	301,550	229,120	221,620	185,012
Other geese	9,025	6,658	7,723	13,895	6,250	3,940	4,800	8,820	7,130	6,510	4,448
American coot	15,938	24,909	16,061	23,871	14,810	26,340	10,520	16,720	15,130	17,050	15,861
Common snipe	5,336	4,221	3,933	2,210	1,490	1,940	1,390	1,420	2,310	520	223
Rails / gallinules	0	1,329	2,569	163	300	80	390	80	70	80	1,039
Crow	92,742	69,188	54,319	51,742	56,350	57,300	81,500	90,260	67,440	56,020	57,576
American woodcock	27,919	39,907	27,866	29,210	35,430	29,770	24,980	30,360	31,920	25,810	37,270
Mourning dove [d]	77,749	85,950	101,161	132,577	109,940	100,230	74,000	92,760	80,480	103,370	96,552
Ring-necked pheasant	585,299	587,580	655,443	522,071	398,130	359,400	198,500	250,140	169,100	152,800	243,176
Ruffed grouse	224,309	417,153	293,544	318,338	357,420	465,580	383,150	341,320	288,410	301,190	267,997
Spruce grouse	10,079	26,568	17,705	16,997	19,130	14,960	18,640	11,980	13,110	14,590	9,856
Sharp-tailed grouse	6,387	11,939	13,790	13,695	9,530	16,820	11,600	10,650	7,130	8,530	7,929
Gray partridge	16,289	11,545	11,000	9,660	8,040	9,150	3,950	5,160	2,380	3,590	3,187
Gray squirrel	122,078	140,788	133,194	121,534	109,790	138,920	115,840	126,110	84,010	91,250	96,400
Fox squirrel	62,187	66,068	47,736	51,079	53,970	61,690	48,100	49,750	33,940	40,840	46,383
Eastern cottontail	90,062	77,872	78,588	79,927	57,760	53,870	34,640	64,140	40,710	38,820	41,716
White-tailed jack rabbit	5,493	4,149	9,482	6,446	2,610	7,220	5,180	1,910	1,870	1,050	742
Snowshoe hare	10,406	16,801	5,789	11,343	5,360	6,770	8,430	16,800	6,200	7,860	6,374
Raccoon (Sept -Feb)	29,191	62,891	46,739	72,026	66,700	77,690	44,080	48,340	46,690	52,800	38,387
Raccoon [c] (Mar –Aug)	7,331										
Red fox (Sept –Feb)	10,166	7,872	6,188	4,408	10,270	8,780	7,120	7,990	5,190	3,220	3,780
Red fox [c] (Mar –Aug)	1,141										
Gray fox	927	3,593	559	2,443	1,860	2,380	1,160	250	430	600	816
Coyote	38,612	20,769	34,377	45,689	46,070	44,050	33,410	51,990	23,630	17,430	35,123
Badger	924	1,091	159	490	750	600	230	330	290	80	149

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.

Table 6. Mail survey results of nonresident small game hunters, 2005-06 through 2015-16.

	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Nonresident licenses issued [a]	5,897	7,356	7,858	7,114	6,934	6,695	6,312	6,456	6,031	6,056	6,755
Questionnaires:											
Number mailed	210	185	185	226	196	163	169	166	162	165	169
Number not delivered	10	11	11	15	10	6	11	11	10	12	5
Number (percent) returned	134 (67)	115 (62)	101 (58)	89 (42)	105 (54)	107 (66)	91 (54)	71 (43)	81 (50)	70 (42)	73 (43)
Estimated nonresidents and (percent) of all licensed nonresidents hunting:											
Ducks	2,040 (35)	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)
Canada goose	1,818 (31)	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)
Ruffed grouse	1,774 (30)	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)
Ring-necked pheasant	2,572 (44)	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)
Raccoon [b, c]	44 (0.7)	0 (0)	78 (1.0)	0 (0)	0 (0)	63 (0.9)	0 (0)	0 (0)	80 (1.2)	0 (0)	0 (0)
Estimated nonresident take:											
Ducks	12,149	12,173	22,718	15,463	11,755	17,055	13,840	20,380	20,410	13,060	16,863
Canada goose	3,946	3,580	3,501	5,762	3,698	6,334	4,050	2,270	3,650	2,680	1,484
Ruffed grouse	6,429	11,522	7,236	6,938	8,651	12,600	8,980	10,090	4,990	9,090	13,805
Ring-necked pheasant	13,656	16,079	17,661	10,642	6,274	8,076	4,860	6,820	3,430	3,720	6,581
Raccoon [b, c]	887	0	3,268	0	0	593	0	0	1,280	0	0

[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 2014 - 2015 and 2015-16 hunting seasons. U.S. Fish and Wildlife Service, Laurel, Maryland, U.S.A. The entire report is available on-line at http://www.fws.gov/migratorybirds/pdf/surveys-and-data/HarvestSurveys/MigratoryBirdHuntingActivityandHarvestforthe2014-15and2015-16HuntingSeasons.pdf

Table 1. Species composition of the Minnesota waterfowl harvest, 2014 and 2015. (from: Raftovich, R.V., S.C. Chandler, and K.A. Wilkins. 2016. Migratory Bird Hunting activity and harvest during the 2014-15 and 2015-16 hunting seasons. U.S. Fish and Wildlife Service, Laurel, Maryland. USA July 2016. 63 pp).

	Minnesota Harvest					Mississippi Flyway Harvest		
Species	2014	% of Harvest	2015	% of Harvest	Percent change in Harvest 14-15	2014	2015	Percent change Harvest 14-15
Mallard	161,859	28.33	136,645	23.83	-18	1,992,886	1,695,598	-18
Domestic mallard	0	0	0	0	0	680	1,087	+37
American black duck	1,465	0.26	0	0	0	15,885	16,254	+2
Black x mallard	0	0	343	0.06	100	1,747	1,692	-3
Gadwall	12,451	2.18	17,510	3.05	+29	947,364	559,674	-69
American wigeon	7,690	1.35	8,927	1.56	+14	84,575	63,988	-32
Green-winged teal	31,859	5.58	41,199	7.19	+23	911,663	529,417	-72
Blue-winged /cinnamon teal	82,028	14.36	76,562	13.35	-7	648,805	506,316	-28
Northern shoveler	13,549	2.37	8,240	1.44	-64	294,147	155,309	-89
Northern pintail	2,563	0.45	8,240	1.44	+69	115,644	95,746	-21
Wood duck	114,620	20.06	130,465	22.75	+12	602,451	557,838	-8
Redhead	25,268	4.42	16,480	2.87	-53	122,872	86,213	-43
Canvasback	6,592	1.15	12,703	2.22	+48	43,558	30,696	-42
Greater scaup	366	0.06	2,060	0.36	+82	37,927	25,053	-51
Lesser scaup	2,563	0.45	13,046	2.28	+80	156,083	118,419	-32
Ring-necked duck	67,014	11.73	64,546	11.26	-4	250,727	183,485	-37
Goldeneye	1,099	0.19	3,777	0.66	+71	32,910	25,123	-31
Bufflehead	15,014	2.63	23,690	4.13	+37	70,647	73,064	+3
Ruddy duck	2,197	0.38	1,030	0.18	-113	20,930	4,805	-336
Scoters	0	0	0	0	0	9,309	3,100	-200
Hooded merganser	20,873	3.65	7,210	1.26	-190	54,723	37,751	-45
Other mergansers	1,465	0.26	343	0.06	-327	12,811	24,008	+47
Total Duck Harvest [a] (retrieved kill)	571,300 ±12%		573,400 ±13%		0	6,462,800 ±6%	4,822,700 ±6%	-34

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

Table 2. Top 10 states in number of **adult duck hunters**, 2015, and number of hunter-days and retrieved duck kill. (from: Raftovich, R.V., S.C. Chandler, and K.A. Wilkins. 2016. Migratory Bird Hunting activity and harvest during the 2014-15 and 2015-16 hunting seasons. U.S. Fish and Wildlife Service, Laurel, Maryland. USA July 2016. 63 pp).

State	Number of active duck hunters	Duck hunter days afield	Total duck harvest	Seasonal duck harvest per hunter
Texas	61,200 ± 21%	309,500 ± 17%	733,700± 12%	12.0 ± 24%
Wisconsin	57,500 ± 12%	386,200 ± 12%	449,300 ± 14%	7.8 ± 19%
Minnesota	57,100 ± 15%	365,600 ± 15%	573,400 ± 13%	10.0 ± 16%
Arkansas	48,600 ± 9%	390,300 ± 11%	945,400 ± 12%	19.4 ± 15%
Louisiana	47,000 ± 11%	308,300 ± 18%	846,300 ± 23%	18.0 ± 25%
California	46,900 ± 12%	373,700 ± 17%	1,266,300 ± 22%	27.0 ± 25%
Michigan	36,400 ± 11%	219,400 ± 14%	317,500 ± 15%	8.7 ± 19%
North Dakota	34,600 ± 7%	179,100 ± 7%	509,300 ± 8%	14.7 ± 11%
North Carolina	31,700 ± 18%	185,200 ± 24%	309,200 ± 20%	9.8 ± 27%
Missouri	30,400 ± 12%	214,800 ± 20%	408,600 ± 21%	13.4 ±25%
Mississippi Flyway		2,702,700 ± 5%	4,822,700 ± 6%	
United States		5,496,200 ± 3%	10,992,900 ± 4%	

Table 3. Top 10 states in number of **adult goose hunters**, 2015, and number of hunter-days and retrieved goose kill. (from: Raftovich, R.V., S.C. Chandler, and K.A. Wilkins. 2016. Migratory Bird Hunting activity and harvest during the 2014-15 and 2015-16 hunting seasons. U.S. Fish and Wildlife Service, Laurel, Maryland. USA July 2016. 63 pp).

State	Number of active goose hunters	Goose hunter days afield	Total goose harvest	Seasonal goose harvest per hunter
Minnesota	43,700 ± 11%	283,600 ± 17%	143,700 ± 17%	3.3 ± 21%
Wisconsin	42,300 ± 9%	323,100 ± 14%	99,600 ± 14%	2.4 ± 16%
Michigan	37,200 ± 11%	227,500 ± 14%	159,600 ± 16%	4.3 ± 20%
Texas	29,300 ± 21%	93,300 ± 35%	92,600 ± 29%	3.2 ± 36%
California [b]	28,700 ± 11%	182,900 ± 16%	169,100 ± 16%	5.8 ± 19%
North Dakota	28,200 ± 6%	129,700 ± 8%	162,400 ± 13%	5.8 ± 14%
Pennsylvania	22,600 ± 17%	95,000 ± 18%	76,400 ± 26%	3.4 ± 31%
Maryland [b]	22,000 ± 7%	108,700 ± 10%	106,100 ± 13%	4.8 ± 15%
Illinois	21,700 ± 15%	160,700 ± 24%	90,100 ± 27%	4.1 ± 31%
Arkansas	19,800 ± 12%	110,600 ± 20%	86,800 ± 20%	4.4 ± 23%
Mississippi Flyway		1,628,200 ± 6%	913,100 ± 7%	
United States [b]		3,253,100 ± 4%	2,537,500 ± 4%	

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

HUNTER ACTIVITY AND GOOSE HARVEST DURING THE AUGUST AND SEPTEMBER 2015 EARLY CANADA GOOSE HUNTS IN MINNESOTA

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Minnesota has had statewide September Canada goose seasons since 1999 and began an August Canada goose Conservation Action (hereafter August season) in 2013. The August and September Canada goose seasons in Minnesota were 8-23 August, and 5-22 September, 2015 respectively. The August Season was open in a portion of the state, the Intensive Harvest Zone (IHZ; Fig 1), and the daily bag limit was 10 Canada geese per day with no possession limit. Shooting hours were 1/2-hour before sunrise to 1/2-hour after sunset. During the September season the daily bag limit was 10 Canada geese per day in the IHZ, and 5 geese per day in the rest of the state. Shooting hours were 1/2 hour before sunrise to sunset. Taking of Canada geese was prohibited on or within 100 yards of all surface waters in the Northwest Goose Zone, in the Carlos Avery Wildlife Management Area (Anoka County) and on Swan Lake (Nicollet County). Goose hunters in both the August and September seasons were required to obtain a $4.00 permit to participate in the seasons. This report documents results of the 2015 August and September goose hunter mail questionnaire survey (Appendix A).

METHODS

In 2013 and 2014, we conducted separate hunter surveys of August and September goose seasons. The September survey also included questions pertaining to the August hunt. The estimates from two years of August surveys were similar enough to the estimates derived from the September survey questions pertaining to the August hunt that we dropped the separate August survey in 2015. 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 asked hunters the number of days hunted, number of geese shot and retrieved, number of geese knocked down and not retrieved, in each of the August and September goose seasons. Hunters were asked to indicate the number of days during that they hunted over water and the number of geese they shot over water during August and September. Finally, the questionnaire asked hunters a series of questions to gauge their satisfaction with the August and September Canada goose hunting seasons in Minnesota and the higher daily bag limit (10/day) used in the Intensive Harvest Zone.

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

RESULTS AND DISCUSSION

The DNR License Bureau reported that 27,168 Special Canada Goose Season permits were sold by 22 September, 2015. Response rate to the survey was 43%. Among those respondents, 8.3% indicated that they only hunted during the August season, 42.2% hunted in only the September season, 14.8% hunted in both seasons, and 34.7% did not hunt.

Responses from the survey indicate that 6,278 hunters participated in the August hunt (Table 1), while 15,465 participated in the September hunt (Table 2). A total of 21,743 hunters hunted during either the August and/or September early goose season. Hunters shot and retrieved 20,010 Canada geese in the IHZ during the August season, 18,604 Canada geese in the IHZ during September, and 36,272 Canada geese in the remainder of state during September 2015. The total early season Canada goose harvest was 74,886.

We asked hunters how many days they hunted over water and how many days they hunted away from water. A total of 36% of hunters statewide hunted over water in August and September. The survey indicates that 20% of the geese harvested in the two early seasons (14,921 total geese) were harvested by hunters overwater.

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 were very similar to the two previous years. Mean satisfaction in 2015 for the August season was: overall experience 4.5 (4.4 in 2014), geese bagged 3.6 (3.5 in 2014), number of geese seen 3.7 (3.9 in 2014), and regulations 4.8 (4.7 in 2014). Mean satisfaction in 2015 for the September season was: overall experience 4.7 (5.1 in 2014), geese bagged 3.8 (4.2 in 2014), number of geese seen 3.9 (4.4 in 2014), and regulations 4.9 (5.0 in 2014).

Finally we asked hunters how they felt about the 10 Canada goose daily bag limit in the Intensive Harvest zone during the August and September seasons. About 3% of respondents felt the limit was too low, 47% of respondents felt the limit was about right, 19% felt the limit was too high, and 30% of respondents had no opinion.

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

LITERATURE CITED

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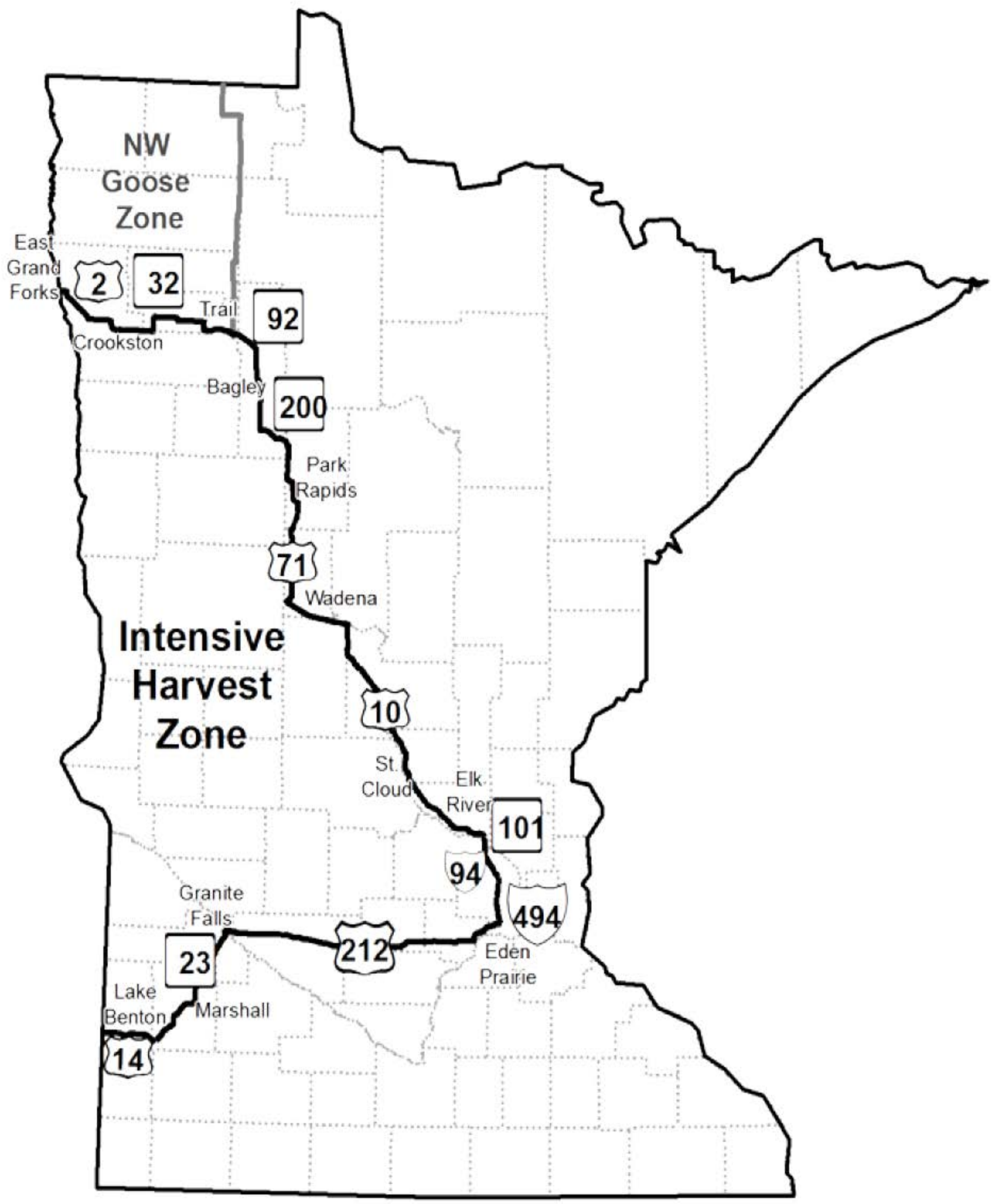


Figure 1. Intensive Harvest Zone in relation to the Northwest (NW) Goose Zone within Minnesota, 2015.

Table 1. Permit sales, hunter activity, and harvest during the August Canada Goose season 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 2. Permit sales, hunter activity, and harvest during the September Canada Goose season in Minnesota, 2013-2015.

Parameter	2013	2014	2015
Total permits sold	27,778	29,603	27,168
Questionnaires delivered	3,100	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	3.9	3.3	3.6
Geese shot and retrieved per active hunter	4.8	4.1	3.5
Unretrieved harvest per active hunter	0.4	0.4	0.3
% unretrieved harvest	8.4	8.4	7.9
EXPANDED:			
Active hunters	16,840	18,760	15,465
Hunter days	64,970	61,620	56,414
Retrieved harvest	81,230	76,440	54,876
Est. unretrieved harvest	7,440	7,070	4,719
Total estimated take	88,670	83,510	59,595

Table 3. Retrieved harvest estimates by zone during the September Canada Goose season in Minnesota, 2000 – 2009. Total retrieved harvest estimates during the September Canada Goose season in Minnesota, 2010-2012. 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**				27,168

Appendix A.

MNDNR

2015 August and / or September Special Canada Goose Season Hunter Survey

You are being asked to provide information to help us evaluate the harvest of Canada geese in Minnesota during August 8-23 or September 5-22, 2015. Your cooperation is important. Please return this survey card even if you did not hunt Canada geese. THANK YOU! Ed Boggess, Director, Division of Fish and Wildlife, MN DNR.

1. Did you hunt during the **August** 8-23 Intensive Harvest Zone Special Canada Goose season?
   __ Yes   __ No   (Please check one.)

   If YES, please continue to question 2. If NO, proceed to question 4.

2. Indicate the number of days you hunted and the total number of geese you **personally** shot and retrieved (do not include information from other members in your party).

Goose Season/zone *(see map for goose-zone boundaries)*	Number of days hunted	**Total geese personally shot and retrieved**	**Total geese personally knocked down but <u>not</u> retrieved**
August 8-23 Intensive Harvest Zone			

3. If you hunted geese during the 2015 **August** Canada goose season, how satisfied or dissatisfied were you with the following? (Please circle one response for each.) If you did not hunt this season please skip to question 4.

	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. Did you hunt during the **September** 5-22 September Special Canada Goose season?
   __ Yes   __ No   (Please check one.)

   If YES, please continue to question 5. If NO, proceed to question 7.

5. Indicate the number of days you hunted and the total number of geese you **personally** shot and retrieved (do not include information from other members in your party).

Goose Season/zone *(see map for goose-zone boundaries)*	Number of days hunted	**Total geese personally shot and retrieved**	**Total geese personally knocked down but <u>not</u> retrieved**
September 5-22 (Intensive Harvest zone)			
September 5-22 (Remainder of State zone)			

6. If you hunted geese during the 2015 **September** Canada goose season, how satisfied or dissatisfied were you with the following? (*Please circle <u>one</u> response <u>for each.</u>*)

	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

7. Did you personally hunt geese overwater (for example with decoys floating in or along the shore of a wetland or pass shooting next to a wetland) during either the August or September Canada goose season?
   ______Yes   ______No   (If No, please proceed to Question 8.)

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

8. The Canada goose daily bag limit in the Intensive Harvest zone during the August and September seasons this year was 10 Canada geese per day. Which one statement describes how you feel about the daily goose bag limit used in the Intensive Harvest zone?

- ❑ The daily limit was too low.
- ❑ The daily limit was about right.
- ❑ The daily limit was too high.
- ❑ No opinion.

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:

2016 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 2016 Light Goose Conservation Order hunter mail questionnaire survey.

METHODS

Minnesota held a light goose Conservation Order harvest from 1 March - 30 April 2016. 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 1,143 permits were issued and 491 responses (43 %) to the questionnaire were obtained (Table 1). In calculating harvest estimates, we assumed that the 652 non-respondents participated in the conservation action and took light geese in the same manner as respondents. Five hundred thirty four people attempted to take light geese during the 61-day conservation order period. Active participants pursued light geese for 2,605 days and 2,121 light geese were shot and retrieved. This was an average retrieved take of 4 geese per active participant. Another 215 light geese were estimated wounded and not retrieved.

ACKNOWLEDGEMENTS

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

Figure 1. Light Goose Conservation Order hunter mail questionnaire, 2016.

MINNESOTA 2016 LIGHT GOOSE HARVEST SURVEY

For the Period of March 1 - April 30, 2016 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, 2016. 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 2016 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, 2016? 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, 2016?

   ____

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, 2004 – 2016.

	Year												
Statistic	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Total permits sold	1,424	1,383	1,363	1,292	1,406	1,670	952	994	1,048	1,405	1,278	1,141	1,143
Useable returns	1,095	998	955	921	910	1,057	671	659	675	810	759	520	491
Response rate (%)	77.0	72.0	70.0	71.0	65.0	63.0	72.3	67.1	65.3	58.3	60.0	46	43
Active hunters (%)	48.5	44.7	37.3	39.8	54.9	66.0	40.8	45.7	56.9	54.9	44.0	50	47
Estimated total hunters	690	618	516	514	773	1,103	389	455	600	770	560	569	534
Estimated hunter days	3,372	2,643	2,665	2,302	3,404	4,647	1,475	1,830	2,270	3,070	2,580	2,434	2,605
Mean days/hunter	4.9	4.3	5.2	4.5	4.4	4.2	3.8	4.0	3.8	4.0	4.6	4	5
Estimated harvest (shot & retrieved)	2,735	1,395	1,360	1,786	2,409	4,366	559	1,554	2,620	2,430	2,880	3,266	2,121
Mean harvest/hunter	4.0	2.3	2.6	3.5	3.1	4.0	1.4	3.4	4.4	3.2	5.1	6	4
Estimated crippling losses	315	150	163	172	302	640	70	145	210	370	210	349	215
Percent using unplugged guns	48.2	44.0	42.3	43.6	46.7	46.8	44.9	44.2	43.0	49.4	48.8	NA	NA
Est. number hunters using unplugged guns	333	272	215	224	361	516	175	201	260	380	270	NA	NA
Est. number geese **shot** with unplugged guns	1,385	777	689	1,032	1,275	2,413	348	742	1,510	1,670	2,060	NA	NA
Est. harvest with shell 4-5-6	491	269	287	277	339	822	131	311	460	620	770	NA	NA
Percent using electronic calls	19.3	17.8	14.4	17.1	19.1	23.5	25.9	21.3	22.2	24.5	27.8	NA	NA
Est. number hunters using e-calls	133	110	73	88	148	260	101	97	130	190	160	NA	NA
Est. harvest while using e-calls	326	268	280	329	566	1,171	192	531	460	620	1,710	NA	NA
Percent hunting 1/2-hr after sunset	38.4	42.7	43.9	38.3	42.3	43.1	39.7	39.7	42.4	33.4	36.2	NA	NA
Est. number hunting after 1/2-hr sunset	265	264	223	197	326	475	154	180	250	260	200	NA	NA
Est. harvest 1/2-hr after sunset	311	242	246	209	511	713	87	238	240	260	550	NA	NA

MINNESOTA'S WILD TURKEY HARVEST – 2016

Steve Merchant, Wildlife Populations and Regulations Manager

This report summarizes the fall 2015 and spring 2016 Minnesota wild turkey harvest information. 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.

Significant changes were made to the spring turkey season structure in 2016. The new structure for 2016 spring turkey season was intended to regulate harvest and distribute hunting pressure by allocating permits across 12 permit areas (Figure 1), however the 12 permit areas now include the entire state. Previous to 2016, much of the northcentral and northeastern portions of the state were not open to turkey hunting. There are now only 6 time periods using a quota system for the first 2 time periods. In 2015 there were 8 time periods, with the first 3 using a quota. In 2016 the first 5 time periods were all one week long, while the last time period was 14 days long, and all unsuccessful licensed turkey hunters from the previous time periods could hunt during this final time period. The first time period began on April 13, and the final time period concluded on May 31.

During spring, adult hunters interested in pursuing turkeys for the first 2 time periods were required to apply for a permit through a lottery system, but youth hunters, and for the first time licensed archery hunters, were able to purchase a permit over-the-counter, and hunt in any permit area for the entire season. Preference for this lottery system was determined by the number of years a valid but unsuccessful application had been submitted since last receiving a permit. Hunters could apply individually or in a group of up to 4 hunters. Successful applicants were notified through U.S. Mail and unsuccessful applicants were awarded a preference point.

Alternatively, firearms hunters could simply purchase a permit over-the-counter for one of the last 4 time periods. The goal of this new season structure is to provide additional quality turkey hunting opportunities while still managing hunter interference rates by maintaining 12 permit areas and 2 quota time periods.

Fall 2015 Turkey Season

The number of permits issued to hunters decreased slightly from 8,339 permits in 2014 to 8,210 in 2015 (Table 1, Figure 2). Hunters still needed to select and hunt within one of the 12 permit areas, except for youth who could hunt in all permit areas. There were 1,124 turkeys harvested during fall 2015, which was a 1% increase from 2014 (Table 1). Hunter success rates in 2015 remained similar to 2014 (13.7% vs. 13.6% respectively), and remained below the 5-year average (15%).

Spring 2016 Turkey Season

There were 49,991 permits issued during the spring season, including 11,329 general lottery and landowner permits, 11,449 youth permits, 10,343 archery permits, and 16,870 surplus over-the-counter permits (Table 6). The number of youth permits increased from 2015 by 1% (116). Archery permits increased by 105% (5291), likely a result of the expanded opportunity that allowed archers to hunt the entire season. Both lottery (- 13.4%) and surplus gun permits (-1.9%) purchased decreased from 2015. The total number of permits purchased increased from 2015 by 7.1% (3,316), primarily as a result of archery license sales more than doubling. Hunters registered 12,313 turkeys (Tables 3, 5, and 6), which was the second highest harvest recorded and above the 5-year average (11,442; Figure 3). The winter of 2015-16 was again mild, and likely was not a significant mortality factor beyond normal winter mortality for turkeys. Spring weather was generally warm, and spring "green-up" was earlier than normal.

Table 1. Permits available and issued, applicants, registered harvest, and hunter success rates for fall wild turkey seasons 1990 – 2015, Minnesota.

Year	Permits available	Applicants	Permits issued	Registered harvest	Hunter success (%)[a]
1990	1,000	4,522	951	326	34
1991	2,200	2,990	2,020	552	27
1992	2,200	2,782	2,028	588	29
1993	2,400	3,186	2,094	605	29
1994	2,500	3,124	2,106	601	29
1995	2,500	3,685	2,125	648	30
1996	2,500	4,453	2,289	685	30
1997	2,580	4,574	2,378	698	29
1998	2,710	4,526	2,483	828	33
1999	2,890	5,354	2,644	865	33
2000	3,090	5,263	2,484	735	30
2001	2,870	4,501	2,262	629	28
2002	3,790	5,180	2,945	594	20
2003	3,870	5,264	2,977	889	30
2004	4,380	5,878	3,277	758	23
2005	4,410	4,542	2,978	681	23
2006	4,290	4,167	2,802	618	22
2007	4,490	4,464	2,837	695	24
2008	7,560	5,834	4,981	1,187	24
2009	9,330	7,738	5,019	1,163	23
2010	10,430	6,869	6,607	1,353	20
2011	10,430	3,538	5,382	953	18
2012	Unlimited	N/A	10,779	1,753	16
2013	Unlimited	N/A	8,193	1,078	13
2014	Unlimited	N/A	8,339	1,137	14
2015	Unlimited	N/A	8,210	1,124	14

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

Table 2. Permits issued, registered harvest, and hunter success during the 2016 Minnesota Spring wild turkey season.

Permit area	Regular permits issued [a]	Total registered harvest [b]	Regular gun harvest [c]	Regular gun success rates
501	6,496	2,974	2,319	35.7%
502	563	194	129	22.9%
503	3,076	1,493	1,039	33.8%
504	704	361	239	33.9%
505	2,186	1,040	776	35.5%
506	1,029	409	271	26.3%
507	6,172	3,120	2,067	33.5%
508	3,166	1,453	995	31.4%
509	206	166	89	43.2%
510	1,831	1,010	621	33.9%
511	104	42	19	18.3%
512	78	50	24	30.8%

[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 3. Permits available, permits issued, registered harvest, and relative success rates from 1978 – 2016 for all Spring wild turkey hunting seasons in Minnesota.

	Permits				
Year	Available	Issued	Issued (%)	Registered harvest	Success (%) [a]
1978	420	411	97.9	94	23
1979	840	827	98.5	116	14
1980	1,200	1,191	99.3	98	8
1981	1,500	1,437	95.8	113	8
1982	2,000	1,992	99.6	106	5
1983	2,100	2,079	99.0	116	6
1984	3,000	2,837	94.6	178	6
1985	2,750	2,449	89.1	323	13
1986	2,500	2,251	90.0	333	15
1987	2,700	2,520	93.3	520	21
1988	3,000	2,994	99.8	674	23
1989	4,000	3,821	95.5	930	24
1990	6,600	6,126	92.8	1,709	28
1991	9,170	8,607	93.9	1,724	20
1992	9,310	9,051	97.2	1,691	19
1993	9,625	9,265	96.3	2,082	23
1994	9,940	9,479	95.4	1,975	21
1995	9,975	9,550	95.7	2,339	25
1996	12,131	10,983	90.5	2,841	26
1997	12,530	11,610	92.7	3,302	28
1998	14,035	13,229	94.3	4,361	33
1999	18,360	16,387	89.3	5,132	31
2000	20,160	18,661	92.6	6,154	33
2001	22,936	21,404	93.3	6,383	30
2002	24,136	22,607	93.7	6,516	29
2003	25,016	22,770	91.0	7,666	34
2004	27,600	25,261	91.5	8,434	33
2005	31,748	27,638	87.1	7,800	28
2006	32,624	27,876	85.4	8,241	30
2007[b]	33,976	28,320	83.4	9,412	33
2008[b]	37,992	31,942	84.1	10,994	34
2009[b]	42,328	36,193	85.5	12,210	34
2010[b]	55,982	46,548[c]	83.0	13,467	29
2011[b]	Unlimited	43,521[c]	N/A	10,055	23
2012[b]	Unlimited	38,906[c]	N/A	11,325	29
2013[b]	Unlimited	34,281c	N/A	10,390	30
2014[b]	Unlimited	43,305[c]	N/A	11,447	25
2015[b]	Unlimited	41,623[c]	N/A	11,734	28
2016[b]	Unlimited	39,648[c]	N/A	12,313	31

[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, 5052, and 10,343 permits issued to archers in 2011, 2012, 2013, 2014, 2015, and 2016 respectively.

Table 4. Permits available and issued by license type (resident and non-resident) and time period for the Spring 2016 wild turkey season, Minnesota.

Time period	Permits available	General lottery[a]	Surplus	Youth[b]	Archery[c]
A: Apr 13-19	6,983	6,017	179	X	X
B: Apr 20-26	6,983	5,233	1,024	X	X
C: Apr 27-May 3	Unlimited	7	8,217	X	X
D: May 4-10	Unlimited	4	3,978	X	X
E: May 11-17	Unlimited	0	602	X	X
F: May 18-31	Unlimited	0	245[d]	X	X
Total [a]	Unlimited	11,329	16,870	11,449	10,343

[a] Includes landowner licenses.

[b] Youth permits were valid for all time periods.

[c] Archery permits were valid for all time periods.

[d] Number of surplus licenses sold for this time period. Actual number of hunters in unknown because all unsuccessful hunters from previous time periods could hunt.

Table 5. Total harvest by time-period, Spring 2016 wild turkey season, Minnesota.

Time period	Total harvest	Percent harvest (%)
A	3,997	32.5
B	2,857	23.2
C	2,487	20.2
D	1,330	10.8
E	611	4.9
F	1,031	8.4
Total	12,313	100

Table 6. Total permits issued, harvest and success rate by type of permit, Spring 2016 wild turkey season, Minnesota.

	Total permits sold	Harvest	Success (%)[a]
Lottery	11,329	4,245	37
Surplus	16,870	4,344	26
Youth	11,449	2,243	20
Archery	10,343	1,481	14
Total	49,991	12,313	25

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

Wild Turkey Permit Areas

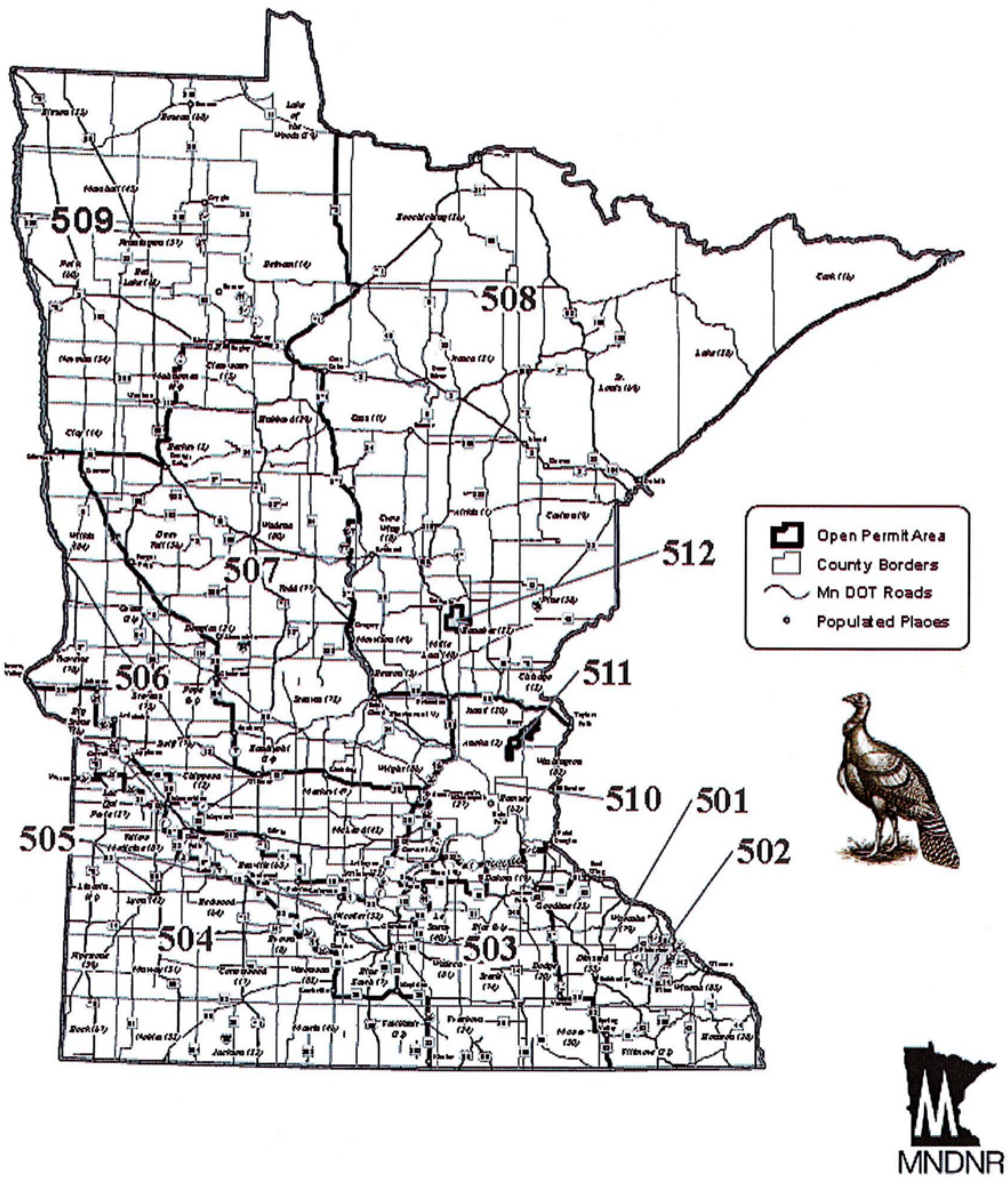


Figure 1. Permit areas open for hunting during the 2016 Spring turkey hunting season, Minnesota.

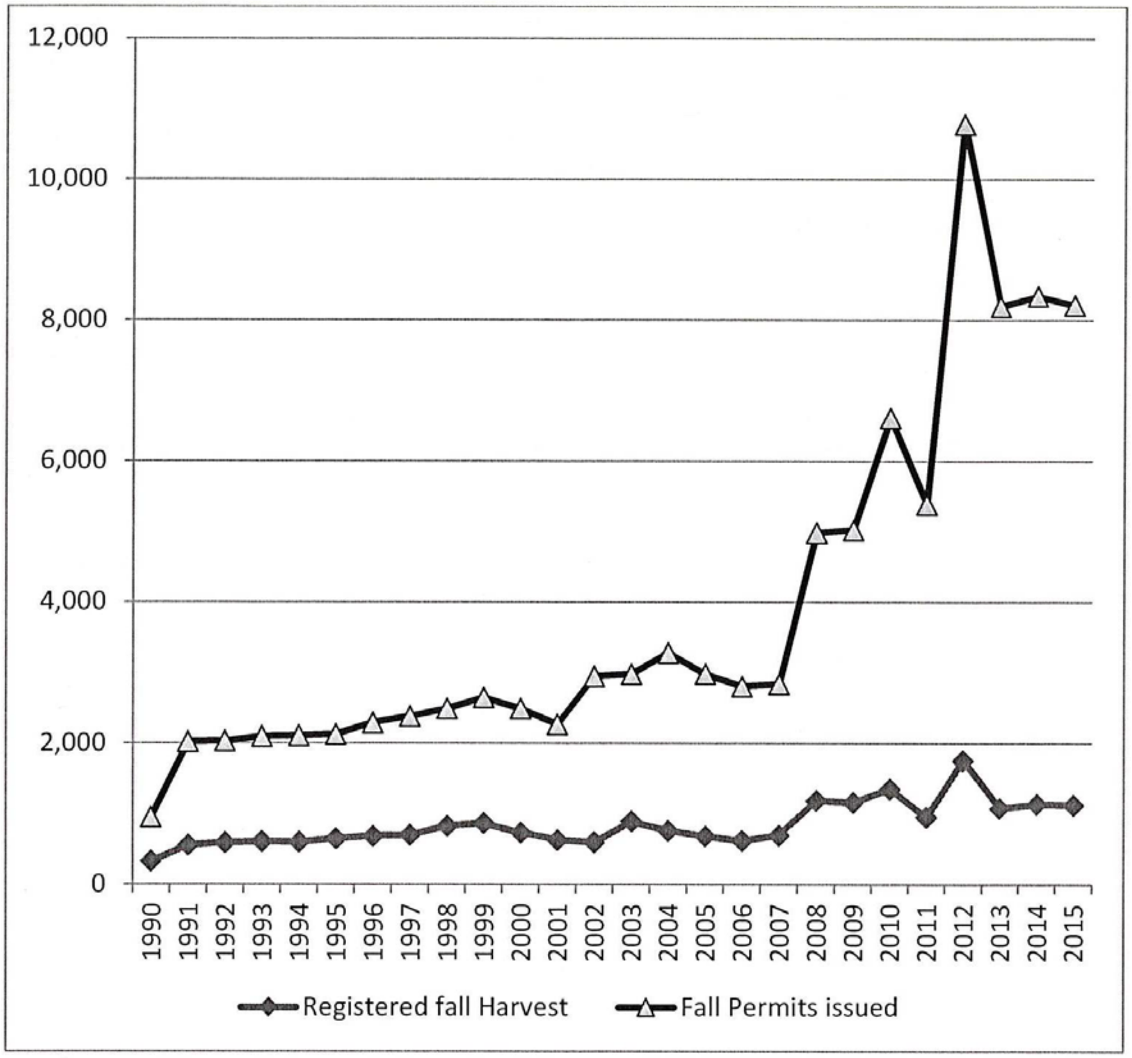


Figure 2. Permits issued and registered harvest for fall wild turkey seasons, 1990-2016, Minnesota.

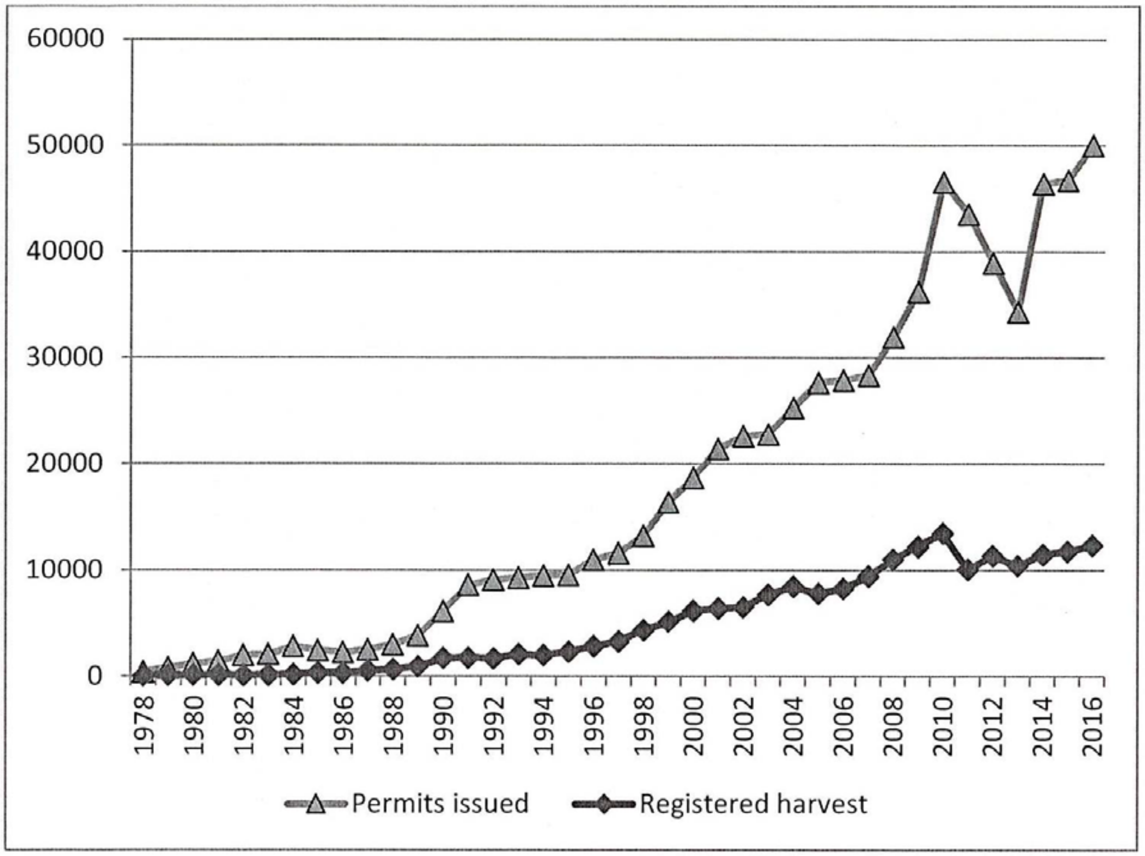


Figure 3. Permits issued and registered harvest for Spring wild turkey seasons, 1978- 2016, Minnesota.

2015 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 2015, 112 hunters were estimated to have gone afield and harvested 103 prairie-chickens and 22 sharp-tailed grouse (*Tympanuchus phasianellus*) during prairie-chicken hunts. Hunter success (0.55) and satisfaction (3.6 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. Nevertheless, we included a question this year to revisit season timing, due to comments received in recent surveys. Results indicated that hunter preferences for season timing are split, but that most respondents (56%) prefer the season to open the last Saturday of September rather than the Saturday nearest October 20 (44%), in support of the current season.

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. In 2015, the prairie-chicken season opened 26 September and closed 4 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 7 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, how satisfied were you (on a scale of 1-5), and do you prefer a season opener on the last Saturday of September or the Saturday nearest October 20?

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 2015 was 126 permits, and 271 individuals applied in the lottery (Table 1). Of the 124 lottery winners, 110—including 4 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-two permit purchasers (85%, n = 108) responded to the survey and 2 surveys were undeliverable; 74 (69%) responded to the first mailing and 18 (17%) to the second mailing. This response rate is slightly lower than survey response rates during 2012 (95%), but similar to 2010 (84%), 2011 (90%), 2013 (83%), and 2014 (87%). In contrast to 2013, we did not detect a strong response bias between the first and second mailings. Although respondents to the first mailing were slightly more likely than respondents to the second mailing to have hunted (99% vs. 94% of respondents), they hunted a similar number of days (2.1 vs. 2.9), reported harvesting prairie-chickens at similar rates (59% vs. 47%), reported harvesting a similar number of chickens (1.0 vs. 0.8 birds per hunter) and sharp-tailed grouse (0.2 vs. 0.3 birds per hunter), and reported similar satisfaction (mean 3.7 vs. 3.4, median 4 vs. 3), with 78% and 82% of respondents reporting satisfaction scores $\geq$3, respectively. Thus, I combined responses from both mailings this year for the analysis.

Ninety respondents reported that they hunted prairie-chickens (Table 2). I estimated the total number of hunters to be 112 (i.e., purchasers who went afield) after accounting for hunting by non-respondents. Hunters reported harvesting 87 prairie-chickens and total harvest after accounting for non-respondents was estimated as 103 prairie-chickens. An estimated 62 hunters bagged $\geq$1 chicken. Survey respondents reported harvesting 22 sharp-tailed grouse while hunting prairie-chickens from permit areas 803A, 804A, and 805A (Figure 1). Although successful hunters reported higher average satisfaction (4.2) than respondents that were not successful (2.8), satisfaction of prairie-chicken hunters was high overall.

Prairie-chicken hunter success and satisfaction during 2015 was similar to 2013 and 2014 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.

ACKNOWLEDGEMENTS

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 and Jason Abraham for sharing the 2013 Wildlife Public Input Survey results.

Table 1. Prairie-chicken hunt lottery applicants, winners, and hunting permit purchasers in Minnesota during 2015.

Permit area	Permits available	No. of applicants	Lottery winners No.[b]	Lottery winners Proportion	Permit purchasers[a] No.	Permit purchasers[a] Proportion	Surplus purchasers[c]
803A	10	21	10	0.48	10	1.00	0
804A	12	19	12	0.63	11	0.92	0
805A	12	64	14	0.22	13	0.93	0
806A	12	33	12	0.36	7	0.58	0
807A	20	31	20	0.65	18	0.90	0
808A	15	28	15	0.54	15	1.00	0
809A	15	18	15	0.83	13	0.87	0
810A	15	23	15	0.65	12	0.80	0
811A	5	11	5	0.45	5	1.00	0
812A	5	22	5	0.23	5	1.00	0
813A	5	1	1	1.00	1	1.00	4
All	126	271	124	0.46	110	0.89	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 2015.

Permit area	No. of hunters[a] Self-reported	No. of hunters[a] Estimated	Birds harvested Self-reported	Birds harvested Estimated	Birds per harvester[b]	Success rate[c]
803A	7	10	10	14	1.6	0.90
804A	10	11	2	2	2.0	0.09
805A	11	12	15	16	1.6	0.83
806A	6	7	9	11	1.8	0.86
807A	15	18	17	20	1.8	0.61
808A	12	15	12	15	1.7	0.60
809A	12	13	9	10	2.0	0.38
810A	8	11	5	7	1.2	0.55
811A	3	5	0	0	NA	0
812A	5	5	8	8	1.6	1.0
813A	1	5	0	0	NA	0
All	90	112[d]	87	103[d]	1.7[d]	0.55[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 2003–2015.

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

[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 – 2015 (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.

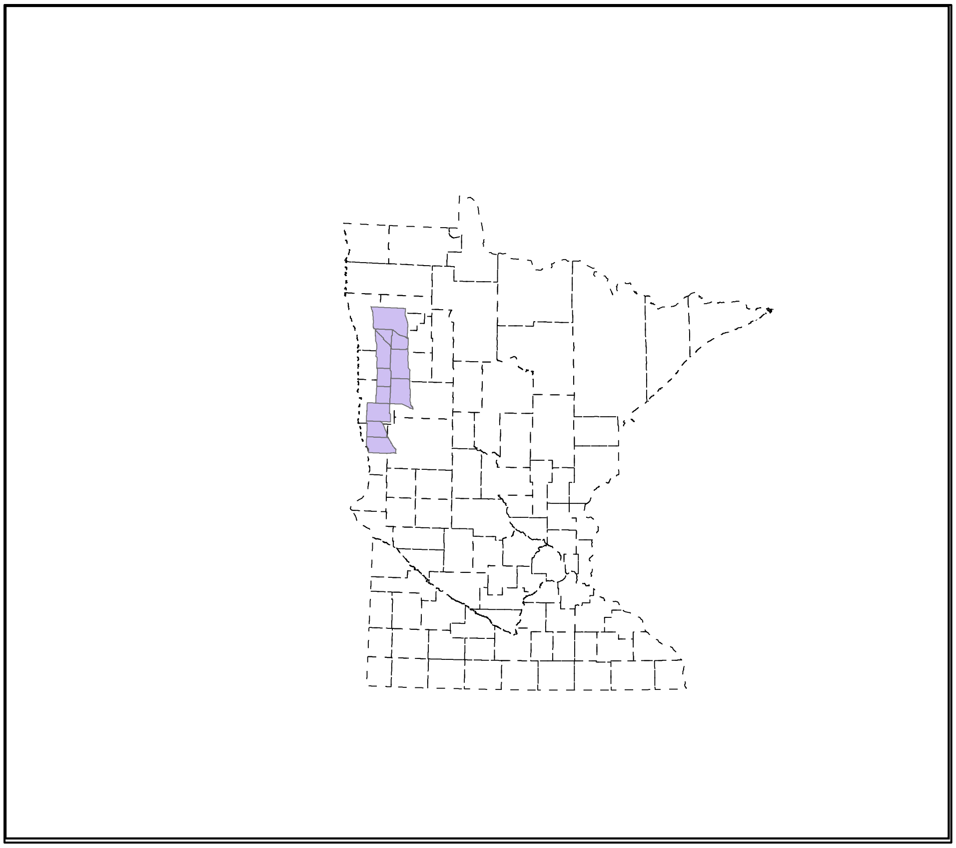


Figure 2. Northwestern location of prairie-chicken hunting permit areas within the state relative to county boundaries (dashed lines).

MNDNR

2015 MINNESOTA BEAR HARVEST REPORT

David L. Garshelis, Forest Wildlife Populations and Research Group

INTRODUCTION

The Minnesota bear range is divided into 11 bear management units (BMUs). Each has a separate quota on hunting licenses, and 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, either electronically at designated registration stations or 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 has stabilized at 18–19,000 (Table 1). Permit availability has remained constant for the past 3 years. The low permit availability has driven up sales of no-quota licenses, which were the highest on record in 2015. The higher number of hunters combined with a high success rate resulted in a higher harvest this year than the past 2 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

The number of available quota zone permits remained the same for all Bear Management Units (BMUs, see Fig. 2), since 2013, except for a slight reduction in BMU 12 (Table 2). This was the 5th 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. BMU 22 (BWCAW) remained under-subscribed even after these surplus sales (Table 3).

Quota zone lottery

As permit allocations have been reduced, the percentage of 1st-year applicants drawn in the lottery diminished (Table 4). In 2011, some 1st-year applicants (preference level 1) were drawn in all but 3 BMUs. In 2013–2015, 1st-year applicants were drawn only in BMU 22 (BWCAW). In 2015, no hunters with preference level 2 were drawn in 6 of 11 BMUs, and in BMU 45, no preference level 3 hunters were drawn. This is the first time this has occurred since the lottery system was instituted in 1982.

Harvest by BMU

In 2015, most BMUs had higher harvests than in 2014, although notably BMU 13 had the lowest since 1988 and BMU 41 had a record low harvest (for the second year in a row)(Table 5). The no-quota harvest was fairly normal. The percent of the total statewide harvest contained within the no-quota zone has increased with reduction of quota zone permits, reaching a record in 2015 (27%) (Fig. 3). Most notable in 2015 was a statewide harvest sex ratio of 66% male (the highest ever); four BMUs had sex ratios exceeding 70% male.

Hunting success by BMU

Hunting success was generally higher in 2015 than in 2014 (Table 6). Success was especially high (40% or more) in BMUs 12 (following a very low success rate in 2014), 24, 25, and 31. It was also a record-high success (for second year in a row) in BMU 45. For the quota zone as a whole, success rate was highest since the last food failure year of 1995. 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.

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). In the past 3 years, a low percentage of the harvest occurred in the first week: only 58% occurred in the first week of the 2015 harvest, normally indicative of abundant foods (which was not the case, but it was especially warm).

Predictions of harvest

The 2015 harvest was about 500 bears lower than 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. The 2015 under-harvest (compared to this prediction) is particularly evident for the quota zone.

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: only BMU 51 showed a significant trend (increasing percent males)(Fig. 5). BMU 26 had >60% males in past 4 of 5 years. BMUs 12 and 13, which adjoin, showed sharply opposite trends since 2010.

Harvest ages

Long-term declining trends in median ages of harvested females were evident in BMUs 41, 24, 25, and 51 (Fig. 6). These likely contributed most to the long-term decline in the median age of harvested females statewide (Fig. 7). However, median ages of harvested females increased in nearly all BMUs in 2015, and the proportion of the harvest composed of 1–2 year-olds declined (Fig. 8). Median ages of harvested males have been relatively stable for 2 decades, but have increased the last 2 years.

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, >25% have not complied. "Violation notices" were sent to non-compliant hunters in 2014, which seems to have spurred a much better compliance (81%) in 2015 (Fig. 9). A "reminder" notice was also sent in 2015 (yielding a compliance of 91%). Since 2013, hunters could register by phone or internet, and pick up a tooth envelope later: in the past, these hunters had much poorer compliance with tooth submission than hunters who registered their bear at a registration station, but their compliance improved considerably this year, for all registration methods and for all BMUs (Fig. 10).

Table 1. Bear permits, licenses, hunters, harvests, and success rates, 1995–2015.

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Permit applications	29922	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]
Permits available	11950	12030	11370	18210	20840	20710	20710	20610	20110	16450	15950	14850	13200	11850	10000	9500	7050[b]	6000	3750	3750	3700
Licenses purchased (total)	12448	12414	11440	16737	18355	19304	16510	14639	14409	13669	13199	13164	11936	10404	9892	9689	9555	8986	6589	6620	6962
Quota zone [c]	10304	10592	9655	14941	16563	17021	13632	12350	9833	10063	9340	9169	8905	7842	7342	7086	5684	4951	3188	3177	3257
Quota surplus/military [c]							235	209	2554	1356	1591	1561	526	233	77	83	1385	1070	578	583	446
No-quota zone [c]	2144	1822	1785	1796	1792	2283	2643	2080	2022	2238	2268	2434	2505	2329	2473	2520	2486	2965	2823	2860	3259[h]
% Licenses bought																					
Of permits available [d]	86.2	88.0	84.9	82.0	79.5	82.2	67.0	60.9	61.6	69.4	68.5	72.3	71.4	67.7	73.4	74.6	100	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
Estimated no. hunters [e]	11600	11500	10300	14500	15900	16800	15500	13800	13600	12900	12500	12500	11300	9900	9400	9200	9100	8600	6300	6300	6600
Harvest	4956	1874	3212	4110	3620	3898	4936	1915	3598	3391	3340	3290	3172	2135	2801	2699	2131	2604	1866	1627	1971
Harvest sex ratio (%M) [f]	47	62	55	55	53	58	56	61	58	57	59	58	57	62	59	59	61	59	62	62	66[i]
Success rate (%)																					
Total harvest/hunters [g]	43	16	31	28	23	23	29	14	26	26	26	26	28	21	30	29	23	30	30	26	30
Quota harvest/licenses	42	15	29	25	20	20	28	14	25	26	25	25	28	21	30	30	24	33	37	33	39[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).

[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 July 31. 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 2011-15, 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 2011-15 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 2015, 26 hunters bought 2 licenses but only 1 killed 2 bears.

[h] Record high number of no-quota zone licenses purchased (47% of total licenses purchased).

[i] Record high % males in statewide harvest.

[j] 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, 1987–2015 (no-quota zone first partitioned out in 1987). Number of licenses explains 40% of variation in hunting success during this period (P = 0.0002). Large variation in hunting success is also attributable to food conditions.

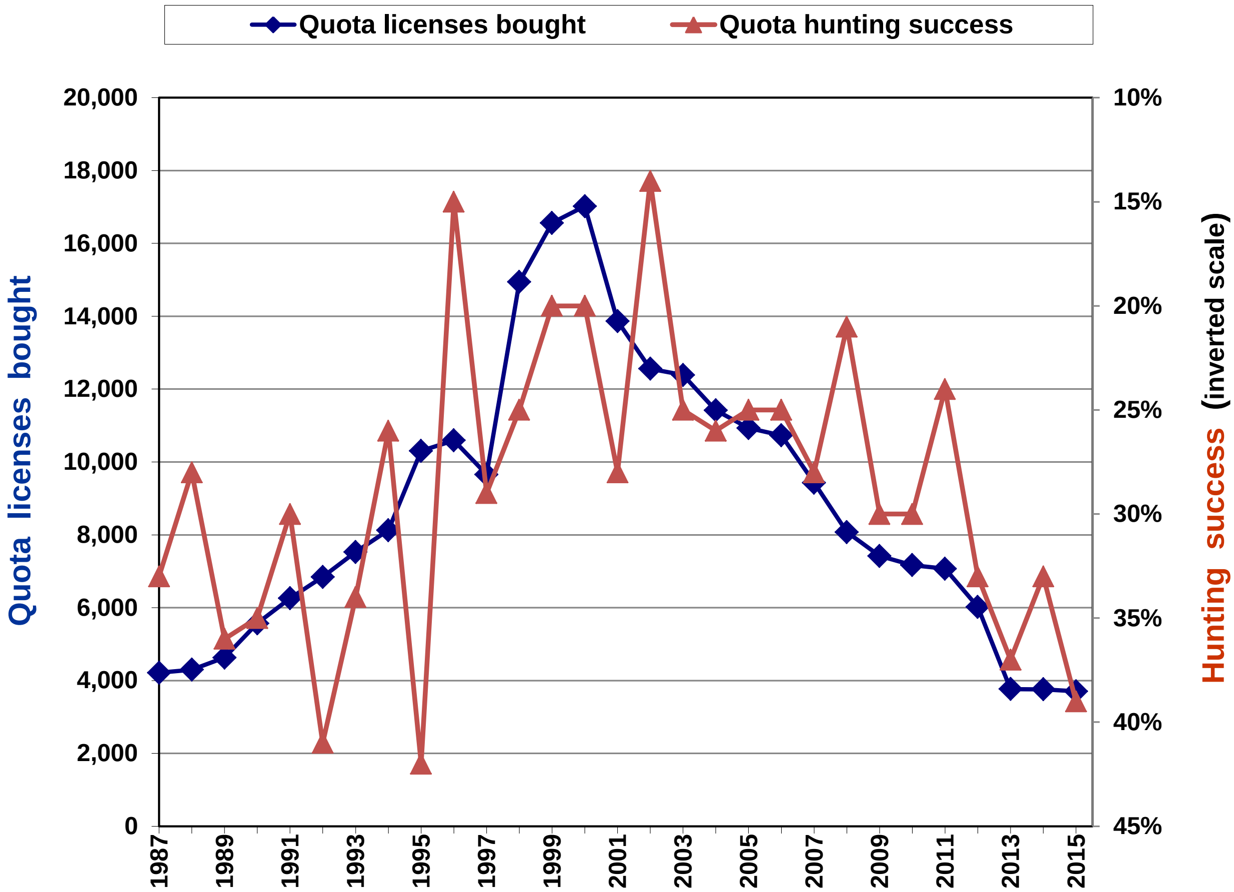


Figure. 2. Bear management units (BMUs) within quota (white) and no-quota (gray) zones. Hunters in the quota zone are restricted to a single BMU, whereas no-quota hunters can hunt anywhere within that zone.

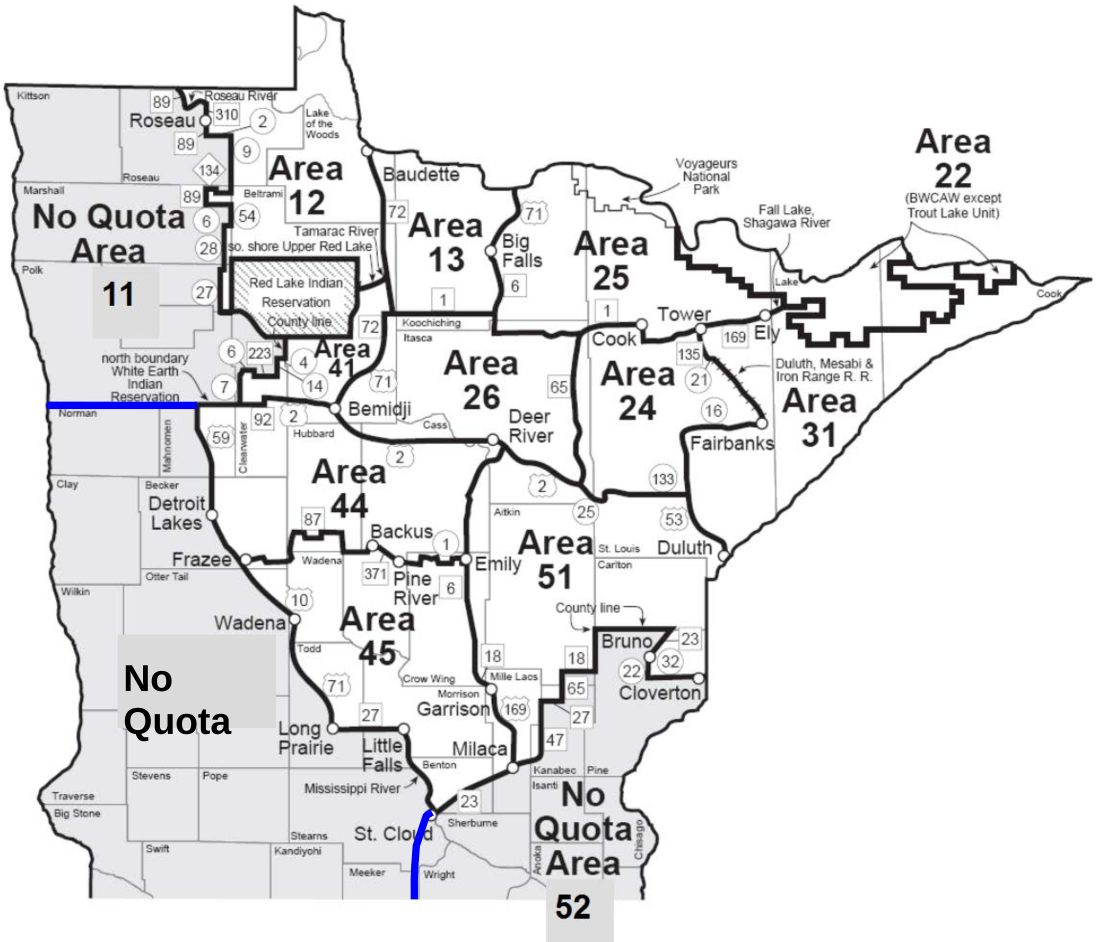


Table 2. Number of bear hunting quota area permits available, 2011–2015 (aligned with permit applications in Table 3 below; highlighted values show drop from previous year).

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

[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).

Table 3. Number of quota BMU permit applicants and surplus licenses bought, 2011–2015[a]. Shaded values indicate undersubscribed areas (applications < permits available).

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

[a] Beginning in 2011, all licenses not purchased by permittees were sold as "surplus". Surplus = Permits available (Table 2) minus Bought license (±4 to account for groups applying together). 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 number of applications (Apps)(unlike Table 1, where they are included).

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

Table 4. Percentage of quota BMU lottery applicants with preference level 1 (1st-year applicants), 2, and 3 who were drawn for a bear permit, 2011–2015. 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.

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

Table 5. Minnesota bear harvest tally[a] for 2015 by Bear Management Unit (BMU) and sex compared to harvests during 2010–2014 and record high and low harvests (since establishment of each BMU).

	2015											
BMU	M	(%M)	F	Total	2014	2013	2012	2011	2010	5-year mean	Record low harvest (yr)	Record high harvest (yr)
QUOTA												
12	37	(62)	23	60	38[d]	62	82	106	95	77	38 (14)	263 (01)
13	53	(74)	19	72[e]	91	95	112	119	155	114	71 (88)	258 (95)
22	4	(57)	3	7	5	9	8	11	9	8	3 (03)	41 (89)
24	51	(53)	46	97	50[f]	76	108	122	124	96	50 (14)	288 (95)
25	139	(61)	88	227	168[g]	197	254	317	307	249	149 (96)	584 (01)
26	87	(72)[c]	34	121	117[h]	121	238	167	232	175	117 (14)	513 (95)
31	198	(64)	109	307	221	197	363	358	363	300	157 (88)	697 (01)
41	20	(57)	15	35[i]	36	40	70	54	71	54	36 (14)	201 (01)
44	107	(68)[c]	51	158	170	181	188	130	248	183	130 (11)	643 (95)
45	38	(69)	17	55	54	48	67	32	58	52	32 (11)	178 (01)
51	195	(65)	107	302	291	349	471	288	501	380	247 (91)	895 (01)
Total	929	(64)	512	1441	1241[j]	1375	1961	1704	2163	1689	1192 (88)	4288 (01)
NO-QUOTA[B]												
11	151	(77)[m]	44	195	77[k]	136	224	219	178	167	38 (87)	351 (05)
10	8	(73)	3	11	8	9	14	3	11	9		
52	217	(67)	107	324	301	346	405	205	347	321	105 (02)	405 (12)
Total	376	(71)	154	530	386	491	643	427	536	497	198 (87)	678 (95)
STATE	1305	(66)[c]	666	1971	1627[j]	1866	2604	2131	2699	2185		4956 (95)

[a] Hunters receive tooth envelopes at registration stations, but the 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.

Also, some tooth envelopes had no corresponding registration data. These were added to the harvest tally. The number of missing registrations was greatly in the last few years.

Year	Quota zone	No-quota zone
2010	20	8
2011	11	2
2012	6	1
2013	5	1
2014	2	1
2015	4	2

[b] Some hunters with no-quota licenses hunted in the quota zone, and their kills were assigned to the BMU where they apparently hunted:

2010: 14; 2011: 14; 2012: 8; 2013: 11; 2014: 4; 2015: 12.

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).

[c] Record high % males

[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 since 1988 (quota—no-quota split in 1987).

[k] Lowest harvest since 1999.

[m] Highest % males since 1999.

Figure 3. Trends in statewide bear harvest and proportions of harvest in the no-quota zones, 1987–2015.

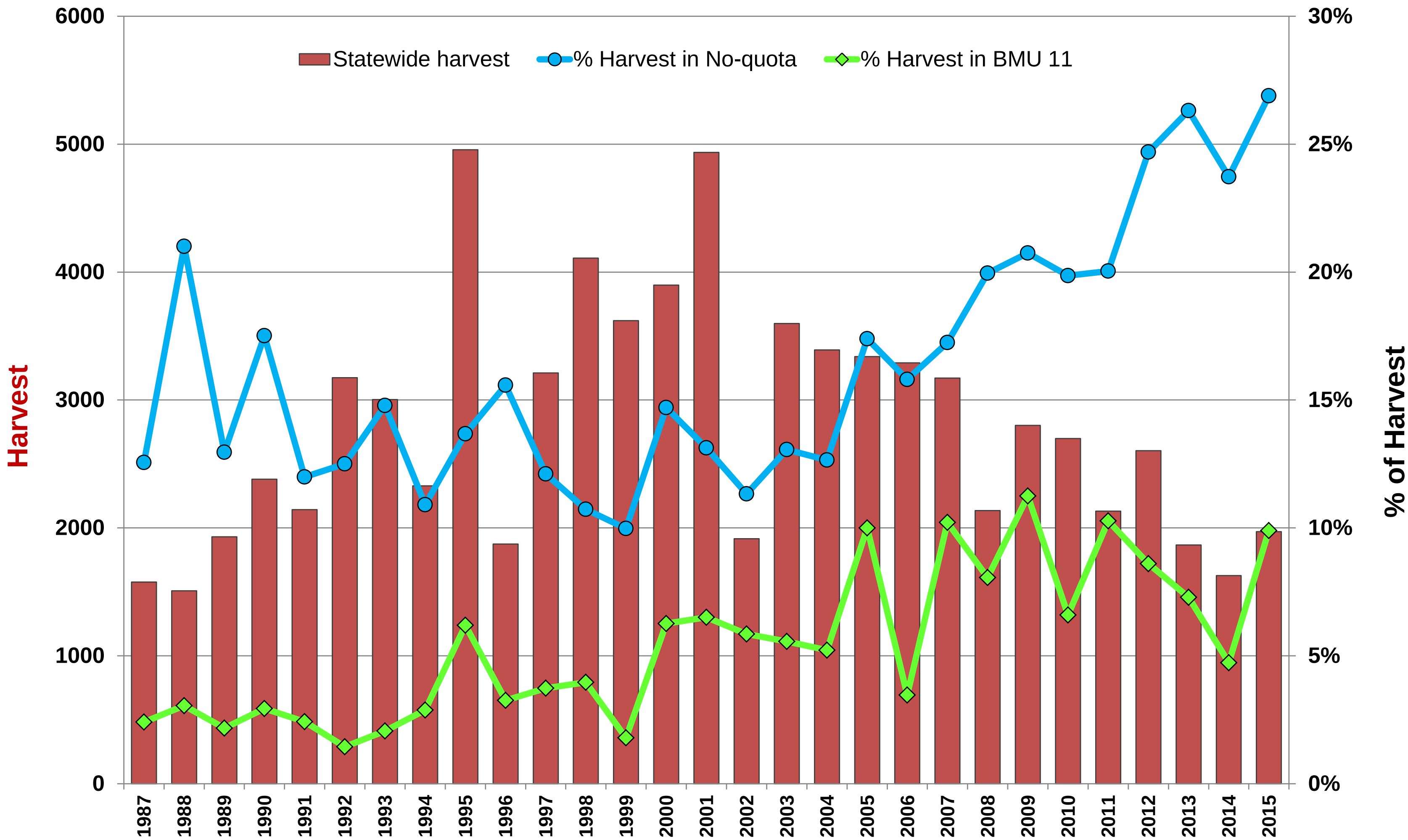


Table 6. Bear hunting success (%) by BMU, measured as the registered harvest divided by the number of licenses sold[a], 2010–2015.

BMU	Max success (yr)		Mean success 2010-2014	2015	2014	2013	2012	2011	2010
12	49	(95)	27	40	19[h]	30	27	30	30
13	59	(95)	32	29	36	38[d]	28	26	34[c]
22	21	(92)	12	13	10	18[e]	8	11	14
24	45	(92)	33	48[i]	25	38[e]	36[e]	35[e]	29
25	47	(92)	34	45[e]	34	39[d]	30	35	34
26	59	(95)	34	34	33	34	43[d]	26	34
31	55	(92)	38	56[i]	40	36	40[d]	36	36
41	50	(95)	24	23	24	26	28	18	25
44	43	(95)	30	35	38	40[d]	27	15[f]	28
45	36	(14)	27	36[i]	36[i]	32	33[b]	13	21[d]
51	39	(13)	29	33	32	39[g]	32[d]	16[f]	27
Quota	42	(95)	*31*	*39*[d]	*33*	*37*[d]	*33*[d]	*24*	*30*
11[j]				20	9	15			
10[j]				7	7	12			
52[j]				15	16	19			
No Quota	32	(95)	*17*	16	13	17	20	*15*[f]	*20*
Statewide	40	(95)	*26*	*28*	*25*	*28*	*28*	*22*	*27*

[a] Harvest/licenses instead of harvest/hunters because BMU-year-specific estimates for the proportion of license-holders that hunted are unreliable. No-quota hunters could take 2 bears during 2008-2012, so their success was calculated by whether or not they shot at least 1 bear. Statewide estimates of harvest/hunters are presented in Table 1.

[b] Highest success since establishment of this BMU in 1994
[c] Highest success since 1997 (until this year).
[d] Highest success since 1995 (until this year).
[e] Highest success since 1992 (until this year)
[f] Lowest success since 2002 (until this year).
[g] Highest success since establishment of this BMU in 1987.
[h] Lowest success in >20 years (same as 2006).
[i] Record high success.

[j] Since 2013, an attempt was made to differentiate the number of no-quota (NQ) hunters by BMU. When no-quota hunters bought licenses, they recorded the deer block where they anticipated hunting. In 2015, 3150 of 3259 selected blocks in (or adjacent to) NQ-BMUs 10 (5%), 11 (30%), or 52 (65%), and 8 chose NQ blocks in SE Minnesota (but none harvested a bear there); 108 chose blocks in the quota zone (12 harvested a bear there, 7 harvested a bear in the NQ zone, 89 were unsuccessful, so the location of their hunt was unknown — these were distributed in NQ-BMUs proportional to those who selected blocks there).

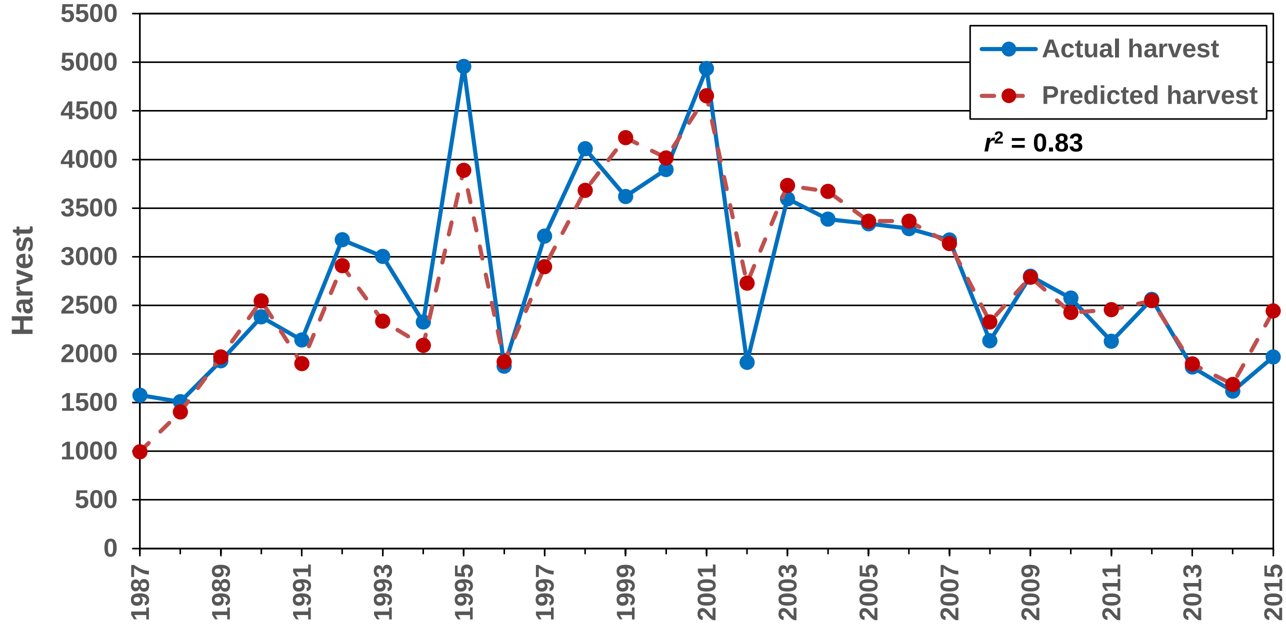
Table 7. Cumulative bear harvest (% of total harvest) by date, 1995–2015.

Year	Day of week for opener	Aug 22/23 – Aug 31	Sep 1 – Sep 7	Sep 1 – Sep 14	Sep 1 – Sep 30
1995	Fri		72	87	97
1996	Sun		56[a]	70	87
1997	Mon		76	88	97
1998	Tue		76	87	96
1999	Wed		69	81	95
2000	Wed	57	72	82	96
2001	Wed	67	82	88	98
2002	Sun		57[a]	69[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

[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: top: statewide (1987–2015); bottom: quota zone only (2000–2015).



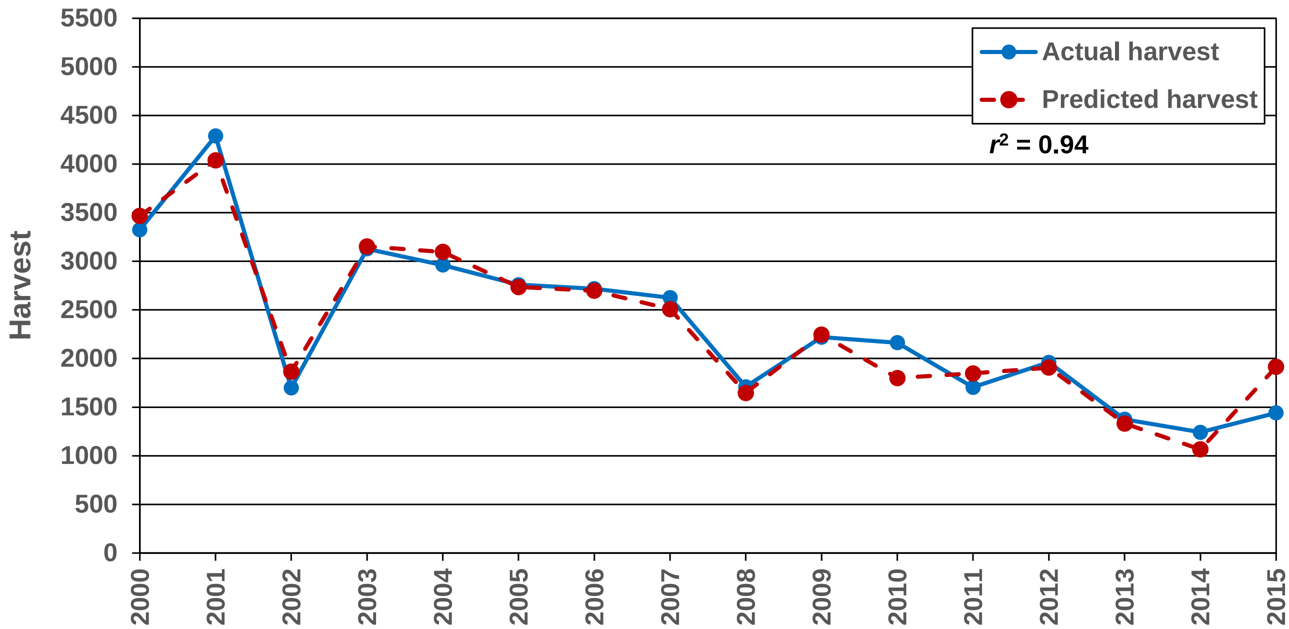
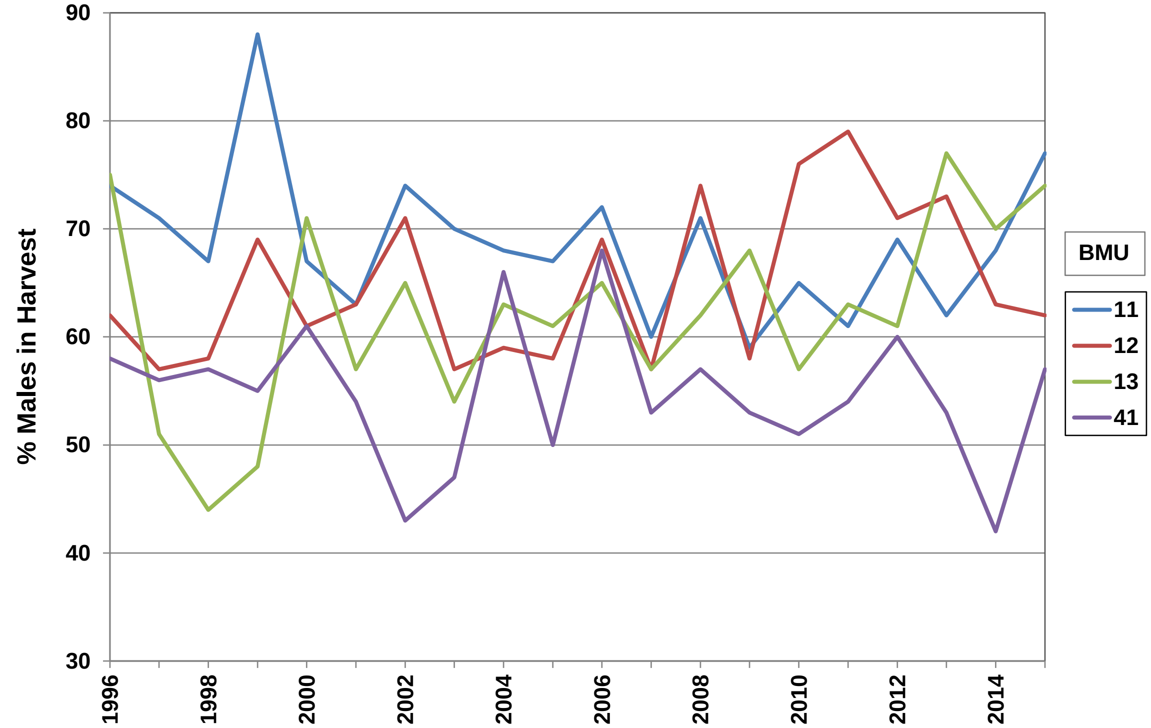


Figure 5. Sex ratios of harvested bears by BMU, 1996–2015.



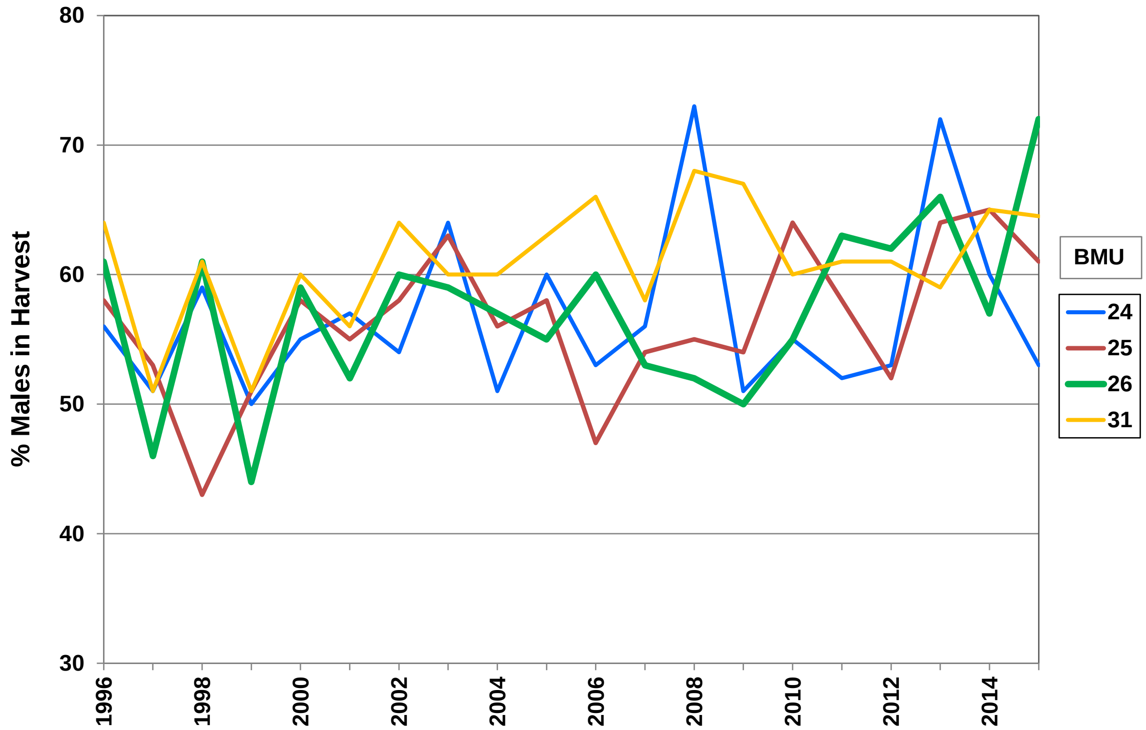


Figure 5. continued.

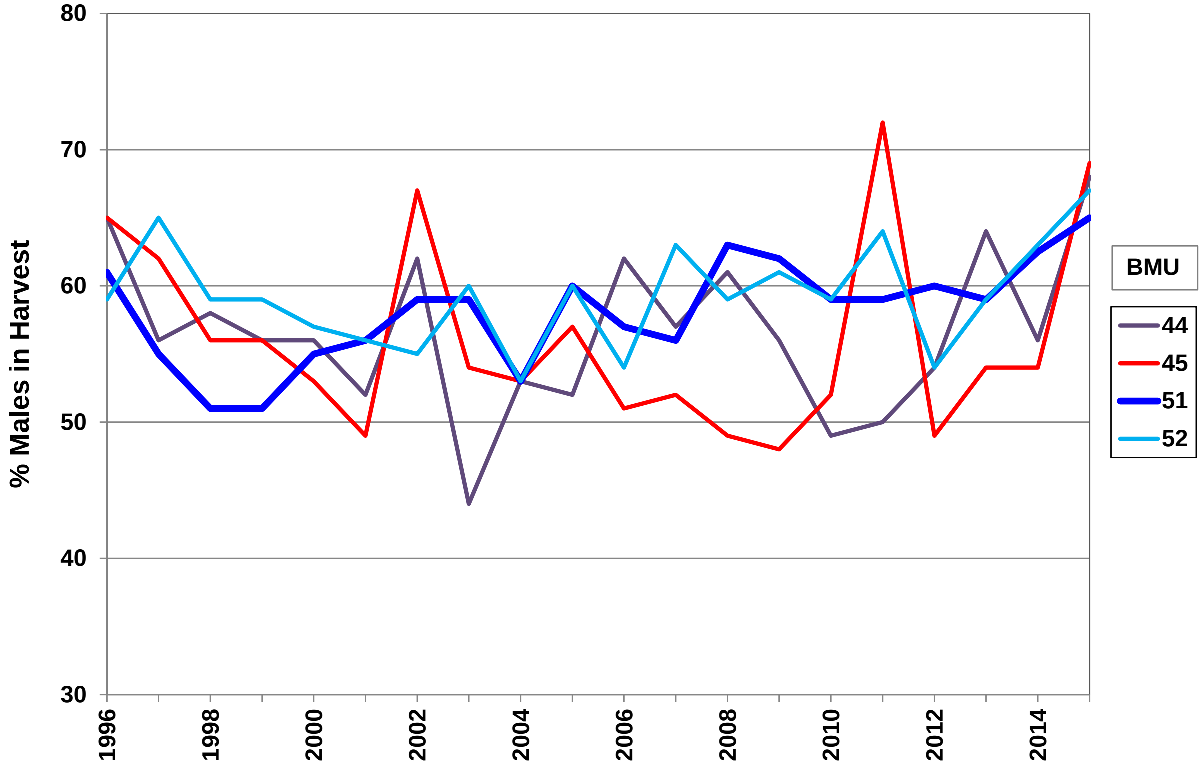
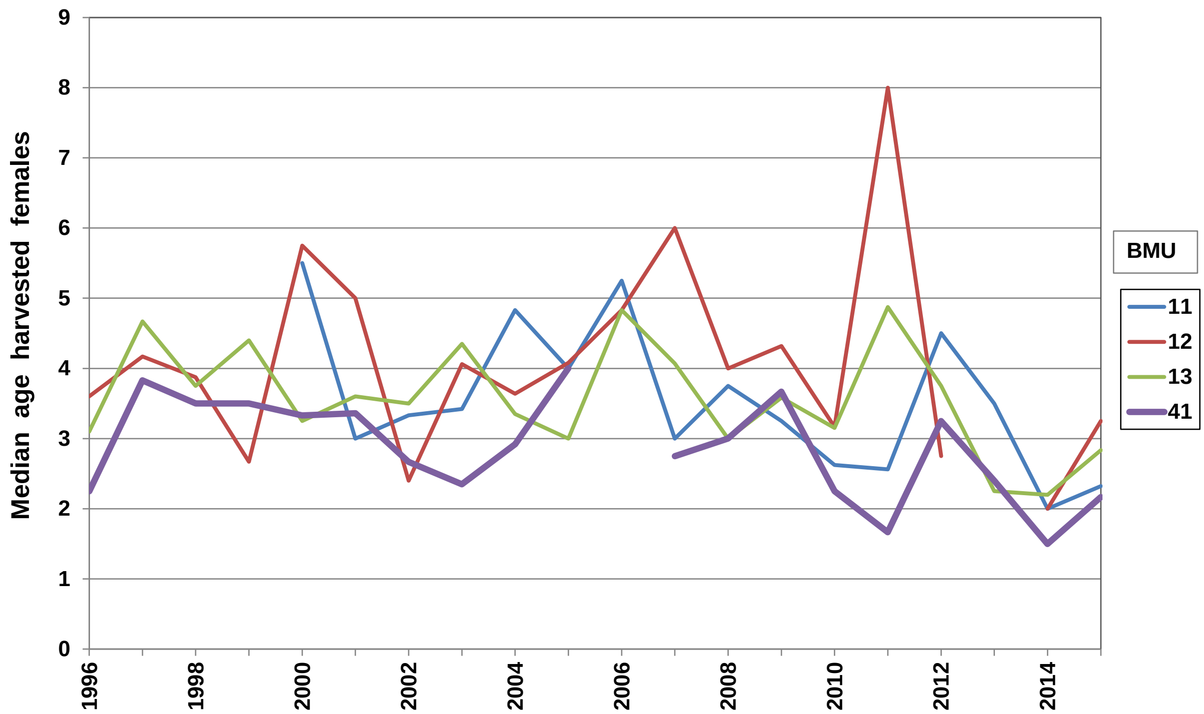


Figure 6. Median ages of harvested female bears by BMU, 1996–2015.
Curves with thicker lines show significant declines through time.



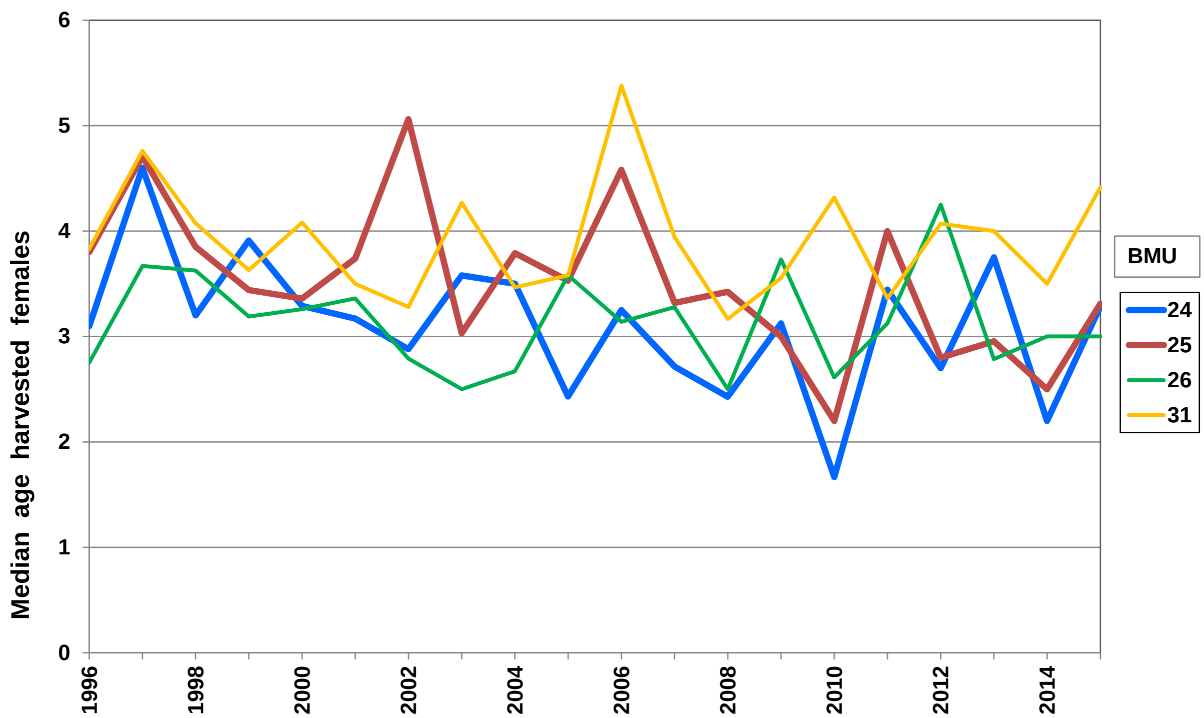


Figure 6. continued.

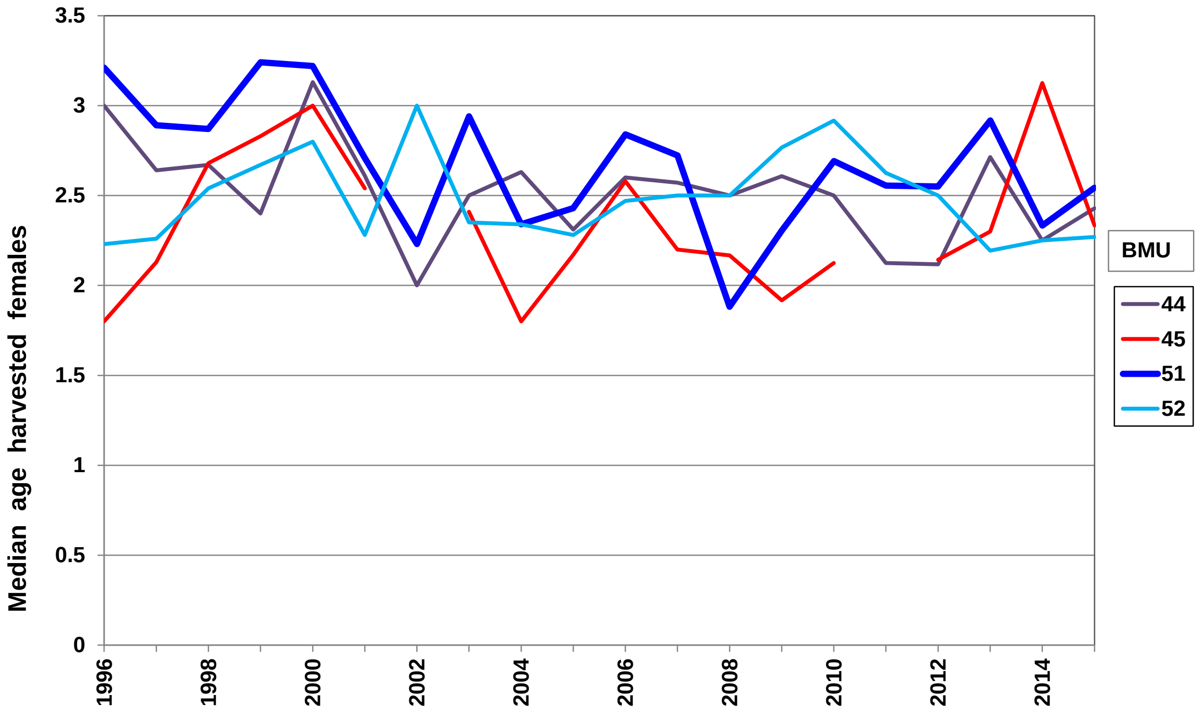


Figure 7. Statewide median ages (yrs) of harvested bears by sex, 1982–2015.

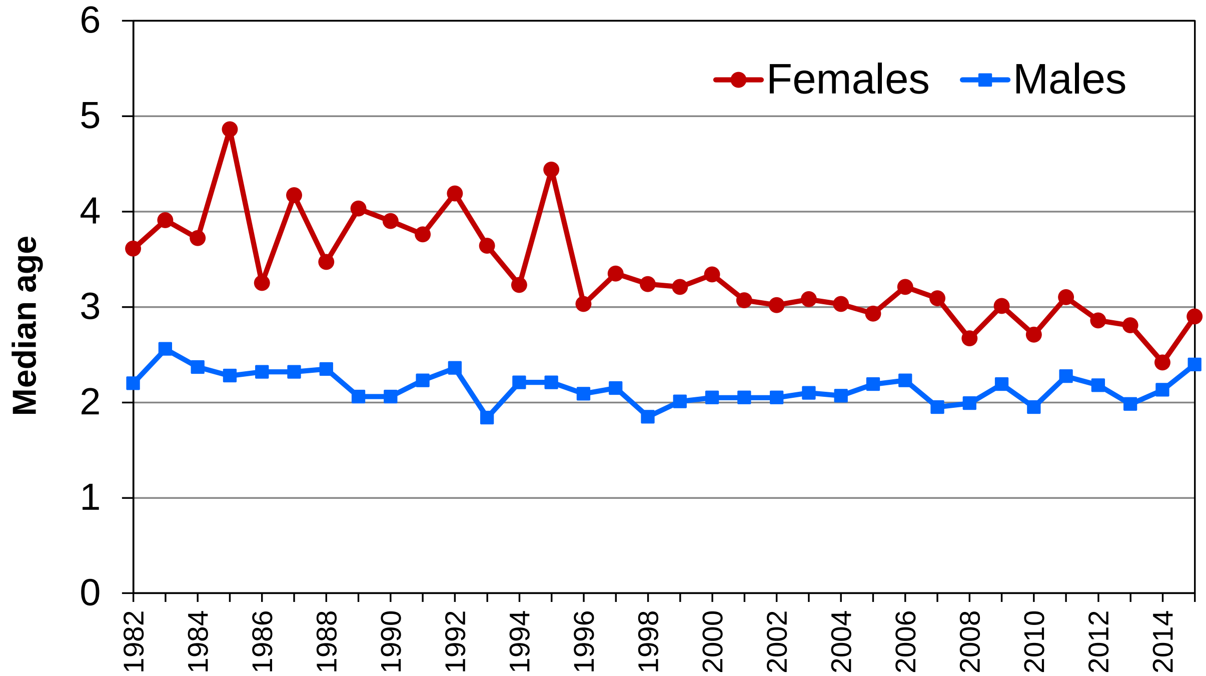


Figure 8. Statewide harvest structure: proportion of each sex in age category, 1982–2015. Trend lines are significant.

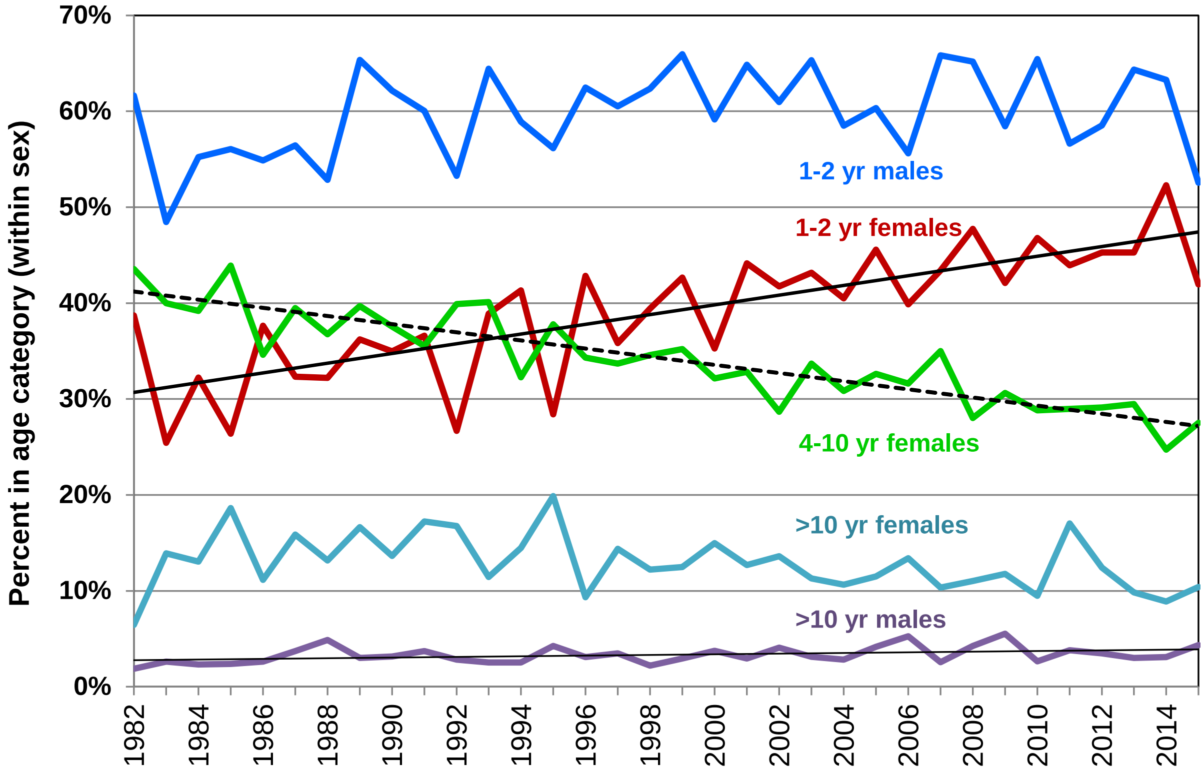


Figure. 9. Percent of hunters submitting bear teeth for aging (now vital for population monitoring, see Figs. 12–14). Cooperation levels exceeded 80% when registration stations were paid to extract teeth (this practice ended in 1993) and when non-compliant hunters were sent a reminder.

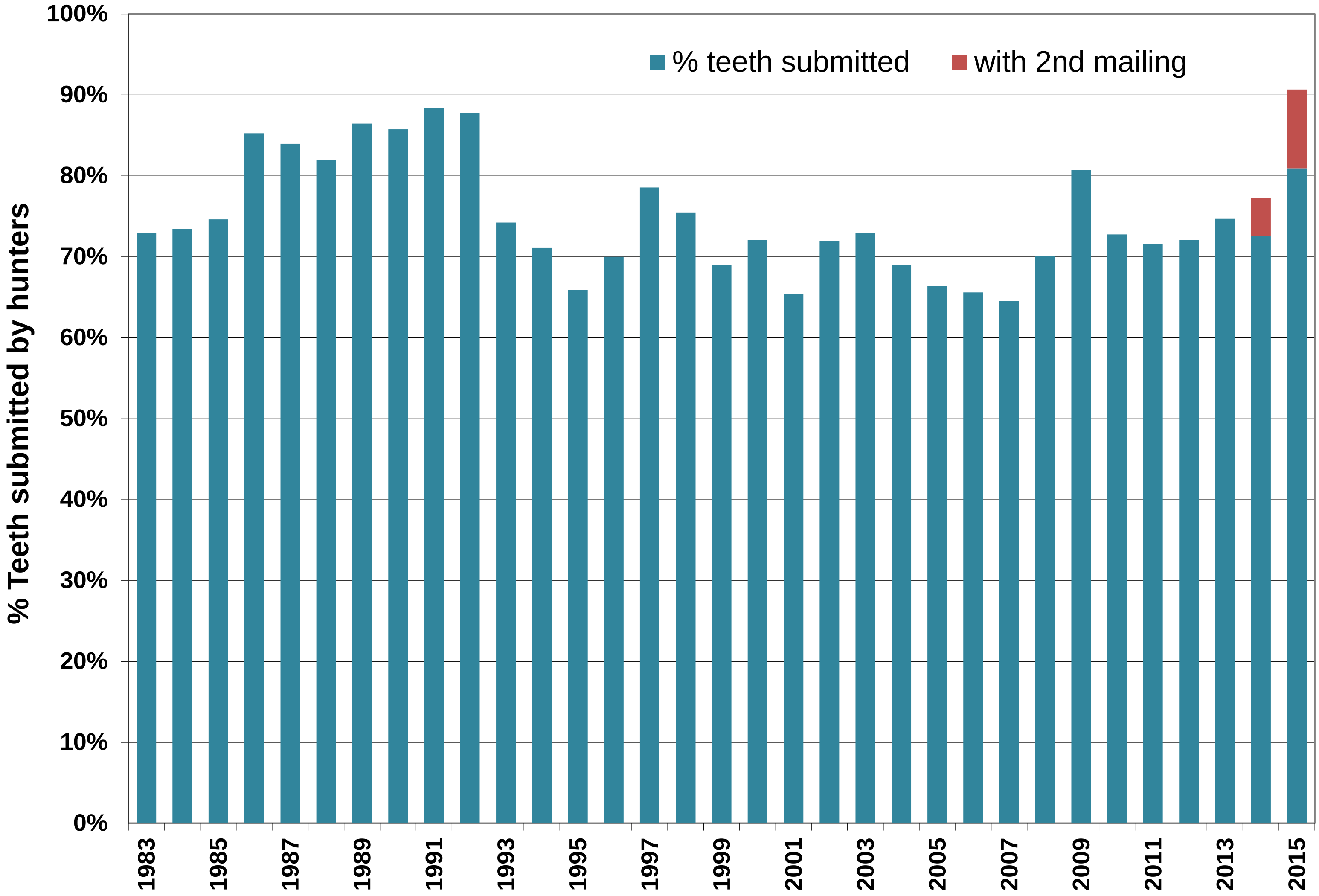
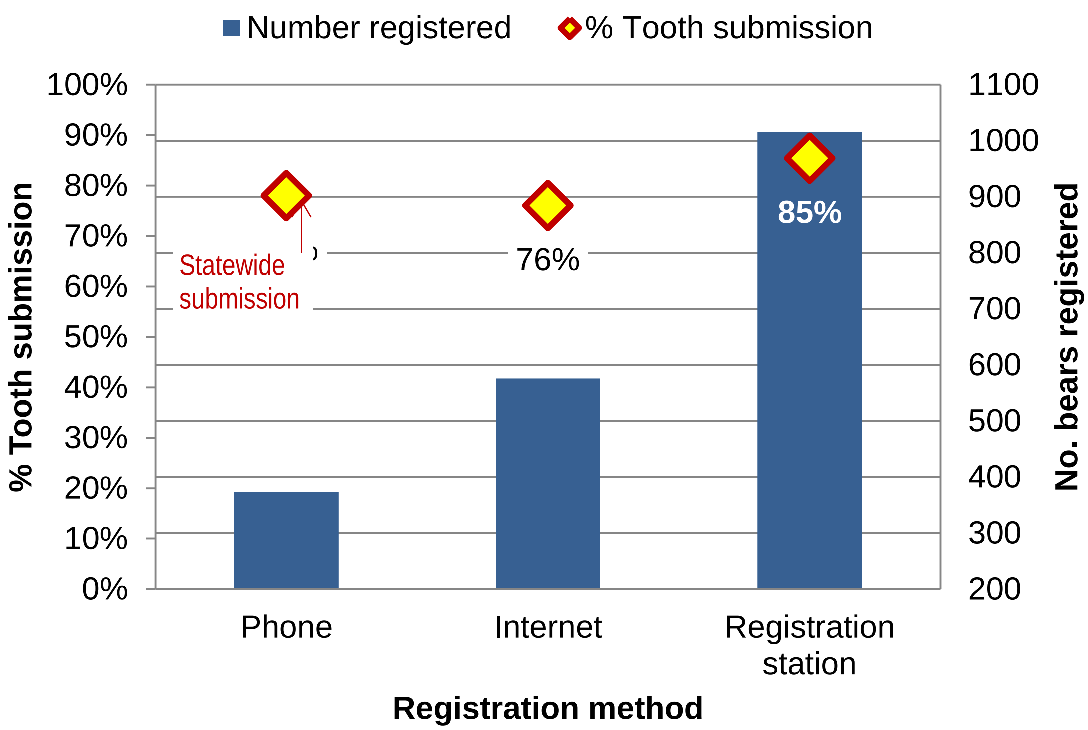
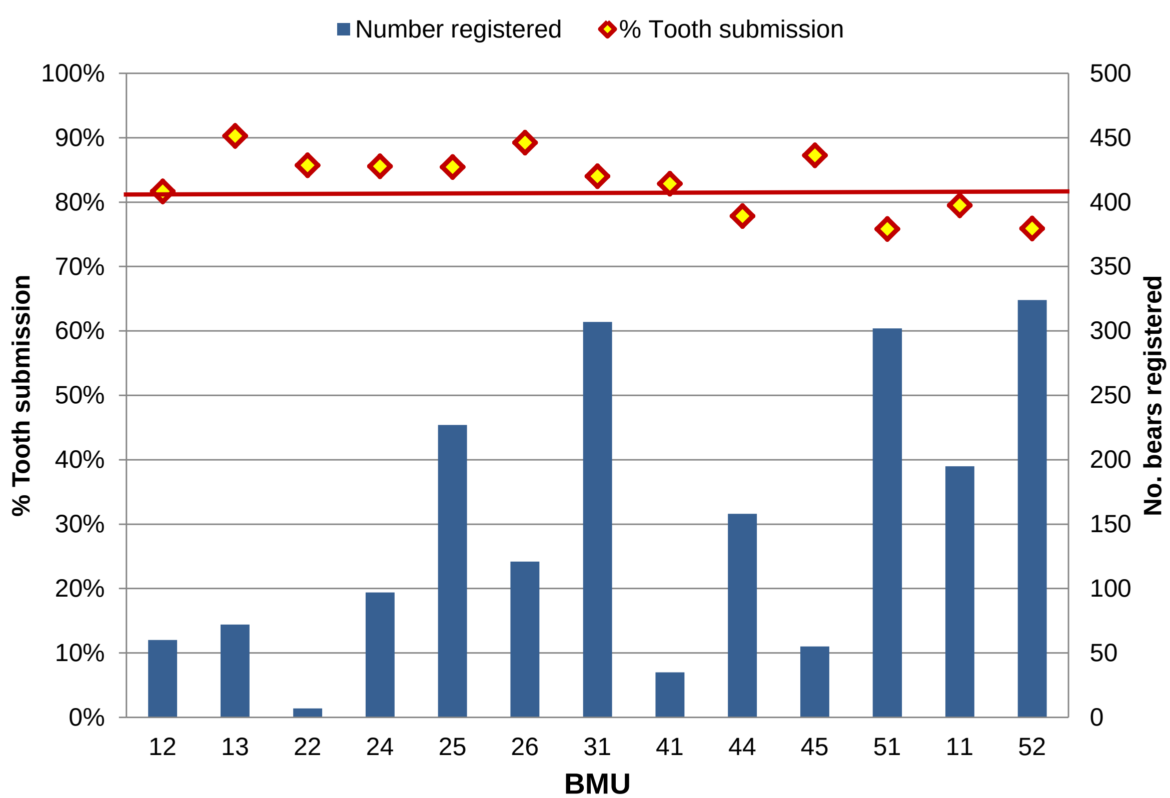


Figure 10. Percent of hunters who submitted a bear tooth in 2015 (before being mailed a reminder letter), by method of registration (top panel) and by BMU (bottom panel). Beginning in 2013, hunters could register their bear by phone or internet.


Number registered
% Tooth submission
% Tooth submission
No. bears registered
Statewide submission
76%
85%
Phone
Internet
Registration station
Registration method


Number registered
% Tooth submission
% Tooth submission
No. bears registered
12 13 22 24 25 26 31 41 44 45 51 11 52
BMU

2015 MINNESOTA DEER HARVEST REPORT

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

INTRODUCTION

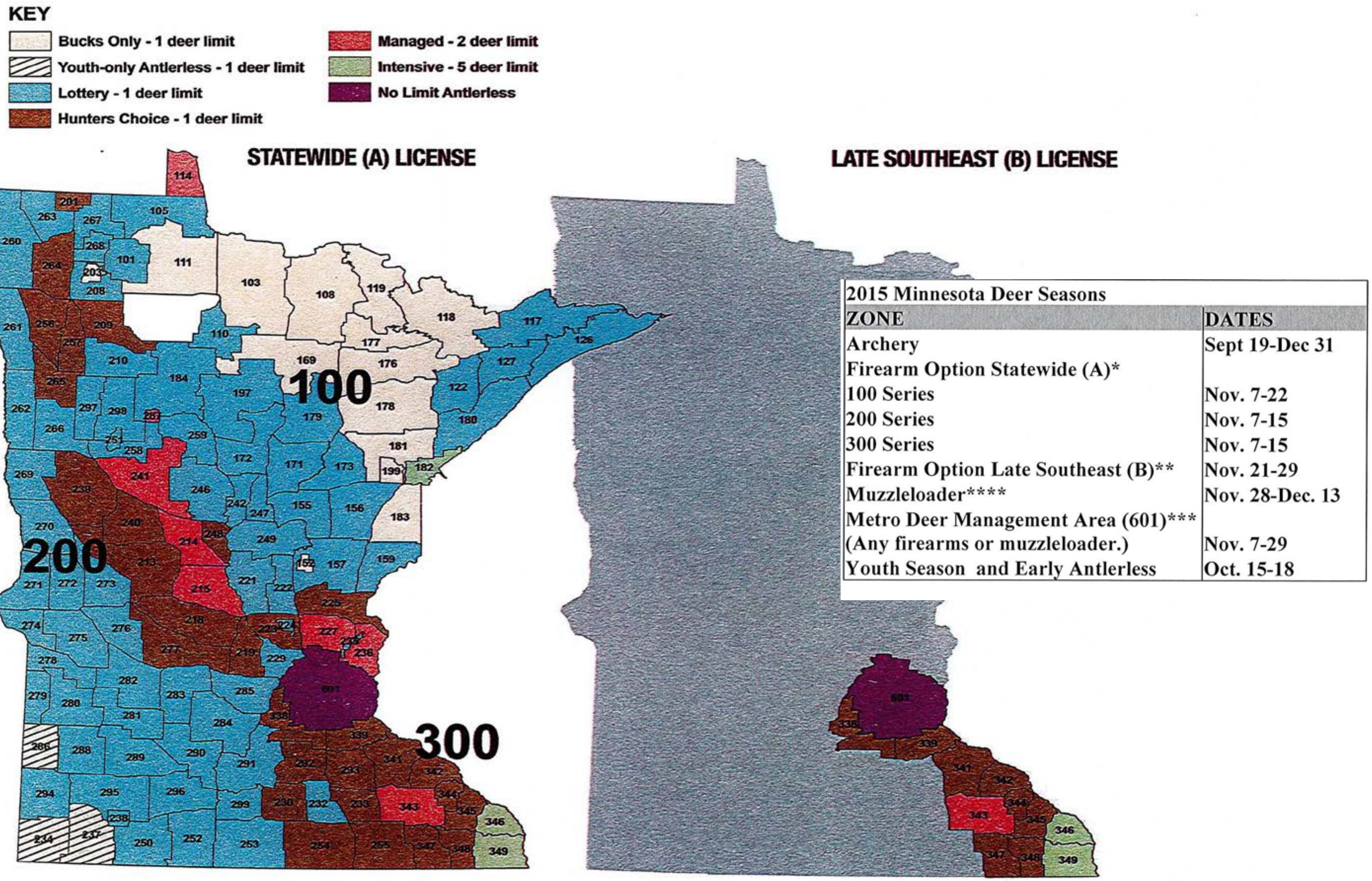
The white-tailed deer may be considered Minnesota's most popular wildlife species. In 2015, nearly 450,000 hunters participated in the season. 2015 was a conservative season designed to rebuild deer numbers across much of the state. During the archery, firearms and muzzleloader seasons, hunters registered 159,343 deer.

METHODS

Every deer taken by hunting in Minnesota must be registered. In 2015, 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 2015 deer harvest are presented in the following tables.



2015 Minnesota Deer Seasons	
ZONE	DATES
Archery	Sept 19-Dec 31
Firearm Option Statewide (A)*	
100 Series	Nov. 7-22
200 Series	Nov. 7-15
300 Series	Nov. 7-15
Firearm Option Late Southeast (B)**	Nov. 21-29
Muzzleloader****	Nov. 28-Dec. 13
Metro Deer Management Area (601)***	
(Any firearms or muzzleloader.)	Nov. 7-29
Youth Season and Early Antlerless	Oct. 15-18

Figure 1. 2015 Firearms and Archery Deer Seasons.

Table 1. Statewide Firearms, Archery, and Muzzleloader Harvest, License Sales, and Success Rates, 2004-2015.

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
REGULAR FIREARMS												
Resident License Sales	309,698	291,298	299,774	285,286	376,006	377,077	379,866	382,668	391,822	391,967	374,314	371,612
Non-Resident License Sales	12,036	12,523	12,520	12,520	11,883	11,759	11,908	11,955	12,483	12,496	11,674	13,501
Bonus Permit Sales	183,186	184,566	167,343	145,522	190,156	140,920	143,763	142,049	89,750	97,402	29,642	31,065
Multi-Zone Buck License Sales	32,359	28,233	15,984	15,051	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Youth License Sales	51,347	50,501	49,599	49,242	50,397	56,678	59,726	60,943	62,949	64,748	62,488	62,333
All Season Deer License Sales	46,008	59,090	75,511	76,385	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total License Sales	634,634	626,211	620,731	584,006	628,442	586,434	595,263	597,615	557,004	566,613	478,118	448,007
Registered Buck Harvest[1]	116,612	95,594	95,695	97,528	85,646	83,820	88,027	76,003	84,729	70,627	70,627	83,939
Antlerless Permits Offered	30,760	28,830	18,925	18,830	32,325	60,100	60,083	15,525	32,854	36,816	26,332	31,065
Antlerless Permits Issued	24,111	25,656	18,925	18,830	32,325	60,100	60,083	15,525	32,854	36,816	26,332	31,065
Antlerless Permits App.	28,454	31,403	31,403	31,403	31,403	90,882	86,783	21,071	67,308	68,811	96,580	95,656
Registered AL Harvest[1]	123,278	119,363	135,981	118,860	98,147	78,525	86,077	88,197	71,140	67,885	46,030	48,758
Registered Total Harvest[1]	239,890	214,957	231,676	216,388	183,793	162,345	174,104	164,200	155,869	145,449	116,657	132,697
Registered % Successful[2]	37.8	34.3	37.3	41.7	34.8	33.8	35.9	32.9	32.0	29.7	25.3	29.6
ARCHERY												
Resident License Sales	50,601	50,293	49,595	52,780	87,872	88,707	91,156	90,252	95,259	92,717	92,301	93,462
Non-Resident License Sales	1,144	1,207	1,286	1,509	1,509	1,610	1,638	1,718	1,814	1,952	1,946	2,032
Youth Archery Sales	7,261	7,489	7,688	7,663	9,005	9,157	9,577	10,306	11,276	12,212	11,965	11,905
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	59,006	58,989	58,569	61,952	99,033	99,474	102,371	102,276	108,349	106,881	106,212	107,399
Total Harvest - All-Season License	3,489	4,563	8,284	6,900	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Archery Harvest	20,726	23,538	25,360	24,161	22,632	20,629	22,057	20,444	21,605	19,388	17,119	20,074
Registered % Successful[2]	29.2	24.6	24.8	24.3	18.5	17.5	17.8	17.0	18.8	14.5	15.3	18.7
MUZZLELOADER												
Total Muzzleloader License Sales	10,512	9,226	10,781	9,867	64,673	63,282	55,640	59,384	58,363	51,092	43,946	50,176
Estimated All-Season Hunters	14,168	23,293	23,293	26,813	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Muzzleloader Harvest	9,289	15,421	13,507	12,138	9,572	7,929	9,023	7,416	7,779	7,045	5,814	6,572
Registered % Successful[2]	37.6	47.4	39.6	28.2	13.4	11.3	14.4	11.6	12.4	12.7	12.7	7.6
Antlerless Permits Offered							5,792	1,997	1,626	2,144	1,593	1,434
Antlerless Permits App.							7,260	2,615	3,743	3,544	4,588	3,393
TOTAL Registered Harvest	260,604	255,736	270,778	260,434	221,837	194,186	207,313	192,331	186,634	172,781	139,442	159,343

[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, 2015.

Season	Hunters	Harvest			Overall Success	Unique Successful Hunters[3]
		Bucks	Antlerless	Total		
1A	160,725	26,614	6,296	32,910	20.5%	32,923
2A	244,119	49,273	31,225	80,498	32.6%	79,618
3A	27,410	5,534	4,518	10,052	34.6%	9,493
3B	12,739	1,048	3,280	4,328	32.6%	4,155
Metro Firearm	N/A	619	559	1,178	N/A	1,044
Youth	N/A	600	590	1,190	N/A	1,190
Depredation[1]	N/A	0	72	72	N/A	51
Disabled/Mentored[1]	N/A	10	16	26	N/A	
Early Antlerless[1]	N/A	1	441	442	N/A	357
Free Landowner[1]	N/A	0	1,416	1,416	N/A	1,416
900 Series[1]	4,402	472	1527	1,999	25.0%	1,101
Muzzleloader	50,176	2,629	3,650	6,279	12.0%	6,031
Archery	107,399	9,264	9,689	18,953	16.5%	17,730
Total[2]	**606,970**	**96,064**	**63,279**	**159,343**		**155,109**

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

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

[3] Number of individuals who harvested at least one deer. For example 51 unique persons harvested 72 antlerless deer utilizing depredation permits in 2015.

Table 3. Firearms Harvest and Harvest per Square Mile by Permit Area, 2015. 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	425	22	7	5	459	496	0.86	0.07	0.93
103	1A	696	3	3	1	703	1,824	0.38	0.00	0.39
105	1A	889	103	23	19	1,034	932	0.95	0.16	1.11
108	1A	892	9	1	0	902	1,701	0.52	0.01	0.53
110	1A	883	188	40	31	1,142	530	1.66	0.49	2.15
111	1A	441	10	3	0	454	1,440	0.31	0.01	0.32
114	1A	30	10	0	1	41	412	0.07	0.03	0.10
117	1A	44	2	0	0	46	1,129	0.04	0.00	0.04
118	1A	523	0	2	0	525	1,445	0.36	0.00	0.36
119	1A	352	4	1	1	358	946	0.37	0.01	0.38
122	1A	167	62	14	7	250	622	0.27	0.13	0.40
126	1A	265	74	12	3	354	979	0.27	0.09	0.36
127	1A	53	10	1	1	65	587	0.09	0.02	0.11
152	1A	75	8	2	0	85	62	1.22	0.16	1.38
155	1A	934	389	121	64	1,508	639	1.46	0.90	2.36
156	1A	1224	227	61	39	1,551	834	1.47	0.39	1.86
157	1A	1935	450	166	77	2,628	904	2.14	0.77	2.91
159	1A	977	176	59	28	1,240	575	1.70	0.46	2.15
169	1A	1307	12	7	3	1,329	1,202	1.09	0.02	1.11
171	1A	961	220	59	34	1,274	729	1.32	0.43	1.75
172	1A	1650	494	145	97	2,386	786	2.10	0.94	3.03
173	1A	628	127	36	26	817	617	1.02	0.31	1.32
176	1A	1269	7	5	0	1,281	1,150	1.10	0.01	1.11
177	1A	642	5	0	0	647	553	1.16	0.01	1.17
178	1A	1350	12	8	3	1,373	1,325	1.02	0.02	1.04
179	1A	1561	338	98	61	2,058	939	1.66	0.53	2.19
180	1A	554	168	39	13	774	999	0.55	0.22	0.77
181	1A	754	10	4	3	771	746	1.01	0.02	1.03
182	1A	392	287	114	60	853	280	1.40	1.65	3.05
183	1A	899	18	9	3	929	675	1.33	0.04	1.38
184	1A	2776	703	201	126	3,806	1,318	2.11	0.78	2.89
197	1A	975	135	40	27	1,177	1,343	0.73	0.15	0.88
199	1A	91	0	1	0	92	152	0.60	0.01	0.60
201	2A	136	50	15	6	207	169	0.80	0.42	1.22
203	2A	73	1	0	1	75	132	0.55	0.02	0.57
208	2A	275	33	9	8	325	379	0.73	0.13	0.86
209	2A	538	258	52	35	883	641	0.84	0.54	1.38
210	2A	827	184	68	34	1,113	635	1.30	0.45	1.75
213	2A	2310	1066	322	212	3,910	1,161	1.99	1.38	3.37
214	2A	1673	1121	441	308	3,543	566	2.96	3.30	6.26
215	2A	1432	963	452	269	3,116	730	1.96	2.31	4.27
218	2A	1063	567	202	158	1,990	912	1.17	1.02	2.18
219	2A	613	318	109	73	1,113	427	1.44	1.17	2.61
221	2A	1126	333	130	96	1,685	647	1.74	0.86	2.60
222	2A	826	299	121	76	1,322	413	2.00	1.20	3.20
223	2A	624	321	114	81	1,140	385	1.62	1.34	2.96
224	2A	89	27	9	13	138	49	1.81	1.00	2.81
225	2A	1383	677	288	161	2,509	635	2.18	1.77	3.95

Table 3. Continued.

Permit Area	Zone	Adult Male	Fawn Male	Adult Female	Fawn Female	Total	Area Size (sq.mi.)	Bucks/ Sq. Mile	Antlerless/ Sq. Mile	Total/ Sq. Mile
227	2A	963	547	217	152	1,879	491	1.96	1.86	3.82
229	2A	257	67	17	19	360	313	0.82	0.33	1.15
230	2A	228	156	46	35	465	464	0.49	0.51	1.00
232	2A	261	54	18	11	344	380	0.69	0.22	0.90
233	2A	207	90	33	14	344	386	0.54	0.35	0.89
234	2A	206	18	6	2	232	637	0.32	0.04	0.36
235	2A	60	19	4	3	86	37	1.63	0.71	2.34
236	2A	601	379	99	73	1,152	404	1.49	1.37	2.85
237	2A	278	48	7	10	343	737	0.38	0.09	0.47
238	2A	83	17	5	6	111	98	0.85	0.29	1.14
239	2A	1584	809	275	163	2,831	1,110	1.43	1.12	2.55
240	2A	1898	891	283	207	3,279	694	2.73	1.99	4.72
241	2A	3388	2585	854	609	7,436	1,047	3.24	3.87	7.10
242	2A	575	133	50	25	783	307	1.87	0.68	2.55
246	2A	2050	487	176	122	2,835	860	2.38	0.91	3.30
247	2A	636	281	111	67	1,095	263	2.42	1.74	4.16
248	2A	401	198	71	45	715	229	1.75	1.37	3.13
249	2A	1065	402	158	82	1,707	729	1.46	0.88	2.34
250	2A	331	78	22	10	441	730	0.45	0.15	0.60
251	2A	101	25	10	2	138	68	1.48	0.54	2.03
252	2A	327	119	19	16	481	735	0.44	0.21	0.65
253	2A	395	130	23	8	556	987	0.40	0.16	0.56
254	2A	530	272	72	44	918	946	0.56	0.41	0.97
255	2A	457	200	66	31	754	774	0.59	0.38	0.97
256	2A	538	260	57	51	906	654	0.82	0.56	1.39
257	2A	399	195	63	37	694	426	0.94	0.69	1.63
258	2A	914	290	112	70	1,386	381	2.40	1.24	3.64
259	2A	1382	490	175	95	2,142	546	2.53	1.39	3.92
260	2A	463	59	14	7	543	1,252	0.37	0.06	0.43
261	2A	230	53	19	12	314	796	0.29	0.11	0.39
262	2A	215	52	18	11	296	677	0.32	0.12	0.44
263	2A	454	80	23	11	568	513	0.89	0.22	1.11
264	2A	798	414	84	44	1,340	672	1.19	0.81	1.99
265	2A	522	303	79	55	959	495	1.06	0.88	1.94
266	2A	404	76	12	8	500	625	0.65	0.15	0.80
267	2A	287	39	6	9	341	472	0.61	0.11	0.72
268	2A	330	58	10	9	407	239	1.38	0.32	1.70
269	2A	212	59	14	16	301	652	0.33	0.14	0.46
270	2A	213	41	9	8	271	758	0.28	0.08	0.36
271	2A	266	78	11	8	363	646	0.41	0.15	0.56
272	2A	197	49	7	3	256	544	0.36	0.11	0.47
273	2A	513	224	46	37	820	634	0.81	0.48	1.29
274	2A	264	77	10	9	360	381	0.69	0.25	0.95
275	2A	393	106	22	11	532	777	0.51	0.18	0.69
276	2A	612	219	52	39	922	575	1.06	0.54	1.60
277	2A	1561	820	201	150	2,732	876	1.78	1.34	3.12
278	2A	370	89	21	9	489	422	0.88	0.28	1.16
279	2A	205	108	9	11	333	346	0.59	0.37	0.96
280	2A	253	93	9	11	366	676	0.37	0.17	0.54
281	2A	492	167	40	20	719	579	0.85	0.39	1.24

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
282	2A	137	26	7	2	172	780	0.18	0.04	0.22
283	2A	312	61	13	9	395	640	0.49	0.13	0.62
284	2A	342	145	25	15	527	853	0.40	0.22	0.62
285	2A	419	104	29	10	562	580	0.72	0.25	0.97
286	2A	302	49	8	4	363	458	0.66	0.13	0.79
287	2A	82	83	28	16	209	51	1.62	2.51	4.12
288	2A	413	156	43	27	639	630	0.66	0.36	1.01
289	2A	248	79	13	14	354	820	0.30	0.13	0.43
290	2A	436	169	42	33	680	666	0.66	0.37	1.02
291	2A	688	248	68	37	1,041	832	0.83	0.42	1.25
292	2A	568	272	101	47	988	517	1.10	0.81	1.91
293	2A	544	230	85	45	904	512	1.06	0.70	1.77
294	2A	403	205	29	18	655	689	0.59	0.37	0.95
295	2A	524	102	26	12	664	855	0.61	0.16	0.78
296	2A	333	137	25	17	512	675	0.49	0.27	0.76
297	2A	212	24	7	5	248	449	0.47	0.08	0.55
298	2A	668	74	30	15	787	677	0.99	0.18	1.16
299	2A	285	119	27	13	444	389	0.73	0.41	1.14
338	3A	225	125	36	22	408	472	0.48	0.39	0.86
338	3B	39	58	16	6	119	472	0.08	0.17	0.25
339	3A	222	120	36	24	402	406	0.55	0.44	0.99
339	3B	33	53	18	10	114	406	0.08	0.20	0.28
341	3A	631	306	100	80	1,117	626	1.01	0.78	1.78
341	3B	128	256	76	46	506	626	0.20	0.60	0.81
342	3A	531	204	50	34	819	374	1.42	0.77	2.19
342	3B	104	200	67	42	413	374	0.28	0.83	1.10
343	3A	570	430	128	120	1,248	664	0.86	1.02	1.88
343	3B	83	204	60	58	405	664	0.13	0.49	0.61
344	3A	328	234	47	56	665	190	1.73	1.78	3.50
344	3B	41	116	30	12	199	190	0.22	0.83	1.05
345	3A	368	141	43	39	591	335	1.10	0.66	1.76
345	3B	96	159	60	28	343	335	0.29	0.74	1.02
346	3A	764	493	160	111	1,528	328	2.33	2.33	4.66
346	3B	171	325	131	89	716	328	0.52	1.66	2.18
347	3A	397	130	43	31	601	434	0.92	0.47	1.39
347	3B	77	164	36	30	307	434	0.18	0.53	0.71
348	3A	482	243	61	38	824	332	1.45	1.03	2.48
348	3B	62	173	53	31	319	332	0.19	0.77	0.96
349	3A	1016	656	178	156	2,006	499	2.04	1.98	4.02
349	3B	214	536	164	139	1,053	499	0.43	1.68	2.11
601	Metro	619	360	125	74	1,178	1,756	0.35	0.32	0.67
Total		**83,088**	**30,974**	**9,703**	**6,386**	**130,151**	**83,586**	**0.99**	**0.56**	**1.56**

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

Table 4. Firearm Harvest using Bonus Permits, 2015.
Managed Permit Areas.

Permit Area	Zone	Adult Female	Fawn Male	Fawn Female	Total
114	1A	5	0	0	5
214	2A	565	197	155	917
215	2A	451	186	132	769
227	2A	269	105	82	456
236	2A	201	56	43	300
241	2A	1,347	397	312	2,056
287	2A	49	16	9	74
343	3A	275	69	65	409
343	3B	112	32	39	183
Total		**3,274**	**1,058**	**837**	**5,169**

Intensive Permit Areas

Permit Area	Zone	Adult Female	Fawn Male	Fawn Female	Total
182	1A	171	77	41	289
346	3A	362	110	83	555
346	3B	197	69	56	322
349	3A	511	119	116	746
349	3B	320	94	99	513
Total		**1,561**	**469**	**395**	**2,425**

Table 5. Early Antlerless Season Harvest by Permit Area, 2015.

Permit Area	Adult Female	Fawn Male	Fawn Female	Total
346	130	36	29	195
349	159	42	42	243
Total	**289**	**78**	**71**	**438**

Table 6. Summary of Firearms Special Hunts, 2015. 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	11/7 11/22	NA†*	2	1	0	1	4
901-Rice Lake NWR	11/14-11/22	40*	2	4	1	1	8
902-Saint Croix State Park	11/19 - 11/22	350*	28	68	23	16	135
903-Lake Louise State Park	11/14 - 11/15	25***	8	9	11	5	33
904-Gooseberry Falls State Park	11/7 - 11/22	50*	3	8	3	0	14
905-Split Rock Lighthouse State Park	11/7 - 11/22	30*	5	8	1	0	14
906-Tettegouche State Park	11/7 - 11/22	125*	7	10	4	2	23
907-Scenic State Park	11/7 - 11/22	30*	2	4	1	0	7
908-Hayes Lake State Park	11/7 - 11/22	50	5	3	0	0	8
909-Lake Bemidji State Park	11/7 - 11/10	30***	5	10	1	2	18
910-Zippel Bay State Park	11/7 - 11/22	55**	0	14	5	3	22
911-Judge CR Magney State Park	11/7 - 11/22	NA†*	2	1	1	0	4
912-Schoolcraft State Park	11/7 - 11/22	NA†*	2	1	0	0	3
913-Lake Carlos State Park	11/7 - 11/8	18**	1	4	2	2	9
914-William O'Brien State Park	11/14 - 11/15	50*	10	15	1	6	32
915-Lake Bronson State Park	11/7 - 11/15	30*	9	4	0	0	13
916-Maplewood State Park	11/7 - 11/10	100*	23	14	5	2	44
919-Glacial Lakes State Park	11/12 - 11/15	30**	0	6	3	0	9
920-Zumbro Falls SNA	11/7 - 11/15	12**	0	2	6	3	11
921-Forestville/Mystery Cave State Park	11/7 - 11/8	130*	37	49	17	19	122
922-Beaver Creek Valley State Park	11/7 - 11/8	20*	3	4	1	2	10
923-Zumbro Falls SNA	11/21 - 11/29	12**	0	7	2	0	9
925A-Vermillion Highlands Research (A or B)	11/7 - 11/20	20*	3	2	1	0	6
927-Whitewater State Park	11/21 - 11/22	50*	1	19	6	7	33
929-Frontenac State Park	11/21 - 11/23	60*	6	28	4	7	45
931-City of Grand Rapids	11/7 - 11/22	NA†*	10	11	8	9	38
932A-Lake Elmo Park Reserve	11/7 - 11/8	40*	5	4	2	0	11
932B-Lake Elmo Park Reserve	11/14 - 11/15	40*	4	6	5	5	20
933A-Carver Park Reserve (A or B)	11/14 - 11/15	110*	23	31	5	4	63
934-Whitewater State Game Refuge	11/21 - 11/29	75**	0	20	3	2	25
Total			**206**	**367**	**122**	**98**	**793**

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

Table 7. Free Landowner Firearms Harvest by Permit Area, 2015.

Permit Area	Adult Female	Fawn Male	Fawn Female	Total
182	1	0	0	1
201	2	0	0	2
209	17	3	1	21
213	78	18	16	112
214	70	31	13	114
215	31	18	11	60
218	10	2	0	12
219	1	2	1	4
223	1	1	0	2
225	17	3	5	25
227	3	3	1	7
230	0	1	0	1
233	2	2	0	4
236	2	0	2	4
239	34	7	7	48
240	78	16	16	110
241	101	35	30	166
248	7	2	0	9
254	5	0	0	5
255	6	2	2	10
256	15	3	3	21
257	29	2	5	36
264	25	3	2	30
265	13	2	2	17
277	5	2	1	8
292	7	4	2	13
293	6	1	1	8
338	6	1	0	7
339	4	2	1	7
341	34	11	7	52
342	45	5	4	54
343	11	8	4	23
344	14	3	1	18
345	24	6	6	36
346	23	8	5	36
347	6	1	2	9
348	19	4	4	27
349	38	5	11	54
Total	**790**	**217**	**166**	**1,173**

Table 8. Archery Harvest by Permit Area, 2015. 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	11	4	0	0	15
103	7	0	0	0	7
105	23	15	1	3	42
108	26	0	0	0	26
110	24	18	1	3	46
111	7	0	0	0	7
114	1	3	0	0	4
118	11	0	0	0	11
119	9	0	0	0	9
122	7	7	0	0	14
126	5	8	2	1	16
127	2	4	0	0	6
152	4	1	0	0	5
155	54	55	10	2	121
156	58	58	7	7	130
157	126	66	18	7	217
159	68	36	9	5	118
169	30	0	1	0	31
171	20	41	13	5	79
172	65	94	22	10	191
173	18	21	5	3	47
176	38	1	0	1	40
177	17	1	1	0	19
178	62	0	0	0	62
179	93	89	16	9	207
180	31	24	3	3	61
181	38	6	1	2	47
182	111	234	59	30	434
183	42	5	0	2	49
184	198	122	25	12	357
197	27	29	4	3	63
199	3	2	1	0	6
201	4	2	1	1	8
203	1	0	0	0	1
208	8	4	1	0	13
209	32	16	0	1	49
210	28	12	4	0	44
213	328	179	22	25	554
214	124	190	41	33	388
215	219	325	63	32	639
218	172	109	19	18	318
219	149	81	12	15	257
221	120	58	17	8	203
222	88	25	8	2	123
223	198	118	26	16	358
224	17	6	4	0	27
225	170	83	17	13	283
227	294	303	45	47	689
229	67	33	12	6	118
230	39	25	1	2	67
232	33	22	4	4	63
233	41	25	7	4	77

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
250	58	22	3	1	84
251	7	2	2	1	12
252	40	25	7	2	74
253	69	56	8	2	135
254	88	46	3	3	140
255	112	51	17	7	187
256	24	15	0	3	42
257	22	21	3	2	48
258	44	21	7	0	72
259	54	45	10	3	112
260	12	6	1	0	19
261	24	8	2	2	36
262	50	19	4	3	76
263	19	7	0	1	27
264	26	22	1	2	51
265	23	18	3	2	46
266	25	15	2	0	42
267	7	6	2	1	16
268	14	4	1	1	20
269	34	18	3	1	56
270	18	13	0	1	32
271	22	18	0	2	42
272	17	7	1	3	28
273	65	36	6	1	108
274	30	15	4	1	50
275	35	25	3	0	63
276	71	39	0	2	112
277	222	172	26	15	435
278	52	34	1	4	91
279	15	14	0	2	31
280	14	11	2	0	27
281	68	39	7	3	117
282	20	11	2	0	33
283	51	33	3	1	88
284	54	21	0	6	81
285	106	51	6	5	168
286	32	3	1	0	36
288	57	60	4	4	125
289	35	23	1	2	61
290	70	29	2	2	103
291	183	105	13	7	308
292	89	55	7	5	156
293	110	51	8	7	176
294	45	20	3	2	70
295	70	47	5	5	127
296	33	18	0	3	54
297	12	2	0	0	14
298	19	6	0	0	25
299	52	50	10	7	119
338	61	30	4	6	101
339	58	48	7	5	118
341	213	116	18	13	360

Table 8. Continued.

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
234	36	1	0	0	37
235	22	12	2	1	37
236	246	226	43	33	548
237	36	3	2	1	42
238	12	5	0	0	17
239	103	55	9	8	175
240	106	69	8	4	187
241	229	437	46	49	761
242	93	85	14	6	198
246	107	76	8	7	198
247	83	61	13	9	166
248	50	27	8	1	86
249	79	60	11	6	156

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
342	126	47	5	6	184
343	266	400	67	53	786
344	74	23	8	13	118
345	83	41	7	7	138
346	187	233	53	37	510
347	102	38	8	8	156
348	93	42	15	3	153
349	213	281	36	70	600
601	799	1,073	231	177	2,280
970	32	31	16	10	89
971	62	25	20	7	114
Total	**9,358**	**7,540**	**1,356**	**1,002**	**19,256**

970 = Camp Ripley First Hunt

971 = Camp Ripley Second Hunt

Table 9. Archery Harvest using Bonus Permits by Permit Area, 2015.

Permit Area	Adult Female	Fawn Male	Fawn Female	Total
114	1	0	0	1
182	185	48	25	258
214	144	27	23	194
215	257	42	28	327
227	225	30	32	287
236	164	29	19	212
241	313	33	31	377
343	336	50	39	425
346	206	41	31	278
349	281	27	61	369
601	949	196	162	1307
Total	**3,061**	**523**	**451**	**4,035**

Table 10. Summary of Archery Special Hunts, 2015. Includes Regular, Youth, and Bonus Permits.

Area	Dates	Permits Issued	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
970 - Camp Ripley 1	10/15 - 10/16	2000*	32	31	16	10	89
971 - Camp Ripley 2	10/31 - 11/1	2000*	62	25	20	7	114
972 - Crow Hansen Park Reserve	10/30 - 11/1	130*	0	0	0	0	-
973 - Murphy Hanrehan Park	10/30 - 11/1	180*	0	0	1	0	1
975 - Vermillion Highlands WMA	9/19-10/30; 12/19 -12/31	60*	2	1	2	0	5
976 - City of New Ulm	10/17 - 12/31	50**	5	30	7	6	48
977 - City of Red Wing	9/19 - 12/31	NA†*	5	37	5	4	51
978 - City of Redwood Falls	10/17 - 12/31	20*	1	13	0	2	16
979 - City of Fergus Falls	9/19 - 12/31	25*	5	8	2	0	15
980 - City of Duluth	9/19 - 12/31	400***	60	185	60	52	357
981 - City of Mankato	9/19 - 12/31	40**	1	7	4	1	13
982 - City of Granite Falls	9/19 - 12/31	10**	0	0	0	0	0
983 - City of Ortonville	9/19 - 12/31	30***	0	16	1	0	17
984 - City of Canby	9/19 - 12/31	20*	0	2	0	0	2
985 - City of Bemidji	9/19 - 12/31	45***	0	9	3	3	15
986 - Carleton Game Refuge	11/26 - 12/31	40***	2	5	4	2	13
987 - Greenleaf State Recreation Area	9/19 - 12/31	NA†*	0	1	0	0	1
Total			**201**	**515**	**142**	**107**	**965**

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

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

Table 11. Free Landowner Archery Harvest by Permit Area, 2015.

Permit Area	Adult Female	Fawn Male	Fawn Female	Total
213	9	0	1	10
214	1	2	1	4
215	6	0	0	6
218	1	0	2	3
219	1	0	0	1
225	2	1	0	3
236	1	0	0	1
239	3	0	1	4
240	3	0	2	5
241	14	1	1	16
248	2	0	0	2
254	1	1	0	2
255	0	1	0	1
257	1	1	0	2
265	1	0	0	1
277	2	0	0	2
292	1	0	1	2
293	2	0	0	2
338	0	0	1	1
339	1	0	0	1
341	2	0	0	2
342	3	0	0	3
343	2	0	0	2
344	1	0	0	1
345	4	2	0	6
346	5	0	0	5
347	2	0	0	2
348	3	0	0	3
349	6	1	1	8
601	1	0	0	1
Total	**81**	**10**	**11**	**102**

Table 12. Muzzleloader Harvest by Permit Area, 2015.
Includes Regular, Muzzleloader, Youth, and Bonus permits. Does not include Park hunts.

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
101	14	1	0	0	15
103	6	0	0	0	6
105	13	7	0	0	20
108	11	1	0	0	12
110	7	1	1	0	9
111	4	1	0	0	5
114	1	0	0	0	1
118	6	0	0	0	6
119	2	0	0	0	2
122	3	1	0	0	4
126	4	1	0	0	5
127	1	1	0	0	2
155	4	7	0	2	13
156	16	6	1	1	24
157	14	17	0	3	34
159	7	4	0	0	11
169	14	0	0	0	14
171	7	3	0	1	11
172	20	10	0	1	31
173	6	4	0	1	11
176	17	2	0	0	19
177	6	0	0	0	6
178	15	1	0	0	16
179	22	9	1	1	33
180	4	8	1	2	15
181	5	0	0	0	5
182	5	19	4	1	29
183	6	0	0	0	6
184	36	16	6	1	59
197	7	1	1	0	9
201	8	7	1	3	19
203	18	8	1	0	27
208	18	3	0	0	21
209	24	15	7	2	48
210	24	5	2	0	31
213	77	115	31	14	237
214	36	103	23	19	181
250	43	14	1	0	58
251	3	0	0	0	3
252	25	7	2	0	34
253	39	12	5	0	56
254	46	44	5	7	102
255	30	21	10	6	67
256	17	16	6	1	40
257	11	10	2	0	23
258	19	9	2	2	32
259	32	18	6	3	59
260	21	5	0	0	26
261	13	6	2	0	21
262	25	1	1	0	27
263	25	5	1	0	31
264	39	45	4	4	92
265	21	35	11	5	72
266	26	10	0	2	38
267	20	1	2	0	23
268	21	1	2	2	26
269	30	5	3	2	40
270	20	5	2	1	28
271	24	6	2	0	32
272	11	3	0	1	15
273	20	20	4	1	45
274	22	15	4	0	41
275	32	17	2	0	51
276	25	43	2	3	73
277	91	141	21	12	265
278	37	19	0	1	57
279	30	21	3	1	55
280	16	7	1	0	24
281	30	28	6	1	65
282	7	1	0	0	8
283	19	10	0	0	29
284	24	11	2	3	40
285	30	11	0	0	41
286	35	5	1	1	42

Table 12. Continued.

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
215	49	105	38	28	220
218	47	78	10	8	143
219	27	64	14	13	118
221	26	16	6	1	49
222	9	19	4	3	35
223	33	52	8	5	98
225	31	44	9	8	92
227	46	102	25	19	192
229	15	4	0	1	20
230	16	17	4	0	37
232	14	9	2	0	25
233	15	26	8	0	49
234	12	2	0	0	14
235	0	0	0	1	1
236	25	50	17	11	103
237	24	3	0	0	27
238	3	1	0	0	4
239	28	49	13	7	97
240	40	54	12	11	117
241	62	185	44	30	321
242	11	6	1	0	18
246	35	21	2	1	59
247	14	7	0	2	23
248	8	11	3	2	24
249	12	11	6	5	34
287	0	9	1	1	11
288	42	23	5	2	72
289	23	10	1	2	36
290	18	25	7	4	54
291	61	34	2	5	102
292	27	51	10	4	92
293	32	42	11	11	96
294	27	14	2	1	44
295	42	19	3	0	64
296	37	17	1	3	58
297	4	2	0	0	6
298	8	2	0	0	10
299	19	13	2	1	35
338	13	33	3	2	51
339	9	13	3	3	28
341	18	54	14	13	99
342	21	42	14	8	85
343	30	59	14	9	112
344	13	28	5	4	50
345	12	17	1	2	32
346	24	100	23	17	164
347	11	35	4	1	51
348	9	22	8	5	44
349	39	144	32	25	240
601	21	39	11	3	74
TOTAL	**2,629**	**2,788**	**598**	**393**	**6,408**

Table 13. Muzzleloader Harvest using Bonus Permits by Permit Area, 2015.

Permit Area	Adult Female	Fawn Male	Fawn Female	Total
182	10	2	0	12
214	53	12	9	74
215	59	21	16	96
227	55	15	10	80
236	21	6	9	36
241	103	24	16	143
287	7	0	0	7
343	34	12	5	51
346	69	15	13	97
349	104	25	17	146
601	27	10	1	38
TOTAL	**542**	**142**	**96**	**780**

Table 14. Summary of Muzzleloader Special Hunts, 2015. Includes Regular, Youth, and Bonus Permits.

Area	Dates	Permits Issued	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
935 - Jay Cook SP[1]	12/5-12/9	95*	3	16	1	6	26
936 - Crow Wing SP	12/5-12/6	25*	1	6	1	1	9
937 - Soudan Mine and Lake Vermilion SP[1]	11/28-12/13	20*	1	4	0	0	5
938 - City of Tower	11/28-12/13	20**	0	3	1	0	4
941 - Nerstrand Big Woods SP[1]	12/5-12/6	50***	1	7	4	4	16
942 - Sibley State Park[1]	11/28 - 11/29	60**	0	10	5	1	16
943 - Myre-Big Island State Park[1]	11/28 - 11/30	50**	0	32	3	9	44
944 - Vermillion Highlands WMA[1]	11/28-12/13	20*	2	2	0	0	4
945 - Camp Ripley	11/30 - 12/2	100*	15	2	1	0	18
946 -City of Grand Rapids[1]	11/28-12/13	NA†*	1	0	0	0	1
947 -Lake Bemidji State Park[1]	12/4-12/6	30*	4	2	2	2	10
Total			**28**	**84**	**18**	**23**	**153**

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

*Either Sex ***Earn-A-Buck

Table 15. Free Landowner Muzzleloader Harvest by Permit Area, 2015.

Permit Area	Adult Female	Fawn Male	Fawn Female	Total
209	1	1	0	2
213	11	2	3	16
214	10	2	0	12
215	7	1	2	10
223	1	0	0	1
225	1	0	1	2
227	1	0	0	1
239	0	1	0	1
240	3	0	0	3
241	5	4	1	10
254	1	1	0	2
255	2	0	0	2
256	1	1	0	2
257	1	0	0	1
264	6	0	0	6
265	2	0	0	2
277	3	1	1	5
292	4	0	0	4
293	1	0	1	2
338	1	0	0	1
339	1	0	0	1
341	6	3	2	11
342	5	1	3	9
344	1	0	1	2
345	1	1	0	2
346	6	1	1	8
347	1	0	0	1
348	0	1	0	1
349	6	0	3	9
Total	**89**	**21**	**19**	**129**

Table 16. Summary of mentored* and youth seasons, 2015.

Permit Area	Dates	Permits Issued	Harvest Adult Male	Adult Female	Fawn Male	Fawn Female	Total
950 - Camp Ripley Archery	10/10-10/11	175	3	1	1	0	5
951 - Afton SP	11/7-11/8	25	8	7	1	4	20
952 - Sibley State Park	10/24 - 10/25	10	4	1	0	0	5
953 - Zipple Bay SP	10/24-10/25	20	1	1	0	0	2
954 - Lake Bemidji SP	10/16-10/18	20	0	7	1	0	8
955 - Lake Alexander Preserve	10/10 - 10/11	20	0	0	1	0	1
956 - St. Croix SP	10/31-11/1	90	7	3	2	2	14
957 - Rydell NWR	10/17-10/18	15	0	0	0	0	0
958 - Savanna Portage SP	10/24-10/25	20	2	6	0	0	8
959 - Buffalo River SP	11/7-11/8	14	0	3	0	0	3
960 - Tettegouche SP	10/17-10/18	10	0	1	0	0	1
961 - Itasca SP	10/24-10/25	75	1	2	0	0	3
963 - Kilen Woods State Park	10/24 - 10/25	5	0	1	0	0	1
964 - Savann Portage SP II	10/31 - 11/1	20	1	0	0	1	2
965 - Banning SP	10/31-11/1	6	0	3	0	0	3
966 - Blue Mounds SP	11/21-11/22	10	1	1	0	0	2
967 - Camden SP	10/31-11/1	15	2	1	0	0	3
968 - Lake Shetek SP	10/24-10/25	12	7	0	0	0	7
159 - St Croix SP Adult	10/31-11/1	13	1	0	0	0	1
Total		**575**	**38**	**38**	**6**	**7**	**89**

* Includes special youth and adult mentored hunts

Youth Deer Season - October 15 - 18, unlimited permits.

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
101	10	7	3	3	23
105	43	30	13	5	91
111	8	18	3	0	29
114	0	1	1	0	2
201	9	6	0	0	15
203	1	0	2	1	4
208	17	13	5	2	37
209	21	25	1	3	50
256	33	15	3	4	55
257	28	16	6	5	55
260	19	12	2	2	35
263	23	9	2	1	35
264	41	39	6	0	86
267	13	2	4	3	22
268	14	12	5	6	37
338	10	6	0	0	16
339	14	8	5	3	30
341	51	29	9	9	98
342	32	26	5	6	69
343	35	24	6	8	73
344	22	10	11	7	50
345	19	6	5	3	33
346	30	25	8	5	68
347	23	16	4	4	47
348	26	9	3	2	40
349	42	9	5	3	59
601	11	8	2	0	21
Total	**595**	**381**	**119**	**85**	**1180**

Table 17. Total Deer Harvest by Permit Area, 2015. Includes all license types, permits, and special hunts.

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
101	460	34	10	8	512
103	709	3	3	1	716
105	968	155	37	27	1,187
108	929	10	1	0	940
110	914	207	42	34	1,197
111	460	29	6	0	495
114	32	14	1	1	48
117	44	2	0	0	46
118	540	0	2	0	542
119	363	4	1	1	369
122	177	70	14	7	268
126	274	83	14	4	375
127	56	15	1	1	73
152	79	9	2	0	90
155	992	452	131	68	1,643
156	1,298	291	69	47	1,705
157	2,075	533	184	87	2,879
159	1,053	216	68	33	1,370
169	1,351	12	8	3	1,374
171	988	264	72	40	1,364
172	1,735	598	167	109	2,609
173	652	152	41	30	875
176	1,324	10	5	1	1,340
177	665	6	1	0	672
178	1,427	13	8	3	1,451
179	1,676	436	115	71	2,298
180	589	200	43	18	850
181	797	16	5	5	823
182	508	540	177	91	1,316
183	947	23	9	5	984
184	3,010	841	232	139	4,222
197	1,009	165	45	30	1,249
199	94	2	2	0	98
201	157	65	17	10	249
203	93	9	3	2	107
208	318	53	15	10	396
209	615	314	60	41	1,030

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
289	306	112	15	18	451
290	524	223	51	39	837
291	932	387	83	49	1,451
292	684	378	118	56	1,236
293	686	324	104	63	1,177
294	475	239	34	21	769
295	637	168	34	17	856
296	403	172	26	23	624
297	228	28	7	5	268
298	695	82	30	15	822
299	356	182	39	21	598
338	348	252	59	36	695
339	336	242	69	45	692
341	1,041	761	217	161	2,180
342	814	526	141	97	1,578
343	984	1,119	275	248	2,626
344	478	412	101	92	1,083
345	578	404	124	86	1,192
346	1,177	1,306	411	288	3,182
347	610	384	96	74	1,164
348	672	495	141	80	1,388
349	1,524	1,785	457	435	4,201
601	1,450	1,480	369	254	3,553
900	2	1	0	1	4
901	2	4	1	1	8
902	28	68	23	16	135
903	8	9	11	5	33
904	3	8	3	0	14
905	5	8	1	0	14
906	7	10	4	2	23
907	2	4	1	0	7
908	5	3	0	0	8
909	5	10	1	2	18
910	0	14	5	3	22
911	2	1	1	0	4
912	2	1	0	0	3
913	1	4	2	2	9

Table 17. Continued.

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
210	880	201	74	34	1,189
213	2,715	1,360	375	251	4,701
214	1,833	1,415	505	360	4,113
215	1,700	1,393	553	329	3,975
218	1,282	754	231	184	2,451
219	789	463	135	101	1,488
221	1,273	410	153	105	1,941
222	923	343	133	81	1,480
223	855	491	148	102	1,596
224	106	33	13	13	165
225	1,584	804	314	182	2,884
227	1,303	952	287	218	2,760
229	339	104	29	26	498
230	283	198	51	37	569
232	308	85	24	15	432
233	263	141	48	18	470
234	254	21	6	2	283
235	83	34	6	5	128
236	872	655	159	117	1,803
237	338	54	9	11	412
238	98	23	5	6	132
239	1,715	913	297	178	3,103
240	2,044	1,014	303	222	3,583
241	3,679	3,208	944	689	8,520
242	679	226	65	32	1,002
246	2,192	585	186	130	3,093
247	733	349	124	78	1,284
248	461	239	83	48	831
249	1,156	473	175	93	1,897
250	432	114	26	11	583
251	111	27	12	3	153
252	392	151	28	18	589
253	504	198	36	10	748
254	664	362	80	54	1,160
255	599	272	93	44	1,008
256	612	306	66	59	1,043
257	460	242	74	44	820
258	977	320	121	72	1,490

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
914	10	15	1	6	32
915	9	4	0	0	13
916	23	14	5	2	44
919	0	6	3	0	9
920	0	2	6	3	11
921	37	49	17	19	122
922	3	4	1	2	10
923	0	7	2	0	9
925	3	2	1	0	6
927	1	19	6	7	33
929	6	28	4	7	45
931	10	11	8	9	38
932	9	10	7	5	31
933	23	31	5	4	63
934	0	20	3	2	25
935	3	16	1	6	26
936	1	6	1	1	9
937	1	4	0	0	5
938	0	3	1	0	4
941	1	7	4	4	16
942	0	10	5	1	16
943	0	32	3	9	44
944	2	2	0	0	4
945	15	2	1	0	18
946	1	0	0	0	1
947	4	2	2	2	10
950	3	1	1	0	5
951	8	7	1	4	20
952	4	1	0	0	5
953	1	1	0	0	2
954	0	7	1	0	8
955	0	0	1	0	1
956	7	3	2	2	14
958	2	6	0	0	8
959	0	3	0	0	3
961	0	1	0	0	1
963	1	2	0	0	3
964	0	1	0	0	1

Table 17. Continued.

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
259	1,468	553	191	101	2,313
260	515	82	17	9	623
261	268	67	23	14	372
262	290	72	23	14	399
263	521	101	26	13	661
264	904	520	95	50	1,569
265	567	356	93	62	1,078
266	455	101	14	10	580
267	327	48	14	13	402
268	379	75	18	18	490
269	276	82	20	19	397
270	251	60	11	10	332
271	312	102	13	10	437
272	225	59	8	7	299
273	598	280	56	39	973
274	316	107	18	10	451
275	460	148	27	11	646
276	708	301	54	44	1,107
277	1,874	1,133	248	177	3,432
278	464	143	22	14	643
279	250	143	12	14	419
280	283	111	12	11	417
281	590	234	53	24	901
282	164	38	9	2	213
283	382	104	16	10	512
284	420	177	27	24	648
285	555	166	35	15	771
286	369	57	10	5	441
287	82	92	29	17	220
288	512	239	52	33	836

Permit Area	Adult Male	Adult Female	Fawn Male	Fawn Female	Total
965	1	0	0	1	2
966	0	3	0	0	3
967	1	1	0	0	2
968	2	1	0	0	3
970	7	0	0	0	7
971	32	31	16	10	89
973	62	25	20	7	114
975	0	0	1	0	1
976	2	1	2	0	5
977	5	30	7	6	48
978	5	37	5	4	51
979	1	13	0	2	16
980	5	8	2	0	15
981	60	185	60	52	357
982	1	7	4	1	13
983	0	16	1	0	17
984	0	2	0	0	2
985	0	9	3	3	15
986	2	5	4	2	13
987	0	1	0	0	1
989	7	33	3	4	47
990	3	21	3	4	31
991	0	9	0	0	9
992	0	1	0	0	1
993	2	19	3	4	28
995	2	40	3	4	49
996	11	13	2	2	28
997	0	8	3	2	13
998	1	1	0	0	2
TOTAL	**96,064**	**42,995**	**12,117**	**8,167**	**159,343**

Table 18. Estimated firearm hunter numbers, density, and harvest by Permit Area, 2015. Excludes data from all 900-series hunts.

Permit Area	Firearm Hunters	Area Size (sq mi)	Hunters / mile^2	Harvest/ mile^2
101	2,023	496	4.1	0.9
103	2,614	1,820	1.4	0.4
105	3,995	740	5.4	1.4
108	4,219	1,651	2.6	0.5
110	4,158	528	7.9	2.2
111	2,126	1,438	1.5	0.3
114	213	116	1.8	0.3
117	151	927	0.2	0.0
118	2,816	1,220	2.3	0.4
119	2,605	770	3.4	0.5
122	2,061	603	3.4	0.4
126	1,725	941	1.8	0.4
127	486	564	0.9	0.1
152	715	61	11.7	1.4
155	7,585	593	12.8	2.6
156	8,526	825	10.3	1.9
157	12,980	673	19.3	4.0
159	6,756	571	11.8	2.2
169	6,552	1,124	5.8	1.2
171	6,643	701	9.5	1.9
172	10,523	687	15.3	3.5
173	4,872	584	8.3	1.4
176	6,495	1,113	5.8	1.2
177	3,271	480	6.8	1.3
178	7,982	1,280	6.2	1.1
179	9,743	862	11.3	2.4
180	4,720	977	4.8	0.8
181	4,944	708	7.0	1.1
182	2,915	267	10.9	3.4
183	6,153	663	9.3	1.4
184	14,209	1,229	11.6	3.2
197	5,475	954	5.7	1.2
199	474	148	3.2	0.6
201	591	161	3.7	1.3
203	241	83	2.9	0.9
208	1,151	414	2.8	0.8
209	2,758	639	4.3	1.4
210	4,036	615	6.6	1.9
213	9,791	1,057	9.3	3.8
214	7,502	554	13.5	6.6
215	7,154	701	10.2	4.7
218	5,743	884	6.5	2.3
219	3,801	391	9.7	2.9

Permit Area	Firearm Hunters	Area Size (sq mi)	Hunters / mile^2	Harvest /mile^2
221	5,498	642	8.6	2.7
222	5,043	413	12.2	3.3
223	3,498	375	9.3	3.1
224	693	47	14.6	2.8
225	7,597	618	12.3	4.3
227	5,240	472	11.1	4.1
229	1,548	284	5.4	1.3
230	1,575	452	3.5	1.1
232	1,274	377	3.4	0.9
233	1,053	385	2.7	0.9
234	696	636	1.1	0.4
235	592	34	17.6	2.6
236	3,088	370	8.3	3.2
237	1,060	728	1.5	0.5
238	363	95	3.8	1.2
239	7,962	919	8.7	3.2
240	7,759	643	12.1	5.2
241	14,875	996	14.9	7.7
242	2,620	214	12.2	3.8
246	11,152	840	13.3	3.4
247	3,650	228	16.0	5.0
248	2,156	214	10.1	3.5
249	6,245	715	8.7	2.5
250	1,549	713	2.2	0.6
251	572	55	10.4	2.7
252	1,414	715	2.0	0.7
253	2,088	974	2.1	0.6
254	2,829	929	3.0	1.0
255	1,957	774	2.5	1.0
256	2,484	654	3.8	1.4
257	2,030	412	4.9	1.7
258	4,308	343	12.6	4.2
259	7,296	490	14.9	4.5
260	1,897	1,249	1.5	0.4
261	869	795	1.1	0.4
262	1,023	677	1.5	0.4
263	1,706	512	3.3	1.1
264	3,870	669	5.8	2.1
265	2,167	494	4.4	2.0
266	1,867	617	3.0	0.8
267	1,062	472	2.2	0.7
268	1,268	228	5.6	1.8
269	1,348	650	2.1	0.5

Table 18. Continued.

Permit Area	Firearm Hunters	Area Size (sq mi)	Hunters/ mile²	Harvest/ mile²
270	1,083	747	1.4	0.4
271	1,125	632	1.8	0.6
272	1,135	531	2.1	0.5
273	2,949	571	5.2	1.5
274	1,148	354	3.2	1.0
275	2,031	764	2.7	0.7
276	3,200	542	5.9	1.7
277	7,060	812	8.7	3.4
278	1,964	402	4.9	1.2
279	1,304	344	3.8	1.0
280	1,474	675	2.2	0.5
281	2,557	575	4.5	1.3
282	929	778	1.2	0.2
283	1,537	613	2.5	0.7
284	1,771	837	2.1	0.6
285	2,443	549	4.5	1.1
286	1,183	446	2.7	0.8
287	597	46	13.1	4.8
288	2,064	625	3.3	1.0
289	1,131	815	1.4	0.4
290	2,368	662	3.6	1.0
291	3,990	800	5.0	1.3
292	3,104	479	6.5	2.2
293	2,598	511	5.1	1.8
294	1,536	686	2.2	1.0
295	2,296	839	2.7	0.8
296	1,841	667	2.8	0.8
297	1,048	438	2.4	0.6
298	3,473	618	5.6	1.3
299	1,571	386	4.1	1.2
338	2,153	454	4.7	1.2
339	1,894	393	4.8	1.4
341	4,963	612	8.1	2.7
342	3,666	349	10.5	3.6
343	4,633	663	7.0	2.5
344	3,252	189	17.2	4.6
345	2,824	322	8.8	3.0
346	4,481	318	14.1	8.0
347	2,907	434	6.7	2.1
348	3,211	332	9.7	3.6
349	6,166	490	12.6	6.8
601	3,013	1,625	1.9	0.8
Total	**448,007**	**78,855**	**5.7**	**1.7**

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, 2015.

Permit Area	Area Size/mi²	Archery Harvest/ mi²	Firearm Harvest/m i²	Muzz. Harvest/ mi²	EA Harvest/ mi²	Youth Harvest/ mi²	Total Harvest/mi²	Rank
101	496	0.03	0.93	0.03	0.00	0.05	1.03	91
103	1,820	0.00	0.39	0.00	0.00	0.00	0.39	124
105	740	0.06	1.40	0.03	0.00	0.12	1.60	60
108	1,651	0.02	0.55	0.01	0.00	0.00	0.57	111
110	528	0.09	2.16	0.02	0.00	0.00	2.27	46
111	1,438	0.00	0.32	0.00	0.00	0.02	0.34	125
114	116	0.03	0.35	0.01	0.00	0.02	0.41	122
117	927	0.00	0.05	0.00	0.00	0.00	0.05	128
118	1,220	0.01	0.43	0.00	0.00	0.00	0.44	120
119	770	0.01	0.46	0.00	0.00	0.00	0.48	116
122	603	0.02	0.41	0.01	0.00	0.00	0.44	118
126	941	0.02	0.38	0.01	0.00	0.00	0.40	123
127	564	0.01	0.12	0.00	0.00	0.00	0.13	127
152	61	0.08	1.39	0.00	0.00	0.00	1.47	69
155	593	0.20	2.54	0.02	0.00	0.00	2.77	38
156	825	0.16	1.88	0.03	0.00	0.00	2.07	50
157	673	0.32	3.91	0.05	0.00	0.00	4.28	19
159	571	0.21	2.17	0.02	0.00	0.00	2.40	43
169	1,124	0.03	1.18	0.01	0.00	0.00	1.22	83
171	701	0.11	1.82	0.02	0.00	0.00	1.95	53
172	687	0.28	3.47	0.05	0.00	0.00	3.80	26
173	584	0.08	1.40	0.02	0.00	0.00	1.50	67
176	1,113	0.04	1.15	0.02	0.00	0.00	1.20	86
177	480	0.04	1.35	0.01	0.00	0.00	1.40	71
178	1,280	0.05	1.07	0.01	0.00	0.00	1.13	89
179	862	0.24	2.39	0.04	0.00	0.00	2.67	40
180	977	0.06	0.79	0.02	0.00	0.00	0.87	97
181	708	0.07	1.09	0.01	0.00	0.00	1.16	87
182	267	1.62	3.19	0.11	0.00	0.00	4.92	10
183	663	0.07	1.40	0.01	0.00	0.00	1.48	68
184	1,229	0.29	3.10	0.05	0.00	0.00	3.44	33
197	954	0.07	1.23	0.01	0.00	0.00	1.31	75
199	148	0.04	0.62	0.00	0.00	0.00	0.66	106
201	161	0.05	1.29	0.12	0.00	0.09	1.55	65
203	83	0.01	0.91	0.33	0.00	0.05	1.30	77
208	414	0.03	0.79	0.05	0.00	0.09	0.96	94
209	639	0.08	1.38	0.08	0.00	0.08	1.61	59
210	615	0.07	1.81	0.05	0.00	0.00	1.93	54
213	1,057	0.52	3.70	0.22	0.00	0.00	4.45	17
214	554	0.70	6.39	0.33	0.00	0.00	7.42	4
215	701	0.91	4.44	0.31	0.00	0.00	5.67	7
218	884	0.36	2.25	0.16	0.00	0.00	2.77	37
219	391	0.66	2.84	0.30	0.00	0.00	3.80	25
221	642	0.32	2.63	0.08	0.00	0.00	3.02	35
222	413	0.30	3.20	0.08	0.00	0.00	3.58	29
223	375	0.95	3.04	0.26	0.00	0.00	4.25	20
224	47	0.57	2.92	0.00	0.00	0.00	3.49	32

Table 19. Continued.

Permit Area	Area Size/mi²	Archery Harvest/ mi²	Firearm Harvest /mi²	Muzz. Harvest /mi²	EA Harvest/ mi²	Youth Harvest/ mi²	Total Harvest/ mi²	Rank
225	618	0.46	4.06	0.15	0.00	0.00	4.67	15
227	472	1.46	3.98	0.41	0.00	0.00	5.85	5
229	284	0.42	1.27	0.07	0.00	0.00	1.75	57
230	452	0.15	1.03	0.08	0.00	0.00	1.26	81
232	377	0.17	0.91	0.07	0.00	0.00	1.15	88
233	385	0.20	0.89	0.13	0.00	0.00	1.22	84
234	636	0.06	0.36	0.02	0.00	0.00	0.44	119
235	34	1.10	2.55	0.03	0.00	0.00	3.68	28
236	370	1.48	3.11	0.28	0.00	0.00	4.88	11
237	728	0.06	0.47	0.04	0.00	0.00	0.57	112
238	95	0.18	1.17	0.04	0.00	0.00	1.39	72
239	919	0.19	3.08	0.11	0.00	0.00	3.38	34
240	643	0.29	5.10	0.18	0.00	0.00	5.58	9
241	996	0.76	7.47	0.32	0.00	0.00	8.56	3
242	214	0.93	3.66	0.08	0.00	0.00	4.67	14
246	840	0.24	3.37	0.07	0.00	0.00	3.68	27
247	228	0.73	4.80	0.10	0.00	0.00	5.62	8
248	214	0.40	3.34	0.11	0.00	0.00	3.85	24
249	715	0.22	2.39	0.05	0.00	0.00	2.65	41
250	713	0.12	0.62	0.08	0.00	0.00	0.82	102
251	55	0.22	2.51	0.05	0.00	0.00	2.78	36
252	715	0.10	0.67	0.05	0.00	0.00	0.82	101
253	974	0.14	0.57	0.06	0.00	0.00	0.77	104
254	929	0.15	0.99	0.11	0.00	0.00	1.25	82
255	774	0.24	0.97	0.09	0.00	0.00	1.30	76
256	654	0.06	1.39	0.06	0.00	0.08	1.60	61
257	412	0.12	1.68	0.06	0.00	0.13	1.99	52
258	343	0.21	4.04	0.09	0.00	0.00	4.35	18
259	490	0.23	4.38	0.12	0.00	0.00	4.72	13
260	1,249	0.02	0.43	0.02	0.00	0.03	0.50	115
261	795	0.05	0.40	0.03	0.00	0.00	0.47	117
262	677	0.11	0.44	0.04	0.00	0.00	0.59	110
263	512	0.05	1.11	0.06	0.00	0.07	1.29	78
264	669	0.08	2.00	0.14	0.00	0.13	2.35	44
265	494	0.09	1.94	0.15	0.00	0.00	2.18	48
266	617	0.07	0.81	0.06	0.00	0.00	0.94	95
267	472	0.03	0.72	0.05	0.00	0.05	0.85	98
268	228	0.09	1.78	0.11	0.00	0.16	2.15	49
269	650	0.09	0.46	0.06	0.00	0.00	0.61	109
270	747	0.04	0.36	0.04	0.00	0.00	0.44	121
271	632	0.07	0.57	0.05	0.00	0.00	0.69	105
272	531	0.05	0.48	0.03	0.00	0.00	0.56	113
273	571	0.19	1.44	0.08	0.00	0.00	1.70	58
274	354	0.14	1.02	0.12	0.00	0.00	1.27	79
275	764	0.08	0.70	0.07	0.00	0.00	0.85	99
276	542	0.21	1.70	0.13	0.00	0.00	2.04	51
277	812	0.54	3.37	0.33	0.00	0.00	4.23	21

Table 19. Continued.

Permit Area	Area Size/mi²	Archery Harvest/ mi²	Firearm Harvest/ mi²	Muzz. Harvest/ mi²	EA Harvest/ mi²	Youth Harvest/ mi²	Total Harvest/ mi²	Rank
278	402	0.23	1.22	0.14	0.00	0.00	1.59	62
279	344	0.09	0.97	0.16	0.00	0.00	1.22	85
280	675	0.04	0.54	0.04	0.00	0.00	0.62	107
281	575	0.20	1.25	0.11	0.00	0.00	1.57	63
282	778	0.04	0.22	0.01	0.00	0.00	0.27	126
283	613	0.14	0.64	0.05	0.00	0.00	0.83	100
284	837	0.10	0.63	0.05	0.00	0.00	0.77	103
285	549	0.31	1.02	0.07	0.00	0.00	1.41	70
286	446	0.08	0.81	0.09	0.00	0.00	0.99	93
287	46	0.00	4.57	0.24	0.00	0.00	4.81	12
288	625	0.20	1.02	0.12	0.00	0.00	1.34	73
289	815	0.07	0.43	0.04	0.00	0.00	0.55	114
290	662	0.16	1.03	0.08	0.00	0.00	1.26	80
291	800	0.38	1.30	0.13	0.00	0.00	1.81	55
292	479	0.33	2.06	0.19	0.00	0.00	2.58	42
293	511	0.34	1.77	0.19	0.00	0.00	2.30	45
294	686	0.10	0.96	0.06	0.00	0.00	1.12	90
295	839	0.15	0.79	0.08	0.00	0.00	1.02	92
296	667	0.08	0.77	0.09	0.00	0.00	0.94	96
297	438	0.03	0.57	0.01	0.00	0.00	0.61	108
298	618	0.04	1.27	0.02	0.00	0.00	1.33	74
299	386	0.31	1.15	0.09	0.00	0.00	1.55	64
338	454	0.22	1.16	0.11	0.00	0.04	1.53	66
339	393	0.30	1.31	0.07	0.00	0.08	1.76	56
341	612	0.59	2.65	0.16	0.00	0.16	3.56	30
342	349	0.53	3.53	0.24	0.00	0.20	4.50	16
343	663	1.19	2.49	0.17	0.00	0.11	3.96	23
344	189	0.62	4.56	0.26	0.00	0.26	5.71	6
345	322	0.43	2.90	0.10	0.00	0.10	3.53	31
346	318	1.60	7.06	0.52	0.62	0.21	10.01	1
347	434	0.36	2.09	0.12	0.00	0.11	2.68	39
348	332	0.46	3.45	0.13	0.00	0.12	4.16	22
349	490	1.22	6.24	0.49	0.50	0.12	8.57	2
601	1,625	1.40	0.73	0.05	0.00	0.01	2.19	47
Total	**78,855**	**0.24**	**1.65**	**0.08**	**0.01**	**0.02**	**1.99**	

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, 2015.

Permit Area	Adult Female	Fawn Male	Fawn Female	Total
342	7	0	1	8
343	2	0	0	2
344	1	0	0	1
345	39	7	7	53
348	6	1	1	8
TOTAL	**55**	**8**	**9**	**72**

Table 21. 2015 Firearm Lottery Distribution Report.

Permit Area Number	Preference Level	Applications Total	Applications Rejected	Unsuccessful	Winners	Permits Available
101	1	124	1	124	0	**24**
	2	160	1	160	0	
	3	140	0	116	24	
		424	2	**400**	**24**	
105	1	342	4	342	0	**148**
	2	493	1	493	0	
	3	519	3	374	145	
	4	2	0	0	2	
	9	1	0	0	1	
		1357	8	**1209**	**148**	
110	1	721	4	721	0	**348**
	2	1156	3	836	320	
	3	18	0	0	18	
	4	10	0	0	10	
		1905	7	**1557**	**348**	
117	1	10	0	0	10	**25**
	2	7	0	0	7	
	3	1	0	0	1	
	4	1	0	0	1	
		19	0	**0**	**19**	
122	1	387	2	387	0	**250**
	2	313	0	77	236	
	3	11	0	0	11	
	4	3	0	0	3	
		714	2	**464**	**250**	
126	1	419	0	97	322	**394**
	2	61	0	0	61	
	3	9	0	0	9	
	4	2	0	0	2	
		491	0	**97**	**394**	
127	1	94	0	0	94	**149**
	2	17	0	0	17	
	3	5	0	0	5	
	4	8	0	0	8	
	5	1	0	0	1	
		125	0	**0**	**125**	
155	1	1318	7	1318	0	**988**
	2	2078	17	1162	916	
	3	68	0	0	68	
	4	1	0	0	1	
	5	2	0	0	2	
	9	1	0	0	1	
		3468	**24**	**2480**	**988**	

Table 21. Continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
156	1	1176	5	1176	0	**296**
	2	2008	11	1751	257	
	3	33	0	0	33	
	4	2	0	0	2	
	5	1	0	0	1	
	6	1	0	0	1	
	9	2	0	0	2	
		3223	16	**2927**	**296**	
157	1	4365	19	3329	1036	**1479**
	2	392	0	0	392	
	3	43	0	0	43	
	4	6	0	0	6	
	5	1	0	0	1	
	6	1	0	0	1	
		4808	19	**3329**	**1479**	
159	1	1112	6	1112	0	**247**
	2	1186	11	974	212	
	3	31	0	0	31	
	4	2	0	0	2	
	5	1	0	0	1	
	6	1	0	0	1	
		2333	17	**2086**	**247**	
171	1	891	3	891	0	**295**
	2	1408	10	1408	0	
	3	866	5	574	292	
	9	3	0	0	3	
		3168	18	**2873**	**295**	
172	1	1484	8	1484	0	**986**
	2	2275	6	2275	0	
	3	1834	8	853	981	
	4	5	0	0	5	
		5598	22	**4612**	**986**	
173	1	839	7	839	0	**295**
	2	1231	7	1025	206	
	3	89	1	0	89	
		2159	15	**1864**	**295**	
179	1	1393	10	1393	0	**496**
	2	2258	14	1891	367	
	3	114	4	0	114	
	4	11	0	0	11	
	5	2	0	0	2	
	6	1	0	0	1	
	9	1	0	0	1	
		3780	28	**3284**	**496**	

Table 21. Continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
180	1	1083	7	466	617	**789**
	2	142	1	0	142	
	3	27	0	0	27	
	4	2	0	0	2	
	5	1	0	0	1	
		1255	8	**466**	**789**	
184	1	3882	20	3882	0	**1969**
	2	3097	22	1170	1927	
	3	37	0	0	37	
	4	3	0	0	3	
	9	2	0	0	2	
		7021	42	**5052**	**1969**	
197	1	709	6	709	0	**198**
	2	1178	7	1178	0	
	3	481	3	284	197	
	4	1	0	0	1	
		2369	16	**2171**	**198**	
208	1	158	1	158	0	**97**
	2	171	5	82	89	
	3	7	0	0	7	
	4	1	0	0	1	
		337	6	**240**	**97**	
210	1	1308	8	467	841	**979**
	2	119	0	0	119	
	3	17	1	0	17	
	5	2	0	0	2	
		1446	9	**467**	**979**	
221	1	2358	10	1555	803	**977**
	2	128	0	0	128	
	3	36	0	0	36	
	4	5	0	0	5	
	5	3	0	0	3	
	6	2	0	0	2	
		2532	10	**1555**	**977**	
222	1	1946	4	614	1332	**1463**
	2	106	1	0	106	
	3	21	0	0	21	
	4	4	0	0	4	
		2077	5	**614**	**1463**	
224	1	215	0	96	119	**150**
	2	25	0	0	25	
	3	6	0	0	6	
		246	0	**96**	**150**	

Table 21. Continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
229	1	448	0	304	144	**288**
	2	137	1	0	137	
	3	6	0	0	6	
	4	1	0	0	1	
		592	1	**304**	**288**	
232	1	388	2	185	203	**242**
	2	29	0	0	29	
	3	9	0	0	9	
	4	1	0	0	1	
		427	2	**185**	**242**	
235	1	56	1	18	38	**64**
	2	21	0	0	21	
	3	5	0	0	5	
		82	1	**18**	**64**	
238	1	100	1	85	15	**47**
	2	30	0	0	30	
	3	2	0	0	2	
		132	1	**85**	**47**	
242	1	629	6	547	82	**485**
	2	381	1	0	381	
	3	20	0	0	20	
	4	2	0	0	2	
		1032	7	**547**	**485**	
246	1	1954	5	1954	0	**980**
	2	3153	13	2592	561	
	3	414	0	0	414	
	4	3	0	0	3	
	6	1	0	0	1	
	9	1	0	0	1	
		5526	18	**4546**	**980**	
247	1	647	3	647	0	**972**
	2	693	5	79	614	
	3	352	2	0	352	
	4	5	0	0	5	
	5	1	0	0	1	
		1698	10	**726**	**972**	
249	1	2632	17	1436	1196	**1474**
	2	225	0	0	225	
	3	50	0	0	50	
	4	2	0	0	2	
	9	1	0	0	1	
		2910	17	**1436**	**1474**	

Table 21. Continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
250	1	329	2	329	0	**272**
	2	336	1	67	269	
	3	1	0	0	1	
	4	1	0	0	1	
	6	1	0	0	1	
		668	3	**396**	**272**	
251	1	132	1	132	0	**96**
	2	142	1	51	91	
	3	5	0	0	5	
		279	2	**183**	**96**	
252	1	356	2	215	141	**364**
	2	208	1	0	208	
	3	13	0	0	13	
	4	1	0	0	1	
	5	1	0	0	1	
		579	3	**215**	**364**	
253	1	371	2	371	0	**263**
	2	385	0	215	170	
	3	89	0	0	89	
	4	4	0	0	4	
		849	2	**586**	**263**	
258	1	905	4	905	0	**977**
	2	1213	12	251	962	
	3	14	0	0	14	
	9	1	0	0	1	
		2133	16	**1156**	**977**	
259	1	1395	6	1395	0	**1650**
	2	2103	14	854	1249	
	3	398	1	0	398	
	4	2	0	0	2	
	9	1	0	0	1	
		3899	21	**2249**	**1650**	
260	1	218	2	218	0	**97**
	2	263	2	235	28	
	3	69	0	0	69	
		550	4	**453**	**97**	
261	1	184	1	17	167	**236**
	2	69	0	0	69	
		253	1	**17**	**236**	
262	1	179	1	179	0	**138**
	2	190	1	54	136	
	3	2	0	0	2	
		371	2	**233**	**138**	

Table 21. Continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
263	1	216	2	216	0	**286**
	2	289	2	137	152	
	3	134	2	0	134	
		639	6	**353**	**286**	
266	1	276	1	276	0	**143**
	2	380	1	293	87	
	3	56	1	0	56	
		712	3	**569**	**143**	
267	1	165	0	165	0	**99**
	2	132	0	70	62	
	3	37	0	0	37	
		334	0	**235**	**99**	
268	1	184	2	184	0	**97**
	2	166	3	166	0	
	3	119	0	22	97	
		469	5	**372**	**97**	
269	1	259	0	259	0	**223**
	2	266	3	54	212	
	3	11	0	0	11	
		536	3	**313**	**223**	
270	1	170	1	170	0	**91**
	2	187	0	132	55	
	3	36	0	0	36	
		393	1	**302**	**91**	
271	1	251	2	193	58	**226**
	2	165	0	0	165	
	3	3	0	0	3	
		419	2	**193**	**226**	
272	1	178	1	178	0	**97**
	2	202	1	166	36	
	3	60	1	0	60	
	9	1	0	0	1	
		441	3	**344**	**97**	
273	1	1005	4	122	883	**1222**
	2	319	1	0	319	
	3	16	0	0	16	
	4	4	0	0	4	
		1344	5	**122**	**1222**	
274	1	247	0	247	0	**215**
	2	246	0	70	176	
	3	38	0	0	38	
	4	1	0	0	1	
		532	0	**317**	**215**	

Table 21. Continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
275	1	509	2	509	0	**234**
	2	309	4	106	203	
	3	27	2	0	27	
	4	4	0	0	4	
		849	8	**615**	**234**	
276	1	1047	4	380	667	**1109**
	2	424	3	0	424	
	3	18	0	0	18	
		1489	7	**380**	**1109**	
278	1	322	1	322	0	**177**
	2	396	4	396	0	
	3	193	1	18	175	
	4	2	0	0	2	
	5	0	2	0	0	
		913	8	**736**	**177**	
279	1	554	4	124	430	**526**
	2	81	0	0	81	
	3	15	0	0	15	
		650	4	**124**	**526**	
280	1	373	3	373	0	**182**
	2	183	0	16	167	
	3	12	1	0	12	
	4	2	0	0	2	
	9	1	0	0	1	
		571	4	**389**	**182**	
281	1	417	1	417	0	**446**
	2	454	2	172	282	
	3	156	1	0	156	
	4	8	0	0	8	
		1035	4	**589**	**446**	
282	1	85	0	85	0	**24**
	2	51	0	51	0	
	3	39	0	36	3	
	4	21	0	0	21	
		196	0	**172**	**24**	
283	1	251	2	251	0	**184**
	2	243	0	181	62	
	3	120	1	0	120	
	4	2	0	0	2	
		616	3	**432**	**184**	

Table 21. Continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
284	1	368	3	368	0	**283**
	2	319	2	143	176	
	3	98	1	0	98	
	4	8	0	0	8	
	5	1	0	0	1	
		794	6	**511**	**283**	
285	1	1015	1	932	83	**280**
	2	184	0	0	184	
	3	13	1	0	13	
		1212	2	**932**	**280**	
288	1	542	4	391	151	**448**
	2	275	1	0	275	
	3	18	0	0	18	
	4	4	0	0	4	
		839	5	**391**	**448**	
289	1	212	0	212	0	**178**
	2	165	1	11	154	
	3	21	0	0	21	
	4	3	0	0	3	
		401	1	**223**	**178**	
290	1	464	4	464	0	**350**
	2	493	4	325	168	
	3	181	0	0	181	
	4	1	0	0	1	
		1139	8	**789**	**350**	
291	1	912	6	912	0	**718**
	2	842	3	266	576	
	3	138	2	0	138	
	4	2	0	0	2	
	5	1	0	0	1	
	6	1	0	0	1	
		1896	11	**1178**	**718**	
294	1	549	0	185	364	**459**
	2	86	0	0	86	
	3	9	0	0	9	
		644	0	**185**	**459**	
295	1	410	4	410	0	**272**
	2	360	5	266	94	
	3	177	2	0	177	
	4	1	1	0	1	
		948	12	**676**	**272**	

Table 21. Continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
296	1	334	1	334	0	**260**
	2	365	3	228	137	
	3	122	0	0	122	
	5	1	0	0	1	
		822	4	**562**	**260**	
297	1	141	2	141	0	**96**
	2	147	0	69	78	
	3	18	0	0	18	
		306	2	**210**	**96**	
298	1	352	3	352	0	**98**
	2	554	4	554	0	
	3	270	2	172	98	
		1176	9	**1078**	**98**	
299	1	419	2	397	22	**355**
	2	306	2	0	306	
	3	26	0	0	26	
	4	1	0	0	1	
		752	4	**397**	**355**	
TOTAL		**95,656**	**515**	**64,771**	**30,885**	**31,065**

Table 22. 2015 Muzzleloader Lottery Distribution Report.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
101	1	6	0	6	0	**1**
	2	4	0	4	0	
	3	1	0	0	1	
		11	0	**10**	**1**	
105	1	11	1	11	0	**2**
	2	5	0	4	1	
	3	1	0	0	1	
		17	1	**15**	**2**	
110	1	4	0	4	0	**2**
	2	8	0	6	2	
		12	0	**10**	**2**	
126	1	6	0	1	5	**6**
	2	1	0	0	1	
		7	0	**1**	**6**	
127	1	1	0	0	1	**1**
		1	0	**0**	**1**	
155	1	20	0	20	0	**12**
	2	20	0	10	10	
	3	2	0	0	2	
		42	0	**30**	**12**	
156	1	21	0	21	0	**4**
	2	19	0	16	3	
	3	1	0	0	1	
		41	0	**37**	**4**	
157	1	55	0	46	9	**21**
	2	9	0	0	9	
	3	2	0	0	2	
	4	1	0	0	1	
		67	0	**46**	**21**	
159	1	17	0	17	0	**3**
	2	14	0	12	2	
	3	1	0	0	1	
		32	0	**29**	**3**	
171	1	23	0	23	0	**5**
	2	18	0	18	0	
	3	7	0	2	5	
		48	0	**43**	**5**	
172	1	27	0	27	0	**14**
	2	29	0	29	0	
	3	20	0	6	14	
		76	0	**62**	**14**	
173	1	19	0	19	0	**5**
	2	19	0	14	5	
		38	0	**33**	**5**	

Table 22. Continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
179	1 2	18 12 **30**	0 0 0	18 8 **26**	0 4 **4**	**4**
180	1 2 3	14 2 1 **17**	0 0 0 0	6 0 0 **6**	8 2 1 **11**	**11**
184	1 2 3 4	73 32 4 1 **110**	0 0 0 0 0	73 6 0 0 **79**	0 26 4 1 **31**	**31**
197	1 2 3	14 10 1 **25**	0 0 0 0	14 9 0 **23**	0 1 1 **2**	**2**
208	1 2	9 2 **11**	0 0 0	8 0 **8**	1 2 **3**	**3**
210	1 2	29 2 **31**	0 0 0	10 0 **10**	19 2 **21**	**21**
221	1 2 3	48 7 3 **58**	0 0 0 0	35 0 0 **35**	13 7 3 **23**	**23**
222	1 2 3 4	45 4 1 1 **51**	1 0 0 0 1	14 0 0 0 **14**	31 4 1 1 **37**	**37**
229	1 2	19 3 **22**	0 0 0	11 0 **11**	8 3 **11**	**11**
232	1	14 **14**	0 0	6 **6**	8 **8**	**8**
235	1	12 **12**	0 0	1 **1**	11 **11**	**11**
238	1 2	4 3 **7**	0 0 0	4 0 **4**	0 3 **3**	**3**
242	1 2	24 7 **31**	0 0 0	16 0 **16**	8 7 **15**	**15**

Table 22. Continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
246	1	68	1	68	0	**20**
	2	43	0	23	20	
		111	1	**91**	**20**	
247	1	16	0	16	0	**28**
	2	25	0	3	22	
	3	6	0	0	6	
		47	0	**19**	**28**	
249	1	40	0	25	15	**26**
	2	9	0	0	9	
	3	1	0	0	1	
	4	1	0	0	1	
		51	0	**25**	**26**	
250	1	32	0	32	0	**28**
	2	28	0	2	26	
	3	2	0	0	2	
		62	0	**34**	**28**	
251	1	6	0	6	0	**4**
	2	5	0	1	4	
		11	0	**7**	**4**	
252	1	39	0	16	23	**36**
	2	13	1	0	13	
		52	1	**16**	**36**	
253	1	56	0	56	0	**37**
	2	50	0	13	37	
		106	0	**69**	**37**	
258	1	25	0	25	0	**23**
	2	23	0	0	23	
		48	0	**25**	**23**	
259	1	60	0	60	0	**50**
	2	49	0	5	44	
	3	5	0	0	5	
	4	1	0	0	1	
		115	0	**65**	**50**	
260	1	9	0	9	0	**3**
	2	9	0	6	3	
		18	0	**15**	**3**	
261	1	11	0	0	11	**14**
	2	3	0	0	3	
		14	0	**0**	**14**	
262	1	15	0	15	0	**12**
	2	15	0	3	12	
		30	0	**18**	**12**	
263	1	19	0	15	4	**14**
	2	10	0	0	10	
		29	0	**15**	**14**	

Table 22. Continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
266	1	21	0	21	0	**7**
	2	13	0	7	6	
	3	1	0	0	1	
		35	0	**28**	**7**	
267	1	1	0	1	0	**1**
	2	3	0	2	1	
		4	0	**3**	**1**	
268	1	7	0	7	0	**3**
	2	3	0	3	0	
	3	5	0	2	3	
		15	0	**12**	**3**	
269	1	36	0	31	5	**27**
	2	22	0	0	22	
		58	0	**31**	**27**	
270	1	15	0	15	0	**9**
	2	19	0	10	9	
		34	0	**25**	**9**	
271	1	33	0	17	16	**24**
	2	8	0	0	8	
		41	0	**17**	**24**	
272	1	6	0	6	0	**3**
	2	7	0	4	3	
		13	0	**10**	**3**	
273	1	64	0	3	61	**78**
	2	16	0	0	16	
	3	1	0	0	1	
		81	0	**3**	**78**	
274	1	44	1	39	5	**35**
	2	28	0	0	28	
	3	2	0	0	2	
		74	1	**39**	**35**	
275	1	43	0	39	4	**16**
	2	12	0	0	12	
		55	0	**39**	**16**	
276	1	90	0	22	68	**91**
	2	23	0	0	23	
		113	0	**22**	**91**	
278	1	46	0	46	0	**23**
	2	51	0	35	16	
	3	7	0	0	7	
		104	0	**81**	**23**	
279	1	73	0	6	67	**74**
	2	5	0	0	5	
	3	2	0	0	2	
		80	0	**6**	**74**	

Table 22. Continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
280	1	34	0	32	2	**18**
	2	16	0	0	16	
		50	0	**32**	**18**	
281	1	59	1	57	2	**54**
	2	47	0	0	47	
	3	4	0	0	4	
	9	1	0	0	1	
		111	1	**57**	**54**	
282	1	4	0	4	0	**1**
	2	1	0	1	0	
	3	1	0	1	0	
	4	2	0	1	1	
		8	0	**7**	**1**	
283	1	27	0	27	0	**16**
	2	12	0	5	7	
	3	9	0	0	9	
		48	0	**32**	**16**	
284	1	22	1	22	0	**17**
	2	22	0	5	17	
		44	1	**27**	**17**	
285	1	77	0	60	17	**20**
	2	3	0	0	3	
		80	0	**60**	**20**	
288	1	61	0	35	26	**52**
	2	25	0	0	25	
	3	1	0	0	1	
		87	0	**35**	**52**	
289	1	22	0	22	0	**22**
	2	22	0	1	21	
	3	1	0	0	1	
		45	0	**23**	**22**	
290	1	71	0	71	0	**50**
	2	70	0	21	49	
	3	1	0	0	1	
		142	0	**92**	**50**	
291	1	102	0	102	0	**82**
	2	91	0	10	81	
	3	1	0	0	1	
		194	0	**112**	**82**	
294	1	41	0	12	29	**41**
	2	10	0	0	10	
	3	2	0	0	2	
		53	0	**12**	**41**	

Table 22. Continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
295	1	40	0	40	0	**28**
	2	41	0	22	19	
	3	9	0	0	9	
		90	0	**62**	**28**	
296	1	56	1	56	0	**40**
	2	50	0	13	37	
	3	3	0	0	3	
		109	1	**69**	**40**	
297	1	5	0	5	0	**4**
	2	5	0	2	3	
	3	1	0	0	1	
		11	0	**7**	**4**	
298	1	12	0	12	0	**2**
	2	11	0	10	1	
	3	1	0	0	1	
		24	0	**22**	**2**	
299	1	58	0	40	18	**45**
	2	27	0	0	27	
		85	0	**40**	**45**	
TOTAL		**3,393**	**8**	**1,959**	**1,434**	**1,434**

Table 23. 2015 Special Permit Areas for Firearms Hunters.

Permit Area Number	Preference Level	Applications Total	Applications Rejected	Unsuccessful	Winners	Permits Available
901 - Rice Lake NWR	1	48	22	0	32	**40**
	2	23	14	0	0	
	3	1	1	0	0	
		72	**37**	0	**32**	
902 - Saint Croix State Park	1	441	0	290	151	**350**
	2	195	0	0	195	
	3	6	0	0	6	
	4	1	0	0	1	
		643	0	**290**	**353**	
903 - Lake Louise State Park	1	38	0	38	0	**25**
	2	42	0	31	11	
	3	13	0	0	13	
	4	1	0	0	1	
		94	0	**69**	**25**	
904 - Gooseberry Falls State Park	1	28	0	0	28	**50**
	2	6	0	0	6	
		34	0	**0**	**34**	
905 - Split Rock Lighthouse State Park	1	45	0	17	28	**30**
	2	2	0	0	2	
		47	0	**17**	**30**	
906 - Tettegouche State Park	1	93	0	0	93	**125**
	2	9	0	0	9	
	3	1	0	0	1	
		103	0	**0**	**103**	
907 - Scenic State Park	1	28	0	2	26	**30**
	2	7	0	0	7	
		35	0	**2**	**33**	
908 - Hayes Lake State Park	1	45	0	1	44	**50**
	2	2	0	0	2	
	3	4	0	0	4	
		51	0	**1**	**50**	
909 - Lake Bemidji State Park	1	33	0	8	25	**30**
	2	5	0	0	5	
		38	0	**8**	**30**	

Table 23. Continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
910 - Zippel Bay State Park	1	42	0	0	42	**55**
	2	12	0	0	12	
	3	2	0	0	2	
		56	0	**0**	**56**	
913 - Lake Carlos State Park	1	25	0	9	16	**18**
	2	4	0	0	4	
		29	0	**9**	**20**	
914 - William O'Brien State Park	1	70	0	70	0	**50**
	2	80	0	39	41	
	3	10	0	0	10	
		160	0	**109**	**51**	
915 - Lake Bronson State Park	1	31	0	17	14	**30**
	2	17	0	0	17	
	3	1	0	0	1	
		49	0	**17**	**32**	
916 - Maplewood State Park	1	136	0	136	0	**100**
	2	99	0	99	0	
	3	98	0	31	67	
	4	32	0	0	32	
	9	1	0	0	1	
		366	0	**266**	**100**	
919 - Glacial Lakes State Park	1	36	0	6	30	**30**
		36	0	**6**	**30**	
920 - Zumbro Falls SNA	1	15	0	11	4	**12**
	2	6	0	0	6	
	3	2	0	0	2	
		23	0	**11**	**12**	
921 - Forestville/ Mystery Cave State Park	1	136	0	82	64	**130**
	2	67	0	0	67	
	3	11	0	0	11	
		214	0	**82**	**142**	
922 - Beaver Creek Valley State Park	1	35	0	35	0	**20**
	2	28	0	28	0	
	3	21	0	0	21	
		84	0	**63**	**21**	

Table 23. Continued.

Permit Area Number	Preference Level	Applications Total	Applications Rejected	Unsuccessful	Winners	Permits Available
923 - Zumbro Falls SNA	1	7	0	0	7	**12**
	2	2	0	0	2	
		9	0	0	**9**	
925A - Vermillion Highlands Research (A)	1	43	0	43	0	**18**
	2	13	0	12	1	
	3	17	0	0	17	
		73	0	**55**	**18**	
925B - Vermillion Highlands Research (B)	2	6	0	3	3	**2**
		6	0	**3**	**3**	
927 - Whitewater State Park	1	72	0	57	15	**50**
	2	36	0	0	36	
		108	0	**57**	**51**	
929 - Frontenac State Park	1	76	0	37	39	**50**
	2	21	0	0	21	
		97	0	**37**	**60**	
931 - City of Grand Rapids	1	42	0	0	42	**59**
	2	17	0	0	17	
		59	0	**0**	**59**	
932A - Lake Elmo Park Reserve	1	108	0	108	0	**39**
	2	53	0	25	28	
	3	10	0	0	10	
	5	1	0	0	1	
		172	0	**133**	**39**	
932B - Lake Elmo Park Reserve	1	2	0	2	0	**1**
	2	3	0	2	1	
		5	0	**4**	**1**	
933A - Carver Park Reserve	1	220	0	220	0	**97**
	2	144	0	80	64	
	3	29	0	0	29	
	4	6	0	0	6	
		399	0	**300**	**99**	
933B - Carver Park Reserve	1	26	0	26	0	**13**
	2	22	0	14	8	
	3	5	0	0	5	
		53	0	**40**	**13**	
934 - Whitewater State Game Refuge	1	74	0	9	65	**75**
	2	11	0	0	11	
		85	**0**	9	**76**	
TOTAL		**3,200**	**37**	**1,588**	**1,582**	**1,591**

Table 24. 2015 Special Permit Areas for Muzzleloader Hunts.

Permit Area Number	Preference Level	Applications Total	Applications Rejected	Unsuccessful	Winners	Permits Available
935 - Jay Cook SP	1	147	0	130	17	**95**
	2	74	0	0	74	
	3	5	0	0	5	
		226	0	**130**	**96**	
936 - Crow Wing SP	1	35	0	35	0	**25**
	2	29	0	26	3	
	3	13	0	0	13	
	4	11	0	0	11	
		88	**0**	**61**	**27**	
937 - Lake Vermilion SP	1	47	0	34	13	**20**
	2	7	0	0	7	
		54	**0**	**34**	**20**	
938 - City of Tower	1	8	0	0	8	**20**
	2	2	0	0	2	
		10	**0**	**0**	**10**	
941 - Nerstrand Big Woods SP	1	115	0	115	0	**50**
	2	68	0	68	0	
	3	52	0	8	44	
	4	5	0	0	5	
	5	2	0	0	2	
		242	**0**	**191**	**51**	
942 - Sibley SP	1	98	0	98	0	**60**
	2	51	0	13	38	
	3	18	0	0	18	
	4	3	0	0	3	
	9	2	0	0	2	
		172	**0**	**111**	**61**	
943 - Myre Big Island SP	1	64	0	64	0	**50**
	2	50	0	14	36	
	3	12	0	0	12	
	4	1	0	0	1	
	9	1	0	0	1	
		128	**0**	**78**	**50**	
944 - Vermillion Highlands Research	1	34	0	34	0	**20**
	2	16	0	7	9	
	3	10	0	0	10	
	4	1	0	0	1	
		61	**0**	**41**	**20**	
946 - City of Grand Rapids	1	14	0	0	14	**16**
	2	1	0	0	1	
	3	1	0	0	1	
		16	**0**	**0**	**16**	
947 - Lake Bemidji SP	1	19	0	0	19	**30**
	2	7	0	0	7	
		26	**0**	**0**	**26**	
TOTAL		**1,023**	**0**	**646**	**377**	**386**

GRAND TOTAL		**103,272**	**560**	**68,964**	**34,278**	**34,476**

2015 MINNESOTA ELK HARVEST REPORT

Leslie McInenly, Big Game Program Leader; Ruth Anne Franke, Area Wildlife Supervisor

Graham Parson, Asst. Area Wildlife Manager; Joel Huener, Wildlife Area Supervisor

INTRODUCTION

A limited number of licenses are offered to Minnesota residents to hunt elk. In 2015, 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 2015, there was one regular season hunt (September 12-20). Hunts were held during the first season in both zones and during the remaining season only in zone 20. 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 ticks (if found), whole blood, hair with skin, muscle tissue, and a small sample of lung and liver tissue. Hunters are required to 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 1,439 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 2015, a total of 5 elk were harvested in the zones (Table 2). Long-term elk harvest for the zones is depicted in Tables 3 and 4.

Table 1. License allocation and application numbers for three elk hunting zones, 2015.

Zone	Either-Sex	Antlerless	Bull-only	Total	Total Applicants
20 – Kittson Central	0	0	5	5	846
30 – Kittson NE	0	0	2	2	593
Total	**0**	**0**	**7**	**7**	**1,439**

Table 2. Distribution of the 2015 Minnesota elk harvest.

Kittson County Central Hunt Zone (20)

Season	Bulls-only Licenses	Antlerless Licenses	Bulls taken	Antlerless taken	Total elk taken
September 12 - 20	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 12 - 20	2	2	2
Total	**2**	**2**	**2**

Table 3. Grygla elk harvests, 1987-2015.

	Grygla			
	Bulls (or Either-Sex)		**Antlerless**	
Year	**Permits**	**Harvest**	**Permits**	**Harvest**
1987	2	1	2	1
1996	2	2	7 (1 alternate)	6
1997	5 (2 alternate)	1	5 (2 alternate)	2
1998	4 (2 alternate)	2	0	0
2004	1	1	4	2
2005	1	0	4	0
2006	2	2	6	2
2007	0	0	6	6
2008	2	2	10	6
2009	2	3*	12	11
2010	2	1	5	3
2011	2	2	3	0
2012	2	1	3	0
2013	Closed	0	Closed	0
2014	Closed	0	Closed	0
2015	Closed	0	Closed	0
Total	**27**	**19**	**67**	**39**

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

Table 4. Kittson County elk harvests, 2008-2015.

	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
Total	**45**	**33**	**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 Zones.

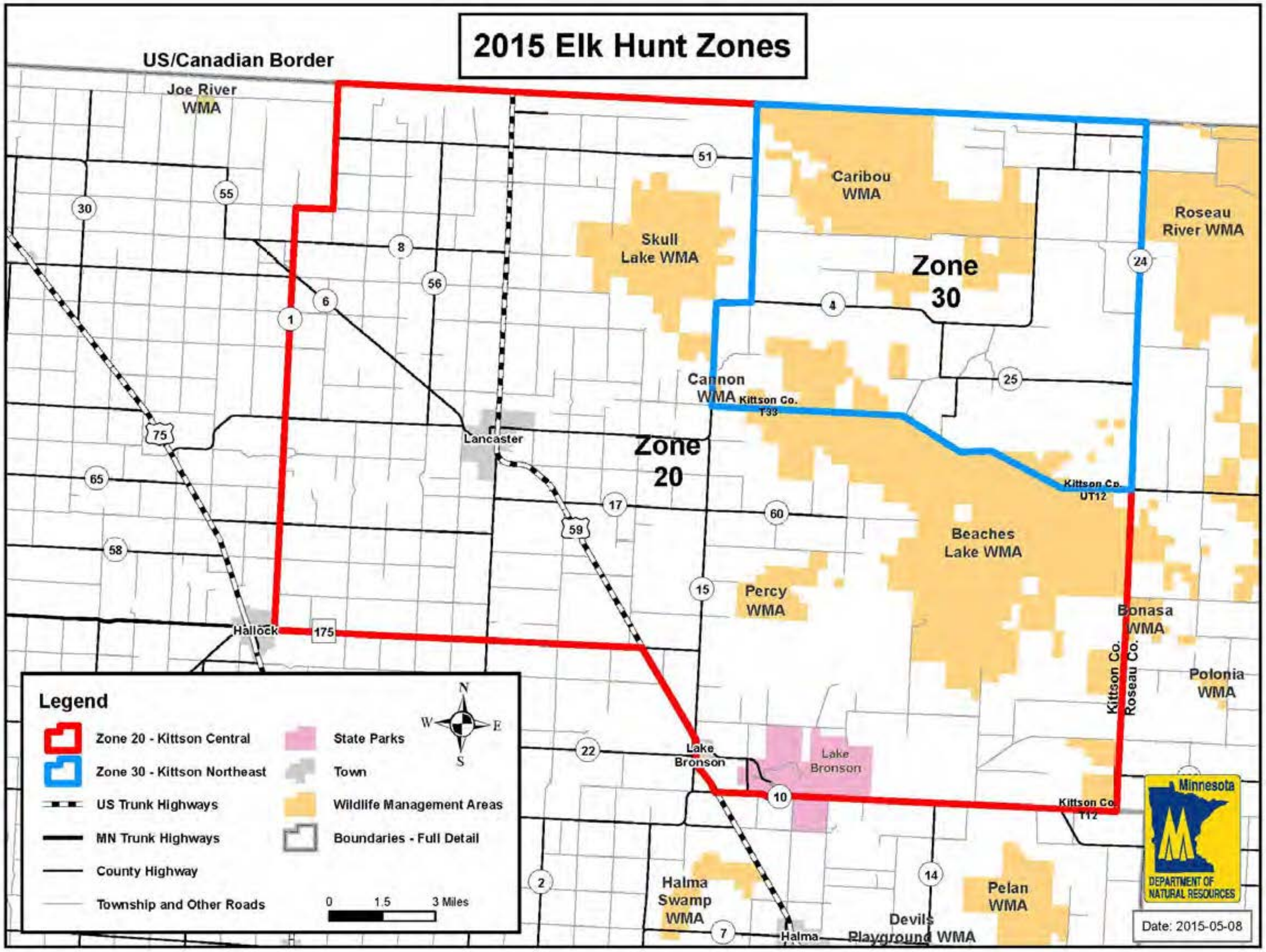
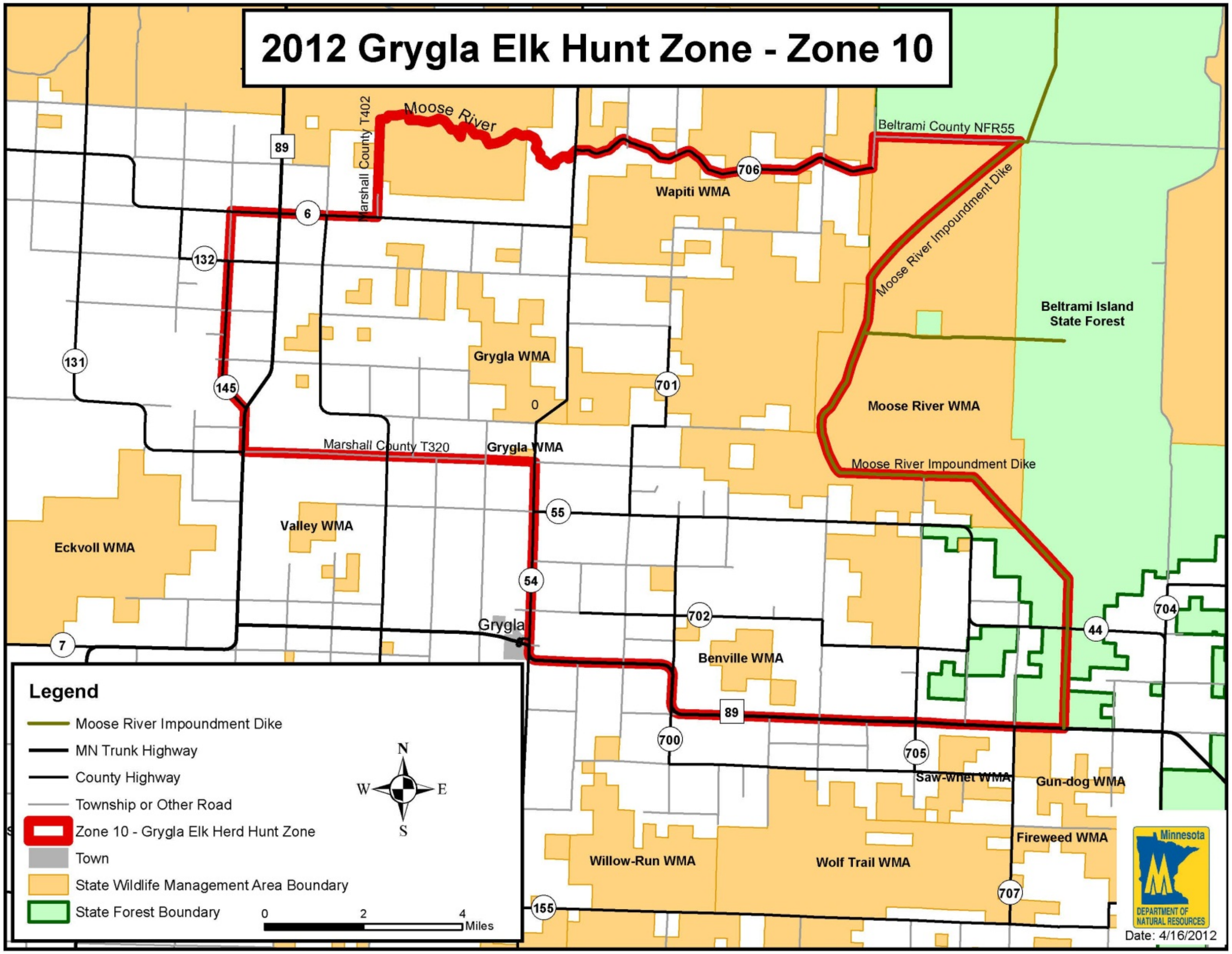


Figure 2. Grygla Elk Hunt Zone.



MINNESOTA SANDHILL CRANE HARVEST REPORT, 2015

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 2015 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 – 2015.

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

Table 2. Sandhill crane permit sales, estimated number of active hunters and harvest for NW Minnesota, 2010-2015. (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

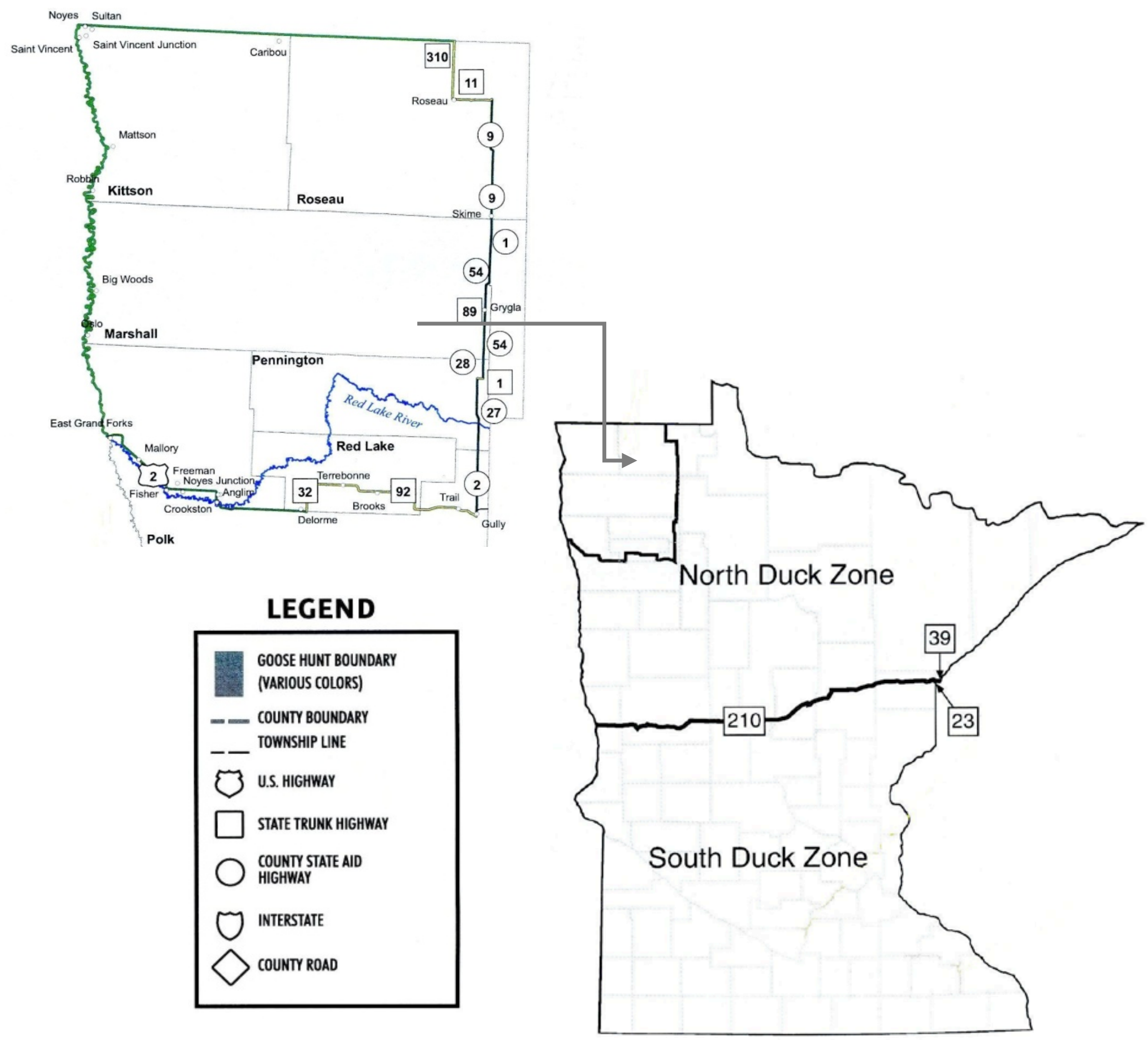


Figure 1. Sandhill crane hunting zone in Minnesota, 2010-2015.

TRAPPING HARVEST STATISTICS

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

2015 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 2016. There were 8,334 active trapping licenses in the ELS database, which consisted of 6,216 Resident Regular Trappers, 371 Resident Junior Trappers, 1,202 Resident Senior Trappers, 533 "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 3.1.2 (2014-10-31); R Development Core Team [RDCT] 2014) to summarize responses.

RESULTS

We mailed out 8,334 surveys, 88 surveys were undeliverable and 4,792 were returned for an adjusted response rate of 58.1%. Sixty nine percent of respondents (adults = 68%, youth = 77%) 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.

ACKNOWLEDGEMENTS

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Minnesota Department of Natural Resources
Division of Fish and Wildlife
Wildlife Research Unit
500 Lafayette Road, Box 20
St. Paul, MN 55155

RETURN SERVICE REQUESTED

Dear Trapper:

You are being asked as a trapping license buyer to assist us in evaluating the 2015-2016 trapping season (**March 2015-February 2016**). For Spring Beaver, please report only animals taken between March 2015 and May 15, 2015. 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 set 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

2015 Trapper Report

1. Did you set traps / snares in Minnesota during the 2015-2016 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 had set 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 Set Per Day*	*County You Trapped In Most*
Muskrat	80				
Mink	32				
Gray Fox	96				
Striped skunk	34				
Coyote (brush wolf)	97				
Beaver (Mar-May '15)	81				
Beaver (Oct '15-Feb '16)	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				

Minnesota Department of Natural Resources
Division of Fish and Wildlife
Wildlife Research Unit
500 Lafayette Road, Box 20
MNDNR St. Paul, MN 55155

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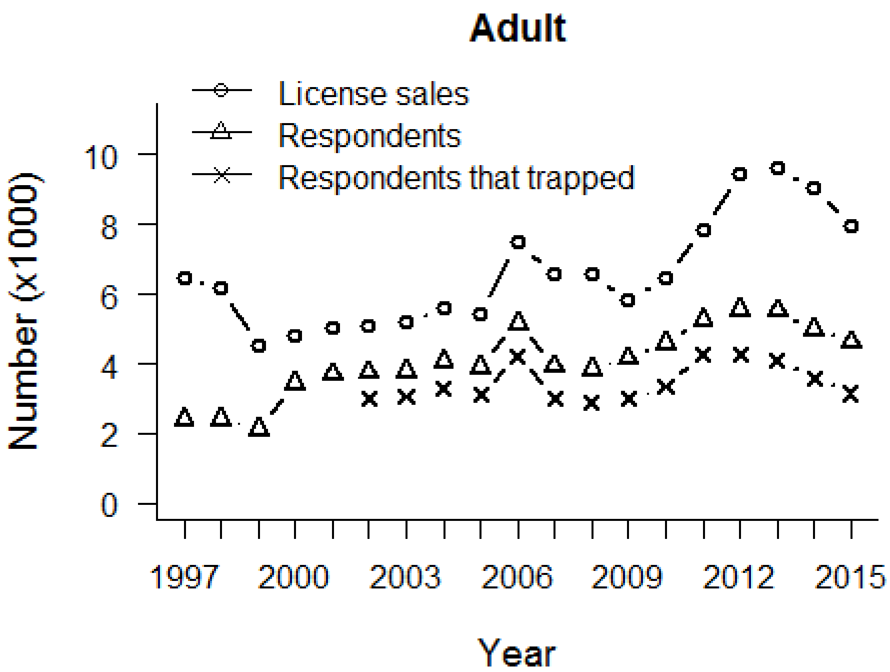
Figure 1. Trapper survey card 2015.



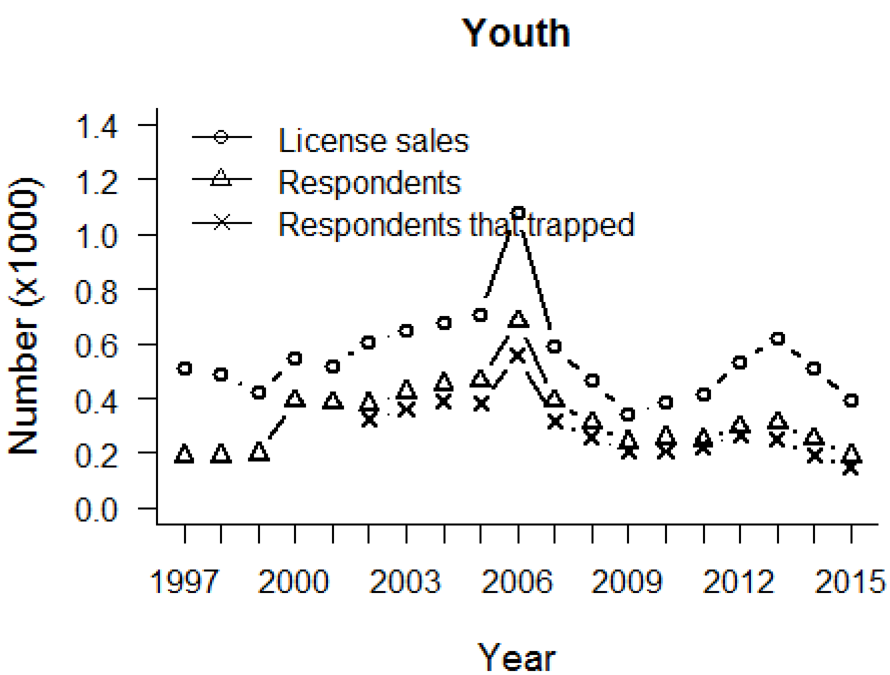


Figure 2. Trapper license sales and mail survey response by age class (Adult vs Youth), 1997-98 through 2015-16.

Table 1. Use of trapper licenses, 2002-03 through 2015-16.

Year		Returns from mail survey	Projections from license sales
2002-03	Trapped Did not trap	3,344 (80.6%) 804 (19.4%) 4,148 (100%)	4,615 1,111 5,726[a]
2003-04	Trapped Did not trap	3,412 (81.1%) 793 (18.9%) 4,205 (100.0%)	4,737 1,104 5,841[a]
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]

[a] excludes duplicates.

Table 2. Estimated number of trappers of various furbearers, 2002-03 through 2015-16.

	Estimated number of trappers													
	2002-03	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
Muskrat	2137	2117	2269	2351	4228	2371	2393	2088	2760	4,320	4,110	3,410	2,902	2,218
Mink	1945	1917	2085	1864	3033	2168	2044	1541	1847	2,470	3,110	2,780	2,158	1,587
Short-tailed weasel	408	473	470	349	864	595	511	417	546	800	690	510	666	289
Long-tailed weasel	312	374	299	211	694	434	345	254	333	560	540	480	519	265
Raccoon (Sept -Feb)	2427	2384	2505	2315	3766	3189	3150	2320	2567	4,060	4,680	4,660	4,182	2,781
Raccoon (Mar -Aug)[a]	354	338	406	322										
Striped skunk	1052	1102	1161	1023	1644	1485	1488	949	1130	1,800	1,940	1,610	1,541	1,234
Eastern spotted skunk	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
Badger	237	292	310	219	347	330	293	206	229	310	360	390	284	247
Opossum	754	934	1037	957	1511	1392	1169	701	645	830	1,100	1,110	575	463
Red fox (Sept -Feb)	1319	1290	1179	991	1608	1320	1232	1006	1068	1,900	2,240	2,080	2,012	1,434
Red fox (Mar -Aug)[a]	111	113	110	85										
Gray fox	421	441	451	407	806	654	657	529	555	970	1,180	1,060	1,035	684
Coyote	813	812	826	857	1379	1203	1141	888	998	1,720	2,360	2,200	2,396	1,981
Beaver (Oct 15- Feb 16)	1844	1883	2171	1965	2659	2008	1877	1650	1722	2,360	2,620	2,710	2,189	1,894
Beaver (Mar 15- May 15)	1296	1233	1449	1455	1710	1408	1257	1260	1367	1,510	1,810	1,150	1,305	1,145

[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, 2002-03 through 2015-2016.

	Estimated take per successful trapper reporting that species													
	2002-03	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
Muskrat	36	33	32	39	58	32	34	48	66	82	59	36	39	51
Mink	11	9	11	10	9	9	9	9	8	7	6	6	5	5
Short-tailed weasel	8	8	6	7	10	7	7	8	10	10	7	5	8	4
Long-tailed weasel	4	5	4	4	6	5	3	4	6	6	4	3	5	3
Raccoon (Sept -Feb)	26	23	23	22	21	24	23	20	23	25	18	16	15	11
Raccoon (Mar Aug)[a]	12	15	13	12										
Striped skunk	8	8	8	7	7	8	7	7	8	7	7	6	6	6
Eastern spotted skunk	Closed	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	2
Opossum	12	13	14	13	14	13	10	8	7	6	7	7	7	4
Red fox (Sept -Feb)	6	6	4	4	5	4	3	3	4	4	4	3	4	3
Red fox (Mar -Aug)[a]	6	6	4	3										
Gray fox	3	3	2	2	3	3	3	3	2	3	3	2	2	2
Coyote	5	5	5	5	4	5	4	5	5	6	5	5	5	6
Beaver (Oct 15-Feb 16)	13	13	14	14	13	11	12	12	10	12	10	9	8	8
Beaver (Mar 15-May 15)	27	22	27	25	25	19	23	20	22	20	20	9	16	14

[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, 2002-03 through 2015-2016[a]

	2002-03	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
Trapper license sales [b]	5,725	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
Estimated harvest [c]														
Muskrat	75,190	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
Mink	19,894	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
Short-tailed weasel	2,895	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
Long-tailed weasel	1,138	1,781	1,007	651	3,494	2,013	1,118	838	1,732	3,020	2,030	1,410	2,568	734
Raccoon (Oct - Feb)	61,221	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
Raccoon (Mar -Aug)[f]	4,137	4,933	4,940	3,594										
Striped skunk	7,901	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
Eastern spotted skunk [g]	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
Badger	358	552	455	339	461	499	424	316	344	490	570	600	347	376
Opossum	8,491	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
Red fox (Oct - Feb)	7,851	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
Red fox (Mar -Aug)[f]	612	635	334	222										
Gray fox	892	915	898	797	1,703	1,360	1,320	1,084	1,110	2,100	2,550	1,940	1,902	1,161
Coyote	3,641	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
Beaver (Oct 15- Feb 16)	23,592	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
Beaver (Mar 15-May 15)	33,721	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
Registered harvest [d]														
Otter	2,145	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
Lynx [g]	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
Bobcat [e]	544	483	631	590	890	702	853	884	1,012	1,711	1,875	1,038	1,380	766
Fisher	2,660	2,517	2,552	2,388	3,251	1,682	1,712	1,259	903	1,473	1,293	1,146	919	756
Marten	2,839	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

[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, 2016 - 8,334 trapping licenses were sold in 2015: 371 (4.5%) were junior licenses, 6,216 (74.6%) were Regular adult licenses, 1,202 (14.4%) were Senior licenses, 533 (6.4%) 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 2015-2016 HUNTING AND TRAPPING SEASON

Jason Abraham, Wildlife Season Setting/Furbearer Specialist
Margaret Dexter, Wildlife Policy and Research Unit

INTRODUCTION

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

METHODS

In August 2016, 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 2015-16 and the "average price" paid to those hunters and trappers based on all furs purchased. A total of 30 usable surveys were received, for a return rate of 78 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 2015-16 was $346,260.91, a 52 percent decrease from 2014-2015.

Table 1. Minnesota fur prices as reported by licensed fur dealers, 2015-16.

Species	Number Pelts	Minimum Price	Maximum Price	Weighted Mean
Muskrat	30,917	1.00	5.00	2.28
Mink Female	376	2.00	8.00	4.99
Mink male	410	2.00	12.00	6.18
Raccoon	18,990	0.00	20.00	5.11
Red Fox	894	5.00	20.00	11.86
Gray Fox	55	10.00	20.00	10.64
Coyote	4,024	13.00	30.00	21.48
Bobcat	50	42.00	70.00	57.46
River Otter	213	15.00	25.00	30.03
Beaver 10-12	2,034	4.72	14.00	8.77
Beaver 3-4	3,584	5.00	9.00	8.24
L.T. Weasel	41	1.00	1.81	1.41
S.T. Weasel	79	1.00	2.00	1.46
Striped Skunk	98	1.00	7.50	3.65
Badger	27	7.00	18.50	9.57
Opossum	68	0.75	5.00	1.98
Fisher Male	29	25.00	43.33	34.88
Fisher Female	19	30.00	43.33	34.39
Marten Male	38	26.67	35.00	30.83
Marten Female	15	25.00	30.00	28.89
Deer Hides	6,540	3.00	7.00	5.62
Bear Hides	68	25.00	50.00	46.03

Table 2. Average price per pelt paid to hunters and trappers in Minnesota, 2005-06 through 2015-16.

	Average pelt prices paid hunters and trappers in Minnesota (dollars)										
Species	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Muskrat	2.81	5.79	2.96	1.85	4.43	5.33	5.86	7.91	8.72	4.85	2.28
Mink (female)	10.23	13.18	9.05	7.45	8.02	9.33	11.54	17.53	13.72	7.45	4.99
Mink (male)	14.29	18.04	12.32	9.14	9.37	13.66	14.68	18.27	18.11	10.50	6.18
S.T. Weasel	2.6	3.58	3.18	3.57	3.02	1.50	2.10	2.51	0.00	2.00	1.41
L.T. Weasel	2.56	4.35	5	2.21	3.12	2.87	4.02	4.10	2.35	1.78	1.46
Raccoon	9.61	11.92	14.32	9.34	9.18	10.87	12.57	16.60	16.58	8.64	5.11
Striped Skunk	3.77	4.46	5.27	2.56	3.66	3.29	3.55	5.00	4.14	3.86	3.65
Badger	13.4	15.71	13.92	7.70	8.81	10.43	13.47	14.54	13.72	9.52	9.57
Opossum	1.4	1.52	1.76	1.21	1.30	2.64	5.80	1.52	1.52	1.17	1.98
Red Fox	16.96	17.68	14.69	11.79	10.85	13.35	22.87	33.52	30.90	20.41	11.86
Gray Fox	15	22.36	30.09	14.08	11.55	14.64	15.11	19.20	21.27	14.17	10.64
Coyote	13.57	17.76	13.51	7.12	8.62	9.47	17.99	22.04	21.30	25.10	21.48
Bobcat	95.74	101.07	93.41	74.74	42.77	71.44	98.18	144.79	88.63	66.67	57.46
Beaver (fall-winter)	14.48	18.35	14.6	14.63	12.49	11.95	14.29	18.47	16.52	12.40	8.77
Beaver (spring)	16.49	14.81	17.77	9.36	14.47	14.50	19.96	12.80	14.77	10.69	8.24
Otter	88.89	42.85	29.49	24.33	35.65	34.53	51.40	72.12	61.32	34.57	30.03
Fisher (male)	36.03	76.33	63.09	22.27	34.45	38.19	47.69	62.38	61.32	41.76	34.88
Fisher (female)	31.46	67.82	48.24	37.22	34.90	37.31	39.59	63.02	67.73	50.87	34.39
Marten (male)	37.47	74.04	58.72	30.61	26.76	39.80	42.32	56.57	74.10	38.92	30.83
Marten (female)	31.53	66.09	50.05	28.19	29.95	36.57	39.49	54.29	70.94	32.20	28.89
Deer Hides	4.14	4.51	3.92	3.53	4.44	4.41	3.95	5.18	6.09	5.59	5.62
Bear Hides	39.3	43.03	36.57	29.81	43.00	33.38	28.79	30.28	42.63	32.94	46.03

REGISTERED FURBEARER HARVEST STATISTICS

Forest Wildlife Populations and Research Group
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REGISTERED FURBEARER HARVEST STATISTICS 2015-16

John Erb, Forest Wildlife Populations and 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 subject to effects of habitat change. Hence, detailed harvest information is desirable to help ensure sustainable populations. For the past 39 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 2014 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.

ACKNOWLEDGEMENTS

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.

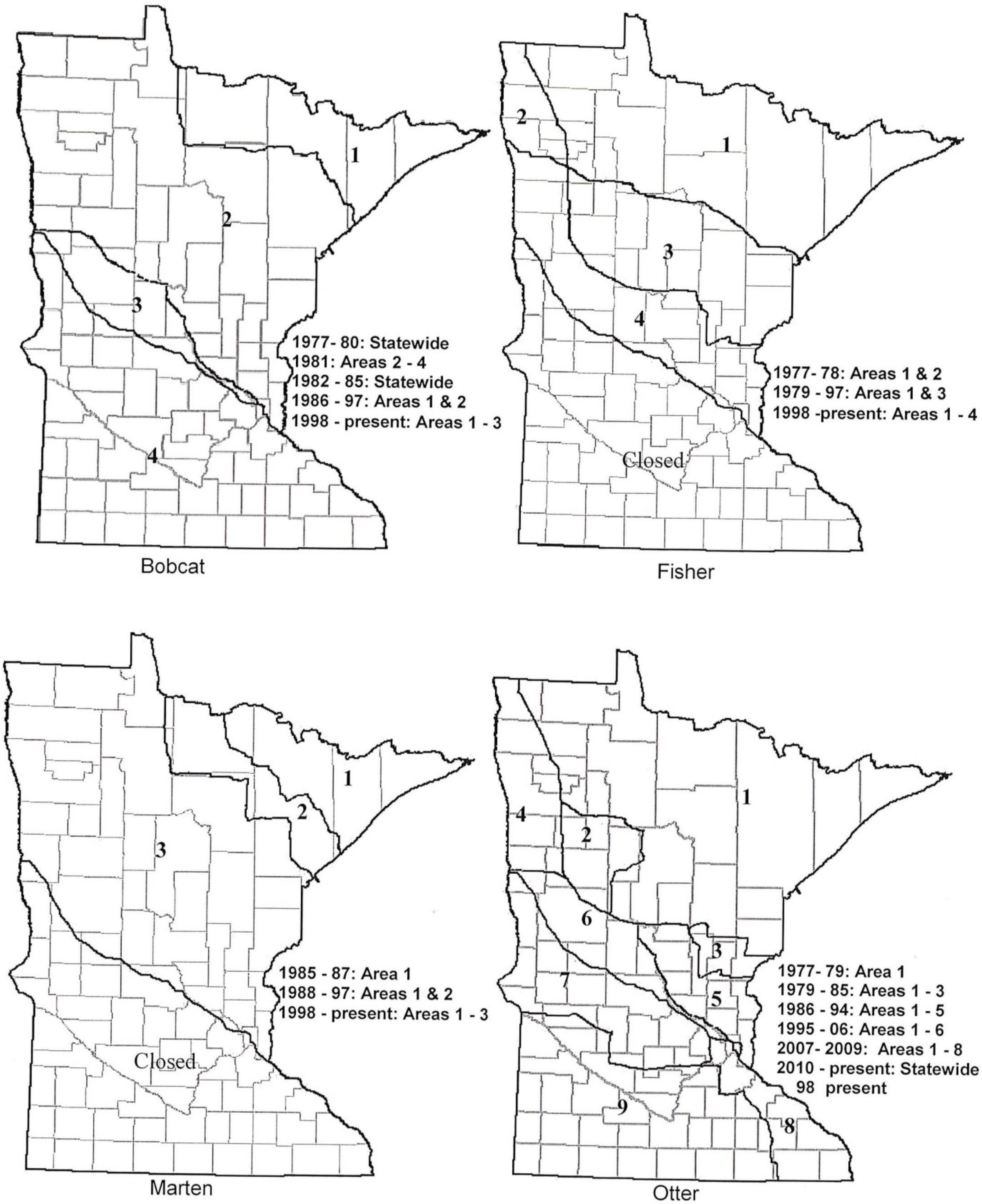

Figure 1. Open trapping areas for fisher, marten, bobcat, and otter, 1977 - present.

Table 1. Registered furbearer seasons and harvests, 1985-2015.

	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
1985-86	11/30-1/19	51	5	119	11/30-12/15	16	1	678	11/30-12/15	16	1	430	11/16-12/15	30	3	559
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

[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).

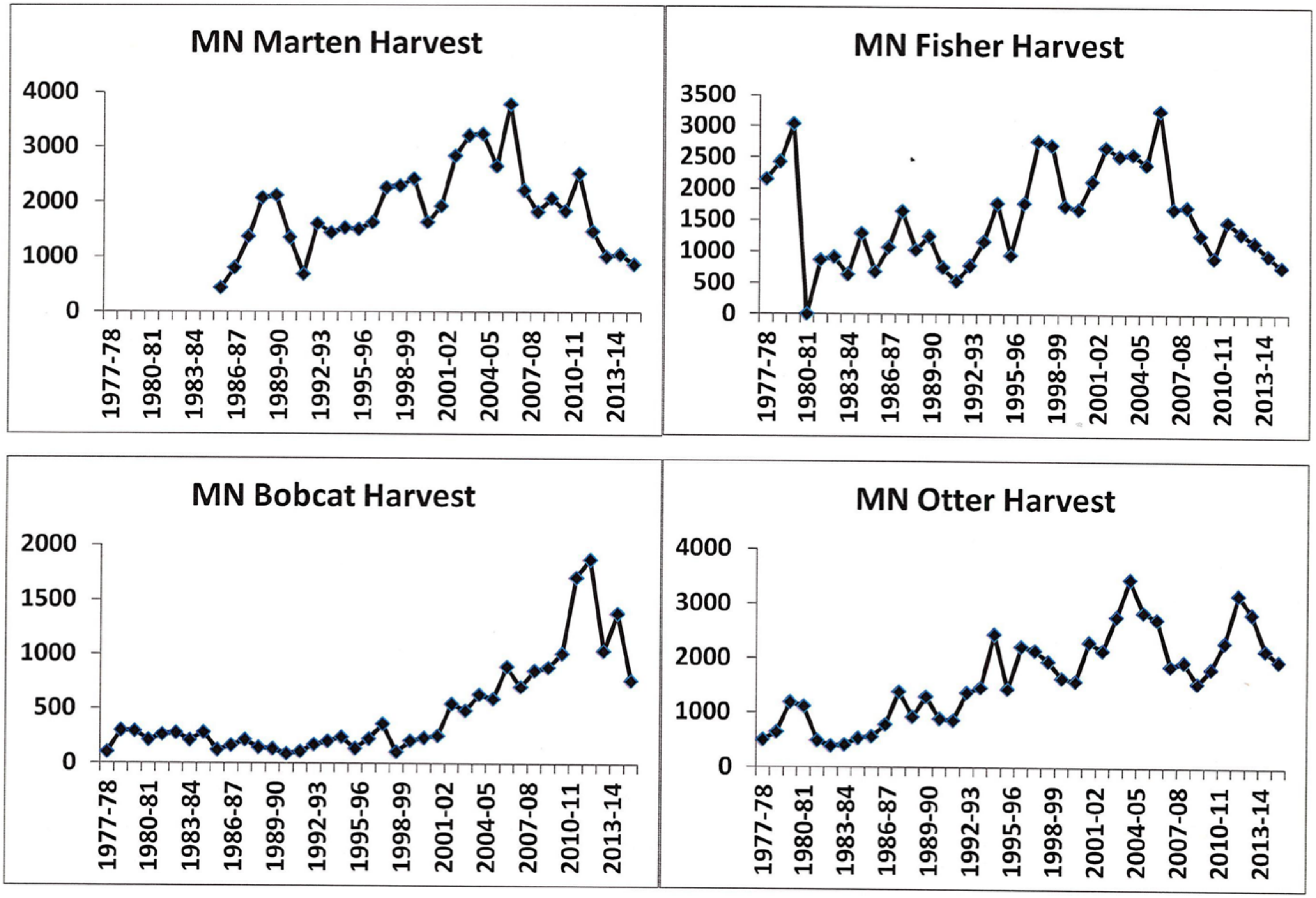

Figure 2. Harvest of registered furbearers in Minnesota, 1977-present.

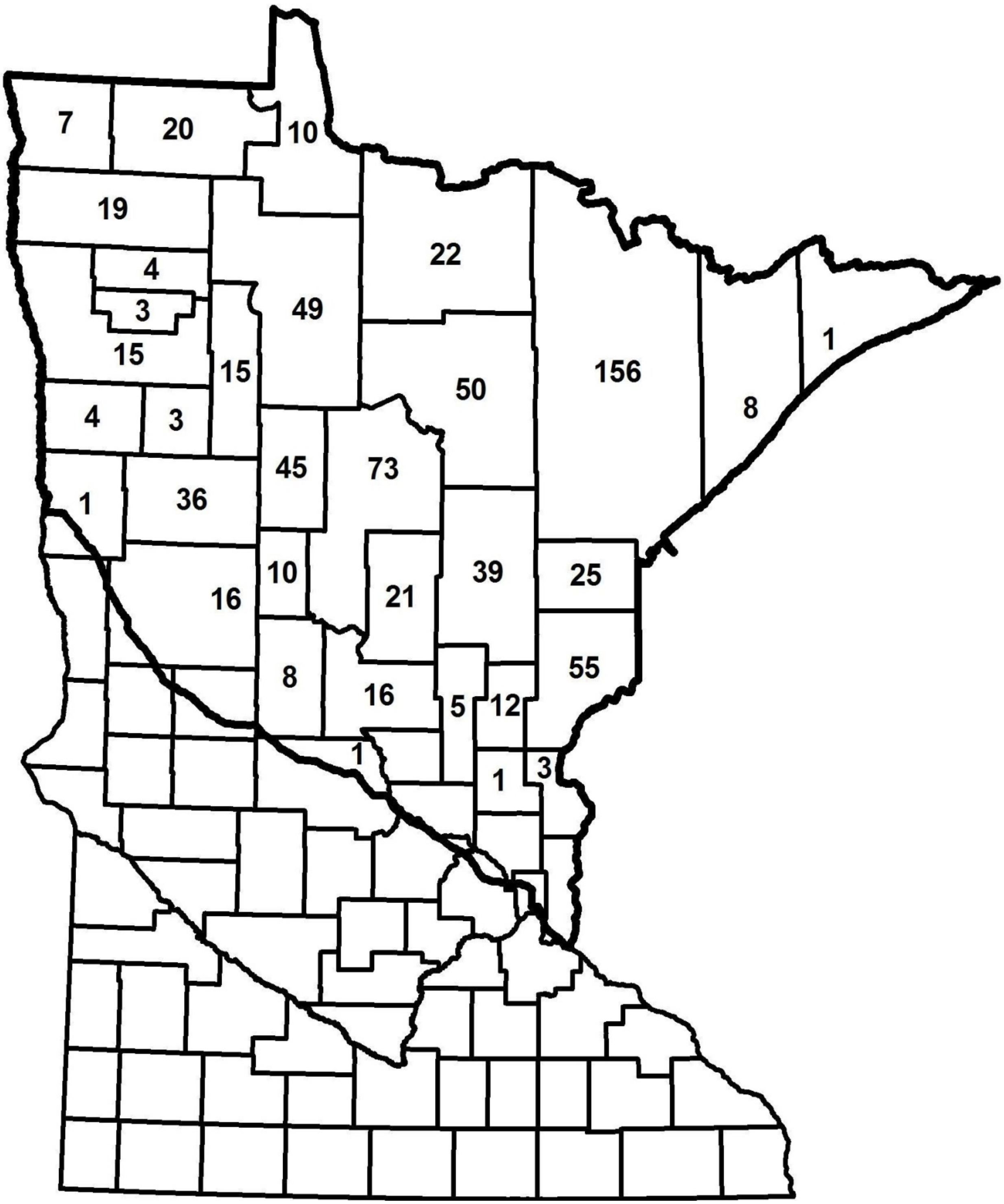

Figure 3. Bobcat harvest by county, 2015-16.

Table 2. Bobcat harvest by county and sex, 2015-16.

County	Sex* Male	Female	Unknown	Total	Harvest/ 100 Mile^2
Aitkin	17	21	1	39	1.96
Anoka	0	0		0	0.00
Becker	23	13		36	2.49
Beltrami	31	18		49	1.60
Benton	0	0		0	0.00
Carlton	12	13		25	2.86
Cass	31	42		73	3.03
Chisago	3	0		3	0.68
Clay	0	1		1	0.09
Clearwater	8	7		15	1.46
Cook	0	1		1	0.06
Crow Wing	11	10		21	1.82
Douglas	0	0		0	0.00
Hubbard	28	17		45	4.50
Isanti	1	0		1	0.22
Itasca	22	28		50	1.71
Kanabec	8	4		12	2.25
Kittson	2	5		7	0.63
Koochiching	13	9		22	0.70
Lake	4	4		8	0.35
Lake of the Woods	6	4		10	0.56
Mahnomen	1	1	1	3	0.51
Marshall	8	9	2	19	1.05
Mille Lacs	2	3		5	0.73
Morrison	8	7	1	16	1.39
Norman	4	0		4	0.46
Otter Tail	8	8		16	0.72
Pennington	3	1		4	0.65
Pine	29	26	1	56	3.91
Polk	8	7		15	0.75
Red Lake	2	1		3	0.69
Roseau	11	9		20	1.19
Sherburne	0	0		0	0.00
St. Louis	72	84		156	2.32
Stearns	1	0		1	0.07
Todd	4	4		8	0.82
Wadena	6	4		10	1.84
Unknown	5	7		12	
Total	392	368	6	766	

* 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, 2005-2015.

County	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Aitkin	32	46	56	64	82	73	121	142	65	105	39
Anoka	0	0	0	0	0	0	1	0	0	1	0
Becker	19	46	24	37	25	39	70	58	36	48	36
Beltrami	34	90	33	49	70	108	139	139	59	73	49
Benton	0	0	1	5	2	0	4	3	3	0	0
Carlton	25	34	25	45	44	37	94	63	42	88	25
Cass	103	137	50	98	115	117	164	150	76	126	73
Chisago	0	0	3	0	0	1	0	3	1	1	3
Clay	0	0	0	0	1	3	1	3	2	3	1
Clearwater	18	42	25	43	27	30	58	40	19	29	15
Cook	3	0	0	1	0	1	3	3	9	17	1
Crow Wing	18	27	21	36	38	29	64	65	19	32	21
Douglas	0	0	0	0	0	0	0	1	1	0	0
Hubbard	22	69	40	49	81	59	129	105	51	50	45
Isanti	1	0	0	0	0	0	0	0	1	0	1
Itasca	68	113	86	72	106	132	186	194	93	110	50
Kanabec	11	14	16	23	11	16	21	46	16	46	12
Kittson	3	5	4	9	4	9	10	7	5	5	7
Koochiching	22	16	37	31	25	54	66	82	50	40	22
Lake	2	1	0	1	2	7	15	21	13	15	8
Lake of the Woods	3	2	9	12	16	10	28	13	20	26	10
Mahnomen	2	7	8	0	4	2	9	7	4	4	3
Marshall	16	19	32	18	15	31	42	44	15	21	19
Mille Lacs	9	8	13	11	10	10	13	23	7	14	5
Morrison	18	17	23	28	13	23	25	35	15	25	16
Norman	0	1	0	0	1	0	3	6	3	8	4
Otter Tail	1	7	9	7	7	14	21	38	18	17	16
Pennington	3	2	11	9	6	5	4	13	7	3	4
Pine	47	59	87	101	49	50	94	135	54	87	56
Polk	1	3	0	4	9	9	17	20	10	16	15
Red Lake	6	1	0	0	7	16	20	25	6	11	3
Roseau	28	36	32	18	19	26	46	60	38	27	20
Sherburne	0	0	0	0	1	0	3	0	0	0	0
St. Louis	44	45	39	58	56	81	202	283	255	307	156
Stearns	0	0	1	0	0	0	0	0	2	0	1
Todd	7	12	6	14	10	9	14	16	5	8	8
Wadena	17	16	9	7	21	9	17	23	18	18	10
Unknown	7	15	2	3	7	2	7	9	0	3	12
Total	590	890	702	853	884	1012	1711	1875	1038	1384	766

Table 4. Bobcat harvest by sex and week, 2015-16 season.

Date	Sex* Male	Female	Unknown	Total	% of Total	Cumulative %
Nov.28 - Dec.4	89	61	1	151	19.71	19.71
Dec.5 - Dec.11	73	76	1	150	19.58	39.30
Dec.12 - Dec.18	68	62	2	132	17.23	56.53
Dec.19 - Dec.25	77	78	1	156	20.37	76.89
Dec.26 - Jan.3**	78	87	1	166	21.67	98.56
Unknown	7	4		11	1.44	100.00
Total	392	368	6	766	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, 1990-2015.

Number (%)of Takers	Number taken					Total Takers
	1	2	3	4	5	
1990-91	47 (77)	9 (15)	1 (2)	4 (7)	0 (0)	61
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

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

Table 6. Bobcat harvest by method of take, 1988-2015.

Year	Total Harvest[a]	Trapping Harvest	Trapping % of Total	Trapping # Takers	Trapping Ave. Take	Trapping % Males[b]	Hunting Harvest	Hunting % of Total	Hunting # Takers	Hunting Ave. Take	Hunting % Males[b]
1988-89	140	94	67	76	1.2		46	33	32	1.4	
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

[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

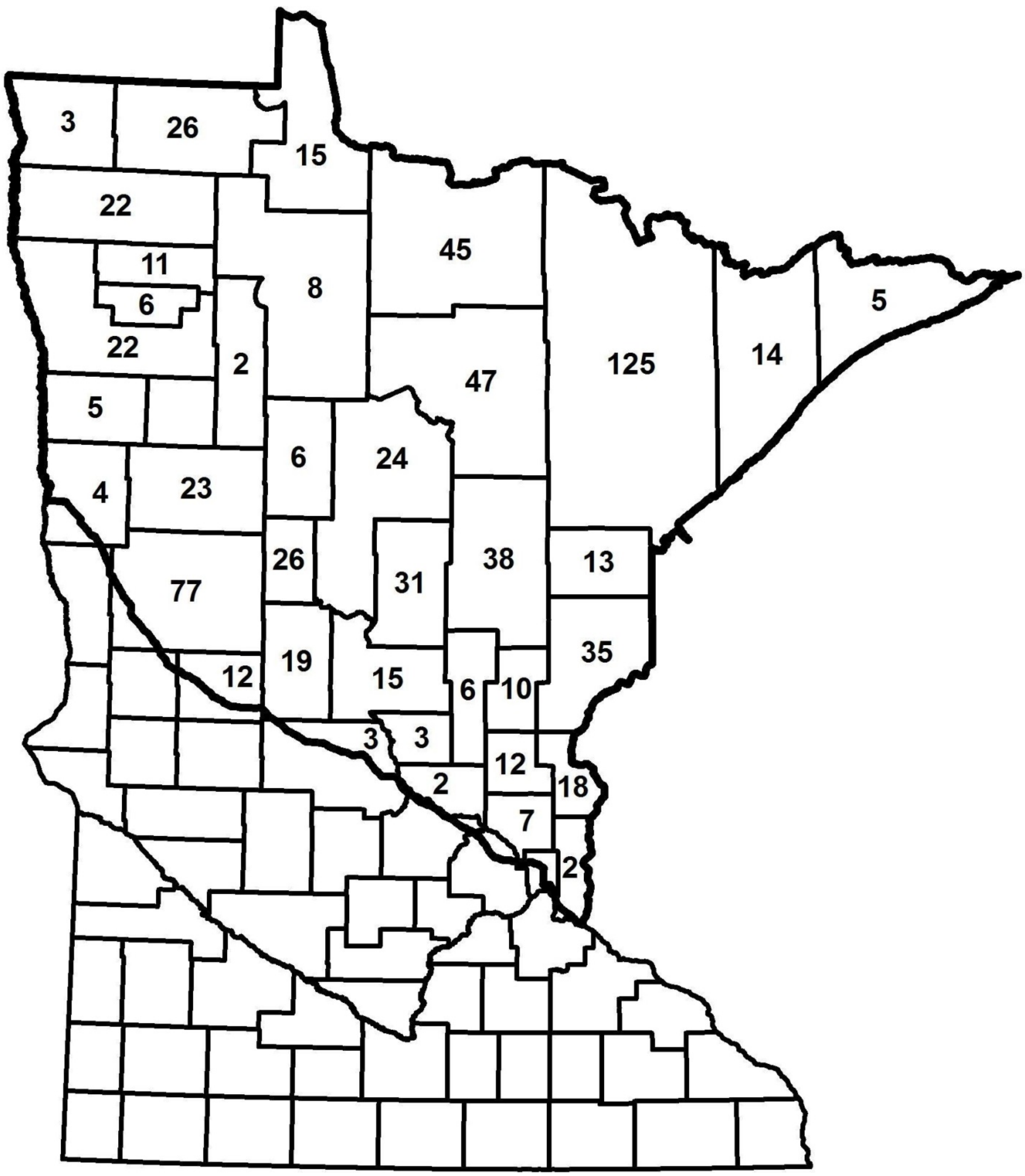

Figure 4. Fisher harvest by county, 2015.

Table 7. Fisher harvest by county and sex, 2015 season.

County	Sex			Total	Harvest/ 100 Mile^2
	Male	Female	Unknown		
Aitkin	20	18		38	1.91
Anoka	2	5		7	1.57
Becker	12	11		23	1.59
Beltrami	5	3		8	0.26
Benton	3	0		3	0.73
Carlton	5	8		13	1.49
Cass	12	12		24	0.99
Chisago	12	6		18	4.07
Clay	0	4		4	0.38
Clearwater	2	0		2	0.19
Cook	2	3		5	0.31
Crow Wing	16	15		31	2.68
Douglas	8	4		12	1.67
Grant	0	0		0	0.00
Hubbard	3	3		6	0.60
Isanti	6	6		12	2.66
Itasca	22	25		47	1.61
Kanabec	2	8		10	1.88
Kittson	3	0		3	0.27
Koochiching	24	21		45	1.43
Lake	7	5	2	14	0.61
Lake of the Woods	9	6		15	0.84
Mahnomen	0	0		0	0.00
Marshall	11	11		22	1.21
Mille Lacs	3	3		6	0.88
Morrison	9	6		15	1.30
Norman	4	1		5	0.57
Ottertail	42	35		77	3.46
Pennington	8	3		11	1.78
Pine	16	19		35	2.44
Polk	10	12		22	1.10
Red Lake	2	4		6	1.39
Roseau	10	16		26	1.55
Sherburne	0	2		2	0.44
St. Louis	63	62		125	1.86
Stearns	1	2		3	0.22
Todd	5	14		19	1.94
Wadena	16	10		26	4.79
Washington	2	0		2	0.47
Wilkin	0	0		0	0.00
Unknown	13	1		14	
Total	390	364	2	756	

Table 8. Comparison of fisher harvest by county, 2004-2015.

County	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Aitkin	96	97	156	67	75	50	35	55	52	47	24	38
Anoka	0	0	0	0	2	0	0	1	2	1	2	7
Becker	92	49	87	57	36	44	30	32	45	38	21	23
Beltrami	71	47	54	40	15	22	10	25	21	17	4	8
Benton	0	1	1	0	3	2	0	5	5	2	4	3
Carlton	40	35	49	13	19	15	12	12	14	8	14	13
Cass	186	149	209	80	77	57	43	41	37	23	30	24
Chisago	6	2	18	7	4	10	6	10	3	4	16	18
Clay	0	0	1	0	3	0	6	10	6	5	6	4
Clearwater	41	35	54	19	37	13	6	8	5	12	3	2
Cook	24	40	35	29	10	11	17	28	11	13	11	5
Crow Wing	113	79	140	81	116	42	48	64	55	51	34	31
Douglas	3	3	6	2	5	2	6	15	24	8	20	12
Grant	0	0	0	0	0	0	1	0	0	0	0	0
Hubbard	32	20	51	20	38	18	13	10	11	10	8	6
Isanti	2	3	5	1	5	9	1	4	6	11	11	12
Itasca	323	320	405	195	195	166	88	142	105	116	78	47
Kanabec	13	15	26	11	26	20	13	21	27	30	9	10
Kittson	2	7	2	5	8	5	7	5	9	11	2	3
Koochiching	179	209	221	105	115	96	51	116	80	51	67	45
Lake	87	85	87	49	54	49	45	56	53	35	28	14
Lake of the Woods	33	63	74	17	42	21	9	33	21	13	12	15
Mahnomen	13	9	27	25	6	3	0	3	0	4	2	0
Marshall	25	18	26	19	26	6	7	13	14	17	22	22
Mille Lacs	14	16	20	15	17	18	18	17	20	17	12	6
Morrison	7	5	23	21	14	10	8	10	24	25	23	15
Norman	11	6	4	9	12	7	4	10	19	21	12	5
Otter Tail	52	60	158	110	152	67	100	138	121	117	102	77
Pennington	42	22	22	16	8	2	4	8	8	11	19	11
Pine	56	42	82	39	74	30	26	22	42	46	44	35
Polk	47	38	72	61	49	31	25	54	58	45	32	22
Red Lake	29	34	32	29	23	23	10	17	16	24	18	6
Roseau	114	110	127	84	89	58	20	79	61	42	32	26
Sherburne	0	0	0	0	0	3	1	6	2	2	2	2
St. Louis	740	688	898	407	283	296	186	350	233	220	171	125
Stearns	1	0	0	0	1	1	0	4	1	4	2	3
Todd	18	23	21	13	33	22	18	15	29	22	15	19
Wadena	31	40	44	27	37	23	23	31	25	23	21	26
Washington	0	0	0	1	0	0	0	1	1	0	2	2
Wilkin	0	0	0	0	0	0	0	1	0	0	0	0
Unknown	9	18	14	8	3	7	6	1	27	0	8	14
Total	2,552	2,388	3,251	1,682	1,712	1,259	903	1,473	1,293	1,146	943	756

Table 9. Fisher harvest by date and sex, 2015 season.

	Sex				% of Known	Cumulative
Date	Male	Female	Unknown	Total	Total	%
Nov. 28	4	3		7	0.93	0.93
Nov. 29	77	79	1	157	20.77	21.69
Nov. 30	108	87	1	196	25.93	47.62
Dec. 1	62	70		132	17.46	65.08
Dec. 2	70	49		119	15.74	80.82
Dec. 3	60	66		126	16.67	97.49
Unknown	9	10		19	2.51	100%
Total	390	364	2	756	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)	276 (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

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

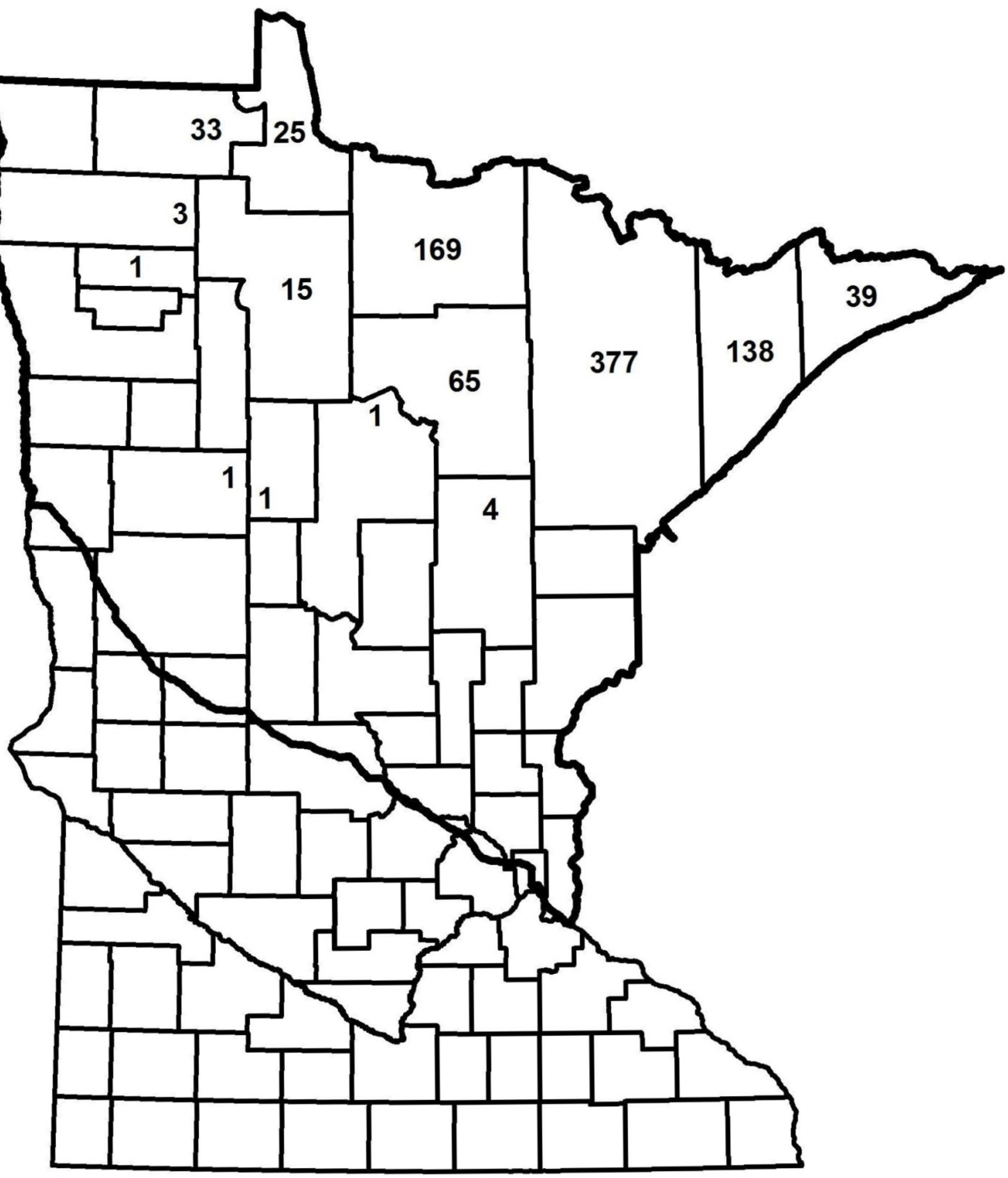

Figure 5. Marten harvest by county, 2015.

Table 11. Marten harvest by county and sex, 2015 season.

County	Sex			Total	Harvest/ 100 Mile^2
	Male	Female	Unknown		
Aitkin	2	2		4	0.20
Becker	1	0		1	0.07
Beltrami	11	4		15	0.49
Carlton	0	0		0	0.00
Cass	1	1		2	0.08
Clearwater	0	0		0	0.00
Cook	20	19		39	2.43
Crow Wing	0	0		0	0.00
Hubbard	1	0		1	0.10
Itasca	34	30		64	2.19
Kanabec	0	0		0	0.00
Kittson	0	0		0	0.00
Koochiching	119	50		169	5.36
Lake	87	50	1	138	6.03
Lake of the Woods	15	10		25	1.41
Mahnomen	0	0		0	0.00
Marshall	2	1		3	0.17
Otter Tail	0	0		0	0.00
Pennington	1	0		1	0.16
Pine	0	0		0	0.00
Red Lake	0	0		0	0.00
Roseau	22	11		33	1.97
St. Louis	247	130		377	5.60
Unknown	4	1		5	
Total	567	309		877	

Table 12. Comparison of marten harvest by county in Minnesota, 2004-2015.

County	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Aitkin	6	6	13	4	12	5	4	13	10	8	12	4
Becker	0	0	0	0	0	0	0	0	0	0	0	1
Beltrami	65	17	19	8	6	10	2	11	20	15	7	15
Carlton	1	10	6	1	4	8	5	6	3	1	1	0
Cass	3	1	4	0	1	2	1	2	0	0	3	2
Clearwater	1	0	0	0	0	0	0	0	0	0	0	0
Cook	318	369	446	269	151	244	191	205	148	78	43	39
Crow Wing	0	0	0	0	0	1	0	1	0	0	1	0
Hubbard	0	0	0	0	0	0	0	0	0	0	0	1
Itasca	136	98	155	74	72	91	73	118	46	62	79	64
Kanabec	0	0	2	0	0	0	0	0	0	0	0	0
Kittson	0	0	0	0	0	0	1	0	4	0	1	0
Koochiching	549	418	592	348	300	354	336	516	276	218	265	169
Lake	551	536	892	520	438	496	491	577	290	185	149	138
Lake of the Woods	122	54	46	31	17	17	13	49	32	18	23	25
Mahnomen	2	0	0	0	0	0	0	0	0	0	0	0
Marshall	5	3	0	1	0	4	0	3	3	5	5	3
Otter Tail	0	0	0	0	0	0	0	0	0	0	1	0
Pennington	0	0	0	1	0	0	0	0	0	0	0	1
Pine	2	1	1	1	0	0	1	0	0	0	1	0
Red Lake	0	0	0	0	0	0	0	0	1	1	0	0
Roseau	127	51	31	69	46	32	13	98	77	37	40	33
St. Louis	1,346	1,065	1,579	885	769	803	709	926	562	386	421	377
Unknown	7	24	2	9	7	6	2	0	0	0	7	5
Total	3,241	2,653	3,788	2,221	1,823	2,073	1,842	2,525	1,472	1,014	1,059	877

Table 13. Marten harvest by date and sex, 2015 season.

Date	Sex			Total	% of Total	Cumulative %
	Male	Female	Unknown			
Nov. 28	3	0		3	0.34	0.34
Nov. 29	147	67		214	24.40	24.74
Nov. 30	134	72		206	23.49	48.23
Dec. 1	103	72	1	176	20.07	68.30
Dec. 2	76	46		122	13.91	82.21
Dec. 3	98	48		146	16.65	98.86
Unknown	6	4		10	1.14	100%
Total	567	309	1	877	100%	

Table 14. Distribution of marten harvest* among trappers, 1993-2015.

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

* 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, 2015.
(Combined limit = 2)

Number of Takers		Number of Marten					
		0	1	2	3	4	5
Number of Fisher	0		134	309			
	1	233	113				
	2	203					
	3						
	4						
	5				Total takers of at least 1 fisher or marten		992

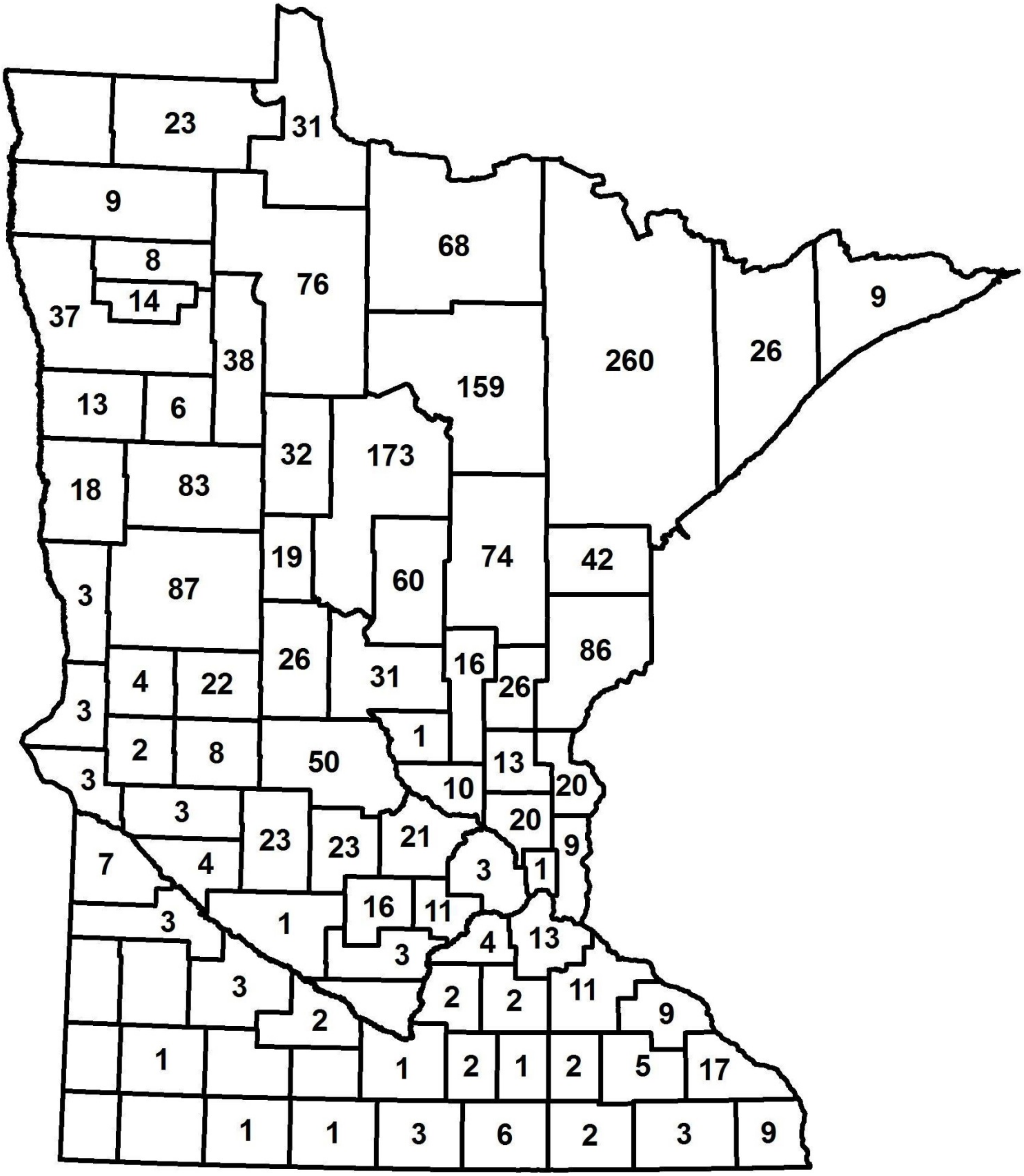

Figure 6. Otter harvest by county, 2015-16.

Table 16. Otter harvest by county and sex, 2015-16 season.

County	Sex			Total	Harvest/
	Male	Female	Unknow		100 Mile[2]
Aitkin	51	23		74	3.71
Anoka	11	9		20	4.49
Becker	52	31		83	5.74
Beltrami	44	31	1	76	2.49
Benton	1	0		1	0.24
Big Stone	2	1		3	0.57
Blue Earth	1	0		1	0.13
Brown	1	1		2	0.32
Carlton	25	17		42	4.80
Carver	7	4		11	2.93
Cass	121	50	1	172	7.13
Chippewa	3	1		4	0.68
Chisago	15	5		20	4.52
Clay	12	6		18	1.71
Clearwater	25	13		38	3.69
Cook	5	4		9	0.56
Crow Wing	33	26		59	5.10
Dakota	7	6		13	2.22
Dodge	2	0		2	0.46
Douglas	11	11		22	3.05
Faribault	3	0		3	0.42
Fillmore	2	1		3	0.35
Freeborn	3	3		6	0.83
Goodhue	6	5		11	1.41
Grant	4	0		4	0.69
Hennepin	3	0		3	0.49
Houston	7	2		9	1.58
Hubbard	17	15		32	3.20
Isanti	10	3		13	2.88
Itasca	88	69	2	159	5.43
Jackson	0	1		1	0.14
Kanabec	14	12		26	4.88
Kandiyohi	13	10		23	2.67
Kittson	0	0		0	0.00
Koochiching	40	27	1	68	2.16
Lac Qui Parle	3	4		7	0.90
Lake	18	8		26	1.14
Lake of the Woods	22	9		31	1.74
Le Sueur	1	1		2	0.42
Lincoln	0	0		0	0.00
Mahnomen	4	2		6	1.03
Marshall	5	4		9	0.50
Martin	1	0		1	0.14
McLeod	9	7		16	3.17
Meeker	16	7		23	3.57
Mille Lacs	6	10		16	2.35
Morrison	16	15		31	2.69
Mower	2	0		2	0.28
Murray	1	0		1	0.14
Nicollet	0	0		0	0.00
Nobles	0	0		0	0.00
Norman	5	8		13	1.48

Table 16 (continued). Otter harvest by county and sex, 2015-16 season.

County	Sex			Total	Harvest / 100 Mile²
	Male	Female	Unknown		
Olmsted	3	1	1	5	0.76
Otter Tail	56	31		87	3.91
Pennington	6	2		8	1.29
Pine	59	27		86	6.00
Polk	20	17		37	1.85
Pope	5	3		8	1.12
Ramsey	1	0		1	0.59
Red Lake	12	2		14	3.23
Redwood	3	0		3	0.34
Renville	1	0		1	0.10
Rice	1	1		2	0.39
Rock	0	0		0	0.00
Roseau	18	5		23	1.37
Scott	2	2		4	1.09
Sherburne	7	3		10	2.22
Sibley	3	0		3	0.50
St. Louis	163	97		260	3.86
Stearns	26	24		50	3.60
Steele	0	1		1	0.23
Stevens	1	1		2	0.35
Swift	2	1		3	0.40
Todd	14	14		28	2.86
Traverse	2	1		3	0.51
Wabasha	7	0	2	9	1.64
Wadena	8	11		19	3.50
Waseca	2	0		2	0.46
Washington	7	2		9	2.13
Watonwan	0	0		0	0.00
Wilkin	3	0		3	0.40
Winona	10	7		17	2.65
Wright	12	9		21	2.94
Yellow Medicine	2	0	1	3	0.39
Unknown	8	9	1	18	
Total	1,212	733	10	1,955	

Table 17. Comparison of otter harvest by county, 2004-2015.

County	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Aitkin	113	132	124	53	65	54	59	107	111	90	67	74
Anoka	32	22	16	26	18	26	8	13	31	25	23	20
Becker	178	107	117	54	55	39	53	95	127	87	77	83
Beltrami	216	170	154	105	80	74	77	112	120	98	74	76
Benton	19	14	16	9	11	3	13	13	21	17	8	1
Big Stone	0	0	0	0	2	1	0	3	3	9	8	3
Blue Earth	0	0	0	0	0	0	0	2	3	1	2	1
Brown	0	0	0	0	0	0	0	0	0	0	0	2
Carlton	53	36	39	36	29	30	35	29	38	37	26	42
Carver	0	0	0	2	5	6	5	15	8	9	17	11
Cass	255	231	236	124	160	90	135	140	183	161	193	172
Chippewa	0	0	0	0	0	0	5	7	8	12	6	4
Chisago	20	28	33	16	15	18	23	19	24	32	26	20
Clay	15	18	35	8	14	7	23	42	23	16	14	18
Clearwater	62	48	41	39	35	19	38	41	46	47	23	38
Cook	56	46	39	13	12	16	19	36	55	57	28	9
Crow Wing	141	102	111	63	99	76	66	107	117	96	83	59
Dakota	0	0	0	0	5	7	1	0	11	10	6	13
Dodge	0	0	0	0	0	0	3	1	1	3	4	2
Douglas	27	16	30	18	28	11	14	34	37	23	33	22
Faribault	0	0	0	0	0	0	0	1	12	3	1	3
Fillmore	0	0	0	6	1	1	5	5	10	6	13	3
Freeborn	0	0	0	0	0	0	5	10	10	1	7	6
Goodhue	0	0	0	3	3	7	11	7	18	2	2	11
Grant	0	0	0	3	3	6	1	8	12	6	13	4
Hennepin	0	0	0	1	3	6	2	3	4	5	6	3
Houston	0	0	0	9	15	11	11	10	26	22	14	9
Hubbard	91	80	72	59	72	41	52	42	67	61	36	32
Isanti	35	38	30	30	17	18	14	9	18	28	23	13
Itasca	483	362	334	205	201	191	247	281	346	345	184	159
Jackson	0	0	0	0	0	0	0	0	0	0	0	1
Kanabec	57	79	62	44	29	23	17	22	52	45	34	26
Kandiyohi	0	0	0	2	6	6	8	8	10	20	20	23
Kittson	3	3	5	11	2	3	8	2	9	7	4	0
Koochiching	167	131	118	70	95	61	81	62	127	115	55	68
Lac Qui Parle	0	0	0	0	0	0	2	6	15	6	1	7
Lake	88	65	60	35	34	45	28	36	66	67	45	26
Lake of the Woods	31	34	24	30	17	8	15	27	27	27	31	31
Le Sueur	0	0	0	0	0	0	3	0	9	5	2	2
Lincoln	0	0	0	0	0	0	0	0	4	0	0	0
Mahnomen	24	29	26	24	7	7	9	20	15	25	7	6
Marshall	29	18	7	6	2	0	13	13	15	15	4	9
Martin	0	0	0	0	0	0	0	0	1	0	0	1

Table 17 (continued).

County	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
McLeod	0	0	0	6	6	8	12	18	19	22	18	16
Meeker	0	0	0	13	13	16	12	28	19	32	35	23
Mille Lacs	48	51	21	33	26	28	19	15	30	39	28	16
Morrison	64	77	60	45	43	31	29	29	52	52	50	31
Mower	0	0	0	0	0	0	8	20	14	9	8	2
Murray	0	0	0	0	0	0	0	0	0	0	0	1
Nicollet	0	0	0	0	0	0	2	1	5	7	1	0
Nobles	0	0	0	0	0	0	0	0	0	0	4	0
Norman	16	17	11	9	17	11	12	21	45	27	19	13
Olmsted	0	0	0	0	2	3	2	3	0	7	7	5
Otter Tail	113	85	81	50	82	32	65	109	173	154	97	87
Pennington	18	33	15	9	0	1	4	2	12	5	8	8
Pine	99	51	111	50	74	37	38	44	66	98	59	86
Polk	104	45	47	32	25	19	36	49	83	71	47	37
Pope	0	0	0	11	12	12	11	20	22	14	19	8
Ramsey	0	0	0	0	0	0	0	0	3	1	1	1
Red Lake	58	26	30	19	8	20	22	19	26	11	10	14
Redwood	0	0	0	0	0	0	0	2	4	6	8	3
Renville	0	0	0	0	0	0	0	1	6	0	3	1
Rice	0	0	0	0	0	0	1	9	4	8	1	2
Rock	0	0	0	0	0	0	0	0	2	0	0	0
Roseau	69	60	53	32	53	23	32	33	64	48	44	23
Scott	0	0	0	3	3	1	4	2	4	3	2	4
Sherburne	25	15	29	26	10	17	7	19	12	9	10	10
Sibley	0	0	0	0	0	0	6	6	6	3	2	3
St. Louis	508	428	344	290	251	233	253	239	363	293	258	260
Stearns	22	21	33	9	38	24	13	41	53	53	41	50
Steele	0	0	0	0	0	0	1	0	3	1	0	1
Stevens	0	0	0	1	3	1	6	1	3	12	4	2
Swift	0	0	0	9	4	5	2	11	10	10	9	3
Todd	53	63	81	35	37	32	41	63	55	55	19	28
Traverse	0	0	0	1	0	2	0	1	4	1	0	3
Wabasha	0	0	0	15	7	18	7	8	20	21	19	9
Wadena	34	38	32	15	19	15	16	20	43	30	30	19
Waseca	0	0	0	0	0	0	0	0	0	0	2	2
Washington	8	11	16	18	19	11	16	18	12	24	27	9
Watonwan	0	0	0	0	0	0	0	0	0	1	0	0
Wilkin	0	0	0	2	0	0	0	0	3	2	0	3
Winona	0	0	0	11	19	13	15	20	21	17	5	17
Wright	3	2	5	7	9	8	11	17	23	26	21	21
Yellow Medicine	0	0	0	0	0	0	0	0	7	9	0	3
Unknown	13	14	22	6	18	12	2	17	40	2	18	18
Totals	3,450	2,846	2,720	1,861	1,938	1,544	1,814	2,294	3,171	2,824	2,154	1,955

Table 18. Otter harvest by sex and week, 2015-16 season.

Date	Sex			Total	% of	Cumulative
	Male	Female	Unknown	Harvest	Total	%
Oct.24 - Oct.30	90	62	2	154	7.88	7.88
Oct.31 - Nov.6	209	111		320	16.37	24.25
Nov.7 - Nov.13	164	121		285	14.58	38.82
Nov.14 - Nov.20	162	93	1	256	13.09	51.92
Nov.21 - Nov.27	103	70		173	8.85	60.77
Nov.28 - Dec.4	143	71	4	218	11.15	71.92
Dec.5 - Dec.11	95	56	2	153	7.83	79.74
Dec.12 - Dec.18	137	71	1	209	10.69	90.43
Dec.19 - Dec.25	66	50		116	5.93	96.37
Dec.26 - Jan.3*	43	27		70	3.58	99.95
Unknown	0	1		1	0.05	100.00
Total	1,212	733	10	1,955	100%	

* 9-day interval.

Table 19. Distribution of otter harvest* among trappers, 1993-2015.

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

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