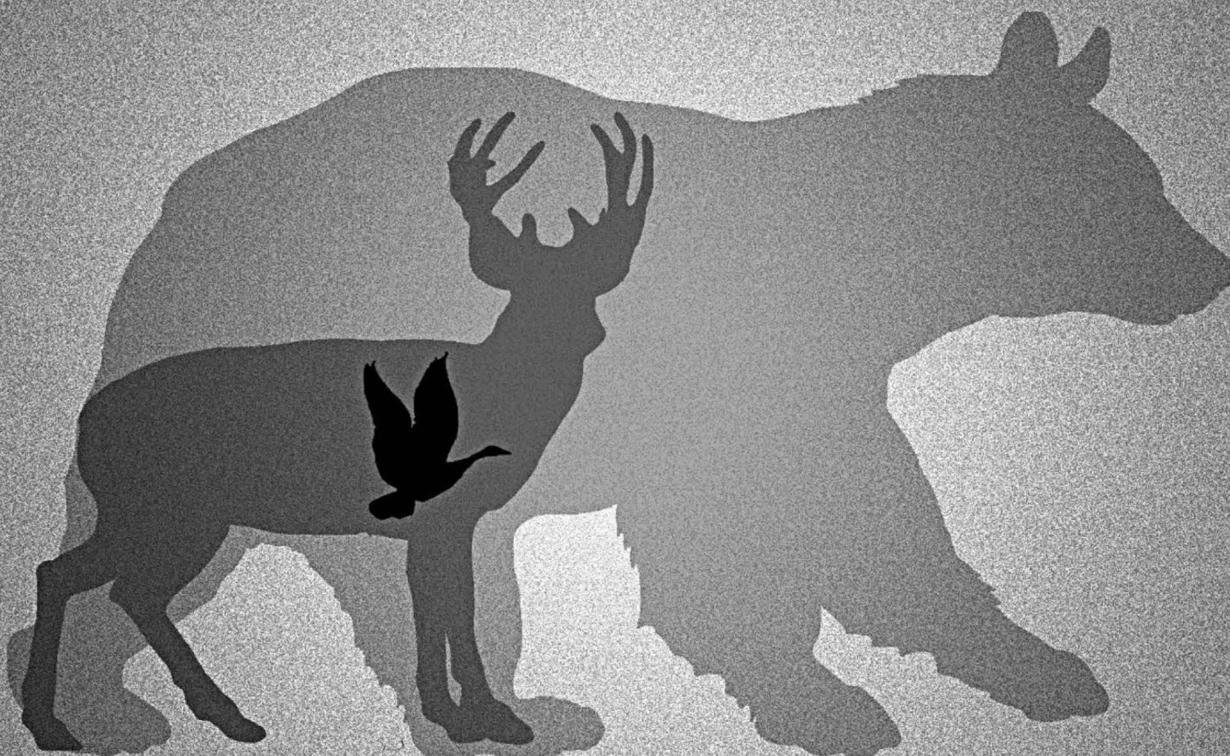

Status of Wildlife Populations

Fall 2019

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

DEPARTMENT OF NATURAL RESOURCES

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Status of Wildlife Populations, Fall 2019

(Including 2009-2019 Hunting and Trapping Harvest Statistics)

edited by
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December, 2022 State of Minnesota, Department of Natural Resources

This report should be cited as follows:

Dexter, M.H., editor. 2022. Status of wildlife populations, fall 2019. Unpub. Rep., Division of Fish and Wildlife, Minn. Dept. Nat. Res., St. Paul, Minnesota. 312 pp.

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 2019

(Including 2009-2019 Hunting and Trapping Harvest Statistics)

This is the 43rd year that the DNR has compiled this booklet; it is primarily an administrative document intended for DNR personnel. Since 1984 we have also generated a companion volume, *Summaries of Wildlife Research Findings*, containing annual summaries of activities and findings from ongoing research projects in the Wildlife Policy and Research Unit. This publication will be posted on the DNR website and available in other formats upon request. In the on-line format links are available to the U.S. Fish and Wildlife Service Division of Migratory Bird Management to access their reports for Waterfowl Population Status; Migratory Bird Harvest Information Preliminary Estimates; American Woodcock Population Status; and Mourning Dove Population Status.

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

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

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

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FARMLAND WILDLIFE POPULATIONS

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2019 MINNESOTA AUGUST ROADSIDE SURVEY

Lindsey Messinger, Farmland Wildlife Populations and Research Group

Tim Lyons, Farmland Wildlife Populations and Research Group

SUMMARY

The 2019 range-wide pheasant index (37.4 birds/100 mi) decreased 17% from 2018 (45.2 birds/100 mi). The brood index and proportion of hens with broods also decreased, and estimated hatch dates were one week later than the 10-year and long-term averages. Severe late-season winter snowstorms, heavy spring rains, and resulting flooding throughout much of the core pheasant range likely impacted nesting activity during the 2019 breeding season. Grassland habitat on private, state, and federally-owned lands increased by 29,903 acres statewide since 2018. The range-wide indices for eastern cottontail rabbits and gray partridge were similar to 2018 while the white-tailed deer and Sandhill crane indices increased from 2018. The mourning dove index decreased from 2018 and white-tailed jackrabbit observations continue to be historically low across our survey area.

INTRODUCTION

This report summarizes the 2019 Minnesota August Roadside Survey (ARS). Since 1955, the Minnesota Department of Natural Resources (MN DNR) wildlife and enforcement personnel have conducted the annual ARS during the first two weeks of August throughout Minnesota's farmland regions (Figure 1). The 2019 ARS consisted of 172 25-mile routes (1-4 routes/county); 152 routes were located in the ring-necked pheasant range.

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

HABITAT CONDITIONS

In Minnesota's farmland region, total undisturbed grassland habitat increased again in 2019. Statewide, 29,903 grassland habitat acres were gained since 2018. A majority of these gains occurred on private lands with acres enrolled in Reinvest in Minnesota (RIM) increasing by 4,501 acres. Likewise, acres enrolled in the Conservation Reserve Program (CRP) and Conservation Reserve Enhancement Program (CREP) increased by 5,307 acres and 8,198 acres respectively. Lands enrolled in the Wetlands Reserve Program (WRP) decreased by

1,617 acres statewide while RIM-WRP acres were unchanged from 2018. Publically-owned grassland habitat increased by 13,508 acres statewide since last year. Federally-owned U.S. Fish and Wildlife Service (USFWS) Waterfowl Production Areas (WPA), wildlife refuges, and conservation easements increased by 3,907 acres and state-owned Wildlife Management Areas (WMA) increased by 9,601 acres. Undisturbed grassland habitat acres in the pheasant range increased by 26,529 acres and were primarily gained on private lands with enrollment in CRP (8,654 total acres) and CREP (8,122 total acres) accounting for a majority of these gains. Public lands grassland habitat gains within the pheasant range include 3,715 acres of USFWS land and 6,378 acres of WMAs added since 2018. Protected grassland habitat accounts for 6.5% of the landscape within the pheasant range (range by agricultural region: 3.2-10.1%; Table 1), and 6.2% of the landscape statewide.

Grassland and wetland habitat conservation remains a priority concern for Minnesota. Federally-funded private-lands conservation programs, including CRP, continue to make up a large portion of protected grassland habitat in Minnesota (Figure 2). Despite the gain in private lands habitat conservation program acres in 2019, approximately 614,348 acres of CRP have been lost in Minnesota since 2007 and an additional 80,000 acres are under contracts set to expire after September 30, 2019. The 2018 Farm Bill was signed into law on December 20, 2018 and the nationwide cap for CRP enrollment was increased from 24 million to 27 million acres. Other programmatic changes to CRP were outlined intended to make the program more cost effective. Working lands programs funded under the federal Farm Bill received attention during the 2018 revision. Funding for the Environmental Quality Incentives Program (EQIP) was increased; however, funding for the Conservation Stewardship Program (CSP) will be reduced over the 10-year life of the Farm Bill. In Minnesota, funding from the Legacy Amendment[1] has helped partially offset habitat losses but the pace has not kept up with the rate of CRP losses in the last decade. 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 2011, Minnesota's Walk-in Access (WIA) program continues to provide public hunting opportunities on private land already enrolled in existing conservation programs or has high quality natural habitat. The program has grown each year since inception, and in 2019, features more than 250 sites totaling nearly 30,000 across 47 counties in the farmland region of Minnesota. Sites are open to public hunting 1 September – 31 May where boundary signs are present. Hunters must purchase a $3 WIA Validation which allows access to all WIA lands statewide. 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. The WIA program is currently funded through a grant from the Natural Resource Conservation Service of the U.S. Department of Agriculture. Other funding sources are provided through a surcharge on nonresident hunting licenses, a one-time appropriation from the Minnesota Legislature in 2012, and donations from hunters.

WEATHER SUMMARY

Minnesota's winter 2018-2019 (1 December 2018 – 31 March 2019) was cold and snowy across the state with average temperatures 2.5-4.9°F below thirty-year averages (Table 2; Minnesota Climatology Working Group [MCWG] 2019, Climate Summary). Of particular note were air

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

temperatures experienced 27-31 January 2019 when artic conditions statewide blanketed Minnesota with sub-zero temperatures and wind chills persisting over the 4-day period. Winter snow cover was widespread across the farmland zone, with snow depths exceeding six inches for at least one 2-week period in every agricultural region. In fact, snow depths exceed six inches for at least four consecutive weeks in all agricultural regions and up to 17 weeks in the Northwest region. Statewide, most of the major snow events contributing to the deep and persistent snow cover occurred during the month of February with snow cover remaining deeper than six inches throughout most of March. By April 18, 2019, snow was absent over the entire survey region.

Spring 2019 (1 April – 31 May) temperatures were 2.3-3.8°F below thirty-year averages statewide and precipitation was above normal across much of the farmland zone. The Northwest region was the only region drier than normal with the remaining agricultural regions experiencing at least one inch greater than normal precipitation. Melting snow and precipitation events combined to contribute to widespread flooding across much of the state during spring 2019.

Summer 2019 (1 June – 31 July) temperatures were 1.4-2.3°F below thirty-year averages statewide. Summer rainfall was near thirty-year averages in June and July statewide (ranging from -0.2-0.9 inches from normal across agricultural regions).

Overall, the conditions for over-winter survival of wildlife were below average to average throughout the farmland zone. Widespread deep and persistent snow cover over most of the core pheasant range combined with colder than normal temperatures may have adversely impacted adult game bird survival. Likewise, cooler than normal temperatures in the spring along with spring flooding events caused by melting snow and above-normal precipitation potentially delayed nest initiation and first nesting attempts for many bird species. However, mild summer temperatures and drier weather may have benefited birds nesting or re-nesting later in the season.

SURVEY CONDITIONS

The survey period was extended (30 July – 18 August) to allow survey routes (n = 172) to be completed in 2019. Weather conditions during the survey ranged from excellent (calm winds, heavy dew, clear sky) to moderate (light dew and overcast skies). Medium or heavy dew conditions were present at the start of 95% of the survey routes, which was up from 2018 (89%) and above the 10-year average (85%). Clear skies (<30% cloud cover) were present at the start of 86% of routes which was up slightly from 2018 (80%). Wind speeds <7 mph were recorded for 96% of the routes compared to 92% in 2018. Overall, survey conditions in 2019 were slightly wetter, less overcast, and calmer than in 2018 but similar to conditions over the long-term and were unlikely to have reduced detection rates.

SPECIES REPORTS

Ring-necked Pheasant

In 2019, the average number of pheasants observed range-wide (37.4 birds/100 mi) decreased 17% from 2018 (45.2 birds/100 mi) and was slightly lower than the 10-year average of 41.2 birds/100 mi. The index was 60% below the long-term average of 91.4 birds/100 mi (Table 3, Figure 3A). Total pheasants observed per 100 mi ranged from 8.7 birds in the Southeast agricultural region to 48.8 birds in the West Central region (Table 4). The change in the pheasant index from 2018 to 2019 varied greatly statewide with increases in the South Central (24%) and East Central (13%) regions while the Southwest region, a core area of Minnesota's pheasant range, decreased 32% from 2018. The best harvest opportunities will be in the West

Central and South Central regions but hunters will also find good opportunities in the Southwest and Central regions.

The range-wide hen index declined slightly in 2019 (6.4 hens/100 mi) compared to 2018 (7.5 hens/100 mi) and was at the 10-year average (6.2 hens/100 mi) but still 54% below the long-term average (13.3 hens/100 mi; Table 3). The hen index ranged from 1.6 hens/100 mi in the Southeast to 9.4 hens/100 mi in the West Central region. The Southwest region saw the greatest decline (46%), while the hen indices among remaining regions were equivalent to 2018.

The range-wide cock index (6.5 cocks/100 mi) did not change from 2018 or the 10-year average, but remained 40% below the long-term average of 10.5 cocks/100 mi (Table 3). The cock index ranged from 2.4 cocks/100 mi in the Southeast to 8.3 cocks/100 mi in the West Central region. The 2018 cock index increased in the East Central, South Central, and Southeast regions and decreased in the West Central and Southwest regions.

The 2019 hen-to-cock ratio (0.98) was slightly below the 2018 ratio (1.16) and still below the long-term average (1.33).

The 2019 range-wide brood index (5.4 broods/100 mi) decreased modestly from 2018 (7.3 broods/100 mi; Table 3). The index was similar to the 10-year average (6.4 broods/100 mi). Still, the brood index was 56% below the long-term average (12.1 broods/100 mi). Regional brood indices declined in all regions except for the South Central, where they remained relatively constant. The brood index ranged from 1.6 broods/100 mi in the Southeast region to 7.2 broods/100 mi in the West Central region. The average brood size in 2019 (4.6 chicks/brood) was slightly larger compared to 2018 (4.3 chicks/brood) and equivalent to the 10-year average (4.6 chicks/brood). However, the brood size index remains below the long-term average of 5.6 chicks/brood. The median hatch date (assigned using estimated brood ages from broods observed during the survey) for pheasant broods across their range was 20 June 2019 (n = 204 broods), which was nearly a week later than 2018 (14 June) and the 10-year average (12 June; Table 3).

Declines in the brood index, the number of broods/100 hens (a measure of breeding success), and later estimated hatch dates suggest that severe winter snowstorms, heavy spring rains, and resulting flooding throughout much of the core pheasant range adversely impacted nesting activity during the 2019 breeding season. Though regional and statewide pheasant indices declined, available grassland habitat and habitat quality can help mediate the impacts of annual variation in weather on local populations. Therefore, hunters may encounter good bird numbers where habitat was unaffected by severe weather and flooding, even among regions that exhibited overall declines. Expect that birds will be more difficult to locate in areas where adjacent agricultural fields were too wet to plant and in areas where fall corn and soybean harvest is delayed.

Long term, Minnesota has experienced a gradual but steady loss of habitat, especially CRP, and the impact of these losses correlates well with an overall decline in the pheasant population and harvest since the mid-2000s (Figures 2 & 3A).

Gray Partridge

The 2019 range-wide gray partridge index (2.4 birds/100 mi) was greater than in 2018 and is similar to the 10-year average (Table 3). However, the gray partridge index remains 82% below the long-term average (13.8 birds/100 mi; Table 3, Figure 3B). Indices for partridge ranged from 0 birds/100 mi in the Southeast and East Central regions to 5.4 birds/100 mi in the South Central region (Table 4). 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 Midwestern United States 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 South Central and Central regions will offer the best opportunities for harvesting gray partridge in 2019.

Cottontail Rabbit and White-tailed Jackrabbit

Range-wide, the 2019 eastern cottontail rabbit index (6.1 rabbits/100 mi) was equivalent to the index in 2018 (5.9 rabbits/100 mi) and was 11% above the 10-year average (5.4 rabbits/100 mi). The 2019 index was comparable to the long-term average (6.6 rabbits/100 mi; Table 3, Figure 4A). Regionally, the 2019 cottontail rabbit index ranged from 1.3 rabbits/100 mi in the Northwest to 14.3 rabbits/100 mi in the East Central region (Table 4). Good harvest opportunities should exist in the East Central, Central, and Southeast regions.

Single white-tailed jackrabbits were recorded on two survey routes in the West Central Region in 2019 (Table 3) yielding a range-wide index less than 0.01/100 mi. This was 98% below the long-term average of 1.6 rabbits/100 mi (Table 3, Figure 4B). The West Central region was the only region that saw no decline in the jackrabbit index (Table 3). Minnesota's jackrabbit population peaked in the late 1950s, declined to low levels in the 1980s, and has remained at low levels since then. The long-term decline in jackrabbits can primarily be attributed to loss of preferred habitats (i.e., pasture, hayfields, and small grains).

White-tailed Deer

The white-tailed deer index (33.4 deer/100 mi) increased 45% from 2018 (23.0 deer/100 mi) and was 59% above the 10-year average and 168% above the long-term average (20.3 deer/100 mi and 12.0 deer/100 mi, respectively; Table 3, Figure 5A). Regional roadside indices for deer ranged from 14.6 deer/100 mi in the South Central region to 64.7 deer/100 mi in the Northwest region (Table 4).

Mourning Dove

The 2019 range-wide mourning dove index (90.8 doves/100 mi) was 29% lower than 2018 (128.5 doves/100 mi), 48% below the 10-year average (173.9 doves/100 mi), and 64% below the long-term average (257.4 doves/100 mi; Table 3, Figure 5B). Regional indices ranged from 45.7 doves/100 mi in the East Central region to 122.6 doves/100 mi in the West Central region (Table 4). The best opportunities for harvesting doves should be in the Southwest, South Central, and West Central regions.

Sandhill Crane

The 2019 roadside index of sandhill cranes was 16.6 total cranes/100 mi, a 25% increase from 2018 (13.3 total cranes/100 mi; Table 3). Regional indices ranged from 0.0 total cranes/100 mi in the Southwest region to 90.9 total cranes/100 mi in the East Central region (Table 4). The range-wide index of juveniles was 2.3 juvenile cranes/100 mi, which decreased 79% from 2017 (Table 3).

Other Species

Notable incidental sightings recorded by observers included: black bear (Marshall County), pileated woodpecker (Kandiyohi and Stearns Counties), red-headed woodpecker (Brown, Faribault, Freeborn, Kanabec, and Olmsted Counties), sharp-tailed grouse (Roseau and Polk Counties), sora rail (Chippewa County), tiger salamander (Olmsted County), trumpeter swan (Faribault and Scott Counties), and upland sandpiper (Brown County). American crow, Canada goose, and wild turkey were noted in multiple counties.

ACKNOWLEDGMENTS

We thank the many cooperators for completing the routes required for this survey; without their efforts, this survey would not be possible. Tonya Klinkner was invaluable in providing logistical assistance and entering route data. Tabor Hoek (Minnesota Board of Water and Soil Resources) provided enrollment data on cropland retirement programs in Minnesota, Jay Johnson (MN DNR) provided updated MN DNR land acquisition information, and Ethan Mooar (U.S. Fish and Wildlife Service) provided federal land acquisition data. John Giudice and Nicole Davros (MN DNR Wildlife Research) reviewed an earlier draft of this report. This work was funded in part through the Federal Aid in Wildlife Restoration Act.

LITERATURE CITED

Minnesota Climatology Working Group (MCWG). 2019a. MCWG Climate Summary Table. Accessed 23 August 2019.

Table 1. Abundance (total acres) and density (acres/mi^2) of undisturbed grassland habitat within Minnesota's pheasant range, 2019, by agricultural region (AGREG).

	Cropland Retirement (private lands)[a]					Public Lands				
AGREG	CRP	CREP	RIM	RIM-WRP	WRP	USFWS[b]	MNDNR[c]	Total	% of landscape	Density ac/mi^2
WC[d]	268,370	39,569	22,733	14,275	19,893	204,049	112,508	681,396	10.1	64.2
SW	117,635	27,328	20,546	2,553	576	24,333	73,552	266,523	7.0	45.1
C	133,819	16,368	41,767	7,026	2,702	92,164	52,652	346,498	5.7	36.7
SC	98,628	29,403	13,663	10,780	7,797	11,091	37,763	209,125	5.2	33.1
SE	81,500	2,904	7,294	1,070	976	36,988	56,677	187,409	5.1	32.4
EC	3,015	0	1,133	0	4	4,994	93,349	102,495	3.2	20.4
Total	702,968	115,572	107,136	35,704	31,947	373,618	426,501	1,793,447	6.5	41.6

[a] Unpublished data, Tabor Hoek, BWSR, 20 August 2019.

[b] Includes Waterfowl Production Areas (WPA), USFWS refuges, & USFWS conservation easements

[c] MN DNR Wildlife Management Areas (WMA).

[d] Does not include Norman County which is not in the historic pheasant range.

Table 2. Average temperature, snow depth, and precipitation by season and agricultural region in Minnesota, 2019.

	Agricultural Region							
	NW	WC	C	EC	SW	SC	SE	STATE
Winter (December 1 - March 31)								
Temperature (average °F)	9.3	13.8	15.1	16.4	17.1	17.4	19.0	15.0
Departure from normal (°F)[a]	-4.9	-4.2	-3.5	-2.6	-4.0	-3.3	-2.5	-3.3
Snow Depth (average inches)	13.9[b]	11.0[b]	8.0[b]	7.7[b]	8.9[b]	7.8[b]	6.8[b]	9.2[b]
Spring (April 1 - May 31)								
Temperature (average °F)	45.7	48.0	47.1	46.8	49.0	49.4	49.4	46.7
Departure from normal (°F)[a]	-3.0	-2.8	-3.8	-3.4	-3.1	-2.6	-2.3	-3.1
Precipitation (total inches)	3.7	7.2	9.67	8.7	11.4	11.5	10.3	8.3
Departure from normal (inches)[a]	-0.2	1.0	1.7[c]	1.3[c]	2.5[c]	1.9[c]	1.6[c]	1.2[c]
Summer (June 1 - July 31)								
Temperature (average °F)	51.8	54.5	54.2	53.8	56.0	55.4	55.8	53.6
Departure from normal (°F)	-1.7	-1.5	-2.0	-2.0	-1.4	-2.3	-1.7	-1.8
Precipitation (total inches)	8.2	10.0	9.7	10.3	10.2	11.6	14.0	10.6
Departure from normal (inches)[a]	-0.2	0.5	-0.1	0.1	0.3	0.3	0.9	0.2

[a] Departures calculated using 30-year NOAA average (1981-2010) over respective time period.

[b] At least one two-week period with snow depth exceeding 6 inches.

[c] Precipitation >1 inch above normal.

Table 3. Range-wide trends (% change) in number of wildlife observed per 100 miles driven, Minnesota August roadside survey, 1955-2019.

Species	**Change from 2018[a]**					**Change from 10-year average[b]**				**Change from long-term average (LTA)[c]**			
Subgroup	*n*	2018	2019	%	95% CI	*n*	2009-2018	%	95% CI	*n*	LTA	%	95% CI
Ring-necked pheasant													
Total pheasants	152	45.2	37.4	-17	±19	149	41.2	-11	±15	151	91.4	-60	±9
Cocks	152	6.5	6.5	0	±22	149	5.8	9	±19	151	10.5	-40	±13
Hens	152	7.5	6.4	-15	±19	149	6.2	-1	±17	151	13.3	-54	±11
Broods	152	7.3	5.4	-26	±18	149	6.4	-17	±15	151	12.1	-57	±11
Chicks per brood[d]	204	4.3	4.6	6			4.6	0			5.6	-18	
Broods per 100 hens	152	96.5	84.6	-12			102.6	-17			90.2	-5	
Median hatch date[d]	204	14-Jun	20-Jun				12-Jun						
Gray partridge	171	1.3	2.4	79	±166	168	2.3	4	±87	151	13.8	-82	±21
Eastern cottontail	171	5.9	6.1	2	±27	168	5.4	11	±24	151	6.6	-2	±21
White-tailed jackrabbit	171	0.1	0.0	-50	±99	168	0.1	-83	±43	151	1.6	-98	±14
White-tailed deer	171	23.0	33.4	45	±22	168	20.3	59	±20	170	12.0	168	±38
Mourning dove	171	128.5	90.8	-29	±13	168	173.9	-48	±10	151	257.4	-64	±7
Sandhill crane[e]	171	13.3	16.6	25	±54	168	11.8	17	±42				
Total cranes	171	1.3	2.3	79	±57	168	1.7	2	±39				
Juveniles	152	45.2	37.4	-17	±19	149	41.2	-11	±15	151	91	-60	±9

[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 1955-2018, except for deer (1974-2018). 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] Sample size is the total number of broods observed across all surveys rather than the number of routes run in 2019.

[e] Sandhill cranes were added to the survey in 2009; thus, long-term averages are not calculated.

Table 4. Regional trends (% change) in number of wildlife observed per 100 miles driven, Minnesota August roadside survey, 1955-2019.

Region	Change from 2018[a]					Change from 10-year average[b]					Change from long-term average (LTA)[c]			
Species	*n*	2018	2019	%	95% CI	*n*	2009-2018	%	95% CI		*n*	LTA	%	95% CI
Northwest[d]														
Gray partridge	19	3.8	2.1	-44	±246	19	0.7	214	±606		19	3.0	-30	±152
Eastern cottontail	19	0.6	1.3	95	±335	19	0.7	83	±239		19	0.9	47	±181
White-tailed jackrabbit	19	0.2	0.0	-100	±210	19	0.2	-100	±65		19	0.6	-100	±41
White-tailed deer	19	50.8	64.7	27	±53	19	47.1	37	±49		19	34.2	89	±66
Mourning dove	19	120.0	68.7	-43	±47	19	92.7	-26	±28		19	117.0	-41	±17
Sandhill crane[e]	19	24.3	34.3	41	±64	19	39.7	-14	±42					
West Central[f]														
Ring-necked pheasant	39	65.1	48.8	-25	±31	35	47.6	-1	±40		37	93.8	-53	±26
Gray partridge	39	0.1	1.3	1200	±2645	35	0.4	233	±693		37	8.8	-84	±39
Eastern cottontail	39	2.5	3.8	54	±91	35	2.4	44	±80		37	3.9	-16	±45
White-tailed jackrabbit	39	0.2	0.2	0.0	±145	35	0.2	-25	±147		37	2.1	-95	±23
White-tailed deer	39	29.2	43.9	51	±45	35	22.2	80	±42		37	11.8	225	±98
Mourning dove	39	162.4	122.6	-25	±33	35	225.2	-46	±19		37	353.1	-66	±14
Sandhill crane[e]	39	3.4	2.3	-31	±120	35	1.8	41	±78		37	1.9	28	±66
Central														
Ring-necked pheasant	30	48.1	39.8	-17	±31	30	37.1	7	±33		30	68.1	-42	±19
Gray partridge	30	0.7	4.0	500	±740	30	1.0	290	±437		30	8.4	-52	±64
Eastern cottontail	30	7.2	9.1	26	±55	30	4.6	99	±69		30	6.2	47	±51
White-tailed jackrabbit	30	0.0	0.0			30	0.1	-100	±113		30	1.1	-100	±21
White-tailed deer	30	13.9	31.5	127	±85	30	16.4	92	±72		30	7.4	323	±179
Mourning dove	30	103.5	78.2	-25	±37	30	161.0	-52	±20		30	218.8	-64	±15
Sandhill crane[e]	30	38.0	28.7	-25	±85	30	18.4	56	±55		30	19.3	49	±48
East Central														
Ring-necked pheasant	12	23.9	27.0	13	±51	13	40.7	-28	±22		13	81.6	-64	±23
Gray partridge	12	0.7	0.0	-100	±220	13	0.2	-100	±149		13	0.2	-100	±132
Eastern cottontail	12	12.9	14.3	11	±69	13	12.1	9	±59		13	9.2	44	±63
White-tailed jackrabbit	12	0.0	0.0			13	0.0				13	0.1	-100	±72
White-tailed deer	12	26.9	41.7	55	±64	13	21.5	95	±62		13	11.5	264	±115
Mourning dove	12	61.8	45.7	-26	±25	13	81.8	-39	±26		13	112.7	-56	±25
Sandhill crane[e]	12	34.6	90.9	163	±179	13	43.5	106	±127					

Table 4. Continued.

Region	Change from 2018[a]					Change from 10-year average[b]				Change from long-term average (LTA)[c]			
Species	*n*	2018	2019	%	95% CI	*n*	2009-2018	%	95% CI	*n*	LTA	%	95% CI
Southwest													
Ring-necked pheasant	19	54.1	36.8	-32	±56	19	68.3	-46	±30	19	110.4	-67	±23
Gray partridge	19	3.2	1.3	-60	±176	19	5.5	-77	±48	19	37	-97	±20
Eastern cottontail	19	3.8	1.7	-56	±94	19	5.6	-70	±35	19	7.8	-78	±21
White-tailed jackrabbit	19	0.2	0.0	-100	±210	19	0.4	-100	±58	19	3.4	-100	±22
White-tailed deer	19	17.3	21.7	26	±52	19	19.9	9	±38	19	10.6	104	±73
Mourning dove	19	180.6	92.0	-49	±30	19	236.0	-61	±19	19	299.8	-69	±17
Sandhill crane[e]	19	0.0	0.0			19	0.0						
South Central													
Ring-necked pheasant	32	35.1	43.7	24	±63	32	39.8	10	±31	32	119.3	-63	±15
Gray partridge	32	0.2	5.4	2050	±3336	32	4.9	11	±188	32	17.1	-69	±50
Eastern cottontail	32	6.0	5.4	-10	±55	32	7.3	-27	±38	32	7.7	-30	±39
White-tailed jackrabbit	32	0.0	0.0			32	0.1	-100	±73	32	1.5	-100	±25
White-tailed deer	32	7.2	14.6	102	±70	32	6.9	111	±61	32	4.3	237	±107
Mourning dove	32	128.6	114.0	-11	±23	32	221.3	-49	±30	32	248.7	-54	±11
Sandhill crane[e]	32	3.5	4.4	25	±145	32	1.4	215	±290				
Southeast													
Ring-necked pheasant	20	22.4	8.7	-61	±73	20	13	-34	±41	20	65.7	-87	±29
Gray partridge	20	2.8	0.0	-100	±154	20	3.6	-100	±67	20	12.6	-100	±32
Eastern cottontail	20	13.4	10.8	-20	±69	20	8.6	25	±79	20	8.0	35	±81
White-tailed jackrabbit	20	0.0	0.0			20	0.0	-100	±209	20	0.5	-100	±43
White-tailed deer	20	26.4	22.0	-17	±34	20	18.3	21	±34	20	11.8	86	±64
Mourning dove	20	97.8	58.0	-41	±26	20	105.7	-45	±22	20	205.8	-72	±23
Sandhill crane[e]	20	0.6	0.6	0	±267	20	0.3	115	±482				

[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 1955-2018, except for Northwest region (1982-2018) and white-tailed deer (1974-2018). Estimates based on routes (*n*) surveyed $\geq$40 years (1955-2018), except for Northwest ($\geq$20 years) and white-tailed deer ($\geq$25 years).

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

[e] Sandhill cranes were added to the survey in 2009; thus, long-term averages are not calculated.

[f] Two routes were added to the West Central region in 2014.

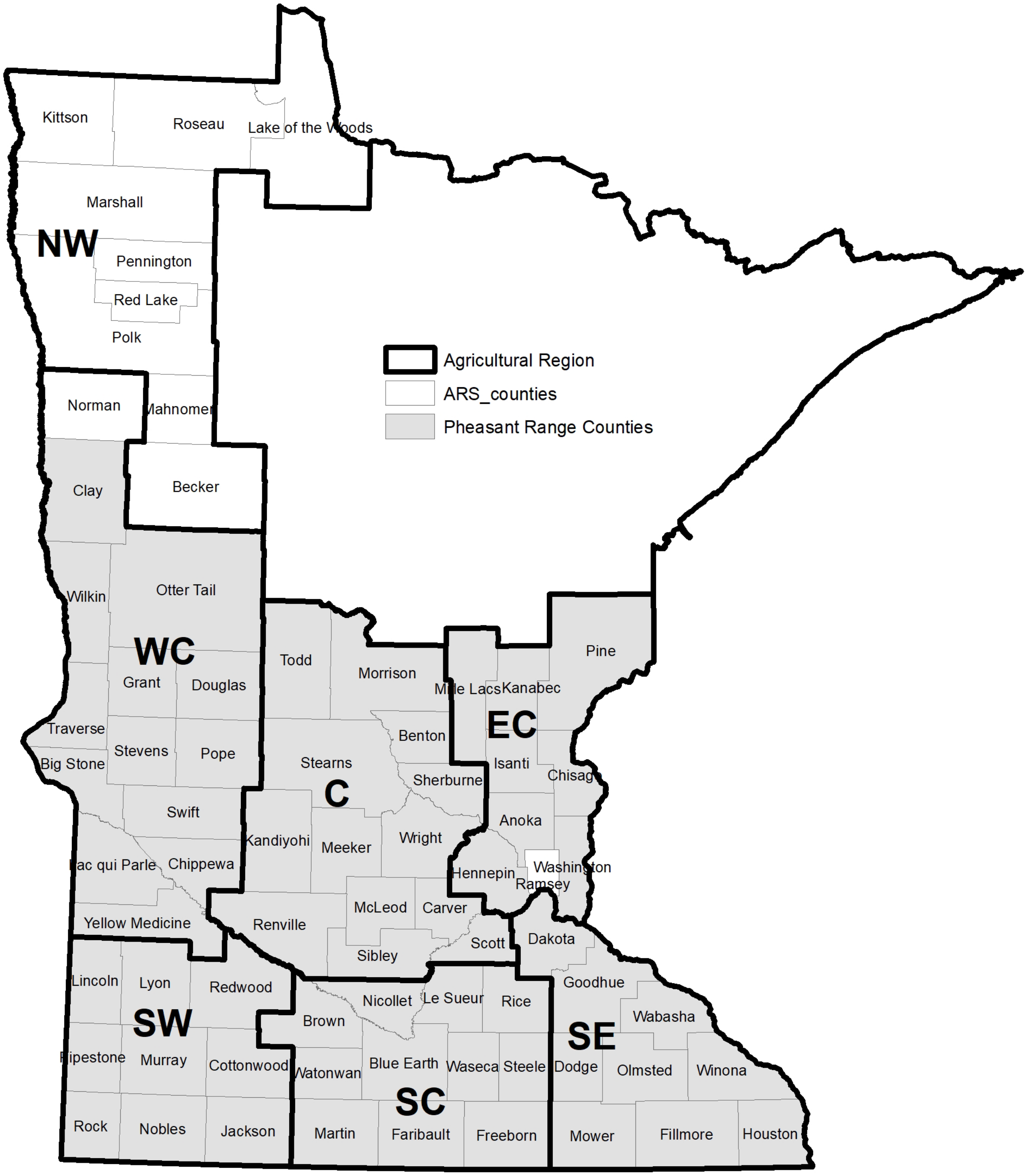


Figure 1. Survey regions and ring-necked pheasant range delineation for Minnesota's August roadside survey, 2019.

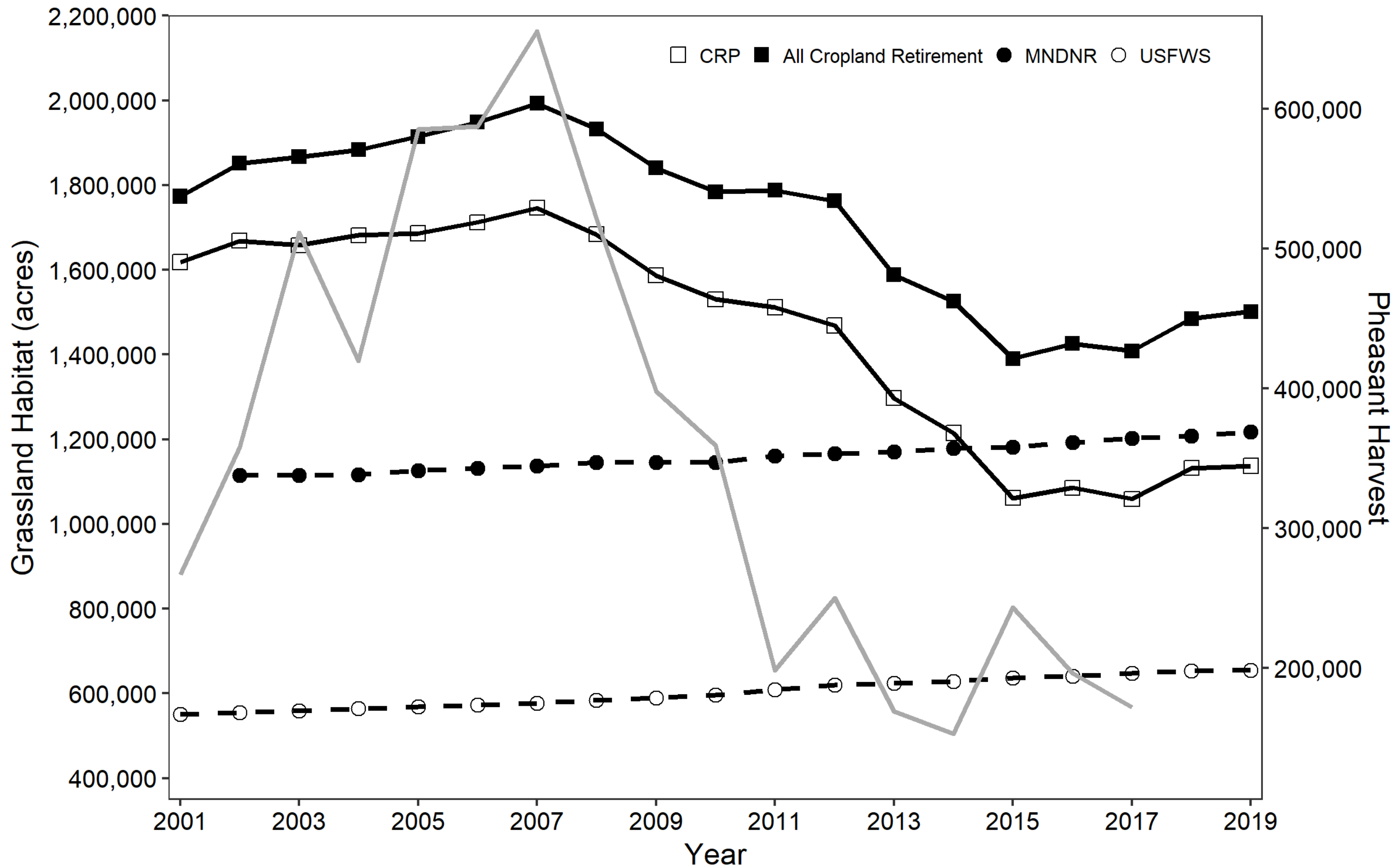
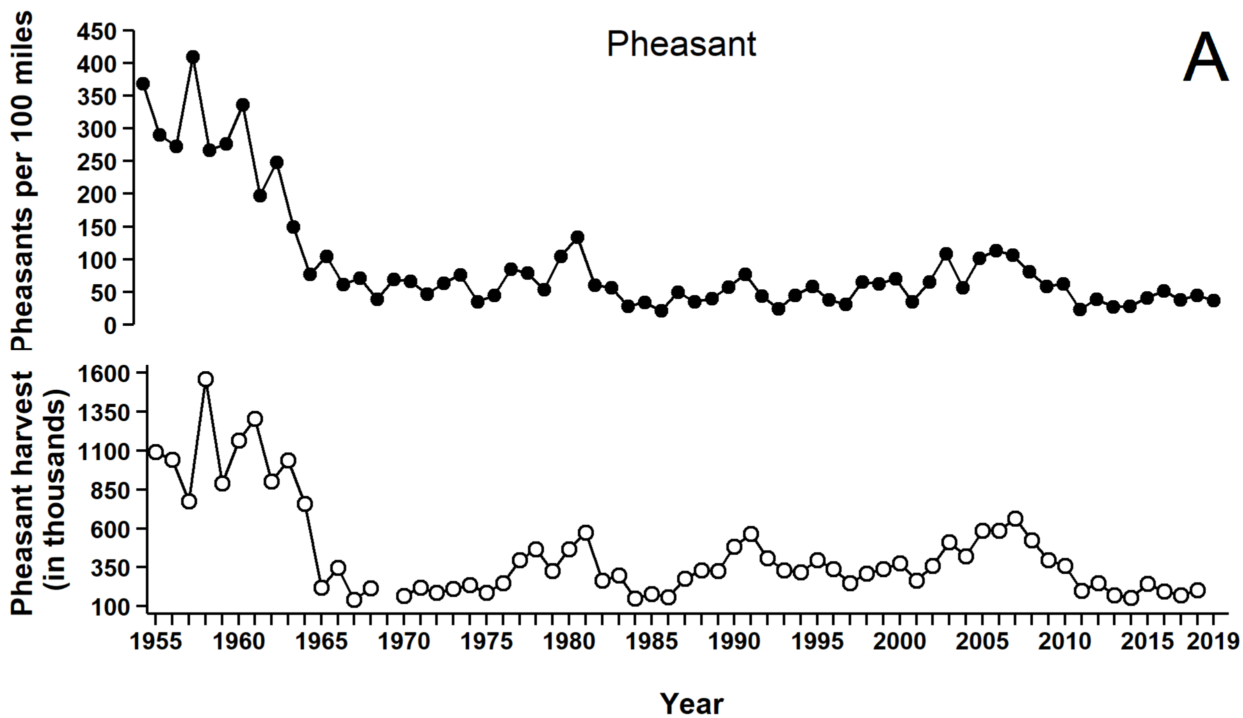


Figure 2. Acres enrolled in private (solid black lines with open and solid squares) and public (dashed black lines with open and solid circles) land habitat conservation programs vs. ring-necked pheasant harvest trends (solid gray line) in Minnesota, 2001-2019. Acres represent STATEWIDE totals. All cropland retirement includes Conservation Reserve Program (CRP), Conservation Reserve Enhancement Program (CREP), Reinvest in Minnesota (RIM), Wetlands Reserve Program (WRP), and RIM-WRP.



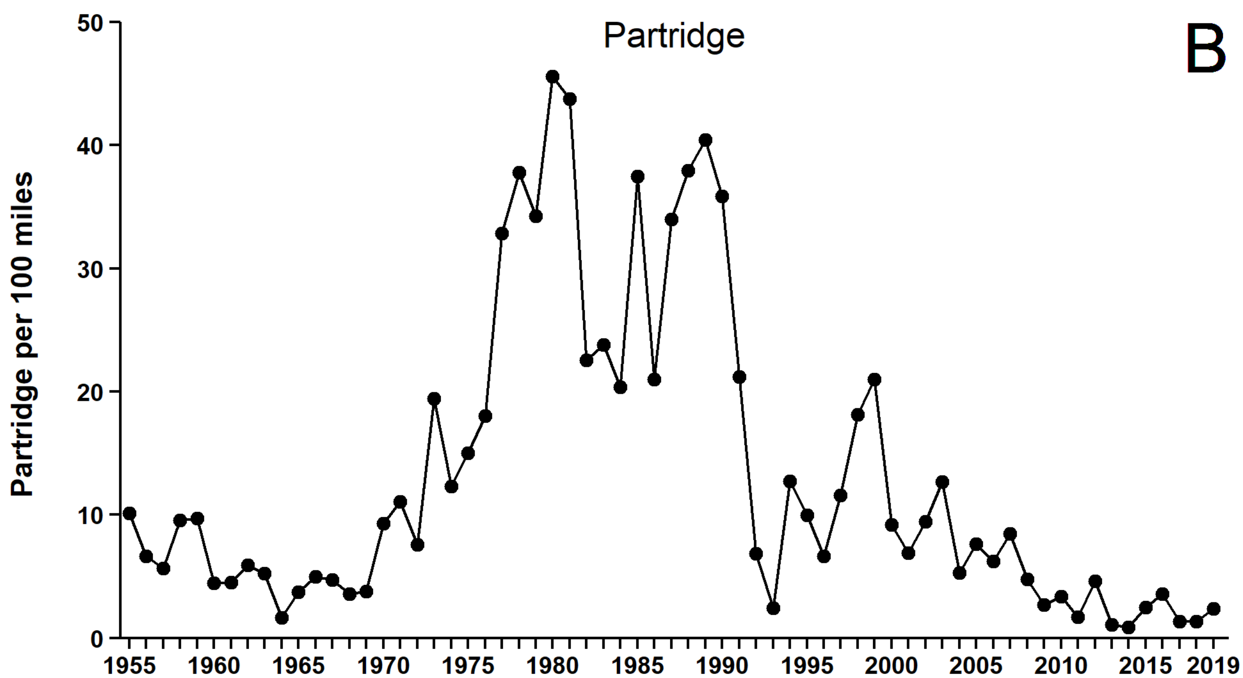
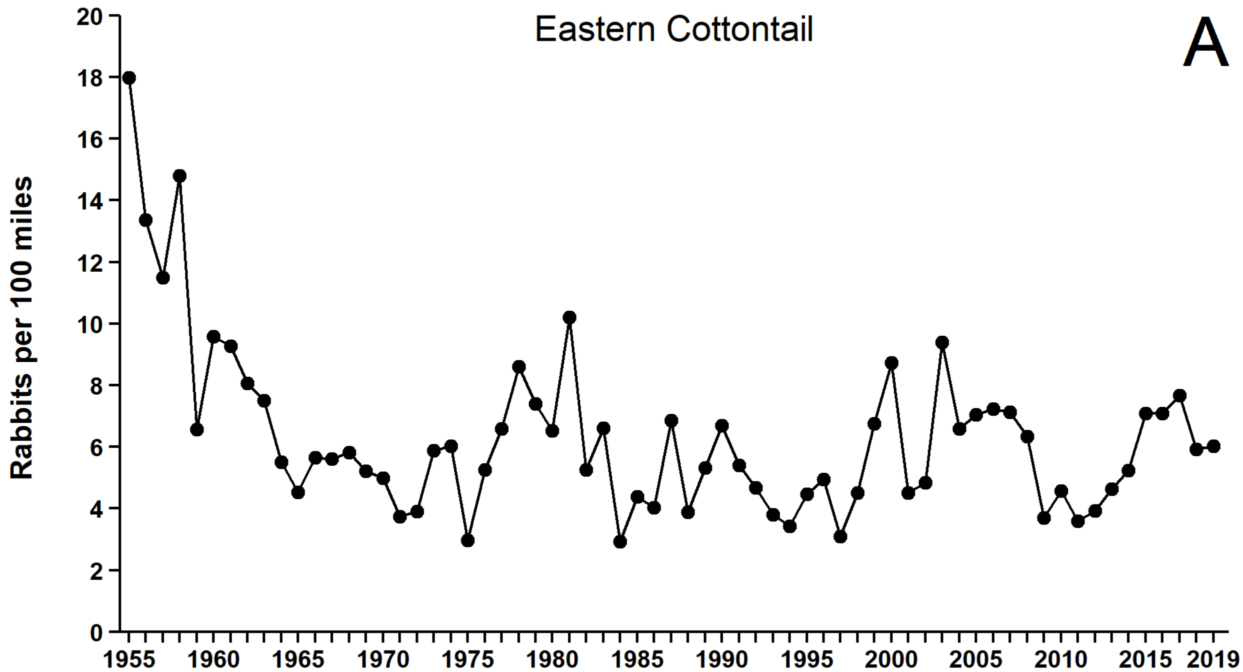


Figure 3. Range-wide index of ring-necked pheasants (A) and gray partridge (B) seen per 100 miles driven in Minnesota, 1955-2019. Does not include the Northwest region. Based on all survey routes completed.



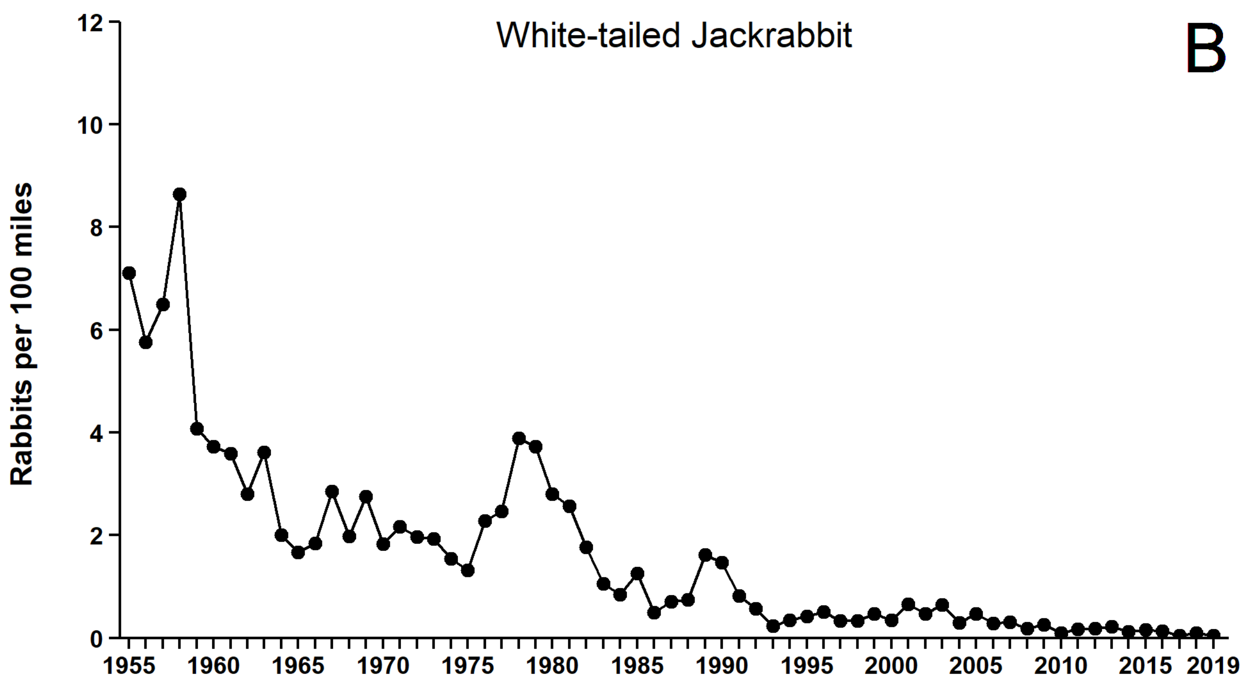
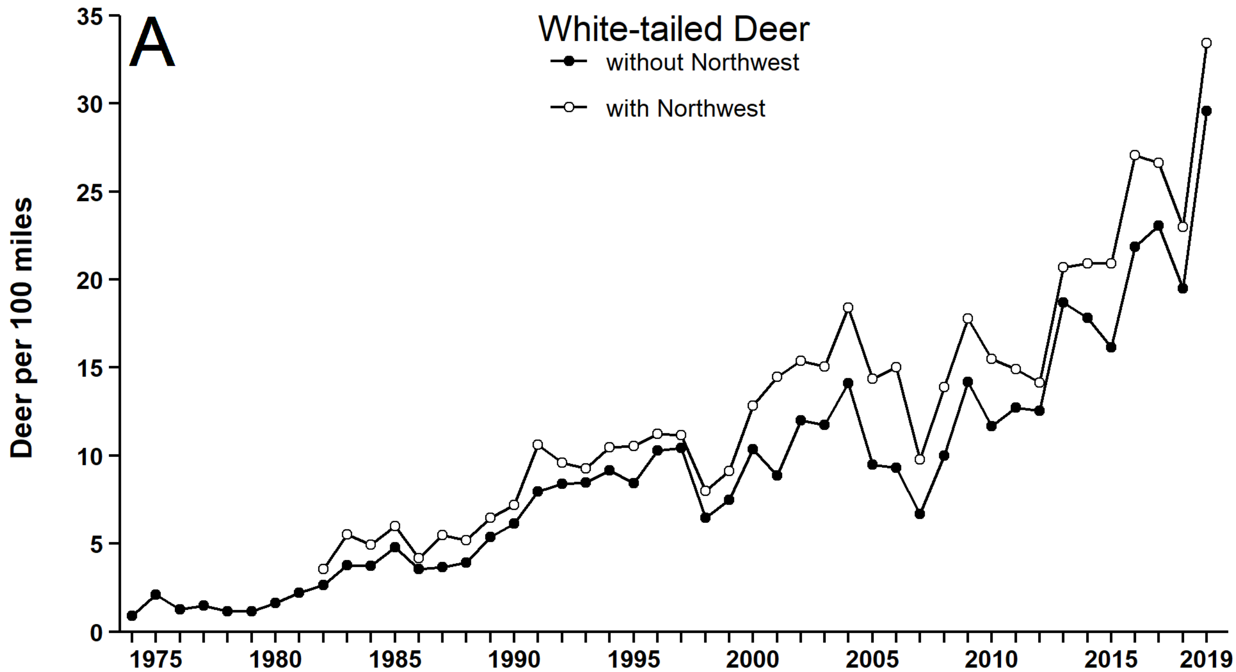


Figure 4. Range-wide index of eastern cottontail (A) and white-tailed jackrabbits (B) seen per 100 miles driven in Minnesota, 1955-2019. Does not include the Northwest region. Based on all survey routes completed.



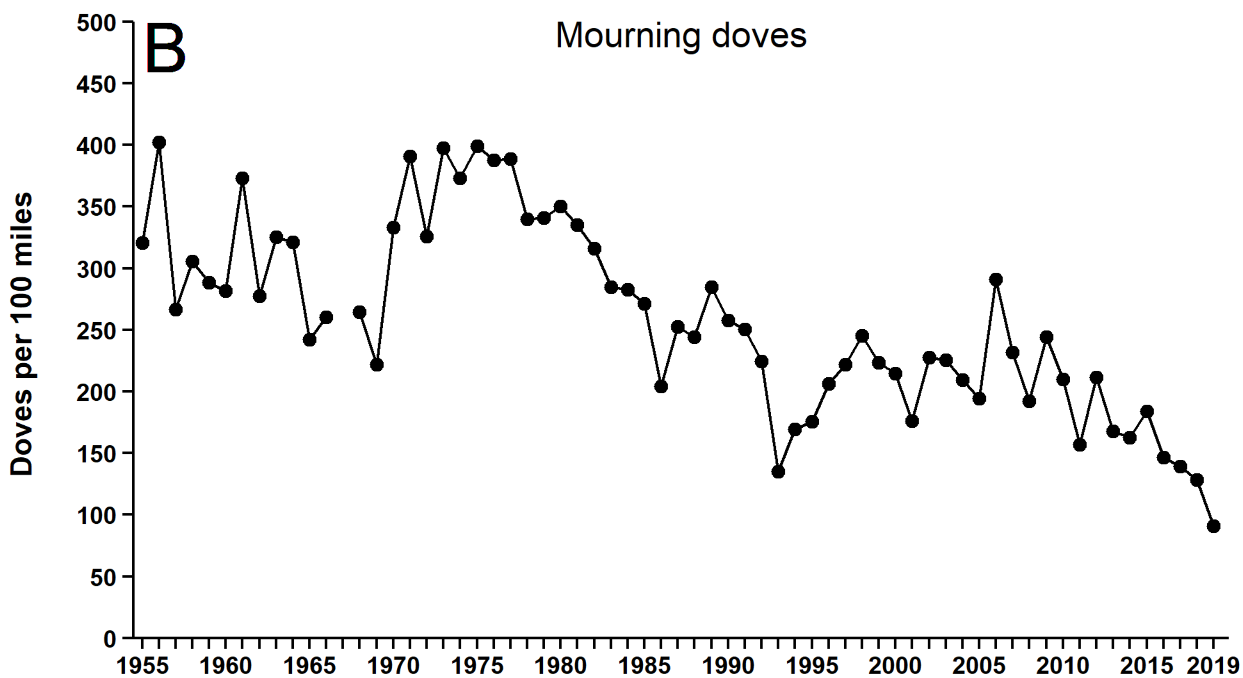


Figure 5. Range-wide index of: (A) white-tailed deer seen per 100 miles driven in Minnesota, 1974-2019, with and without the Northwest region included; and (B) mourning doves seen per 100 miles driven in Minnesota, 1955-2019. Doves were not counted in 1967 and the dove index does not include the Northwest region. Based on all survey routes completed.

DEPARTMENT OF NATURAL RESOURCES

MONITORING POPULATION TRENDS OF WHITE-TAILED DEER IN MINNESOTA – 2019

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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, MNDNR Biologists consider output from population modeling 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. This report summarizes the structure and parameters of the simulation model, and provides a description of recent trends in deer populations.

METHODS

We used a stochastic population model to simulate annual variations in deer densities within individual DPAs. We defined ranges of values for fecundity (number of offspring born per female) 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.

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 = 0.45 [SD = 0.02], adult males mean = 0.20 [SD = 0.02]). We allocated the remaining proportion (0.35) equally to young-of-year (YOY) males and females.

Within each annual cycle, we applied age-specific fecundity rates to females to estimate reproduction. We subjected all age- and sex-classes to spring/summer mortality, and the result was the pre-hunt fall population. We subtracted hunter-harvested deer from the pre-hunt population. We estimated winter mortality rates by age-class relative to winter severity, and we then applied winter mortality rates 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. We provide more detailed information about model parameter selection in the following sections.

Reproduction

We used fecundity rates, from a range of values reported for Iowa, Minnesota, and Wisconsin (Iowa DNR unpublished data, Fuller 1990, McCaffery et al. 1998, DelGiudice et al. 2007, Dunbar 2007, Grund 2011, Storm 2014, Storm 2015, Dittrich 2016). We partitioned fecundity rates by 2 age-classes of breeding females (i.e., <1 year old [YOY] when bred and ≥1 years old [adult] when bred) and allowed rates to vary by 3 eco-geographic zones (northeast, farmland and transition areas, and southeast) that reflected relative differences in climate and habitat quality. We estimated fecundity rates to be lowest in the northeast (YOYs, mean = 0.06 [SD = 0.005]; adults, mean = 1.55 [SD = 0.001]), moderate in the farmland and transition zone (YOYs, mean = 0.07 [SD = 0.017]; adults, mean = 1.71 [SD = 0.022]), and greatest in the southeast (YOYs, mean = 0.13 [SD = 0.029]; adults, mean = 1.81 [SD = 0.055]). Sex ratio of fawns at birth in most deer populations is approximately 50:50, but may vary annually (Ditchkoff 2011). Therefore, we allowed the proportion of male fawns at birth to vary uniformly between 0.48-0.52.

Spring/Summer Survival

Winter survival rates of deer 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.

We used estimates reported in the primary literature for deer in Minnesota and populations in similar habitats for fawn spring/summer survival (Wisconsin DNR unpublished data, 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, Warbington et al. 2017). We adjusted fawn survival rates to estimate the effects of winter severity on the condition of adult females during the previous winter. Mean spring/summer fawn survival values were 0.70 (SD = 0.031), 0.55 (SD = 0.037), and 0.45 (SD = 0.037) when WSI<100, 100≤WSI<180, and 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 similar 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 randomly (female = 0.96 [SD = 0.011], male = 0.97 [SD = 0.015]). 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 Recovery Rates

Hunter harvest represents the greatest source of mortality for deer populations in most DPAs in Minnesota during 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 not registered during the hunting season or they were harvested illegally (Dusek et al. 1992, Rupp et al. 2000), wounded and not recovered (Nixon et al. 2001), or died from other non-hunting causes (e.g., deer-vehicle-collision, Norton 2015). We applied a mean multiplier of 1.05 (SD = 0.002) to the numerical harvest to account for non-registered deer that died during the hunting season. Because we expect the true multiplier to be greater than 1.05, density estimates are conservative, but resulting population trends will likely be similar when different multipliers are used based on the modeling procedures.

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, Norton 2015). We estimated winter survival rates relative to winter severity based on studies conducted in Minnesota (Nelson and Mech 1986a, DelGiudice et al. 2002, Brinkman et al. 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, Norton 2015).

For adult deer, we set mean winter survival at 0.95 when WSI≤25. When WSI>25, we used an equation to calculate survival to account for increased winter severity based on previous research in Minnesota. For fawns, we set the mean winter survival rate at 0.85 when WSI≤60.When WSI was above 60 and less than 100, we applied the same equation used to calculate adult survival. However, we subtracted an additional mortality rate of 0.05 to represent lower survival of fawns versus adults. For more severe winters (100≤WSI≤240), we adjusted the equation to represent increased mortality reported for fawns in field studies. When WSI exceeded 240, we set fawn survival at 0.033. We calculated winter survival relationships based on previous Minnesota research studies of radiocollared deer.

Modeling Procedures

To model each DPA, we tested several initial population densities including: 1) population estimates from field surveys when available (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.

To determine the most appropriate initial population density, we examined the modeled population trends relative to: 1) population estimates from field surveys when available; 2) the trend in reported deer harvest; and 3) the relationship between estimated population densities and adult male harvest success. We incrementally increased and decreased the density and re-examined the modeled trend relative to the aforementioned indices to refine the initial population density. In some cases, we also adjusted other vital rates slightly in conjunction with varying initial population densities.

Because the initial population density is the primary parameter adjusted, similar population trends are fitted when the mean for parameters that are constant (with only random variation) among years (e.g., recovery rates, adult summer survival) are changed. However, the absolute density will shift similarly among years (e.g., all density estimates may be 20% greater if recovery rates are increased), because the modeler can adjust the initial density to fit the same trend. Importantly, the resulting density estimates are only unbiased when all input parameters are unbiased, but accurate trends can still be estimated even when mean values for parameters are biased.

We ran model simulations for 5 years (2014-2019) with the final population estimate occurring pre-fawning for the spring following the most recent deer hunting season (i.e., spring 2019). We performed all simulations with the R programming language (ver. 3.3.2, R Core Team 2017) and used 500 Monte Carlo simulations until we determined the most reasonable set of starting parameters. We then used 5,000 simulations for the final run.

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

RESULTS

Deer Population Trends and Management Recommendations

Although we derived the model parameters from studies of deer in Minnesota or from studies from states that have similar habitats and environmental conditions, uncertainty is inherent in modeling wild deer populations. Our modeling allowed input parameters to vary randomly to represent uncertainty that occurs in wild populations, and model outputs 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 105 of 130 DPAs in Minnesota to estimate deer densities before reproduction during spring 2019 (Table 1, Figure 2).

Following 3 deer seasons with relatively conservative management designations and 3 winters with mild conditions across most of the state, deer populations in most DPAs increased through 2019. Management designations in 2019 were consistent in most DPAs compared to 2018 in attempt to stabilize or reduce densities that had exceeded goals. However, some DPAs in the southwestern farmland and northeastern forest remained below goal, even with conservative hunting regulations, likely due to resource limitations. Because firearm hunting season conditions across some areas in the state were below average in 2018, antlerless harvest goals were not achieved, resulting in more deer after the hunting season than intended with hunting season regulations. Liberal antlerless seasons in 2019 will be required again to effectively manage deer populations in DPAs with average and above average productivity.

In terms of management intensity, the 2019 designations afford more antlerless deer harvest opportunities to hunters in about 17% of the DPAs versus the 2018 season. For most of the remaining DPAs, designations in 2019 were the same as 2018 and about 14% of DPA designations afforded less antlerless harvest opportunity.

Farmland Zone

Of the 36 farmland zone DPAs, 4 were within 10% of goal, 4 were at least 10% below goal, and 19 were at least 10% above goal based on modeling or buck harvest trends. Modeling deer densities in the farmland with harvest data continues to be a challenge, and relatively stable buck harvests the past 20 years suggests a stable population with limited potential for growth, likely a result of habitat constraints. We selected management designations to stabilize deer numbers with consistent regulations across years whenever possible. Most farmland DPAs (n = 24) were under a Lottery designation. Five of the DPAs required Hunter Choice and 7 were under Managed designations to stabilize or reduce deer numbers at appropriate levels.

Farmland-Forest Transition Zone

Deer populations in the farmland-forest transition zone are highly productive due to excellent habitat and generally milder winters as compared to the forest zone. Historical harvests and modeled population trends suggested that Lottery designations were not sufficient to stabilize deer numbers in most transition zone DPAs as evidenced by few DPAs with Lottery recommendations. Of the 50 transition zone DPAs with goals, 3 were within 10% of goal, 0 were at least 10% below goal, and 38 were at least 10% above goal based on modeling or buck harvest trends. For the 2019 season designations, Lottery will be used for 3 of the DPAs, Hunter Choice for 7 DPAs, and Managed for 14 DPAs. In 18 DPAs, Intensive designations will be necessary to continue reducing deer densities toward goal level, 1 of which (DPA 343) have additional antlerless seasons. In the metro area (DPA 701) and the chronic wasting disease management zone (DPAs 645, 646, 647, 648, 649, and 655), Unlimited Antlerless opportunity will be available during the legal hunting seasons.

Forest Zone

Many deer populations in the forest zone with adequate habitat have recovered from the severe winter of 2013-14. Of the 44 forest zone DPAs, 8 were within 10% of goal, 13 were at least 10% below goal, and 15 were at least 10% above goal based on modeling or buck harvest trends. For 2019 season designations, Bucks-only will be used in 2 DPAs, Lottery in 14 DPAs, Hunter Choice in 19 DPAs, Managed in 5 DPAs, Intensive in 2 DPAs, and Unlimited Antlerless in 2 DPAs.

ABRIDGED DESCRIPTIONS OF DEER HUNTING SEASON DESIGNATIONS (MNDNR 2019)

Bucks-only. <u>All</u> hunters, including youth and archery hunters, are restricted to harvesting only legal bucks. No antlerless deer may be harvested; limited exceptions for hunters ≥84 years of age or persons in veterans homes. The bag limit is **one** deer.

Lottery. A hunter may apply for authorization to harvest one either-sex deer during either the firearm or muzzleloader season. Archery hunters can take a deer of either sex. Under this scenario, archers, youth, and disabled hunters can kill a deer of either-sex. The bag limit is **one** deer.

Hunter Choice. The initial license is either-sex and bonus permits cannot be used. There is no antlerless permit lottery application and all hunters potentially could harvest an antlerless deer, regardless of season. The bag limit is **one** deer.

Managed. The initial license is either-sex and a maximum of **two** deer (one buck) can be taken using any combination of licenses and permits.

Intensive. The initial license is either-sex and the maximum of **three** deer (one buck) can be taken using any combination of licenses and permits.

***Early Antlerless.** A hunter could harvest **five additional** deer in these permit areas during the early antlerless season (e.g. the annual limit in an intensive permit area with an early antlerless season would be eight deer).

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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, 2014-2019.

		Pre-fawn deer density[a]					
Deer Permit Area	Land area (mi^2)	2014	2015	2016	2017	2018	2019
101	496	8	9	11	12	14	15
103	1820	3	3	4	4	5	5
105	740	10	11	13	14	16	15
108	1655	5	5	7	7	8	8
110	529	11	12	14	15	16	16
111	1438	2	2	3	3	3	3
114	123	-	-	-	-	-	-
117	936	-	-	-	-	-	-
118	1239	4	4	4	4	4	4
119	782	5	5	6	7	7	7
126	942	3	3	3	3	3	3
130	746	3	3	4	4	4	4
131	899	-	-	-	-	-	-
132	482	4	5	5	6	7	6
133	352	7	8	9	10	10	9
152	60	-	-	-	-	-	-
155	594	15	17	20	23	25	25
156	819	10	12	13	15	16	17
157	888	20	20	22	25	19	19
159	571	12	13	15	17	19	21
169	1124	8	9	11	12	13	13
171	701	10	11	13	15	16	16
172	692	19	21	24	27	28	28
173	584	8	9	10	12	13	13
176	921	7	8	9	10	10	10
177	491	11	12	14	15	14	13
178	1195	8	9	11	13	14	14
179	857	12	13	15	16	16	15
181	629	9	10	12	14	15	16
182	278	-	-	-	-	-	-
183	664	11	12	15	18	20	21
184	1229	16	17	19	21	22	20
197	957	9	10	12	13	15	15
199	153	-	-	-	-	-	-
201	161	9	10	12	13	15	16
203	118	-	-	-	-	-	-
208	378	4	5	6	7	8	8

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

		Pre-fawn deer density[a]					
Deer Permit Area	Land area (mi^2)	2014	2015	2016	2017	2018	2019
209	639	7	8	9	10	10	10
210	615	8	8	9	10	10	9
213	1059	15	16	18	20	22	23
214	553	25	27	29	32	34	35
215	701	18	20	21	23	25	26
218	884	10	11	13	14	16	18
219	392	12	13	14	16	18	21
221	643	13	14	16	19	22	23
222	413	15	16	18	21	23	25
223	377	14	15	17	18	20	21
224	46	-	-	-	-	-	-
225	618	17	18	20	22	24	25
227	471	18	20	22	25	28	30
229	285	9	10	12	14	15	17
230	454	-	-	-	-	-	-
232	377	5	6	7	7	9	10
233	384	5	6	6	7	8	9
234	636	2	3	3	3	4	4
235	35	-	-	-	-	-	-
236	368	16	18	20	22	26	29
237	728	-	-	-	-	-	-
238	95	-	-	-	-	-	-
239	928	12	13	13	14	15	15
240	643	20	22	24	27	29	29
241	997	26	27	28	29	30	27
242	213	20	22	25	28	29	27
246	838	16	17	20	22	23	23
247	229	17	19	20	21	21	19
248	216	15	16	17	18	18	17
249	502	16	17	19	21	23	24
250	712	-	-	-	-	-	-
251	55	-	-	-	-	-	-
252	716	-	-	-	-	-	-
253	974	-	-	-	-	-	-
254	930	4	4	4	4	5	5
255	774	5	5	6	7	8	9
256	654	7	7	8	9	10	9
257	412	8	9	10	11	12	12
258	343	18	19	22	24	26	25
259	490	17	19	21	22	22	21

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

		Pre-fawn deer density[a]					
Deer Permit Area	Land area (mi^2)	2014	2015	2016	2017	2018	2019
260	1248	3	4	5	6	7	7
261	793	3	4	4	5	7	7
262	677	3	3	4	4	5	5
263	512	8	9	11	12	14	14
264	669	12	13	16	17	19	19
265	494	9	10	11	12	14	13
266	617	5	6	6	7	9	9
267	472	4	5	5	6	6	5
268	228	9	9	10	11	10	10
269	650	3	3	4	4	5	5
270	736	3	3	3	4	5	5
271	632	3	3	3	3	4	4
272	532	-	-	-	-	-	-
273	572	6	6	7	8	9	10
274	355	6	6	6	7	8	9
275	764	4	4	4	5	5	6
276	542	9	10	11	13	15	16
277	812	12	13	14	15	16	18
278	402	6	6	7	8	9	10
279	344	4	4	4	5	5	5
280	674	3	3	3	3	3	3
281	575	7	7	8	10	12	13
282	778	-	-	-	-	-	-
283	613	4	4	4	4	4	4
284	840	-	-	-	-	-	-
285	546	5	5	6	7	8	9
286	447	5	5	6	7	8	9
287	47	-	-	-	-	-	-
288	624	5	5	5	6	6	6
289	816	2	2	3	3	3	4
290	661	5	6	6	7	8	8
291	799	6	6	7	8	9	10
292	480	9	10	11	12	14	16
293	511	8	9	10	10	11	12
294	687	4	4	4	5	5	6
295	839	4	5	5	6	7	8
296	665	3	4	4	4	5	6
297	438	3	3	3	4	5	5
298	618	9	10	12	15	17	17
299	387	5	6	6	6	7	8

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

		Pre-fawn deer density[a]					
Deer Permit Area	Land area (mi^2)	2014	2015	2016	2017	2018	2019
338	454	6	7	8	9	11	13
339	394	6	7	8	10	11	13
341	611	14	16	17	20	22	24
342	350	14	16	18	20	22	25
343	662	13	14	14	15	17	17
344	190	19	19	18	19	21	22
345	326	13	14	15	17	18	19
346	319	28	28	27	28	29	28
347	272	-	-	-	-	-	-
348	122	-	-	-	-	-	-
349	492	26	27	27	29	31	33
601	1632	-	-	-	-	-	-

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

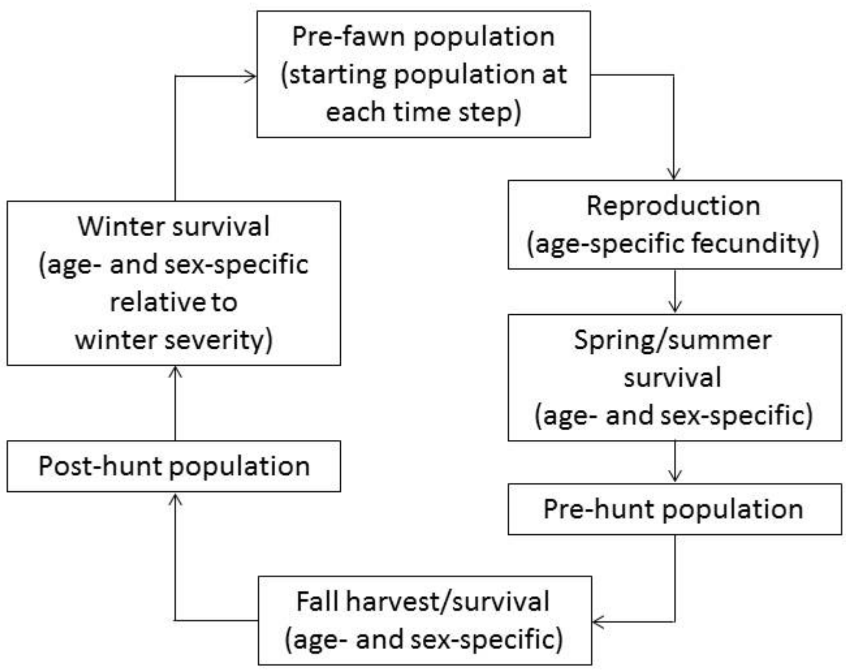

Figure 1. Model structure for simulations of white-tailed deer populations in Minnesota.

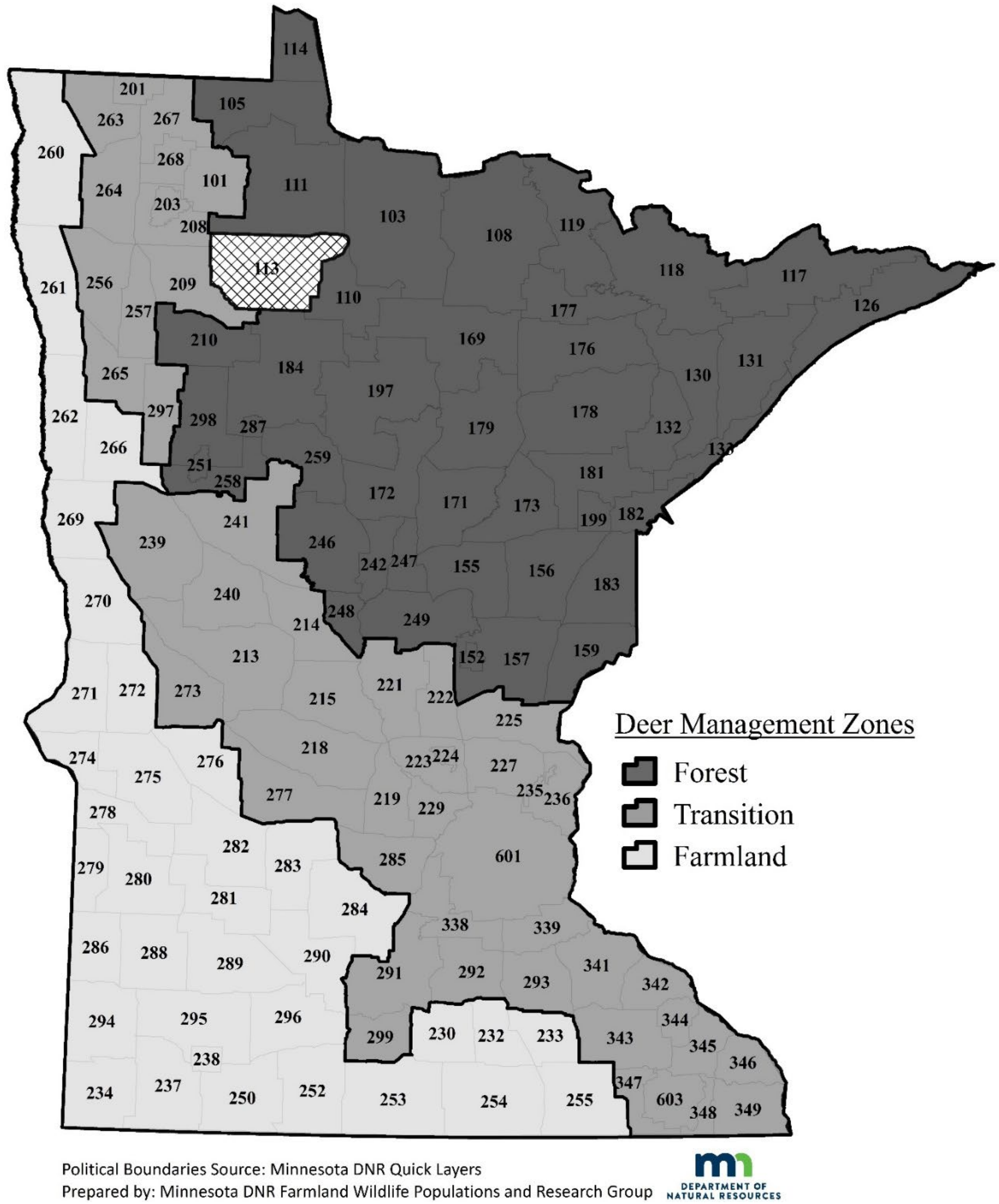

Figure 2. Deer permit areas (DPAs) in Minnesota and deer management zones used to describe deer population and harvest trends, 2018. DPAs were assigned to forest, transition, or farmland zones based on historical land cover and current woody cover. Generally, forested DPAs were composed of ≥60% woody cover, transition DPAs were composed of 6%-50% woody cover, and farmland DPAs were composed of ≤5% woody cover.

2019 WHITE-TAILED DEER AERIAL SURVEYS

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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 121 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 (Norton and Giudice 2017). In general, model inputs include estimates of initial population size, reported harvest, and spatial and temporal estimates of survival and reproduction for various age and sex cohorts. Because simulated population estimates are subject to drift as model input errors accumulate over time, managers should 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).

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

METHODS

We estimated deer populations in select 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. hemionus*; Bartmann et al. 1986) in a variety of habitat types. Within each area, we delineated quadrats by Public Land Survey (PLS) section (640 ac) boundaries. We used regression trees (Fabrizi and Trivisano 2007, Fieberg and Lenarz 2012), the R programming language (R Core Team 2018), and R package 'stratification' (Baillargeon and Rivest 2018) 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. We derived woody cover data from the 2011 National Land Cover database (Homer et al. 2015). We used optimal allocation, R package 'spsurvey' (Kincaid and Olsen 2019), and a generalized random tessellation stratified procedure (GRTS; Stevens and Olsen 2004) to draw spatially balanced stratified random samples within each PA.

For comparison with a concurrent study of road-based distance-sampling surveys of deer (MNDNR, unpublished data), we also estimated deer populations in a 4-PA distance-sampling study area (DSSA), using a similar aerial survey design. However, because habitat within the DSSA was predominately row-crop agriculture with limited woody cover, we stratified this sampling frame into 3 density categories (low, medium, high) using the local wildlife manager's knowledge of deer abundance and distribution.

During all surveys, we used Bell OH-58 and MD-500E helicopters and attempted to maintain flight altitude at 200 ft (60 m) above ground level and airspeed at 50-60 mi/hr (80-97 km/hr). A pilot and 2 observers searched for deer along transects spaced at 0.17-mi (270-m) intervals until they were confident all "available" deer were observed. When animals fled the helicopter, we noted direction of movement 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, Inc., Redlands, CA) shapefiles. To maximize sightability, we completed surveys during winter when snow cover measured at least 6 in (15 cm) and we varied survey intensity as a function of cover and deer numbers (Gasaway et al. 1986).

We implemented double sampling (Eberhardt and Simmons 1987, Thompson 2002) on a subsample of quadrats within each PA to estimate sightability of deer from the helicopter. We sorted the sample of survey quadrats by woody cover abundance, excluded quadrats likely to contain no deer (e.g., low stratum quadrats or quadrats where woody cover < 80 ac [0.32 km^2]), and selected a 4% systematic subsample of sightability quadrats. Immediately after completing the operational survey on each sightability quadrat, a second more intensive survey was flown at reduced speed (40-50 mi/hr [64-80 km/hr) to identify animals that were missed (but assumed available) on the first survey (Gasaway et al. 1986). We used geo-referenced deer locations, group size, and movement information from DNRSurvey (Haroldson et al. 2015) to "mark" deer (groups) observed in the operational survey and help estimate the number of "new" (missed) animals detected in the sightability survey. We used a binary logistic model to estimate average detection probabilities (i.e., the conditional probability of detection given animals are present in the sampling unit and available for detection) for each PA and the DSSA.

We computed population estimates adjusted for both sampling and sightability. We used the R package 'spsurvey' (Kincaid and Olsen 2019) to compute deer abundance and density (mean count per quadrat) indices within each stratum, where indices were expanded for sampling but not sightability. We used the local mean variance estimator (Kincaid and Olsen 2019) with a finite population correction to compute stratum-specific estimates of sampling variance. We summed stratum-specific estimates by management unit (Cochran 1977:34) to compute deer abundance and density indices for each PA and the DSSA. We used a Horvitz-Thompson estimator (Thompson 2002:53, Fieberg and Giudice 2008) to convert population indices to population estimates (adjusted for sightability), and the Delta method (Seber 1982:9) to compute the variance. We evaluated precision using coefficient of variation (CV), defined as standard deviation of the population estimate divided by the population estimate, and relative error, defined as the 90% confidence interval bound divided by the population estimate (Krebs 1999).

RESULTS AND DISCUSSION

We completed 4 surveys during 2019 (Figure 1). We stratified PAs 215, 219, and 229 using the relationship between woody cover abundance per quadrat and historic deer density. We combined PAs 252, 253, 296, and 299 into a single survey area (i.e., DSSA) and we stratified each PA by expected deer density based upon input from local field staff. Mean deer density estimates for the PA surveys ranged from 15-17 deer/quadrat (90% CI = 12–19; Table 1). Within the DSSA, mean density was 6 deer/quadrat (90% CI = 5–8). Except for the DSSA, all estimates met precision goals (relative error ≤ 20%; Table 1). We observed deer in 65-80% of sample quadrats in the PA surveys and 41% of quadrats in the DSSA, with greater occupancy occurring in areas 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 0.643 (SE = 0.027) in PA 229 to 0.795 (SE = 0.016) in the DSSA and averaged 0.714 (SE = 0.076), which were similar to sightability estimates during 2010-2018 (range = 0.633-0.909; mean = 0.757). Correcting for sightability increased relative variance (CV [%]) of population estimates by 2-8%, 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. In the event when animals are unavailable, resulting population estimates would be underestimated. Our approach also assumes that sightability is constant across animals and quadrats. Heterogeneity in detection probabilities can lead to biased estimates of abundance. Common methods for correcting for heterogeneous detection probabilities include distance sampling, mark-recapture methods, and logistic-regression sightability models (based on radio-marked animals). We did not have marked animals in our populations, and relatively high densities of deer in our survey areas would present logistical and statistical problems for distance sampling and double-observer methods (Nichols et al 2000, Bart et al 2004). Therefore, our double-sampling approach is a reasonable alternative to using unadjusted counts or applying more complicated methods whose assumptions are difficult to attain in practice. Nevertheless, our population estimates must still be viewed as approximations to the truth.

ACKNOWLEDGMENTS

We thank T. Obermoller and field staff throughout the survey areas for logistical assistance and conducting the surveys. B. Maas, J. Heineman, and L. Ettl piloted the helicopters during all surveys. E. Michel reviewed an earlier draft of this report. Deer surveys were funded in part under the Federal Aid in Wildlife Restoration Act.

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Table 1. White-tailed deer population and density (deer/quadrat) estimates derived from aerial surveys in Minnesota, 2019. Summary statistics (CI, CV) are also presented. Confidence intervals for density estimates were based on α = 0.10.

Permit area	Sampling rate (%)	Sightability rate	Population estimate		CV (%)	Relative error (%)[a]	Density estimate	
			N	90% CI			$\bar{x}$	90% CI
215	20	0.656	10,180	8,808–11,552	8.2	13.5	15	13–17
219	20	0.709	6,811	5,878–7,744	8.3	13.7	17	15–19
229	20	0.643	4,119	3,366–4,872	11.1	18.3	15	12–17
DSSA[b]	6	0.795	17,275	13,628–20,922	12.8	21.1	6	5–8

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

[b]Distance Sampling Study Area (permit areas 252, 253, 296, 299).

Table 2. Sampling metrics from aerial surveys of white-tailed deer in Minnesota, 2019.

Permit area	Quadrats in permit area	Quadrats sampled	Quadrats occupied[a]	Deer observed	Deer groups observed	Groups / occupied quadrat		Group size / occupied quadrat		Max. quadrat count
						$\bar{x}$	Range	$\bar{x}$	Range	
215	691	139	90	1,742	360	4	1–14	5	1–35	86
219	406	82	66	1,294	324	5	1–15	4	1–26	67
229	282	57	41	671	145	4	1–8	5	1–25	70
DSSA[b]	2,714	162	67	1,652	302	5	1–14	5	1–32	109

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

[b]Distance Sampling Study Area (permit areas 252, 253, 296, 299).

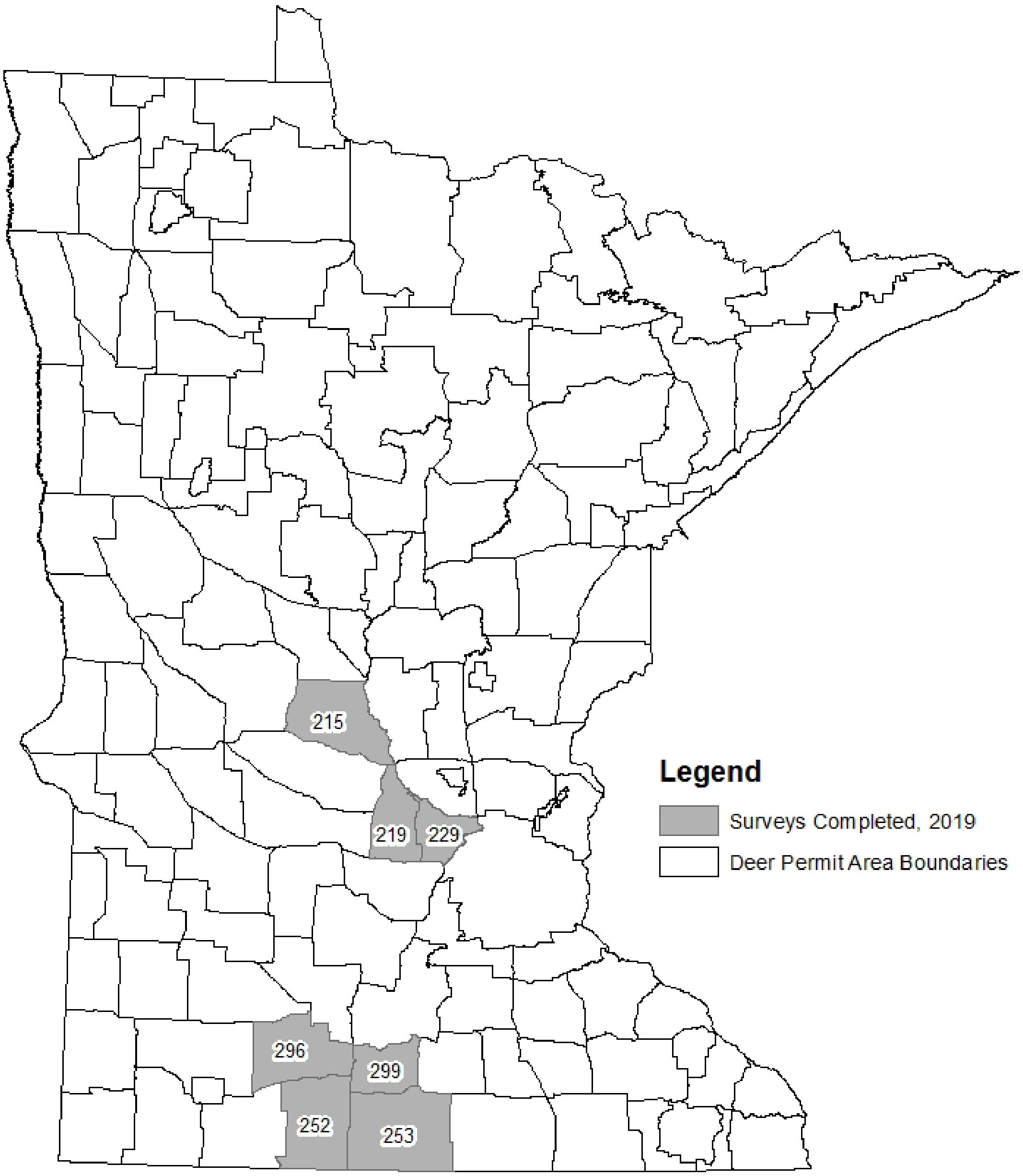

Figure 1. Permit areas (PA) flown during aerial surveys of white-tailed deer in southern Minnesota, winter 2019. PAs 252, 253, 296, and 299 were combined into a single survey area for comparison with a concurrent study using roadside distance-sampling surveys.

FOREST WILDLIFE POPULATIONS

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CARNIVORE SCENT STATION SURVEY SUMMARY, 2018

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

INTRODUCTION

Monitoring the distribution and abundance of carnivores can be important for understanding the effects of harvest, habitat change, and environmental variability on these populations. However, many carnivores are highly secretive, difficult to repeatedly capture, and naturally occur at low to moderate densities, making it difficult to annually estimate abundance over large areas using traditional methods (e.g., mark-recapture, distance sampling, etc.).

Hence, indices of relative abundance are often used to monitor such populations over time (Sargeant et al. 1998, 2003, Hochachka et al. 2000, Wilson and Delahay 2001, Conn et al. 2004, Levi and Wilmers 2012).

In the early 1970's, the U.S. Fish and Wildlife Service initiated a carnivore survey designed primarily to monitor trends in coyote populations in the western U.S. (Linhart and Knowlton 1975). In 1975, the Minnesota DNR began to utilize similar survey methodology to monitor population trends for numerous terrestrial carnivores within the state. This year marks the 42nd 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 187 routes and 1,721 stations were surveyed this year, the fewest since the survey became fully operational in the early 1980's. Route density varied from 1 route per 953 km^2 in the Forest Zone to 1 route per 1,480 km^2 in the Farmland Zone (Figure 1). The decline in survey effort was likely a result of staffing shortages and competing workload demands.

Statewide, route visitation rates (% of routes with detection), in order of increasing magnitude, were bobcats (7%), opossums (8%), wolves (10%), domestic dogs (15%), domestic cats (22%), red foxes (24%), coyotes (29%), skunks (31%), and raccoons (33%). Regionally, route visitation rates were as follows: red fox – FA 17%, TR 24%, FO 28%; coyote – FO 15%, TR 35%, FA 50%; skunk – FO 22%, TR 26%, FA 54%; raccoon – FO 6%, TR 37%, FA 80%; domestic cat – FO 6%, TR 30%, FA 46%; domestic dog – FO 5%, TR 22%, FA 26; opossum - FO 0%, FA 11%, TR 19%; wolf - FA 0%, TR 0%, FO 22%; and bobcat - FA 0%, TR 7%, FO 11%.

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 degree of confidence interval overlap, notable changes this year include 1) marginally significant declines in red fox indices in both the Farmland and Forest Zones (Figures 2 and 4), 2) a decline in the domestic cat index in the Farmland Zone (Figure 2), and 3) a decline in the raccoon index in the Forest Zone (Figure 4).

In the Farmland Zone (Figure 2), the red fox index exhibited a marginally significant decline, and indices have remained below the long-term average for nearly 20 years. Although the farmland coyote index has increased over time and remains above the long-term average, indices have been stable over the last 4 years. Raccoon indices also remain above their long- term average, but have been relatively stable over the last 20 years. There has been no consistent trend in Farmland skunk indices for nearly 3 decades, with the current index near the long-term average.

There were no significant changes from last year for any species in the Transition Zone (Figure 3). Coyote and bobcat indices in the Transition have increased over time and are above their long-term averages, whereas red fox indices have been below their long-term averages for most of the last 2 decades. Raccoon and skunk indices have generally been stable and near their long-term averages over the last 2 decades. Wolves had exhibited a mild increase in the Transition Zone over time, but indices have been below the long-term average the past 2 years.

In the Forest Zone (Figures 4 and 5), the raccoon index exhibited a significant decline from last year and was the lowest since the early 1980's. The red fox index exhibited a marginally significant decline, and has been near or slightly below the long-term average in the Forest Zone for the last 2 decades. Unlike in the Farmland and Transition Zones, the Forest Zone coyote index has not increased over time and has been stable and below the long-term average for 2 decades, likely attributable to wolf presence in the Forest Zone. Skunk indices have also remained below their long-term average in the Forest Zone over the past 2 decades. Wolf and bobcat indices have been at peak levels over the past decade and remain above their long-term averages, but both have also exhibited fluctuations during this time.

ACKNOWLEDGMENTS

I wish to thank all of the cooperators who participated in the 2018 survey: DNR Division of Wildlife staff; Superior National Forest Aurora District; Sherburne National Wildlife Refuge; 1854 Treaty Authority, White Earth, Red Lake, and Leech Lake Tribal Natural Resource Departments;

Lori Schmidt and Vermillion Community College; Peter Jacobson and Faribault High School; and Steven Hogg and the Three Rivers Park District. This project was funded in part by the Wildlife Restoration Program (Pittman-Robertson).

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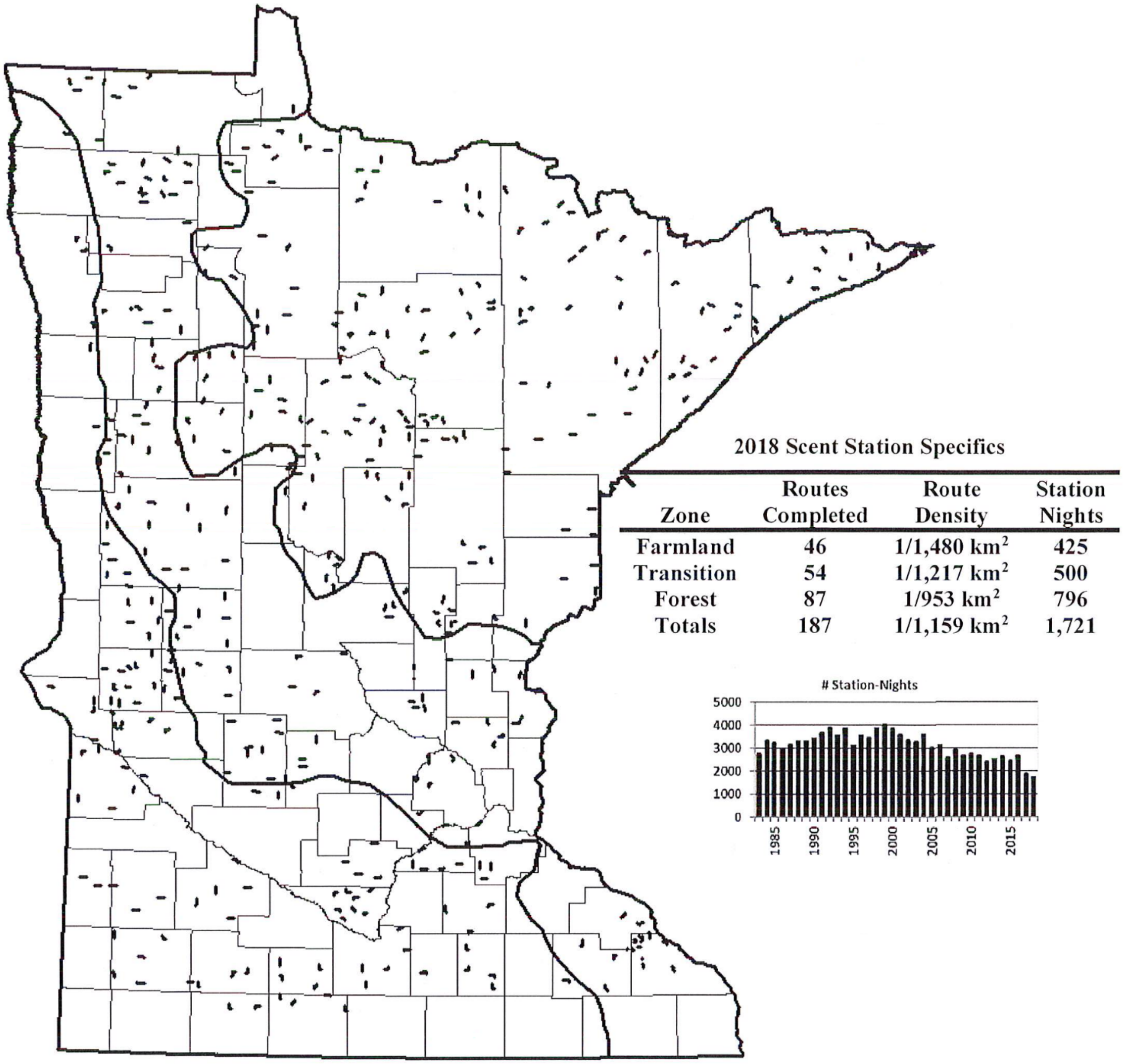

2018 Scent Station Specifics

Zone	Routes Completed	Route Density	Station Nights
Farmland	46	1/1,480 km^2	425
Transition	54	1/1,217 km^2	500
Forest	87	1/953 km^2	796
Totals	187	1/1,159 km^2	1,721

Figure 1. Locations of existing scent station routes (not all completed every year). Insets show 2018 route specifics and the number of station-nights per year since 1983.

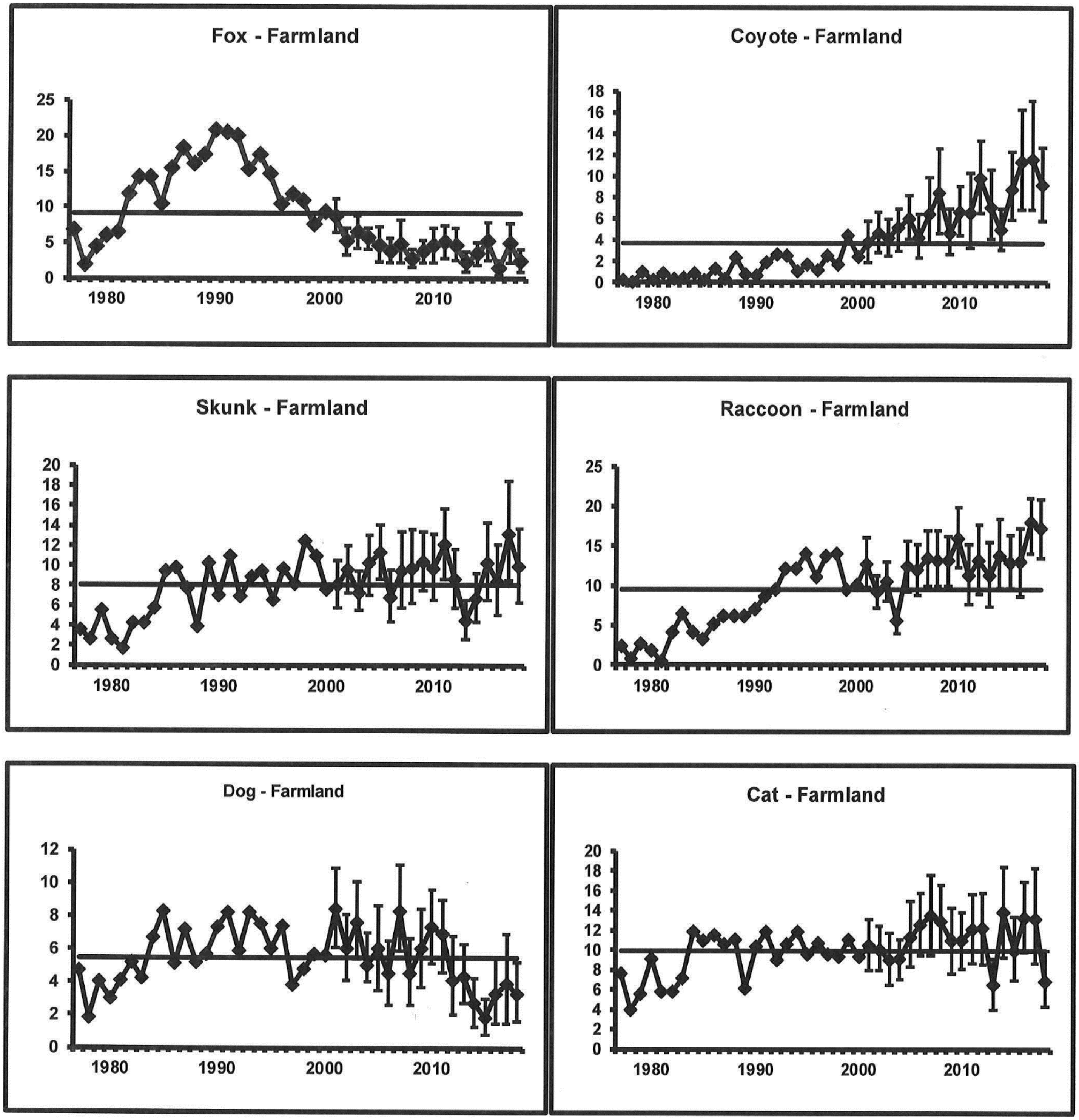

Figure 2. Percentage of scent stations visited by selected species in the Farmland Zone of Minnesota, 1977-2018. Horizontal line represents long-term mean.

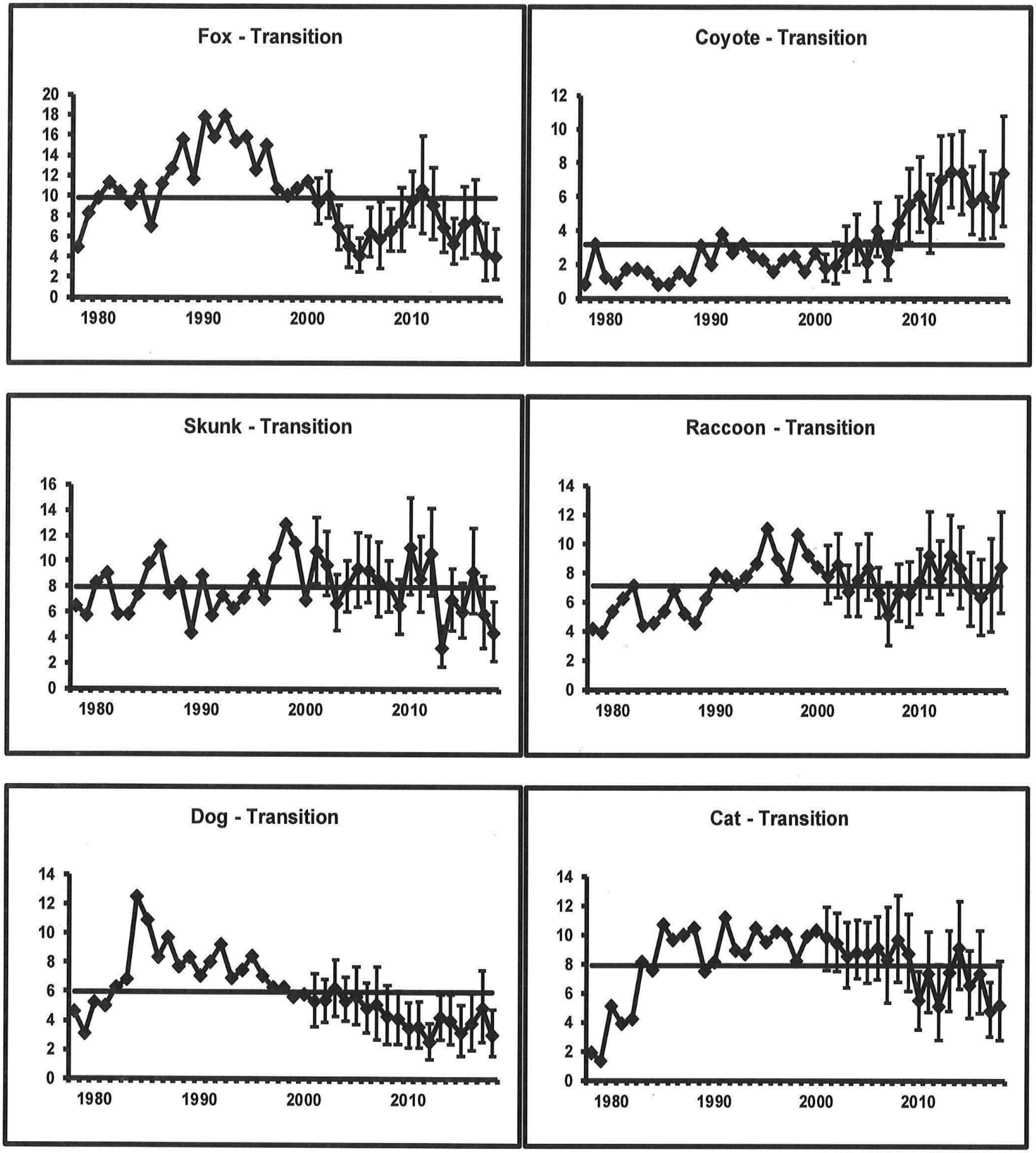

Figure 3. Percentage of scent stations visited by selected species in the Transition Zone of Minnesota, 1978-2018. Horizontal line represents long-term mean.

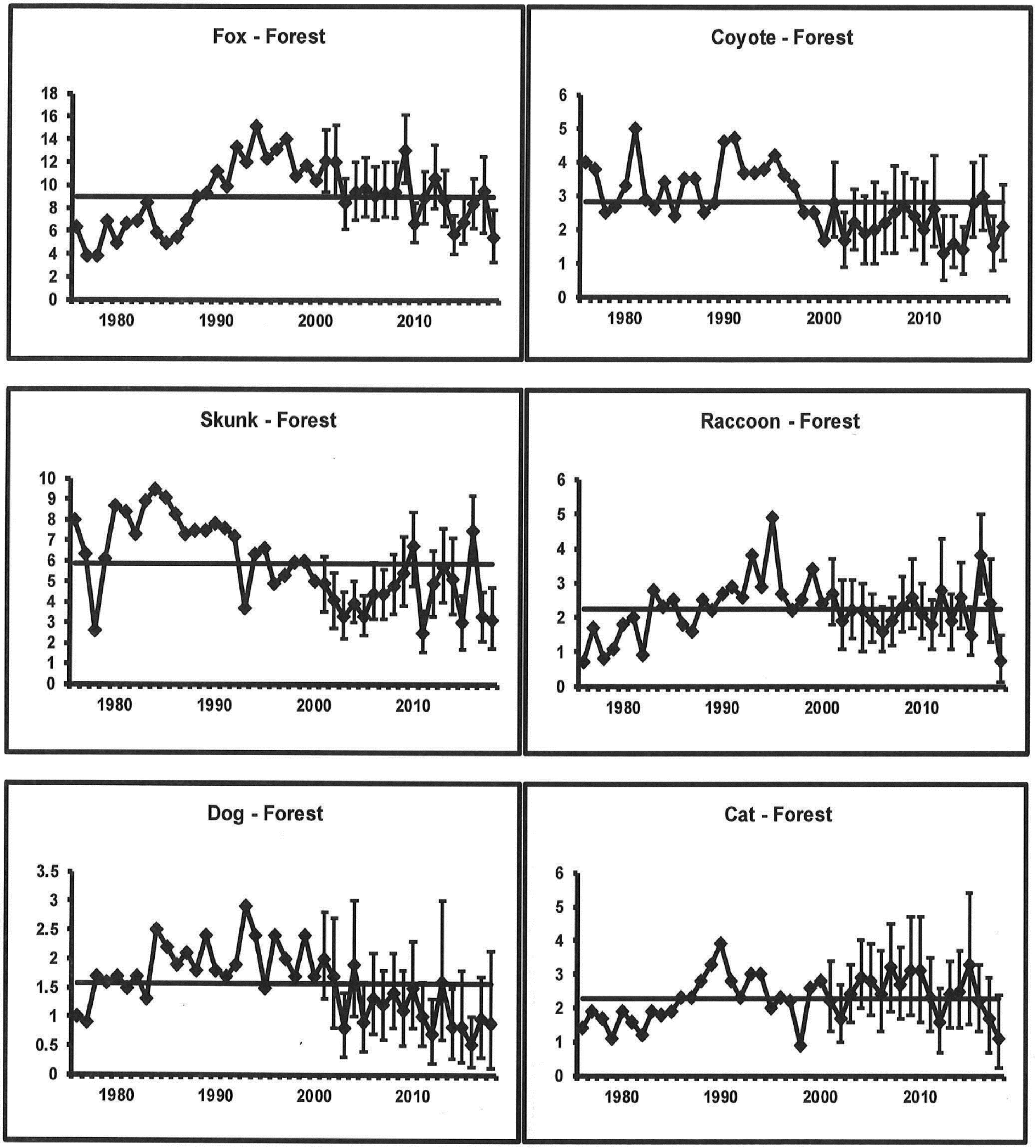

Figure 4. Percentage of scent stations visited by selected species in the Forest Zone of Minnesota, 1976-2018. Horizontal line represents long-term mean.

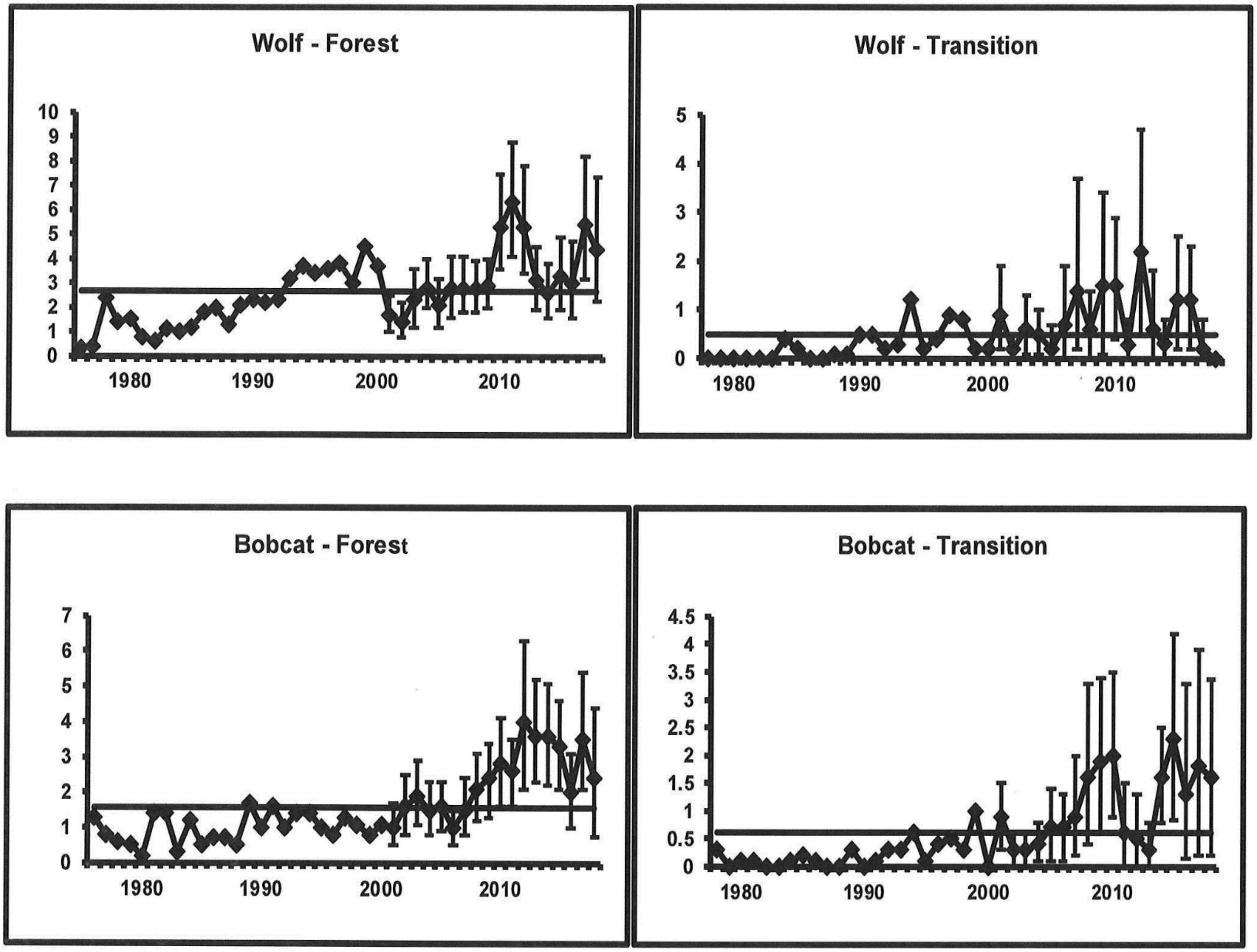

Figure 5. Percentage of scent stations visited by wolves and bobcat in the Forest and Transition Zones of Minnesota, 1976-2018. Horizontal lines represents long-term mean

FURBEARER WINTER TRACK SURVEY SUMMARY, 2018

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

INTRODUCTION

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

In winter, tracks of carnivores are readily observable following snowfall. Starting in 1991, Minnesota initiated a carnivore snow-track survey in the northern portion of the State. The survey's primary objective is to use a harvest-independent method to monitor distribution and population trends of fisher (*Pekania pennanti*) and marten (*Martes americana*), two species for which no other survey data is available. Because sign of other carnivores is readily detectable in snow, participants also record tracks for other selected species. After three years of evaluating survey logistics, the survey became operational in 1994. Formal recording of gray fox detections did not commence until 2008.

METHODS

Presently, 57 track survey routes are operational across the northern portion of the state (Figure 1). Each route is a total of 10 miles long and follows secondary roads or trails. A majority of routes are continuous 10-mile stretches of road/trail but a few are composed of multiple discontinuous segments. Route locations were subjectively determined based on availability of suitable roads/trails but were chosen where possible to represent the varying forest habitat conditions in northern Minnesota. For data recording, each 10-mile route is divided into 20 0.5-mile segments.

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

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

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

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

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

RESULTS

This winter, 42 of the 57 routes were completed (Figure 2). Survey routes took an average of 2 hours to complete. Snow depths averaged 18.4" along completed routes, the second-most since the survey began (Figure 3). Mean overnight low temperature the night preceding the surveys was 4°F, similar to the long-term average (Figure 3). Survey routes were completed between November 21st and March 11th, with a mean survey date of January 23rd, the second latest since the survey began (Figure 3).

Based on degree of confidence interval overlap, notable changes from last winter include a significant decrease in red foxes, a marginally significant decline in weasels and wolves, and a marginally significant increase in coyotes (Figure 4). For species monitored on both surveys, these changes mirror results from the fall scent station survey in the Forest Zone.

Fishers were detected on approximately 3% of the route segments and along 40% of the routes (Figure 4). Numerous sources of information indicate that over the past decade fishers have expanded in distribution and abundance along the southern and western edge of their Minnesota range, an area currently with few or no track survey routes. Hence, fisher indices in this report are presumed indicative of population trends only in the previous 'core' of fisher range. In the core area, data indicates a longer-term decline, with low but stable numbers since 2012; at their peak (2003/2004), fishers were detected on 14% of route segments and 78% of the survey routes.

Within the 'marten zone', martens were detected on approximately 6% of the route segments and 55% of the survey routes (Figure 4), nearly identical to last year. Similar to results for fishers, marten indices have declined over the long-term, but have been low and without consistent trend over the last 11 years. However, marten fluctuations do show indications of 3-5 year cycles, consistent in timing with cyclic fluctuations of some of their rodent prey species in Minnesota (e.g., Oestricher 2018, Berg et al. 2017).

Bobcat indices had increased for approximately 15 years through 2014, and then declined to their long-term average by 2016. Data from the past 2 years show a quick rebound from the recent decline, with the indices approaching peak levels once again. Bobcats were detected on 4.1% of the segments and 45% of the routes.

Wolves were detected on approximately 9% of the route segments and 76% of the survey routes, both down slightly from last winter (Figure 4). The average number of wolves detected per route was 3. Coyotes were detected on 3.6% of the route segments and 45% of the routes. As with martens and weasels (see below), coyote indices appear to exhibit 3 to 5 year cycles consistent in timing with data for some rodent species in MN. Long-term red fox indices display a 'stair-step' decline over time, being lowest and comparatively stable since 2012. Red foxes were detected on approximately 8% of the segments and 67% of the routes (Figure 4), both significant declines from the previous winter. Gray fox detections have only been formally recorded since 2008. Although it is premature to characterize longer patterns in gray fox detections, data from the past 10 years suggests, similar to coyotes, martens, and weasels, some potential influence of cyclic prey fluctuations. There was a significant decrease in gray fox indices from last winter, with gray foxes being detected on < 1% of the route segments and 2% of the routes.

Weasel (*Mustela erminea* and *Mustela frenata*) indices exhibited a marginally significant decline from last winter and their long-term fluctuations continue to be characterized by 4 to 5 year cycles or 'irruptions' superimposed on a declining trend (Figure 4). No significant change was observed in winter snowshoe hare indices from last winter. Since the winter track survey began in 1994, hare indices had steadily increased, leveled off some around 2010, and have slowly declined since (Figure 4). Both the spring and winter indices were slightly below their long-term averages (Figure 4). Historic data (pre-1994; not presented here) for the spring index of snowshoe hares clearly exhibited 10-year cycles. Since then, only subtle signs of a cycle are apparent in both surveys during the first few years of each decade.

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. Notable changes detected this winter were a significant decrease in red foxes, a marginally significant decline in weasels and wolves, and a marginally significant increase in coyotes. With the exception of ambient temperature, the timing and conditions during this winter's survey suggest conditions more 'extreme' than their long-term averages (i.e., second latest average completion date, second highest snow depths). Although this could negatively bias indices for some species as a result of reduced animal activity, it is not currently possible to quantify and adjust for these potential effects and there is no indication that results were consistently biased downward for all species. Nonetheless, it remains a possible factor and inferences from this survey should largely be restricted to examination of long-term trends.

ACKNOWLEDGMENTS

I wish to thank all those who participated in this year's survey, including staff with the Minnesota DNR, Superior National Forest (Cook, Ely, and Grand Marais offices), Leech Lake, Fond-du-Lac, 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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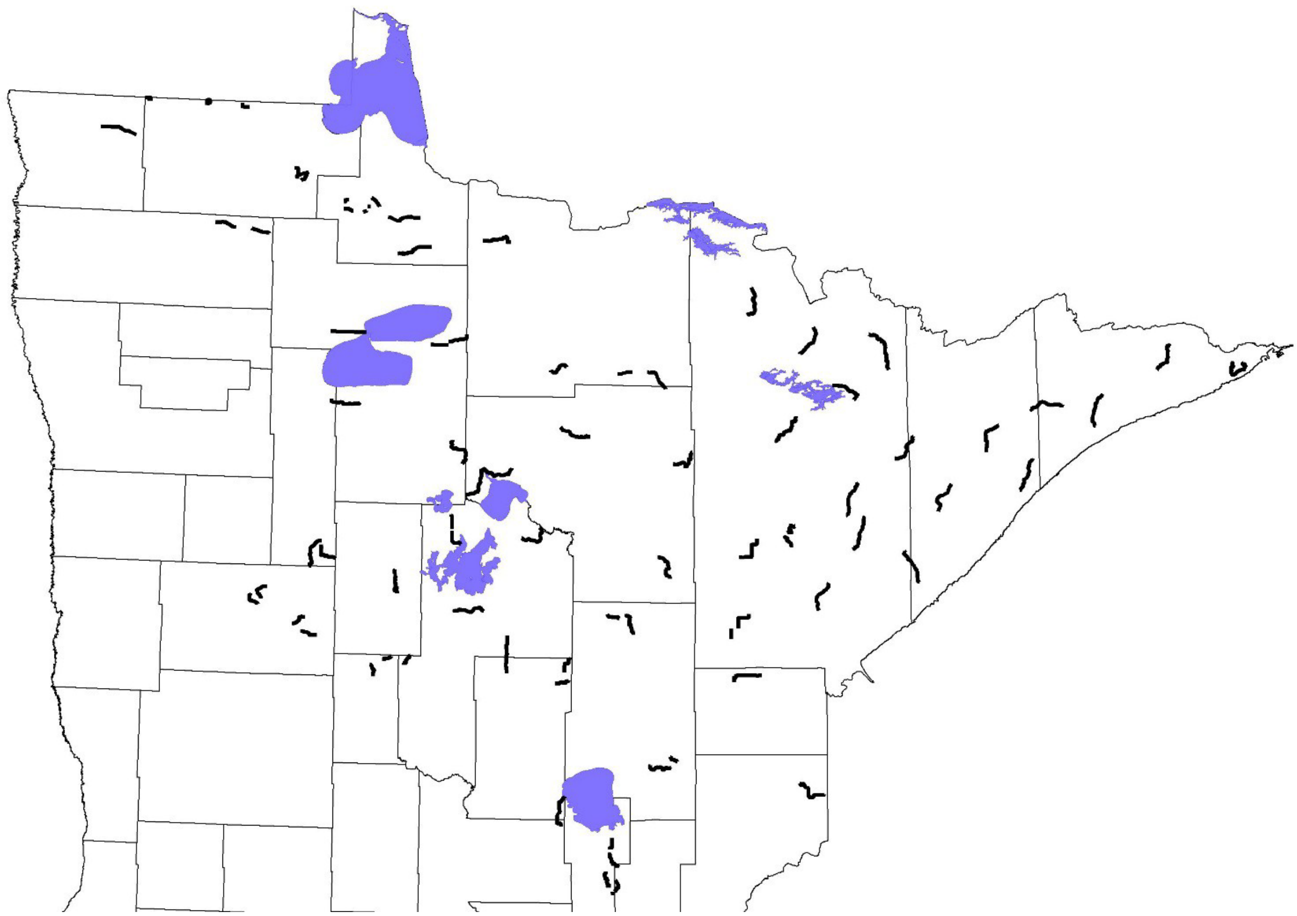


Figure 1. Locations of furbearer winter track survey routes in northern Minnesota.

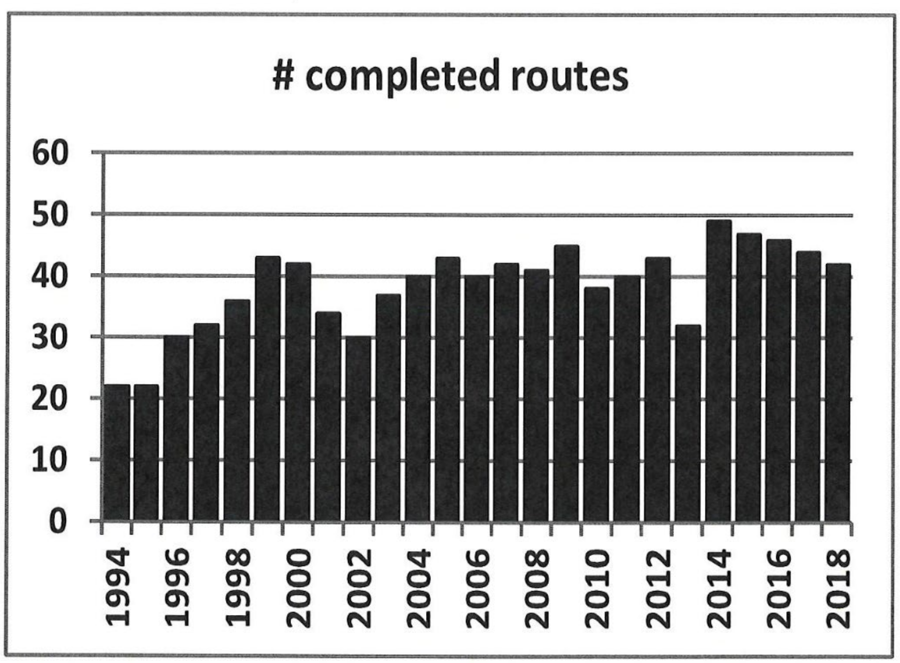
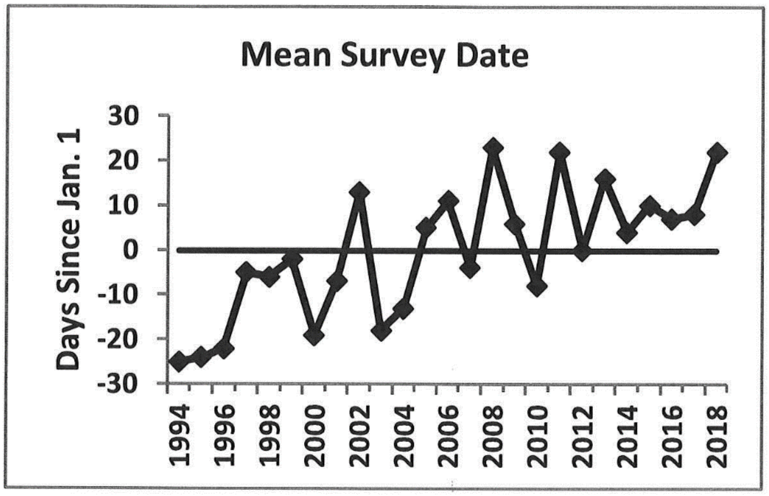
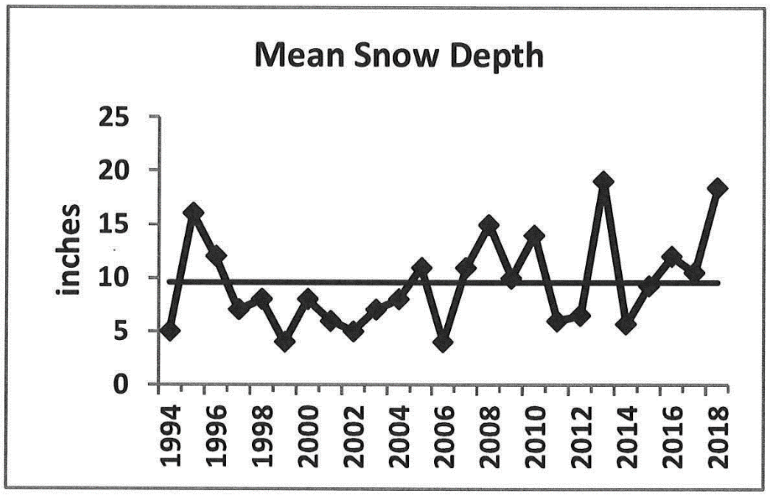


Figure 2. Number of snow track routes surveyed in Minnesota, 1994-2018.





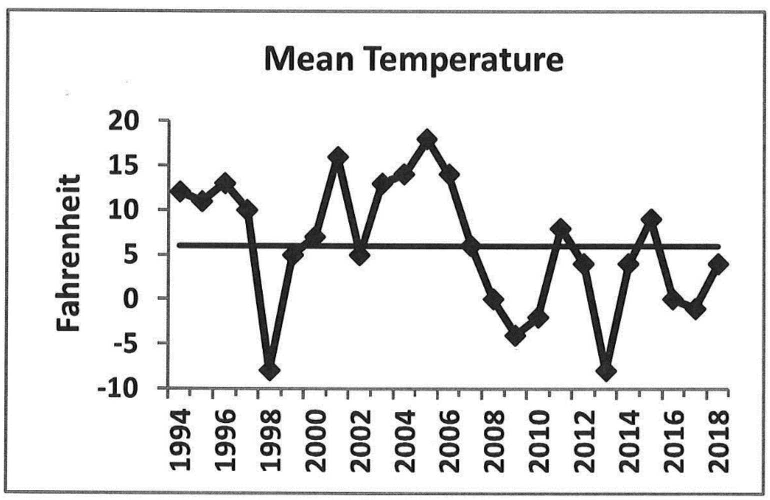


Figure 3. Average survey date, snow depth, and temperature for snow track routes completed in Minnesota, 1994-2018. Horizontal line represents long-term mean.

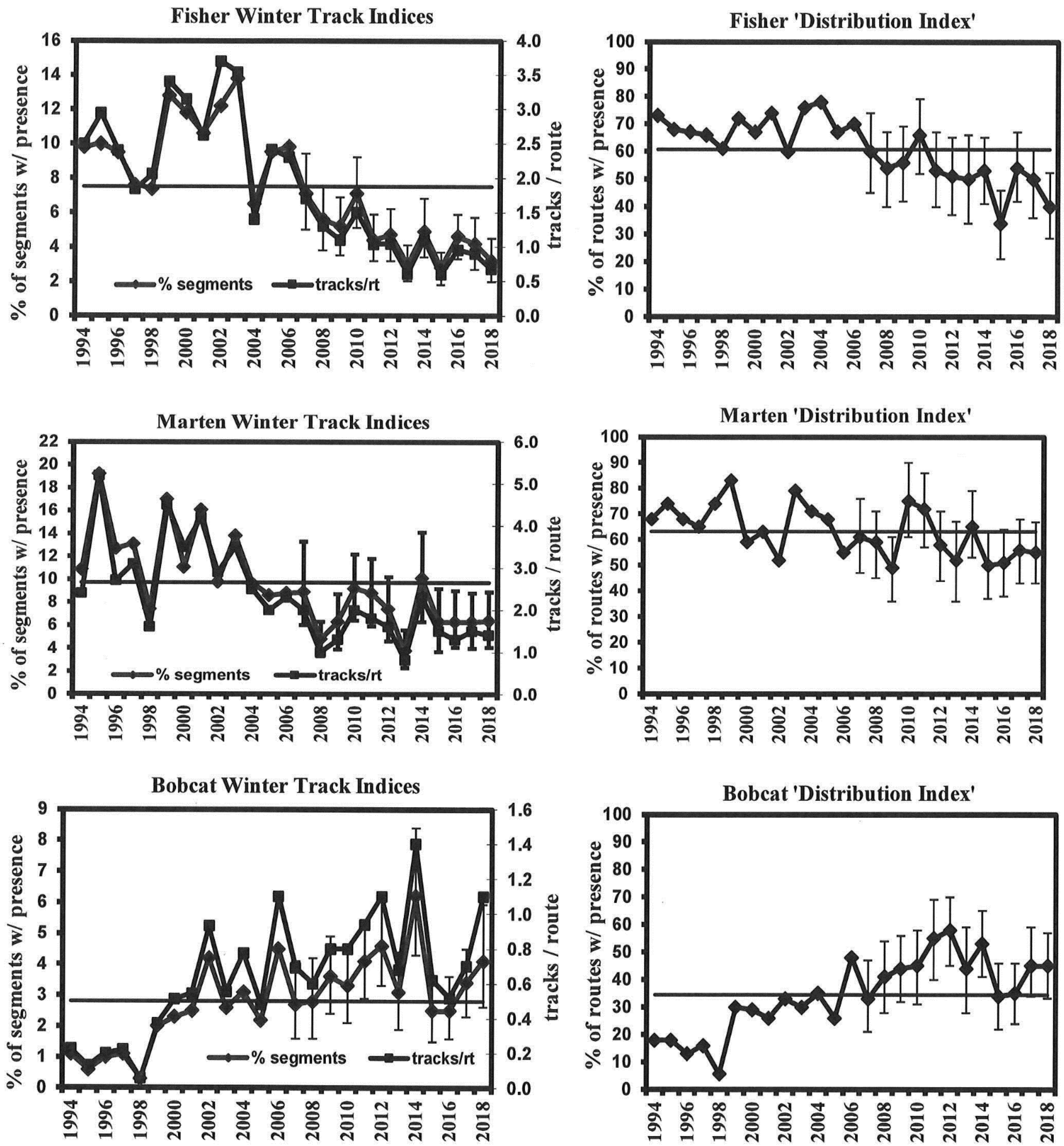


Figure 4. Winter track indices for selected species in Minnesota, 1994-2018. Confidence intervals are presented only for % segments and % routes with track presence; horizontal lines represent their long-term averages.

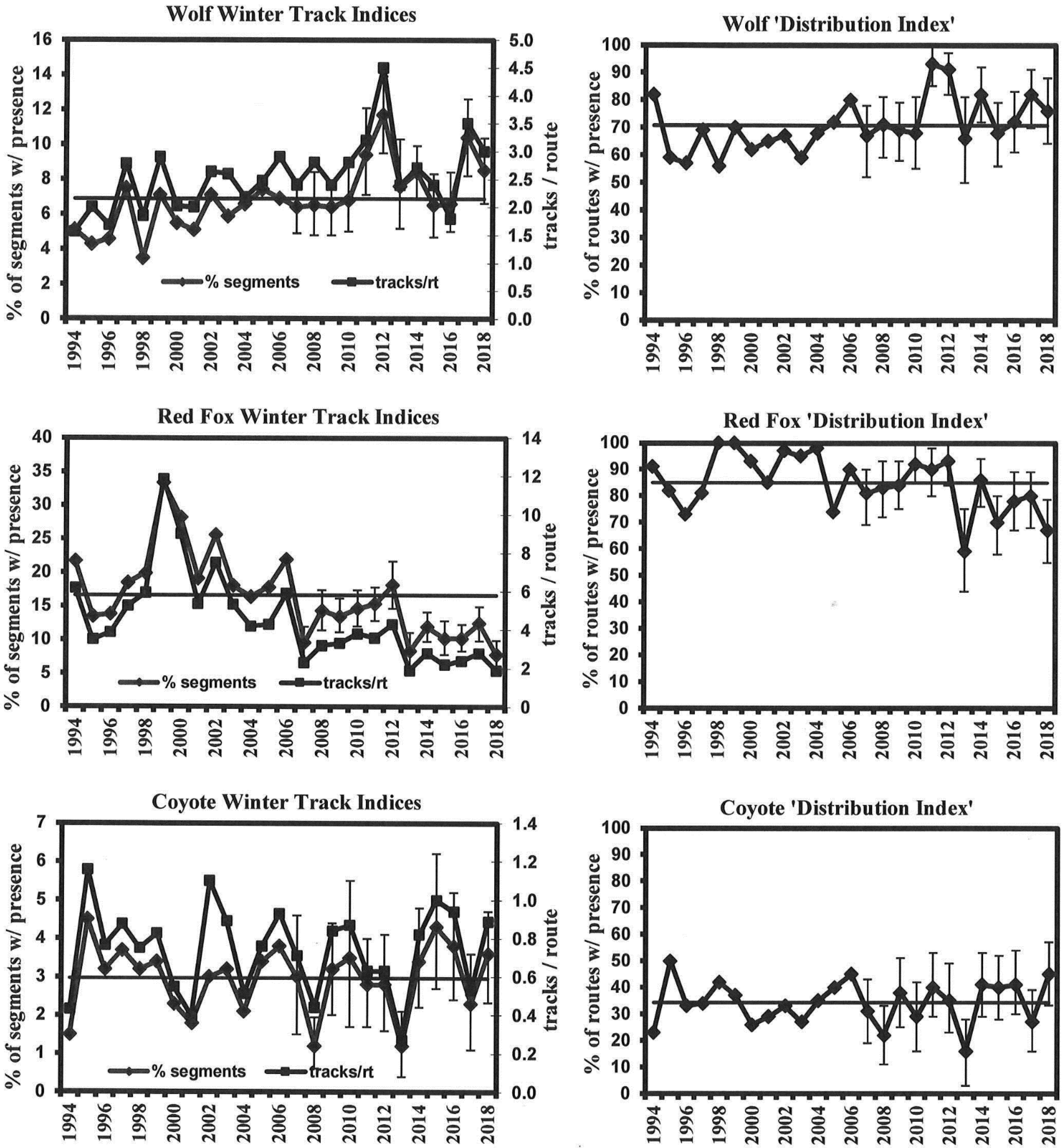


Figure 4 (continued). Winter track indices for selected species in Minnesota, 1994-2018.

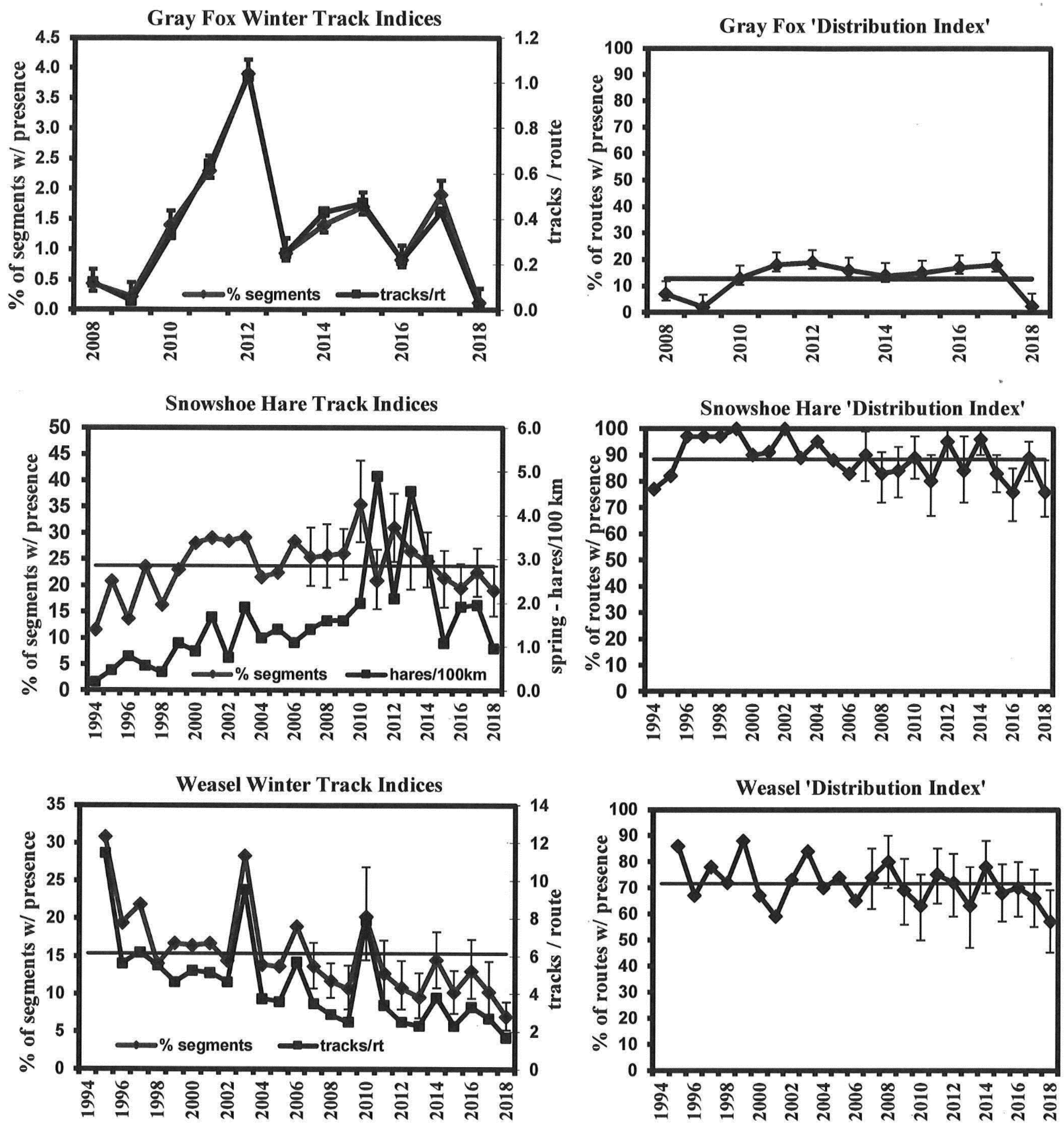


Figure 4 (continued). Winter track indices for selected species in Minnesota, 1994-2018.

REGISTERED FURBEARER POPULATION MODELING UPDATE 2019

John Erb, Forest Wildlife Populations and Research Group

INTRODUCTION

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

In the late 1970s, Minnesota developed population models for fishers (*Pekania pennanti*), martens (*Martes americana*), bobcats (*Lynx rufus*), and river otters (*Lontra canadensis*) to help estimate population size and monitor population changes. All are deterministic accounting models that do not currently incorporate density-dependence. However, annual adjustments to demographic inputs are often made for bobcats, fishers, and martens in response to the known or assumed influence of factors such as prey fluctuations, winter conditions, or competitor or predator density. Modeling projections are interpreted in conjunction with harvest data and results from any annual field-based track surveys.

METHODS

Primary model inputs include the estimated 1977 'starting' population size, estimates of age-specific survival and reproduction, and sex- and age-specific harvest data. Reproductive inputs were originally based largely on carcass data collected in the early 1980s. However, more recent reproductive data for fishers and martens was collected from 2007 – 2015 as part of a telemetry study (Erb et al. 2017), and for bobcats, additional carcass data was collected in 1992 and from 2003-present. Initial and subsequent survival inputs were based on a review of published estimates in the literature, updated for fishers and martens based on recent Minnesota research, and are periodically adjusted based on presumed relationships as noted above. In some cases, parameter adjustments for previous years are delayed until additional data on prey trends is available. Hence, population estimates reported in previous reports may not always match those reported in current reports.

Harvest data is obtained through mandatory furbearer registration. A detailed summary of 2018-19 harvest information is available in a separate report. Bobcat, marten, and fisher age data is obtained via x-ray examination of pulp cavity width or microscopic counts of cementum annuli from teeth of harvested animals. Although the population models only utilize data for the 3 age-classes (juvenile, yearling, adult), cementum annuli counts have periodically been collected for all non-juveniles either to examine age-specific reproductive output (bobcats) or to obtain periodic information on year-class distribution for selected species. The data was also used for deriving independent estimates of abundance using statistical population reconstruction (e.g., Skalski et al. 2012, Berg et al. 2017). In years where age data was not obtained for a given species, I use average harvest age proportions from the most recent period when data was collected.

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

RESULTS AND DISCUSSION

Bobcat. The 2018-19 state-registered trapping and hunting harvest of bobcats increased 39% to 1,015 (Table 1). Total modeled harvest, which includes reported tribal take, was 1,047. Juveniles accounted for 26% of the harvest, which was also comprised of 1.2 juveniles per adult female. Although both metrics have declined slightly over the past 3 years, they remain within the long-term observed range (Table 1, Figures 1 – 3). Median age for both male and female harvested bobcats was 2.5.

Reproductive data from female bobcats harvested in 2018 was also within previously observed bounds. Although there is a slight increasing trend in average litter sizes over the past 16 years, there has been minimal variation in reproductive output across years. Average litter sizes and pregnancy rates are slightly or significantly lower, respectively, for yearlings compared to older adults (Figures 4 and 5).

Based on projections from the population model, 14% of the fall 2018 population was harvested in 2018. Modeling projects minimal change to the 2019 fall population, projected to be near 8,000 bobcats (Figure 6). Both track indices remain near the upper end of their previously recorded range (Figure 6).

Fisher. The 2018 state-registered trapping harvest of fishers increased ~ 7% to 510 (Table 2). Modeled harvest, which includes reported tribal take, was 564.

After a 15-year lapse, fisher carcass collections were resumed in 2010 to collect current information on harvest age distribution; 488 carcasses were collected in 2018 (Table 2). Juveniles accounted for 54% of the total fisher harvest, similar to the average since aging resumed in 2010 but below the earlier average (64%) from 1977-1994. The juvenile to adult female ratio was 4.5, also similar to the post-2010 average but below the 1977-1994 average (6.6) (Table 2). Median age of harvested male and female fishers was 0.5 and 1.5, respectively (Figures 7 and 8).

Based on model projections, 7% of the fall fisher population was harvested during the 2018 season. Modeling projects a modest population increase over the past 3 years, in contradiction to the stable or slightly declining trend exhibited in the recent snow-track indices (Figure 9). Along the southern and western periphery of fisher range, an area not represented in track surveys, harvest and anecdotal information clearly indicate a population increase over the past 5-10 years. This area of range expansion is a comparatively small portion of overall fisher range, but may explain some of the discordance between track surveys (restricted to northern counties) and the spatially unbounded projections from the model. Acknowledging this caveat, modeling projects a 5% increase to the 2019 fall population, projected to be near 8,900 fishers statewide (Figure 9).

Marten. The 2018 state-registered trapping harvest of martens was 665, a 32% decline from the previous year (Table 3). Modeled harvest, which includes reported tribal take, was 732.

Juveniles accounted for 29% of the total harvest with a juvenile to adult female ratio of 2.3, both the second lowest since data collection began (Table 3, Figure 10). Though data suggests a long-term downward trend in these metrics, the low numbers this year are also likely part of shorter-term cyclic fluctuation in recruitment driven by prey cycles (Berg et al. 2017). Median age for both harvested males and females was 1.5 (Figures 11 and 12).

Based on projections from the marten population model, 7% of the fall 2018 population was harvested (Table 3). Similar to fishers, modeling projects a modest population increase in recent years, in contradiction to the stable or slightly declining trend exhibited in recent snow-track indices (Figure 13). Contrary to fishers, however, spatial discordance between the track surveys and modeling projections is an unlikely explanation. It remains unclear whether track surveys are becoming biased low, model projections biased high, or both. Acknowledging this uncertainty, modeling projects a 12% increase to the 2019 fall population, projected to be near 11,100 martens (Figure 13).

Otter. From 1977 - 2007, otter harvest was only allowed in the northern part of the state. From 2007-2009, otter harvest was allowed in 2 separate zones with differing individual trapper limits (4 in the north zone, 2 in the southeast zone). Beginning in 2010, otter harvest was allowed statewide with a consistent limit of 4 otters per trapper. The 2018 state-registered trapping harvest of otters increased 4% to 1,351 (Table 4). Modeled statewide otter harvest, which includes tribal take, was 1,398 (Table 4).

An estimated 8% of the fall 2018 otter population was harvested, similar to the previous 2 years. Carcass collections ended in 1986 so no age or reproductive data are available, and no harvest-independent otter survey is currently established. Because demographic parameters in the otter model are usually held constant, fluctuations in population trajectory are largely a function of varying harvest levels. At recent population levels, harvests exceeding ~3,000 for consecutive years typically predict population declines. Since 2002, otter population estimates have varied as a result of notable fluctuations in pelt prices that have altered harvest above and below this threshold. With harvests remaining well below this threshold in recent years, and carrying capacity or density-dependent demographic constraints not currently incorporated in to the model, population projections are likely to be, or to become, unrealistic. Nevertheless, the population clearly remains near its high point estimated over the past 35 years (Figure 14), with the 2019 fall population projected to be ~ 22,000, a 9% increase from 2018.

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Table 1. Bobcat harvest data, 1989 to 2018.

Year	DNR Harvest	Modeled Harvest[1]	% Autumn Pop. Taken[2]	Carcasses Examined	% juveniles	% yearlings	% adults	Juv: Ad Female ratio	% Male juveniles	% Male yearlings	% Male adults	Overall % males	Mean Pelt Price[3]
1989	129	129	6	119	39	17	44	2.0	49	53	56	53	$48
1990	84	87	4	62	20	34	46	0.8	58	80	44	59	$43
1991	106	110	5	93	35	33	32	3.5	59	55	70	61	$37
1992	167	167	7	151	28	22	50	1.2	55	45	53	53	$28
1993	201	210	8	161	32	20	48	1.4	51	45	52	50	$43
1994	238	270	11	187	26	16	58	0.8	64	43	45	50	$36
1995	134	152	6	96	31	15	54	2.7	57	71	79	71	$32
1996	223	250	10	164	35	20	45	1.8	51	30	49	46	$33
1997	364	401	16	270	35	16	49	1.4	60	37	43	48	$30
1998	103	107	4	77	29	26	45	1.6	59	60	60	60	$28
1999	206	228	8	163	18	24	58	0.8	55	59	62	60	$24
2000	231	250	8	183	31	26	43	1.4	54	59	50	53	$33
2001	259	278	8	213	30	21	49	1.3	46	45	47	52	$46
2002	544	621	15	475	27	25	48	1.1	68	51	48	54	$72
2003	483	518	13	425	25	13	62	0.9	62	48	54	55	$96
2004	631	709	14	524	28	34	38	1.7	52	40	55	49	$99
2005	590	638	13	485	25	13	62	0.8	51	48	47	48	$96
2006	890	983	18	813	26	17	57	1.1	60	51	58	57	$101
2007	702	758	14	633	34	14	52	1.2	55	60	47	52	$93
2008	853	928	15	714	26	25	49	1.1	55	52	50	52	$75
2009	884	942	15	844	24	22	54	0.9	57	46	51	51	$43
2010	1012	1042	15	955	38	16	46	1.4	62	55	42	52	$71
2011	1711	1898	26	1626	23	21	55	0.8	61	73	47	56	$98
2012	1875	2026	30	1744	25	19	56	1.0	63	53	54	56	$144
2013	1038	1128	20	634	35	18	47	1.4	59	50	48	52	$89
2014	1384	1453	27	1296	28	16	56	1.3	60	48	60	58	$60
2015	766	803	17	674	24	25	51	1.3	63	63	65	64	$57
2016	484	491	9	464	32	21	47	1.9	66	57	64	63	$36
2017	731	758	12	682	29	25	46	1.5	65	51	58	58	$64
2018	1015	1047	14	984	26	22	52	1.2	59	57	60	59	$60

[1] Includes DNR and Tribal harvests

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

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

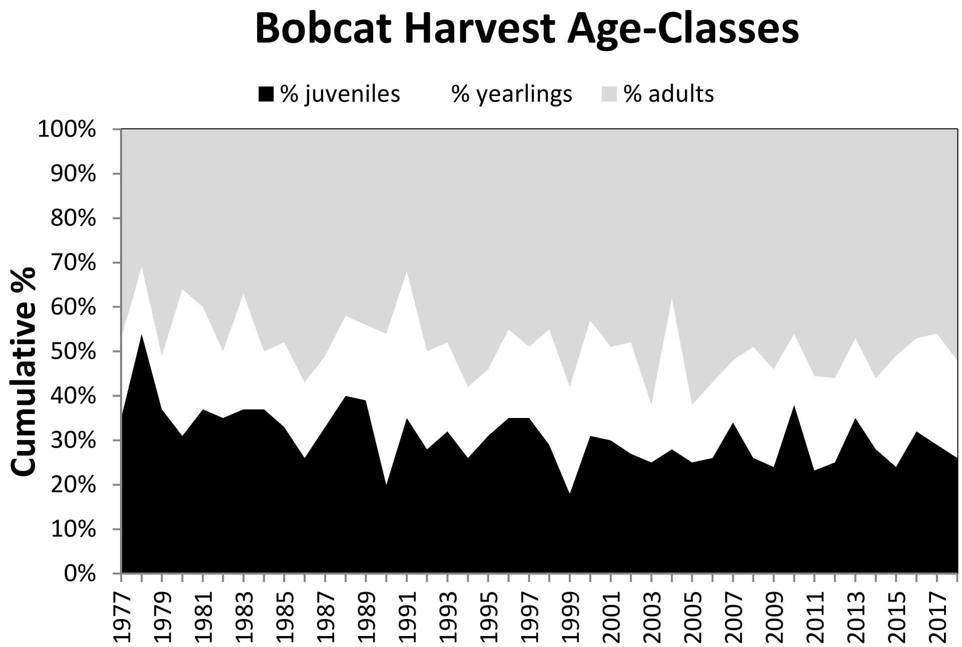


Figure 1. Age-class distribution of bobcats harvested in Minnesota, 1977-2018.

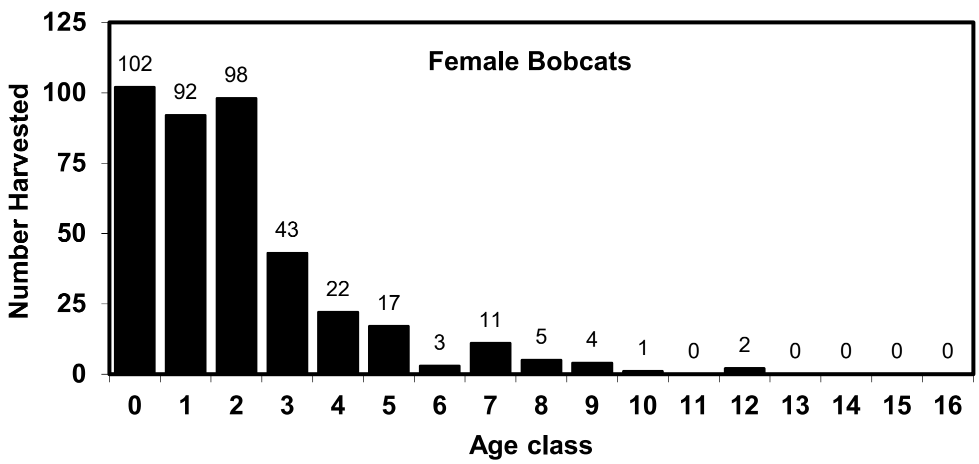


Figure 2. Age structure of female bobcats in the 2018 harvest.

Figure 3. Age structure of male bobcats in the 2018 harvest.

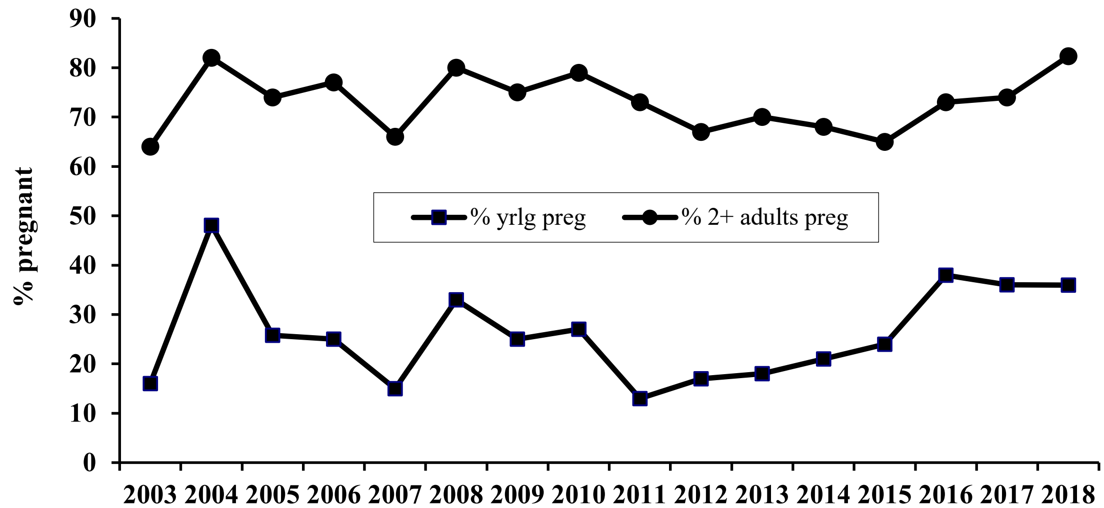


Figure 4. Pregnancy rates for yearling and adult bobcats in Minnesota, 2003-2018.

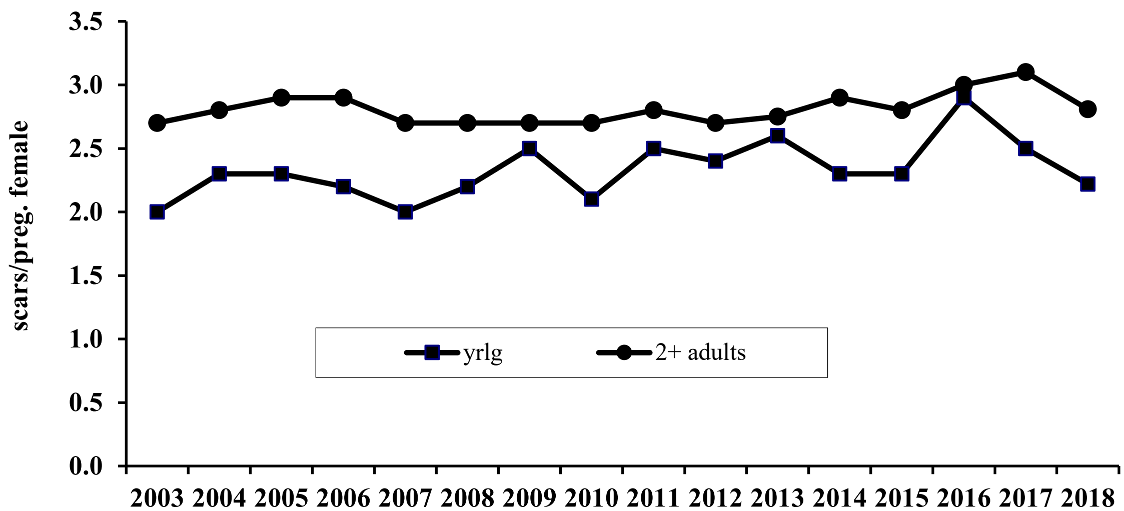


Figure 5. Litter size for parous yearling and adult bobcats in Minnesota, 2003-2018.

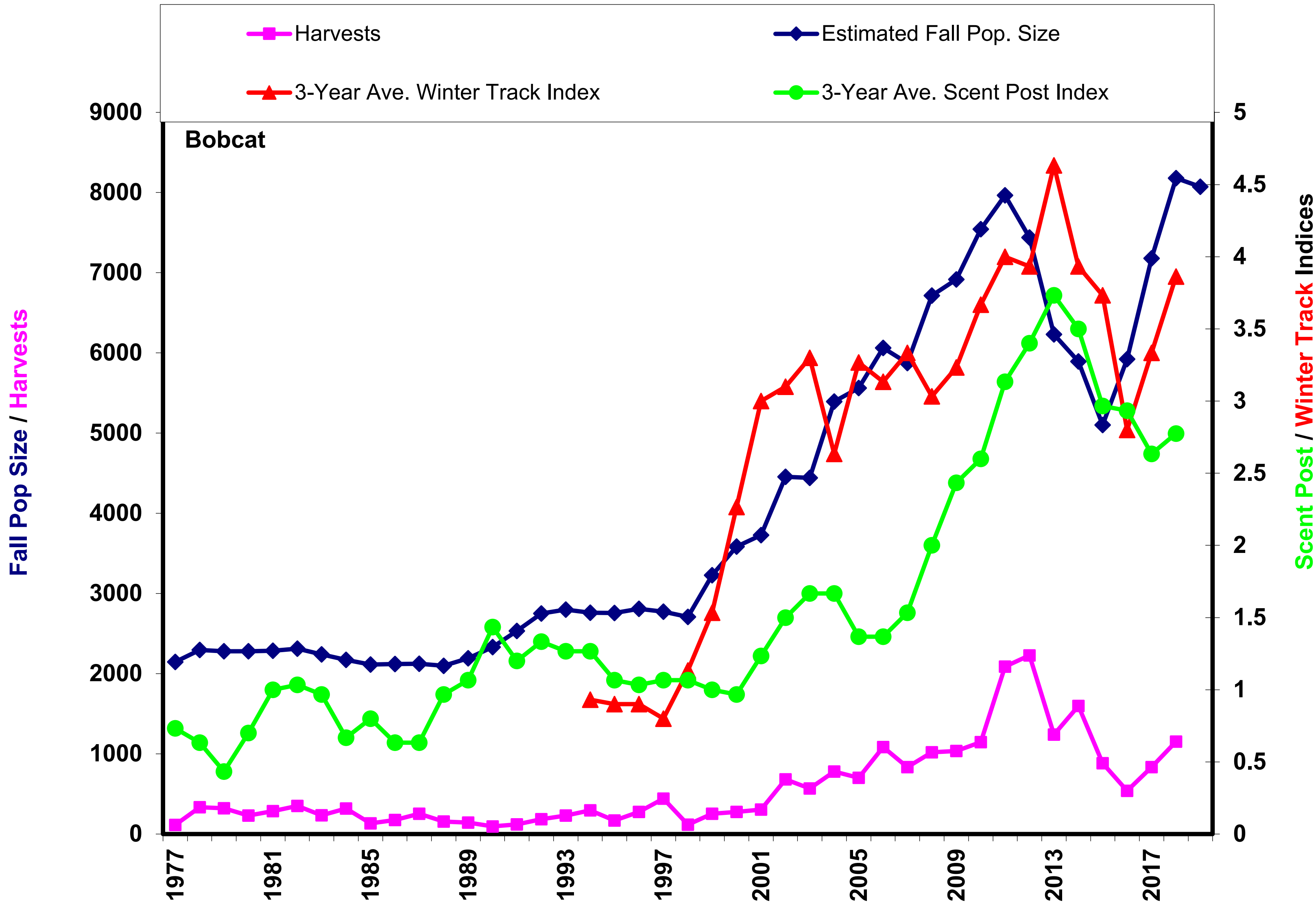


Figure 6. Bobcat population projections, harvests, and survey indices, 1977-2019. Harvests include an estimate of non-reported take.

Table 2. Fisher harvest data, 1989 to 2018.

Year	DNR harvest	Modeled Harvest[1]	% Autumn Pop. Harvested[2]	Carcasses examined	% juveniles	% yearlings	% adults	Juv: Ad. Female ratio	% male juveniles	% male yearlings	% male adults	% males overall	Pelt price Males[3]	Pelt price Females[3]
1989	1243	1243	16	1024	64	19	17	5.8	47	47	36	45	$26	$53
1990	746	756	9	592	65	14	21	4.4	44	55	30	43	$35	$46
1991	528	528	6	410	66	20	14	7.5	50	52	35	48	$21	$48
1992	778	782	8	629	58	21	21	4.8	42	55	45	46	$16	$29
1993	1159	1192	10	937	59	22	19	6.0	47	37	42	44	$14	$28
1994	1771	1932	15	1360	57	18	25	4.0	47	54	44	48	$19	$30
1995	942	1060	8	-	-	-	-	-	-	-	-	45	$16	$25
1996	1773	2000	14	-	-	-	-	-	-	-	-	45	$25	$34
1997	2761	2974	20	-	-	-	-	-	-	-	-	45	$31	$34
1998	2695	2987	20	-	-	-	-	-	-	-	-	45	$19	$22
1999	1725	1880	13	-	-	-	-	-	-	-	-	45	$19	$20
2000	1674	1900	13	-	-	-	-	-	-	-	-	45	$20	$19
2001	2145	2362	15	-	-	-	-	-	-	-	-	54	$23	$23
2002	2660	3028	20	-	-	-	-	-	-	-	-	54	$27	$25
2003	2521	2728	19	-	-	-	-	-	-	-	-	55	$27	$26
2004	2552	2753	20	-	-	-	-	-	-	-	-	52	$30	$27
2005	2388	2454	19	-	-	-	-	-	-	-	-	52	$36	$31
2006	3250	3500	29	-	-	-	-	-	-	-	-	51	$76	$68
2007	1682	1811	18	-	-	-	-	-	-	-	-	52	$63	$48
2008	1712	1828	19	-	-	-	-	-	-	-	-	52	$22	$37
2009	1259	1323	15	-	-	-	-	-	-	-	-	53	$35	$34
2010	903	951	11	759	52	25	23	4.5	55	54	50	54	$38	$37
2011	1473	1651	19	1314	47	28	25	3.2	59	53	42	53	$48	$40
2012	1293	1450	18	1108	51	24	25	3.7	59	53	45	54	$62	$63
2013	1146	1295	17	1040	51	24	25	3.4	55	56	42	52	$74	$68
2014	943	1045	15	881	56	21	23	3.7	57	57	36	52	$44	$55
2015	756	818	12	698	55	19	26	3.8	57	52	44	53	$35	$34
2016	399	434	6	348	56	22	22	4.5	53	56	42	51	$28	$37
2017	477	509	7	440	52	30	18	6.4	65	51	58	58	$31	$38
2018	510	564	7	488	54	24	22	4.5	59	48	46	53	$43	$40

[1] Includes DNR and Tribal harvests

[2] Estimated from population model, includes estimated non-reported harvest of 20% 1977-1992, and 10% from 1993-present.

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

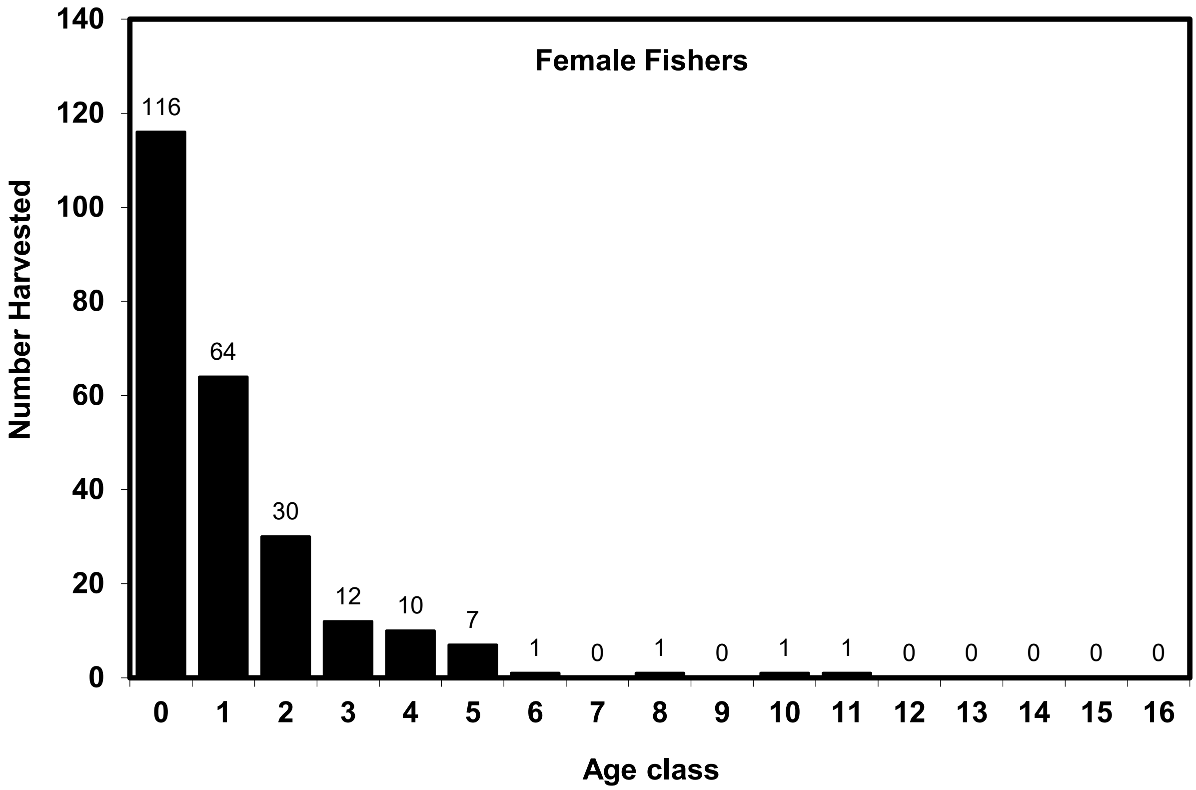


Figure 7. Age structure of female fishers in the 2018 harvest.

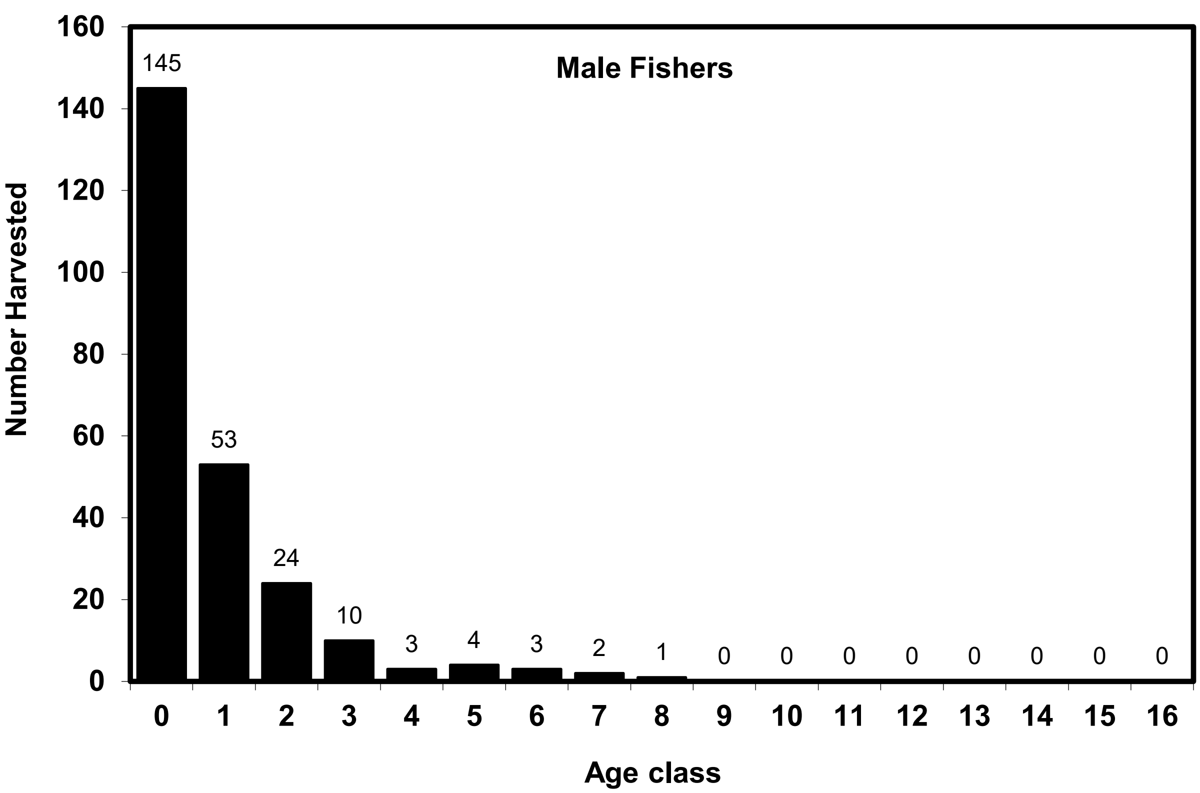


Figure 8. Age structure of male fishers in the 2018 harvest.

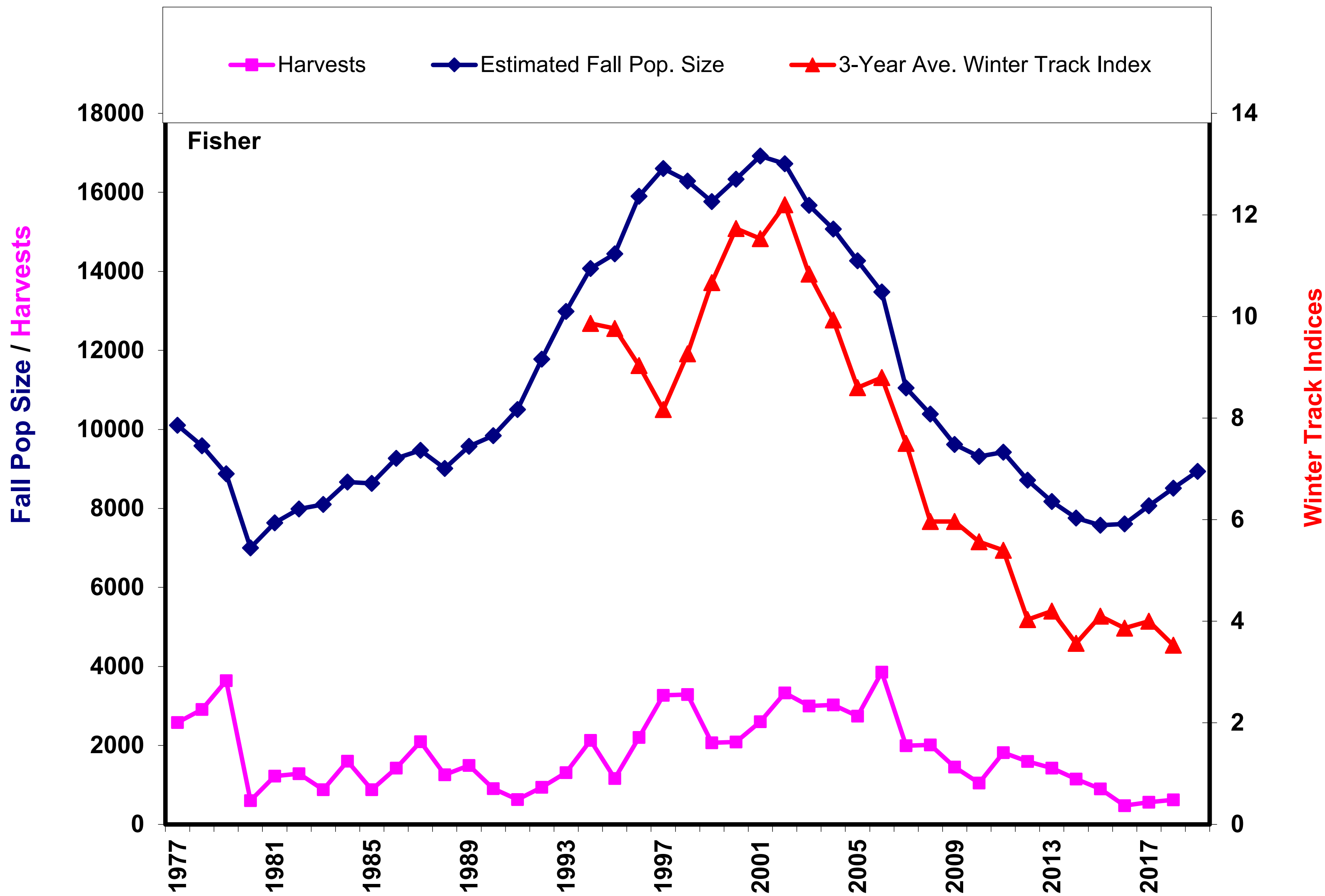


Figure 9. Fisher population projections, harvests, and survey indices, 1977-2019. Harvests include an estimate of non-reported take.

Table 3. Marten harvest data, 1989 to 2018.

Year	DNR harvest	Modeled Harvest[1]	% Autumn Pop. Harvested[2]	Carcasses Examined[3]	% juveniles	% yearlings	% adults	Juv: Ad. Female ratio	% male juveniles	% male yearlings	% male adults	% males overall	Pelt price Males[4]	Pelt price Females[4]
1989	2119	2119	18	1014	68	12	20	9.9	57	63	65	59	$48	$47
1990	1349	1447	12	1375	48	18	34	3.6	59	54	61	59	$44	$41
1991	686	1000	9	716	74	9	17	13.5	69	71	72	70	$40	$27
1992	1602	1802	14	1661	65	18	17	14.8	63	70	75	66	$28	$25
1993	1438	1828	13	1396	57	20	23	7.6	61	71	67	64	$36	$30
1994	1527	1846	13	1452	58	15	27	6.5	62	76	67	66	$34	$28
1995	1500	1774	12	1393	60	18	22	8.2	63	68	66	65	$28	$21
1996	1625	2000	14	1372	48	22	30	4.9	62	69	67	65	$34	$29
1997	2261	2762	19	2238	61	13	26	6.2	60	60	63	61	$28	$22
1998	2299	2795	20	1577	57	18	25	6.5	62	66	65	63	$20	$16
1999	2423	3000	20	2013	67	12	21	9.9	65	66	67	66	$25	$21
2000	1629	2050	14	1598	56	25	19	8.8	62	69	66	64	$28	$21
2001	1940	2250	15	1895	62	15	23	10.7	65	73	74	69	$24	$23
2002	2839	3192	19	2451	38	30	32	3.3	59	65	62	62	$28	$27
2003	3214	3548	22	2391	49	16	35	4.2	59	66	68	64	$30	$27
2004	3241	3592	25	2776	26	28	46	1.4	54	67	59	60	$31	$27
2005	2653	2873	22	1992	62	13	25	7.2	66	64	66	66	$37	$32
2006	3788	4120	31	1914	64	17	19	9.5	67	68	67	67	$74	$66
2007	2221	2481	22	1355	30	29	41	1.6	60	68	54	60	$59	$50
2008	1823	1953	20	1095	40	21	39	2.4	62	64	57	60	$31	$28
2009	2073	2250	23	1252	55	16	29	5.1	67	49	63	63	$27	$30
2010	1842	1977	20	1202	47	25	28	4.4	71	56	62	65	$40	$37
2011	2525	2744	28	1615	39	25	36	2.7	64	64	60	62	$42	$39
2012	1472	1610	19	1260	34	30	36	2.6	67	57	64	63	$57	$54
2013	1014	1323	16	942	43	20	37	3.5	59	62	68	63	$74	$71
2014	1059	1124	13	991	58	14	28	5.8	65	67	64	65	$45	$34
2015	877	956	11	812	49	25	26	4.9	64	69	60	64	$31	$29
2016	551	677	7	504	56	23	21	8.1	68	73	68	69	$30	$30
2017	979	1076	11	865	50	25	25	5.0	63	72	60	64	$39	$38
2018	665	732	7	638	29	34	37	2.3	63	69	66	66	$42	$33

[1] Includes DNR and Tribal harvests

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

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

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

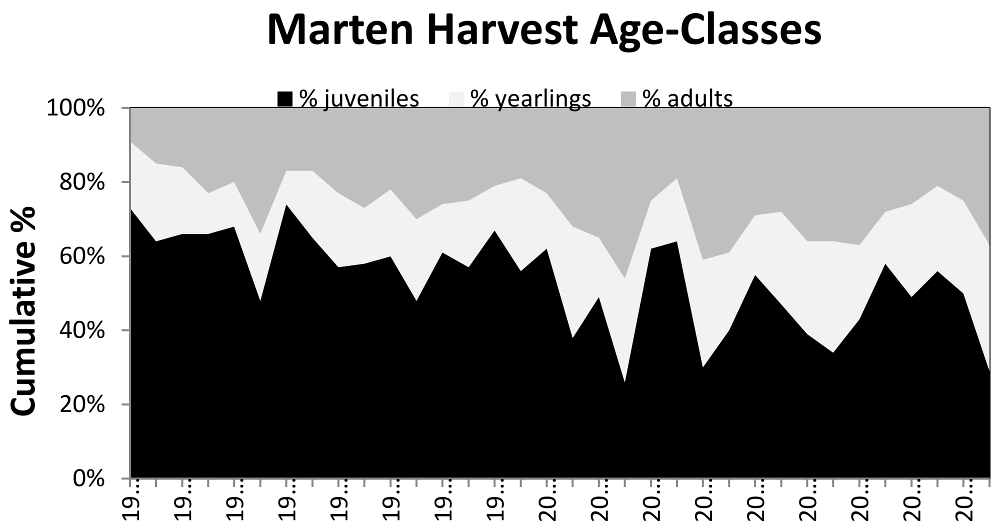


Figure 10. Age-class distribution of martens harvested in Minnesota, 1985 - 2018.

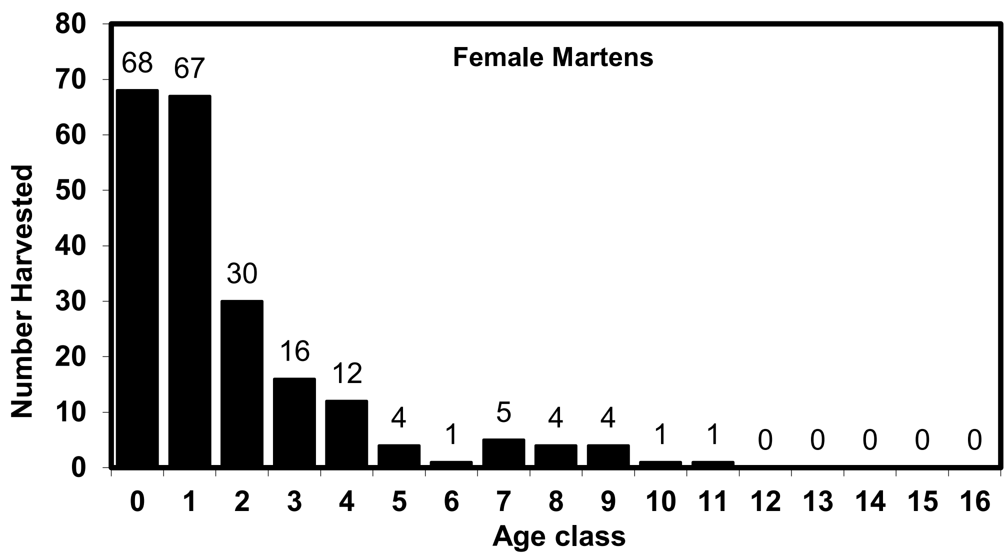


Figure 11. Age structure of female martens in the 2018 harvest.

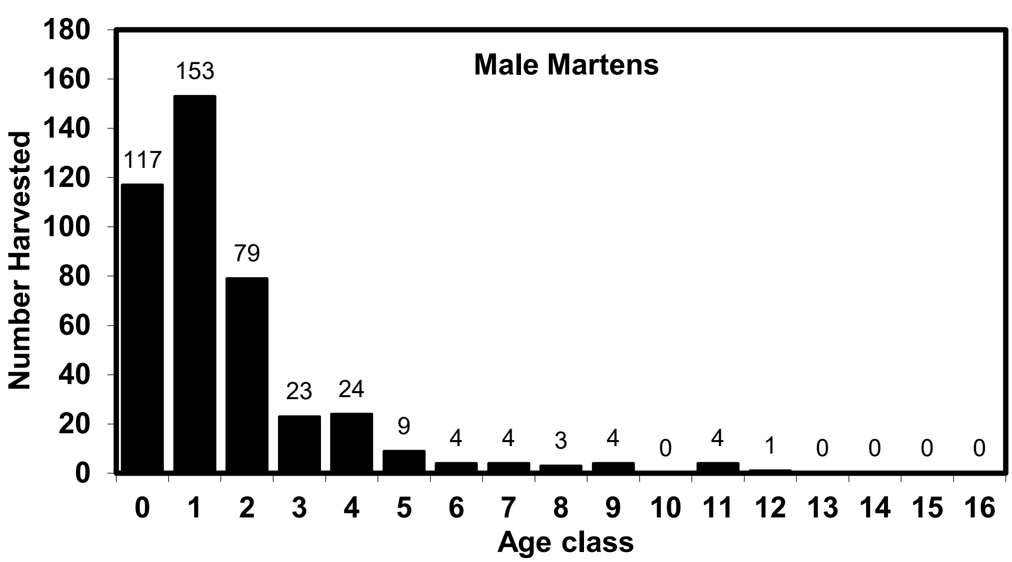


Figure 12. Age structure of male martens in the 2018 harvest.

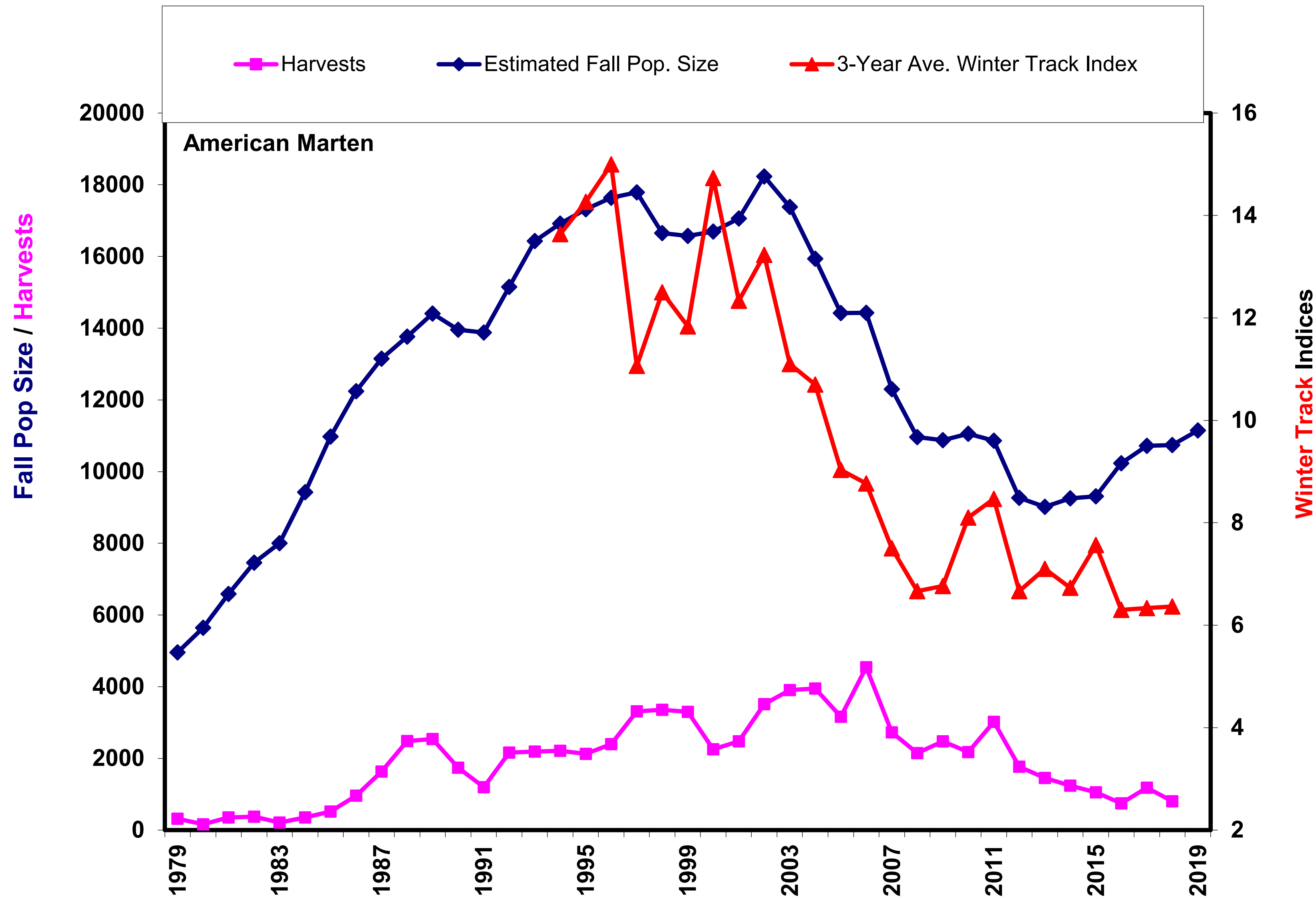


Figure 13. American marten population projections, harvests, and survey indices, 1979-2018. Harvests include an estimate of non-reported take.

Table 4. Otter harvest data[1], 1989 to 2018. Carcasses were only collected from 1980-86.

Year	DNR harvest	Modeled Harvest[1]	% Autumn Pop. Harvested[2]	Carcasses examined	% juveniles	% yearlings	% adults	Juv:ad. females	% Male juveniles	% Male yearlings	% Male adults	% Males overall	Pelt price Otter[3]	Pelt price Beaver[3]
1989	1294	1294	12	-	-	-	-	-	-	-	-	52	$22	$12
1990	888	903	8	-	-	-	-	-	-	-	-	52	$24	$9
1991	855	925	8	-	-	-	-	-	-	-	-	51	$25	$9
1992	1368	1365	10	-	-	-	-	-	-	-	-	52	$30	$7
1993	1459	1368	10	-	-	-	-	-	-	-	-	52	$43	$10
1994	2445	2708	18	-	-	-	-	-	-	-	-	52	$48	$14
1995	1435	1646	12	-	-	-	-	-	-	-	-	52	$39	$12
1996	2219	2500	17	-	-	-	-	-	-	-	-	52	$39	$19
1997	2145	2313	16	-	-	-	-	-	-	-	-	52	$40	$17
1998	1946	2139	15	-	-	-	-	-	-	-	-	52	$34	$13
1999	1635	1717	12	-	-	-	-	-	-	-	-	52	$41	$11
2000	1578	1750	12	-	-	-	-	-	-	-	-	52	$51	$14
2001	2301	2531	17	-	-	-	-	-	-	-	-	57	$46	$13
2002	2145	2390	15	-	-	-	-	-	-	-	-	59	$61	$10
2003	2766	2966	19	-	-	-	-	-	-	-	-	57	$85	$12
2004	3450	3700	24	-	-	-	-	-	-	-	-	56	$87	$14
2005	2846	3018	22	-	-	-	-	-	-	-	-	58	$89	$15
2006	2720	2873	21	-	-	-	-	-	-	-	-	56	$43	$17
2007	1861	1911	15	-	-	-	-	-	-	-	-	55	$29	$16
2008	1938	1983	15	-	-	-	-	-	-	-	-	59	$24	$12
2009	1544	1578	12	-	-	-	-	-	-	-	-	59	$36	$13
2010	1814	1830	13	-	-	-	-	-	-	-	-	57	$35	$13
2011	2294	2490	17	-	-	-	-	-	-	-	-	58	$51	$17
2012	3171	3377	22	-	-	-	-	-	-	-	-	60	$72	$16
2013	2824	2993	21	-	-	-	-	-	-	-	-	48	$61	$17
2014	2154	2235	16	-	-	-	-	-	-	-	-	59	$35	$12
2015	1955	2030	14	-	-	-	-	-	-	-	-	62	$30	$8
2016	1195	1227	8	-	-	-	-	-	-	-	-	62	$21	$8
2017	1295	1336	8	-	-	-	-	-	-	-	-	60	$22	$10
2018	1351	1398	8	-	-	-	-	-	-	-	-	57	$25	$9

[1] Includes DNR and Tribal harvests

[2] Estimated from population model. Incl. estimated non-reported harvest of 30% to 1991, 22% from 1992-2001, and 15% from 2002-present.

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

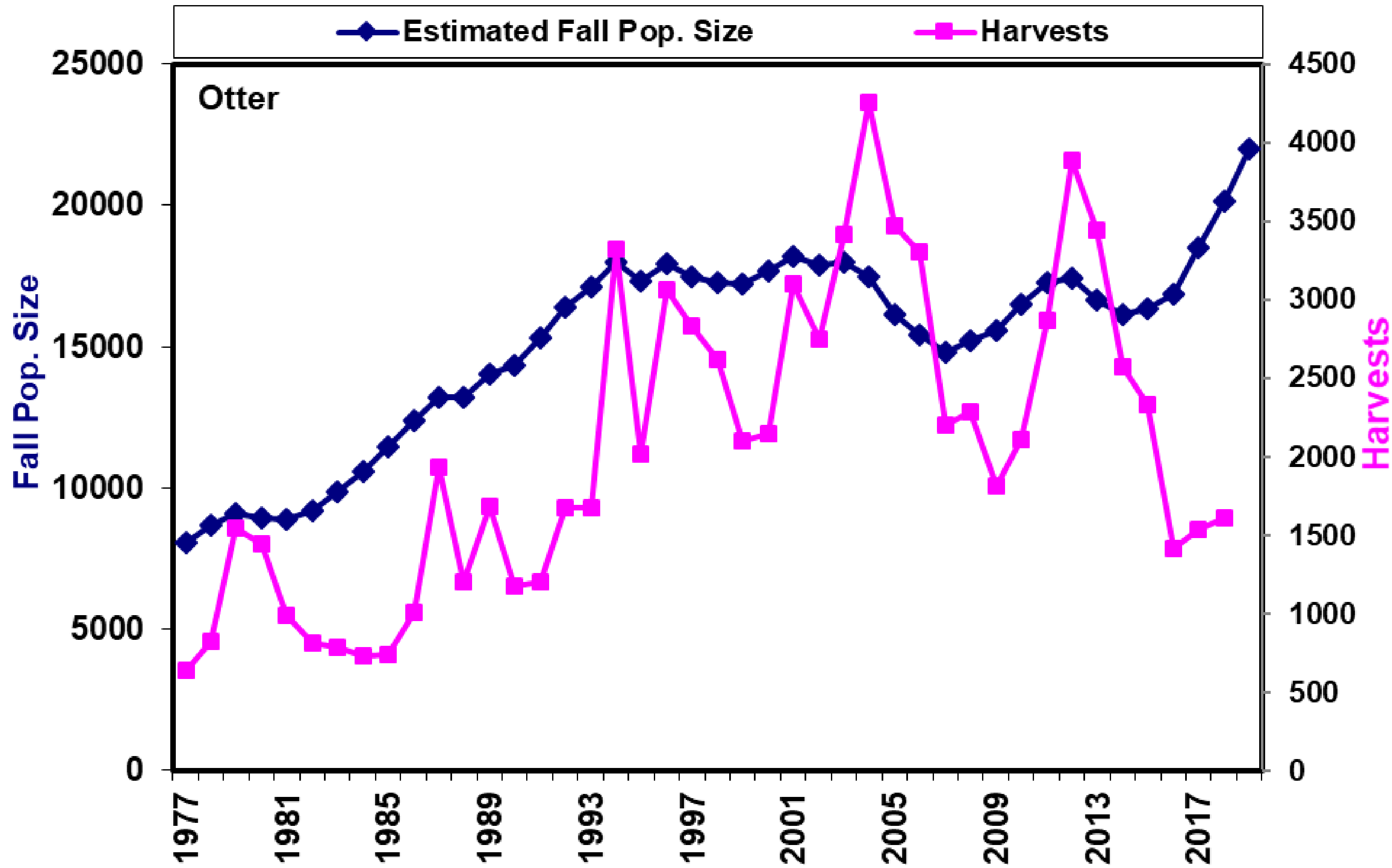


Figure 14. Otter population projections and harvests, 1977-2018. Harvests include an estimate of non-reported take.

STATUS OF MINNESOTA BLACK BEARS, 2018

Dave Garshelis and Andy Tri, Forest Wildlife 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. Additionally, population information may be inferred by examination of nuisance bear complaints and the seasonal abundance of natural bear foods.

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 statewide

Ages of harvested bears accumulated since 1980 were used to reconstruct minimum statewide population sizes through time (i.e., the size of the population that eventually died due to hunting) using a technique formulated by Downing. This was scaled upwards (to include bears that died of other causes), using 4 statewide tetracycline mark–recapture estimates as a guide. One trajectory, which assumed non-harvest mortality was 23% of total mortality (curves elevated x1.3) matched the 1991 tetracycline estimate, but fell below the other tet-estimates. Another trajectory, which assumed non-harvest mortality was 44% of all mortality (curves elevated x1.8) matched the 1997, 2002, and 2008 tet-estimates (Figures 1 & 2).

This year another population trajectory was added, derived from a Bayesian model recently developed by Allen et al. (2018) for bear monitoring in Wisconsin. Besides the sex-ages of harvested bears, this model also includes reproductive and survival parameters.

From 1980 to 2000, the Allen matched the Downing model that included 23% non-harvest mortality. But in the last 10 years, the Allen model better matched the Downing model with 44% non-harvest mortality. However, whereas both models show a decline since the late 1990s, that decline is much less steep in the Allen model.

Since 2013, quotas were maintained at a low and consistent level (Table 1) in an attempt to reverse the population decline (and also to allow the models to perform better, without the confounding issue of changing hunter effort). The Downing model indicates the reduced hunting pressure has worked, enabling a population increase from 2014 to 2016 (although estimates for 2017 and 2018 are not obtainable with this model). The Allen model, in contrast, shows a continued decline until pre-hunt 2015, and then a leveling off (at 11–12,000 bears, excluding cubs) through 2018.

Of note, 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), non-harvest mortality should comprise a greater proportion of total mortality. Therefore, it is possible that the Downing curve should be higher in recent years (which have lower harvest rates; see Fig. 3). That would make the disparity between the Allen and Downing trajectories greater during the most recent years.

Population trend: quota vs no-quota zones

Downing reconstruction indicated vastly different population trajectories for the quota and no-quota zones (Figure 2). Whereas the quota zone has shown a decline of about 50% of the population from 2000 to 2014, the no-quota zone remained relatively stable. With reduced quotas and lower harvests since then, the quota zone population increased almost 10% in 2 years (2014–2016), according to this model. Meanwhile, despite a surge in "overflow" hunters in the no-quota zone (Figure 4) prompted by the lower number of quota zone permits available, harvests in the no-quota zone have not increased, and the Downing model shows a recent population increase.

The Downing model does not produce population estimates for the most recent 2 years, so the effects of the high harvest in 2016 (in both quota and no-quota zones) is not yet reflected in the trajectories of this model.

Trends in harvest rates

The sex ratio of harvested bears varies by age in accordance with the relative vulnerability of the sexes (Figure 3). Male bears are more vulnerable to harvest than females, so males always predominate among harvested 1-year-olds (67–75%). Males also predominate, but less strongly among 2 and 3-year-old harvested bears. However, older-aged harvested bears (≥8 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 in the living population. The age at which the line fitted to these proportions crosses the 50:50 sex ratio is approximately the inverse of the harvest rate. Segregating the data into time blocks showed harvest rates increasing from 1980–1999, then declining with reductions in hunter numbers (Figure 5). Based on this method, harvest rates since 2015 have been significantly less than what they were in the early 1980s, when the bear population was increasing (Figure 1).

One problem in using this very simple method is that it assumes that the relative difference for males versus females in their vulnerability to harvest does not change systematically through time. This may not be true, given the steadily increasing male-skewed harvests since the late 1990s, and especially in recent years (Figures 6 & 7).

Nuisance complaints and kills

The total number of recorded bear complaints slowly increased over the past decade, reaching a peak in 2015 and 2016 (Table 2, Figure 8). Number of complaints declined in 2017, despite a higher number of DNR personnel recording complaints, and declined again in 2018, with abundant natural foods all summer (Tables 3 & 4). A new recording system was instituted in 2017 whereby Wildlife Managers recorded all bear complaints online as they were received, instead of submitting reports at the end of each month (thus, unlike previous years, Managers who had no complaints were not counted in the number of personnel participating). Conservation Officers continued to use the monthly reporting system (and recorded zero when they had no complaints). In 2018, although the total number of complaints was the lowest since 2011, hotspots of nuisance activity were apparent: Little Falls, Park Rapids, Brainerd, Bemidji (all with 30–50 recorded complaints) and Cloquet (85 complaints). The number of nuisance bears killed equaled that of 2011, the lowest since recording began in 1982. In 2018 a list was distributed of 116 “area 88” hunters, who expressed interest in taking a nuisance bear in the quota area on a no-quota license. We have no records of any hunters doing so (it is unclear how many were authorized to do so).

Food abundance

The composite range-wide, all-season abundance of natural bear foods (fruits and nuts) in 2018 was the second highest on record and considerably higher than 2015–2017 (Table 3). Abundance of nearly all the summer foods was well above the long-term (34-year) average (Table 4), in all but the west-central region. On the other hand, fall foods were high in the west-central and east-central regions (Table 5). The statewide fall food index (productivity of dogwood+oak+hazel), which helps predict annual harvest after accounting for hunter effort (Figures 9 &10), was the highest since 2002, because fall foods were so high in the west-central and east-central areas (but near normal in the northwest). Hazelnut production was average in the northwest, and above-average in most other areas (with patches of exceptional production). Dogwood production was generally above-average across the range. Oak production occurred in 3 bands, increasing from average to exceptional along a northwest to southeast gradient.

Predictions of harvest from food abundance

The 2018 statewide harvest was close, but slightly higher than expected (1766 actual vs. 1715 predicted), based on regression of harvest as a function of hunter numbers and the fall food productivity index (Figure 10). This regression is even stronger (and has accurately predicted previous harvests) when only the past 15 years are considered. For the quota zone, the actual harvest in 2018 was also close but higher (1272 actual vs. 1201 predicted) than predicted by this regression.

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

Table 1. Number of bear hunting quota area permits available, 2013–2018. Highlighted values show a change from the previous year. BMUs 26 and 44 were divided into 27/28 and 46/47, respectively, in 2016.

				2016			
BMU	**2013**	**2014**	**2015**	**Before BMU split [a]**	**After BMU split**	**2017**	**2018**
12	200	200	150	150	150	125	125
13	250	250	250	250	250	225	225
22	50	50	50	50	50	50	50
24	200	200	200	200	200	175	175
25	500	500	500	500	500	400	400
26	350	350	350	325			
27					250	225	225
28					75	60	60
31	550	550	550	550	550	500	500
41	150	150	150	125	125	125	125
44	450	450	450	450			
46					400	350	350
47					50	40	40
45	150	150	150	250	250	175	175
51	900	900	900	1000	1000	900	900
Total	**3750**	**3750**	**3700**	3850	**3850**	**3350**	**3350**

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

Table 2. Number of nuisance bear complaints registered by Conservation Officers and Wildlife Managers during 1998–2018, including number of nuisance bears killed and translocated, and bears killed in vehicular collisions.

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017 [j]	2018 [j]
Number of personnel participating in survey [a]	71	52	60	54	50	39	34	42	46	46	37	51	40	34	56	63	64	61	55	86 (51,35)	78 (56,23)
Complaints examined on site	226	189	105	122	75	81	75	61	57	63	59	65	70	37	113	69	79	97	118	71 (22,49)	40 (21,19)
Complaints handled by phone [b]	743	987	618	660	550	424	507	451	426	380	452	535	514	396	722	623	570	840	780	644 (450,194)	438 (369,69)
Total complaints received	969	1176	723	782	625	505	582	512	483	443	511	600	584	433	835	692	649	937	898	715	478
• % Handled by phone	77%	84%	85%	84%	88%	84%	87%	88%	88%	86%	88%	89%	88%	91%	86%	90%	88%	90%	87%	90%	92%
Bears killed by: • Private party or DNR	31	25	25	22	12	13	25	28	11	21	22	23	22	9	16	24	26	45	53	22 (4, 18)	9 [k] (4,5)
• Hunter before season [c]																					
– from nuisance survey	23	5	7	4	0	3	3	6	2	18	3	4	3	3	11	0	0	1	13	1	2
– from registration file	31	24	43	20	11	8	4	13	6	25	5	15	10	5	12	0	1	4	6	3	11 [m]
• Hunter during/after season [d]	3	0	1	1	0	0	0	1	0	0	0	0	0	0	0	1	0	1	1	1	0
• Hunter by Area 88 license [e]																				1	[m]
• Permittee [f]	11	7	2	6	4	6	1	5	4	5	1	3	5	0	0	1	0	3	0	0	1
Bears translocated	24	29	1	6	3	1	3	3	3	1	3	2	2	2	0	3	2	0	0	0	0
• % bears translocated [g]	11	15	1	5	4	1	4	5	5	2	5	3	3	5	0	4	3	0	0	0	0
Bears killed by cars [h]	61	60	39	43	26	25	16	22	18	20	27	18	28	15	33	32	28	47 h	27	9 (0,9) [h]	25 (15,10) [h]

Table 8. (continued)

a Maximum number of people turning in a nuisance bear report each month. Monthly reports were required beginning in 1984, and included cases of zero complaints. In 2017, the recording system was changed, where it was no longer possible to differentiate Wildlife Managers who participated month by month. Instead, the number reflects the total number of people receiving and recording at least 1 complaint during that year. For consistency, the records from Conservation Officers were handled the same way.

b If a complaint was handled by phone, it means a site visit was not made.

c The discrepancy between the number recorded on the nuisance survey and the number registered before the opening of the season indicates incomplete data. Similarity between the two values does not necessarily mean the same bears were reported.

d Data only from nuisance survey because registration data do not indicate whether bear was a nuisance.

e Beginning in 2017, hunters could choose Area 88 in the quota lottery, and if drawn, could hunt for a nuisance bear, if authorized. In 2017, 11 hunters were authorized, but only 1 killed a bear.

f A permit for non-landowners to take a nuisance bear before the bear season was officially implemented in 1992, but some COs individually implemented this program in 1991. Data are based on records from the nuisance survey, not directly from permit receipts. Only 4 bears have been killed by permittees since 2011.

g Percent of on-site investigations resulting in a bear being captured and translocated.

h Car kill data were reported on the monthly nuisance form for the first time in 2005. In all previous years, car kill data were from Enforcement's confiscation records. In 2015, confiscation records had more car-kills than the nuisance survey (47 vs 33), so the higher number is shown here. In 2017, only 1 car-kill was in the confiscation records. The number of reported car-kills in 2017 was the lowest since record-keeping began in 1981.

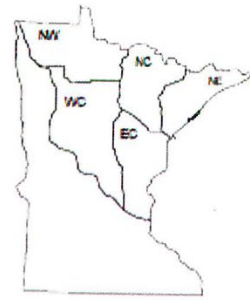
j Beginning in 2017, Wildlife Managers recorded nuisance bear complaints on an all-species wildlife damage app, whereas Conservation Officers continued to submit monthly nuisance bear survey forms (April–Oct). The 2 survey tools are not exactly the same, so data are presented separately for each in parenthesis (Wildlife Managers, COs). For consistency, only April–October data are included (in 2017 10 calls were received in other months).

[k] Lowest number of nuisance bears were killed in 2011 and 2018, since recording began in 1982.

[m] 9 of the 11 pre-season hunters in 2018 were in BMU 11. None were NQ hunters authorized to hunt in the quota zone (Area 88).

Table 3. Regional bear food indices[a] in Minnesota's bear range, 1984–2018. Shaded blocks indicate particularly low (<45; pink) or high (≥70; green) values.

Year	Survey Area					
	NW	NC	NE	WC	EC	Range wide
1984	32.3	66.8	48.9	51.4	45.4	51.8
1985	43.0	37.5	35.3	43.5	55.5	42.7
1986	83.9	66.0	54.7	74.7	61.1	67.7
1987	62.7	57.3	46.8	67.4	69.0	61.8
1988	51.2	61.1	52.7	54.4	47.3	56.0
1989	55.4	58.8	48.1	47.8	52.9	51.6
1990	29.1	39.4	55.4	44.0	47.9	44.1
1991	59.7	71.2	64.8	72.1	78.9	68.4
1992	52.3	59.9	48.6	48.1	63.3	58.2
1993	59.8	87.8	75.0	73.9	76.8	74.3
1994	68.6	82.3	61.3	81.5	68.2	72.3
1995	33.8	46.5	43.9	42.0	50.9	44.4
1996	89.5	93.2	88.4	92.2	82.1	87.6
1997	58.2	55.5	58.8	62.0	70.1	63.9
1998	56.9	72.8	66.4	72.3	84.5	71.1
1999	63.7	59.9	61.1	63.2	60.6	62.0
2000	57.7	68.0	54.7	69.2	67.4	62.3
2001	40.6	48.7	55.6	62.2	66.0	55.8
2002	53.1	63.4	60.4	68.6	68.3	66.8
2003	59.1	57.5	55.2	58.6	49.7	58.8
2004	57.0	60.5	61.1	70.3	67.9	64.4
2005	53.4	65.9	61.4	59.9	72.6	62.3
2006	51.0	64.9	53.4	51.0	52.1	56.9
2007	68.4	79.0	57.3	67.6	70.0	69.4
2008	58.6	74.1	64.7	66.6	71.4	65.4
2009	59.9	67.8	63.2	69.2	69.5	66.5
2010	70.0	71.3	79.0	60.8	57.3	68.0
2011	61.4	59.6	57.9	66.7	63.5	62.5
2012	49.1	50.3	59.4	50.5	41.5	50.7
2013	71.9	77.1	76.0	59.1	63.2	71.8
2014	71.4	70.7	71.4	61.0	66.5	70.2
2015	47.2	56.3	44.8	57.2	46.5	50.7
2016	79.5	64.3	75.8	64.4	60.6	70.3
2017	67.1	57.5	56.2	70.6	73.9	61.3
2018	72.6	82.4	101.8[b]	71.5	88.3[b]	83.9[b]



[a] Each bear food index value represents the sum of the mean index values for 14 species, based on surveys conducted in that area. Range-wide mean is derived directly from all surveys conducted in the state (i.e., not by averaging survey area means).

[b] Record high food rating in NE and EC regions, and second-highest statewide.

Table 4. Regional mean index values[a] for bear food species in 2018 compared to the previous 34-year mean (1984-2017) in Minnesota's bear range. Shading indicates particularly high (green) or low (pink) fruit abundance relative to average (≥1 point difference for individual foods; ≥5 points difference for totals).

	NW		NC		NE		WC		EC		Rangewide	
FRUIT	34yr mean	2018 (*n* = 11[b])	34yr mean	2018 (*n* = 10)	34yr mean	2018 (*n* = 5)	34yr mean	2018 (*n* =7)	34yr mean	2018 (*n* = 11)	34yr mean	2018 (*n* = 36)
SUMMER												
Sarsaparilla	4.6	6.5	5.8	7.2	5.3	8.4	4.5	4.0	5.3	6.0	5.0	6.3
Pincherry	3.3	5.1	4.4	6.1	4.2	9.4	3.8	3.8	3.7	5.4	3.9	5.8
Chokecherry	5.7	9.4	5.4	8.8	4.5	9.8	5.4	8.3	4.6	6.8	5.2	8.9
Juneberry	5.2	6.6	4.9	6.7	5.0	8.8	3.7	4.3	3.9	8.4	4.5	6.8
Elderberry	1.6	0.5	3.0	3.2	3.6	4.5	3.1	2.5	3.3	3.6	2.9	2.7
Blueberry	5.1	7.5	5.4	9.9	4.9	8.7	3.6	5.0	3.8	5.2	4.4	7.4
Raspberry	6.4	8.1	7.9	9.0	7.9	12.4	7.1	6.1	7.0	9.2	7.1	8.7
Blackberry	1.3	1.5	2.4	1.0	1.2	1.0	3.6	4.0	4.4	6.9	2.9	3.7
FALL												
Wild Plum	2.2	4.2	1.8	6.1	1.1	6.3	2.7	5.6	2.4	3.0	2.2	4.7
HB Cranberry	5.3	5.3	4.5	4.0	3.9	6.5	3.8	2.6	3.8	4.6	4.2	4.3
Dogwood	6.2	7.0	5.7	5.1	4.9	6.3	5.9	7.7	5.9	6.6	5.7	6.8
Oak	3.5	3.1	3.1	3.3	1.9	4.3	5.8	9.0	5.6	8.7	4.4	6.4
Mountain Ash	1.6	1.5	2.5	4.4	2.5	7.3	1.7	1.3	2.3	4.1	2.6	3.7
Hazel	6.3	6.2	7.3	7.4	7.3	8.2	7.9	7.3	7.6	9.8	7.2	7.7
TOTAL	58.3	72.6	64.1	82.4	58.2	101.8	62.6	71.5	63.4	88.3	62.3	83.9

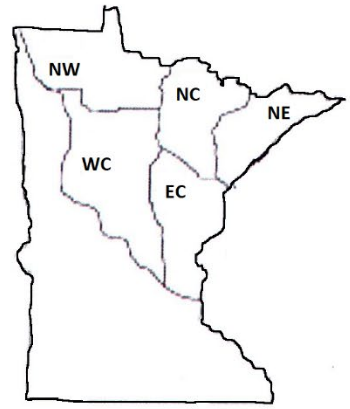
[a] Food abundance indices were calculated by multiplying species abundance ratings x fruit production ratings.

[b] *n* = Number of surveys used to calculate area-specific means

[c] Sample size for the entire range does not equal the sum of the sample sizes of 5 survey areas because some surveys were conducted on the border of 2 or more areas and were included in calculations for both.

Table 5. Regional productivity index[a] for important fall foods (oak + hazel + dogwood) in Minnesota's bear range, 1984–2018. Shading indicates particularly low (≤ 5.0; yellow) or high (≥8.0; tan) values.

	Survey Area					
Year	NW	NC	NE	WC	EC	Entire Range
1984	4.2	7.6	7.0	6.2	7.0	6.5
1985	4.9	2.8[b]	4.2	4.7	5.3	4.4
1986	7.2	5.0	4.0	7.0	6.2	6.2
1987	8.0	7.8	7.3	7.6	8.0	7.7
1988	5.5	7.2	7.3	6.8	6.1	6.7
1989	6.0	5.3	4.1	5.7	6.4	5.8
1990	3.3[b]	4.2	6.4	5.7	6.4	5.2
1991	6.2	6.2	5.4	7.2	7.7	6.7
1992	4.7	5.0	4.4	4.4[b]	6.8	5.1
1993	5.3	7.1	6.7	6.2	7.7	6.5
1994	7.1	7.8	5.8	7.8	7.1	7.2
1995	4.8	4.8	5.1	4.6	5.3	4.9
1996	8.7	8.6	8.1	9.2	8.5	8.6
1997	5.8	5.4	5.1	6.8	6.5	6.2
1998	5.8	6.0	6.3	7.1	7.8	6.7
1999	6.4	5.1	5.9	6.6	6.0	6.2
2000	5.8	7.7	7.2	7.5	8.5	7.0
2001	3.4	4.1	5.7	6.0	6.5	5.2
2002	8.7	7.1	6.6	8.8	8.2	8.1
2003	6.3	6.0	5.5	6.2	6.0	6.1
2004	6.1	5.4	5.4	6.4	6.1	5.9
2005	5.8	5.8	6.1	6.4	7.0	6.2
2006	6.7	6.1	6.0	6.7	5.8	6.3
2007	6.0	5.8	5.7	6.6	6.4	6.2
2008	6.6	7.3	6.2	7.0	8.9	7.1
2009	5.1	6.2	5.3	6.3	6.5	6.0
2010	7.7	6.4	6.5	6.2	5.4	6.6
2011	5.8	6.5	6.2	7.0	7.4	6.5
2012	6.2	6.3	6.3	6.5	4.8	6.1
2013	6.8	6.0	5.7	6.7	6.9	6.3
2014	7.0	5.6	5.4	7.7	6.1	6.7
2015	5.8	5.9	3.5[b]	8.2	3.7[b]	5.6
2016	5.7	5.2	6.0	5.4	5.2	5.3
2017	6.8	5.6	5.1	7.4	7.1	6.5
2018	5.8	6.1	7.7	8.3	8.4	7.2



[a] Values represent the sum of mean production scores for hazel, oak, and dogwood, derived from surveys conducted in each survey area. Range-wide mean is for all surveys conducted in the state (i.e. not an average of survey area means).

[b] Record low fall food score in survey area.

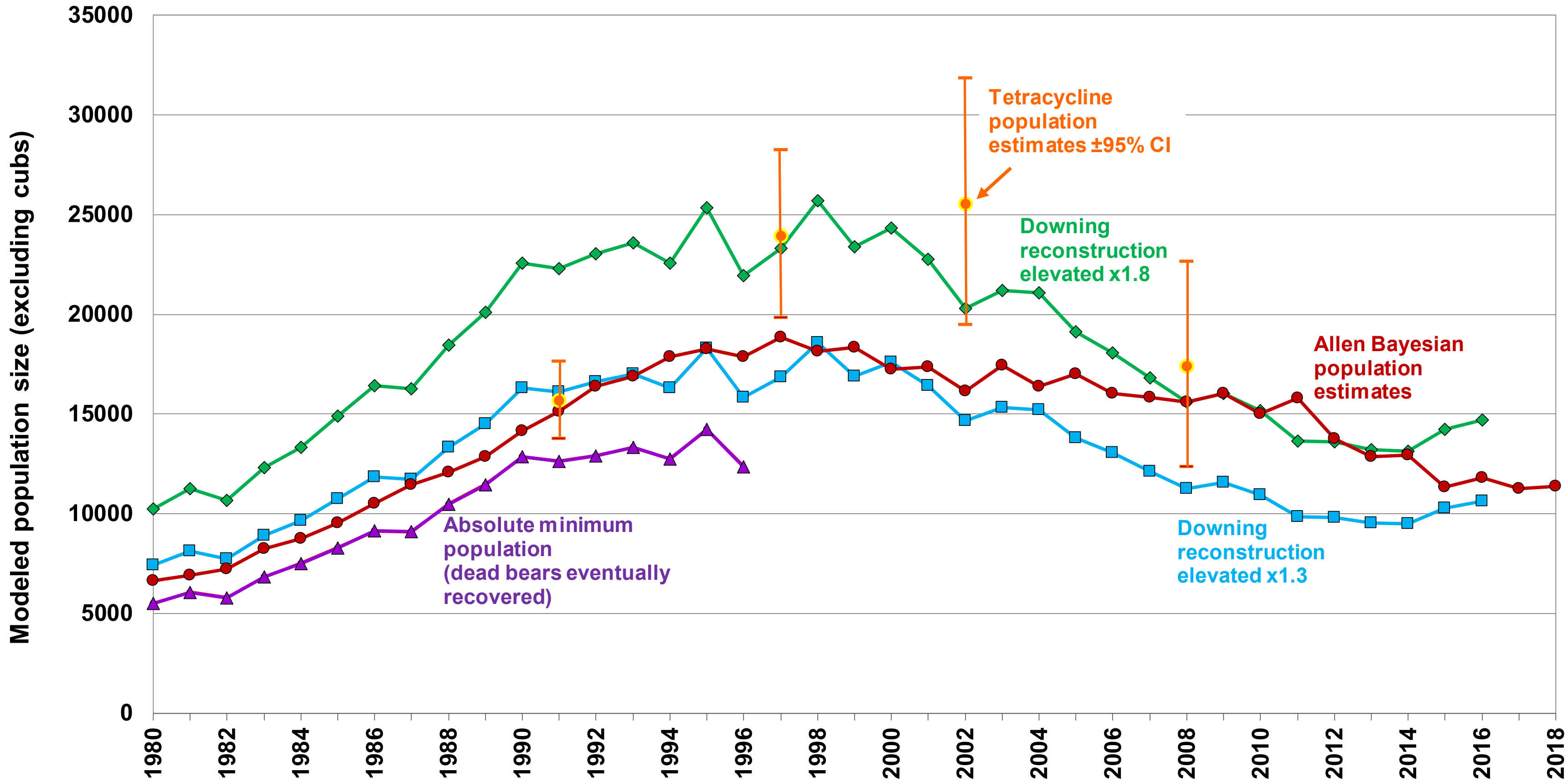


Figure 1. Statewide bear population trend (pre-hunt) derived from 2 population models: (1) Downing reconstruction, based solely on sex-specific harvest age structures, scaled (elevated to account for non-harvest mortality) to various degrees to attempt to match the tetracycline-based mark–recapture estimates (2 such curves shown here; estimates beyond 2016 are unreliable); and (2) a new Bayesian population model by Allen et al. (2018), which, besides harvest data includes estimates of reproduction and survival as well as an initial population size, and allows for estimates of the current year.

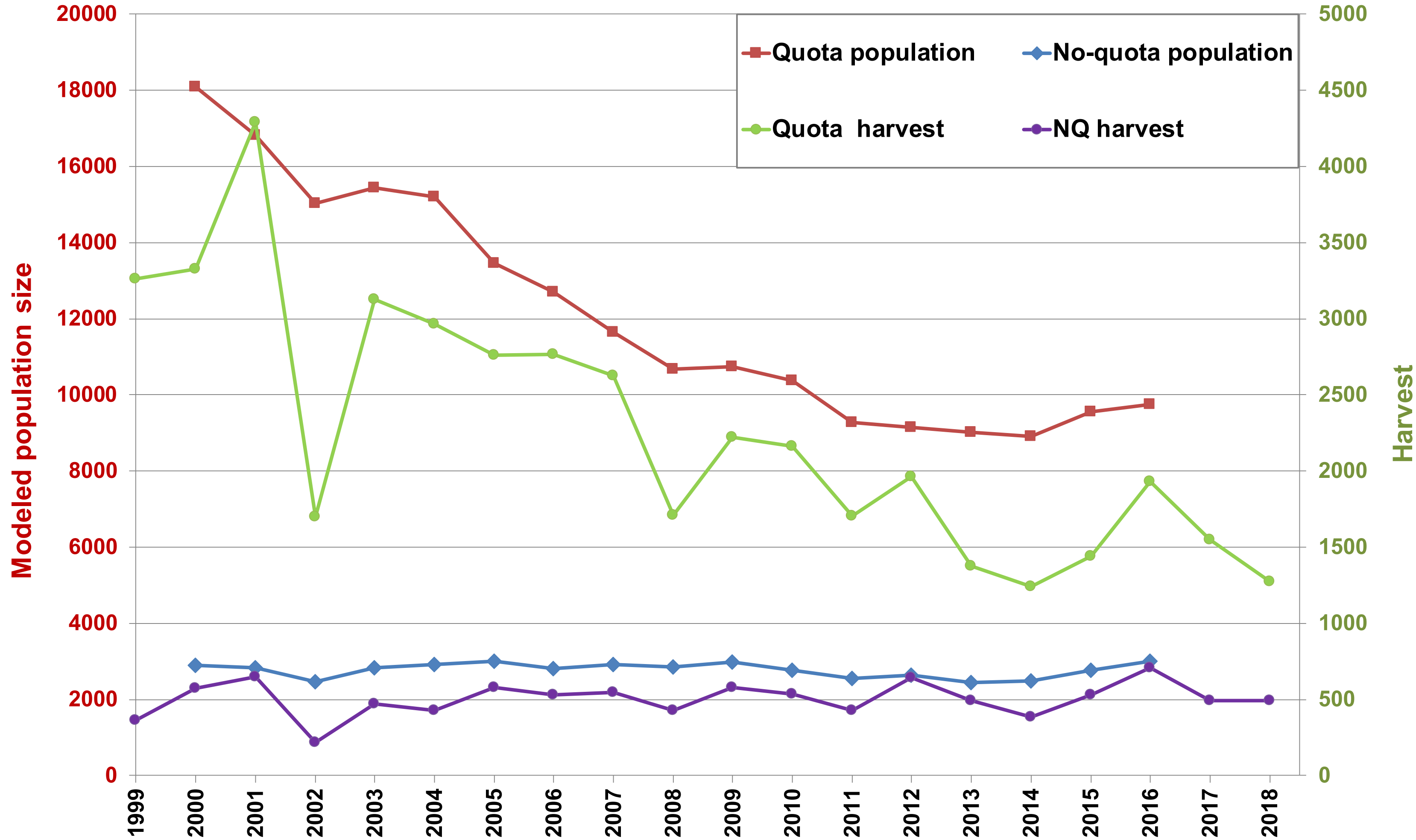


Figure 2. Population trends during 2000s derived from Downing reconstruction for quota and no-quota zones compared to respective harvests. Reconstruction-based estimates <2 years from the most recent harvest age data are unreliable (hence curves terminate in pre-hunt 2016). Population curves were scaled (elevated to account for non-harvest mortality) to fall between the 2 Downing curves in Figure 2 (i.e., the actual scale of the population estimates is not empirically-based).

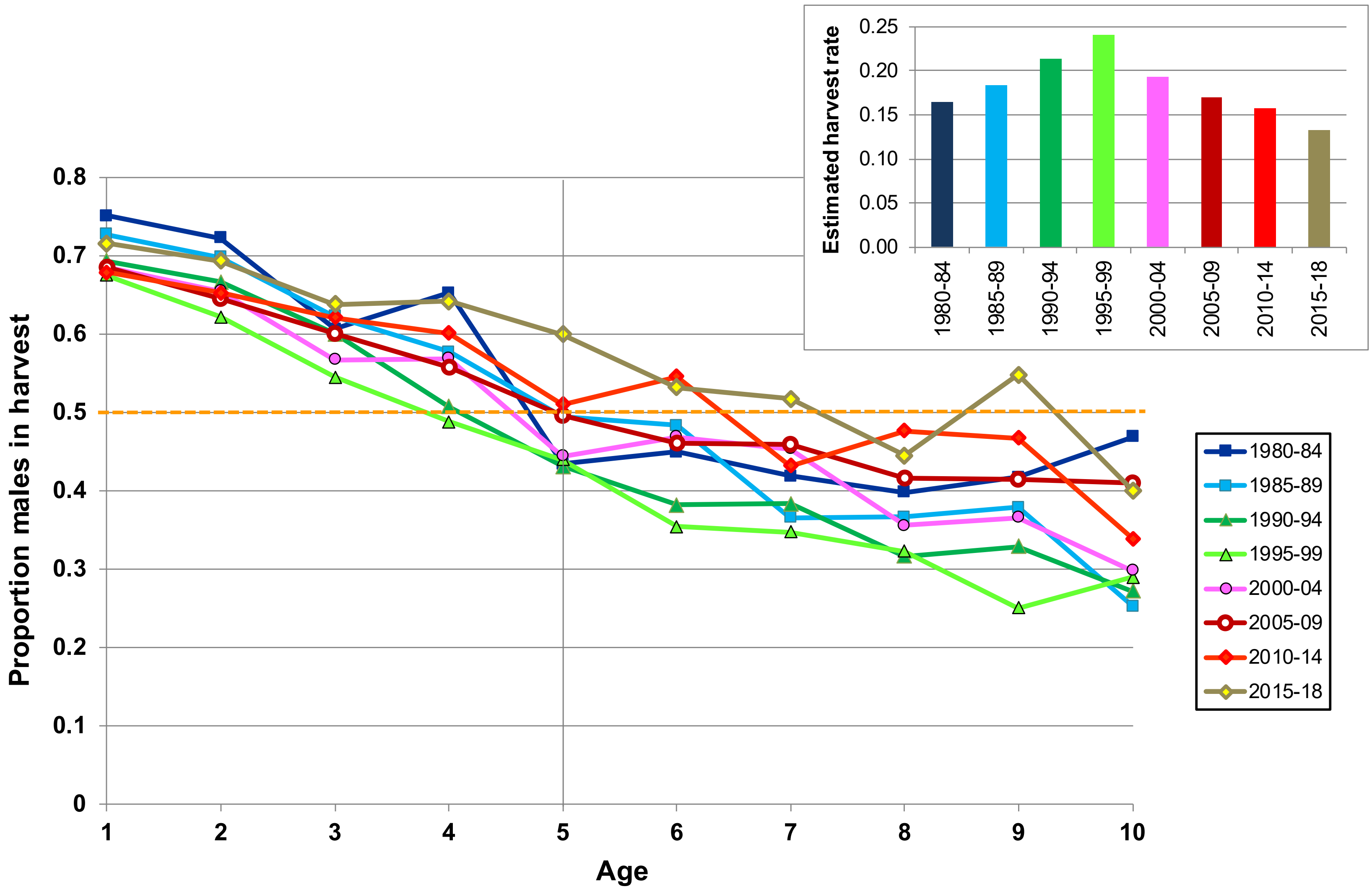


Figure 3. Trends in proportion of male bears in statewide harvest at each age, 1–10 years, grouped in 5-year time blocks, 1980–2018 (last interval = 4 years). Higher harvest rates result in steeper curves because males in the living population are reduced faster than females. Fitting a line to the data for each time block and predicting the age at which 50% of the harvest is male (dashed tan line) yields approximately the inverse of the harvest rate (derived rates are shown in inset). Flatter curves in recent years indicate lower harvest rates.

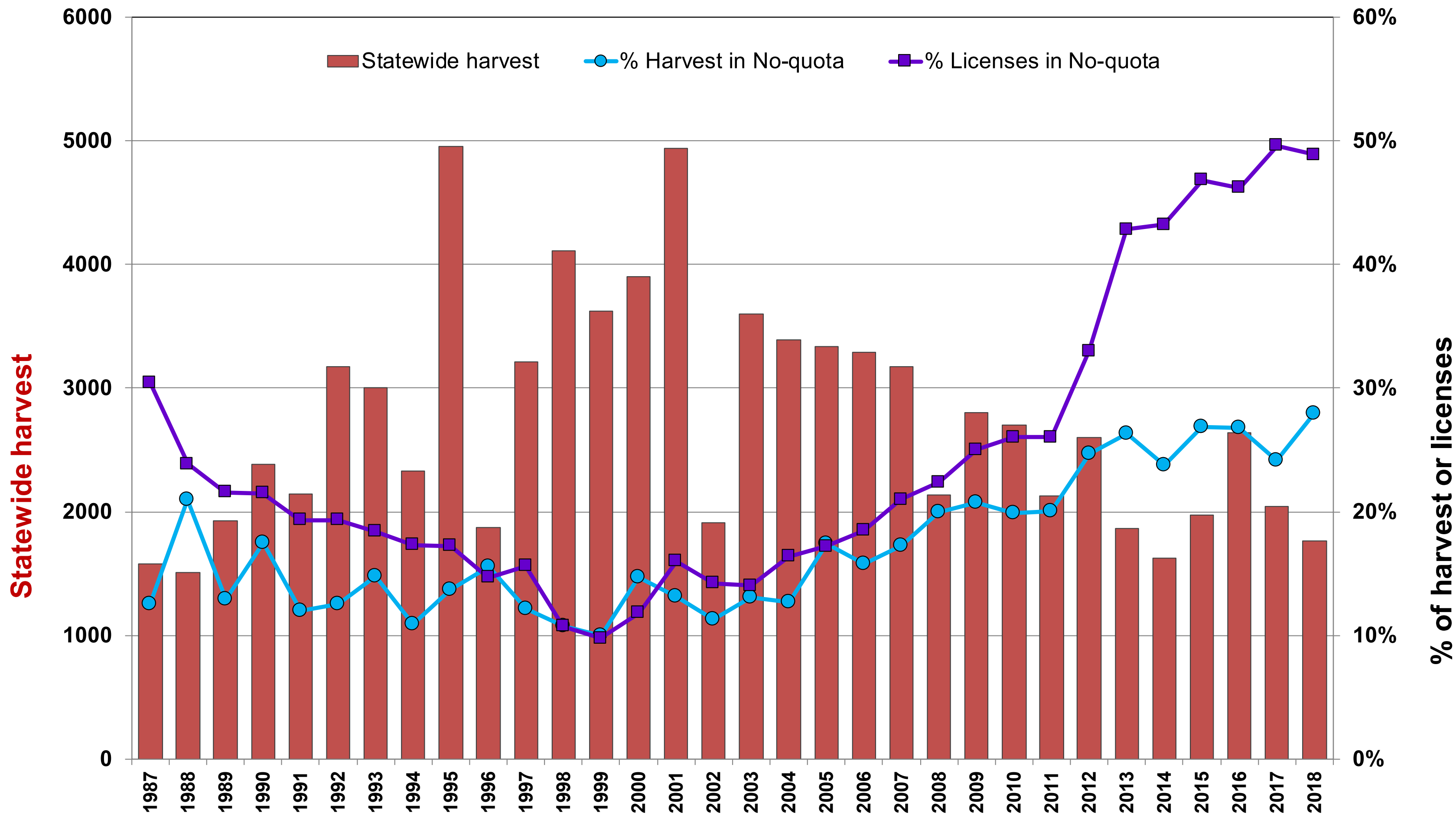


Figure 4. Trends in statewide bear harvest and proportions of harvest and licenses in the no-quota zones, 1987–2018.

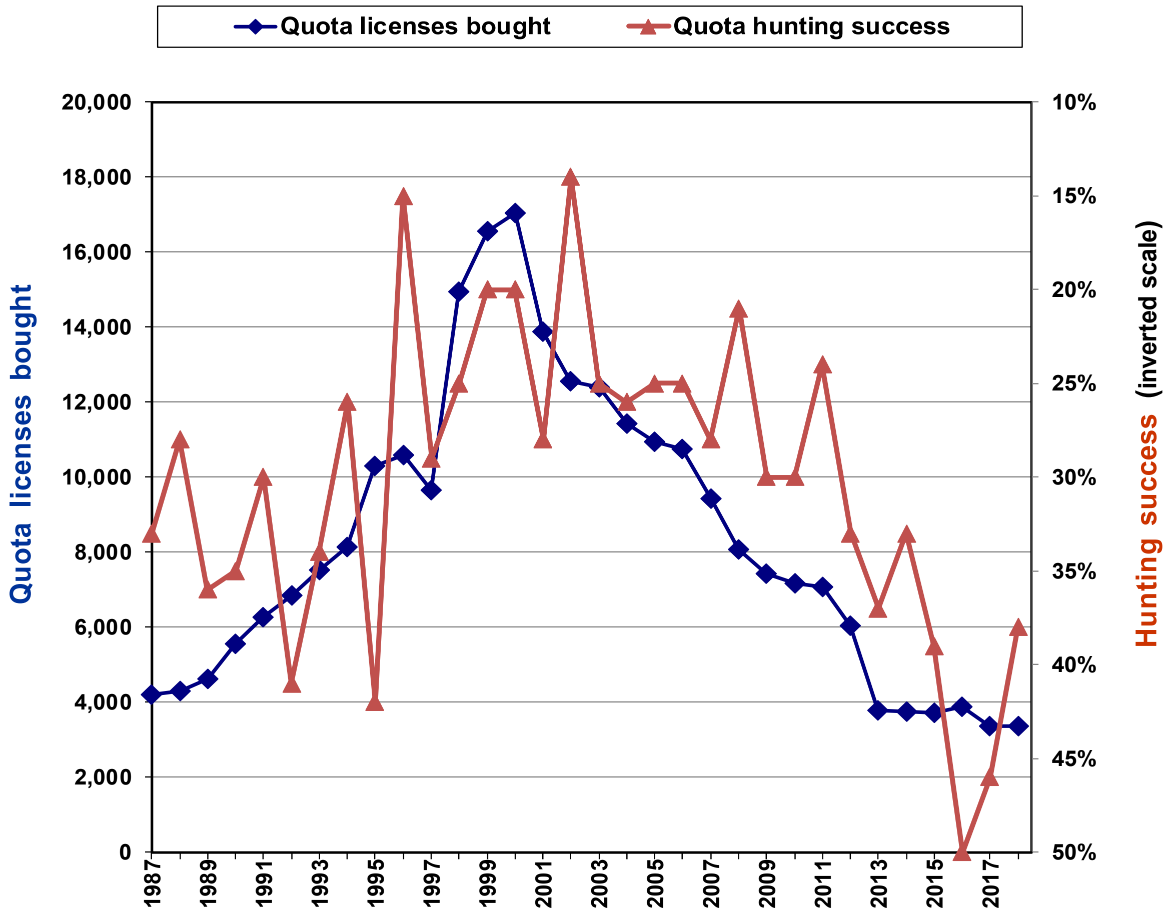


Figure 5. Relationship between licenses sold and hunting success (*note inverted scale*) in quota zone, 1987–2018 (quota and no-quota zones first partitioned in 1987). Number of licenses explains 47% of variation in hunting success during this period. Large variation in hunting success is also attributable to food conditions (e.g., during 2013–2018, when licenses were held relatively constant).

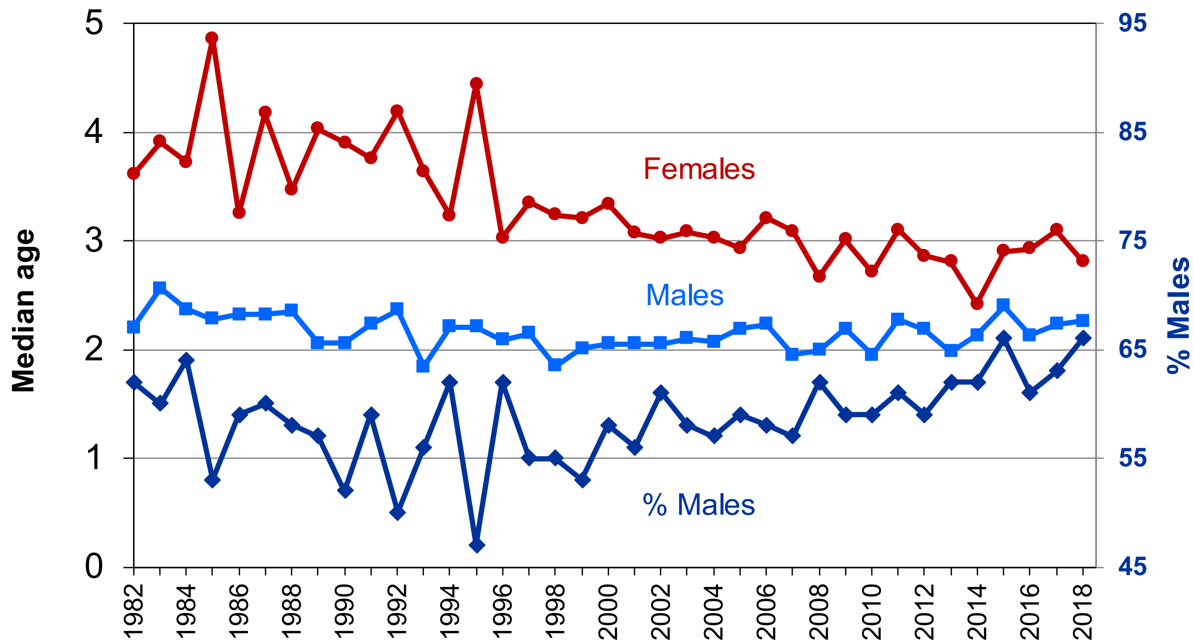


Figure 6. Statewide median ages (years) and sex ratio of harvested bears, 1982–2018.

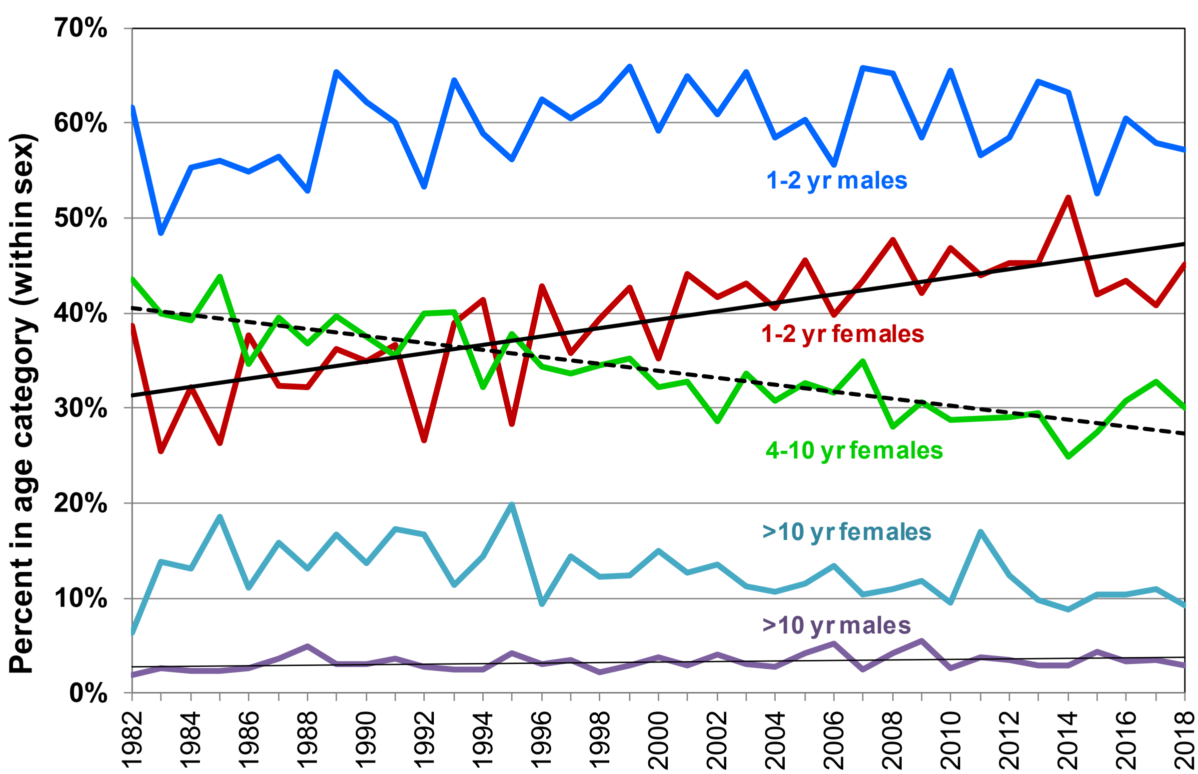


Figure 7. Statewide harvest structure: proportion of each sex in age category, 1982–2018. Trend lines shown are significant, but since 2008 the trend is level.

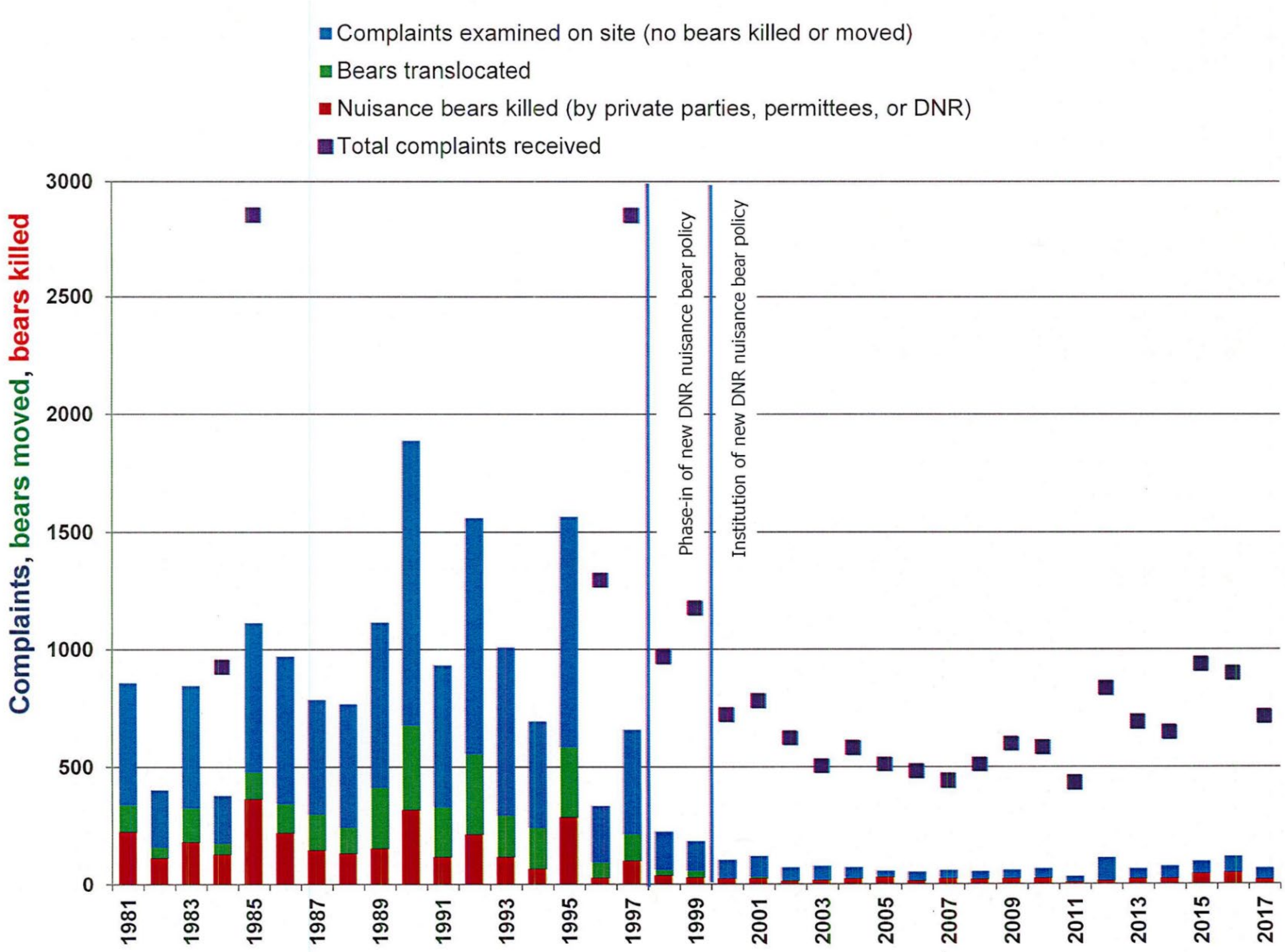


Figure. 8. Trends in nuisance bear complaints, and nuisance bears killed and moved, 1981–2018, showing dramatic effect of change in nuisance bear policy, and slight increasing trend over past decade, until 2018.

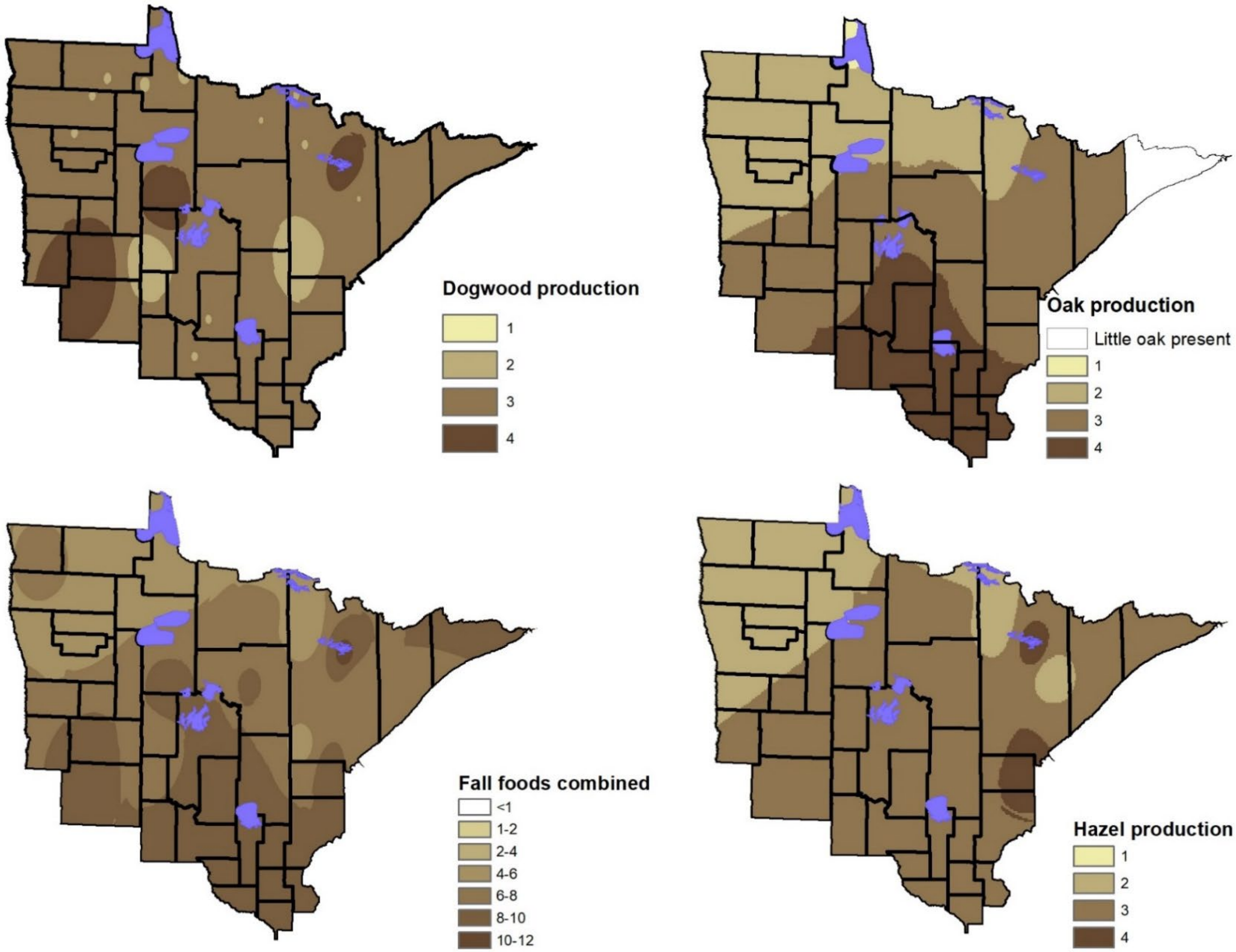


Figure 9. Production of fall bear foods (dogwood, oak, hazel) across Minnesota, 2018.

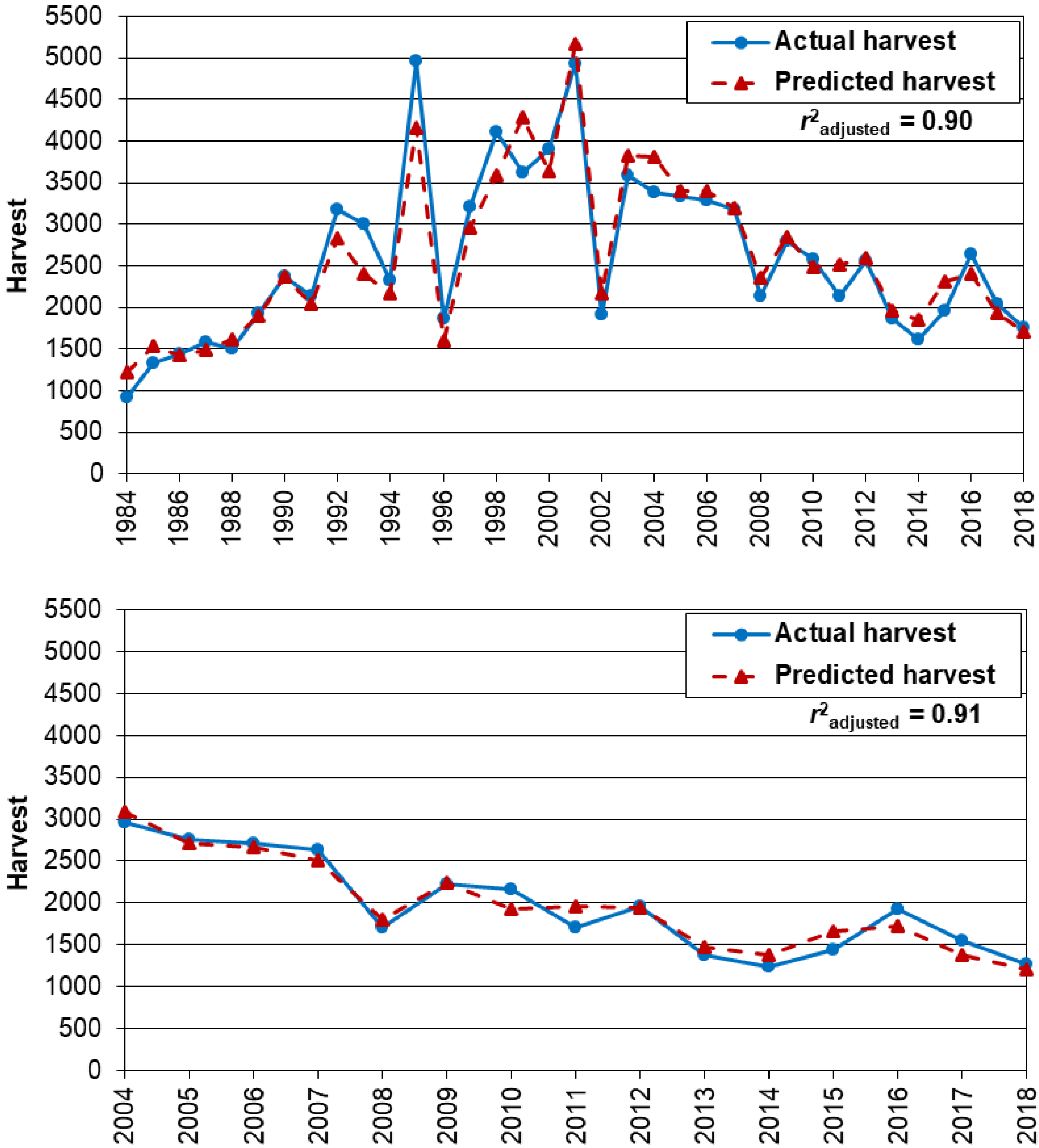


Figure 10. Number of bears harvested vs. number predicted to be harvested based on number of hunters and fall food production — top panel: statewide 1984–2018; bottom panel: quota zone only, most recent 15 years. Regression for the full dataset included an interaction term between food and hunters to better predict the drastic changes in harvest when fall foods were extremely high or low.

2019 MINNESOTA SPRING GROUSE SURVEYS

Charlotte Roy, Forest Wildlife Populations and Research Group Minnesota

SUMMARY OF FINDINGS

The Minnesota DNR coordinates ruffed grouse (*Bonasa umbellus*) and sharp-tailed grouse (*Tympanuchus phasianellus*) surveys each spring with the help of wildlife staff and cooperating federal, tribal, and county agencies. In 2019, ruffed grouse surveys were conducted between 15 April and 17 May. Mean ruffed grouse drums per stop (dps) were 1.5 statewide (95% confidence interval = 1.3–1.7) which is similar to last year. High points in the population cycle occur on average every 10 years, and surveys indicate that the last peak occurred in 2017, with counts similar to the previous peak in 2009.

Sharp-tailed grouse surveys were conducted between 18 March and 5 May 2019, with 1,555 birds (males and birds of unknown sex) observed at 152 leks. The mean numbers of sharp-tailed grouse/lek were 7.2 (5.4–9.5) in the East Central (EC) survey region, 11.0 (9.7– 12.3) in the Northwest (NW) region, and 10.2 (9.1–11.4) statewide. Comparisons between leks observed in consecutive years (2018 and 2019) indicated similar numbers of birds/lek statewide ($t = 0.5$, $P = 0.65$) and in the NW region ($t = 0.05$, $P = 0.96$, $n = 101$). In the EC region, a 23% decrease in birds/lek observed in consecutive years occurred but was not statistically significant ($t = 1.7$, $P = 0.10$, $n = 31$), likely due to the smaller number of leks surveyed in the EC region and the impact that sample size has on the statistical power to detect differences between years.

INTRODUCTION

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

The Minnesota DNR coordinates grouse surveys each year to monitor changes in grouse populations through time. These surveys provide a reasonable index to population trends, when the primary source of variation in counts among years is change in densities. However, weather, habitat conditions, observer ability, and grouse behavior, also vary over time and can influence survey counts. Thus, making inferences from survey data over short time periods (e.g., a few years) can be tenuous. Nevertheless, over longer time periods and when large changes in index values occur, these surveys can provide a reasonable index to long-term grouse population trends. Spring surveys provide evidence that the ruffed grouse population cycles at approximately 10-year intervals. The spring survey also used to correlate strongly with the fall harvest, but since the early 2000's, this relationship has weakened.

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 2.5th and 97.5th percentiles of bootstrap frequency distributions.

Sharp-tailed Grouse

Wildlife staff 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. In the EC region, and in eastern portions of the NW region where sharp-tailed grouse occur at low densities, most known leks are surveyed each year.

Some leks may have been missed, but most managers in these regions believed that they included most of the leks in their work area, with the exception of Aitkin and Tower work areas where workloads do not permit exhaustive surveys. In the western part of the NW region, sharp-tailed grouse occur at higher densities, and thus surveying all leks is not feasible. Therefore, in the western portion of the NW region (e.g., Roseau, Thief River Falls), managers conduct surveys along 20-25 mile (32-40 km) routes. 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. 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 collecting data.

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

RESULTS & DISCUSSION

Ruffed Grouse

Observers from 14 cooperating organizations surveyed 131 routes between 15 April and 17 May 2019. Most routes (97%) were surveyed between 15 April and 15 May, with a median survey date of May 3, which is similar to the last 2 years (May 3) and the median survey date for the most recent 10 years. Excellent (68%), Good (29%), and Fair (3%) survey conditions were reported for 121 routes reporting conditions.

Statewide counts of ruffed grouse drums averaged 1.5 dps (95% confidence interval = 1.3–1.7 dps) during 2019 (Figure 3). Drum counts were 1.6 (1.3–1.9) dps in the Northeast (n = 103 routes), 2.1 (1.2–3.0) dps in the Northwest (*n* = 5), 0.8 (0.5–1.4) dps in the Central Hardwoods (*n* = 15), and 0.7 (0.4–1.1) dps in the Southeast (*n* = 8) regions (Figure 4a-d).

Statewide drum counts were similar to last year. Surveys indicate the most recent peak occurred in 2017. Although peaks in the cycle occur on average approximately every 10 years, they vary from 8 to 11 years apart (Figure 3).

Sharp-tailed Grouse

A total of 1,555 male sharp-tailed grouse and grouse of unknown sex were counted at 152 leks (Table 1) during 18 March to 5 May 2019. The statewide index value of 10.2 (9.1–11.4) grouse/lek was centrally located among values observed since 1980 (Figure 5). In the EC survey region, 216 grouse were counted on 30 leks, and 1,339 grouse were counted on 122 leks in the NW survey region. The grouse/lek index was similar statewide and in both survey regions compared to 2018 (Table 1). Leks with $\geq$2 grouse were observed an average of 1.7 times. Counts at leks observed during both 2018 and 2019 were similar statewide ($t = 0.5$, $P = 0.65$) and in the NW region ($t = 0.5$, $P = 0.96$). However, a 23% decline in the EC region was not significant ($t = 1.7$, $P = 0.10$; Table 2), likely because fewer leks were surveyed in that region, which limits statistical power to detect differences statistically (Figure 6). Furthermore, a loss of small leks would tend to maintain or increase the average lek size, whereas it would cause comparisons of leks surveyed in successive years to decline.

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. This year, ruffed grouse and sharp-tailed grouse populations both remained similar to last year.

ACKNOWLEDGMENTS

The ruffed grouse survey was accomplished this year through the combined efforts of staff and volunteers at Chippewa and Superior National Forests (USDA Forest Service); Fond du Lac, Leech Lake, Red Lake, and White Earth Reservations; 1854 Treaty Authority; Blandin Paper; Vermilion Community College; Beltrami County and Cass County Land Departments; and DNR staff at Aitkin, Baudette, Bemidji, Brainerd, 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, Cloquet, Crookston, Karlstad, International Falls, Tower, Thief River Falls, and Thief Lake work areas, and staff and volunteers at Red Lake and Roseau River WMAs for participating in sharp-tailed grouse surveys. Pam Coy, Alex Elliott, Joe Rohm, and Ben Bullard also helped with lek surveys this year. Laura Gilbert helped enter ruffed grouse data. Gary Drotts, John Erb, and Rick Horton organized an effort to enter the ruffed grouse survey data for 1982–2004, and Doug Mailhot and another volunteer helped enter the data. I would also like to thank Mike Larson for making helpful comments on this report. This work was funded in part through the Federal Aid in Wildlife Restoration Act.

Table 1. Sharp-tailed grouse / lek (≥2 males) at all leks observed during spring surveys each year in Minnesota.

	Statewide			Northwest[a]			East Central[a]		
Year	Mean	95% CI[b]	*n*[c]	Mean	95% CI[b]	*n*[c]	Mean	95%CI[b]	*n*[c]
2004	11.2	10.1 – 12.3	183	12.7	11.3 – 14.2	116	8.5	7.2 – 9.9	67
2005	11.3	10.2 – 12.5	161	13.1	11.5 – 14.7	95	8.8	7.3 – 10.2	66
2006	9.2	8.3 – 10.1	161	9.8	8.7 – 11.1	97	8.2	6.9 – 9.7	64
2007	11.6	10.5 – 12.8	188	12.7	11.3 – 14.1	128	9.4	8.0 – 11.0	60
2008	12.4	11.2 – 13.7	192	13.6	12.0 – 15.3	122	10.4	8.7 – 12.3	70
2009	13.6	12.2 – 15.1	199	15.2	13.4 – 17.0	137	10.0	8.5 – 11.7	62
2010	10.7	9.8 – 11.7	202	11.7	10.5 – 12.9	132	8.9	7.5 –10.5	70
2011	10.2	9.5 – 11.1	216	11.2	10.2 – 12.2	156	7.8	6.7 – 8.9	60
2012	9.2	8.2 – 10.3	153	10.7	9.3 – 12.3	100	6.3	5.4 – 7.3	53
2013	9.2	8.2 – 10.2	139	10.5	9.3 – 11.7	107	4.8	3.8 – 5.9	32
2014	9.8	8.8 – 10.9	181	10.9	9.8 – 12.1	144	5.4	4.5 – 6.4	37
2015	9.8	8.9 – 10.7	206	10.8	9.9 – 11.9	167	5.3	4.4 – 6.4	39
2016	9.5	8.6 – 10.5	182	10.2	9.2 – 11.4	152	6.0	4.9 – 7.3	30
2017	9.7	8.7 – 10.8	181	10.4	9.2 – 11.8	141	7.2	5.8 – 8.6	40
2018	9.3	8.4 – 10.3	161[d]	9.8	8.8 – 10.9	130	7.3	5.4 – 9.6	30
2019	10.2	9.1 – 11.4	152	11.0	9.7 – 12.3	122	7.2	5.4 – 9.5	30

[a] Survey regions; see Figure 1.

[b] 95% CI = 95% confidence interval

[c] *n* = number of leks in the sample.

[d] One lek was located just south of the NW region in Clearwater County.

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	99.0	1.2	0.1 – 2.3	53
2007 – 2008	0.4	-0.8 – 1.5	166	0.0	-1.6 – 1.6	115	1.2	0.1 – 2.5	51
2008 – 2009	0.9	-0.4 – 2.3	181	1.8	-0.1 – 3.8	120	-0.8	-2.1 – 0.6	61
2009 – 2010	-0.6	-1.8 – 0.6	179	-0.8	-2.6 – 1.0	118	-0.1	-1.2 – 1.0	61
2010 – 2011	-1.7	-2.7 – -0.8	183	-1.8	-3.1 – -0.5	124	-1.5	-2.8 – -0.3	59
2011 – 2012	-2.0	-2.9 – -1.1	170	-1.7	-2.9 – -0.4	112	-2.4	-3.3 – -1.6	58
2012 – 2013	-0.8	-2.0 – 0.4	140	0.4	-1.3 – 2.3	88	-2.9	-4.2 – -1.8	52
2013 – 2014	1.4	0.1 – 2.7	121	1.6	-0.3 – 3.5	79	1.1	-0.1 – 2.3	42
2014 – 2015	-0.2	-1.4 – 0.9	141	-0.3	-1.9 – 1.3	102	-0.1	-1.1 – 1.1	39
2015 – 2016	-1.3	-2.3 – -0.2	167	-1.6	-2.9 – -0.2	129	-0.2	-1.3 – 0.9	38
2016 – 2017	-0.3	-1.5 – 0.9	166	-0.3	-1.8 – 1.2	128	-0.2	-1.2 – 0.8	38
2017 – 2018	-2.2	-3.3 – -1.1	159[e]	-2.4	-3.9 – -0.4	123	-1.4	-2.8 – 0.2	36
2018 – 2019	-0.3	-1.5 – 1.0	132	0.0	-1.5 – 1.6	101	-1.4	-3.0 – 0.1	31

[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.

[e] One lek was located just south of the NW region in Clearwater County.

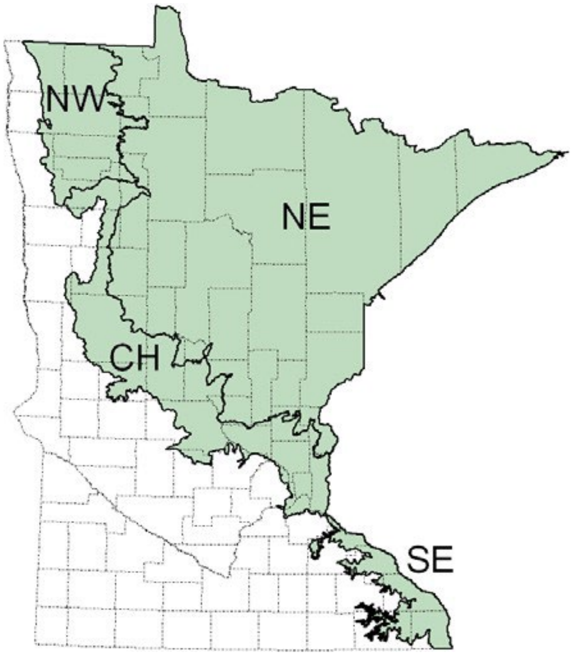


Figure 1. Survey regions for **ruffed grouse** in Minnesota. Northwest (NW), Northeast (NE), Central Hardwoods (CH), and Southeast (SE) survey regions are depicted relative to county boundaries (dashed lines) and influenced by the Ecological Classification System.

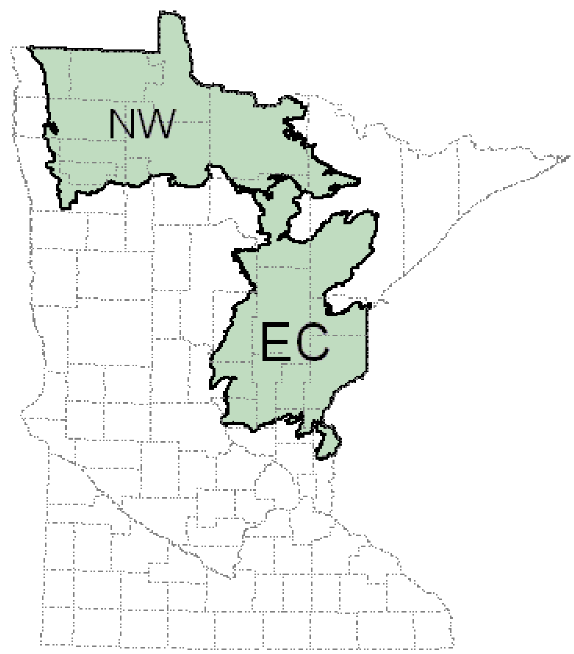


Figure 2. Survey regions for **sharp-tailed grouse** in Minnesota. Northwest (NW) and East Central (EC) survey regions are depicted relative to county boundaries (dashed lines) and influenced by Ecological Classification System Subsections boundaries.

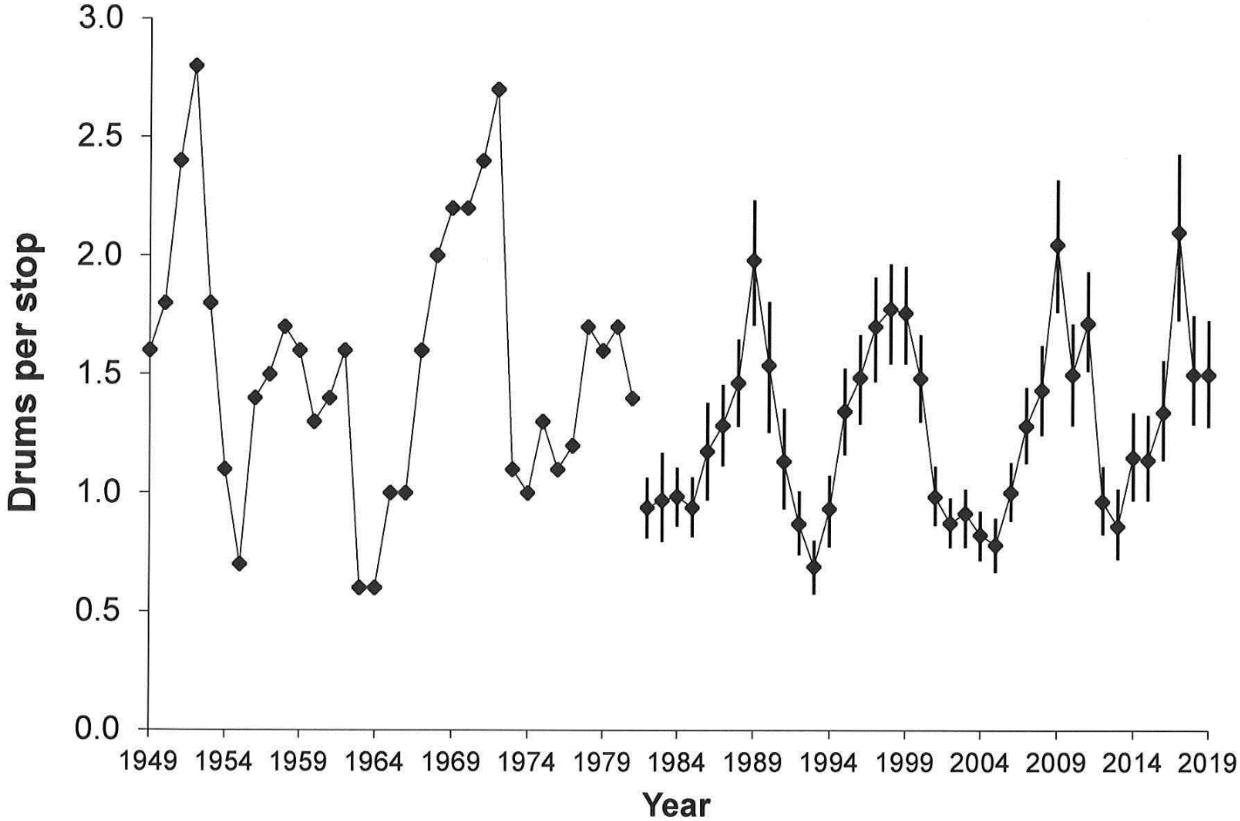
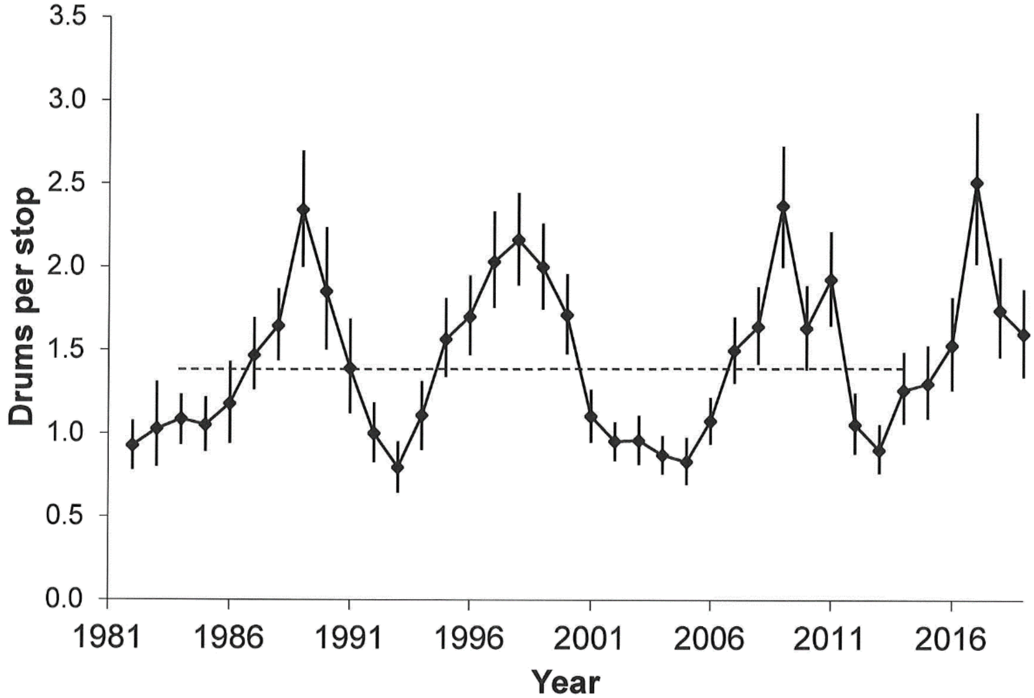


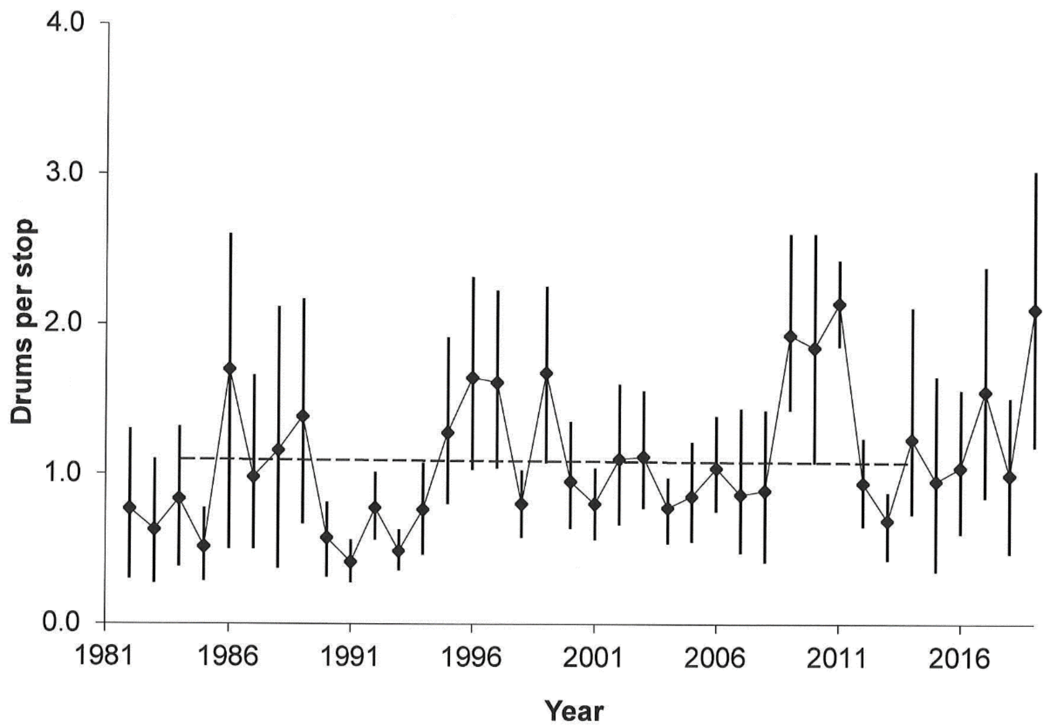
Figure 3. Statewide ruffed grouse population index values in Minnesota. Bootstrap (95%) confidence intervals (CI) are provided after 1981, but different analytical methods were used prior to this and thus CI are not available for earlier years. The difference between 1981 and 1982 is biological and not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

a.



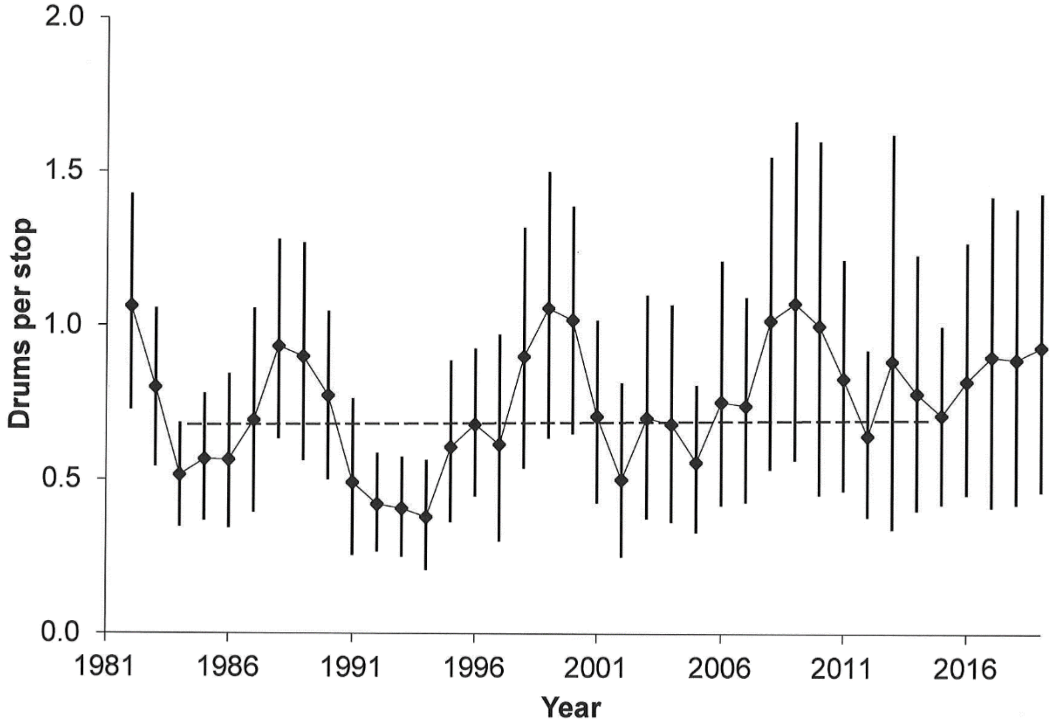
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Drums per stop
1981
1986
1991
1996
2001
2006
2011
2016
Year

b.



4.0
3.0
2.0
1.0
0.0
Drums per stop
1981
1986
1991
1996
2001
2006
2011
2016
Year

c.



d.

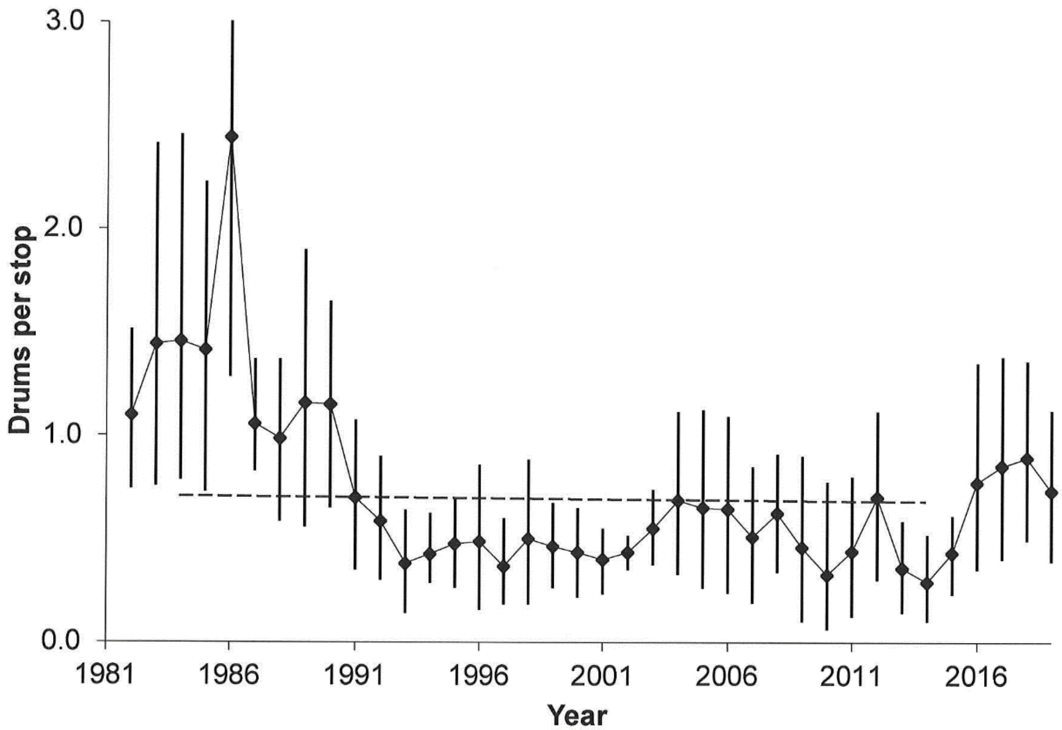


Figure 4a,b,c,d. Ruffed grouse population index values in the **Northeast** (a), **Northwest** (b), **Central Hardwoods** (c), and **Southeast** (d) survey regions of Minnesota. The mean for 1984-2014 is indicated by the dashed line. Bootstrap (95%) confidence intervals are provided for each mean. In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

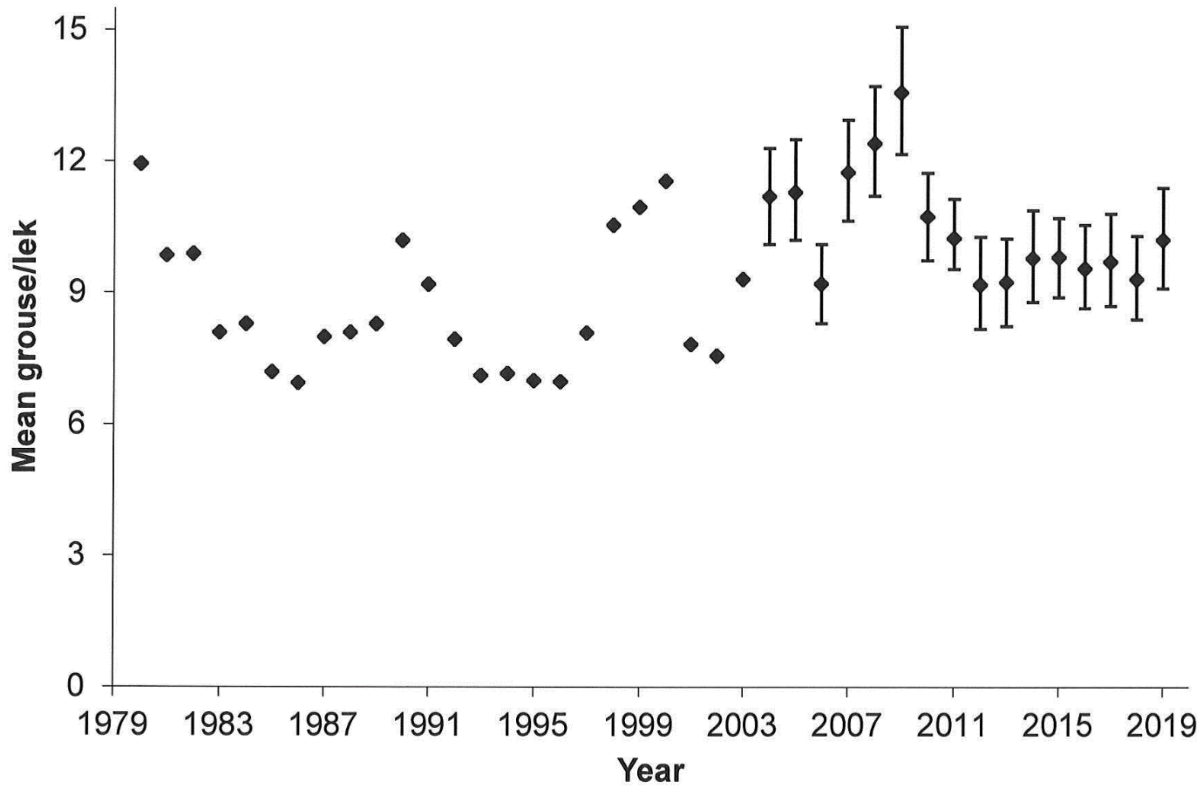


Figure 5. **Sharp-tailed grouse** counted in spring lek surveys statewide in Minnesota during 1980–2019. Bootstrap (95%) confidence intervals are provided for recent years. Annual means are not connected by lines because the same leks were not surveyed every year.

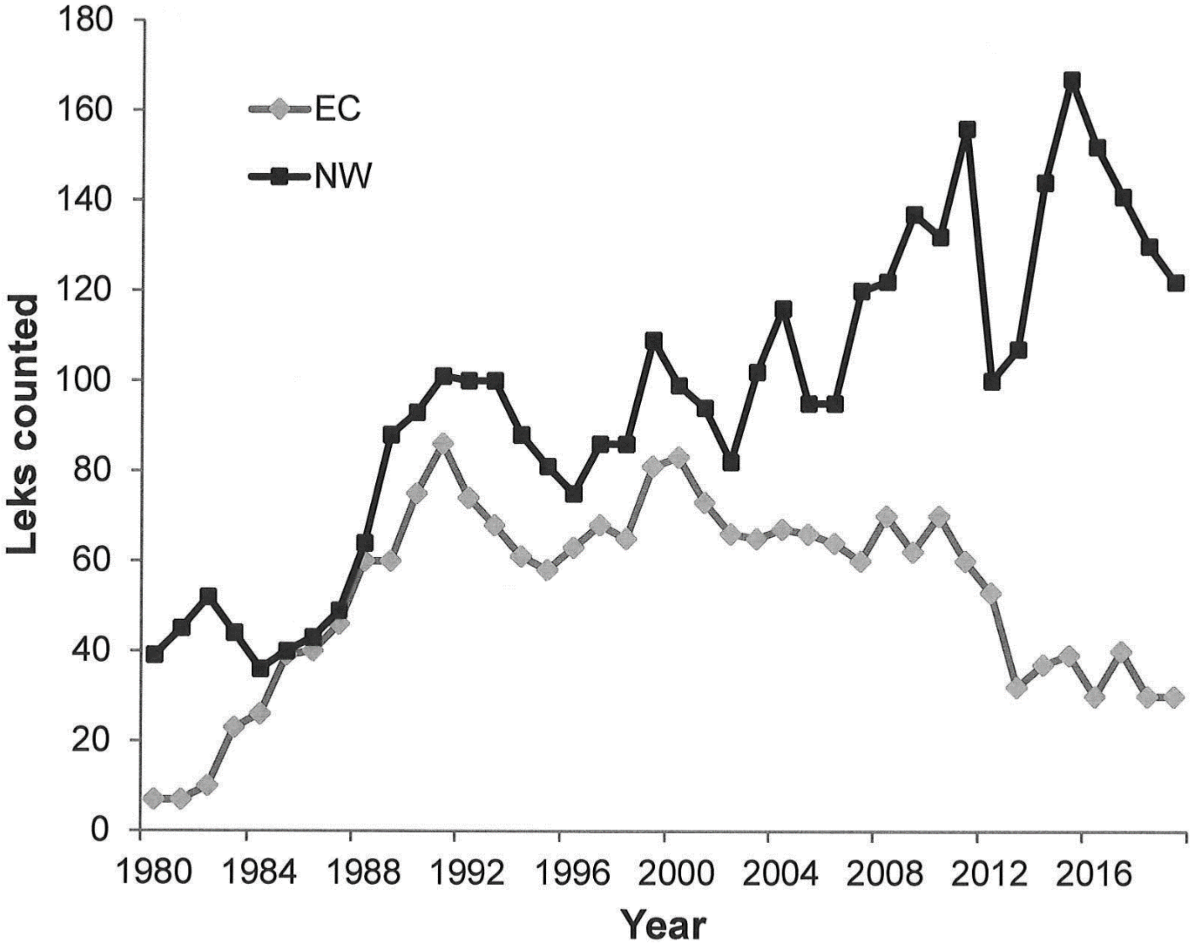


Figure 6. The number of **sharp-tailed grouse** leks with 2 or more birds counted in spring lek surveys in the Northwest (NW) and East Central (EC) survey regions of Minnesota during 1980- 2019.

2019 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 2019. Observers located 45 booming grounds and counted 497 males and birds of unknown sex in the survey blocks, which is a decline of more than 20% in the number of leks and birds counted compared to last year. Including areas outside the survey blocks, observers located 113 booming grounds, 1,039 male prairie-chickens, and 115 birds of unknown sex throughout the prairie-chicken range. Estimated densities of 0.06 (0.05–0.08) booming grounds/km^2 and 11.0 (8.5–13.6) 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). 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, 2 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 19982006. 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 April and May. Each survey block was 3 nonrandomly selected so that surveys would be conducted in areas where habitat was expected to be good (i.e., grassland was relatively abundant) and leks were known to occur. Each observer attempted to find and survey each booming ground repeatedly in his/her assigned block, which comprised 4 sections of the Public Land Survey (approximately 4,144 ha). Observers obtained multiple counts at each booming ground in the morning because male attendance at leks varies throughout the season and throughout the day.

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

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

I also encouraged observers to submit surveys of booming grounds outside the survey blocks because these observations may provide additional information that is helpful to prairie-chicken management. These data were included in estimates of minimum abundance of prairie-chickens. However, these data were not used in the analysis of lek and prairie-chicken densities because effort and methods may have differed from those used in the survey blocks. 4

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 6 April and 14 May 2019. Observers located 113 booming grounds and observed 1,039 male prairie-chickens and 115 birds of unknown sex within and outside the survey blocks (Table 1). These counts represent a minimum number of prairie-chickens in Minnesota during 2019, but because survey effort outside of survey blocks is not standardized among years, these counts should not be compared among years or permit areas.

Table 1. Minimum abundance of prairie-chickens within and outside hunting permit areas in Minnesota during spring 2019. Lek and bird counts are not comparable among permit areas or years.

Permit Area	Area (km2)	Leks	Males	Unk[a]
803A	1,411	11	68	0
804A	435	1	8	0
805A	267	12	89	4
806A	747	13	58	19
807A	440	14	164	25
808A	417	20	309	0
809A	744	13	161	0
810A	505	3	39	11
811A	706	7	31	15
812A	914	6	23	0
813A	925	4	29	2
PA subtotal	7,511	104	979	76
Outside PAs[b]	NAc	9	60	39
Grand total	NAc	113	1,039	115

[a] Unk = prairie-chickens for which sex was unknown, but which were probably males.

[b] Counts done outside permit areas (PA).

[c] NA = not applicable because the area outside permit areas was not defined.

Within the standardized survey blocks, 497 males and birds of unknown sex were counted on 45 booming grounds during 2019 (Table 2). These counts are the lowest since the standardized survey began in 2004 when 1,566 males and 95 booming grounds were counted. This contrasts with the high count of 1,618 males and 114 booming grounds in 2007. Each lek was observed an average of 2.5 times (median = 2), with 35% of booming grounds observed 5 just once. These counts should not be regarded as estimates of abundance because detection probabilities of leks and birds were not estimated. However, if we assume that detection probabilities and effort are similar among years in the survey blocks, then population indices based on survey block data can be used to monitor changes in abundance among years.

Densities of prairie-chickens in the 10 core survey blocks were 0.08 (0.05–0.10) booming grounds/km^2 and 12.3 (9.2–15.4) males/booming ground (Table 2, Figure 2). In the 7 peripheral survey blocks, densities were 0.04 (0.02–0.07) booming grounds/km^2 and 8.0 (4.1– 11.9) males/booming ground. The density of 0.06 (0.05–0.08) booming grounds/km^2 in all survey blocks during 2019 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 11.0 (8.5–13.6) males/booming ground in all survey blocks during 2019 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 can be found in the recent publication, *Adkins, K., C. L. Roy, D. E. Anderson, R. Wright. 2019. Landscape-scale Greater Prairie-chicken Habitat Relations and the Conservation Reserve Program. The Journal of Wildlife Management DOI: 10.002/jwmg.21724*

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

Range[b]	Survey Block	Area (km^2)	2019 Booming grounds	2019 Males[c]	Change from 2018[a] Booming grounds	Change from 2018[a] Males[c]
Core	Polk 1	41.2	5	26	1	-9
	Polk 2	42.0	3	32	-2	-33
	Norman 1	42.0	1	3	0	-5
	Norman 2	42.2	3	21	-2	-10
	Norman 3	41.0	3	25	-4	-25
	Clay 1	46.0	7	126	1	22
	Clay 2	41.0	2	55	0	0
	Clay 3	42.0	4	61	-1	-25
	Clay 4	39.0	2	7	1	4
	Wilkin 1	40.0	2	38	-2	-3
	Core subtotal	415.0	32	393	-8	-84
Periphery	Mahnomen	41.7	2	42	-1	-20
	Becker 1	41.4	4	17	-3	-31
	Becker 2	41.7	1	6	-1	1
	Wilkin 2	41.7	1	10	0	6
	Wilkin 3	42.0	3	13	0	0
	Otter Tail 1	41.0	1	8	-1	-3
	Otter Tail 2	40.7	1	9	-2	-12
	Periphery subtotal	290.6	13	104	-8	-59
Grand Total		705.5	45	497	-16	-143

[a] The 2018 count was subtracted from the 2019 count, so positive values indicate increases.

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

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

ACKNOWLEDGMENTS

I would like to thank cooperators who conducted and helped coordinate the prairie-chicken survey. Cooperators within the DNR included Emily Hutchins, Brian Torgusson, Rob Baden, Michael Oehler, Matt Morin, and Becky Ekstein; cooperators with The Nature Conservancy included Brian Winter, Travis Issendorf, and volunteers Pat Beauzay, Matt Mecklenburg, Tyler Larson, Derek Savage, Tony Nelson, and Carl Altenbernd; cooperators with the US Fish and Wildlife Service included Shawn Papon, Chad Raitz, Ben Walker, Erin Lentz, Traver Fields, and Stacy Salvevold; and numerous additional volunteers participated, including Dan Svedarsky, Doug Wells, Jon Voz, Ross Hier, Phil Doll, and Doug Hedtke. University of North Dakota students also assisted with surveys this year. This survey was funded in part by the Wildlife Restoration (Pittman-Robertson) Program W-69-S-16 Project #12. Mike Larson provided assistance and comments which improved this report.

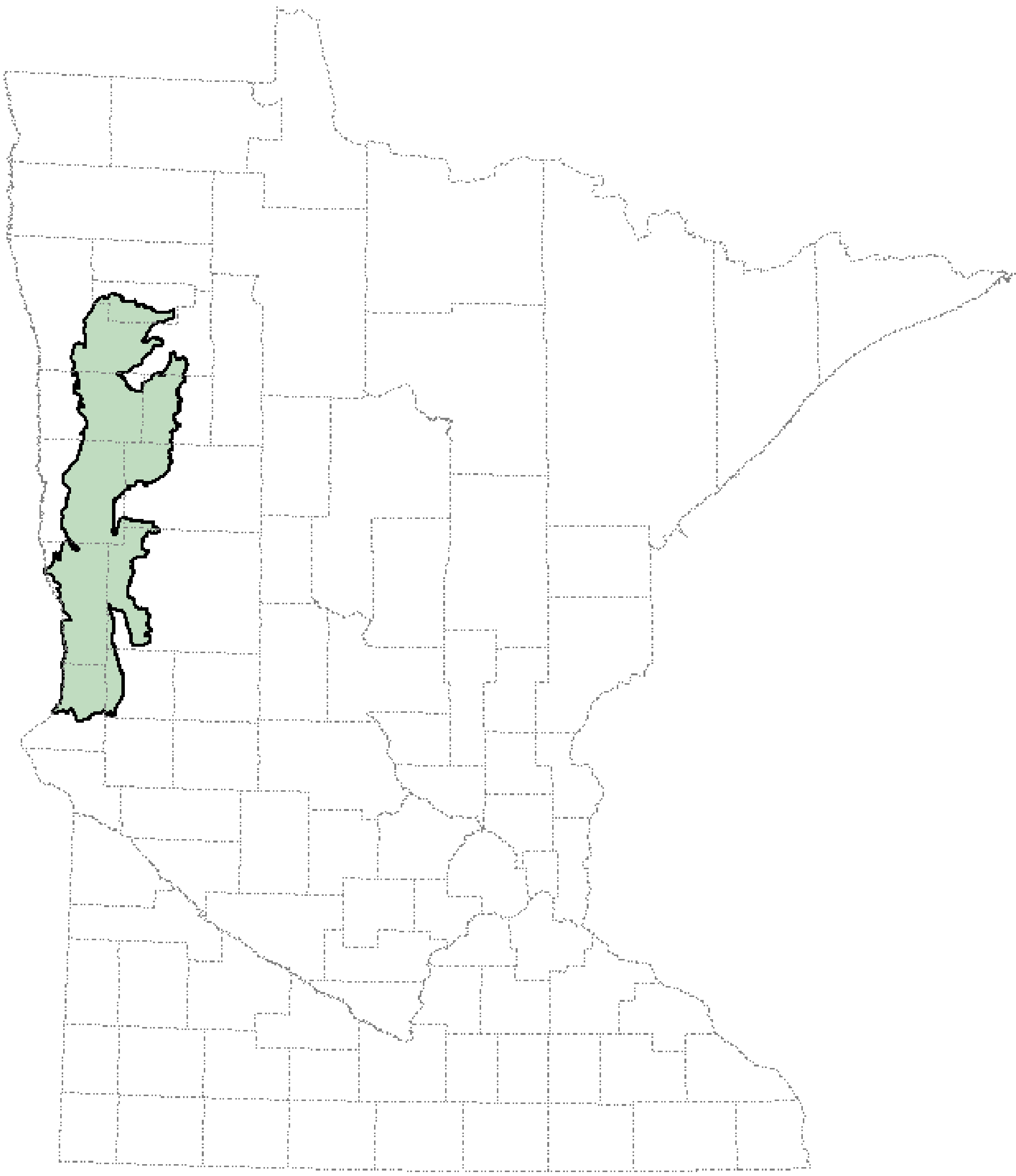


Figure 1. Primary greater prairie-chicken range in Minnesota (shaded area) relative to county boundaries. The range boundary was based on Ecological Classification System Land Type Associations and excludes some areas known to be occupied by prairie-chickens.

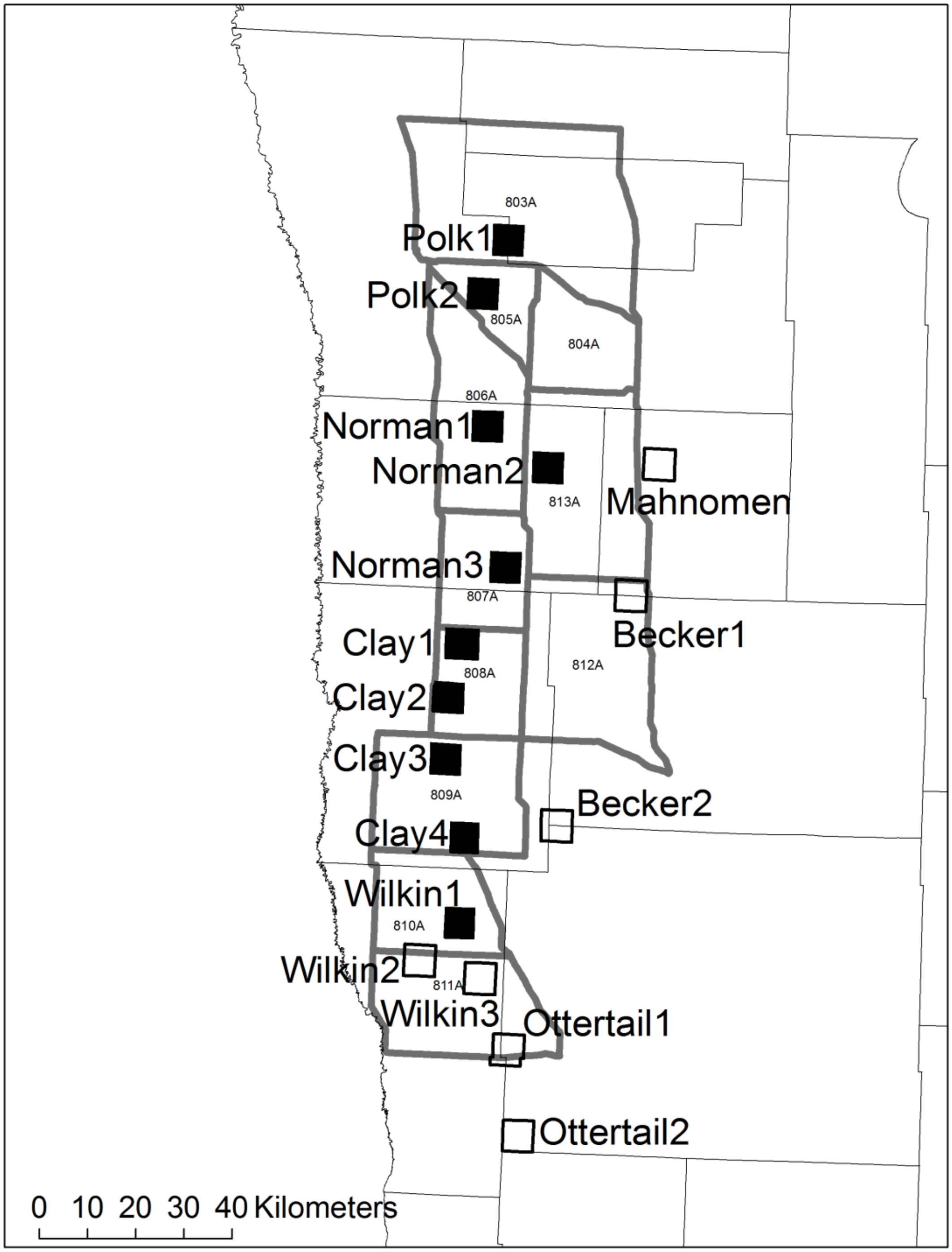


Figure 2. Prairie-chicken lek survey blocks (41 km^2, labeled squares) and hunting permit areas (thick grey lines) in western Minnesota. Survey blocks were either in the core (black) or periphery (white) of the range with a threshold of 1.0 male/km^2 in 2010, and were named after their respective counties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

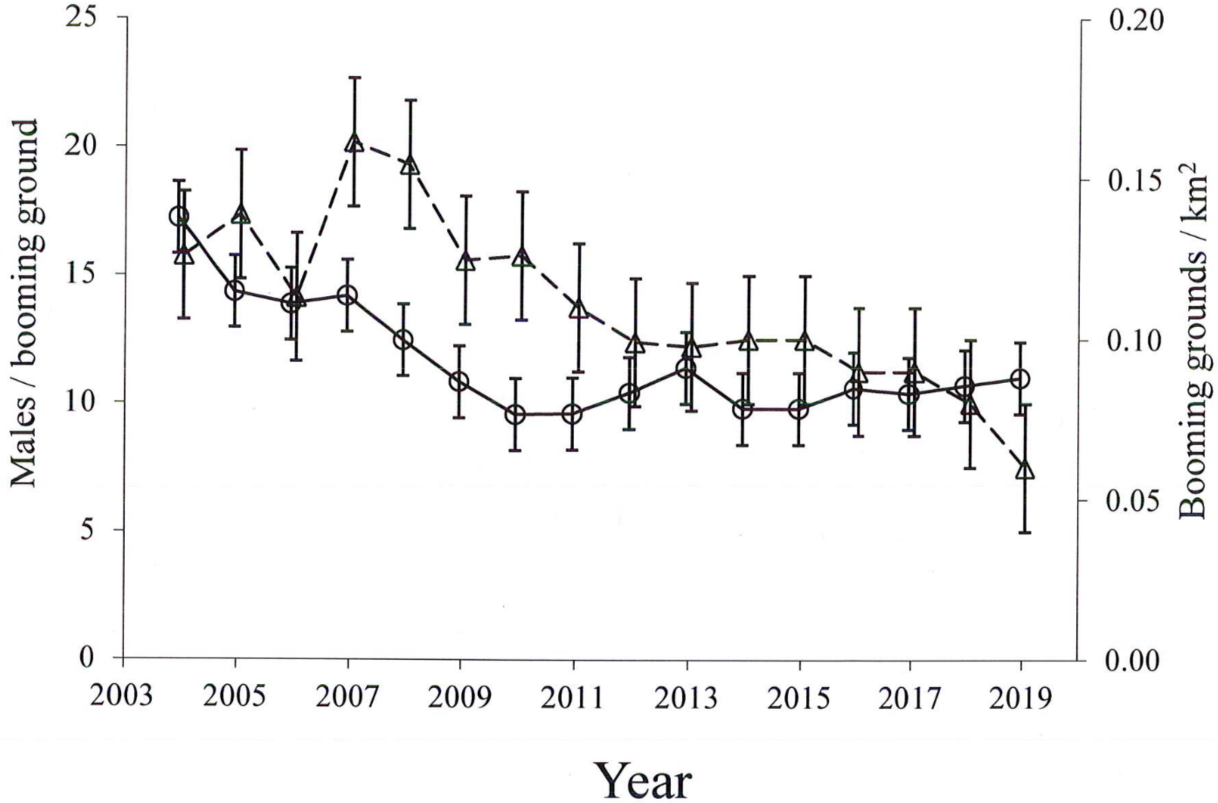


Figure 3. Mean prairie-chicken males/booming ground (circles connected by solid line) and booming grounds/km^2 (triangles connected by dashed line) in survey blocks in Minnesota with 95% confidence intervals.

2019 NW MN ELK SURVEYS

Doug Franke, Area Wildlife Manager, Thief River Falls

INTRODUCTION

Minnesota DNR Fish and Wildlife and Enforcement staff used a single fixed-wing aircraft (Cessna 185 Skywagon) to conduct aerial elk surveys for the Grygla and Lancaster elk herds between February 10th and February 16th, 2019. As in the past, survey transects were spaced 1/5 mile apart and flown at an altitude of 300 to 400 feet and speeds of 80-85 mph. A pilot and two observers recorded elk locations and documented antlerless and antlered elk. Cow and calf elk were combined and recorded as antlerless since differentiating the two is difficult due to the animals moving and the altitude and speed of the fixed-wing aircraft. Antlered elk were recorded as either branch antlered or spike bulls.

The survey block for Grygla was expanded this year by fourteen square miles in the northeast corner after local landowners reported two mature bulls frequenting an area outside of the previous boundary. The same predetermined transects used in 2018 were flown for the Lancaster survey block. The Caribou-Vita elk survey block was not flown this year since Manitoba Wildlife was not able to fund an aerial elk survey on the Canadian side.

Observability conditions were excellent this year. Snow depths and conditions were very consistent and considered very good for both elk survey blocks. Snow depths ranged from 20 to 25 inches across both the Grygla and Lancaster areas. Weather conditions were also very good for this time of the year with temperatures ranging from a low of -10°F to a high of 13°F with mostly cloudy skies. There was a two-day weather delay between the first and second days of the Grygla survey due to snow and high winds.

Grygla Survey Block

This survey started on February 10th and after a two-day weather delay was completed on February 13, 2019. The area surveyed was the same 133 mi^2 block that has been used the past two years with an additional 14 mi^2 added in the northeast corner—147 mi^2 total (Figure 2). After the 2018 survey, Thief Lake WMA staff received information that a landowner had been feeding two bull elk just north of the survey block. This prompted the decision to expand the survey boundary. Total aircraft engine time to complete this survey (takeoff to landing) was 10.9 hours. The fixed-wing crew recorded elk at 4 separate locations within the survey boundary--all elk were observed on the first day. Total elk observed was 19 and included: 8 antlerless and 11 bulls (10 branch antlered and 1 spike). Of special note is that many of the elk were located on State Wildlife Management Area land at the time of the survey.

Lancaster Survey Block—Water Tower and Percy WMA herds

This survey started on February 15th and was completed on February 16, 2019. The area surveyed was the same 167 mi^2 area that has been flown the past several years (Figure 1). Total aircraft time to complete the survey was 14.5 hours (takeoff to landing). The fixed-wing crew recorded elk at 7 separate locations within the survey boundary. Total elk recorded within the Lancaster block was 94 and included: 61 antlerless and 33 bulls (22 branch antlered and 11 spikes). As with the Grygla elk herd, there were several elk either directly located on or in close proximity to State Wildlife Management Area land at the time of the survey.

- The Water Tower herd had 37 antlerless and 2 spike bull elk and were located in the same exact woodlot the antlerless group was recorded in 2018. In addition, there were 7 branch antlered and 5 spike bulls located within one to five miles of the antlerless group.
- The Percy WMA herd had 24 antlerless and 1 spike bull elk and were located approximately four miles northwest of the Percy WMA (within one mile of the 2018 location). There were 14 branch antlered and 4 spike bulls observed within 2 to 3 miles east of the antlerless group. One lone branch antlered bull was located near the western edge of the Percy WMA (similar location where a single spike bull was observed in 2018).

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

This survey block was not completed in 2019. Table 2 was included again this year as a reference—it details the age/sex breakdown for these two populations in Canada for 2017 and 2018.

Table 1 summarizes MN DNR elk observations during the past five years of NW MN aerial elk surveys. The last two pages are maps showing the 2019 locations of elk within each survey block.

ACKNOWLEDGMENTS

I would like to thank all those that helped with the survey this year, especially the fixed-wing pilot Bob Geving who provided safe flying and A+++ landings for all of us! Observers this year included: Kyle Arola (Thief Lake Area Wildlife Manager), Jason Wollin (Karlstad Assistant Area Wildlife Manager), and myself. Special thanks again to Brian Haroldson who put together all of the survey materials and computer used during the survey—much appreciated!

Table 1. Comparison of aerial survey elk observations between 2015 and 2019 for the Lancaster, Caribou-Vita, and Grygla herds.

	Lancaster					Caribou-Vita (US side of border)					Grygla				
	2015	2016	2017	2018	2019	2015	2016	2017	2018	2019*	2015	2016	2017	2018	2019
Spike bull	2	6	2	5	11	5	0	0	1	-	3	2	4	2	1
Branch antlered bull	16	12	14	13	22	17	6	1	6	-	6	9	6	6	10
Total bulls	**18**	**18**	**16**	**18**	**33**	**22**	**6**	**1**	**7**	**-**	**9**	**11**	**10**	**8**	**11**
Antlerless	**16**	**34**	**45**	**57**	**61**	**57**	**4**	**0**	**0**	**-**	**9**	**10**	**7**	**7**	**8**
Total elk	**34**	**52**	**61**	**75**	**94**	**79**	**10**	**1**	**7**	**-**	**18**	**21**	**17**	**15**	**19**

* Survey was not completed in 2019

Table 2. Aerial survey elk observations recorded by Manitoba Wildlife—2017 and 2018

	Border (Caribou)		Vita		Combined Total	
	2017	2018	2017	2018	2017	2018
Spike bull	2	3	4	2	6	5
Branch antlered bull	17	12	7	5	24	17
Total bulls	**19**	**15**	**11**	**7**	**30**	**22**
Cow	68	*	32	*	100	*
Calf	21	*	12	*	33	*
Total antlerless	**89**	**65**	**44**	**39**	**133**	**104**
Total elk	**108**	**80**	**55**	**46**	**163**	**126**

* Manitoba Wildlife did not differentiate antlerless elk between cows and calves in 2018

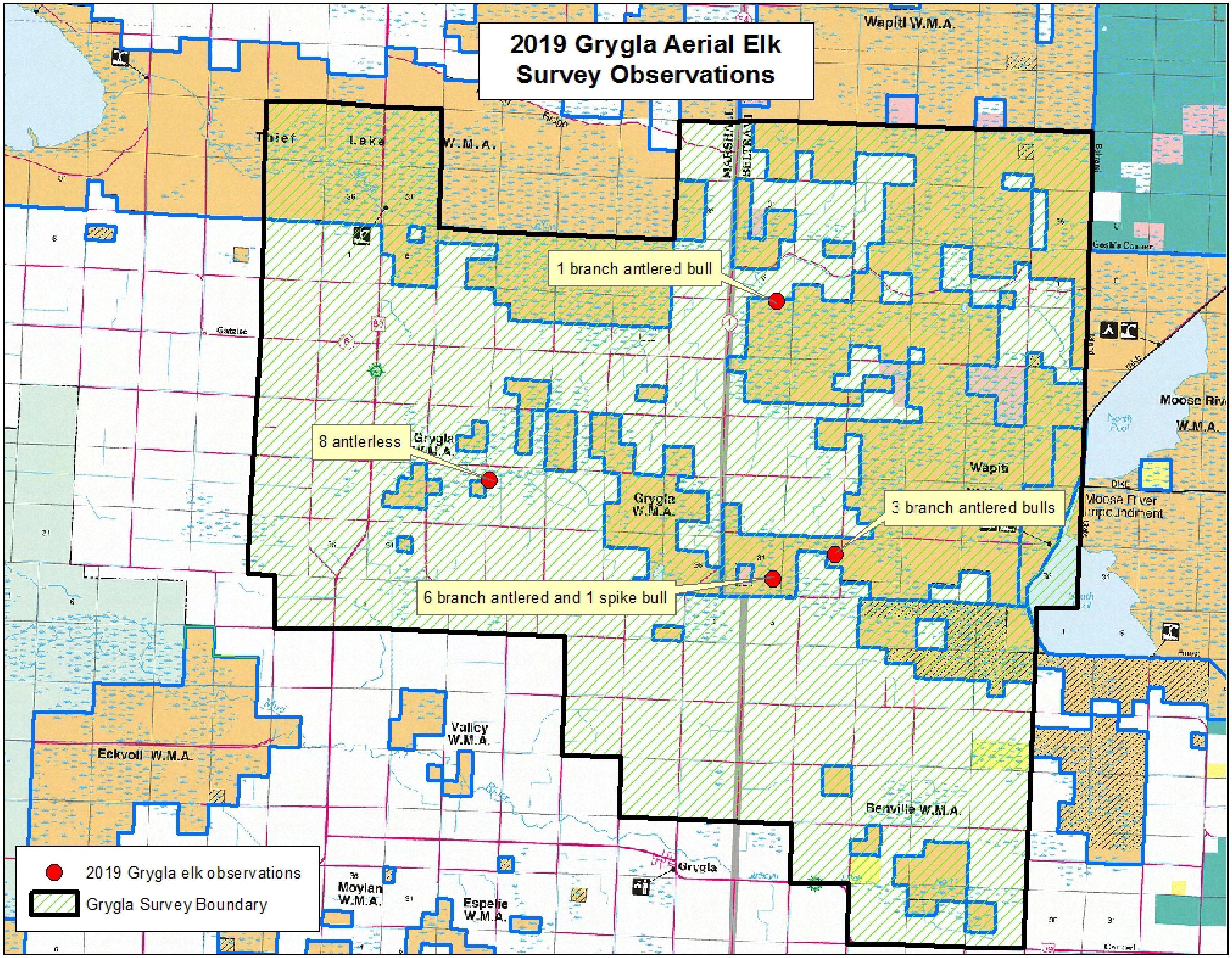


Figure 1. Locations of elk observed within the Grygla area survey blocks, 2019

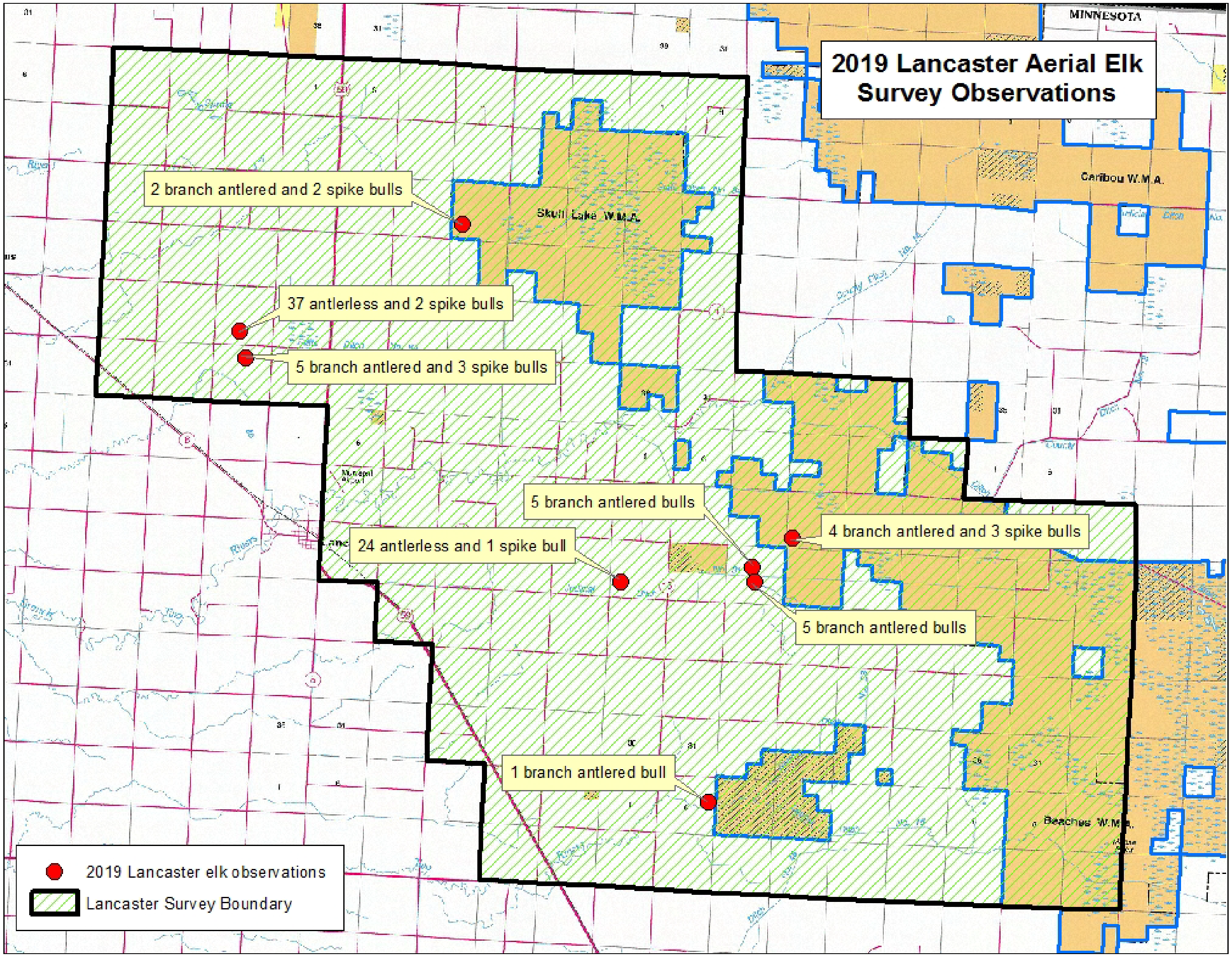


Figure 2. Locations of elk observed within the Lancaster area survey blocks, 2019.

2019 AERIAL MOOSE SURVEY

Glenn D. DelGiudice, Forest Wildlife Populations and Research Group

INTRODUCTION

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

METHODS

The survey area is approximately 5,985 mi^2 (almost 4 million acres, Lenarz 1998, Giudice et al. 2012). We estimate moose numbers and age and sex ratios by flying transects within a stratified random sample of the 436 total survey plots that cover the full extent of moose range in northeastern Minnesota (Figure 1). To keep the stratification current, all survey plots are reviewed and re-stratified as low, medium, or high moose density about every 5 years based on past survey observations of moose, locations of recently harvested moose, and extensive field experience of moose managers and researchers. Low, medium, or high density classes are based on whether ≤ 2, 3–7, or ≥8 moose, respectively, would be expected to be observed in a specific plot. The most recent re-stratification was conducted in October 2018 for the 2019 survey. Additionally, individual plots may be re-stratified after each annual survey as warranted by aerial observations. Stratification is most important to optimizing precision of our survey estimates. In 2012, we added a 4th stratum represented by a series of 9 plots (referred to as "habitat plots") which have already undergone, or will undergo significant disturbance by wildfire, prescribed burning, or timber harvest. These same 9 plots are surveyed each year in an effort to better understand moose use of disturbed areas and evaluate the effect of forest disturbance on moose density over time. In total, we surveyed 52 (43 randomly sampled and the 9 habitat plots) of the 436 plots this year.

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

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

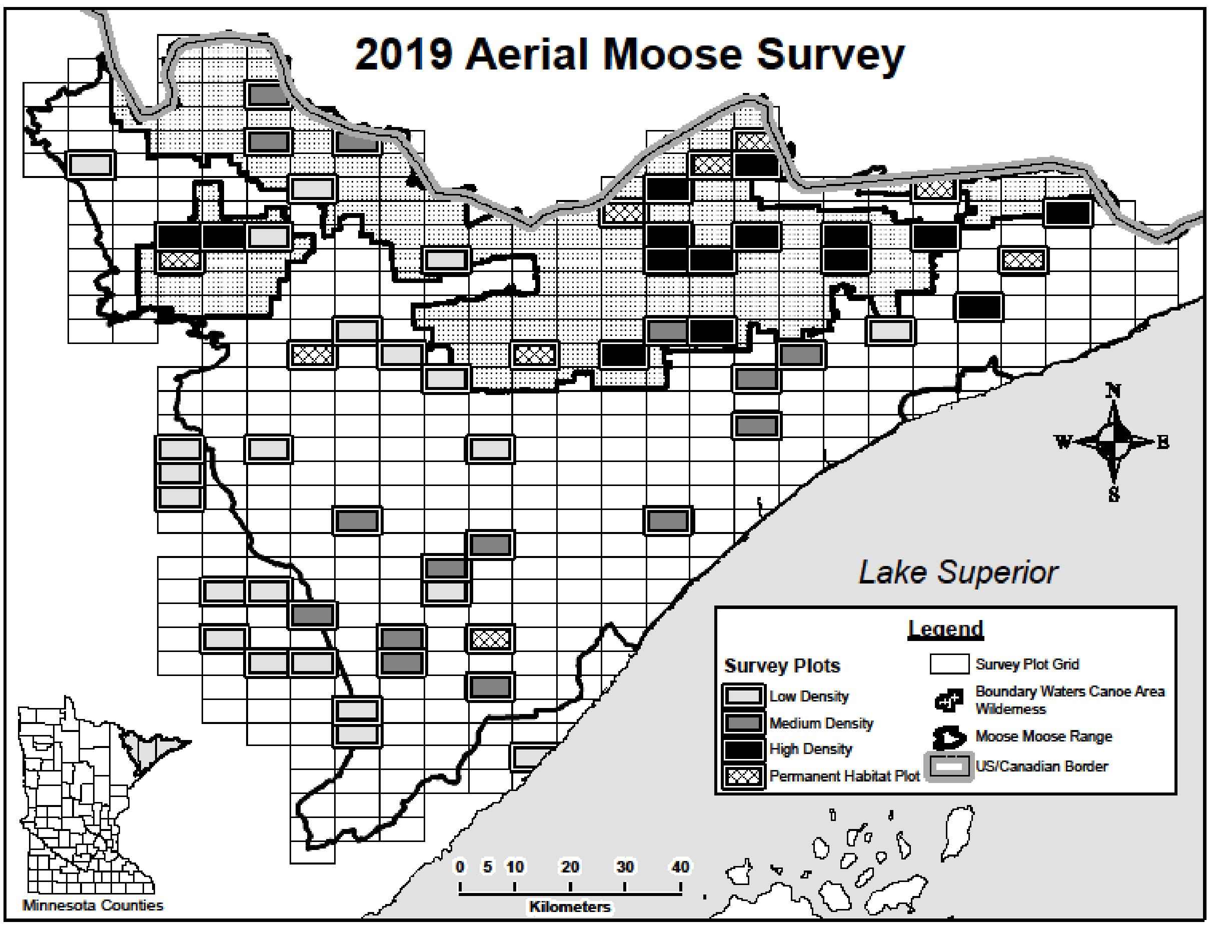


Figure 1. Moose survey area and 52 sample plots flown in the 2019 aerial moose survey.

RESULTS AND DISCUSSION

The survey was conducted from 3 to 17 January 2019. It consisted of 10 actual survey days, and as from 2014 to 2018, it included a sample of 52 survey plots. This year, based on optimal allocation analyses, we surveyed 19 low-, 12 medium-, and 12 high-density plots, and the 9 permanent or habitat plots (Giudice 2019). Generally, 8" of snow cover is our minimum threshold depth for conducting the survey. Snow depths were 8–16" and >16" on 8% and 92% of the sample plots, respectively. Overall, survey conditions were rated as good for 86%, fair for 12%, and poor for 2% of the plots when surveyed. Average survey intensity was 47 minutes/plot (13.9 mi^2) and ranged from 30 to 55 minutes/plot (Giudice 2019).

This year 429 moose were observed on 43 (83%) of the 52 plots surveyed (a total 723 mi^2), more than the 415 moose observed on 37 of 52 plots during the 2018 survey. An average of 10.0 moose (range = 1–38) were observed per "occupied" plot. Plot occupancy during the past 15 years averaged 81% (range = 65–95%) with a mean 11.7 moose observed per occupied plot. This year's 429 observed moose included 179 bulls, 182 cows, 61 calves, and 7 unclassified adults. Overall, estimated VO averaged 40% (range = 5−90%) and average estimated detection probability was 0.59 (range = 0.20−0.83). Both VO and detection probability have remained relatively constant since 2005.

After adjusting for sampling and sightability, we estimated the population in northeastern Minnesota at 4,180 (3,250–5,580, 90% confidence interval [CI]) moose (Table 1, Figure 2). As can be noted from the 90% confidence intervals associated with the population point estimates, statistical uncertainty inherent in aerial wildlife surveys can be quite large, even when surveying large, dark, relatively conspicuous animals such as moose against a white background during winter. This is attributable to the varied (1) occurrence of dense vegetation, (2) habitat use by moose, (3) behavioral responses to aircraft, (4) effects of annual environmental conditions (e.g., snow depth, ambient temperature) on their movements, and (5) interaction of these and other factors. Consequently, year-to-year statistical comparisons of population estimates are *not* supported by these surveys. These data are best suited to establishing long-term trends; even short-term trends must be viewed cautiously.

Past aerial survey and research results have indicated that the long-term trend of the population in northeastern Minnesota has been declining since 2006 (Lenarz et al. 2010, DelGiudice 2018). The current population estimate is 53% less than the estimate in 2006 and the declining linear trend during the past decade remains statistically significant (r^2 = 0.76, P< 0.001, Figure 2). However, the leveling since 2012 persists, and a piecewise polynomial curve indicates that the trend from 2012 to 2019 is not declining (Figure 3). While this recent short-term trend (8-year) is noteworthy, it applies only to the existing survey estimates, and does not forecast the future trajectory of the population (Giudice 2019).

The January 2019 calf:cow ratio of 0.33 is lower than the 14-year average since 2005 (0.40, Table 1, Figure 4). Calves were 14% of the total 429 moose actually observed and represented 13% of the estimated population (Table 1, Figure 4). Twin calves were observed with 5 of the 182 (3%) cow moose (Table 1). Although we know from recent field studies that fertility (pregnancy rates) of the population's adult females has been robust, overall, survey results indicate calf survival to January 2019 remains low, typical compared to most years since the population decline began following the 2006 survey (Table 1). Calf survival during the January−April interval can decline markedly (Schrage et al., unpublished data), and annual spring recruitment of calves (survival to 1 year old) can have a significant influence on the population's performance and dynamics. Findings of a recent field study documented similar low calf survival (0.442−0.485) to early winter in 2015−16 and 2016−17 (Obermoller 2017, Severud 2017). Calf survival by spring 2017 (recruitment) had declined to just 0.33. But it is also important to note that adult moose survival has the greatest long-term impact on annual changes in the moose population (Lenarz et al. 2010). Consistent with the recent relative stability of the population trend, the annual survival rate of adult GPS-collared moose has changed little (85–88%) during 2014−2017 (Carstensen et al. 2017, unpublished data), but is slightly higher than the previous long-term (2002−2008) average of 81% (Lenarz et al. 2009).

The January 2019 estimated bull:cow ratio (1.23, Table 1; Figure 5) appears to be elevated compared to the long-term average of 1.00 during 2005–2018, and compared to the mean ratio (0.87) of 2009−2012, when the population decline was steepest. Estimated bull:cow ratios have been this high previously (2013 and 2014) during the recent interval of apparent stability; however, due to the notable annual variability associated with the bull:cow ratios, there is no apparent upward or downward long-term trend (Figure 5).

Table 1. Estimated moose abundance, 90% confidence intervals, calf:cow ratios, percent calves in the population, percent cows with twins, and bull:cow ratios estimated from aerial surveys in northeastern Minnesota, 2005–2019.

Survey	Estimate	90% Confidence Interval	Calf: Cow	% Calves	% Cows w/ twins	Bull: Cow
2005	8,160	6,090 – 11,410	0.52	19	9	1.04
2006	8,840	6,790 – 11,910	0.34	13	5	1.09
2007	6,860	5,320 – 9,100	0.29	13	3	0.89
2008	7,890	6,080 – 10,600	0.36	17	2	0.77
2009	7,840	6,270 – 10,040	0.32	14	2	0.94
2010	5,700	4,540 – 7,350	0.28	13	3	0.83
2011	4,900	3,870 – 6,380	0.24	13	1	0.64
2012	4,230	3,250 – 5,710	0.36	15	6	1.08
2013	2,760	2,160 – 3,650	0.33	13	3	1.23
2014	4,350	3,220 – 6,210	0.44	15	3	1.24
2015	3,450	2,610 – 4,770	0.29	13	3	0.99
2016	4,020	3,230 – 5,180	0.42	17	5	1.03
2017	3,710	3,010 − 4,710	0.36	15	4	0.91
2018	3,030	2,320 – 4,140	0.37	15	4	1.25
2019	4,180	3,250 – 5,580	0.33	13	3	1.23

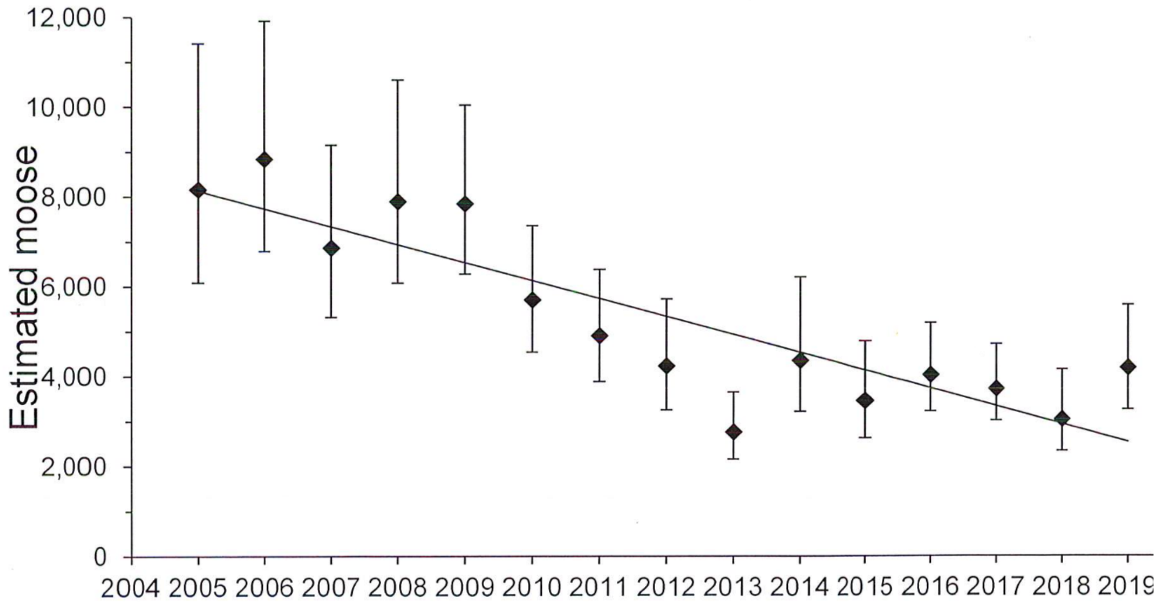


Figure 2. Point estimates, 90% confidence intervals, and a linear trend line of estimated moose abundance in northeastern Minnesota, 2005–2019 (y = -400*x* + 809841, r^2 = 0.76, P < 0.001). Note: The 2005 survey was the first to be flown with helicopters, and to include a sightability model and a uniform grid of east-west oriented rectangular 13.9-mi^2 plots.

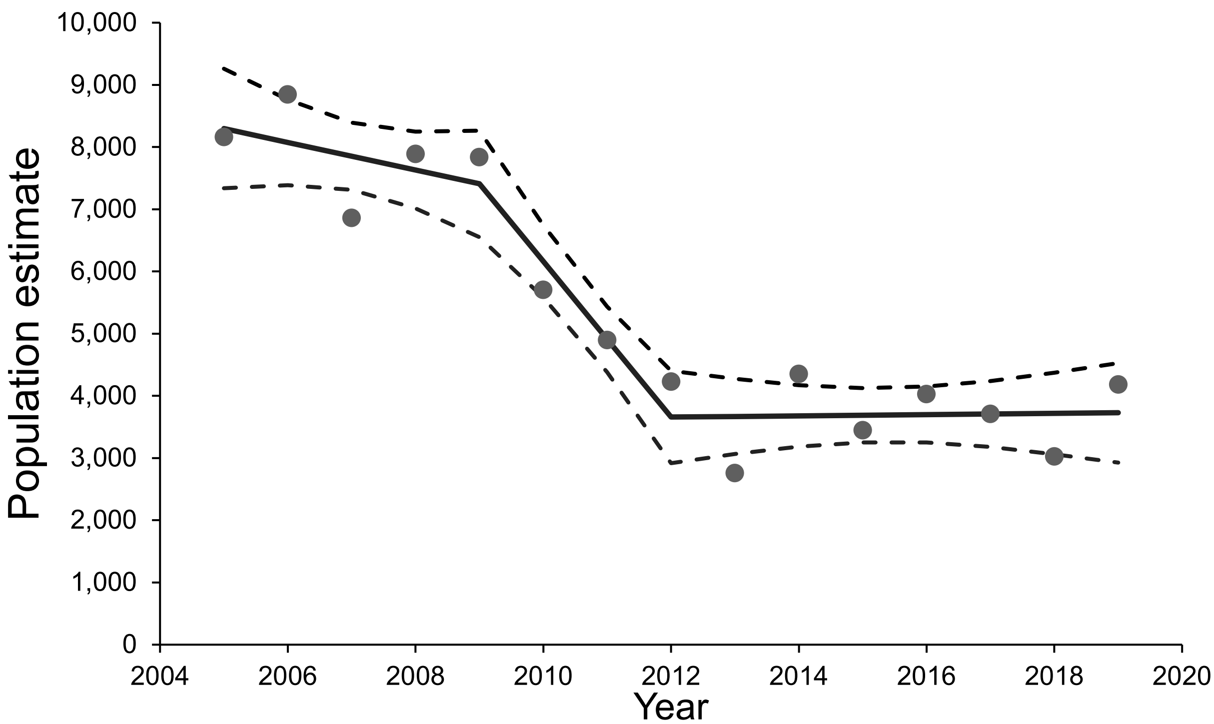


Figure 3. Point estimates, 95% confidence intervals, and a piecewise polynomial curve of moose abundance in northeastern Minnesota, 2005–2019 (Giudice 2019). This curve shows a change in the short-term slope of the trend from 2012 to 2019 compared to 2009 to 2012.

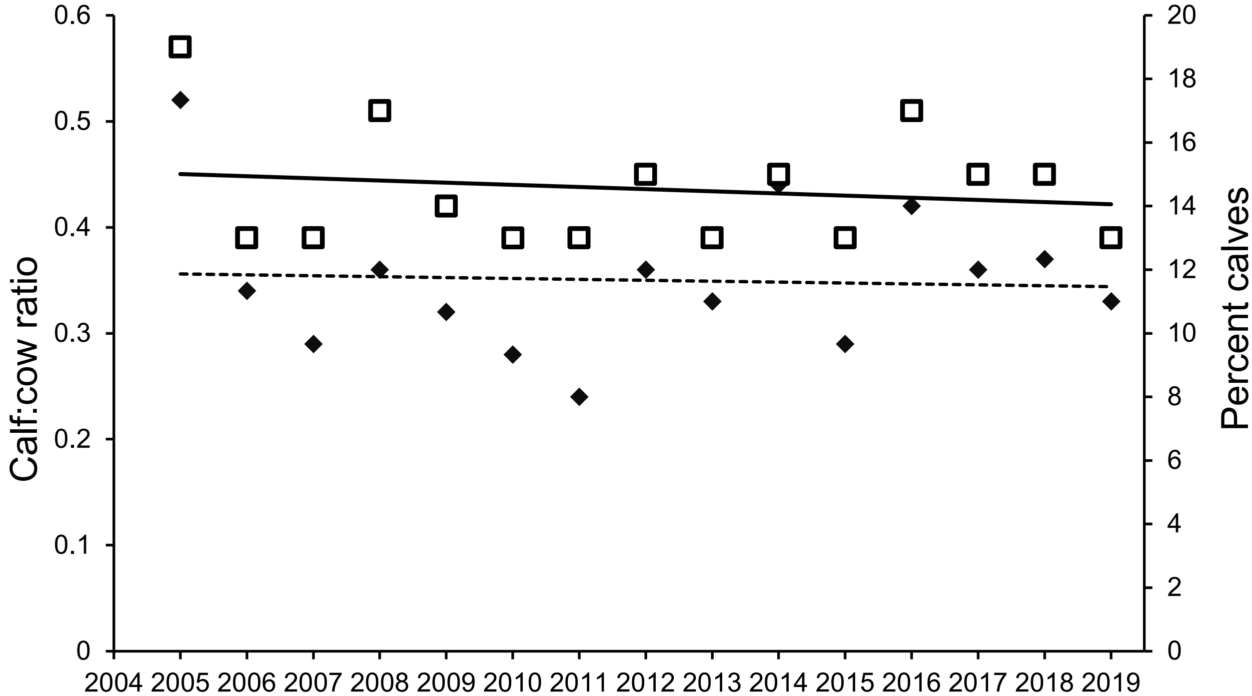


Figure 4. Estimated calf:cow ratios (solid diamonds, dashed trend line) and percent calves (open squares, solid trend line) of the population from aerial moose surveys in northeastern Minnesota, 2005–2019.

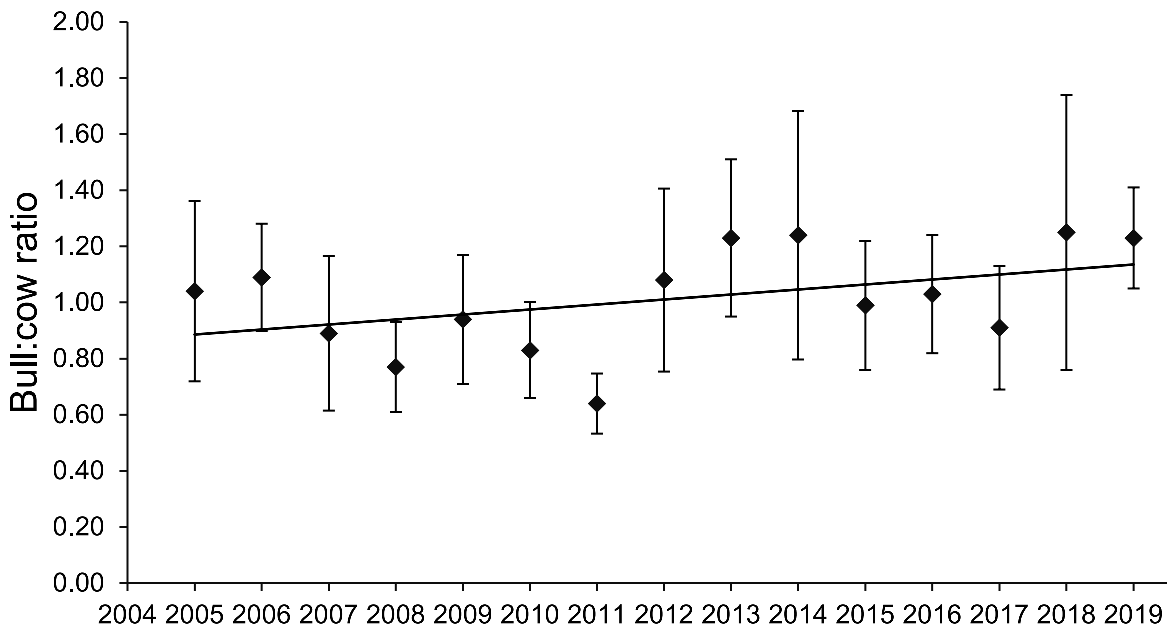


Figure 5. Estimated bull:cow ratios, 90% confidence intervals, and trend line from aerial moose surveys in northeastern Minnesota, 2005–2019.

ACKNOWLEDGMENTS

This survey is an excellent partnership between the Divisions of Enforcement and of Fish and Wildlife, the Fond du Lac Band of Lake Superior Chippewa, and the 1854 Treaty Authority. Specifically, thank you to Thomas Buker, Chief Pilot, for coordinating all of the aircraft and pilots; Tom Rusch for coordinating flights, survey crews, and other important parts of this effort; and Mike Schrage (Fond du Lac Band of Lake Superior Chippewa) and Darren Vogt (1854 Treaty Authority) for securing supplemental survey funding from their respective groups. Enforcement pilots, Brad Maas and John Heineman, and Luke Ettl (MIFC) skillfully piloted the aircraft during the surveys; Tom Rusch, Mike Schrage, and Nancy Hansen flew as our seasoned observers, and welcome to Morgan Swingen, our newest observer and member of the team. Thank you to John Giudice who continues to provide critical statistical consultation and analyses, and to Barry Sampson (now retired) 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, updates specific maps, provided refresher training for survey observers using DNRSurvey, and now also assumes Barry Sampson's GIS survey responsibilities. The efforts of all of these people contribute to survey improvements, ensure the survey's rigor and the comparability of long-term results. This report has been reviewed by Paul Telander, Lou Cornicelli, Mike Larson, John Giudice, Mike Schrage, and Morgan Swingen. This project was funded in part by the Wildlife Restoration (Pittman-Robertson) Program.

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MINNESOTA WOLF POPULATION UPDATE 2019

John Erb and Carolin Humpal, 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 only minor change in the total amount of land occupied by wolf packs; similar patterns were found 5 years later as part of the winter 2017-18 survey (Erb et al. 2018).

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. Since that time, wolf surveys have continued on an annual basis. Herein we provide an update of population status from the 2018-19 winter survey.

METHODS

The methodology used to estimate wolf population size in Minnesota utilizes three primary pieces of information: 1) an estimate of the total area of land occupied by wolf packs; 2) an estimate of average wolf pack territory size; and 3) an estimate of average mid-winter pack size. It is likely that occupied range changes on a comparatively slow timescale compared to fluctuations in average territory and pack size. As such, occupied range is estimated only once every 5 years, with the last being during winter 2017-18; we assume that occupied range has remained unchanged (i.e., 73,972 km^2; Erb et al. 2018) and use that in our population calculations for winter 2018-19.

To radio-collar wolves, we and various collaborators captured wolves using foothold traps (LPC # 4, LPC #4 EZ Grip, or LPC #7 EZ Grip) approved as part of research conducted under the Association of Fish and Wildlife Agencies Best Management Practices for trapping program.

Twenty-five wolves have also been captured with the use of live-restraining neck snares, and a few by helicopter dart-gun. Wolves were typically immobilized using a mixture of either Ketamine:Xylazine or Telazol:Xylazine. After various project-specific wolf samples and measurements were obtained, the antagonist Yohimbine and an antibiotic were typically administered to all animals prior to release. Various models of radio-collars were deployed depending on study area and collar availability. Most GPS radio-collars were programmed to take 3-6 locations per day, while wolves fitted with VHF-only radio-collars were relocated at approximately 7- to 10-day intervals throughout the year, or in some cases primarily from early winter through spring.

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

In past surveys where all or the majority of territories were delineated using VHF radiolocations, raw territory sizes were increased 37% to account for the average amount of interstitial space between delineated wolf pack territories, as estimated from several Minnesota studies (Fuller et al. 1992:50) where the number of radiolocations per pack typically averaged 30-60. Interstitial spaces are a combination of small voids created by landscape geometry and wolf behavior, but can also be an artifact of territory underestimation when there are comparatively sparse radiolocations. Hence, for packs with < 100 radiolocations (n=7; mean number of radiolocations = 36), we multiplied each estimated territory size by 1.37 as in the past. For packs with > 100 radiolocations (n = 31; mean number of radiolocations = 3,040), 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

A total of 39 packs were monitored during all or part of the survey period (April 2018 to April 2019). We obtained territory and winter pack size data from 26 radio-marked wolf packs (Figure 1). Twelve additional wolf packs had adequate radiolocation data to delineate territories, but we were unable to obtain mid-winter pack counts, and we obtained pack counts on 1 pack for which there was insufficient data to delineate a territory.

Similar to winter 2017-18, a land cover comparison using the 2011 National Land Cover Database suggests that the location of collared packs this winter led to some over-representation of habitat classified as woody wetlands and under-representation of deciduous forest (Table 1), likely a combined result of slight over-representation of packs (with large territories) near Red Lake and fewer collared packs in our southwest study area. In addition, collared pack territories under-represented, as is typically the case, areas in occupied range classified as hay/pasture/cropland, largely a result of these areas being on private land where less wolf collaring is undertaken. (Table 1). Using spring 2018 deer density data (MNDNR, unpublished data) for deer hunting permit areas, weighted by number of radio-collared wolf packs in a permit area, we estimate an average of approximately 10 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, 2018 spring deer density for the entirety of occupied wolf range (weighted by permit area) in Minnesota was approximately 13 deer/mi2.

The point estimate for average territory size this winter declined 7% from last winter. However, this change was not significant, and with possible exception of the 2014-15 estimate, average territory size has not fluctuated notably from 2003 to the present (Figure 2). After applying the territory scaling factors, average estimated territory size for radio-marked packs during the 2018-19 survey was 148 km^2 (range = 27 – 561 km^2).

Though the point estimate for average winter pack size declined by 5% from last winter, the confidence interval widely overlaps those from the previous 5 surveys, suggesting no significant changes. Average winter pack size in 2018-19 was estimated to be 4.6 (range = 2 – 8, Figure 3).

Wolf Numbers

Given an average territory size of 148 km^2 and assuming occupied range has not changed since the 2017-18 survey (73,972 km^2; Erb et al. 2018), we estimated a total of 500 wolf packs in Minnesota during winter 2018-19. 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).

After accounting for the assumed 15% lone wolves in the population, we estimated the 2018-19 mid-winter wolf population at 2,699 wolves, or 3.65 wolves per 100 km^2 of occupied range. The 90% confidence interval was approximately +/- 675 wolves, specifically 2,046 to 3,430. Given the nearly complete overlap with the 2017-18 confidence interval, we conclude that the 2018-19 statewide wolf population was unchanged from the previous winter.

Although local variability occurred, from spring 2018 to spring 2019 the overall average deer density within wolf range remained stable. Over the past 5 years, wolf population estimates have been positively correlated with average deer density within wolf range (Figure 6).

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.

Land Cover Category	Overall Occupied Wolf range % Area	Radio-collared Wolf Territories % Area
Woody Wetlands	32.6	38.0
Deciduous Forest	23.6	19.6
Emergent Herbaceous Wetlands	9.9	12.1
Mixed Forest	7.2	8.6
Evergreen Forest	7.0	8.7
Open Water	5.4	4.6
Shrub/Scrub	4.5	4.8
Pasture/Hay/Grassland/Crops	7.7	2.1
Developed, All	2.2	1.5

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

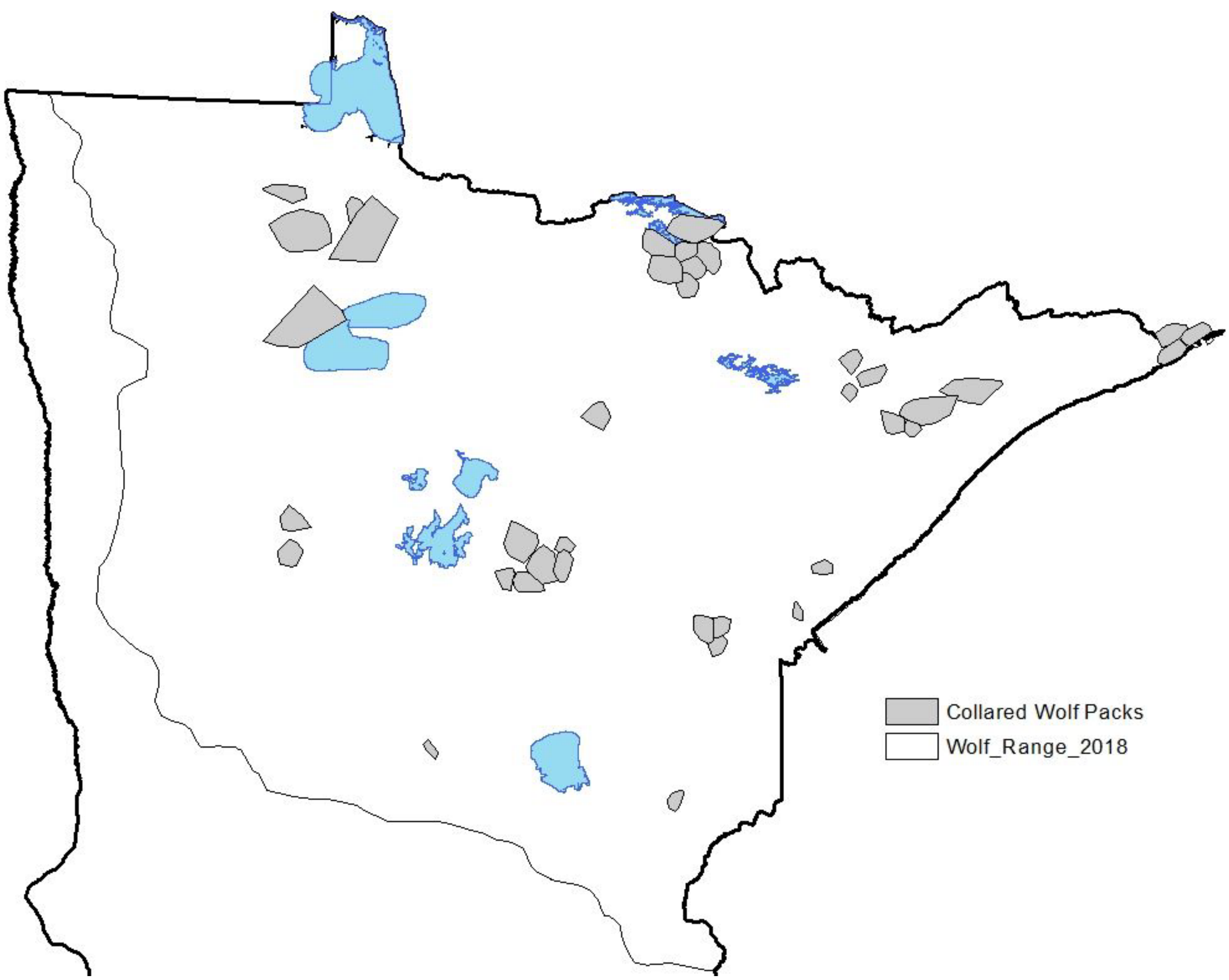

Figure 1. Location of radio-marked wolf packs during the 2018-19 survey.

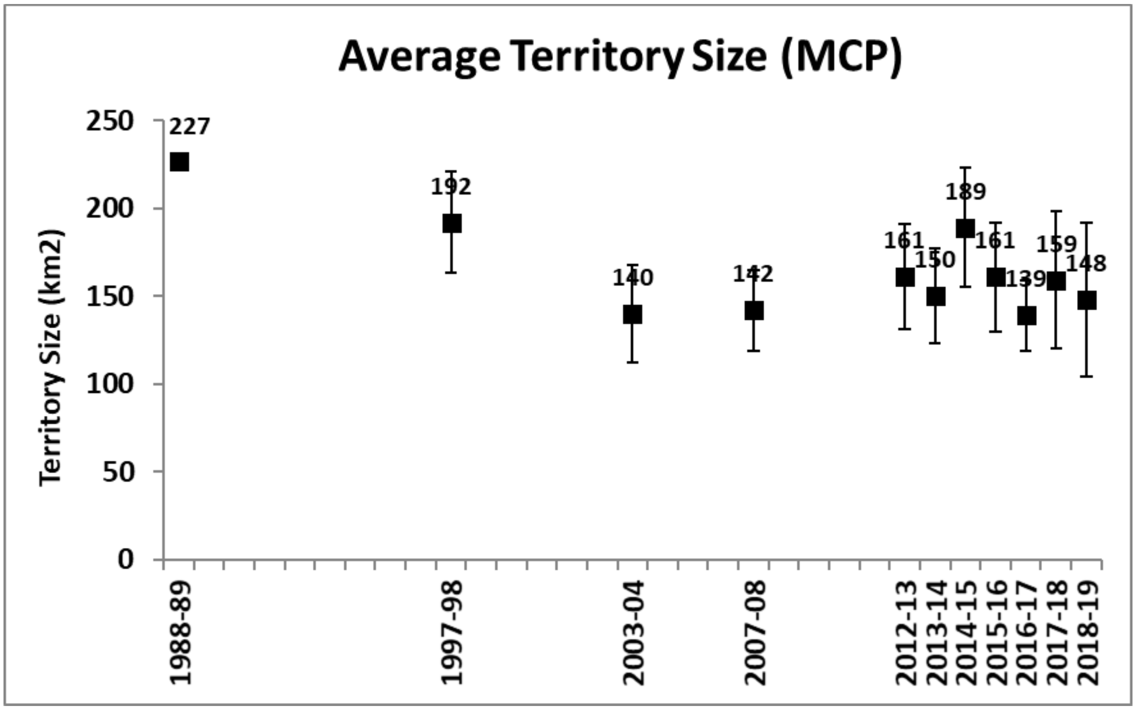

Figure 2. Average scaled territory size for radio-marked wolf packs in Minnesota from 1989 to 2018.

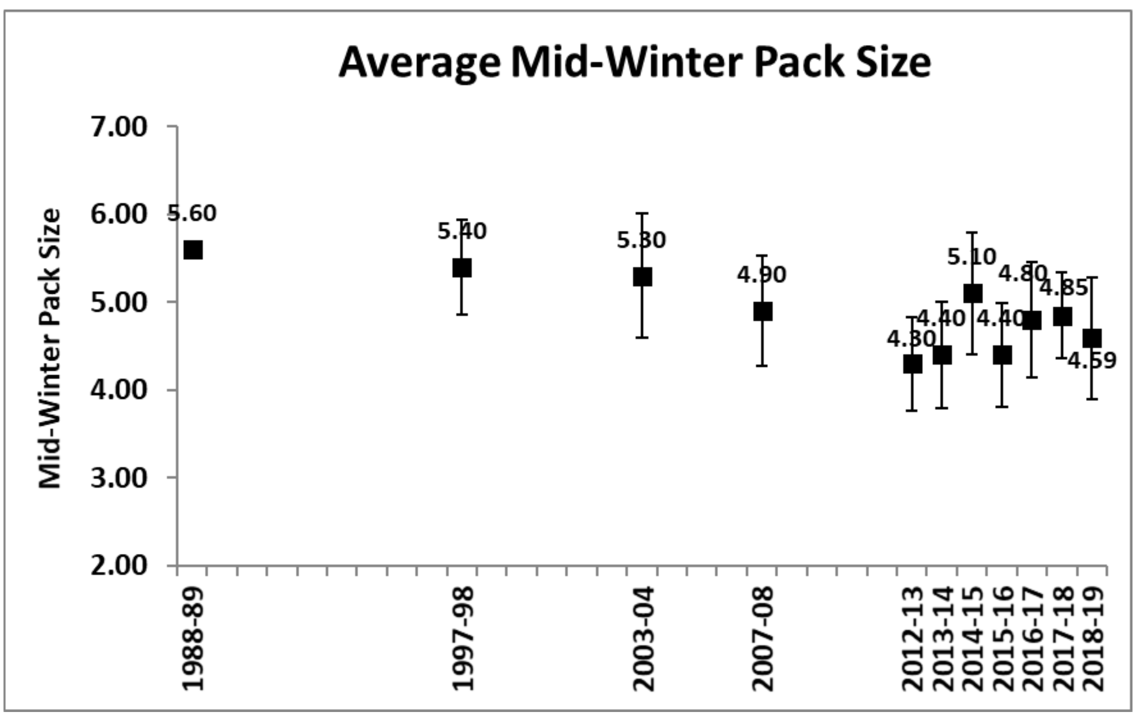

Figure 3. Average mid-winter pack size for radio-marked wolf packs in Minnesota from 1989 to 2018.

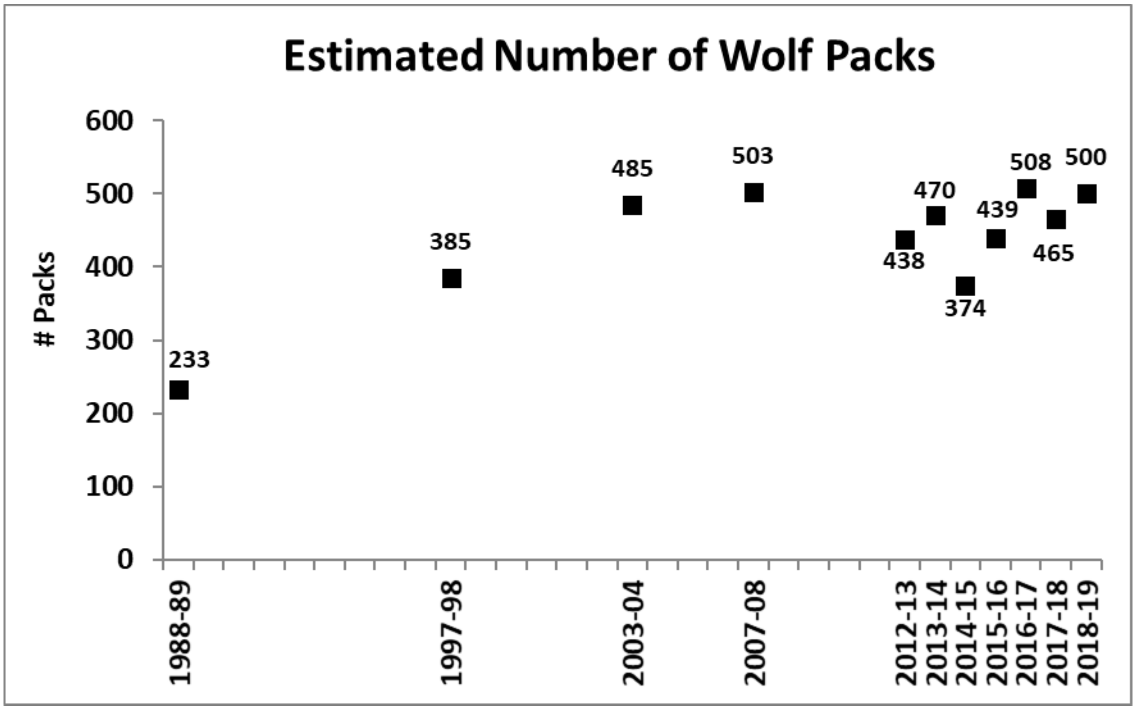

Figure 4. Estimated number of wolf packs in Minnesota at periodic intervals from 1989 to 2018.

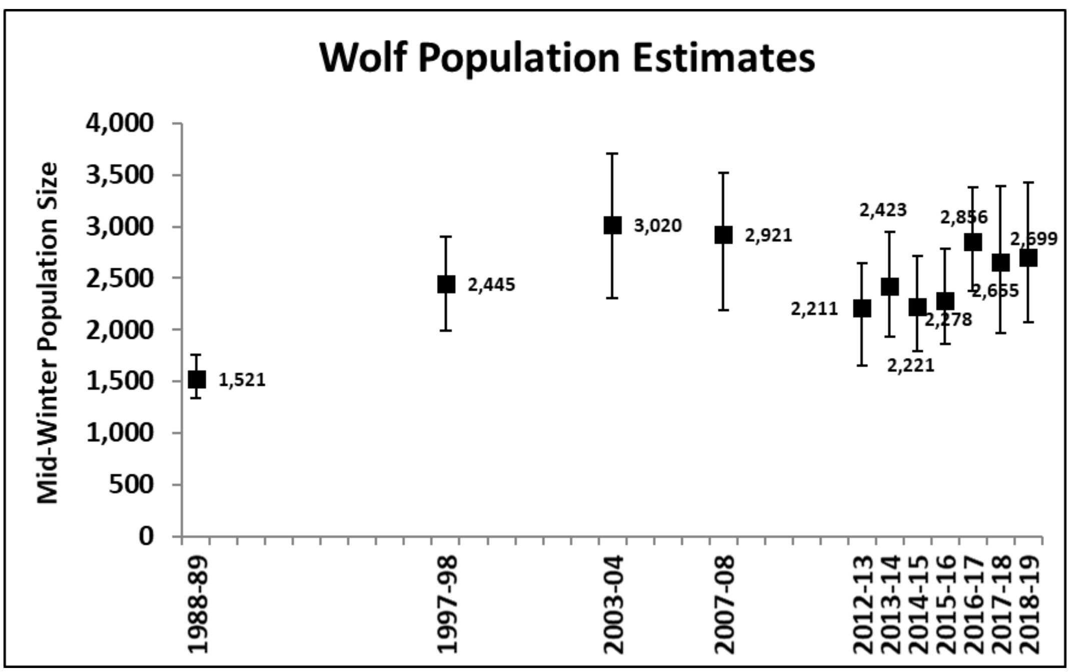

Figure 5. Wolf population estimates from periodic standardized surveys in Minnesota from 1989 to 2018.

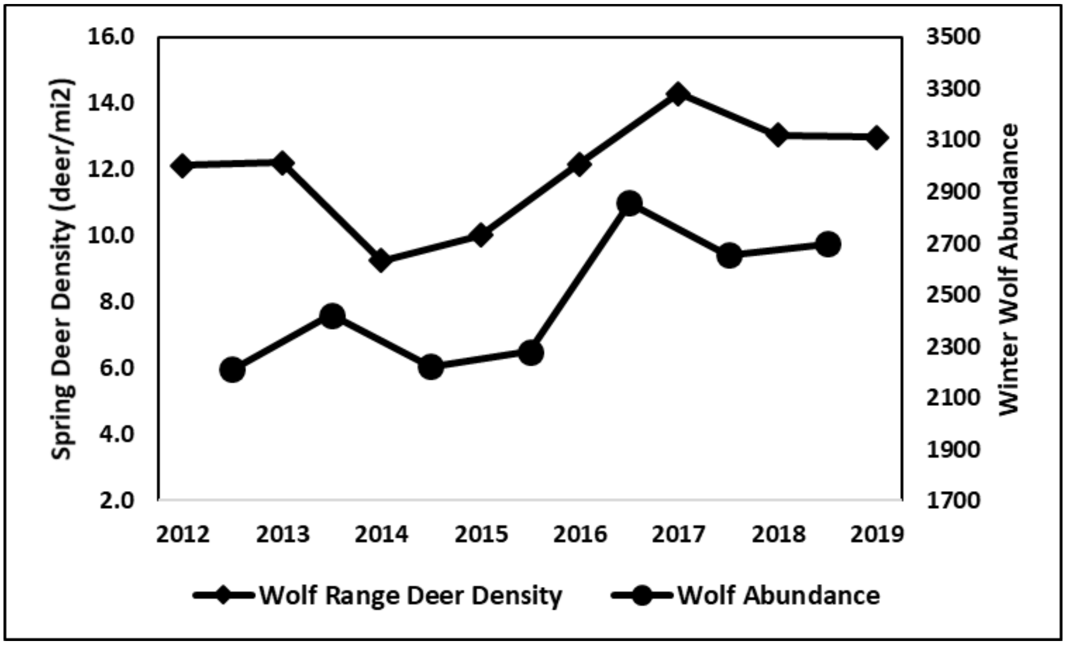

Figure 6. Comparison of estimated spring (pre-fawn) deer density and winter wolf abundance in Minnesota, 2012-2019.

ACKNOWLEDGMENTS

We thank staff with the USDA Wildlife Services program (John Hart, Kevin Fuller, and Jeff Grabarkewitz) and Barry Sampson for assistance with capturing and radio-collaring wolves. We are grateful for the critical contributions of DNR pilots Jason Jensen, John Heineman, Chris Lofstuen, Tom Buker, and Bob Geving during wolf telemetry and winter pack counts. Special thanks to numerous collaborators for their assistance or sharing of radio-telemetry data utilized in this survey, including Dave Mech and Shannon Barber-Meyer (USGS), Steve Windels, Tom Gable, Austin Homkes, and Sean Johnson-Bice (Voyageurs National Park), Jay Huseby, Dave Price, and Sarah Ruffing (Red Lake Band of Chippewa), Seth Moore and Yvette Ibrahim (Grand Portage Band of Chippewa), Mike Schrage, Lance Overland, Terry Perrault, and Matt Weske (Fond du Lac Resource Management Division), Morgan Swingen (1854 Treaty Authority), and Brian Dirks and Nancy Dietz (Camp Ripley Military Reservation). This project was funded in part by the Wildlife Restoration Program (Pittman-Robertson).

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WETLAND WILDLIFE POPULATIONS

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WATERFOWL BREEDING POPULATION SURVEY FOR MINNESOTA

Steve Cordts, Minnesota DNR, Waterfowl Staff Specialist

ABSTRACT:

The number of breeding waterfowl in a portion of Minnesota has been estimated each year since 1968 as a part of the overall inventory of North American breeding waterfowl. The survey consists of aerial observations in addition to more intensive ground counts on selected routes to determine the proportion of birds counted by the aerial crew. Procedures used are similar to those used elsewhere across the waterfowl breeding grounds. The 2019 aerial survey portion was flown from May 6-21. Overall, it was a cold, wet, and late spring across the state. Spring ice-out dates were about 1 week behind median dates. Temperatures in April averaged 1.6°F below normal statewide; temperatures in May averaged 4.5°F below normal statewide. Precipitation was 0.59 inches above normal in April and 1.6 inches above normal in May. Overall, wetland numbers (Types II-V) were 19% higher than 2018, 14% above the 10-year and 23% above the long-term average.

The 2019 estimated mallard breeding population was 286,000, which was 3% lower than last year's estimate of 295,000 mallards and statistically unchanged (P=0.88). Mallard numbers were 14% above the 10-year average and 27% above the long-term average of 225,000 breeding mallards. The estimated blue-winged teal population was 223,000, which was 17% above last year's estimate of 191,000 blue-winged teal, but statistically unchanged (P=0.71). Blue-winged teal numbers were 33% above the 10-year average and 7% above the long-term average of 208,000 blue-winged teal. The combined population index of other ducks, excluding scaup, was 185,000 ducks, which was 10% below last year's estimate, unchanged from the 10-year average and 5% above the long-term average of 176,000 other ducks.

The estimate of total duck abundance (695,000), which excludes scaup, was unchanged from last year's estimate and 15% above the 10-year average and 14% above the long-term average of 610,000 ducks. The estimated number of Canada geese was 110,000 and 32% lower than last year and 28% below both the 10-year average and the long-term average.

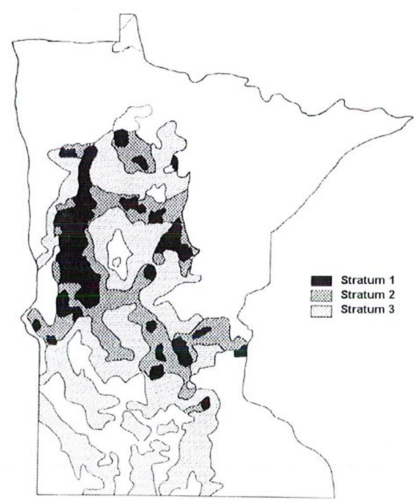

Figure 1. Location of waterfowl breeding population survey strata in Minnesota.

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.

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 or Cessna 185. 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 2018 and 2019 were compared using two-tailed Z-tests.

SURVEY CHRONOLOGY:

The 2019 aerial survey began on 6 May in southern Minnesota and concluded in northern Minnesota on 21 May. The survey start date was delayed a few days due to ice coverage still present in northern areas. Transects were flown on 9 days and completed in 49 flight hours. Flights began near 7 AM and were completed by 12:00 PM each day. The median date for survey completion was May 15, which was the same as last year.

WEATHER AND HABITAT CONDITIONS:

For most of the state, ice out was about 1 week behind historical median dates. On April 10-12, most of the state saw a late spring blizzard, with some isolated areas in western MN seeing 20+ inches of snow. Temperatures in April averaged 1.6°F below normal and precipitation was 0.59 inches above normal statewide. Temperatures in May averaged 4.5°F below normal statewide and precipitation was 1.8 inches above normal statewide (http://climate.umn.edu). Precipitation from early April until the survey was completed showed well above average precipitation in southern and central Minnesota and below average precipitation in northern Minnesota (Appendix A).

Overall wetland conditions in spring 2019 were improved from last year. In early May 2019, the U.S. drought monitor indicated 100% of the state was under no dryness designation. By late May, 93% of the state was under no drought designation and 7% was classified as abnormally dry in extreme NW Minnesota. On May 6, statewide topsoil moisture indices were rated as 0% very short, 0% short, 58% adequate and 42% surplus moisture. By May 29, statewide topsoil moisture indices were rated as 1% very short, 2% short, 44% adequate and 53% surplus moisture (http://droughtmonitor.unl.edu).

Wetland numbers (Types II-V) in 2019 were 313,000 ponds which was 19% above last year's estimate of 263,000 ponds. Wetland numbers were 14% above the 10-year average and 23% above the long-term average (Table 2; Figure 2). The number of temporary (Type 1) sheet water wetlands was 237% higher than last year and 13% above the long-term average.

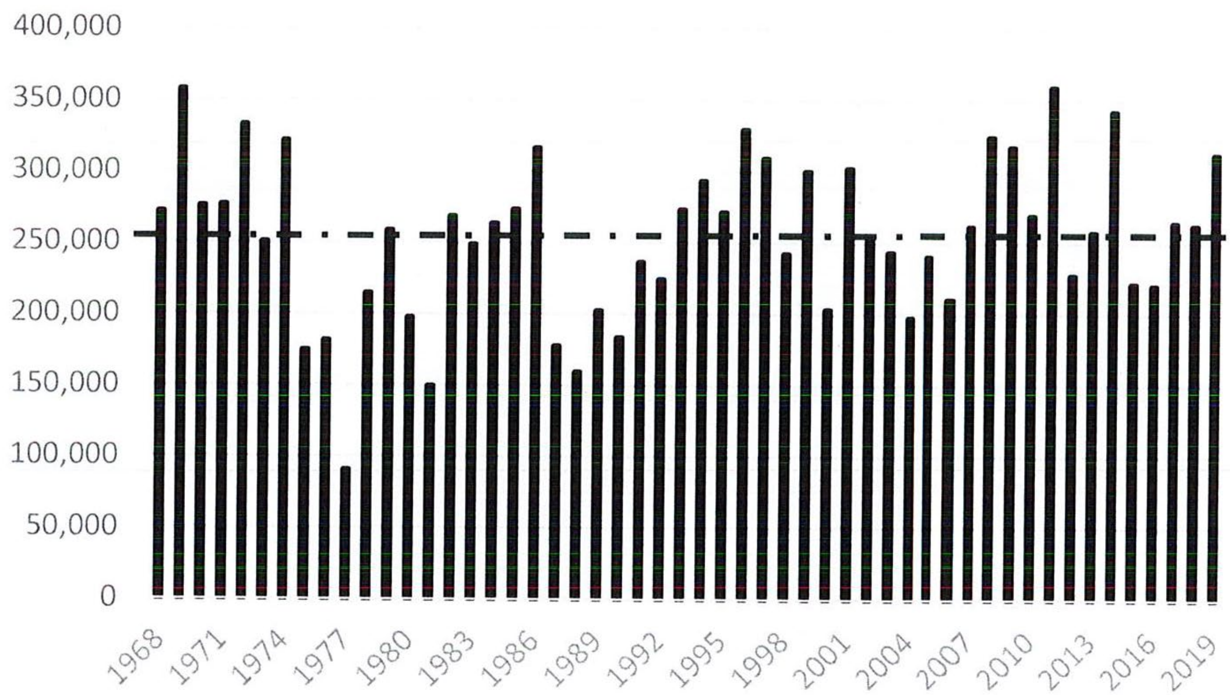

Figure 2. Number of May ponds (Type II-V) and long-term average (dashed line) in Minnesota, 1968-2019.

Planting dates for row crops were very late in 2019. By May 26, about 66% of the corn acres had been planted which was 8 days behind last year and 13 days behind average. By June 2rd, about 5% of alfalfa hay had been cut, 8 days behind last year and 13 days behind average (Minnesota Agricultural Statistics Service Weekly Crop Weather Reports, (http://www.nass.usda.gov/mn/).

WATERFOWL POPULATIONS:

The number of ducks, Canada geese, coots, and swans, by stratum, are shown in Tables 3-5; total numbers are presented in Table 6. These estimates are expanded for area but not corrected for visibility bias. Table 7 and Table 8 provide the unadjusted population index (Unad. PI), which is multiplied by the visibility correction factor (VCF) to obtain the population index (PI) for ducks and Canada geese. The standard error (SE) of the estimate is also provided for mallard and blue-winged teal estimates.

The 2019 breeding population estimate of mallards was 286,000 (SE = 35,570), which was 3% lower than the 2018 estimate of 295,000 mallards, but statistically unchanged ($Z = 0.15$, $P = 0.88$) (Table 7, Figure 3). Mallard numbers were 14% above the 10-year average and 27% above the long-term average of 225,000 mallards. In 2019, the mallard population was comprised of 85% lone or flocked males, 12% pairs, and 3% flocked mallards. The 5-year average is 78% lone or flocked males, 14% pairs, and 8% flocked mallards.

The estimated blue-winged teal population was 223,000 (SE = 42,000), which was 17% higher than the 2018 estimate of 191,000 blue-winged teal, but statistically unchanged ($Z = 0.37$, $P = 0.71$). Blue-winged teal numbers were 33% above the 10-year average and 7% above the long-term average (Table 7, Figure 4). The blue-winged teal population was comprised of 10% lone males, 52% pairs, and 38% flocks. The 5-year average is 8% lone males, 42% pairs, and 50% flocks.

The combined population estimate of other ducks (excluding scaup) was 185,000 which was 10% below last year's estimate of 207,000 other ducks, unchanged from the 10-year average and 5% above the long-term average (Table 7, Figure 5). Ring-necked ducks and wood ducks were the most abundant species of other ducks (Table 6). Scaup numbers (40,000) were 28% above last year's estimate and 32% below the long-term average.

The total duck population index, excluding scaup, was 695,000 ducks and was unchanged from last year's index of 693,000 ducks and 15% above the 10-year average and 14% above the long-term average (Table 8, Figure 6).

The population index for total ducks was 735,000 ducks, which was 2% above last year, 16% above the 10-year average and 10% above the long-term average.

Annual Visibility Correction Factors (VCFs) are calculated and used for mallards, blue-winged teal, other ducks combined, and Canada geese (Table 7, Table 8). The mallard VCF (2.63) was 5% above the 10-year average. The blue-winged teal VCF (4.56) was 22% above the 10-year average. The VCF for other ducks (2.58) was 5% below the 10-year average. The VCF for Canada geese (1.45) was 28% below the 10-year average and the lowest recorded since 1990. Due to the extremely late spring, leaf out and wetland vegetation emergence was not an issue during the survey.

The population estimate of Canada geese (adjusted for visibility) was 110,410, which was 32% below last year's estimate and 28% below the long-term average (Table 8, Figure 7). The population estimate (unadjusted for visibility bias) was identical to the 10-year average. A total of 9 Canada goose broods were observed, compared to 2 in 2018. This was one of the lowest numbers observed in the past 15 years, but nesting effort was improved from last year and goose production is expected to be near average.

The estimated coot population, uncorrected for visibility, was 4,645 compared to 27,000 in 2018.

The estimated number of swans (likely all trumpeters) was 23,200 compared to last year's estimate of 22,850 (Table 6; Figure 8). Lone swans are not doubled and the estimate is expanded for area but not visibility, although visibility of swans is extremely high. Trumpeter swans continue to expand their range and dramatically increase in number.

ACKNOWLEDGMENTS:

Thanks to the ground crews and the pilot for all of their efforts. This project was funded in part by the Wildlife Restoration (Pittman-Robertson) Program.

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

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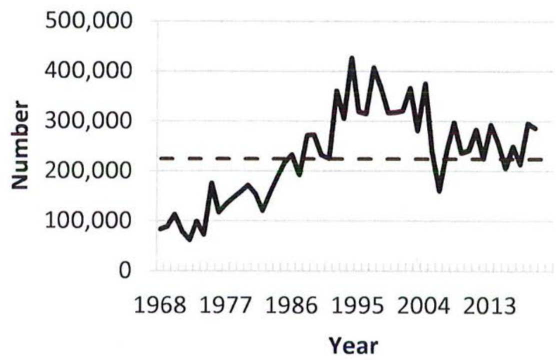

Figure 3. Mallard population estimates (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1968-2019.

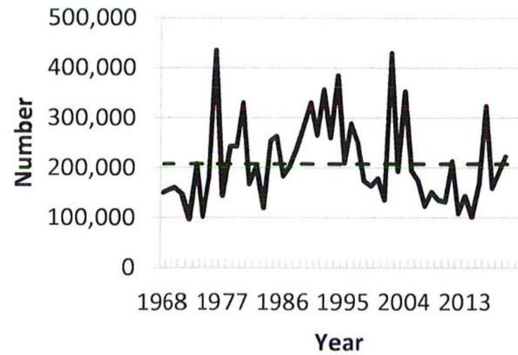

Figure 4. Blue-winged teal population estimates (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1968-2019.

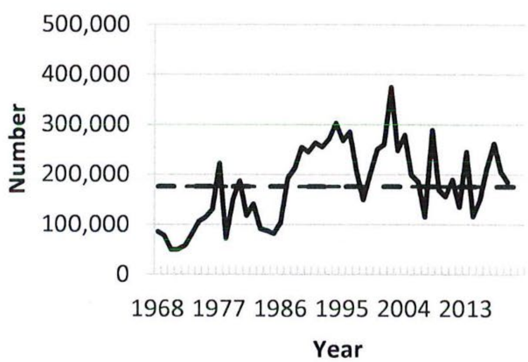

Figure 5. Other duck (excluding scaup) population estimates (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1968-2019

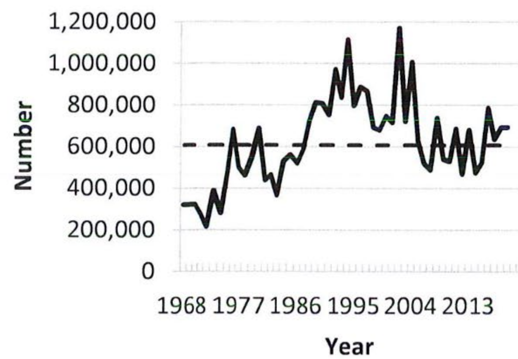

Figure 6. Total duck (excluding scaup) population estimates (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1968-2019

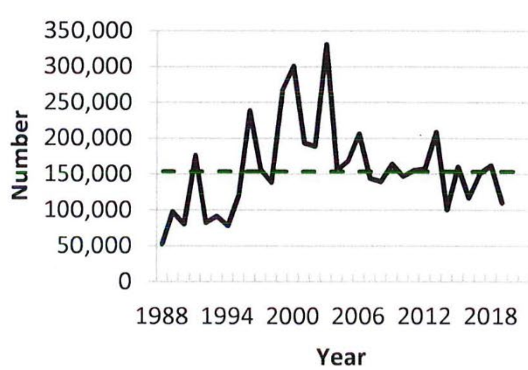

Figure 7. Canada goose population (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1988-2019.

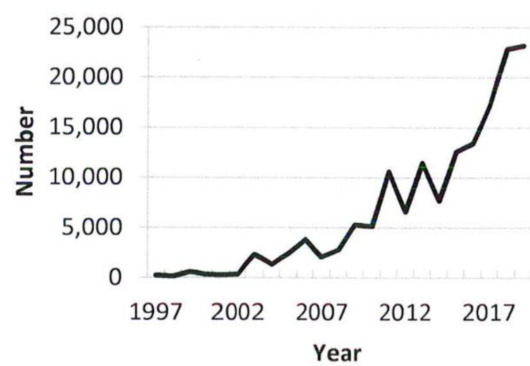

Figure 8. Trumpeter swan population in Minnesota, 1997-2019.

Table 1. Survey design for Minnesota, May 2019.[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), 1968-2019.

Year	Number of Ponds[1]		Year	Type 1 wetlands	Number of Ponds[1]
1968	272,000		1991	83,000	237,000
1969	358,000		1992	10,000	225,000
1970	276,000		1993	200,000	274,000
1971	277,000		1994	124,000	294,000
1972	333,000		1995	140,000	272,000
1973	251,000		1996	148,000	330,000
1974	322,000		1997	31,000	310,000
1975	175,000		1998	21,000	243,000
1976	182,000		1999	153,000	301,000
1977	91,000		2000	5,000	204,000
1978	215,000		2001	66,000	303,000
1979	259,000		2002	31,000	254,000
1980	198,000		2003	34,000	244,000
1981	150,000		2004	9,000	198,000
1982	269,000		2005	31,000	241,000
1983	249,000		2006	57,000	211,000
1984	264,000		2007	32,000	262,000
1985	274,000		2008	70,000	325,000
1986	317,000		2009	39,000	318,000
1987	178,000		2010	27,000	270,000
1988	160,000		2011	89,000	360,000
1989	203,000		2012	31,000	228,000
1990	184,000		2013	10,000	258,000
			2014	54,000	343,000
			2015	22,000	222,000
			2016	34,000	221,000
			2017	54,000	265,000
			2018	20,000	263,000
			2019	66,000	313,000
		Averages:	10-year	38,000	275,000
			Long-term	58,000	255,000
		% change from:	2018	237%	19%
			10-year	73%	14%
			Long-term	13%	23%

[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, 2001-2019.

	Year																		
Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Dabblers:																			
Mallard	28,742	29,297	25,937	29,381	19,050	16,829	16,357	25,104	19,467	18,439	19,856	18,911	21,161	19,522	19,633	26,020	21,688	23,160	23,632
Black Duck	0	0	0	0	56	0	0	0	0	0	0	0	333	167	222	0	56	0	0
Gadwall	1,333	944	1,250	2,111	1,166	1,444	889	1,166	1,055	1,000	167	1,389	722	555	1,083	1,000	2,138	1,888	167
American Wigeon	111	0	56	555	167	0	56	111	56	56	111	222	222	167	111	111	167	167	111
Green-winged Teal	56	278	222	444	56	56	167	278	167	56	56	56	0	0	56	111	278	0	0
Blue-winged Teal	7,387	14,218	9,664	23,771	9,303	5,665	5,332	9,942	5,998	7,304	4,665	5,110	4,193	3,388	4,360	6,998	8,609	4,888	3,860
Northern Shoveler	305	1,277	278	1,166	333	167	56	1,000	666	1,027	111	56	333	722	111	666	916	333	500
Northern Pintail	389	56	111	56	0	56	0	56	56	0	111	0	111	167	222	0	111	111	56
Wood Duck	6,720	2,888	4,499	8,081	5,498	3,555	2,666	6,665	4,277	3,999	3,416	4,138	3,249	2,527	2,222	5,610	4,971	6,498	5,276
Dabbler Subtotal	45,043	48,958	42,017	65,565	35,629	27,772	25,523	44,322	31,742	31,881	28,493	29,882	30,324	27,215	28,020	40,516	38,934	37,045	33,602
Divers:																			
Redhead	1,444	750	333	805	666	666	916	1,389	472	944	805	750	861	1,333	583	2,166	1,000	333	639
Canvasback	2,027	1,833	1,333	666	972	833	1,000	2,277	1,333	1,222	833	722	1,555	1,777	1,027	1,944	2,666	1,277	1,250
Scaup	5,832	2,444	2,055	5,971	4,110	111	555	6,276	8,553	2,777	2,222	1,055	1,000	1,250	5,526	10,969	7,359	1,500	2,694
Ring-necked Duck	2,444	2,777	1,361	5,165	1,722	2,055	1,555	21,494	6,859	3,138	4,804	2,666	3,582	4,554	3,110	8,220	12,608	4,221	6,220
Goldeneye	333	111	0	222	222	56	222	278	278	222	56	56	333	444	278	278	1,000	500	111
Bufflehead	111	222	111	389	167	222	56	1,611	833	389	278	56	611	56	278	500	2,444	611	222
Ruddy Duck	83	1,305	417	305	1,222	305	0	1,027	861	28	56	0	305	111	694	1,500	222	1,722	305
Hooded Merganser	722	555	333	278	333	555	111	666	944	555	500	555	333	666	1,000	1,222	1,222	1,222	2,333
Large Merganser	111	0	972	0	111	0	278	333	333	333	111	56	222	139	167	56	167	56	56
Diver Subtotal	13,107	9,997	6,915	13,801	9,525	4,803	4,693	35,351	20,466	9,608	9,665	5,916	8,802	10,330	12,663	26,855	28,688	11,442	13,830
Total Ducks	58,150	58,955	48,932	79,366	45,154	32,575	30,216	79,673	52,208	41,489	38,158	35,798	39,126	37,545	40,683	67,371	67,622	48,487	47,432
Other:																			
Coot	1,722	2,888	2,666	21,411	2,444	639	139	16,829	2,166	139	2,194	444	10,386	2,360	1,972	10,608	13,191	7,137	83
Canada Goose	24,882	24,104	22,160	23,160	22,938	21,633	29,797	18,717	16,523	16,440	13,691	26,437	23,771	18,578	23,077	17,995	18,273	25,854	18,717
Swan	0	111	1,000	305	417	861	389	694	500	694	1,611	1,277	2,944	1,944	2,472	3,693	4,054	3,804	4,665

Table 4. Minnesota waterfowl breeding populations by species for Stratum II (medium wetland density), expanded for area but not visibility, 2001-2019.

	Year																		
Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Dabblers:																			
Mallard	44,650	43,773	34,715	44,474	26,883	25,130	24,779	27,935	23,494	21,507	30,974	29,689	27,409	28,987	24,078	32,085	26,299	26,533	33,312
Black Duck	117	0	0	0	0	0	0	0	0	0	0	0	0	0	117	0	0	117	0
Gadwall	1,636	701	584	3,565	584	1,052	234	3,039	1,169	1,286	935	1,987	701	234	818	1,286	4,442	2,805	4,091
American Wigeon	0	0	0	2,513	117	0	0	351	0	351	0	117	234	0	234	234	1,052	234	468
Green-winged Teal	117	468	234	234	0	117	0	0	234	117	0	0	117	351	584	0	0	0	117
Blue-winged Teal	9,701	21,390	15,955	30,624	11,513	9,000	8,416	12,740	11,104	8,474	12,390	9,000	4,383	7,364	5,026	10,753	15,487	8,007	9,760
Northern Shoveler	1,052	2,221	1,403	1,753	234	584	351	468	701	2,513	1,052	0	351	935	877	935	3,857	584	2,279
Northern Pintail	117	0	117	0	0	0	234	0	0	0	234	0	0	117	0	0	0	0	117
Wood Duck	7,831	5,143	4,558	8,766	3,273	1,753	2,221	6,546	5,260	6,312	6,955	5,143	4,792	1,636	1,753	4,149	4,851	5,961	4,792
Dabbler subtotal	65,221	73,696	57,566	91,929	42,604	37,636	36,235	51,079	41,962	40,560	52,540	45,936	37,987	39,624	33,487	49,442	55,988	44,241	54,936
Divers:																			
Redhead	2,455	234	584	1,110	292	175	935	935	584	760	1,578	468	468	526	468	1,110	818	117	175
Canvasback	0	468	1,052	234	0	0	1,169	468	234	117	584	117	935	1,286	1,169	1,403	2,338	234	701
Scaup	3,039	5,961	2,279	7,188	2,981	468	643	3,097	2,104	0	1,929	935	2,045	2,396	4,909	5,318	5,260	1,344	1,052
Ring-necked Duck	3,799	6,370	2,455	5,377	1,929	3,331	1,578	13,149	9,117	2,396	11,455	1,695	6,253	5,143	4,325	4,792	9,292	4,968	3,214
Goldeneye	468	234	234	351	117	117	0	351	584	468	468	584	935	1,519	935	1,169	818	234	234
Bufflehead	0	1,169	117	468	351	117	117	1,403	818	643	1,403	468	0	818	0	234	2,279	584	234
Ruddy Duck	0	1,870	2,688	0	351	58	0	0	175	409	58	234	117	0	351	643	468	0	1,461
Hooded Merganser	1,403	701	701	234	234	351	234	584	701	117	2,221	1,636	701	234	1,169	2,455	3,448	1,403	2,045
Large Merganser	117	0	0	234	351	0	0	351	0	0	234	0	234	117	234	117	0	117	117
Diver subtotal	11,281	17,007	10,110	15,196	6,606	4,617	4,676	20,338	14,317	4,910	19,930	6,137	11,688	12,039	13,560	17,241	24,721	9,001	9,233
Total Ducks	76,502	90,703	67,676	107,125	49,210	42,253	40,911	71,417	56,279	45,470	72,470	52,073	49,675	51,663	47,047	66,683	80,709	53,242	64,169
Other:																			
Coot	468	4,909	1,519	8,007	584	292	409	23,961	0	117	292	292	2,571	877	0	0	6,370	584	1,169
Canada Goose	24,604	20,688	22,091	28,461	20,688	26,825	25,890	19,753	22,675	18,935	14,201	23,260	22,442	20,572	24,312	17,533	21,799	27,994	19,286
Swan	117	292	994	701	1,461	994	468	1,519	2,922	2,279	7,188	3,507	6,604	3,740	5,318	4,325	5,084	10,169	10,344

Table 5. Minnesota waterfowl breeding populations by species for Stratum III (low wetland density), expanded for area but not visibility, 2001-2019.

	Year																		
Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Dabblers:																			
Mallard	72,642	72,121	55,156	84,561	36,539	30,884	35,843	50,371	35,408	40,976	51,415	47,848	62,638	62,899	51,154	59,593	56,983	57,505	51,937
Black Duck	0	0	0	174	0	0	174	174	0	0	0	174	174	0	0	0	0	0	0
Gadwall	10,701	3,306	1,566	6,960	2,001	5,568	4,176	870	1,392	1,392	4,089	1,566	5,220	1,914	2,088	9,570	5,046	7,134	6,873
American Wigeon	174	1,218	174	1,566	1,044	174	348	348	174	348	1,044	174	348	174	1,566	870	174	0	348
Green-winged Teal	1,392	522	174	0	174	522	0	0	0	0	174	348	696	0	348	0	348	174	870
Blue-winged Teal	20,618	56,374	21,140	39,758	27,578	23,663	15,659	18,095	20,183	16,964	44,716	35,669	18,617	21,227	24,098	53,155	39,323	42,455	35,321
Northern Shoveler	10,701	6,264	870	3,828	348	522	870	4,002	2,088	6,873	2,088	8,265	6,786	522	1,914	4,959	3,219	1,392	696
Northern Pintail	522	0	174	348	174	174	348	174	0	174	0	174	174	0	174	522	174	522	0
Wood Duck	17,225	13,572	12,702	20,705	7,482	7,308	5,394	14,442	10,266	12,354	13,659	10,962	12,180	9,657	8,265	8,700	16,094	11,919	10,875
Dabbler subtotal	133,975	153,377	91,956	157,900	75,340	68,815	62,812	88,476	69,511	79,081	117,185	105,180	106,833	96,393	89,607	137,369	121,361	121,101	106,920
Divers:																			
Redhead	3,654	1,305	174	1,740	1,479	0	522	783	870	174	4,350	3,306	1,827	1,566	1,305	1,044	3,480	1,914	1,131
Canvasback	522	696	1,131	2,784	0	0	348	1,566	1,218	348	1,044	1,044	696	522	696	348	1,914	522	696
Scaup	6,873	4,611	783	17,747	5,307	1,392	696	5,481	1,914	522	5,133	696	8,874	2,871	435	3,915	22,271	8,091	11,919
Ring-necked Duck	8,526	7,395	1,479	5,133	10,179	6,699	1,392	8,526	6,525	3,045	6,264	9,135	6,960	5,568	3,480	4,089	18,095	6,177	5,742
Goldeneye	1,566	3,132	1,305	696	1,044	1,044	870	348	522	174	870	0	348	174	1,218	870	1,566	1,392	1,044
Bufflehead	0	1,218	783	2,088	0	174	696	1,218	870	174	2,871	174	3,915	4,698	522	2,523	1,740	348	3,132
Ruddy Duck	696	18,878	87	2,262	870	696	261	87	348	0	3,828	522	522	174	0	87	1,305	783	1,218
Hooded Merganser	174	2,175	174	1,740	1,218	870	174	696	348	1,218	1,044	1,044	348	348	522	1,392	1,653	3,132	1,914
Large Merganser	0	522	0	0	261	957	348	348	348	348	174	174	0	0	0	870	957	0	0
Diver subtotal	22,011	39,932	5,916	34,190	20,358	11,832	5,307	19,053	12,963	6,003	25,578	16,095	23,490	15,921	8,178	15,138	52,981	22,359	26,796
Total Ducks	155,986	193,309	97,872	192,090	95,698	80,647	68,119	107,529	82,474	85,084	142,763	121,275	130,323	112,314	97,785	152,507	174,342	143,460	133,716
Other:																			
Coot	3,132	14,007	7,134	77,427	8,613	14,702	5,742	15,137	7,047	435	1,479	25,664	27,578	15,746	7,917	5,829	10,962	19,139	3,393
Canada Goose	39,932	33,407	43,412	46,717	39,758	27,230	42,629	31,841	28,274	30,710	32,711	37,496	48,022	24,707	43,498	31,145	30,101	38,888	38,192
Swan	174	0	348	348	522	2,001	1,218	609	1,914	2,175	1,827	1,827	2,088	2,001	4,785	5,394	8,091	8,874	8,178

Table 6. Minnesota waterfowl breeding populations by species for Stratum I-III combined, expanded for area coverage but not for visibility, 2001-2019.

	Year																		
Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Dabblers:																			
Mallard	146,034	145,191	115,974	158,416	82,472	72,843	76,979	103,411	78,368	80,922	102,245	96,448	111,208	111,408	94,866	117,698	104,970	107,198	108,881
Black Duck	117	0	0	174	56	0	174	174	0	0	0	174	507	167	339	0	56	117	0
Gadwall	13,670	4,951	3,400	12,635	3,752	8,064	5,298	5,075	3,616	3,677	5,191	4,941	6,643	2,703	3,989	11,855	11,626	11,827	11,130
American Wigeon	285	1,218	230	4,634	1,327	174	404	810	230	754	1,155	513	804	341	1,911	1,215	1,393	400	927
Green-winged Teal	1,564	1,267	630	678	230	694	167	278	400	172	230	404	813	351	988	111	626	174	987
Blue-winged Teal	37,706	91,982	46,759	94,152	48,394	38,328	29,407	40,777	37,286	32,742	61,772	49,779	27,194	31,979	33,484	70,907	63,418	55,349	48,941
Northern Shoveler	12,058	9,762	2,550	6,747	915	1,273	1,276	5,469	3,456	10,413	3,251	8,320	7,470	2,179	2,902	6,560	7,992	2,310	3,475
Northern Pintail	1,028	56	402	404	174	230	582	230	56	174	345	174	285	284	396	522	285	633	172
Wood Duck	31,777	21,603	21,759	37,553	16,253	12,616	10,281	27,652	19,802	22,664	24,029	20,242	20,221	13,820	12,240	18,459	25,916	24,378	20,943
Dabbler subtotal	244,239	276,030	191,704	315,393	153,573	134,222	124,568	183,876	143,214	151,518	198,218	180,995	175,145	163,232	151,115	227,327	216,282	202,386	195,456
Divers:																			
Redhead	7,552	2,289	1,092	3,656	2,438	842	2,373	3,107	1,926	1,878	6,733	4,523	3,155	3,425	2,356	4,320	5,298	2,364	1,945
Canvasback	2,549	2,996	3,516	3,684	972	833	2,517	4,311	2,785	1,687	2,461	1,883	3,186	3,585	2,892	3,694	6,918	2,033	2,647
Scaup	15,743	13,016	5,117	30,906	12,397	1,971	1,894	14,854	12,571	3,299	9,283	2,686	11,919	6,517	10,870	20,202	34,890	10,934	15,664
Ring-necked Duck	14,768	16,542	5,294	15,675	13,829	12,085	4,525	43,169	22,501	8,579	22,523	13,495	16,795	15,265	10,915	17,101	39,995	15,365	15,177
Goldeneye	2,367	3,477	1,539	1,269	1,383	1,216	1,092	976	1,384	864	1,393	640	1,616	2,138	2,431	2,317	3,384	2,126	1,389
Bufflehead	111	2,609	1,011	2,944	517	513	868	4,231	2,521	1,206	4,551	697	4,526	5,572	800	3,257	6,463	1,543	3,588
Ruddy Duck	779	22,054	3,192	2,567	2,443	1,060	261	1,114	1,384	437	3,942	756	944	285	1,045	2,229	1,995	2,505	2,984
Hooded Merganser	2,299	3,432	1,209	2,251	1,785	1,776	519	1,947	1,993	1,890	3,765	3,236	1,383	1,248	2,691	5,068	6,323	5,756	6,292
Large Merganser	228	522	972	234	723	957	626	1,032	681	681	519	230	456	256	400	1,042	1,124	172	172
Diver subtotal	46,396	66,937	22,942	63,186	36,487	21,253	14,675	74,741	47,746	20,521	55,170	28,146	43,980	38,291	34,400	59,230	106,390	42,798	49,858
Total Ducks	290,635	342,967	214,646	378,579	190,060	155,475	139,243	258,617	190,960	172,039	253,388	209,141	219,125	201,523	185,515	286,557	322,672	245,184	245,314
Other:																			
Coot	5,321	21,804	11,319	106,845	11,641	15,633	6,290	55,927	9,213	691	3,965	26,401	40,535	18,984	9,888	16,437	30,523	26,861	4,645
Canada Goose	89,418	78,200	87,663	98,339	83,384	75,688	98,316	70,311	67,473	66,085	60,603	87,193	94,235	63,857	90,887	66,672	70,172	92,735	76,195
Swan	291	403	2,341	1,355	2,400	3,855	2,074	2,823	5,336	5,148	10,626	6,611	11,500	7,700	12,575	13,412	17,230	22,847	23,187

Table 7. Mallard, blue-winged teal, and other duck (excluding scaup) populations in Minnesota, 1968-2019.

	Mallard				Blue-winged teal				Other ducks (exc. scaup)		
Year	Unad. PI	VCF	PI	SE	Unad. PI	VCF	PI	SE	Unad. PI	VCF	PI
1968	41,030	2.04	83,701		61,493	2.44	151,141		41,419	2.08	86,152
1969	53,167	1.67	88,789		45,180	3.45	155,871		34,605	2.27	78,553
1970	67,463	1.69	113,945		31,682	5.06	160,343		30,822	1.62	49,932
1971	47,702	1.65	78,470		42,445	3.49	148,218		29,520	1.71	50,450
1972	49,137	1.27	62,158		49,386	1.96	96,895		34,405	1.69	58,127
1973	56,607	1.76	99,832		53,095	3.92	208,292		33,155	2.45	81,362
1974	44,866	1.62	72,826		39,402	2.59	102,169		38,266	2.79	106,609
1975	55,093	3.19	175,774		45,948	3.95	181,375		34,585	3.31	114,459
1976	69,844	1.69	117,806		89,370	4.87	435,607		39,022	3.35	130,669
1977	60,617	2.21	134,164		37,391	3.86	144,187		18,633	11.95	222,748
1978	56,152	2.61	146,781		28,491	8.53	242,923		22,034	3.30	72,798
1979	61,743	2.57	158,704	28,668	46,708	5.21	243,167	62,226	39,749	3.79	150,545
1980	83,775	2.05	171,957	22,312	50,966	6.49	330,616	40,571	47,322	3.97	188,020
1981	79,562	1.95	154,844	16,402	64,546	2.59	167,258	23,835	30,947	3.80	117,667
1982	51,655	2.33	120,527	17,078	42,772	4.75	203,167	34,503	32,726	4.32	141,501
1983	73,424	2.12	155,762	15,419	42,728	2.81	119,980	20,809	32,240	2.84	91,400
1984	94,514	1.99	188,149	24,065	89,896	2.82	253,821	33,286	40,326	2.18	87,709
1985	96,045	2.26	216,908	32,935	90,453	2.91	263,607	33,369	35,018	2.35	82,383
1986	108,328	2.16	233,598	30,384	68,235	2.69	183,338	28,204	38,900	2.67	103,851
1987	165,881	1.16	192,289	23,500	102,480	1.99	203,718	32,289	76,746	2.51	192,947
1988	155,543	1.75	271,718	38,675	101,183	2.38	240,532	39,512	81,514	2.61	212,988
1989	124,362	2.19	272,968	26,508	90,300	3.16	285,760	39,834	88,109	2.89	254,887
1990	140,879	1.65	232,059	26,316	107,177	3.09	330,659	44,455	124,531	1.97	245,152
1991	128,315	1.75	224,953	28,832	91,496	2.90	265,138	42,057	93,784	2.81	263,619
1992	144,126	2.50	360,870	43,621	93,107	3.83	356,679	53,619	109,779	2.33	255,774
1993	123,771	2.47	305,838	31,103	64,670	4.02	260,070	36,307	82,612	3.28	271,263
1994	138,482	3.08	426,455	66,240	70,324	5.48	385,256	82,580	85,671	3.55	303,847
1995	142,557	2.24	319,433	48,124	47,737	4.40	210,043	40,531	66,096	4.05	267,668
1996	153,473	2.05	314,816	53,461	57,196	5.05	288,913	64,064	107,950	2.64	285,328
1997	160,629	2.54	407,413	65,771	45,496	5.57	253,408	67,526	76,095	2.72	207,316
1998	188,972	1.95	368,450	61,513	47,788	3.66	174,848	33,855	91,478	1.64	149,786
1999	169,213	1.87	316,394	51,651	36,106	4.53	163,499	36,124	80,459	2.49	200,570

	Mallard				Blue-winged teal				Other ducks (exc. scaup)		
Year	Unad. PI	VCF	PI	SE	Unad. PI	VCF	PI	SE	Unad. PI	VCF	PI
2000	157,853	2.02	318,134	36,857	60,288	2.97	179,055	32,189	120,158	2.09	250,590
2001	146,034	2.20	320,560	39,541	37,706	3.60	135,742	19,631	91,152	2.85	260,051
2002	145,191	2.53	366,625	46,264	91,982	4.67	429,934	87,312	92,778	4.04	374,978
2003	115,974	2.42	280,517	34,556	46,759	4.13	193,269	36,176	46,796	5.30	248,019
2004	158,416	2.37	375,313	57,591	94,152	3.75	353,209	56,539	95,105	2.94	279,802
2005	82,472	2.89	238,500	28,595	48,394	4.01	194,125	37,358	46,797	4.26	199,355
2006	72,843	2.21	160,715	24,230	38,328	4.53	173,674	60,353	42,333	4.41	186,719
2007	76,979	3.15	242,481	30,020	29,407	4.20	123,588	20,055	30,963	3.73	115,390
2008	103,411	2.88	297,565	27,787	40,777	3.74	152,359	24,157	99,575	2.91	289,629
2009	78,368	3.02	236,436	36,539	37,286	3.63	135,262	32,155	62,725	2.70	169,568
2010	80,922	2.99	241,884	33,940	32,742	4.04	132,261	27,430	55,076	2.84	156,599
2011	102,245	2.77	283,329	49,845	61,772	3.46	213,584	88,720	79,743	2.39	190,586
2012	96,448	2.33	224,965	45,057	49,779	2.18	108,607	31,971	60,228	2.24	135,017
2013	111,208	2.64	293,239	58,463	27,194	5.29	143,927	46,635	68,804	3.57	245,729
2014	111,408	2.31	256,996	55,366	31,979	3.18	101,640	24,089	51,619	2.24	115,751
2015	94,866	2.17	206,229	37,498	33,484	5.04	168,615	56,787	46,295	3.23	149,330
2016	117,698	2.13	250,204	42,850	70,907	4.57	323,916	94,952	77,750	2.74	212,967
2017	104,970	2.04	213,644	32,704	63,418	2.51	159,483	55,100	119,394	2.20	262,867
2018	107,198	2.76	295,370	46,578	55,349	3.45	190,695	77,961	71,703	2.88	206,505
2019	108,881	2.63	286,357	35,570	48,941	4.56	223,171	42,200	71,828	2.58	185,316
Averages: 10-year	100,533	2.52	250,230	43,884	46,391	3.74	167,799	53,580	69,334	2.70	184,492
Long-term	100,989	2.19	224,828	37,921	56,288	3.80	208,143	44,978	61,106	3.03	176,453
% change from											
2018	2%	-5%	-3%	-24%	-12%	32%	17%	-46%	0%	-10%	-10%
10-year average	8%	5%	14%	-19%	5%	22%	33%	-21%	4%	-5%	0%
Long-term average	8%	20%	27%	-6%	-13%	20%	7%	6%	18%	-15%	5%

Table 8. Scaup, total ducks (excluding scaup), total ducks, and Canada goose populations in Minnesota, 1968-2019.

	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

Year	Scaup Unad. PI	VCF	PI	Total Ducks (exc. scaup) Unad. PI	PI	Total ducks Unad. PI	PI	Canada geese Unad. PI	VCF	PI
1998	28,416	1.64	46,528	328,238	693,084	356,654	739,612	79,147	1.75	138,507
1999	14,041	2.49	35,002	285,778	680,463	299,819	715,465	80,012	3.35	268,168
2000	32,376	2.09	67,520	338,299	747,779	370,675	815,299	105,932	2.84	301,298
2001	15,743	2.85	44,914	274,892	716,353	290,653	761,267	89,418	2.17	193,887
2002	13,016	4.04	52,606	327,951	1,171,537	340,967	1,224,143	78,200	2.42	189,353
2003	5,117	5.3	27,120	209,529	721,805	214,646	748,925	87,663	3.78	331,094
2004	30,906	2.94	90,926	347,673	1,008,324	378,579	1,099,250	98,339	1.58	155,859
2005	12,397	4.26	52,811	177,663	631,980	190,060	684,791	83,384	2.02	168,469
2006	1,971	4.41	8,692	153,504	521,109	155,475	529,801	75,688	2.73	206,757
2007	1,894	3.73	7,058	137,349	488,517	139,243	495,575	98,316	1.47	144,289
2008	14,854	2.91	43,205	243,763	739,553	258,617	782,758	70,311	1.99	139,708
2009	12,571	2.7	33,979	178,379	541,266	190,950	575,245	67,473	2.44	164,405
2010	3,299	2.84	9,380	168,740	530,744	172,039	540,124	66,085	2.22	146,960
2011	9,283	2.39	22,186	244,105	687,499	253,043	709,685	60,603	2.57	155,750
2012	2,686	2.24	6,021	206,455	468,589	209,141	474,610	87,193	1.81	157,706
2013	11,919	3.57	42,568	207,206	682,895	219,125	725,463	94,235	2.22	208,825
2014	6,517	2.24	14,614	195,006	474,387	201,523	489,001	63,857	1.57	100,255
2015	10,870	3.23	35,062	174,645	524,174	185,515	559,236	90,887	1.77	160,427
2016	20,202	2.74	55,336	266,355	787,087	286,557	842,423	66,672	1.75	117,096
2017	34,890	2.2	76,817	287,782	635,994	322,672	712,811	70,172	2.16	151,740
2018	10,934	2.88	31,490	234,250	692,570	245,184	724,060	92,735	1.75	162,286
2019	15,664	2.58	40,413	229,650	694,844	245,314	735,257	76,195	1.45	110,410
Averages:										
10-year	12,317	2.7	32,745	216,292	602,521	228,575	635,266	75,991	2.03	152,545
Long-term	20,277	3.03	59,232	218,359	609,559	238,630	668,791	49,182	2.19	154,325
% change from 2018	43%	-10%	28%	-2%	0%	0%	2%	-18%	-17%	-32%
10-year average	27%	-5%	23%	6%	15%	7%	16%	0%	-28%	-28%
Long-term average	-23%	-15%	-32%	5%	14%	3%	10%	55%	-34%	-28%

Appendix A. Precipitation in selected regions of Minnesota, 1 April - 21 May 2019 (Source: Minnesota DNR; http://www.dnr.state.mn.us/climate/historical/summary.html).

Region	Precipitation	Departure from normal
Northwest	2.40	-0.64
North Central	3.08	-0.52
Northeast	4.19	-0.01
West Central	5.89	1.76
Central	7.50	2.66
East Central	7.01	2.14
Southwest	8.34	3.06
South Central	7.73	1.54
Southeast	7.62	1.84
Statewide	6.30	1.51

WATERFOWL POPULATION STATUS, 2019

Waterfowl information is taken from the U.S. Fish and Wildlife Service report Waterfowl Population Status, 2019 by Joshua Dooley, Walt Rhodes, and Nathan Zimpfer. The entire report is available on the Division of Migratory Bird Management website (https://www.fws.gov/migratorybirds/pdf/surveys-and-data/Population-status/Waterfowl/WaterfowlPopulationStatusReport19.pdf)

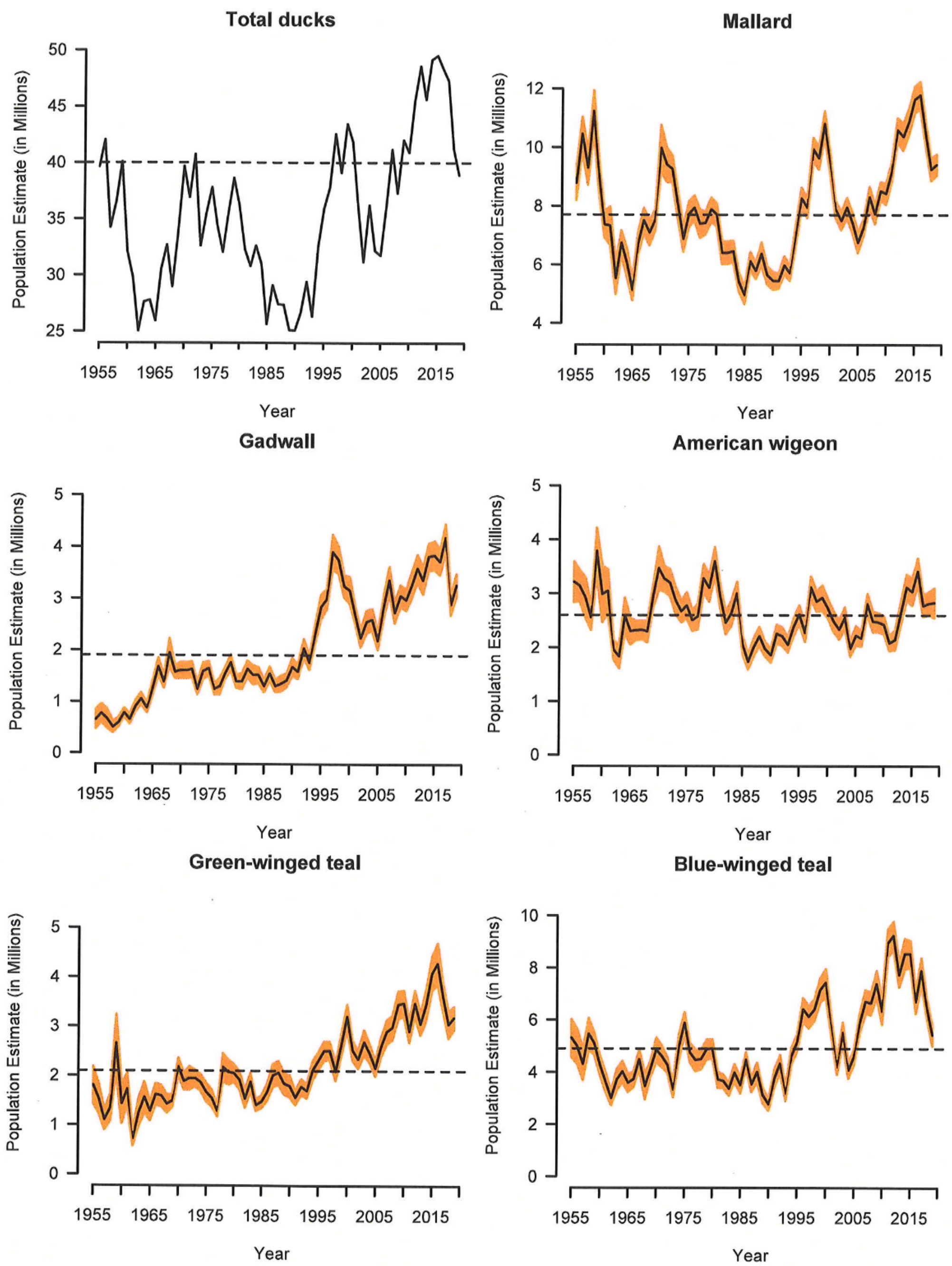

Figure 1 Estimates of North American breeding populations, 90% confidence intervals, and North American Waterfowl Management Plan population goal (dashed line) for selected species and number of water areas in May in Prairie Canada and Northcentral U.S (from: U.S. Fish and Wildlife Service 2019).

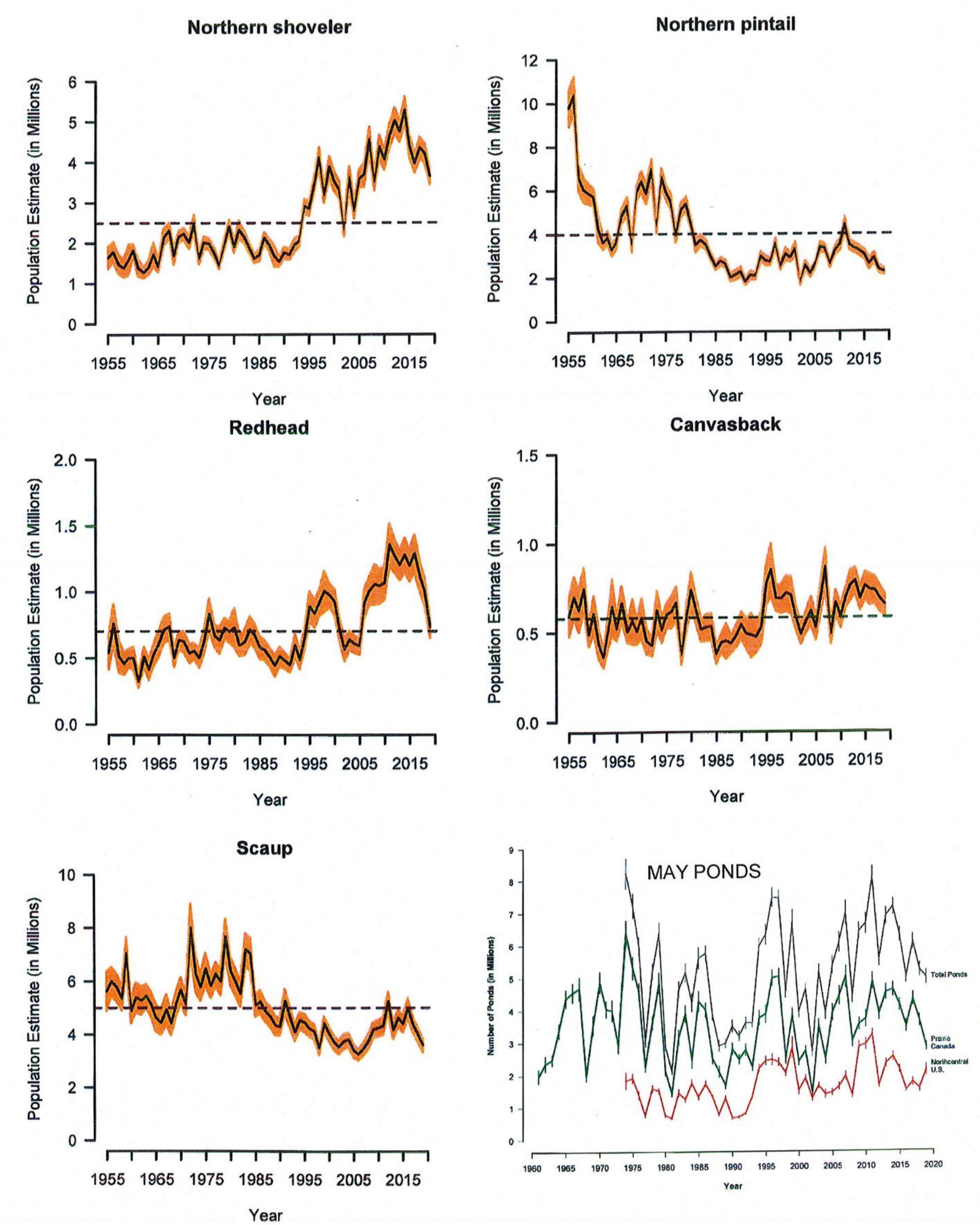

Figure 1 (continued).

MOURNING DOVE POPULATION STATUS, 2019.

Mourning dove information is taken from the U.S. Fish and Wildlife Service report by Seamans, M.E. 2019. Mourning dove population status, 2019. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 22 pp. The entire report is available on the Division of Migratory Bird Management web site

(https://www.fws.gov/migratorybirds/pdf/surveys-and-data/Population-status/MourningDove/MourningDovePopulationStatus19.pdf).

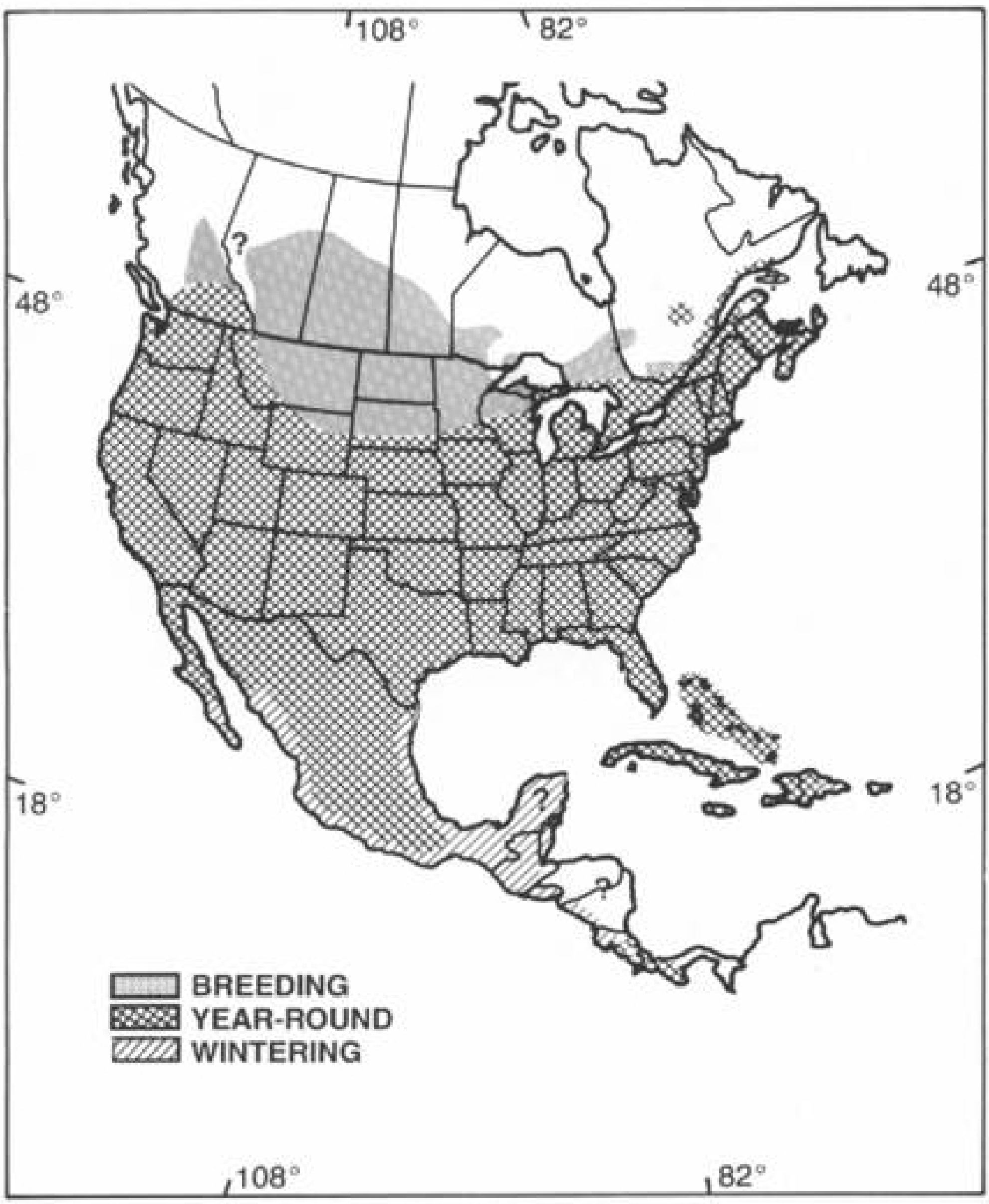

Figure 1. Breeding and wintering ranges of the mourning dove (adapted from Mirarchi and Baskett 1994). (From: Seamans, M.E. 2019. Mourning dove population status, 2019. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 22 pp.)

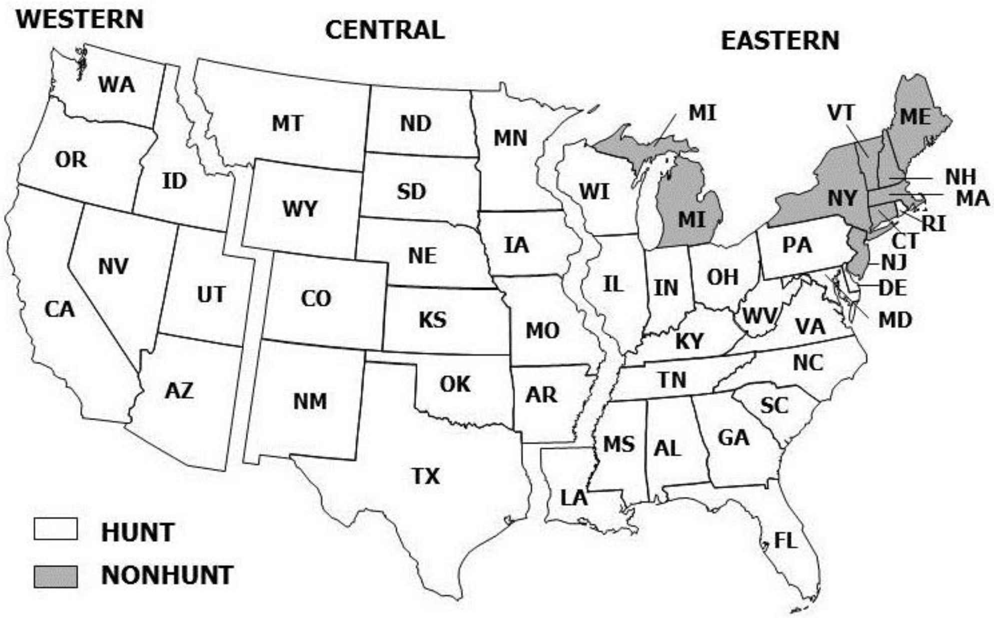

Figure 2. Mourning dove management units with 2018 -19 hunting and non-hunting states. (From: Seamans, M.E. 2019. Mourning dove population status, 2019. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 22 pp.)

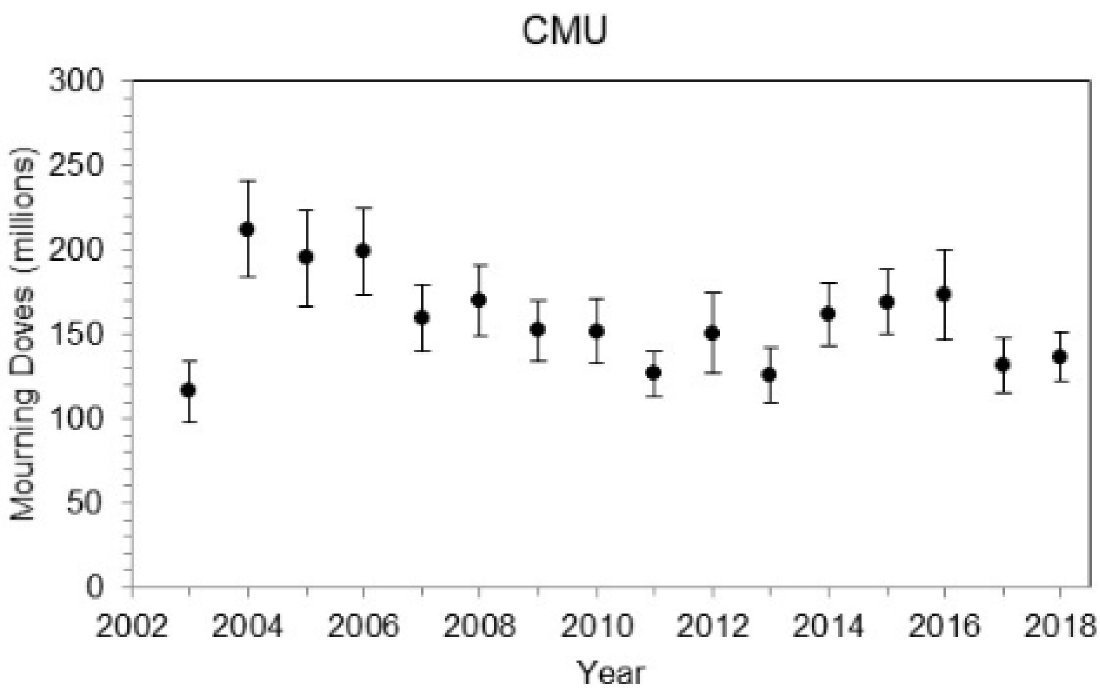

Figure 3. Estimates and 95% confidence intervals of mourning dove absolute abundance by in the Central Management Unit (CMU), 2003-18. Estimates based on band recovery and harvest data. (From: Seamans, M.E. 2019. Mourning dove population status, 2019. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 22 pp.)

Table 1. Preliminary estimates and 95% confidence intervals (CI, expressed as the interval half width in percent) of mourning dove harvest and hunter activity for the Central management unit during the 2016, 2017 and 2018 seasons [a]. (From: Seamans, M.E. 2019. Mourning dove population status, 2019. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 22 pp.)

Management unit / State	Active Hunters			Hunter Days Afield			Total Harvest		
	2016	2017	2018	2016	2017	2018	2016	2017	2018
CENTRAL	430,400 [b]	332,200 [b]	332,900	1,344,400 ±13	1,058,800 ±11	852,100 ±6	7,334,600 ±14	5,462,800 ±10	4,749,100 ±6
AR	16,300 ±28	16,200 ±29	12,400 ±21	36,200 ±27	35,500 ±30	24,500 ±21	258,200 ±29	287,100 ±35	170,600 ±26
CO	13,100 ±18	11,300 ±19	10,000 ±11	29,700 ±19	24,100 ±20	20,200 ±13	141,200 ±20	117,600 ±25	121,500 ±14
IA	9,700 ±15	11,200 ±13	9,000 ±11	25,300 ±17	28,300 ±17	23,500 ±13	128,100 ±19	134,900 ±16	107,800 ±11
KS	28,600 ±12	21,800 ±24	22,900 ±17	77,200 ±17	58,300 ±35	44,300 ±17	427,600 ±18	290,600 ±34	337,600 ±22
MN	6,500 ±58	6,800 ±63	7,100 ±34	18,000 ±55	16,200 ±45	16,900 ±32	96,700 ±79	39,100 ±30	55,300 ±25
MO	25,200 ±14	27,400 ±13	26,000 ±8	65,100 ±21	65,700 ±16	48,300 ±9	321,600 ±20	367,200 ±18	309,400 ±12
MT	1,900 ±44	1,300 ±57	1,200 ±29	3,500 ±43	2,200 ±63	3,500 ±32	16,000 ±53	8,900 ±45	9,800 ±22
NE	9,700 ±19	12,300 ±16	11,600 ±11	24,500 ±18	31,000 ±15	33,700 ±14	132,000 ±22	177,900 ±16	189,100 ±18
NM	4,400 ±18	5,500 ±57	9,900 ±10	12,800 ±33	16,800 ±70	28,200 ±12	47,900 ±26	73,900 ±51	126,900 ±16
ND	5,300 ±24	4,100 ±26	3,900 ±16	15,800 ±35	11,400 ±31	11,800 ±24	76,900 ±30	59,400 ±26	65,200 ±23
OK	23,800 ±14	17,500 ±16	13,600 ±15	58,500 ±21	45,600 ±24	29,200 ±15	400,400 ±28	315,600 ±29	181,300 ±16
SD	5,600 ±22	5,700 ±22	4,900 ±12	17,100 ±33	18,400 ±26	11,500 ±13	112,400 ±46	111,600 ±31	69,400 ±15
TX	278,700 ±13	190,500 ±13	199,100 ±9	956,800 ±18	703,300 ±17	553,200 ±9	5,155,300 ±19	3,469,500 ±14	2,990,400 ±9
WY	1,700 ±27	700 ±42	1,400 ±18	3,700 ±36	2,200 ±84	3,200 ±21	20,100 ±40	9,400 ±57	14,800 ±20

[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 POPULATION STATUS, 2019.

American Woodcock information is taken from the U.S. Fish and Wildlife Service report American Woodcock Population Status, 2019. Seamans, M.E. and R.D. Rau. U.S. Fish and Wildlife Service, Laurel, MD. 20 pp.

The entire report is available on the Division of Migratory Bird Management home page https://www.fws.gov/migratorybirds/pdf/surveys-and-data/Population-status/Woodcock/AmericanWoodcockStatusReport19.pdf)

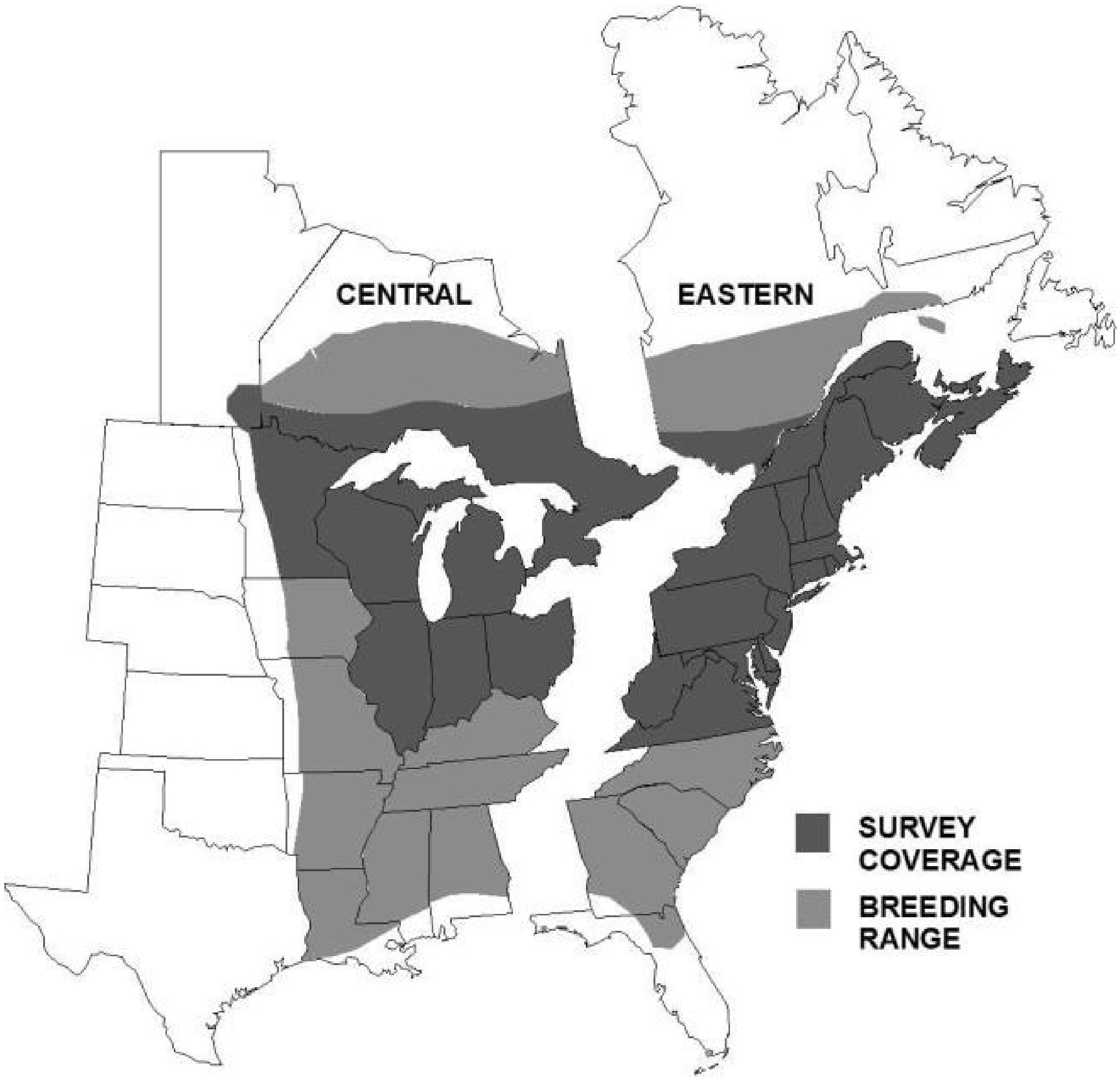

Figure 1. Woodcock management regions, breeding range, singing-ground survey coverage. (from: Seamans, M.E. and R.D. Rau. 2019. American woodcock population status, 2019. U.S. Fish and Wildlife Service, Laurel, MD. 20 pp.).

Table 1. Short term (2018–19), 10 –year (2009-2019), and long-term (1968-2019) 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. 2019. American woodcock population status, 2019. U.S. Fish and Wildlife Service, Laurel, MD. 20 pp.).

Management Unit/State	Number of Routes[b]	n[c]	2018-19			2009-19			1968-19		
			% Change	95% CI[d]		% Change	95% CI[d]		% Change	95% CI[d]	
				lower	upper		lower	upper		lower	upper
CENTRAL	481	758	3.43	-3.70	11.14	-0.78	-1.62	0.02	-0.89	-1.12	-0.68
IL	27	47	-1.65	-67.59	203.75	-1.51	-11.05	9.26	-1.09	-3.69	1.66
IN	15	62	-13.99	-52.05	36.86	-3.96	-9.08	1.16	-4.10	-5.34	-3.02
MB[e]	19	30	5.33	-21.14	43.99	0.65	-2.56	4.18	0.18	-1.35	1.65
MI	114	158	12.23	-1.26	27.79	-0.67	-2.03	0.69	-1.01	-1.36	-0.67
MN	87	124	-6.43	-20.03	9.72	0.43	-1.22	2.15	0.49	-0.06	1.07
OH	35	73	6.44	-14.14	39.11	-1.65	-4.21	0.84	-1.45	-2.16	-0.74
ON	87	166	-3.32	-17.62	12.65	-2.24	-4.17	-0.37	-1.32	-1.77	-0.88
WI	97	128	11.76	-5.08	31.76	-0.21	-1.61	2.08	-0.26	-0.72	0.20

[a] Median of route trends estimated used hierarchical modeling. To estimate the total percent change over several years, use: $100(\%\ \text{change}/100+1)^{y}-100$ where y is the number of years. Note: extrapolating the estimated trend statistic (% change per year) over time (e.g., 30 years) may exaggerate the total change over the period.

[b] Total number of routes surveyed in 2019 for which data were received by 10 July, 2019.

[c] Number of routes with at least one year of non-zero data between 1968 and 2019.

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

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

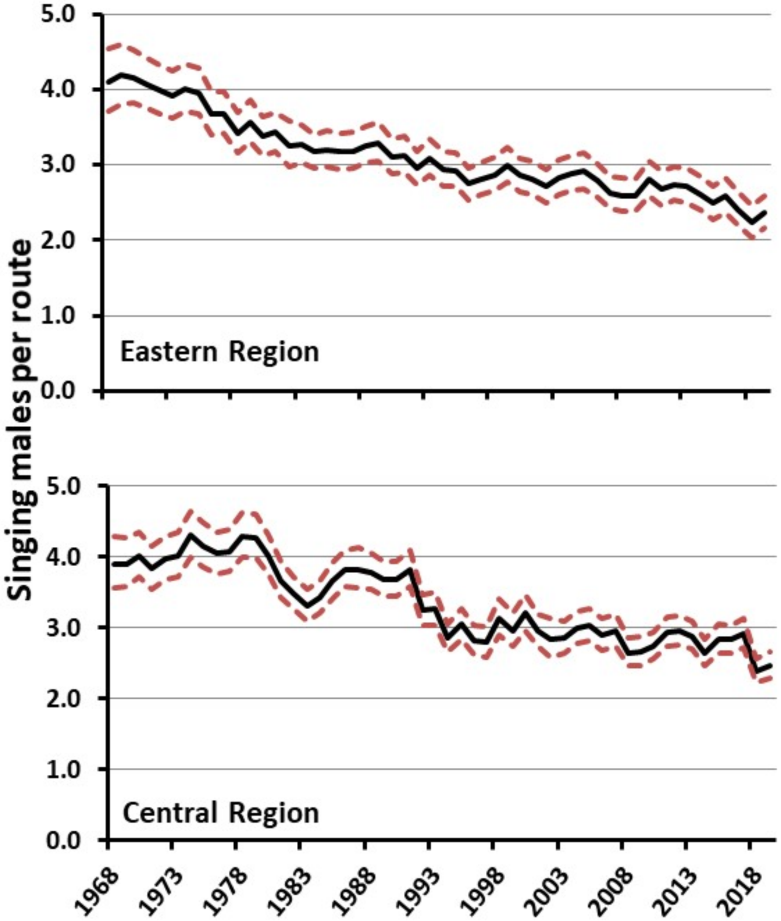

Figure 2. Annual indices of the number of woodcock heard on the Singing-ground Survey, 1968-2019. The dashed lines represent the 95 % credible interval. (from: Seamans, M.E. and R.D. Rau. 2019. American woodcock population status, 2019. U.S. Fish and Wildlife Service, Laurel, MD. 20 pp.).

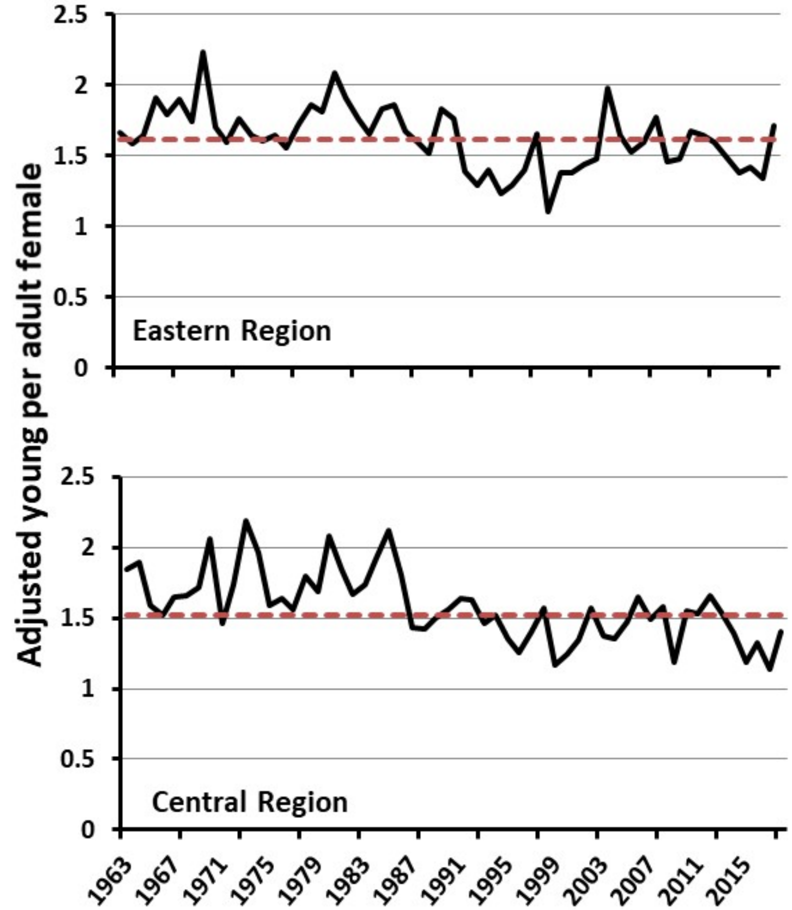

Figure 3. Weighted annual indices of American woodcock recruitment, 1963-2018. Dashed line is the 1963-2017 average. (from: Seamans, M.E. and R.D. Rau. 2019. American woodcock population status, 2019. U.S. Fish and Wildlife Service, Laurel, MD. 20 pp.).

Table 2. Preliminary estimates of woodcock hunter numbers, days afield, and harvest for selected states, from the 2015-16 2016-17, 2017-18 and 2018-19 Harvest Information Program surveys. (from: Seamans, M.E. and R.D. Rau. 2019. American woodcock population status, 2019. U.S. Fish and Wildlife Service, Laurel, MD. 20 pp.).

Management Unit / State	Active woodcock hunters ([a])				Days afield ([a, c])				Harvest ([a, c])			
	2015-16	2016-17	2017-18	2018-19	2015-16	2016-17	2017-18	2018-19	2015-16	2016-17	2017-18	2018-19
Central Region	n.a. [b]	n.a. [b]	n.a. [b]	n.a. [b]	284,200 ±16	300,200 ±32,500	272,400 ±22,800	246,000 ±35,800	145,700 ± 19	158,000 ±16,300	140,900 ±15,500	130,600 ±16,400
IL	1,000 ± 170	1,500 ±1,000	100 <100	<100 <100	1,300 ± 133	13,200 ±11,000	300 ±100	100 ±100	200 ± 114	1,600 ±1,400	400 ±300	0 0
IN	400 ± 99	300 ±200	1,100 ±400	100 <100	1,100 ± 83	1,300 ±500	2,900 ±1,000	200 ±100	600 ± 56	900 ±200	1,500 ±1,100	200 ±100
MI	26,000 ± 18	24,100 ±2,300	24,100 ±2,300	29,300 ±3,700	124,700 ± 21	107,100 ±11,600	122,800 ±15,200	135,800 ±31,900	63,200 ± 23	64,900 ±8,600	66,100 ±10,300	59,600 ±10,400
MN	13,500 ±34	13,500 ±2,300	11,900 ±2,100	10,400 ±2,100	47,600 ± 40	46,000 ±8,200	45,700 ±8,200	41,500 ±9,700	25,600 ± 42	25,900 ±4,700	26,700 ±5,000	22,500 ±3,900
OH	1,900 ± 80	2,600 ±900	1,900 ±800	500 ±100	7,500 ± 95	8,200 ±3,700	5,000 ±1,800	800 ±300	2,100 ± 85	3,200 ±1,300	400 ±200	600 ±400
WI	14,700 ± 27	11,700 ±1700	11,700 ±1,800	10,800 ±2,100	66,600 ± 29	55,100 ±8,900	52,400 ±7,700	45,900 ±9,300	31,000 ± 25	35,100 ±4,400	31,100 ±4,600	25,500 ±4,300

[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.

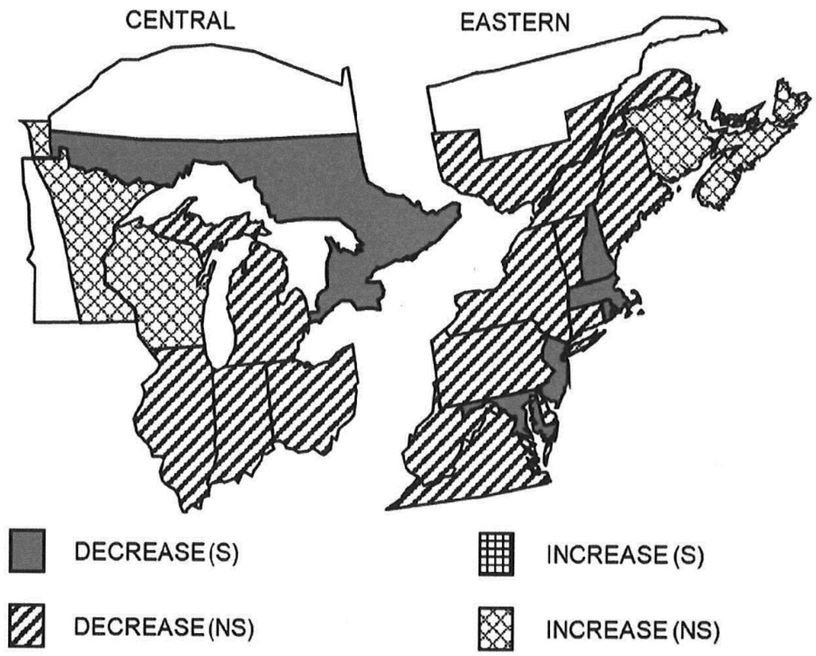

Figure 4. Ten-year trends in number of American woodcock heard on the Singing-ground Survey; 2009-19, as determined by the hierarchical modeling method. A significant trend (S) does not include zero in the 95% credible interval, while a non-significant (NS) trend does include zero. (from: Seamans, M.E. and R.D. Rau. 2019. American woodcock population status, 2019. U.S. Fish and Wildlife Service, Laurel, MD. 20 pp.).

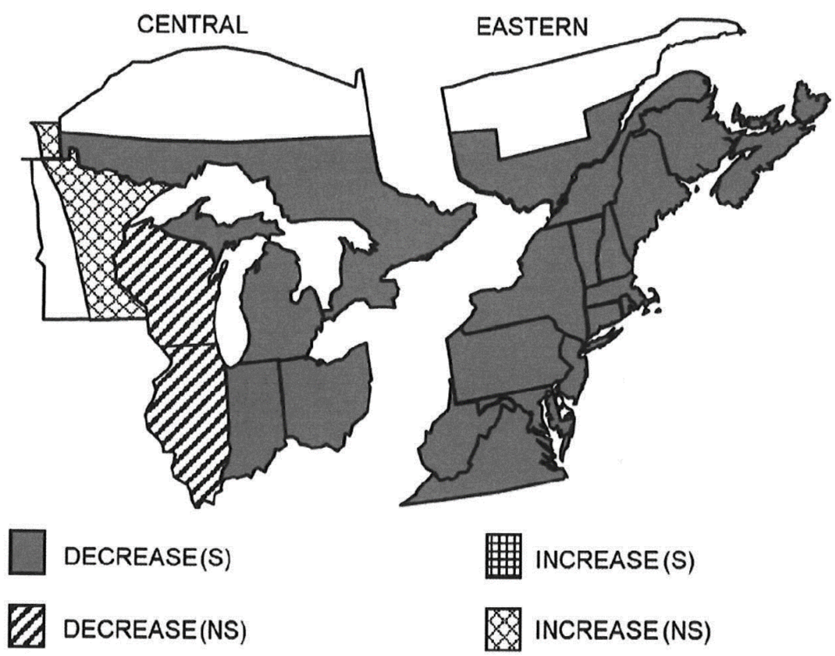

Figure 5. Long-term trends in number of American woodcock heard on the Singing-ground Survey; 1968-2019, as determined by the hierarchical modeling method. A significant trend (S) does not include zero in the 95% credible interval, while a non-significant (NS) trend does include zero. (from: Seamans, M.E. and R.D. Rau. 2019. American woodcock population status, 2019. U.S. Fish and Wildlife Service, Laurel, MD. 20 pp.).

HUNTING HARVEST STATISTICS

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2018 SMALL GAME HUNTER MAIL SURVEY

Nicole Davros and 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 (Figure 1) was mailed in early March following the close of the small game hunting season. Hunters who returned it within three weeks were eliminated from a follow-up mailing to non-respondents. The sampling frame consisted of individuals who purchased a small game hunting license (any type) for the 2018-19 small game hunting season (N=225,932). A stratified random sample (n=7,000, 3.1%), allocated proportionally by license type, was drawn from the Minnesota DNR electronic licensing system (ELS) database. Small game license types included: 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=219,214) and “Nonresident” (N=6,718) (Figure 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 harvest estimates and license sales are comparable among years. Also, beginning in 2017, license holders <18-yrs old at the time of the survey were excluded from the sampling frame but included in the overall expansion for sampling. This group comprised <3% of license holders and thus estimates should be comparable among years.

Recipients were asked if they hunted small game in 2018-19 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 were tabulated using Viking Data Entry VDE+ software and analyzed using Program R (ver. 3.5.2; R Development Core Team 2018).

RESULTS

Survey Response and Overall License Sales Trends

Statewide (resident and nonresident) small game license sales and survey response rate are shown in Figure 2. Of the 7,000 mailed surveys, 181 surveys were returned as undeliverable; 2,904 surveys were completed and returned for an adjusted response rate of 43%. The percent of respondents who said they hunted or did not hunt is reported in Table 1. Overall, statewide license sales (225,932 small game licenses) declined 7% from the previous year (Figure 2,

Table 2) and were at their lowest level since 1969. Nonresident small game license sales (6,718 licenses) declined slightly in 2018 but was slightly above the 10-year average (6,591 stamps; Table 3).

Estimates by Species

Harvest trends for the four most sought-after small game species (ducks – all species, Canada geese, ruffed grouse, and ring-necked pheasants) in Minnesota since 2002 are shown in Figure 3 and discussed separately below. For all other species, estimated harvest (Table 2) and number of statewide hunters (Table 4) declined compared to 2017. Similarly, the estimated harvest per active hunter declined for most species except gray partridge which increased slightly (Table 5). Most successful hunters harvested fewer animals except for those hunting American woodcock, gray partridge, and white-tailed jackrabbit who harvested a similar number of animals compared to 2017 (Table 6). Most hunter success rates declined or held steady from last year except for gray partridge and white-tailed jackrabbits success rates which both increased (Table 6).

Ducks – all species

Fewer state duck stamps (82,955 stamps) were sold in 2018 than in each of the previous 10 years (Table 2). The 2018 duck harvest (614,780) was lower than 2017 (688,225 ducks; Table 2) but there were also fewer duck hunters (61,618) afield in 2018 compared to 2017 (63,426 duck hunters; Table 4). Although the estimated harvest per active duck hunter (10.0 ducks/hunter; Table 5) and the mean harvest for successful duck hunters (11.3 ducks/successful hunter; Table 6) were lower in 2018 than 2017 (10.9 ducks/hunter and 12.5 ducks/successful hunter, respectively), the duck hunter success rate (89%) was slightly better than 2017 (87%; Table 6). Despite there being 28% fewer nonresident duck hunters in 2018 than last year, the estimated nonresident harvest was comparable (Table 3).

Canada geese

The 2018 Canada goose harvest (187,578) was well-below the estimated 2017 harvest (267,192 geese) and was the second lowest harvest total in the last 11 years (Table 2). The estimated number of goose hunters (38,278) was also lower than 2017 (44,678 hunters) and the 10-year average (51,526 hunters; Table 4). The estimated harvest per active hunter (4.9) was below the 2017 estimate (6.0 geese/hunter) but comparable to the 10-year average (4.8 geese/hunter; Table 5). Similarly, the mean harvest for successful hunters (6.3) was below the 2017 estimate (7.4 geese/successful hunter) but comparable to the 10-year average of 6.4 geese/successful hunter (Table 6). The 2018 goose hunter success rate (77%) was down from 2017 (81%) but was slightly greater than the 10-year average (75%; Table 6). The number of nonresident goose hunters declined by 27% and their estimated goose harvest (2,940) declined 58% from last year’s record high (6,994 geese) (Table 3).

Ruffed grouse

The 2018 ruffed grouse harvest (195,515) declined 30% from the 2017 estimate (285,180 grouse) and was the lowest harvest in the last 11 years (Table 2) while the estimated number of grouse hunters (67,765) was the lowest on record (spanning more than 40 years). The harvest per active hunter (2.9 grouse/hunter) was below the 2017 estimate (3.5 grouse/hunter) and the 10-year average (3.9 grouse/hunter), and the mean harvest for successful hunters (4.3 grouse/successful hunter) was below the 2017 estimate (4.8 grouse/successful hunter) and the 10-year average (5.4 grouse/successful hunter)(Tables 4, 5, and 6, respectively). The 2018 ruffed grouse hunter success rate was 67%, which was below 2017 (73%) and the 10-year average (72%; Table 6). Although a similar number of nonresidents hunted ruffed grouse in

2018 (2,270 hunters) compared to the previous year (2,280 hunters), they harvested 63% fewer grouse (2,856 grouse in 2018 compared to 6,994 grouse in 2017; Table 3).

Ring-necked pheasants

Slightly more pheasant stamps were sold in 2018 (72,192) than in 2017 but these sales have been declining overall in the last 10 years (Table 2). The pheasant harvest increased 19% with 205,395 roosters harvested in 2018 compared to 171,883 roosters the previous year (Table 2). The estimated number of pheasant hunters (55,861) increased from 2017 (45,263 hunters) but is well-below the 10-year average of 73,341 hunters (Table 4). The estimated harvest per active hunter was 3.7 pheasants/hunter which was similar to 2017 (3.8 pheasants/hunter) and slightly above the 10-year average (3.5 pheasants/hunter; Table 5). The mean harvest per successful hunter in 2018 was similar to 2017 (5.4 vs. 5.5 roosters) and slightly above the 10-year average (5.2 roosters; Table 6). Pheasant hunter success in 2018 (68%) was similar to 2017 (69%) and the 10-year average (68%; Table 6). The number of nonresident pheasant hunters increased 54% (2,350 hunters in 2018 vs. 1,520 hunters in 2017) but their harvest was down 17% from last year (6,048 roosters in 2018 vs. 7,274 roosters in 2017) (Table 3).

ACKNOWLEDGMENTS

This project was funded in part by the Federal Aid in Wildlife Restoration Program. John Giudice analyzed the data and Tim Lyons provided comments on a previous draft of this report.

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 2018-2019 small game hunting season **(March 2018-February 2019)**. We need information to estimate the season's harvest and to help set future small game seasons. Answer only for your Minnesota 2018 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

2018 Small Game Hunter Report

1. Did you hunt small game, listed below, in Minnesota this year (March 2018 - Feb 2019)? ☐ No ☐ Yes (Please check box)
2. Indicate the **total number of days** spent hunting small game of all species listed below, in Minnesota. _________
3. For the species you hunted indicate your harvest, number of days hunted, and county in which you hunted most for each species, even if **None** were bagged. Report only game **you personally** bagged and retrieved in Minnesota. **Do not** include birds taken on shooting preserves or game farms.

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

Figure 1. Sample of Small Game Hunter survey card.

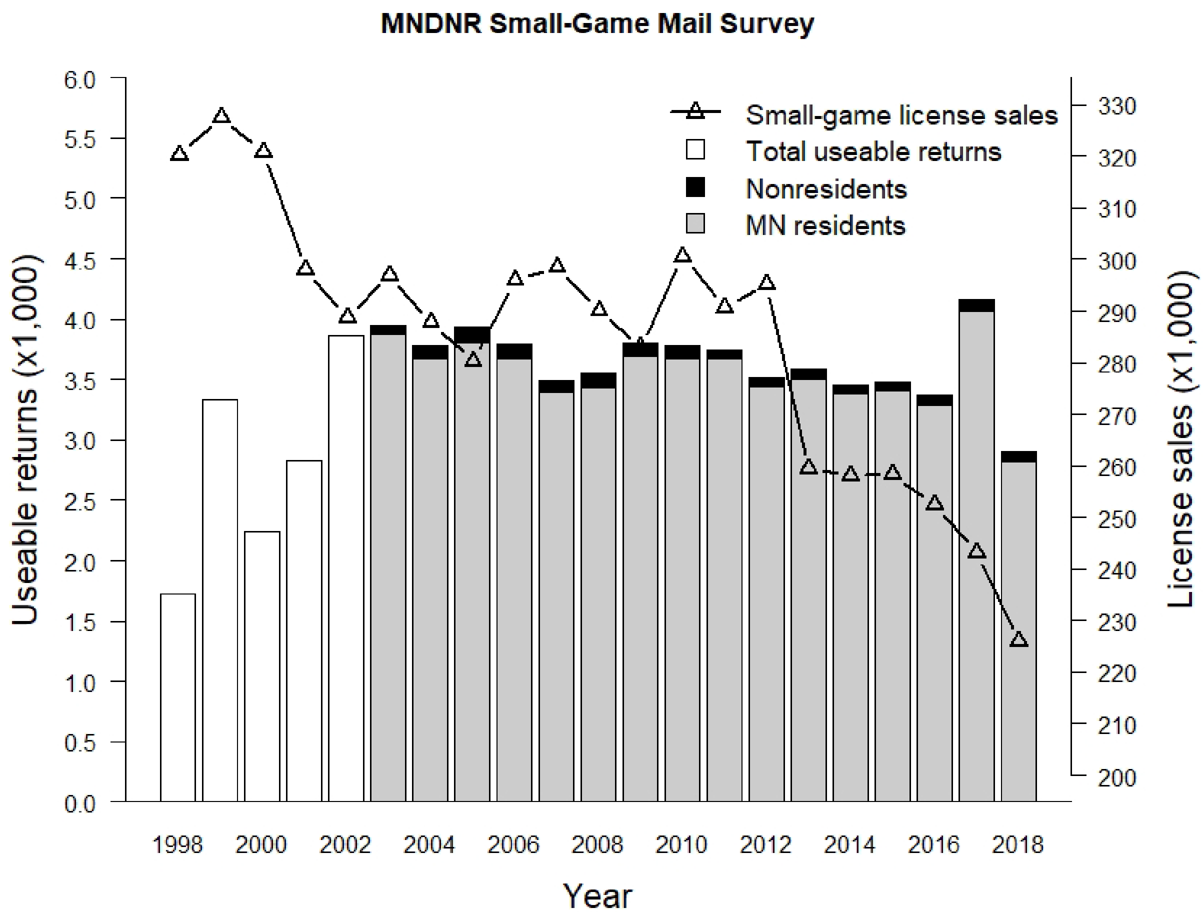


Figure 1. Number of Minnesota small game licenses sold and usable returned surveys, 1998-2018. Includes resident and non-resident licenses, and excludes duplicate and free licenses.

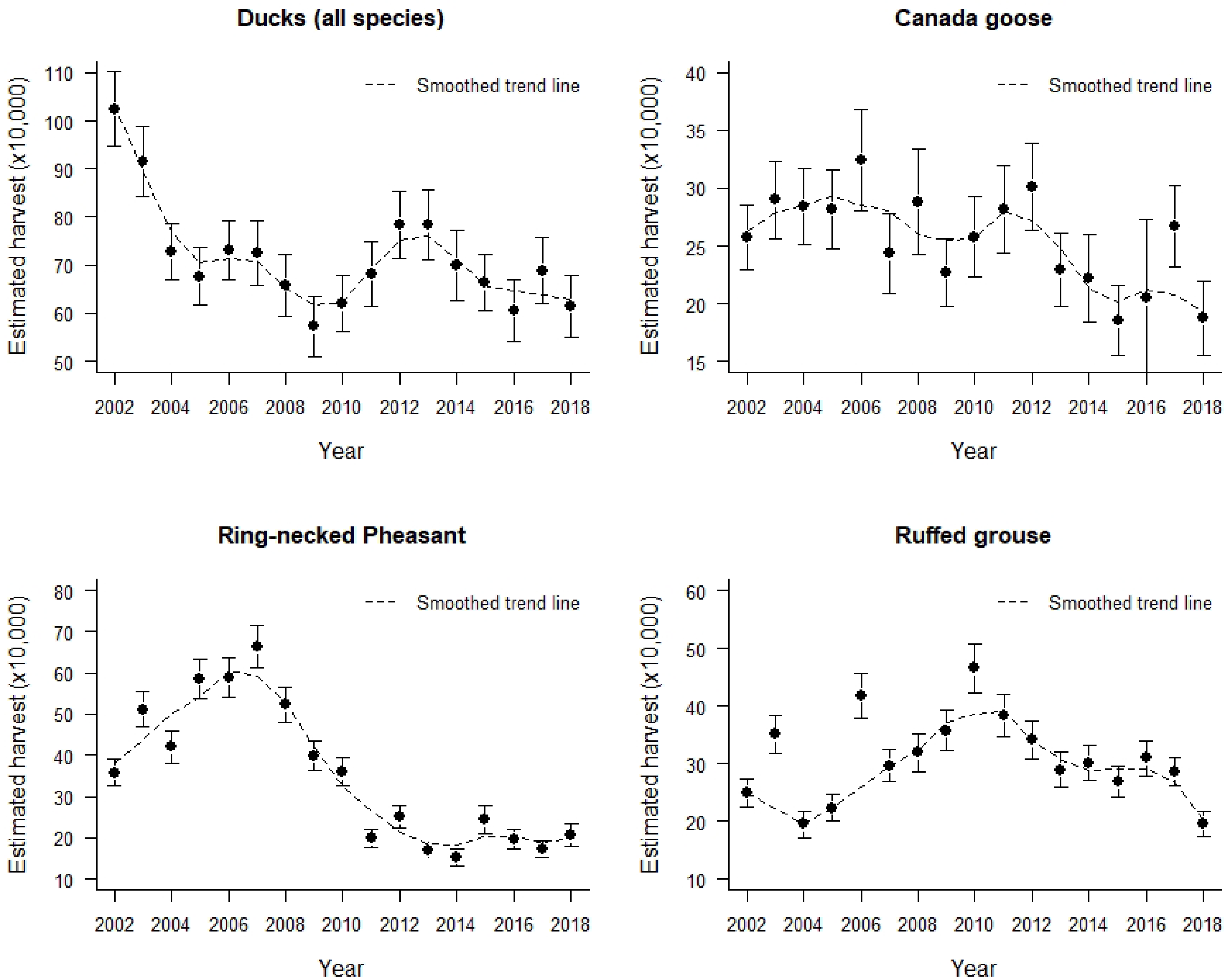


Figure 3. Harvest trends for top four small game species harvested in Minnesota, 2002-2018.

Table 1. Percent of respondents who hunted small game, 2008-09 through 2018-2019[a].

		Returns from mail survey	Projections from license sales
2008-09	Hunted Did not hunt	2,678 (75%) 873 (25%) 3,551 (100.0%)	218,753 71,311 290,064
2009-10	Hunted Did not hunt	2,850 (75%) 952 (25%) 3,802 (100.0%)	212,126 70,857 282,983
2010-11	Hunted Did not hunt	2,824 (75%) 953 (25%) 3,777 (100.0%)	210,129 70,911 281,040
2011-12	Hunted Did not hunt	2,761 (74%) 987 (26%) 3,748 (100.0%)	214,137 76,549 290,686
2012-13	Hunted Did not hunt	2,669 (76%) 851 (24%) 3,520 (100%)	223,808 71,360 295,168
2013-14	Hunted Did not hunt	2,586 (72%) 1,003 (28%) 3,589 (100%)	186,317 72,264 258,581
2014-15	Hunted Did not hunt	2,476 (72%) 975 (28%) 3,451 (100%)	185,186 72,923 258,109
2015-16	Hunted Did not hunt	2,505 (72%) 980 (28%) 3,485 (100%)	185,604 72,612 258,216
2016-17	Hunted Did not hunt	2,426 (72%) 945 (28%) 3,371 (100%)	181,614 70,744 252,358
2017-18	Hunted Did not hunt	2,768 (66%) 1,395 (34%) 4,163 (100%)	161,658 81,472 243,130
2018-19	Hunted Did not hunt	2,000 (69%) 904 (31%) 2,904 (100%)	155,601 70,331 225,932

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

Table 2[a]. Statewide (resident and non-resident) small game hunting license sales and estimated hunter harvest, 2008-09 through 2018-19.

	2008-09	2009-10	2010-11	2011-12[b]	2012-13[b]	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Small game license sales[c]	290,064	282,983	282,227	271,768	264,063	258,581	258,109	258,208	252,358	243,130	225,932
State duck stamp sales	95,675	89,942	88,069	89,681	90,052	93,412	94,265	92,176	88,905	86,258	82,955
Pheasant stamp sales	123,270	110,456	104,286	86,868	90,541	77,597	74,295	77,750	76,920	71,925	72,192
Estimated harvest[d]											
Ducks	658,186	572,220	619,600	681,550	784,360	782,810	699,620	663,811	606,458	688,225	614,780
Canada geese	288,411	227,160	257,530	281,630	301,550	229,120	221,620	185,012	204,825	267,192	187,578
Other geese	13,895	6,250	3,940	4,800	8,820	7,130	6,510	4,448	7,188	8,062	1,557
American coot	23,871	14,810	26,340	10,520	16,720	15,130	17,050	15,861	21,564	19,976	10,663
Common snipe	2,210	1,490	1,940	1,390	1,420	2,310	520	223	1,948	1,928	1,401
Rails / gallinules	163	300	80	390	80	70	80	1,039	n.a.[e]	1,697	n.a.[f]
Crow	51,742	56,350	57,300	81,500	90,260	67,440	56,020	57,576	48,590	110,034	34,940
American woodcock	29,210	35,430	29,770	24,980	30,360	31,920	25,810	37,270	46,867	38,546	30,500
Mourning dove	132,577	109,940	100,230	74,000	92,760	80,480	103,370	96,552	58,618	88,021	54,623
Ring-necked pheasant	522,071	398,130	359,400	198,500	250,140	169,100	152,800	243,176	196,141	171,883	205,395
Ruffed grouse	318,338	357,420	465,580	383,150	341,320	288,410	301,190	267,997	308,955	285,180	195,515
Spruce grouse	16,997	19,130	14,960	18,640	11,980	13,110	14,590	9,856	15,348	12,032	7,081
Sharp-tailed grouse	13,695	9,530	16,820	11,600	10,650	7,130	8,530	7,929	8,610	11,097	5,681
Gray partridge	9,660	8,040	9,150	3,950	5,160	2,380	3,590	3,187	3,745	4,557	3,893
Gray squirrel	121,534	109,790	138,920	115,840	126,110	84,010	91,250	96,400	95,374	105,712	71,888
Fox squirrel	51,079	53,970	61,690	48,100	49,750	33,940	40,840	46,383	39,603	41,994	28,398
Eastern cottontail	79,927	57,760	53,870	34,640	64,140	40,710	38,820	41,716	49,187	47,135	32,057
White-tailed jack rabbit	6,446	2,610	7,220	5,180	1,910	1,870	1,050	742	1,124	585	623
Snowshoe hare	11,343	5,360	6,770	8,430	16,800	6,200	7,860	6,374	5,990	10,864	3,191
Raccoon	72,026	66,700	77,690	44,080	48,340	46,690	52,800	38,387	22,312	68,685	29,332
Red fox	4,408	10,270	8,780	7,120	7,990	5,190	3,220	3,780	2,247	9,229	1,868
Gray fox	2,443	1,860	2,380	1,160	250	430	600	816	225	3,798	78
Coyote	45,689	46,070	44,050	33,410	51,990	23,630	17,430	35,123	24,481	56,184	22,408
Badger	490	750	600	230	330	290	80	149	375	760	78

[a] Harvest estimates in this table, and the number of hunters and mean take per hunter in Table 4, 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 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.

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

[c] Includes all types of small game licenses. Duplicate and free licenses not included.

[d] Estimates based upon response of hunters to questionnaires.

[e] Only 1 respondent indicated they hunted rails and they reported 0 bagged.

[f] No respondents indicated they hunted rails.

Table 3. Mail survey results of nonresident small game hunters, 2008-09 through 2018-19.

	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Nonresident licenses issued[a]	7,114	6,934	6,695	6,312	6,456	6,031	6,056	6,755	6,701	6,854	6,718
Questionnaires:											
Number mailed	226	196	163	169	166	162	165	169	190	200	200
Number not delivered	15	10	6	11	11	10	12	5	15	19	16
Number (percent) returned	89 (42)	105 (54)	107 (66)	91 (54)	71 (43)	81 (50)	70 (42)	73 (43)	78 (41)	99 (50)	80 (40)
Estimated nonresidents and (percent) of all licensed nonresidents hunting:											
Ducks	2,293 (32)	1,849 (27)	2,003 (29.9)	2,430 (38.5)	2,360 (36.6)	2,010 (33.3)	2,340 (38.6)	1,850 (27.4)	2,320 (34.6)	2,350 (34.3)	1,680 (25)
Canada goose	1,587(22)	726 (10)	1,314 (19.6)	1,620 (25.6)	1,360 (21.1)	1,270 (21.0)	1,300 (21.4)	650 (9.6)	770 (11.5)	1,730 (25.3)	1,260 (18.8)
Ruffed grouse	1,940 (27)	1,915 (28)	2,503 (37.4)	1,460 (23.1)	2,820 (43.7)	2,010 (33.3)	2,600 (42.9)	2,870 (42.5)	3,520 (52.6)	2,280 (33.3)	2,270 (33.8)
Ring-necked pheasant	3,116 (44)	1,519 (22)	2,003 (29.9)	1,780 (28.2)	1,910 (29.6)	1,420 (23.5)	1,380 (22.9)	1,480 (21.9)	1,550 (23.1)	1,520 (22.2)	2,350 (35)
Raccoon[b,c]	0 (0)	0 (0)	63 (0.9)	0 (0)	0 (0)	80 (1.2)	0 (0)	0 (0)	170 (2.6)	70 (1.0)	0
Estimated nonresident take:											
Ducks	15,463	11,755	17,055	13,840	20,380	20,410	13,060	16,863	17,701	15,717	15,792
Canada goose	5,762	3,698	6,334	4,050	2,270	3,650	2,680	1,484	1,462	6,994	2,940
Ruffed grouse	6,938	8,651	12,600	8,980	10,090	4,990	9,090	13,805	11,772	6,994	2,856
Ring-necked pheasant	10,642	6,274	8,076	4,860	6,820	3,430	3,720	6,581	4,040	7,274	6,048
Raccoon [b, c]	0	0	593	0	0	1,280	0	0	172	770	0

[a] Excludes duplicate licenses and nonresident shooting preserve licenses.
[b] In 2008, 2009, 2011, 2012, 2014, 2015 and 2018 no non-residents reported hunting/harvesting raccoons.
[c] In 2013 and 2017 only one non-resident reported hunting/harvesting raccoons. The extrapolated estimate is not reliable.

Table 4. Estimated number of statewide hunters by species, 2008-09 through 2018-19.

	2008-09	2009-10	2010-11	2011-12[a]	2012-13[a]	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Ducks	81,358	77,480	72,770	76,090	80,770	76,950	75,170	76,243	67,301	63,426	61,618
Canada goose	59,222	55,520	53,430	57,220	58,900	51,160	48,240	45,938	40,950	44,678	38,278
Other geese	4,411	3,280	3,650	2,710	3,830	2,810	2,770	2,520	2,321	2,512	1,323
American coot	4,166	4,090	4,610	3,480	3,990	3,820	4,410	3,261	3,519	3,446	3,113
Common snipe	1,797	1,340	1,340	1,160	1,160	1,370	820	667	899	1,285	934
Rails / gallinules	408	370	220	230	500	140	300	445	75	234	n.a.[b]
Crow	10,047	10,640	9,380	10,360	11,480	8,570	7,400	7,410	7,412	11,564	4,669
American woodcock	12,171	11,760	10,790	9,430	13,310	12,030	9,650	12,596	12,877	12,615	10,737
Mourning dove	11,599	10,500	10,640	8,970	9,230	10,380	9,950	8,966	7,636	8,878	6,536
Ring-necked pheasant	106,763	99,440	89,140	72,840	76,950	62,110	57,590	63,350	59,965	45,263	55,861
Ruffed grouse	86,505	87,230	92,490	88,620	91,260	81,130	83,020	79,058	82,348	80,654	67,765
Spruce grouse	8,332	9,750	8,860	10,210	7,400	10,810	10,320	8,225	9,658	8,819	7,314
Sharp-tailed grouse	6,616	5,510	7,140	6,190	6,570	6,700	5,460	5,113	6,214	5,198	4,202
Gray partridge	4,411	4,240	3,720	2,400	3,080	2,450	2,540	2,075	2,097	2,103	1,479
Gray squirrel	22,382	22,260	23,740	23,280	24,710	21,690	21,240	22,303	23,806	20,967	17,972
Fox squirrel	13,233	13,180	15,630	12,060	14,220	12,030	12,790	13,411	13,625	11,798	9,803
Eastern cottontail	17,644	16,300	15,030	12,300	16,390	14,550	13,160	11,633	16,096	14,368	12,449
White-tailed jackrabbit	2,451	1,790	2,230	2,320	1,750	1,220	1,350	890	1,423	643	623
Snowshoe hare	4,574	3,500	3,800	3,250	4,820	3,750	4,560	4,076	3,369	4,439	2,101
Raccoon	7,433	7,300	8,260	8,040	8,570	7,640	6,880	5,632	5,840	8,936	4,746
Red fox	5,800	7,820	7,220	6,030	5,820	5,910	4,560	4,150	3,594	5,549	3,035
Gray fox	1,879	1,790	1,640	1,390	1,580	1,730	1,050	1,186	899	2,103	623
Coyote	19,278	19,280	19,420	17,940	21,050	17,650	17,580	18,302	15,871	22,193	14,394
Badger	490	370	600	310	330	500	80	297	375	701	234

[a] Estimates from these years were recomputed without license type 99- free youth license to be consistent with other years of data.
[b] No respondents indicated they hunted rails.

Table 5. Estimated harvest per active hunter by species, 2008-09 through 2018-19.

	2008-09	2009-10	2010-11	2011-12[a]	2012-13[a]	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Ducks	8.1	7.4	8.5	9.0	9.7	10.2	9.3	8.7	9.0	10.9	10.0
Canada geese	4.9	4.1	4.8	4.9	5.1	4.5	4.6	4.0	5.0	6.0	4.9
Other geese	3.2	1.9	1.1	1.8	2.3	2.5	2.4	1.8	3.1	3.2	1.2
American coot	5.7	3.6	5.7	3.0	4.2	4.0	3.9	4.9	6.1	5.8	3.4
Common snipe	1.2	1.1	1.4	1.2	1.2	1.7	0.6	0.3	2.2	1.5	1.5
Rails/gallinules	0.4	0.8	0.3	1.7	0.2	0.5	0.2	2.3	n.a.[b]	7.2	n.a.[c]
Crow	5.2	5.3	6.1	7.9	7.9	7.9	7.6	7.8	6.6	9.5	7.5
American woodcock	2.4	3.0	2.8	2.6	2.3	2.7	2.7	3.0	3.6	3.1	2.8
Mourning dove	11.4	10.5	9.4	8.2	10.0	7.8	10.4	10.8	7.7	9.9	8.4
Ring-necked pheasant	4.9	4.0	4.0	2.7	3.3	2.7	2.7	3.8	3.3	3.8	3.7
Ruffed grouse	3.7	4.1	5.0	4.3	3.7	3.6	3.6	3.4	3.8	3.5	2.9
Spruce grouse	2.0	2.0	1.7	1.8	1.6	1.2	1.4	1.2	1.6	1.4	1.0
Sharp-tailed grouse	2.1	1.7	2.4	1.9	1.6	1.1	1.6	1.6	1.4	2.1	1.4
Gray partridge	2.2	1.9	2.5	1.6	1.7	1.0	1.4	1.5	1.8	2.2	2.6
Gray squirrel	5.4	4.9	5.9	5.0	5.1	3.9	4.3	4.3	4.0	5.0	4.0
Fox squirrel	3.9	4.1	3.9	4.0	3.5	2.8	3.2	3.5	2.9	3.6	2.9
Eastern cottontail	4.5	3.5	3.6	2.8	3.9	2.8	2.9	3.6	3.1	3.3	2.6
White-tailed jackrabbit	2.6	1.5	3.2	2.2	1.1	1.5	0.8	0.8	0.8	0.9	1.0
Snowshoe hare	2.5	1.5	1.8	2.6	3.5	1.7	1.7	1.6	1.8	2.4	1.5
Raccoon	9.7	9.1	9.4	5.5	5.6	6.1	7.7	6.8	3.8	7.7	6.2
Red fox	0.8	1.3	1.2	1.2	1.4	0.9	0.7	0.9	0.6	1.7	0.6
Gray fox	1.3	1.0	1.5	0.8	0.2	0.2	0.6	0.7	0.2	1.8	0.1
Coyote	2.4	2.4	2.3	1.9	2.5	1.3	1.0	1.9	1.5	2.5	1.6
Badger	1.0	2.0	1.0	0.8	1.0	0.6	1.0	0.5	1.0	1.1	0.3

[a] Estimates from these years were recomputed without license type 99- free youth license to be consistent with other years of data.
[b] Only 1 respondent indicated they hunted rails and they reported 0 bagged.
[c] No respondents indicated they hunted rails.

Table 6. Mean harvest for successful hunters and hunter success rates (%), 2008-09 through 2018-19.

	2008-09	2009-10	2010-11	2011-12[a]	2012-13[a]	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Ducks	9.8 (83)	9.2(80)	10.3 (83)	10.5 (85)	11.1 (87)	11.7 (87)	11.0 (85)	10.6 (82)	10.9 (83)	12.5 (87)	11.3 (89)
Canada geese	6.4 (77)	5.6 (73)	6.1 (80)	6.3 (78)	6.5 (78)	5.8 (77)	6.6 (69)	5.7 (71)	7.1 (70)	7.4 (81)	6.3 (77)
Other geese	6.3 (50)	3.5 (55)	2.6 (41)	3.4 (51)	4.4 (52)	5.5 (46)	4.3 (54)	4.0 (44)	8.0 (39)	8.6 (37)	3.3 (35)
American coot	6.9 (82)	5.5 (65)	7.2 (79)	4.4 (69)	5.2 (81)	5.2 (75)	5.0 (78)	6.7 (73)	7.6 (81)	8.1 (71)	5.3 (65)
Common snipe	1.7 (73)	1.8 (61)	2.2 (67)	1.6 (73)	2.1 (57)	2.1 (79)	1.4 (45)	1.0 (33)	3.2 (67)	2.5 (59)	2.6 (58)
Rails / gallinules	1.0 (40)	1.3 (60)	1.0 (33)	5.0 (33)	1.0 (17)	1.0 (50)	1.0 (25)	3.5 (67)	n.a.[b]	14.5 (50)	n.a.[c]
Crow	5.9 (88)	5.9 (90)	6.7 (91)	8.9 (88)	8.8 (90)	9.4 (84)	8.7 (87)	8.3 (94)	7.6 (86)	11.0 (86)	9.4 (80)
American woodcock	3.3 (74)	4.1 (73)	3.6 (76)	3.8 (70)	3.4 (68)	3.8 (70)	4.2 (64)	4.4 (67)	5.4 (67)	4.5 (69)	4.4 (65)
Mourning dove	13.2 (87)	11.4 (92)	11.1 (85)	10.5 (78)	12.5 (80)	9.2 (85)	12.5 (83)	13.3 (81)	10.3 (75)	11.6 (86)	10.2 (82)
Ring-necked pheasant	6.4 (77)	5.8 (69)	5.6 (72)	4.4 (63)	4.9 (67)	4.2 (64)	4.3 (61)	5.4 (71)	5.0 (65)	5.5 (69)	5.4 (68)
Ruffed grouse	5.0 (74)	5.5 (74)	6.6 (76)	5.9 (74)	5.2 (71)	5.2 (68)	5.1 (71)	4.9 (69)	5.3 (70)	4.8 (73)	4.3 (67)
Spruce grouse	3.0 (68)	3.1 (64)	2.4 (71)	3.0 (61)	2.8 (57)	2.4 (51)	2.5 (56)	2.4 (50)	2.7 (58)	2.4 (57)	1.9 (50)
Sharp-tailed grouse	3.2 (64)	3.0 (58)	3.5 (68)	3.1 (61)	3.4 (48)	3.2 (33)	3.8 (41)	3.1 (51)	2.9 (47)	4.0 (53)	3.0 (44)
Gray partridge	3.4 (65)	3.3 (58)	4.2 (58)	3.2 (52)	3.1 (54)	2.5 (38)	4.4 (32)	2.7 (57)	3.3 (54)	4.3 (50)	4.5 (58)
Gray squirrel	6.2 (88)	5.8 (86)	7.0 (84)	6.3 (78)	6.3 (80)	5.0 (77)	5.5 (78)	5.3 (81)	5.1 (79)	5.7 (89)	4.8 (83)
Fox squirrel	4.6 (83)	4.8 (85)	4.6 (86)	5.4 (74)	4.4 (80)	3.7 (75)	4.3 (75)	4.9 (71)	3.8 (76)	4.3 (83)	3.6 (81)
Eastern cottontail	5.3 (85)	4.3 (83)	4.4 (81)	4.1 (69)	5.5 (71)	3.5 (79)	4.1 (73)	5.0 (72)	4.0 (77)	4.0 (83)	3.6 (71)
White-tailed jackrabbit	3.8 (70)	2.1 (71)	4.6 (70)	3.5 (63)	2.3 (48)	5.2 (29)	1.8 (44)	2.0 (42)	1.9 (42)	1.7 (55)	1.6 (62)
Snowshoe hare	3.5 (71)	2.6 (60)	2.6 (69)	3.8 (69)	5.0 (69)	2.9 (58)	3.0 (57)	3.0 (53)	3.2 (56)	3.9 (63)	2.7 (56)
Raccoon	10.6 (91)	9.6 (95)	10.0 (94)	6.1 (89)	6.1 (93)	6.9 (89)	8.5 (90)	7.7 (88)	4.1 (92)	8.2 (93)	7.4 (84)
Red fox	1.5 (49)	2.4 (54)	2.3 (54)	2.4 (49)	2.7 (50)	2.0 (44)	1.7 (41)	1.6 (57)	1.4 (44)	2.6 (63)	1.2 (51)
Gray fox	3.3 (39)	2.5 (42)	4.0 (36)	2.5 (33)	1.0 (16)	1.5 (17)	2.0 (29)	1.4 (50)	1.0 (25)	2.8 (64)	1.0 (12)
Coyote	4.4 (54)	4.6 (52)	4.0 (57)	4.0 (47)	5.1 (49)	2.7 (50)	2.4 (41)	3.4 (57)	3.1 (49)	4.3 (59)	2.9 (53)
Badger	1.2 (83)	2.5 (80)	1.0 (100)	1.5 (50)	1.0 (100)	1.0 (57)	1.0 (100)	1.0 (50)	1.2 (80)	1.6 (67)	1.0 (33)

[a] Estimates from these years were recomputed without license type 99- free youth license to be consistent with other years of data.
[b] Only 1 respondent indicated they hunted rails and they reported 0 bagged.
[c] No respondents indicated they hunted rails.

MIGRATORY BIRD HUNTING ACTIVITY AND HARVEST DURING THE 2017 - 2018 AND 2018-19 HUNTING SEASONS.

The following information has been excerpted from: U.S. Fish and Wildlife Service. Migratory bird hunting activity and harvest during the 2017 - 2018 and 2018-19 hunting seasons. U.S. Fish and Wildlife Service, Laurel, Maryland, U.S.A. The entire report is available on-line at

https://fws.gov/migratorybirds/pdf/surveys-and-data/HarvestSurveys/MBHActivityHarvest2017-18and2018-19.pdf

Hunter setting decoys.

USFWS/Milton Friend

Table 1. Species composition of the Minnesota waterfowl harvest, 2017 and 2018. (from: Raftovich, R.V., S.C. Chandler, and C.M. Cain. 2019. Migratory bird hunting activity and harvest during the 2017-18 and 2018-19 hunting seasons. U.S. Fish and Wildlife Service, Laurel, Maryland. USA August, 2019. 75 pp).

	Minnesota Harvest					Mississippi Flyway Harvest		
Species	2017	% of Harvest	2018	% of Harvest	Percent change in Harvest 17-18	2017	2018	Percent change Harvest 17-18
Mallard	159,718	25.36	105,149	21.79	-34	1,643,472	1,407,353	-17
Domestic mallard	0		212	0.04		1,184	1,397	15
American black duck	308	0.05	212	0.04	-31	17,855	16,032	-11
Black x mallard	0		0	0.00		477	1,186	60
Gadwall	29,543	4.69	22,471	4.66	-24	623,532	421,296	-48
American wigeon	11,386	1.81	10,812	2.24	-5	108,267	65,348	-66
Green-winged teal	60,317	9.58	37,947	7.86	-37	717,625	452,685	-59
Blue-winged /cinnamon teal	78,166	12.41	61,479	12.74	-21	439,383	399,992	-10
Northern shoveler	11,079	1.76	5,724	1.19	-48	237,247	127,236	-86
Northern pintail	13,541	2.15	5,300	1.10	-61	134,643	68,949	-95
Wood duck	116,326	18.47	85,010	17.62	-27	610,542	407,754	-50
Redhead	21,234	3.37	13,144	2.72	-38	57,348	60,193	5
Canvasback	6,155	0.98	6,148	1.27	0	40,087	30,592	-31
Greater scaup	2,462	0.39	3,180	0.66	29	28,929	35,375	18
Lesser scaup	8,617	1.37	10,812	2.24	25	185,503	86,568	-114
Ring-necked duck	80,321	12.75	81,618	16.92	2	267,900	182,667	-47
Goldeneye	6,770	1.07	5,936	1.23	-12	31,870	44,721	29
Bufflehead	12,925	2.05	16,960	3.52	31	96,285	98,519	2
Ruddy duck	615	0.10	848	0.18	38	7,142	6,721	-6
Scoters	1,231	0.20	424	0.09	-66	3,451	5,740	40
Hooded merganser	8,309	1.32	8,904	1.85	7	47,789	33,738	-42
Other mergansers	923	0.15	212	0.04	-77	11,140	7,334	-52
Total Duck Harvest [a] (retrieved kill)	629,900 ±15%		482,500 ±16%		-23	5,339,800 ±5%	3,979,000 ±9%	-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**, 2018, and number of hunter-days and retrieved duck kill. (from: Raftovich, R.V., S.C. Chandler, and C.M. Cain. 2019. Migratory bird hunting activity and harvest during the 2017-18 and 2018-19 hunting seasons. U.S. Fish and Wildlife Service, Laurel, Maryland. USA August, 2019. 75 pp).

State	Number of active duck hunters	Duck hunter days afield	Total duck harvest	Seasonal duck harvest per hunter
Texas	74,300 ± 29%	358,200 ± 28%	955,900± 23%	12.9 ± 37%
Arkansas	60,700 ± 15%	500,900 ± 26%	1,006,200 ± 25%	16.6 ± 29%
Minnesota	53,200 ± 15%	264,900 ± 15%	482,500 ± 16%	9.7 ± 22%
California	51,400 ± 14%	370,000 ± 11%	1,083,300 ± 16%	21.1 ± 21%
Wisconsin	47,600 ± 19%	287,000 ± 26%	366,400 ± 21%	7.7 ± 28%
North Carolina	41,000 ± 25%	229,300 ± 27%	476,300 ± 27%	11.6 ± 36%
Louisiana	36,300 ± 17%	222,200 ± 37%	505,800 ± 32%	13.9 ± 37%
Missouri	35,100 ± 18%	256,100 ± 30%	314,100 ± 20%	9.0 ±27%
North Dakota	33,800 ± 11%	160,400 ± 13%	470,800 ± 14%	14.0 ± 18%
Michigan	33,200 ± 22%	165,500 ± 18%	239,600 ± 20%	7.2 ± 30%
Mississippi Flyway		2,452,800 ± 8%	3,979,000 ± 9%	
United States		5,491,500 ± 5%	10,813,400 ± 5%	

Table 3. Top 10 states in number of **adult goose hunters**, 2018, and number of hunter-days and retrieved goose kill.(from: Raftovich, R.V., S.C. Chandler, and C.M. Cain. 2019. Migratory bird hunting activity and harvest during the 2017-18 and 2018-19 hunting seasons. U.S. Fish and Wildlife Service, Laurel, Maryland. USA August, 2019. 75 pp).

State	**Number of active goose hunters**	**Goose hunter days afield**	**Total goose harvest**	**Seasonal goose harvest per hunter**
Texas	43,600 ± 28%	166,600 ± 50%	149,500 ± 40%	3.4 ± 49%
Minnesota	43,200 ± 17%	215,800 ± 21%	144,200 ± 26%	3.3 ± 31%
California [B]	36,800 ± 12%	245,900 ± 15%	198,200 ± 19%	5.4 ± 23%
Wisconsin	36,000 ± 16%	221,600 ± 19%	128,600 ± 26%	3.6 ± 30%
Michigan	31,800 ± 22%	163,000 ± 27%	93,900 ± 26%	3.0 ± 35%
Arkansas	26,500 ± 19%	138,900 ± 28%	126,700 ± 42%	4.8 ± 46%
North Dakota	23,300 ± 10%	104,400 ± 13%	138,500 ± 34%	6.0 ± 36%
Maryland [B]	20,700 ± 9%	96,000 ± 13%	94,300 ± 16%	4.6 ± 19%
Pennsylvania	19,500 ± 25%	100,300 ± 25%	90,500 ± 29%	4.6 ± 38%
Washington [B]	18,000 ± 8%	108,600 ± 17%	118,500 ± 40%	6.5 ± 40%
Mississippi Flyway		1,334,300 ± 9%	843,900 ± 11%	
United States [b]		3,030,800 ± 6%	2,499,700 ± 6%	

[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.

2019 LIGHT GOOSE CONSERVATION ORDER HARVEST IN MINNESOTA

Steve Cordts, Wildlife Populations and Regulations Unit

Margaret Dexter, Wildlife Populations and Research Unit

J. Giudice, MNDNR Biometrics Unit

INTRODUCTION

This report documents results of the 2019 Light Goose Conservation Order hunter mail questionnaire survey.

METHODS

Minnesota held a light goose Conservation Order harvest from 15 February - 30 April 2019. Participants were required to obtain a $2.50 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 (except for youth <18 years old) were sent a questionnaire after the season. Survey questions are listed in Figure 1.

RESULTS AND DISCUSSION

A total of 965 permits were issued and 348 responses (41%) to the questionnaire were obtained (Table 1). In calculating harvest estimates, we assume that the 507 non-respondents participated in the conservation action and took light geese in the same manner as respondents. An estimated 444 hunters attempted to take light geese during the conservation order period. Active participants pursued light geese for 1,537 days and 1,612 light geese were shot and retrieved. This was an average retrieved take of 4 geese per active participant. An estimated 206 light geese were wounded and not retrieved.

ACKNOWLEDGMENTS

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

MINNESOTA 2019 LIGHT GOOSE HARVEST SURVEY
For the Period of February 15 - April 30, 2019 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 February 15 - April 30, 2019. 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 2019 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 February 15 - April 30, 2019? 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 February 15 - April 30, 2019? ______

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? ________________

Figure 1. Light Goose Conservation Order hunter mail questionnaire, 2019.

Table 1. Summary of Light Goose Conservation Order harvest in Minnesota, 2007 – 2019.

Statistic	Year 2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Total permits sold	1,292	1,406	1,670	952	994	1,048	1,405	1,278	1,141	1,143	974	912	965
Useable returns	921	910	1,057	671	659	675	810	759	520	491	393	353	348
Response rate (%)	71.0	65.0	63.0	72.3	67.1	65.3	58.3	60.0	46	43	41	43	41
Active hunters (%)	39.8	54.9	66.0	40.8	45.7	56.9	54.9	44.0	50	47	48	35	46
Estimated total hunters	514	773	1,103	389	455	600	770	560	569	534	471	321	444
Estimated hunter days	2,302	3,404	4,647	1,475	1,830	2,270	3,070	2,580	2,434	2,605	1,966	1,204	1537
Mean days/hunter	4.5	4.4	4.2	3.8	4.0	3.8	4.0	4.6	4	5	4	3.8	4
Estimated harvest (shot & retrieved)	1,786	2,409	4,366	559	1,554	2,620	2,430	2,880	3,266	2,121	1,713	1,021	1612
Mean harvest/hunter	3.5	3.1	4.0	1.4	3.4	4.4	3.2	5.1	6	4	4	3.2	4
Estimated crippling losses	172	302	640	70	145	210	370	210	349	215	298	78	206
Percent using unplugged guns	43.6	46.7	46.8	44.9	44.2	43.0	49.4	48.8	NA	NA	NA	NA	NA
Est. number hunters using unplugged guns	224	361	516	175	201	260	380	270	NA	NA	NA	NA	NA
Est. number geese **shot** with unplugged guns	1,032	1,275	2,413	348	742	1,510	1,670	2,060	NA	NA	NA	NA	NA
Est. harvest with shell 4-5-6	277	339	822	131	311	460	620	770	NA	NA	NA	NA	NA
Percent using electronic calls	17.1	19.1	23.5	25.9	21.3	22.2	24.5	27.8	NA	NA	NA	NA	NA
Est. number hunters using e-calls	88	148	260	101	97	130	190	160	NA	NA	NA	NA	NA
Est. harvest while using e-calls	329	566	1,171	192	531	460	620	1,710	NA	NA	NA	NA	NA
Percent hunting 1/2-hr after sunset	38.3	42.3	43.1	39.7	39.7	42.4	33.4	36.2	NA	NA	NA	NA	NA
Est. number hunting after 1/2-hr sunset	197	326	475	154	180	250	260	200	NA	NA	NA	NA	NA
Est. harvest 1/2-hr after sunset	209	511	713	87	238	240	260	550	NA	NA	NA	NA	NA

MINNESOTA'S WILD TURKEY HARVEST – FALL 2018, SPRING 2019

Lindsey Messinger, Farmland Wildlife Populations and Research Group

SUMMARY OF SEASON STRUCTURE

This report summarizes the fall 2018 and spring 2019 Minnesota wild turkey harvest. The fall turkey season was 30 days in length (29 September – 28 October) and allowed for an unlimited number of hunters to take one wild turkey of either sex in one of 12 hunter declared permit areas (501-512, Figure 1). Fall permits for youth hunters were valid statewide (i.e., no restrictions on permit area); all other hunters were restricted to a declared permit area.

There were no major changes to the spring turkey season structure in 2019. The spring turkey season was 45 days in length (17 April – 31 May) and allowed hunters to take one bearded wild turkey (tom, jake, or bearded hen). The spring turkey season was divided into six distinct time periods (A-F) with permits valid during a specified time period and permit area (501-512; Figure 1). A restricted number of permits were available through a lottery system in each permit area during time periods A and B (A: 17-23 April, and B: 24-30 April). Permits not sold during the lottery process were available for over-the-counter surplus sales. Permits for the remaining time periods (C: 1-7 May, D: 8-14 May, E: 15-21 May, F: 22-31 May) were available over-the-counter in unlimited quantities in each permit area. Hunters possessing a permit unfilled during time periods A-E were permitted to hunt during the final time period (F) in their respective permit area. Permits for archery and youth hunters were valid the entire season and statewide (i.e., no time period or permit area restrictions).

FALL 2018 SEASON

Permits Issued

Permits issued to hunters decreased 12% from 7,650 permits in 2017 to 6,719 permits in 2018 (Table 1, Figure 2), and was 10% below the 10-year average (7,488 permits issued). Youth permit sales accounted for 21% of total license sales during the fall 2018 season which was similar to 2017.

Harvest

There were 834 harvested turkeys registered during the fall 2018 season which decreased 18% from 1,015 harvested turkeys registered in 2017 and was 29% below the 10-year average (1,181 harvested turkeys registered) (Table 1; Figure 2). A hunter success rate of 12% in 2018 was similar to 2017 (13%), and was 23% below the 10-year average (16.1%) The greatest number of permits were issued in permit areas 507, 508, and 501 (Table 2). These three permit areas also had the highest registered harvest (Table 2). Statewide, females (hens) represented 56% of the total harvest while juvenile males (jakes) and mature males (toms) represented 15% and 28% of the total harvest respectively (Table 2).

SPRING 2019 SEASON

Permits Issued

There were 46,424 permits issued during the spring 2019 season, including 8,901 general lottery and landowner permits, 15,664 surplus over-the-counter permits, 10,032 youth permits, and 11,792 archery permits (Table 3). The total number of permits purchased increased 2% in 2019 from 2018 but was 13% below the 10-year average (39,724 permits issued) (Table 4). Youth permit sales comprised 22% of total permit sales while archery permits accounted for 25% of total permit sales (Table 3). These percentages were similar to 2018 (Table 4) and may indicate archery and youth permit sales are leveling after regulation changes in 2016 which allowed archery and youth hunters to hunt statewide during any time period. Purchase of lottery permits increased 2% from 2018; however, lottery permit applications remained under-subscribed in many permit areas. Surplus permits issued in 2019 were similar to 2018. The greatest number of regular gun permits were issued in permit areas 507, 501, and 508 (in descending order; Table 5). Permit areas 507 and 501 represent the core turkey range in Minnesota. Permit area 508 represents an area of potentially expanding opportunity as this permit area was expanded in 2016 to include the entire north-central and northeastern regions of Minnesota. Permit sales for the first non-lottery time period (C) were the highest statewide, followed by lottery time periods A and B, respectively (Table 6).

Harvest

Hunters registered 10,699 turkeys (Tables 3, 4, 5, & 7), which was 6% below the 10-year average (11,372 turkeys, Figure 3, Table 4). Although harvest remained the highest in the core turkey range in permit areas 507 (2,821 turkeys) and 501 (2,237 turkeys), harvest in permit area 508 (1,623 turkeys) continued to surpass 503 (1,139 turkeys) for the third year in a row (Table 5). Youth (1,835 turkeys), lottery (3,171 turkeys), and archery (1,721 turkeys) harvest each increased 4% from 2018 whereas surplus harvest (3,966 turkeys) decreased 6% from 2018 (Table 3). These trends may be attributable to weather conditions (see below).

Weather Summary

Weather conditions can impact wild turkey abundance and behavior as well as wild turkey hunter participation. Weather may help to explain short-term trends in hunter participation and harvest, particularly during the spring wild turkey hunting season when a majority of wild turkey hunter harvest occurs. Winter 2018-2019 was mild through mid-January 2019. Record-breaking low and persistent sub-zero temperatures occurred in the final week of January and multiple snowfall events in February and March blanketed much of the core turkey range with deep snow exceeding 6 inches from mid-February through mid-March. Prolonged periods of deep snow can impede the ability of adult turkeys to locate food resources which are critical for maintaining optimal body condition and may impact overwinter survival. Spring weather was wet and cold across much of the turkey range with multiple rain events throughout the spring hunting season. Lingering snow and colder than normal temperatures likely delayed nesting activities and vegetation “green up” was later than normal. Cold and wet weather conditions may have impacted hunter participation and effort, and therefore harvest, in some areas.

Table 1. Permits available, number of applicants, permits issued, registered harvest, and hunter success rates for the ten most recent fall wild turkey seasons in Minnesota, 2009-2018.

Year	Permits available	Applicants	Permits issued	Registered harvest	Hunter success (%)[a]
2009	9,330	7,738	5,019	1,163	23.2
2010	10,430	6,869	6,607	1,353	20.5
2011	10,430	3,538	5,382	953	17.7
2012[b]	Unlimited	N/A	10,628	1,752	16.5
2013[b]	Unlimited	N/A	8,060	1,137	14.1
2014[b]	Unlimited	N/A	8,236	1,216	14.8
2015[b]	Unlimited	N/A	8,109	1,213	15.0
2016[b]	Unlimited	N/A	8,469	1,176	13.9
2017	Unlimited	N/A	7,650	1,015	13.3
2018	Unlimited	N/A	6,719	834	12.4

[a] Total hunter success (all permits issued divided by registered harvest). Success rates not adjusted for non-participation or un-registered harvest.

[b] Permits issued, registered harvest, and derived hunter success (%) was reviewed and adjusted to address inconsistencies in data query and previous reporting.

Table 2. Permits issued, registered harvest by sex, total registered harvest, regular harvest, and hunter success rates during the 2018 fall wild turkey season in Minnesota.

Permit area	Regular permits issued[a]	Toms[b]	Jakes[b]	Hens[b]	Total registered harvest[b]	Regular harvest[c]	Regular success rates (%)[d]
501	730	32	12	52	96	86	11.8
502	64	0	2	3	5	5	7.8
503	515	21	5	39	65	55	10.7
504	119	2	4	4	10	10	8.4
505	267	12	5	18	35	31	11.6
506	185	9	2	14	25	23	12.4
507	1,386	81	43	175	299	264	19.0
508	1,162	41	32	96	169	147	12.7
509	162	9	9	24	42	27	16.7
510	586	34	11	37	82	74	12.6
511	65	1	0	3	4	4	6.2
512	68	1	0	1	2	2	2.9
TOTAL	**5,309**	**243**	**125**	**466**	**834**	**728**	**13.7**

[a] Youth permits were not included as there is no declared permit area (valid in all permit areas). No separate license type for archery hunters was available so archery hunters are reflected in regular permits issued.
[b] Total harvest for all license types.
[c] All firearm and archery harvest, excluding youth.
[d] Overall youth success rate was 7.5% in 2018; unable to quantify by permit area as youth permits were valid in all permit areas).

Table 3. Total permits issued, harvest, and success rate by permit type during the spring 2019 wild turkey season in Minnesota.

	Total permits issued	Harvest	Success (%)[a]
Lottery	8,901	3,171	35.6
Surplus	15,664	3,966	25.3
Youth	10,032	1,835	18.3
Archery	11,792	1,721	14.6
Military	35	6	17.1
Total	46,424	10,699	23.0

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

Table 4. Permits available, permits issued, registered harvest, and hunter success rates for the ten most recent spring wild turkey hunting seasons in Minnesota, 2010-2019.

		Permits			Harvest	
Year[a]	Available	Issued[b]	Issued (%)	Archery permits issued	Registered harvest	Success (%)[c]
2010[d]	55,982	46,548	83.0	2,910	13,467	27.2
2011[d]	Unlimited	43,521	N/A	2,462	10,055	21.9
2012[d]	Unlimited	38,155	N/A	3,325	11,276	27.2
2013[d]	Unlimited	40,430	N/A	3,885	10,321	23.3
2014[d]	Unlimited	42,134	N/A	4,760	11,425	24.4
2015[d]	Unlimited	40,824	N/A	4,930	11,694	25.6
2016[d]	Unlimited	38,895	N/A	10,132	12,277	25.0
2017[d]	Unlimited	37,882	N/A	11,043	11,803	24.1
2018[d]	Unlimited	34,214	N/A	11,200	10,706	23.6
2019	Unlimited	34,632	N/A	11,792	10,699	23.0

[a] Youth hunt data included.
[b] Permits issued to archery hunters were not included to facilitate comparison to previous years.
[c] Total hunter success (registered harvest divided by all permits issued). Success rates not adjusted for non-participation or un-registered harvest.
[d] Permits issued, derived issued %, registered harvest, and derived hunter success (%) were reviewed and adjusted to address inconsistencies in data query and previous reporting.

Table 5. Regular (non-youth) firearm permits issued, registered harvest, and hunter success during the 2019 spring wild turkey season in Minnesota.

Permit area	Regular permits issued[a]	Total registered harvest[b]	Regular gun harvest[c]	Regular gun success rates (%)[d]
501	5,927	2,237	1,747	29.5
502	533	149	110	20.6
503	2,801	1,139	828	29.6
504	623	253	160	25.7
505	1,859	749	571	30.7
506	895	332	191	21.3
507	6,036	2,821	1,792	29.7
508	3,546	1,623	1,013	28.6
509	354	250	115	32.5
510	1,801	1,060	573	31.8
511	123	48	24	19.5
512	102	38	19	18.6
TOTAL	**24,600**	**10,699**	**7,143**	**29.0**

[a] Permits issued for the archery, youth, and the Camp Ripley disabled veterans hunt were not included.

[b] Total harvest for all license types.

[c] All lottery, military, and surplus permit harvest, excluding youth and archery licenses.

[d] Regular gun success (regular gun harvest divided by regular permits issued). Success rates not adjusted for non-participation or un-registered harvest.

Table 6. Permits available and issued by license type and time period for the spring 2019 wild turkey season in Minnesota.

Time period	Permits available	General lottery[a] permits issued	Surplus permits issued	Youth permits issued	Archery permits issued
A: 17-23 April	7,010	5,117	781	Not applicable – Youth and archery permits were valid during all time periods.	
B: 24-30 April	7,010	3,801	1,997		
C: 1-7 May	Unlimited	6	7,241		
D: 8-14 May	Unlimited	9	2,984		
E: 15-21 May	Unlimited	2	1,860		
F: 22-31 May	Unlimited	1	801[b]		
Total	**Unlimited**	**8,936**	**15,664**	**10,032**	**11,792**

[a] Includes landowner and military permits.

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

Table 7. Total harvest by time period during the spring 2019 wild turkey season in Minnesota.

Time period	Total harvest	Harvest (%)
A	3,608	33.7
B	2,436	22.8
C	2,306	21.6
D	897	8.4
E	537	5.0
F	915	8.6
Total	**10,699**	**100**

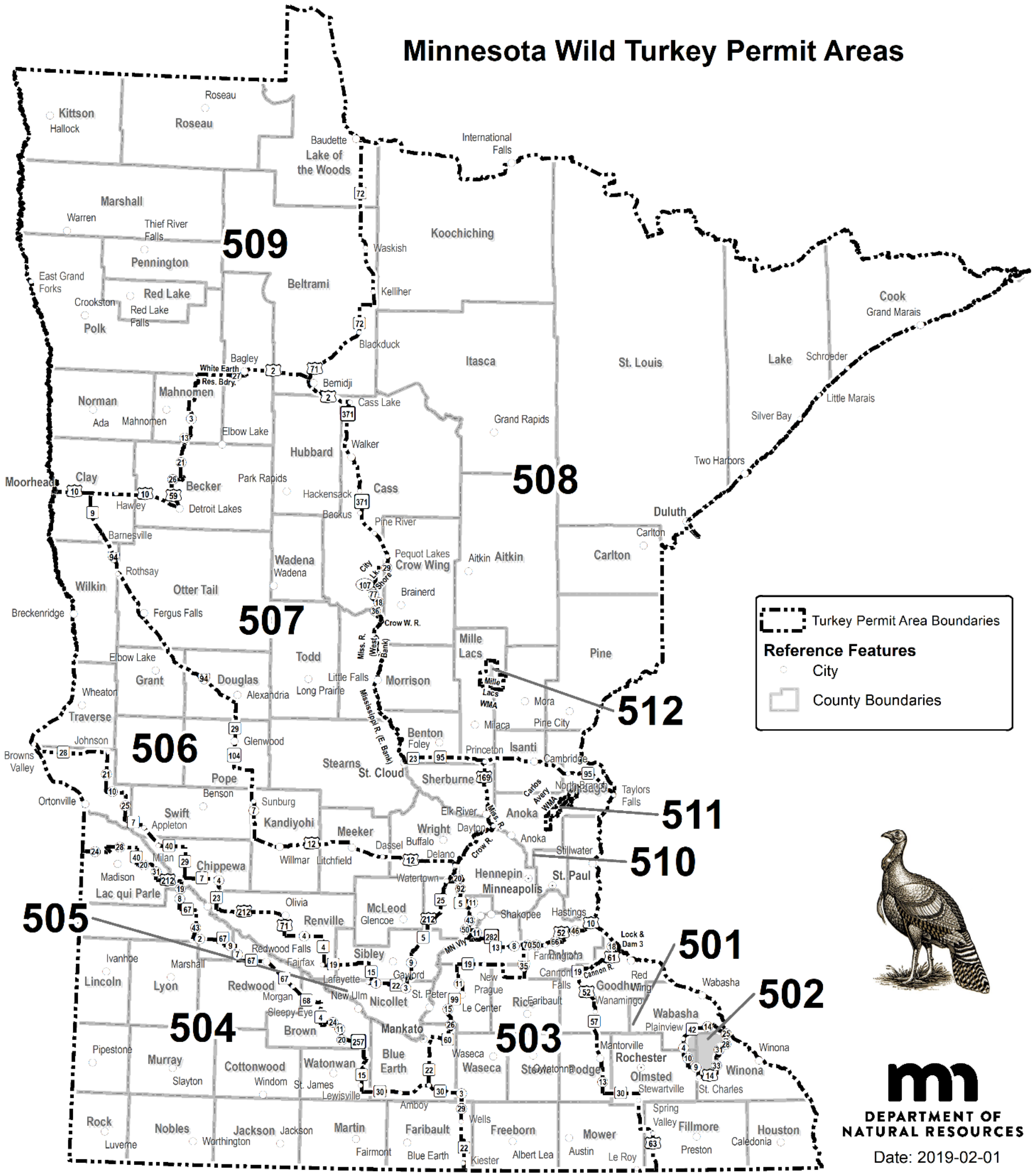


Figure 2. Permit areas open for hunting, fall 2018 and spring 2019 wild turkey seasons in Minnesota.

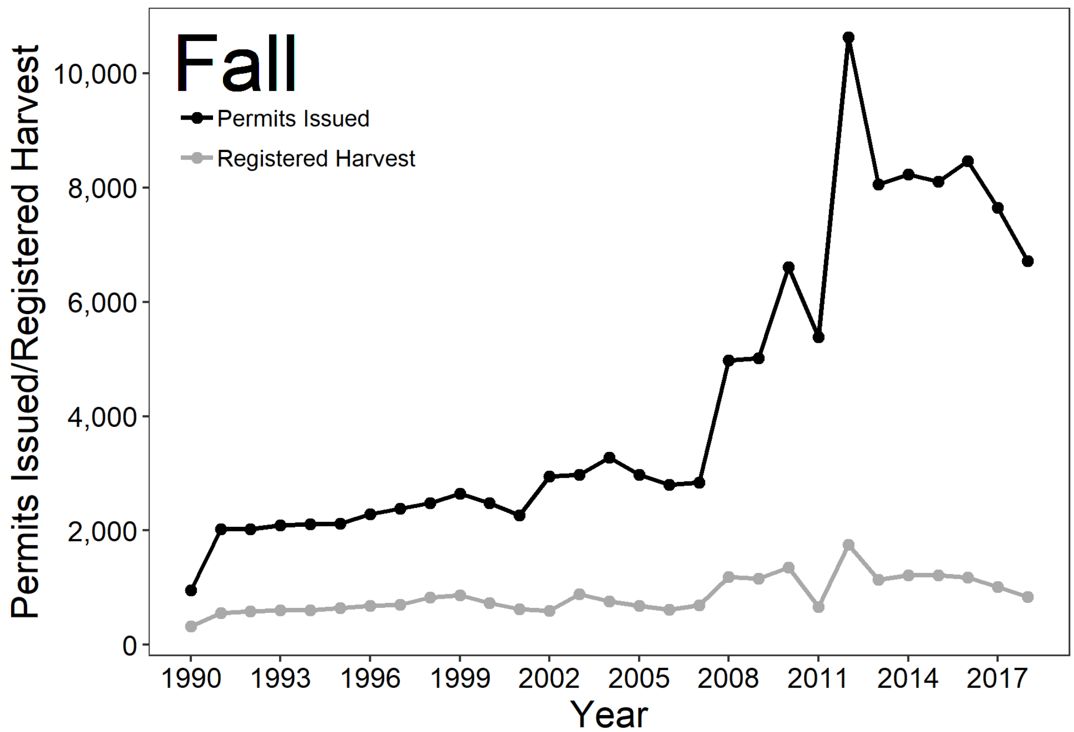


Figure 3. Permits issued and registered harvest for fall wild turkey seasons in Minnesota, 1990-2018.

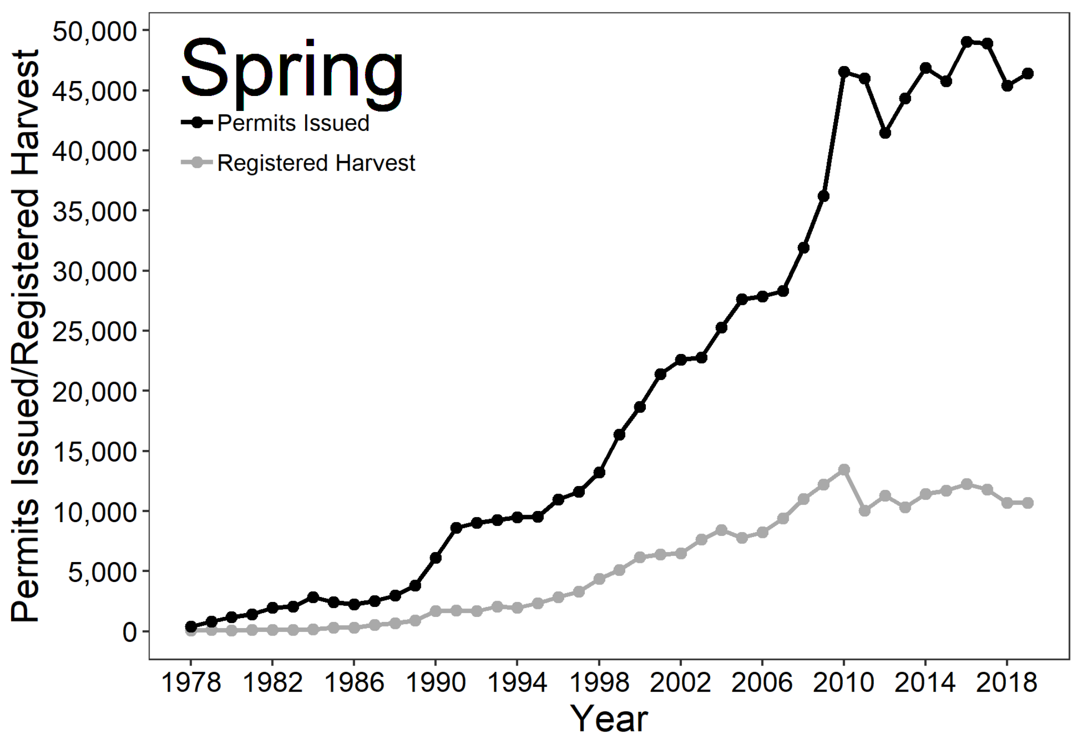


Figure 4. Permits issued and registered harvest for spring wild turkey seasons in Minnesota, 1978-2019.

2018 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 2018, 104 hunters were estimated to have gone afield and harvested 82 prairie-chickens and 36 sharp-tailed grouse (*Tympanuchus phasianellus*) during prairie-chicken hunts. Hunter success (0.51) and satisfaction (4.0 on a scale of 1-5) were similar to recent years and consistent with improvement following changes to the permit areas and season (i.e., longer length and earlier dates) in 2013.

INTRODUCTION

Prairie-chicken (*Tympanuchus cupido pinnatus*) hunting in Minnesota was closed in 1943 because of population declines resulting from habitat loss. However, hunting was reopened in 2003 because prairie-chicken populations were considered robust enough to allow a limited season. During 2003-2005, a limited-entry 5-day hunting season was opened in 7 permit areas in western Minnesota. Permits were awarded through a lottery system, with a bag and season limit of 2 prairie-chickens. In 2006, 4 new permit areas were added and the number of permits was increased in some areas. Surplus licenses were offered for sale after the lottery for the first time in 2011, and in 2013, the permit areas were revised again. These most recent changes eliminated 801A and 802A, modified 803A to include portions of the former 802A and 803A, and added 812A and 813A to expand hunting eastward (Figures 1 and 2). The number of available permits was also reduced in some permit areas to more closely reflect opportunities to harvest prairie-chickens in each permit area. The season was lengthened from 5 days to 9 days to provide hunting opportunity on >1 weekend and was moved from mid-October to open in late-September. The earlier season was an attempt to improve hunter success and satisfaction by providing hunting opportunities before pheasant season opened (to reduce hunter interference and flushing distance). These changes were based on hunter comments received by DNR Wildlife Managers during prior years and input received during a public input survey during March 2013. Responses of surveyed prairie-chicken hunters in 2015 provided additional evidence that the earlier season is preferred by most, although hunter preferences were clearly divided. In 2018, the prairie-chicken season opened 29 September and closed 7 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 in the western part of the state (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. Five weeks later I sent another postcard to people who had not yet responded. Postcards contained 6 questions: did you purchase a permit, did you hunt, and if so, for how many days, how many prairie-chickens did you harvest, how many sharp-tailed grouse did you harvest during prairie-chicken hunts, and how satisfied were you (on a scale of 1-5)?

Only responses from lottery winners who purchased a hunting permit or reported hunting were considered in the analysis. I compared responses from the first mailing to responses from the second mailing to examine possible nonresponse bias. I did not detect a bias in the number of days afield or the number of sharp-tailed grouse harvested between respondents to the first and second mailings. However, a nonresponse bias was detected in the number of respondents that hunted and the number of prairie-chickens harvested. Therefore, I calculated the number of birds harvested, birds per harvester, and hunter success for each permit area assuming that non-respondents were more similar to respondents from the second mailing than to those from the first mailing. Each of these metrics was calculated by permit area and summed for all areas.

RESULTS & DISCUSSION

The combined quota for the 11 permit areas during 2018 was 125 permits, and 303 individuals applied in the lottery (Table 1). Of the 128 lottery winners, 104—including 4 landowners—later purchased a permit. One additional winner who was not on the list of purchasers returned a survey indicating that he/she hunted, so he/she was added to the sample of “purchasers” for this analysis and summary. All permit areas had more applicants than permits available.

Ninety permit purchasers (86%, n = 105) responded to the survey; 79 (76%) responded to the first mailing and 11 (11%) to the second mailing. This response rate is similar to survey response rates since 2010 (mean: 87%; range: 83-95%). Respondents to the first mailing reported harvesting prairie-chickens at higher rates (60% vs. 30%) and reported harvesting more chickens (0.9 vs. 0.3 birds per hunter). Thus, hunters that were more successful were more likely to respond to the survey. Respondents to the first mailing were more likely than respondents to the second mailing to have hunted (100% vs. 91% of respondents), they hunted a similar number of days (2.2 vs. 2.9), harvested a similar number of sharp-tailed grouse (0.4 vs. 0.4 birds per hunter), and reported similar satisfaction (mean 4.1 vs. 3.1, median 5 vs. 3), with 90% and 87% of respondents reporting satisfaction scores >3, respectively.

To correct for the nonresponse bias in harvest this year, I assumed that non-respondents to the survey would have had similar success to respondents to the second mailing (i.e., class method of correction). This assumption may not eliminate nonresponse bias if non-respondents were less successful than respondents to the second mailing, but should more closely approximate the actual harvest than assuming similar responses of non-respondents and all respondents.

Eighty-nine respondents reported that they hunted prairie-chickens (Table 2). I estimated the total number of hunters to be 104 (i.e., purchasers who went afield) after accounting for hunting by non-respondents. Hunters reported harvesting 79 prairie-chickens and total harvest after accounting for non-respondents was estimated as 82 prairie-chickens. An estimated 53 hunters bagged >1 chicken. Survey respondents reported harvesting 36 sharp-tailed grouse while hunting prairie-chickens from permit areas 803A, 804A, 805A, and 807A, 808A, and 810A (Figure 1). Although successful hunters reported higher average satisfaction (4.4) than respondents that were not successful (3.4), satisfaction of prairie-chicken hunters was high overall.

Prairie-chicken hunter success and satisfaction during 2018 were similar to 2013-2017, which is consistent with improved success and satisfaction following changes to the season framework in 2013 to accomplish this goal (Table 3). Hunter survey responses in the 2013 Wildlife Public Input Survey and through this postcard survey in 2015 indicated that hunter preferences are split, but that the majority of hunters support the current season framework. Both the 2013 and 2015 surveys asked hunters about their preference for a season opening on the last Saturday in September or an opener on the Saturday nearest 20 October. The majority of respondents to the 2013 survey (64% of respondents who expressed an opinion) indicated a preference for the earlier season. Likewise, in the 2015 survey, 56% of respondents indicated a preference for the earlier 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. Although a large minority still indicated a preference for a later season, the current season meets the timing preferences of the majority of responding prairie-chicken hunters.

ACKNOWLEDGMENTS

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

Table 1. Prairie-chicken hunt lottery applicants, winners, and hunting permit purchasers in Minnesota during 2018.

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	8	19	9	0.47	8	0.89	0
804A	10	20	10	0.50	9	0.90	0
805A	10	61	10	0.16	10	1.00	0
806A	12	31	13	0.42	8	0.62	0
807A	20	38	21	0.55	20	0.95	0
808A	20	40	20	0.50	14	0.70	0
809A	15	30	15	0.50	12	0.80	0
810A	15	33	15	0.45	13	0.87	0
811A	5	5	5	1.00	3	0.60	0
812A	5	18	5	0.28	4	0.80	0
813A	5	8	5	0.63	4	0.80	0
All	125	303	128	0.42	105	0.82	0

[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. Surplus permits were not available in 2018.

Table 2. Prairie-chicken harvest in Minnesota during 2018.

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	8	7	7	1.4	0.63
804A	8	9	5	5	1.3	0.44
805A	9	10	8	8	2.0	0.40
806A	5	8	5	6	1.5	0.50
807A	18	20	19	20	1.5	0.65
808A	12	13	13	13	1.6	0.62
809A	9	12	10	11	1.8	0.50
810A	12	13	3	3	1.0	0.23
811A	2	3	2	2	1.0	0.67
812A	3	4	1	1	1.0	0.25
813A	4	4	6	6	2.0	0.75
All	89	104[d]	79	82[d]	1.5[d]	0.51[d]

[a] Permit purchasers who hunted.
[b] Estimated number of birds harvested per successful hunter, assuming non-respondents had success similar to that of respondents to the second mailing.
[c] Proportion of estimated hunters harvesting ≥1 prairie-chicken.
[d] Assumed that non-respondents were represented by respondents in the second mailing.

Table 3. Summary of prairie-chicken hunting in Minnesota during 2003–2018.

Year	Permits available	Applicants	Hunters[a]	Birds harvested	Success rate[b]	Hunter satisfaction[c]
2003	100	853	92	130	0.75	4.4
2004	101	759	87	58	0.45	3.6
2005	110	500	86	94	0.63	4.0
2006	182	512	149	109	0.49	3.6
2007[d]	187	519		122	0.53	
2008	186	535	137	133	0.58	3.9
2009	186	512	143	118	0.52	3.4
2010	186	421	136	78[e]	0.32	3.0
2011	186	264	138	103	0.45	3.4
2012	186	298	158	86	0.39	3.4
2013	126	277	93[f]	96[f]	0.60[f]	3.7[f]
2014	126	305	102	95	0.54	3.7
2015	126	271	112	103	0.55	3.6
2016	126	304	111	102	0.58	3.8
2017	125	317	97	86[f]	0.55[f]	4.0[f]
2018	125	303	104	82[f]	0.51[f]	3.9[f]

[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, 2017, and 2018.

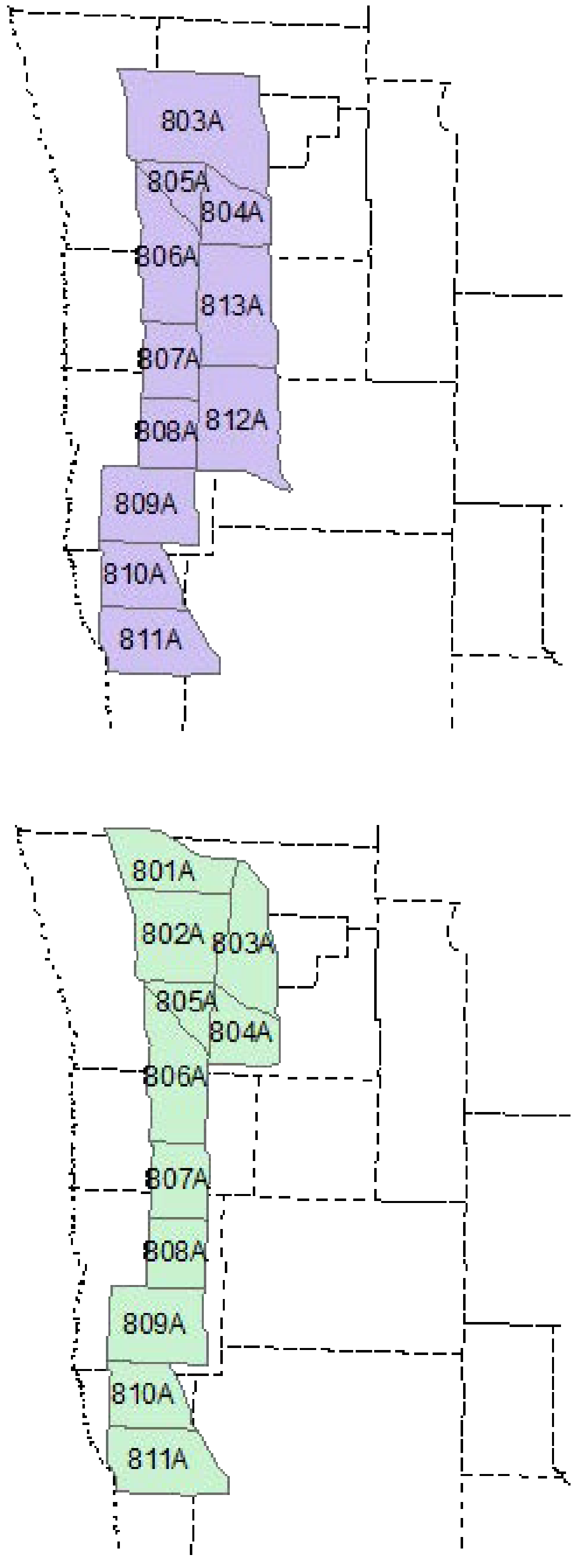


Figure 1. Prairie-chicken hunting permit area boundaries in northwestern Minnesota since 2013 (top) compared to during 2006–2012 (bottom). County boundaries are indicated by dashed lines. Permit areas 812A and 813A were added, 801A was eliminated, and 802A and portions of 803A were combined into a revised permit area 803A.

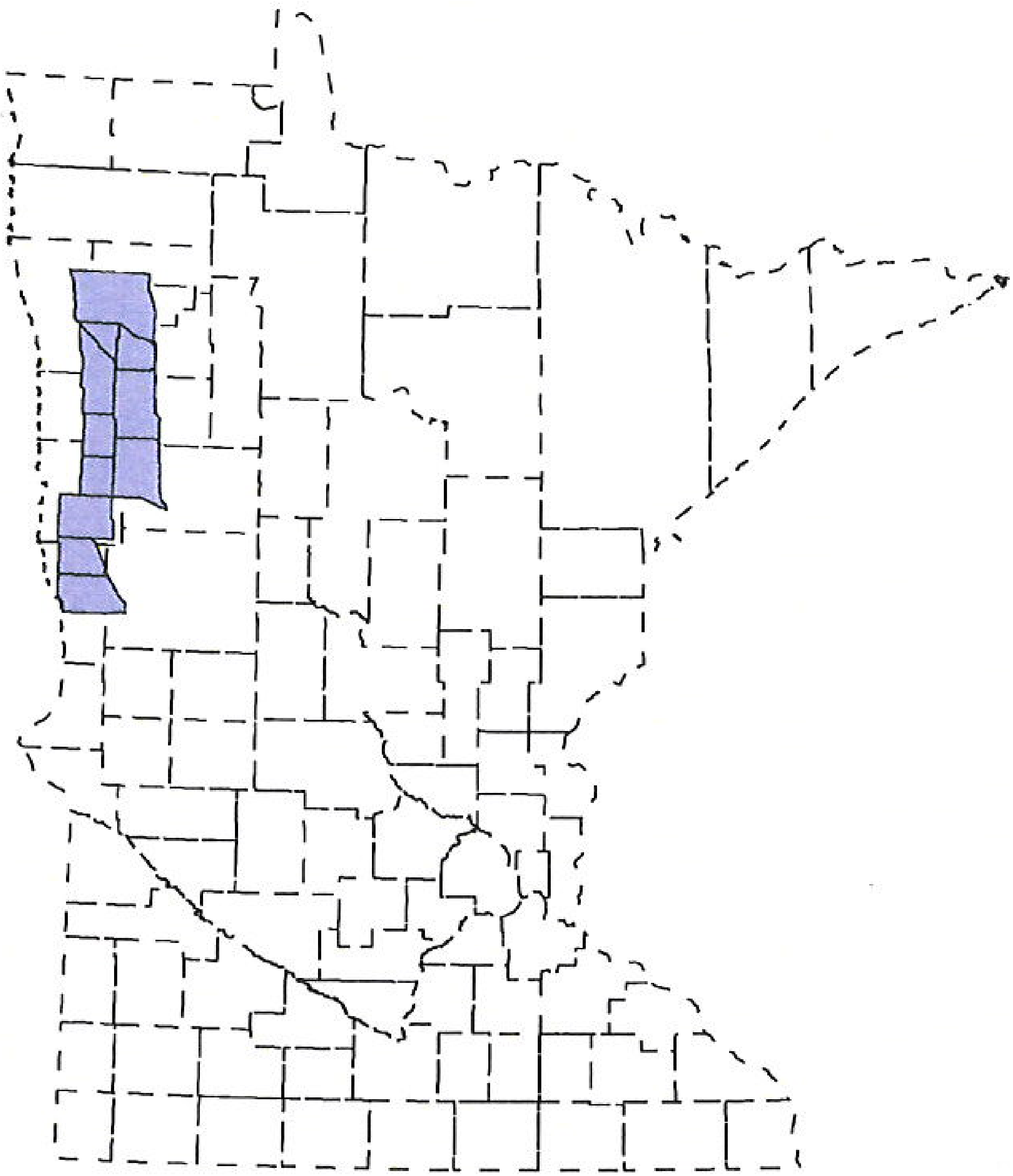


Figure 2. Northwestern location of prairie-chicken hunting permit areas within the state relative to county boundaries (dashed lines).

STATUS OF MINNESOTA BLACK BEARS, 2018

Dave Garshelis and Andy Tri, Forest Wildlife Research Group

INTRODUCTION

The Minnesota bear range has historically been divided into 11 bear management units (BMU). Each has a separate quota on hunting licenses, and hunters must enter a lottery (based on preference points) to obtain a license. Outside the primary bear range, where bear depredation to crops is a primary concern, license sales are unlimited (no-quota area), and hunters can purchase licenses right up to and through the season, over the counter. In all areas the season runs from September 1 through mid-October. About 80% of hunters use bait. This report summarizes status and trends in bear hunting and harvests.

METHODS

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

RESULTS

Permits, licenses, harvest, and success rates

Permit applications for bear licenses exceeded 21,000 again in 2018 (as they did in 2017) (Table 1). Of these, >3,200 (15%), a record high number, applied for area 99, meaning that they only sought to raise their preference level for the permit system. Permit availability was the same as in 2017, but the harvest was 13% lower because natural food availability was high during fall of 2018, making hunters' baits less attractive. Hunting success is inversely related to the number of hunters but also strongly affected by fall foods. (Figure 1).

Bear Management Units

There are currently 13 Bear Management Units (BMUs) where license sales are limited by a quota, and 4 BMUs with no quota (Figure 2). The BMU divisions in the no-quota zone are for internal data analysis purposes only: hunters do not have to choose a BMU in which to hunt within this zone. In the quota zone, hunters must apply for a certain BMU and are drawn through a preference lottery based on their number of previously unsuccessful applications (Table 4). The first digit in each BMU (1–5) refers to 5 larger BMUs in which each was previously a part (when numbering began in 1985). Since then several BMUs have been split, to better adjust hunting pressure. The most recent split was in 2016, when BMU 26 was divided into 27 and 28, and BMU 44 was split into 46 and 47 (BMUs 28 and 47 comprise the Leech Lake Reservation). This split, along former BMU lines, allows current data to be regrouped into these former BMUs and thereby compared to older data (which is done in this report).

Quota zone permits and licenses

The number of quota zone permits available in 2018 was the same as it was for 2017 for all BMUs (Table 2). This is the 6th year (since 2013) that permits have been kept low (<3,900). This was the 8th year (since 2011) of a system whereby licenses for the quota zone that were not purchased by permittees selected in the lottery could be purchased later as surplus. All surplus licenses (>400) were purchased (Table 3).

Quota zone applicants

Statewide, quota zone applications increased 17% over the past 10 years (Figure 3), but much of that increase was for area 99 (preference level application). Among applications for specific BMUs, only BMU 45 showed a significant, steady increase, and was one of the few BMUs with higher applications in 2018 than in 2017 (Figure 3).

Quota zone lottery

The low quota zone permit availability over the past 6 years has made it increasingly difficult to succeed in the lottery (Table 4). This year, although quotas were the same as last year, a higher level of preference was needed to secure a permit because a large number of hunters who had accumulated preference points by previously applying to area 99 entered the lottery for a BMU. First-time applicants were successful only in BMU 22 (wilderness area hunt), and second-time applicants were successful only in BMUs 22 and 13. Four BMUs required a preference level of at least 4 for a chance of success, and BMU 45 required a preference level of 5 or above. This high threshold for BMU 45 is due to the increasing number of applicants (Figure 3), not a change in number of available permits (Table 2).

Harvest by BMU

The statewide harvest in 2018 was lower than in 2017 (Table 5). However, BMUs along the northern edge of the state (BMU 11, 12, 13, 25) had slightly higher harvests in 2018. The most extreme declines from 2017 to 2018 were in the east-central portion of the bear range (BMUs 51 and 52; BMU 51 was the lowest since the division of these 2 BMUs in 1987; Figure 2).The sex ratio of the harvest was ≥60% males in all BMUs except one (BMU 31). The statewide harvest sex ratio of 66% males equaled the record set in 2015. The statewide harvest sex ratio has exceeded 60% in all years since 2013 (Table 1), when permits were reduced. However, these same highly male-biased sex ratios have also occurred in the no-quota area, suggesting that it is not just due to low hunter density.

Harvest by quota vs no-quota zones

Permit availability continuously declined during the decade 2003–2013 (Table 1), and with that, total harvests declined and the percent of the harvest in the no-quota zone increased (Figure 4). The percent harvest in the no-quota zone has leveled off in recent years, with stabilization of the number of quota-zone permits available, but nevertheless was a record high this year (28%), most of it occurring in BMU 11 (16% of statewide harvest; Table 5). Nearly half the bear hunters were hunting with a no-quota license in 2017 and 2018.

Hunting success by BMU

Record-breaking success was experienced by hunters in 2016 and 2017 (Table 6). In 2018, success was generally lower, yet was still exceptionally high in many areas (>50% in BMUs 12, 13, 25; 60% in BMU 28 [which has a high proportion of guided hunters]). Success rate in the no-quota zone as a whole (15%) was less than half that in the quota zone (38%). The distribution of hunters within the no-quota zone is gleaned from where they said they would hunt when they purchased their license: a growing proportion indicated that they planned to hunt in BMU 10 (although the hunting success rate in this area is lowest in the state).

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). During years with abundant fall foods, the harvest is shifted later in the season, with <60% occurring during the first week. This delayed pattern occurred in 2018.

Predictions of harvest

The 2018 statewide harvest was close, but slightly higher than expected (1766 actual vs. 1715 predicted), based on regression of harvest as a function of hunter numbers and the fall food productivity index (Figure 5). This regression is even stronger (and has accurately predicted previous harvests) when only the past 15 years are considered. For the quota zone, the actual harvest in 2018 was also close but higher (1272 actual vs. 1201 predicted) than predicted by this regression.

Harvest sex ratios

Harvest sex ratios within BMUs varied considerably year-to-year over the past 2 decades. Five BMUs have shown a significantly increasing trend in percent males during 1998–2018; these were not concentrated in a single region but rather represent the northwest (BMU 13), north-central (BMU 25, 26), and southeastern (BMU 51, 52) portions of the bear range (and include both quota and no-quota areas. Statewide there has been a clear shift toward more males in the harvest (see Figure 9). 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, hunter selectivity, and possibly density of baits). (Figure 6).

Harvest ages

Statewide, the median age of harvested females dipped below 3 years old, breaking what had been a 3-year upward trend (Figure 7). Likewise, the proportion of the female harvest composed of 1–2 year-olds increased slightly and 4–10 year-olds decreased. On a BMU-basis, median ages of harvested females has not shown an obvious trend over the past 20 years. However, it is notable that BMUs 45 and 52 had especially young females harvested in 2018 (median ages <2 years in both of these BMUs, Figure 8). This was likely a result of the abundant fall foods in the southern portion of the bear range: it is common for older females in particular to shun hunters' baits when natural foods are abundant. The median age of harvested males (slightly over 2 years old statewide) has been relatively stable (Figure 9), but creeping upward.

Submission of bear teeth for aging

Ages of harvested bears are used as the principal means of monitoring population trends. Although hunters are required to submit a tooth from their harvested bear, historically >25% did not comply. Reminder notices were sent to non-compliant hunters each year during 2014–2017, which spurred a higher initial compliance the following years (>80%). However, ~90% compliance was achieved only through a reminder mailing (Figure 10). In 2018 no reminder mailing was sent and compliance was 85%. Since 2013, hunters could register by phone or internet, and pick up a tooth submission envelope later: tooth submission compliance by these hunters has been significantly less than for hunters who registered their bear in person and picked up a tooth envelope at that time (Figure 11). Less than 80% of successful hunters in BMUs 41, 46, and 10 submitted a tooth.

Trends in harvest rates

The sex ratio of harvested bears varies by age in accordance with the relative vulnerability of the sexes. Male bears are more vulnerable to harvest than females, so males always predominate among harvested 1-year-olds (67–75%). Males also predominate, but less strongly among 2 and 3-year-old harvested bears (Figure 12). However, older-aged harvested bears (≥8 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 in the living population. The age at which the line fitted to these proportions crosses the 50:50 sex ratio is approximately the inverse of the harvest rate. Segregating the data into time blocks showed harvest rates increasing from 1980–1999, then declining with reductions in hunter numbers (Figure 1). Based on this method, harvest rates since 2015 have been significantly less than what they were in the early 1980s, when the bear population was increasing.

One problem in using this very simple method is that it assumes that the relative difference for males versus females in their vulnerability to harvest does not change systematically through time. This may not be true, given the steadily increasing male-skewed harvests since the late 1990s, and especially in recent years (Figure 9).

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

Table 1. Bear permits, licenses, hunters, harvests, and success rates, 1998–2018.

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Permit applications [a]	30245	29384	29275	26824	21886	16431	16466	16153	15725	16345	17362	17571	18647	19184	18103	18107	18885	18422	19958	21034	21184
Permits available [b]	18210	20840	20710	20710	20610	20110	16450	15950	14850	13200	11850	10000	9500	7050	6000	3750	3750	3700	3850	3350	3350
Licenses purchased (total)[c]	16737	18355	19304	16510	14639	14409	13669	13199	13164	11936	10404	9892	9689	9555	8986	6589	6620	6962	7177	6655	6550
Quota zone [c]	14941	16563	17021	13632	12350	9833	10063	9340	9169	8905	7842	7342	7086	5684	4951	3188	3177	3257	3420	2954	2922
Quota surplus/military [c]				235	209	2554	1356	1591	1561	526	233	77	83	1385	1070	578	583	446	441	401	428
No-quota zone [c]	1796	1792	2283	2643	2080	2022	2238	2268	2434	2505	2329	2473	2520	2486	2965	2823	2860	3259	3316 [h]	3300 [h]	3200
% Licenses bought																					
Of permits available [d]	82.0	79.5	82.2	67.0	60.9	61.6	69.4	68.5	72.3	71.4	67.7	73.4	74.6	100	100	100	100	100	100	100	100
Of permits issued [d]	84.4	87.2	83.9	69.8	66.3	65.7	68.3	67.1	68.9	70.0	67.2	73.8	74.5	80.7	82.7	85.0	84.7	87.9	88.7	88.2	87.2
Estimated no. hunters [e]	14500	15900	16800	15500	13800	13600	12900	12500	12500	11300	9900	9400	9200	9200	8600	6300	6300	6700	6900	6400	6300
Harvest	4110	3620	3898	4936	1915	3598	3391	3340	3290	3172	2135	2801	2699	2131	2604	1866	1627	1971	2641	2040	1766
Harvest sex ratio (%M) [f]	55	53	58	56	61	58	57	59	58	57	62	59	59	61	59	62	62	66 [i]	61	63	66 [i]
Success rate (%)																					
Total harvest/hunters [g]	28	23	23	29	14	26	26	26	26	28	21	30	29	23	30	30	26	30	39	32	28
Quota harvest/licenses	25	20	20	28	14	25	26	25	25	28	21	30	30	24	33	37	33	39 [j]	50 [j]	46 [j]	38

[a] From 2008 to 2018, includes area 99, a designation to increase preference but not to obtain a license (2008 = 528, 2009 = 835; 2010 = 1194; 2011 = 1626; 2012 = 1907; 2013 = 2129; 2014=2377; 2015=2455; 2016=2641; 2017=2803; 2018=3254 (record high); additionally, area 88 nuisance-only bear license applications counted in this total in 2017=3 and 2018=6 (people who selected area 88 as 1st preference).

[b] Beginning in 2011 a procedure was implemented that ensures that all available licenses are purchased (see Table 2).

[c] Quota zone established in 1982. No-quota zone established in 1987. Surplus licenses from undersubscribed quota areas sold beginning in 2000; originally open only to unsuccessful permit applicants, but beginning in 2003, open to all. In 2011, surplus licenses offered for all lottery licenses not purchased by August 1. Free licenses for 10 and 11 year-olds were available beginning 2009.

[d] Quota licenses bought (including surplus)/permits available, or licenses bought (prior to surplus)/permits issued. Beginning in 2008, some permits were issued for area 99; these are no-hunt permits, just to increase preference, and are not included in this calculation. In 2011–17, 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%). Beginning in 2011 all unpurchased quota licenses were sold as “surplus” in August, and this process is quick and competitive; thus, for 2011–17 all Surplus and Military license-holders were considered to have hunted.

[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 both 2016 and 2017, 5 hunters legally killed 2 bears.

[h] Record high number of no-quota zone licenses purchased in 2016; record high % of licenses in no-quota zone in 2017 (nearly 50%; see Fig. 4).

[i] Record high % males in statewide harvest.

[j] 2015: highest success rate in quota zone since very poor food year of 1995; 2016: record high success rate; 2017: second-highest success rate.

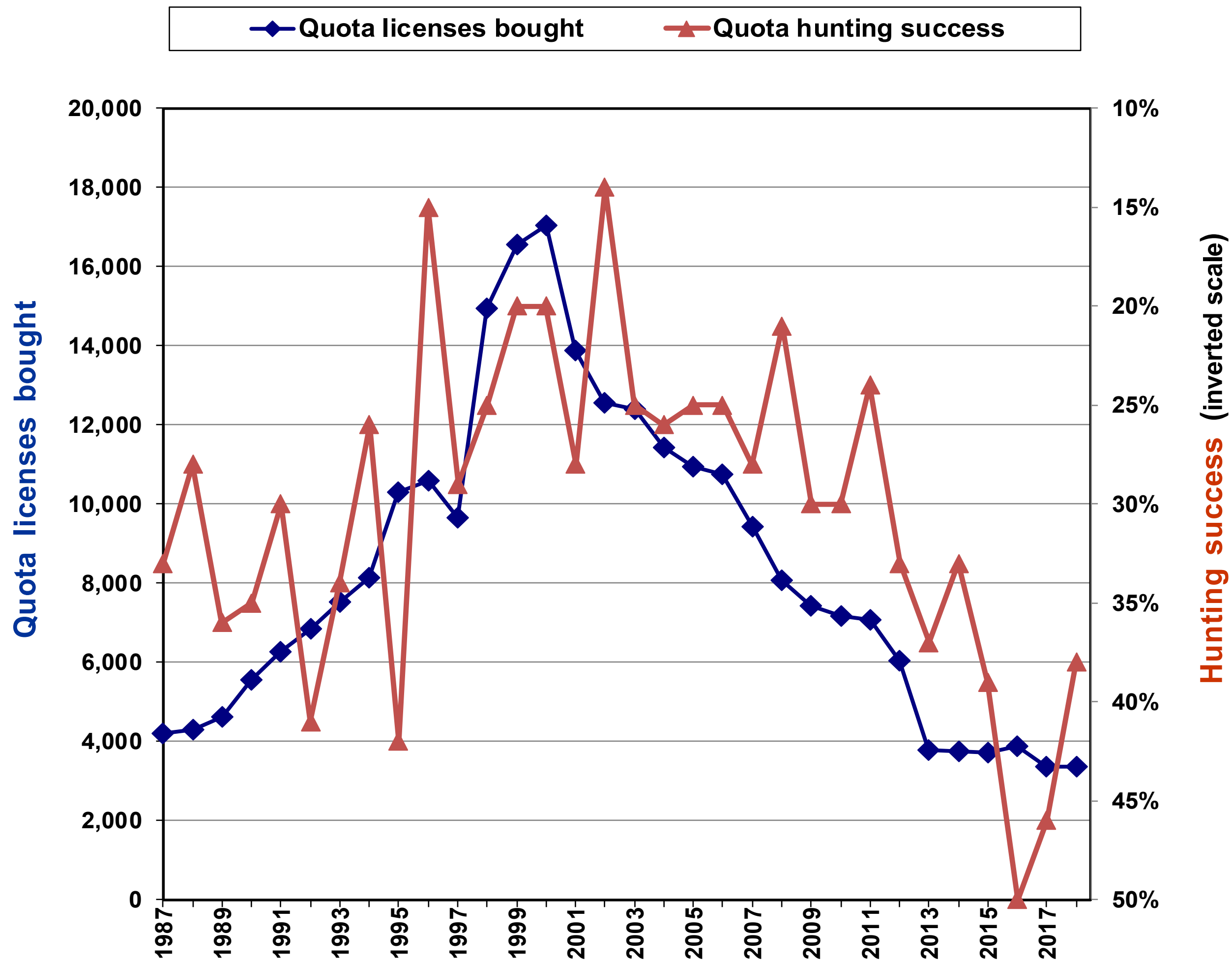


Figure 1. Relationship between licenses sold and hunting success (note inverted scale) in quota zone, 1987–2018 (no-quota zone first partitioned out in 1987). Number of licenses explains 47% of variation in hunting success during this period. Large variation in hunting success is also attributable to food conditions (e.g., during 2013–2018, when licenses were held relatively constant).

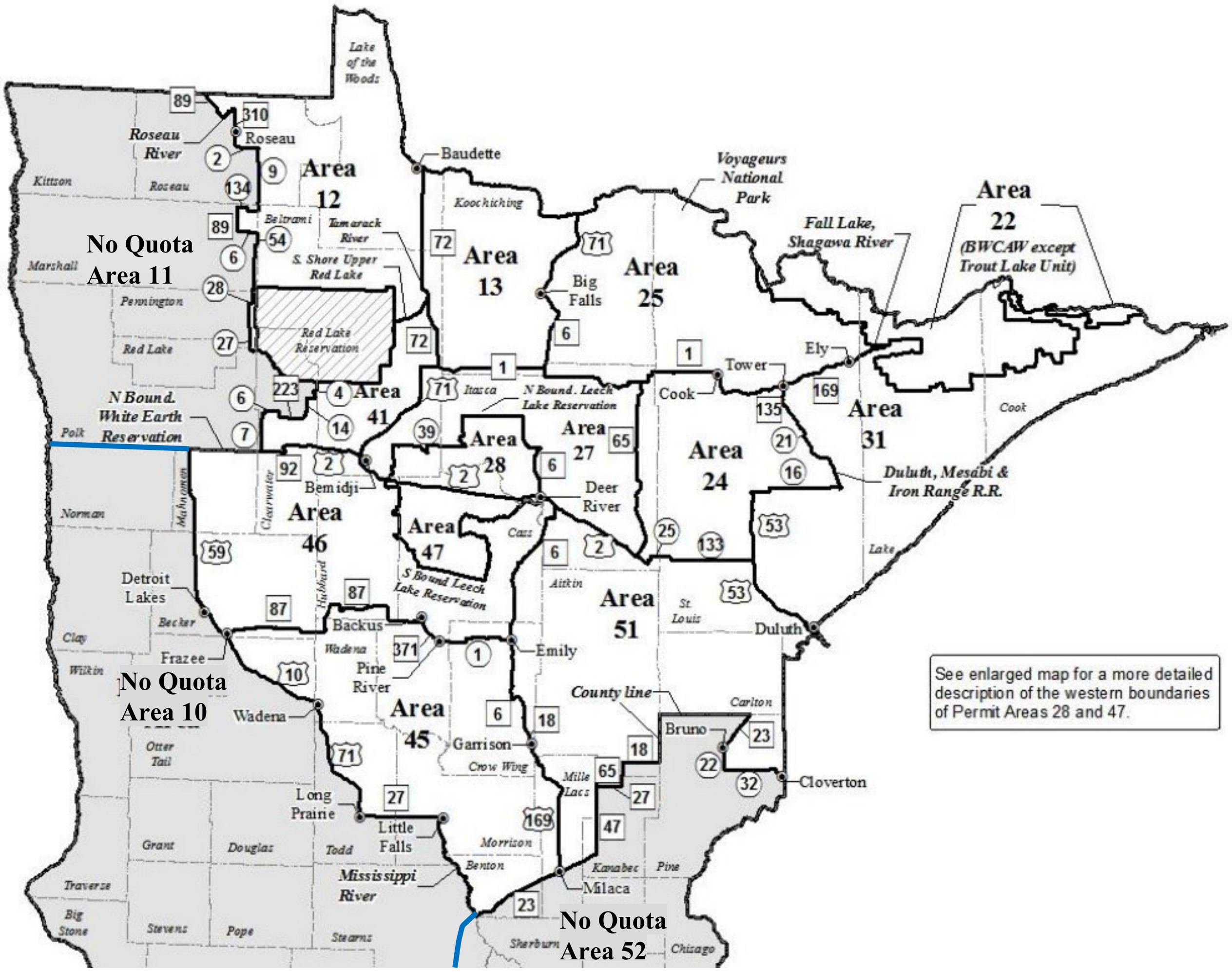


Figure 2. Bear management units (BMUs) within quota (white) and no-quota (gray) zones. Hunters in the quota zone are restricted to a single BMU. In 2016, BMU 26 was divided into 27 and 28, and BMU 44 was split into 46 and 47 (BMUs 28 and 47 comprise the Leech Lake Reservation). No-quota hunters can hunt anywhere within the gray-colored zone, including the southeast corner of Minnesota (not shown; designated area 60).

Table 2. Number of bear hunting quota area permits available, 2013–2018. Highlighted values show a change from the previous year. BMUs 26 and 44 were divided into 27/28 and 46/47, respectively, in 2016.

BMU	2013	2014	2015	2016 Before BMU split [a]	2016 After BMU split	2017	2018
12	200	200	150	150	150	125	125
13	250	250	250	250	250	225	225
22	50	50	50	50	50	50	50
24	200	200	200	200	200	175	175
25	500	500	500	500	500	400	400
26	350	350	350	325			
27					250	225	225
28					75	60	60
31	550	550	550	550	550	500	500
41	150	150	150	125	125	125	125
44	450	450	450	450			
46					400	350	350
47					50	40	40
45	150	150	150	250	250	175	175
51	900	900	900	1000	1000	900	900
Total	**3750**	**3750**	**3700**	3850	**3850**	**3350**	**3350**

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

Table 3. Number of quota BMU permit applicants (Apps), licenses bought (after permits drawn) and surplus licenses bought, 2013–2018[a]. Shaded values indicate undersubscribed (applications less than permits available).

	2013			2014			2015			2016			2017			2018		
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	Apps	Bought license	Surplus bought
12	707	160	44	661	164	36	612	130	20	624	133	17	774	113	12	703	109	16
13	664	213	37	703	218	32	692	210	40	716	221	29	772	200	25	682	177	47
22	55	36	14	65	33	17	48	36	9[b]	52	37	13	47	34	16	76	36	14
24	763	170	30	875	174	26	771	171	29	884	173	27	945	158	17	928	155	20
25	1575	432	69	1533	424	76	1396	433	67	1443	440	60	1651	354	46	1561	355	44
26	1695	303	47	1696	298	52	1650	309	42									
27										1224	219	31	1297	197	28	1265	204	21
28										325	72	3	330	52	8	309	52	8
31	2261	478	72	2257	468	82	2021	488	62	2180	489	62	2076	441	59	2074	428	71
41	575	135	15	561	129	21	570	129	21	618	114	11	614	109	16	648	114	11
44	2682	386	65	2751	393	57	2626	402	48									
46										2690	370	30	2774	319	31	2769	317	33
47										194	45	5	214	33	7	182	35	5
45	1205	141	9	1403	127	23	1703	139	11	2046	227	23	2323	161	14	2383	160	15
51	3796	734	166	4003	748	152	3878	810	90	4321	880	121	4411	783	117	4344	779	123
Total	15978	3188	568	5406	875	175	5581	949	101	17317	3420	432	9722	1296	169	17924	2921	428

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

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

[c] Beginning in 2008, applicants could apply for area 99 in order to increase future preference, but not buy a license; these are not included in the total number of applications (unlike Table 1, where they are included).

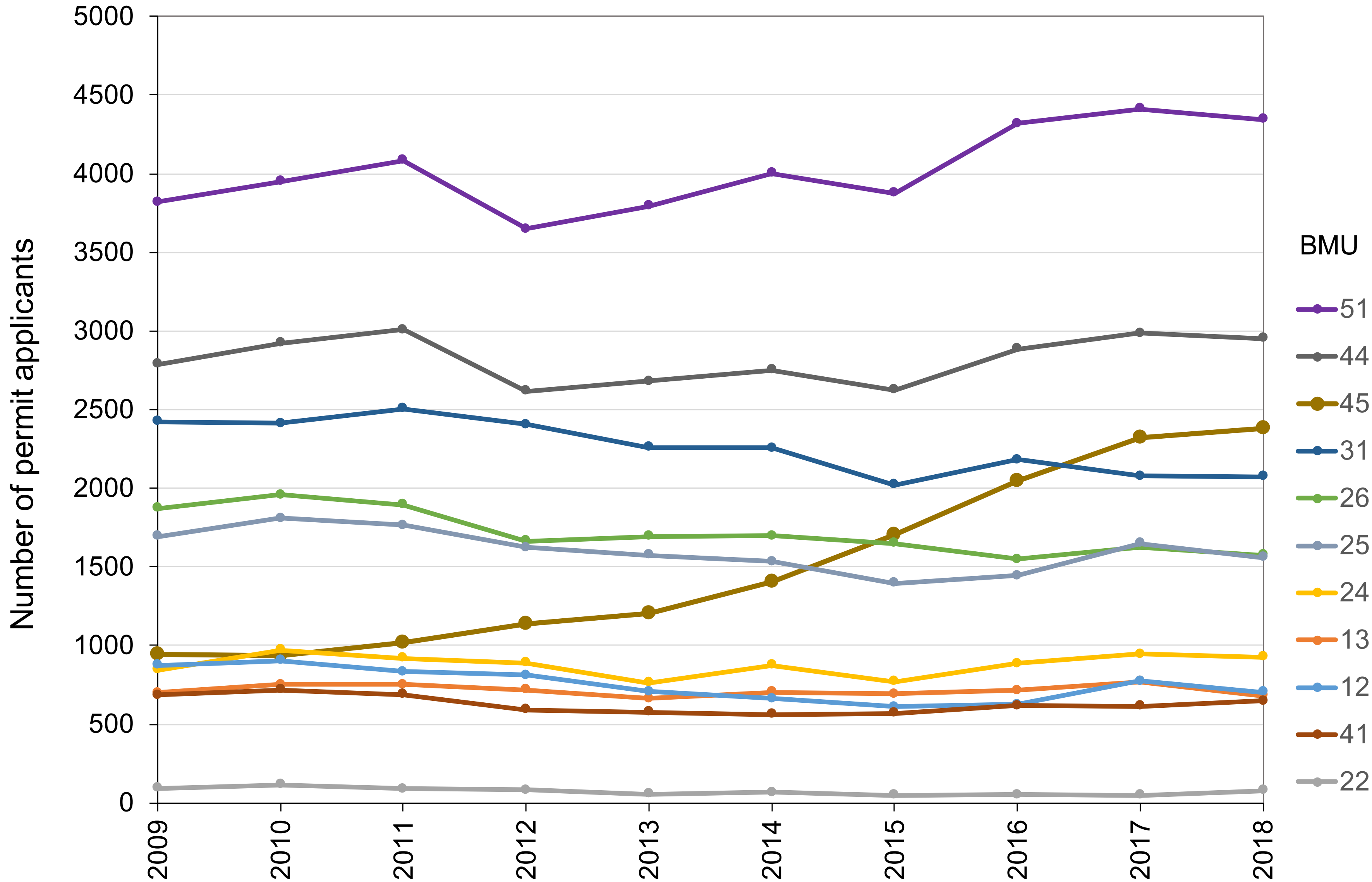


Figure 3. Trends in number of applicants for quota zone permits by BMU over past 10 years, 2009–2018. For 2016 - 2018, BMUs 27 and 28 were grouped into old BMU 26 and BMUs 46 and 47 were grouped into old BMU 44. BMU 45 is highlighted because applications there nearly tripled over this time period.

Table 4. Percent of quota BMU lottery applicants with preference levels 1 (1st-year applicants), 2, 3, and 4 who were drawn for a bear permit during 2013–2018. Blank spaces indicate 100% of applicants were drawn. All preference level 2 applicants were drawn, except where 0 preference level 1 applicants were drawn. Likewise, all preference level 3 applicants were drawn, except where 0 preference level 2 applicants were drawn[a].

	2013			2014			2015				2016				2017				2018				
BMU	Pref 1	Pref 2	Pref 3	Pref 1	Pref 2	Pref 3	Pref 1	Pref 2	Pref 3	Pref 4	Pref 1	Pref 2	Pref 3	Pref 4	Pref 1	Pref 2	Pref 3	Pref 4	Pref 1	Pref 2	Pref 3	Pref 4	Pref 5
12	0	46		0	40		0	17			0	0	98		0	0	57		0	0	41		
13	4			0	72		0	56			0	38			0	16			0	11			
22	89			72			100				98				100				60				
24	0	41		0	13		0	2			0	0	86		0	0	57		0	0	26		
25	0	81		0	57		0	44			0	42			0	6			0	0	80		
26[b]	0	7		0	0	80	0	0	51														
27											0	0	30		0	0	2		0	0	0	85	
28											0	0	0	99	0	0	0	76	0	0	0	46	
31	0	45		0	15		0	0	87		0	0	75		0	0	67		0	0	48		
41	0	43		0	19		0	0	99		0	0	77		0	0	56		0	0	27		
44[b]	0	0	68	0	0	41	0	0	18														
46											0	0	0	85	0	0	0	51	0	0	0	24	
47											0	0	10		0	0	0	49	0	0	0	26	
45	0	0	75	0	0	30	0	0	0	81	0	0	0	63	0	0	0	16	0	0	0	0	72
51	0	53		0	22		0	0	89		0	0	72		0	0	54		0	0	35		

[a] As an example, in 2017: BMU 12: 0% of preference level 1 and 2 applicants were drawn, 57% of preference level 3, and 100% of preference level 4 and above were drawn for a permit; BMU 22: all preference level 1 applicants were selected; BMU 45: no preference level 1–3 applicants were drawn, 16% of hunters with preference 4 were drawn, and 100% of hunters with preference level 5 and above were drawn.

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

Table 5. Minnesota bear harvest tally for 2018 by Bear Management Unit (BMU)[a] and sex[b] compared to harvests during 2013–2017 and record high and low harvests (since establishment of each BMU).

BMU	2018 M	(%M)	F	Total	2017	2016	2015	2014	2013	5-year mean	Record low harvest (yr)	Record high harvest (yr)
Quota												
12	42	(64)	24	66	54	78	60	38[d]	62	58	38 (14)	263 (01)
13	84	(71)	35	119	100	147	72[e]	91	95	101	71 (88)	258 (95)
22	3	(75)	1	4	8	5	7	5	9	7	3 (03)	41 (89)
24	37	(62)	23	60	81	96	97	50[f]	76	80	50 (14)	288 (95)
25	149	(67)	74	223	212	287	227	168[g]	197	218	149 (96)	584 (01)
26	[94]	[67]	[47]	[141]	[162]	[171]	121	117[h]	121	138	117 (14)	513 (95)
27	70	(70)	35	105	120	131						
28	24	(67)	12	36	42	40						
31	125	(59)	86	211	262	312	307	221	197	260	157 (88)	697 (01)
41	36	(62)	22	58	61	57	35[i]	36	40	46	35 (15)	201 (01)
44	[102]	[66]	[52]	[154]	[158]	[215]	158	170	181	176	130 (11)	643 (95)
46	93	(67)	46	139	141	190						
47	9	(60)	6	15	17	25						
45	33	(64)	18	51	77	102[m]	55	54	48	67	32 (11)	178 (01)
51	131	(71)[q]	54	185[d]	372	463	302	291	349	355	247 (91)	895 (01)
Total	836	(66)	436	1272	1547	1933	1441	1241[j]	1375	1507	1192 (88)	4288 (01)
No-Quota[b]												
11	193	(67)	94	287	179	291	195	77[k]	136	176	38 (87)	351 (05)
10	16	(76)	5	21[n]	18	15	11	8	9	12		18 (17)
52	127	(68)	59	186[p]	295	402	324	301	346	334	105 (02)	405 (12)
60	0		0	0	1	0	0	0	0			
Total	336	(68)	158	494	493	708[n]	530	386	491	522	198 (87)	708 (16)
State	1172	(66)[q]	594	**1766**	2040	2641	1971	1627[j]	1866	2029		4956 (95)

[a] Some tooth envelopes were received from hunters who did not register their bear. These were added to the harvest tally:

2013:6; 2014:3; 2015:6; 2016:7; 2017:4; 2018:2

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

2013:11; 2014:4; 2015:12; 2016:9; 2017:2; 2018:4*

*None were authorized NQ license-holders hunting in quota zone.

Some quota area hunters also apparently hunted in the wrong BMU, based on the block where they said they killed a bear, but these were recorded in the BMU where they were assigned (presuming most were misreported kill locations).

[b] Sex recorded on tooth envelopes may differ from the registered sex. Sex shown on table is the registered sex.

[c] BMU 60 designates SE Minnesota, which is within No-quota zone. The only hunter-harvested bear in this area was in 2017..

Notable harvests:

[d] Record low harvest since this area was established in 1987.
[e] Lowest harvest since 1988.
[f] Record low harvest since this area was established in 1989.
[g] Lowest harvest since 1996.
[h] Record low harvest since this area was established in 1991.
[i] Record low harvest since this area was established in 1990.
[j] Lowest harvest since 1988 (quota—no-quota split in 1987).
[k] Lowest harvest since 1999.
[m] Highest harvest since 2007.
[n] Record high harvest.
[p] Record high % males.
[q] Record high % males (or tie for record).

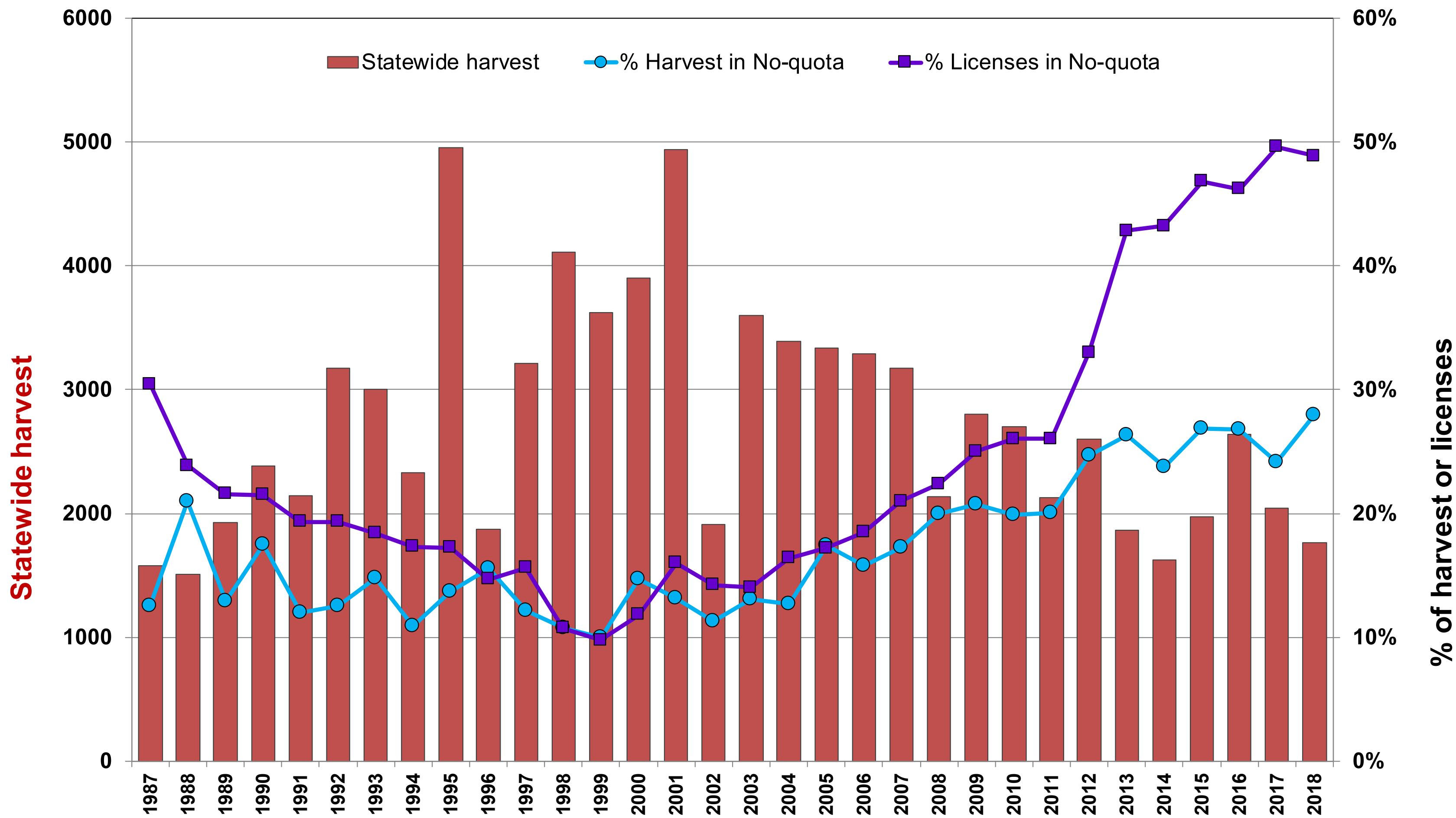


Figure 4. Trends in statewide bear harvest and proportions of harvest and licenses in the no-quota zones, 1987–2018.

Table 6. Bear hunting success (%) by BMU, measured as the registered harvest divided by the number of licenses sold [a], 2013–2018

BMU	Max success (yr) prior to 2018		Mean success 2013–2017	2018	2017	2016	2015	2014	2013
12	52	(16)	37	53[b]	43	52[c]	40	19[e]	30
13	59	(95,16)	41	53[c]	45	59[b]	29	36	38
22	21	(92)	13	8	16	10	13	10	18[c]
24	48	(15,16)	41	34	46[c]	48[b]	48[b]	25	38
25	57	(16)	46	56[c]	53	57[b]	45	34	39
26	59	(95)	42	49	57[c]	52	34	33	34
27				47	53	52			
28				60	70[d]	53			
31	56	(15,16)	48	42	52	56[b]	56[b]	40	36
141	50	(95)	34	46	49[c]	46	23	24	26
44	48	(16)	40	39	41	48[b]	35	38	40
46				39	40	47			
47				38	43	50			
45	44	(17)	37	29	44[b]	40[c]	36	36	32
51	46	(16)	38	21	41[c]	46[b]	33	32	39
Quota	50	(16)	41	38	46[C]	50[B]	39	33	37
11[f]			18	25	17	28	20	9	15
10[f]			9	9	8	9	7	7	12
52[f]			17	10	14	19	15	16	19
No Quota	32	(95)	18	15	15	21	16	13	17
Statewide	40	(95)	29	27	31	37[C]	28	25	28

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

b Record high (or tied record high) success.

c Second highest success.

d Highest success ever for any BMU.

e Tied record lowest success.

f Since 2013, an attempt was made to differentiate the number of no-quota (NQ) hunters by BMU in order to estimate success rates. When no-quota hunters bought licenses, they recorded the deer block where they anticipated hunting. A significant number chose blocks in the quota zone; those who did not harvest a bear in the quota zone were divided up into NQ-BMUs in proportion to those who chose blocks in or adjacent to NQ-BMUs. A few chose BMU 60 (SE Minnesota); the first bear was harvested there in 2017.

Table shows % indicating where they planned to hunt (number of hunters in parentheses for BMU 60 and Quota zone):

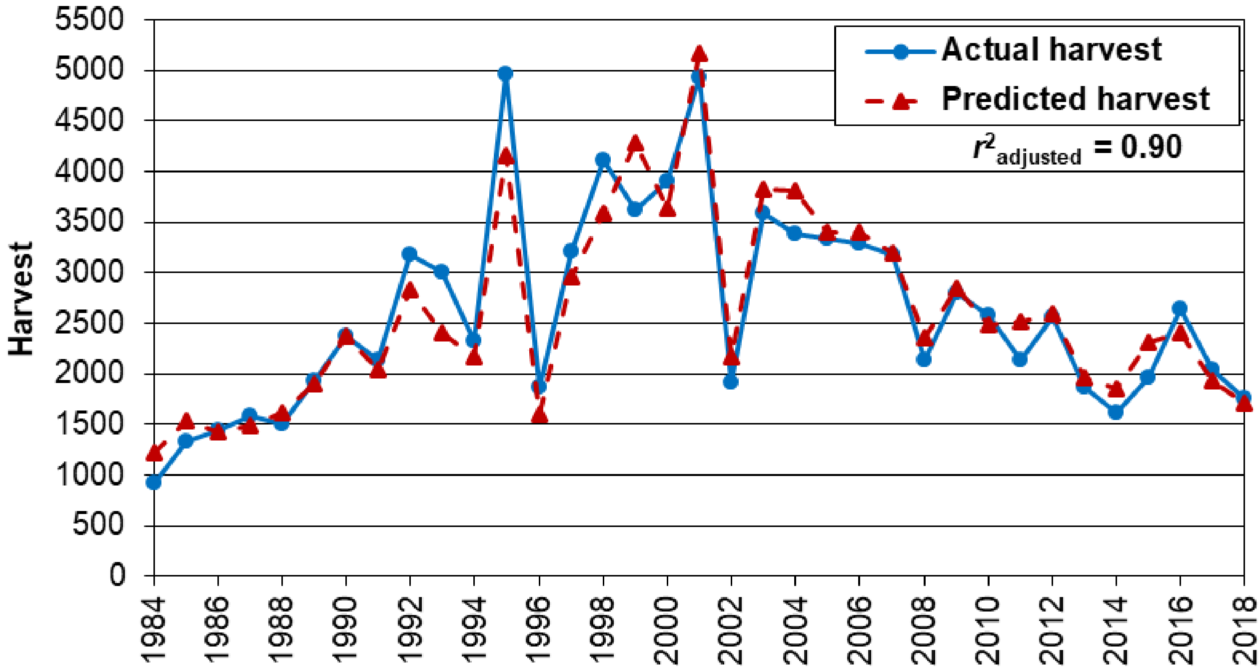
BMU	2018		2017		2016		2015		2014		2013	
11	34.6		29.8		30.3		29.3		28.5		30.0	
10	7.4		6.6		4.9		4.4		4.1		2.6	
52	55.3		59.2		61.2		63.9		64.7		62.6	
60 (n)	0.1	(4)	0.1	(4)	0.4	(12)	0.2	(8)	0.6	(17)	0.4	(10)
Quota zone (n)	2.6	(83)	4.2	(137)	3.2	(105)	3.1	(101)	2.1	(60)	4.5	(127)

Table 7. Cumulative bear harvest (% of total harvest) by date, 1997–2018.

Year	Day of week for opener	Aug 22/23 – Aug 31	Sep 1 – Sep 7	Sep 1 – Sep 14	Sep 1 – Sep 30
1997	Mon		76	88	97
1998	Tue		76	87	96
1999	Wed		69	81	95
2000	Wed	57	72	82	96
2001	Wed	67	82	88	98
2002	Sun		57[a]	69[a]	90
2003	Mon		72	84	96
2004	Wed		68	82	95
2005	Thu		72	81	94
2006	Fri		69	83	96
2007	Sat		69	82	96
2008	Mon		58[a]	71[a]	92
2009	Tue		74	86	96
2010	Wed		69	84	96
2011	Thu		65	78	93
2012	Sat		68	83	96
2013	Sun		61	76	94
2014	Mon		60	75	92
2015	Tue		58[b]	75	91
2016	Thu		68	83	95
2017	Fri		69	83	93
2018	Sat		59[a]	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.



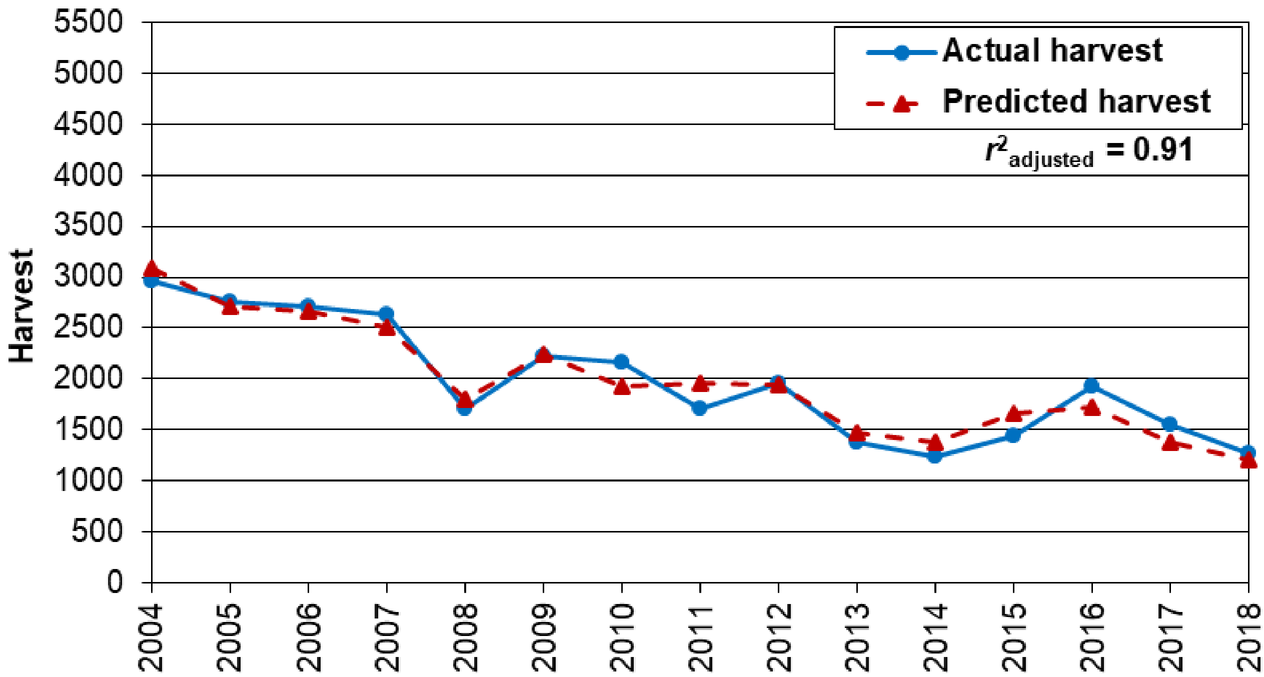
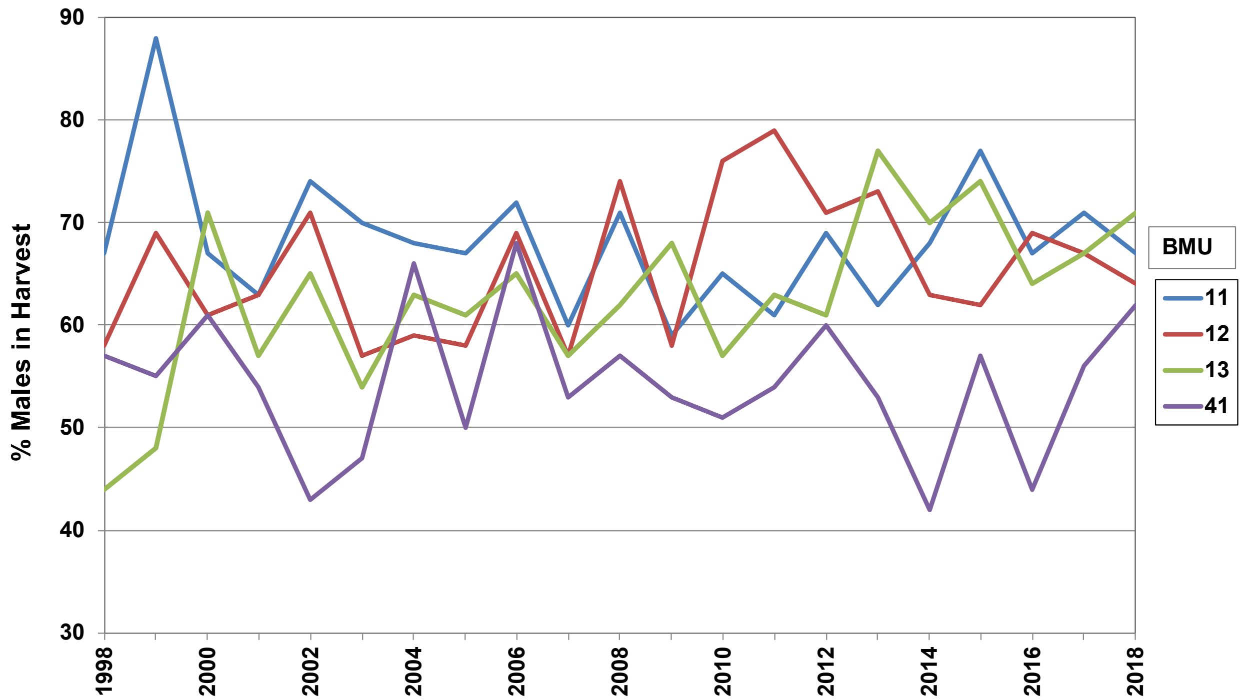


Figure 5. Number of bears harvested vs. number predicted to be harvested based on number of hunters and fall food production — top panel: statewide 1984–2018; bottom panel: quota zone only, most recent 15 years. Regression for the full dataset included an interaction term between food and hunters to better predict the drastic changes in harvest when fall foods were extremely high or low.



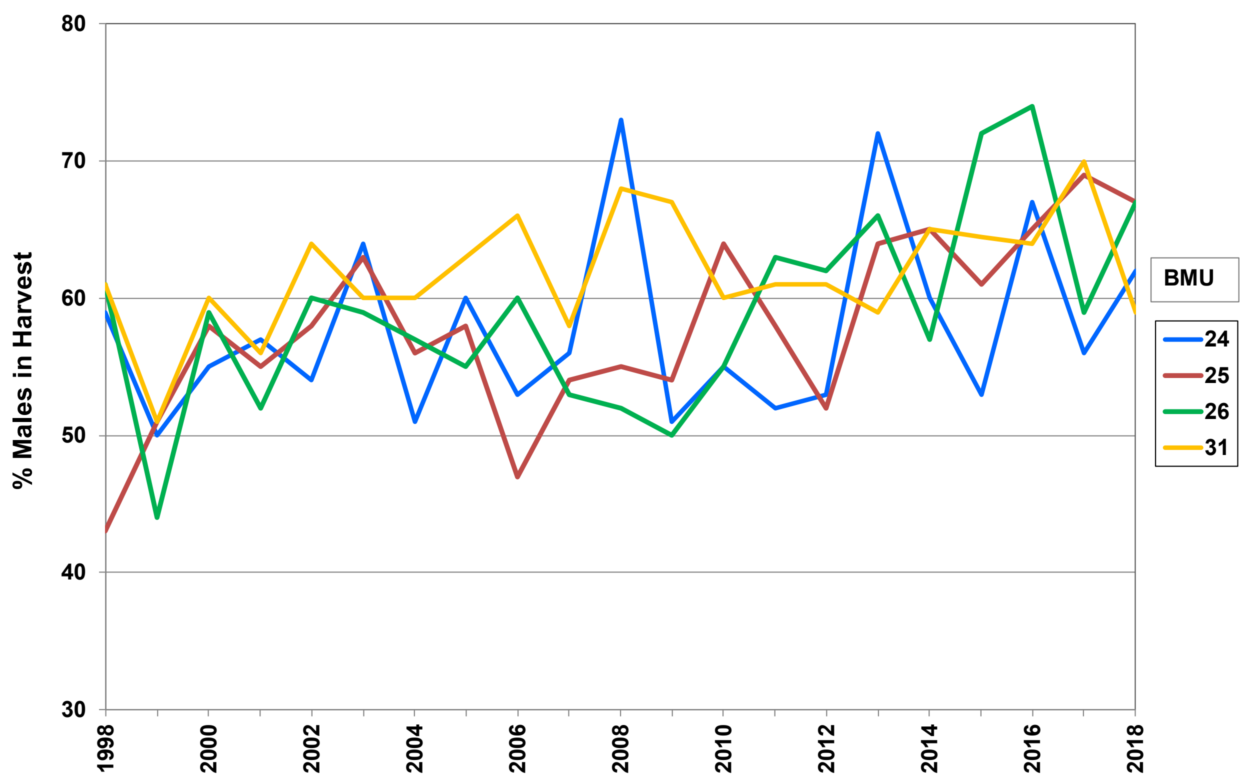


Figure 6. Sex ratios of harvested bears by BMU, 1998–2018. Thick lines show increasing trend across this period.

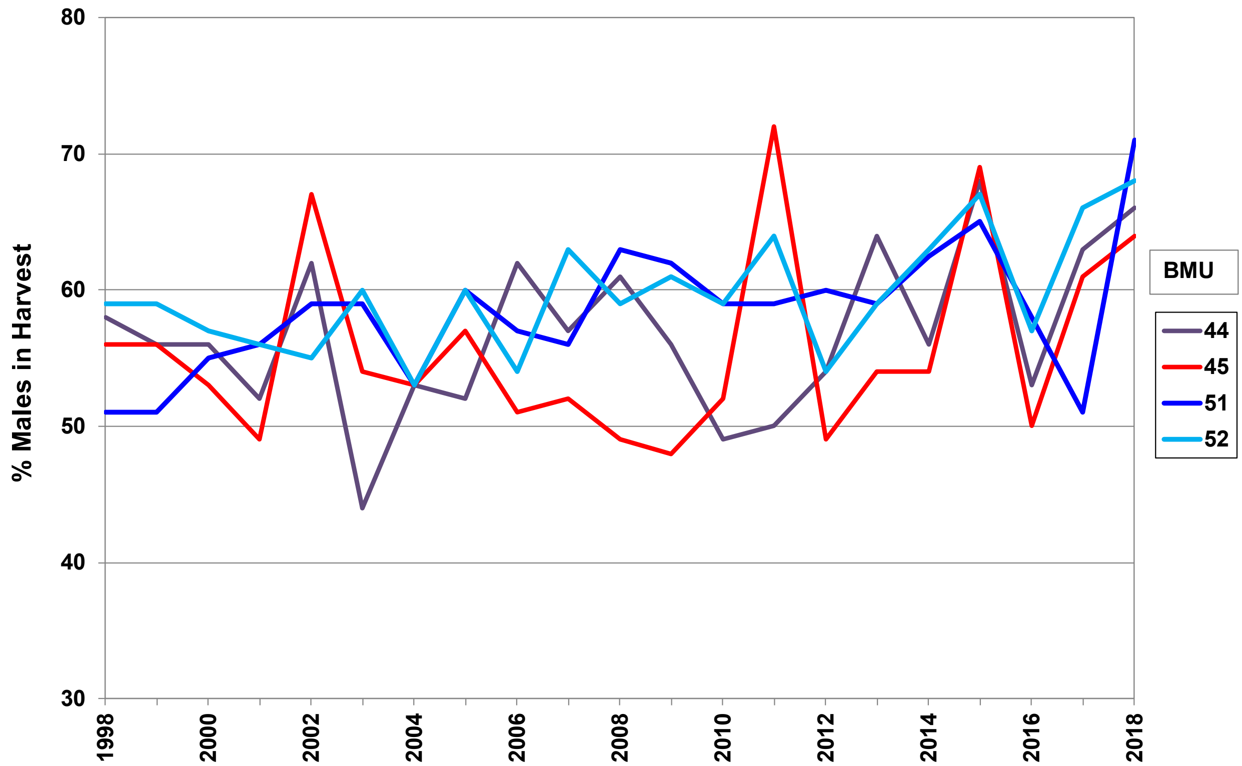


Figure 6 (continued)

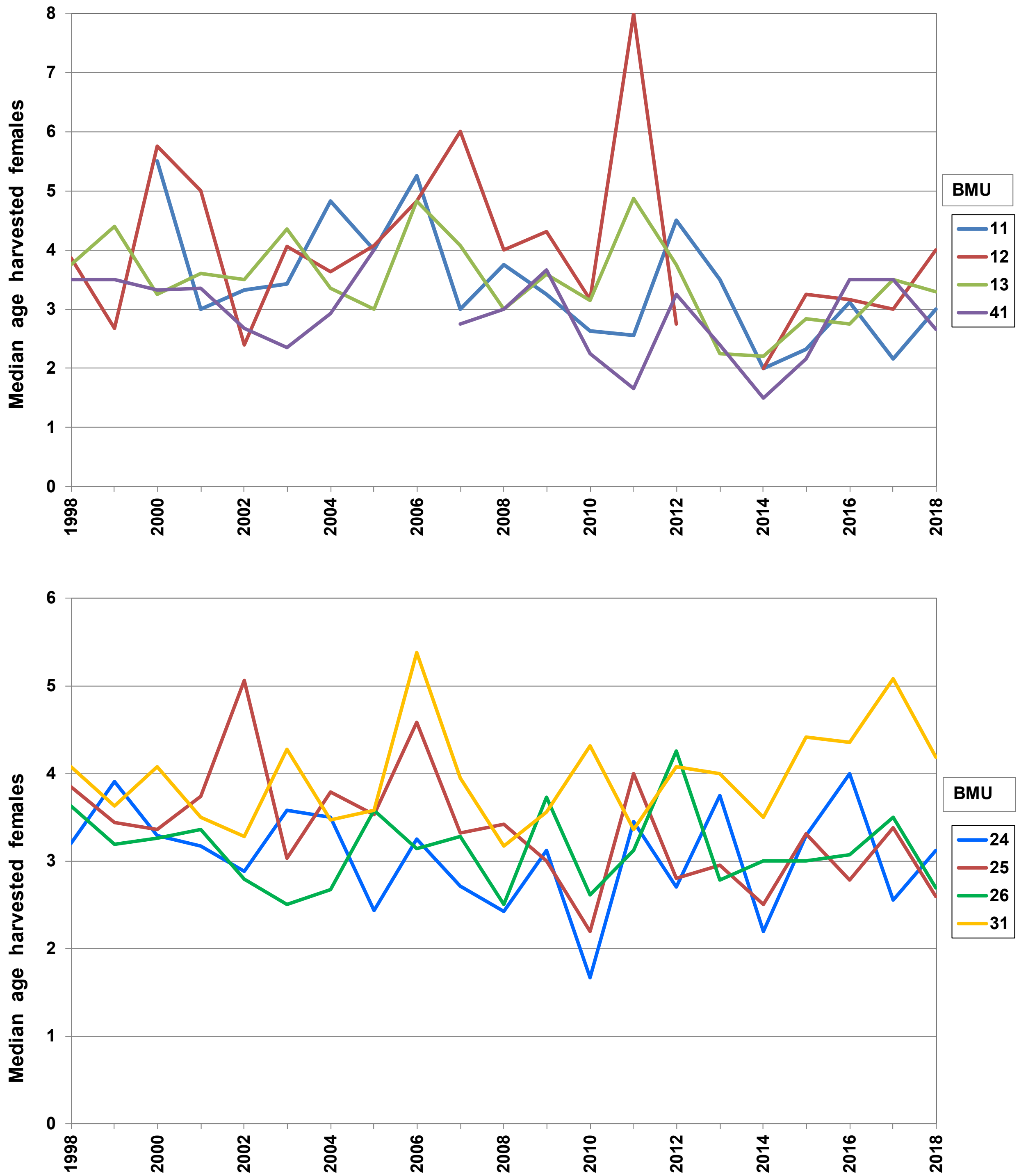


Figure 7. Median ages of harvested female bears by BMU, 1998–2018.

Thick lines show decreasing trends continuing through 2017. Breaks in line occur when sample sizes were too small to calculate a meaningful median.

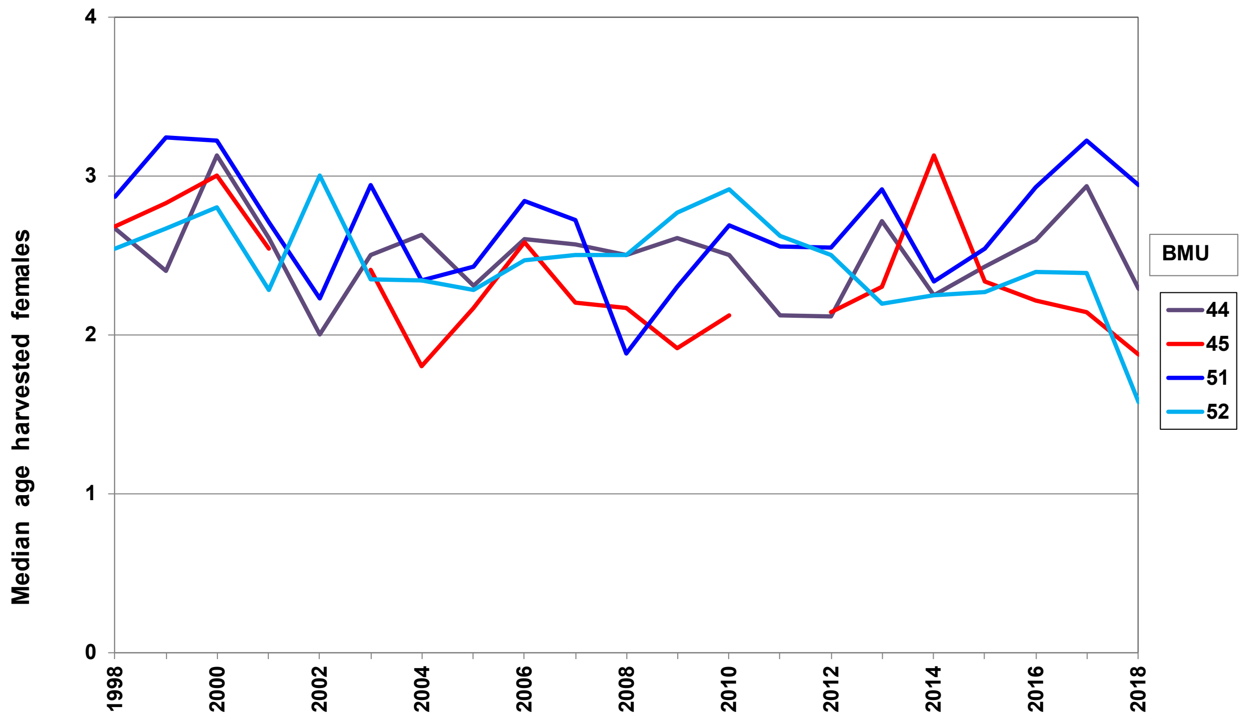


Figure 7. (continued)

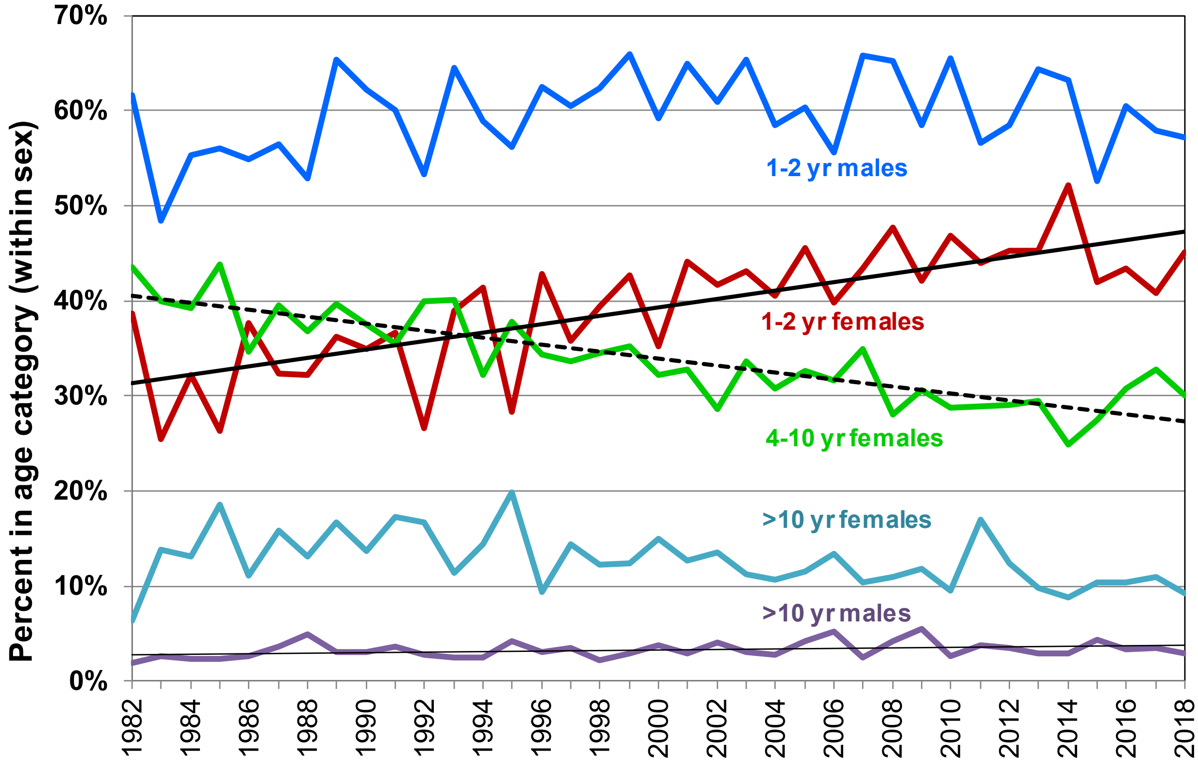


Figure 8. Statewide harvest structure: proportion of each sex in age category, 1982–2018. Trend lines are significant, but the last few years show a different trend.

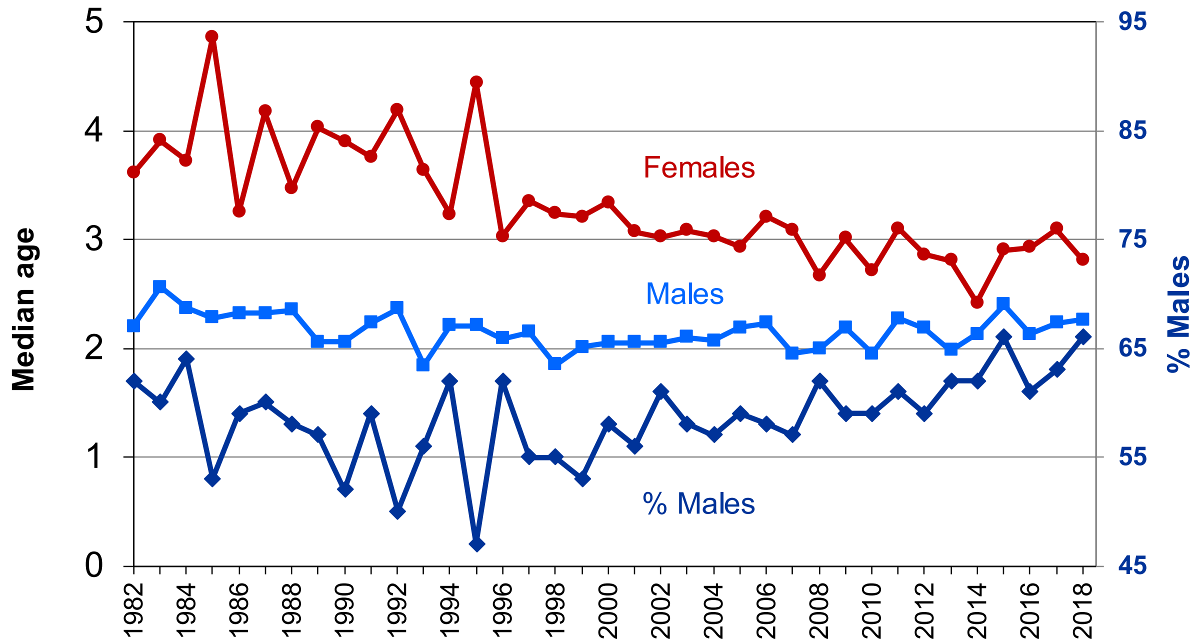


Figure 9. Statewide median ages (years) and sex ratio of harvested bears, 1982–2018.

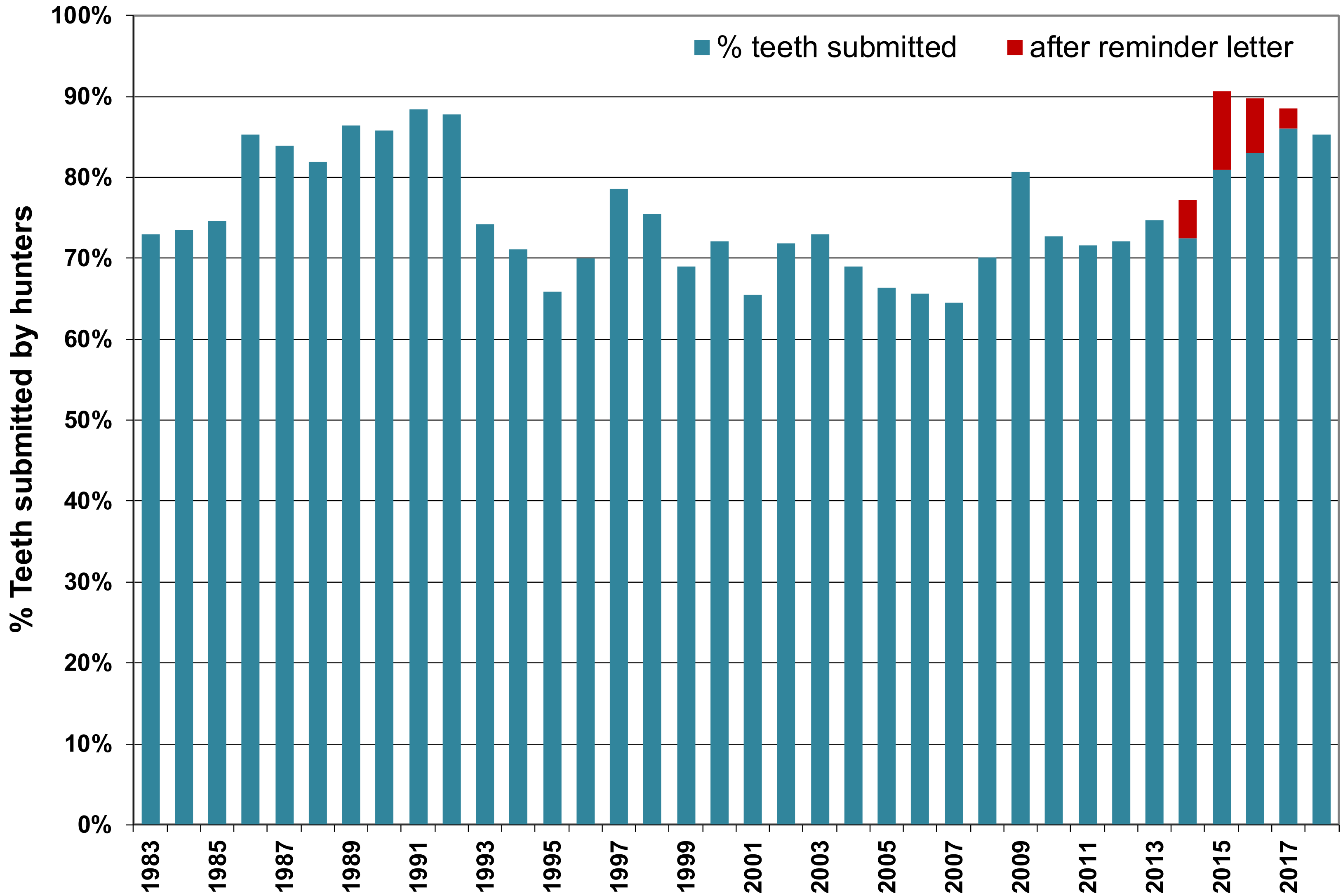
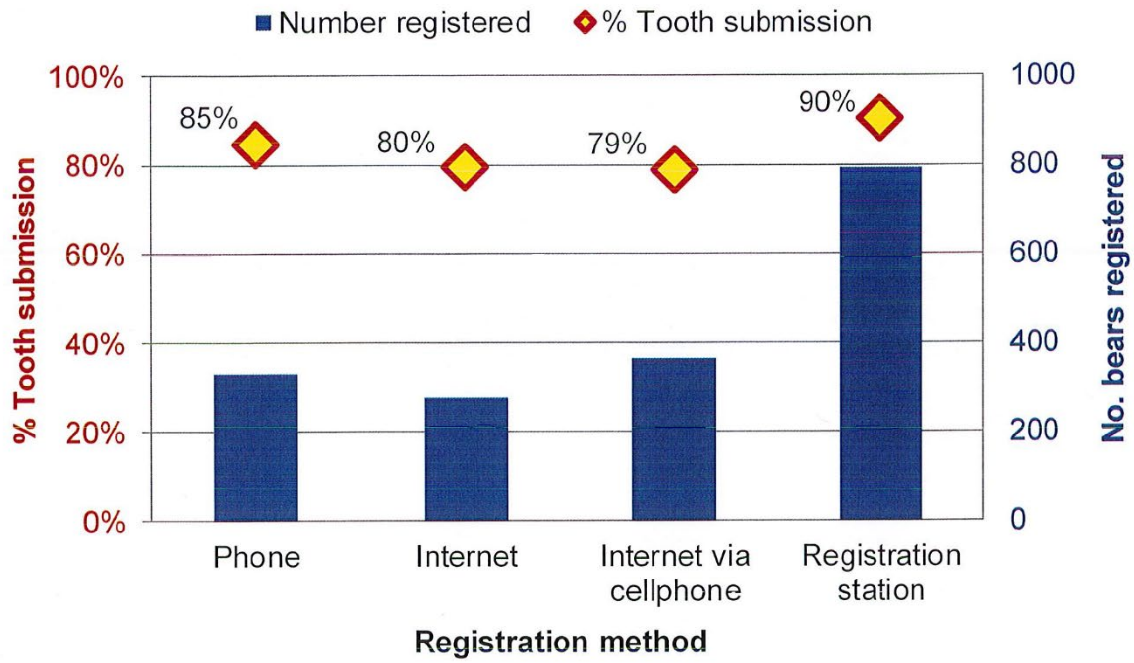


Figure 10. Percent of hunters submitting useable bear teeth for aging (vital for population monitoring, see Figs. 14–16). Cooperation levels exceeded 80% when registration stations were paid to extract teeth (this practice ended in 1993), and in recent years after a series of reminder letters (no letter was sent in 2018).



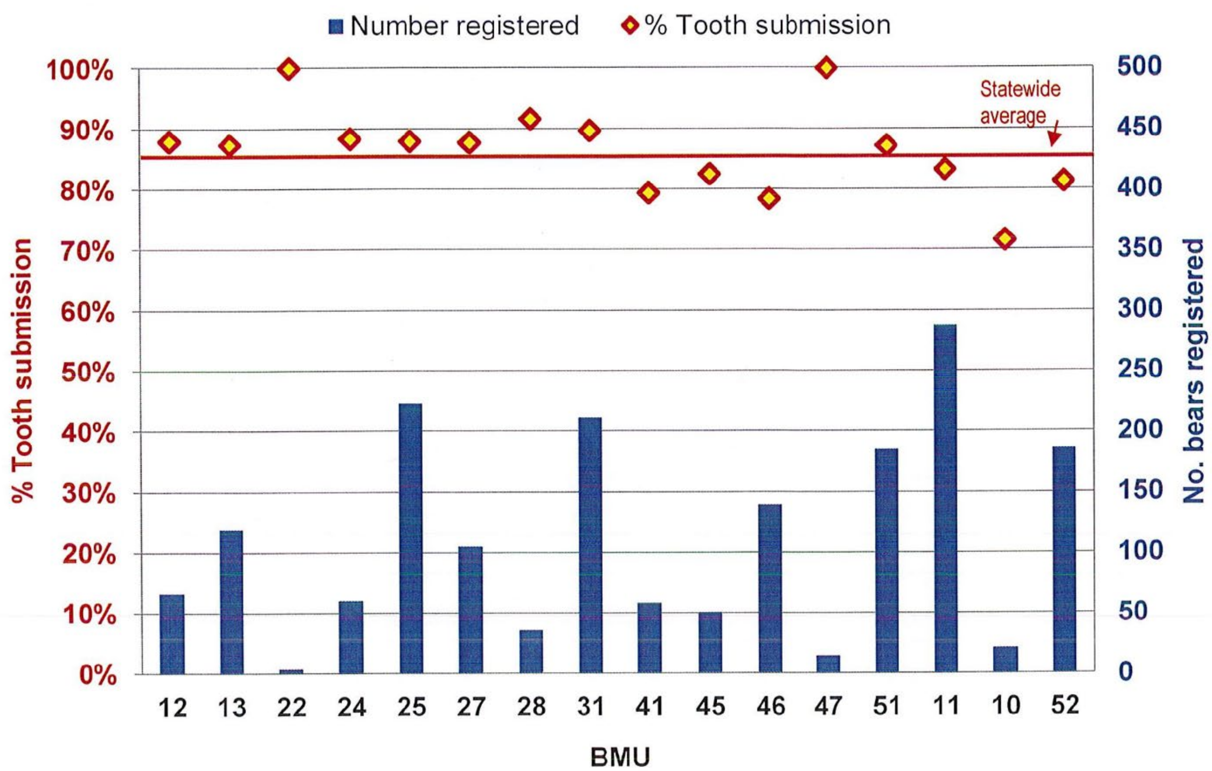


Figure 11. Percent of hunters who submitted a bear tooth in 2018 by method of registration (top panel) and by BMU (bottom panel). Beginning in 2013, hunters could register their bear by phone or internet, as well as in person at a station.

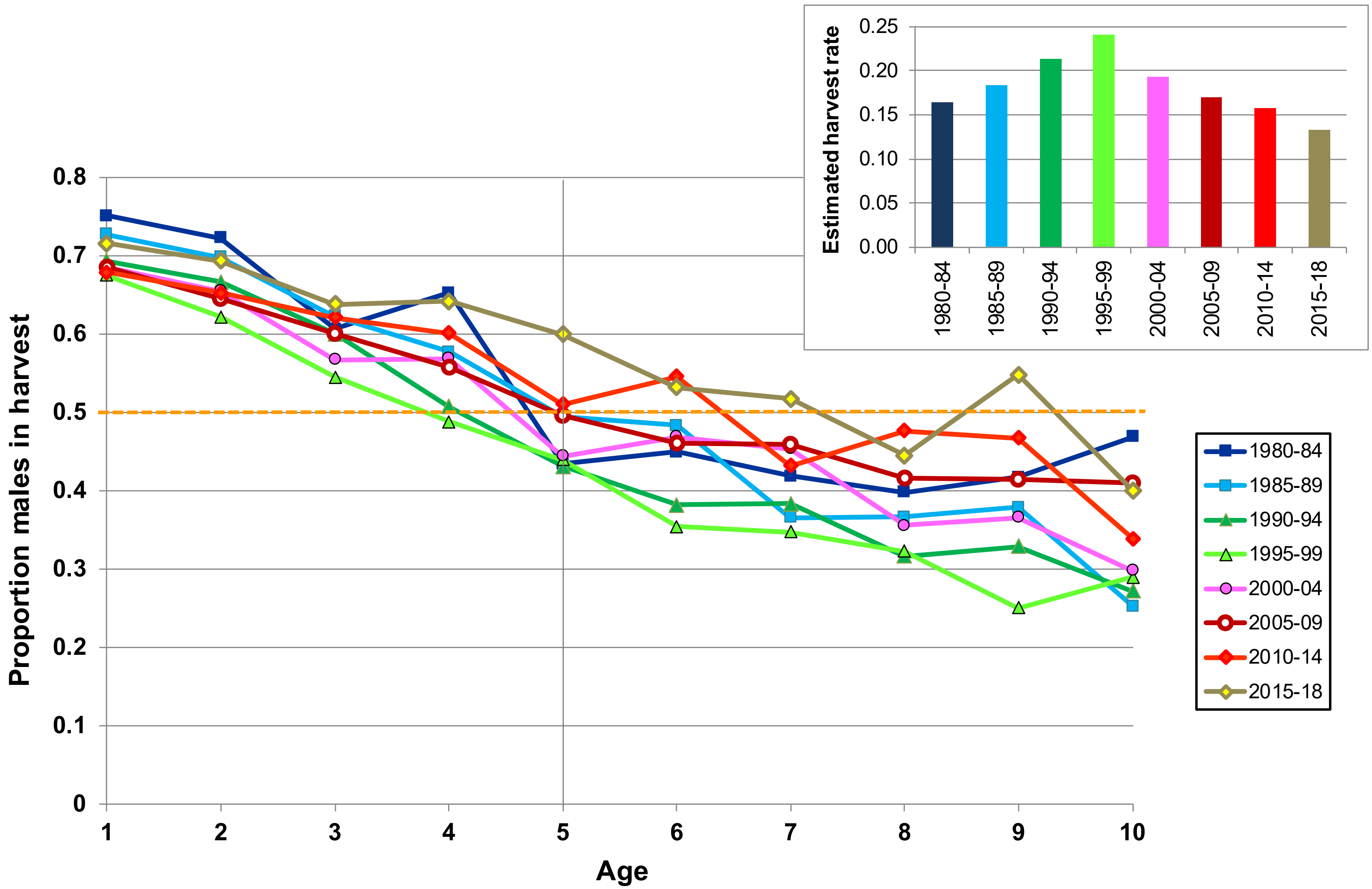


Figure 12. Trends in proportion of male bears in statewide harvest at each age, 1–10 years, grouped in 5-year time blocks, 1980–2018 (last interval is 4 years). Higher harvest rates result in steeper curves because males are reduced faster than females. Fitting a line to the data for each time block and predicting the age at which 50% of the harvest is male (dashed tan line) yields approximately the inverse of the harvest rate (derived rates are shown in inset). Flatter curves in recent years indicate lower harvest rates.

2018 MINNESOTA DEER HARVEST REPORT

Barbara Keller, Big Game Program Leader, Division of Fish and Wildlife

INTRODUCTION

The white-tailed deer may be considered Minnesota's most popular wildlife species. In 2018, nearly 500,000 hunters participated in the season. 2018 was a generally liberal season designed to stabilize or reduce deer population growth across much of the central and southern portions of the state after they had mostly recovered from consecutive severe winters. Management of deer populations in the northcentral and northeastern regions remained conservative. During the archery, firearms and muzzleloader seasons, hunters registered 188,706 deer.

METHODS

Every deer taken by hunting in Minnesota must be registered. Deer may be registered at any of the 825 to nearly 900 "Big Game Registration" stations available throughout the state. Beginning in 2011, deer could also be registered using the internet and telephone. 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 the time of registration includes date of kill, deer permit area, and season. In 2016, carcass import restrictions were instituted to help prevent the spread of Chronic Wasting Disease (CWD). CWD was detected in three deer in Fillmore County during routine surveillance efforts. This prompted additional late season deer harvest for sample collection in southeast Minnesota around that area. Additionally, deer farms in Meeker and Crow Wing counties tested positive for CWD in the spring of 2017. For 2018 mandatory testing of all deer > 1 year old was instituted for the opening weekend of firearms season in three areas of the state and for the entire hunting season in the newly created CWD disease management zone 603.

RESULTS

Outcomes of the 2018 deer harvest are presented in the following tables.

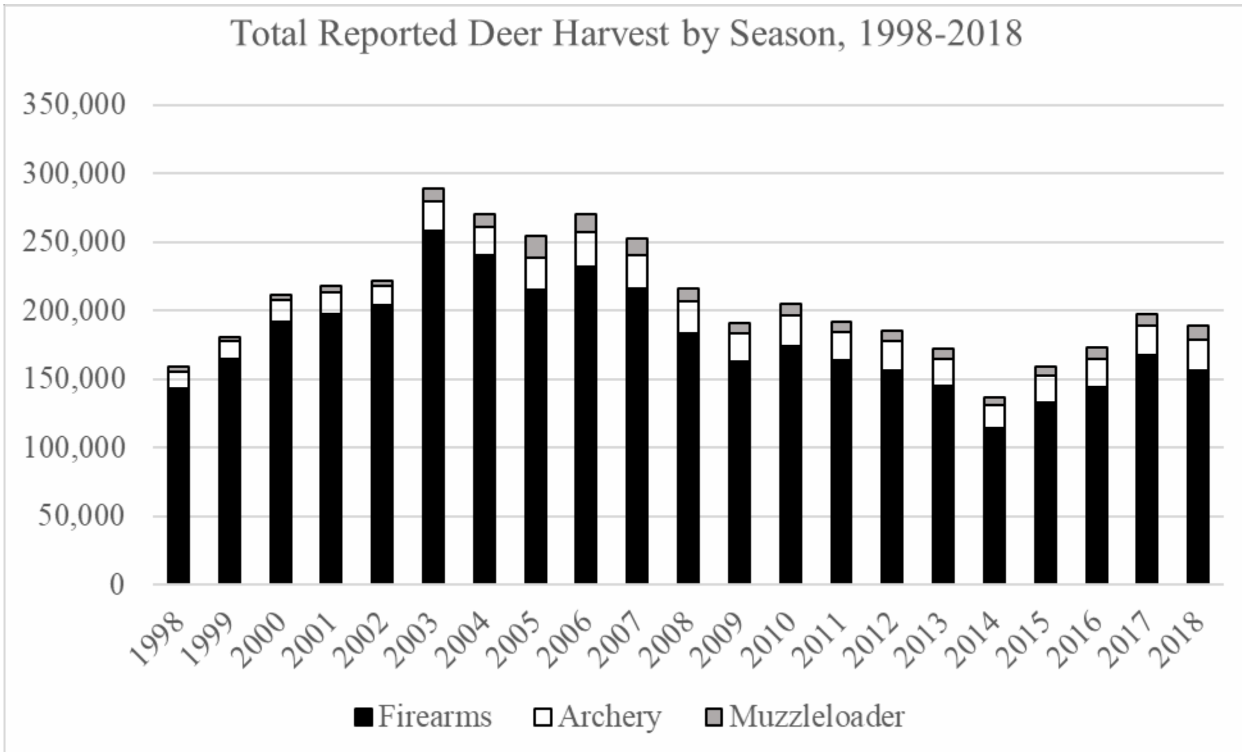
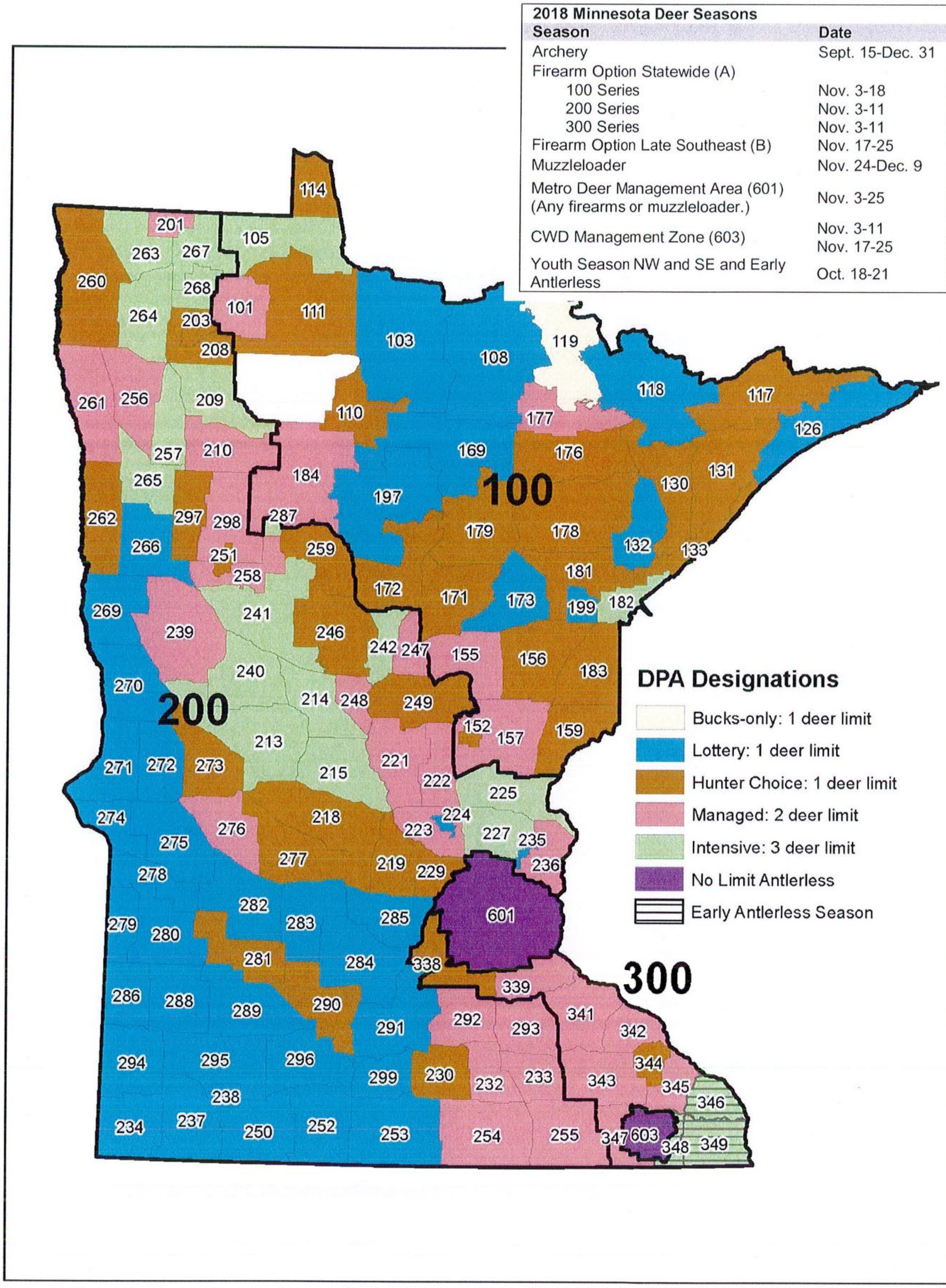


Figure 1. Total deer harvest by season, 1998-2018.



2018 Minnesota Deer Seasons

Season	Date
Archery	Sept. 15-Dec. 31
Firearm Option Statewide (A)	
100 Series	Nov. 3-18
200 Series	Nov. 3-11
300 Series	Nov. 3-11
Firearm Option Late Southeast (B)	Nov. 17-25
Muzzleloader	Nov. 24-Dec. 9
Metro Deer Management Area (601) (Any firearms or muzzleloader.)	Nov. 3-25
CWD Management Zone (603)	Nov. 3-11 Nov. 17-25
Youth Season NW and SE and Early Antlerless	Oct. 18-21

Figure 2. 2018 Deer Permit Areas, Seasons and Deer Management Designations.

Table 1. Statewide Firearms, Archery, and Muzzleloader Harvest, License Sales, and Success Rates, 2007-2018.

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
REGULAR FIREARMS												
Resident License Sales	285,286	376,006	377,077	379,866	382,668	391,822	391,967	374,314	371,612	372,645	368,407	360,873
Non-Resident License Sales	12,520	11,883	11,759	11,908	11,955	12,483	12,496	11,674	13,501	12,540	12,923	12,928
Bonus Permit Sales	145,522	190,156	140,920	143,763	142,049	89,750	97,402	29,642	31,065	44,365	93,309	117,640
Multi-Zone Buck License Sales	15,051	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Youth License Sales	49,242	50,397	56,678	59,726	60,943	62,949	64,748	62,488	62,333	61,138	58,779	56,989
All Season Deer License Sales	76,385	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	584,006	628,442	586,434	595,263	597,615	557,004	566,613	478,118	478,511	490,688	533,418	548,430
Registered Buck Harvest[1]	97,528	85,646	83,820	88,027	76,003	84,729	70,627	69,851	83,939	87,855	88,467	81,772
Antlerless Permits Offered	18,830	32,325	60,100	60,083	15,525	32,854	36,816	26,332	31,065	39,646	20,540	14,023
Antlerless Permits Issued	18,830	32,325	60,100	60,083	15,525	32,854	36,816	26,332	31,065	39,646	20,385	13,971
Antlerless Permits App.	31,403	31,403	90,882	86,783	21,071	67,308	68,811	96,580	95,656	97,056	45,001	29,302
Registered AL Harvest[1]	118,860	98,147	78,525	86,077	88,197	71,140	67,885	44,038	48,758	52,338	79,033	74,203
Registered Total Harvest[1]	216,388	183,793	162,345	174,104	164,200	155,869	145,449	113,889	132,697	144,470	167,500	155,975
Registered % Successful[2]	41.7	34.8	33.8	35.9	32.9	32.0	29.7	25.3	28.9	31.2	33.7	31.7
ARCHERY												
Resident License Sales	52,780	87,872	88,707	91,156	90,252	95,259	92,717	92,301	93,462	92,076	91,875	89,292
Non-Resident License Sales	1,509	1,509	1,610	1,638	1,718	1,814	1,952	1,946	2,032	2,062	2,016	2,020
Youth Archery Sales	7,663	9,005	9,157	9,577	10,306	11,276	12,212	11,965	11,905	10,846	9,961	9,052
Total License Sales	61,952	99,033	99,474	102,371	102,276	108,349	106,881	106,212	107,399	104,984	103,852	100,364
Total Archery Harvest	24,161	22,632	20,629	22,057	20,444	21,605	19,388	17,119	20,074	20,360	21,058	22,665
Registered % Successful[2]	24.3	18.5	17.5	17.8	17.0	18.8	14.5	15.3	16.5	18.5	18.7	20.3
MUZZLELOADER												
Total Muzzleloader License Sales	9,867	64,673	63,282	55,640	59,384	58,363	51,092	43,946	50,176	53,097	51,961	48,589
Estimated All-Season Hunters	26,813	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Muzzleloader Harvest	12,138	9,572	7,929	9,023	7,416	7,779	7,045	5,847	6,572	8,383	9,210	10,066
Registered % Successful[2]	28.2	13.4	11.3	14.4	11.6	12.4	12.7	12.7	12.0	15.2	16.6	18.7
Antlerless Permits Offered				5,792	1,997	1,626	2,144	1,593	1,434	1,352	935	874
Antlerless Permits App.				7,260	2,615	3,743	3,544	4,588	3,393	2,930	1,902	1,592
TOTAL Registered Harvest	**260,434**	**221,837**	**194,186**	**207,313**	**192,331**	**186,634**	**172,781**	**139,442**	**159,343**	**173,213**	**197,768**	**188,706**

[1] Does not include free landowner licenses

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

Table 2. Deer Harvest by Season, 2018.

Season	Total Hunters	Buck Harvest	Antlerless Harvest	Total Harvest	Successful Hunters[2]	Overall Success
Archery	96,936	9,009	13,656	22,665	19,661	20.3%
100 Series A	157,401	28,185	22,018	50,203	48,077	30.5%
200 Series A	230,562	45,962	41,847	7,809	79,289	34.4%
300 Series A[1]	23,422	4,594	4,319	8,913	7,907	33.8%
300 Series B[1]	10,033	1,221	3,189	4,410	3,746	37.3%
Metro Firearms (601)	2,473	591	437	1,028	914	37.0%
Muzzleloader	47,472	3,784	6,033	9,817	9,038	19.0%
Youth	N/A	764	577	1,341	1,331	N/A
Early Antlerless	2,258	0	737	737	601	26.6%
Special Firearms Hunts[3]	3,958	303	745	1,048	880	22.2%
Late CWD[4]	N/A	181	554	735	N/A	N/A
Total	**474,908**	**94,594**	**94,112**	**188,706**	**166,462**	**35.1%**

[1]Includes deer harvested in area 603

[2]Number of individuals who harvested at least one deer

[3]Includes deer harvested from both special firearm and special muzzleloader hunt

[4]Harvest was underreported for the late CWD season, based on samples collected a least 1,003 deer were harvested.

Table 3. Firearms Deer Harvest by Sex and Age Class, 2018.

Includes regular, youth, and antlerless, but no special hunts.

Permit Area	Land Area (Sq. Mile)	Firearms Hunters	Hunters/ Sq. Mile	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest	Bucks/ Sq. Mile	Antlerless/ Sq. Mile	Total/ Sq. Mile
101	496	1,892	3.8	424	38	239	47	748	0.86	0.65	1.51
103	1,820	2,963	1.6	716	27	236	17	996	0.39	0.15	0.55
105	740	4,234	5.7	991	145	856	129	2,121	1.34	1.53	2.87
108	1,651	4,272	2.6	909	18	144	14	1,085	0.55	0.11	0.66
110	529	3,758	7.1	855	86	472	72	1,485	1.62	1.19	2.81
111	1,438	2,063	1.4	409	29	141	13	592	0.28	0.13	0.41
114	116	112	1.0	22	1	9	0	32	0.19	0.09	0.28
117	927	140	0.2	15	2	6	0	23	0.02	0.01	0.02
118	1,220	2,976	2.4	675	12	99	10	796	0.55	0.10	0.65
119	770	2,050	2.7	447	1	9	0	457	0.58	0.01	0.59
126	942	1,492	1.6	248	5	39	0	292	0.26	0.05	0.31
130	746	1,944	2.6	259	17	130	14	420	0.35	0.22	0.56
131	899	1,019	1.1	82	6	39	6	133	0.09	0.06	0.15
132	482	2,196	4.6	297	10	71	12	390	0.62	0.19	0.81
133	352	2,108	6.0	366	25	174	19	584	1.04	0.62	1.66
152	61	598	9.8	69	15	26	8	118	1.13	0.80	1.93
155	593	6,910	11.7	1,112	244	1,046	202	2,604	1.87	2.52	4.39
156	825	8,393	10.2	1,316	148	833	108	2,405	1.60	1.32	2.92
157	888	12,856	14.5	2,350	419	1,546	280	4,595	2.65	2.53	5.18
159	571	6,386	11.2	1,121	141	638	95	1,995	1.96	1.53	3.49
169	1,124	8,032	7.1	1,475	57	382	38	1,952	1.31	0.42	1.74
171	701	6,048	8.6	872	118	588	89	1,667	1.24	1.13	2.38
172	687	9,808	14.3	1,490	295	1,196	198	3,179	2.17	2.46	4.63
173	584	4,507	7.7	620	67	357	44	1,088	1.06	0.80	1.86
176	921	5,659	6.1	1,021	69	571	48	1,709	1.11	0.75	1.86
177	480	3,971	8.3	739	92	566	62	1,459	1.54	1.50	3.04
178	1,195	8,691	7.3	1,497	117	1,046	117	2,777	1.25	1.07	2.32
179	862	8,769	10.2	1,531	239	1,036	153	2,959	1.78	1.66	3.43
181	629	5,240	8.3	1,002	89	518	60	1,669	1.59	1.06	2.65
182	278	2,292	8.2	390	66	251	46	753	1.40	1.31	2.71
183	663	7,052	10.6	1,136	144	876	115	2,271	1.71	1.71	3.42
184	1,229	13,465	11.0	2,714	474	2,056	391	5,635	2.21	2.38	4.59
197	955	5,000	5.2	1,037	41	206	25	1,309	1.09	0.28	1.37
199	153	467	3.1	109	7	27	1	144	0.71	0.23	0.94
201	161	480	3.0	129	16	79	6	230	0.80	0.63	1.43
203	118	240	2.0	68	5	22	3	98	0.58	0.25	0.83

Permit Area	Land Area (Sq. Mile)	Firearms Hunters	Hunters/ Sq. Mile	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest	Bucks/ Sq. Mile	Antlerless/ Sq. Mile	Total/ Sq. Mile
208	379	1,031	2.7	256	22	110	11	399	0.68	0.38	1.05
209	640	2,562	4.0	579	90	393	83	1,454	0.91	0.89	1.79
210	615	3,874	6.3	827	137	535	100	1,599	1.34	1.25	2.60
213	1,057	10,030	9.5	2317	563	1514	432	4,826	2.19	2.37	4.57
214	554	7,099	12.8	1698	461	1297	379	3,835	3.06	3.86	6.92
215	701	7,006	10.0	1466	384	921	301	3,072	2.09	2.29	4.38
218	884	5,540	6.3	1034	150	518	132	1,834	1.17	0.91	2.07
219	391	3,270	8.4	592	83	274	79	1,028	1.51	1.11	2.63
221	642	5,750	9.0	1387	317	876	237	2,817	2.16	2.23	4.39
222	413	4,976	12.0	982	200	623	151	1,956	2.38	2.36	4.73
223	376	3,272	8.7	638	106	396	88	1,228	1.70	1.57	3.27
224	47	595	12.6	101	11	45	9	166	2.14	1.37	3.51
225	618	7,142	11.6	1612	300	910	218	3,040	2.61	2.31	4.92
227	472	4,709	10.0	989	182	528	144	1,843	2.10	1.81	3.91
229	284	1,424	5.0	286	34	92	21	433	1.01	0.52	1.52
230	452	1,357	3.0	192	45	128	19	384	0.42	0.42	0.85
232	377	1,292	3.4	239	32	140	40	451	0.63	0.56	1.20
233	385	898	2.3	189	31	91	17	328	0.49	0.36	0.85
234	636	745	1.2	158	11	34	7	210	0.25	0.08	0.33
235	34	349	10.4	52	5	10	1	68	1.54	0.47	2.02
236	370	2,942	8.0	632	82	281	58	1,053	1.71	1.14	2.85
237	728	1,056	1.4	208	6	36	5	255	0.29	0.06	0.35
238	95	276	2.9	69	2	23	3	97	0.73	0.29	1.02
239	919	7,582	8.3	1733	314	979	236	3,262	1.89	1.66	3.55
240	643	7,656	11.9	1882	417	1355	345	3,999	2.93	3.29	6.22
241	996	13,938	14.0	3187	751	2574	652	7,164	3.20	3.99	7.19
242	214	2,812	13.1	596	138	491	101	1,326	2.79	3.41	6.20
246	840	10,624	12.6	1812	320	1249	251	3,632	2.16	2.17	4.32
247	228	3,576	15.7	671	152	539	111	1,473	2.94	3.51	6.45
248	214	1,980	9.2	398	95	261	67	821	1.86	1.97	3.83
249	502	5,637	11.2	1121	256	757	177	2,311	2.23	2.37	4.61
250	713	1,363	1.9	278	15	67	8	368	0.39	0.13	0.52
251	55	420	7.6	63	20	47	12	142	1.15	1.44	2.58
252	715	1,297	1.8	265	17	95	16	393	0.37	0.18	0.55
253	974	1,761	1.8	328	12	78	18	436	0.34	0.11	0.45
254	929	2,445	2.6	434	66	288	33	821	0.47	0.42	0.88
255	774	1,809	2.3	418	65	178	39	700	0.54	0.36	0.90
256	654	2,228	3.4	500	73	362	81	1,016	0.76	0.79	1.55
257	412	1,868	4.5	419	73	355	71	918	1.02	1.21	2.23
258	343	4,202	12.3	837	203	682	153	1,875	2.44	3.03	5.47

Permit Area	Land Area (Sq. Mile)	Firearms Hunters	Hunters/ Sq. Mile	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest	Bucks/ Sq. Mile	Antlerless/ Sq. Mile	Total/ Sq. Mile
259	490	6,801	13.9	1018	212	752	140	2,122	2.08	2.25	4.33
260	1,249	1,713	1.4	403	31	165	14	613	0.32	0.17	0.49
261	795	794	1.0	181	17	122	14	334	0.23	0.19	0.42
262	677	903	1.3	177	13	79	12	281	0.26	0.15	0.41
263	512	1,895	3.7	452	56	340	43	891	0.88	0.86	1.74
264	669	3,522	5.3	760	91	566	96	1,513	1.14	1.13	2.26
265	494	2,114	4.3	478	108	437	98	1,121	0.97	1.30	2.27
266	617	1,918	3.1	400	32	119	18	569	0.65	0.27	0.92
267	472	1,253	2.7	317	42	253	35	647	0.67	0.70	1.37
268	228	1,326	5.8	302	29	255	36	622	1.32	1.40	2.72
269	650	1,268	2.0	254	17	80	11	362	0.39	0.17	0.56
270	748	978	1.3	187	7	49	7	250	0.25	0.08	0.33
271	632	1,062	1.7	233	14	71	11	329	0.37	0.15	0.52
272	531	1,063	2.0	176	12	42	8	238	0.33	0.12	0.45
273	571	2,577	4.5	427	48	205	37	717	0.75	0.51	1.25
274	354	1,094	3.1	165	15	59	19	258	0.47	0.26	0.73
275	764	1,829	2.4	300	14	89	9	412	0.39	0.15	0.54
276	542	3,129	5.8	554	73	331	58	1,016	1.02	0.85	1.87
277	812	6,624	8.2	1307	175	628	124	2,234	1.61	1.14	2.75
278	402	1,751	4.4	349	17	76	12	454	0.87	0.26	1.13
279	344	1,124	3.3	144	11	53	12	220	0.42	0.22	0.64
280	675	1,286	1.9	180	8	34	11	233	0.27	0.08	0.35
281	575	2,459	4.3	425	43	206	18	692	0.74	0.46	1.20
282	778	609	0.8	97	1	17	3	118	0.12	0.03	0.15
283	613	1,379	2.2	243	12	50	8	313	0.40	0.11	0.51
284	838	1,809	2.2	272	19	93	14	398	0.32	0.15	0.48
285	549	2,142	3.9	334	39	154	18	545	0.61	0.38	0.99
286	446	1,367	3.1	195	20	97	14	326	0.44	0.29	0.73
287	46	439	9.6	54	19	51	9	133	1.18	1.73	2.91
288	625	1,837	2.9	279	23	142	18	462	0.45	0.29	0.74
289	815	1,120	1.4	146	9	77	12	244	0.18	0.12	0.30
290	662	2,374	3.6	380	46	277	36	739	0.57	0.54	1.12
291	800	3,366	4.2	596	36	203	21	856	0.74	0.32	1.07
292	479	2,992	6.2	455	83	293	44	875	0.95	0.88	1.83
293	511	2,477	4.8	490	104	303	72	969	0.96	0.94	1.89
294	686	1,286	1.9	253	16	147	20	436	0.37	0.27	0.64
295	839	2,162	2.6	391	20	114	16	541	0.47	0.18	0.64
296	667	1,578	2.4	241	20	77	5	343	0.36	0.15	0.51
297	438	940	2.1	179	25	75	16	295	0.41	0.26	0.67
298	618	3,587	5.8	619	95	433	82	1,229	1.00	0.99	1.99

Permit Area	Land Area (Sq. Mile)	Firearms Hunters	Hunters/ Sq. Mile	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest	Bucks/ Sq. Mile	Antlerless/ Sq. Mile	Total/ Sq. Mile
299	386	1,501	3.9	238	23	88	16	365	0.62	0.33	0.95
338	454	1,956	4.3	233	33	159	28	453	0.51	0.48	1.00
339	394	1,701	4.3	246	84	210	58	598	0.63	0.89	1.52
341	612	4,774	7.8	815	205	676	169	1,865	1.33	1.71	3.05
342	349	3,577	10.2	567	163	521	129	1,380	1.62	2.33	3.95
343	663	3,838	5.8	603	159	472	107	1,341	0.91	1.11	2.02
344	190	2,380	12.6	317	76	225	55	673	1.67	1.88	3.55
345	323	2,682	8.3	431	109	341	116	997	1.34	1.76	3.09
346	318	4,040	12.7	860	251	831	320	2,262	2.71	4.41	7.12
347	272	1,522	5.6	280	51	153	50	534	1.03	0.93	1.96
348	123	1,315	10.7	199	64	201	52	516	1.62	2.58	4.20
349	490	5,670	11.6	1006	322	1033	364	2,725	2.05	3.51	5.56
601	1,625	2,472	1.5	600	71	333	53	1,057	0.37	0.28	0.65
603	372	2,720	7.3	545	136	410	128	1,219	1.47	1.81	3.28
TOTAL[1]	**78,854**	**426,571**	**5.4**	**81,311**	**12,945**	**49,929**	**10,244**	**154,429**	**1.03**	**0.93**	**1.96**

[1]Does not include figures from special firearm hunts (see Table 6)

Table 4. Archery Harvest by Sex and Age Class, 2018. Excludes special hunts.

Permit Area	Adult Male	Fawn Male	Adult Female	Fawn Female	Total Harvest
101	8	1	10	1	20
103	12	1	10	0	23
105	37	6	63	7	113
108	33	1	25	4	63
110	25	1	19	2	47
111	5	0	6	0	11
114	5	0	1	0	6
117	1	1	0	0	2
118	14	0	25	1	40
119	3	0	1	0	4
126	11	4	9	0	24
130	5	1	10	1	17
131	8	0	3	0	11
132	10	2	10	1	23
133	26	3	16	2	47
152	2	1	7	1	11
155	62	17	123	13	215
156	61	4	53	3	121
157	145	27	183	22	377
159	63	7	62	8	140
169	39	3	46	3	91
171	30	5	25	3	63
172	72	4	60	5	141
173	21	1	19	2	43
176	32	4	40	4	80
177	22	8	34	3	67
178	61	3	53	2	119
179	98	11	91	8	208
181	39	3	38	5	85
182	135	27	185	17	364
183	60	2	57	3	122
184	194	34	239	19	486
197	39	1	31	4	75
199	4	1	2	0	7
201	6	0	1	0	7
203	0	0	0	1	1
208	6	0	4	0	10
209	33	3	53	6	95
210	29	7	33	6	75
213	167	54	376	33	630
214	124	50	248	26	448
215	185	60	390	40	675
218	158	12	79	14	263
219	128	11	62	12	213
221	141	26	173	26	366
222	71	16	90	10	187
223	203	28	237	24	492
224	13	0	7	1	21
225	182	40	266	39	527
227	279	72	397	44	792
229	63	8	34	6	111
230	36	3	14	2	55
232	42	10	44	4	100
233	47	8	66	12	133
234	34	6	11	0	51
235	18	3	12	1	34
236	236	36	181	23	476
237	31	3	19	0	53
238	2	0	7	0	9
239	128	23	137	20	308
240	137	27	281	20	465
241	226	57	477	56	816
242	128	31	228	30	417
246	89	12	79	6	186
247	71	16	122	14	223
248	56	10	56	14	136
249	88	11	54	3	156
250	54	2	23	2	81
251	8	0	2	1	11
252	40	4	24	7	75
253	62	2	43	0	107
254	91	8	87	0	186
255	88	12	85	7	192
256	33	3	36	2	74
257	28	7	40	7	82
258	51	6	62	11	130
259	38	7	38	10	93
260	16	2	10	4	32
261	22	3	18	0	43
262	38	2	20	3	63

Permit Area	Adult Male	Fawn Male	Adult Female	Fawn Female	Total Harvest
263	19	2	19	0	40
264	29	9	74	0	112
265	36	11	82	9	138
266	30	0	12	2	44
267	8	4	19	0	31
268	13	2	25	2	42
269	36	3	10	1	50
270	33	2	12	3	50
271	26	0	17	1	44
272	15	1	4	1	21
273	71	2	26	2	101
274	35	2	10	1	48
275	34	2	21	0	57
276	47	5	81	7	140
277	216	21	145	9	391
278	53	4	29	2	88
279	14	0	6	1	21
280	18	0	9	2	29
281	59	2	34	3	98
282	22	0	8	1	31
283	47	2	22	1	72
284	36	1	21	1	59
285	79	0	40	0	119
286	23	10	17	3	53
287	2	9	2	4	17
288	49	1	46	0	96
289	24	5	12	10	51
290	59	12	42	0	113
291	135	17	80	6	238
292	94	13	120	8	235
293	105	0	106	10	221
294	24	1	15	2	42
295	45	9	47	3	104
296	24	1	17	1	43
297	5	6	6	1	18
298	14	5	19	2	40
299	54	3	66	5	128
338	67	18	42	2	129
339	59	0	83	14	156
341	166	21	248	35	470
342	99	19	131	20	269
343	252	38	321	40	651
344	38	3	19	7	67
345	76	10	91	6	183
346	167	35	240	43	485
347	45	9	70	8	132
348	28	10	34	7	79
349	197	35	263	49	544
601	756	182	947	133	2,018
603	88	19	90	18	215
TOTAL[1]	**8,779**	**1,451**	**10,182**	**1,177**	**21,589**

[1]Does not include 943 deer from 900-series Archery Hunts, including Camp Ripley hunts (see Table 8)

Table 5. Muzzleloader Season Deer Harvest by Sex and Age Class, 2018. Excludes special hunts.

Permit Area	Adult Male	Fawn Male	Adult Female	Fawn Female	Total Harvest
101	13	0	13	2	28
103	10	0	6	0	16
105	21	3	22	4	50
108	13	1	6	0	20
110	14	2	17	3	36
111	4	0	3	0	7
114	0	0	0	0	0
117	0	0	0	0	0
118	12	2	13	0	27
119	3	0	1	0	4
126	3	0	1	0	4
130	4	0	7	0	11
131	5	0	0	0	5
132	3	0	1	0	4
133	10	1	7	1	19
152	1	0	0	0	1
155	11	3	29	4	47
156	11	5	18	1	35
157	21	8	43	4	76
159	11	1	15	1	28
169	16	0	6	0	22
171	14	2	23	0	39
172	24	3	46	5	78
173	6	1	6	1	14
176	7	1	17	2	27
177	8	2	21	3	34
178	13	2	29	3	47
179	18	2	43	3	66
181	5	1	13	3	22
182	8	2	21	3	34
183	8	1	28	3	40
184	49	11	80	7	147
197	11	0	6	0	17
199	0	0	0	0	0
201	11	0	4	2	17
203	1	0	2	0	3
208	14	2	8	0	24
209	26	4	44	5	79
210	23	2	35	4	64

Permit Area	Adult Male	Fawn Male	Adult Female	Fawn Female	Total Harvest
213	99	44	217	38	398
214	41	16	86	30	173
215	77	46	164	27	314
218	75	13	77	7	172
219	33	13	68	8	122
221	43	19	88	9	159
222	27	3	44	7	81
223	41	11	46	9	107
224	1	0	2	1	4
225	40	20	76	12	148
227	62	18	92	15	187
229	24	1	16	1	42
230	24	3	35	4	66
232	19	8	36	4	67
233	25	6	42	8	81
234	34	0	5	0	39
235	4	2	4	1	11
236	28	5	53	8	94
237	36	1	10	0	47
238	13	0	2	0	15
239	51	11	60	19	141
240	52	20	99	15	186
241	89	42	219	35	385
242	21	11	41	7	80
246	35	10	63	5	113
247	18	3	41	4	66
248	24	2	47	11	84
249	23	5	40	8	76
250	50	2	17	0	69
251	2	0	2	1	5
252	23	1	12	1	37
253	57	5	32	4	98
254	52	15	68	14	149
255	44	10	34	7	95
256	28	2	30	3	63
257	27	4	42	1	74
258	33	4	30	2	69
259	35	6	49	5	95
260	28	0	14	0	42

Permit Area	Adult Male	Fawn Male	Adult Female	Fawn Female	Total Harvest
261	30	3	18	0	51
262	19	3	13	1	36
263	40	1	45	4	90
264	61	5	63	5	134
265	45	9	65	8	127
266	42	1	5	2	50
267	27	1	25	1	54
268	21	4	21	5	51
269	38	1	15	1	55
270	34	1	4	2	41
271	34	3	13	0	50
272	22	0	4	0	26
273	34	4	30	3	71
274	29	3	14	0	46
275	48	0	10	3	61
276	71	21	92	12	196
277	142	16	162	12	332
278	46	1	24	0	71
279	32	0	10	1	43
280	22	1	10	1	34
281	60	4	52	0	116
282	5	0	0	0	5
283	21	2	9	3	35
284	28	2	8	0	38
285	26	1	25	4	56
286	30	0	10	1	41
287	2	2	5	0	9
288	39	0	36	1	76
289	31	3	11	0	45
290	43	12	74	12	141
291	74	5	41	1	121
292	53	13	60	4	130
293	57	12	72	8	149
294	49	5	12	2	68
295	76	0	23	1	100
296	44	6	22	0	72
297	6	0	3	0	9
298	12	1	13	2	28
299	25	3	17	2	47
338	17	4	20	1	42
339	11	7	46	6	70
341	42	17	109	14	182
342	33	11	88	11	143
343	53	15	72	15	155
344	14	9	22	6	51
345	29	7	48	10	94
346	74	38	139	28	279
347	16	7	26	2	51
348	8	1	9	2	20
349	59	28	143	27	257
601	24	5	28	4	61
603	16	2	35	8	61
TOTAL[1]	**3,784**	**744**	**4,658**	**631**	**9,817**

[1]Does not include special hunts (see Table 7)

Table 6. Summary of Special Firearm Hunts, 2018.

Includes regular, youth, and bonus permits.

Hunt Area	Dates	Permits Issued	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
900 - Cascade River State Park	11/3-11/18	100*	7	1	6	0	14
901 - Rice Lake NWR	11/10-11/18	40*	7	1	4	1	13
902 - St. Croix State Park	11/15-11/18	350*	57	9	53	10	129
903 - Lake Louise State Park	11/10-11/11	25***	6	4	16	3	29
904 - Gooseberry Falls State Park	11/3-11/18	40*	4	1	10	0	15
905 - Split Rock Lighthouse State Park	11/3-11/18	40*	6	1	3	1	11
906 - Tettegouche State Park	11/3-11/18	125*	4	1	8	0	13
907 - Scenic State Park	11/3-11/18	30*	2	0	1	0	3
908 - Hayes Lake State Park	11/3-11/18	75***	1	2	6	1	10
909 - Lake Bemidji State Park	11/3-11/16	30***	0	1	1	1	3
910 - Zippel Bay State Park	11/3-11/18	75***	9	12	20	7	48
911 - Judge CR Magney State Park	11/3-11/18	75*	6	2	4	0	12
912 - Schoolcraft State Park	11/3-11/18	NA†	1	0	1	0	2
913 - Lake Carlos State Park	11/3-11/6	20**	0	2	4	0	6
914 - William O'Brien State Park	11/3-11/4	50*	11	5	8	4	28
915 - Lake Bronson State Park	11/3-11/11	30***	4	4	8	3	19
916 - Maplewood State Park	11/3-11/6	100*	43	8	20	5	76
917 - Miesvile Ravine Park Reserve	11/17-11/25	40**	2	5	19	10	36
918 - Beaver Creek Valley State Park	11/3-11/4	25#	4	2	2	0	8
919 - Glacial Lakes State Park	11/8-11/11	30**	0	3	11	1	15
920 - Zumbro Falls Woods SNA	11/3-11/11	12**	1	1	4	2	8
922 - Old Mill State Park	11/3-11/6	10*	2	0	0	0	2
923 - Zumbro Falls Woods SNA	11/17-11/25	12**	0	6	5	2	13
925 - Vermillion Highlands Research, Recreation and WMNA	11/3-11/6	20*	4	0	0	1	5
927 - Elm Creek Park Reserve	11/10-11/11	140*	29	7	19	5	60
928 - Wild River State Park	11/10-11/11	75*	20	5	25	6	56
931 - City of Grand Rapids	11/3 - 11/18	N/A†	7	5	19	3	34
933 - Forestville/ Mystery Cave State Park	11/3-11/4	130*	12	1	7	5	25
934 - Whitewater State Game Refuge	11/17-11/25	75**	1	6	10	6	23
Total[1]			**250**	**95**	**294**	**77**	**716**

*Either sex; **Antlerless-only; ***Earn-A-Buck; #APR, N/A† Unlimited permits

[1]Special hunt harvests are often underreported due to hunters reporting harvest using the DPA and not the 900-series number.

Table 7. Summary of Special Muzzleloader Hunts, 2018.
Includes regular, youth, and bonus permits.

Hunt Area	Dates	Permits Issued	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
921 - Minneopa State Park	12/1-12/3	15***	0	1	7	0	8
929 - McCarthy Beach State Park	11/24-12/2	25*	0	0	2	1	3
930 - Nerstrand Big Woods State Park	12/1-12/2	50***	2	6	11	2	21
932 - Rice Lake State Park	12/1-12/2	20**	0	7	11	4	22
935 - Jay Cooke State Park	12/1-12/5	75*	5	4	9	2	20
936 - Crow Wing State Park	12/1-12/2	25*	1	3	2	0	6
937 - Lake Vermillion - Soudan Underground Mine State Park	11/24-12/9	25*	2	0	6	1	9
938 - City of Tower	11/24-12/9	20*	0	3	5	1	9
939 - Myre-Big Island State Park	12/1-12/2	50**	1	4	20	4	29
940 - Frontenac State Park	12/1-12/3	60*#	2	6	17	6	31
941 - Lake Maria State Park	11/26-11/28	25***	4	5	16	1	26
942 - Sibley State Park	11/24-11/25	60**	0	4	17	2	23
943 - Miesville Ravine Park Reserve	12/1-12/9	40**	1	1	6	1	9
944 - Vermillion Highlands Research, Recreation and WMA	11/24-12/9	20*	3	2	0	0	5
946 - City of Grand Rapids	11/24-12/9	N/A†	0	1	0	0	1
947 - Lake Bemidji State Park	11/30-12/2	30*	4	1	2	1	8
948 - Savanna Portage State Park	11/24-12/2	30*	0	0	1	1	2
949 - St. Croix State Park	11/29-12/2	100*	4	4	7	2	17
Muzzleloader Special Hunt Totals[1]			**29**	**52**	**139**	**29**	**249**

*Either sex

**Antlerless-only

***Earn-A-Buck

#APR, N/A† Unlimited permits

[1]Special hunt harvests are often underreported due to hunters reporting harvest using the DPA and not the 900-series number.

Table 8. Summary of Special Youth and Camp Ripley Archery Hunts, 2018.

Includes regular, youth, and bonus permits.

Hunt Area	Dates	Permits Issued	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
950 - Camp Ripley Youth Archery	10/13-10/14	175*	1	0	5	0	6
951 - Afton State Park	11/3-11/4	25*	9	3	5	1	18
952 - Sibley State Park	10/27 - 10/28	10*	3	0	2	0	5
953 - Zippel Bay State Park	10/20-10/21	20*	0	1	3	0	4
954 - Lake Bemidji State Park	10/19 - 10/21	20*	1	0	0	1	2
955 - Lake Alexander Preserve Archery	10/13-10/14	20*	0	0	0	0	0
956 - St. Croix State Park	10/27-10/28	90*	1	3	5	2	12
957 - Rydell National Wildlife Refuge	10/27-10/28	15*	0	0	0	0	0
958 - Savanna Portage State Park	10/27-10/28	25*	0	0	1	0	1
959 - Buffalo River State Park	11/3 - 11/4	14***	1	0	1	0	2
960 - Tettegouche State Park	10/27-10/28	10*	0	0	0	0	0
961 - Itasca State Park	10/13-10/14	75*	2	0	0	0	2
963 - Kilen Woods State Park	10/27 - 10/28	12***	2	0	1	0	3
965 - Banning State Park	10/27-10/28	6*	0	1	1	0	2
966 - Blue Mounds State Park	11/17-11/18	10***	0	2	4	0	6
967 - Camden State Park	10/27-10/28	12***	2	0	6	2	10
968 - Lake Shetek State Park	11/17 - 11/18	12***	4	0	11	0	15
Youth Special Hunt Totals			**26**	**10**	**45**	**6**	**87**
970 – Camp Ripley First Hunt	10/18-10/19	2,000*	26	6	35	6	73
971 - Camp Ripley First Hunt	11/27-10/28	2,000*	74	8	65	14	161
Camp Ripley Archery Hunt Totals			**100**	**14**	**100**	**20**	**234**

*Either sex

**Antlerless-only

***Earn-A-Buck

#APR, N/A† Unlimited permits

[1]Special hunt harvests are often underreported due to hunters reporting harvest using the DPA and not the 900-series number.

Table 9. Total Deer Harvest by Permit Area, 2018. Includes all seasons, license types, and permits with special hunts harvest reallocated to original permit area.

Permit Area	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest	Land Area (Sq. Mile)	Bucks/ Sq. Mile	Antlerless/ Sq. Mile	Total/ Sq. Mile	Rank
101	445	42	268	51	806	496	0.90	0.73	1.63	73
103	738	28	252	17	1,035	1,820	0.41	0.16	0.57	115
105	1,058	167	967	147	2,339	740	1.43	1.73	3.16	43
108	955	20	175	18	1,168	1,651	0.58	0.13	0.71	105
110	894	89	508	77	1,568	529	1.69	1.28	2.97	47
111	418	29	150	13	610	1,438	0.29	0.13	0.42	124
114	27	1	10	0	38	116	0.23	0.09	0.33	127
117	16	3	6	0	25	927	0.02	0.01	0.03	130
118	701	14	137	11	863	1,220	0.57	0.13	0.71	104
119	453	1	11	0	465	770	0.59	0.02	0.60	112
126	275	12	59	0	346	942	0.29	0.08	0.37	126
130	268	18	147	15	448	746	0.36	0.24	0.60	113
131	95	6	42	6	149	899	0.11	0.06	0.17	129
132	310	12	82	13	417	482	0.64	0.22	0.87	98
133	416	32	218	23	689	352	1.18	0.78	1.96	69
152	72	16	33	9	130	61	1.18	0.95	2.13	62
155	1,194	266	1,202	221	2,883	593	2.01	2.85	4.86	24
156	1,388	157	904	112	2,561	825	1.68	1.42	3.10	45
157	2,516	454	1,772	306	5,048	888	2.83	2.85	5.69	13
159	1,257	167	782	118	2,324	571	2.20	1.87	4.07	33
169	1,531	60	436	41	2,068	1,124	1.36	0.48	1.84	70
171	916	125	636	92	1,769	701	1.31	1.22	2.52	57
172	1,586	302	1,302	208	3,398	687	2.31	2.64	4.95	22
173	647	69	384	48	1,148	584	1.11	0.86	1.97	68
176	1,060	75	644	58	1,837	921	1.15	0.84	1.99	66
177	772	111	649	74	1,606	480	1.61	1.74	3.35	40
178	1,573	124	1,137	124	2,958	1,195	1.32	1.16	2.48	59
179	1,661	267	1,225	168	3,321	862	1.93	1.93	3.85	35
181	1,046	93	569	68	1,776	629	1.66	1.16	2.82	50
182	589	119	587	90	1,385	278	2.12	2.86	4.98	21
183	1,209	151	970	123	2,453	663	1.82	1.88	3.70	36
184	2,980	524	2,446	438	6,388	1,229	2.43	2.77	5.20	18
197	1087	42	243	29	1,401	955	1.14	0.33	1.47	83
199	113	8	29	1	151	153	0.74	0.25	0.99	94
201	146	16	84	8	254	161	0.91	0.67	1.58	76
203	69	5	24	4	102	118	0.59	0.28	0.87	97
208	276	24	122	11	433	379	0.73	0.41	1.14	89

Permit Area	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest	Land Area (Sq. Mile)	Bucks/ Sq. Mile	Antlerless/ Sq. Mile	Total/ Sq. Mile	Rank
209	638	97	490	94	1,319	640	1.00	1.06	2.06	64
210	879	146	603	110	1,738	615	1.43	1.40	2.83	49
213	2,583	663	2,111	503	5,860	1,057	2.44	3.10	5.54	14
214	1,863	527	1,631	435	4,456	554	3.36	4.68	8.04	4
215	1,728	490	1,475	368	4,061	701	2.46	3.33	5.79	12
218	1,267	175	674	153	2,269	884	1.43	1.13	2.57	56
219	753	107	404	99	1,363	391	1.92	1.56	3.48	38
221	1,571	362	1,137	272	3,342	642	2.45	2.76	5.21	17
222	1,080	219	757	168	2,224	413	2.61	2.77	5.38	15
223	882	145	679	121	1,827	376	2.35	2.52	4.87	23
224	115	11	54	11	191	47	2.43	1.61	4.04	34
225	1,854	365	1,277	275	3,771	618	3.00	3.10	6.10	8
227	1,330	272	1,017	203	2,822	472	2.82	3.16	5.98	11
229	377	48	159	29	613	284	1.33	0.83	2.16	61
230	252	51	177	25	505	452	0.56	0.56	1.12	90
232	300	50	220	48	618	377	0.80	0.84	1.64	72
233	261	55	214	44	574	385	0.68	0.81	1.49	81
234	226	19	59	7	311	636	0.36	0.13	0.49	120
235	74	10	26	3	113	34	2.20	1.16	3.35	39
236	907	128	523	93	1,651	370	2.45	2.01	4.46	28
237	275	10	65	5	355	728	0.38	0.11	0.49	121
238	84	2	32	3	121	95	0.88	0.39	1.27	88
239	1,957	356	1,198	280	3,791	919	2.13	2.00	4.13	32
240	2,071	464	1,735	380	4,650	643	3.22	4.01	7.24	6
241	3,502	850	3,270	743	8,365	996	3.52	4.88	8.40	3
242	745	180	760	138	1,823	214	3.48	5.04	8.52	2
246	1,936	342	1,392	262	3,932	840	2.30	2.38	4.68	27
247	760	171	702	129	1,762	228	3.33	4.39	7.72	5
248	580	122	470	112	1,284	214	2.71	3.29	5.99	10
249	1,233	275	853	188	2,549	502	2.46	2.62	5.08	20
250	384	19	108	10	521	713	0.54	0.19	0.73	101
251	73	20	51	14	158	55	1.33	1.55	2.87	48
252	328	22	131	17	498	715	0.46	0.24	0.70	106
253	447	19	153	22	641	974	0.46	0.20	0.66	111
254	578	94	463	58	1,193	929	0.62	0.66	1.28	87
255	559	97	340	68	1,064	774	0.72	0.65	1.38	84
256	561	78	428	86	1,153	654	0.86	0.91	1.76	71
257	474	84	440	79	1,077	412	1.15	1.46	2.61	54
258	921	213	774	166	2,074	343	2.69	3.36	6.05	9

Permit Area	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest	Land Area (Sq. Mile)	Bucks/ Sq. Mile	Antlerless/ Sq. Mile	Total/ Sq. Mile	Rank
259	1,091	225	839	155	2,310	490	2.23	2.49	4.72	26
260	447	36	197	17	697	1,249	0.36	0.20	0.56	116
261	233	23	158	18	432	795	0.29	0.25	0.54	118
262	234	18	112	13	377	677	0.35	0.21	0.56	117
263	515	63	412	50	1,040	512	1.01	1.03	2.03	65
264	852	105	704	104	1,765	669	1.27	1.36	2.64	53
265	559	128	584	115	1,386	494	1.13	1.67	2.81	51
266	472	33	136	20	661	617	0.77	0.31	1.07	91
267	352	47	297	38	734	472	0.75	0.81	1.55	79
268	336	35	301	43	715	228	1.47	1.66	3.13	44
269	329	21	106	13	469	650	0.51	0.22	0.72	103
270	254	10	65	12	341	748	0.34	0.12	0.46	122
271	293	17	101	12	423	632	0.46	0.21	0.67	110
272	213	13	50	9	285	531	0.40	0.14	0.54	119
273	532	54	261	42	889	571	0.93	0.62	1.56	78
274	232	20	98	21	371	354	0.65	0.39	1.05	93
275	382	16	120	13	531	764	0.50	0.20	0.70	107
276	672	102	515	78	1,367	542	1.24	1.28	2.52	58
277	1,668	216	954	147	2,985	812	2.05	1.62	3.68	37
278	450	22	134	15	621	402	1.12	0.43	1.55	80
279	190	11	69	14	284	344	0.55	0.27	0.83	100
280	220	9	58	14	301	675	0.33	0.12	0.45	123
281	544	51	304	21	920	575	0.95	0.65	1.60	74
282	124	1	25	4	154	778	0.16	0.04	0.20	128
283	311	16	81	12	420	613	0.51	0.18	0.68	109
284	336	22	122	14	494	838	0.40	0.19	0.59	114
285	439	50	219	23	731	549	0.80	0.53	1.33	86
286	248	20	124	18	410	446	0.56	0.36	0.92	95
287	60	21	58	9	148	46	1.31	1.93	3.24	42
288	369	32	231	25	657	625	0.59	0.46	1.05	92
289	201	13	100	12	326	815	0.25	0.15	0.40	125
290	485	73	424	69	1,051	662	0.73	0.86	1.59	75
291	815	56	350	30	1,251	800	1.02	0.54	1.56	77
292	602	113	473	56	1,244	479	1.26	1.34	2.60	55
293	666	138	513	98	1,415	511	1.30	1.46	2.77	52
294	327	22	192	29	570	686	0.48	0.35	0.83	99
295	516	29	195	20	760	839	0.61	0.29	0.91	96
296	309	26	116	6	457	667	0.46	0.22	0.69	108
297	190	26	84	17	317	438	0.43	0.29	0.72	102

Permit Area	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest	Land Area (Sq. Mile)	Bucks/ Sq. Mile	Antlerless/ Sq. Mile	Total/ Sq. Mile	Rank
298	645	102	465	86	1,298	618	1.04	1.06	2.10	63
299	319	34	195	28	576	386	0.83	0.67	1.49	82
338	317	40	221	31	609	454	0.70	0.64	1.34	85
339	319	115	371	92	897	394	0.81	1.47	2.28	60
341	1,033	254	1,075	229	2,591	612	1.69	2.54	4.23	30
342	700	200	749	164	1,813	349	2.01	3.19	5.19	19
343	925	218	883	166	2,192	663	1.40	1.91	3.31	41
344	370	94	276	74	814	190	1.95	2.34	4.30	29
345	558	132	506	150	1,346	323	1.73	2.44	4.17	31
346	1,138	374	1,294	433	3,239	318	3.58	6.61	10.19	1
347	365	84	297	71	817	272	1.34	1.66	3.00	46
348	244	84	259	69	656	123	1.98	3.35	5.33	16
349	1,266	386	1,442	442	3,536	490	2.58	4.63	7.21	7
601	1,426	271	1,335	198	3,230	1,625	0.88	1.11	1.99	67
603	734	192	671	189	1,786	372	1.97	2.83	4.80	25
TOTAL	**94,592**	**15,520**	**66,185**	**12,411**	**188,706**	**78,855**	**1.20**	**1.19**	**2.39**	

Table 10. . Youth Deer Season Harvest by Permit Area, 2018.

Permit Area	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
101	19	1	21	1	42
105	87	14	48	6	155
111	12	2	12	0	26
114	2	0	0	0	2
201	4	0	8	0	12
203	0	0	0	0	0
208	22	0	10	0	32
209	53	3	25	4	85
256	36	6	17	4	63
257	35	1	11	7	54
260	33	4	16	0	53
263	41	1	23	3	68
264	57	5	40	4	106
267	39	2	12	1	54
268	28	2	19	1	50
338	12	0	2	4	18
339	8	4	4	0	16
341	39	11	28	2	80
342	24	8	24	10	66
343	34	8	17	4	63
344	9	8	13	4	34
345	25	5	23	8	61
346	38	3	6	2	49
347	20	0	5	0	25
348	10	1	5	0	16
349	43	5	11	5	64
601	9	0	0	0	9
603	25	3	9	1	38
TOTAL	**764**	**97**	**409**	**71**	**1,341**

Table 11. Early Antlerless Deer Season Harvest by Permit Area, 2018.

Permit Area	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
346	39	157	65	261
348	11	31	14	56
349	57	186	75	318
603	17	67	18	102
TOTAL	**124**	**441**	**172**	**737**

Table 12. 300 Series A and B Seasons Firearms Harvest by Permit Area, 2018.

Permit Area	Zone	Adult Male	Fawn Male	Adult Female	Fawn Female	Total
338	3A	201	19	116	18	354
	3B	20	14	41	10	85
339	3A	208	58	143	40	449
	3B	31	22	63	18	134
341	3A	618	105	378	100	1201
	3B	157	89	270	67	583
342	3A	414	90	296	67	867
	3B	129	65	201	52	447
343	3A	463	102	299	56	920
	3B	106	48	155	47	356
344	3A	260	46	126	35	467
	3B	48	22	86	16	172
345	3A	310	58	191	55	614
	3B	96	46	127	53	322
346	3A	637	113	368	131	1249
	3B	185	98	302	123	708
347	3A	217	19	81	19	336
	3B	43	31	64	30	168
348	3A	156	34	108	20	318
	3B	33	18	60	18	129
349	3A	733	114	437	135	1419
	3B	230	146	401	149	926
603	3A	377	65	206	71	719
	3B	143	54	143	40	380
Total		**5815**	**1476**	**4662**	**1370**	**13323**

Table 13. Free Landowner License Harvest by Permit Area, 2018.

Permit Area	Fawn Male	Adult Female	Fawn Female	Total
101	0	7	1	8
105	3	7	2	12
108	0	0	1	1
110	2	16	1	19
111	0	4	0	4
117	0	1	0	1
133	0	1	0	1
155	0	5	2	7
156	1	10	0	11
157	12	16	3	31
159	2	3	0	5
169	0	1	0	1
171	0	2	1	3
172	1	6	2	9
176	0	3	0	3
177	2	6	0	8
178	0	5	1	6
179	2	7	2	11
181	0	1	0	1
182	0	1	0	1
183	1	3	1	5
184	6	23	5	34
197	0	1	0	1
199	0	0	0	0
201	2	1	0	3
203	0	1	0	1
208	0	8	1	9
209	2	13	1	16
210	6	20	4	30
213	19	69	18	106
214	19	77	21	117
215	7	29	8	44
218	1	10	1	12
219	1	2	1	4
221	11	32	3	46
222	3	8	3	14
223	1	1	0	2
225	1	20	2	23
227	1	4	0	5
229	0	1	0	1
232	0	5	1	6
233	0	4	0	4
236	0	3	0	3
239	11	24	5	40
240	16	52	11	79
241	25	92	21	138
246	5	34	4	43
247	0	3	1	4
248	2	4	0	6
249	13	42	15	70
254	0	3	1	4
255	4	6	0	10
256	4	11	4	19
257	2	16	4	22
258	2	5	1	8
259	0	7	0	7
260	2	2	1	5
262	0	2	2	4
263	0	3	0	3
264	0	20	3	23
265	2	13	4	19
267	2	4	0	6
268	0	3	0	3
276	0	1	1	2
277	4	7	0	11
281	0	1	0	1
290	0	3	0	3
291	0	0	0	0
292	2	10	1	13
293	3	4	2	9
294	0	1	0	1
297	0	3	1	4
298	0	5	2	7
338	0	3	0	3
339	1	6	1	8
341	9	18	10	37
342	5	21	6	32
343	2	11	1	14

Table 13, Landowner Permit Harvest Continued.

Permit Area	Fawn Male	Adult Female	Fawn Female	Total
344	3	12	0	15
345	5	11	7	23
346	6	27	15	48
347	1	5	0	6
348	2	0	2	4
349	8	32	11	51
603	1	2	1	4
Total	**248**	**966**	**224**	**1,438**

Table 14. 2018 Firearm Lottery Distribution Report.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
103	1	537	1	232	305	986
	2	314	1	0	314	
	3	266	2	0	266	
	4	93	1	0	93	
	5	5	0	0	5	
	6	3	0	0	3	
	Total	1218	5	232	986	
108	1	269	4	269	0	99
	2	230	0	230	0	
	3	247	2	247	0	
	4	167	1	167	0	
	5	133	1	133	0	
	6	129	0	30	99	
	8	0	1	0	0	
	Total	1175	9	1076	99	
118	1	304	1	304	0	394
	2	214	0	169	45	
	3	148	0	0	148	
	4	145	0	0	145	
	5	56	0	0	56	
	Total	867	1	473	394	
126	1	378	0	281	97	195
	2	94	0	0	94	
	3	3	0	0	3	
	4	1	0	0	1	
	Total	476	0	281	195	
132	1	399	0	399	0	397
	2	381	2	9	372	
	3	25	0	0	25	
	Total	805	2	408	397	

Table 14., continued

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
173	1	978	0	496	509	1477
	2	525	1	0	525	
	3	400	3	0	400	
	4	42	1	0	42	
	5	1	0	0	1	
	Total	1946	5	496	1477	
197	1	707	3	707	0	741
	2	617	1	617	0	
	3	392	1	55	337	
	4	373	0	0	373	
	5	31	2	0	31	
	Total	2120	7	1379	741	
199	1	106	0	1	105	148
	2	40	0	0	40	
	3	2	0	0	2	
	4	1	0	0	1	
	Total	149	0	1	148	
224	1	229	0	0	229	299
	2	18	0	0	18	
	Total	247	0	0	247	
234	1	128	0	128	0	92
	2	88	0	13	75	
	3	17	0	0	17	
	Total	233	0	141	92	
235	1	64	0	28	36	63
	2	26	0	0	26	
	3	1	0	0	1	
	Total	91	0	28	63	
237	1	91	0	91	0	47
	2	94	0	94	0	
	3	95	0	66	29	
	4	18	2	0	18	
	Total	298	2	251	47	
238	1	49	0	48	1	46
	2	37	0	0	37	
	3	7	0	0	7	
	4	1	0	0	1	
	Total	94	0	48	46	
250	1	287	0	287	0	268
	2	231	0	1	230	
	3	38	0	0	38	
	Total	556	0	288	268	
252	1	326	1	128	198	369
	2	158	0	0	158	
	3	13	0	0	13	
	Total	497	1	128	369	
253	1	325	2	325	0	340
	2	276	1	45	231	
	3	109	0	0	109	
	Total	710	3	370	340	
266	1	414	0	163	251	473
	2	201	0	0	201	
	3	21	0	0	21	
	4	0	1	0	0	
	Total	636	1	163	473	

Table 14., continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
269	1	202	1	188	14	317
	2	151	0	0	151	
	3	149	0	0	149	
	4	2	0	0	2	
	9	1	0	0	1	
	Total	505	1	188	317	
270	1	78	0	78	0	141
	2	77	0	77	0	
	3	87	0	34	53	
	4	58	0	0	58	
	5	30	0	0	30	
	Total	330	0	189	141	
271	1	310	3	106	204	327
	2	121	2	0	121	
	3	1	0	0	1	
	4	1	1	0	1	
	Total	433	6	106	327	
272	1	203	0	203	0	196
	2	113	1	25	88	
	3	101	1	0	101	
	4	5	0	0	5	
	5	0	1	0	0	
	9	2	0	0	2	
	Total	424	3	228	196	
274	1	250	0	250	0	220
	2	239	2	47	192	
	3	27	1	0	27	
	4	1	0	0	1	
	Total	517	3	297	220	
275	1	291	0	291	0	237
	2	226	2	189	37	
	3	199	0	0	199	
	4	1	1	0	1	
	5	0	1	0	0	
	Total	717	4	480	237	
278	1	278	0	278	0	355
	2	235	0	221	14	
	3	205	0	0	205	
	4	134	1	0	134	
	5	2	0	0	2	
	8	0	1	0	0	
	Total	854	2	499	355	
279	1	476	1	304	172	261
	2	77	1	0	77	
	3	10	1	0	10	
	4	2	0	0	2	
	Total	565	3	304	261	
280	1	143	0	143	0	92
	2	166	1	166	0	
	3	120	0	33	87	
	4	5	0	0	5	
	6	0	1	0	0	
	Total	434	2	342	92	

Table 14., continued.

Permit Area Number	Preference Level	Applications Total	Applications Rejected	Unsuccessful	Winners	Permits Available
282	1	43	0	43	0	24
	2	46	0	46	0	
	3	43	0	41	2	
	4	22	0	0	22	
	Total	154	0	130	24	
283	1	201	0	201	0	186
	2	188	1	130	58	
	3	128	0	0	128	
	5	0	1	0	0	
	Total	517	2	331	186	
284	1	248	2	248	0	190
	2	278	2	278	0	
	3	238	0	52	186	
	4	4	1	0	4	
	Total	768	5	578	190	
285	1	375	1	191	184	840
	2	314	0	0	314	
	3	296	3	0	296	
	4	45	0	0	46	
	6	0	1	0	0	
	Total	1030	5	191	840	
286	1	259	1	259	0	267
	2	174	2	9	165	
	3	102	0	0	102	
	Total	535	3	268	267	
288	1	426	0	277	149	461
	2	297	0	0	297	
	3	15	0	0	15	
	Total	738	0	277	461	
289	1	356	0	15	341	407
	2	57	0	0	57	
	3	9	0	0	9	
	Total	422	0	15	407	
291	1	716	1	716	0	729
	2	641	2	131	510	
	3	214	1	0	214	
	4	5	0	0	5	
	5	0	1	0	0	
	Total	1576	5	847	729	
294	1	409	0	83	326	454
	2	117	1	0	117	
	3	9	0	0	9	
	4	2	0	0	2	
	5	0	1	0	0	
	Total	537	2	83	454	
295	1	299	0	299	0	266
	2	295	2	223	72	
	3	191	3	0	191	
	4	3	0	0	3	
	5	0	1	0	0	
	Total	788	6	522	266	

Table 14., continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
296	1	289	0	289	0	267
	2	259	0	125	134	
	3	133	0	0	133	
	Total	681	0	414	267	
299	1	390	1	360	30	362
	2	320	0	0	320	
	3	12	2	0	12	
	4	0	1	0	0	
	5	0	1	0	0	
	Total	722	5	360	362	
Total		**29,302**	**112**	**15,359**	**13,971**	**14,023**

Table 15. 2018 Muzzleloader Lottery Distribution Report.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
103	1	8	0	3	5	14
	2	4	0	0	4	
	3	5	0	0	5	
	Total	17	0	3	14	
108	1	5	0	5	0	1
	2	6	0	6	0	
	3	2	0	2	0	
	4	3	0	3	0	
	5	1	0	0	1	
	Total	17	0	16	1	
118	1	9	0	8	1	6
	2	4	0	0	4	
	3	1	0	0	1	
	Total	14	0	8	6	
126	1	10	0	6	4	5
	2	1	0	0	1	
	Total	11	0	6	5	
132	1	4	0	3	1	3
	2	1	0	0	1	
	3	1	0	0	1	
	Total	6	0	3	3	
169	1	23	0	23	0	10
	2	17	0	8	9	
	3	1	0	0	1	
	Total	41	0	31	10	
173	1	21	0	7	14	23
	2	6	0	0	6	
	3	3	0	0	3	
	Total	30	0	7	23	
197	1	13	0	13	0	9
	2	8	0	4	4	
	3	4	0	0	4	
	4	1	0	0	1	
	Total	26	0	17	9	
199	1	2	0	0	2	2
	Total	2	0	0	2	

Table 15., continued.

Permit Area Number	Preference Level	Applications Total	Applications Rejected	Unsuccessful	Winners	Permits Available
224	1	1	0	0	1	1
	Total	1	0	0	1	
234	1	13	0	10	3	8
	2	5	0	0	5	
	Total	18	0	10	8	
235	1	12	0	2	10	12
	2	2	0	0	2	
	Total	14	0	2	12	
237	1	8	0	8	0	3
	2	6	0	6	0	
	3	5	0	2	3	
	Total	19	0	16	3	
238	1	5	0	3	2	4
	2	2	0	0	2	
	Total	7	0	3	4	
250	1	33	0	28	5	32
	2	27	0	0	27	
	Total	60	0	28	32	
252	1	28	0	7	21	31
	2	10	0	0	10	
	Total	38	0	7	31	
253	1	65	0	46	19	60
	2	36	0	0	36	
	3	5	0	0	5	
	Total	106	0	46	60	
266	1	24	0	7	17	27
	2	9	0	0	9	
	3	1	0	0	1	
	Total	34	0	7	27	
269	1	25	0	14	11	33
	2	12	0	0	12	
	3	10	0	0	10	
	Total	47	0	14	33	

Table 15., continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
270	1	8	0	8	0	9
	2	4	0	3	1	
	3	6	0	0	6	
	4	1	0	0	1	
	5	1	0	0	1	
	Total	20	0	11	9	
271	1	24	0	5	19	23
	2	4	0	0	4	
	Total	28	0	5	23	
272	1	4	0	4	0	4
	2	4	0	1	3	
	9	1	0	0	1	
	Total	9	0	5	4	
274	1	39	1	32	7	30
	2	23	0	0	23	
	Total	62	1	32	30	
275	1	14	0	14	0	13
	2	14	0	10	4	
	3	8	0	0	8	
	9	1	0	0	1	
	Total	37	0	24	13	
278	1	36	0	36	0	45
	2	35	0	16	19	
	3	21	0	0	21	
	4	5	0	0	5	
	Total	97	0	52	45	
279	1	67	0	34	33	39
	2	6	0	0	6	
	Total	73	0	34	39	
280	1	13	1	13	0	8
	2	13	0	12	1	
	3	7	0	0	7	
	Total	33	1	25	8	

Table 15., continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
282	1	3	0	3	0	1
	2	1	0	1	0	
	3	1	0	1	0	
	5	1	0	0	1	
	Total	6	0	5	1	
283	1	20	0	20	0	14
	2	10	0	1	9	
	3	5	0	0	5	
	Total	35	0	21	14	
284	1	21	0	21	0	10
	2	15	0	8	7	
	3	3	0	0	3	
	Total	39	0	29	10	
285	1	32	0	9	23	60
	2	25	0	0	25	
	3	12	0	0	12	
	Total	69	0	9	60	
286	1	34	0	26	8	33
	2	21	0	0	21	
	3	4	0	0	4	
	Total	59	0	26	33	
288	1	36	0	18	18	39
	2	21	0	0	21	
	Total	57	0	18	39	
289	1	39	0	0	39	40
	2	1	0	0	1	
	Total	40	0	0	40	
291	1	75	0	68	7	71
	2	60	0	0	60	
	3	3	0	0	3	
	9	1	0	0	1	
	Total	139	0	68	71	
294	1	42	0	3	39	46
	2	7	0	0	7	
	Total	49	0	3	46	

Table 15. continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
295	1	40	0	40	0	34
	2	35	0	15	20	
	3	14	0	0	14	
	Total	89	0	55	34	
296	1	41	0	41	0	33
	2	25	0	0	25	
	3	8	0	0	8	
	Total	74	0	41	33	
299	1	37	0	31	6	38
	2	32	0	0	32	
	Total	69	0	31	38	
Total		**1592**	**2**	**718**	**874**	**874**

Table 16. 2018 Special Firearms Hunt Lottery Distribution Report.

Special Hunt	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
900 - Cascade River SP	1	23	0	0	23	100
	2	1	0	0	1	
	Total	24	0	0	24	
901 - Rice Lake NWR	1	55	0	22	33	40
	2	7	0	0	7	
	4	1	0	0	1	
	Total	63	0	21	41	
902 - St. Croix SP	1	389	0	152	237	350
	2	105	0	0	105	
	3	3	0	0	3	
	4	4	0	0	4	
	9	1	0	0	1	
	Total	502	0	152	350	
903 - Lake Louise SP	1	47	0	47	0	25
	2	15	0	3	12	
	3	15	0	0	15	
	Total	77	0	50	27	
904 - Gooseberry Falls SP	1	31	0	7	24	40
	2	16	0	0	16	
	Total	47	0	7	40	
905 - Split Rock Lighthouse SP	1	34	0	0	34	40
	2	6	0	0	6	
	Total	6	0	0	40	
906 - Tettegouche SP	1	93	0	0	93	125
	2	9	0	0	9	
	Total	102	0	0	102	
907 - Scenic SP	1	32	0	6	26	30
	2	4	0	0	4	
	Total	36	0	6	30	
908 - Hayes Lake SP	1	42	0	0	42	75
	3	1	0	0	1	
	Total	43	0	0	43	
909 - Lake Bemidji SP	1	31	0	8	23	30
	2	7	0	0	7	
	Total	38	0	8	30	
910 - Zippel Bay SP	1	64	0	0	64	75
	2	7	0	0	7	
	3	1	0	0	1	
	Total	72	0	0	72	
911 - Judge CR Magney SP	1	14	0	0	14	75
	Total	14	0	0	14	
913 - Lake Carlos SP	1	26	0	15	11	20
	2	6	0	0	6	
	3	3	0	0	3	
	Total	35		15	20	

Special Hunt	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
914 - William O'Brien SP	1	41	0	41	0	50
	2	54	0	23	31	
	3	18	0	0	18	
	5	1	0	0	1	
	9	1	0	0	1	
	Total	115	0	64	51	
915 - Lake Bronson SP	1	24	0	24	0	30
	2	24	0	0	24	
	3	4	0	0	4	
	9	2	0	0	2	
	Total	54	0	24	30	
916 - Maplewood SP	1	136	0	136	0	100
	2	130	0	130	0	
	3	120	0	35	85	
	4	10	0	0	10	
	9	5	0	0	5	
	Total	401	0	301	100	
917 – Miesville Ravine Park Reserve	1	62	0	38	24	40
	2	13	0	0	13	
	3	3	0	0	3	
	Total	78	0	38	40	
918 – Beaver Creek Valley SP	1	45	0	45	24	40
	2	16	0	2	13	
	3	11	0	0	3	
	Total	72	0	47	40	
919 - Glacial Lakes SP	1	39	0	19	20	30
	2	11	0	0	11	
	Total	50	0	19	31	
920 - Zumbro Falls Woods SNA	1	8	0	2	6	12
	2	6	0	0	6	
	Total	14	0	2	12	
922 - Old Mill SP	1	14	0	14	0	10
	2	10	0	5	5	
	3	5	0	0	5	
	Total	29	0	19	10	
923 - Zumbro Falls Woods SNA	1	14	0	2	12	12
	Total	14	0	2	12	
925A - Vermillion Highlands WMA	1	33	0	33	0	18
	2	25	0	25	0	
	3	17	0	3	14	
	4	4	0	0	4	
	Total	79	0	61	18	
925B - Vermillion Highlands WMA	1	2	0	2	0	2
	2	6	0	6	0	
	3	3	0	0	3	
	Total	11	0	8	3	

Special Hunt	Preference Level	Applications Total	Applications Rejected	Unsuccessful	Winners	Permits Available
927 – Elm Creek Park Reserve	1	185	0	185	0	133
	2	145	0	106	39	
	3	87	0	0	87	
	4	6	0	0	6	
	9	1	0	0	1	
	Total	424	0	291	133	
927 – Elm Creek Park Reserve	1	15	0	11	4	10
	2	5	0	0	5	
	3	1	0	0	1	
	Total	21	0	11	10	
928 – Wild River SP	1	159	0	159	0	75
	2	83	0	46	37	
	3	38	0	0	38	
	Total	280	0	205	75	
931 - City of Grand Rapids	1	42	0	0	42	46
	2	2	0	0	2	
	3	2	0	0	2	
	Total	46	0	0	46	
933 - Forestville - Mystery Cave SP	1	71	0	0	71	130
	2	5	0	0	5	
	Total	76	0	0	76	
934 - Whitewater State Game Refuge	1	81	0	32	49	75
	2	25	0	0	25	
	3	1	0	0	1	
	Total	107	0	32	75	
TOTAL		**2,876**	**0**	**1,360**	**1,565**	**1,8138**

[1]Permits allocated can exceed permits available by a maximum of 3 if the last winning pick is a group of up to 4 hunters.

Table 17. 2018 Special Muzzleloader Hunt Lottery Distribution Report.

Special Hunt	Preference Level	Applications Total	Applications Rejected	Unsuccessful	Winners	Permits Available
921 - Minneopa SP	1	33	0	33	0	15
	2	17	0	10	7	
	3	8	0	0	8	
	Total	58	0	43	15	
929 – McCarthy Beach SP	1	10	0	0	10	25
	2	1	0	0	4	
	Total	14	0	0	14	
930 – Nerstrand Big Woods SP	1	53	0	53	0	50
	2	27	0	5	22	
	3	29	0	0	29	
	4	2	0	0	2	
	Total	111	0	58	53	
932 – Rice Lake SP	1	26	0	21	5	20
	2	12	0	0	12	
	3	4	0	0	4	
	Total	42	0	21	21	
935 - Jay Cooke SP	1	86	0	63	23	75
	2	53	0	0	53	
	Total	139	0	63	76	
936 - Crow Wing SP	1	19	0	19	0	25
	2	32	0	9	23	
	4	3	0	0	3	
	9	1	0	0	1	
	Total	55	0	0	27	
937 - Lake Vermillion-Soudan Underground Mine SP	1	27	0	4	23	25
	2	2	0	0	2	
	Total	29	0	4	25	
938 - City of Tower	1	13	0	0	13	20
	2	2	0	0	2	
	Total	15	0	0	15	
939 - Myre-Big Island SP	1	65	0	52	13	50
	2	33	0	0	33	
	3	7	0	0	7	
	Total	105	0	52	53	
940 - Frontenac SP	1	62	0	47	15	60
	2	41	0	0	41	
	3	5	0	0	5	
	9	1	0	0	1	
	Total	109	0	47	62	

Special Hunt	Preference Level	Applications Total	Applications Rejected	Unsuccessful	Winners	Permits Available
941 – Lake Maria SP	1	53	0	53	0	25
	2	33	0	18	15	
	3	9	0	0	9	
	9	1	0	0	1	
	Total	96	0	71	25	
942 - Sibley SP	1	60	0	53	7	60
	2	52	0	0	52	
	3	2	0	0	2	
	Total	114	0	53	61	
943 – Miesville Ravine Park Reserve	1	24	0	0	24	40
	2	54	0	0	8	
	3	1	0	0	1	
	Total	79	0	0	33	
944 - Vermillion Highlands Research, Recreation, and WMA	1	24	0	17	7	20
	2	14	0	0	14	
	Total	38	0	17	21	
946 - City of Grand Rapids	1	10	0	0	10	12
	2	1	0	0	1	
	3	1	0	0	1	
	Total	12	0	0	12	
947 - Lake Bemidji SP	1	18	0	0	18	30
	Total	18	0	0	18	
948 - Savanna Portage SP	1	12	0	0	12	30
	2	2	0	0	2	
	3	1	0	0	1	
	Total	15	0	0	15	
949 - St. Croix SP	1	97	0	2	95	100
	2	5	0	0	5	
	9	1	0	0	1	
	Total	103	0	2	101	
TOTAL		**1,049**	**0**	**429**	**546**	**682**

[1]Permits allocated can exceed permits available by a maximum of 3 if the last winning pick is a group of up to 4 hunters.

2018 MINNESOTA ELK HARVEST REPORT

Erik Thorson, Acting Big Game Program Leader

Ruth Anne Franke, Area Wildlife Supervisor (Karlstad)

Jason Wollin, Asst. Area Wildlife Manager (Karlstad)

Kyle Arola, Acting Wildlife Area Supervisor (Thief Lake)

INTRODUCTION

A limited number of licenses are offered to Minnesota residents to hunt elk. In 2018, there were two established zones open for elk hunting: 1) Zone 20 - Kittson County Central and 2) Zone 30 - Kittson County Northeast (Figure 1). Elk hunting in Zone 10, near Grygla, Minnesota, has been closed since 2013 because the population is below goal (Figure 2). In 2018, there were three regular season hunts held in Zone 20: 1) Season A - September 8 through September 16, 2) Season B – September 22 through September 30, and 3) Season C - October 6 through October 14. There was one regular season hunt in Zone 30: 1) Season A - September 8 through September 16. The hunts were structured to fall within the breeding season when bull elk are most vulnerable and elk can be located by vocalizations. There were no later season hunts this year and all the seasons were 9 days in length, each included two weekends, with 5 days in between with no hunting. Hunter success rates were generally higher this year with the new season structure. These dates were also chosen to not conflict with the Youth Firearm Deer Season on October 18 through October 21 and the Regular Firearm Deer Season November 3 through November 11.

METHODS

All elk hunters are required to attend a mandatory orientation session the day before their respective hunts begin. At this session, DNR staff provide hunters with their license and a kit to collect biological samples from their harvested animal. Field samples collected by the hunter include blood, hair with skin, muscle tissue, and the whole liver. Hunters must register their animal in person within 24 hours at the local DNR office and provide biological samples. DNR staff help 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), the whole brain (with consent), and a tooth so an accurate age can be determined at a later date. Alternative arrangements are made for the collection of some samples, if immediate collection would interfere with a hunter's planned taxidermy mount. DNR staff submit all biological samples to Wildlife Health for disease testing and other monitoring projects. Results

RESULTS

A total of 22 licenses were available and 2,502 individuals or parties (up to two hunters) applied for the opportunity to hunt elk for both zones and all seasons (Table 1). Applicants were given the opportunity to select both zone and season in which to hunt. First, random drawings were held for landowner names in Zone 20 (20% = 4 tags offered). Once landowner names were drawn and selected, the second round was for names of applicants that had applied for 10 years or more (20% of remaining tags = 3 tags offered). All remaining landowner names were then placed into the general drawing with all the other applicant names for the remaining elk tags available in the zone and season they had selected on their application. Lastly, after all names were picked, there was a random drawing from the names to determine the Either-Sex tags and Antlerless tags. Zone 30 only had two Bull-Only tags available, so no landowner tags were offered.

In 2018, a total of 17 elk were harvested in zones 20 and 30 (Table 2). This gives us a total hunter success rate of 75% for Zone 20 and 100% for Zone 30. Long-term elk harvest for all zones is depicted in Tables 3 and 4.

Table 1. License allocation and application numbers of the 2018 Minnesota elk seasons

Kittson County Season A

Zone	Either-Sex	Antlerless	Bull-only	Total	Total Applicants
Zone 20 – Kittson Central	2	5	0	7	787
Zone 30 – Kittson Northeast	0	0	2	2	716
Total	**2**	**5**	**2**	**9**	**1,503**

Kittson County Season B

Zone	Either-Sex	Antlerless	Bull-only	Total	Total Applicants
Zone 20 – Kittson Central	1	6	0	7	598
Total	**1**	**6**	**0**	**7**	**598**

Kittson County Season C

Zone	Either-Sex	Antlerless	Bull-only	Total	Total Applicants
Zone 20 – Kittson Central	1	5	0	6	401
Total	**1**	**5**	**0**	**6**	**401**

Table 2. Distribution of the 2018 Minnesota elk harvest.

Kittson County Central Hunt Zone (20)

Season	Bulls-only Licenses	Antlerless Licenses	Bulls taken	Antlerless taken	Total elk taken
Season A (Sept 8-16)	2	5	2	5	7
Season B (Sept 22-30)	1	6	1	5	6
Season C (Oct 6 – 14)	1	5	0	2	2
Total	**4**	**16**	**3**	**12**	**15**

Kittson County Northeast Hunt Zone (30)

Season	Bulls-only Licenses	Antlerless Licenses	Bulls taken	Antlerless taken	Total elk taken
Season A (Sept 8 – 16)	2	0	2	0	2
Total	**2**	**0**	**2**	**0**	**2**

Table 3. Grygla elk harvests, 1987-2018

	Grygla Elk Harvests			
	Bulls (or Either-Sex)		Antlerless	
Year	Permits	Harvest	Permits	Harvest
1987	2	1	2	1
1996	2	2	7 (1 alternate)	6
1997	5 (2 alternate)	1	5 (2 alternate)	2
1998	4 (2 alternate)	2	0	0
2004	1	1	4	2
2005	1	0	4	0
2006	2	2	6	2
2007	0	0	6	6
2008	2	2	10	6
2009	2	3*	12	11
2010	2	1	5	3
2011	2	2	3	0
2012	2	1	3	0
2013	Closed	0	Closed	0
2014	Closed	0	Closed	0
2015	Closed	0	Closed	0
2016	Closed	0	Closed	0
2017	Closed	0	Closed	0
2018	**Closed**	**0**	**Closed**	**0**
Total	**27**	**18**	**67**	**39**

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

Table 4. Kittson County elk harvests, 2008-2017

	Kittson County (Combined Zone 20 & 30)			
	Bulls (or Either-Sex)		**Antlerless**	
Year	**Permits**	**Harvest**	**Permits**	**Harvest**
2008	1	1	10	10
2009	12	9[a]	4	5
2010	1	1	3	3
2011	2	3[b]	8[c]	4
2012	5	4[d]	13	3
2013	8	6	15	6
2014	9	6	0	0
2015	7	5	0	0
2016	7	5	0	0
2017	11	9	2	1
2018	6	5	16	12[e]
Total	**69**	**54**	**71**	**44**

[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.

[e] One antlerless cow was taken with and Either-Sex tag.

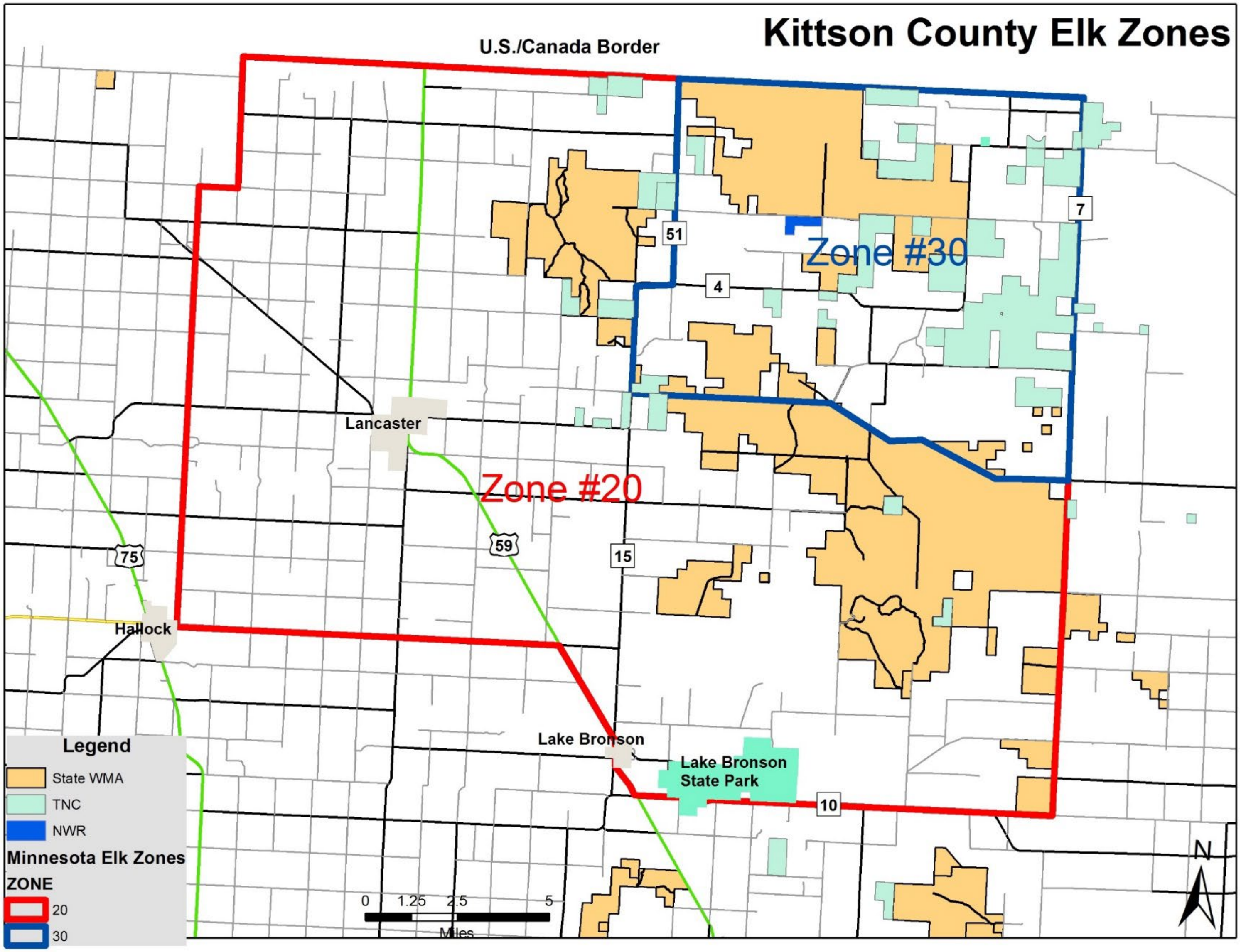


Figure 1. Kittson County Elk Hunt zones.

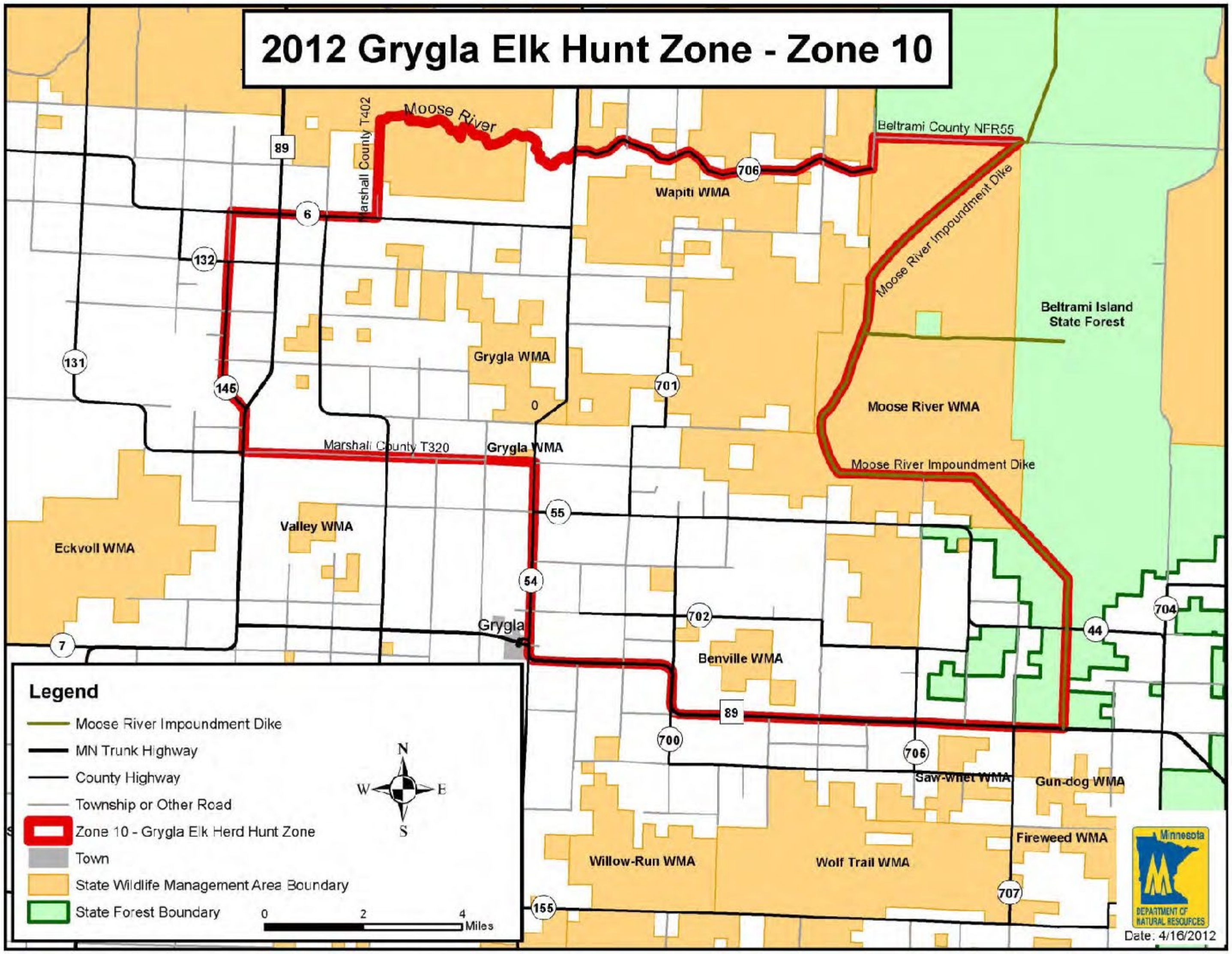


Figure 2. Grygla Elk Hunt zone.

MINNESOTA SANDHILL CRANE HARVEST REPORT, 2018

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. In 2017 the season was shifted to open the third Saturday in September and close the fourth Sunday in October with no changes to the daily and possession limits. This remained the same for the 2018 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 – 2018.

Year	Dates	Daily limit	Possession limit
2010	4 Sept – 10 Oct	2	4
2011	3 Sept – 9 Oct	2	4
2012	15 Sept – 21 Oct	2	4
2013	14 Sept – 20 Oct	2	6
2014	13 Sept – 19 Oct	1	3
2015	12 Sept – 18 Oct	1	3
2016	10 Sept – 16 Oct	1	3
2017	16 Sept – 22 Oct	1	3
2018	15 Sept – 21 Oct	1	3

Table 2. Sandhill crane permit sales, estimated number of active hunters and harvest for NW Minnesota, 2010-2018. (Kruse, K.L. et al. 2015).

Year	Number of Permits	Active Hunters	Harvest
2010	1,954	964	830
2011	1,342	643	765
2012	1,032	410	407
2013	1,086	485	378
2014	1,216	401	247
2015	1,199	424	212
2016	1,139	471	287
2017	1,125	397	196
2018	1,091	383	129

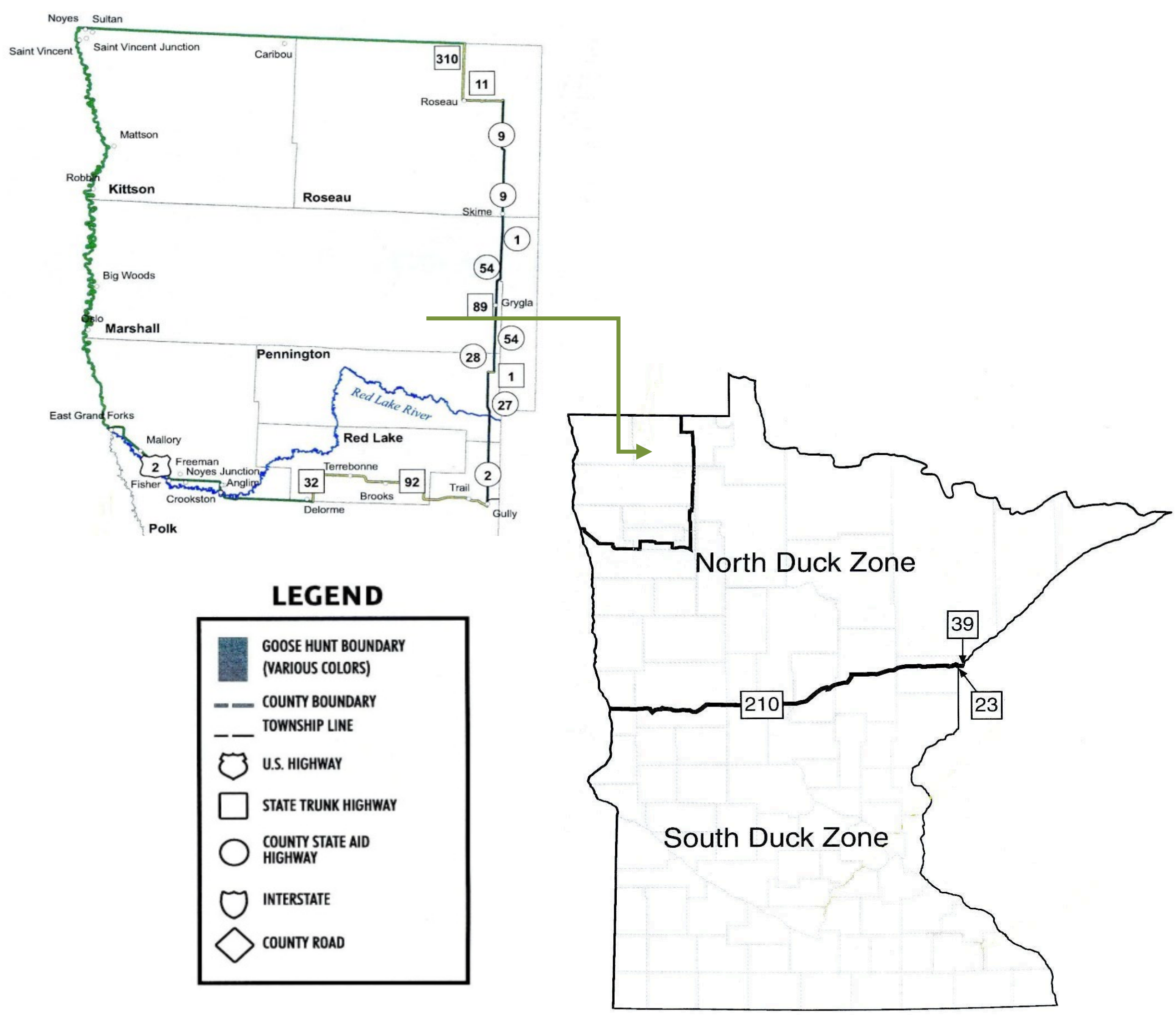


Figure 1. Sandhill crane hunting zone in Minnesota, 2010-2018.

TRAPPING HARVEST STATISTICS

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

2018 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. Beginning in 2017, we excluded license holders <18 years old at the time of the survey, which represents ~3% of license sales. 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) except for youth <18 years old who were excluded from the survey, listed in the Electronic License System (ELS) database in late February 2019. There were 6,815 active trapping licenses in the ELS database, which consisted of 4,853 Resident Regular Trappers, 11 age - eligible (of 186) Resident Junior Trappers, 1,200 Resident Senior Trappers, 559 “active” Lifetime Trappers, and 11 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 = 68%, 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 (>=18-yr old) 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 3.5.2 (2018-12-20); R Development Core Team 2018) to summarize responses.

RESULTS

We mailed out 6,676 surveys, 77 surveys were undeliverable and 3,674 were returned for an adjusted response rate of 55.7%. Sixty five percent of respondents reported setting traps for at least one species (Table 1, Figure 2). Historic trapper estimates are presented in Table 2, Table 3, and Table 4.

ACKNOWLEDGMENTS

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

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

RETURN SERVICE REQUESTED

Presorted
First-Class Mail
U.S. Postage
Paid
Twin Cities, MN
Permit # 171

2018 Trapper Report

1. Did you set traps / snares in Minnesota during the 2018-2019 trapping season?
   ☐ No ☐ Yes (Please check one)
2. Indicate your harvest, the number of days you trapped for each species, the average number of traps you checked PER DAY for each species, and the county in which you trapped **most** for each species. Report only animals **YOU personally** trapped in Minnesota. Animals taken by hunting should **NOT** be reported here.

Species Trapped		*Number YOU Trapped All Season*	*# Days Trapped All Season*	*Average # Traps/Snares Checked Per Day*	*County You Trapped In Most*
Muskrat	80				
Mink	32				
Gray Fox	96				
Striped skunk	34				
Coyote (brush wolf)	97				
Beaver (Mar-May '18)	81				
Beaver (Oct '18-Feb '19)	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				

Dear Trapper:

You are being asked as a trapping license buyer to assist us in evaluating the 2018-2019 trapping season **(March 2018-February 2019)**. For Spring Beaver, please report only animals taken between March 2018 and May 15, 2018. We need this information to estimate the season's harvest and to help set future furbearer trapping seasons. Similar to past years we are also asking for the **average number of traps you checked per day** for each species. If a trap is set for multiple species, count the trap for both species when answering the question. For example, if you ran 20 mink/coon traps each day, enter 20 traps/day for both mink and coon.

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

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

THANK YOU FOR YOUR COOPERATION

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

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

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY MAIL
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POSTAGE WILL BE PAID BY ADDRESSEE

Department of Natural Resources - Wildlife
STATE OF MINNESOTA
395 JOHN IRELAND BLVD
SAINT PAUL, MN 55101-9798

Figure 1. Trapper survey card 2018.

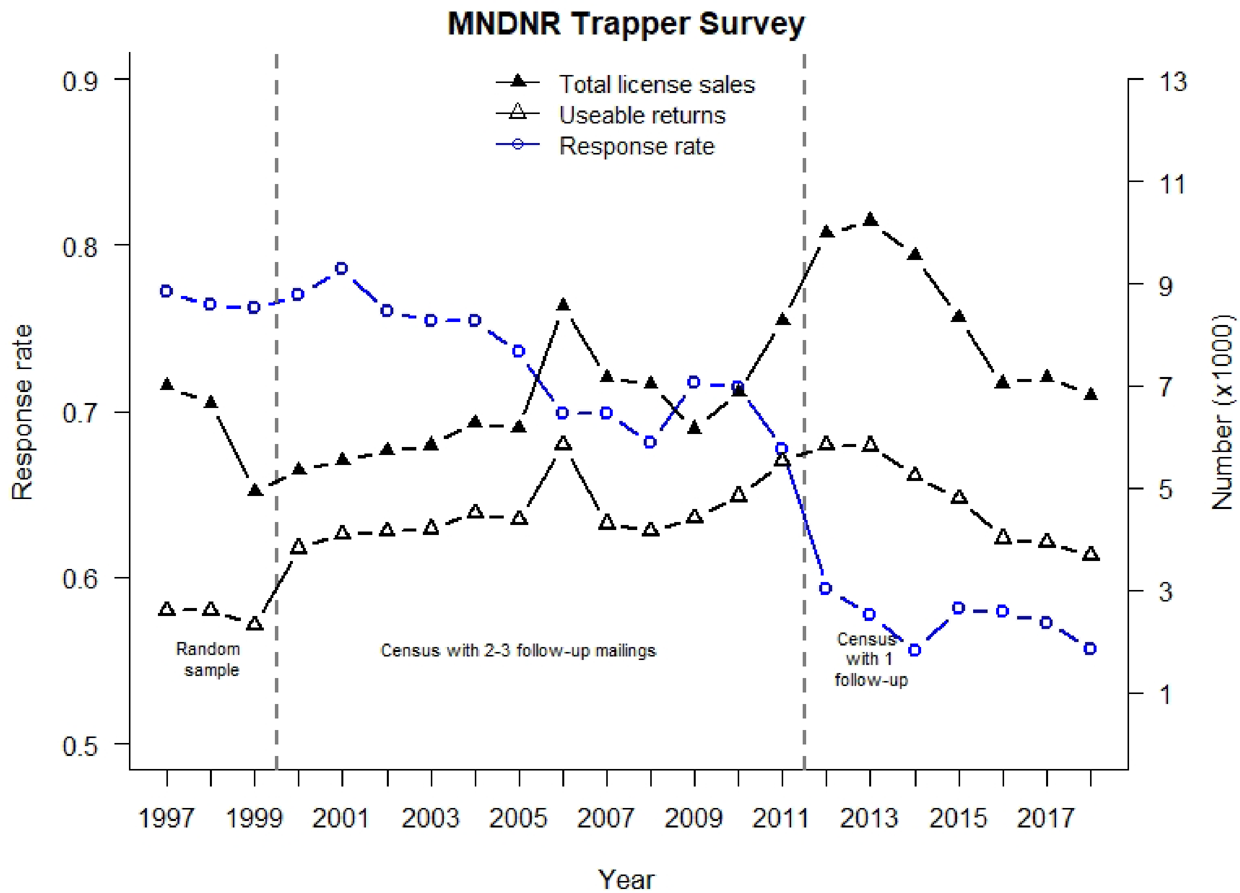

Figure 2. Trapper annual license sales and mail survey response, 1997-98 through 2018-19.

Table 1. Use of trapper licenses, 2007-08 through 2018-19.

Year		Returns from mail survey	Projections from license sales
2007-08	Trapped	3,322 (77.2%)	5,533
	Did not trap	980 (22.8%)	1,634
		4,302 (100.0%)	7,167[a]
2008-09	Trapped	3,154 (75.7%)	5,319
	Did not trap	1,012 (24.3%)	1,708
		4,166 (100.0%)	7,027[a]
2009-10	Trapped	3,202 (72.7%)	4,467
	Did not trap	1,202 (27.3%)	1,677
		4,404 (100.0%)	6,144[a]
2010-11	Trapped	3,546 (73.2%)	5,032
	Did not trap	1,298 (26.8%)	1,843
		4,844 (100.0%)	6,875[a]
2011-12	Trapped	4,498 (81.5%)	6,748
	Did not trap	1,019 (18.5%)	1,532
		5,517 (100.0%)	8,280[a]
2012-13	Trapped	4,537 (77.6%)	7,747
	Did not trap	1,307 (22.4%)	2,236
		5,844 (100.0%)	9,983[a]
2013-14	Trapped	4,342 (74.6%)	7,627
	Did not trap	1,480 (25.4%)	2,597
		5,822 (100.0%)	10,224[a]
2014-15	Trapped	3,786 (72.2%)	6,888
	Did not trap	1,459 (27.8%)	2,652
		5,245 (100.0%)	9,540[a]
2015-16	Trapped	3,296 (68.8%)	5,734
	Did not trap	1,496 (31.2%)	2,600
		4,792 (100.0%)	8,334[a]
2016-17	Trapped	2,558 (63.7%)	4,487
	Did not trap	1,458 (36.3%)	2,557
		4,016 (100.0%)	7,044[a]
2017-18	Trapped	2,654 (67.6%)	4,692
	Did not trap	1,272 (32.4%)	2,249
		3,926 (100.0%)	6,941[a]
2018-19	Trapped	2,382 (64.8%)	4,326
	Did not trap	1,292 (35.2%)	2,350
		3,674 (100%)	6,676[a]

[a] excludes duplicates.

Table 2. Estimated number of trappers of various furbearers, 2007-08 through 2018-19.

	Estimated number of trappers											
	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Muskrat	2371	2394	2088	2760	4,320	4,110	3,410	2,902	2,218	1,797	1,882	1,583
Mink	2168	2045	1541	1847	2,470	3,110	2,780	2,158	1,587	1,049	1,084	995
Short-tailed weasel	595	512	417	546	800	690	510	666	289	195	283	166
Long-tailed weasel	434	346	254	333	560	540	480	519	265	174	190	151
Raccoon	3189	3150	2320	2567	4,060	4,680	4,660	4,182	2,781	2,032	2,168	1,952
Striped skunk	1485	1488	949	1130	1,800	1,940	1,610	1,541	1,234	907	840	798
Badger	330	293	206	229	310	360	390	284	247	193	167	164
Opossum	1392	1170	701	645	830	1,100	1,110	575	463	469	785	646
Red fox	1320	1233	1006	1068	1,900	2,240	2,080	2,012	1,434	1,048	1,258	1,091
Gray fox	654	657	529	555	970	1,180	1,060	1,035	684	446	458	381
Coyote	1203	1141	888	998	1,720	2,360	2,200	2,396	1,981	1,479	1,781	1,586
Beaver (Oct - Feb)	2008	1877	1650	1722	2,360	2,620	2,710	2,189	1,894	1,642	1,495	1,535
Beaver (previous Spring)	1408	1258	1260	1367	1,510	1,810	1,150	1,305	1,145	1,130	1,194	1,000

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, 2007-08 through 2018-2019.

	Estimated take per successful trapper reporting that species											
	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Muskrat	32	34	48	66	82	59	36	39	51	49	45	40
Mink	9	9	9	8	7	6	6	5	5	6	5	5
Short-tailed weasel	7	7	8	10	10	7	5	8	4	5	5	6
Long-tailed weasel	5	4	4	6	6	4	3	5	3	3	3	3
Raccoon	24	23	20	23	25	18	16	15	11	12	14	13
Striped skunk	8	7	7	8	7	7	6	6	6	7	6	5
Badger	2	2	2	2	2	2	2	2	2	2	2	2
Opossum	13	10	8	7	6	7	7	7	4	5	8	9
Red fox	4	3	3	4	4	4	3	4	3	3	4	4
Gray fox	3	3	3	2	3	3	2	2	2	2	2	2
Coyote	5	4	5	5	6	5	5	5	6	5	7	8
Beaver (Oct –Feb)	11	12	12	10	12	10	9	8	8	8	8	9
Beaver (previous Spring)	19	23	20	22	20	20	9	16	14	17	19	19

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, 2007-08 through 2018-2019[a]

	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Trapper license sales [b]	7,167	7,027	6,158	6,885	8,280	9,998	10,224	9,540	8,334	7,044	7,163	6,815
Estimated harvest [c]												
Muskrat	75,598	80,158	98,524	180,480	352,030	242,120	120,500	111,998	112,219	87,958	83,844	63,021
Mink	18,712	16,647	13,207	13,837	15,770	18,460	14,710	10,211	7,745	5,439	5,218	4,412
Short-tailed weasel	4,190	3,515	3,128	4,939	7,300	4,500	2,360	4,806	1,083	930	1,305	995
Long-tailed weasel	2,036	1,118	838	1,728	3,020	2,030	1,410	2,568	734	466	554	340
Raccoon	73,613	71,893	45,118	57,189	98,240	79,800	70,380	58,868	29,963	22,874	28,899	24,845
Striped skunk	10,811	10,355	6,194	7,979	12,250	12,620	9,430	7,956	6,349	5,458	4,476	3,961
Badger	499	424	316	337	490	570	600	347	376	286	278	221
Opossum	17,332	11,297	4,963	4,194	4,400	6,780	6,720	3,524	1,814	2,124	6,160	5,248
Red fox	4,091	3,501	2,984	3,303	7,250	7,540	5,710	6,040	4,061	2,707	4,500	3,530
Gray fox	1,367	1,321	1,084	1,093	2,100	2,550	1,940	1,902	1,161	715	736	611
Coyote	5,392	4,533	3,797	4,264	8,780	11,130	9,010	11,703	10,084	7,308	12,303	11,359
Beaver (Oct- Feb)	21,867	21,076	18,178	17,114	26,620	24,590	23,220	15,671	14,181	13,070	11,223	12,937
Beaver (previous Spring)	26,348	27,816	25,008	29,148	29,500	34,600	10,110	20,820	15,966	19,004	22,293	18,649
Registered harvest [d]												
Otter	1,861	1,938	1,544	1,814	2,294	3,171	2,824	2,148	1,955	1195	1,295	1,351
Lynx [e]	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
Bobcat [g]	702	853	884	1,012	1,711	1,875	1,038	1,380	766	485	731	1,015
Fisher	1,682	1,712	1,259	903	1,473	1,293	1,146	919	756	399	477	510
Marten	2,221	1,823	2,073	1,842	2,525	1,472	1,014	1,055	877	551	979	665

[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, 2019- 6,815 trapping licenses were sold in 2018: 186 (2.7%) were junior licenses, 4,853 (71.2%) were Regular adult licenses, 1,190 (17.5%) were Senior licenses, 572 (8.4%) were Lifetime licenses, and 14 (<1%) were Nonresident (MN Landowner) licenses. Duplicate licenses excluded.

[c] Based upon trappers' responses to mail surveys. [d] Raccoon and red fox season continuous May 1994 thru March 15, 2006.

[e] Lynx (1984) and Eastern spotted skunk (1996) listed as Special Concern and threatened species (respectively) and are fully protected.

[f.] Registered harvest information as reported from annual, mandatory registration. [g] Registered harvest for bobcat includes animals taken by hunting.

MINNESOTA FUR BUYERS SURVEY FOR THE 2018-2019 HUNTING AND TRAPPING SEASON

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

INTRODUCTION

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

METHODS

In September 2019, 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 and the "average price" paid to those hunters and trappers based on all furs purchased. A total of 28 usable surveys were received, for a return rate of 71 percent.

Calculations of average pelt price for each species were weighted according to the number of pelts purchased by each buyer. Total estimated value of the furbearer harvest to trappers and hunters in 2017-18 was $517,506.47, a 2 percent increase from the previous season.

Table 1. Minnesota fur prices as reported by licensed fur dealers, 2018-19.

Species	Number Pelts	Minimum Price	Maximum Price	Weighted Mean
Muskrat	21906	1.50	3.41	2.38
Mink Female	943	2.00	7.27	6.02
Mink male	283	2.00	10.00	7.61
Raccoon	7223	2.00	8.63	7.30
Red Fox	635	6.00	18.00	10.93
Gray Fox	95	5.00	20.00	13.42
Coyote	4288	10.00	55.00	36.20
Bobcat	184	40.00	100.00	60.33
River Otter	313	19.17	31.56	25.07
Beaver 10-12	4526	3.75	11.00	8.30
Beaver 3-4	12345	4.00	13.92	8.95
L.T. Weasel	0	0.00	0.00	0.00
S.T. Weasel	115	1.00	3.00	2.45
Striped Skunk	97	2.00	9.00	5.25
Badger	31	5.00	30.00	7.94
Opossum	22	0.25	1.06	0.96
Fisher Male	33	25.00	55.00	43.03
Fisher Female	23	25.00	55.00	39.57
Marten Male	36	20.00	50.00	41.81
Marten Female	18	20.00	35.00	33.06
Deer Hides	23980	1.00	4.00	3.18
Bear Hides	15	30.00	65.00	32.33

Table 2. Average price per pelt paid to hunters and trappers in Minnesota, 2008-09 through 2018-19

	Average pelt prices paid hunters and trappers in Minnesota (dollars)										
Species	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Muskrat	1.85	4.43	5.33	5.86	7.91	8.72	4.85	2.28	2.65	2.59	2.38
Mink (female)	7.45	8.02	9.33	11.54	17.53	13.72	7.45	4.99	6.20	5.80	6.02
Mink (male)	9.14	9.37	13.66	14.68	18.27	18.11	10.50	6.18	7.47	7.29	7.61
Raccoon	9.34	9.18	10.87	12.57	16.60	16.58	8.64	5.11	4.92	5.76	7.30
Red Fox	11.79	10.85	13.35	22.87	33.52	30.90	20.41	11.86	10.52	13.30	10.93
Gray Fox	14.08	11.55	14.64	15.11	19.20	21.27	14.17	10.64	10.33	11.32	13.42
Coyote	7.12	8.62	9.47	17.99	22.04	21.30	25.10	21.48	17.39	25.15	36.20
Bobcat	74.74	42.77	71.44	98.18	144.79	88.63	66.67	57.46	35.88	63.52	60.33
Otter	24.33	35.65	34.53	51.40	72.12	61.32	34.57	30.03	21.05	21.98	25.07
Beaver (fall-winter)	14.63	12.49	11.95	14.29	18.47	16.52	12.40	8.77	8.14	8.32	8.30
Beaver (spring)	9.36	14.47	14.50	19.96	12.80	14.77	10.69	8.24	7.33	10.39	8.95
L.T. Weasel	2.21	3.12	2.87	4.02	4.10	2.35	1.78	1.46	1.41	0.00	0.00
S.T. Weasel	3.57	3.02	1.50	2.10	2.51	0.00	2.00	1.41	0.00	2.79	2.45
Striped Skunk	2.56	3.66	3.29	3.55	5.00	4.14	3.86	3.65	4.00	7.12	5.25
Badger	7.70	8.81	10.43	13.47	14.54	13.72	9.52	9.57	7.86	9.09	7.94
Opossum	1.21	1.30	2.64	5.80	1.52	1.52	1.17	1.98	1.32	1.34	0.96
Fisher (male)	22.27	34.45	38.19	47.69	62.38	61.32	41.76	34.88	28.00	29.87	43.03
Fisher (female)	37.22	34.90	37.31	39.59	63.02	67.73	50.87	34.39	37.07	36.75	39.57
Marten (male)	30.61	26.76	39.80	42.32	56.57	74.10	38.92	30.83	29.94	36.90	41.81
Marten (female)	28.19	29.95	36.57	39.49	54.29	70.94	32.20	28.89	30.41	33.96	33.06
Deer Hides	3.53	4.44	4.41	3.95	5.18	6.09	5.59	5.62	4.00	4.14	3.18
Bear Hides	29.81	43.00	33.38	28.79	30.28	42.63	32.94	46.03	32.97	25.91	32.33

REGISTERED FURBEARER HARVEST STATISTICS

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REGISTERED FURBEARER HARVEST STATISTICS 2018-19

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

INTRODUCTION

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

In Minnesota, detailed harvest information is collected on 4 carnivores – fishers, martens, bobcats, and river otters. These species have lower reproductive potential, naturally occur at low to moderate densities, have comparatively restricted distributions, or may be more influenced by habitat change. Hence, detailed harvest information is desirable to help ensure sustainable populations. For the past 41 years, detailed harvest data has been collected for these species.

METHODS

Hunters and trappers 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 2017 season. Compared to the previous year, bobcat harvest increased 39%, fisher harvest increased 7%, marten harvest declined 32%, and otter harvest increased 4%. Detailed harvest summaries are provided in the following tables and graphs. Data for years prior to those presented in this report is available (back to 1977) by contacting the Minnesota DNR.

ACKNOWLEDGMENTS

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

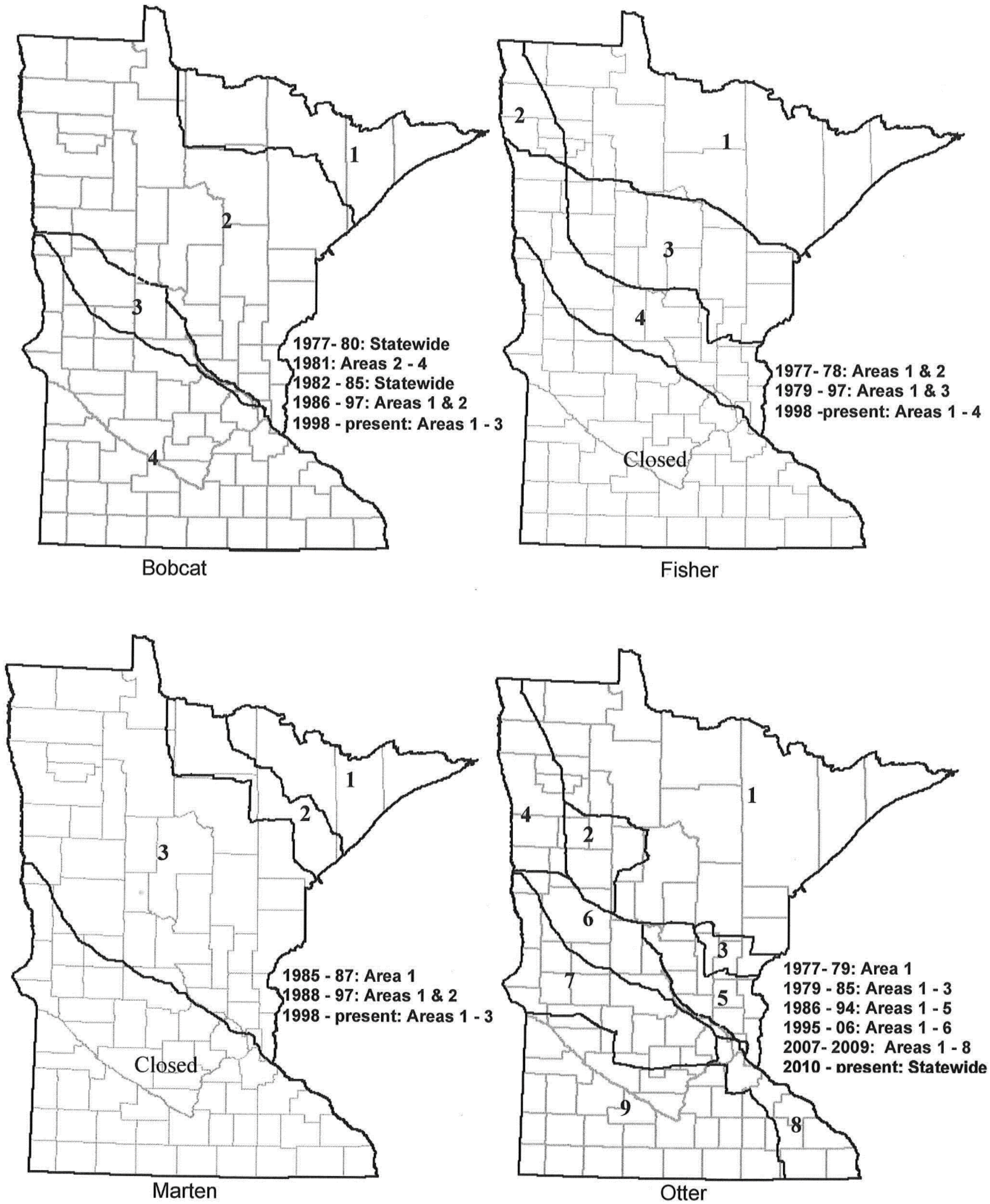

Figure 1. Open trapping areas for fisher, marten, bobcat, and otter, 1977 - present.

Table 1. Registered furbearer seasons and harvests, 1987-2018.

	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
1987-88	11/28-1/3	37	5	212	11/28-12/13	16	1	1641	11/28-12/13	16	1	1363	10/24-11/29	37	3	1386
1988-89	11/26-1/1	37	5	141	11/26-12/11	16	1	1025	11/26-12/11	16	2	2072	10/29-11/27	30	3	922
1989-90	12/2-1/7	37	5	129	12/2-12/17	16	1	1243	12/2-12/17	16	2	2119	10/28-12/17	51	3	1294
1990-91	12/1-1/6	37	5	84	12/1-12/16	16	1	746	12/1-12/16	16	2	1349	10/27-1/6	71	3	888
1991-92	11/30-1/5	37	5	106	11/30-12/15	16	1	528	11/30-12/15	16	1	686	10/26-1/5	71	3	855
1992-93	11/28-1/3	37	5	168	11/28-12/13	16	1	778	11/28-12/13	16	2	1602	10/24-1/3	71	4	1368
1993-94	12/4-1/9	37	5	201	12/4-12/19	16	2	1159	12/4-12/19	16	2	1438	10/23-1/9	78	4	1459
1994-95	12/3-1/8	37	5	238	12/3-12/18	16	2	1772	12/3-12/18	16	2	1527	10/29-1/8	71	4	2445
1995-96	12/2-1/7	37	5	134	12/2-12/17	16	2	942	12/2-12/17	16	2	1500	10/28-1/7	71	4	1435
1996-97	11/30 -1/5	37	5	223	11/30-12/15	16	2	1773	11/30-12/15	16	2	1625	10/26-1/5	71	4	2219
1997-98	11/29-1/4	37	5	359	11/29-12/14	16	2	2761	11/29-12/14	16	2	2261	10/25-1/4	71	4	2145
1998-99	11/28-12/13	16	5	103	11/28-12/13	16	2	2695	11/28-12/13	16	2	2299	10/24-1/3	71	4	1946
1999-00	12/4-1/9	37	5	206	12/4-12/19	16	2	1725	12/4-12/19	16	4	2423	10/23-1/9	78	4	1635
2000-01	12/2-1/7	37	5	231	12/2-12/17	16	4	1674	12/2-12/17	16	4	1629	10/28-1/7	71	4	1578
2001-02	11/24-1/6	44	5	250	11/24-12/9	16	4	2119	11/24-12/9	16	4	1928	10/27-1/6	71	4	2301
2002-03	11/30-1/5	37	5	544	11/30-12/15	16	5	2660	11/30-12/15	16	5	2839	10/26-1/5	71	4	2145
2003-04	11/29-1/4	37	5	483	11/29-12/14	16	5	2521	11/29-12/14	16	5	3214	10/25-1/4	71	4	2766
2004-05	11/27-1/9	44	5	631	11/27-12/12	16	5	2552	11/27-12/12	16	5	3241	10/23-1/9	78	4	3450
2005-06	11/26-1/8	44	5	590	11/26-12/11	16	5	2388	11/26-12/11	16	5	2653	10/29-1/8	71	4	2846
2006-07	11/25-1/7	44	5	890	11/25-12/10	16	5	3251	11/25-12/10	16	5	3788	10/28-1/7	71	4	2720
2007-08	11/24-1/6	44	5	702	11/24-12/2	9	5	1682	11/24-12/2	9	5	2221	10/27-1/6	71	2/4	1861
2008-09	11/29-1/4	37	5	853	11/29-12/7	9	5	1712	11/29-12/7	9	5	1823	10/25-1/4	71	2/4	1938
2009-10	11/28-1/3	37	5	884	11/28-12/6	9	5	1259	11/28-12/6	9	5	2073	10/24-1/3	71	2/4	1544
2010-11	11/27-1/9	44	5	1012	11/27-12/5	9	2	903	11/27-12/5	9	5	1842	10/23-1/9	78	4	1814
2011-12	11/26-1/8	44	5	1711	11/26-12/4	9	2	1473	11/26-12/4	9	5	2525	10/22-1/8	78	4	2294
2012-13	11/24-1/6	44	5	1875	11/24-11/29	6	2	1293	11/24-11/29	6	5	1472	10/27-1/6	71	4	3171
2013-14	11/30-1/5	37	5	1038	11/30-12/5	6	2	1146	11/30-12/5	6	2	1014	10/26-1/5	71	4	2824
2014-15	11/29-1/4	37	5	1384	11/29-12/4	6	2	943	11/29-12/4	6	2	1059	10/25-1/4	71	4	2154
2015-16	11/28-1/3	37	5	766	11/28-12/3	6	2	756	11/28-12/3	6	2	877	10/24-1/3	71	4	1955
2016-17	11/26-1/8	44	5	485	11/26-12/1	6	2	399	11/26-12/1	6	2	551	10/29-1/8	78	4	1195
2017-18	11/25-1/7	44	5	731	11/25-11/30	6	2	477	11/25-11/30	6	2	979	10/28-1/7	78	4	1295
2018-19	11/24-1/6	44	5	1015	11/24-11/29	6	2	510	11/24-11/29	6	2	665	10/27-1/6	78	4	1351

[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).

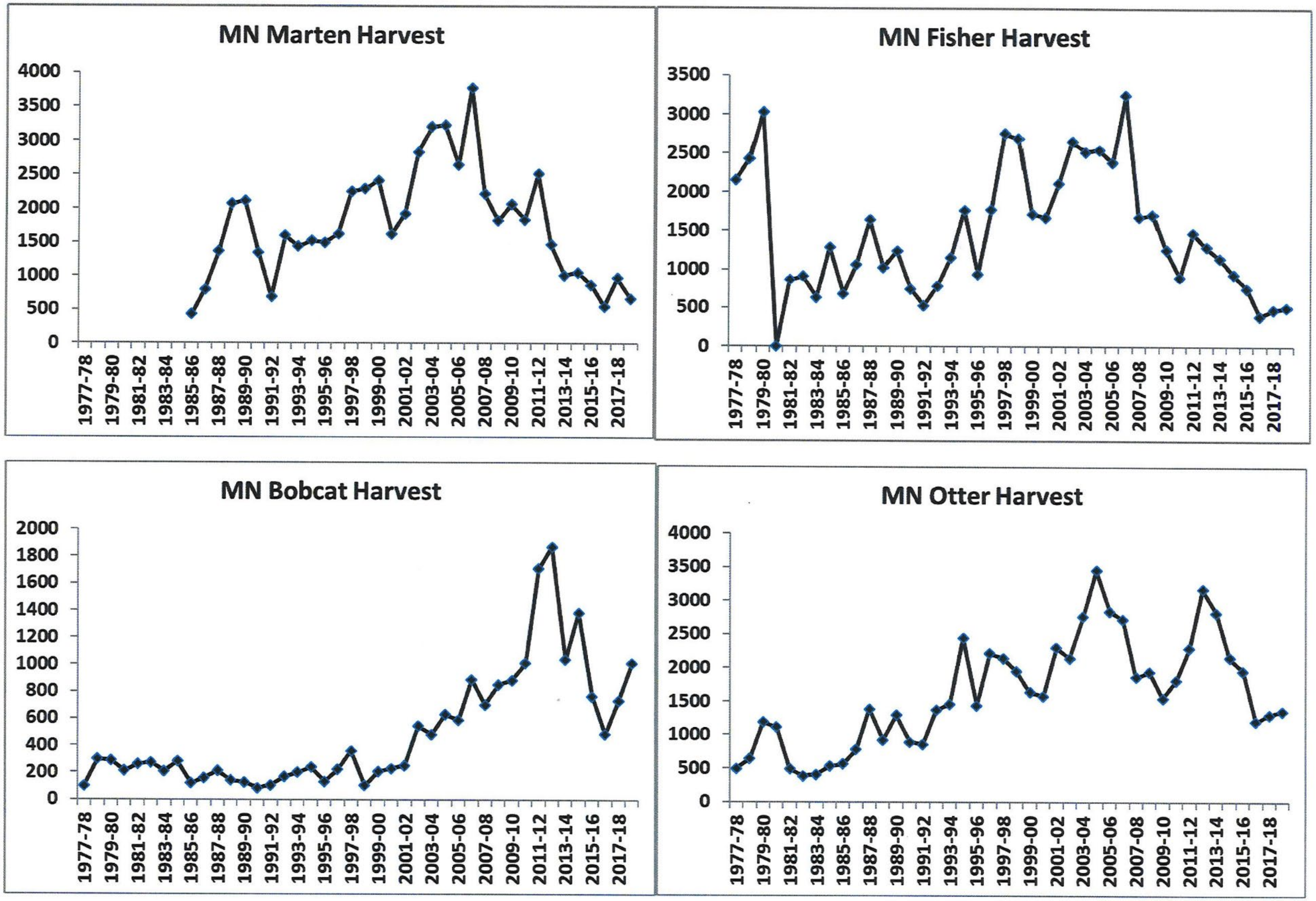

Figure 2. Harvest of registered furbearers in Minnesota, 1977-present.

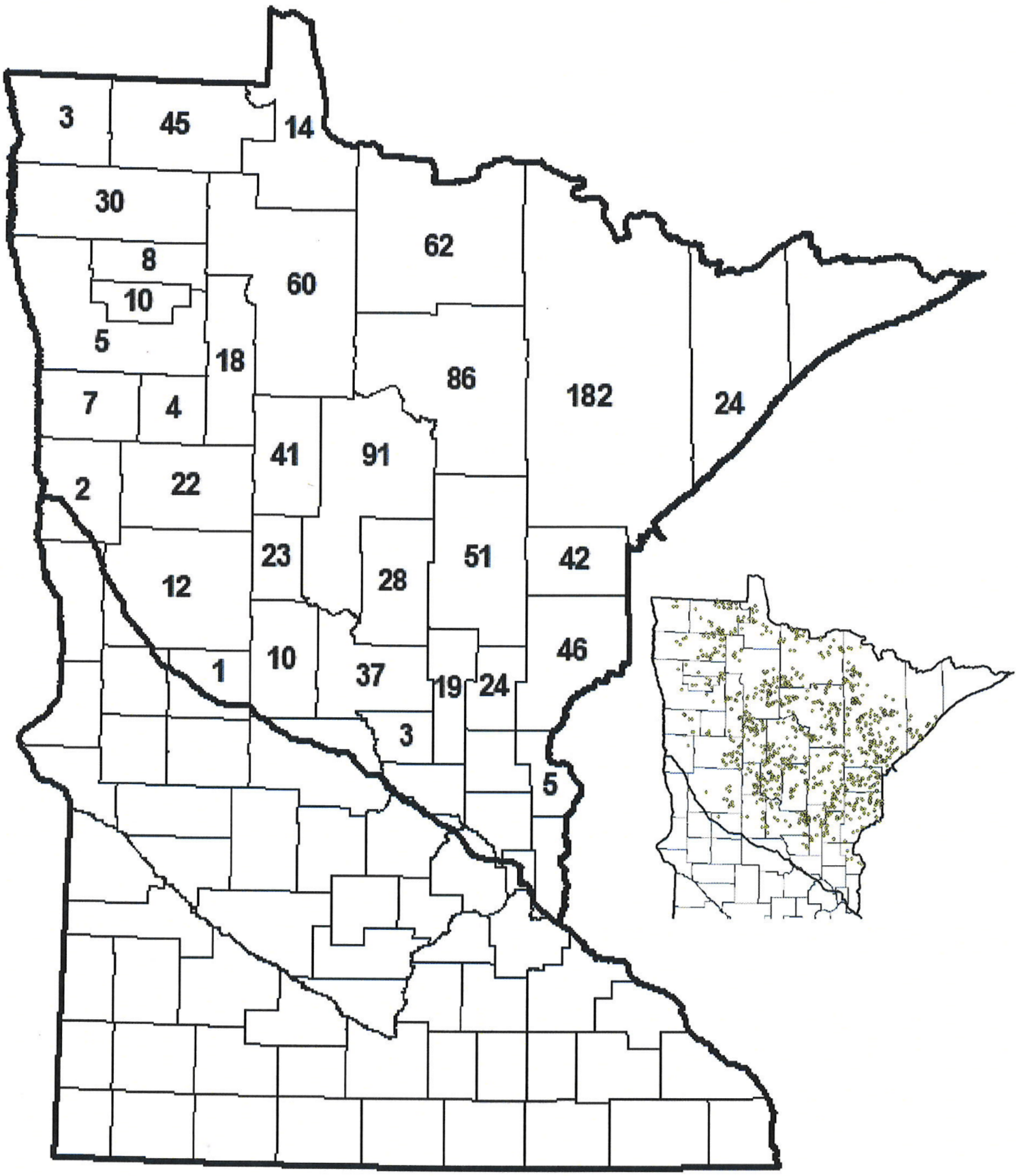

Figure 3. Bobcat harvest by county, 2018-19. Inset shows spatial distribution of harvest locations.

Table 2. Bobcat harvest by county and sex, 2018-19.

County	Sex* Male	Female	Unknown	Total	Harvest/ 100 Mile[2]
Aitkin	32	19		51	2.56
Anoka	0	0		0	0.00
Becker	10	12		22	1.52
Beltrami	29	30	1	60	1.96
Benton	2	1		3	0.73
Carlton	18	24		42	4.80
Cass	41	50		91	3.77
Chisago	3	2		5	1.13
Clay	1	1		2	0.19
Clearwater	13	5		18	1.75
Cook	0	0		0	0.00
Crow Wing	19	9		28	2.42
Douglas	0	1		1	0.14
Hubbard	19	22		41	4.10
Isanti	0	0		0	0.00
Itasca	39	47		86	2.94
Kanabec	16	8		24	4.50
Kittson	2	1		3	0.27
Koochiching	30	32		62	1.97
Lake	12	12		24	1.05
Lake of the Woods	9	5		14	0.79
Mahnomen	0	4		4	0.69
Marshall	19	11		30	1.65
Mille Lacs	6	13		19	2.79
Morrison	20	17		37	3.21
Norman	5	2		7	0.80
Otter Tail	4	8		12	0.54
Pennington	4	4		8	1.29
Pine	22	24		46	3.21
Polk	2	3		5	0.25
Red Lake	6	4		10	2.31
Roseau	22	23		45	2.68
Sherburne	0	0		0	0.00
St. Louis	80	102		182	2.70
Stearns	0	0		0	0.00
Todd	3	7		10	1.02
Wadena	11	12		23	4.23
Unknown	0	0		0	
Total	499	515	1	1015	

* 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, 2008-2018.

County	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Aitkin	64	82	73	121	142	65	105	39	22	41	51
Anoka	0	0	0	1	0	0	1	0	0	0	0
Becker	37	25	39	70	58	36	48	36	10	31	22
Beltrami	49	70	108	139	139	59	73	49	30	37	60
Benton	5	2	0	4	3	3	0	0	1	2	3
Carlton	45	44	37	94	63	42	88	25	16	33	42
Cass	98	115	117	164	150	76	126	73	44	72	91
Chisago	0	0	1	0	3	1	1	3	4	2	5
Clay	0	1	3	1	3	2	3	1	0	0	2
Clearwater	43	27	30	58	40	19	29	15	13	14	18
Cook	1	0	1	3	3	9	17	1	0	2	0
Crow Wing	36	38	29	64	65	19	32	21	7	24	28
Douglas	0	0	0	0	1	1	0	0	0	0	1
Hubbard	49	81	59	129	105	51	50	45	21	44	41
Isanti	0	0	0	0	0	1	0	1	1	0	0
Itasca	72	106	132	186	194	93	110	50	19	54	86
Kanabec	23	11	16	21	46	16	46	12	11	16	24
Kittson	9	4	9	10	7	5	5	7	6	3	3
Koochiching	31	25	54	66	82	50	40	22	25	26	62
Lake	1	2	7	15	21	13	15	8	4	8	24
Lake of the Woods	12	16	10	28	13	20	26	10	7	5	14
Mahnomen	0	4	2	9	7	4	4	3	5	2	4
Marshall	18	15	31	42	44	15	21	19	14	12	30
Mille Lacs	11	10	10	13	23	7	14	5	2	10	19
Morrison	28	13	23	25	35	15	25	16	17	19	37
Norman	0	1	0	3	6	3	8	4	1	4	7
Otter Tail	7	7	14	21	38	18	17	16	15	22	12
Pennington	9	6	5	4	13	7	3	4	1	4	8
Pine	101	49	50	94	135	54	87	56	37	43	46
Polk	4	9	9	17	20	10	16	15	10	9	5
Red Lake	0	7	16	20	25	6	11	3	1	15	10
Roseau	18	19	26	46	60	38	27	20	23	23	45
Sherburne	0	1	0	3	0	0	0	0	0	0	0
St. Louis	58	56	81	202	283	255	307	156	91	123	182
Stearns	0	0	0	0	0	2	0	1	0	0	0
Todd	14	10	9	14	16	5	8	8	9	13	10
Wadena	7	21	9	17	23	18	18	10	18	18	23
Unknown	3	7	2	7	9	0	3	12	0	0	0
Total	853	884	1012	1711	1875	1038	1384	766	485	731	1015

Table 4. Bobcat harvest by sex and week, 2018-19 season.

Date	Sex*			Total	% of Total	Cumulative %
	Male	Female	Unknown			
Nov.24 – Nov. 30	62	65	1	128	12.61	12.61
Dec.1 - Dec.7	80	95		175	17.24	29.85
Dec.8 - Dec.14	106	90		196	19.31	49.16
Dec.15 - Dec.21	91	90		181	17.83	67.00
Dec.22 - Dec.28	93	87		180	17.73	84.73
Dec.29 - Jan.6**	66	88		154	15.17	99.90
Unknown	1	0		1	0.10	100%
Total	499	515	1	1015	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, 1992-2018.

Number (%) of Takers	Number Taken					Total Takers
	1	2	3	4	5	
1992-93	69 (64)	21 (20)	9 (9)	5 (5)	2 (2)	106
1993-94	90 (70)	17 (13)	13 (10)	7 (5)	2 (2)	201
1994-95	103 (68)	25 (17)	12 (8)	6 (4)	5 (3)	151
1995-96	67 (74)	13 (14)	5 (6)	4 (4)	2 (2)	91
1996-97	115 (73)	28 (18)	85 (5)	2 (1)	4 (3)	157
1997-98	129 (61)	43 (20)	17 (8)	12 (6)	9 (5)	210
1998-99	59 (77)	11 (14)	2 (3)	3 (4)	1 (2)	76
1999-00	113 (76)	21 (14)	10 (6)	4 (3)	1(1)	149
2000-01	99 (69)	23 (16)	7 (5)	5 (4)	9 (6)	143
2001-02	101 (71)	23 (16)	12 (8)	1 (1)	5 (4)	142
2002-03	185 (60)	64 (21)	33 (10)	15 (5)	12 (4)	309
2003-04	171 (64)	40 (15)	25 (10)	20 (7)	11 (4)	267
2004-05	193 (59)	55 (17)	32 (10)	25 (7)	24 (7)	329
2005-06	198 (60)	67 (20)	33 (10)	15 (5)	18 (5)	331
2006-07	265 (57)	90 (19)	44 (9)	25 (5)	42 (9)	466
2007-08	212 (58)	71 (19)	30 (8)	16 (4)	38 (10)	367
2008-09	236 (55)	88 (21)	43 (10)	25 (6)	37 (9)	429
2009-10	223 (53)	80 (19)	40 (9)	30 (7)	51 (12)	424
2010-11	242 (50)	103 (21)	58 (12)	35 (7)	49 (10)	487
2011-12	351 (47)	126 (17)	86 (12)	62 (8)	118 (16)	743
2012-13	380 (45)	167 (20)	108 (13)	82 (10)	100 (12)	837
2013-14	350 (60)	112 (19)	51 (9)	44 (8)	26 (4)	583
2014-15	383 (54)	131 (19)	84 (12)	49 (7)	58 (8)	705
2015-16	248 (59)	87 (21)	33 (8)	29 (7)	25 (6)	422
2016-17	126 (58)	47 (22)	26 (12)	6 (3)	11 (5)	216
2017-18	257 (61)	95 (22)	31 (7)	16 (4)	25 (6)	424
2018-19	260 (53)	87 (18)	59 (12)	42 (8)	47 (9)	495

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

Table 6. Bobcat harvest by method of take, 1991-2018.

	Total	Trapping					Hunting				
Year	Harvest[a]	Harvest	% of Total	# Takers	Ave. Take	% Males[b]	Harvest	% of Total	# Takers	Ave. Take	% Males[b]
1991-92	102	59	58	31	1.9		43	42	33	1.3	
1992-93	168	133	79	85	1.6		35	21	23	1.5	
1993-94	201	147	73	88	1.7		54	27	41	1.3	
1994-95	238	189	79	120	1.6		49	21	31	1.6	
1995-96	134	73	54	53	1.4		61	46	38	1.6	
1996-97	203	133	66	91	1.5		70	34	53	1.3	
1997-98	357	313	88	176	1.8		44	12	34	1.3	
1998-99	103	95	92	67	1.4		8	8	8	1.0	
1999-00	206	155	75	114	1.4		51	25	36	1.4	
2000-01	231	140	61	85	1.6		91	39	58	1.6	
2001-02	250	208	83	116	1.8	41	42	17	27	1.6	68
2002-03	544	500	92	279	1.8	38	44	8	32	1.4	57
2003-04	483	415	86	230	1.8	46	68	14	40	1.7	65
2004-05	631	542	86	279	1.9	43	89	14	53	1.7	60
2005-06	583	435	75	250	1.7	37	148	25	85	1.7	65
2006-07	890	779	88	391	2.0	45	111	12	81	1.4	57
2007-08	702	524	75	266	2.0	40	178	25	110	1.6	48
2008-09	853	689	81	334	2.1	42	164	19	99	1.7	59
2009-10	884	736	83	340	2.2	43	148	17	91	1.6	58
2010-11	1012	817	81	372	2.2	40	195	19	123	1.6	50
2011-12	1708	1606	94	670	2.4	47	102	6	74	1.4	60
2012-13	1875	1681	90	721	2.3	46	194	10	130	1.5	52
2013-14	1038	879	85	490	1.8	40	159	15	107	1.5	55
2014-15	1384	1260	91	622	2.0	44	124	9	86	1.4	56
2015-16	766	657	86	355	1.9	49	109	14	68	1.6	70
2016-17	485	377	78	215	1.8	41	108	22	69	1.6	54
2017-18	731	606	83	335	1.8	45	125	17	93	1.3	59
2018-19	1015	865	85	406	2.1	48	150	15	98	1.5	58

[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

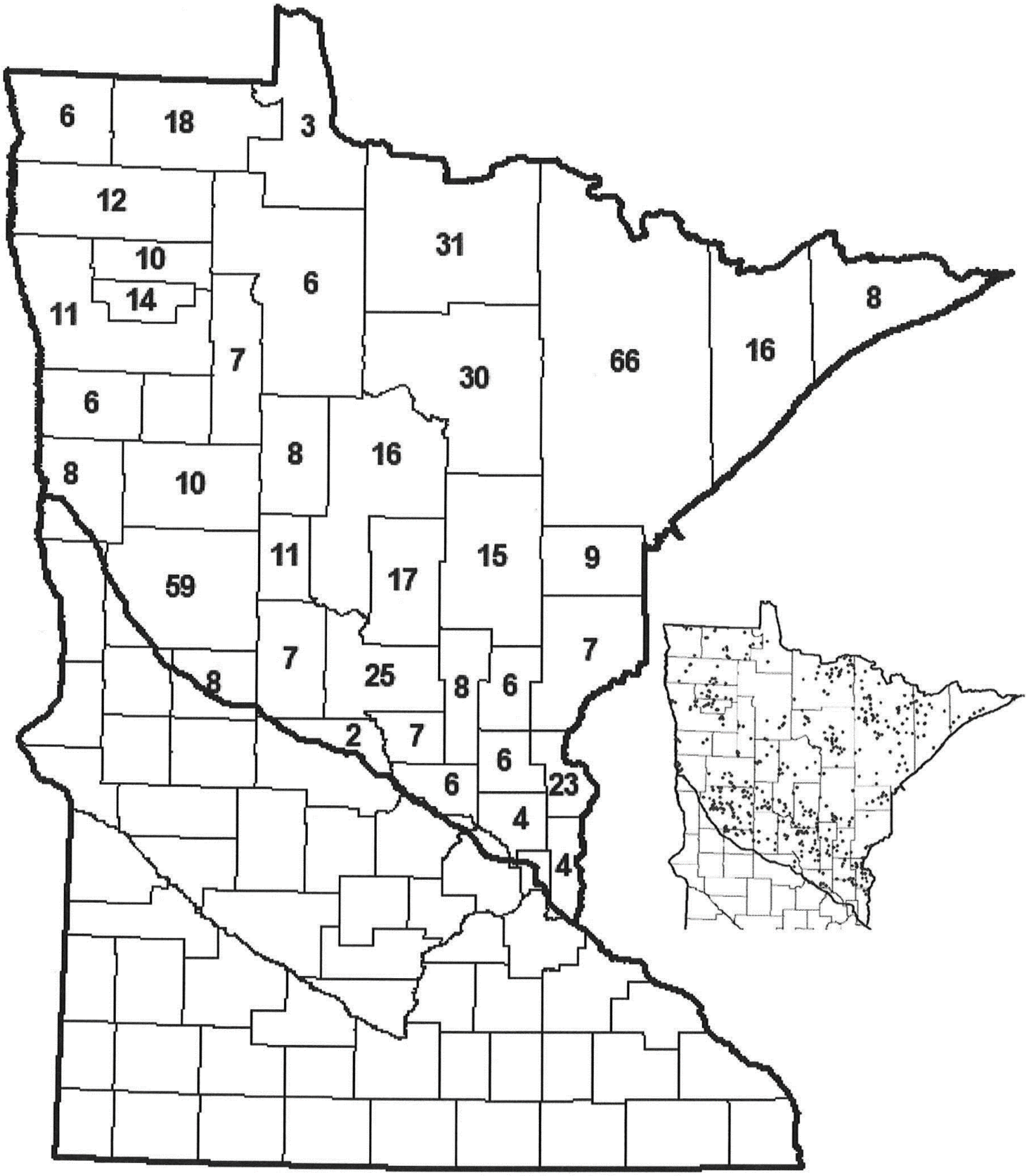

Figure 4. Fisher harvest by county, 2018. Inset shows spatial distribution of harvest locations.

Table 7. Fisher harvest by county and sex, 2018 season.

County	Sex			Total	Harvest/
	Male	Female	Unknown		100 Mile^2
Aitkin	6	9		15	0.75
Anoka	3	1		4	0.90
Becker	4	5	1	10	0.69
Beltrami	6	0		6	0.20
Benton	3	4		7	1.70
Carlton	5	4		9	1.03
Cass	12	4		16	0.66
Chisago	15	8		23	5.20
Clay	4	4		8	0.76
Clearwater	4	3		7	0.68
Cook	5	3		8	0.50
Crow Wing	8	9		17	1.47
Douglas	5	3		8	1.11
Grant	0	0		0	0.00
Hubbard	5	3		8	0.80
Isanti	3	3		6	1.33
Itasca	13	17		30	1.03
Kanabec	4	2		6	1.13
Kittson	6	0		6	0.54
Koochiching	18	13		31	0.98
Lake	5	11		16	0.70
Lake of the Woods	3	0		3	0.17
Mahnomen	0	0		0	0.00
Marshall	4	8		12	0.66
Mille Lacs	5	3		8	1.18
Morrison	13	12		25	2.17
Norman	4	2		6	0.68
Otter Tail	34	25		59	2.65
Pennington	7	3		10	1.62
Pine	5	2		7	0.49
Polk	4	7		11	0.55
Red Lake	5	9		14	3.23
Roseau	8	10		18	1.07
Sherburne	2	4		6	1.33
St. Louis	28	38		66	0.98
Stearns	0	2		2	0.14
Todd	4	3		7	0.71
Wadena	6	5		11	2.03
Washington	3	1		4	0.94
Wilkin	0	0		0	0.00
Unknown	0	0		0	
Total	269	240	1	510	

Table 8. Comparison of fisher harvest by county, 2007-2018.

County	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Aitkin	67	75	50	35	55	52	47	24	38	16	10	15
Anoka	0	2	0	0	1	2	1	2	7	4	0	4
Becker	57	36	44	30	32	45	38	21	23	3	18	10
Beltrami	40	15	22	10	25	21	17	4	8	9	6	6
Benton	0	3	2	0	5	5	2	4	3	7	4	7
Carlton	13	19	15	12	12	14	8	14	13	6	1	9
Cass	80	77	57	43	41	37	23	30	24	11	12	16
Chisago	7	4	10	6	10	3	4	16	18	11	8	23
Clay	0	3	0	6	10	6	5	6	4	4	2	8
Clearwater	19	37	13	6	8	5	12	3	2	3	0	7
Cook	29	10	11	17	28	11	13	11	5	4	3	8
Crow Wing	81	116	42	48	64	55	51	34	31	13	17	17
Douglas	2	5	2	6	15	24	8	20	12	6	2	8
Grant	0	0	0	1	0	0	0	0	0	0	0	0
Hubbard	20	38	18	13	10	11	10	8	6	5	6	8
Isanti	1	5	9	1	4	6	11	11	12	3	13	6
Itasca	195	195	166	88	142	105	116	78	47	13	34	30
Kanabec	11	26	20	13	21	27	30	9	10	6	2	6
Kittson	5	8	5	7	5	9	11	2	3	5	7	6
Koochiching	105	115	96	51	116	80	51	67	45	23	40	31
Lake	49	54	49	45	56	53	35	28	14	14	12	16
Lake of the Woods	17	42	21	9	33	21	13	12	15	6	9	3
Mahnomen	25	6	3	0	3	0	4	2	0	0	0	0
Marshall	19	26	6	7	13	14	17	22	22	6	5	12
Mille Lacs	15	17	18	18	17	20	17	12	6	13	7	8
Morrison	21	14	10	8	10	24	25	23	15	16	11	25
Norman	9	12	7	4	10	19	21	12	5	9	3	6
Otter Tail	110	152	67	100	138	121	117	102	77	41	53	59
Pennington	16	8	2	4	8	8	11	19	11	4	9	10
Pine	39	74	30	26	22	42	46	44	35	18	17	7
Polk	61	49	31	25	54	58	45	32	22	11	9	11
Red Lake	29	23	23	10	17	16	24	18	6	8	18	14
Roseau	84	89	58	20	79	61	42	32	26	15	24	18
Sherburne	0	0	3	1	6	2	2	2	2	0	0	6
St. Louis	407	283	296	186	350	233	220	171	125	61	72	66
Stearns	0	1	1	0	4	1	4	2	3	3	5	2
Todd	13	33	22	18	15	29	22	15	19	12	20	7
Wadena	27	37	23	23	31	25	23	21	26	9	17	11
Washington		1	0	0	0	1	1	0	2	2	1	4
Wilkin		0	0	0	0	1	0	0	0	0	0	0
Unknown		8	3	7	6	1	27	0	8	14	0	0
Total		1,682	1,712	1,259	903	1,473	1,293	1,146	943	756	399	510

Table 9. Fisher harvest by date and sex, 2018 season.

	Sex				% of Known	Cumulative
Date	Male	Female	Unknown	Total	Total	%
Nov. 24	6	4		10	1.96	1.96
Nov. 25	64	57		121	23.73	25.69
Nov. 26	60	53		113	22.16	47.84
Nov. 27	52	54		106	20.78	68.63
Nov. 28	46	32		78	15.29	83.92
Nov. 29	41	38	1	80	15.69	99.61
Unknown	0	2		2	0.39	100%
Total	269	240	1	510	100%	

Table 10. Distribution of fisher harvest* among trappers, 1993-2018.

Number (%) of Takers	Number Taken						
	1	2	3	4	5	Total Takers	Ave. Take
1993	239 (34)	460 (66)	----	----	----	699	1.7
1994	321 (31)	725 (69)	----	----	----	1046	1.7
1995	232 (40)	355 (60)	----	----	----	587	1.6
1996	321 (31)	726 (69)	----	----	----	1047	1.7
1997	351 (23)	1205 (77)	----	----	----	1556	1.8
1998	443 (28)	1141 (72)	----	----	----	1584	1.7
1999	397 (37)	664 (63)	----	----	----	1061	1.6
2000	301(38)	251 (31)	129 (16)	121 (15)	----	802	2.1
2001	294 (33)	271 (31)	146 (17)	168 (19)	----	879	2.2
2002	336 (35)	234 (25)	138 (15)	117 (12)	123 (13)	948	1.8
2003	403 (39)	249 (24)	150 (15)	107 (11)	115 (11)	1024	1.7
2004	390 (37)	260 (25)	184 (17)	95 (9)	132 (12)	1061	1.7
2005	407 (40)	251 (24)	150 (15)	102 (10)	118 (11)	1028	1.7
2006	510 (37)	328 (24)	208 (15)	150 (11)	171 (13)	1367	1.7
2007	416 (50)	193 (23)	104 (12)	68 (8)	57 (7)	838	1.7
2008	382 (48)	182 (23)	91 (11)	65 (8)	79 (10)	799	1.6
2009	372 (55)	156 (23)	69 (10)	42 (6)	38 (6)	677	1.6
2010	330 (54)	279 (46)	----	----	----	609	1.5
2011	553 (55)	451 (45)	----	----	----	1004	1.4
2012	453 (52)	415 (48)	----	----	----	868	1.5
2013	501 (61)	316 (39)	----	----	----	817	1.4
2014	434 (63)	254 (37)	----	----	----	688	1.4
2015	346 (63)	203 (37)	----	----	----	549	1.4
2016	177 (61)	111 (39)	----	----	----	288	1.4
2017	246 (68)	114 (32)	----	----	----	360	1.3
2018	253 (66)	128 (34)	----	----	----	381	1.3

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

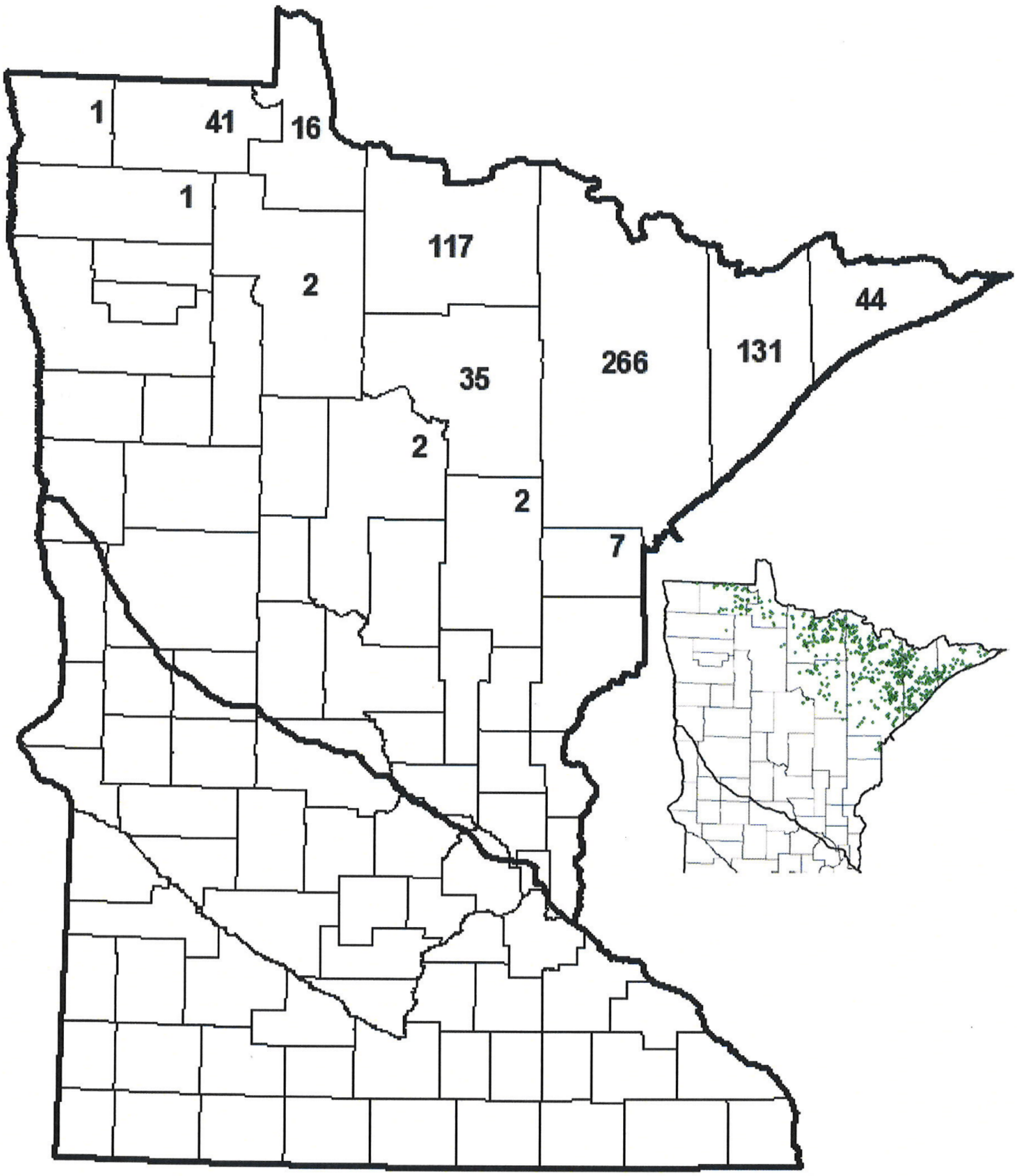

Figure 5. Marten harvest by county, 2018. Inset shows spatial distribution of harvest locations.

Table 11. Marten harvest by county and sex, 2018 season.

County	Sex: Male	Female	Unknown	Total	Harvest/ 100 Mile^2
Aitkin	2	0		2	0.10
Becker	0	0		0	0.00
Beltrami	2	0		2	0.07
Carlton	2	5		7	0.80
Cass	1	1		2	0.08
Clearwater	0	0		0	0.00
Cook	33	11		44	2.74
Crow Wing	0	0		0	0.00
Hubbard	0	0		0	0.00
Itasca	24	11		35	1.20
Kanabec	0	0		0	0.00
Kittson	1	0		1	0.09
Koochiching	83	34		117	3.71
Lake	82	49		131	5.73
Lake of the Woods	9	7		16	0.90
Mahnomen	0	0		0	0.00
Marshall	0	1		1	0.06
Otter Tail	0	0		0	0.00
Pennington	0	0		0	0.00
Pine	0	0		0	0.00
Red Lake	0	0		0	0.00
Roseau	25	16		41	2.44
St. Louis	179	87		266	3.95
Unknown	0	0		0	
Total	443	222	0	665	

Table 12. Comparison of marten harvest by county in Minnesota, 2007-2018.

County	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Aitkin	4	12	5	4	13	10	8	12	4	1	7	2
Becker	0	0	0	0	0	0	0	0	1	0	0	0
Beltrami	8	6	10	2	11	20	15	7	15	7	16	2
Carlton	1	4	8	5	6	3	1	1	0	0	7	7
Cass	0	1	2	1	2	0	0	3	2	2	2	2
Clearwater	0	0	0	0	0	0	0	0	0	0	0	0
Cook	269	151	244	191	205	148	78	43	39	23	40	44
Crow Wing	0	0	1	0	1	0	0	1	0	2	0	0
Hubbard	0	0	0	0	0	0	0	0	1	0	0	0
Itasca	74	72	91	73	118	46	62	79	64	28	52	35
Kanabec	0	0	0	0	0	0	0	0	0	0	0	0
Kittson	0	0	0	1	0	4	0	1	0	0	3	1
Koochiching	348	300	354	336	516	276	218	265	169	107	176	117
Lake	520	438	496	491	577	290	185	149	138	109	172	131
Lake of the Woods	31	17	17	13	49	32	18	23	25	21	32	16
Mahnomen	0	0	0	0	0	0	0	0	0	0	0	0
Marshall	1	0	4	0	3	3	5	5	3	1	1	1
Otter Tail	0	0	0	0	0	0	0	1	0	0	0	0
Pennington	1	0	0	0	0	0	0	0	1	0	0	0
Pine	1	0	0	1	0	0	0	1	0	0	0	0
Red Lake	0	0	0	0	0	1	1	0	0	0	0	0
Roseau	69	46	32	13	98	77	37	40	33	31	74	41
St. Louis	885	769	803	709	926	562	386	421	377	219	397	266
Unknown	9	7	6	2	0	0	0	7	5	0	0	0
Total	2,221	1,823	2,073	1,842	2,525	1,472	1,014	1,059	877	551	979	665

Table 13. Marten harvest by date and sex, 2018 season.

	Sex				% of Known	Cumulative
Date	Male	Female	Unknown	Total	Total	%
Nov. 24	3	3		6	0.90	0.90
Nov. 25	148	72		220	33.08	33.98
Nov. 26	95	47		142	21.35	55.34
Nov. 27	84	51		135	20.30	75.64
Nov. 28	55	30		85	12.78	88.42
Nov. 29	56	19		75	11.28	99.70
Unknown	2	0		2	0.30	100%
Total	443	222	0	665	100%	

Table 14. Distribution of marten harvest* among trappers, 1993-2018.

Number (%) of Takers	Number Taken						
	1	2	3	4	5	Total Takers	Ave. Take
1993	76 (10)	681 (90)	----	----	----	757	1.9
1994	165 (20)	681 (80)	----	----	----	846	1.8
1995	78 (10)	711 (90)	----	----	----	789	1.9
1996	157 (18)	734 (82)	----	----	----	891	1.8
1997	161 (13)	1050 (87)	----	----	----	1211	1.9
1998	187 (15)	1056 (85)	----	----	----	1243	1.8
1999	164 (17)	318 (34)	213 (23)	246 (26)	----	941	2.6
2000	188 (28)	190 (28)	123 (18)	173 (26)	----	674	2.4
2001	147 (23)	175 (27)	138 (21)	187 (29)	----	647	2.6
2002	149 (21)	138 (19)	147 (21)	123 (17)	160 (22)	717	1.9
2003	126 (15)	135 (16)	159 (19)	170 (20)	265 (31)	855	1.8
2004	165 (17)	153 (16)	171 (18)	164 (18)	282 (30)	935	1.8
2005	191 (22)	158 (18)	139 (16)	156 (18)	215 (25)	859	1.8
2006	206 (18)	201 (17)	226 (19)	203 (17)	335 (29)	1171	1.8
2007	176 (23)	160 (21)	147 (19)	141 (18)	142 (19)	766	2.0
2008	153 (24)	139 (22)	108 (17)	110 (17)	122 (19)	632	1.9
2009	121 (19)	105 (16)	106 (17)	134 (21)	173 (27)	639	1.9
2010	95 (17)	77 (14)	120 (22)	92 (17)	170 (31)	554	1.8
2011	154 (19)	131 (16)	179 (22)	166 (20)	181 (22)	811	2.0
2012	198 (33)	134 (22)	131 (22)	73 (12)	64 (11)	600	1.9
2013	341 (51)	332 (49)	----	----	----	673	1.5
2014	307 (45)	376 (55)	----	----	----	683	1.6
2015	247 (44)	309 (56)	----	----	----	556	1.6
2016	142 (41)	202 (59)	----	----	----	344	1.6
2017	233 (39)	365 (61)	----	----	----	598	1.6
2018	200 (46)	231 (54)	----	----	----	431	1.5

* 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, 2018. (Combined limit = 2)

Number of Takers		Number of Marten					
		0	1	2	3	4	5
Number of Fisher	0		121	231			
	1	174	79				
	2	128					
	3						
	4						
	5				Total takers of at least 1 fisher or marten		733

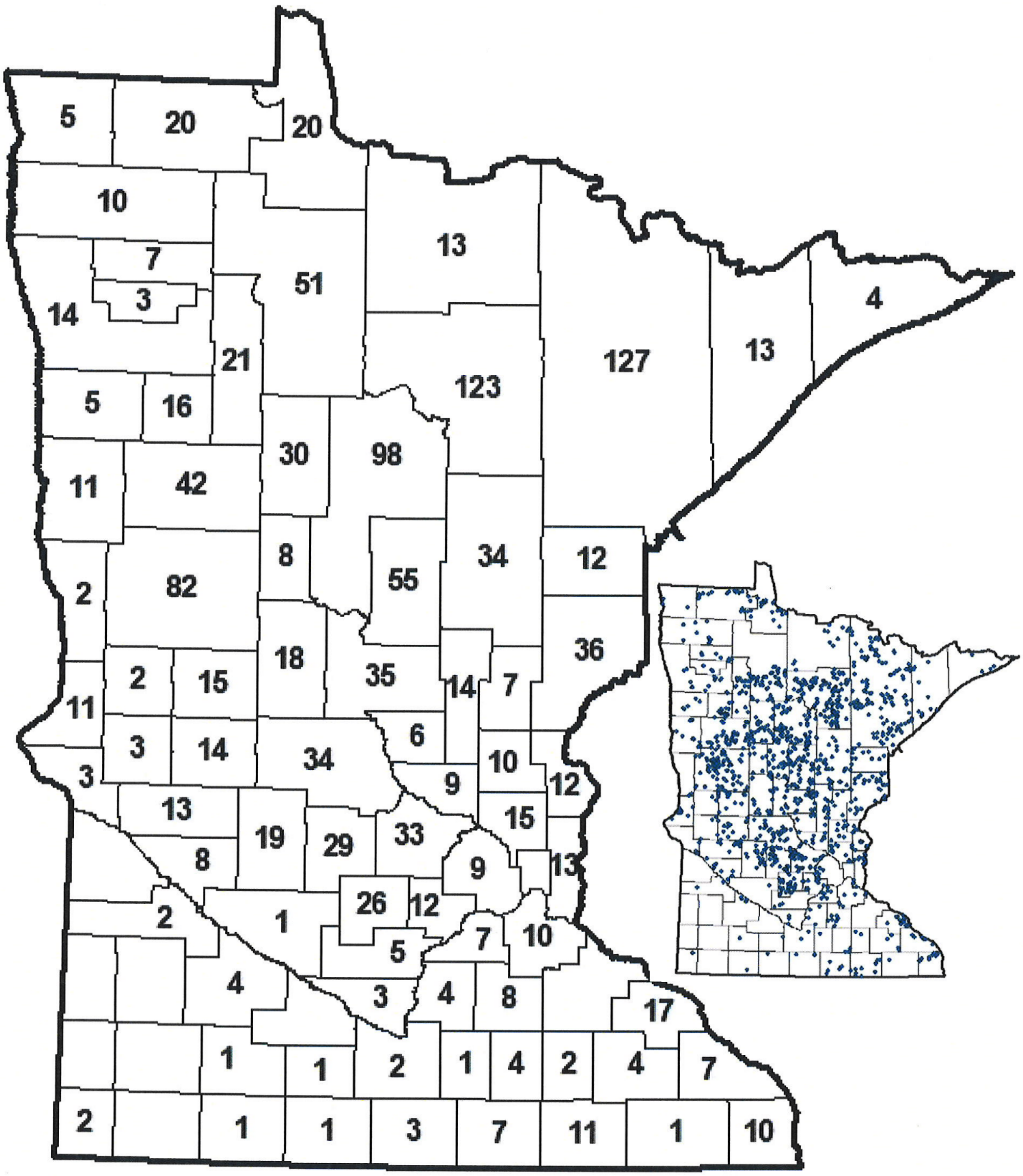

Figure 6. Otter harvest by county, 2018-19. Inset shows spatial distribution of harvest locations.

Table 16. Otter harvest by county and sex, 2018-19 season.

County	Sex			Total	Harvest/ 100 Mile^2
	Male	Female	Unknown		
Aitkin	22	12		34	1.71
Anoka	9	6		15	3.37
Becker	22	20		42	2.91
Beltrami	27	27		51	1.67
Benton	3	3		6	1.45
Big Stone	3	0		3	0.57
Blue Earth	2	0		2	0.26
Brown	0	0		0	0.00
Carlton	7	5		12	1.37
Carver	9	3		12	3.19
Cass	55	43		98	4.06
Chippewa	4	4		8	1.36
Chisago	10	2		12	2.71
Clay	6	5		11	1.04
Clearwater	9	12		21	2.04
Cook	2	2		4	0.25
Cottonwood	0	11		1	0.15
Crow Wing	30	25		55	4.76
Dakota	7	3		10	1.71
Dodge	2	0		2	0.46
Douglas	8	7		15	2.08
Faribault	2	1		3	0.42
Fillmore	1	0		1	0.12
Freeborn	4	3		7	0.97
Goodhue	0	0		0	0.00
Grant	0	2		2	0.35
Hennepin	2	7		9	1.48
Houston	5	5		10	1.76
Hubbard	12	18		30	3.00
Isanti	3	7		10	2.22
Itasca	76	47		123	4.20
Jackson	1	0		1	0.14
Kanabec	6	1		7	1.31
Kandiyohi	6	13		19	2.20
Kittson	5	0		5	0.45
Koochiching	5	8		13	0.41
Lac Qui Parle	0	0		0	0.00
Lake	8	5		13	0.57
Lake of the Woods	10	10		20	1.12
Le Sueur	3	1		4	0.84
Lincoln	0	0		0	0.00
Lyon	0	0		0	0.00
Mahnomen	10	6		16	2.74
Marshall	6	4		10	0.55
Martin	1	0		1	0.14
McLeod	18	8		26	5.15
Meeker	17	12		29	4.50
Mille Lacs	7	7		14	2.06
Morrison	21	14		35	3.04
Mower	5	6		11	1.55
Murray	0			0	0.00
Nicollet	2	1		3	0.64
Nobles	0	0		0	0.00
Norman	1	4		5	0.57
Olmsted	3	1		4	0.61

Table 16 (continued). Otter harvest by county and sex, 2018-19 season.

County	Sex			Total	Harvest/
	Male	Female	Unknown		100 Mile^2
Otter Tail	46	35	1	82	3.69
Pennington	4	3		7	1.13
Pine	21	15		36	2.51
Pipestone	0	0		0	0.00
Polk	7	7		14	0.70
Pope	7	7		14	1.95
Ramsey	0	0		0	0.00
Red Lake	2	1		3	0.69
Redwood	2	2		4	0.45
Renville	0	1		1	0.10
Rice	6	2		8	1.55
Rock	1	1		2	0.41
Roseau	12	8		20	1.19
Scott	5	2		7	1.90
Sherburne	5	4		9	2.00
Sibley	3	2		5	0.83
St. Louis	79	48		127	1.88
Stearns	19	15		34	2.45
Steele	2	2		4	0.93
Stevens	2	1		3	0.52
Swift	7	6		13	1.73
Todd	10	8		18	1.84
Traverse	6	5		11	1.88
Wabasha	8	9		17	3.10
Wadena	5	3		8	1.47
Waseca	0	1		1	0.23
Washington	7	6		13	3.07
Watonwan	0	1		1	0.23
Wilkin	2	0		2	0.27
Winona	5	2		7	1.09
Wright	21	12		33	4.62
Yellow Medicine	2	0		2	0.26
Unknown	0	0		0	
Total	773	577	1	1,351	

Table 17. Comparison of otter harvest by county, 2007 - 2018.

County	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Aitkin	53	65	54	59	107	111	90	67	74	61	33	34
Anoka	26	18	26	8	13	31	25	23	20	12	18	15
Becker	54	55	39	53	95	127	87	77	83	21	27	42
Beltrami	105	80	74	77	112	120	98	74	76	43	40	51
Benton	9	11	3	13	13	21	17	8	1	3	3	6
Big Stone	0	2	1	0	3	3	9	8	3	1	6	3
Blue Earth	0	0	0	0	2	3	1	2	1	3	3	2
Brown	0	0	0	0	0	0	0	0	2	2	0	0
Carlton	36	29	30	35	29	38	37	26	42	32	9	12
Carver	2	5	6	5	15	8	9	17	11	8	8	12
Cass	124	160	90	135	140	183	161	193	172	74	92	98
Chippewa	0	0	0	5	7	8	12	6	4	3	8	8
Chisago	16	15	18	23	19	24	32	26	20	12	18	12
Clay	8	14	7	23	42	23	16	14	18	10	10	11
Clearwater	39	35	19	38	41	46	47	23	38	21	33	21
Cook	13	12	16	19	36	55	57	28	9	4	0	4
Crow Wing	63	99	76	66	107	117	96	83	59	35	41	1
Dakota	0	5	7	1	0	11	10	6	13	3	8	55
Dodge	0	0	0	3	1	1	3	4	2	0	3	10
Douglas	18	28	11	14	34	37	23	33	22	21	15	2
Faribault	0	0	0	0	1	12	3	1	3	5	9	15
Fillmore	6	1	1	5	5	10	6	13	3	3	4	3
Freeborn	0	0	0	5	10	10	1	7	6	2	11	1
Goodhue	3	3	7	11	7	18	2	2	11	4	9	7
Grant	3	3	6	1	8	12	6	13	4	3	5	0
Hennepin	1	3	6	2	3	4	5	6	3	2	2	2
Houston	9	15	11	11	10	26	22	14	9	2	8	9
Hubbard	59	72	41	52	42	67	61	36	32	26	39	10
Isanti	30	17	18	14	9	18	28	23	13	17	13	30
Itasca	205	201	191	247	281	346	345	184	159	67	84	10
Jackson	0	0	0	0	0	0	0	0	1	0	0	123
Kanabec	44	29	23	17	22	52	45	34	26	20	29	1
Kandiyohi	2	6	6	8	8	10	20	20	23	17	18	7
Kittson	11	2	3	8	2	9	7	4	0	8	8	19
Koochiching	70	95	61	81	62	127	115	55	68	19	16	5
Lac Qui Parle	0	0	0	2	6	15	6	1	7	0	8	13
Lake	35	34	45	28	36	66	67	45	26	23	12	0
Lake of the Woods	30	17	8	15	27	27	27	31	31	8	16	13

Table 17 (continued). Comparison of otter harvest by county, 2007 - 2018.

County	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Le Sueur	0	0	0	3	0	9	5	2	2	4	3	4
Lincoln	0	0	0	0	0	4	0	0	0	0	2	0
Lyon	0	0	0	0	0	0	0	0	0	0	1	0
Mahnomen	24	7	7	9	20	15	25	7	6	3	9	16
Marshall	6	2	0	13	13	15	15	4	9	12	15	10
Martin	0	0	0	0	0	1	0	0	1	1	1	1
McLeod	6	6	8	12	18	19	22	18	16	14	16	26
Meeker	13	13	16	12	28	19	32	35	23	11	26	29
Mille Lacs	33	26	28	19	15	30	39	28	16	13	26	14
Morrison	45	43	31	29	29	52	52	50	31	22	24	35
Mower	0	0	0	8	20	14	9	8	2	13	7	11
Murray	0	0	0	0	0	0	0	0	1	0	0	0
Nicollet	0	0	0	2	1	5	7	1	0	0	4	3
Nobles	0	0	0	0	0	0	0	4	0	0	0	0
Norman	9	17	11	12	21	45	27	19	13	9	8	5
Olmsted	0	2	3	2	3	0	7	7	5	3	5	4
Otter Tail	50	82	32	65	109	173	154	97	87	92	100	82
Pennington	9	0	1	4	2	12	5	8	8	11	2	7
Pine	50	74	37	38	44	66	98	59	86	48	20	36
Pipestone	0	0	0	0	0	0	0	0	0	1	1	0
Polk	32	25	19	36	49	83	71	47	37	20	12	14
Pope	11	12	12	11	20	22	14	19	8	19	8	14
Ramsey	0	0	0	0	0	3	1	1	1	0	0	0
Red Lake	19	8	20	22	19	26	11	10	14	13	1	3
Redwood	0	0	0	0	2	4	6	8	3	0	2	4
Renville	0	0	0	0	1	6	0	3	1	1	6	1
Rice	0	0	0	1	9	4	8	1	2	6	3	8
Rock	0	0	0	0	0	2	0	0	0	2	0	2
Roseau	32	53	23	32	33	64	48	44	23	24	22	20
Scott	3	3	1	4	2	4	3	2	4	5	4	7
Sherburne	26	10	17	7	19	12	9	10	10	11	8	9
Sibley	0	0	0	6	6	6	3	2	3	2	2	5
St. Louis	290	251	233	253	239	363	293	258	260	109	146	127
Stearns	9	38	24	13	41	53	53	41	50	45	28	34
Steele	0	0	0	1	0	3	1	0	1	3	3	4
Stevens	1	3	1	6	1	3	12	4	2	1	1	3
Swift	9	4	5	2	11	10	10	9	3	7	7	13
Todd	35	37	32	41	63	55	55	19	28	22	24	18

Table 17 (continued). Comparison of otter harvest by county, 2007-2018.

County	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Traverse	1	0	2	0	1	4	1	0	3	7	4	11
Wabasha	15	7	18	7	8	20	21	19	9	11	11	17
Wadena	15	19	15	16	20	43	30	30	19	5	8	8
Waseca	0	0	0	0	0	0	0	2	2	0	0	1
Washington	18	19	11	16	18	12	24	27	9	12	20	13
Watonwan	0	0	0	0	0	0	1	0	0	0	0	1
Wilkin	2	0	0	0	0	3	2	0	3	1	2	2
Winona	11	19	13	15	20	21	17	5	17	6	13	7
Wright	7	9	8	11	17	23	26	21	21	11	22	33
Yellow Medicine	0	0	0	0	0	7	9	0	3	0	2	2
Unknown	6	18	12	2	17	40	2	18	18	0	0	0
Totals	1,861	1,938	1,544	1,814	2,294	3,171	2,824	2,154	1,955	1,195	1,295	1,351

Table 18. Otter harvest by sex and week, 2018-19 season.

Date	Sex			Total Harvest	% of Total	Cumulative %
	Male	Female	Unknown			
Oct.27 - Nov.2	156	121		277	20.50	20.50
Nov.3 - Nov.9	130	101		231	17.10	37.60
Nov.10 - Nov.16	76	52		128	9.47	47.08
Nov.17 - Nov.23	63	45		108	7.99	55.07
Nov.24 – Nov. 30	100	66		166	12.29	67.36
Dec.1 - Dec.7	67	45		112	8.29	75.65
Dec.8 - Dec.14	51	33		84	6.22	81.87
Dec.15 - Dec.21	36	42	1	79	5.85	87.71
Dec.22 - Dec.28	55	41		96	7.11	94.82
Dec.29 - Jan.6*	39	30		69	5.11	99.93
Unknown	0	1		1	0.07	100.00
Total	773	577	1	1,351	100%	

* 9-day interval

Table 19. Distribution of otter harvest* among trappers, 1993-2018.

Number (%) of Takers	Number Taken					
	1	2	3	4	Total Takers	Ave. Take
1993-94	193 (33)	115 (19)	100 (17)	184 (31)	592	2.5
1994-95	250 (27)	185 (20)	143 (15)	349 (38)	927	2.6
1995-96	183 (31)	134 (23)	88 (15)	180 (31)	585	2.5
1996-97	257 (29)	205 (23)	140 (16)	283 (32)	885	2.5
1997-98	304 (33)	235 (26)	117 (13)	255 (28)	911	2.4
1998-99	263 (32)	183 (23)	139 (17)	226 (28)	811	2.4
1999-00	222 (33)	124 (19)	99 (15)	217 (33)	662	2.5
2000-01	206 (32)	122 (19)	108 (17)	201 (32)	637	2.5
2001-02	147 (23)	175 (27)	138 (21)	187 (29)	647	2.6
2002-03	253 (33)	147 (19)	122 (16)	241 (32)	763	2.5
2003-04	269 (27)	201 (20)	152 (16)	361 (37)	983	2.6
2004-05	302 (25)	235 (19)	182 (15)	498 (41)	1217	2.7
2005-06	291 (27)	213 (20)	186 (17)	386 (36)	1076	2.6
2006-07	372 (34)	216 (19)	194 (17)	328 (30)	1110	2.4
2007-08	308 (39)	153 (19)	119 (15)	207 (26)	787	2.3
2008-09	293 (37)	157 (20)	121 (15)	216 (27)	787	2.3
2009-10	237 (38)	131 (21)	93 (15)	171 (27)	632	2.3
2010-11	263 (34)	166 (22)	130 (17)	206 (27)	765	2.4
2011-12	438 (42)	227 (22)	149 (14)	236 (22)	1050	2.2
2012-13	468 (35)	330 (24)	175 (13)	376 (28)	1349	2.3
2013-14	561 (43)	291 (22)	196 (15)	271 (21)	1319	2.1
2014-15	424 (42)	231 (23)	154 (15)	200 (20)	1009	2.1
2015-16	337 (39)	183 (21)	142 (16)	203 (23)	865	2.2
2016-17	270 (46)	135 (23)	80 (14)	101 (17)	586	2.0
2017-18	243 (41)	139 (23)	77 (13)	135 (23)	594	2.2
2018-19	276 (44)	134 (21)	78 (12)	142 (23)	630	2.1

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