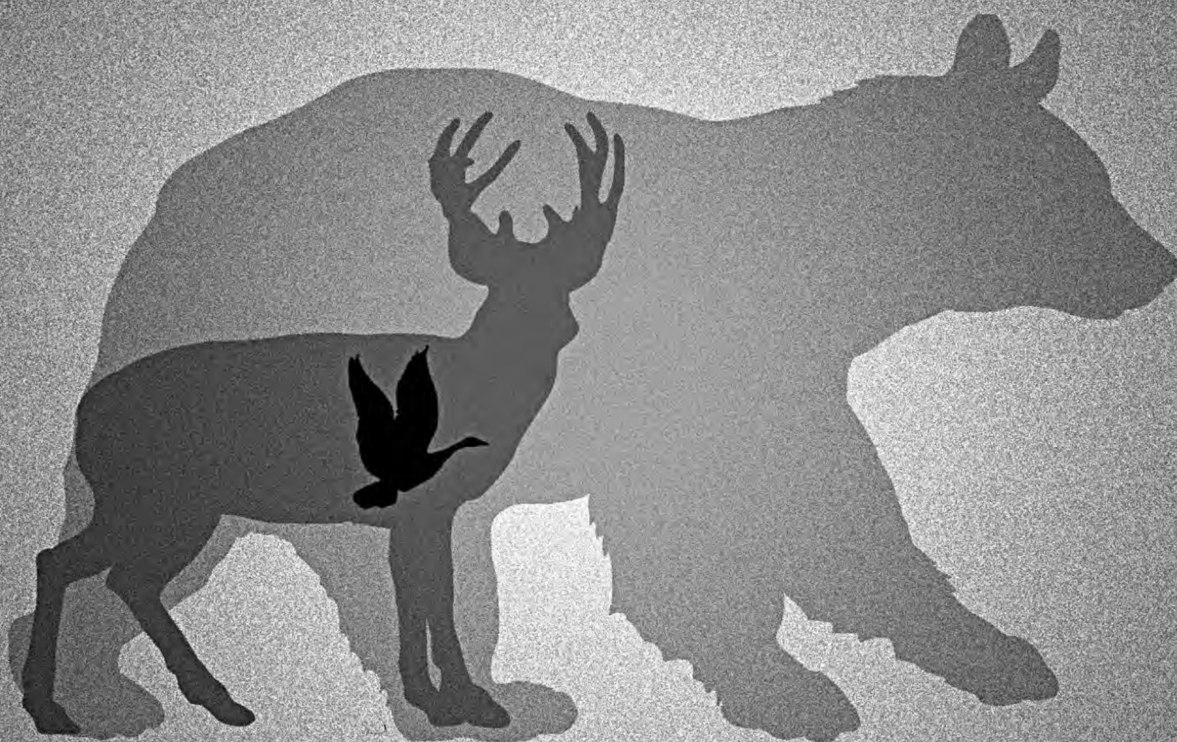

Status of Wildlife Populations

Fall 2024

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 2024

(Including 2014-2024 Hunting and Trapping Harvest Statistics)

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

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Status of Wildlife Populations, Fall 2024

(Including 2014-2024 Hunting and Trapping Harvest Statistics)

This is the 48th 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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2024 MINNESOTA AUGUST ROADSIDE SURVEY

Steven Woodley

SUMMARY OF FINDINGS

INTRODUCTION

Since 1955, the Minnesota Department of Natural Resources (MN DNR) wildlife and enforcement personnel have conducted the annual August Roadside Survey (ARS) during the first two weeks of August throughout Minnesota's farmland regions (Figure 1). Initially developed to provide indices of common upland game species (ring-necked pheasant, grey [Hungarian] partridge, eastern cottontail rabbits, white-tailed jackrabbits, and mourning doves), the survey now formally indexes white-tailed deer and sandhill cranes. The current ARS includes 170 survey routes in 70 counties throughout Minnesota. Two routes were dropped starting this year due to >33% paved and high traffic concerns due to development. The results of the annual survey are made publicly available in the annual ARS report (e.g., Woodley 2024).

OBJECTIVES

1. Index game birds and other common game species within the historic "pheasant range" of Minnesota and throughout the farmland and transition zones of the state.
2. Analyze results to provide public information about population trends of focal species.
3. Summarize weather and habitat conditions that may impact the population trends of pheasants or other focal species.

METHODS

Survey protocol

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, and sandhill cranes they observed. They also recorded information on the sex and age of these species when applicable. Surveys were only performed on mornings with dew, cloud cover <60%, and wind speeds <10mph. 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 with these conditions. These data provide an index of relative abundance that is used to monitor annual changes and long-term trends in regional and range-wide populations. Results are reported by agricultural region and range-wide; however, population indices for species with low detection rates (e.g., white-tailed jackrabbits) are imprecise and unreliable.

Observers recorded the number of male (rooster), female (hen), and juvenile pheasants, whether females were present with a brood, and the estimated age of chicks in each brood. The same measurements were recorded for gray partridge, but adult birds were not sexed because they are not sexually dimorphic. Age and sex were recorded for both white-tailed deer and sandhill cranes when observed. Observers only reported a total count (no sex or age information) for mourning doves and rabbits.

Habitat data collection

We queried the MN DNR GIS database files of Wildlife Management Areas (WMAs) and summed the total area of parcels by county to obtain an estimate of protected habitat. Due to difficulties in classifying vegetation types from remotely sensed data products, this estimate includes areas that are unsuitable for upland habitats (i.e., closed-canopy forests). Aquatic Management Areas and State Parks were not included in this tally as we assume they do not make a meaningful contribution to upland habitat within the state. We obtained information on additional public lands, primarily National Wildlife Refuges (NWRs) and Waterfowl Production Areas (WPAs) from the U.S. Fish and Wildlife Service (USFWS). Finally, we obtained estimates of potential upland habitat on private lands from the Minnesota Board of Water and Soil Resources (BWSR). These lands were enrolled in state or federal programs that retire cropland temporarily (e.g., Conservation Reserve Program [CRP]) or permanently (e.g., Conservation Reserve Enhancement Program [CREP], Reinvest in Minnesota [RIM]).

Weather data collection

We obtained precipitation and temperature data summaries from the Midwest Regional Climate Center ([MRCC]; 2024) and Minnesota Department of Natural Resources ([MDNR]; 2024) for each of the agricultural regions covered by the ARS. We used weekly maps of interpolated snow depth provided by the Minnesota State Climatology Office to compute the mean snow depth for the winter season (December 1 through March 31) in each agricultural region.

Analysis

We computed averages and annual change, as well as 10-year and long-term (since 1955) trend statistics for each focal species. We computed statistics at the state and regional scale, though results from regional analyses are more biased due to the smaller sample sizes. In the analysis, we treated each year and route combination as an independent sample when computing annual change and trend statistics. Thus, the average proportional change for the state or region is the mean of proportional changes at the route level. Confidence intervals were calculated using critical values from Student’s T-distribution.

We calculated additional statistics for pheasants, including the mean estimated hatch date and proportion of hens with a brood. We estimated the mean hatch date by back-calculating the hatch date for each brood based on its estimated age during the survey. We used the proportion of hens with broods as an index of breeding success among hens.

RESULTS

Habitat Conditions

Habitat acres on public and private lands in the primary pheasant range increased by 9,781 acres in 2024. There was an approximately 4,000-acre decline in lands enrolled in the

Conservation Reserve Program (CRP) compared to 2023; however, this was offset by increases in private lands enrolled in the Conservation Reserve Enhancement Program (CREP), Reinvest in Minnesota (RIM) and lands managed by the U. S. Fish and Wildlife Service (USFWS) and MN DNR for public use (Table 1). Private lands enrolled in the CREP and RIM programs increased by 1,545 and 3,713 acres, respectively (Table 1). Federally managed USFWS Waterfowl Production Areas, wildlife refuges, and conservation easements increased by approximately 6,000 acres, and Wildlife Management Areas managed by the DNR increased by approximately 2,300 acres (Table 1). Total protected lands account for 6.7% of lands within the pheasant range, similar to the value in 2023 (6.6%). The West Central and Southwest regions have the highest proportion of protected lands, 10.1% and 7.4%, respectively, and account for 40% of all protected land in the pheasant range (Table 1).

Weather Summary

Following National Oceanic and Atmospheric Administration conventions, the 30-year period used to calculate normal temperatures now includes 1991-2020. Statewide weather conditions for pheasants were warmer in 2023-2024, with wetter spring and summer conditions. Winter conditions across the state were milder than average, primarily because of low snowfall levels throughout the state (Table 2). The average snow depth was 1 inch or less in all regions except the Northwest region, which averaged 1.9 inches (Table 2). All regions were 7.8 degrees or more warmer than average during winter (Table 2). Spring was warmer and wetter than average across the state (Table 2). Summer was also slightly warmer across the state, except for the Southeast region, and wetter, especially in the Southwest, South Central, and Southeast regions (Table 2).

Survey Conditions

Weather conditions during surveys were very good in 2024. Temperature, dew, wind, and sky cover conditions were all similar to 10-year averages. Thus, weather conditions in 2024 were unlikely to substantially influence survey results.

Species Reports

Ring-necked Pheasant

The 2024 range-wide total pheasant index (52.1 birds/100 mi) was similar to 2023 (51.2 birds/100 mi; Table 3, Figure 2A). Range-wide indices of hens and broods increased (32% and 10%, respectively) compared to 2023, whereas the rooster index remained similar (Table 3). The number of chicks per brood (4.2) and broods per 100 hens (76.9) declined from 2023 (Table 3). The total number of pheasants, hens, roosters, and broods per 100 miles all exceeded their 10-year averages, but the index of broods per 100 hens and chicks per brood declined by 21% and 12%, respectively, from the 10-year averages (98.8 and 4.7, respectively; Table 3). All range-wide indices in 2024 were below the long-term averages (Table 3). The index of chicks per brood in 2024 (5.0) is 12% less than the 10-year average (4.7) and 25% less than the long-term average (5.6; Table 3). This suggests that nesting and brood-rearing in 2024 was not as successful relative to last year (2023). Despite the relatively stable index statewide, trends in the pheasant index varied among regions. The pheasant index increased the most from 2023 in the East Central region (70%), followed by the Central (34%), South Central (8%), and West Central (6%) regions (Table 4). Indices declined in the Southwest (-29%) and Southeast (-9%) regions (Table 4). Pheasant indices remain well below their long-term averages in all regions but are near or above their ten-year averages except for the East Central and Southeast regions (Table 4). The Southwest (81.8 birds/100 mi) and West Central (65.9 birds/100 mi) regions had the highest indices, followed by the South Central region (58.6 birds/100 mi). These regions should provide the best hunting opportunities in the state.

Gray Partridge

The 2024 range-wide gray partridge index (1.8 birds/100 mi) was less than 2023 (4.3 birds/100 mi) and the 10-year average (2.7 birds/100 mi). The partridge index remains 85% below the long-term average (12.1 birds/100 mi; Table 3, Figure 2B). Partridges are generally rare throughout the state but may be locally abundant. In 2024, the Southwest (11.4 birds/100 mi) region had the greatest number of observations and should provide the best opportunities for harvesting gray partridge (Table 4). All other regions had less than 1.3 birds/100 mi (Table 4).

Cottontail Rabbit and White-tailed Jackrabbit.

Range-wide, the 2024 eastern cottontail rabbit index (8.7 rabbits/100 mi) increased from 2023 (5.5 rabbits/100 mi) and is above the 10-year average (5.8 rabbits/100 mi) and the long-term average (6.0 rabbits/100 mi; Table 3, Figure 3A). The West Central, Central, East Central, and South Central regions saw the greatest increases in their cottontail index (Table 4). The greatest increase was in the South Central region, where the cottontail index increased 171% to 12.9 rabbits/100 mi. The best rabbit hunting opportunities will be in the South Central, Southeast, and East Central regions (Table 4).

White-tailed jackrabbits were observed on nine routes: Northwest (4 routes), West Central (3 routes), Southwest (1 route) and Central (1 route). Eight routes reported a single jackrabbit, while three jackrabbits were observed on one route. Jackrabbits are rarely detected, making annual or short-term trend comparisons difficult. Still, the jackrabbit index remains below the long-term average (Table 3, Figure 3B). 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 the loss of preferred habitats (e.g., pasture, hayfields, and small grains).

White-tailed Deer

The 2024 white-tailed deer range-wide index (31.6 deer/100 mi) increased by 25% compared to 2023 (25.4 deer/100 mi) and was 16% above the 10-year average (Table 3, Figure 4A). The range-wide index was 172% above the long-term average (11.5 deer/100 mi; Table 3, Figure 4A). Regional indices for deer remained relatively similar in the Southwest, South Central, and Southeast regions and increased (range, 16-50%) in the other regions (Table 4).

Mourning Dove

The 2024 range-wide mourning dove index (142.5 doves/100 mi) decreased 38% compared to the 2023 index (230.7 doves/100 mi), was similar to the 10-year average (144.1 doves/100 mi), and was 41% below the long-term average (236.2 doves/100 mi; Table 3, Figure 4B). The dove index decreased across all regions (range, -16% to -51%; Table 4). Dove indices were greatest in the Southwest (214.8 doves/100 mi) and West Central (209.3 doves/100 mi) regions and should provide the greatest opportunities for harvesting doves.

Sandhill Crane

The 2024 statewide index of sandhill cranes (16.4 total cranes/100 mi) was 43% greater than in 2023 (11.5 total cranes/100 mi; Table 3). Annual changes in regional indices varied greatly. The Northwest and West Central regions saw a 211% and 189% increase in the total crane index, respectively (Table 4). Statewide, the total crane index was greater than the 10-year average (13.8 total cranes/100 mi; Table 3). Regionally, the Northwest and Central indices were 20% and 17% below their 10-year averages, respectively. However, the number of cranes increased in the South Central region by 99% (5.5 cranes/100 mi) compared to the 10-year average (2.8 cranes/100 mi) (Table 4). Crane observations during the ARS are less frequent in the West Central, South Central, and Southeast regions, however, and have yet to be reported in the Southwest region.

Other Species

Notable incidental sightings recorded by observers included sharp-tailed grouse (Red Lake County), red-headed woodpeckers (Freeborn, Pipestone, and Mower counties), and a black bear (Polk County).

ACKNOWLEDGMENTS

We thank our many cooperators for completing the routes required for this survey; without their efforts, this survey would not be possible. Dusty VanThuyne (Minnesota Board of Water and Soil Resources) provided enrollment data on cropland retirement programs in Minnesota, and Lisa Rairdin (U.S. Fish and Wildlife Service) provided federal land acquisition data. Kate Carlson (MNIT Services Regional GIS Support) assisted with updating spatial layers. John Giudice (MN DNR Wildlife Research) was invaluable in assisting with the statistical analyses and reviewing an earlier draft of this report. Nicole Davros and Seth Gorham (MN DNR Wildlife Research) also reviewed an earlier draft of this report. This work was funded in part through the Federal Aid in Wildlife Restoration Act.

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Table 1. Abundance (total acres) and density (acres/mi^2) of undisturbed grassland habitat within Minnesota's pheasant range, 2024, 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	240,680	42,965	23,347	14,275	20,207	225,843	115,934	683,251	10.1%	64.4
SW	120,943	36,782	21,735	2,553	766	28,710	69,941	281,430	7.4%	47.6
C	122,968	21,743	51,457	7,026	3,190	95,227	56,126	357,737	5.9%	37.9
SC	102,416	37,016	13,917	10,780	9,107	12,754	40,023	226,013	5.6%	35.8
SE	75,600	4,020	7,290	1,070	1,577	37,294	59,469	186,320	5.0%	32.2
EC	2,463	0	1,948	0	4	4,994	97,459	106,868	3.3%	21.3
Total	665,070	142,526	119,694	35,704	34,851	404,822	438,952	1,841,619	6.7%	42.7

[a] Unpublished data, BWSR, 2 August 2024.
[b] Includes USFWS Waterfowl Production Areas (WPA), USFWS refuges, & USFWS conservation easements.
[c] MN DNR Wildlife Management Areas (WMA). Comparisons to 2020 and earlier years are invalid due to data source changes.

Table 2. Average temperature, snow depth, and precipitation by season and agricultural region in Minnesota, 2024.

	Agricultural Region							
	NW	WC	C	EC	SW	SC	SE	STATE
Winter (December 1 - March 31)								
Temperature (average °F)	22.8	27.1	28.2	27.2	28.8	30.1	30.4	27.8
Departure from normal (°F)[a]	8.9	9.1	9.1	8.8	7.8	8.6	8.6	8.7
Snow Depth (average inches)	1.9	0.8	0.9	0.8	1.0	0.4	0.4	0.8
Spring (April 1 - May 31)								
Temperature (average °F)	49.5	52.4	52.8	50.5	53.6	54.1	53.0	52.3
Departure from normal (°F)[a]	2.1	2.5	2.6	1.9	2.6	2.4	1.8	2.3
Precipitation (total inches)	3.5	5.0	4.7	4.1	5.2	5.4	4.8	4.7
Departure from normal (inches)[a]	1.3	2.2	1.6	0.9	1.7	1.6	0.7	1.4
Summer (June 1 - July 31)								
Temperature (average °F)	66.7	69.1	68.9	67.1	69.8	70.2	68.9	68.7
Departure from normal (°F)	0.5	0.5	0.2	0.2	0.1	0.2	-0.2	0.2
Precipitation (total inches)	3.6	4.4	5.3	5.1	6.2	8.0	6.9	5.6
Departure from normal (inches)[a]	-0.3	0.3	1.0	0.7	2.0	3.3	2.0	1.3

[a] Departures calculated using the 30-year NOAA average (1991-2020) over the respective time period.

Table 3. Range-wide trends (% change) in wildlife observed per 100 miles driven, Minnesota August roadside survey, 1955-2024.

Species	**Change from 2023**[a]					**Change from 10-year average**[b]				**Change from long-term average (LTA)**[c]			
Subgroup	*n*	2023	2024	%	95% CI	*n*	2014-2023	%	95% CI	*n*	LTA	%	95% CI
Ring-necked pheasant													
Total pheasants	148	51.2	52.1	1	±17	148	43.7	19	±16	148	88.4	-44	±9
Cocks	148	8.6	8.8	2	±18	148	6.2	42	±21	148	10.3	-18	±15
Hens	148	7.7	10.2	32	±20	148	6.6	53	±22	148	12.9	-26	±12
Broods	148	7.2	8	10	±18	148	6.6	21	±16	148	11.7	-35	±9
Broods per 100 hens[d]	290	91.6	76.9				98.8	-21			89.7	12	
Chicks per brood[d]	290	5.0	4.2				4.7	-12			5.6	-25	
Median hatch date[d]	290	16-Jun	12-Jun				15-Jun				9-Jun		
Gray partridge	166	4.3	1.8	-58	±46	167	2.7	-33	±73	167	12.1	-85	±16
Eastern cottontail	166	5.5	8.7	57	±36	167	5.8	51	±34	167	6.0	44	±33
White-tailed jackrabbit[e]	166	0.2	0.2			167	0.1			167	1.4		
White-tailed deer	166	25.4	31.6	25	±8	167	27.5	16	±7	167	11.5	172	±17
Mourning dove	166	230.7	142.5	-38	±1	167	144.1	-1	±1	167	236.2	-41	±1
Sandhill crane[f]													
Total cranes	166	11.5	16.4	43	±17	167	13.8	25	±14				
Juveniles	166	0.7	2.3	243	±293	167	1.6	45	±126				

[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 1955-2024, except for deer (1974-2024). Estimates for all species except deer based on routes (*n*) surveyed ≥40 years; estimates for deer based on routes surveyed ≥25 years. Thus, the Northwest region (8 counties in the Northwest were added to the survey in 1982) included only deer.
[d] Sample size is the total number of broods observed across all surveys rather than the number of routes run in 2024.
[e] White-tailed jackrabbits are too rare to make annual or 10-year comparisons.
[f] 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, 1955-2024.

Region	**Change from 2023**[a]					**Change from 10-year average**[b]				**Change from long-term average (LTA)**[c]			
Species	*n*	2023	2024	%	95% CI	*n*	2014-2023	%	95% CI	*n*	LTA	%	95% CI
Northwest[d]													
Gray partridge[e]	18	14.9	1.3	-91	±14	19	2.8			19	3.2	-60	±66
Eastern cottontail[e]	18	1.3	1.3			19	1.1			19	0.9		
White-tailed jackrabbit[e]	18	0.7	0.7			19	0.2			19	0.5		
White-tailed deer	18	48.7	64.9	33	±4	19	58.1	9	±4	19	37.2	71	±6
Mourning dove	18	194.2	102.9	-47	±1	19	98.8	-1	±2	19	114.9	-15	±2
Sandhill crane[f]	18	18.8	58.4	211	±11	19	46.2	-20	±5				
West Central[g]													
Ring-necked pheasant	39	62.4	65.9	6	±3	39	50.4	31	±4	37	90.7	-34	±2
Gray partridge[e]	39	0.1	0.3	200	±1974	39	0.5			37	8.2	-96	±25
Eastern cottontail	39	3.0	7.1	134	±69	39	2.9	137	±69	37	3.8	58	±53
White-tailed jackrabbit[e]	39	0.2	0.5			39	0.1			37	1.9	-72	±105
White-tailed deer	39	26.6	39.8	50	±8	39	30.6	30	±7	37	10.4	262	±20
Mourning dove	39	297.5	209.3	-30	±1	39	181.8	15	±1	37	340.4	-39	±0.6
Sandhill crane[f]	39	3.0	8.6	189	±68	39	3.5	148	±58				
Central													
Ring-necked pheasant	30	32.1	43.1	34	±5	30	37.9	14	±5	30	66.2	-35	±3
Gray partridge[e]	30	1.2	0.7	-44	±170	30	1.8			30	7.9	-92	±26
Eastern cottontail	30	5.6	8.9	59	±37	30	5.9	51	±35	30	6.2	44	±33
White-tailed jackrabbit[e]	30	0.1	0.1			30	0.1			30	1.0		
White-tailed deer	30	20.5	28.7	40	±10	30	27.1	6	±8	30	7.6	275	±27
Mourning dove	30	183.9	103.3	-44	±1	30	120.1	-14	±2	30	211.2	-51	±1
Sandhill crane[f]	30	20	19.9	-1	±10	30	23.9	-17	±9				
East Central													
Ring-necked pheasant	8	15	25.6	70	±9	8	26.4	-20	±9	10	77.7	-74	±3
Gray partridge[e]	8	0.0	0.0			8	0.3			10	0.2		
Eastern cottontail	8	4.5	9.1	101	±53	8	11.0	9.8	±22	10	9.7	7.2	±23
White-tailed jackrabbit[e]	8	0.0	0.0			8	0.0			10	0.2	-100	
White-tailed deer	8	42.5	49.4	16	±6	8	35.2	60	±7	10	11.3	339	±20
Mourning dove	8	76.0	59.0	-22	±3	8	63.6	8	±4	10	107.0	-39	±2
Sandhill crane[f]	8	92.5	57.2	-38	±3	8	58.3	33	±4				

Table 4. Continued.

Region / Species	Change from 2023[a]					Change from 10-year average[b]				Change from long-term average (LTA)[c]			
	n	2023	2024	%	95% CI	*n*	2014-2023	%	95% CI	*n*	LTA	%	95% CI
Southwest													
Ring-necked pheasant	19	114.7	81.8	-29	±3	19	70.4	16	±3	19	108.3	-25	±2
Gray partridge	19	7.6	11.4	50	±28	19	4.7	142	±45	19	34.8	-67	±6
Eastern cottontail	19	11.0	9.7	-12	±19	19	6.3	53	±33	19	7.8	25	±27
White-tailed jackrabbit[e]	19	0.6	0.2			19	0.3			19	3.2	-93	±66
White-tailed deer	19	19.9	20.0	1	±11	19	21.1	-5	±10	19	8.6	132	±24
Mourning dove	19	318.3	214.8	-33	±1	19	198.4	8	±1	19	292.2	-27	±1
Sandhill crane[e,f]	19	0.0	0.0			19	0.0						
South Central													
Ring-necked pheasant	32	54.1	58.6	8	±4	32	46.5	26	±4	32	114.5	-49	±2
Gray partridge	32	4.8	0.8	-84	±43	32	4.7	-84	±43	32	16.2	-95	±12
Eastern cottontail	32	4.8	12.9	171	±43	32	7.1	81	±29	32	7.6	-70	±27
White-tailed jackrabbit[e]	32	0.0	0.0			32	0.0			32	1.4		
White-tailed deer	32	12.4	11.2	-9	±17	32	10.2	10	±20	32	3.8	196	±54
Mourning dove	32	288.4	139.2	-51	±1	32	169.0	-18	±1	32	242.8	-43	±1
Sandhill crane[f]	32	2.5	5.5	119	±86	32	2.8	99	±74				
Southeast													
Ring-necked pheasant	20	11.8	10.8	-9	±19	20	16.4	-34	±13	20	61.9	-82	±3
Gray partridge	20	5.8	0.2	-97	±36	20	4.1	-95	±51	20	12.0	-98	±18
Eastern cottontail	20	10.8	10.8	0.4	±19	20	11.2	-4	±19	20	8.3	31	±25
White-tailed jackrabbit[e]	20	0.0	0.0			20	0.0			20	0.5		
White-tailed deer	20	28.6	26.6	-7	±7	20	23.7	12	±9	20	10.1	164	±21
Mourning dove	20	90.0	76.1	-16	±2	20	90.4	-16	±2	20	197.3	-61	±1
Sandhill crane[e,f]	20	1.4	5.0			20	0.8						

[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 1955-2023, except for Northwest region (1982-2024) and white-tailed deer (1974-2024). Estimates based on routes (*n*) surveyed ≥40 years (1955-2024), except for Northwest (≥20 years) and white-tailed deer (≥25 years).
[d] Eight Northwestern counties (19 routes) were added to the August roadside survey in 1982.
[e] Species may be too infrequently observed to calculate some trends.
[f] Sandhill cranes were added to the survey in 2009; thus, long-term averages are not calculated.
[g] Two routes were added to the West Central region in 2014.

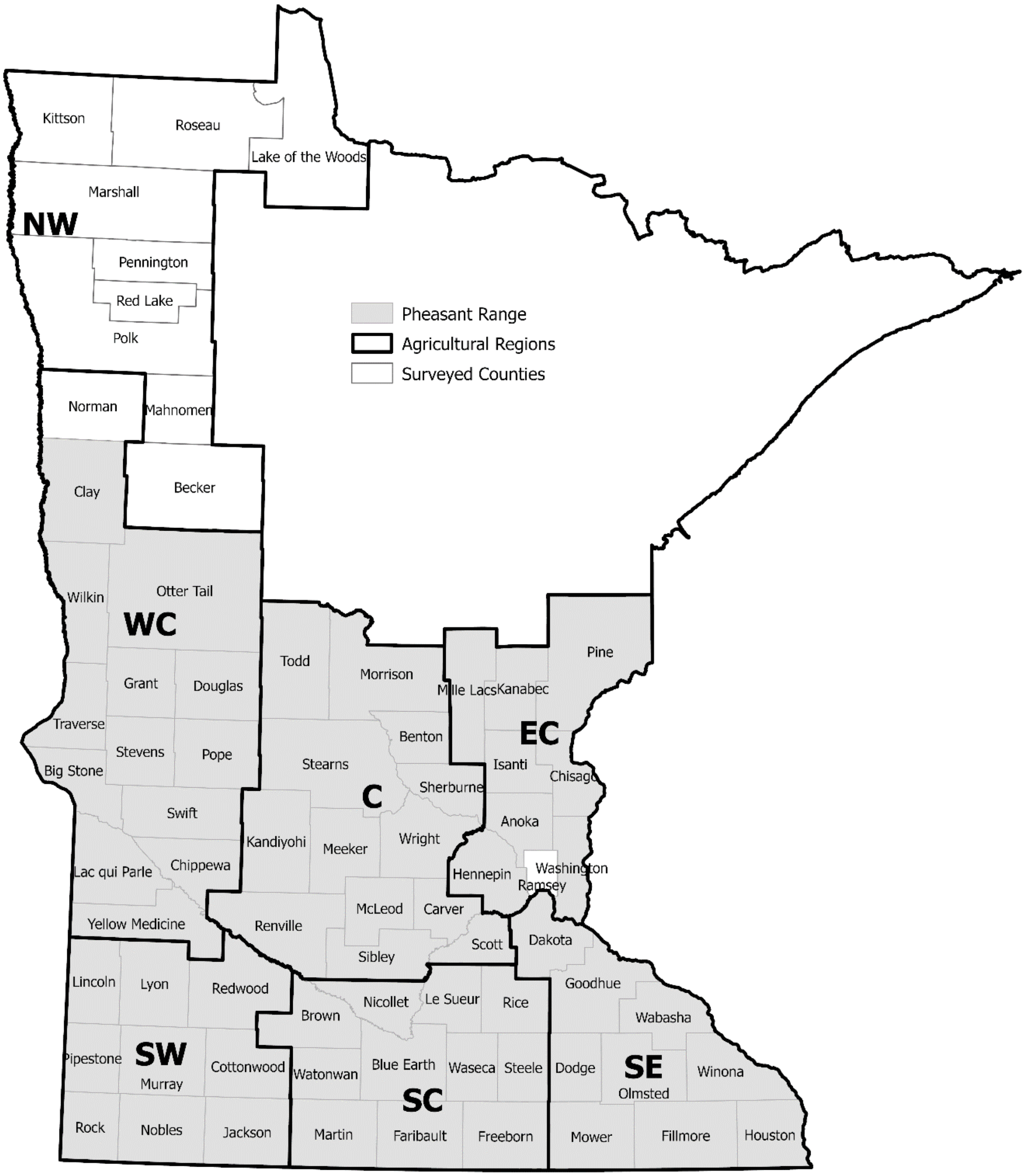

Figure 1. Survey regions and ring-necked pheasant range delineation for Minnesota's August roadside survey, 2024.

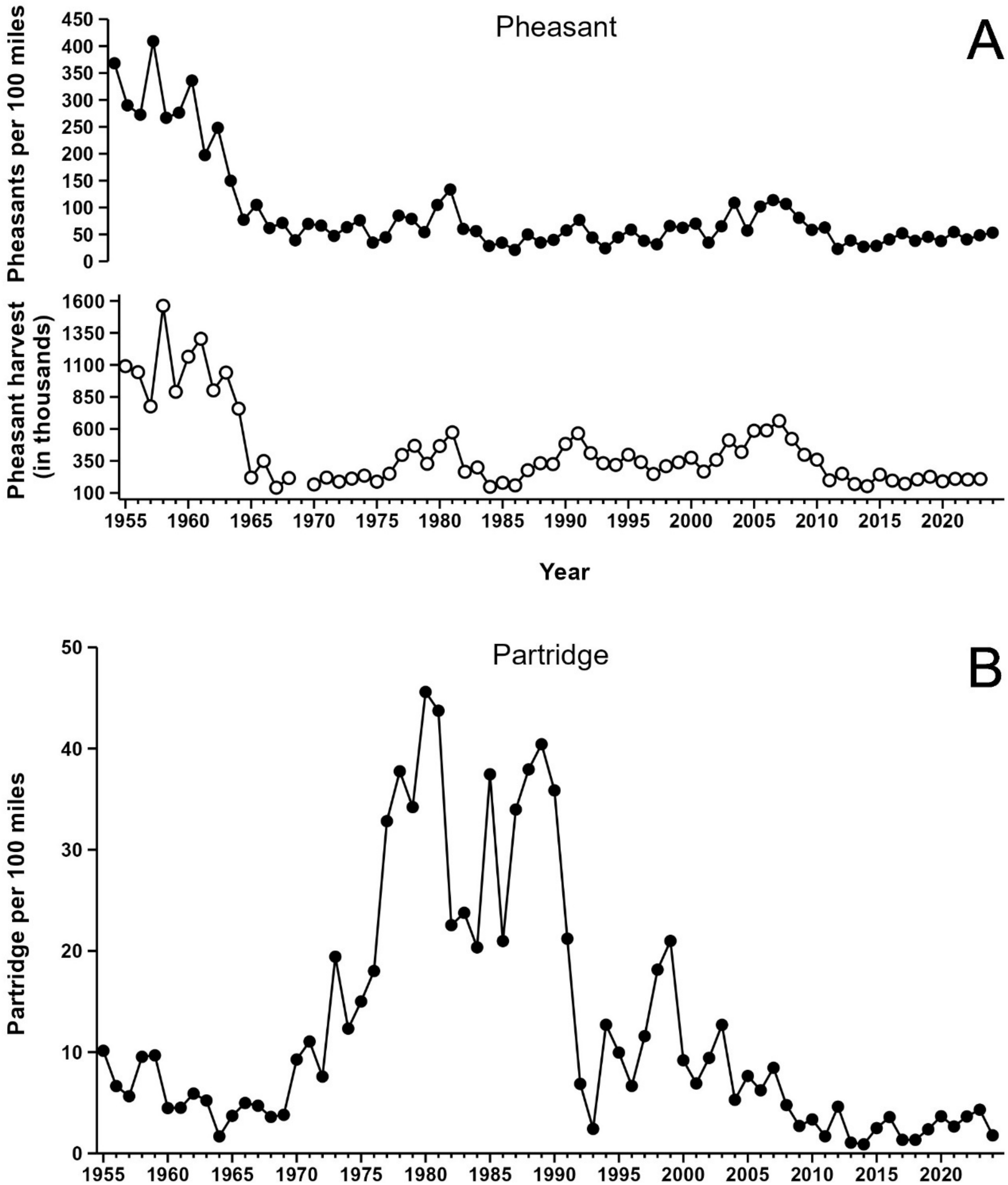

Figure 2. Range-wide index of ring-necked pheasants (A) and gray partridge (B) seen per 100 miles driven in Minnesota, 1955-2024. Based on all survey routes completed.

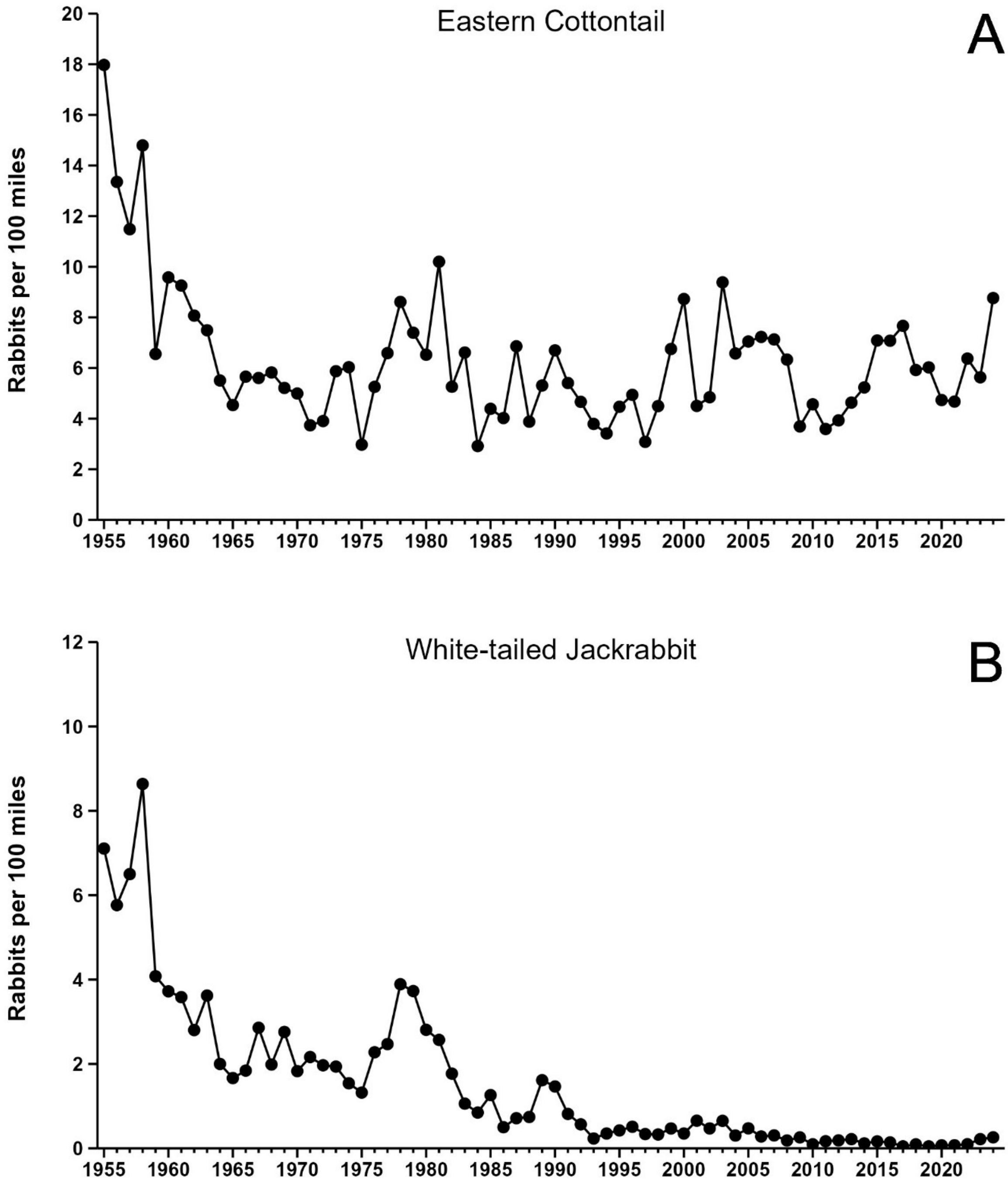

Figure 3. Range-wide index of eastern cottontail (A) and white-tailed jackrabbits (B) seen per 100 miles driven in Minnesota, 1955-2024. Based on all survey routes completed.

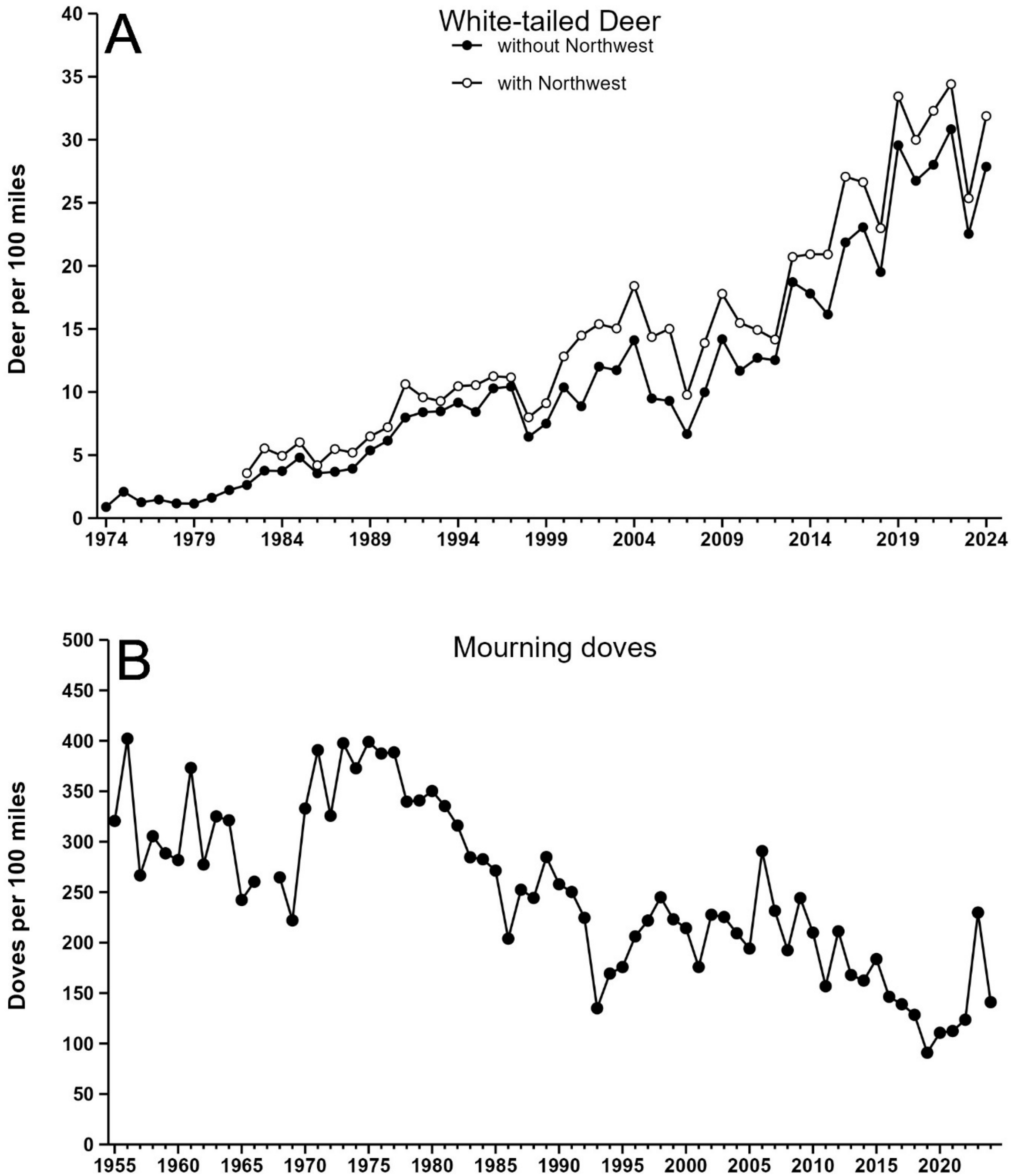

Figure 4. Range-wide index of (A) white-tailed deer seen per 100 miles driven in Minnesota, 1974-2024, with and without the Northwest region included; and (B) mourning doves seen per 100 miles driven in Minnesota, 1955-2024. Doves were not counted in 1967. Based on all survey routes completed.

MONITORING POPULATION TRENDS OF WHITE-TAILED DEER IN MINNESOTA – 2024

Eric S. Michel and John H. Giudice

INTRODUCTION

Hunting is the primary method used to manage white-tailed deer (*Odocoileus virginianus*) populations in Minnesota. Minnesota Department of Natural Resources (MNDNR) sets annual hunting regulations to adjust deer harvest to meet management goals. MNDNR wildlife researchers conduct simulation modeling of deer populations to explore the impacts of various hunting regulations on populations, to understand historical deer herd dynamics, and to predict relative population sizes. 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 modeled density estimates and harvest recommendations.

METHODS

Prior to 2020, we modeled deer populations at the deer permit area (DPA) level. However, with over 130 DPAs, this was a major annual undertaking that limited the time the modeler could devote to each modeling unit, including exploring the sensitivity of the model in each case. Furthermore, we typically lacked empirical data on population vital rates (other than harvest) at the DPA scale and it would be cost-prohibitive to collect such data. Conversely, collecting annual or periodic population data over larger modeling units might be feasible. Therefore, beginning in 2020, we consolidated DPAs into deer modeling units (DMUs; Figure 1). DMUs are generally consistent with goal-setting blocks (GSBs), except some DMUs may contain less than the full set of DPAs within a GSB if there were major boundary changes in the last 5 years (which makes it difficult to interpret harvest data and population trends).

We recognize that annual regulatory decisions still occur at the DPA level and we need to link DMU-level modeling results to DPA-level decision making. Therefore, we used the annual proportional buck harvest in each DPA to convert DMU population estimates to DPA-level density estimates, which we acknowledge is a simplification of factors that can influence variation in deer densities among DPAs and years. Thus, we advise caution when interpreting annual DPA-level estimates of absolute density and, in turn, encourage assessing the overall population trend.

Model Structure

We used the spring of the initial year before reproduction occurred as the starting period for each multi-year simulation (Figure 2). We specified an initial population density (see Modeling Procedures section). The model then converted the initial population density into a total population size by multiplying the density by the total land area of the DMU. 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 approximately equally (with some small variation for primary sex ratio) 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 also 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 DMU were equal.

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 year old [adult] when bred) and allowed rates to vary by 3 ecogeographic 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

We used estimates reported in the primary literature for deer in Minnesota, from research currently being conducted in southern 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 used spring/summer survival rates ranging from 0.50-0.70 to assess the impact of fawn survival on the overall population trend.

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 a range of values that varied stochastically (female: 0.94-0.97 [SD = 0.011], male: 0.92-0.98 [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) and were adjusted using information from recently completed research from northeastern and southeastern Minnesota.

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 deer mortality risk via starvation and predation, with fawns being more susceptible than adults (Nelson and Mech 1986b, DelGiudice et al. 2002, Norton 2015). Subsequently, Minnesota Information Technology (MNIT) Services/MNDNR staff calculate an annual winter severity index (WSI) in each DPA based on snow depth and minimum daily temperatures. From 1 November through 31 May, 1 point was added to the WSI for each day with snow depths $\geq$15 in (38.1 cm). One point was also added to the WSI for each day when temperatures were $\leq 0^0$ F (-17.8^0 C). Therefore, the WSI accumulated 0, 1, or 2 points every day in each DPA. 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 et al. 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.

Modeling Procedures

Simulation models can be sensitive to the parameter for initial population size (e.g., Grund 2014). Therefore, we used density estimates from last year's models as starting points for this year's models. However, we explored alternative starting values in cases where the simulated population was growing or declining at an unrealistic rate (e.g., due to adding new harvest data and, possibly, removing harvest data that are now outside the modeling window). This can lead to some discrepancies with previously reported model estimates, which is not an ideal situation.

However, it reflects an important limitation of simulation models. Thus, we advise caution when interpreting estimates of absolute density (vs. population trends).

We ran model simulations for 5 years (2019-2024) with the final population estimate occurring pre-fawning for the spring following the most recent deer hunting season (i.e., spring 2024). We performed all simulations with the R programming language (ver. 3.6.2, R Core Team 2019) 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 model run.

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 stochastically to represent natural variation 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. We conducted simulation modeling for 23 DMUs (Table 1) and derived subsequent density estimates in 105 of 129 DPAs in Minnesota to estimate deer densities before reproduction during spring 2024 (Table 2; Figure 3). We used a combination of three metrics (modeled density estimates, the number of bucks harvested in each DPA, and hunter success) to evaluate whether a DPA was above, at, or below goal. For simplicity, we did not consider changes in the number of antlerless tags allocated for a lottery designation when interpreting designation changes from 2023 to 2024. We only assessed antlerless opportunities based on if DPAs completely changed a designation (e.g., moving from a Lottery designation to a Bucks Only or Either Sex designation).

Management designations in 2024 were mostly consistent in DPAs compared to 2023 even though the winters of 2023 and 2024 were mild. The number of DPAs recommending the Bucks Only designation slightly increased in 2024 (n = 11) compared to 2023 (n = 9) while there were slight decreases in the number of DPAs with the Three-Deer Limit with Early Antlerless (one less DPA), Three-Deer Limit (two fewer DPAs), and Two-Deer Limit (one less DPA) designations. All three ecogeographic zones observed some DPAs below goal (farmland zone, n = 13; farmland-forest transition zone, n = 12; northeastern forest region, n = 30). Liberal antlerless seasons will be required again in 2023 to effectively manage deer populations in DPAs with average and above average productivity while more conservative strategies will be required for those units below goal.

In terms of management intensity, the 2024 designations did not afford more antlerless deer harvest opportunities to hunters versus the 2023 season (not including changes in number of antlerless tags available for Lottery designations). About 9% of DPA designations afford less antlerless harvest opportunity in 2024 compared to 2023, while a majority (~91%) of designations provide the same antlerless opportunity as 2023.

Farmland Zone

We produced density estimates for 30 of 36 total farmland zone DPAs. Of the 36 DPAs in the farmland zone, 16 were at goal, 13 were below goal, and 7 were above goal. Designations aimed to stabilize or increase deer densities are most prevalent in 2024 (Either Sex, n = 7; Lottery, n = 18), while more liberal designations were less common (Three-deer Limit with Early

Antlerless, n = 1; Three-deer Limit, n = 5; Two-deer Limit, n = 5). We attempt to maintain consistent regulations across years whenever possible to improve model performance.

Farmland-Forest Transition Zone

Deer populations in the farmland-forest transition zone are highly productive due to excellent habitat and generally milder winters compared to the forest zone. Historical harvests and modeled population trends suggested that Antlerless Permit Lottery designations were not sufficient to stabilize deer numbers in most transition zone DPAs as evidenced by few DPAs with Antlerless Permit Lottery recommendations. We produced density estimates for 40 of the 48 farmland-forest transition zone DPAs. Of the 48 DPAs in the farmland-forest transition zone, 19 were at goal, 12 were below goal, and 17 were above goal based. We selected management designations to decrease densities for DPAs above goal while attempting to maintain consistent regulations across years whenever possible to improve model performance. For the 2024 season designations, Bucks Only was used in 1 DPA, Antlerless Permit Lottery was used for 2 DPAs, Either Sex for 5 DPAs, and a Two-deer Limit designation was used for 13 DPAs. In 20 DPAs, a Three-deer Limit designation was necessary to continue reducing deer densities toward goal level, 13 of which have additional antlerless seasons. In the metro area (DPA 701) and the chronic wasting disease management zone (DPAs 605, 643, 645, 646, 647, 648, and 649), a Five Deer Limit with an Early Antlerless season 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. However, the recent severe winters of 2021-22 and 2022-23 continued to decrease deer densities in some DPAs. Even though the winter of 2023-24 was mild, populations will likely require multiple mild winters to fully recover. We produced density estimates for 35 of 44 forest zone DPAs. Of the 44 DPAs in the forest zone, 10 were at goal, 30 were below goal, 1 was above goal, and goals were paused in 3 DPAs due to the detection of CWD. We selected management designations to increase densities for DPAs below goal while attempting to maintain consistent regulations across years whenever possible to improve model performance. For 2024 season designations, Bucks Only was used in 10 DPAs, Antlerless Permit Lottery in 21 DPAs, Either Sex in 8 DPAs, a Two-deer Limit designation in 4 DPAs, and a Three-deer Limit designation in 1 DPA.

Abridged Descriptions of Deer Hunting Season Designations

Bucks Only. All 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.

Antlerless Permit 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.

Either Sex. 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.

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

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

Five-deer Limit. The initial license is either-sex and the maximum of five deer (one buck, except the Southeast 600-series) can be taken using any combination of licenses and permits.

***Early Antlerless.** A hunter could harvest **three 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) for deer modeling units (DMUs) derived from population model simulations in Minnesota, 2019-2024.

Deer Modeling Unit	Land Area (mi^2)	Pre-fawn Deer Density					
		2019	2020	2021	2022	2023	2024
1	1,470	7 (2.0)	8 (2.3)	9 (2.9)	10 (3.4)	10 (3.5)	12 (4.2)
2	2,026	13 (2.5)	14 (3.0)	15 (3.7)	14 (4.0)	14 (4.2)	15 (5.0)
3	1,384	5 (1.0)	5 (1.1)	6 (1.3)	6 (1.3)	6 (1.4)	7 (1.6)
4	3,249	3 (0.7)	3 (0.7)	3 (0.8)	3 (0.8)	3 (0.7)	3 (0.9)
5	2,779	2 (0.5)	2 (0.5)	2 (0.6)	2 (0.5)	2 (0.5)	2 (0.5)
6	3,750	12 (2.7)	13 (3.2)	14 (3.9)	14 (4.4)	14 (4.8)	16 (5.8)
7	3,932	15 (3.0)	14 (3.4)	14 (4.1)	13 (4.4)	12 (4.8)	13 (5.6)
8	3,573	9 (1.8)	8 (1.9)	9 (2.3)	8 (2.4)	8 (2.4)	8 (2.8)
9	3,466	12 (0.8)	11 (0.9)	10 (1.0)	9 (1.1)	7 (1.1)	7 (1.3)
10	3,520	30 (6.0)	31 (7.2)	33 (8.7)	34 (9.9)	33 (10.6)	36 (12.5)
11	2,334	24 (1.5)	22 (1.9)	20 (2.3)	17 (2.6)	15 (2.9)	13 (3.5)
12	3,331	27 (5.3)	31 (7.2)	35 (9.6)	38 (11.9)	42 (14.2)	50 (18.4)
13	2,550	6 (1.1)	7 (1.4)	8 (1.7)	9 (2.0)	10 (2.3)	11 (2.7)
14	1,456	21 (4.9)	24 (6.1)	27 (7.5)	28 (8.7)	29 (9.6)	32 (11.4)
15	3,647	27 (5.4)	32 (7.5)	36 (10.0)	42 (12.8)	46 (15.7)	55 (20.3)
16	546	14 (2.9)	16 (3.6)	18 (4.4)	19 (5.2)	20 (5.8)	23 (6.9)
17	840	7 (1.1)	8 (1.4)	9 (1.7)	11 (2.1)	12 (2.3)	14 (2.8)
18	2,822	8 (0.9)	8 (1.1)	8 (1.4)	8 (1.6)	8 (1.8)	8 (2.2)
19	2,102	5 (1.0)	5 (1.2)	6 (1.5)	6 (1.8)	6 (2.0)	7 (2.4)
20	4,314	8 (2.5)	9 (3.1)	11 (3.8)	13 (4.5)	14 (5.3)	17 (6.3)
21	4,274	7 (1.5)	8 (1.9)	9 (2.4)	9 (2.9)	10 (3.5)	12 (4.3)
22	1,042	26 (5.7)	29 (7.2)	31 (9.0)	34 (10.9)	38 (13.1)	42 (15.9)
23	1,677	31 (5.7)	32 (7.1)	34 (8.8)	36 (10.7)	38 (13.0)	42 (15.9)

Table 2. Estimated mean pre-fawn deer densities (deer/mi^2) for deer permit areas based on population model simulations in Minnesota deer management units, 2019-2024.

Deer Permit Area	Land Area (mi^2)	Pre-fawn Deer Density					
		2019	2020	2021	2022	2023	2024
101	496	11 (2.1)	11 (2.4)	11 (2.8)	12 (3.3)	10 (3.2)	12 (4.0)
[a]104	1,414	-	-	-	-	-	-
[a]105	1,199	-	-	-	-	-	-
[a]107	472	-	-	-	-	-	-
[a]109	1,182	-	-	-	-	-	-
110	529	13 (2.6)	13 (3.3)	13 (3.8)	13 (4.4)	14 (5.3)	15 (6.6)
111	1,384	5 (1.0)	5 (1.1)	6 (1.4)	6 (1.4)	6 (1.4)	7 (1.7)
[a]114	123	-	-	-	-	-	-
117	936	0 (0.1)	0 (0.1)	0 (0.1)	0 (0.1)	0 (0.1)	0 (0.1)
118	1,239	4 (0.7)	3 (0.8)	4 (0.9)	3 (0.8)	3 (0.8)	4 (1.0)
119	782	4 (0.7)	3 (0.7)	3 (0.8)	4 (0.9)	3 (0.8)	4 (1.0)
126	942	4 (1.1)	4 (1.1)	5 (1.4)	4 (1.1)	3 (0.9)	4 (1.1)
130	747	2 (0.4)	2 (0.4)	2 (0.4)	2 (0.4)	1 (0.4)	2 (0.4)
131	901	2 (0.4)	1 (0.3)	1 (0.2)	1 (0.4)	1 (0.3)	1 (0.3)
132	481	4 (0.8)	3 (0.7)	4 (0.9)	4 (1.0)	4 (1.0)	4 (1.1)
133	352	8 (0.5)	8 (0.6)	7 (0.7)	6 (0.7)	5 (0.7)	5 (0.9)
[b]152	60	-	16 (3.7)	18 (4.7)	17 (5.0)	18 (5.8)	25 (8.7)
[b]155	499	-	22 (5.1)	20 (5.4)	20 (6.0)	22 (7.3)	22 (7.7)
156	819	12 (0.8)	11 (0.8)	10 (0.9)	10 (1.1)	7 (1.0)	7 (1.2)
157	888	.	34 (7.8)	40 (10.5)	42 (12.3)	42 (13.6)	46 (16.0)
159	571	16 (1.0)	14 (1.1)	15 (1.5)	13 (1.6)	10 (1.5)	11 (1.9)
[a]169	939	-	-	-	-	-	-
[a]171	740	-	-	-	-	-	-
[b]172	688	-	24 (5.5)	22 (5.8)	26 (7.8)	24 (7.8)	24 (8.5)
[a]173	471	-	-	-	-	-	-
176	917	7 (1.5)	6 (1.5)	7 (1.9)	6 (1.7)	5 (1.6)	5 (1.8)
177	491	10 (2.0)	9 (2.1)	9 (2.4)	8 (2.3)	7 (2.4)	9 (3.1)
178	1,192	8 (1.7)	8 (1.9)	9 (2.5)	8 (2.5)	8 (2.5)	8 (2.8)
181	629	12 (0.8)	9 (0.7)	8 (0.8)	6 (0.8)	6 (0.8)	5 (0.9)
182	278	15 (1.0)	13 (1.0)	14 (1.3)	12 (1.4)	10 (1.4)	10 (1.8)
183	664	13 (0.8)	12 (0.9)	11 (1.1)	10 (1.2)	8 (1.1)	8 (1.4)
197	973	11 (2.2)	10 (2.3)	9 (2.5)	9 (2.8)	9 (3.0)	11 (3.7)
199	153	6 (0.4)	6 (0.4)	5 (0.5)	4 (0.5)	4 (0.6)	4 (0.6)
201	161	11 (2.1)	10 (2.2)	10 (2.4)	10 (2.9)	8 (2.5)	9 (3.1)
203	118	8 (1.9)	5 (1.3)	7 (2.0)	8 (2.6)	5 (1.6)	8 (2.8)
208	378	10 (2.3)	10 (2.6)	12 (3.6)	13 (4.0)	13 (4.5)	13 (4.7)

[a]Indicates deer permit area was not included in DMU population model.
[b]Deer density was not estimated in 2019.

Table 2. Continued

Deer Permit Area	Land Area (mi^2)	Pre-fawn Deer Density 2019	2020	2021	2022	2023	2024
209	639	14 (3.2)	16 (4.0)	16 (4.6)	18 (5.6)	17 (5.6)	21 (7.5)
210	615	11 (2.2)	11 (2.8)	13 (3.8)	11 (3.9)	11 (4.2)	12 (5.2)
213	1,059	26 (5.2)	31 (7.2)	34 (9.5)	36 (11.3)	39 (13.3)	48 (17.4)
214	553	26 (1.6)	26 (2.2)	25 (2.9)	20 (3.0)	18 (3.6)	16 (4.2)
215	701	27 (5.3)	29 (6.9)	36 (9.8)	40 (12.3)	48 (16.3)	58 (21.0)
218	884	25 (5.7)	27 (6.9)	31 (8.6)	32 (10.0)	33 (11.1)	39 (13.8)
219	391	21 (4.2)	25 (5.9)	27 (7.5)	30 (9.3)	36 (12.4)	41 (14.9)
221	643	27 (5.4)	32 (7.6)	37 (10.2)	43 (13.1)	44 (14.9)	52 (19.1)
222	413	29 (5.7)	35 (8.1)	39 (10.8)	47 (14.5)	50 (16.8)	58 (21.2)
223	377	26 (5.1)	31 (7.2)	35 (9.7)	38 (11.6)	46 (15.6)	54 (20.0)
224	46	28 (5.5)	35 (8.2)	34 (9.5)	39 (12.1)	45 (15.4)	55 (20.0)
225	618	34 (6.6)	37 (8.8)	44 (12.0)	49 (15.2)	54 (18.4)	66 (24.2)
227	471	31 (6.2)	37 (8.7)	43 (11.9)	50 (15.5)	57 (19.4)	70 (25.7)
229	285	15 (2.9)	17 (4.0)	19 (5.2)	20 (6.2)	25 (8.4)	32 (11.8)
[b]230	454	-	8 (1.9)	8 (2.2)	9 (2.9)	10 (3.4)	10 (3.9)
[b]232	377	-	10 (2.5)	11 (3.0)	11 (3.5)	14 (4.7)	16 (6.1)
[b]233	384	-	9 (2.2)	10 (2.7)	11 (3.3)	12 (4.0)	12 (4.4)
234	636	7 (2.2)	9 (2.8)	9 (3.2)	12 (4.1)	10 (3.9)	12 (4.4)
235	35	24 (4.7)	33 (7.7)	39 (10.8)	47 (14.4)	42 (14.4)	51 (18.8)
236	368	27 (5.4)	31 (7.3)	35 (9.7)	41 (12.7)	47 (16.1)	57 (20.8)
[b]237	608	-	-	-	-	-	-
238	95	18 (5.4)	21 (6.8)	24 (8.5)	25 (8.9)	23 (8.4)	34 (12.7)
239	928	23 (4.5)	25 (5.9)	27 (7.5)	30 (9.4)	32 (10.8)	39 (14.1)
240	643	35 (6.9)	40 (9.4)	45 (12.3)	51 (15.9)	54 (18.2)	63 (23.2)
241	997	28 (1.7)	26 (2.2)	23 (2.5)	19 (3.0)	16 (3.2)	14 (3.8)
246	784	18 (1.1)	16 (1.4)	14 (1.6)	13 (2.0)	11 (2.2)	11 (2.9)
[b]248	216	-	38 (8.6)	42 (11.1)	42 (12.4)	35 (11.3)	42 (14.6)
[b]249	496	-	40 (9.3)	43 (11.5)	40 (11.8)	39 (12.8)	43 (15.0)
250	712	11 (3.3)	11 (3.7)	13 (4.6)	15 (5.2)	17 (6.3)	18 (7.0)
251	55	10 (2.1)	8 (2.1)	9 (2.8)	10 (3.6)	10 (3.7)	9 (3.7)
252	716	9 (2.8)	12 (3.8)	13 (4.4)	14 (4.9)	17 (6.4)	21 (7.8)
[b]253	974	-	6 (1.4)	6 (1.7)	7 (2.1)	8 (2.6)	8 (3.1)
[b]254	924	-	8 (1.9)	9 (2.5)	10 (3.0)	10 (3.5)	12 (4.3)
[b]255	388	-	9 (2.2)	9 (2.6)	11 (3.5)	11 (3.7)	14 (5.0)
256	654	12 (2.7)	12 (3.0)	14 (3.9)	14 (4.2)	14 (4.8)	15 (5.4)
257	412	16 (3.6)	18 (4.7)	19 (5.5)	20 (6.2)	20 (6.9)	23 (8.3)
258	343	21 (4.2)	21 (5.2)	22 (6.5)	18 (6.3)	16 (6.4)	19 (8.0)
259	489	17 (3.5)	16 (4.1)	16 (4.6)	16 (5.7)	16 (6.0)	16 (7.0)

[a]Indicates deer permit area was not included in DMU population model.
[b]Deer density was not estimated in 2019.

Table 2. Continued

Deer Permit Area	Land Area (mi^2)	Pre-fawn Deer Density 2019	2020	2021	2022	2023	2024
[a]260	1,055	-	-	-	-	-	-
262	677	8 (2.1)	9 (2.6)	10 (3.3)	11 (3.6)	12 (4.3)	13 (4.7)
[a]263	706	-	-	-	-	-	-
264	669	16 (3.0)	16 (3.6)	18 (4.6)	17 (4.8)	17 (5.2)	18 (6.3)
265	494	16 (3.6)	17 (4.4)	19 (5.4)	18 (5.8)	20 (6.7)	21 (7.5)
266	617	11 (2.4)	11 (2.8)	12 (3.4)	11 (3.6)	12 (4.0)	15 (5.2)
267	472	9 (1.8)	10 (2.2)	12 (2.9)	10 (2.7)	10 (3.1)	10 (3.6)
268	228	18 (3.5)	23 (5.1)	22 (5.5)	22 (6.1)	22 (6.7)	21 (7.2)
269	650	7 (1.3)	8 (1.7)	9 (2.0)	10 (2.2)	10 (2.4)	13 (3.0)
270	736	5 (0.9)	6 (1.2)	7 (1.5)	7 (1.5)	7 (1.7)	7 (1.7)
271	632	6 (1.2)	7 (1.4)	9 (1.9)	10 (2.3)	11 (2.7)	13 (3.1)
272	532	6 (1.0)	7 (1.4)	8 (1.6)	10 (2.3)	10 (2.4)	14 (3.4)
273	572	16 (3.7)	19 (4.8)	20 (5.7)	22 (6.7)	22 (7.2)	22 (7.7)
274	355	5 (0.6)	6 (0.9)	7 (1.2)	7 (1.4)	6 (1.5)	6 (1.7)
[a]275	957	-	-	-	-	-	-
[a]277	1,058	-	-	-	-	-	-
278	402	9 (1.1)	9 (1.3)	9 (1.6)	9 (1.8)	8 (2.0)	8 (2.3)
279	344	5 (1.0)	6 (1.3)	5 (1.4)	7 (2.0)	7 (2.3)	8 (2.9)
280	674	7 (2.0)	7 (2.2)	9 (3.1)	10 (3.8)	11 (4.1)	13 (4.8)
281	605	8 (0.9)	8 (1.1)	8 (1.5)	9 (1.8)	8 (2.0)	8 (2.3)
[a]282	1,126	-	-	-	-	-	-
[a]283	337	-	-	-	-	-	-
284	840	7 (1.1)	8 (1.4)	9 (1.7)	11 (2.0)	12 (2.3)	14 (2.8)
285	546	14 (2.9)	16 (3.6)	18 (4.4)	19 (5.2)	20 (5.8)	23 (6.9)
286	447	5 (1.0)	6 (1.4)	6 (1.7)	7 (2.0)	7 (2.4)	8 (2.9)
287	47	10 (2.0)	7 (1.7)	9 (2.6)	7 (2.3)	6 (2.5)	12 (5.2)
288	624	6 (1.1)	6 (1.2)	6 (1.7)	6 (1.9)	6 (2.0)	7 (2.6)
289	816	5 (1.5)	6 (2.0)	7 (2.3)	8 (2.9)	10 (3.6)	12 (4.6)
290	661	6 (0.7)	6 (0.9)	6 (1.1)	7 (1.4)	7 (1.6)	6 (1.8)
291	799	8 (1.0)	8 (1.2)	8 (1.4)	8 (1.6)	8 (1.9)	9 (2.5)
[a]292	362	-	-	-	-	-	-
[a]293	278	-	-	-	-	-	-
294	687	5 (0.9)	5 (1.1)	5 (1.2)	5 (1.4)	5 (1.7)	5 (1.8)
[a]295	959	-	-	-	-	-	-
296	665	9 (2.9)	11 (3.6)	14 (4.7)	17 (6.0)	20 (7.3)	23 (8.7)
297	438	6 (1.4)	6 (1.4)	5 (1.4)	6 (2.0)	6 (2.0)	6 (2.1)
298	619	8 (1.6)	8 (1.9)	7 (2.1)	7 (2.5)	6 (2.2)	7 (2.9)
[b]299	387	-	11 (2.8)	12 (3.4)	12 (3.8)	14 (4.9)	15 (5.7)

[a]Indicates deer permit area was not included in DMU population model.
[b]Deer density was not estimated in 2019.

Table 2. Continued

Deer Permit Area	Land Area (mi2)	Pre-fawn Deer Density 2019	2020	2021	2022	2023	2024
[a]338	316	-	-	-	-	-	-
[b]341	608	-	31 (7.7)	38 (11.0)	41 (13.0)	45 (15.8)	50 (18.8)
342	350	26 (4.6)	23 (5.1)	30 (7.8)	31 (9.4)	36 (12.3)	39 (14.7)
[b]604	673	-	34 (7.9)	35 (9.3)	34 (10.1)	33 (10.6)	38 (13.2)
[a]605	1,192	-	-	-	-	-	-
[a]643	663	-	-	-	-	-	-
644	190	25 (4.5)	28 (6.1)	26 (6.9)	29 (8.8)	34 (11.4)	37 (14.2)
645	326	22 (4.0)	24 (5.1)	25 (6.5)	27 (8.0)	28 (9.6)	30 (11.6)
646	319	47 (8.5)	47 (10.2)	45 (11.7)	46 (13.9)	51 (17.4)	51 (19.6)
[b]647	434	-	26 (6.4)	22 (6.2)	25 (8.0)	28 (9.6)	31 (11.8)
[a]648	332	-	-	-	-	-	-
649	492	33 (5.9)	36 (7.9)	38 (9.8)	40 (11.9)	40 (13.5)	46 (17.5)
[b]655	386	-	6 (1.4)	8 (2.1)	8 (2.6)	8 (2.7)	9 (3.4)
661	793	6 (1.8)	7 (2.1)	8 (2.5)	9 (3.1)	8 (2.8)	10 (3.8)
[a]679	1,024	-	-	-	-	-	-
684	1,235	19 (3.8)	16 (3.9)	16 (4.6)	14 (4.8)	14 (5.2)	13 (5.7)
[a]701	1,324	-	-	-	-	-	-

[a]Indicates deer permit area was not included in DMU population model.
[b]Deer density was not estimated in 2019.

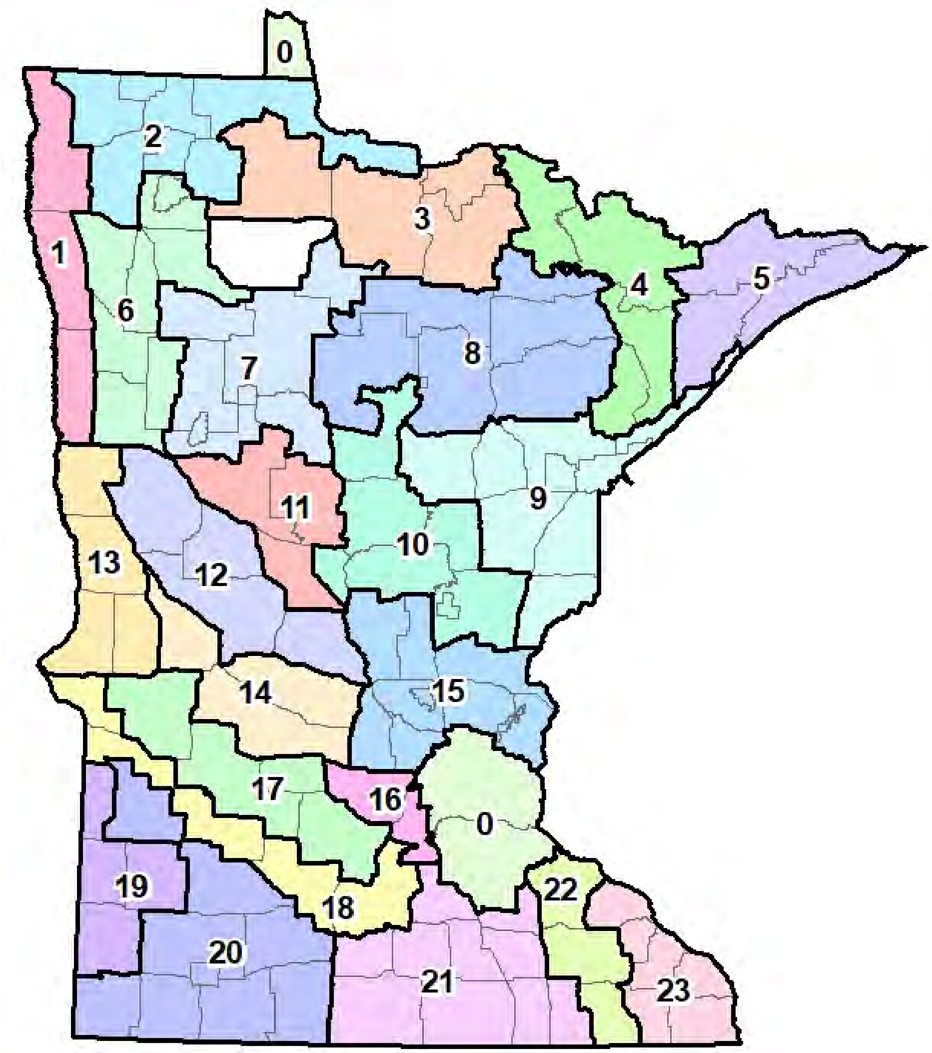

Figure 1. Deer permit areas aggregated into deer modeling units (DMUs; 1 through 23) in Minnesota. Areas not shaded or labeled 0 were not included in aggregated units.

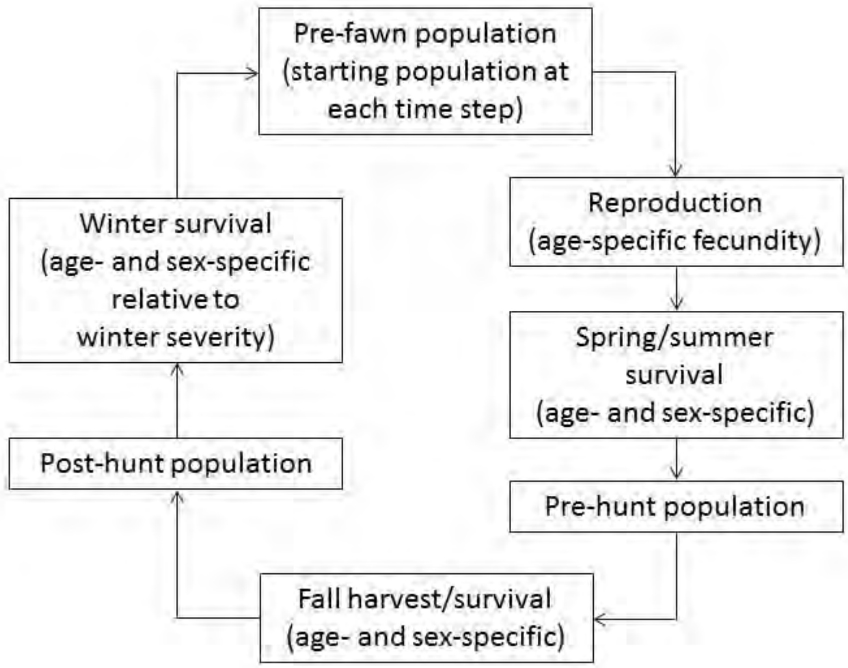

Figure 2. Model structure for simulations of white-tailed deer populations in Minnesota.

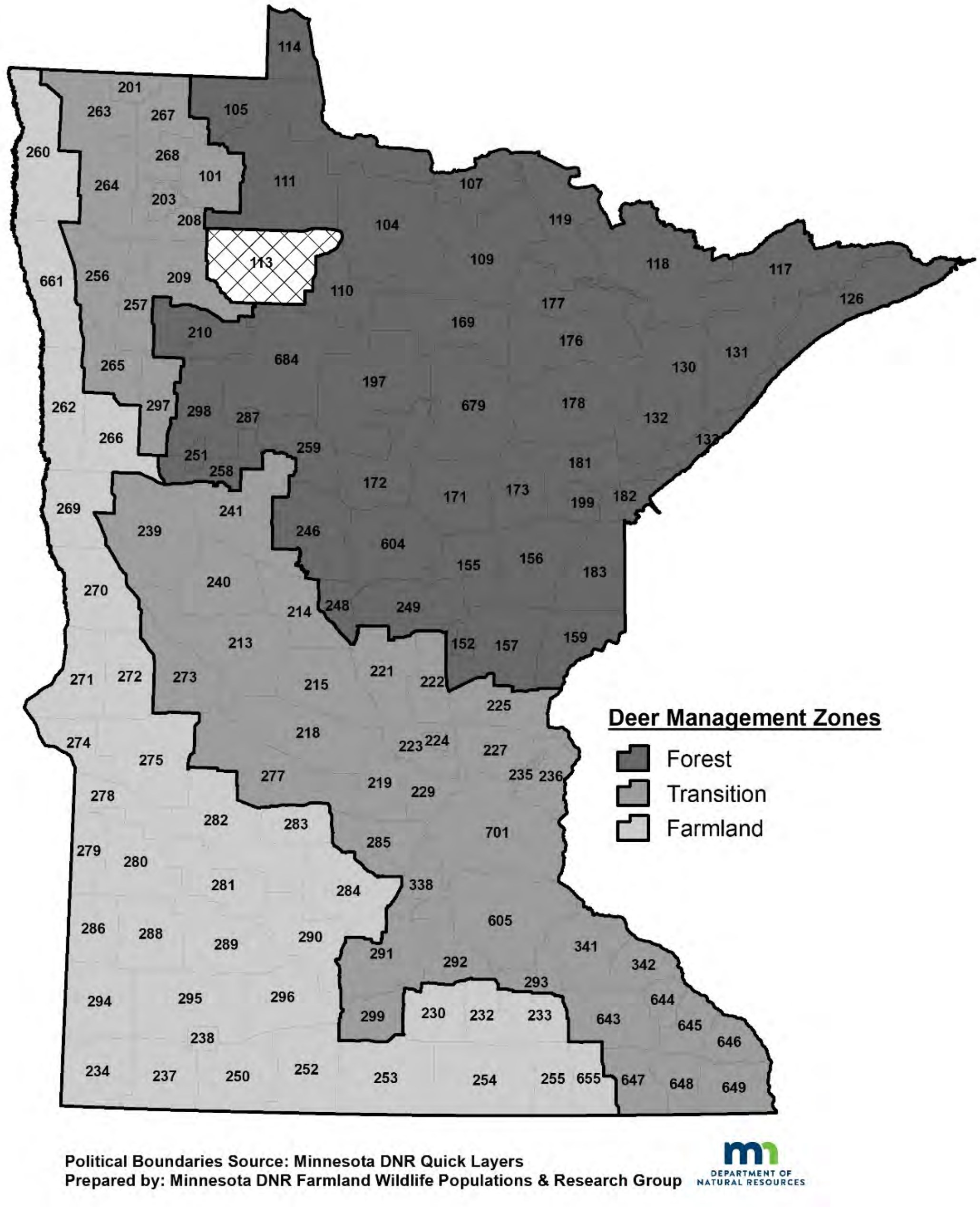

Figure 3. Deer permit areas (DPAs) in Minnesota and deer management zones used to describe deer population and harvest trends, 2024. DPAs were assigned to forest, transition, or farmland zones based on historical land cover and current woody cover. Generally, forested DPAs were composed of ≥60% woody cover, transition DPAs were composed of 6%-50% woody cover, and farmland DPAs were composed of ≤5% woody cover.

2023 MINNESOTA DEER HUNTER OBSERVATION SURVEY REPORT

Eric S. Michel, Tyler R. Obermoller, Adam C. Landon

INTRODUCTION

White-tailed deer (*Odocoileus virginianus*; hereafter, deer) hunting season recommendations should incorporate objective and reliable information to move populations towards a desired density goal. Because the Minnesota Department of Natural Resources (MNDNR) adjusts regulatory decisions (seasons and bag limits) annually, the agency requires current information about deer populations. In Minnesota, deer densities are modeled at the larger deer modeling unit (DMU; N = 23) scale but are managed at the smaller deer permit area (DPA; N = 129) scale. Traditional firearm season lengths are 9 (200-series areas), 16 (100-series areas), or 18 (300-series areas; 2 seasons) days. Bag limits also vary by permit area and range from bucks only (1 antlered deer) to 3-deer limit (1 buck or doe and up to 2 additional antlerless deer) management designations. Additionally, early antlerless seasons are used in limited situations, and DPAs within disease management zones have allowable harvests of up to 5 deer, including one legal buck per each archery, firearm, and muzzleloader season per hunter (3 total bucks). To inform decisions about what regulatory options to implement in what DPAs, MNDNR incorporates mandatory hunter-reported harvest, hunter effort, winter severity, and vital rate parameters (survival, fecundity, etc) into a population model to make population trend inferences (lambda [λ]; Michel and Giudice 2022). Population model indices are sensitive to varying hunting season regulations and changes in the relationship between winter severity and deer survival. Confidence in the population model is improved by collecting annually recurrent information to independently estimate the population trend. The Office of Legislative Auditors (OLA) conducted an independent evaluation of the MNDNR deer population management program (OLA 2016) and recommended additional data collection to improve deer population estimates. Winter aerial surveys can provide an index, but logistical and environmental (e.g., adequate snow cover) constraints limit their use to every 5 to 10 years. Furthermore, aerial surveys are not considered reliable across much of northern Minnesota where predominant coniferous cover results in insufficient detection probability (Haroldson 2014) or across southwestern Minnesota where deer movements vary throughout the year (winter migrations).

Several Midwestern states have explored the use of annual hunter observation surveys for monitoring white-tailed deer population trends (Rolley et al. 2016) and trends of populations of other species of interest (Bauder et al. 2021). We conducted a pilot study from 2017 to 2019 to collect archery hunters' observations of deer using survey methods (mail and online versions). Although the information we gained from this bowhunter survey was useful in developing age and sex ratios to use as indices to measure deer model performance, response rates were low statewide. Therefore, in 2020, we took a community science approach by allowing all deer hunters, regardless of the season they are hunting, to provide observational data in an online format in an attempt to increase hunter participation.

OBJECTIVES

In 2023, our primary objective was to continue to evaluate this community science approach for monitoring trends in deer and other wildlife populations. Our secondary objective was to estimate fawn-to-adult female deer ratios from deer hunter observations.

METHODS

We moved from a traditional mail survey to a community science approach by soliciting participation using a variety of methods. We solicited participation using direct emails to hunters with emails on record with MNDNR's Electronic Licensing System (ELS), radio interviews, agency social media (e.g., Facebook, Twitter) and through agency newsletters such as the Deer Notes emails sent to subscribers. Hunters had the option to print off logs to manually record observations from multiple hunts and then submit them online all at once, or they could document their observations online after each hunt.

We asked deer hunters to document white-tailed deer, badger *(Taxidea taxus),* American black bear *(Ursus americanus),* bobcat *(Lynx rufus),* coyote *(Canis latrans),* fisher *(Martes pennanti),* gray fox *(Urocyon cinereoargenteus),* gray wolf *(Canis lupus),* and wild turkey *(Meleagris gallopavo)* observations and differentiate between antlered, adult female, fawn, and unknown deer age-sex classes while hunting. We also asked hunters to record DPA for hunting trip observations. We produced summary statistics describing the total number of observations for all species, calculated two indices (antlered deer observed per hour and total deer [bucks, adult females, antlerless, and unidentified combined] observed per hour), and calculated the fawn-to-adult female deer ratio as a representation of recruitment.

In Minnesota, there is greater diversity in biogeography than other Midwestern states. Because of the variability of habitat, we chose to report results for three ecozones: 1) farmland, 2) transition, and 3) forest.

RESULTS

We sent two direct emails to 144,430 hunters (including hunters purchasing licenses for all game species) for which we had an email on record. We also advertised via social media, radio interviews, and Deer Notes. Although we did not collect any information from hunters that would allow us to quantify participation in 2023 for comparison to previous years, we determined the total number of recorded observations. We recorded 2,569 total observations from hunters representing 115 of 129 DPAs in 2023 (Table 1). All DMUs and ecozones were represented with the 2023 observations. Hunters recorded: 223 observations in 1,010.5 hours in the farmland zone; 1,194 observations in 4,745 hours in the transition zone; and 1,152 observations in 6,513.5 hours in the forest zone. Statewide observations for each species ranged from 12 observations of badgers to 6,599 observations of deer (Table 2). Firearms hunters submitted 1,398 observations, archery hunters submitted 1,099 observations, and muzzleloader hunters submitted 72 observations. Most hunters recorded observations while hunting out of a tree stand (2,008) or a ground blind (351; Table 3).

In 2023, hunters observed 119, 576, and 350 antlered deer and 883, 3,432, and 2,284 total deer (Table 4) in the farmland, transition, and forest zones, respectively. Fawn-to-adult female deer ratio was 0.68, 0.82, and 0.58 in the farmland, transition, and forest zones, respectively. Antlered bucks observed per hour was 0.14, 0.14, and 0.09 in the farmland, transition, and forest zones, respectively. Total deer observed per hour was 1.08, 0.88, and 0.62 in the farmland, transition, and forest zones, respectively. Although comparing indices across years is difficult due to differences in methodology and low sample sizes in 2020 and 2021, there appears to be consistent variation among the ecozones for fawn-to-adult female deer (Figure 1), number of antlered deer observed per hour (Figure 2), and total deer observed per hour (Figure 3); however, it will take 3-5 years of collecting data under this new methodology to establish trends. Until then, annual comparisons should be made and interpreted with caution.

DISCUSSION

The goal of this survey is to derive an independent index to evaluate population trends for comparison to our deer population model output. Additionally, estimating fawn-to-adult female deer ratios will provide information on recruitment and could help inform the deer population model. Although we currently have 7 years of data from this project, variation in methodology and low sample sizes preclude us from interpreting trends. We will need at least 3 years of information gathered using similar methodology and adequate observations to start interpreting trends. However, we will not be able to make full comparisons to the deer population model until after we have 5 years of data because the deer population model assesses changes in populations over a 5-year period.

Although we have developed an improved methodology to increase our submission of observations from efforts in prior years, we still need to evaluate the potential for bias with this project. For example, hunters may not be as likely to record their observations if they do not see any deer while hunting, though this is a vital piece of information used when calculating our indices. Once we establish that we are collecting enough observations to allow for reasonable interpretations of trends, we will then explore potential methods to evaluate for non-reporting bias.

ACKNOWLEDGMENTS

We thank all deer hunters that participated in this survey and the MNDNR Farmland Wildlife Populations and Research Group staff that provided feedback on earlier versions of the survey and this report. We also thank Pete Takash, Barb Keller, Todd Froberg, and David Schueller for their help coordinating outreach and communication to solicit hunter participation.

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FIGURES AND TABLES

Table 1. Total number of observations by white-tailed deer hunters by year for each ecozone from 2017 to 2023 in Minnesota, USA.

Year	Ecoregion		
	Farmland	Transition	Forest
2017[a]	1,654	6,992	3,066
2018[a]	4,215	6,548	4,260
2019[a]	4,986	8,568	4,936
2020[b]	67	433	266
2021[b]	37	107	42
2022[c]	542	1,807	2,295
2023c	223	1,128	1,194

[a]Bowhunter observation survey with direct mailings to hunters.

[b]Community science approach without direct emails.

[c]Community science approach with direct emails.

Table 2. Total number of 9 species observed by deer hunters in 2023 for each ecozone in Minnesota, USA.

Ecoregion	Species								
	Deer	Wild turkey	Badger	Grey fox	Black bear	Fisher	Bobcat	Coyote	Wol f
Farmland	883	614	0	1	2	1	0	24	1
Transition	3,432	3,085	11	21	17	11	14	74	37
Forest	2,284	1,705	1	38	49	14	33	125	373
Statewide total	6,599	5,404	12	60	68	26	47	223	411

Table 3. Hunting methods used by deer hunters submitting observations in 2023, by ecozone, in Minnesota, USA.

	Ecoregion		
Hunting Method	Farmland	Transition	Forest
Tree stand	140	919	949
Ground blind	60	174	117
Stalking	9	28	46
Deer drive	2	3	3
Other	12	70	37

Table 4. Total number of observations by deer hunters of antlered deer, adult females, fawns, and unknown by ecozone for 2023 in Minnesota, USA.

Ecoregion	Antlered Deer	Adult Females	Fawns	Unknown
Farmland	119	446	269	49
Transition	576	1,391	1,183	282
Forest	350	1,124	631	179

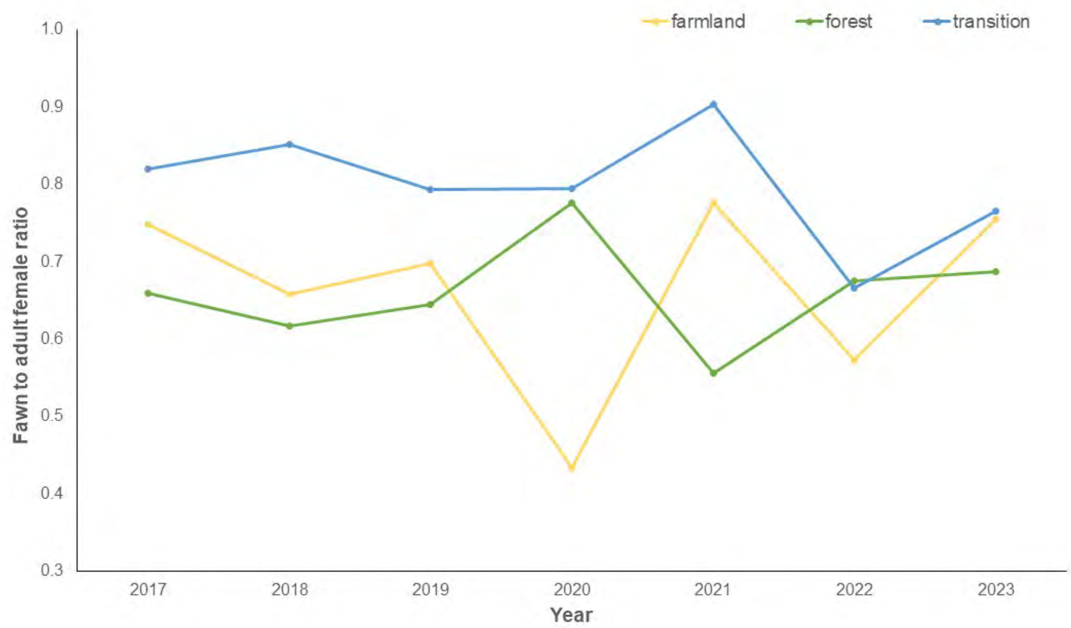

Figure 1. Index of the number of fawns-to-adult female deer ratio for the farmland, transition, and forest ecozones from 2017 to 2023 in Minnesota, USA.

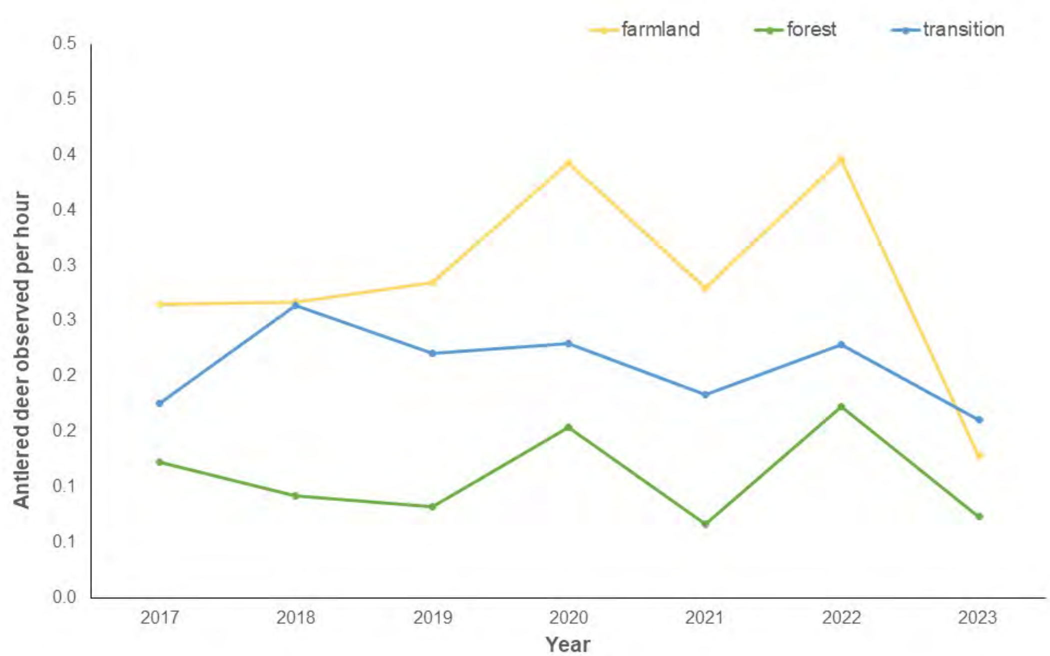

Figure 2. Total number of antlered deer observed per hour for the farmland, transition, and forest zones from 2017 to 2023 in Minnesota, USA.

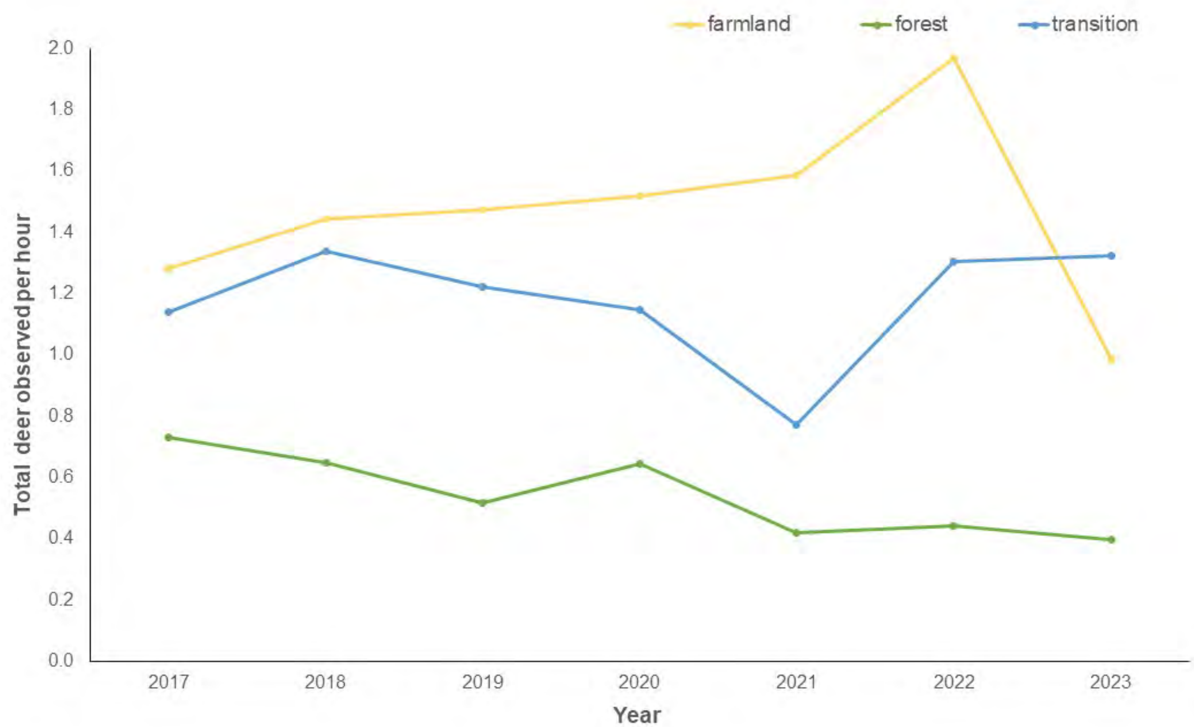

Figure 3. Total number of deer observed per hour in the farmland, transition, and forest zones from 2017 to 2023 in Minnesota, USA

FOREST WILDLIFE POPULATIONS

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CARNIVORE SCENT STATION SURVEY SUMMARY, 2023

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 (Johnson 1998, 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 49th 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 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, had 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 or 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 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.

Although the survey is intended to document long-term trends in populations, confidence intervals (CI) improve interpretation of the significance of any annual changes. However, I refrain from formal significance testing (e.g., determination of whether a CI on the difference between means overlaps 0) and instead use more informal methods (i.e., degree of CI overlap; Cumming and Finch 2005) to highlight changes from last year that likely represent significant differences.

RESULTS AND DISCUSSION

A total of 228 routes and 2,093 stations were surveyed this year, like but slightly above effort over the last 7 years. Route density varied from 1 route per 691 km^2 in the Forest Zone to 1 route per 1,583 km^2 in the Farmland Zone (Figure 1).

Statewide, route visitation rates (% of routes with detection), in order of increasing magnitude, were opossums (6%), bobcats (9%), wolves (11%), domestic dogs (19%), domestic cats (20%), skunks (24%), coyotes (32%), and red foxes and raccoons (35%). Regionally, species-specific route visitation rates (% of routes with detection) were as follows:

	Red fox	Coyote	Striped skunk	Raccoon	Opossum	Wolf	Bobcat	Dog	Cat
Farmland	28	65	40	72	12	0	0	21	35
Transition	26	32	23	46	12	6	6	31	23
Forest	43	22	19	16	0	18	13	12	13

Figures 2-5 show station visitation indices (% of stations visited) from the survey's inception through the current year. The only notable change this year was a significant decrease in bobcat detections in the Forest Zone (Figure 5).

In the Farmland Zone (Figure 2), red fox indices continue to remain stable but well below their long-term average as they have been for nearly 20 years. Conversely, coyote and raccoon indices steadily increased and continue to be near record levels. Low red fox indices are likely related in part to increased coyote abundance (Levi and Wilmers 2012). No consistent long-term trends are evident for other species in the Farmland Zone, though domestic dog detections have remained below the long-term average for over a decade and domestic cat detections have been near record lows over the past 3 years.

As in the Farmland, red fox and coyote indices have generally exhibited inverse patterns in the Transition Zone, with red fox indices remaining below average for nearly 2 decades and coyote indices generally increasing during that same time (Figure 3). No consistent long-term trends are evident for other species in the Transition Zone. Wolves and bobcats continue to occur in the Transition Zone (Figure 5), but at low levels and sometimes with erratic fluctuations compared to the Forest Zone.

Unlike in the Farmland and Transition Zones, the Forest Zone coyote index has not increased over time and was below the long-term average for 2 decades (Figure 4), likely due to the presence and long-term increase of wolves in the Forest Zone (Levi and Wilmers 2012).

Coyote point indices, however, have increased and remained above the long-term average the last 5 years, coincident with wolf indices dropping to near or below their long-term average during this same period. Red foxes, raccoons, and striped skunks have not exhibited consistent or notable trends over the past 20 years, with red fox and raccoon indices near their long-term averages and striped skunks below their average. After remaining low for an extended period (1976 – 2000), bobcat indices increased for over a decade (~ 2000 – 2012) and have since been relatively stable at levels well above the long-term average (Figure 4). However, the significant decrease this year reduced the bobcat index to near its long-term average.

ACKNOWLEDGMENTS

I wish to thank all the cooperators who participated in this year's survey: DNR Division of Wildlife staff; Superior National Forest Aurora District; Rydell and Sherburne National Wildlife Refuges; 1854 Treaty Authority, White Earth, Red Lake, and Leech Lake Tribal Natural Resource Departments; Ryan Miller, Rita Koch, and Vermillion Community College; 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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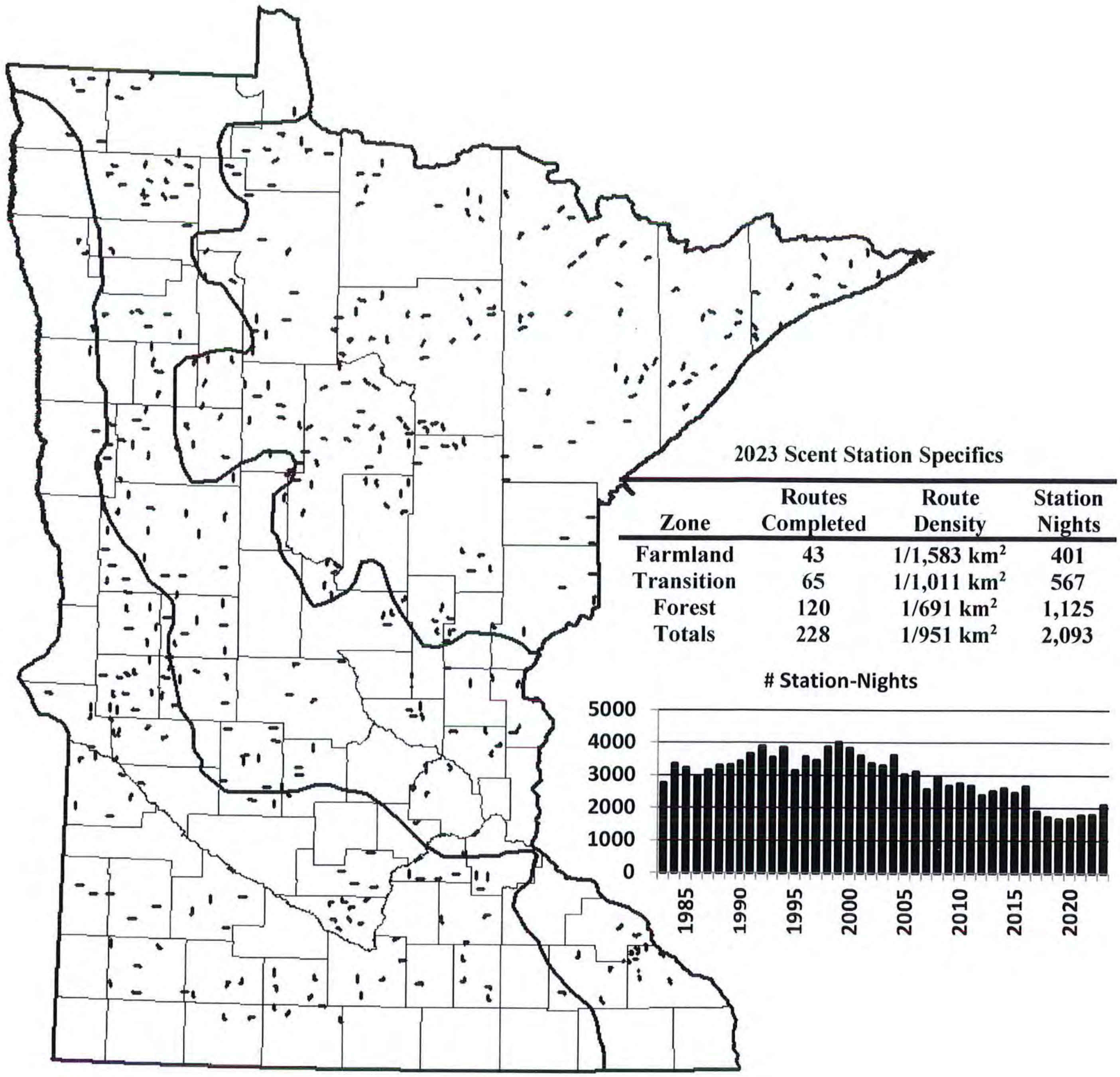

2023 Scent Station Specifics

Zone	Routes Completed	Route Density	Station Nights
Farmland	43	$1/1{,}583\ km^2$	401
Transition	65	$1/1{,}011\ km^2$	567
Forest	120	$1/691\ km^2$	1,125
Totals	228	$1/951\ km^2$	2,093

Figure 1. Locations of existing scent station routes (not all completed every year). Insets show 2023 route specifics and the number of station-nights per year since 1983.

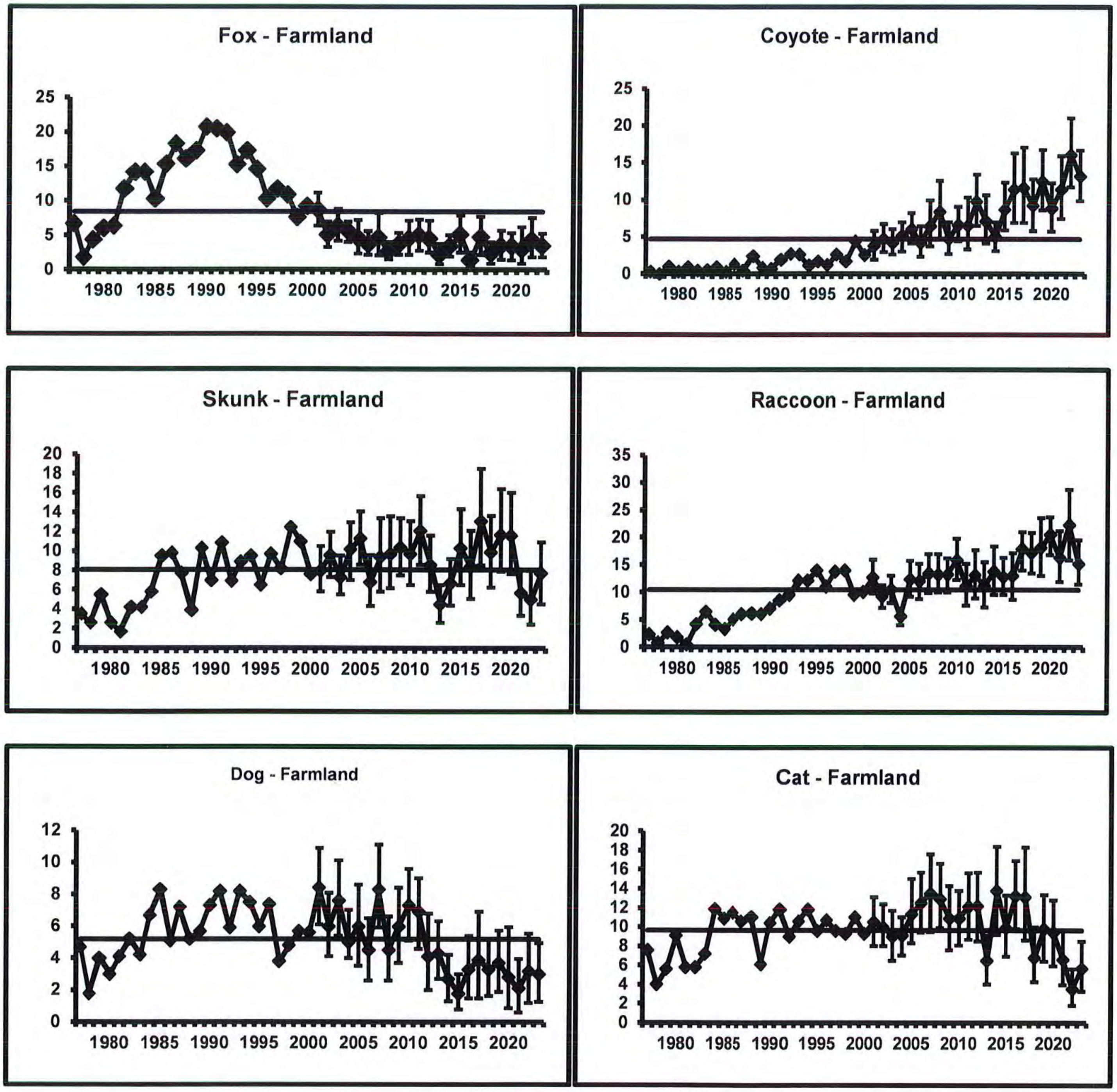

Figure 2. Percentage of scent stations visited by selected species in the Farmland Zone of Minnesota, 1977-2023. Horizontal lines represent long-term means.

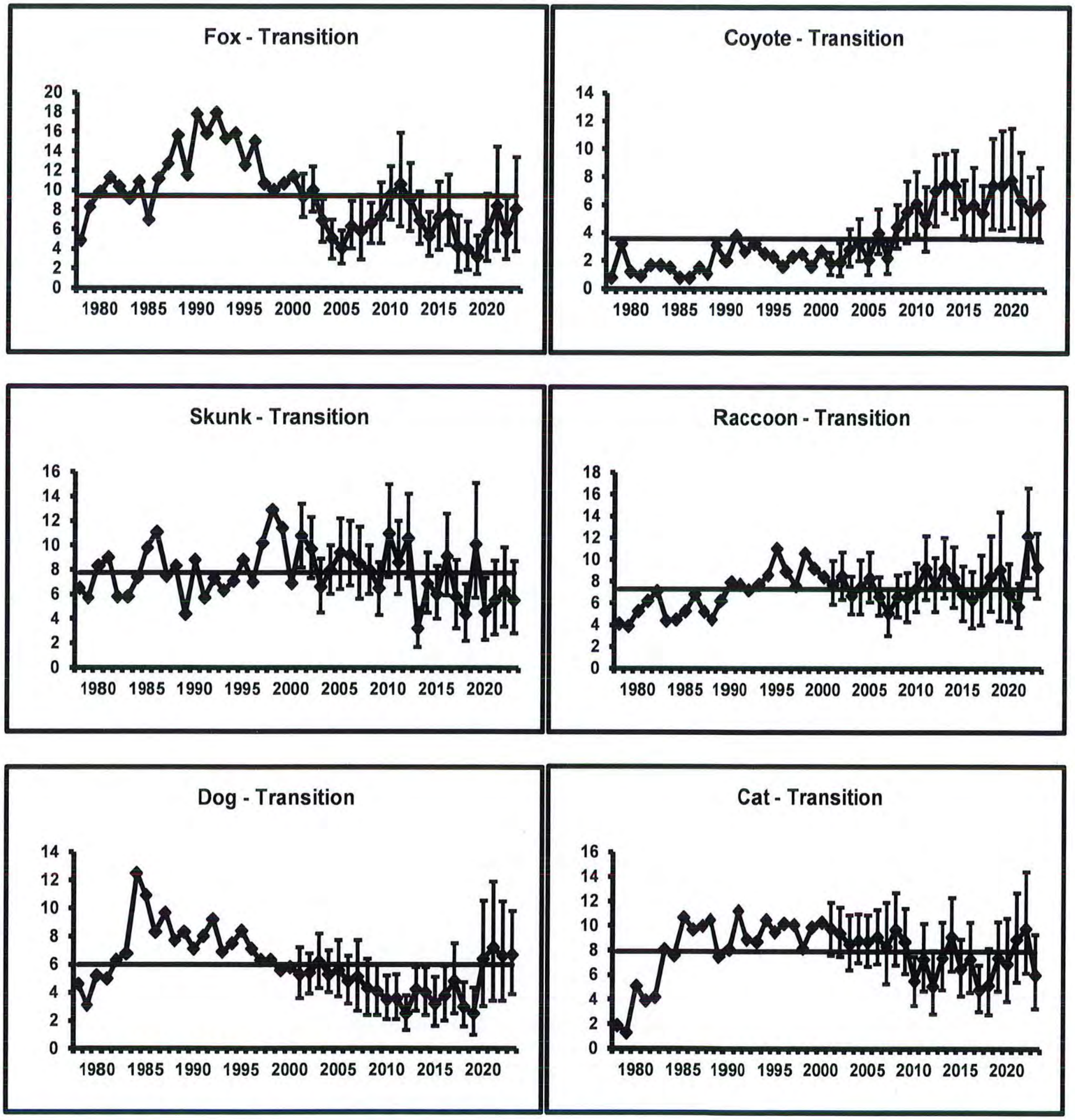

Figure 3. Percentage of scent stations visited by selected species in the Transition Zone of Minnesota, 1978-2023. Horizontal lines represent long-term means.

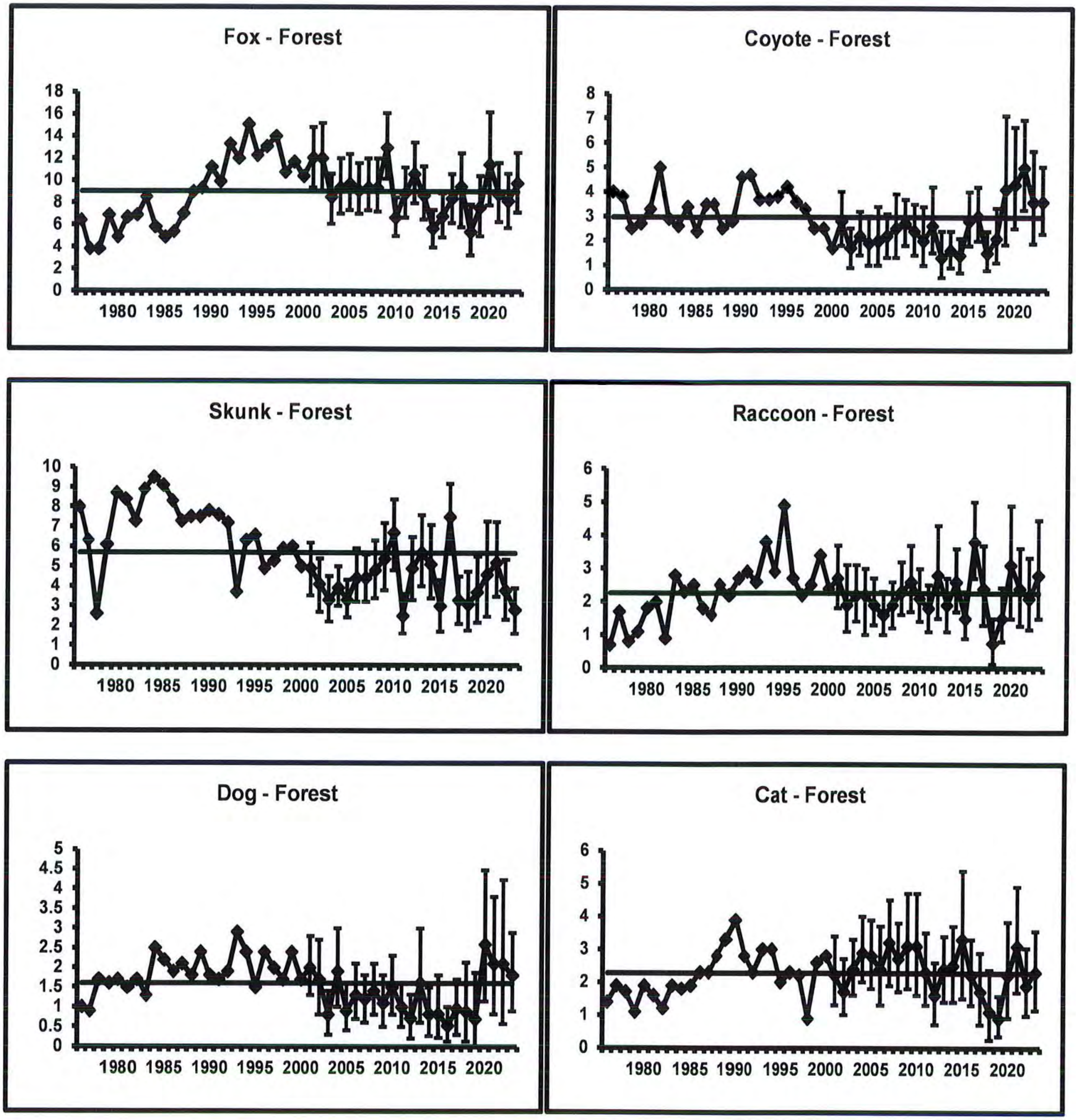

Figure 4. Percentage of scent stations visited by selected species in the Forest Zone of Minnesota, 1976- 2023. Horizontal lines represent long-term means.

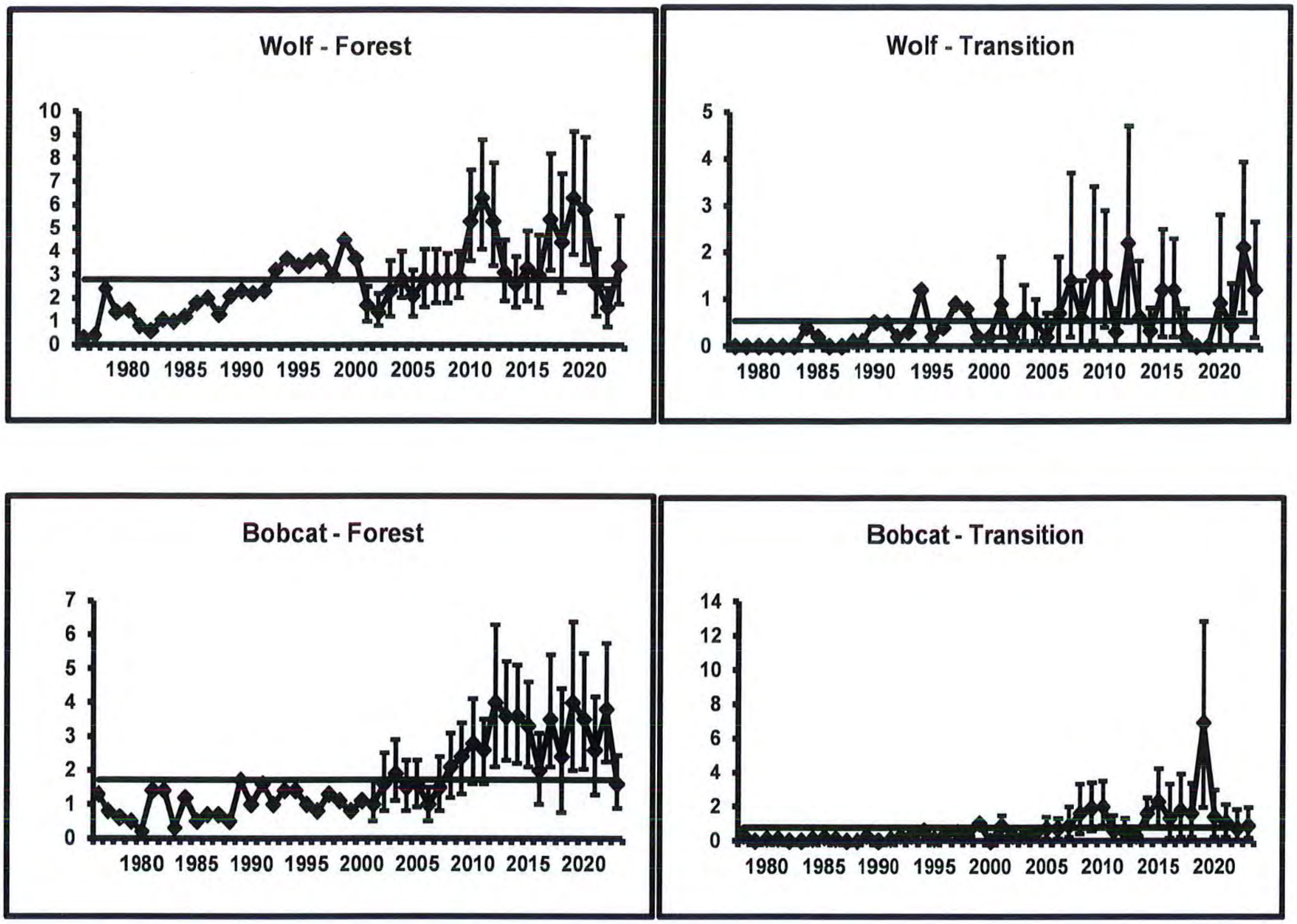

Figure 5. Percentage of scent stations visited by wolves and bobcat in the Forest and Transition Zones of Minnesota, 1976-2023. Horizontal lines represent long-term means.

FURBEARER WINTER TRACK SURVEY SUMMARY, 2023

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 their 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 populations over time (Johnson 1998, 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 fishers (*Pekania pennanti*) and martens (*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 (*Urocyon cinereoargenteus*) detections did not commence until 2008.

METHODS

Presently, 58 track survey routes are established across the northern portion of the state (Figure 1); for various reasons, not all are surveyed each year. Each route is 10 miles long and follows secondary roads or trails. Most routes are continuous 10-mile stretches of road or trail, but a few are composed of multiple discontinuous segments. Route locations were subjectively determined based on availability of suitable roads or trails, but were chosen when 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 recorded only 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 these 'duplicate' tracks are excluded in calculation of track indices (see below), recording data in this manner allows for future analysis of animal activity in relation to survey 'plot' size and habitat. Snowshoe hares (*Lepus americanus*) are recorded only as present or absent in the first 0.1 miles of each 0.5-mile segment. For standardization, routes are to be surveyed one day after the conclusion of a snowfall (ending by ~ 6:00 pm). However, in most years a few routes are completed two nights following snowfall; track counts on those routes are divided by the number of nights since snowfall.

Because most species of interest occur throughout the area where survey routes are located, calculated indices for all species in reports 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 (hereafter, the 'marten zone'). However, in general there were minimal differences in temporal patterns observed in this subset versus the full sample of routes.

Currently, I present three summary statistics for each species. First, I compute the percentage of 0.5-mile segments with species presence, hereafter the 'track index', after removing any duplicates (e.g., if the same red fox (*Vulpes vulpes*) clearly traverses two adjacent 0.5-mile segments of the road, and it was the only 'new' red fox 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 computed after removing any obvious duplicate tracks across segments. For wolves (*Canis lupus*) traveling through adjacent segments, I use the maximum number of pack members recorded in any one of those segments 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 (percent of segments occupied and number of 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 foxes 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, I include both indices on the same graph. Because snowshoe hares are tallied only as present or absent, the two indices are 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'). I compute this measure to help assess whether any notable changes in the above-described track indices are a result of larger-scale changes in distribution (i.e., more/fewer routes with presence) or finer-scale changes in density along routes.

Using a bootstrapping approach (percentile method; Thompson et al. 1998), 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 50^{th} and 950^{th} values constitute the lower and upper bounds of the confidence interval. Although the survey is intended to document long-term trends in populations, confidence intervals (CI) improve interpretation of the significance of any annual changes. However, I refrain from formal significance testing (e.g., determination of whether a CI on the difference between means overlaps 0) and instead use an informal approach (i.e., degree of CI overlap; Cumming and Finch 2005) to highlight changes from last year that likely represent significant differences.

RESULTS AND DISCUSSION

Lack of snowfall this winter limited opportunity for completion of track survey routes, with 28 routes being surveyed (Figures 1 and 2). Survey routes took an average of 2.2 hours to complete. Snow depths averaged 5” along completed routes, the lowest since 2006 (Figure 3). Mean overnight low temperature the night preceding the surveys was 8°F, slightly above the long-term mean (Figure 3). Survey routes were completed between December 10th and March 29th, with the mean survey date of January 20th (Figure 3).

Reliable interpretation of annual changes in 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), though trends in indices should be reliable provided there is no increasing or decreasing trend in detection rate. Because assumption validity remains uncertain, caution is warranted when interpreting changes, particularly annual changes of low to moderate magnitude or short-term trends. Based on degree of confidence interval overlap, there were no significant changes in track indices from last year (Figure 4).

Fishers were detected on 4.1% of the route segments and along 43% of the routes (Figure 4), with the latter being a marginally significant decline from the previous winter. 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 most indicative of population trends in only the northern ‘core’ of fisher range. Although there was a slight increase in the fisher track index four years ago, with no trend since, indices have remained below their long-term average for the past 15 years and far below their peak; in 2002, fishers were detected on 14% of survey route segments.

Within the ‘marten zone’, martens were detected on 9.4% of the route segments and 64% of the survey routes (Figure 4), both non-significant changes from the previous winter. At their peak in 1999, martens were detected on 13% of the ‘marten zone’ route segments and 83% of the ‘marten zone’ survey routes. Like but preceding the fisher decline by a few years, marten indices had also declined over a 14-year period (through 2008). Although low and without unidirectional trend since 2008, marten indices show indications of 3 - 5-year cycles consistent in timing with cyclic fluctuations of some of their rodent prey species in Minnesota (Figure 4; Berg et al. 2017, Swingen 2020). Data suggests this winter was near or at another peak in the apparent cycle.

Bobcat indices had increased for approximately 14 years through 2012 (Figure 4). Since then, indices have erratically fluctuated and generally remained above, sometimes well above, the long-term average. Bobcats were detected on 4.8% of the segments and 57% of the routes, both above their long-term averages but representing non-significant changes from last winter (Figure 4).

Wolves were detected on 9.9% of the route segments and 89% of the survey routes, both above their long-term averages and representing non-significant increases from last winter (Figure 4); the average number of wolves detected per route was 3.4. Coyotes were detected on 4.8% of the route segments and 46% of the routes. Though neither represented a significant change from last winter, both are at or near record levels since the survey began (Figure 4). The long-term trend in coyote indices has been stable, but as with martens and weasels (see below), coyote track indices show indications of 3 - 5-year cycles consistent in timing with fluctuations in some rodent populations in MN. Long-term, red fox indices have displayed somewhat of a ‘stair-step’ decline, being lowest and comparatively stable from 2013 – 2018. Over the last 5 years, indices have slowly climbed to near the long-term average. Red foxes were detected on approximately 14% of the segments and 86% of the routes (Figure 4), both representing non-significant increases from last winter. Although no long-term trend is evident in gray fox indices, data from the past 14 years suggests that, similar to coyotes, martens, and weasels, they may fluctuate in concert with cyclic rodent populations (Figure 4). Gray foxes were detected on 1.2% of the route segments and on 14% of the routes, both near their long-term means.

Weasel (*Mustela* spp.) indices are characterized by 3 - 5-year cycles or 'irruptions' superimposed on a declining trend, though the declining trend appears to have leveled off since 2012 (Figure 4). Weasels were detected on 13% of the route segments (peak of 31% in 1995) and on 64% of the routes (peak of 88% in 1999) and indices are suggestive of being at or near a cyclic peak, albeit below the long-term average.

Both spring and winter hare indices steadily increased from 1994 – 2012. Since then, there has been less consistency between the 2 indices though both had generally declined for 4 - 5 years and then remained relatively stable near their long-term averages (Figure 4); this year, neither the spring or winter hare index changed appreciably from the previous year. Historic data (pre-1994; not presented here) for the spring snowshoe hare index clearly exhibited 10-year cycles, with peaks and rapid declines often occurring in the first few years of each decade and somewhat synchronous with the ruffed grouse cycle (which currently appears to be near a cyclic peak). Recent data suggests hare cycling has dampened or disappeared, with minimal connection to the more distinct grouse cycles.

ACKNOWLEDGMENTS

I wish to thank all those who participated in this year's survey, including staff with the Minnesota DNR, Superior National Forest, and the 1854 Treaty Authority. This project was funded in part by the Wildlife Restoration Program (Pittman-Robertson).

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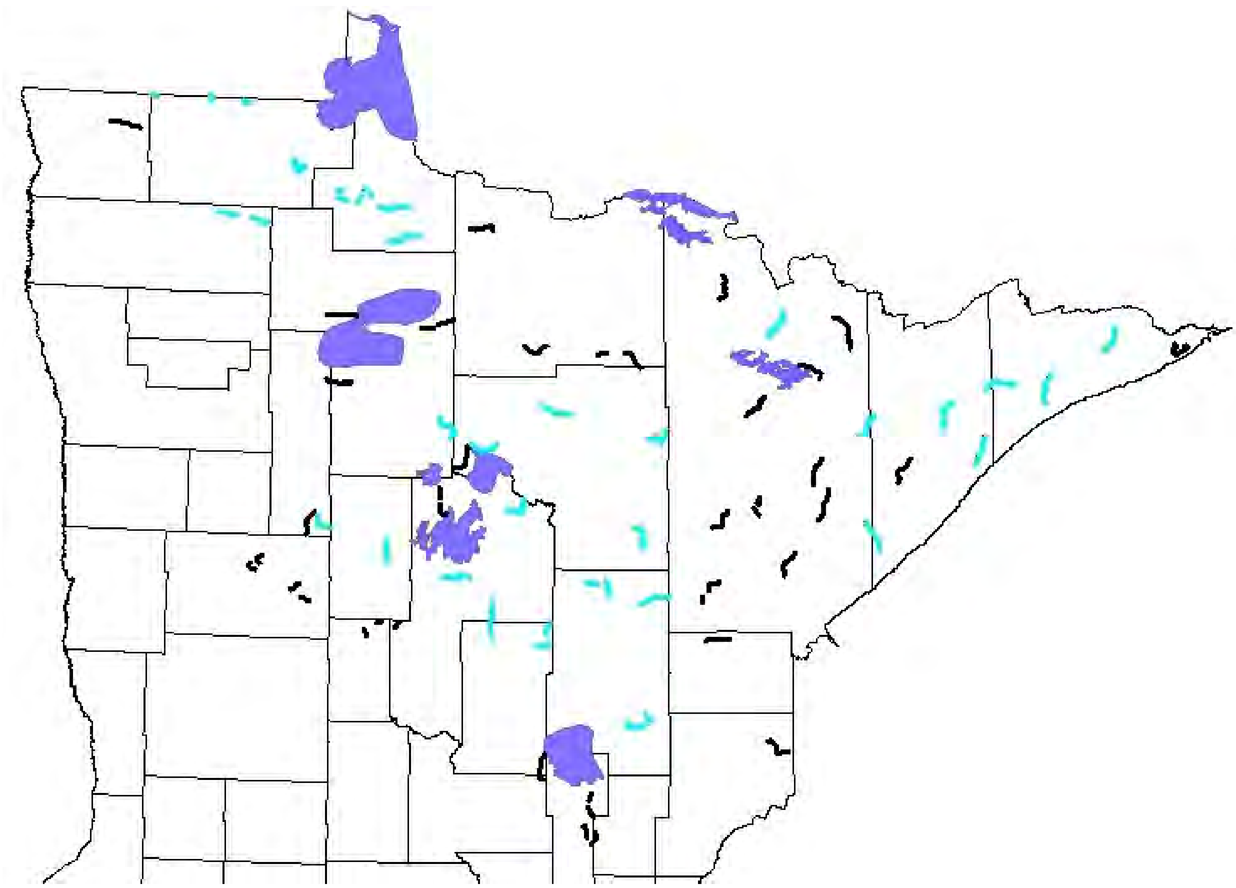

Figure 1. Locations of furbearer winter track survey routes in northern Minnesota. Blue routes are those completed during winter 2023-24.

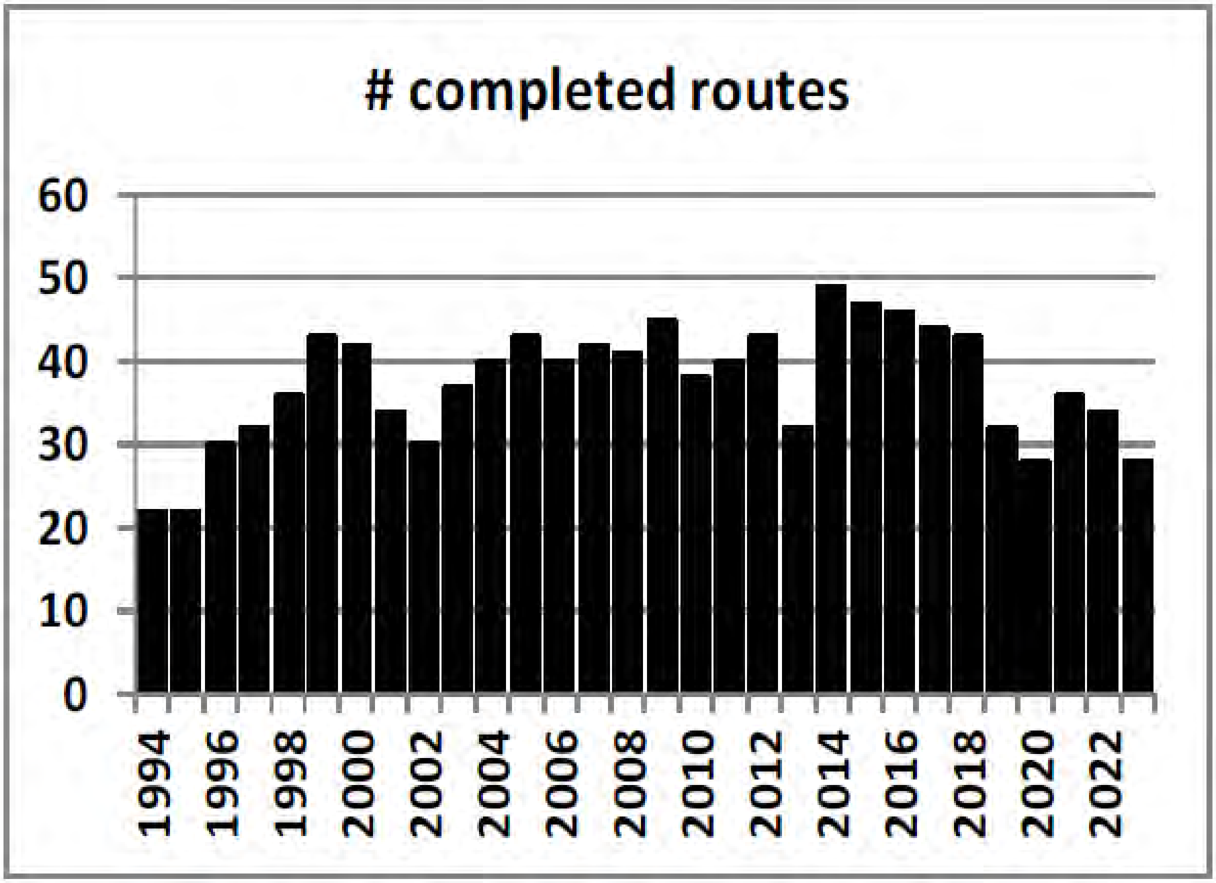

Figure 2. Number of snow track routes surveyed in Minnesota, 1994-2023.

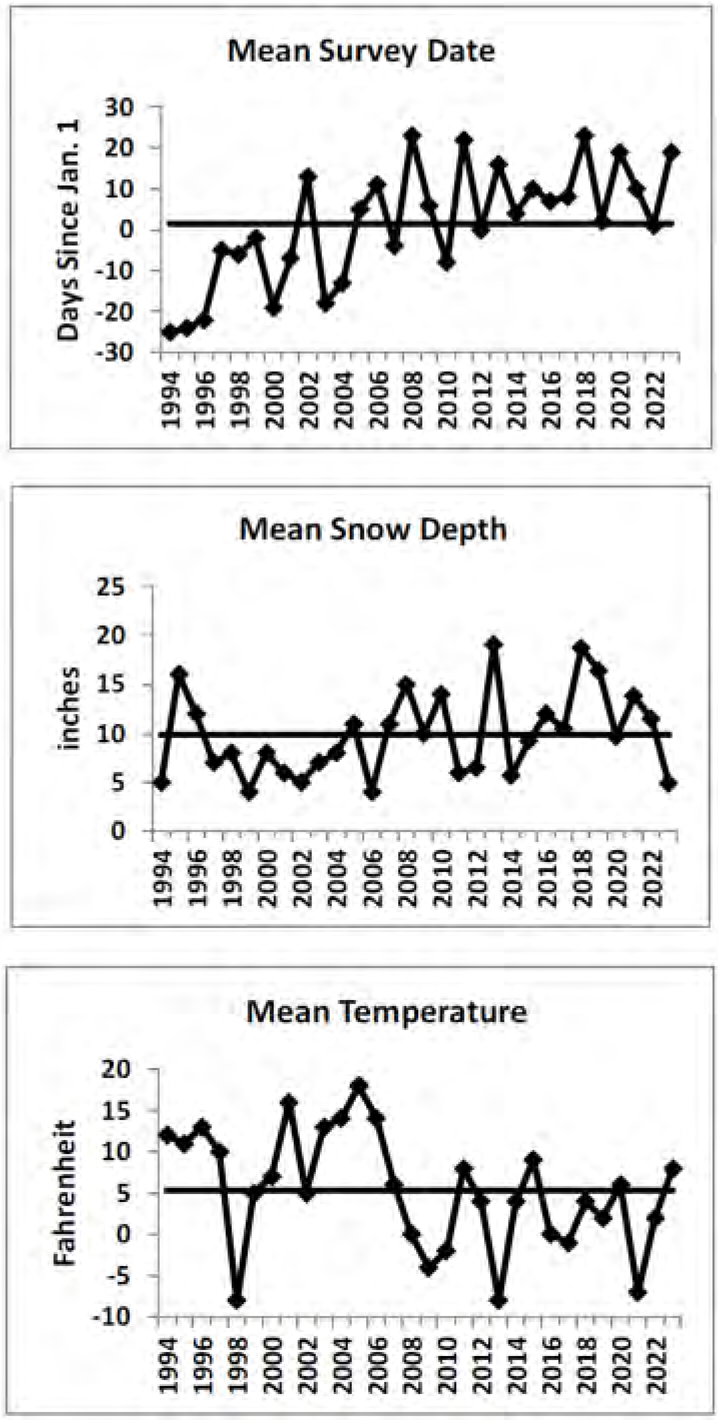

Figure 3. Average survey date, snow depth, and temperature for snow track routes completed in Minnesota, 1994-2023. Horizontal line represents long-term mean.

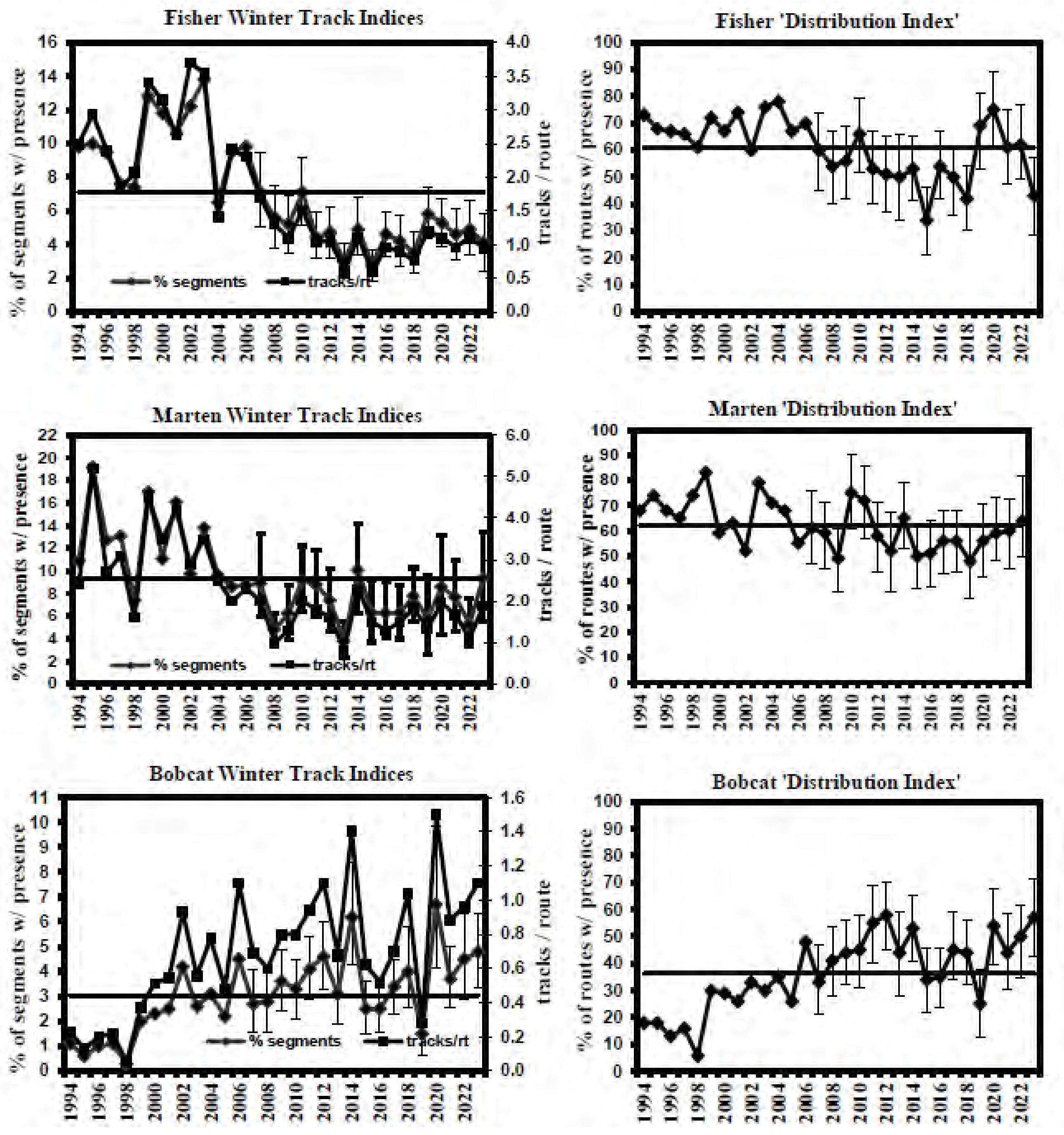

Figure 4. Winter track indices for selected species in Minnesota, 1994-2023. Confidence intervals are presented only for % segments and % routes with track presence; horizontal lines represent their long-term averages.

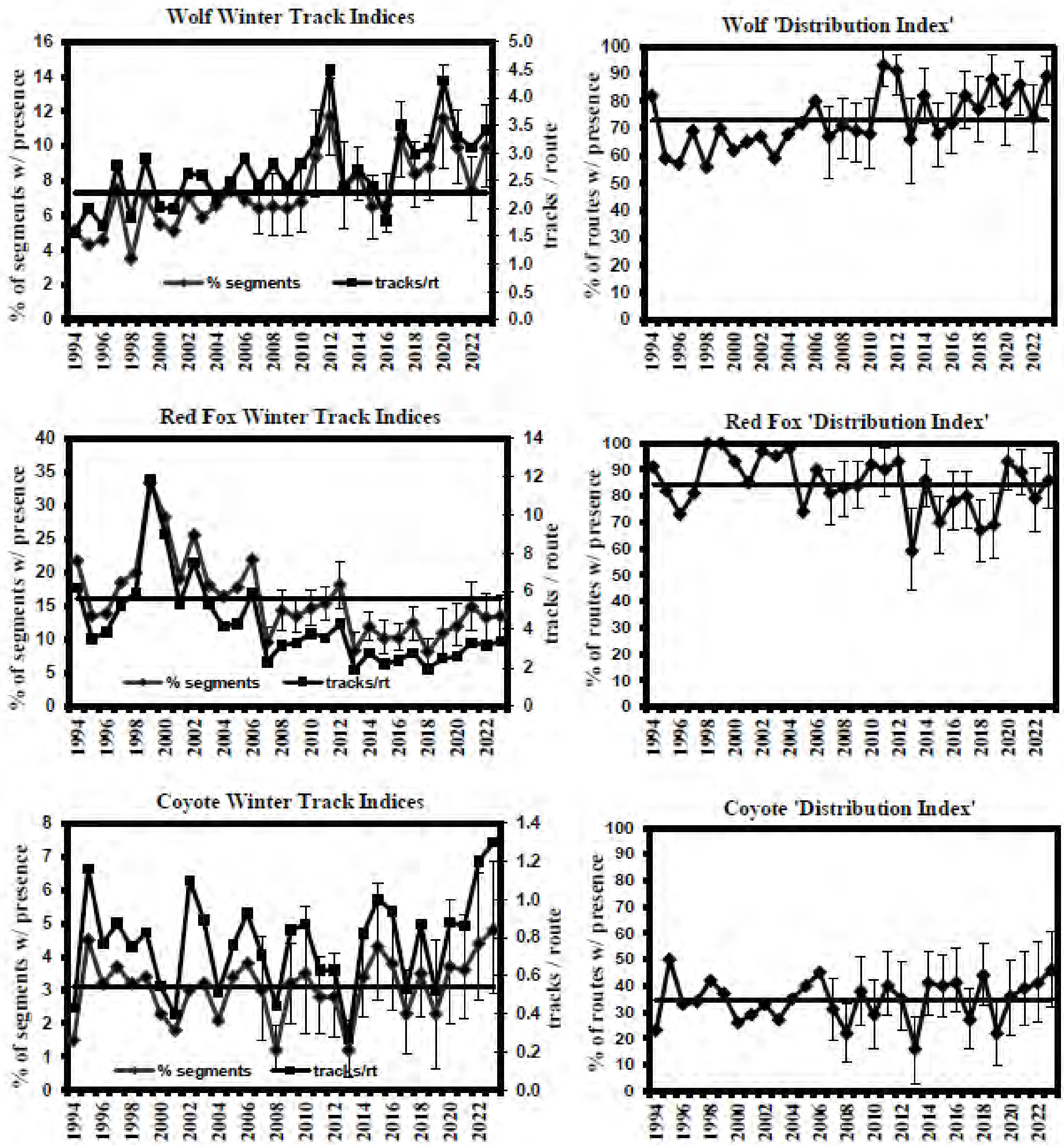

Figure 4 (continued). Winter track indices for selected species in Minnesota, 1994-2023.

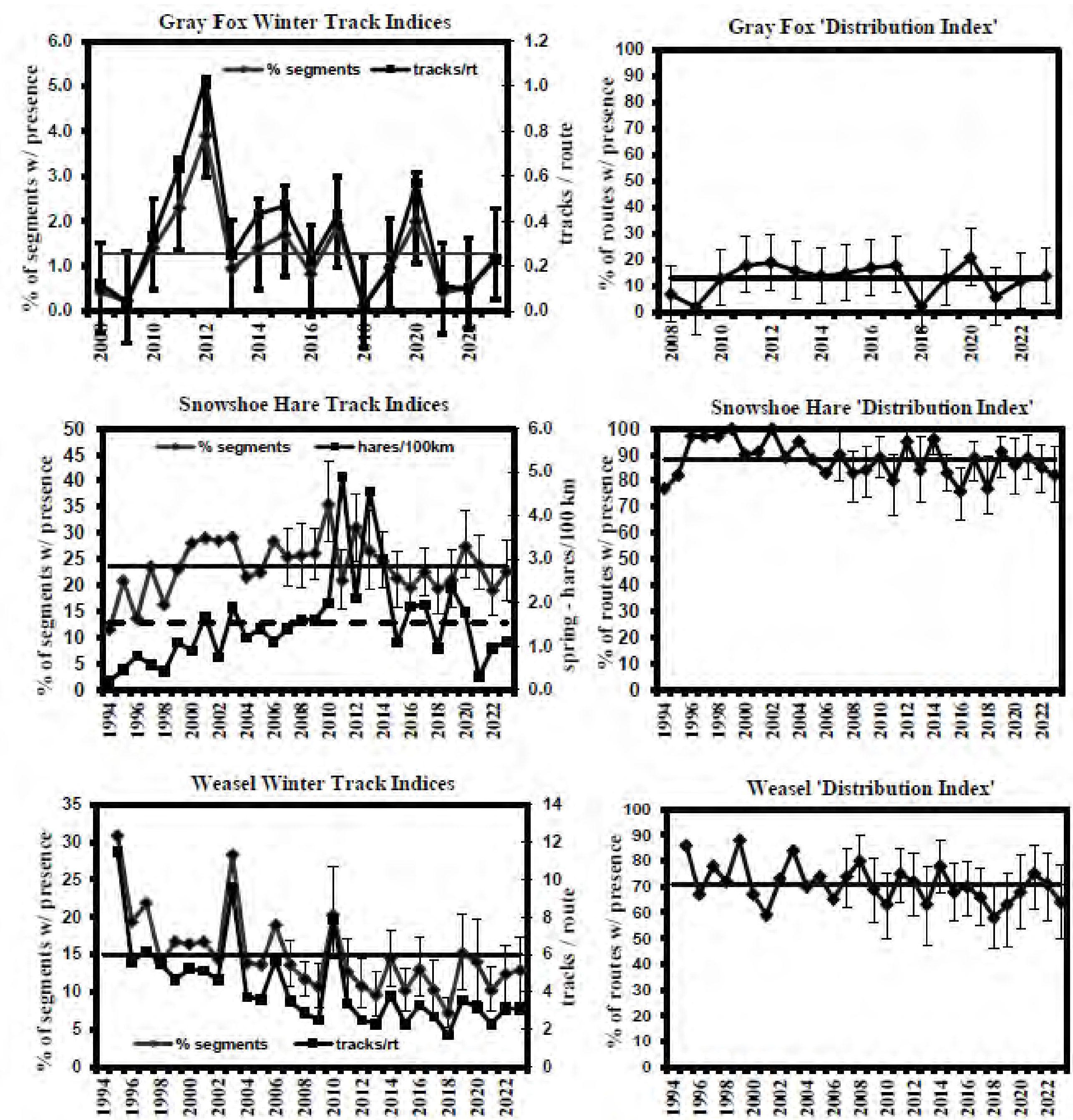

Figure 4 (continued). Winter track indices for selected species in Minnesota, 1994-2023.

DEPARTMENT OF NATURAL RESOURCES

STATUS OF MINNESOTA BLACK BEAR POPULATIONS, 2023*

Andrew N. 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 and quota vs no-quota zones

A new Bayesian model developed by Allen et al. (2018) for bear monitoring in Wisconsin includes not only the sex-age composition of harvested bears (like the Downing), but also reproductive and survival parameters (obtained from data collected from long-term monitoring of radio-collared bears in different study sites across Minnesota). The trajectory of this model is robust to assumption violations but seems to be an underestimate compared to our tetracycline estimates. The models for this year indicated that the statewide population has stabilized and is slowly recovering. It is also not dissimilar to the Downing model overall trajectory. Notably, the quota area as a whole has stabilized since 2012 and has been increasing steadily the past couple years. The no-quota area has been increasing steadily for the last 20 years (Figure 1).

Population trend: BMU-level

Using the Allen et al. (2018) population model, we were able to estimate population trend for each BMU (Figure 2). This has been something out of reach until this year due to limitations from small annual harvests over time and the insensitivity of the Downing model with small populations. The population estimates tended to follow what we know about bear reproduction in Minnesota (Figure 3). The poor soils in NE Minnesota BMUs produce less bear food and subsequently, have much lower bear reproduction (BMUs 24, 25, 31) than areas farther south. In the western and southern BMUs (the periphery of bear range in Minnesota), oak forest and agriculture provide bears with abundant food. Bears in these BMUs (11, 46 and 47 [former 44], 45, 51, and 52) reproduce at younger ages and will be the quickest to recover from the population reduction in the 2000s. The remaining BMUs have reproduction levels between the north and south. They are the areas we would expect to stabilize and recover after the periphery of bear range.

Caution in interpreting the estimates is needed. Modeled population trends are far more robust than population estimates for a given year. The scale (estimated population size) is not as accurate as the overall trend (increasing, decreasing, or stable). There is little to no population closure in any given BMU due to their small size and the frequency of bear migration in MN. Furthermore, a way to evaluate our current management goals is to compare the most recent estimates with those in 2012–2013, when permits were cut dramatically. Harvest quotas have been essentially level since that point and comparing with that cut point will allow for a better understanding of recent trends.

After permit cuts in BMUs 12, 24, 25, and 31 last year and the abundant natural foods, there seems to be some flattening of the decline in BMUs 25 and 31. This is welcome news and is a good indicator that the cuts are helping. We'll need a few more years of low permit numbers in these BMUs to ensure the population has stabilized and the decline has reversed.

The good news is that populations in BMUs 26 (current BMUs 27 and 28), 41, 44 (current BMUs 46 and 47), 45, and 51 seem to have stabilized since the permit cuts in 2012. All of the aforementioned BMUs have been stable and started to increase since the permit cut, although BMUs 41 and 51 have had a very negligible decline over the past few years.

The no-quota BMUs have been increasing rather quickly since 2012. Estimates of growth are 6.0% (BMU 11) and 2.0% (BMU 52) annually from 2012–2024. We do not have an explanation for why these areas with unlimited hunting are growing so quickly but hypothesize that it is the high-quality habitat and relatively low/uneven hunting pressure across BMU 11 and 52. There are big tracts of public land in the no-quota areas (especially in BMU 11), but generally these WMAs are large wetland complexes and hard to access by hunters. The remainder of the areas are dominated by private land with limited access to hunters. The modeled population trend seems to match the perception among the public and area wildlife staff that bear populations are increasing quickly. Specifically, in BMU 11, bears were non-existent in the early 1990s, but bear range and population size have expanded since then. Commensurately in BMU 52, there are regular bear sightings in the northern suburbs of the Twin Cities in Anoka, Chisago, and Washington counties.

Trends in harvest rates

The sex ratio of harvested bears varies by age (Figure 4). 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 as individuals, 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 in recent years have been similar to the early 1980s when the population was similarly small (~15% of the total bear population was harvested).

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 4).

Human bear conflicts

The total number of recorded bear complaints has been stable for a decade (Table 1) but has fluctuated with natural food abundance (Figure 7). 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 implemented a similar system beginning July 2019. This dramatically increased the reporting rate of Conservation Officers. This year, we received the fewest number of bear complaints since we started recording these data in 1980.

Food abundance

The composite range-wide, all-season abundance of natural bear foods (fruits and nuts) in 2023 was the 4th best on record (Table 2). Abundance of many summer foods was above the long-term (38-year) average for all regions (Table 3). In general, summer food conditions were exceptionally good across the state. The statewide fall food index (productivity of dogwood + oak + hazel), which helps predict annual harvest after accounting for hunter effort (Fig. 7), was the 3rd best year on record. Hazelnuts, acorns, and dogwood berries were above average in many areas of the state (Table 4, Figure 8). The oak production this year was exceptional in almost all areas where oaks exist.

Predictions of harvest from food abundance

The 2023 statewide harvest was roughly what was expected, based on regression of harvest as a function of hunter numbers and the fall food productivity index (Figure 7). For the quota zone, the actual harvest in 2023 was nearly the same as predicted by this regression.

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 (Figure 9). Reminder notices were sent to non-compliant hunters each year during 2014–2017, which spurred a higher initial compliance the following years (>80%). Since 2018, with no reminder mailing, compliance has been 82–87%. Since 2013, hunters could register by phone or internet, and pick up a tooth submission envelope later: tooth submission compliance by these hunters has equalized across all registration types. A decreasing proportion of hunters are registering their bear at a registration station over the past years. Compliance with tooth submission was higher in the quota zones than in the no-quota area (Figure 10) but was especially low (<80%) in a number of units (BMUs 10, 12, 22, 41, and 52).

**Population data extracted from the Status of Minnesota Black Bears, 2023 Final Report to the Bear Committee. All data contained herein are subject to revision, due to updated information, improved analysis techniques, and/or regrouping of data for analysis.*

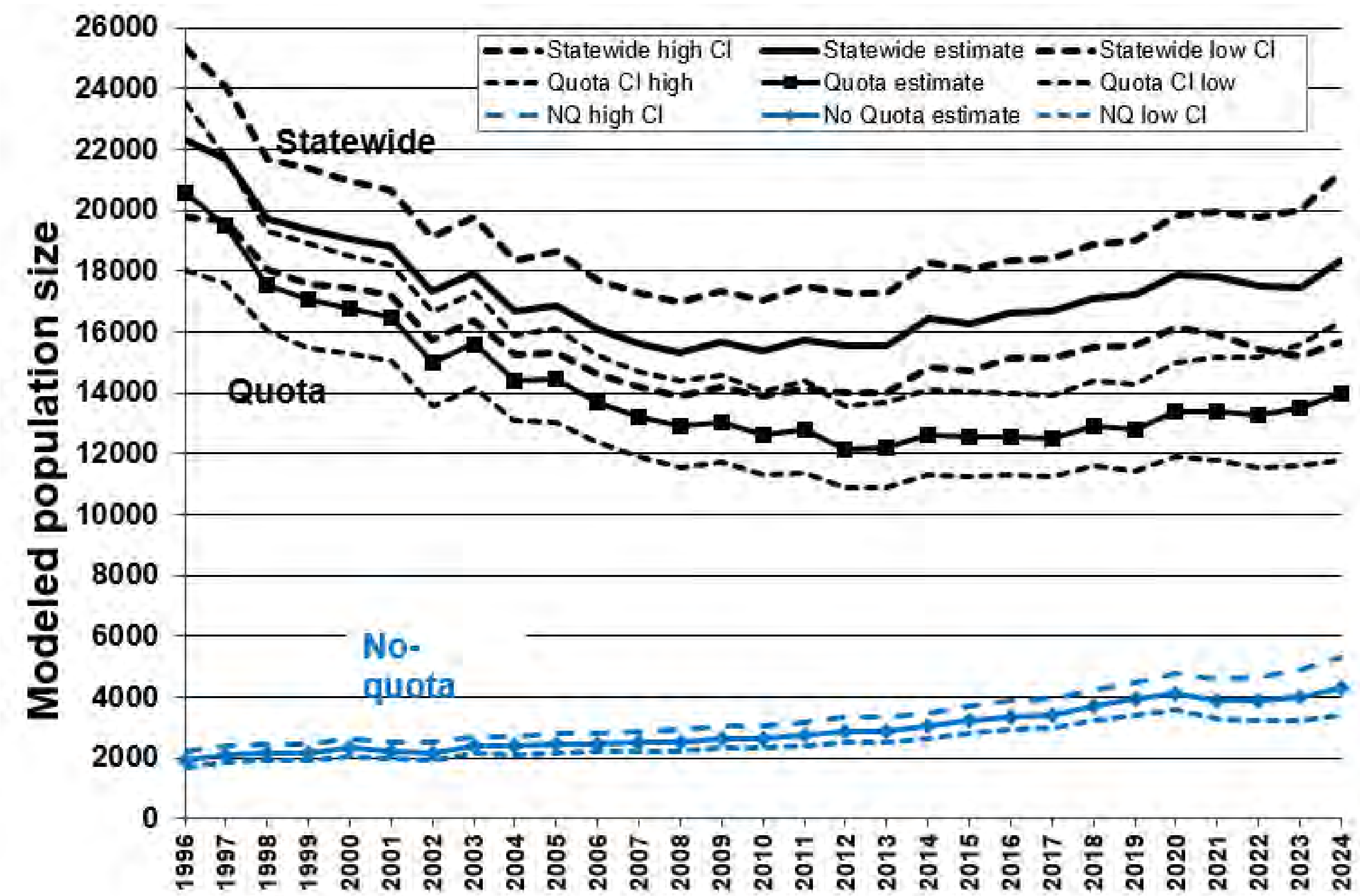

Figure 1. Population trends during 1996–2024 derived from Allen et al. (2018) model statewide estimates (± 95% credible intervals), and population estimates for quota and no-quota zones.

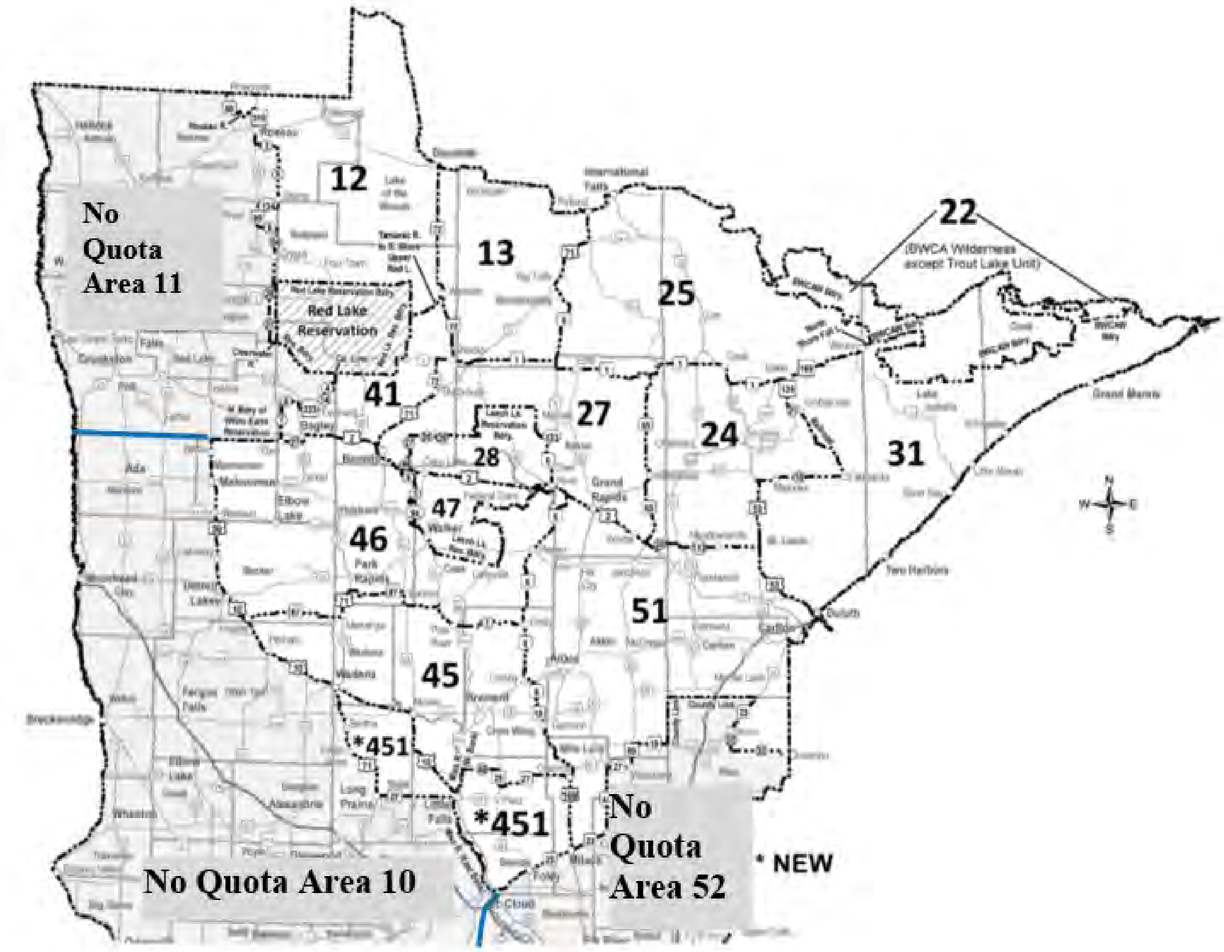

Figure 2. Bear management units (BMUs) within quota (white) and no-quota (gray) zones. Hunters in the quota zone are restricted to a single BMU. In 2016, BMU 26 was divided into 27 and 28, and BMU 44 was split into 46 and 47 (BMUs 28 and 47 comprise the Leech Lake Reservation). No-quota hunters can hunt anywhere within the gray-colored zone, including the southeast corner of Minnesota (not shown; designated area 60). In 2020, zone 451 was split from 3 deer permit areas of 45 to relieve crop damage in the area. This area is in the quota-zone, but with an unlimited number of participants.

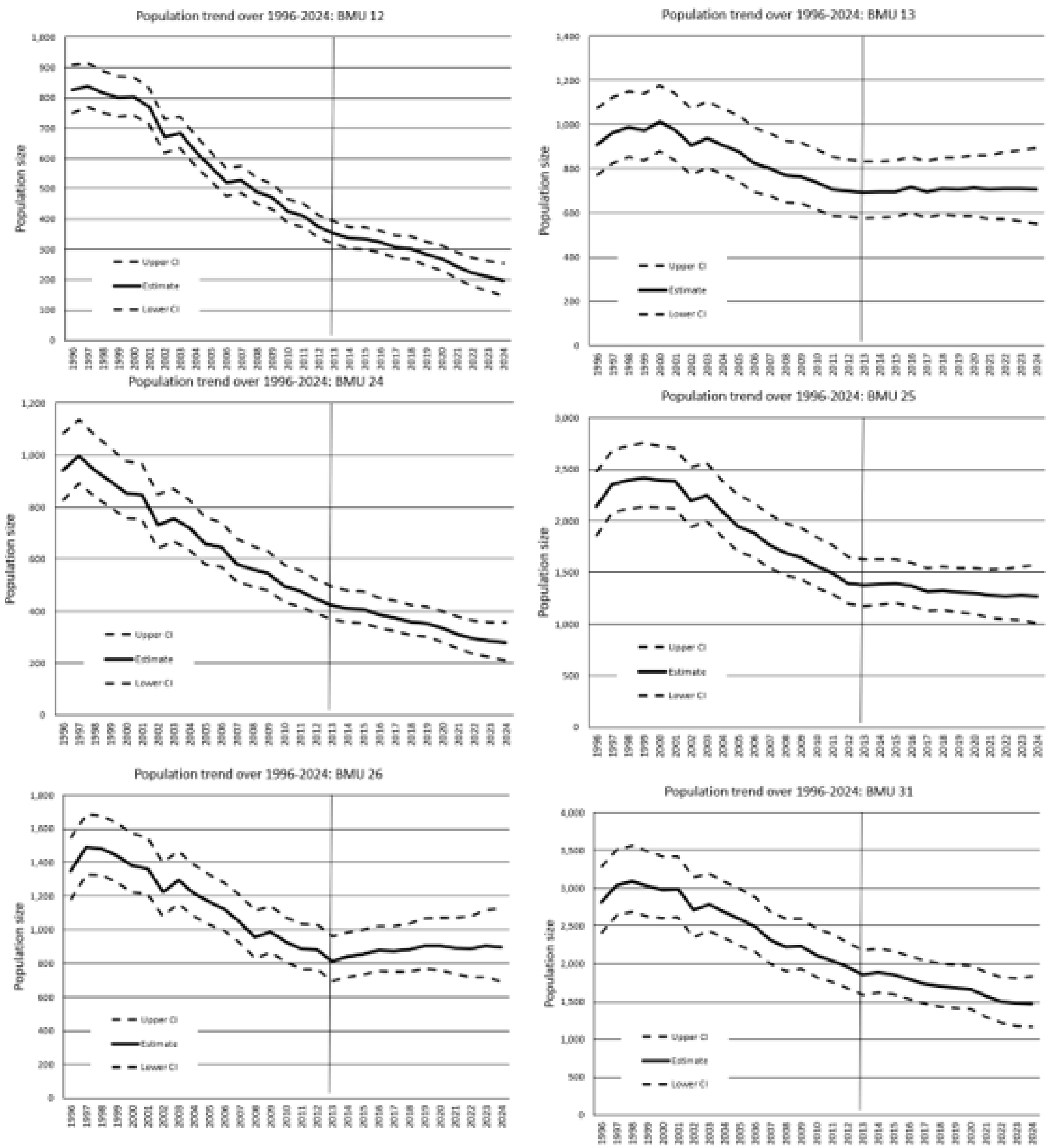

Figure 3. Allen et al. (2018) BMU-level, pre-hunt estimates 2000–2024. The vertical black line in 2012-2013 represents when quota permits were cut by >50% and have remained stable at low levels since then. The dashed lines represent the 95% pointwise credible intervals of the population estimate. With the small population size at BMU level, estimates of population trend are more reliable than actual population size. BMU harvest in area 22 is too small to reliably model. BMU population estimates are compiled into pre-2017 BMUs (e.g., BMU 27 and 28 are aggregated into BMU 26; BMU 46 and 47 are aggregated into BMU 44).

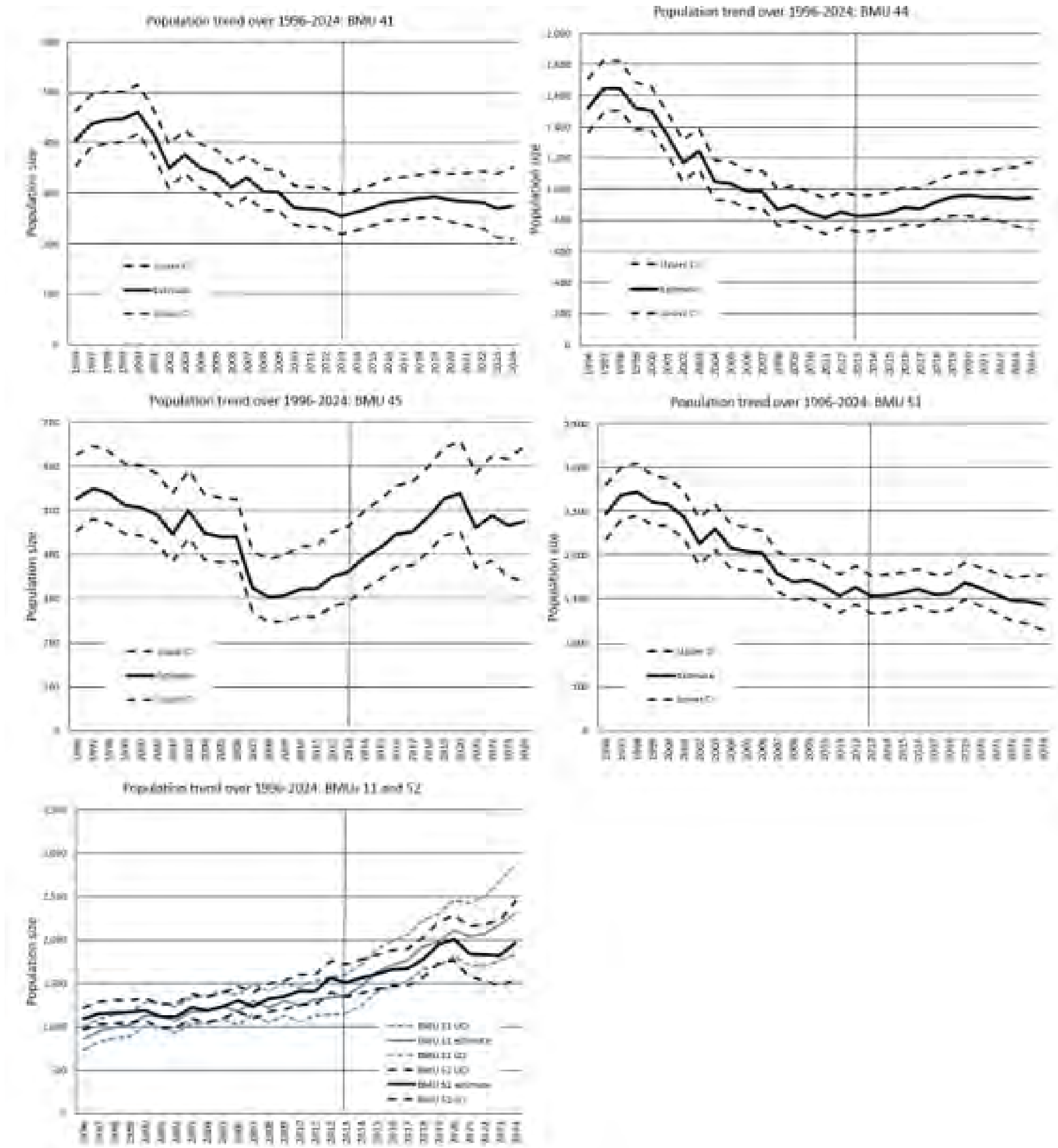

Figure 3 cont.

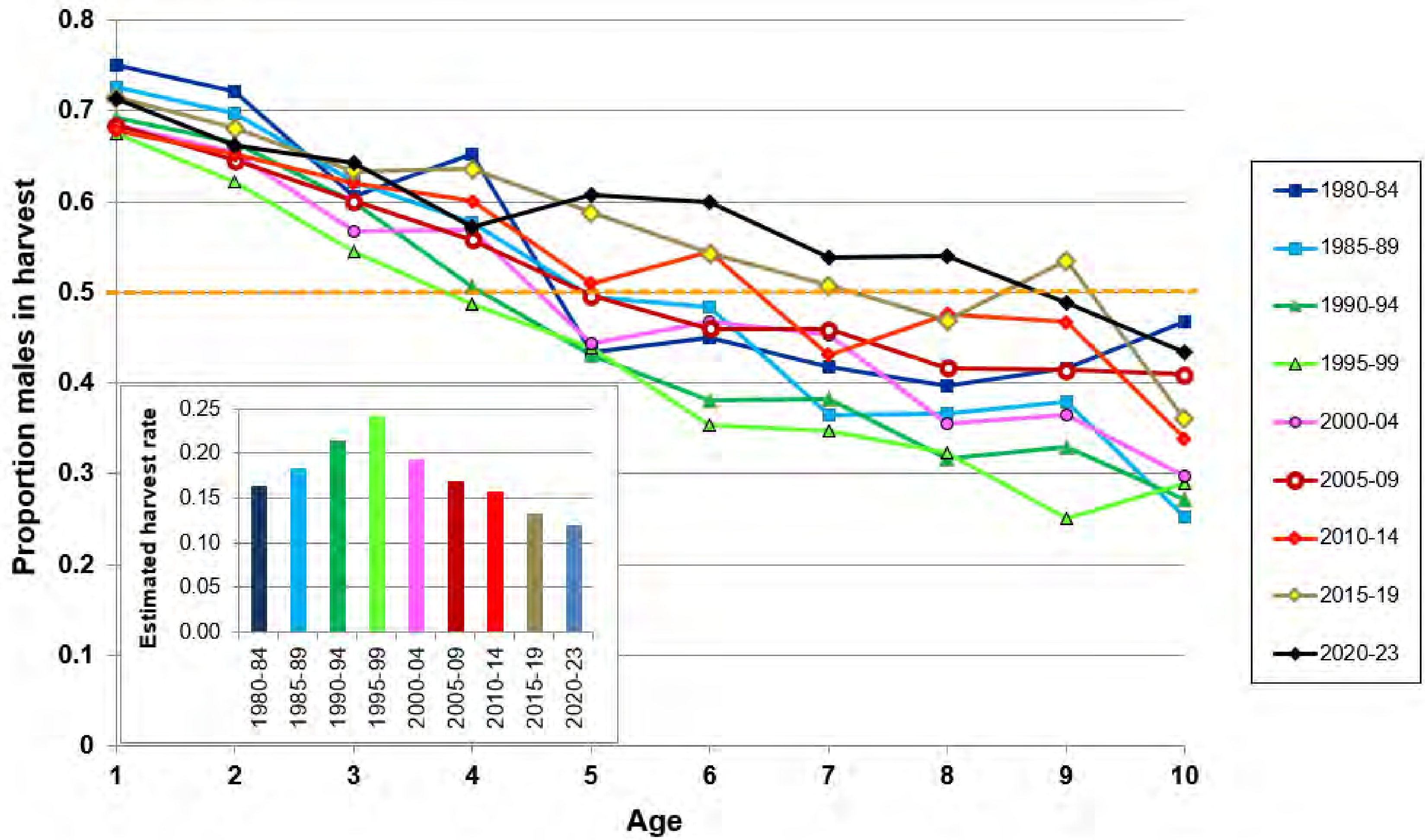

Figure 4. Trends in proportion of male bears in statewide harvest at each age, 1–10 years, grouped in 5-year time blocks, 1980–2023. Higher harvest rates result in steeper curves because males in the living population are reduced faster than females. Fitting a line to the data for each time block and predicting the age at which 50% of the harvest is male (dashed orange horizontal line) yields approximately the inverse of the harvest rate (derived rates are shown in inset). Flatter curves in recent years indicate lower harvest rates (e.g., 2015–19 lower than 1980–84), but a slight increase in recent years.

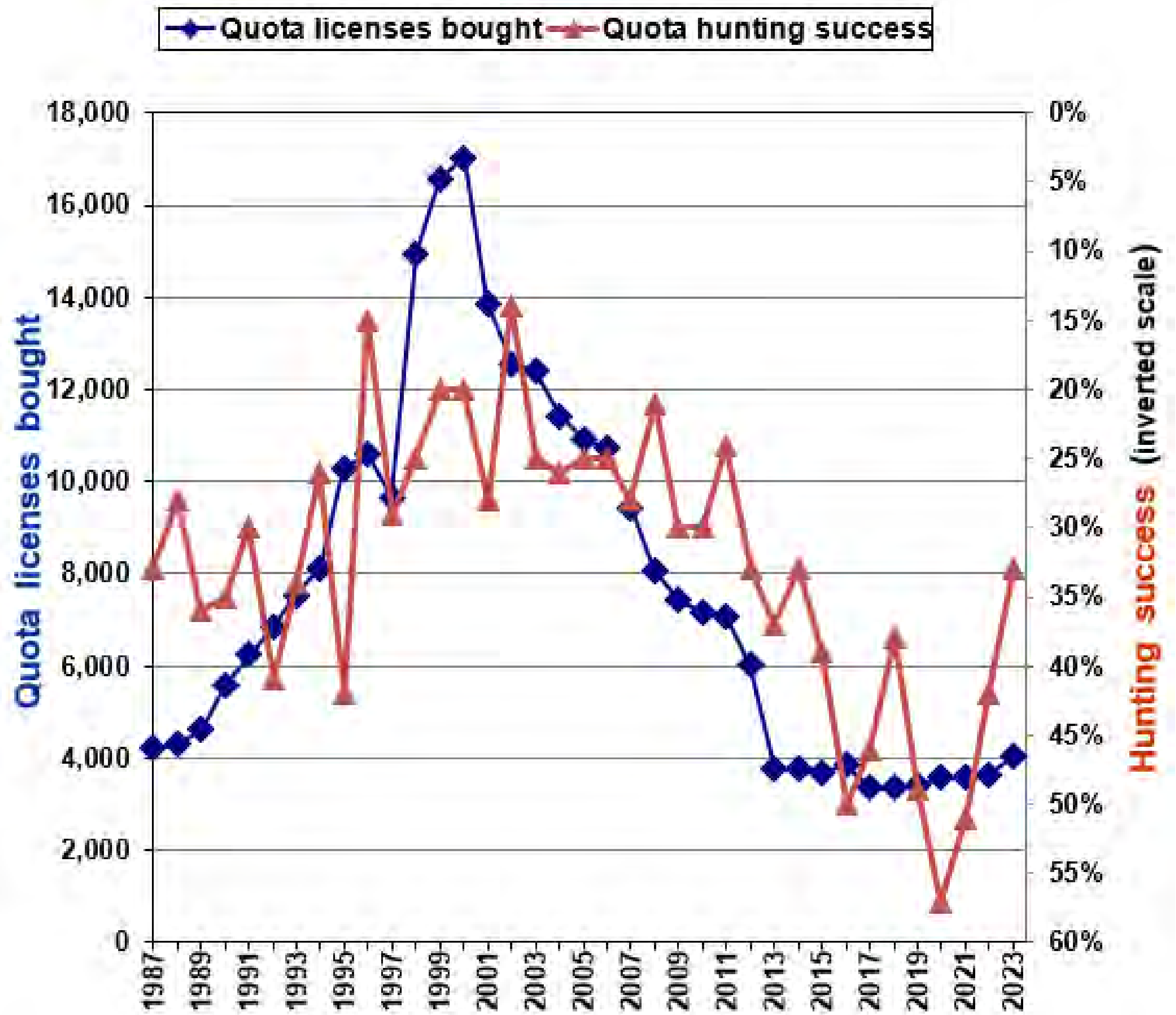

Figure 5. Relationship between licenses sold and hunting success (*note inverted scale*) in quota zone, 1987–2023 (quota and no-quota zones first partitioned in 1987). Number of licenses bought explains 60% of variation in hunting success during this period. Large variation in hunting success is also attributable to food conditions (e.g., during 2013–2023, when licenses were held relatively constant). Statistics from BMU 451 are not included in this graph to allow for quota zone comparisons with the past.

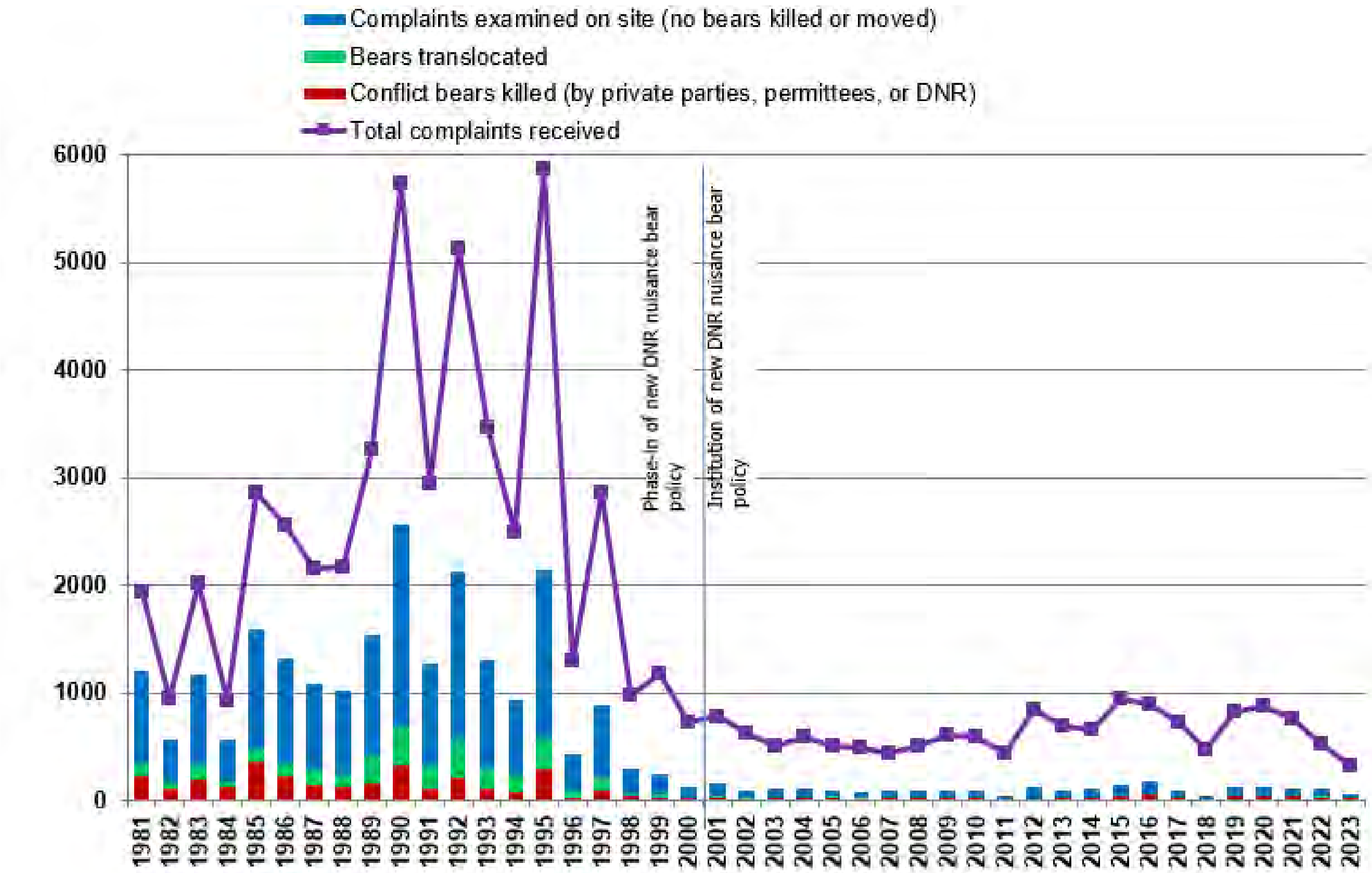

Figure 6. Trends in human-bear conflict complaints, and conflict bears killed and moved, 1981–2023, showing dramatic effect of change in human-bear conflict policy, and a stable trend over the past decade.

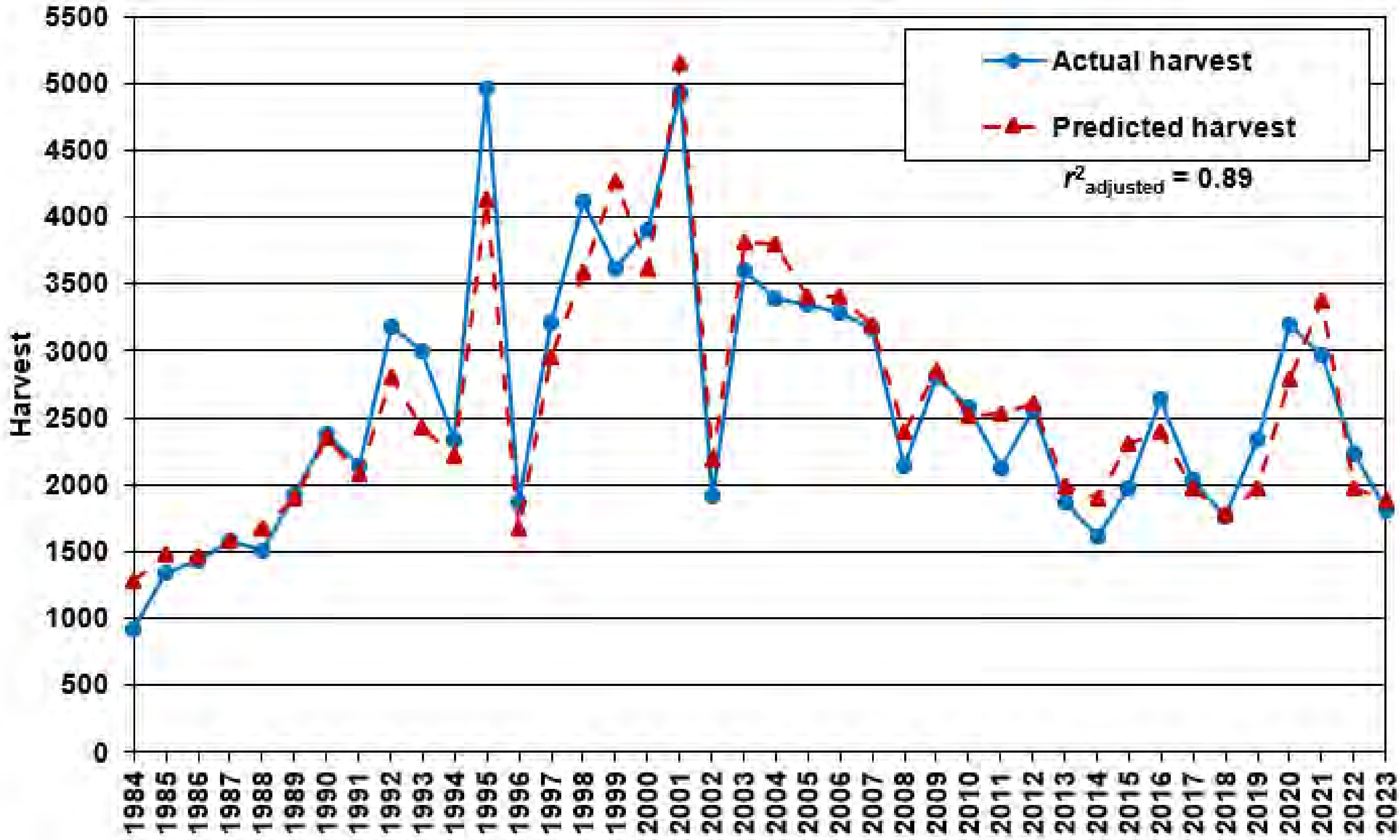

Figure 7. Number of bears harvested vs. number predicted to be harvested based on number of hunters and fall food production statewide 1984–2023. Regression for the dataset included an interaction term between food and hunters to better predict changes in harvest when foods were extremely high or low.

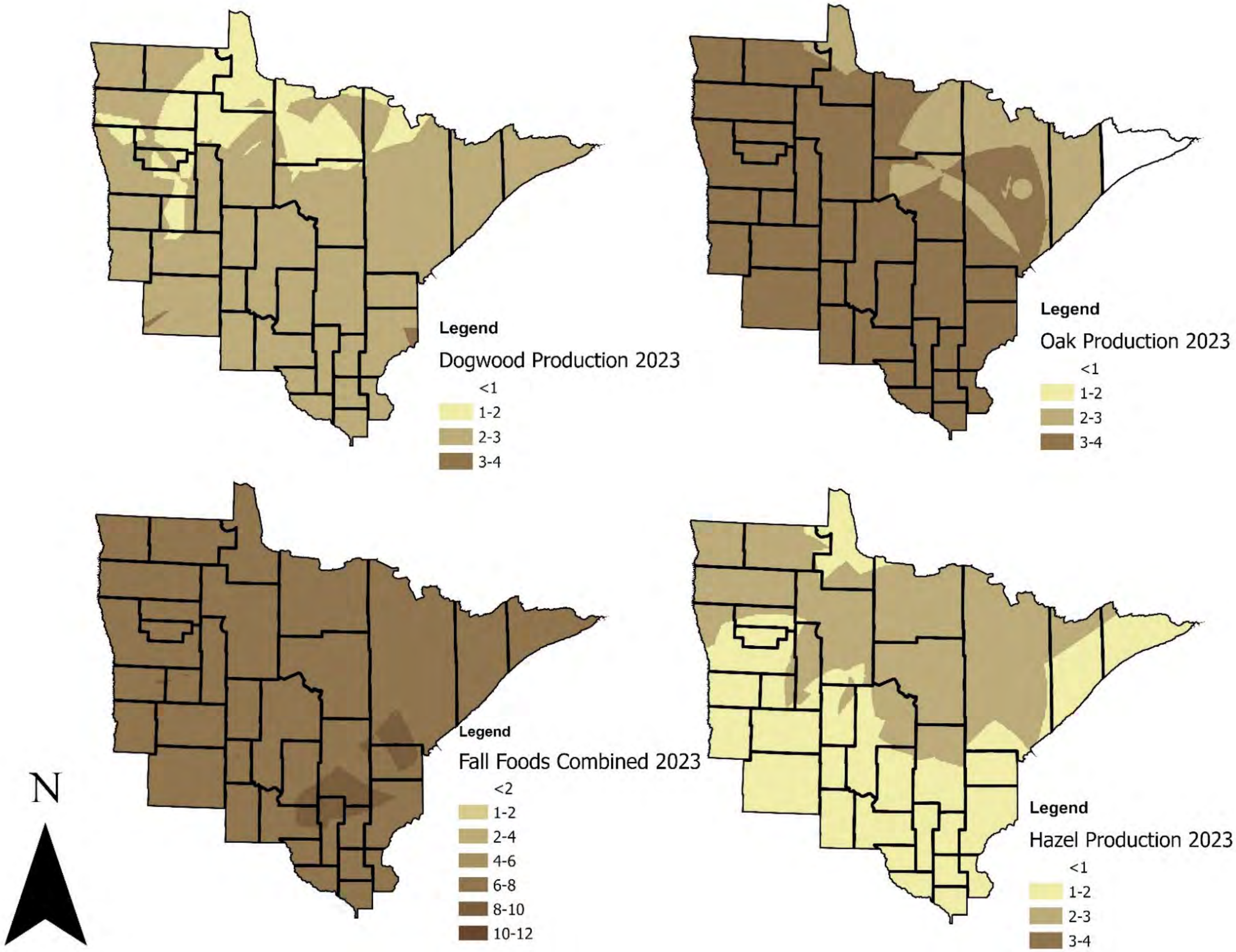

Figure 8**.** Production of fall bear foods (dogwood, oak, hazel) across Minnesota, 2023.

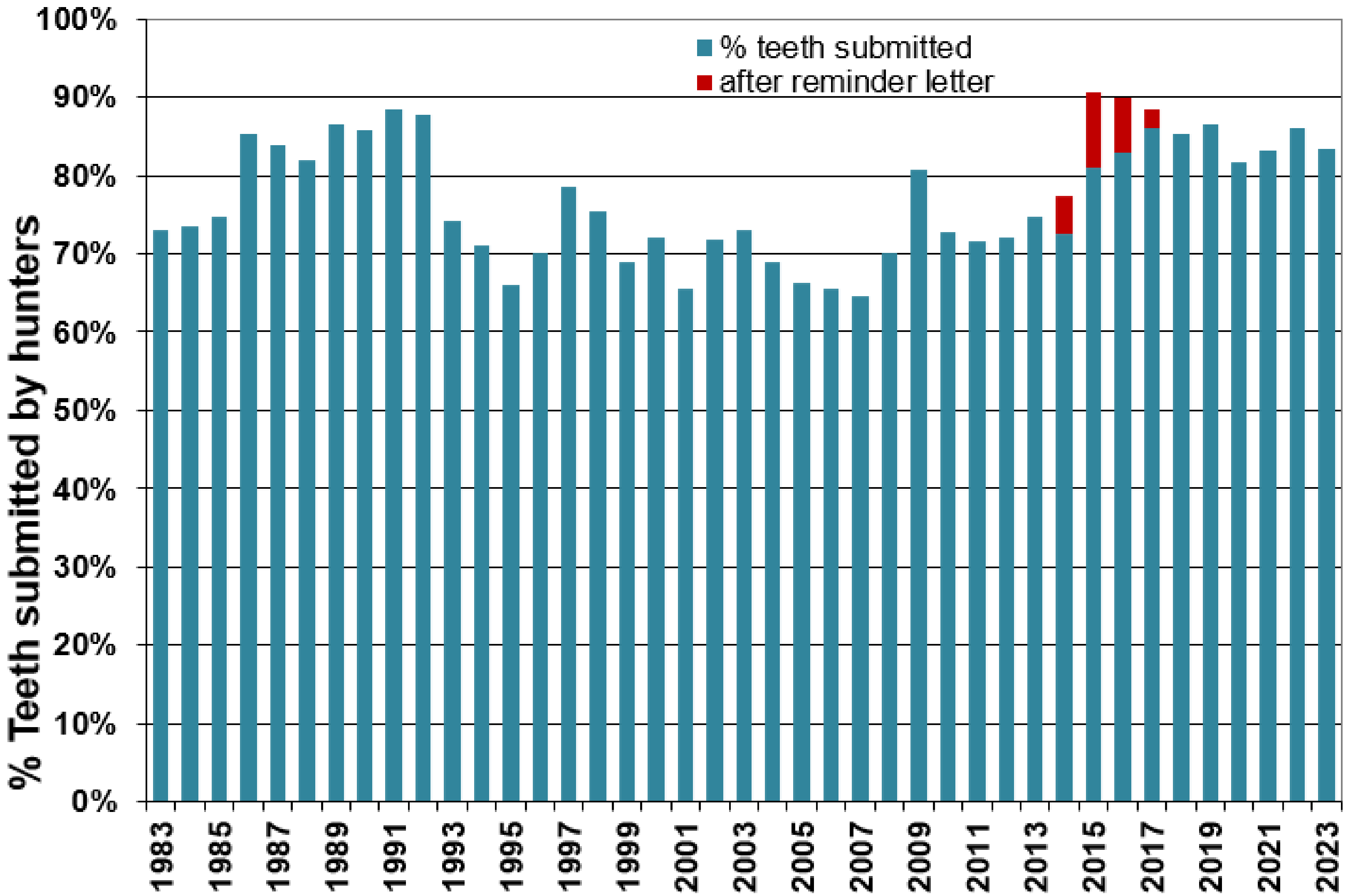

Figure 9. Percent of hunters submitting useable bear teeth for aging (vital for population monitoring. Cooperation levels exceeded 80% when registration stations were paid to extract teeth (this practice ended in 1993), and in recent years after a series of reminder letters (however, no letter was sent after 2017).

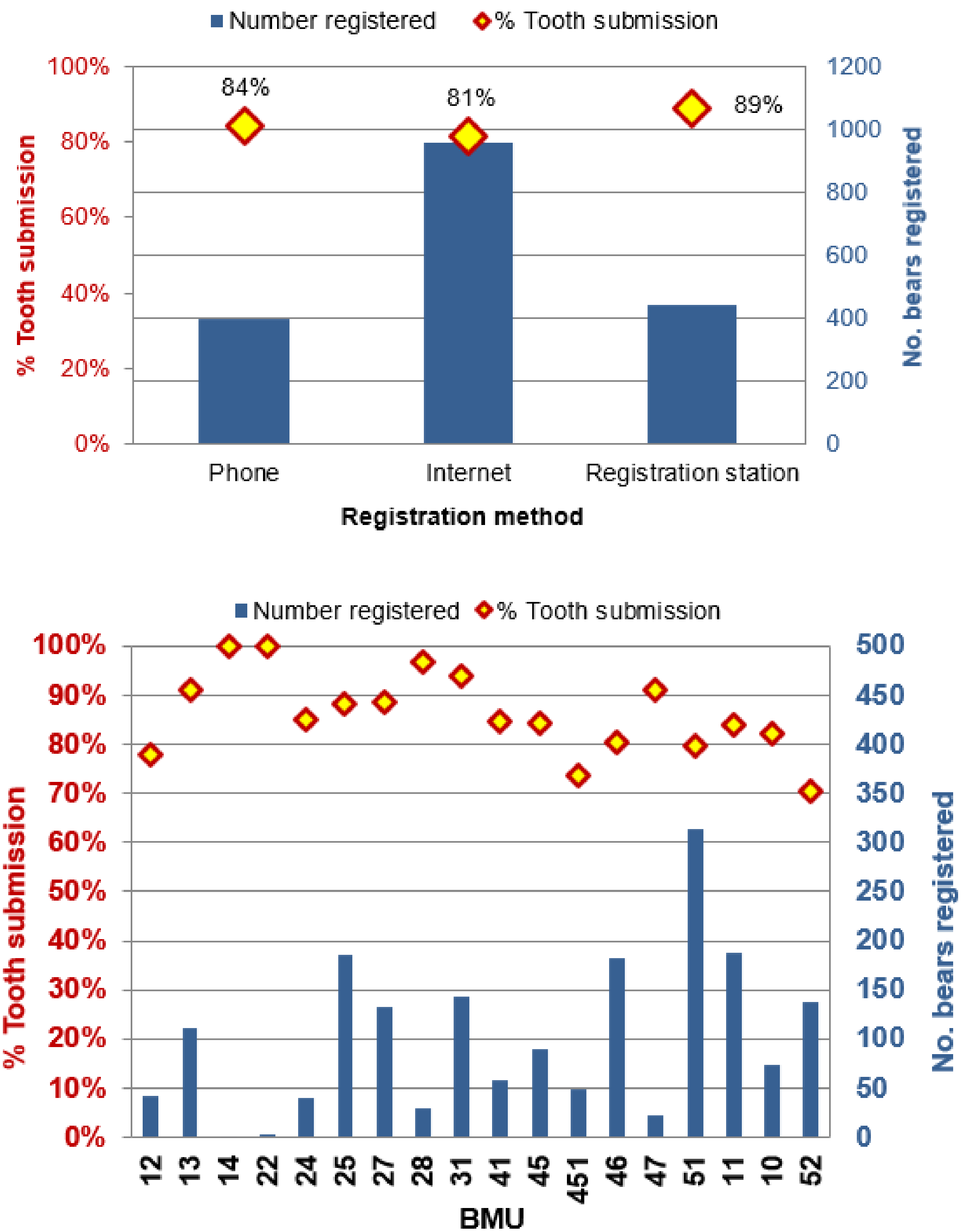

Figure 10. Percent of hunters who submitted a bear tooth in 2023 by method of registration (top panel) and by BMU (bottom panel). Beginning in 2013, hunters could register their bear by phone, internet, and in person at a station. The 2023 statewide submission average (84%; red line, bottom panel) was above the long-term average (77%).

Table 1. Number of human-bear conflict complaints registered by Wildlife Managers and Conservation Officers during April–October during 2005–2023, including number of conflict bears killed and translocated, and bears killed in vehicular collisions.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017 [j]	2018 [j]	2019 [j]	2020 [j]	2021 [j]	2022 [j]	2023 [j]
Number of personnel participating in survey [a]	42	46	46	37	51	40	34	56	63	64	61	55	86 (51,35)	78 (56,23)	126 (60,66)	112 (70,42)	94 (36,58)	95 (39, 56)	92 (38, 54)
Complaints examined on site	61	57	63	59	65	70	37	113	69	79	97	118	71 (22,49)	40 (21,19)	82 (37,45)	87 (3,84)	83 (6,77)	68 (2,66)	30 (1,29)
Complaints handled by phone [b]	451	426	380	452	535	514	396	722	623	570	840	780	644 (450,194)	438 (369,69)	736 (599,137)	784 (591,193)	595 (450,145)	461 (339,122)	298 (196,102)
Total complaints received	512	483	443	511	600	584	433	835	692	649	937	898	715	478	818	871	753	529	328
• % Handled by phone	88	88	86	88	89	88	91	86	90	88	90	87	90	92	90	90	79	87	91
Calls handled by the information center [m]																281	364	281	186
Bears killed by:																			
• Private party or DNR	28	11	21	22	23	22	9 [k]	16	24	26	45	53	22 (4,18)	9 [k] (4,5)	45 (5,40)	42 (3,39)	36 (3,33)	30 (2,28)	15 (2,13)
• Hunter before season [c]																			
– from nuisance survey	6	2	18	3	4	3	3	11	0	0	1	13	1	2	0	20	4	4	2
– from registration file	13	6	25	5	15	10	5	12	0	1	4	6	3	11	5	34	24	8	2
• Hunter during/after season [d]	1	0	0	0	0	0	0	0	1	0	1	1	1	0	0	3	23	1	1
• Hunter by Area 888 license [e]													1		3 [m]	40 [m]	45 [m]	9 [m]	2
• Permittee [f]	5	4	5	1	3	5	0	0	1	0	3	0	0	1	2	5	2	2	3
Bears translocated [g]	3	3	1	3	2	2	2	0	3	2	0	0	0	0	0	3	2	2	4
Bears killed by cars [h]	22	18	20	27	18	28	15	33	32	28	47 [h]	27	9 (0,9) [h]	25 (15,10) [h]	16 (11,5) [h]	25 (23, 2) [h]	15 (10,5)	12 (6,6)	7 (6,1)

[a] Maximum number of people turning in a human-bear conflict report each month. Monthly reports were required beginning in 1984 and included cases of zero complaints. In 2017, the recording system was changed, where Wildlife Managers only recorded actual complaints (not zero complaints), generally at the time the complaint was received. Since then, 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. Beginning July 2019, COs recorded complaints electronically and individually (as they occurred), similar to Wildlife Managers (but using a different recording system).

[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 human-bear conflict 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 human-bear conflict survey because registration data do not indicate whether bear was involved in a human-bear conflict. In 2021 and 2022, data included all validation letter information in this total.

[e] In 2017, hunters could choose Area 88 in the quota lottery, and if drawn, could hunt for a conflict bear, if authorized. Starting in 2021, Area 888 was only a designation for hunters willing to take a conflict bear in the quota area on a no-quota license, if so authorized; 17 of these hunters were authorized to do so. Other hunters were authorized to take a conflict bear on a validated license (12 in total).

[f] A permit for non-landowners to take a conflict 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 human-bear conflict survey, not directly from permit receipts. Only 12 bears have been killed by permittees since 2011. In 2020, 13 permits were issued but only 5 bears killed.

[g] According to DNR human-bear conflict policy, trapped conflict bears should not be translocated. Generally, these are cubs that were sent to rehab.

[h] Car kill data were reported on the monthly human-bear conflict form beginning 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 human-bear conflict survey (47 vs 33), so the higher number is shown here. In 2017, only 1 car-kill was in the confiscation records, and in 2018 there were just 2. In 2017, the electronic system used by managers did not allow for recording of car kills. In 2018, an effort was made to increase car-kill reporting by managers, which was further increased in 2019 by adding a distinct coding for non-confiscated car kills that were either observed or reported by the public.

[j] Beginning in 2017, Wildlife Managers recorded human-bear conflicts on an all-species wildlife damage app, whereas Conservation Officers continued to submit monthly human-bear conflict survey forms (April–Oct). Beginning in 2019, COs also used an electronic app to record bear complaints (but a different app than wildlife). Because the 2 survey tools are not exactly the same, data are presented separately for each in parenthesis (Wildlife Managers, COs). For consistency, only April–October data are included (in 2017 managers recorded 10 calls in other months; in 2018 14 calls were in other months; in 2019 16 calls were in other months; in 2020, 21 calls were in other months; in 2021, 17 calls were in other months; in 2022, 14 calls were in other months; in 2023, 2 calls were in other months). For the wildlife manager data, anytime a WCIL row was entered, it is considered an independent complaint, so there are some duplicates when there were repeat issues at the same location.

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

[m] Although it is unknown when this started, the information center at Central Office has been fielding human-bear conflict calls. We started to record these data in 2020. To date, some calls (~40%) are forwarded on to wildlife managers or conservation officers, but the rest are handled by the information center.

Table 2. Regional bear food indices[a] in Minnesota's bear range, 1984–2023. Shaded blocks indicate particularly low (<50; pink) or high (≥70; green) values.

Year	Survey Area					
	NW	NC	NE	WC	EC	Rangewide
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	62.7	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	67.3	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
2019	68.8	60.9	64.4	59.8	65.1	63.9
2020	65.3	42.1	47.5	51.7	51.9	53.0
2021	28.8	38.0	34.7	32.0	42.1	35.2
2022	80.2	91.4[b]	89.4	78.9	78.5	84.7[b]
2023	70.6	81.7	84.4	69.4	73.0	78.6

[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..

Table 3. Regional mean index values[a] for bear food species in 2023 compared to the previous 38-year mean (1984-2022) 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).

FRUIT	NW 38yr mean	NW 2023 (*n* = 8[b])	NC 38yr mean	NC 2023 (*n* = 10)	NE 38yr mean	NE 2023 (*n* = 9)	WC 38yr mean	WC 2023 (*n* = 5)	EC 38yr mean	EC 2023 (*n* = 11)	Rangewide 38yr mean	Rangewide 2023 (*n* = 31[c])
SUMMER												
Sarsaparilla	4.7	4.6	5.8	6.0	5.2	5.3	4.4	3.0	5.2	4.4	5.0	5.0
Pincherry	3.4	6.7	4.4	7.0	4.3	6.3	3.7	2.0	3.7	4.4	3.9	7.8
Chokecherry	5.9	9.3	5.4	8.7	4.7	9.4	5.4	5.6	4.6	6.2	5.3	7.9
Juneberry	5.1	6.5	4.7	8.6	4.9	10.8	3.6	4.2	3.9	5.0	4.4	7.4
Elderberry	1.7	2.7	2.9	3.3	3.7	5.5	3.1	4.7	3.2	4.4	3.0	4.5
Blueberry	5.0	4.2	5.3	4.9	5.0	5.0	3.6	8.0	3.9	4.5	4.4	5.2
Raspberry	6.4	4.9	7.8	11.3	7.8	8.4	7.0	5.8	6.9	8.4	7.1	7.8
Blackberry	1.4	1.3	2.5	2.5	1.4	1.7	3.6	3.4	4.5	3.6	3.0	2.8
FALL												
Wild Plum	2.4	5.1	1.9	4.0	1.5	5.1	2.8	3.0	2.5	3.7	2.3	4.5
HB Cranberry	5.2	3.5	4.3	3.3	4.0	3.4	3.7	3.6	3.8	2.3	4.1	3.1
Dogwood	6.2	5.9	5.6	4.4	4.9	7.1	5.9	7.3	5.9	8.7	5.7	6.7
Oak	3.6	8.0	3.2	7.6	2.1	5.2	5.9	10.6	5.7	9.9	4.5	8.2
Mountain Ash	1.6	2.3	2.6	3.0	4.7	5.4	1.8	3.0	2.4	3.8	2.7	3.8
Hazel	6.4	5.7	7.3	7.8	6.8	5.8	7.6	5.3	7.4	3.8	7.1	5.9
TOTAL[d]	58.9	70.6	64.0	81.7	60.9	84.4	62.1	69.4	63.6	73.0	62.6	78.6

[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.

[d] Because of rounding error, these totals may be slightly different than the sum of adding down the columns.

Table 4. Regional productivity index[a] for important fall bear foods (oak + hazel + dogwood), 1984–2023. Particularly low (≤ 5.0; yellow) or high (≥8.0; tan) values are shaded.

	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	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	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
2019	6.2	7.1	6.6	6.5	7.1	6.7
2020	5.8	5.4	5.1	5.4	5.4	5.5
2021	3.8	4.3	3.3[b]	4.2[b]	4.4	4.2[b]
2022	7.2	7.9	6.7	7.8	7.9	7.4
2023	7.6	7.5	7.6	7.7	7.7	7.7

[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.

2024 MINNESOTA RUFFED GROUSE BROOD SURVEY

Charlotte Roy, Forest Wildlife Populations and Research Group

SUMMARY OF FINDINGS

The Minnesota DNR launched a new ruffed grouse (*Bonasa umbellus*) brood survey during summer 2019 that is now in its sixth year. Staff and cooperators kept a log of time spent in the forest during June, July, and August and any grouse observations while on foot or while driving. In 2024, 40 observers submitted data for grouse observed while afield, which is similar to participation last year. Participants reported observing 69 broods during 972 hrs on foot in the forest and 95 broods during 1870 hrs driving in the forest, which is about half as many observations while driving compared to last year but similar numbers while on foot (184 and 58, respectively) with comparable time spent afield both years. The total number of grouse observed was 627 compared to 1028 birds in 2023, and included 216 adults, 398 chicks, and 13 grouse of unknown age. The annual brood indices were 7.1 broods/100 person-hrs on foot (95% confidence interval [CI]: 1.4–12.8) and 5.1 broods/100 person-hrs driving (95% CI: 0.0–19.2) in 2024. Brood observations peaked in late-June/early-July this year but the peak was smaller than last year, likely due to the extremely wet June throughout much of ruffed grouse range which may have resulted in brood losses when chicks were young. A second peak in brood observations while on foot (but not while driving) occurred during August which might reflect differences in brood habitat use during the extremely wet summer and fewer birds to utilize resources. The proportion of adult grouse with broods decreased from 80.6% in June, which is the highest proportion reported in the survey to date, to 67.6% in July, and then remained steady in August at 66.7%, consistent with early loss of broods when chicks were young. The number of chicks (mean $\pm$ SE) in broods for which chick counts were attempted was 3.3 $\pm$ 0.3 in June (n = 47), 3.3 $\pm$ 0.3 in July (n = 45), and 3.6 $\pm$ 0.4 in August (n = 26), which is smaller than last year during the same period and in previous years of the survey. Counties with the most brood observations per unit of survey effort included Cook and Lake, but Carlton, Cass, Itasca and St. Louis counties also had counts above the median. Further interpretation of the observed patterns will be dependent on future data collection to determine production over several years and relationships to harvest statistics. Thus far, mean ruffed grouse harvest per active hunter reported by hunters has ranged 3.5–5.1 during 2019–2023.

INTRODUCTION

The Minnesota DNR coordinates a multi-agency spring drumming survey to monitor ruffed grouse (*Bonasa umbellus*) breeding populations. However, drumming surveys are conducted 4 months before hunting season begins and do not reflect production of young over the summer, which is an important component of the number of birds that hunters see each fall. Juvenile birds (i.e., <6 months old) typically comprise the majority of birds harvested (Dorney and Kabat 1960, Dorney 1963). In a recent West Nile virus study involving hunter-submitted grouse, juveniles comprised 64% and 71% of submitted samples in Minnesota during 2018 and 2019, respectively (Roy et al. 2020). Therefore, hunter experiences may be negatively impacted by lower production and the smaller resulting harvestable surplus. Production of young is influenced not only by weather conditions (Bump et al. 1947, Dorney and Kabat 1960), but also may be influenced by numerous other factors (e.g., disease, parasites, food availability, predators, Hewitt et al. 2001).

Between 1949 and 2005, ruffed grouse harvest in Minnesota was strongly related to the statewide drumming survey index (r = 0.77, Figure 1). Similar patterns between statewide drumming survey indices and hunting success were also documented in Michigan, Ohio, and New York (Ammann and Ryel 1963; r = 0.90 in Ohio, Stoll 1980; New York Department of Environmental Conservation 2018). Thus, hunters came to rely on the drumming survey as an indication of the upcoming season. However, since 2005 this relationship has weakened considerably in Minnesota (r = 0.35, Figure 1), which is likely influenced, in part, by reductions in hunter numbers from a high of 161,600 in 1989, to as low as 57,284 in 2021 (Minnesota Department of Natural Resources 2023). Hunter numbers used to peak with peaks in the drumming cycle, but that has not been the case for the last two cycles.

Another possible contributor to the weakening relationship between the drumming survey data and harvest is that summer production of young might have declined, despite an otherwise robust breeding population that is cycling around a stable 30-year average. Lower production would not be reflected in the drumming survey data of the same year because the drumming survey is conducted in the spring before nests hatch. Furthermore, lower production may not be reflected in the drumming survey the following year if production is still above replacement-level and hunting is compensatory, although hunters might see and harvest fewer birds in the fall during years of low production. Lower production than anticipated from the current point in the 10-year cycle would be expected to become discernable in the drumming survey data if hunting became a source of additive mortality, although this is not currently supported by the available data.

The DNR needs better information on brood production to bridge the gap between the drumming survey, which is conducted in April and May, and the time when most ruffed grouse hunters go afield in September and October. Such information may help improve the ability to forecast the hunting season and may also improve our understanding of the causal mechanisms behind the changing pattern between the drumming survey and fall harvest period. Thus, the DNR launched a new passive brood survey in 2019, which was modeled after similar efforts in Pennsylvania that have been conducted since 1981 and for which survey data exhibit a strong relationship to fall flush rates. In Pennsylvania, a strong relationship between grouse observed per day and hunter flushes per hour existed during 1981–2001 (r = 0.75), and this data informed predictions of “above average,” “average,” or “below average” fall harvests (pers. comm., L. Williams, Pennsylvania Game Commission). Since 2002, the relationship between grouse observed per day and hunter flushes weakened slightly (r = 0.65, pers. comm., L. Williams, Pennsylvania Game Commission), but is still much stronger than the recent relationship between the drumming survey data and total harvest in Minnesota.

METHODS

I asked cooperators on the ruffed grouse drumming survey, private and county foresters, and DNR Forestry, DNR Wildlife, and DNR Ecological and Water Resources staff in forested regions to keep a record of the number of broods encountered each hour afield during June, July, and August. Each observer reported hours afield on foot separately from hours driving each day in the forest (to account for partial days afield), county, the number of grouse broods seen, brood size, and the total number of adult grouse seen, as well as broods of other species observed (e.g., woodcock, turkey, spruce grouse). Observations were conducted while doing other planned field work, so did not incur additional cost or substantial time beyond recording daily observations (or lack thereof), which was reported to take ~1 min per observer per day.

I summarized the total number of broods and total number of grouse observed each day, as well as the broods/hr in a catch-per-unit-effort type of approach, where effort was defined by total observer hours in the field (e.g., broods/100 person-hrs afield). People working alongside each other in the field reported observations for 1 observer. This allowed distinction between changes in numbers of birds due to changes in time spent afield vs changes in numbers of birds due to actual changes in the number of birds. I also expected changes in the number of birds observed each month to be influenced by changes in the behavior of young birds as they mature, but assumed birds would behave similarly among years, whereas sources of mortality may vary considerably among years. If these assumptions are true, then this survey should allow meaningful comparisons of brood numbers among years.

RESULTS AND DISCUSSION

Cooperators from 1854 Treaty Authority (4), Leech Lake Band of Ojibwe (1), Red Lake Nation (3), Fond du Lac Reservation (1), Superior National Forest (1), Chippewa National Forest (1), Bemidji State University (1), and Ruffed Grouse Society (1), as well as county foresters (1), private foresters (2), DNR Ecological and Water Resources staff (1), DNR Forestry staff (2), and DNR Wildlife staff (21) submitted data in 2024. Observations occurred while doing other work between 1 June and 31 August for a total of 972 hrs on foot and 1870 hrs driving in the forest. Reported time afield was 431, 255, 286 hrs on foot in June, July, and August, and 603, 655, and 612 hrs driving in the forest during June, July, and August, respectively. Consistent participation assists with interpretation of patterns over time, with observer effort this year similar to last year, but lower than in previous years.

Observers recorded 164 ruffed grouse broods and 84 broods of other species while working in the forest, including 78 turkey broods, 2 woodcock broods, and infrequent brood sightings of numerous other species. The total number of grouse observed was 627, including 216 adults, 398 chicks that could be counted, and 13 grouse of unknown age (i.e., a mix of juveniles and adults), which is half as many birds as observed last year. Most of the grouse reported to be of unknown age were reported in August, when it is more difficult to discern adults from chicks. The total number of grouse observed, including adult grouse, chicks, and grouse of unknown age, was related to survey effort over time this year (Figure 2), perhaps reflecting less consistent survey effort this year than in other years.

The brood index (broods/100 person-hrs afield) adjusts for changes in survey effort and is more appropriate for comparison of brood numbers among years than brood counts that do not take survey effort into consideration. The annual index during 2024 was 7.1 broods/100 person-hrs on foot (95% confidence interval [CI]: 1.4–12.8, Table 1) and was 5.1 broods/100 person-hrs driving (95% CI: 0–19.2). The brood index was highest in the arrowhead region with Cook and Lake counties having the most brood observations of those counties with $\geq$100 hrs of reported time afield (on foot and driving combined). Other counties with $\geq$100 hrs of reported time afield included Beltrami, Carlton, Cass, Clearwater, Crow Wing, Itasca, Lake-of-the-Woods, and St. Louis counties. All other counties had $\leq$100 hrs of observations submitted. Carlton, Cass, Itasca and St. Louis counties also had brood counts above the median.

Examining weekly and monthly patterns in brood metrics provides additional insights into production. The weekly brood index rose in late-June/early-July (Figure 3), after the usual peak in hatching at this latitude (mid-June, Maxson 1978, Larson et al. 2003). A drop in the weekly brood index was evident shortly thereafter, when mortality of ruffed grouse chicks is highest (Larson et al. 2001). Importantly, June 2024 was extremely wet throughout most of Minnesota (MN DNR Climate Journal) when grouse chicks are most vulnerable, likely producing widespread brood losses. While one might expect a decline in monthly brood indices over time as chicks are lost to various mortality factors, chicks are more detectable as they mature

(Godfrey 1975), which offsets detection of the actual loss of chicks and broods throughout the summer to some degree. Broods/100 hrs of driving in the forest in August was the lowest observed yet, whereas broods observed while on foot in August was the highest yet (Tables 1 and 2). These seemingly incongruous results may reflect a difference in habitat use during this very wet year with fewer surviving chicks utilizing widespread resources and spending less time near roads.

The proportion of adults reported with broods decreased with time since hatch from 80.6% in June, which is the highest proportion ever reported in this survey, to 67.6% in July after the fifth wettest month on record (MN DNR Climate Journal), and then stayed steady in August (66.7%, Table 1). The number of chicks (mean ± SE) per brood, when counted, was 3.3 ± 0.3 in June (n = 47), 3.3 ± 0.3 in July (n = 45), and 3.6 ± 0.4 (n = 26) in August. Notably these are the smallest brood sizes since the inception of this survey. A decline in brood size over time is consistent with chick mortality and partial brood loss during summer. However, brood size did not decline over the summer suggesting that chicks that survived June rainfall events and floods fared well.

The observed chick counts were lower than brood sizes reported for July (7.3 and 8.1) and August (6.2 and 6.8) in Alberta over 50 years ago (Rusch and Keith 1971) and also by Dorney and Kabat (1960) for Wisconsin (7.4 and 7.9 in July, 6.8 and 7.9 in August). However, counts observed in this survey are consistent with a previous study of a radio-marked brood of 9.0 known chicks per encounter in Minnesota that averaged 4.7 chicks observed per encounter (Godfrey 1975). Chick counts are known to underestimate the actual number of chicks and are considered very unreliable for young broods with many chicks that hide quickly because the degree of undercounting varies with many factors (Godfrey 1975, Larson et al. 2001). Moreover, observers in this brood survey were counting chicks while performing other duties, which may have produced lower counts than those of observers focused primarily on obtaining accurate counts, and potentially dedicating more time to search for chicks. Nevertheless, participants in this survey will likely have similar competing demands on their time among years, so comparisons among years of this survey are more likely to be tenable. Future data collection will be helpful to see how brood counts vary among years in Minnesota and whether they can be informative about the frequency of hunter encounters during fall.

Interpretation of the observed patterns as “above average,” “average,” or “below average” will require additional years of data collection to determine an average. I will continue to reach out to potential observers to increase participation in the survey next year to allow for more robust data comparisons among years. Strong participation is imperative to produce useful information, because variability in brood counts among years is likely to be caused by many factors and extracting meaningful patterns will require that sample sizes are sufficient to detect a meaningful signal from among the variability.

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Table 1. Ruffed grouse brood observation metrics in Minnesota during 2019–2024 and harvest metrics for the fall hunting seasons the same year.

	Prop. adults with broods			Brood size (Mean ± SE)			Harvest/ hunter[3]
Timeframe	Jun	Jul	Aug	Jun	Jul	Aug	Sep-Jan
2019[1]	66.7	58.6	0.00[1]	4.1 ± 0.9	4.7 ± 0.7	4.0 ± 2.1	3.7
2020	63.6	51.8	43.5	5.5 ± 0.7	4.0 ± 0.4	3.7 ± 0.4	3.5
2021	60.7	77.4	70.1	5.0 ± 0.5	3.7 ± 0.3	3.9 ± 0.4	3.6
2022	62.6	68.8	71.6	5.7 ± 0.6	5.0 ± 0.6	4.1 ± 0.5	3.7
2023	63.0	80.5	78.8	3.9 ± 0.4	3.9 ± 0.3	4.4 ± 0.3	5.1
2024	80.6	67.6	66.7	3.3 ± 0.3	3.3 ± 0.3	3.6 ± 0.4	

[1] Effort was low the first year of the survey with only 7 adults without broods observed Aug 2019.

[2]Broods observed while driving were not included in the survey during the first year but were added in 2020.

[3]Harvest metrics are from Minnesota Department of Natural Resources (2024).

Table 2. Ruffed grouse brood indices in Minnesota by month during 2019-2024.

	Broods/100 hrs on foot				Broods/100 hrs driving[1]			
Timeframe	Jun	Jul	Aug	Summer	Jun	Jul	Aug	Summer
2019[1]	4.57	5.92	4.48	5.1	NA	NA	NA	NA
2020	3.35	3.35	3.34	3.4	3.46	5.99	5.80	5.3
2021	2.48	5.15	5.48	4.2	7.46	8.20	10.90	9.0
2022	3.57	2.60	5.06	3.7	6.02	9.37	5.79	7.1
2023	1.87	7.20	6.29	5.4	7.84	16.21	8.45	10.6
2024	6.26	5.88	9.43	7.1	5.97	6.26	3.02	5.1

[1]Records of observations of broods while driving were implemented beginning in 2020, so no data are available for 2019.

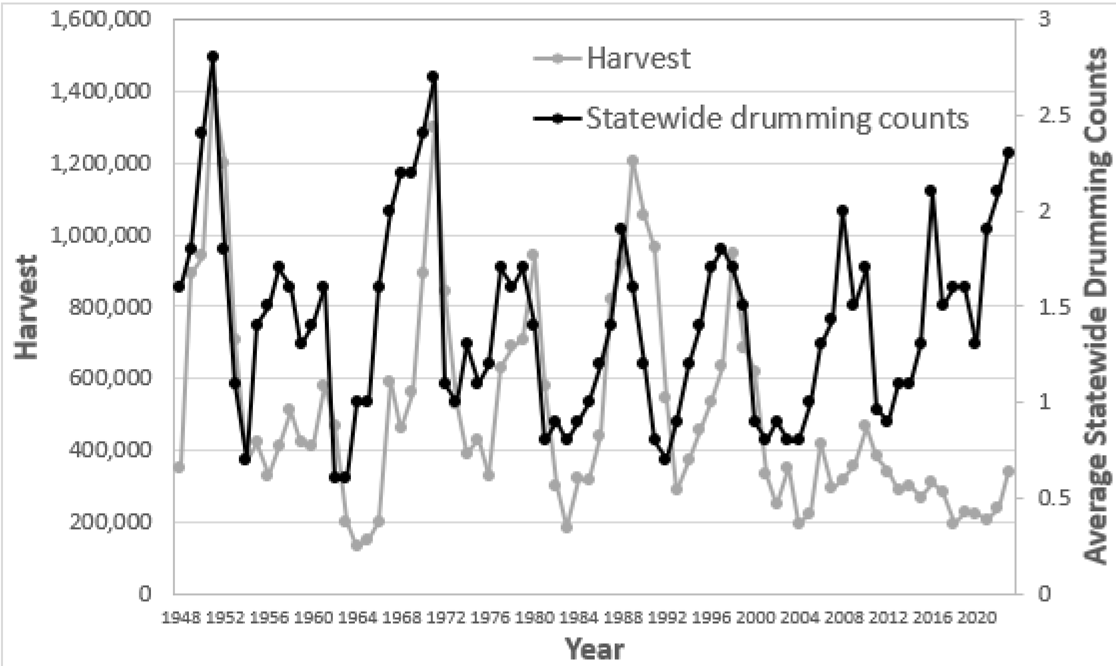

Figure 1. Comparison of average statewide ruffed grouse drumming survey data (Roy 2023) and data on harvest of ruffed grouse from the Small Game Hunter Harvest Survey (Minnesota Department of Natural Resources 2023) in Minnesota during 1948–2024. The two metrics were correlated more strongly prior to the early-2000s.

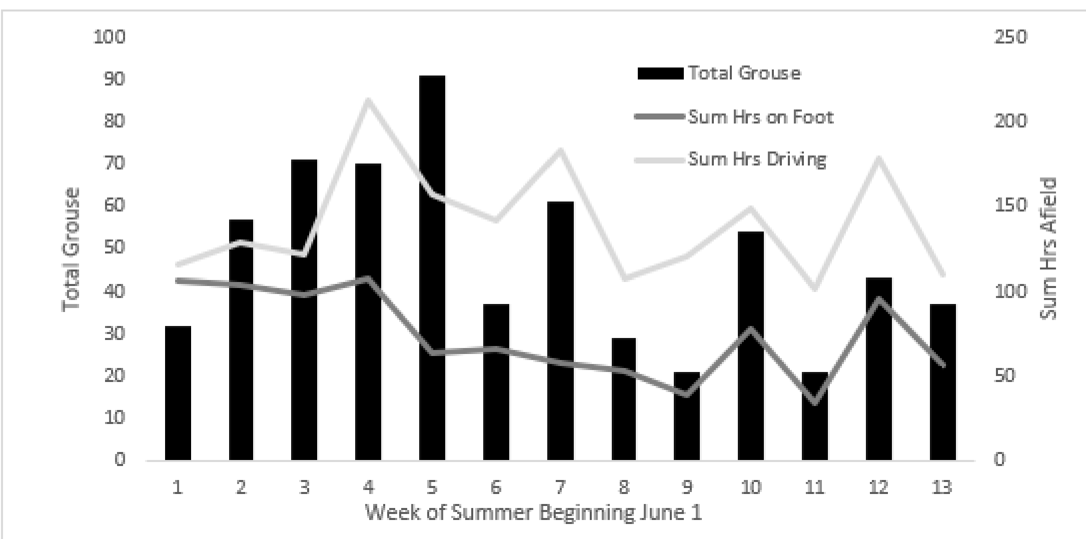

Figure 2. The chronology of ruffed grouse brood survey effort in the forest on foot and while driving and total number of grouse observed (young, adults, and birds of unknown age) by participating staff and cooperators during summer 2024 in Minnesota. Survey effort varied throughout the 13-week season.

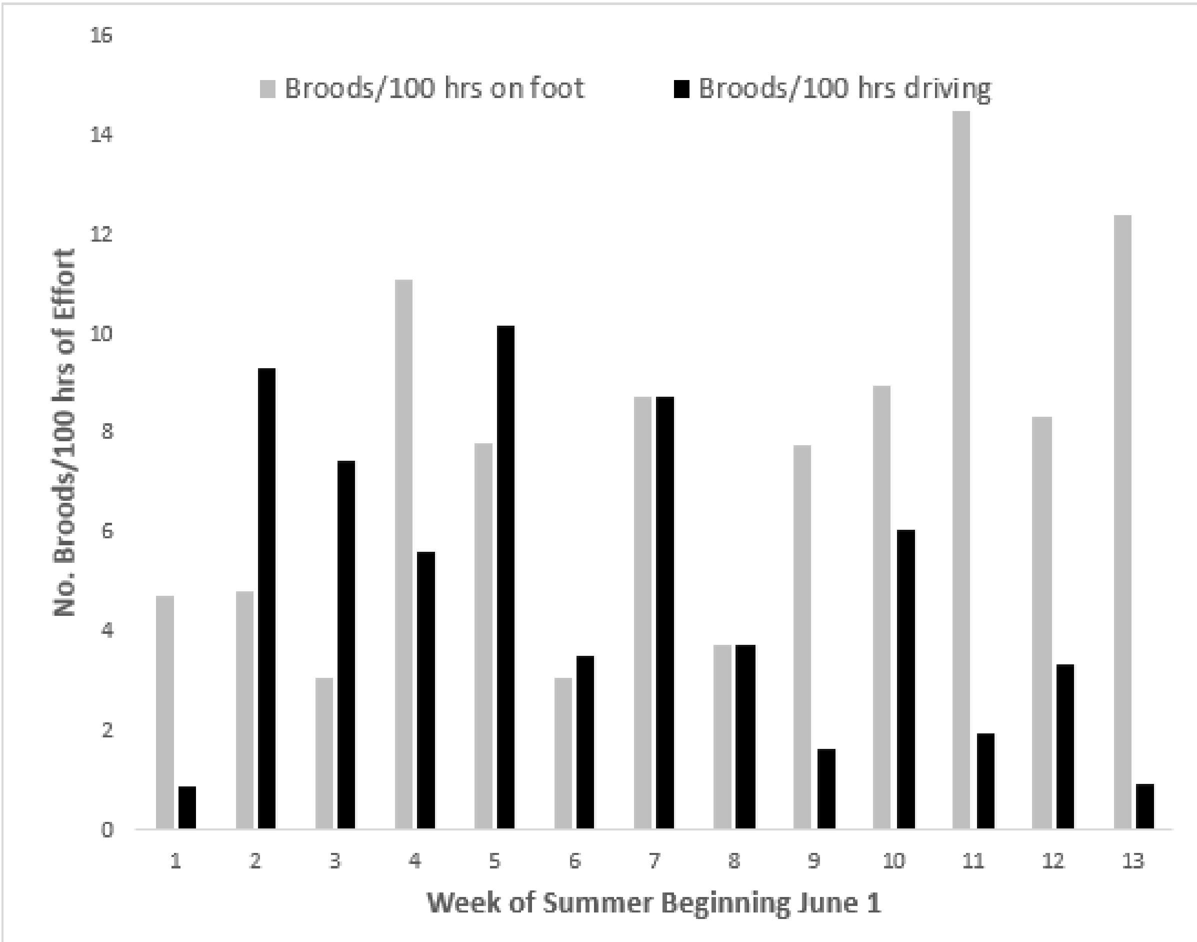

Figure 3. Ruffed grouse broods/100 person-hrs afield each week while either on foot or while driving in Minnesota during June, July, and August 2024. This index is adjusted for effort so that comparisons can be made among years in which time spent afield varies.

2024 MINNESOTA RUFFED GROUSE SURVEY

Charlotte Roy, Forest Wildlife Populations and Research Group

SUMMARY OF FINDINGS

The Minnesota DNR coordinates ruffed grouse (*Bonasa umbellus*) drumming surveys each spring with the help of wildlife staff and cooperating federal, tribal, and county biologists. Mean ruffed grouse drums per stop (dps) were 2.3 statewide (95% confidence interval = 1.9 – 2.6), which is similar to last year and the highest estimate reported in over 50 years. This is the 3rd consecutive year of statewide counts cycling upward, indicating that the low in the approximately 10-year population cycle occurred in 2021 (1.3), but that the cycle did not dip as low as it has in past cycles (0.69, 0.78, 0.86 dps in 1993, 2005, and 2013, respectively). Statewide dps were highest in the northeast survey region, which is the core of ruffed grouse range in Minnesota. The ruffed grouse drumming survey assumes that only the number of grouse varies among years. However, a substantial turnover in observers has occurred in recent years, with many retirements and hiring of new staff that may differ in their ability to hear low frequency drums, which could influence counts to some degree. We have also had numerous extreme weather conditions the last few years, including an extreme summer drought in 2021, spring flooding in 2022, good snow roosting conditions in winters 2021-2022 and 2022-2023, and a very mild winter with warmer than average temperatures in 2023-2024. These conditions may have increased production and overwinter survival of ruffed grouse the last few years. The drumming survey is useful for monitoring long-term population trends, but interpretation of 1 or a few years of data can be tenuous.

INTRODUCTION

The ruffed grouse (*Bonasa umbellus*) is the most popular game bird in Minnesota, with an annual harvest of 200,000 – 500,000 birds. Ruffed grouse hunter numbers have been as high as 92,000 during the last decade, although hunter numbers did not peak with recent peaks in grouse numbers, as they have traditionally.

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 data also correlated strongly with the fall harvest before the early 2000s, but in recent decades, 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 then, staff and cooperators have conducted spring drumming counts 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.

METHODS

Observers conducted ruffed grouse surveys 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.

I engaged survey observers from among state, federal, tribal, and private biologists that had a professional background in wildlife science. Most observers had previously participated in the survey. I provided each observer a set of instructions and route location information but did not provide formal survey training; however, new observers usually accompanied experienced observers on $\geq$1 survey route prior to surveying alone. I asked participants to conduct surveys at sunrise during peak drumming activity (in April or May) on days that had little wind and no precipitation. I provided guidance about the timing of the usual peak in drumming but allowed flexibility in timing to match the peak if it occurred outside the usual survey windows. 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.

I used the number of drums heard per stop (dps) as the survey index value. I determined the mean dps for each route, for each survey region (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 each Ecological Classification Section (ECS). 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 ECS sections in the Northeast region and the 7 ECS sections in the state. I used the geographic area of the section 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). I reduced the area used to weight drum index means for the MIM and PP sections to reflect the portion of these areas within ruffed grouse range (~50%) using subsection boundaries. I calculated a 95% confidence interval (CI) 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. I defined confidence interval boundaries as the 2.5th and 97.5th percentiles of bootstrap frequency distributions.

RESULTS AND DISCUSSION

Observers from 13 cooperating organizations surveyed routes between 5 April and 26 May 2024. Many observers reported an earlier spring than usual and completed surveys when they believed the peak of drumming occurred in their local area. Most routes (97%) were surveyed between 15 April and 11 May, with a median survey date of 30 April, which is similar to most years (median survey date close to May 3). Observers reported Excellent (56%), Good (39%), and Fair (6%) survey conditions for 118 routes reporting conditions.

Statewide ruffed grouse drums were similar to last year and averaged 2.3 dps (95% confidence interval = 1.9 – 2.6 dps; Figure 2). This is the highest point estimate reported in 50 years, although confidence intervals overlapped with previous peaks in the cycle. Drum counts were 2.7 (2.3 – 3.2) dps in the Northeast (*n* = 100 routes), 0.66 (0.4 – 1.0) dps in the Northwest (*n* = 8), 1.6 (0.7 – 2.7) dps in the Central Hardwoods (*n* = 11), and 0.7 (0.4 – 1.2) dps in the Southeast region (*n* = 8; Figure 3a-d). Thus, patterns varied among survey regions. The highest dps were in the core of ruffed grouse range in Minnesota. Substantial (>50%) declines occurred in the Northwest, but it is unclear why the counts declined in this region.

The ruffed grouse population in Minnesota cycles on average every 10 years, but peaks in the cycle vary from 8 to 11 years apart (Figure 2). Increasing statewide dps for the 3rd consecutive year indicate that the low value observed in 2021 (1.3 dps) was indeed a low in the population cycle, although substantially higher than past lows in the cycle (i.e., most had a dps <0.9). Moreover, the high observed this year is higher than estimated statewide peaks for the last 5 decades. The last 2 peaks occurred during 2009 (2.1 dps) and 2017 (2.1 dps), with lows occurring during 2005 (0.8 dps) and 2013 (0.9 dps).

The ruffed grouse population survey assumes that the only variable changing among years is the number of ruffed grouse. However, several variables have changed in recent years. We hired many new staff to fill positions vacated by retirements, and these new hires may differ in hearing ability from the recently retired staff. We also had numerous extreme weather events including prolonged summer drought in 2021, spring flooding in 2022, good snow roosting conditions in 2021-2022 and 2022-2023, and warmer than average winter conditions in 2023-2024 that may have influenced production and overwinter survival. Warm temperatures and summer drought conditions may produce strong production of young birds (Bump et al. 1947, Dorney and Kabat 1960). Winter conditions favorable for snow roosting in much of the core of ruffed grouse range may improve overwinter survival (Thompson and Fritzell 1988).

ACKNOWLEDGMENTS

The ruffed grouse survey was accomplished this year through the combined efforts of staff and volunteers at 1854 Treaty Authority; Agassiz National Wildlife Refuge (NWR); Blandin Paper; Beltrami and Cass County Land Departments; Camp Ripley; Chippewa National Forest (NF); Fond du Lac, Leech Lake, and Red Lake Reservations; Superior NF; Tamarac NWR; White Earth Reservation; and DNR staff at Aitkin, Baudette, Bemidji, Brainerd, Cloquet, Detroit Lakes, Erskine, Fergus Falls, Grand Rapids, 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. G. Drotts, J. Erb, and R. Horton organized entry of 1982–2004 survey data, with D. Mailhot and another volunteer prior to 2013. J. Bates and N. Dotson entered 1979–1981 data in 2020; L. Spann entered 1972–1978 data in 2021; J. Hanrahan entered 1968–1971 data in 2022. L. Gilbert entered survey data this year. M. Larson reviewed this report. This work was funded in part by the Federal Aid in Wildlife Restoration Act.

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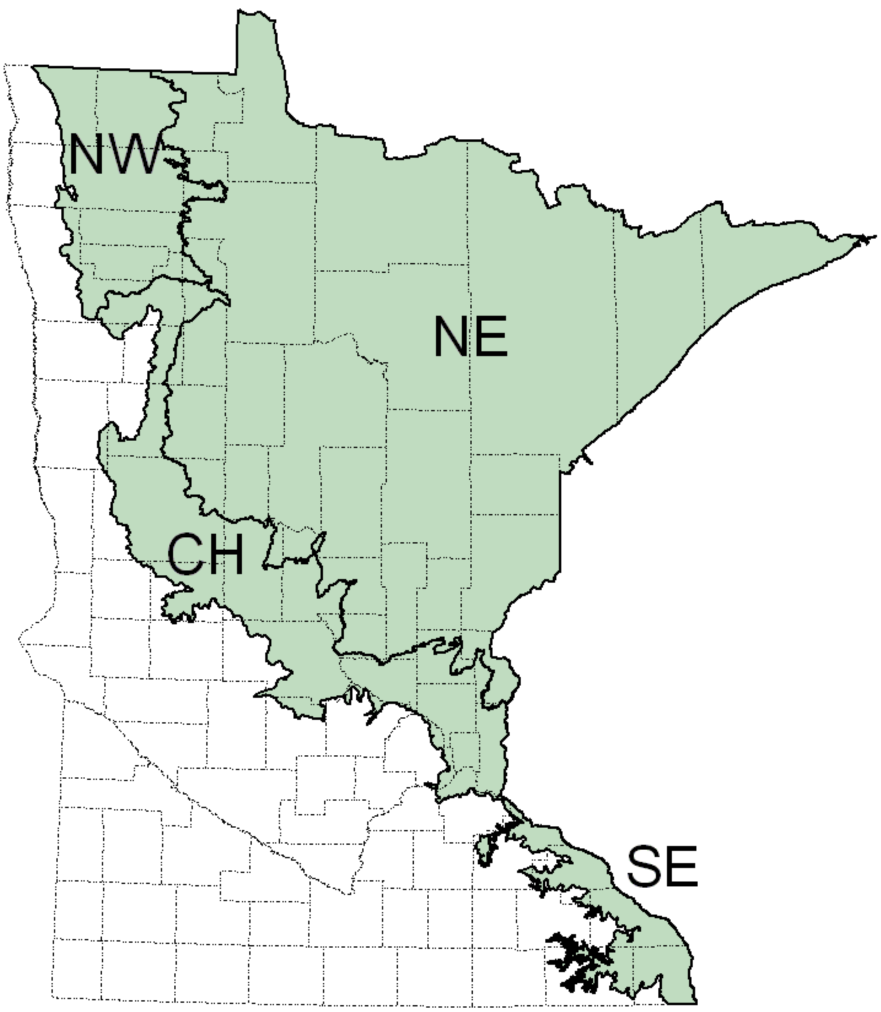


Figure 1. Survey regions for ruffed grouse in Minnesota. Northwest (NW), Northeast (NE), Central Hardwoods (CH), and Southeast (SE) survey regions are depicted relative to county boundaries (dashed lines) and influenced by the Ecological Classification System.

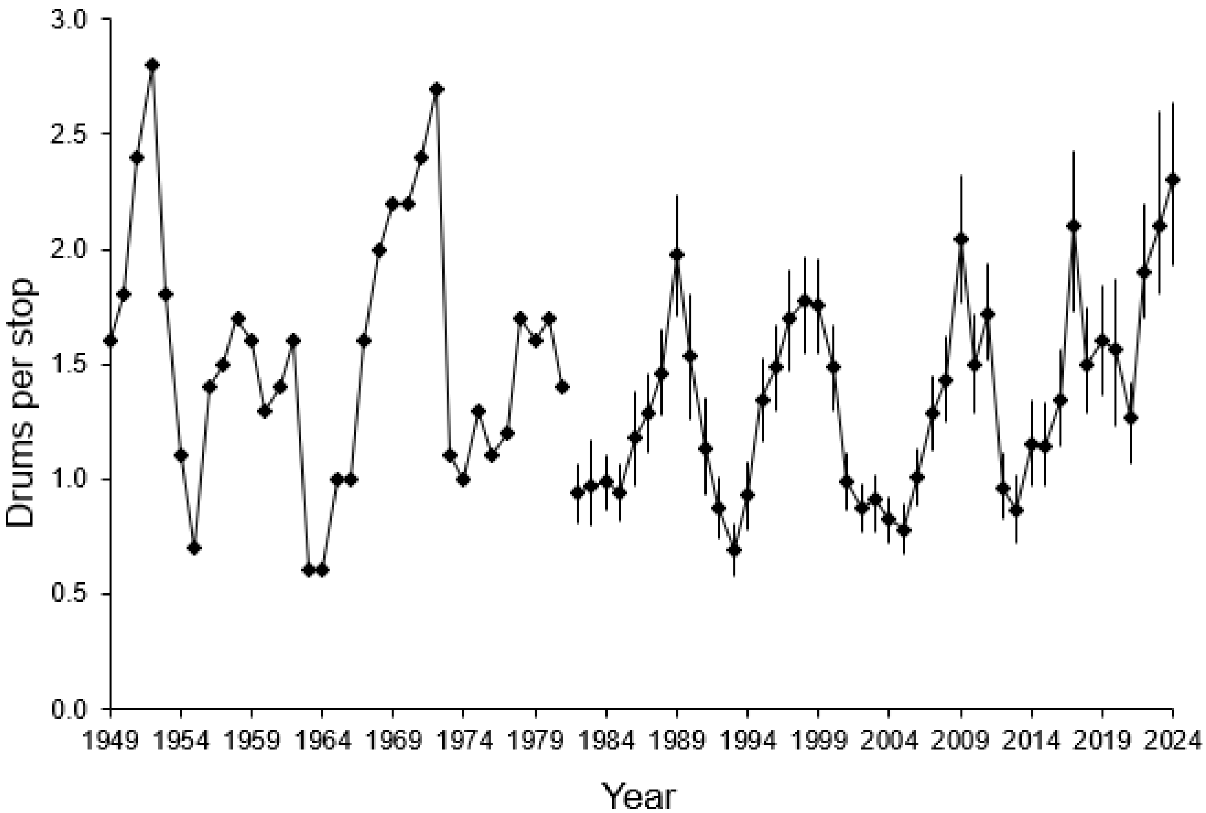
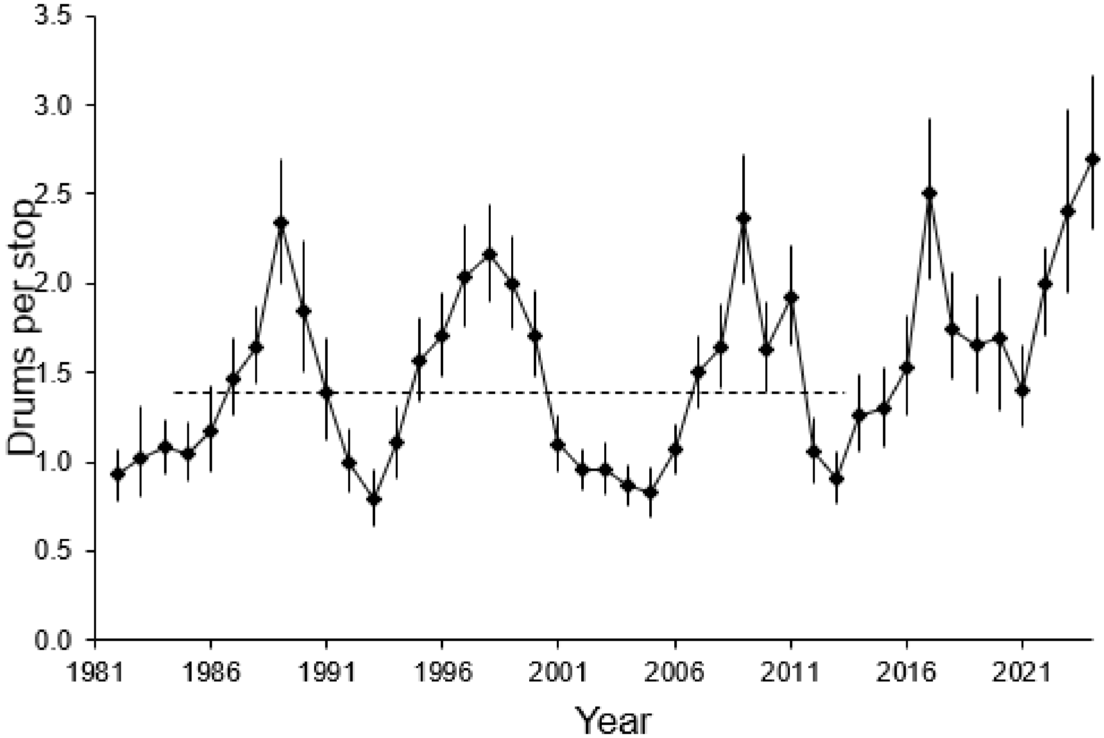


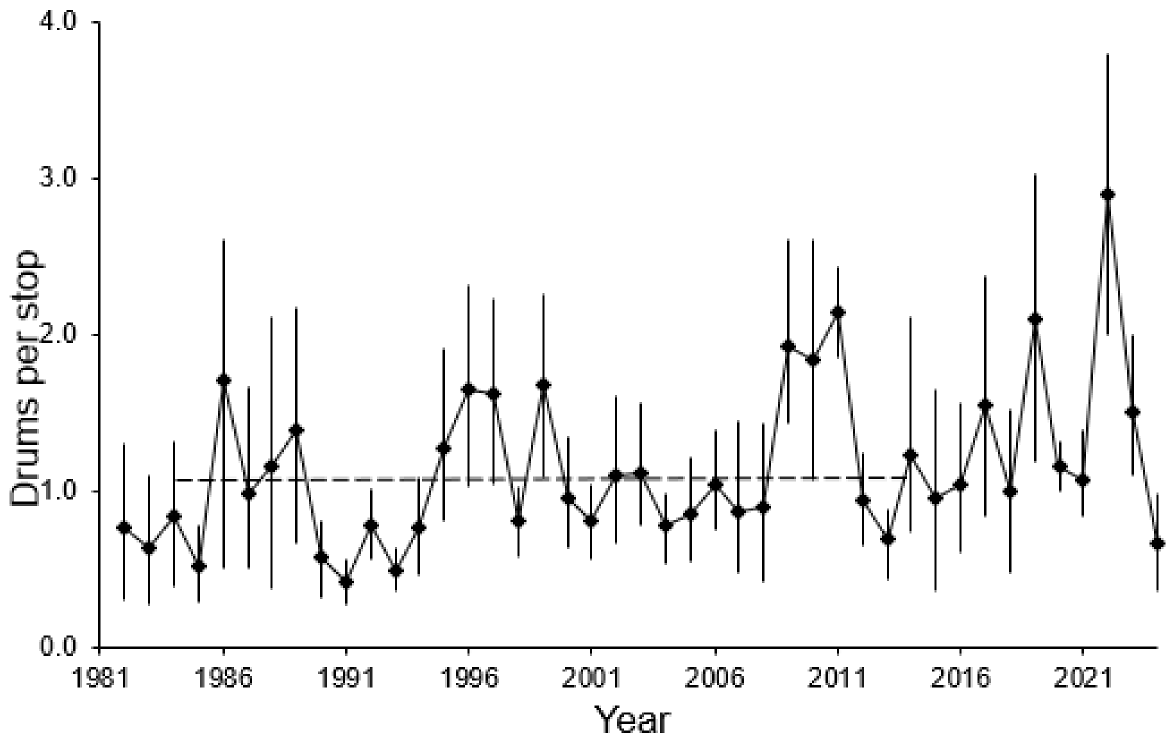
Figure 2. Statewide ruffed grouse population index values in Minnesota. Bootstrap (95%) confidence intervals (CIs) are provided after 1981, but different analytical methods were used prior to this and thus CIs are not available for earlier years. The difference between 1981 and 1982 is biological and not an artifact of the change in analysis methods.

a.



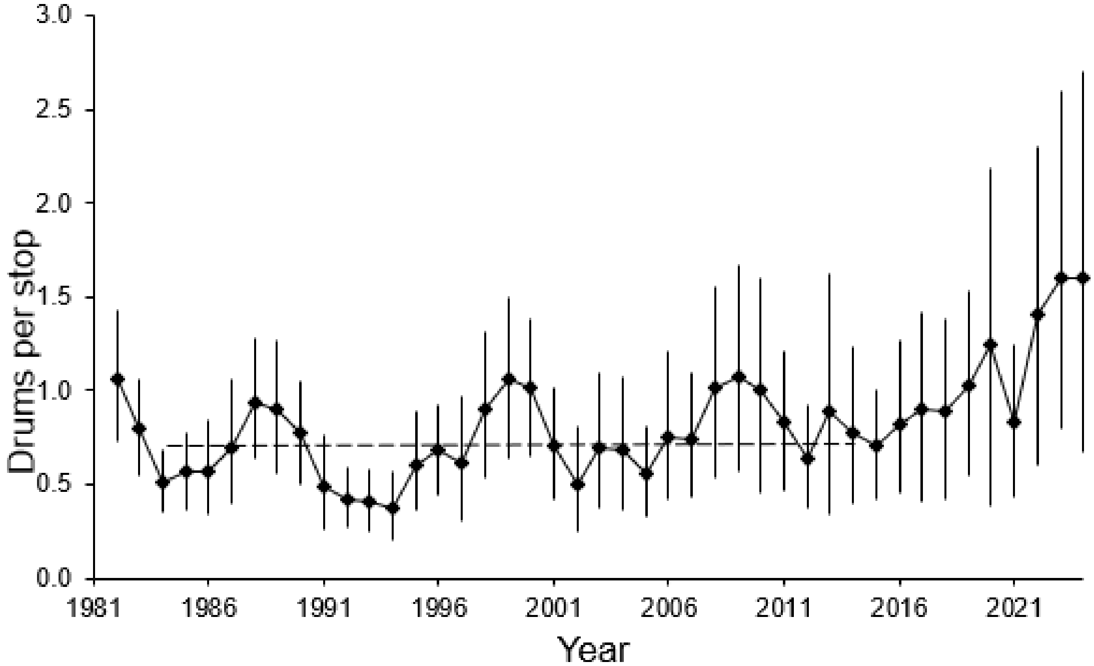
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Drums per stop
1981
1986
1991
1996
2001
2006
2011
2016
2021
Year

b.



4.0
3.0
2.0
1.0
0.0
Drums per stop
1981
1986
1991
1996
2001
2006
2011
2016
2021
Year

c.



d.

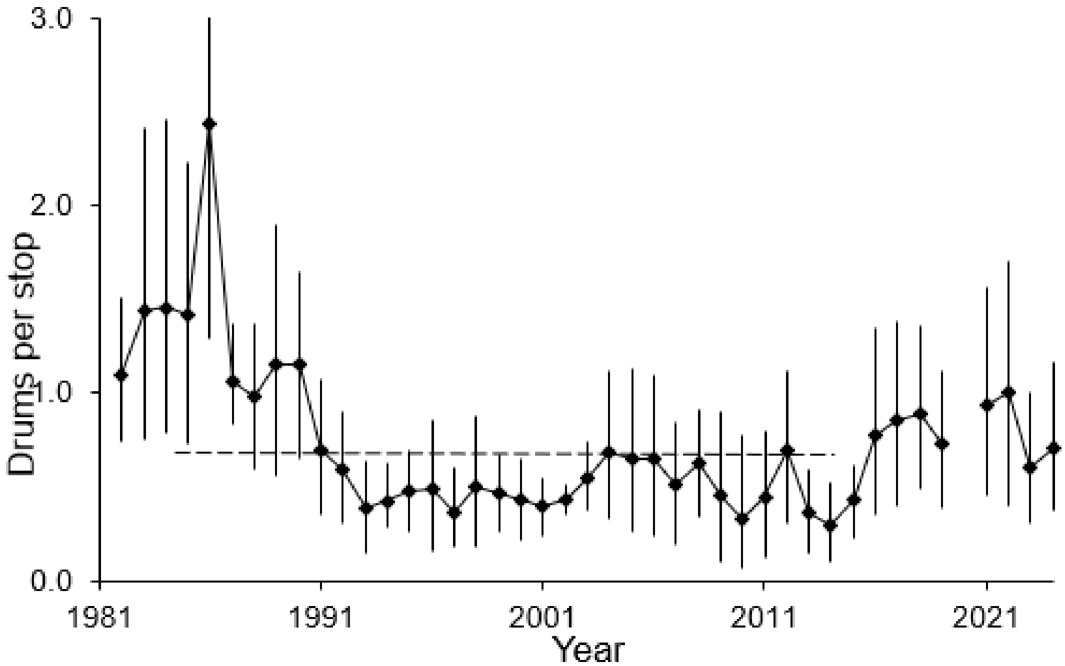


Figure 3a,b,c,d. Ruffed grouse population index values in the **Northeast** (a), **Northwest** (b), **Central Hardwoods** (c), and **Southeast** (d) survey regions of Minnesota. The mean for 1984-2014 is indicated by the dashed line. Bootstrap (95%) confidence intervals are provided for each mean. In the bottom panel, the CI for 1986 extends beyond area depicted in the figure. Data were not collected during the survey window in the Southeast during the COVID-19 pandemic in 2020.

2024 MINNESOTA SHARP-TAILED GROUSE SURVEY

Charlotte Roy, Forest Wildlife Populations and Research Group

SUMMARY OF FINDINGS

The Minnesota DNR coordinates sharp-tailed grouse (*Tympanuchus phasianellus*) surveys each spring with the help of wildlife staff and cooperating biologists in the Northwest (NW) and East-Central (EC) survey regions. Sharp-tailed grouse surveys were conducted between 14 March and 9 May 2024, with 2,822 birds (males and birds of unknown sex) observed at 184 leks. Additionally, 21 birds were observed at 2 leks in southwestern Minnesota. The mean numbers of sharp-tailed grouse/lek were 11.8 (8.4 – 15.4) in the EC survey region, 15.9 (14.3 – 17.6) in the NW region, and 15.3 (13.9 – 16.9) statewide (EC and NW combined). Comparisons between leks observed in both 2023 and 2024 indicated more birds were observed in the NW region ($t = 4.4$, $P < 0.001$) and statewide ($t = 4.6$, $P < 0.001$) this year, but similar numbers of birds/lek were observed in the EC region ($t = 1.3$, $P = 0.21$). The number of leks in the EC region remains low ($n = 25$) compared to the 70 leks counted as recently as 2010. Small populations are vulnerable to stochastic events like catastrophic storms, extreme flooding, and disease outbreaks.

INTRODUCTION

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.

The first surveys of sharp-tailed grouse (*Tympanuchus phasianellus*) in Minnesota occurred 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. Staff and cooperators conduct surveys in openland portions of the state where sharp-tailed grouse persist, although sharp-tailed grouse were formerly much more widely distributed in Minnesota at the early part of the 20th century. In recent years, sharp-tailed grouse have reportedly been expanding southward into the range of the Greater Prairie-chicken (*Tympanuchus cupido*) in western Minnesota but have been declining in the east-central part of the state.

Sharp-tailed grouse are popular among hunters. Annual harvest has been 5,000 – 22,000 birds since the early-1990s, with 4,000 – 10,000 hunters in Minnesota. However, the hunting season was closed in the East-Central (EC) region beginning in 2021 due to concerns about the population decline in this region and challenges to implementing a hunting season with remaining leks concentrated primarily in the Aitkin Wildlife area.

METHODS

Wildlife staff and volunteers survey known sharp-tailed grouse lek locations in the Northwest (NW) and EC portions of the state (Figure 1) during the peak in lek attendance, which usually occurs in the latter half of April and the first week of May. The NW survey region consists of Lake Agassiz & Aspen Parklands, Northern Minnesota & Ontario Peatlands, and Red River Valley Sections of the Ecological Classification System (ECS). The EC survey region consists 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 believe that they include most of the leks in their work area, with the exception of Aitkin and Tower work areas where workloads have not permitted 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- to 25-mile (32- to 40-km) routes. Given the uncertainty in the proportion of leks missed, especially those occurring outside traditional areas, the survey does not 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.

Beginning in 2022, the Minnesota Sharp-tailed Grouse Society (MSGS) has been leading an independent citizen volunteer effort to search for sharp-tailed grouse in southwestern Minnesota. I included their findings in this report to document the presence of lek activity outside the traditional survey region.

RESULTS AND DISCUSSION

A total of 2,843 male sharp-tailed grouse and grouse of unknown sex were counted statewide at 184 leks, including 21 birds at 2 leks in Southwest MN located by MSGS volunteers (Table 1). Surveys were conducted during 14 March to 9 May 2024. Leks with $\geq$2 grouse were observed an average of 1.8 times. The statewide index value of 15.3 (13.9 – 16.9) grouse/lek was the highest observed since surveys began in 1980 (Figure 2) and leks observed statewide in both 2023 and 2024 had more birds this year than last year ($t = 4.6$, $P < 0.001$). The winter of 2023-2024 was warmer than average and this may have contributed to higher overwinter survival of birds.

In the EC survey region, 295 sharp-tailed grouse were counted on 25 leks in 2024, which was similar to 2023. This represents a 123% increase from the 132 birds counted on 18 leks in 2021 that prompted the close of the hunting season in this region. Birds and leks declined sharply in this region in the 2021 survey compared to 2019 (surveys were not conducted in 2020 during the Governor's COVID-related Stay at Home Order), when 216 grouse were counted on 30 leks (Figure 3). Improvements in bird numbers are consistent with a benefit to the season closure, although other factors may have contributed or be entirely responsible. The grouse/lek index in the EC region was similar (11.8, CI: 8.4 – 15.4) to last year, and counts at leks surveyed in both 2023 and 2024 were also similar ($t = 1.3$, $P = 0.21$; Table 2). The distribution and number of leks in the EC region is localized and small. Most (80%) leks reported in the EC region were in the Aitkin Wildlife work area. No leks have been reported in the Cambridge work area since 2018, despite fairly consistent survey effort. The Tower work area reported 3 leks in 2022 and 2023, but only one in 2024, although no leks were reported in 2021. Birds were heard at St. Croix State Park this year, which is the third year that birds have been reported at the park in the spring. Three additional leks were reported in the Cloquet work area, which is 1 more than was observed last year. These survey data, in combination with studies indicating a genetic population bottleneck in the EC region (Roy and Gregory, 2019) and reporting inconsistent lek attendance (Roy and Coy, 2021), support the conclusion that birds in the EC region are exhibiting traits of a population in decline and may be vulnerable to stochasticity among years.

In the NW survey region, 2,527 grouse were counted on 159 leks with 15.9 (14.3 – 17.6) grouse/lek. Counts at leks that were observed during both 2023 and 2024 were higher in the NW survey region ($t = 4.4$, $P < 0.001$), and sharp-tailed grouse appear to be increasing in the NW region. Biologists in the greater prairie-chicken survey regions (the southern part of the NW survey region for sharp-tailed grouse) have also reported more sharp-tailed grouse in areas that used to primarily hold greater prairie-chickens. However, reports of sharp-tailed grouse observed during prairie-chicken surveys were not included in this report because data were incomplete at the time of report writing. Nevertheless, this report provides an index of sharp-tailed grouse in the traditionally surveyed regions. Range shifts to new areas are not easily detected with these methods, but if survey effort expands and is consistent each year, new areas could be incorporated into this report in the future.

ACKNOWLEDGMENTS

Annual sharp-tailed grouse surveys were accomplished through the efforts of staff and volunteers at Aitkin, Baudette, Bemidji, Cambridge, Cloquet, Grand Rapids, Karlstad, Red Lake WMA, Roseau River WMA, Thief Lake WMA, Thief River Falls, and Tower work areas. Cooperators from Glacial Ridge National Wildlife Refuge also participated. In 2022, the Minnesota Sharp-tailed Grouse Society initiated an effort to survey southwestern Minnesota for sharp-tailed grouse leks and submitted data for state records. Dave Pauly also completed surveys in the Cambridge work area and at St. Croix State Park. Mike Larson reviewed this report. This work was funded in part through the Federal Aid in Wildlife Restoration Act.

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Table 1. Sharp-tailed grouse / lek (≥2 males) at leks observed during spring surveys each year in the Northwest and East Central regions 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
2020	NA[e]	NA	NA	NA	NA	NA	NA	NA	NA
2021	10.8	9.7 – 11.9	150[d]	11.3	10.1 – 12.5	131	7.3	5.1 – 9.8	18
2022	12.2	11.0 – 13.4	163	12.5	11.2 – 13.9	142	9.8	7.0 – 13.0	21
2023	11.5	10.4 – 12.7	154	12.4	11.1 – 13.8	123	8.0	6.3 – 9.9	31
2024	15.3	13.9 – 16.9	184	15.9	14.3 – 17.6	159	11.8	8.4 – 15.4	25

[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.

[e] No data were collected in 2020 due to the Governor’s Stay at Home Order during the COVID-19 pandemic.

Table 2. Difference in the number of sharp-tailed grouse / lek observed during spring surveys of the same lek in consecutive years in Minnesota.

	Statewide			Northwest[a]			East Central[a]		
Comparison[b]	Mean	95% CI[c]	*n*[d]	Mean	95% CI[c]	*n*[d]	Mean	95% CI[c]	*n*[d]
2004 – 2005	-1.3	-2.2 – -0.3	186	-2.1	-3.5 – -0.8	112	0.0	-1.0 – 1.1	74
2005 – 2006	-2.5	-3.7 – -1.3	126	-3.6	-5.3 – -1.9	70	-1.1	-2.6 – 0.6	56
2006 – 2007	2.6	1.5 – 3.8	152	3.3	1.7 – 5.1	99	1.2	0.1 – 2.3	53
2007 – 2008	0.4	-0.8 – 1.5	166	0.0	-1.6 – 1.6	115	1.2	0.1 – 2.5	51
2008 – 2009	0.9	-0.4 – 2.3	181	1.8	-0.1 – 3.8	120	-0.8	-2.1 – 0.6	61
2009 – 2010	-0.6	-1.8 – 0.6	179	-0.8	-2.6 – 1.0	118	-0.1	-1.2 – 1.0	61
2010 – 2011	-1.7	-2.7 – -0.8	183	-1.8	-3.1 – -0.5	124	-1.5	-2.8 – -0.3	59
2011 – 2012	-2.0	-2.9 – -1.1	170	-1.7	-2.9 – -0.4	112	-2.4	-3.3 – -1.6	58
2012 – 2013	-0.8	-2.0 – 0.4	140	0.4	-1.3 – 2.3	88	-2.9	-4.2 – -1.8	52
2013 – 2014	1.4	0.1 – 2.7	121	1.6	-0.3 – 3.5	79	1.1	-0.1 – 2.3	42
2014 – 2015	-0.2	-1.4 – 0.9	141	-0.3	-1.9 – 1.3	102	-0.1	-1.1 – 1.1	39
2015 – 2016	-1.3	-2.3 – -0.2	167	-1.6	-2.9 – -0.2	129	-0.2	-1.3 – 0.9	38
2016 – 2017	-0.3	-1.5 – 0.9	166	-0.3	-1.8 – 1.2	128	-0.2	-1.2 – 0.8	38
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
2019 – 2020[f]	NA	NA	NA	NA	NA	NA	NA	NA	NA
2019 – 2021[g]	-0.7	-2.2 – 0.7	124	-0.5	-2.3 – 1.3	96	-1.6	-2.9 – -0.3	28
2021 – 2022	1.6	0.2 – 3.0	122	1.3	-0.3 – 3.0	96	2.7	0.5 – 5.0	26
2022 – 2023	0.7	-1.6 – 1.7	127	0.19	-1.7 – 2.1	106	-0.5	-3.4 – 1.9	21
2023 – 2024	4.6	2.7 – 6.6	147	5.3	3.1 – 7.8	115	1.8	-0.7 – 4.0	32

[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.

[f]No data were collected in 2020 due to the Governor's Stay at Home Order during the COVID-19 pandemic.

[g]Comparisons were made between 2019 and 2021 because the survey was not conducted in 2020.

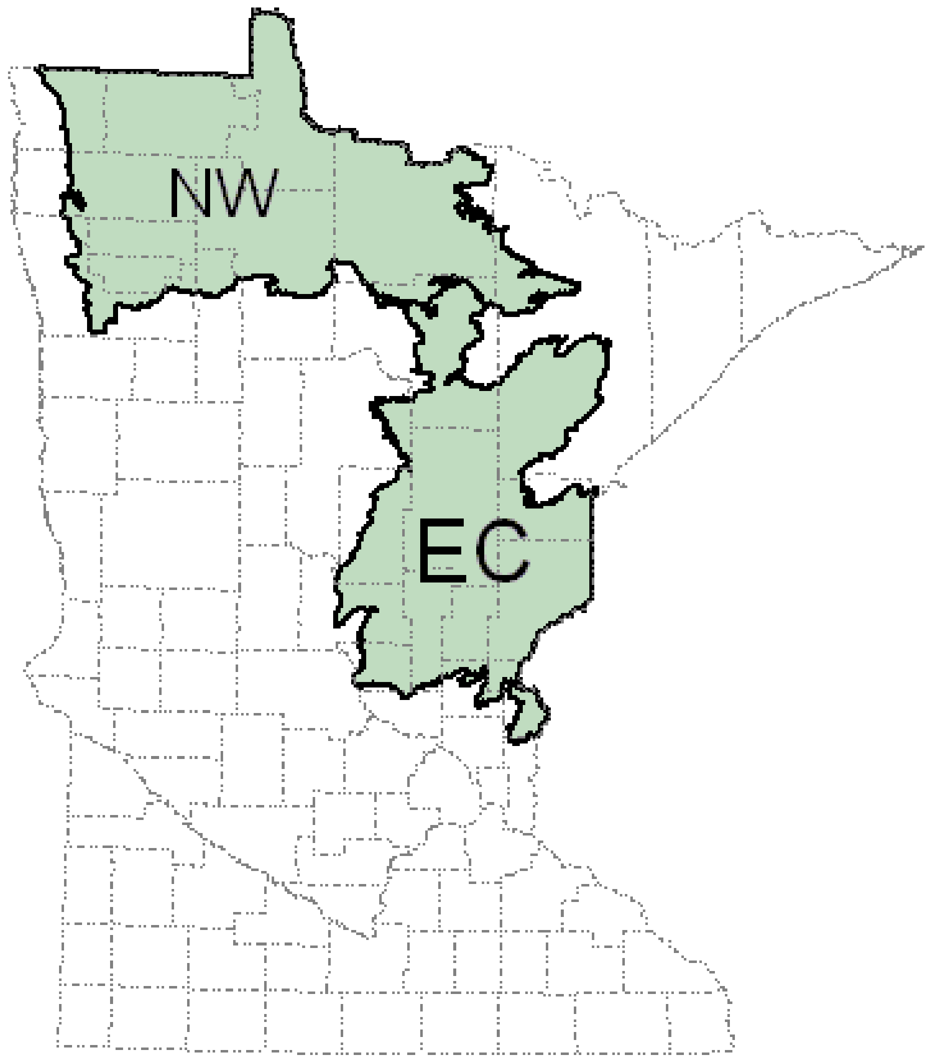

Figure 1. Survey regions for **sharp-tailed grouse** in Minnesota. Northwest (NW) and East Central (EC) survey regions are depicted relative to county boundaries (dashed lines) and influenced by Ecological Classification System Subsection boundaries.

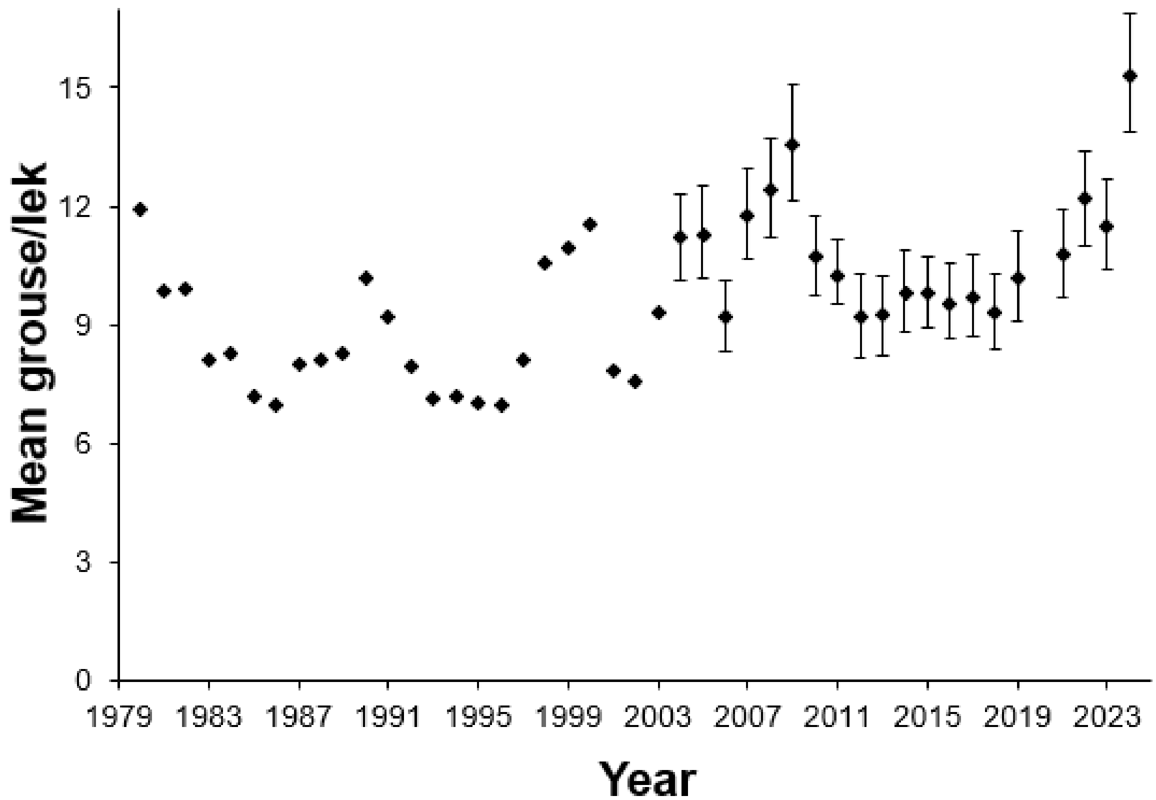

Figure 2. **Sharp-tailed grouse** counted in spring lek surveys statewide in Minnesota during 1980–2024. Bootstrap (95%) confidence intervals are provided for recent years. Annual means are not connected by lines because the same leks were not surveyed every year. No data were collected in 2020 due to the Governor's Stay at Home Order during the COVID-19 pandemic.

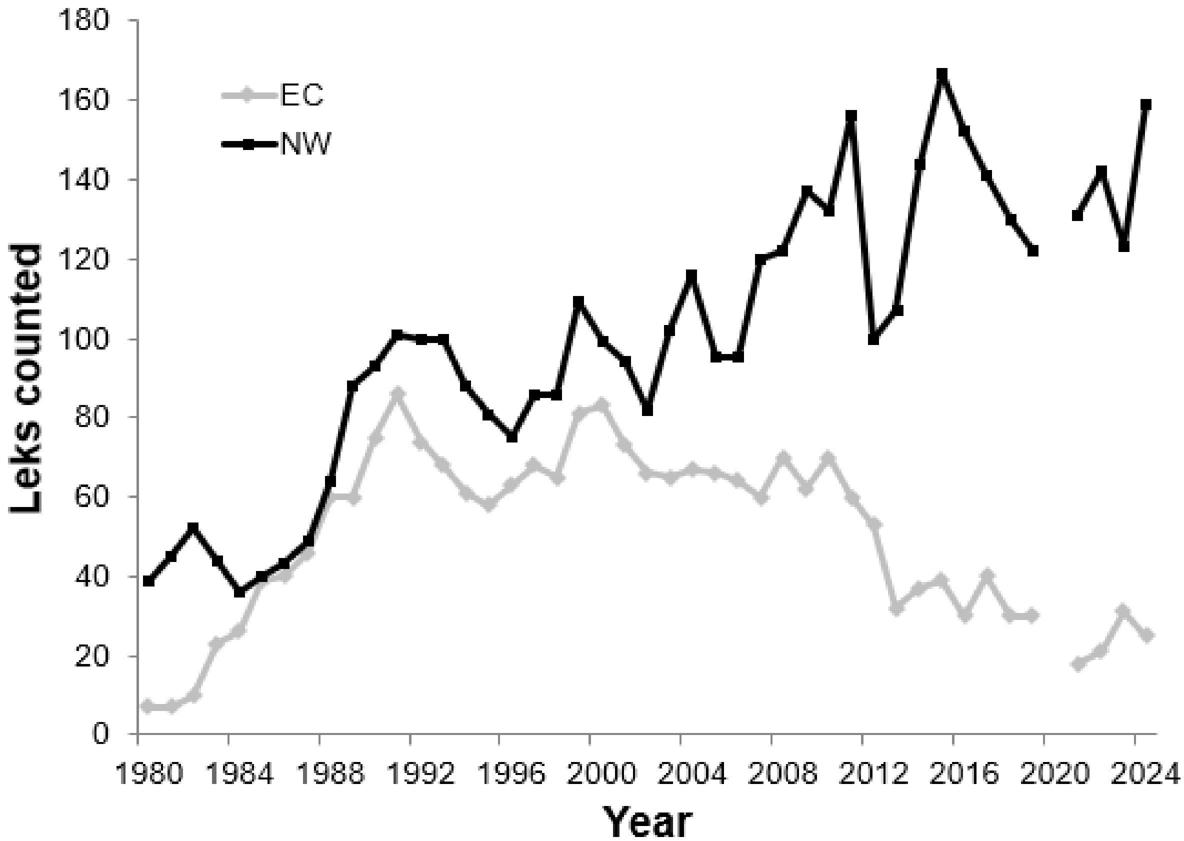

Figure 3. The number of **sharp-tailed grouse** leks with 2 or more birds counted in spring lek surveys in the Northwest (NW) and East Central (EC) survey regions of Minnesota during 1980 – 2024. This metric can be influenced by survey effort. Survey data were not collected in 2020 due to the Governor’s Stay at Home Order during the COVID-19 pandemic.

2024 MINNESOTA SPRUCE GROUSE SURVEY

Charlotte Roy and John Giudice, Forest Wildlife Populations and Research Group

SUMMARY OF FINDINGS

The Minnesota Department of Natural Resources (MNDNR) initiated a spring (March-May) spruce grouse (*Canachites candadensis*) survey in 2018 with the help of dozens of cooperators and citizen volunteers. During 2018-2021, we used replicate surveys to quantify variation in the pellet detection process. Spruce grouse pellets were detected at an average of 32% of sites (range: 26 to 39) during initial visits. However, data from replicate surveys indicated that 57–66% of survey sites classified as "unused" in initial surveys may have had spruce grouse pellets present but they were missed (overlooked) or not available for detection (e.g., buried in the snow). Fortunately, the detection process appears to be relatively consistent over time. Therefore, although naïve site use is a biased estimate of true site use, it should serve as a reasonable monitoring metric in this case; especially given our monitoring goal is to be able to detect a relatively large decrease over a 10-yr interval. Beginning in 2022, we conducted single-visit surveys. The mean conditional pellet count in 2024 (25.6 pellets/used site) was almost double that observed in 2023 (14.2), whereas the proportion of used sites (39%) and used routes (64%) was similar to 2023 (33% and 62%, respectively). Furthermore, we did not find evidence of a statistically significant change in mean pellet counts rangewide during 2018-2024. However, at the ecosection level, count indices suggest a possible decrease in the Minnesota Drift and Lake Plains, which is the southern part of spruce grouse range in MN. We have relatively few routes (10) and survey sites (44) in this ecosection and the counts are dominated by zeros, which makes the observed changes more difficult to detect and interpret. Overall, the spruce grouse population appears to be reasonably stable in terms of our monitoring metrics and spatial extent, except possibly in the extreme southern part of their range in MN.

INTRODUCTION

Spruce grouse, *Canachites candadensis*, are a conifer-dependent gamebird in Minnesota and are expected to experience a range contraction due to climate change-induced habitat loss (Scheller and Mladenoff 2005, Prasad et al. 2007, Iverson et al. 2008). Thus, spruce grouse will likely have a more limited distribution in the southern portions of their range, which includes the Great Lakes region, in the future. The spruce grouse is considered a Species of Special Concern in Michigan (Michigan DNR 2005) and was listed as threatened in Wisconsin in 1997 (Wisconsin DNR 2004). Minnesota is unique among the Great Lakes states in that it still permits spruce grouse hunting, although they are a Species of Greatest Conservation Need because they are vulnerable to decline (Minnesota Department of Natural Resources, MNDNR 2015). Yet, the only data the MNDNR collected on spruce grouse before 2018 was estimated total harvest as part of the annual Small Game Harvest Mail Survey (Davros and Dexter 2020). Estimated total harvest of spruce grouse has been 7,000–19,000 birds/year since 2010 (Davros and Dexter 2020). However, variation in spruce grouse harvest among years may be more reflective of the number of ruffed grouse (*Bonasa umbellus*) hunters; thus these harvest data cannot be used as a population index for spruce grouse (Gregg et al. 2004).

During 2014–2017, we developed survey methodology to provide an index of the spruce grouse population (Roy et al. 2014, 2015, 2016, 2017, 2020). We evaluated an auditory survey using playback of female cantus calls (Roy et al. 2020), which is the most common approach to survey spruce grouse (Fritz 1979, Boag and McKinnon 1982, Schroeder and Boag 1989, Whitcomb et al. 1996, Lycke et al. 2011), and also evaluated a fecal pellet survey (Roy et al. 2020) as a means to monitor the population. Fecal pellets are easily detected in late winter/early spring as the snow pack dissipates and pellets that have been deposited and frozen during winter become visible on the snow surface, indicating spruce grouse use of forest stands. The pellet survey was more efficient and had higher detection rates than the auditory survey. We also found road effects to be negligible in high-use cover types [e.g., jack pine (*Pinus banksiana*) and black spruce (*Picea mariana*)]. Thus, we designed a monitoring program based on a survey of sites centered on road-based points (hereafter, survey “sites”) in spruce grouse cover types dispersed across their range in Minnesota.

In 2018, MNDNR launched the annual spruce grouse pellet survey with the cooperation of biologists from the Chippewa National Forest, Grand Portage Band of Lake Superior Chippewa, Leech Lake Band of Ojibwe, Minnesota Department of Natural Resources, Red Lake Band of Chippewa Indians, Superior National Forest, 1854 Treaty Authority, Vermilion Community College, and dozens of citizen volunteers. This survey is expected to be able to detect meaningful changes in the population over a 10-year period (i.e., >15% decline) and is intended to provide population information (i.e., status and distribution) that can be used to guide management decisions. In addition to collecting data on spruce grouse, we also count pellets from ruffed grouse and snowshoe hares (*Lepus americanus*), and report simple count-based monitoring metrics for these species.

METHODS

The pellet survey is composed of 319 sites (waypoints) organized into 67 routes with 4-5 road-based sites per route spaced >400 m apart (Figure 1). Each route has >1 point with >30% black spruce or jack pine habitat. For the operational survey, sites are visited once during March-May, although we did conduct some revisit surveys during 2018-2021 to better understand the observation and detection process. Observers use a Global Positioning System (GPS) to walk a circular transect with a 100-m radius (i.e., 628-m length) centered on roadside sampling points. Observers record single grouse pellets and roost piles <1 m on either side of transects. Multiple pellets within a 30-cm diameter circle are considered a “roost” for the purpose of this survey. This standardization of the method is necessary because spruce grouse often roost in trees during winter and pellets fall to the ground in poorly defined roost piles. Ruffed grouse pellets tend to be shorter, thicker, and usually have a uric acid wash, whereas spruce grouse pellets are longer, thinner, and infrequently have a uric acid wash. Spruce grouse pellets are also darker green in color when spruce grouse are consuming conifer needles (during winter), but color changes depend on diet; spruce grouse pellets can have a similar color to ruffed grouse pellets later in the spring. At each site observers also record covariate data on major disturbances; access issues; the proportion of the 628-m transect that is located in spruce grouse cover types; days since last snow fall; whether snow cover is complete, partial, or gone; and survey conditions on a scale of 0-10, with 10 being the best conditions to detect pellets. Ruffed grouse and snowshoe hare pellets were recorded in a similar manner to spruce grouse pellets, but snowshoe hare pellets were reclassified in ordinal categories (0, 1-4, 5-11, 12-25, 25+) because the historic data contained inconsistent right-censored values and non-numeric data (e.g., “lots”, “so many”).

For the operational survey, we compute 3 annual count metrics for spruce grouse, ruffed grouse, and snowshoe hare: 1) proportion of sites surveyed where at least 1 pellet was detected (index of site use), 2) mean conditional pellet count (index of pellet abundance at used sites), and 3) proportion of routes surveyed where at least 1 pellet was detected (route-level index). We computed 85% confidence intervals (CI) for these monitoring metrics by generating 500 bootstrap samples and then extracting the 0.075 and 0.925 quantiles of the bootstrapped estimates. We used revisit surveys and occupancy modeling during 2018-2021 to better understand the observation and detection process in spruce-grouse pellet surveys (see Roy et al. 2017), but maintaining this level of survey effort was not feasible (money or staff time) for the long-term operational survey. As a compromise, we used the information from our occupancy models to construct a model based on single-visit surveys. We examined whether a temporal trend in the mean annual spruce grouse pellet count was supported while adjusting for zero-inflation and annual variation in the sampling process (due to mean survey conditions and random year effects).

RESULTS AND DISCUSSION

Spruce Grouse

In 2024, 63 of 67 routes and 294 of 319 sites were surveyed by cooperating biologists (88% of surveys) and citizen volunteers (12% of surveys) between 4 March and 16 June (Table 1). Observers detected spruce grouse pellets at 115 (39%) sites in 2024, compared to an average of 30% of sites during initial visits in 2018-2023 (Figure 2). At the route level, spruce grouse pellets were detected on 40 routes (63%) in 2024 (Figure 3). Observers detected an average of 25.6 (range: 1–386) spruce grouse pellets (singles + roost piles) at used sites in 2024, compared to an average of 16.6 (annual range: 12.6-22.0) during initial visits in 2018-2023 (Figure 4). We failed to find evidence of a temporal trend (positive or negative) in mean spruce grouse pellet counts (log of estimated slope = -0.025; 85% CI: -0.153 to 0.102; Figure 5). Assuming pellet abundance is a good index of spruce grouse abundance, then the range-wide spruce grouse population in Minnesota appears to have been relatively stable during the 2018-2024 monitoring period (Figure 5). However, there are some indications that spruce grouse abundance in the Minnesota Drift & Lake Plains ecosection may have declined (see Figures 2, 3, and 4). Conversely, we have not observed any large, obvious changes in the spatial distribution of spruce grouse pellet detections over time (Figure 6). We have relatively few routes (n = 10) and sites (n = 44) in the Minnesota Drift & Lake Plains region because it is at the southern edge of the spruce grouse range. Thus, our ability to detect a meaningful population change is low for this subset of the population and it would be difficult to increase sample sizes given the paucity of good spruce grouse habitat in this area, which results in mostly zeros for pellet counts.

Ruffed Grouse and Snowshoe Hare

We detected ruffed grouse pellets (single pellets and roost piles) at 238 (81%) sites in 2024 (Table 1, Figures 2 and 3), with a mean count of 14.7 (range: 1-181) pellets per used site (Figure 4). Observers detected pellets of both spruce grouse and ruffed grouse at 100 sites (34%), whereas we failed to detect pellets of either species at 41 sites (14%).

We detected snowshoe hare pellets at 256 (90%) sites in 2024 (Table 1, Figures 2 and 3). Most (49%) pellet counts were in the 25+ count bin (Figure 4). Snowshoe hares may be declining at the site level in the Northern Minnesota Drift and Lake Plains ecological region since the survey began.

Observers detected pellets of both spruce grouse and snowshoe hares at 107 sites (36%). Pellets of spruce grouse, snowshoe hare, and ruffed grouse were detected at 94 sites (32%).

ACKNOWLEDGMENTS

C. Scharenbroich assisted with selection of survey points in GIS during the design phase of the survey. Special thanks to G. Mehmel and S. Laudenslager for their suggestion and support of survey development. Biologists at Grand Portage Band of Chippewa Indians, Red Lake Nation, 1854 Treaty Authority, Leech Lake Band of Ojibwe, U.S. Forest Service, and MNDNR Wildlife provided valuable feedback on survey design and assisted with surveys. Special thanks to all the cooperators and volunteers that assisted with this survey, with special thanks to cooperators in the Superior National Forest and 1854 Treaty Authority who conducted additional surveys during the COVID-19 pandemic in 2020. Seasonal technicians that assisted with repeat surveys included L. Hause, A. Elliott, J. Bates, N. Dotson, and C. Bradley. Citizen-scientist volunteers included C. Bradley, D. Johnson, A. Swarts, R. Anderson, J. Bigelow, G. Larson, J. Keenan, J. Asfoor, J. Elton Turbes, W. Fleischman, B. Rothauge, K. Boettcher, E. Gdula, C. Jensen, G. Jensen, D. Kuder, M. Rothstein, D. Klett, J. Ridlbauer, A. Vinar, E. Berg, R. Berg, D. Elliott, A. Krulc, A. Sporre, R. Langerud, N. Scheffler, M. Gabrys, S. Anderson, K. Jankofsky, E. Shea, and Vermilion Community College students. L. Gilbert assisted with paperwork for volunteers, logistics, and data entry. M. Larson reviewed this report. This work was funded through the Federal Aid in Wildlife Restoration Act.

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Table 1. Spruce grouse (SPGR) routes and sites surveyed in northern Minnesota in 2024 by Department of Natural Resources (DNR) staff, cooperators, and volunteers, and the proportion of sites where observers detected spruce grouse, ruffed grouse (RUGR), and/or snowshoe hare (SNHA) pellets (singles and roosts per used site) during initial visits.

Cooperator	Ecosection	Routes	Sites	SPGR	RUGR	SNHA
Aurora Superior National Forest (SNF)	212N	3	15	0.07	0.93	0.93
Baudette DNR	212M	4	19	0.21	0.37	0.89
Bemidji DNR	212N	2	10	0.10	0.50	0.10
Chippewa National Forest	212N	4	19	0.00	0.63	0.63
Cook SNF	212L	4	20	0.40	0.70	0.80
Duluth DNR	212L	2	9	0.00	0.78	1.00
Ely Superior National Forest	212L	4	17	0.35	1.00	1.00
Grand Marais DNR	212L	2	8	0.25	0.75	1.00
Grand Marais SNF	212L	3	14	0.57	0.64	1.00
Grand Portage Reservation	212L	3	15	0.00	0.93	1.00
Grand Rapids Area (DNR)	212L	1	4	0.25	0.75	1.00
International Falls Area (DNR)	212M	3	13	0.77	0.92	1.00
Orr DNR	212L	4	18	0.67	0.94	0.83
Red Lake Reservation	212N	3	13	0.00	0.77	0.92
Red Lake DNR	212M	5	23	0.96	0.91	1.00
1854 Treaty Authority	212L	4	20	0.50	1.00	0.85
Tofte SNF	212L	6	29	0.76	0.83	1.00
Two Harbors DNR	212L	3	14	0.00	1.00	1.00
Tower DNR	212L	3	14	0.57	0.86	1.00
Not Surveyed	NA	4	25	NA	NA	NA
Total	NA	63	294	0.39	0.81	0.90

212L = Northern Superior Uplands

212M = Northern Minnesota & Ontario Peatlands

212N = Northern Minnesota Drift & Lake Plains

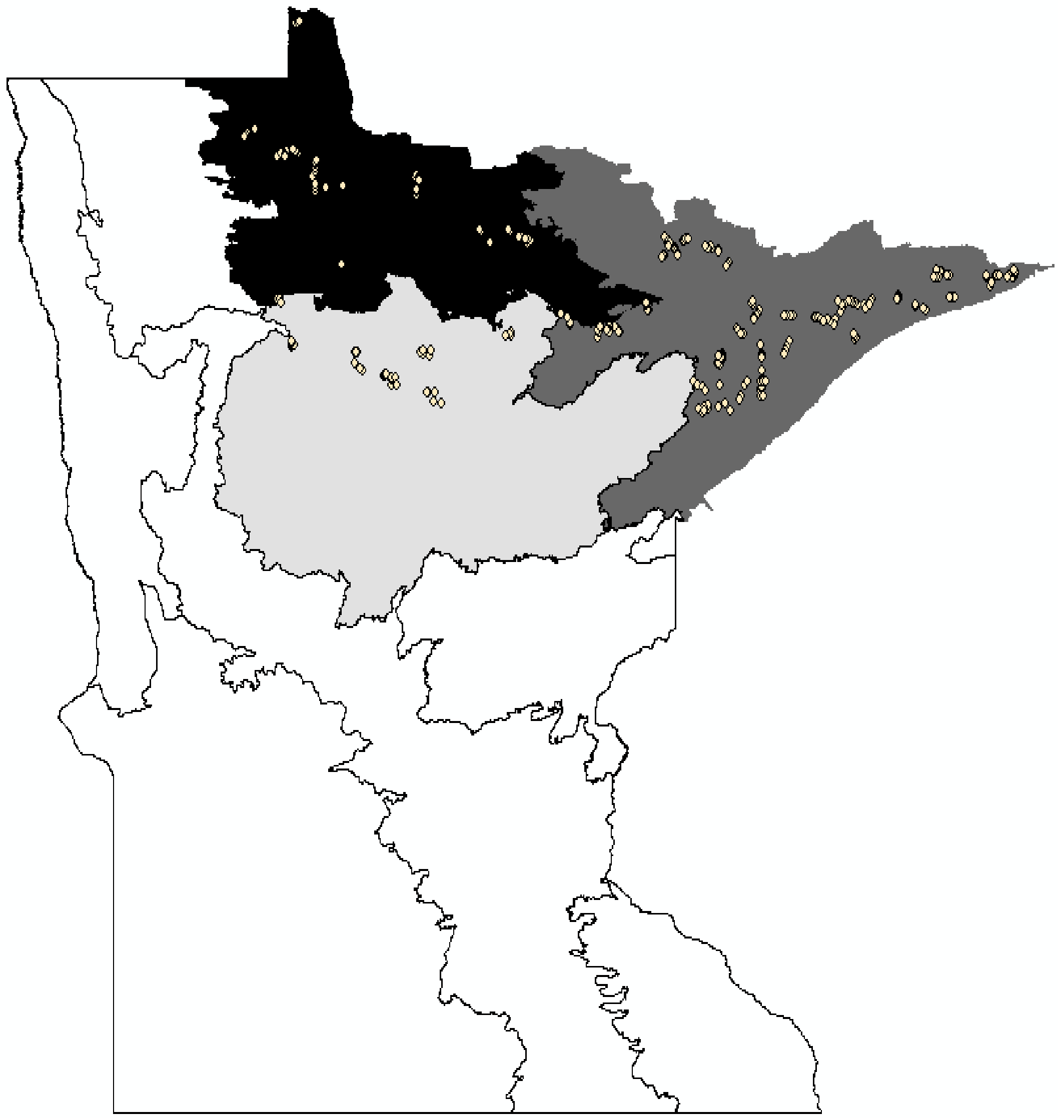

Figure 1. Distribution of sampling sites in northern Minnesota during 2018-2024. Ecological Classification System sections included the Northern Minnesota and Ontario Peatlands (n = 17 routes and 85 sites) in the northwest, the Northern Superior Uplands (n = 40 routes and 190 sites) in the east, and the Northern Minnesota Drift and Lake Plains (n = 10 routes and 44 sites) in the southcentral survey region.

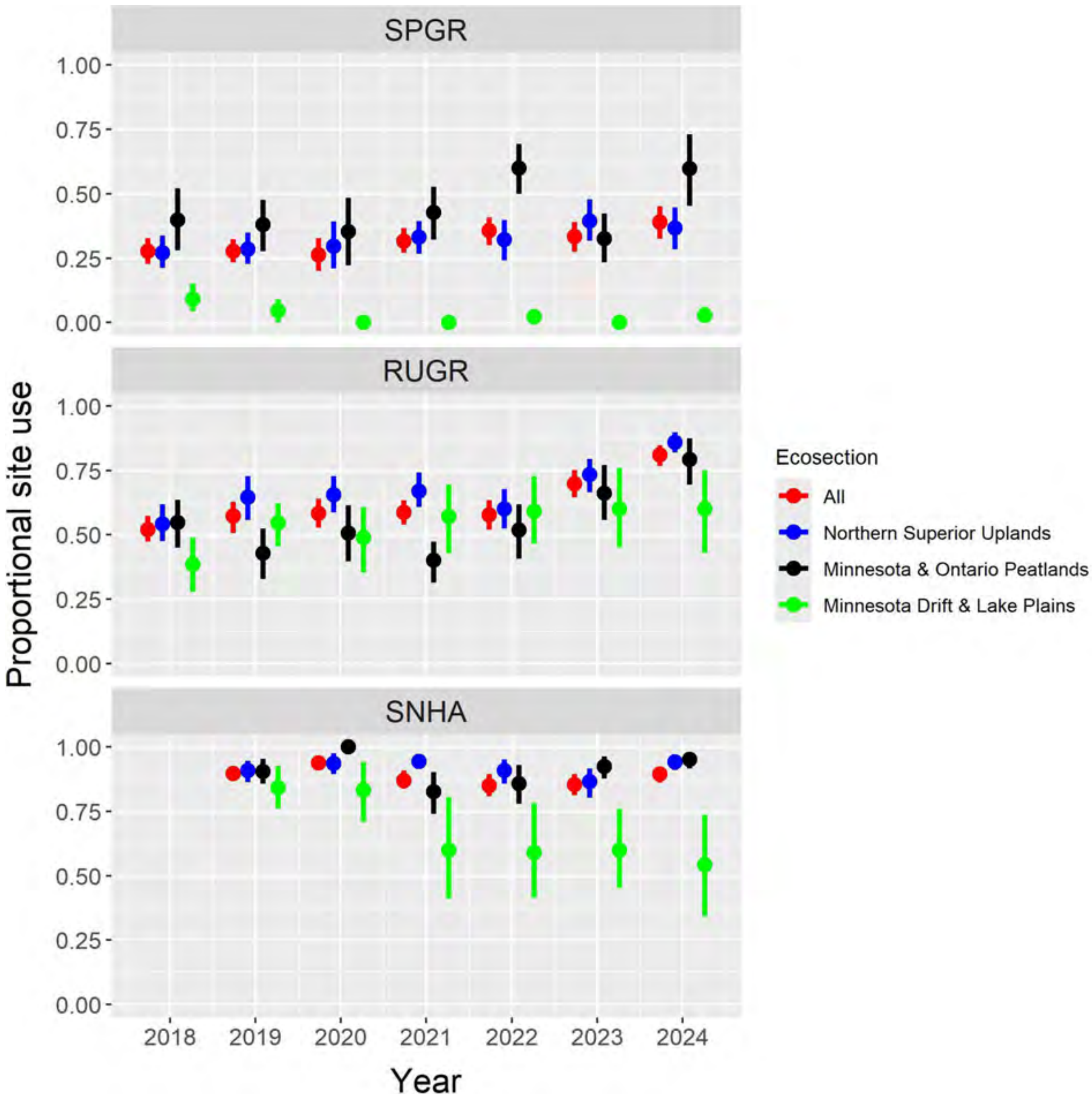

Figure 2. Index of site use in northern Minnesota during 2018-2024 based on the proportion of sites surveyed where at least 1 pellet was detected for spruce grouse (SPGR), ruffed grouse (RUGR), or snowshoe hare (SNHA). Error bars are bootstrapped 85% confidence intervals.

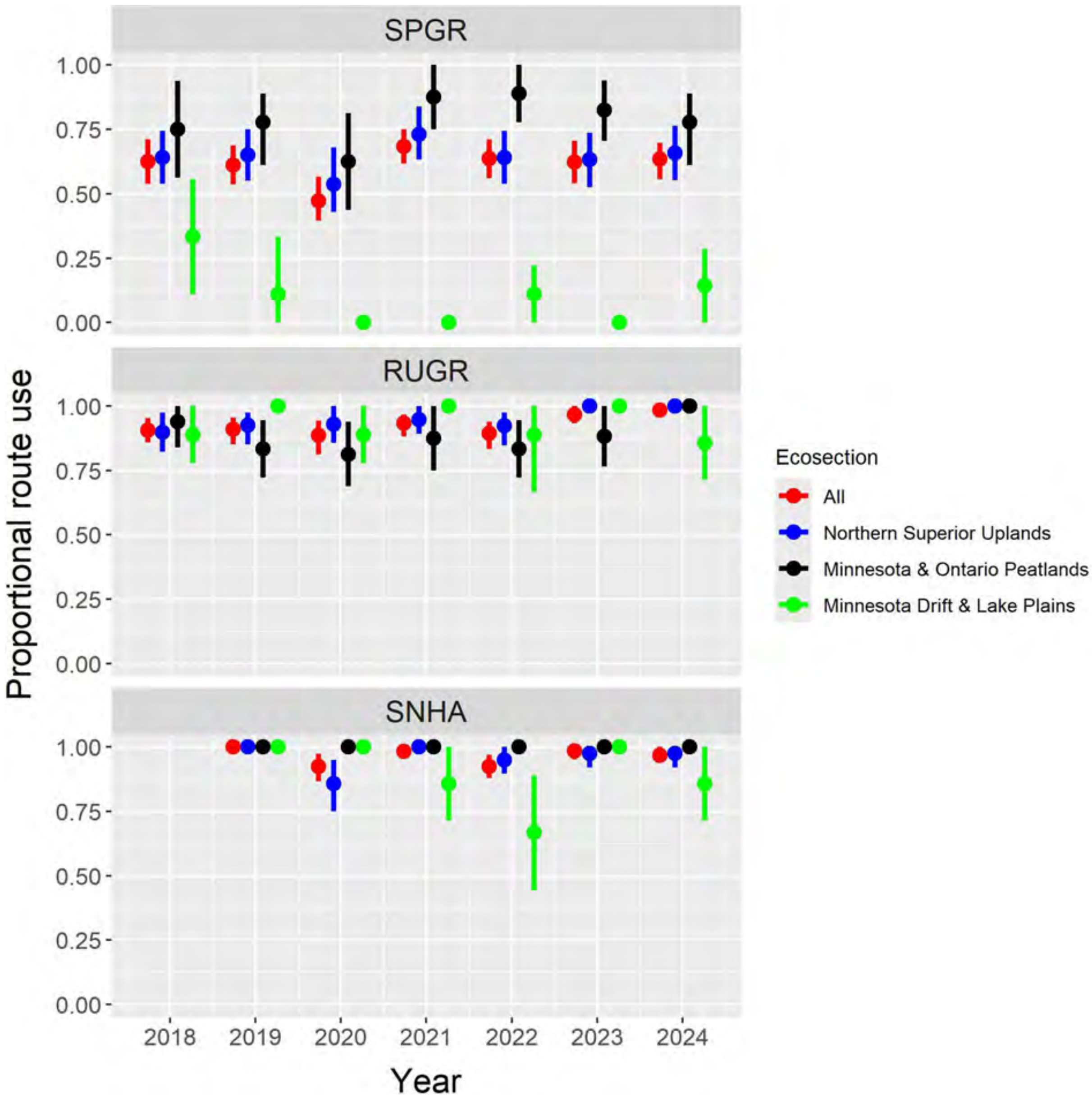

Figure 3. Index of route use in northern Minnesota during 2018-2024 based the proportion of routes surveyed where at least 1 pellet was detected for spruce grouse (SPGR), ruffed grouse (RUGR), or snowshoe hare (SNHA). Error bars are bootstrapped 85% confidence intervals.

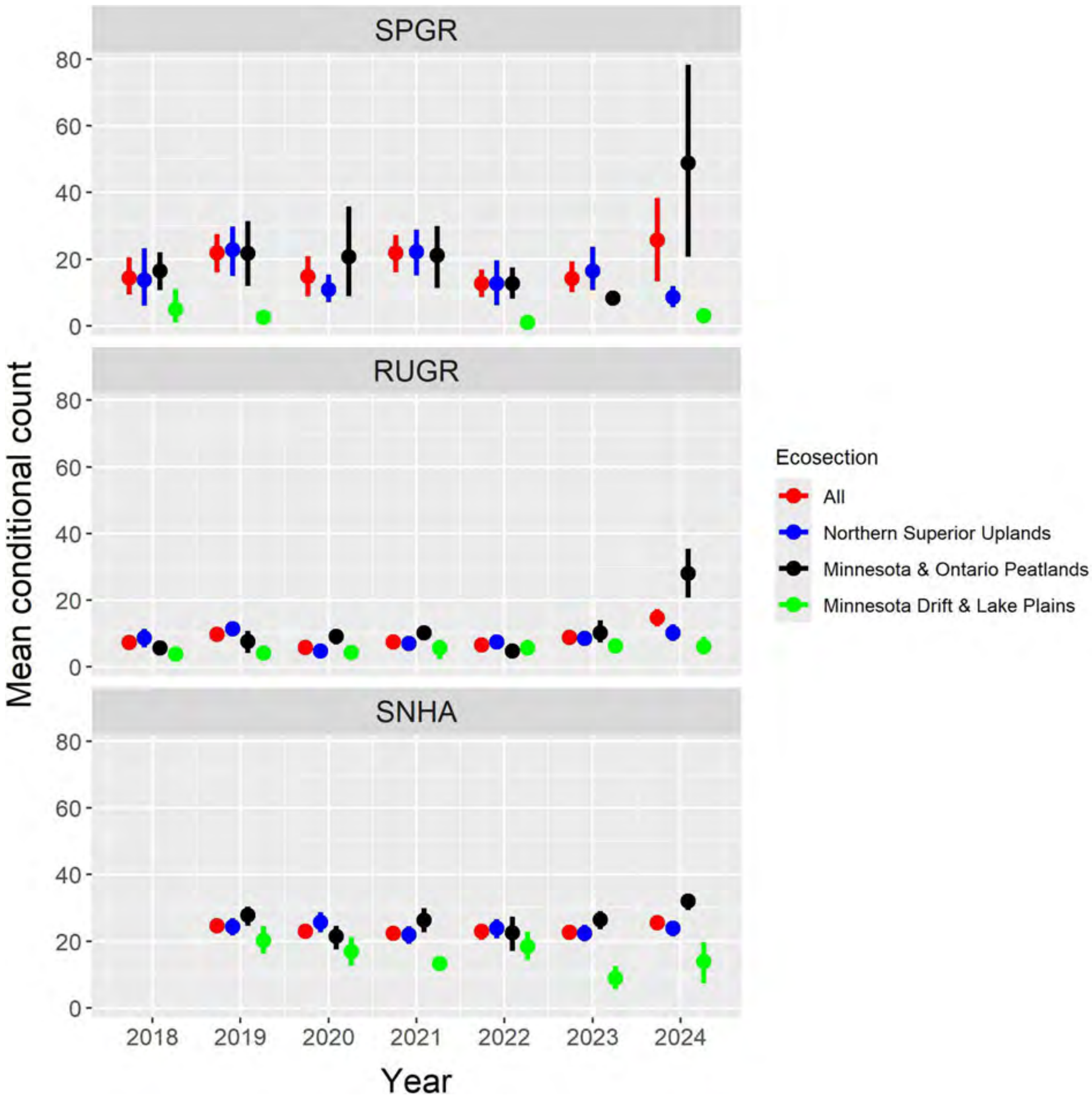

Figure 4. Index of pellet abundance at used sites for spruce grouse (SPGR), ruffed grouse (RUGR), and snowshoe hare (SNHA) in northern Minnesota during 2018-2024. Error bars are bootstrapped 85% confidence intervals. Note: missing data points for spruce grouse in 2020, 2021, and 2023 in the Minnesota Drift and Lake Plains region indicate there were no survey points where pellets were detected, whereas missing data points for snowshoe hare in 2018 are because we did not start systematically counting hare pellets until 2019.

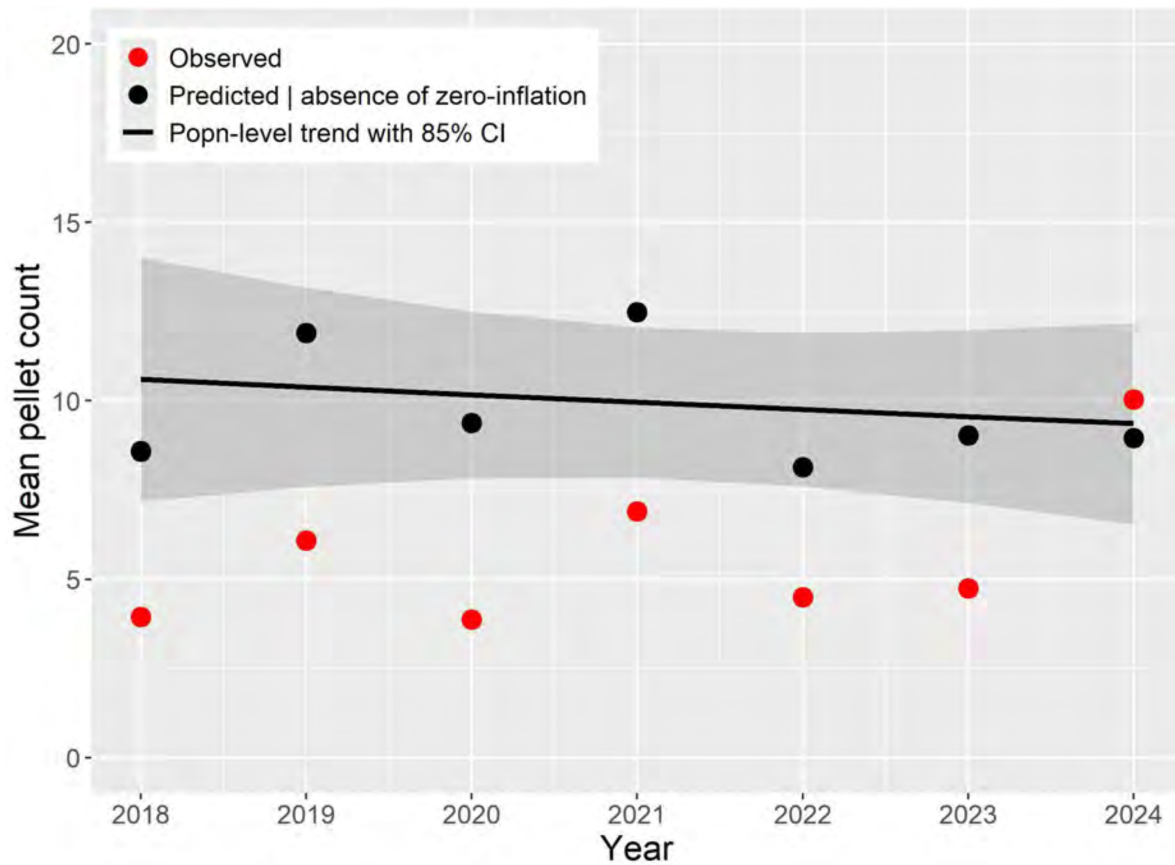

Figure 5. Predicted mean spruce grouse pellet counts in northern Minnesota during 2018- 2024 and the estimated temporal population-level (popn-level) trend with 85% confidence intervals (CI) from the model.

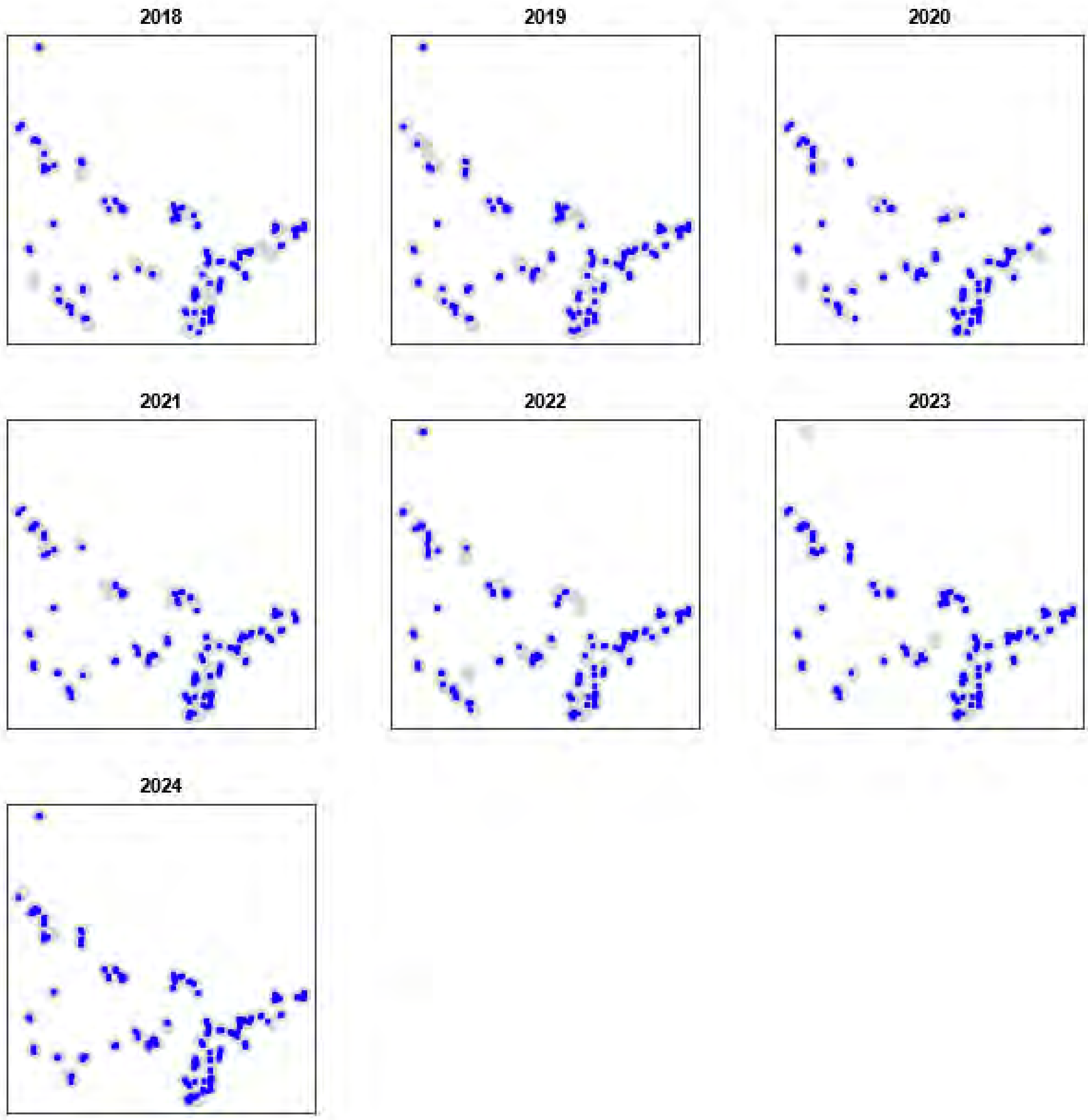

Figure 6. Spatial distribution of sampling effort and spruce grouse pellet detections by year in northern Minnesota during 2018-2024.

2024 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 16 of the 17 survey blocks during the spring of 2024. Observers located 48 booming grounds and counted 502 males and birds of unknown sex in the survey blocks. Including areas outside the survey blocks, observers located 113 booming grounds, 1,080 male prairie-chickens, and 78 birds of unknown sex. Estimated densities of 0.07 (0.04–0.10) booming grounds/km^2 and 10.5 (8.5–12.4) males/booming ground within the survey blocks were similar to densities during recent years and during the 10 years preceding modern hunting seasons (i.e., 1993–2002), but lower than the peak in booming grounds/km^2 in 2007 when Conservation Reserve Program (CRP) enrollments were also the highest.

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 European colonists expanded and modified the landscape with farming and forest removal, providing abundant food sources for priairie-chickens and access to new areas. Later, as grass continued to be lost from the landscape, prairie-chicken populations began to decline, their range contracted to western Minnesota, and hunting seasons closed after 1942. In an attempt to bolster populations and expand prairie-chicken range, the Minnesota Department of Natural Resources (MNDNR) conducted a series of unsuccessful translocations in the Upper Minnesota River Valley during 1998-2006. Today, the beach ridges of glacial Lake Agassiz hold most of Minnesota's prairie-chickens, but their populations do extend southward (Figure 1). Hunting was re-opened using a limited-entry season in 2003, and ~100 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 over a mile.

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 on 16 of the 17 designated survey blocks in western Minnesota (Figure 2) during March, April and May. Each survey block was nonrandomly selected so that surveys would be conducted in areas where habitat was expected to be good (i.e., grassland was relatively abundant) and leks were known to occur. Each observer attempted to find and survey each booming ground repeatedly in his/her assigned block, which comprised 4 sections of the Public Land Survey (approximately 4,144 ha). Observers obtained multiple counts at each booming ground in the morning because male attendance at leks varies throughout the season and throughout the day.

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

In the analysis, I used counts of males and unknowns at each booming ground but not females.

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

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

In 2021, MPCS requested that sharp-tailed grouse (*Tympanuchus phasianellus*) observed during prairie-chicken surveys be included in this report because of concerns that sharp-tailed grouse are expanding into range previously occupied primarily by the prairie-chicken. Prior to the survey season, I asked observers to include observations of sharp-tailed grouse with their data.

RESULTS AND DISCUSSION

Observers from MNDNR Section of Wildlife, the U.S. Fish & Wildlife Service (USFWS), and The Nature Conservancy (TNC), as well as many unaffiliated volunteers counted prairie-chickens between 23 March and 8 May 2024. Observers located 113 booming grounds and observed 1,080 male prairie-chickens and 78 birds of unknown sex within and outside the survey blocks (Table 1). These counts represent a minimum number of prairie-chickens in Minnesota during 2024, but because survey effort outside of survey blocks is not standardized among years, these counts should not be compared among years or permit areas.

Within the standardized survey blocks, 502 males and birds of unknown sex were counted on 48 booming grounds during 2024 (Table 2). This contrasts with the high count of 1,618 males and 114 booming grounds in 2007. Each lek was observed an average of 2.3 times (median =

2), with 34% of booming grounds observed just once. These counts should not be regarded as estimates of abundance because detection probabilities of leks and birds were not estimated. However, if 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 0.09 (0.05–0.13) booming grounds/km^2 and 10.7 (8.5–13.0) males/booming ground (Figure 3). In the peripheral survey blocks, densities were 0.03 (0.004–0.07) booming grounds/km^2 and 9.4 (5.7–13.1) males/booming ground. For all survey blocks, the density of 0.07 (0.04–0.10) booming grounds/km^2 during 2024 was similar to densities during recent years (Figure 3) and the average of 0.08 (0.06–0.09) booming grounds/km^2 during the 10 years preceding recent hunting seasons (i.e., 1993–2002). Similarly, the density of 10.5 (8.5–12.4) males/booming ground in all surveyed blocks during 2024 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 (Figure 3).

The observed densities are lower than the years preceding 2008 when CRP enrollments in the counties containing the survey blocks were highest. These changes in the population indices coincide with gains and losses in enrollments in the CRP. Changes in the quantity of grassland on the landscape impacts prairie-chicken populations. 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.*

Prairie-chicken survey cooperators submitted reports of sharp-tailed grouse observed during prairie-chicken surveys in 2024. In Polk County, 183 male and 5 female sharp-tailed grouse were counted at 12 sharp-tailed grouse dancing grounds. Twenty-nine additional male sharp-tailed grouse and 1 female were located at mixed-species leks that included prairie-chickens. Five hybrids of sharp-tailed grouse and prairie-chickens were also located during surveys. In Norman County, 2 sharp-tailed grouse leks with 2 males were observed and another sharp-tailed grouse lek was heard during surveys. In Clay County, 10 male and 1 female sharp-tailed grouse were observed among 4 prairie-chicken booming grounds and 2 hybrids were counted on 1 of these grounds during surveys. In Wilkin County, 2 sharp-tailed grouse were observed at 2 different prairie-chicken booming grounds (1 at each ground). Research staff conducting a study of hybrids observed additional sharp-tailed grouse and hybrids in Mahnomen (5 and 4, respectively), Norman (17 and 2, respectively), and Polk counties (1 and 7, respectively). Sharp-tailed grouse appear to be increasing within the prairie-chicken range.

ACKNOWLEDGMENTS

I would like to thank cooperators who conducted and helped coordinate the prairie-chicken survey. Cooperators with The Nature Conservancy included Travis Issendorf, and volunteers Pat Beauzay, Derek Savage, and Sara Nagel; cooperators within MNDNR included Rob Baden, Becky Ekstein, Emily Hutchins, Greg Henderson, Matt Mecklenburg, Matt Morin, and Nick Snavely; cooperators with U.S. Fish and Wildlife Service included Chad Raitz, Shawn Papon, Stacy Salvevold, Ben Walker; and numerous additional volunteers, including Brian Winter, Dan Svedarsky, Doug Wells, Jon Voz, Ross Hier, Dan Hertel, and Doug Hedtke. This survey was funded in part by the Wildlife Restoration (Pittman-Robertson) Program. Mike Larson reviewed this report.

Table 1. Minimum abundance of prairie-chickens within and outside hunting permit areas in Minnesota during spring 2024. Lek and bird counts are not comparable among permit areas or years.

Permit Area	Area (km^2)	Leks	Males	Unknown[a]
803A	1,411	11	93	0
804A	435	0	0	0
805A	267	11	138	0
806A	747	10	71	20
807A	440	19	148	52
808A	417	17	244	0
809A	744	14	155	0
810A	505	7	68	0
811A	706	3	13	0
812A	914	6	43	3
813A	925	6	39	0
PA subtotal	7,511	104	1,012	75
Outside PAs[b]	NA[c]	9	68	3
Grand total	NA[c]	113	1,080	78

[a] Unknown = 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.

Table 2. Prairie-chicken counts within survey blocks in Minnesota during spring 2024 and change in counts compared to 2023.

			2024		Change from 2023[a]	
Range[b]	Survey Block	Area (km^2)	Booming grounds	Males[c]	Booming grounds	Males[c]
Core	Polk 1	41.2	2	21	1	7
	Polk 2	42.0	5	59	2	23
	Norman 1	42.0	2	36	0	23
	Norman 2	42.2	3	22	0	6
	Norman 3	41.0	6	66	3	30
	Clay 1	46.0	8	87	-1	-19
	Clay 2	41.0	2	45	-1	-20
	Clay 3	42.0	8	54	4	6
	Clay 4	39.0	1	12	-1	-10
	Wilkin 1	40.0	1	6	-3	-69
	Core subtotal	415.0	38	408	4	-23
Periphery	Mahnomen	41.7	2	33	0	0
	Becker 1	41.4	5	39	-3	-25
	Becker 2	41.7	0	NA	-1	-5
	Wilkin 2	41.7	1	2	-1	-5
	Wilkin 3	42.0	0	NA	-2	NA
	Otter Tail 1	41.0	1	7	0	0
	Otter Tail 2	40.7	1	13	0	-7
	Periphery subtotal	290.6	10	94	-7	-71
Grand total		705.5	48	502	-3	-94

[a] The 2023 count was subtracted from the 2024 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.

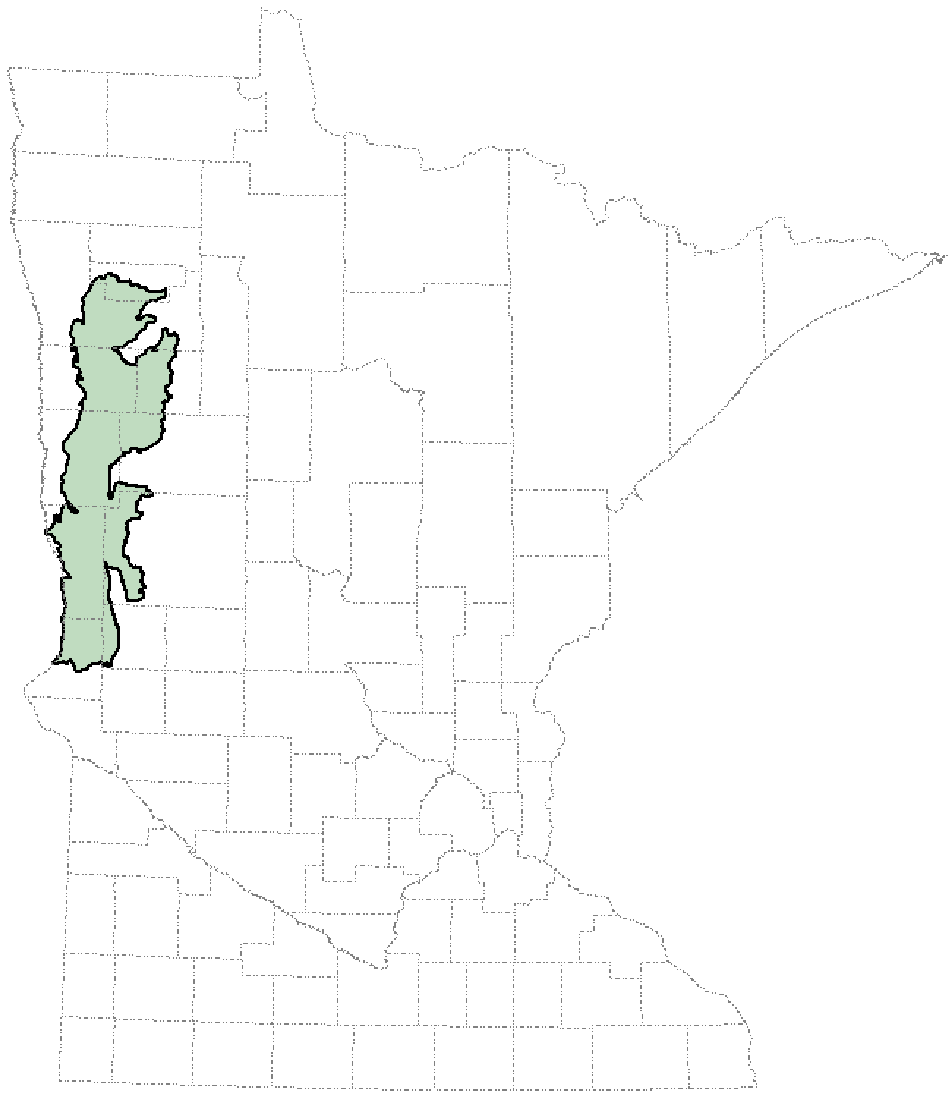

Figure 1. Primary greater prairie-chicken range in Minnesota (shaded area) relative to county boundaries. The range boundary was based on Ecological Classification System Land Type Associations and excludes some areas known to be occupied by prairie-chickens.

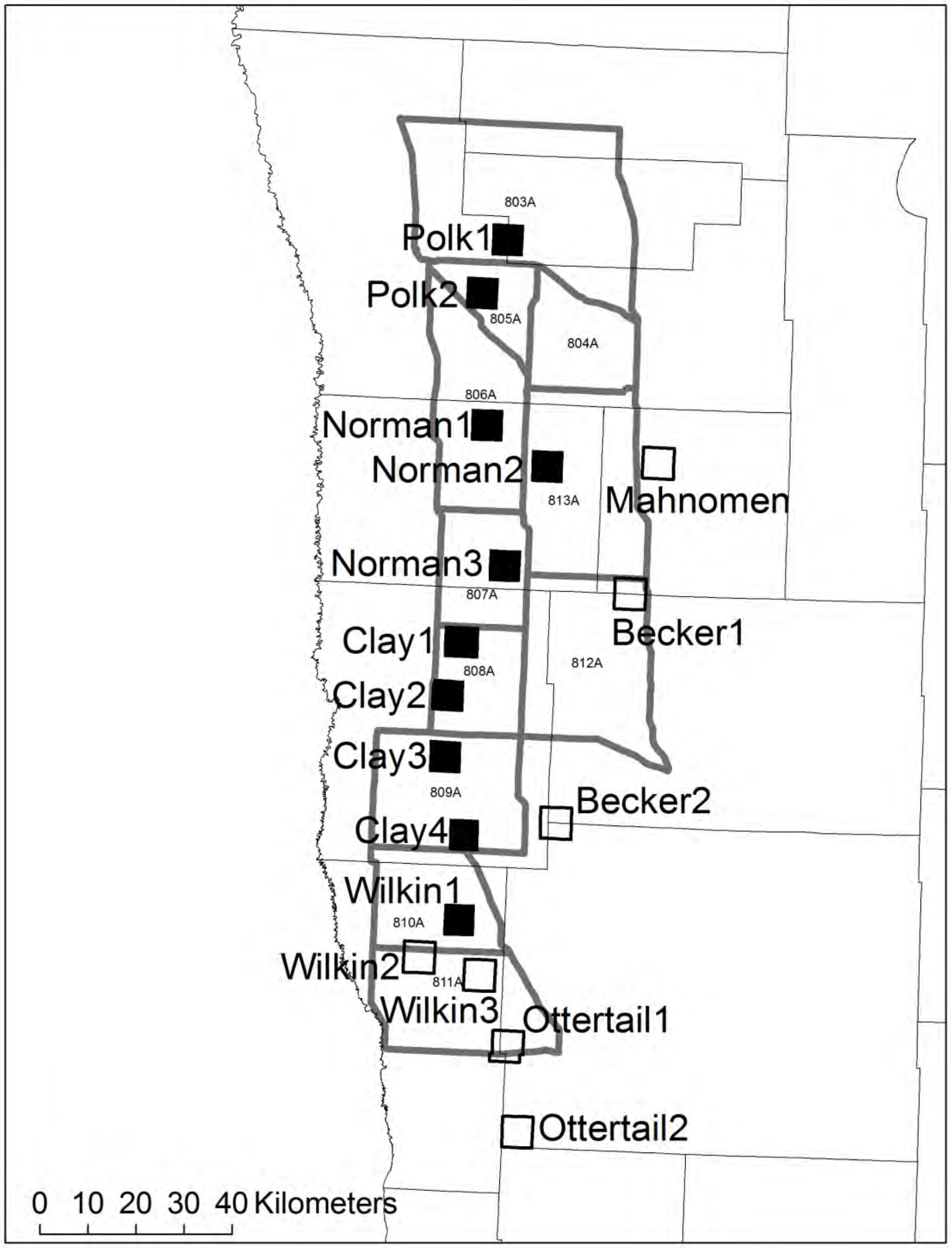

Figure 2. Prairie-chicken lek survey blocks (41 km^2, labeled squares) and hunting permit areas (thick grey lines) in western Minnesota. Survey blocks were either in the core (black) or periphery (white) of the range with a threshold of 1.0 male/km^2 in 2010, and were named after their respective counties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

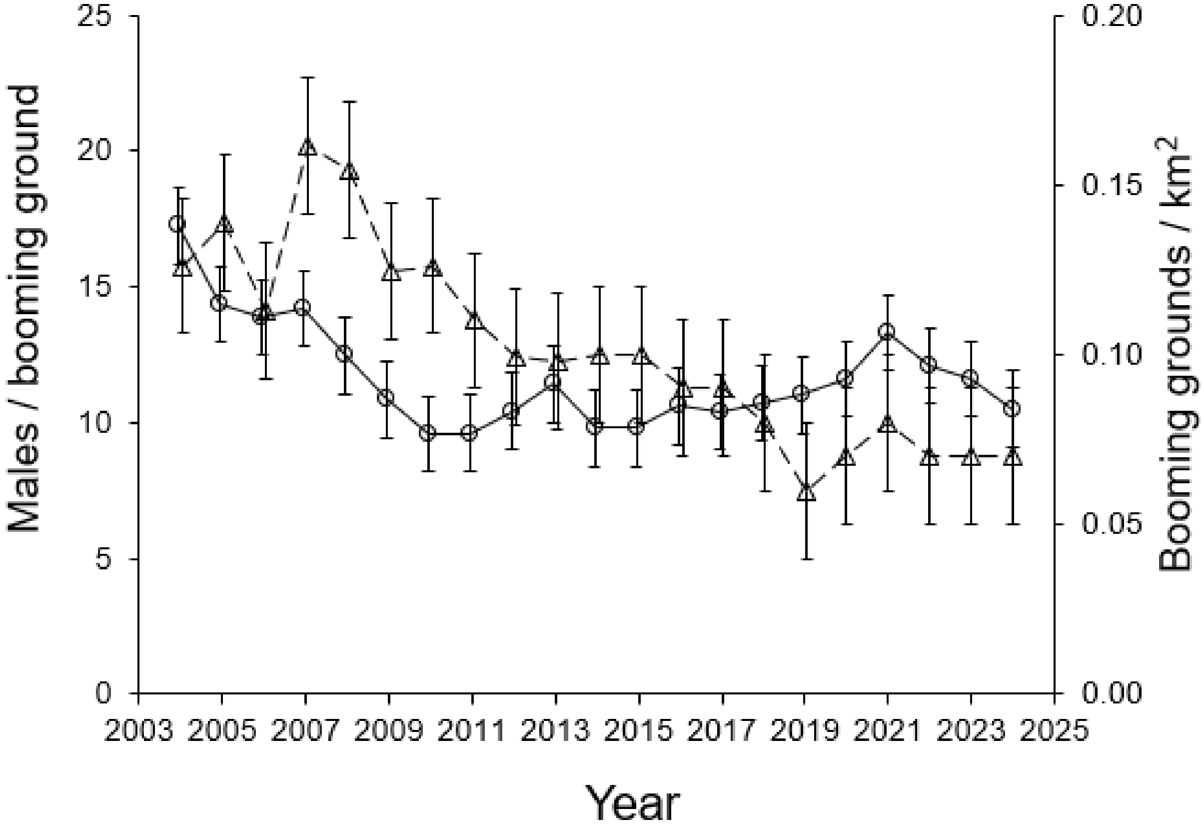

Figure 3. Mean prairie-chicken males/booming ground (circles connected by solid line) and booming grounds/km^2 (triangles connected by dashed line) in survey blocks in Minnesota with 95% confidence intervals.

AERIAL ELK SURVEYS – 2024

Eric Michel, Farmland Wildlife Populations

INTRODUCTION

Historically, elk (*Cervus elaphus*) inhabited much of Minnesota (O'Gara and Dundas 2002) but today are limited to three relatively small herds found in Kittson, Roseau, Marshall, and Beltrami counties in the northwest portion of the state (Figure 1). Row crops are a dominant land use in this part of the state and subsequently, there is potential for crop depredation caused by elk. Elk management in Minnesota is therefore mandated to prevent populations from increasing in accordance with Minnesota Statute 97B.516. Specifically, the Grygla herd must be managed for 30 to 38 elk, the Kittson County herd for 50 to 60 elk, and the Caribou-Vita herd for 150 to 200 elk (Minnesota Department of Natural Resources 2017). Since the mid-1990s, Minnesota Department of Natural Resources (MNDNR) personnel have conducted an annual aerial elk survey from mid-January to mid-March in northwest Minnesota.

Our primary objective was to estimate elk abundance within each herd. MNDNR staff use this data to monitor long-term trends, document changes in spatial distribution and sex ratios, and help set harvest quotas for annual hunting seasons. However, per flight protocol, we require a minimum of 8 inches of snow cover prior to initiating aerial elk surveys. Because this threshold was not met during January-March 2024, we did not fly any surveys. Therefore, we had limited activity occurring for this project within this annual reporting timeframe.

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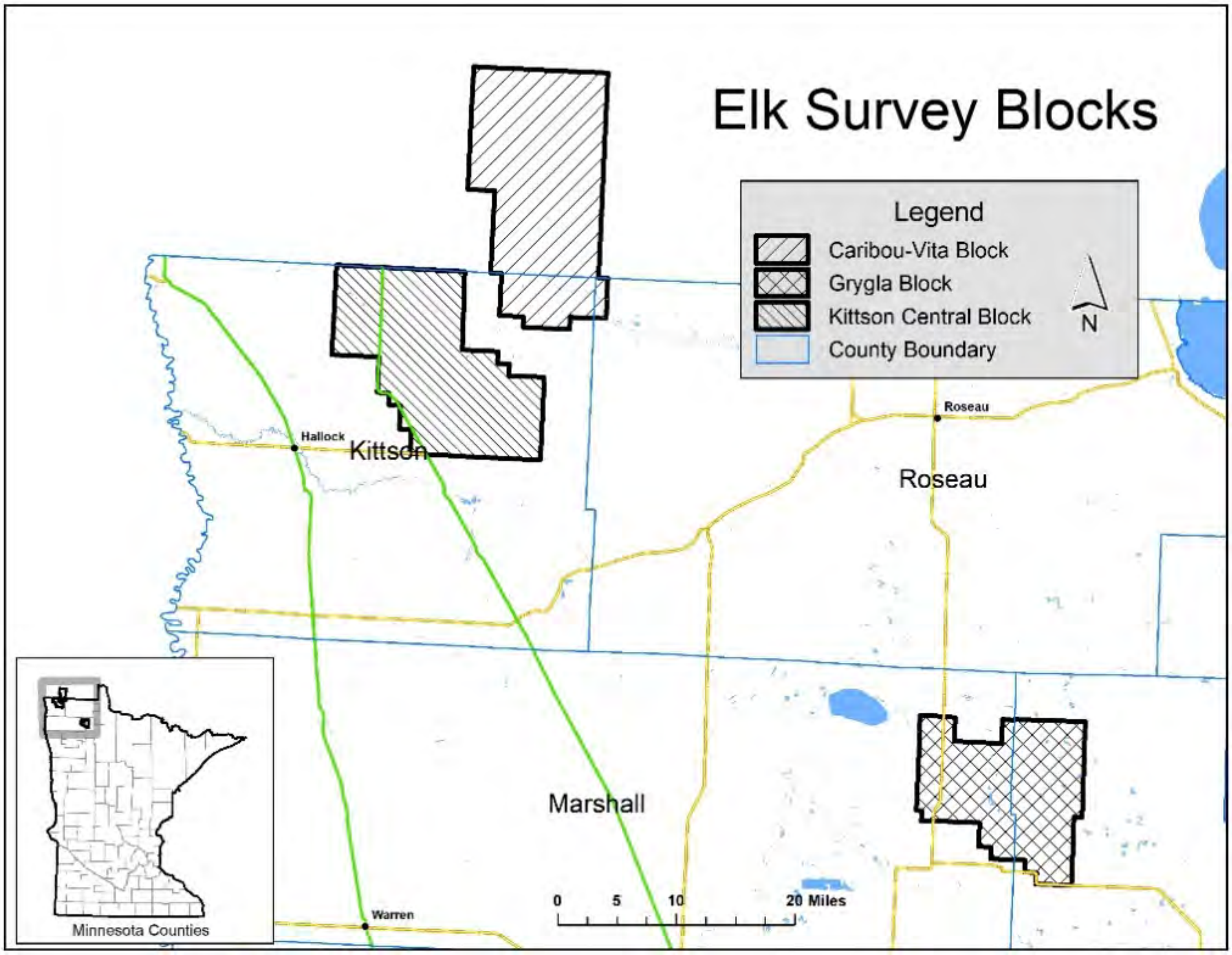

Figure 1. Winter aerial survey blocks flown for elk in northwest Minnesota.

2024 AERIAL MOOSE SURVEY

John H. Giudice, MNDNR Wildlife Biometrics Group

INTRODUCTION

Each year we conduct an aerial survey in northeastern Minnesota to estimate moose (*Alces alces*) abundance and monitor and assess changes in the overall status of the state's largest deer species. The primary objective of this survey is to estimate moose abundance, percent calves, and calf:cow and bull:cow ratios. These demographic data help us to: 1) determine and understand the population's long-term trend (decreasing, stable, or increasing), sex-age 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) contribute to sound management strategies.

METHODS

The survey area is approximately 5,945 mi^2 (~3.8 million acres; Lenarz 1998, Giudice et al. 2012) and includes the Boundary Waters Canoe Area Wilderness (Figure 1). We estimate moose numbers and age and sex ratios by flying transects within a stratified sample of plots randomly drawn from a sampling frame that covers most of the moose range in northeastern Minnesota (Figure 1). We used historic observations of moose, habitat information, and the extensive field experience of moose managers and researchers to stratify the sampling frame into low-, medium-, and high-density plots based on whether 0-2, 3–7, or 8 or more moose, respectively, would be expected (on average) to be observed in a specific plot. To keep the stratification current, we periodically review the stratification scheme about every 5 years. We conducted the last stratification review in October 2018 and the next review will occur later this year. Stratification helps to improve precision of the estimates (i.e., compared to a simple random sample). In 2012, we modified the stratification scheme by adding a 4th stratum (referred to as "long-term habitat plots") to better understand moose use of disturbed areas and evaluate the effect of forest disturbance on moose density over time. Initially, we selected 9 plots that have undergone or will undergo significant disturbance by wildfire, prescribed burning, or timber harvest. We survey the same habitat plots each year in order to better document temporal trends. In 2022, we added a 10th habitat plot (plot 208; part of the 2021 Greenwood Lake wildfire). This year we surveyed 53 plots (43 randomly sampled and 10 habitat plots; see Figure 1).

The sampling frame (designed in 2005) contained 435 uniform rectangular plots (~5 mi x 2.7 mi; ~13.3 mi^2) oriented east to west (Figure 1). Sample plots were surveyed using helicopters (OH-58A, MD500E, and Bell-206B3) flying 200-350 ft above-ground-level at 52-69 mph on east-west transects spaced ~0.3 mi apart, with search intensities that averaged 3.6 min/mi^2 (range: 1.9-5.6). Survey crews consisted of a MNDNR pilot and, 2 observers (one seated behind the pilot). 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 field personnel.

We accounted for visibility bias using a sightability model (Giudice et al. 2012). The model was developed during 2004-2007 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 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.

Since 2004, we have used the SightabilityModel package (Fieberg 2012) in the R programming language (R Core Team 2023) to compute annual population estimates for NE Minnesota.

These estimates are adjusted for both sightability and sampling. We also annually compute composition ratios that include calf:cow, calf:total (proportion calves), and bull:cow ratios. We use these ratios as indices of annual productivity and breeding viability (given a polygamous mating system). For historic compatibility, we compute composition ratios using the combined ratio estimator (Cochran 1977:165), which accounts for the sampling design but not sightability.

Historic population estimates have moderate levels of sampling uncertainty, which makes it difficult to compare annual estimates with confidence, especially when differences are relatively small. The strength of the survey is describing trends in population estimates and composition ratios. For example, the significant population decline that occurred between 2009 and 2013 is readily evident in our time series, even with moderate levels of sampling uncertainty. In theory, we could reduce sampling uncertainty by increasing the number of plots surveyed, but we are already pushing the limits of what we can realistically accomplish given staff, equipment, and financial constraints. An alternative approach to improving precision is to consider moving from our current design-based estimator to a model-assisted estimator (e.g., state-space model; Auger-Methe 2021) or a fully model-based estimator (e.g., Fieberg et al. 2013, ArchMiller et al. 2018). The latter research used moose-survey data from NE Minnesota. An important advantage of model-based estimators is that information can be shared across time or space to help increase the precision of annual population estimates and smooth estimated trends over time. Similar to last year, we explored using alternative estimators to estimate moose abundance and temporal trends. However, to avoid confusion, the main report continues to focus on traditional estimators, and results from alternative estimators are limited to qualitative summaries in Addendum A.

RESULTS AND DISCUSSION

We surveyed 53 sample plots consisting of 15 low-, 18 medium-, and 10 high-density plots, and 10 habitat plots (Figure 1). The survey required 12 surveys days between 17 Jan and 02 Feb to complete, which is slightly longer than usual (annual mean = 9 days; range: 8 to 10) because we were limited to 1 aircraft for much of the survey. We also started 10 days later than usual due to marginal snow conditions. Generally, 8" of snow cover is our minimum threshold depth for conducting the survey. Only 26% of survey plots in 2024 had snow depths ≥8", but overall survey conditions were rated as fair-to-good for 100% of the plots. Furthermore, survey intensity, aircraft speed and height, etc. were very similar to values observed in previous surveys (see Giudice 2024).

Crews this year observed 323 moose (148 bulls, 120 cows, 43 calves, 12 unclassified adults) on 39 (74%) plots with an average of 8.3 moose per "occupied" plot. For comparison, apparent occupancy (ignoring detectability) in the previous 19 years ranged from 65-95% (mean = 81%), and the mean moose count/occupied plot ranged from 6.4-18.5 (annual mean = 11.0). Crews observed an average of 3.8 moose groups per occupied plot (range: 1-10) in 2024 compared to an average of 5.5 groups/plot (annual range: 3.0-9.3) in the previous 19 years. The average group size in 2024 was 2.2 moose (range: 1-8) compared to a mean of 2.0 (range: 1.8-2.4) in the previous 19 years. Visual obstruction estimates in 2024 averaged 41% (range: 0 to 90) and the average estimated detection probability was 0.57 (range: 0.20 to 0.85). The latter is similar to mean values observed in previous years (range: 0.52 to 0.66; see Giudice 2024).

After adjusting for sampling and sightability, the estimated moose population in northeastern Minnesota was 3,470 moose (90% CI: 2,570–4,940) (Table 1, Figure 2). Bulls, cows, and calves accounted for about 48%, 35%, and 17% of the estimated population total, respectively. Estimated overall bull density was 0.28 bulls/mi^2 (90% CI: 0.19 to 0.43). However, it varied by stratum: 0.17 bulls/mi^2 (90% CI: 0.09 to 0.46) in the low stratum, 0.34 bulls/mi^2 (90% CI: 0.21 to 0.58) in the medium stratum, 0.61 bulls/mi^2 (90% CI: 0.41 to 1.04) in the high stratum, and 0.60 bulls/mi^2 (90% CI: 0.51 to 0.84) in the habitat-plot stratum. This year's estimated calf:cow ratio was 0.51 (90% CI: 0.39 to 0.62) and the bull:cow ratio was 1.33 (90% CI: 1.04 to 1.62). This year's calf:cow ratio is higher than last year's point estimate (0.38) and is the highest estimated ratio since 2005 (Figure 3). However, there is moderate-to-high levels of sampling uncertainty associated with our ratio estimates. Thus, it is difficult to separate true annual change from sampling variation when comparing ratio estimates among years (Figure 3). The calf:total ratio (proportion calves) closely mirrors the calf:cow ratio but with slightly less annual variability (Figure 3). The bull:cow ratio increased slightly compared to last year, but precision of the bull:cow ratio is relatively poor (Figure 4). Furthermore, there is a lot of sampling variation in the bull:cow time series that likely reflects annual variation in the classification process and, possibly, how bulls and cows are distributed in space. The calf:cow ratio is better in this regard.

Although we know from field studies that fertility (pregnancy rates) of the population's adult females has been robust (Lenarz et al. 2010; DelGiudice, unpublished data), overall, survey results suggest that calf survival remains relatively low. 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, Severud et al. 2019). Calf survival by spring 2017 (recruitment) had declined to just 0.33. However, 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 changed little (85–88%) during 2014−2017 (Carstensen et al. 2017) but was slightly higher than the previous long-term (2002−2008) average of 81% (Lenarz et al. 2009).

This year's population estimate is up 5% from last year's point estimate (Table 1, Figure 2). However, sampling uncertainty is moderately high in this survey (see 90% CIs) and, thus, it is often difficult to make statistically confident statements about the magnitude of annual population changes unless those changes are relatively large. This level of uncertainty is common in wildlife surveys, 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. Thus, the best use of survey results is for monitoring population trends over several years rather than focusing on the magnitude of differences in annual estimates, including composition ratios.

Based on aerial surveys and research results (e.g., Lenarz et al. 2009, 2010; Severud 2017; Carstensen et al. 2017; Severud et al. 2019, 2020, 2022), we can say with reasonable confidence the moose population in NE Minnesota declined steeply between 2009 and 2013 and has since more-or-less stabilized at around 3,700 moose (Figure 2; also see Addendum A). The term "stabilized" as used here does not mean the population is constant, but rather true annual changes appear to be reasonably small (on average) and random (some years are up, and some are down). Furthermore, we caution there might be a small underlying population trend (a true mean rate of change that is either positive or negative), but it would be difficult to detect over the short term given the limitations of our survey. Finally, we caution that current population trends do not predict future population trends because underlying demographic factors affecting population abundance can change over time.

ACKNOWLEDGMENTS

This survey is an excellent partnership between MNDNR Enforcement and Fish and Wildlife, the Fond du Lac Band of Lake Superior Chippewa, and the 1854 Treaty Authority. Specifically, thank you to Nancy Hansen (MNDR) for annual survey planning and coordination; Capt. Jacob Willis, Chief Pilot, for coordinating all of the aircraft and pilots; and Mike Schrage (Fond du Lac Band of Lake Superior Chippewa) and Darren Vogt and Morgan Swingen (1854 Treaty Authority) for securing supplemental survey funding from their respective groups. Enforcement pilots Grace Zeller and Brad Maas skillfully piloted the aircraft during this year's surveys; Nancy Hansen, Mike Schrage, Morgan Swingen, Jessica Holmes, and Sammi Shimota flew as observers. Thank you to Bob Wright (recently retired), Brian Haroldson, and Chris Pouliot for creating the program DNRSurvey, which is essential to the survey's efficiency and consistency. Brian also maintains the software, updates maps and data forms, and provides refresher training for observers using DNRSurvey. Brian Haroldson and Ethan Bott provided GIS support. The efforts of these people (and the many others who were involved in previous surveys) contribute to the survey's success and ensure the survey's rigor and comparability of long-term results. This report was improved by review comments from Seth Goreham, Nancy Hansen, Barb Keller, Mike Larson, Mike Schrage, and Morgan Swingen.

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Table 1. Estimated moose abundance, 90% confidence intervals, calf:cow ratios, percent calves in the population, percent cows with twins, and bull:cow ratios from aerial surveys in northeastern Minnesota, 2005–2024. Note: the survey was not conducted in 2021 due to the Covid-19 pandemic.

Year	Population estimate	90% CI	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 – 9,150	0.29	13	3	0.89
2008	7,890	6,080 – 10,600	0.36	16	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	12	3	1.23
2014	4,350	3,220 – 6,210	0.44	17	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	0.32	13	3	1.24
2020	3,150	2,400 – 4,320	0.36	18	2	0.90
2022	4,700	3,440 – 6,780	0.45	19	3	0.94
2023	3,290	2,480 – 4,560	0.38	16	6	1.26
2024	3,470	2,570 – 4,940	0.51	17	6	1.33

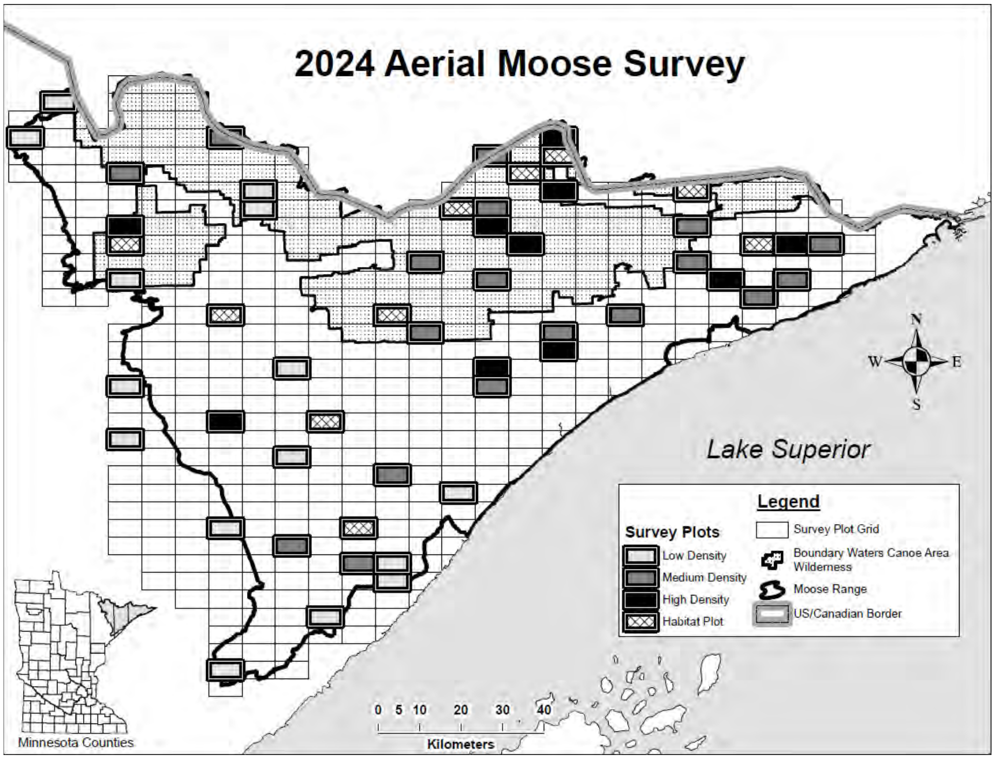

Figure 1. Moose survey area, sampling frame, and the 53 sample plots flown in the 2024 aerial moose survey.

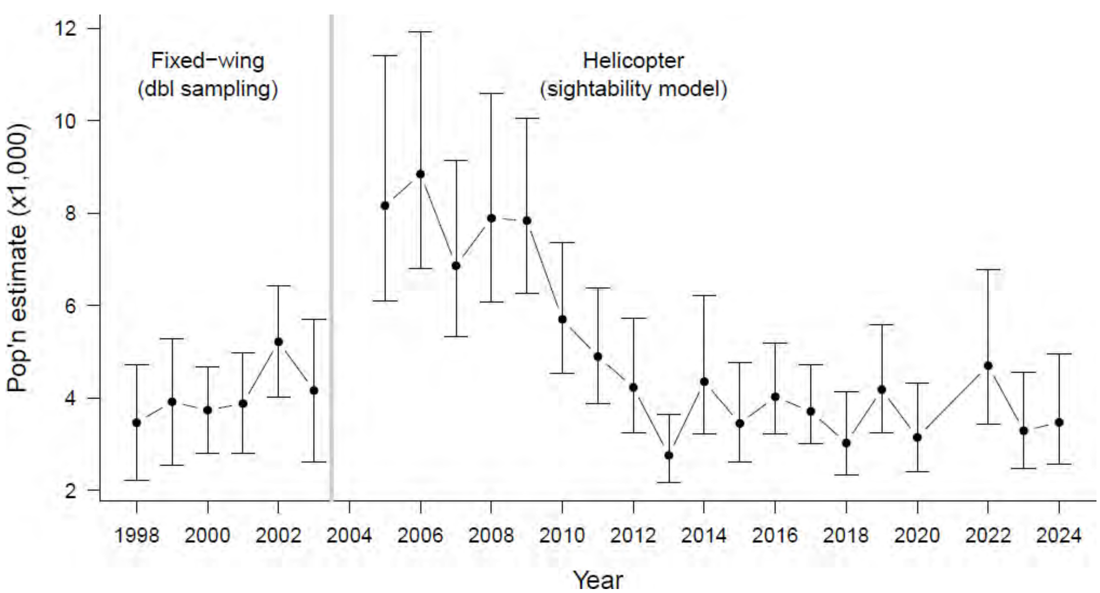

Figure 2. Aerial-survey estimates (with 90% CIs) of moose abundance in NE Minnesota, 1998–2024. Note: the 1998-2003 survey period is not directly comparable to 2005-2024 estimates. It is shown here for documentation only.

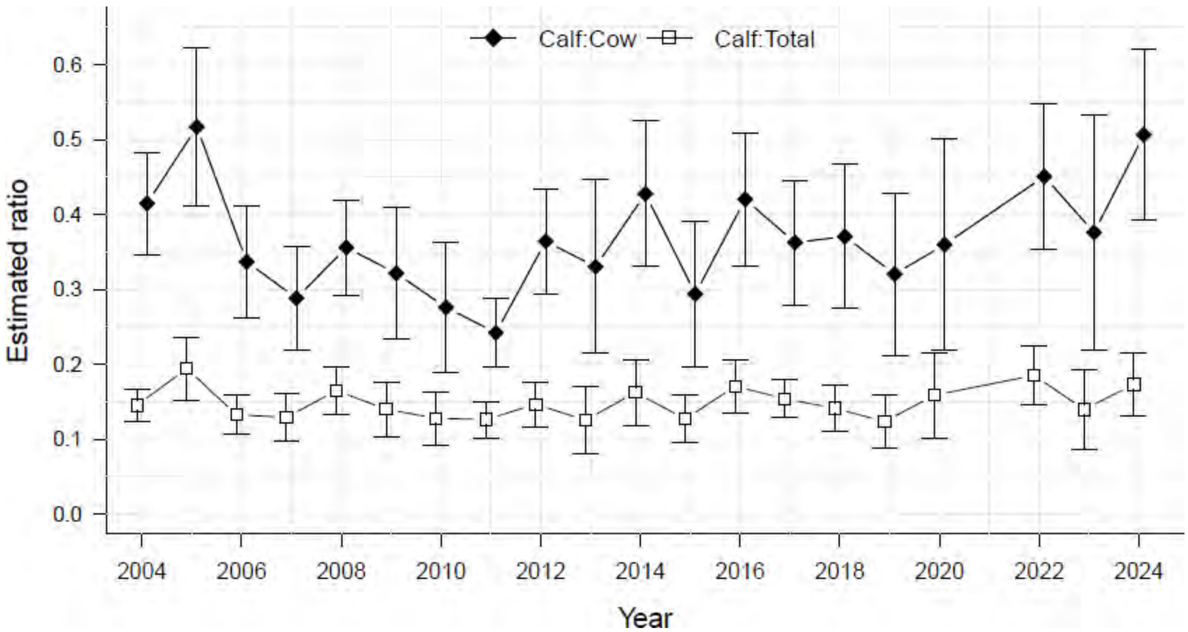

Figure 3. Estimated calf:cow ratios (solid diamonds, with 90% CI) and proportion calves (open squares, with 90% CI) from aerial moose surveys in northeastern Minnesota, 2004–2024.

Note: the survey was not conducted in 2021 due to the Covid-19 pandemic.

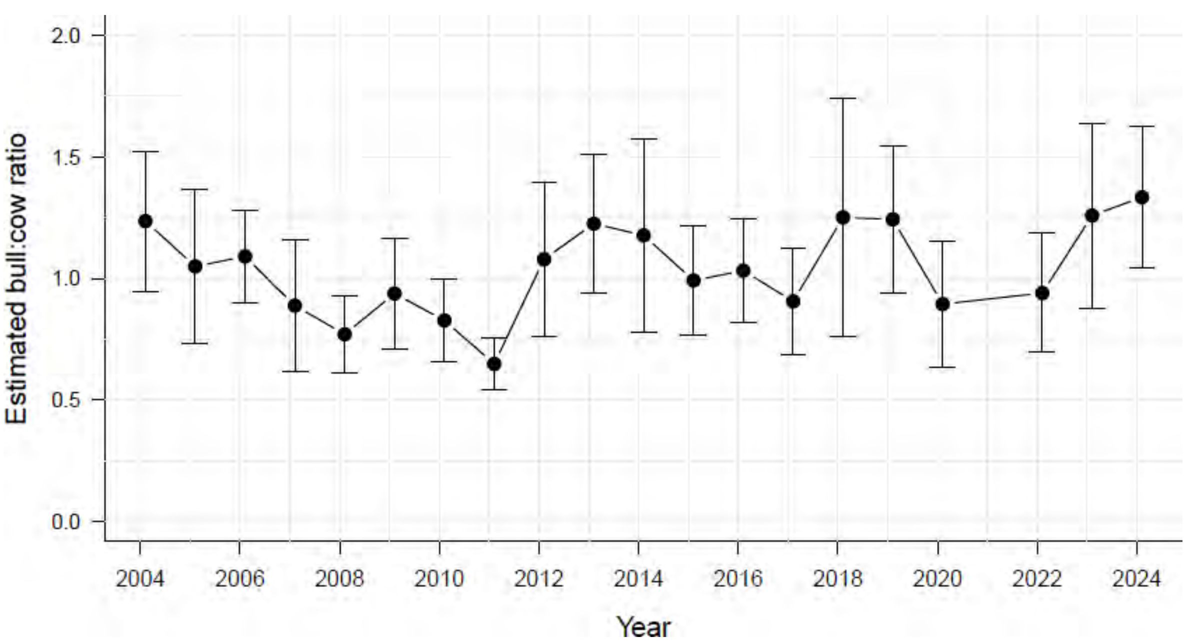

Figure 4. Estimated bull:cow ratios (with 90% CI) from aerial moose surveys in northeastern Minnesota, 2004–2024. Note: the survey was not conducted in 2021 due to the Covid-19 pandemic.

ADDENDUM A: EXPLORING ALTERNATIVE MODES OF INFERENCE

John H. Giudice, Wildlife Biometrics Group

INTRODUCTION

We currently use a design-based estimator (referred to as a modified Horvitz-Thompson estimator; mHT) with data from aerial surveys and a sightability model to compute estimates of moose abundance in northeastern Minnesota. Design-based estimators are analytical formulas derived from the principles of survey sampling (Cochran 1977, Thompson 2002). Design-based estimators are generally robust and have proven to be a useful and popular approach in wildlife population estimation. However, in the case of the moose survey, there are some important limitations, including imprecise annual estimates (due to moderate-to-high sampling variation), large inter-annual variation (due to treating survey years as independent), and in some cases, estimates of population change that are biologically suspect. Furthermore, sampling issues in the low-density stratum and the inability to make inferences to sub-regions of the NE moose range (the Small Area Estimation conundrum) are problematic. Significantly increasing the sampling effort to ameliorate these issues is not a viable alternative in this case.

One potential solution is to explore alternative modes of inference, including model-assisted and model-based modes of inference (*sensu* Gregoire 1998, Chambers and Clark 2012). An example of the first would be to use our design-based estimates (including estimates of sampling uncertainty) in a Bayesian state-space model (*sensu* Auger-Methe 2021). These models can take many forms, but they have two basic components. The first component is an observation process that links observed counts (or, in our case, population estimates) to true abundance, which is the unknown parameter we want to estimate. This is usually accomplished by treating the observed counts as a random variable whose distribution is drawn from the true population but with sampling or observation error. The second component is a state process that describes the true state or population process (e.g., where true abundance in year t is a function of abundance in year t-1, a mean intrinsic rate of change, and some annual variation in the true growth rate). These models are relatively simple to fit and offer the benefit of improving the precision of annual estimates and reducing inter-annual variation by shrinking estimates toward the mean, especially when estimates have high levels of sampling uncertainty.

A model-based approach can also take many forms. In this application, the focus switches from expanding the sample using analytical formulas and survey weights (design-based inference) to prediction/imputation for unsampled plots given the sample data, survey design, and distributional assumptions about how plot counts (moose groups) and group sizes are distributed over space (e.g., survey strata) and time (e.g., survey years). In 2011, Dr. John Fieberg of the MNDNR Wildlife Biometrics Unit (now a faculty member at the University of Minnesota) began research on a model-based estimator for the MN moose survey. He eventually published a peer-reviewed paper (Fieberg et al. 2013) that described a Bayesian model-based estimator that closely mimicked the design-based estimator (mHT) that we currently use. This is important because it validates model and distributional assumptions that are integral to model-based estimators. The authors also noted the power and flexibility of their model-based approach for addressing complicated sampling issues (e.g., see the previous paragraph). ArchMiller et al. (2018) expanded on this research by developing a temporally smoothed Bayesian time-series model (TSM) that allowed information on stratum-specific plot counts to be shared among survey years, which resulted in more precise population estimates and greatly reduced inter-annual variability. The TSM approach also has the potential to generate spatially explicit population estimates.

The primary limitations of the TSM approach are that it is computationally expensive (e.g., it takes 3 days to run on a high-end computer) and it currently only generates estimates of total population size (vs. age/sex and stratum-specific population estimates). The latter is also true for the state-space model. We resolved the first issue by purchasing a high-end desktop computer that is dedicated to biometrics simulation work. The second issue will be part of future work on the TSM estimator and the state-space model. As part of our continued effort to improve inferences from the moose survey, we fit the TSM estimator to moose survey data from 2005-2024 and compared it to estimates derived using the design-based mHT approach and the state-space model. In this addendum, we describe the results of this alternative analysis and discuss the potential benefits and challenges of using either the state-space model or TSM approach going forward.

RESULTS AND DISCUSSION

State-Space Model

As expected, population estimates from the state-space model are more precise (i.e., the method reduces annual sampling uncertainty) and extreme estimates are shrunk back toward the mean, which results in a smoother, more realistic population trajectory (Figure A1, below). A good example of this is the population estimate for 2004, which we traditionally do not report because it was unrealistically high (re: first year of sightabilty-model approach) and precision was extremely poor. The state-space model shrunk this estimate back to a more reasonable number and greatly increased precision (relative to the original estimate). Another benefit is that we can generate population estimates for non-survey years such as 2021 (pandemic year; see Figure A1). The simple state-space model suggests the population has more-or-less stabilized since 2013 and continues to bounce along at around 3,700 animals. This year's point estimate is down slightly (3%) from the 2023 estimate, which was down 8% from the 2022 estimate (Figure A1); thus, suggesting a possible 2-year decrease. However, we have seen this before (e.g., 2016 to 2018). Furthermore, the CIs of estimates from 2013-2024 overlap, which makes it

difficult to separate sampling noise from small but true annual differences. This model also does a good job of permitting the mean intrinsic rate of change to vary over time. For example, the mean intrinsic rate of change during 2004-2009 was -0.086 compared to the steep decline during 2010-2013 (mean = -0.163) and the more recent (2014-2024) period of relative stability

(-0.007). This is accomplished by modeling the intrinsic rate of change as a random variable from a normal distribution with a mean of -0.06 and a relatively large SD (~0.15). This is a simplified approach compared to the TSM estimator, which uses a basis spline and change points to smooth the population trajectory. However, the state-space model approach appears to work reasonably well with the moose-survey dataset.

TSM Estimator

Similar to the findings of ArchMiller et al. (2018), the TSM approach generated more precise population estimates than the mHT estimator (Figure A1), and it greatly reduced inter-annual variability in both estimates of abundance (Figure A1) and log rates of population change (Figure A2). The estimated log rates of change from the TSM approach are also more biologically plausible, especially for a species with relatively low reproductive potential (e.g., see years 2013-2015 and 2019-2023 in Figure A2). Likewise, it is easier to visualize estimated population trends with the TSM approach compared to the mHT approach where it can be difficult to separate true population changes from sampling noise, especially when comparing annual estimates (Figure A1). However, one caveat is that smoothed trends from the TSM estimator can be sensitive to the number and location nodes (change points) used in the basis spline. Based on the mHT time series and research findings, we would intuitively establish change points around 2009 and 2013 because that is where population trends appeared to have changed. Conversely, in its current form the spline smoother in the TSM estimator selects nodes based on the 0.33 and 0.66 quantiles of the time series, which this year resulted in nodes at about 2011.3 and 2017.5 (Figure A1). The latter may partly explain why the TSM estimator indicated a slight population increase in 2023 and 2024, whereas the state-space estimator indicated small decreases (Figure A1). Regardless, the CIs overlap in both cases, which means the small annual differences in point estimates could partly reflect sampling noise.

CONCLUSIONS

1. If we treat years as independent, then the model-based approach mimics our conventional design-based estimator. The code looks different, but the assumptions and estimates are fundamentally the same. Treating years as independent is fine, but sometimes it can lead to estimated population changes that are not biologically reasonable (especially for a species with low reproductive potential). In addition, precision of annual estimates is relatively poor.
2. Allowing the sharing of information among years (TSM or state-space model) helps smooth out annual fluctuations and reduces uncertainty in annual population estimates. However, we acknowledge that smoothed estimates could occasionally mask a true large population change (e.g., high winter mortality due to an epizootic event), at least until additional years of data are available for the time series. Nevertheless, one could make similar incorrect conclusions under the mHT method because of high sampling uncertainty (e.g., the sample data may not be representative in some years). Thus, regardless of whether we use the mHT, TSM, or state-space approach, it is important to consider ancillary information from surveys, directed field studies (e.g., estimates of survival and pregnancy rates), and professional on-the-ground expertise when making management decisions.
3. Regardless of the estimation approach (mHT, TSM, state-space model), the big-picture conclusions are consistent for the 2005-2024 survey period: there was a significant population decline from about 8,000-9,000 in 2005-2006 to a low of about 3,000-4,000 moose in 2013, but the population appears to have more-or-less stabilized since then (with annual estimates fluctuating around 3,400-4,000 moose). The trends are just easier to visualize with the TSM and state-space model approaches.
4. Compared to the mHT approach, the TSM and state-space approaches offer more flexibility to deal with sampling and estimation issues, including missing data, sampling and estimation issues in the low-density strata, non-linear trends, spatially explicit population estimates, etc.
5. The TSM approach has many potential benefits, but we acknowledge there are some limitations too. It is computationally expensive (computer time), requires a high level of technical expertise to modify and run the analysis each year, and can be challenging to explain to a lay audience (the black-box conundrum). Conversely, the state-space model is simple to fit and much easier to explain. Nevertheless, in both cases, historic population estimates can change (albeit trivially in most cases) with the addition of new data (years), with each model run (for the simulation-based TSM approach), or if model and/or distributional assumptions are modified in the future. However, values derived with the mHT approach are estimates too; the only reason they do not change is that we treat each year as independent in the mHT approach.
6. We could theoretically estimate composition ratios via the TSM or state-space approach, but it would take a lot of coding work and some new assumptions. We currently use the combined ratio estimator (Cochran 1977:165) to compute composition ratios, which means they do not depend on sightability or the mHT estimator. Sightability does not appear to have a large effect on estimated composition ratios. Nevertheless, we probably should consider computing sightability-adjusted composition ratios to ensure subpopulation estimates (cows, bulls, calves) from the sightability model are consistent

with reported composition ratios. Regardless, the precision of our ratio estimates is relatively poor and inter-annual variability is high, which limits the utility of our composition ratios as annual monitoring metrics (especially bull:cow ratios). Thus, our estimates of composition ratios would also benefit from using the TSM or state-space model approach.

NEXT STEPS

1. At least for the next few years, we will continue to use our conventional mHT-derived population estimates to make management and harvest decisions. Even if switched to the TSM approach for inference, we will likely continue to compute mHT-derived population estimates because it is an efficient method and would provide a check on model-based estimates. The challenge will be how to present the two estimates in way that will not cause confusion with our constituents.
2. We will continue to conduct research on the TSM and state-space estimators, including some additional work on the TSM temporal smoother (e.g., using a random-walk approach). The latter is important because the nodes in the current smoother change location with the addition of new data, which might not be ideal given that there are some obvious change points in our time series (e.g., around 2009 and 2013). We also plan to do more research on the potential for deriving smoothed estimates of composition ratios and subpopulation components (cows, bulls, calves).
3. In theory, the Bayesian TSM approach could account for spatial covariates (e.g., habitat data) and generate spatially explicit population estimates. This is another area of potential research and advancement.

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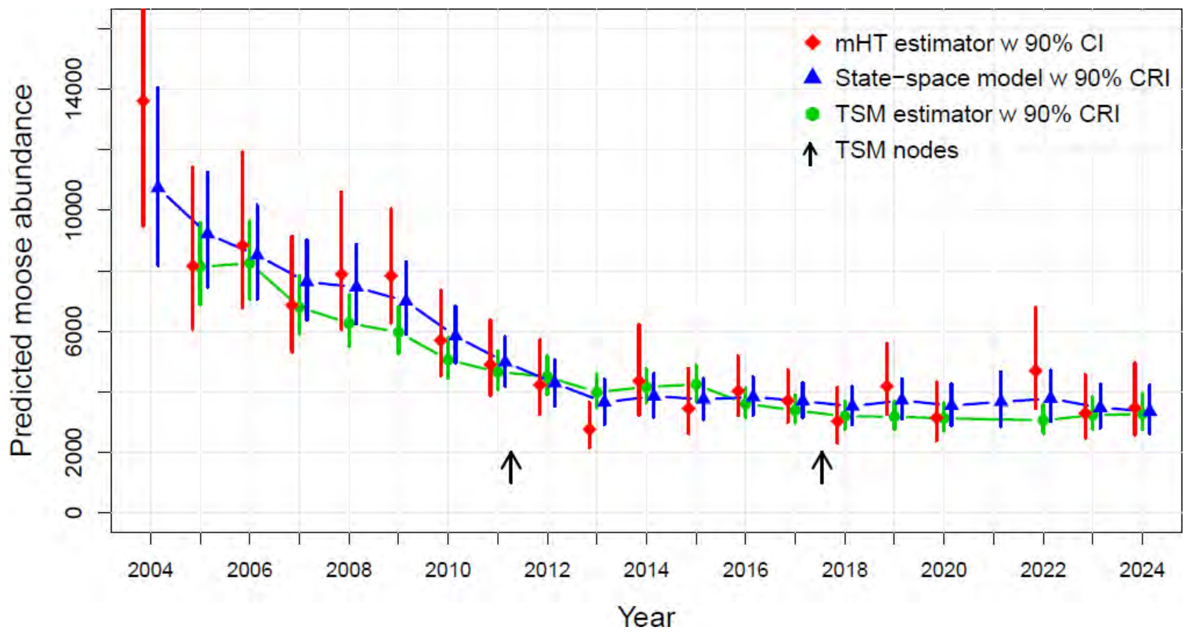

Figure A1. Comparison of moose population estimates (with 90% CIs) from the design-based Horvitz-Thompson estimator (mHT, red diamonds), state-space model (blue triangles), and the TSM estimator (green dots). The location of TSM nodes are denoted with arrows.

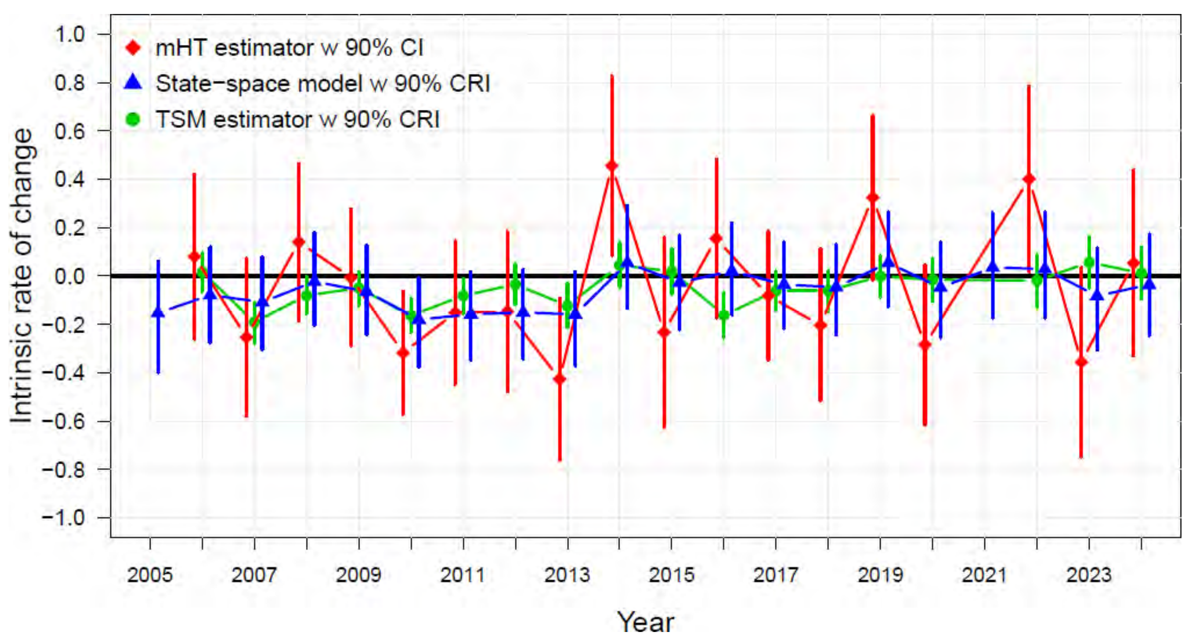

Figure A2. Estimated intrinsic rates of annual population change (0 = no change, + = increase, – = decrease) based on the conventional mHT estimator (red diamonds), state-space model (blue triangles), and TSM estimator (green dots).

WETLAND WILDLIFE POPULATIONS

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2024 WATERFOWL BREEDING POPULATION SURVEY, MINNESOTA

Bruce Davis, Wetland Wildlife Research Group

ABSTRACT

The number of breeding waterfowl in a portion of Minnesota has been estimated annually since 1968 as a part of the overall inventory of North American breeding waterfowl. The survey con sists 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 2024 aerial survey portion was flown from 30 April – 17 May. Conditions were extremely dry across most of the state just a few weeks prior to survey. However, in the days immediately prior to and during the survey, numerous large rain events changed the landscape from very dry to very wet quite quickly. Rivers were flooded beyond their banks, and many large wetlands expanded their footprints due to large amounts of runoff. With an earlier than normal ice-out throughout the state and dry conditions persisting through the ice-out period, settling conditions were likely poor and didn't attract many breeding ducks to the landscape. Overall, Numbers of wet Type I wetlands were 6X greater than in 2023, but wet Type II-V wetlands were fewer than 2023 and the extrapolated estimate was 20% below the long-term average.

The 2024 estimated mallard breeding population was 142,000 (rounded to nearest 1000), which was statistically unchanged (P=0.15) from the 2023 estimate of 222,000. Mallard numbers were 43% below the 10-year average and 41% below the long-term average of 240,000 breeding mallards. The estimated blue-winged teal population was 232,938, which was 84% above last year's estimate of 126,000 blue-winged teal, but statistically unchanged (P=0.27). Blue-winged teal numbers were 11% above the 10-year average and 27% above the long-term average estimates. The combined population index of other ducks, excluding scaup, was 121,000 ducks, which was 8% below last year's estimate, 30% below the 10-year average and 32% below the long-term average estimates. Scaup, Wood Ducks, and Ring-necked ducks were the most abundant species of other ducks (Table 3).

The estimate of total duck abundance excluding scaup, was 388,000 and 19% below last year's estimate and 35% below the 10-year average and 37% below the long-term average estimates. The estimated number of Canada geese was 106,000 and 7% lower than last year and 31% below the long-term average estimate.

METHODS

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

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

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

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

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

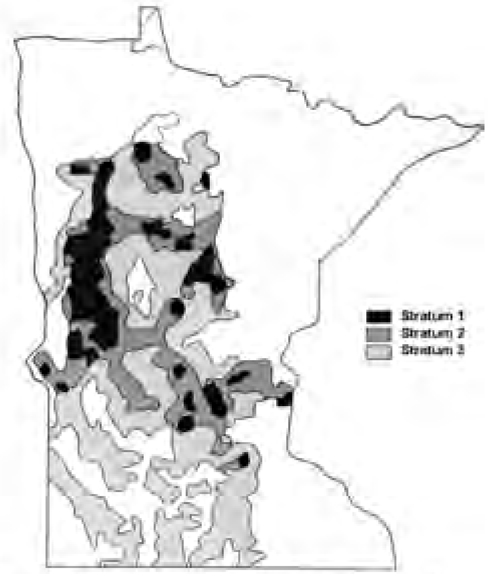

Figure 1. Location of waterfowl breeding population survey strata in Minnesota.

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 2023 and 2024 were compared using two-tailed Z-tests.

SURVEY CHRONOLOGY

The 2024 aerial survey began on 30 April in southern Minnesota and concluded in northern Minnesota on 17 May. Transects were flown on 10 days and completed in 52 flight hours. Flight crew was on transect by 06:30 most days and flights were completed by approximately 12:00 PM most days.

WEATHER AND HABITAT CONDITIONS

Ice out was approximately 3-4 weeks earlier than historical median dates in southern Minnesota and about 2 weeks earlier than median dates in northern Minnesota. Conditions were extremely dry across most of the state in early April, but extensive rains fell immediately prior to and during the survey; these numerous large rain events changed the landscape from very dry to very wet quite quickly. Rivers were flooded beyond their banks, and many large wetlands expanded their footprints due to large amounts of runoff. Temperatures in April and May averaged 2.1°F above normal statewide and precipitation was 3.0 inches above normal statewide (http://climate.umn.edu). Precipitation from April until the survey was completed was well above average throughout the state with regions of southern and West Central Minnesota receiving the most rainfall (Appendix A).

Wetland conditions in spring 2024 differed substantially from last year. In 2024, numbers of wet Type 1 wetlands increased by 640% from 2023 and were 85% above the long-term average. However, numbers of wet Type II-V wetlands were 29% lower than in 2023 and 20% below the long-term average. In early April 2024, the U.S. drought monitor indicated that nearly the entire state had abnormally dry to severe drought conditions, but by late May only about 12% of the state had any abnormally dry to drought designation. (http://droughtmonitor.unl.edu).

WATERFOWL POPULATIONS

The number of ducks, Canada geese, coots, and swans are shown in Table 3. These estimates are expanded for area but not corrected for visibility bias. Table 4 and Table 5 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 2024 breeding population estimate of mallards was 142,000 (SE = 27,378), which was 36% lower than the 2023 estimate of 222,000 mallards, but statistically unchanged (P = 0.16, Table 4). Mallard numbers were 43% below the 10-year average and 41% below the long-term average of 225,000 mallards.

The estimated blue-winged teal population was 233,000 (SE = 71,991), which was 84% higher than the 2023 estimate of 126,000 blue-winged teal, but statistically unchanged (P = 0.27). Blue-winged teal numbers were 11% above the 10-year average and 27% above the long-term average (Table 4).

The combined population estimate of other ducks (excluding scaup) was 121,000 which was 8% below last year’s estimate of 133,000 other ducks, 30% below 10-year average and 32% below the long-term average (Table 4). Scaup, Wood Ducks, and Ring-necked ducks were the most abundant species of other ducks (Table 3). Scaup numbers (58,000) were 291% above last year’s estimate and 2% below the long-term average.

The total duck population index, excluding scaup, was 388,000 ducks and was 19% below last year’s index of 481,000 ducks and 35% below the 10-year average and 37% below the long-term average (Table 4).

The population index for total ducks was 446,000 ducks, which was 10% below 2023, 30% below the 10-year average and 34% below 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 4, Table 5). The mallard VCF (1.32) was 40% below the long-term average and the lowest ever recorded. The blue-winged teal VCF (3.87) was unchanged from the long-term average. The VCF for Canada geese (1.28) was 41% below the long-term average.

The population estimate of Canada geese (adjusted for visibility) was 106,000, which was 7% below last year’s estimate and 31% below the long-term average (Table 5).

The estimated number of swans (likely all trumpeters) was 37,000 similar to last year’s estimate of 39,000 (Table 3). 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

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

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Table 1. Survey design for Minnesota, May 2024.[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), 1968-2024.

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
			2020	No Survey	
			2021	No Survey	
			2022	100,000	341,000
			2023	15,000	286,000
			2024	111,000	204,000
		Averages:	10-year	48,600	271,600
			Long-term	59,900	256,000
		% change from:	2023	+640%	-29%
			10-year	+128%	-25%
			Long-term	+85%	-20%

[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-III combined, expanded for area coverage but not for visibility, 2004-2024.

	Year																		
Species	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2022	2023	2024
Dabblers:																			
Mallard	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	125,575	123,710	107,141
Black Duck	174	56	0	174	174	0	0	0	174	507	167	339	0	56	117	0	174	552	111
Gadwall	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	4,375	3,670	807
American Wigeon	4,634	1,327	174	404	810	230	754	1,155	513	804	341	1,911	1,215	1,393	400	927	1,354	693	228
Green-winged Teal	678	230	694	167	278	400	172	230	404	813	351	988	111	626	174	987	2,782	1,104	289
Blue-winged Teal	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	44,832	36,638	41,235
Northern Shoveler	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	2,842	1,216	1,258
Northern Pintail	404	174	230	582	230	56	174	345	174	285	284	396	522	285	633	172	756	408	348
Wood Duck	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	23,463	19,904	23,177
Dabbler subtotal	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	206,153	187,895	174,594
Divers:																			
Redhead	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	3,752	1,091	1,028
Canvasback	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	2,763	2,411	1,291
Scaup	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	17,850	5,865	33,592
Ring-necked Duck	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	17,866	12,394	13,098
Goldeneye	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	4,235	2,023	2,795
Bufflehead	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	7,319	2,018	3,944
Ruddy Duck	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	1,214	305	850
Hooded Merganser	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	4,253	2,913	339
Large Merganser	234	723	957	626	1,032	681	681	519	230	456	256	400	1,042	1,124	172	172	1,159	1,914	694
Diver subtotal	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	60,411	30,934	57297
Total Ducks	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	266,564	218,829	231,891
Other:																			
Coot	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	57,317	3,276	13,459
Canada Goose	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	84,545	75,651	82,854
Swan	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	25,113	38,527	36,592

Table 4. Mallard, blue-winged teal, and other duck (excluding scaup) populations in Minnesota, 1968-2024.

	Mallard				Blue-winged teal				Other ducks (exc. scaup)		
Year	Unad. PI	VCF	PI	SE	Unad. PI	VCF	PI	SE	Unad. PI	VCF	PI
1968	41,030	2.04	83,701		61,493	2.44	151,141		41,419	2.08	86,152
1969	53,167	1.67	88,789		45,180	3.45	155,871		34,605	2.27	78,553
1970	67,463	1.69	113,945		31,682	5.06	160,343		30,822	1.62	49,932
1971	47,702	1.65	78,470		42,445	3.49	148,218		29,520	1.71	50,450
1972	49,137	1.27	62,158		49,386	1.96	96,895		34,405	1.69	58,127
1973	56,607	1.76	99,832		53,095	3.92	208,292		33,155	2.45	81,362
1974	44,866	1.62	72,826		39,402	2.59	102,169		38,266	2.79	106,609
1975	55,093	3.19	175,774		45,948	3.95	181,375		34,585	3.31	114,459
1976	69,844	1.69	117,806		89,370	4.87	435,607		39,022	3.35	130,669
1977	60,617	2.21	134,164		37,391	3.86	144,187		18,633	11.95	222,748
1978	56,152	2.61	146,781		28,491	8.53	242,923		22,034	3.30	72,798
1979	61,743	2.57	158,704	28,668	46,708	5.21	243,167	62,226	39,749	3.79	150,545
1980	83,775	2.05	171,957	22,312	50,966	6.49	330,616	40,571	47,322	3.97	188,020
1981	79,562	1.95	154,844	16,402	64,546	2.59	167,258	23,835	30,947	3.80	117,667
1982	51,655	2.33	120,527	17,078	42,772	4.75	203,167	34,503	32,726	4.32	141,501
1983	73,424	2.12	155,762	15,419	42,728	2.81	119,980	20,809	32,240	2.84	91,400
1984	94,514	1.99	188,149	24,065	89,896	2.82	253,821	33,286	40,326	2.18	87,709
1985	96,045	2.26	216,908	32,935	90,453	2.91	263,607	33,369	35,018	2.35	82,383
1986	108,328	2.16	233,598	30,384	68,235	2.69	183,338	28,204	38,900	2.67	103,851
1987	165,881	1.16	192,289	23,500	102,480	1.99	203,718	32,289	76,746	2.51	192,947
1988	155,543	1.75	271,718	38,675	101,183	2.38	240,532	39,512	81,514	2.61	212,988
1989	124,362	2.19	272,968	26,508	90,300	3.16	285,760	39,834	88,109	2.89	254,887
1990	140,879	1.65	232,059	26,316	107,177	3.09	330,659	44,455	124,531	1.97	245,152
1991	128,315	1.75	224,953	28,832	91,496	2.90	265,138	42,057	93,784	2.81	263,619
1992	144,126	2.50	360,870	43,621	93,107	3.83	356,679	53,619	109,779	2.33	255,774
1993	123,771	2.47	305,838	31,103	64,670	4.02	260,070	36,307	82,612	3.28	271,263
1994	138,482	3.08	426,455	66,240	70,324	5.48	385,256	82,580	85,671	3.55	303,847
1995	142,557	2.24	319,433	48,124	47,737	4.40	210,043	40,531	66,096	4.05	267,668
1996	153,473	2.05	314,816	53,461	57,196	5.05	288,913	64,064	107,950	2.64	285,328
1997	160,629	2.54	407,413	65,771	45,496	5.57	253,408	67,526	76,095	2.72	207,316
1998	188,972	1.95	368,450	61,513	47,788	3.66	174,848	33,855	91,478	1.64	149,786
1999	169,213	1.87	316,394	51,651	36,106	4.53	163,499	36,124	80,459	2.49	200,570
2000	157,853	2.02	318,134	36,857	60,288	2.97	179,055	32,189	120,158	2.09	250,590

	Mallard				Blue-winged teal				Other ducks (exc. scaup)		
Year	Unad. PI	VCF	PI	SE	Unad. PI	VCF	PI	SE	Unad. PI	VCF	PI
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
2020							No Survey				
2021							No Survey				
2022	125,575	1.84	231,058	38,411	44,832	3.60	161,395	69,123	78,307	2.23	174,625
2023	123,710	1.79	222,185	49,387	36,638	3.45	126,401	65,470	52,616	2.52	132,592
2024	107,141	1.32	142,192	27,378	41,235	3.87	232,938	71,991	50,617	2.39	120,872
Averages: 10-year	111,266	2.16	250,230	42,421	45,398	3.95	210,315	60,431	68,893	3.04	173,425
Long-term	103,941	2.21	239,747	37,900	56,338	3.87	183,218	46,543	62,380	2.66	177,981
% change from											
2023	-13%	-35%	-36%		13%	12%	84%		-4%	5%	-8%
10-year average	-4%	-39%	-43%		-9%	-2%	11%		-27%	-21%	-30%
Long-term average	3%	-40%	-41%		-27%	0%	27%		-19%	-13%	-32%

Table 5. Scaup, total ducks (excluding scaup), total ducks, and Canada goose populations in Minnesota, 1968-2024.

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

Year	Scaup Unad. PI	Scaup VCF	Scaup PI	Total Ducks (exc. scaup) Unad. PI	Total Ducks (exc. scaup) PI	Total ducks Unad. PI	Total ducks PI	Canada geese Unad. PI	Canada geese VCF	Canada geese PI
2003	5,117	5.30	27,120	209,529	721,805	214,646	748,925	87,663	3.78	331,094
2004	30,906	2.94	90,926	347,673	1,008,324	378,579	1,099,250	98,339	1.58	155,859
2005	12,397	4.26	52,811	177,663	631,980	190,060	684,791	83,384	2.02	168,469
2006	1,971	4.41	8,692	153,504	521,109	155,475	529,801	75,688	2.73	206,757
2007	1,894	3.73	7,058	137,349	488,517	139,243	495,575	98,316	1.47	144,289
2008	14,854	2.91	43,205	243,763	739,553	258,617	782,758	70,311	1.99	139,708
2009	12,571	2.70	33,979	178,379	541,266	190,950	575,245	67,473	2.44	164,405
2010	3,299	2.84	9,380	168,740	530,744	172,039	540,124	66,085	2.22	146,960
2011	9,283	2.39	22,186	244,105	687,499	253,043	709,685	60,603	2.57	155,750
2012	2,686	2.24	6,021	206,455	468,589	209,141	474,610	87,193	1.81	157,706
2013	11,919	3.57	42,568	207,206	682,895	219,125	725,463	94,235	2.22	208,825
2014	6,517	2.24	14,614	195,006	474,387	201,523	489,001	63,857	1.57	100,255
2015	10,870	3.23	35,062	174,645	524,174	185,515	559,236	90,887	1.77	160,427
2016	20,202	2.74	55,336	266,355	787,087	286,557	842,423	66,672	1.75	117,096
2017	34,890	2.20	76,817	287,782	635,994	322,672	712,811	70,172	2.16	151,740
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
2020						No Survey				
2021						No Survey				
2022	17,850	2.23	39,806	248,714	567,078	266,564	606,884	84,545	1.36	114,981
2023	5,865	2.52	14,780	212,964	481,178	218,829	495,958	75,651	1.52	114,990
2024	33,592	0.02	*57,860	198,693	387,641	232,225	445,501	82,854	1.28	106,094
Averages:										
10-year	16,830	2.42	40,875	225,527	592,785	242,351	633,659	79,780	1.68	134,710
Long-term	20,498	2.99	58,780	222,631	615,052	243,122	673,832	52,549	2.16	153,853
% change from										
2023	473%	-99%	291%	-6%	-19%	6%	-10%	10%	-16%	-7%
10-year average	100%	-99%	41%	-11%	-35%	-4%	-30%	4%	-24%	-21%
Long-term average	63%	-99%	-2%	-11%	-37%	-4%	-34%	58%	-41%	-31%

*Calculated using VCF derived excluding scaup.

Appendix A. Precipitation in selected regions of Minnesota, 1 April - 17 May 2024 (Source: Minnesota DNR; http://www.dnr.state.mn.us/climate/historical/summary.html).

Region	Precipitation	Departure from normal
Northwest	4.25	+1.44
North Central	4.13	+0.88
Northeast	4.07	+0.32
West Central	6.25	+2.41
Central	6.57	+1.89
East Central	5.63	+0.90
Southwest	7.36	+2.27
South Central	8.37	+2.48
Southeast	6.79	+0.85
Statewide	6.30	+1.51

WATERFOWL POPULATION STATUS, 2024.

Waterfowl information is taken from the U.S. Fish and Wildlife Service report Waterfowl Population Status, 2024 by Joshua Dooley, Walt Rhodes, and Nathan Zimpfer. The entire report is available on the Division of Migratory Bird Management website Waterfowl Population Status, 2024 | FWS.gov

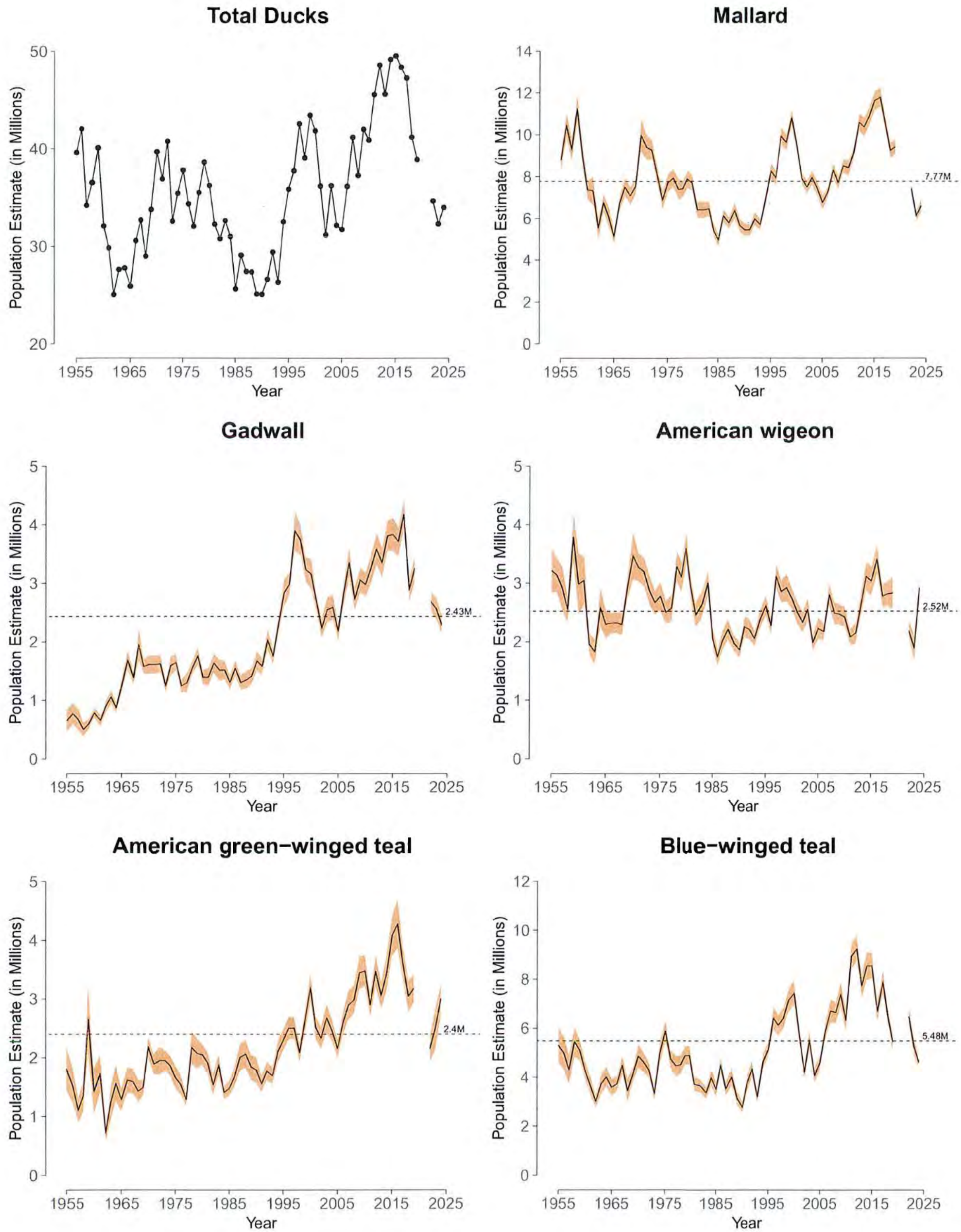


Figure 1. Estimates of North American breeding populations, 90% confidence intervals, and North American Waterfowl Management Plan population goal (dashed line) for selected species and number of water areas in May in Prairie Canada and Northcentral U.S (from: U.S. Fish and Wildlife Service 2024).

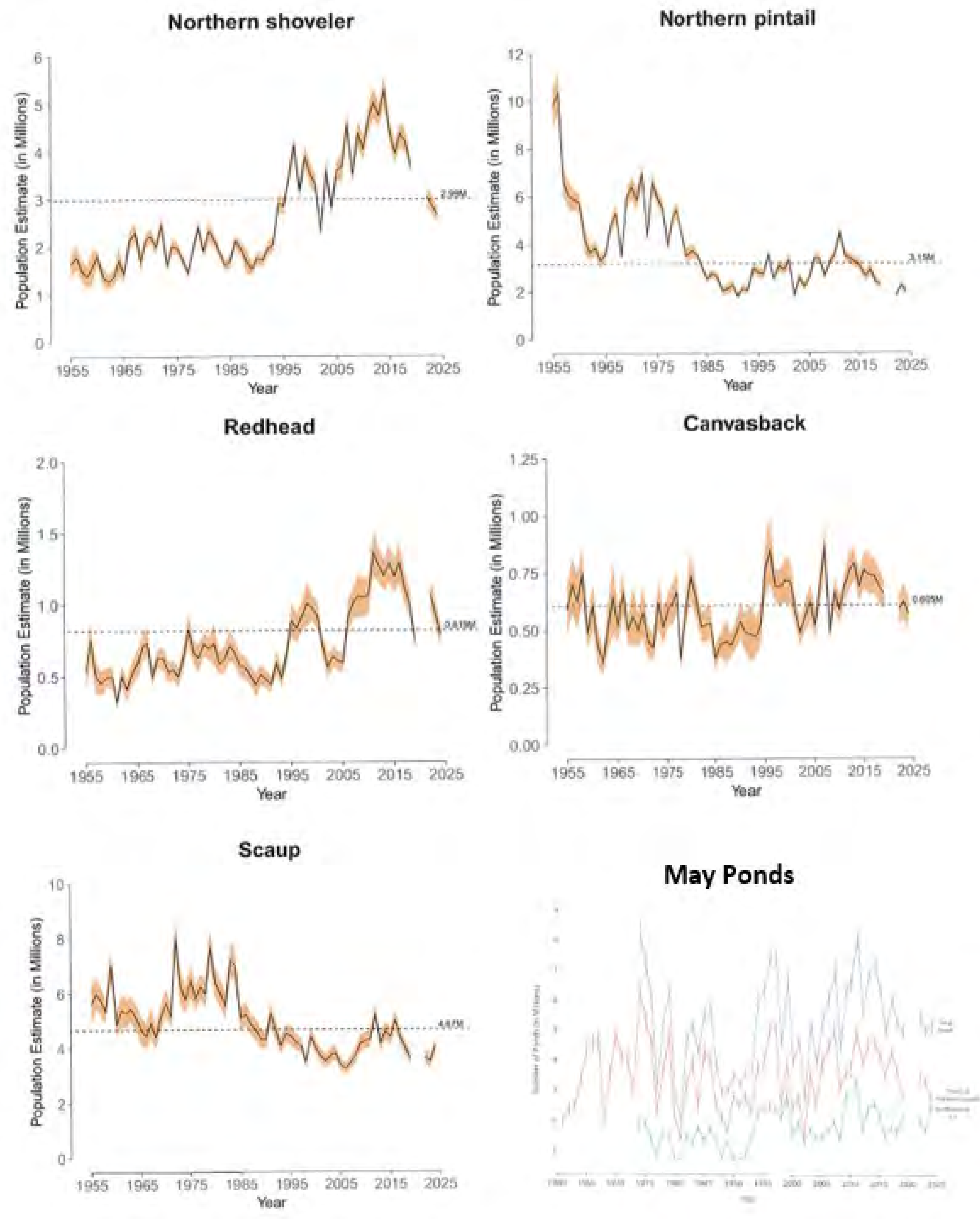


Figure 1. (cont.)

MOURNING DOVE POPULATION STATUS, 2024

Mourning dove information is taken from the U.S. Fish and Wildlife Service report by Seamans, M.E. 2024. Mourning dove population status, 2024. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 19 pp. The entire report is available on the Division of Migratory Bird Management web site

Mourning Dove Population Status, 2024 | FWS.gov

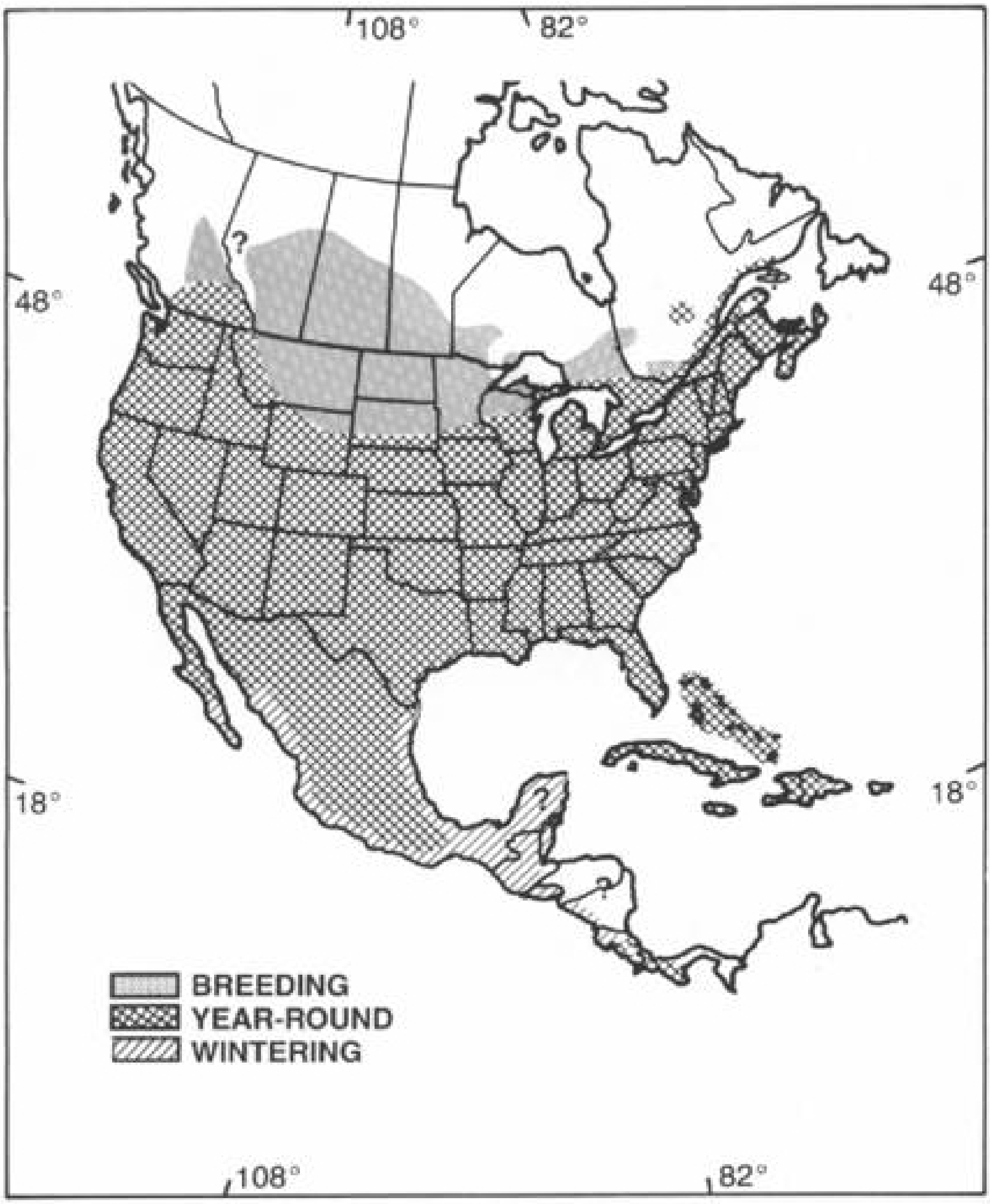


Figure 1. Breeding and wintering ranges of the mourning dove (adapted from Mirarchi and Baskett 1994). (From: Seamans, M.E. 2024. Mourning dove population status, 2024. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 19 pp.)

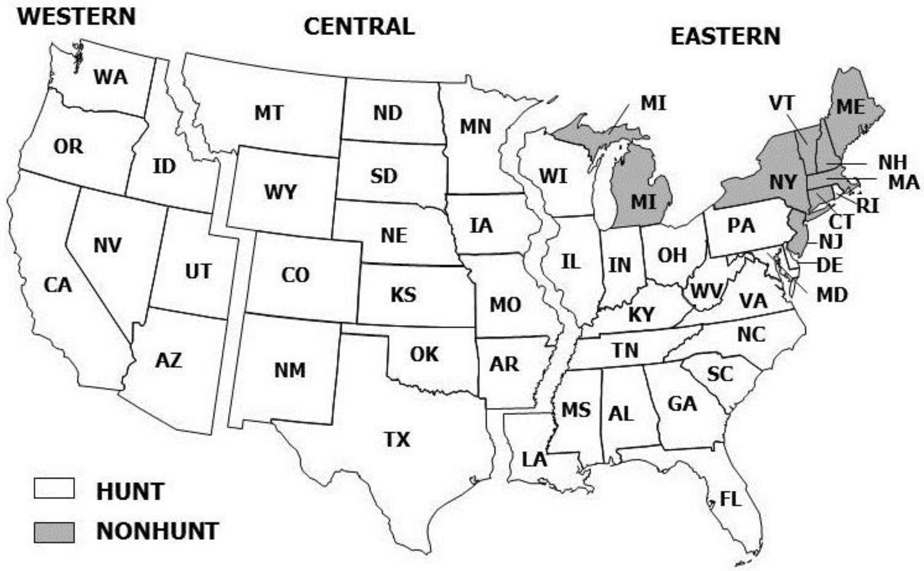


Figure 2. Mourning dove management units with 2023 -24 hunting and non-hunting states. (From: Seamans, M.E. 2024. Mourning dove population status, 2024. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 19 pp.)

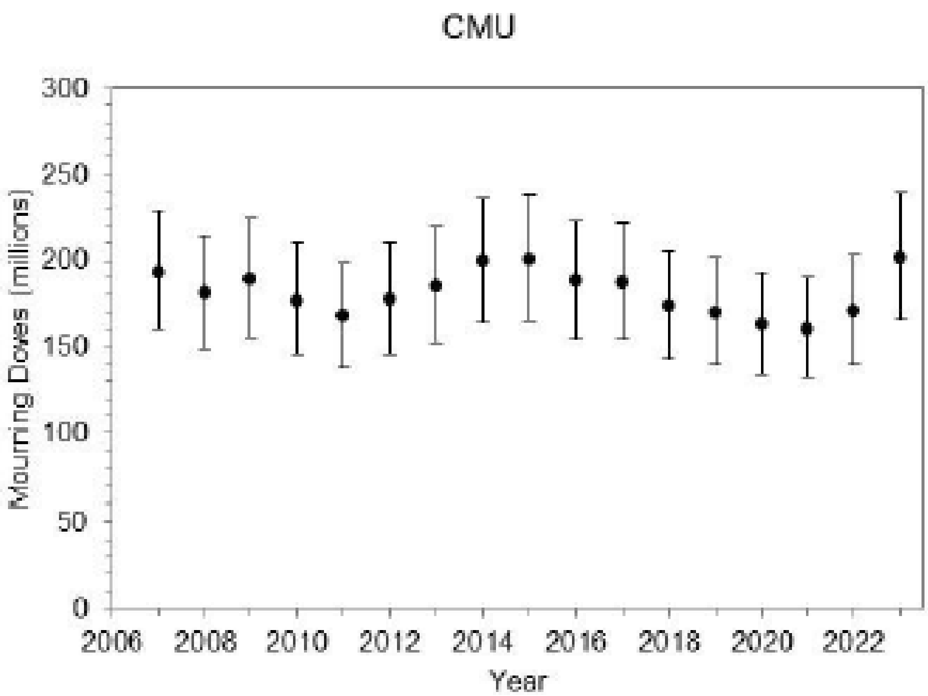


Figure 3. Estimates and 95% confidence intervals of mourning dove absolute abundance by in the Central Management Unit (CMU), 2003-23. Estimates based on band recovery and harvest data. (From: Seamans, M.E. 2024. Mourning dove population status, 2024. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 19 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 2021, 2022 and 2023 seasons [a]. (From: Seamans, M.E. 2024. Mourning dove population status, 2024. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 19 pp.)

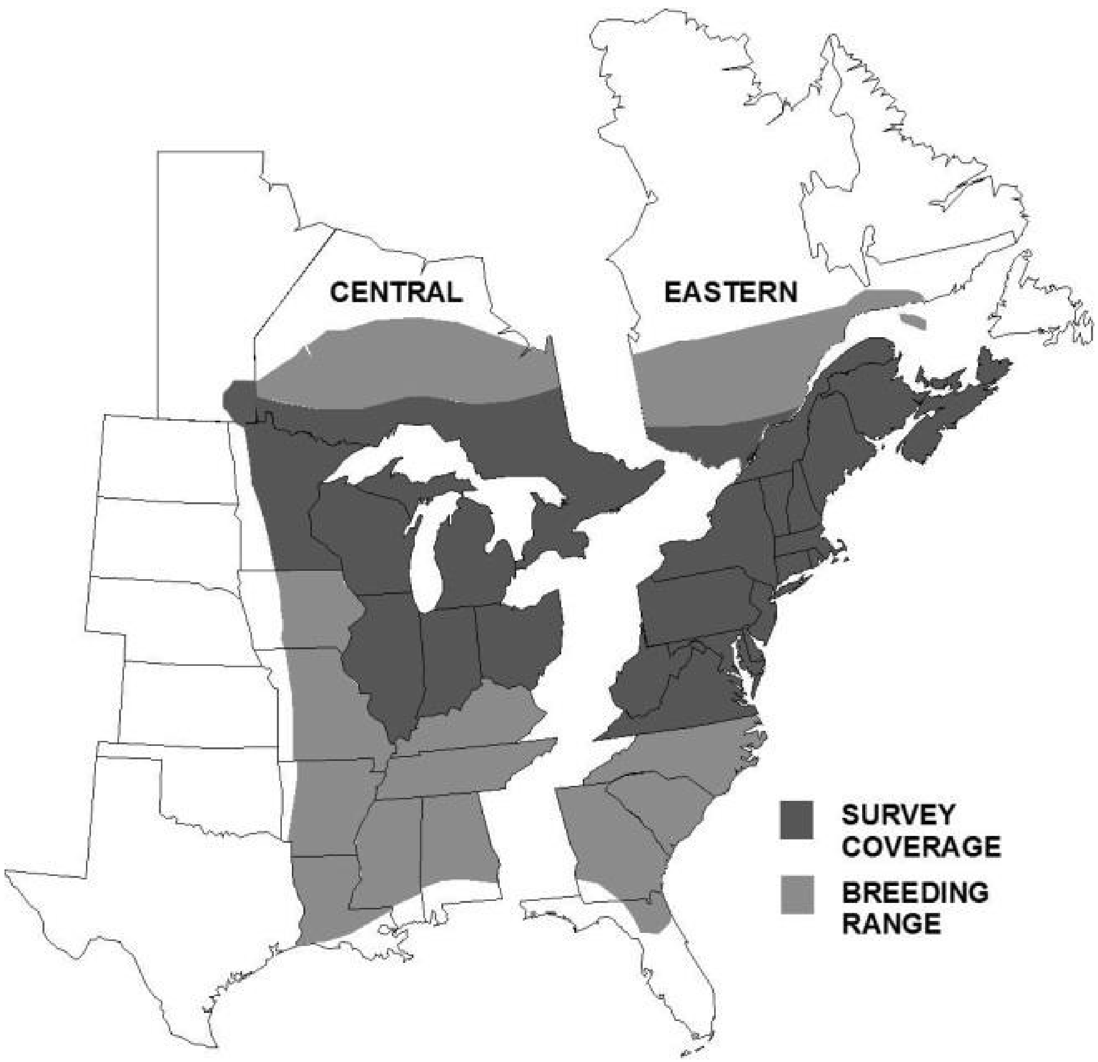
Management unit / State	Active Hunters			Hunter Days Afield			Total Harvest		
	2021	2022	2023	2021	2022	2023	2021	2022	2023
CENTRAL	303,500 [b]	281,100 [b]	487,900 [b]	874,700 ±50,300	659,200 ±28,700	1,714,700 ±38,200	4,236,600 234,500	4,038,600 239,400	9,243,400 254,500
AR	15,500 ±2,100	10,000 ±1,500	15,600 ±1,400	31,200 ±4,700	20,400 ±4,400	46,100 ±5,300	181,300 ±29,400	123,500 ±24,100	256,900 ±33,700
CO	9,800 ±800	8,700 ±700	10,900 ±700	25,700 ±3,000	17,800 ±1,600	31,400 ±3,000	122,900 ±13,900	112,700 ±12,700	177,700 ±21,900
IA	7,500 ±1,000	6,300 ±700	8,400 ±700	20,900 ±4,000	9,300 ±1,400	26,400 ±3,800	61,400 ±10,000	58,300 ±10,700	102,900 ±12,600
KS	25,500 ±2,500	22,000 ±1,600	32,100 ±1,600	64,600 ±6,900	57,000 ±7,300	110,100 ±7,300	400,200 ±44,000	375,600 ±44,300	638,400 ±47,800
MN	4,200 ±2,000	7,200 ±1,300	13,400 ±1,700	9,700 ±2,800	14,800 ±3,000	37,900 ±5,800	22,600 ±6,500	65,800 ±18,500	135,300 ±24,800
MO	19,800 ±2,000	15,600 ±1,600	24,700 ±1,800	51,300 ±6,300	34,900 ±5,300	68,100 ±7,000	259,700 ±39,700	182,600 ±30,800	313,900 ±36,800
MT	2,100 ±400	1,600 ±600	3,200 ±200	4,700 ±1,200	4,000 ±2,000	10,000 ±800	18,400 ±4,400	17,900 ±6,700	38,800 ±4,100
NE	10,400 ±1,100	10,000 ±1,200	12,900 ±900	27,000 ±3,000	24,500 ±4,100	46,100 ±3,900	148,000 ±15,800	131,000 ±28,000	270,100 ±28,400
NM	11,500 ±1,400	5,300 ±400	6,600 ±900	33,700 ±5,000	14,400 ±1,500	18,100 ±2,900	151,800 ±26,600	77,800 ±10,700	72,600 ±15,700
ND	5,500 ±900	2,700 ±700	9,600 ±300	20,100 ±3,400	4,900 ±1,500	32,800 ±1,400	91,500 ±15,800	33,600 ±15,400	175,500 ±8,800
OK	14,800 ±2,100	14,200 ±1,800	23,000 ±2,000	38,100 ±4,800	30,500 ±6,500	75,400 ±8,200	212,900 ±35,500	149,600 ±38,000	359,800 ±43,700
SD	5,400 ±900	4,000 ±800	9,800 ±1,100	12,300 ±1,800	9,600 ±2,600	31,100 ±3,800	88,200 ±16,900	50,500 ±17,700	197,500 ±27,100
TX	170,300 ±13,100	172,000 ±6,100	316,000 ±7,000	532,500 ±48,100	412,800 ±25,200	1,176,200 ±34,100	2,467,700 ±218,000	2,640,600 ±224,100	6,485,800 ±234,400
WY	1,200 ±300	1,400 ±300	1,800 ±100	2,900 ±800	4,400 ±1,600	4,900 ±500	10,000 ±2,600	19,200 ±8,000	18,300 ±1,800

[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, 2024

American Woodcock information is taken from the U.S. Fish and Wildlife Service report American Woodcock Population Status, 2024. Seamans, M.E. and R.D. Rau. 2023. U.S. Fish and Wildlife Service, Laurel, MD. 17 pp.



The entire report is available on the Division of Migratory Bird Management [American Woodcock Population Status, 2024 | FWS.gov]

Figure 1. Woodcock management regions, breeding range, singing-ground survey coverage. (from: Seamans, M.E. and R.D. Rau. 2024. American woodcock population status, 2024. U.S. Fish and Wildlife Service, Laurel, MD. 17 pp.).

Table 1. Short term (2023–24), 10 –year (2014-2024), and long-term (1968-2024) 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. 2021) (from: Seamans, M.E. and R.D. Rau. 2024. American woodcock population status, 2024. U.S. Fish and Wildlife Service, Laurel, MD. 17 pp.).

Management Unit/State	Number of Routes[b]	n[c]	2023-24			2014-24			1968-24		
			% Change	95% CI[d]		% Change	95% CI[d]		% Change	95% CI[d]	
				lower	upper		lower	upper		lower	upper
CENTRAL	416	790	3.18	-2.39	9.21	-0.25	-1.15	0.37	-0.46	-0.65	-0.27
IL	18	51	14.44	-29.06	103.2	4.58	-4.60	14.84	-0.61	-2.49	1.43
IN	19	63	5.69	-20.36	47.13	0.02	-6.47	7.13	-3.12	-4.29	-2.04
MB[e]	9	31	1.23	-16.54	24.40	-0.15	-3.27	3.22	-0.46	-2.57	1.59
MI	101	161	3.45	-6.55	14.63	-1.24	-2.49	0.09	-0.59	-0.91	-0.27
MN	78	128	1.33	-10.93	15.21	1.61	-0.05	3.43	0.99	0.50	1.52
OH	27	74	10.88	-8.45	41.15	-3.76	-6.74	-0.61	-1.83	-2.51	-1.17
ON	82	179	3.86	-7.96	17.61	-1.35	-2.98	0.31	-0.91	-1.30	-0.50
WI	82	134	1.74	-9.82	14.94	0.60	-1.12	2.36	-0.02	-0.43	0.38

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

[b] Total number of routes surveyed in 2024 for which data were received by 8 July, 2024.

[c] Number of routes with at least one year of non-zero data between 1968 and 2024.

[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.

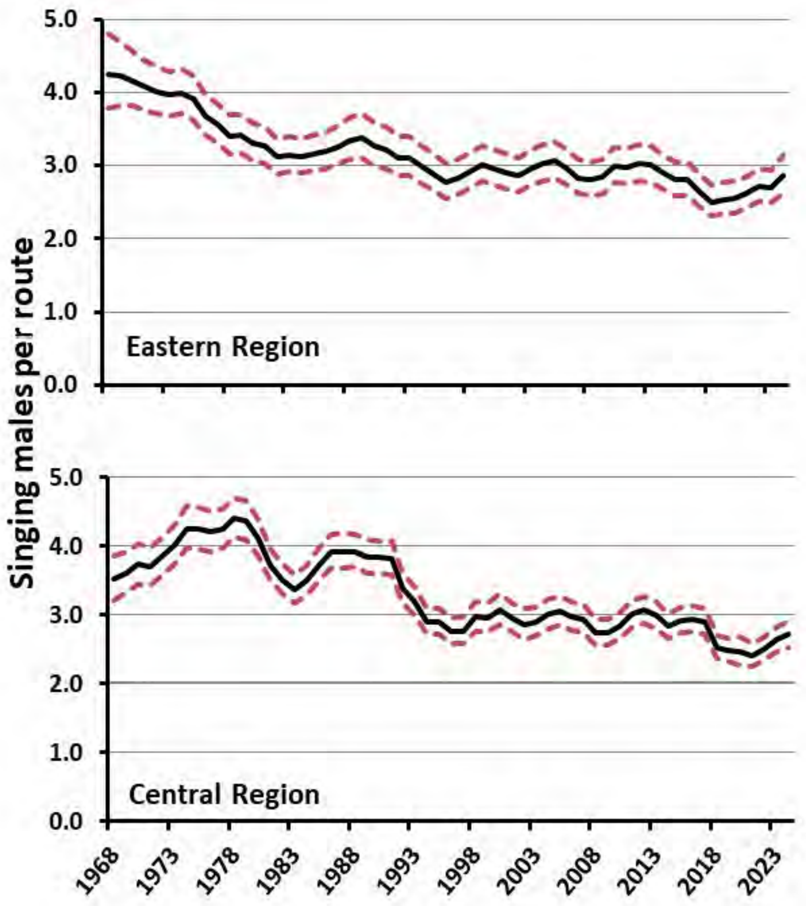


Figure 2. Annual indices of the number of woodcock heard on the Singing-ground Survey, 1968-2024. The dashed lines represent the 95 % credible interval. (from: Seamans, M.E. and R.D. Rau. 2024. American woodcock population status, 2024. U.S. Fish and Wildlife Service, Laurel, MD. 17 pp.).

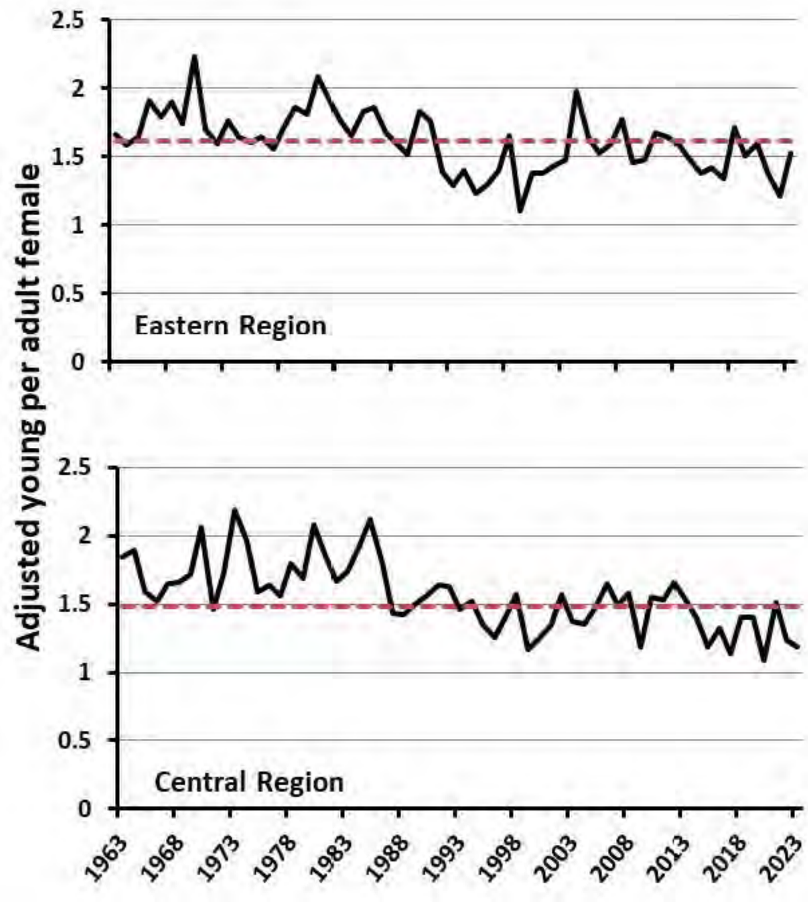


Figure 3. Annual indices of American woodcock recruitment, 1963-2023. Dashed line is the 1963-2022 average. (from: Seamans, M.E. and R.D. Rau. 2024. American woodcock population status, 2024. U.S. Fish and Wildlife Service, Laurel, MD. 17 pp.).

Table 2. Preliminary estimates of woodcock hunter numbers, days afield, and harvest for selected states, from the 2020-21, 2021-22, 2022-23 and 2023-24 Harvest Information Program surveys. (from: Seamans, M.E. and R.D. Rau. 2024. American woodcock population status, 2024. U.S. Fish and Wildlife Service, Laurel, MD. 17 pp.).

Management Unit / State	Active woodcock hunters ([a])				Days afield ([a, c])				Harvest ([a, c])			
	2020-21	2021-22	2022-23	2023-24	2020-21	2021-22	2022-23	2023-24	2020-21	2021-22	2022-23	2023-24
Central Region	67,100[d] n.a.[d]	60,700[d] n.a.[d]	68,600[d] n.a.[d]	81,400[d] n.a.[d]	260,600 ±23,800	273,100 ±26,900	189,600 ±25,000	353,400 ±48,900	123,700 ±13,300	141,300 ±16,400	112,500 ±8,300	160,500 ±19,200
IL	1,800 ±1,800	1,500 ±1,400	1,800 ±1,700	100 <100	5,400 ±5,300	1,500 ±1,400	2,300 ±1,700	500 ±200	100 ±100	200 ±200	100 ±100	200 ±100
IN	1,100 ±500	800 ±500	1,100 ±900	200 <100	3,200 ±1,600	2,100 ±800	1,400 ±1,000	800 ±200	1,000 ±500	1,700 ±700	300 ±100	600 ±200
MI	18,500 ±2,100	20,100 ±2,500	23,700 ±5,500	26,600 ±5,200	82,900 ±10,000	93,700 ±11,100	55,800 ±8,700	109,400 ±18,400	37,400 ±5,600	47,500 ±6,000	32,100 ±1,400	50,400 ±6,600
MN	12,000 ±2,100	11,000 ±2,300	14,100 ±4,000	15,500 ±4,800	49,700 ±9,700	47,800 ±10,800	54,700 ±19,200	69,500 ±25,200	25,000 ±4,700	26,300 ±6,600	23,300 ±3,000	30,300 ±5,100
OH	2,000 ±800	1,500 ±1,100	1,700 ±1,200	2,400 ±1,900	5,200 ±2,200	9,300 ±6,500	3,100 ±1,300	6,200 ±3,800	2,900 ±1,300	1,400 ±600	2,100 ±1,300	1,300 ±200
WI	17,200 ±2,500	12,900 ±2,200	13,300 ±3,200	18,800 ±4,300	82,300 ±14,800	72,700 ±15,600	45,200 ±10,100	95,900 ±24,800	49,300 ±10,700	42,400 ±12,200	32,600 ±2,900	32,000 ±3,500

[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.

[d] Hunter number estimates at the regional and national levels may be biased high because the HIP sample frames are state specific; therefore, hunters were counted more than once if they hunted in >1 state. Variance was inestimable.

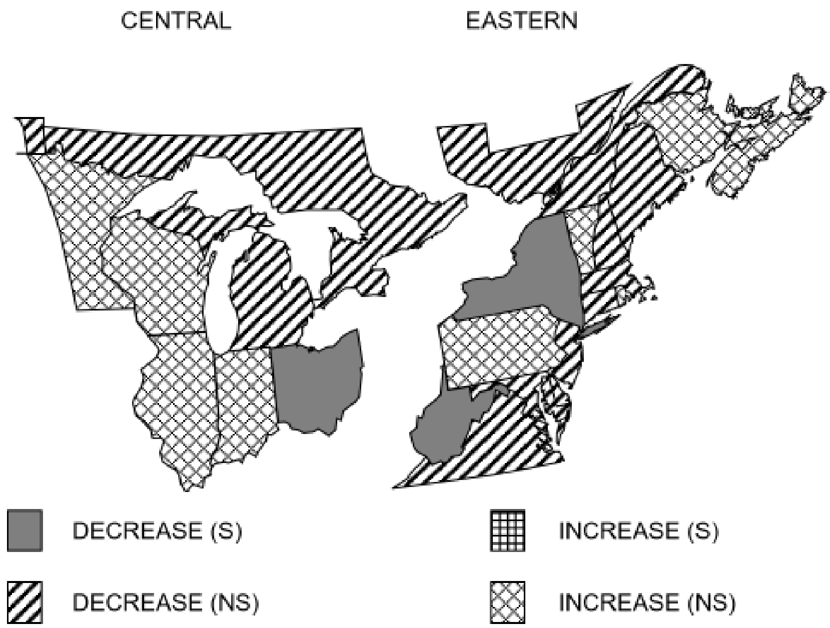


Figure 4. Ten-year trends in number of American woodcock heard on the Singing-ground Survey; 2014-24, as determined by the hierarchical modeling method. A significant trend (S) does not include zero in the 95% credible interval, while a non-significant (NS) trend does include zero. (from: Seamans, M.E. and R.D. Rau. 2024. American woodcock population status, 2024. U.S. Fish and Wildlife Service, Laurel, MD. 17 pp.).

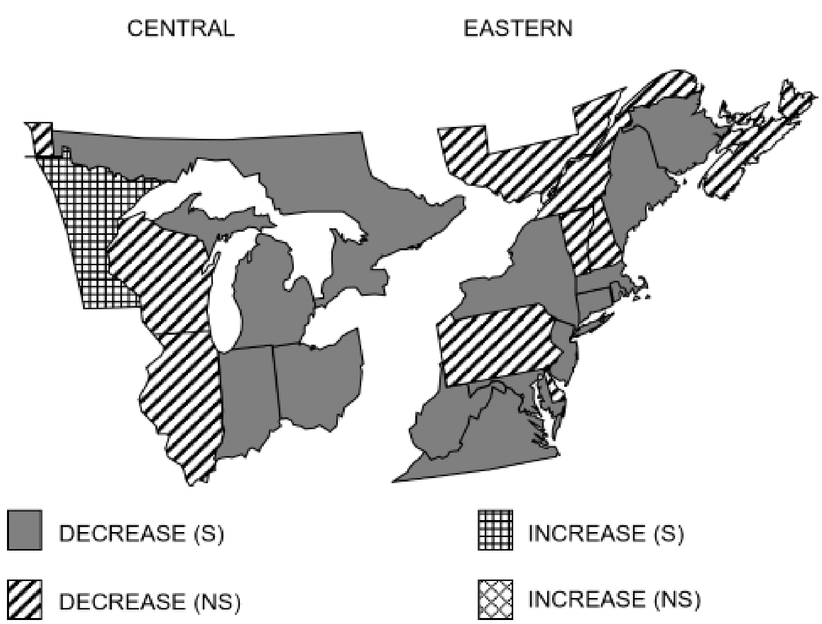


Figure 5. Long-term trends in number of American woodcock heard on the Singing-ground Survey; 1968-2024, as determined by the hierarchical modeling method. A significant trend (S) does not include zero in the 95% credible interval, while a non-significant (NS) trend does include zero. (from: Seamans, M.E. and R.D. Rau. 2024. American woodcock population status, 2024. U.S. Fish and Wildlife Service, Laurel, MD. 17 pp.).

HUNTING HARVEST STATISTICS

Division of Fish and Wildlife
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2023 SMALL GAME HUNTER MAIL SURVEY

Prepared by staff in the Wildlife Research Unit

INTRODUCTION

The Minnesota Department of Natural Resources (MNDNR), 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 2024 following the close of the 2023-24 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 2023-24 small game hunting season (N=230,283). A stratified random sample (n=7,000, 3%), allocated proportionally by license type, was drawn from the MNDNR 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, Non-resident Youth, and Non-resident Adult. For analysis, license types were pooled into "Resident" (N=220,218) and "Non-resident" (N=10,065) (Figure 2). Also, beginning in 2017, license holders <18-years 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 2023-24 and if not, they were instructed to return the survey. Respondents who hunted were asked: (1) total number of days they hunted small game, (2) number bagged by species, (3) number of days hunted by species, and (4) the county in which they hunted most for each species listed. Returned surveys were checked for completeness, consistency, and biological practicability. Dual key-entry and quality control checks were used to minimize transcription errors. Data was tabulated using Viking Data Entry VDE+ software and analyzed using R programming language (R version 4.4.1 (2024-06-24 ucrt); R Core Team 2024).

RESULTS

Survey Response and Overall License Sales Trends

Statewide (resident and non-resident) small game license sales and survey response rate are shown in Figure 2. Of the 7,000 mailed surveys, 180 surveys were returned as undeliverable; 2,210 surveys were completed and returned for an adjusted response rate of 32%, which has slowly declined over time. The percent of respondents who said they hunted or did not hunt is reported in Table 1. Overall, statewide license sales (230,283 small game licenses) increased by 1% from the previous year and were 5% below the 10-year average (242,688 licenses;

Figure 2, Table 2). Non-resident small game license sales (10,065 licenses) increased 13% in 2023 and were 40% above the 10-year average (7,204 licenses; Table 2).

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. Non-resident estimates for these four species over the past decade are shown in Table 3. For all other species, the estimated number of statewide hunters and harvest for 2023-24, the previous year, and the 10-year averages are shown in Tables 4 and 5, respectively. Table 6 shows the estimated mean harvest per active hunter and Table 7 shows the estimated mean harvest for successful hunters and hunter success rates (%) for all species for 2023-24, the previous year, and the 10-year averages. Tables 4-6 also provide trend information (i.e., the percent change) for annual and 10-year comparisons. One caveat is that sample sizes (i.e., the number of respondents that reported hunting a particular species) are small and sampling error is relatively large for most species and years (e.g., Tables 4 and 5), especially for species with n<30 and where reported harvest has a skewed distribution. Thus, caution is advised when comparing point estimates of harvest statistics between individual years. The value of the small game survey is long-term trends in license/stamp sales, active hunters, and harvest statistics, especially for the top four taxonomic groups (ducks, Canada geese, ruffed grouse, and ring-necked pheasants).

Ducks – all species

In 2023, state duck stamp sales (82,742 stamps) were slightly greater than last year's sales (81,864 stamps) and 5% below the 10-year average (87,889 stamps; Table 2). An estimated 50,434 hunters pursued ducks in 2023 which was 12% higher than last year's estimate (45,172 hunters) but 24% below the 10-year average (66,362 hunters; Table 4). The 2023 harvest estimate (565,716 ducks) was 20% above last year's estimated harvest (470,309 ducks) but 15% below the 10-year average (662,184 ducks; Table 5). Overall, duck hunters harvested an average of 11.2 ducks/hunter, which was slightly greater than the 10-year average (10.0 ducks/hunter; Table 6). Successful hunters bagged slightly more ducks in 2023 (13.3 ducks) compared to the 10-year average (11.8 ducks) despite similar success rates (84% and 85%, respectively; Table 7).

Canada geese

An estimated 29,698 hunters harvested approximately 146,823 Canada geese in 2023 (Tables 4 and 5) for an average of 4.9 geese/ hunter. The estimated number of goose hunters was 9% above last year's estimate (27,207 hunters) but 32% below the 10-year average (43,600 hunters; Tables 4 and 5). This year's estimated goose harvest (146,823) was 15% above last year's estimated harvest (127,520) but 36% below the 10-year average (228,047). Hunter success (76%) and mean harvest per successful hunter (6.5 geese) were similar to the 10-year averages (75%; 6.8 geese; Table 7).

Ruffed grouse

In 2023, an estimated 66,793 hunters harvested an estimated 339,592 ruffed grouse (Tables 4 and 5). The estimated number of hunters was slightly greater last year's estimate (64,591 hunters) but 7% below the 10-year average (72,089 hunters; Table 4). In contrast, this year's estimated grouse harvest was 43% above last year's estimated harvest (237,700 grouse) and 34% above the 10-year average (253,859 grouse; Table 5). The mean harvest per active hunter (5.1 grouse) was greater in 2023 than the previous year (3.7 grouse) and the 10-year average (3.5 grouse; Table 6). Hunter success (73%) was similar to the 10-year average (70%), whereas mean harvest per successful hunter (6.9 grouse/hunter) was almost 2 birds more than the 10-year average (5.0 grouse; Table 7).

Ring-necked pheasants

Pheasant stamp sales in 2023 (79,803 stamps) were 3% greater than 2022 sales (77,448 stamps) and nearly 5% greater than the 10-year average (76,344 stamps; Table 2). An estimated 50,642 hunters harvested an estimated 208,821 roosters in 2023 (Tables 4 and 5). These estimates represent 8% fewer hunters compared to the 10-year average (55,078 hunters; Table 4) but a harvest increase of 2% over last year and 6% above the 10-year average (204,052 and 196,965 roosters, respectively; Table 5). The mean harvest per active hunter was 4.1 roosters, which was only slightly greater than the 10-year average (3.6 roosters; Table 6). The hunter success rate (72%) in 2023 was higher than the 10-year average (68%) although the mean harvest per successful hunter (5.7 roosters) was only slightly above the 10-year average (5.3 roosters; Table 7).

ACKNOWLEDGMENTS

This project was funded in part by the Federal Aid in Wildlife Restoration Program. John Giudice analyzed the data, Nicole Davros and Margaret Dexter compiled the report, and John Giudice provided comments on a previous draft of this report.

FIGURES AND TABLES

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 2023-2024 small game hunting season **(March 2023-February 2024)**. We need information to estimate the season's harvest and to help set future small game seasons. Answer only for your Minnesota 2023 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

Wildlife Research Program Manager
Division of Fish and Wildlife
Department of Natural Resources

2023 Small Game Hunter Report

1. Did you hunt small game, listed below, in Minnesota this year (March 2023 - Feb 2024)? ☐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			
Pheasant	70			
Ruffed grouse (Forest partridge)	71			
Spruce grouse	72			
Sharp-tailed grouse	73			
Hungarian (Gray) partridge	74			
Fox squirrel	89			
Gray squirrel	90			
Cottontail rabbit	91			
Jackrabbit	92			
Snowshoe hare	93			
Badger	35			
Coyote (brush wolf)	97			
Gray fox	96			
Raccoon	94			
Red fox	95			

Figure 1. Sample of Small Game Hunter survey card.

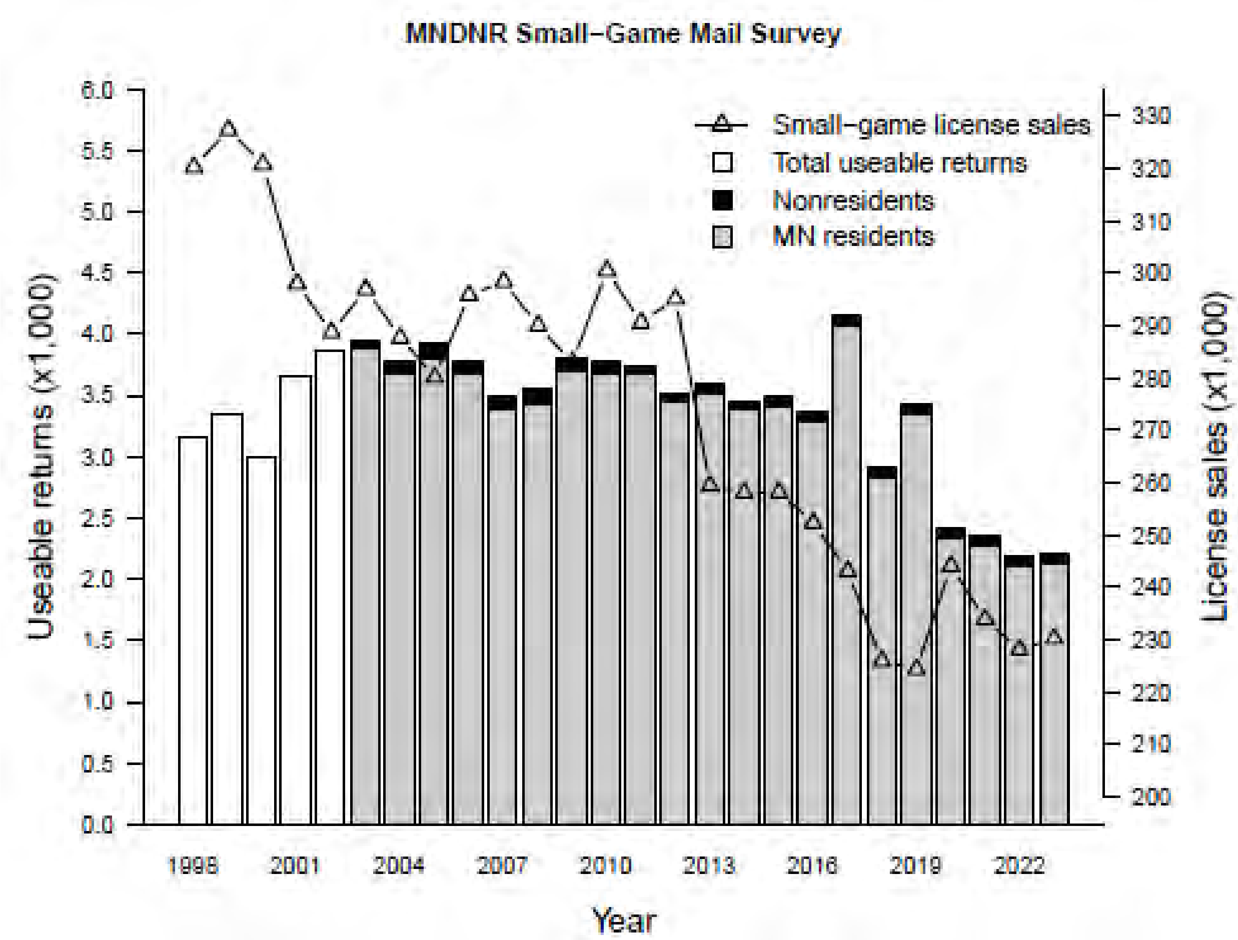

Figure 2. Number of Minnesota small game licenses sold and usable returned surveys, 1998-2023. Includes resident and non-resident licenses and excludes duplicate and free licenses.

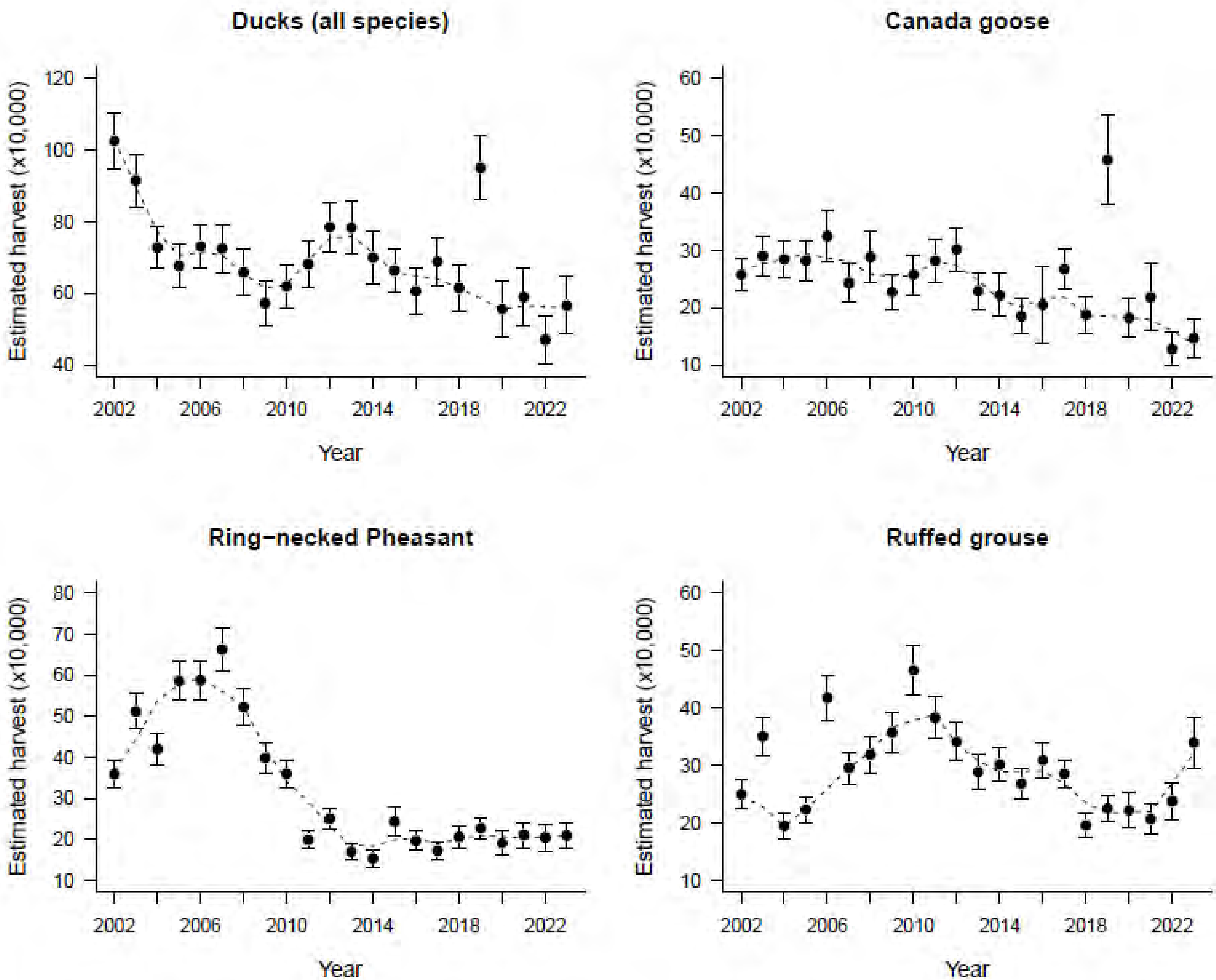

Figure 3. Harvest trends for top four small game species harvested in Minnesota, 2002-2023.

Table 1. Percent of respondents who hunted small game, 2013-14 through 2023-2024[a].

		Returns from mail survey	Projections from license sales
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
2019-20	Hunted Did not hunt	2,524 (73%) 911 (27%) 3,435 (100%)	164,896 59,517 224,413
2020-21	Hunted Did not hunt	1,487 (62%) 926 (38%) 2,413 (100%)	150,425 93,675 244,100
2021-22	Hunted Did not hunt	1,399 (59%) 957 (41%) 2,356 (100%)	138,891 95,010 233,901
2022-23	Hunted Did not hunt	1,383 (63%) 814 (37%) 2,197 (100%)	143,615 84,528 228,143
2023-2024	Hunted Did not hunt	1,360 (62%) 850 (38%) 2,210 (100%)	141,713 88,570 230,283

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

Table 2. Statewide (resident and non-resident) small game hunting license sales and stamp sales, 2013-14 through 2023-24.

	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
Total small game license sales[a]	258,581	258,109	258,208	252,358	243,130	225,932	224,413	244,100	233,901	228,143	230,283
Non-resident license sales[b]	6,031	6,056	6,755	6,701	6,854	6,718	6,887	8,375	8,730	8,927	10,065
State duck stamp sales	93,412	94,265	92,176	88,905	86,258	82,955	86,568	88,163	84,327	81,864	82,742
Pheasant stamp sales	77,597	74,295	77,750	76,920	71,925	72,192	74,921	81,850	78,538	77,448	79,803

[a] Includes all types of small game licenses. Duplicate and free licenses not included.
[b] Excludes duplicate licenses and non-resident shooting preserve licenses.

Table 3. Mail survey results[a] of non-resident small game hunters, 2013-14 through 2023-24.

	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
Estimated non-residents and (percent) of all licensed non-residents hunting:											
Ducks	2,010 (33)	2,340 (39)	1,850 (27)	2,320 (35)	2,350 (34)	1,680 (25)	3,040 (44)	1,230 (15)	3,740 (43)	1,632 (18)	2,517 (25)
Canada goose	1,270 (21)	1,300 (21)	650 (10)	770 (12)	1,730 (25)	1,260 (19)	3,120 (45)	1,560 (19)	1,770 (20)	1,152 (13)	1,678 (17)
Ring-necked pheasant	1,420 (24)	1,380 (23)	1,480 (22)	1,550 (23)	1,520 (22)	2,350 (35)	1,120 (16)	890 (11)	1,460 (17)	4,032 (45)	1,798 (18)
Ruffed grouse	2,010 (33)	2,600 (43)	2,870 (43)	3,520 (53)	2,280 (33)	2,270 (34)	1,760 (26)	3,800 (45)	2,700 (31)	3,648 (41)	4,674 (46)
Estimated non-resident harvest:											
Ducks	20,410	13,060	16,863	17,701	15,717	15,792	21,228	5,810	39,395	7,008	13,664
Canada goose	3,650	2,680	1,484	1,462	6,994	2,940	15,060	4,134	30,039	4,224	5,873
Ring-necked pheasant	3,430	3,720	6,581	4,040	7,274	6,048	2,645	5,141	5,924	14,112	7,432
Ruffed grouse	4,990	9,090	13,805	11,772	6,994	2,856	4,325	24,793	11,020	7,104	16,659

[a] Estimates for non-resident hunters are generally based on small samples sizes; harvest estimates therefore have moderate to high sampling uncertainty.

Table 4. Estimated number of statewide hunters (residents and non-residents) by species for current year (2023-24), previous year (2022-23), and the preceding 10-year (2013-2022) average. Annual and 10-year trends (% change) are also shown.

	2023-24			2022-23			10-yr mean (2013-22)		Change from 2022		Change from 10-yr mean	
	n	Hunters	SE	n	Hunters	SE	Hunters	SE	%	95% CI	%	95% CI
Ducks	484	50,434	2,017	435	45,172	1,931	66,362	610	12	7	-24	3
Canada geese	285	29,698	1,635	262	27,207	1,571	43,600	523	9	9	-32	4
Other geese	15	1,564	401	12	1,247	358	2,288	132	25	48	-32	18
American coot	17	1,772	427	28	2,908	544	3,333	160	-39	19	-47	13
Common snipe	9	938	311	9	935	310	1,010	89	0	47	-7	32
Rails & Gallinules	1	105	104	4	416	207	279	46	-75	28	-62	38
American crow	36	3,752	618	30	3,116	563	6,468	217	20	29	-42	10
American woodcock	96	10,004	994	113	11,735	1,071	11,295	291	-15	12	-11	9
Mourning dove	46	4,794	697	43	4,466	672	7,992	243	7	22	-40	9
Ring-necked pheasant	486	50,642	2,020	504	52,337	2,038	55,078	579	-3	5	-8	4
Ruffed grouse	641	66,793	2,213	622	64,591	2,183	72,089	629	3	5	-7	3
Spruce grouse	78	8,128	900	79	8,204	903	8,384	252	-1	15	-3	11
Sharp-tailed grouse	45	4,690	689	40	4,154	648	4,881	193	13	24	-4	15
Gray partridge	15	1,564	401	17	1,766	425	1,994	123	-11	31	-22	21
Gray squirrel	152	15,839	1,235	133	13,812	1,156	19,197	370	15	13	-17	7
Fox squirrel	87	9,066	949	69	7,166	846	10,545	278	27	20	-14	9
Eastern cottontail	77	8,024	895	79	8,204	903	12,099	297	-2	15	-34	8
White-tailed jackrabbit	9	938	311	8	831	292	981	89	13	55	-4	33
Snowshoe hare	33	3,439	592	14	1,454	386	2,952	148	137	75	16	21
Raccoon	46	4,794	697	36	3,739	616	6,034	213	28	28	-21	12
Red fox	17	1,772	427	21	2,181	472	3,864	169	-19	26	-54	11
Gray fox[a]	0	NA	NA	5	520	231	1,039	87	---	---	---	---
Coyote	90	9,379	964	89	9,243	956	15,635	334	1	15	-40	6
Badger	4	417	208	1	104	104	286	46	301	448	46	76

[a]Gray fox was not reported by any hunter in our 2023-24 survey.

Table 5. Estimated hunter harvest (residents and non-residents) by species for current year (2023-24), previous year (2022-23), and the preceding 10-year (2013-2022) average. Annual and 10-year trends (% change) are also shown.

	2023-24			2022-23			10-yr mean (2013-22)		Change from 2022		Change from 10-yr mean	
	n	Harvest	SE	n	Harvest	SE	Harvest	SE	%	95% CI	%	95% CI
Ducks	484	565,716	41,006	435	470,309	34,290	662,184	11,571	20	12	-15	6
Canada geese	285	146,823	17,417	262	127,520	14,697	228,047	7,492	15	19	-36	8
Other geese	15	3,128	2,116	12	1,767	1,165	5,234	810	77	167	-40	41
American coot	17	6,150	2,787	28	5,089	1,718	13,715	1,334	21	68	-55	21
Common snipe	9	626	529	9	728	373	1,284	195	-14	85	-51	42
Rails & Gallinules	1	NA	NA	4	104	104	571	149	---	---	---	---
American crow	36	34,602	11,771	30	10,595	2,374	50,670	4,171	227	133	-32	24
American woodcock	96	37,515	8,223	113	34,479	6,924	34,143	1,855	9	32	10	25
Mourning dove	46	52,422	12,487	43	39,883	10,441	71,482	3,981	31	47	-27	18
Ring-necked pheasant	486	208,821	16,695	504	204,052	16,760	196,965	4,345	2	12	6	9
Ruffed grouse	641	339,592	22,420	622	237,700	16,446	253,859	4,483	43	14	34	9
Spruce grouse	78	17,507	3,836	79	13,916	3,363	11,497	704	26	41	52	35
Sharp-tailed grouse	45	13,445	4,084	40	5,401	1,739	8,031	841	149	110	67	54
Gray partridge	15	1,252	640	17	1,766	807	2,874	370	-29	49	-56	23
Gray squirrel	152	68,984	9,426	133	94,504	14,734	92,014	3,337	-27	15	-25	11
Fox squirrel	87	25,219	4,696	69	23,368	4,934	33,770	1,508	8	30	-25	14
Eastern cottontail	77	24,594	7,171	79	22,951	3,997	35,956	1,484	7	36	-32	20
White-tailed jackrabbit	9	1,664	8	8	624	327	1,246	306	117	156	9	60
Snowshoe hare	33	11,151	3,194	14	1,247	547	5,352	521	794	468	108	63
Raccoon	46	21,469	4,789	36	12,464	2,887	38,045	3,061	72	55	-44	13
Red fox	17	2,085	671	21	2,285	744	4,259	381	-9	42	-51	16
Gray fox[a]	0	NA	NA	5	208	207	839	165	---	---	---	---
Coyote	90	19,175	4,341	89	23,264	4,896	32,677	2,239	-18	25	-41	14
Badger	4	522	275	1	104	---	220	46	402	---	137	134

[a]Gray fox was not reported by any hunter in our 2023-24 survey.

Table 6. Mean harvest per active hunter (residents and non-residents) for current year (2023-24), previous year (2022-23), and the preceding 10-year (2013-2022) average. Annual and 10-year trends (% change) are also shown.

	2023-24			2022-23			10-yr mean (2013-22)		Change from 2022		Change from 10-yr mean	
	n	Mean	SE	n	Mean	SE	Mean	SE	%	95% CI	%	95% CI
Ducks	484	11.2	0.68	435	10.4	0.62	10.0	0.15	8	9	12	7
Canada geese	285	4.9	0.52	262	4.7	0.47	5.2	0.16	4	15	-6	10
Other geese	15	2.0	1.30	12	1.4	0.88	2.1	0.30	43	129	-5	63
American coot	17	3.5	1.37	28	1.8	0.50	4.1	0.35	94	94	-15	34
Common snipe	9	0.7	0.55	9	0.8	0.32	1.2	0.15	-13	77	-42	46
Rails & Gallinules	NA	NA	NA	4	0.2	0.25	1.9	0.46	---	---	---	---
American crow	36	9.2	2.78	30	3.4	0.46	7.4	0.62	171	90	24	39
American woodcock	96	3.8	0.74	113	2.9	0.53	3.0	0.14	31	35	27	25
Mourning dove	46	10.9	2.09	43	8.9	1.94	8.9	0.45	22	35	22	24
Ring-necked pheasant	486	4.1	0.29	504	3.9	0.28	3.6	0.07	5	11	14	8
Ruffed grouse	641	5.1	0.29	622	3.7	0.22	3.5	0.06	38	11	46	9
Spruce grouse	78	2.2	0.41	79	1.7	0.37	1.4	0.07	29	37	57	30
Sharp-tailed grouse	45	2.9	0.77	40	1.3	0.37	1.7	0.17	123	87	71	48
Gray partridge	15	0.8	0.37	17	1.0	0.40	1.4	0.17	-20	49	-43	27
Gray squirrel	152	4.4	0.49	133	6.8	0.90	4.9	0.17	-35	11	-10	10
Fox squirrel	87	2.8	0.43	69	3.3	0.58	3.2	0.13	-15	20	-13	14
Eastern cottontail	77	3.1	0.83	79	2.8	0.38	3.0	0.11	11	33	3	28
White-tailed jackrabbit	9	1.4	0.55	8	0.8	0.31	1.2	0.23	75	97	17	51
Snowshoe hare	33	3.2	0.75	14	0.9	0.31	1.8	0.15	256	149	78	44
Raccoon	46	4.5	0.77	36	3.3	0.55	6.2	0.50	36	33	-27	14
Red fox	17	1.2	0.26	21	1.0	0.26	1.1	0.10	20	41	9	26
Gray fox[a]	NA	NA	NA	5	0.4	0.40	0.7	0.12	---	---	---	---
Coyote	90	2.0	0.41	89	2.5	0.46	2.2	0.16	-20	22	-9	20
Badger	4	1.2	0..25	1	1.0	---	0.8	0.08	20	---	50	35

[a]Gray fox was not reported by any hunter in our 2023-24 survey.

Table 7. Hunter success rates and mean harvest per successful hunter (residents and non-residents) for current year (2023-24), previous year (2022-23), and the preceding 10-year (2013-2022) average.

	2023-24				2022-23				10-yr mean (2013-22)		
	n	% Success	Mean	SE	n	% Success	Mean	SE	% Success	Mean	SE
Ducks	408	84	13.3	0.76	359	83	12.6	0.69	85	11.8	0.15
Canada geese	217	76	6.5	0.65	185	71	6.6	0.61	75	6.8	0.16
Other geese	8	53	3.8	2.32	4	33	4.2	2.13	41	5.1	0.30
American coot	12	71	4.9	1.80	17	61	2.9	0.70	71	5.7	0.35
Common snipe	2	22	3.0	1.99	5	56	1.4	0.40	59	1.9	0.15
Rails & Gallinules	NA	NA	NA	NA	1	25	1.0	---	44	4.1	0.46
American crow	33	92	10.1	3.00	25	83	4.1	0.44	86	8.7	0.62
American woodcock	73	76	4.9	0.93	81	72	4.1	0.70	68	4.5	0.14
Mourning dove	35	76	14.4	2.48	37	86	10.4	2.16	83	10.8	0.45
Ring-necked pheasant	352	72	5.7	0.36	341	68	5.8	0.38	68	5.3	0.07
Ruffed grouse	469	73	6.9	0.36	427	69	5.4	0.29	70	5.0	0.06
Spruce grouse	43	55	3.9	0.63	38	48	3.5	0.65	53	2.6	0.07
Sharp-tailed grouse	25	56	5.2	1.21	16	40	3.2	0.69	46	3.6	0.17
Gray partridge	5	33	2.4	0.67	8	47	2.1	0.66	44	3.2	0.17
Gray squirrel	117	77	5.7	0.59	110	83	8.3	1.04	83	5.9	0.17
Fox squirrel	60	69	4.0	0.55	48	70	4.7	0.74	77	4.2	0.13
Eastern cottontail	53	69	4.5	1.16	60	76	3.7	0.44	76	3.9	0.11
White-tailed jackrabbit	5	56	2.6	0.60	4	50	1.5	0.29	47	2.6	0.23
Snowshoe hare	26	79	4.1	0.88	7	50	1.7	0.42	59	2.9	0.15
Raccoon	43	93	4.8	0.80	30	83	4.0	0.59	90	6.8	0.50
Red fox	12	71	1.7	0.26	14	67	1.6	0.31	55	2.0	0.10
Gray fox[a]	0	NA	NA	NA	1	20	2.0	---	35	1.8	0.12
Coyote	56	62	3.3	0.61	61	69	3.7	0.62	56	3.8	0.16
Badger	4	100	1.2	0.25	1	100	1.0	---	72	1.1	0.08

[a]Gray fox was not reported by any hunter in our 2023-24 survey.

The following information has been excerpted from: U.S. Fish and Wildlife Service. Migratory bird hunting activity and harvest during the 2022 - 2023 and 2023-24 hunting seasons. U.S. Fish and Wildlife Service, Laurel, Maryland, U.S.A. The entire report is available on-line at

Migratory Bird Hunting Activity and Harvest during the 2022–23 and 2023–24 Hunting Seasons | FWS.gov

Table 1. Species composition of the Minnesota waterfowl harvest, 2022 and 2023. (from: Raftovich, R.V., K.K. Fleming, S.C. Chandler, and C.M. Cain. 2024. Migratory bird hunting activity and harvest during the 2022-23 and 2023-24 hunting seasons. U.S. Fish and Wildlife Service, Laurel, Maryland. USA August, 2024. 73 pp).

	Minnesota Harvest					Mississippi Flyway Harvest		
Species	2022	% of Harvest	2023	% of Harvest	Percent change in Harvest 22-23	2022	2023	Percent change Harvest 22-23
Mallard	63,072	14.38	112,801	17.99	79	981,547	1,618,440	39
Domestic mallard	0	0.00	332	0.05		3,902	2,180	-79
American black duck	0	0.00	0	0.00		11,589	21,041	45
Black x mallard	0	0.00	332	0.05		313	2,038	85
Gadwall	7,635	1.74	23,224	3.70	204	371,974	807,584	54
American wigeon	11,951	2.73	14,266	2.28	19	64,724	109,116	41
Green-winged teal	46,142	10.52	82,610	13.18	79	555,419	1,088,286	49
Blue-winged /cinnamon teal	125,813	28.69	145,978	23.28	16	419,913	600,728	30
Northern shoveler	6,639	1.51	14,598	2.33	120	110,989	243,402	54
Northern pintail	6,971	1.59	13,271	2.12	90	75,268	171,966	56
Wood duck	62,076	14.16	95,881	15.29	54	384,182	826,475	54
Redhead	10,291	2.35	15,593	2.49	52	40,922	64,565	37
Canvasback	3,652	0.83	5,972	0.95	64	27,344	55,024	50
Greater scaup	664	0.15	995	0.16	50	11,131	24,160	54
Lesser scaup	5,311	1.21	11,612	1.85	119	49,530	116,427	57
Ring-necked duck	71,703	16.35	53,746	8.57	-25	160,342	252,428	36
Goldeneye	7,967	1.82	5,972	0.95	-25	20,549	30,521	33
Bufflehead	5,975	1.36	16,920	2.70	183	53,728	134,224	60
Ruddy duck	0	0.00	664	0.11		4,001	18,187	78
Scoters	0	0.00	0	0.00		3,847	9,042	57
Hooded merganser	2,656	0.61	11,944	1.90	350	28,178	64,060	56
Other mergansers	0	0.00	0	0.00		3,331	13,345	75
Total Duck Harvest [a] (retrieved kill)	438,500 ±17%		627,000 ±14%		43	3,402,500 ±7	6,315,300 ±5	46

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

Table 2. Top 10 states in number of **adult duck hunters**, 2023, and number of hunter-days and retrieved duck kill (from: Raftovich, R.V., K.K. Fleming, S.C. Chandler, and C.M. Cain. 2024. Migratory bird hunting activity and harvest during the 2022-23 and 2023-24 hunting seasons. U.S. Fish and Wildlife Service, Laurel, Maryland. USA August, 2024. 73 pp).

State	Number of active duck hunters	Duck hunter days afield	Total duck harvest	Seasonal duck harvest per hunter
Texas	141,500 ± 5%	755,500 ± 9%	1,860,400 ± 10%	13.1 ± 12%
Arkansas	65,900 ± 4%	437,400 ± 11%	1,127,900 ± 17%	17.1 ± 17%
Minnesota	60,000 ± 6%	363,600 ± 10%	627,000 ± 14%	10.4 ± 15%
California	57,800 ± 5%	470,100 ± 9%	1,038,900 ± 10%	18.0 ± 11%
Louisiana	55,300 ± 5%	418,900 ± 11%	1,097,000 ± 14%	19.8 ± 15%
Wisconsin	55,000 ± 5%	349,900 ± 10%	371,200 ± 11%	6.8 ± 12%
North Carolina	47,800 ± 8%	297,900 ± 11%	445,000 ± 14%	9.3 ± 16%
Michigan	41,700 ± 7%	279,600 ± 12%	406,000 ± 17%	9.7 ± 18%
North Dakota	41,700 ± 6%	201,600 ± 10%	582,200 ± 12%	13.9 ± 13%
Missouri	40,500 ± 7%	317,400 ± 12%	625,700 ± 19%	15.4 ± 20%
Mississippi Flyway		3,460,600 ± 3%	6,315,300 ± 5%	
United States		7,704,100 ± 2%	14,755,600 ± 3%	

Table 3. Top 10 states in number of **adult goose hunters**, 2023, and number of hunter-days and retrieved goose kill. (from: Raftovich, R.V., K.K. Fleming, S.C. Chandler, and C.M. Cain. 2024. Migratory bird hunting activity and harvest during the 2022-23 and 2023-24 hunting seasons. U.S. Fish and Wildlife Service, Laurel, Maryland. USA August, 2024. 73 pp).

State	Number of active goose hunters	Goose hunter days afield	Total goose harvest	Seasonal goose harvest per hunter
Wisconsin	38,800 ± 7%	245,600 ± 15%	159,400 ± 26%	4.1 ± 27%
Texas	38,600 ± 12%	112,700 ± 21%	122,900 ± 29%	3.2 ± 32%
Minnesota	37,600 ± 9%	198,400 ± 17%	152,300 ± 25%	4.1 ± 27%
Michigan	32,700 ± 9%	198,400 ± 15%	241,200 ± 21%	7.4 ± 23%
Arkansas	31,800 ± 9%	139,000 ± 22%	191,000 ± 22%	6.0 ± 24%
California [b]	30,700 ± 8%	240,000 ± 15%	251,300 ± 31%	8.2 ± 32%
North Dakota	30,000 ± 9%	145,600 ± 16%	179,500 ± 23%	6.0 ± 25%
Pennsylvania	24,600 ± 11%	117,600 ± 24%	103,000 ± 30%	4.2 ± 32%
Maryland [b]	21,000 ± 10%	109,100 ± 18%	109,200 ± 20%	5.2 ± 23%
Missouri	19,100 ± 13%	123,700 ± 23%	131,600 ± 33%	6.9 ± 35%
Mississippi Flyway		1,661,100 ± 6%	1,415,200 ± 8%	
United States [b]		3,487,800 ± 4%	3,401,800 ± 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.

2024 LIGHT GOOSE CONSERVATION ORDER HARVEST IN MINNESOTA

Margaret Dexter, Wildlife Populations and Research Unit

J. Giudice, MNDNR Biometrics Unit

INTRODUCTION

This report documents results of the 2024 Light Goose Conservation Order hunter mail questionnaire survey.

METHODS

Minnesota held a light goose Conservation Order harvest from 18 February - 30 April 2024. 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 596 permits were issued in 2024. This is a 44% decline from the previous year (n=1,075 permits). Surveys were sent to 546 license holders and 175 responses (30%) to the questionnaire were obtained (Table 1, Figure 2). In calculating harvest estimates, we assume that the non-respondents participated in the conservation action and took light geese in the same manner as respondents. An estimated 270 hunters attempted to take light geese during the conservation order period. Active participants pursued light geese for 1,203 days and 699 light geese were shot and retrieved. This was an average retrieved take of 3 geese per active participant. An estimated 62 light geese were wounded and not retrieved.

ACKNOWLEDGMENTS

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

MINNESOTA 2024 LIGHT GOOSE HARVEST SURVEY

For the Period of February 17- April 30, 2024 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 17 - April 30, 2024. 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 2024 hunting experience.** THANK YOU! The Wildlife Research Program, Division of Fish and Wildlife, MN DNR.

1. Did you hunt light geese in Minnesota during February 17 - April 30, 2024? 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 17 - April 30, 2024? __________

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, 2024. **Note:** the actual hunt period listed on the card should have read February 18 to April 30, 2024. This does not impact interpretation of the results since hunters would not have been afield prior to February 18.

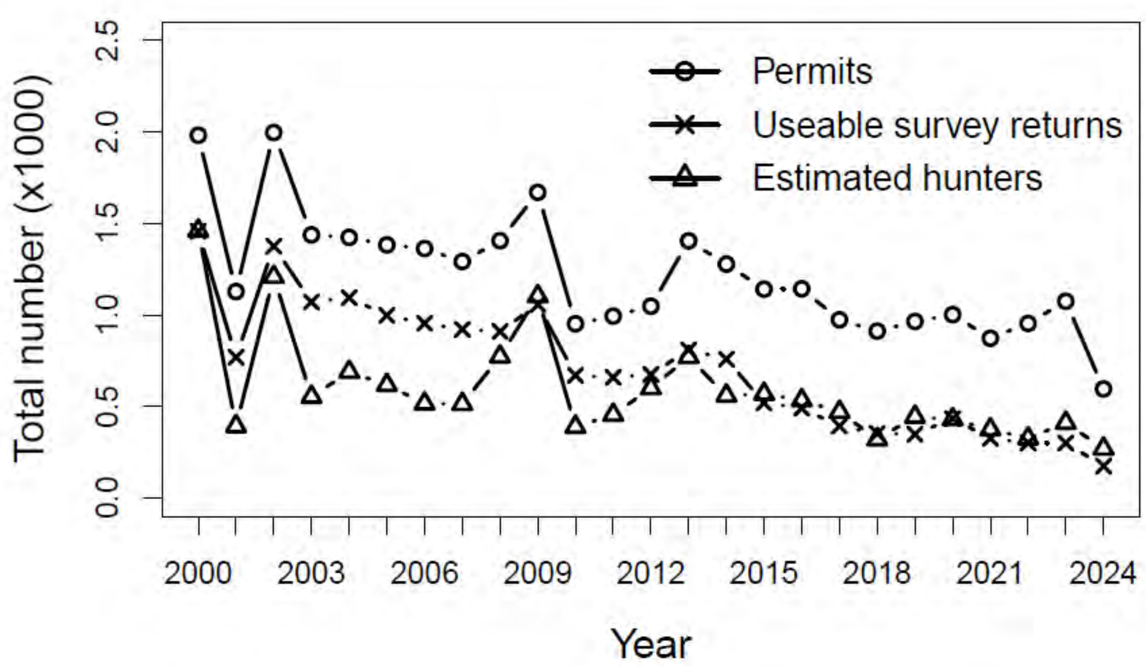

Figure 2. Light goose permits issued, survey response, and estimated hunters in Minnesota, 2000-2024.

Table 1. Summary of Light Goose Conservation Order harvest in Minnesota, 2014 – 2024.

	Year										
Statistic	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Total permits sold	1,278	1,141	1,143	974	912	965	1,002	873	954	1,075	596
Useable returns	759	520	491	393	353	348	434	326	302	301	175
Response rate (%)	60.0	46	43	41	43	41	44	38	32	29	30
Active hunters (%)	44.0	50	47	48	35	46	43	43	34	38	45
Estimated total hunters	560	569	534	471	321	444	430	375	326	411	270
Estimated hunter days	2,580	2,434	2,605	1,966	1,204	1,537	1,529	1,481	1,122	1,675	1,203
Mean days/hunter	5	4	5	4	4	4	4	4	3	4	4
Estimated harvest (shot & retrieved)	2,880	3,266	2,121	1,713	1,021	1612	785	1,455	967	1,600	699
Mean harvest/hunter	5	6	4	4	3	4	2	4	3	4	3
Estimated crippling losses	210	349	215	298	78	206	54	150	86	54	62
Percent using unplugged guns	48.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Est. number hunters using unplugged guns	270	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Est. number geese **shot** with unplugged guns	2,060	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Est. harvest with shell 4-5-6	770	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Percent using electronic calls	27.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Est. number hunters using e-calls	160	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Est. harvest while using e-calls	1,710	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Percent hunting 1/2-hr after sunset	36.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Est. number hunting after 1/2-hr sunset	200	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Est. harvest 1/2-hr after sunset	550	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

MINNESOTA'S WILD TURKEY HARVEST FALL 2023 - SPRING 2024

Nate Huck, Resident Game Bird Consultant

SUMMARY OF SEASON STRUCTURE

The fall 2023 turkey season opened on September 30 and closed on October 27. An unlimited number of permits were available, and hunters could harvest a single bird of any sex in any permit area (Figure 1). All hunters, regardless of license type (archery/firearm), could hunt the entire season.

The spring 2024 hunting season was open from April 17 through May 31. Hunters were limited to harvesting a single bird: either a tom, jake, or bearded hen. Firearm hunters were restricted to hunting one of 5 week-long time periods (A-E), in addition to the final two weeks of the season (F) if they did not harvest a bird earlier. Archery and youth hunters could hunt the entire season. An unlimited number of permits were available during all time periods, except for 3 permit areas that maintained a lottery during the A-C periods (511, 512) or A-B periods (502). All hunters declared a permit area at the time of license purchase but could harvest a bird within any permit area (Figure 1).

FALL 2023 SEASON

Permits Issued

The number of fall turkey hunters in 2023 (9,713) was similar to the number of hunters in fall 2022 (8,999 hunters; Table 1, Figure 2) and was 18% above the 10-year average (8,222). The proportion of youth hunters was consistent with previous seasons (24%).

Harvest

The fall 2023 harvest (1,224) was 5% less than the fall 2022 harvest (1,285 turkeys; Table 1). Hunter success was 12.6%, which was slightly below the long-term average (14.1%). Hens comprised 55% of the total harvest, with jakes and toms comprising 15% and 31% of the total fall harvest, respectively. Two permit areas, 507 and 508, accounted for 49% of the total fall harvest (Table 2). These two permit areas were also the most hunted, accounting for 48% of all fall permit sales (Table 2).

SPRING 2024 SEASON

Permits Issued

The number of permits issued across all license types in 2024 was up 11% from 53,574 hunters in 2023 to 59,565 hunters in 2024 (Tables 3 and 4, Figure 3). Permit sales increased across all permit categories, though the increase was greatest among archery hunters (Table 4). Permit sales were the second highest all-time (2020, 63,196 permits; Table 4; Figure 3). All hunters had to declare a permit area in 2024 but were not restricted to harvesting a bird in the declared area. Permit sales were greatest in permit area 507 and, along with units 508 and 501, comprised approximately 62% of all permit sales (Table 5).

Harvest

During the 2024 spring turkey season, 16,714 turkeys were harvested (Table 4). The harvest total increased 22% compared to 2023 and is the highest season harvest total for the modern turkey season (since 1978; Figure 3). Permit areas 507, 508, and 501 saw the greatest harvests and comprised roughly 62% of the total harvest (Table 5). Harvest success increased among all license holders (28.1%) compared to 2023 and was the highest in the last 10 years (Tables 3 and 4).

The lack of snowpack across much of the northern portion of the turkey range at the open of the turkey season led to modern turkey season harvest records in periods A, B, and C. In 2024, the combined A and B period harvest accounted for 64.4% of the total spring harvest (Table 6). Collectively, A-C periods accounted for approximately 80% of all spring turkey harvest (Table 6), which is in line with harvest in most years.

Table 1. Permits issued, registered harvest, and hunter success rates for the ten most recent fall wild turkey seasons in Minnesota, 2014-2023.

Year	Permits issued	Registered harvest	Hunter success (%)[a]
2014	8,345	1,216	14.6%
2015	8,210	1,213	14.8%
2016	8,563	1,175	13.7%
2017	7,747	1,017	13.1%
2018	6,725	835	12.4%
2019	6,481	855	13.2%
2020	8,410	1,136	13.5%
2021	9,026	1,238	13.7%
2022	8,999	1,285	14.3%
2023	9,713	1,224	12.6%

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

Table 2. Permits issued, registered harvest by sex, and total registered harvest during the fall 2023 wild turkey season in Minnesota.

Permit area	General permits issued[a]	Youth permits issued	Toms[a]	Jakes[a]	Hens[a]	Total registered harvest[a]
501	894	269	44	12	90	146
502	77	17	1	1	7	9
503	629	178	36	15	63	114
504	238	89	10	4	8	22
505	437	116	20	11	27	58
506	352	119	22	8	28	58
507	1,712	609	94	57	180	331
508	1,829	542	81	36	151	268
509	339	173	21	13	48	82
510	711	154	46	19	61	126
511	115	32	1	2	5	8
512	66	16	0	0	2	2
Total	**7,399**	**2,314**	**376**	**178**	**670**	**1,224**

[a] Total harvest for all license types.

Table 3. Total permits issued, harvest, and hunter success rates by permit type during the spring 2024 wild turkey season in Minnesota.

	Total permits issued	Harvest	Hunter success (%)[a]
General	31,299	10,886	34.8%
Youth	13,771	3,198	23.2%
Archery	14,495	2,630	18.1%
Total	59,565	16,714	28.1%

[a] Success rates (registered harvest divided by number of permits issued) not adjusted for non-participation or unregistered harvest.

Table 4. Permits issued, registered harvest, and hunter success rates for the ten most recent spring wild turkey hunting seasons in Minnesota, 2015-2024.

Year	General permits issued	Youth permits issued	Archery permits issued	Total permits issued	Registered harvest[a]	Hunter success (%)[b]
2015[c]	30,269	11,330	5,046	46,645	11,740	25.2%
2016[c]	28,188	11,448	10,336	49,972	12,323	24.7%
2017[c]	27,235	11,354	11,237	49,826	11,854	23.8%
2018[c]	24,737	9,952	11,399	46,088	10,750	23.3%
2019	24,432	10,032	11,794	46,258	10,746	23.2%
2020	34,173	14,292	14,731	63,196	13,996	22.1%
2021	32,522	12,598	12,966	58,086	12,067	20.8%
2022	29,603	12,551	12,337	54,491	12,297	22.6%
2023	29,542	12,343	11,688	53,574	13,669	25.5%
2024	31,299	13,771	14,495	59,565	16,714	28.1%

[a] Includes all license types.

[b] Total hunter success (registered harvest divided by number of permits issued). Success rates not adjusted for non-participation or unregistered harvest.

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

Table 5. Permits issued by license type and total registered harvest within each permit area during the spring 2024 wild turkey season in Minnesota[a].

Permit area	Archery permits declared	General permits declared	Youth permits declared	Total permits declared	Total registered harvest
501	1,714	5,866	1,771	9,351	2,782
502	172	654	176	1,002	270
503	1,319	3,457	1,362	6,138	1,745
504	582	890	501	1,973	507
505	764	1,791	708	3,263	990
506	748	1,307	705	2,760	689
507	3,922	7,762	4,200	15,884	4,522
508	2,842	6,099	2,518	11,459	3,018
509	535	1,083	692	2,310	672
510	1,646	2,028	931	4,605	1,375
511	180	219	115	514	88
512	71	143	92	306	56
Total	**14,495**	**31,299**	**13,771**	**59,565**	**16,714**

[a] Beginning in 2020, all hunters declared but were not restricted to harvesting a turkey in their declared permit area.

Table 6. Permits issued and harvest by license type and time period for the spring 2024 wild turkey season in Minnesota.

Time period	Archery permits issued[a]	Youth permits issued[a]	General permits issued	Registered harvest[b]	Percent of total harvest[b]
Any	14,495	13,771			
A			11,900	7,123	42.6%
B			7,704	3,649	21.8%
C			6,036	2,595	15.5%
D			2,815	1,268	7.6%
E			1,958	762	4.6%
F			886	1,317	7.9%

[a] Archery and youth permits were valid during any time period.

[b] Includes harvest from all license types.

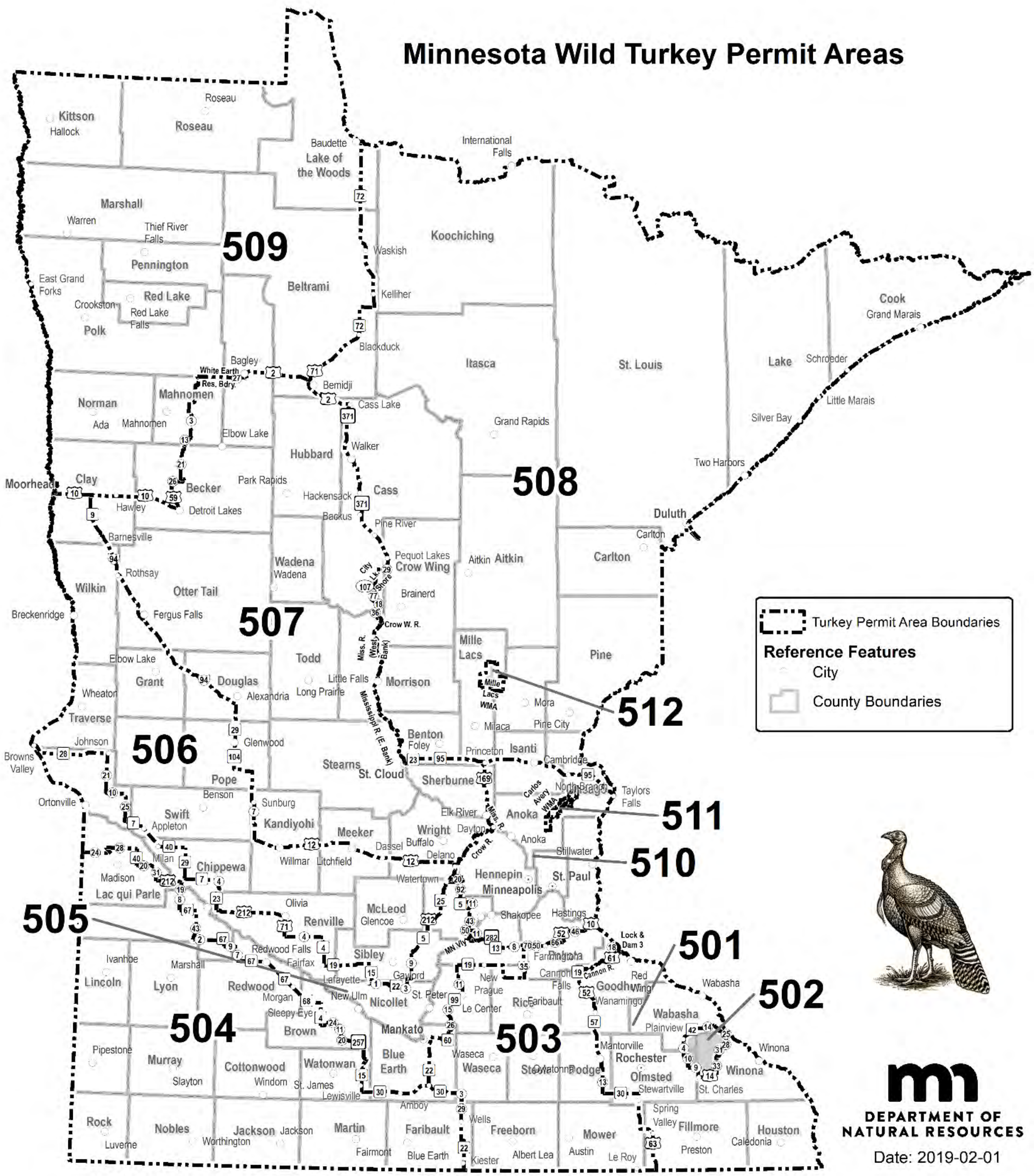

Figure 1. Permit areas open for hunting during fall 2023 and spring 2024 wild turkey seasons in Minnesota.

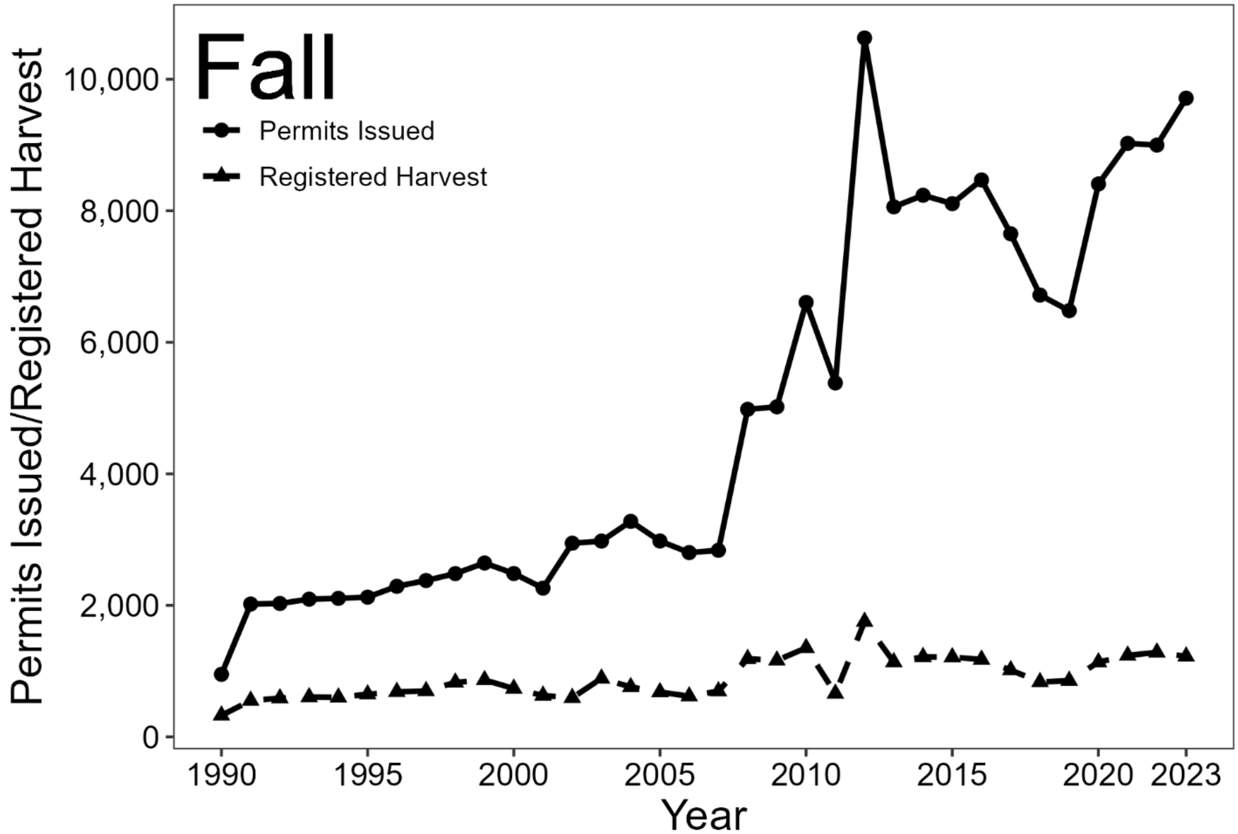

Figure 2. Permits issued and registered harvest for fall wild turkey seasons in Minnesota, 1990-2023.

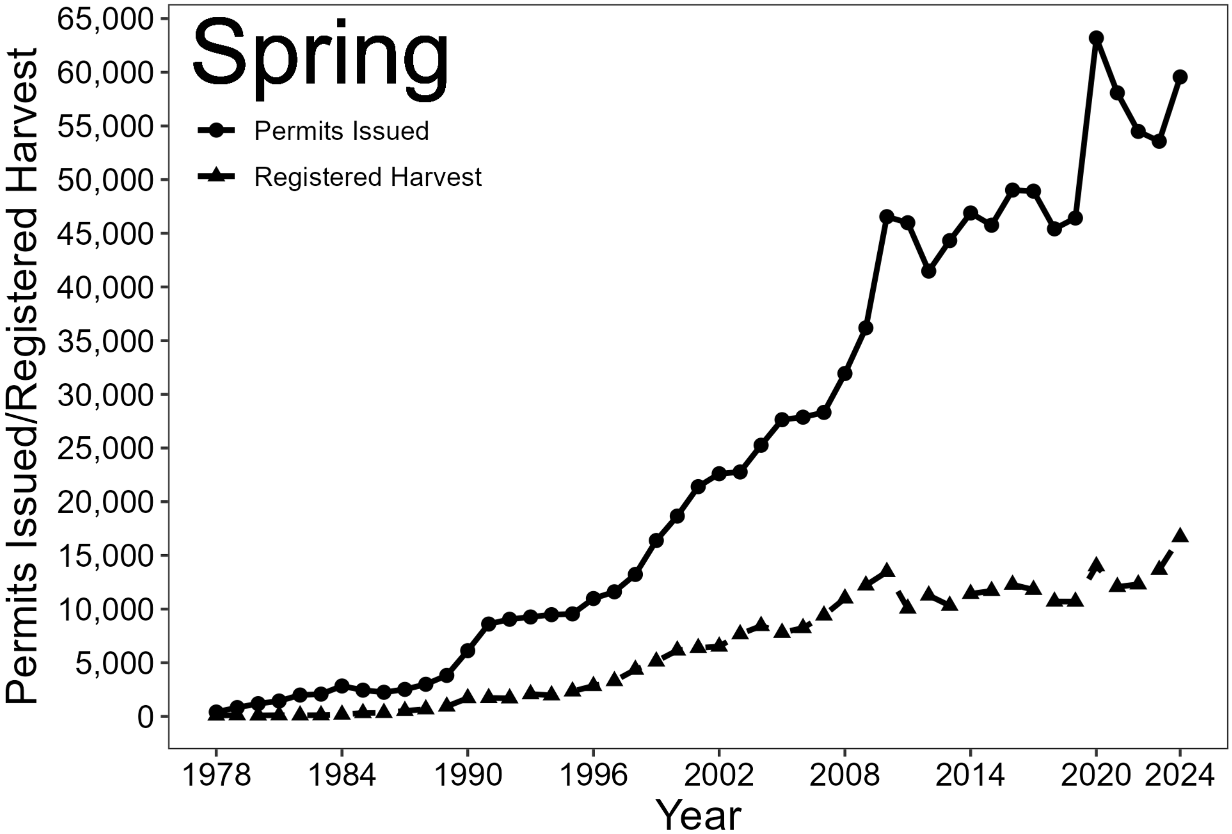

Figure 3. Permits issued and registered harvest for spring wild turkey seasons in Minnesota, 1978-2024.

2023 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 2023, 101 hunters were estimated to have gone afield and harvested 96 prairie-chickens and 42 sharp-tailed grouse (*Tympanuchus phasianellus*) during prairie-chicken hunts. Hunter success (0.59) was similar to recent years. Satisfaction (3.9 on a scale of 1-5) also was similar to recent years and consistent with improvement following changes to the permit areas and season in 2013 (i.e., longer length and earlier dates). Notably, in 2023, the number of applicants (495) for the prairie-chicken lottery was the highest since 2009, indicating more interest in prairie-chicken hunting.

INTRODUCTION

Greater 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 also was 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 2023, the prairie-chicken season opened 30 September and closed 8 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 up to 20% of the available permits in a permit area. Remaining 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 2003-2007, so I determined harvest through a postcard survey. I sent a postcard to each lottery winner the week before hunting season. Six 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 and adjusted as necessary. I calculated the number of birds harvested, birds per harvester, and hunter success (i.e., proportion of estimated hunters harvesting ≥1 prairie-chicken) for each permit area. Each of these metrics was calculated by permit area and for all areas combined.

RESULTS AND DISCUSSION

The combined quota for the 11 permit areas during 2023 was 125 permits, and 495 individuals applied in the lottery (Table 1). Of the 125 lottery winners, 107—including 3 landowners—later purchased a permit. All permit areas had more applicants than permits available, so surplus permits were not available.

Ninety-three purchasers (87%, n = 107) responded to the survey; 82 (77%) responded to the first mailing and 11 (10%) to the second mailing. This response rate is similar to survey response rates since 2010 (mean: 87%; range: 83-95%). I did not detect a response bias in the number of respondents that hunted. Respondents to the first mailing were as likely to have hunted as those responding to the second mailing (95% vs. 100% of respondents). Respondents to the first mailing also harvested prairie-chickens at a statistically similar rate to respondents to the second mailing (58% vs. 45%), harvested similar numbers of chickens (0.9 vs. 0.9 birds per hunter), spent a similar number of days afield (2.6 vs. 2.4, respectively), and harvested similar numbers of sharp-tailed grouse (0.5 vs. 0.2 birds per hunter, respectively). Respondents to the first mailing reported similar satisfaction (mean 3.9 vs. 3.6, median 4.0 vs. 5.0), with 90% and 73% of respondents reporting satisfaction scores ≥3, respectively. Thus, I combined responses from both mailings this year for the analysis. Eighty-seven respondents reported that they hunted prairie-chickens (Table 2). I estimated the total number of hunters to be 101 (i.e., purchasers who went afield) after accounting for hunting by non-respondents. Hunters reported harvesting 83 prairie-chickens, and total harvest after accounting for non-respondents was estimated as 96 prairie-chickens. An estimated 60 hunters bagged ≥1 chicken. Prairie-chicken hunter success during 2023 was similar to other years of the survey. Survey respondents also reported harvesting 42 sharp-tailed grouse while hunting prairie-chickens from permit areas 803A (10), 804A (4), 805A (22), 806A (1), 807A (4), and 808A (1) (Figure 1). Successful hunters reported higher average satisfaction (4.4) than respondents that were not successful (3.3), but satisfaction of prairie- chicken hunters was high overall.

Prairie-chicken hunter satisfaction was similar to 2013-2022, which is consistent with improved 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 and 44% preferred a later season. Supporters of the early season indicated that the birds were less wary early in the season and pheasant hunting did not affect the hunt. Reasons provided in support of a later season included cooler weather for hunters and dogs, better plumage on birds, fewer standing crops, opportunity to harvest pheasants while hunting chickens, and no conflict with the waterfowl opener. Based on comments received in the survey this year, prairie-chicken hunters remain split in their preferences for season timing.

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 2023.

Permit area	Permits available	No. of applicants	Lottery winners		Permit purchasers[a]		Surplus purchasers[c]
			No.[b]	Proportion	No.	Proportion	
803A	8	28	8	0.29	8	1.00	0
804A	10	20	10	0.50	8	0.80	0
805A	10	69	13	0.19	11	0.85	0
806A	12	21	12	0.57	8	0.67	0
807A	20	96	20	0.21	18	0.90	0
808A	20	112	21	0.19	18	0.86	0
809A	15	55	15	0.27	15	1.00	0
810A	15	54	15	0.28	13	0.87	0
811A	5	12	5	0.42	1	0.20	0
812A	5	20	5	0.25	3	0.60	0
813A	5	8	5	0.63	4	0.80	0
All	125	495	129	0.26	107	0.83	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 2023.

Table 2. Prairie-chicken harvest in Minnesota during 2023.

Permit area	No. of hunters[a]		Birds harvested		Birds per harvester[b]	Success rate[c]
	Self-reported	Estimated	Self-reported	Estimated		
803A	5	6	3	4	1.3	0.50
804A	6	8	0	0	NA	0.00
805A	9	10	10	11	1.6	0.70
806A	5	5	5	5	1.7	0.60
807A	15	18	15	18	1.6	0.61
808A	15	18	23	28	1.6	0.94
809A	12	15	9	11	1.4	0.53
810A	11	12	8	9	1.8	0.42
811A	2	2	1	1	1.0	0.50
812A	3	3	5	5	1.7	1.00
813A	4	4	4	4	2.0	0.50
All	87	101	83	96	1.6	0.59

[a] Permit purchasers who hunted.
[b] Estimated number of birds harvested per successful hunter.
[c] Proportion of estimated hunters harvesting ≥1 prairie-chicken.

Table 3. Summary of prairie-chicken hunting in Minnesota during 2003–2023.

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]
2019	125	354	100	64[f]	0.37[f]	3.8[f]
2020	125	366	105	112[f]	0.62[f]	4.0[f]
2021	125	435	111	110[f]	0.49[f]	4.0
2022	125	436	109	111	0.60	3.9
2023	125	495	101	96	0.59	3.9

[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, 2018, 2019, 2020, and 2021.

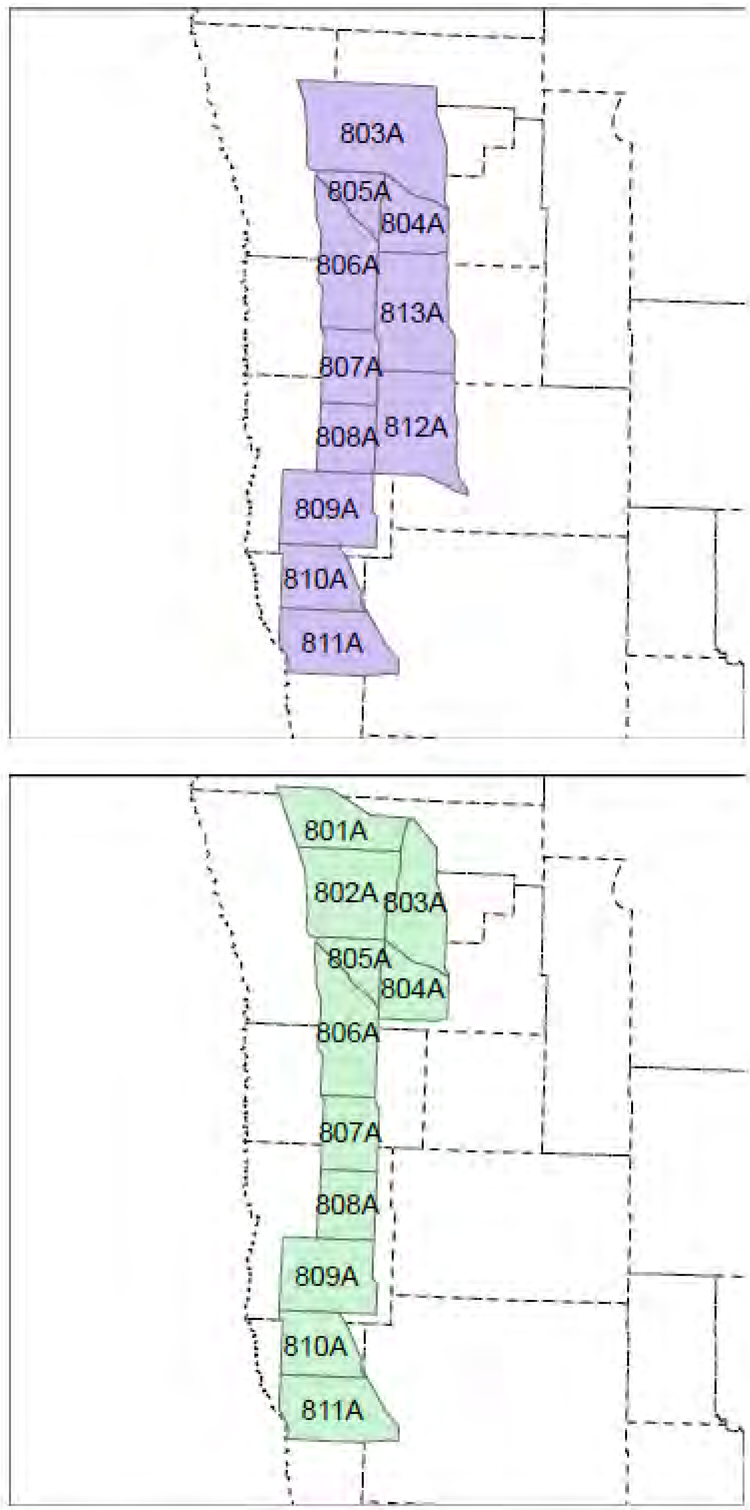

Figure 1. Prairie-chicken hunting permit area boundaries in northwestern Minnesota since 2013 (top) compared to during 2006–2012 (bottom). County boundaries are indicated by dashed lines. Permit areas 812A and 813A were added, 801A was eliminated, and 802A and portions of 803A were combined into a revised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

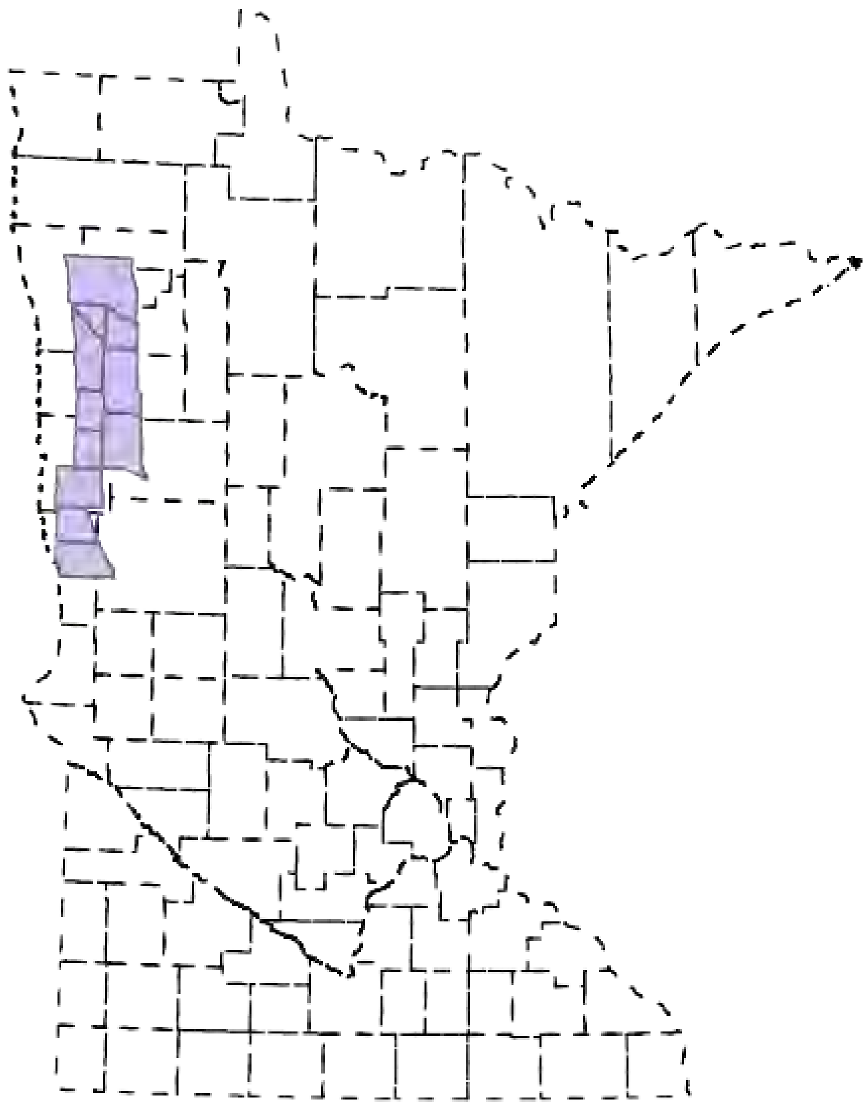

Figure 2. Northwestern location of prairie-chicken hunting permit areas within the state relative to county boundaries (dashed lines).

STATUS OF MINNESOTA BLACK BEAR HARVEST, 2023*

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INTRODUCTION

The Minnesota bear range has historically been divided into 13 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 is 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 20,000 for the seventh straight year. Applications have not been this high since 2001. Of these, nearly 5,000 (19%), a record high number, applied for area 99, meaning that they only sought to raise their preference level for the permit system, but not hunt this year. Permit availability was 11% higher than 2022. Hunting success (Figure 1) is inversely related to the number of hunters but also strongly affected by fall foods. The total number of hunters declined from 2020 and 2021, but there are still nearly 20% more hunters each year than pre-pandemic (Table 1).

Quota zone permits and licenses

The number of quota zone permits available in 2023 increased by 11% from 2022 (Table 2). DNR has kept permits at conservative levels for over a decade (<4,035). This was the 13th year (since 2011) of a system whereby unsold licenses for the quota zone (>500) could be purchased later as surplus. BMU 451 (new in 2020) had an unlimited number of permits but was still part of the quota zone (548 sold, all listed as surplus license sales) (Table 3). This experimental zone was created to test the hypothesis that hunters can effectively reduce nuisance complaints and crop damage.

Bear Management Units

There are currently 14 Bear Management Units (BMUs) where license sales are limited by a quota, 1 BMU where the number of permits is unlimited, and 4 BMUs with no quota at all (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. 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). 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). In 2022, BMU 14 was split from BMU 12. BMU 451 was split from BMU 45 in 2020 as an experimental unit to understand if we could reduce crop damage through hunting. The results for this BMU are reported under the quota zone but were not remerged with BMU 45. This is because of the unlimited number of tags in BMU 451, so BMU-level results would not be comparable with previous years.

Quota zone applicants

Statewide, quota zone applications have been slowly increasing, and all BMUs (except 31) had similar or increased numbers of applicants compared to last year. As in year's past, BMU 45 showed a significant, two-fold increase over the past 10 years (Fig. 3).

Residents vs. Non-resident hunters

The proportion of resident hunters has remained stable for the past 5 years. The Northwest no-quota zone (BMU 11) consistently had the highest proportions of non-resident hunters (17%–29%) (Table 4).

Quota zone lottery

We do not have (nor have we ever had) a bear population that can sustain levels of harvest where everyone who applies for a tag is successfully drawn. The low quota zone permit availability over the past 11 years has made it increasingly difficult to succeed in the lottery, and thus wait times remained high in some areas in 2023 (Table 5). The trade-off is that the quality of the hunt and the success rates are exceedingly high in the quota zone (Table 1, Fig. 1). First-time and second-time applicants were successful only in BMU 22 (wilderness area hunt). Four BMUs required a preference level of 4 for guaranteed success, and BMUs 24, 27, 28, 45, 46, and 47 required a preference level of 5 or above for any chance of drawing a tag. This high threshold for these BMUs is due to the increasing number of applicants this year (Fig. 3), not a reduced number of available permits (Table 2).

Harvest by BMU

The statewide harvest in 2023 was 20% lower than 2022, and 39% lower than 2021 (Table 6) This was likely due to the range-wide boom in production of natural bear foods for the second year in a row, coupled with a very warm opening weekend. The sex ratio of the harvest was ≥60% males in all BMUs, except 22 (BWCA). The statewide harvest sex ratio has exceeded 60% male in all years except 2021 and 2020 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. When natural foods are poor, reproductive females are far more likely to be shot than in average or good food years.

Harvest by quota vs no-quota zones

Permit availability continuously declined during the decade 2003–2013 (Table 1), and commensurately, 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 was down this year slightly, split evenly between BMUs 11 and 52 (Table 5), as was the proportion of hunters in the no-quota.

Participation of no-quota hunters has declined the last two years from the record high in 2021 (Table 1).

Hunting success by BMU

In 2023, success was at or below the 5-year average in quota zones in all BMUs (Table 7). Many were below the 5-year average due to abundant natural foods and high temperatures during opening weekend. The success rate in the quota zone was nearly 3 times higher than in the no-quota zone (33% vs. 12%, respectively). Success rates in the no-quota were below long-term averages (notably low harvest in BMU 52).

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 about 83% occurs by the end of the 2nd week (Table 8). This year lagged behind this pattern somewhat, due to the abundant crops of natural foods across Minnesota this fall and high temperatures during opening weekend.

Predictions of harvest from food abundance

The 2023 statewide harvest was roughly what was expected, based on regression of harvest as a function of hunter numbers and the fall food productivity index (Figure 5). For the quota zone, the actual harvest in 2023 was nearly the same as predicted by this regression (Figure 6).

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 (Figure 7), 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%). Since 2018, with no reminder mailing, compliance has been 82–87% (Figure 8). Since 2013, hunters could register by phone or internet and pick up a tooth submission envelope later: tooth submission compliance by these hunters has equalized across all registration types. A decreasing proportion of hunters are registering their bear at a registration station over the past years. Compliance with tooth submission was higher in the quota zones than in the no-quota area but was especially low (<80%) in a number of units (BMUs 10, 12, 22, 41, and 52).

Population trend: Statewide and quota vs no-quota zones

A new Bayesian model developed by Allen et al. (2018) for bear monitoring in Wisconsin includes not only the sex-age composition of harvested bears (like the Downing), but also reproductive and survival parameters (obtained from data collected from long-term monitoring of radio-collared bears in different study sites across Minnesota). This model does not have a lag time like the Downing (so projections are available to post-hunt 2022, but the estimation method provides a “dampening” effect on the year-to-year variation in population estimates that results in a flatter curve than expected. The trajectory of this model is robust to assumption violations but is certainly an underestimate when considering our tetracycline estimates. The models for this year indicated that the statewide population has stabilized and is slowly recovering (Figure 9). It is also not dissimilar to the Downing model overall trajectory. Notably, the quota area as a whole has stabilized since 2012 and only had a minor decline after the past 2 years of increased harvest, but the no-quota area has been increasing steadily for the last 20 years. The credible intervals for these 2 estimates are not included for ease of reading.

Trends in harvest rates

The sex ratio of harvested bears varies by age. 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 as individuals, 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 (Fig. 1). Based on this method, harvest rates in recent years have been similar to the early 1980s when the population was similarly small (~15%).

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 (Fig. 10).

**Harvest data extracted from the Status of Minnesota Black Bears, 2023: Final Report to the Bear Committee. 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, 2003–2023.

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Permit applications[a]	16431	16466	16153	15725	16345	17362	17571	18647	19184	18103	18107	18885	18422	19958	21034	21184	20632	22279	24598	25817	26138
Permits available[b]	20110	16450	15950	14850	13200	11850	10000	9500	7050	6000	3750	3750	3700	3850	3350	3350	3400	3575	3575	3605	4035
Licenses purchased (total)	14409	13669	13199	13164	11936	10404	9892	9689	9555	8986	6589	6620	6962	7177	6655	6550	6801	8882	8990	8153	8194
Quota zone [c]	9833	10063	9340	9169	8905	7842	7342	7086	5684	4951	3188	3177	3257	3420	2954	2922	2988	3178	3187	3146	3532
Quota surplus/military [c]	2554	1356	1591	1561	526	233	77	83	1385	1070	578	583	446	441	401	428	417	398	392	505	586
Quota-no limit area-451																		1038	768	595	548
No-quota zone [c]	2022	2238	2268	2434	2505	2329	2473	2520	2486	2965	2823	2860	3259	3316	3300	3200	3396	4262[h]	4643	3907	3528
% Licenses bought																					
Of permits available [d]	61.6	69.4	68.5	72.3	71.4	67.7	73.4	74.6	100	100	100	100	100	100	100	100	100	100	100	100	100
Of permits issued [d]	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	87.8	80.8	89.1	86.1	85.4
Residents in Quota [d]													86.3	88.1	76.6	88.9	87.6	86.6	87.5	88.1	88.6
Estimated no. hunters [e]	13600	12900	12500	12500	11300	9900	9400	9200	9200	8600	6300	6300	6700	6900	6400	6300	6700	8400	8500	8100	8200
Harvest	3598	3391	3340	3290	3172	2135	2801	2699	2131	2604	1866	1627	1971	2641	2040	1766	2340	3203	2971	2251	1802
Harvest sex ratio (%M) [f]	58	57	59	58	57	62	59	59	61	59	62	62	66 [i]	61	63	66 [i]	61	56	59	60	69 [i]
Success rate (%)																					
Total harvest/hunters [g]	26	26	26	26	28	21	30	29	23	30	30	26	30	38	32	28	35	38	35	35	22
Quota harvest/licenses [k]	25	26	25	25	28	21	30	30	24	33	37	33	39 [j]	50 [j]	46	38	49 [j]	57[j,k]	51[k]	42	33 [k]

[a] From 2008 to 2023, 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; 2019 = 3450; 2020 = 3691; 2021 = 4189; 2022 = 4470; 2023 = 4928 (record high in the last two decades).

[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 in 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 2011–2022, all unpurchased licenses were put up for sale and were bought. The percent of resident hunters in the quota area each year includes all license types (regular quota, youth, and surplus licenses). This statistic was added to the report in 2021 and was able to easily back-calculate to 2015.

[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%), 2009 (95.3%), 2018 (92.7%) and 2022 (97.8%). Beginning in 2011 all unpurchased quota licenses were sold as "surplus" in August, and this process is quick and competitive; thus, for 2011–23 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 2023, 1 hunter shot 2 bears.

[h] Record high number of no-quota zone licenses purchased in 2021; record high % of licenses in no-quota zone in 2021 (>50%; see Fig. 4).

[i] Record high % males in statewide harvest.

[j] 2020: record highest success rate in quota zone; 2021: second highest success rate; 2016: third-highest success rate.

[k] In 2020, BMU 451 was broken out of BMU 45 and was an area in the quota zone with an unlimited number of licenses. The quota success rate is calculated without BMU 451 in it to make hunting success estimates comparable across years. The 2023 success rate for BMU 451 is listed in Table 6 and the success rate for the quota area with Area 451 included is 30%.

Table 2. Number of bear hunting quota area permits available, 2019–2023. Highlighted values show a change from the previous year.

BMU	2019	2020	2021	2022	2023
12	150	125	125	100	125
13	250	225	225	225	250
14				10	10
22	50	50	50	50	50
24	200	175	175	135	100
25	500	400	400	360	325
27	225	225	225	225	275
28	60	60	60	60	60
31	550	500	500	425	400
41	150	175	175	200	200
45	150	200	200	250	350
46	350	400	400	450	600
47	40	40	40	40	40
51	900	1000	1000	1075	1250
Total	3400	3575	3575	3605	4035

[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 27 and remaining area of BMU 44 renamed BMU 46.

Table 3. Number of quota BMU permit applicants (Apps), licenses bought (after permits drawn) and surplus licenses bought, 2018–2023[a].

BMU	2018			2019			2020			2021			2022			2023		
	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	703	109	16	711	104	21	751	107	18	891	110	15	931	82	18	923	112	13
13	682	177	47	712	199	26	734	195	30	944	198	27	939	192	33	996	208	42
14													51	7	3	20	8	2
22	76	36	14	61	35	14	69	32	18	73	40	10	51	38	12	99	36	14
24	928	155	20	840	153	22	909	155	20	1072	157	18	1144	122	13	1158	86	14
25	1561	355	44	1520	348	52	1627	367	33	1806	356	44	1836	313	47	1904	291	34
27	1265	204	21	1280	200	25	1338	207	18	1532	200	25	1675	203	22	1634	240	35
28	309	52	8	318	51	9	312	49	11	358	59	1	351	55	5	326	52	8
31	2074	428	71	1907	432	67	2022	444	57	2297	428	72	2222	351	74	2125	342	58
41	648	114	11	661	143	7	663	154	21	841	155	20	848	167	33	831	169	31
45	2383	160	15	2351	178	22	1978	186	14	2241	190	10	2308	222	28	2436	306	44
451[c]									1038			768			595			548
46	2769	317	33	2662	313	37	2853	364	36	3340	364	36	3596	391	59	3527	515	85
47	182	35	5	198	34	6	216	33	7	244	33	7	263	34	6	240	34	6
51	4344	779	123	3956	798	102	4058	885	115	4766	897	105	5106	926	149	4991	1046	204
Total[b]	17924	2921	428	17177	2988	410	18577	3178	1454	20405	3187	1158	21343	3146	1097	21343	3532	1134

[a] Beginning in 2011, all licenses not purchased by permittees were sold as “surplus”. In all cases but three (see footnote b), all of the surplus licenses were purchased. Surplus = Permits available (Table 2) minus Bought licenses (±5 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). This number also includes the permits sold in area 451 (1038 in 2020).

[d] Beginning in 2020, applicants could apply for area 451. This was an area in the quota zone with no limit on the quota and all licenses are considered surplus licenses. This is not an area for lottery or applications; only surplus licenses could be purchased.

Table 4. Proportion of resident bear hunters (2018–2023) for each bear management unit (BMU) in Minnesota.

BMU	2018	2019	2020	2021	2022	2023
10[a]	93.8%	93.0%	97.7%	96.3%	91.8%	83
11[a]	78.6%	74.9%	78.6%	75.1%	69.4%	71
12	83.2%	88.8%	85.6%	86.4%	90.0%	80
13	87.9%	79.2%	77.8%	77.8%	79.6%	82
14					100.0%	90
22	94.0%	91.8%	92.0%	94.0%	92.3%	82
24	94.3%	94.9%	98.3%	96.0%	88.3%	82
25	81.2%	81.3%	82.0%	78.8%	83.8%	80
27	91.1%	88.5%	86.7%	88.0%	89.5%	87
28	60.0%	83.3%	71.7%	68.3%	69.4%	71
31	80.5%	81.6%	73.8%	77.4%	78.6%	80
41	90.4%	86.7%	90.9%	86.9%	90.5%	90
45	99.4%	97.5%	98.0%	96.5%	98.8%	97
46	94.9%	93.2%	92.0%	92.8%	92.5%	91
47	62.5%	90.0%	92.5%	82.5%	82.5%	83
51	94.6%	92.6%	93.1%	92.9%	92.8%	93
52[a]	89.8%	91.9%	92.7%	90.8%	91.7%	91
451			97.2%	96.7%	95.8%	94

[a] No-quota hunters must indicate where they plan to hunt when purchasing their license, but sometimes change their mind or indicate permit areas that are not in bear range. We used the reallocated hunter numbers to account for this discrepancy (see Table 7, bottom).

Table 5. Percent of quota BMU lottery applicants with preference levels 1 (1st-year applicants), 2, 3, 4, and 5 who were drawn for a bear permit during 2018–2023. 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].

BMU	2020					2021					2022						2023				
	Pref 1	Pref 2	Pref 3	Pref 4	Pref 5	Pref 1	Pref 2	Pref 3	Pref 4	Pref 5	Pref 1	Pref 2	Pref 3	Pref 4	Pref 5	Pref 6	Pref 1	Pref 2	Pref 3	Pref 4	Pref 5
12	0	0	0	72		0	0	58			0	0	0	25			0	0	0	10	
13	0	0	93			0	0	66			0	0	43				0	0	26		
14											0	0	0	80			0	0	40		
22	65					56					60						42				
24	0	0	0	93		0	0	0	78		0	0	0	35			0	0	0	0	69
25	0	0	45			0	0	32			0	0	97				0	0	0	70	
27[b]	0	0	0	49		0	0	0	20		0	0	0	0	93		0	0	0	0	92
28[b]	0	0	0	2		0	0	0	0	77	0	0	0	0	61		0	0	0	0	49
31	0	0	33			0	0	9			0	0	0	91			0	0	0	59	
41	0	0	26			0	0	26			0	0	15				0	0	13		
46[b]	0	0	0	0	83	0	0	0	0	58	0	0	0	0	41		0	0	0	0	64
47[b]	0	0	0	18		0	0	0	0	72	0	0	0	0	31		0	0	0	0	31
45	0	0	0	0	23	0	0	0	0	5	0	0	0	0	0	91	0	0	0	0	18
51	0	0	24			0	0	18			0	0	20				0	0	26		

[a] As an example, in 2020: BMU 12: 0% of preference level 1, 2, and 3 applicants were drawn, 72% of preference level 4, and 100% of preference level 5 and above were drawn for a permit; BMU 22: 65% preference level 1 applicants were selected, 100% all higher preference levels; BMU 45: no preference level 1–4 applicants were drawn, 23% of hunters with preference level 5 were drawn, and 100% of hunters with preference level 6 and above were drawn.

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

Table 6. Minnesota bear harvest tally for 2023 by Bear Management Unit (BMU)[a] and sex[b] compared to harvests during 2018–2022 and record high and low harvests (since establishment of each BMU, not counting current year).

BMU	2023 M	(%M)	F	Total	2022	2021	2020	2019	2018	5-year mean	Record low harvest (yr)	Record high harvest (yr)
QUOTA												
12	29	71	12	41	48	71	84	62	66	66	38 (14)	263 (01)
13	77	69	34	111	110	110	126	105	119	113	71 (88)	258 (95)
14	1	100	0	1	0							
22	1	50	1	2	1	3	7	3[d]	4	4	3 (03)	41 (89)
24	27	68	13	40	58	81	97	86	60	76	50 (14)	288 (95)
25	126	68	59	185	176	215	251	224	223	218	149 (96)	584 (01)
26					[133]	[174]	[186]	[169]	[141]	[157]	117 (14)	513 (95)
27	84	63	49	133	101	140	148	128	105	124	105 (18)	148 (20)
28	24	83	5	29	32	34	38	41	36	36	36 (18)	42 (20)
31	107	75	36	143	197	296	325	212	211	248	157 (88)	697 (01)
41	36	62	22	58	85	75	74	76	58	73	35 (15)	201 (01)
44					[228]	[228]	[256]	[203]	[154]	[203]	130 (11)	643 (95)
46	126	68	58	182	211	201	231	181	139	192	139 (18)	231 (20)
47	14	64	8	22	16	27	25	22	15	21	15 (18)	25(16,20)
45	61	68	29	90	121	108	85	108	51	94	32 (11)	178 (01)
451	31	63	18	49	74	110	168					
51	220	70	93	313	350	477	511	411	185[d]	387	185 (18)	895 (01)
Total	964	69	437	1401	1578	1948	2210	1659	1272	1790	1192 (88)	4288 (01)
NO-QUOTA												
11	130	69	58	188	268	386	487[f]	269	287	339	38 (87)	487 (20)
10	54	74	19	73	44	50	29[f]	26	21	34	15 (16)	50 (21)
52	89	64	49	138	351	587	476[f]	386	186	397	105 (02)	587 (21)
60[c]	0	0	0	0	0	0	1	0	0	0		
888[g]	1	50	1	2	9							
Total	274	68	127	401	672	1023	993[e]	681	494	709	198 (87)	1023 (21)
STATE	1247	69	571	1818	2251	2971	3203	2340	1766	2330	1509 (88)	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; 2019:18; 2020:8; 2021:4; 2022:10; 2023:16.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*; 2019:4; 2020:6; 2021:11; 2022:10, 2023:2 *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. Only two bears have been harvested in this zone in our records dating back to 1980.

[g] BMU 888 designates NQ hunters authorized to remove a conflict bear (typically prior to the hunting season).

Notable harvests:

[d] Tie for record low harvest.

[e] Highest harvest since 2007.

[f] Record high harvest for these no-quota zones.

Table 7. Bear hunting success (%) by BMU, measured as the registered harvest divided by the number of licenses sold[a], 2018–2023[a].

BMU	Max success (yr) before 2023		Mean success 2018–2023	2023	2022	2021	2020	2019	2018
12	67	(20)	54	32	55[c]	67[b]	53	43	52
13	59	(95,16)	50	44	49	56[c]	53	45	59[b]
14				10	0				
22	18	(92)	10	4	6	14	8	16	10
24	55	(21)	46	40	46	55[b]	34	46	48[c]
25	63	(21)	56	55	54	63[b]	56	53	57[c]
26	65	(21)	58	48	61[c]	65[b]	49	57	52
27	66	(21)	56	48	62[c]	66[b]	47	53	52
28	70	(18)	61	46	57	63[c]	60	70[d]	53
31	65	(21)	52	35	59[c]	65[b]	42	52	56
41	50	(95)	46	29	43	42	46	49[c]	46
44	58	(21)	48	31	52[c]	58[b]	39	41	48
46	58	(21)	47	30	50[c]	58[b]	39	40	47
47	68	(22)	53	54	68[b]	63[c]	38	43	50
45	54	(22)	45	25	54[b]	43	29	44	40
451			15	9	14	16			
51	51	(21)	41	24	47[c]	51[b]	21	41	46
QUOTA[E]	57	(21)	45	33	51[C]	57[B]	38	46	50
11[F]			23	18	24	23	25	17	28
10[F]			10	14	12	12	9	8	9
52[F]			17	7	23	19	10	14	19
NO QUOTA	32	(95)	20	12	22	24	15	15	21
STATEWIDE	40	(95)	33	21	33	38[C]	27	31	37

[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 (or tied second highest) success.

[d] Highest success ever for any BMU.

[e] In 2020, BMU 451 was broken out of BMU 45 and was an area in the quota zone with an unlimited number of licenses. The quota success rate is calculated without BMU 451 in it to make hunting success estimates comparable across years. The success rate for BMU 451 is listed on its own line in the table.

[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, 1 more was killed there in 2020. Table shows % indicating where they planned to hunt (number of hunters in parentheses for BMU 60 and Quota zone):

BMU	2023	2022	2021	2020		2019	
11	30.1	32.4	34.7	34.3		30.9	
10	14.9	9.1	9.3	8.6		14.3	
52	54.5	58.3	56.0	56.8		52.0	
60 (n)	0.5 (18)	0.3 (10)	0	0.3	(13)	0.3	(11)
Quota zone (n)	0	0	0	0.6	(27)	2.5	(94)

Table 8. Cumulative bear harvest (% of total harvest) by date, 1998–2023.

Year	Day of week for opener	Aug 22/23 – Aug 31	Sep 1 – Sep 7	Sep 1 – Sep 14	Sep 1 – Sep 30
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
2019	Sun		71	83	95
2020	Tues		70	83	94
2021	Wed		66	80	95
2022	Thu		51[a]	72[a]	89
2023	Fri		50[a,b]	66[a,b]	87

[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.

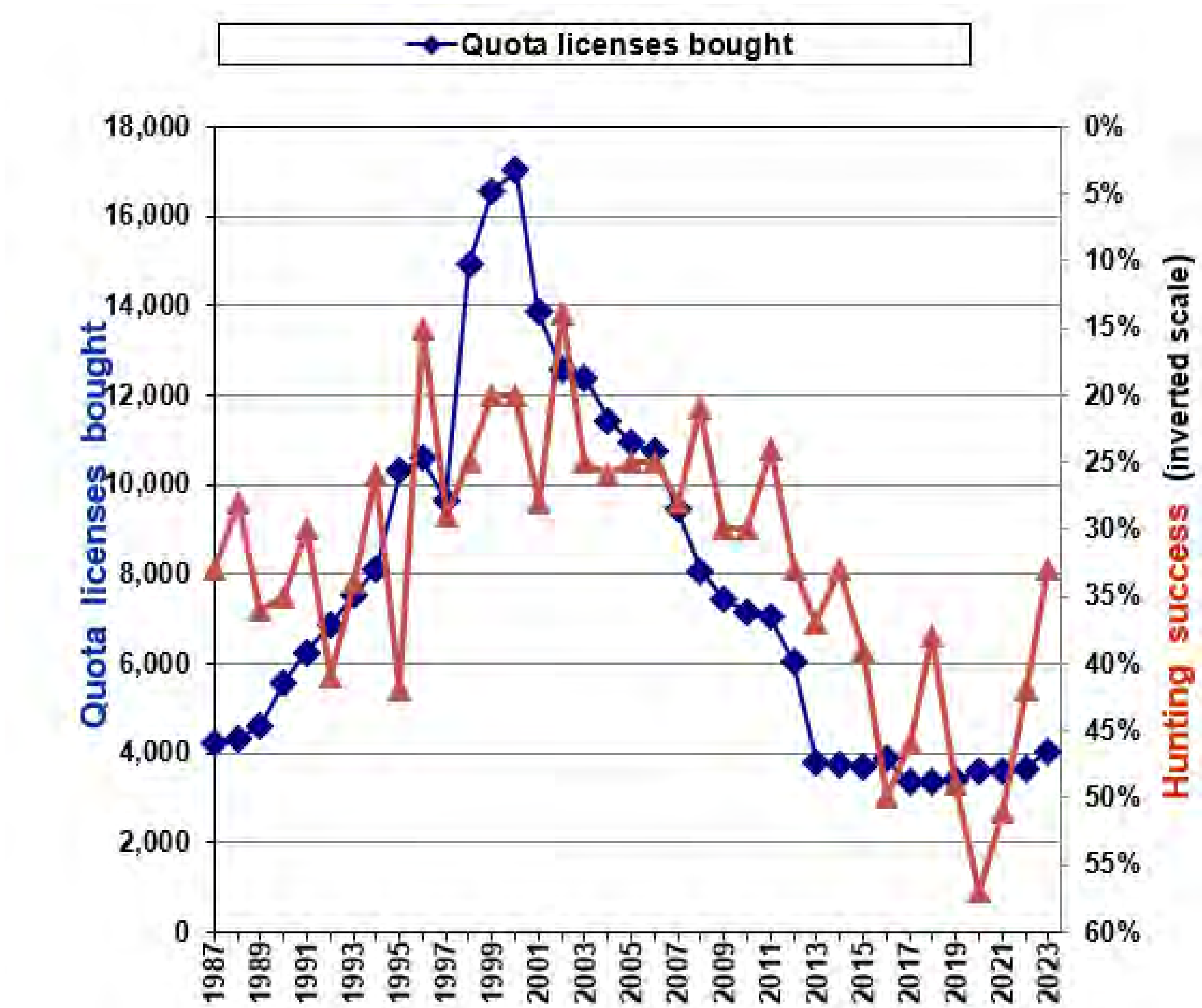

Figure 1. Relationship between licenses sold and hunting success (*note inverted scale*) in quota zone, 1987–2023 (quota and no-quota zones first partitioned in 1987). Number of licenses bought explains 60% of variation in hunting success during this period. Large variation in hunting success is also attributable to food conditions (e.g., during 2013–2023, when licenses were held relatively constant). Statistics from BMU 451 are not included in this graph to allow for quota zone comparisons with the past.

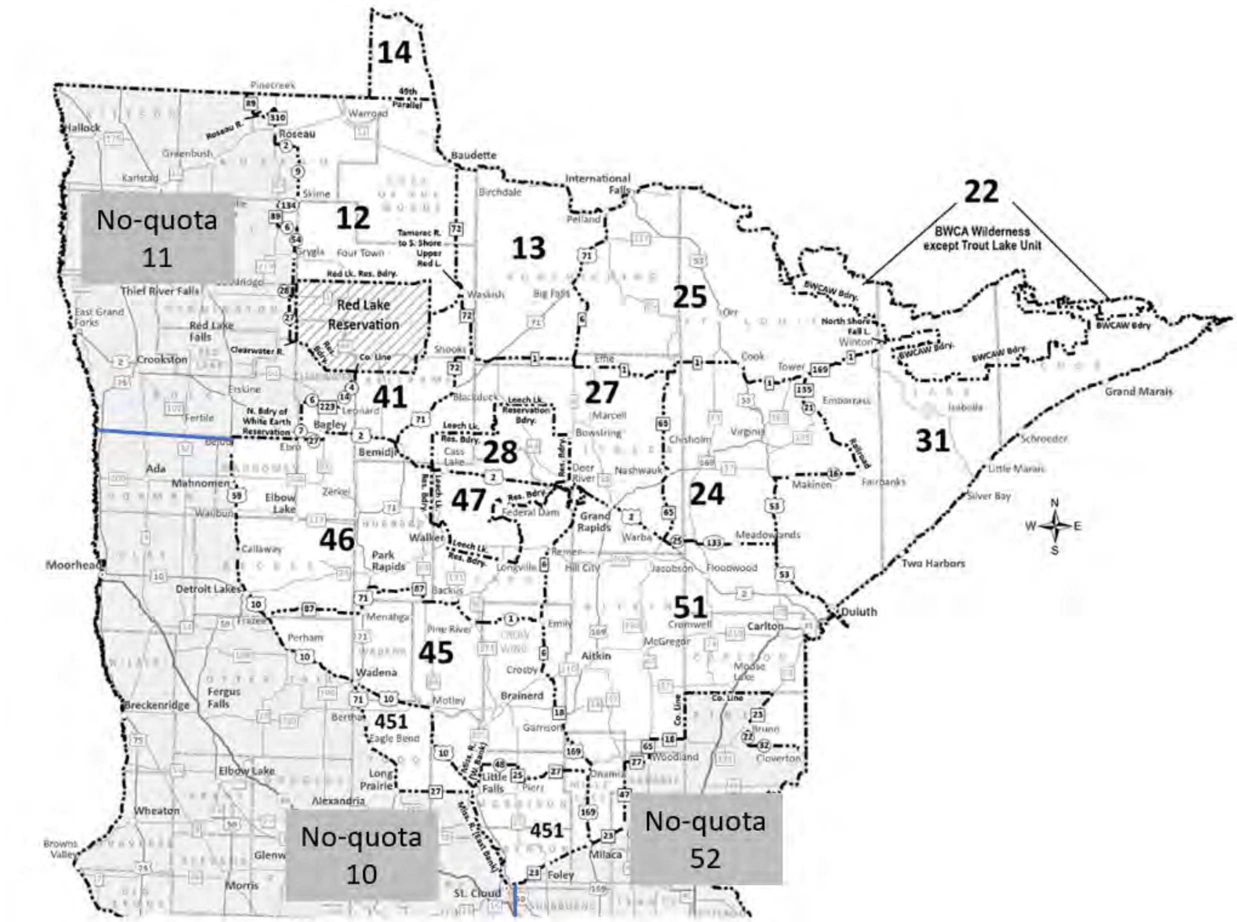

Figure 2. Bear management units (BMUs) within quota (white) and no-quota (gray) zones. Hunters in the quota zone are restricted to a single BMU. In 2016, BMU 26 was divided into 27 and 28, and BMU 44 was split into 46 and 47 (BMUs 28 and 47 comprise the Leech Lake Reservation). BMU 14 was split from BMU 12 in 2022. No-quota hunters can hunt anywhere within the gray-colored zone, including the southeast corner of Minnesota (not shown; designated area 60). In 2020, zone 451 was split from 3 deer permit areas of 45 to relieve crop damage in the area. This area is in the quota-zone, but with an unlimited number of participants.

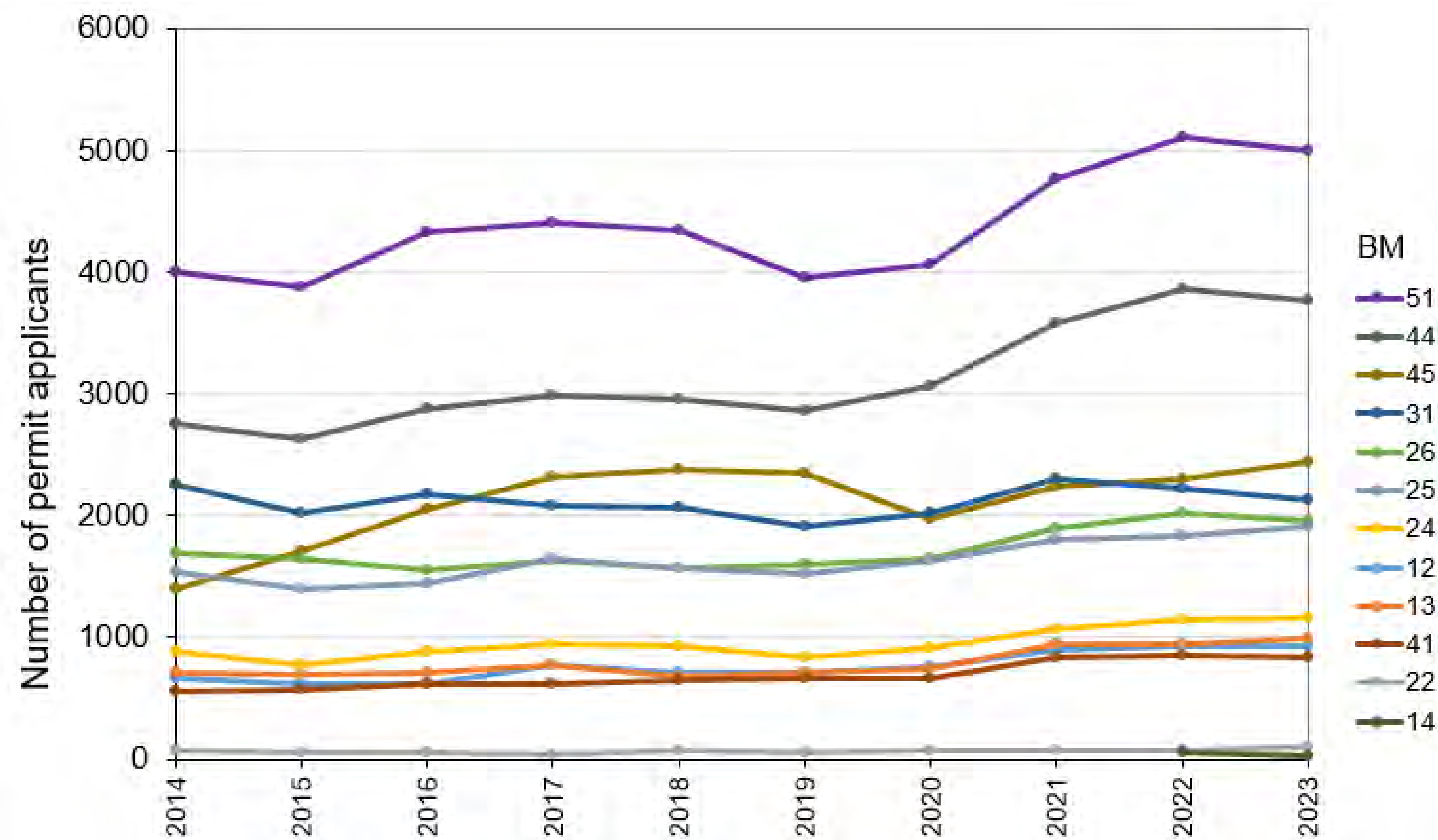

Figure 3. Trends in number of applicants for quota zone permits by BMU over past 10 years, 2014–2023. For 2016–2023, BMUs 27 and 28 were grouped into old BMU 26 and BMUs 46 and 47 were grouped into old BMU 44..

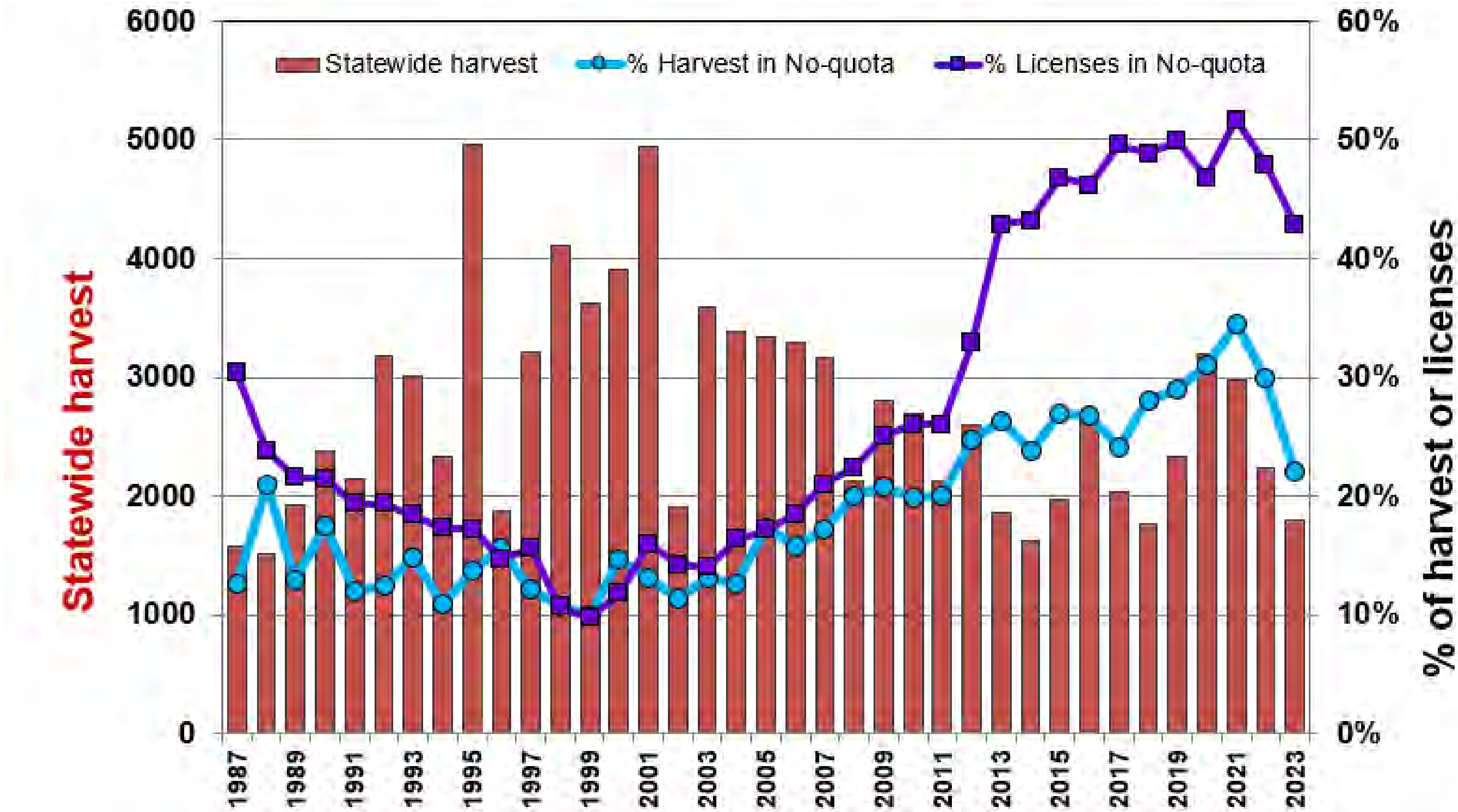

Figure 4. Trends in statewide bear harvest and proportions of harvest and licenses in the no-quota zones, 1987–2023.

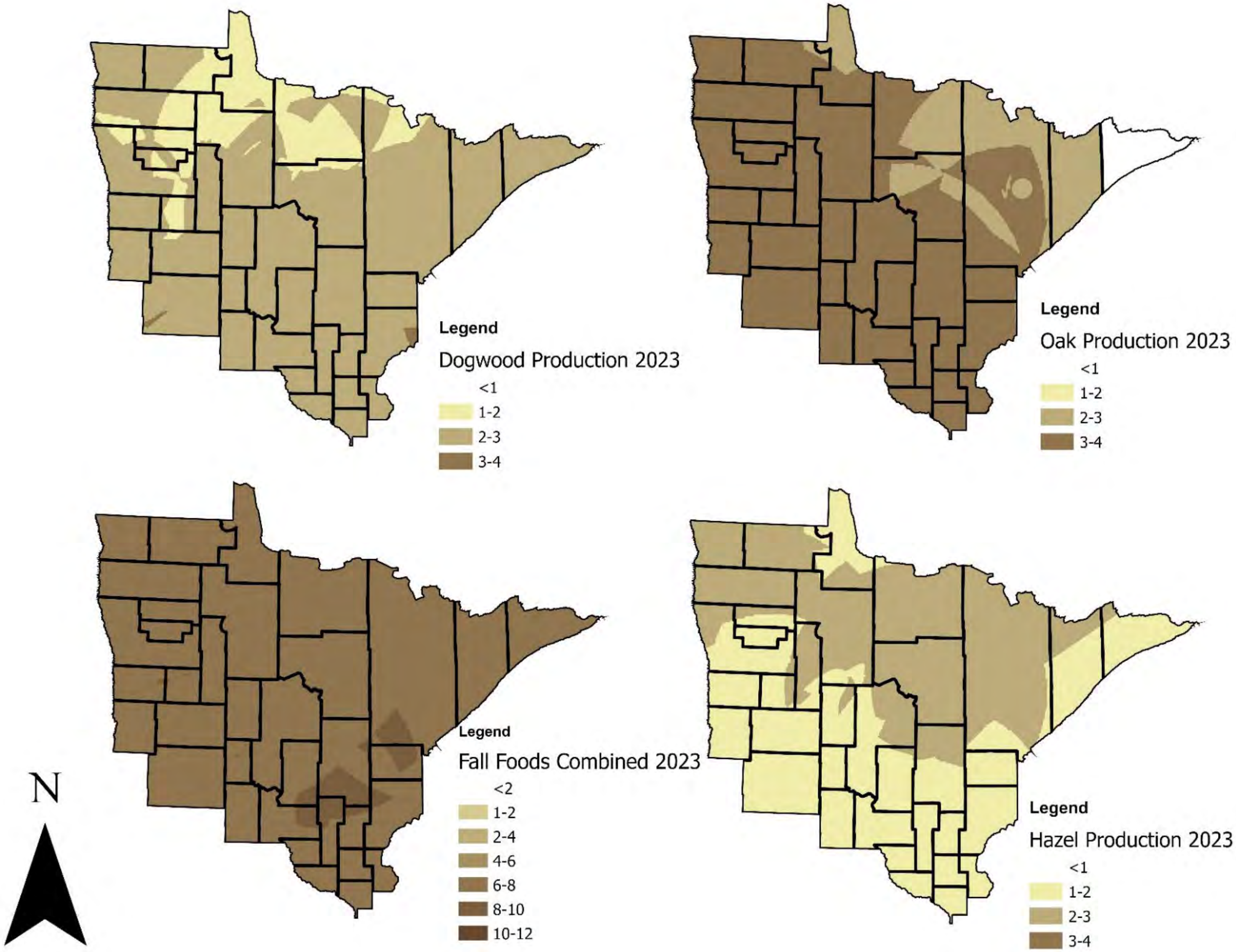

Figure. 5. Production of fall bear foods (dogwood, oak, hazel) across Minnesota, 2023.

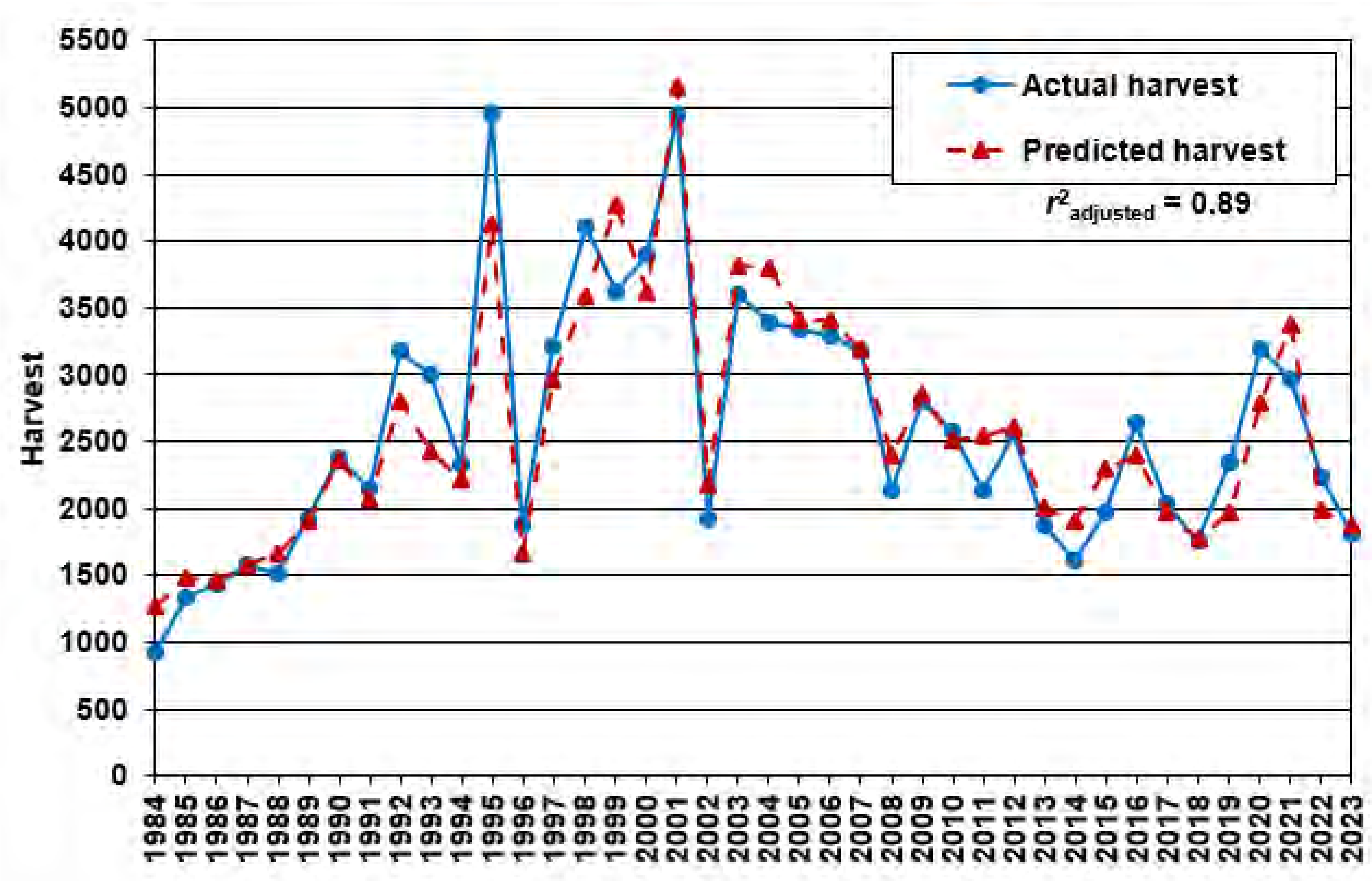

Figure 6. Number of bears harvested vs. number predicted to be harvested based on number of hunters and fall food production statewide 1984–2023. Regression for the dataset included an interaction term between food and hunters to better predict changes in harvest when foods were extremely high or low.

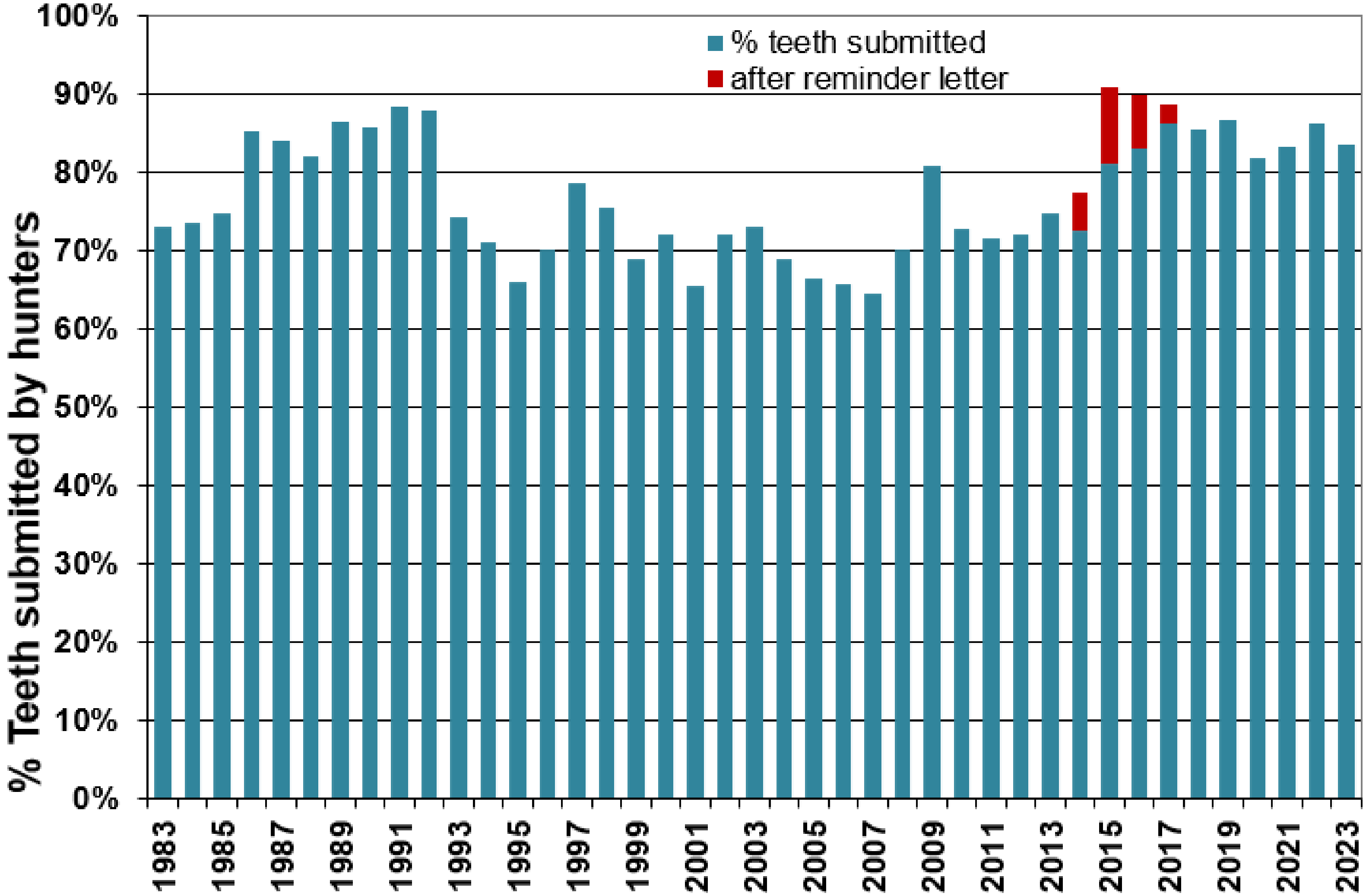

Figure 7. Percent of hunters submitting useable bear teeth for aging (vital for population monitoring, see Figs. 9-10). Cooperation levels exceeded 80% when registration stations were paid to extract teeth (this practice ended in 1993), and in recent years after a series of reminder letters (no letter was sent after 2017).

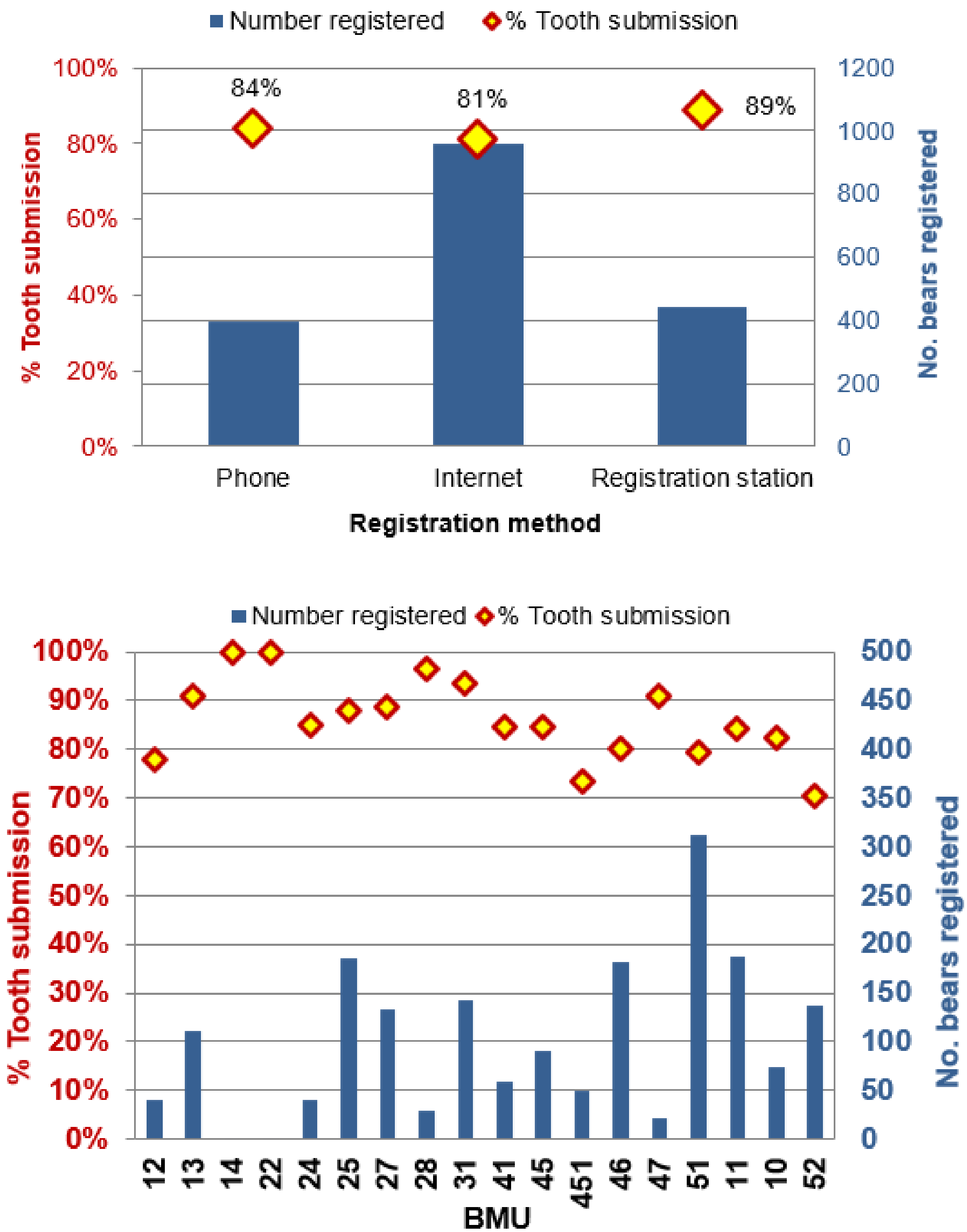

Figure 8. Percent of hunters who submitted a bear tooth in 2023 by method of registration (top panel) and by BMU (bottom panel). Beginning in 2013, hunters could register their bear by phone, internet, and in person at a station. The 2023 statewide submission average (84%; red line, bottom panel) was above the long-term average (77%).

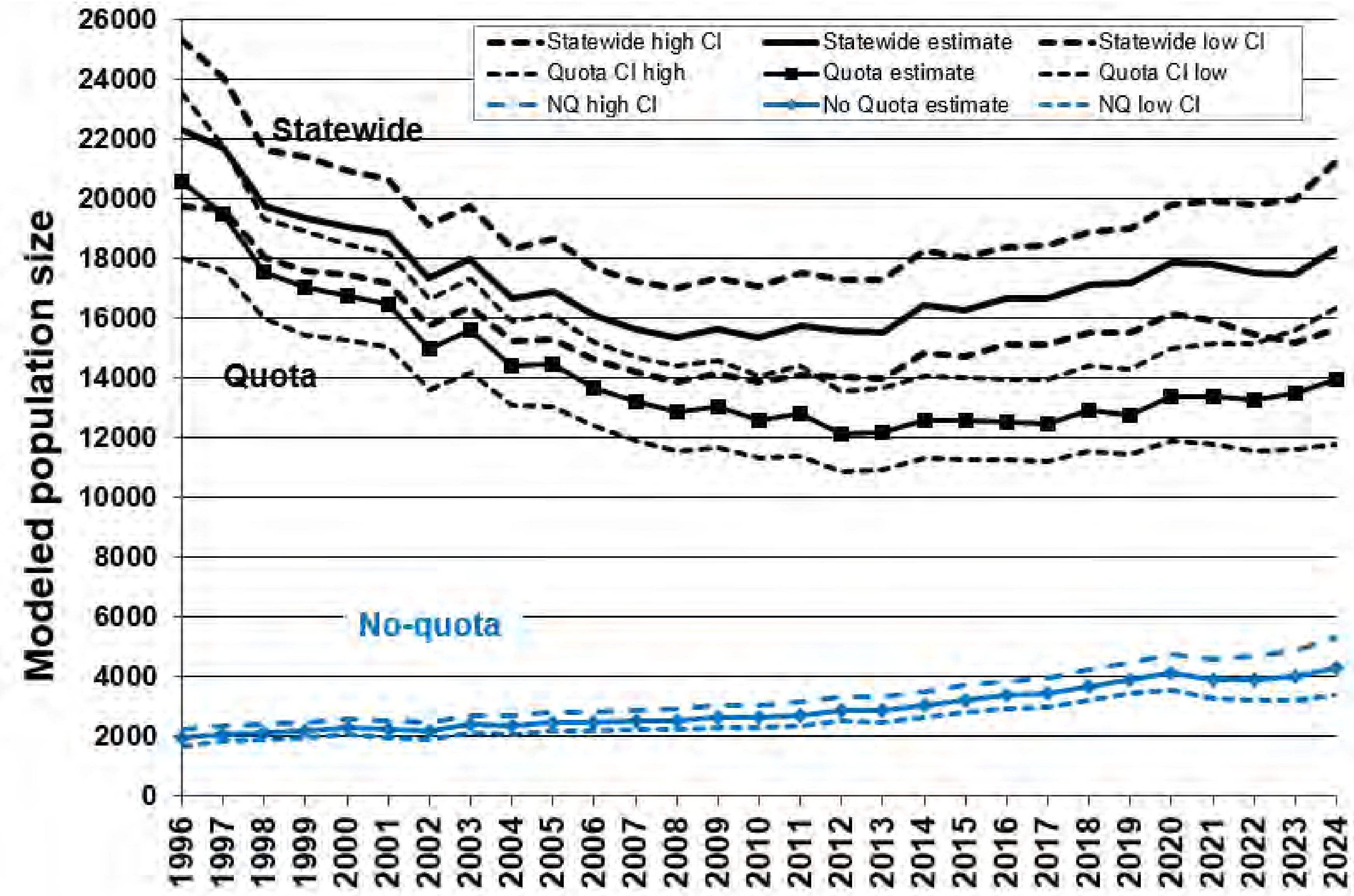

Figure 9. Population trends during 1996–2024 derived from Allen et al. (2018) model statewide estimates (± 95% credible intervals), and population estimates for quota and no-quota zones.

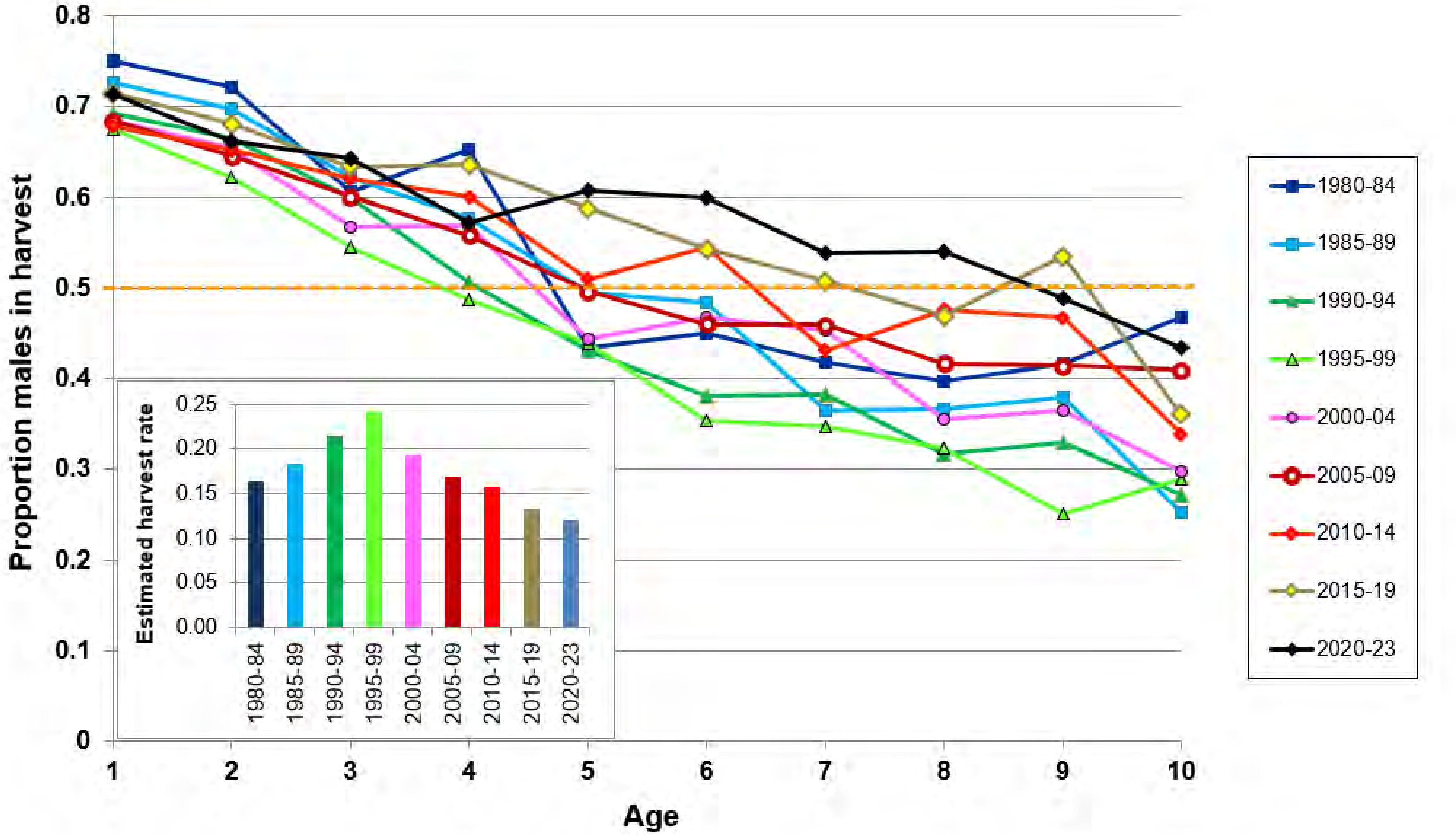

Figure 10. Trends in proportion of male bears in statewide harvest at each age, 1–10 years, grouped in 5-year time blocks, 1980–2023. Higher harvest rates result in steeper curves because males in the living population are reduced faster than females. Fitting a line to the data for each time block and predicting the age at which 50% of the harvest is male (dashed orange horizontal line) yields approximately the inverse of the harvest rate (derived rates are shown in inset). Flatter curves in recent years indicate lower harvest rates (e.g., 2015–19 lower than 1980–84), but a slight increase in recent years.

2023 MINNESOTA DEER HARVEST REPORT

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INTRODUCTION

The white-tailed deer may be considered Minnesota's most popular wildlife species. In 2023, approximately 446,000 hunters participated in the state's deer hunting seasons. Harvest opportunities were generally stable to decreasing, with increased bag limits in only 12 (9%) deer permit areas, decreased limits in 38 areas (29%), and no change in 80 areas (62%) compared to 2022. The early antlerless season was removed from 4 permit areas, bringing the total to 23 areas included in this season. The 2023 deer season focused on stabilizing or reducing deer population growth across much of central Minnesota, particularly in the transition zone and southeastern region, where exceptional habitat exists due to the mix of deciduous forest, prairie, and agriculture. In contrast, management remained conservative in the coniferous forests of north-central and northeastern Minnesota due to severe winter conditions and generally slower local deer population growth. Southwestern Minnesota, dominated by agricultural landscapes, offered slightly more opportunities to harvest antlerless deer. Across the archery, firearms, and muzzleloader seasons, hunters registered a total of 158,678 deer.

METHODS

Every deer taken by hunting in Minnesota must be registered. Hunters may complete registration in person at one of the "Big Game Registration" stations located throughout the state, or they may register their deer electronically via the internet or by telephone. At the time of registration, each deer is recorded as either an adult buck, fawn buck, adult doe, or fawn doe, and additional information including harvest date, deer permit area, weapon type, and season is also collected. In 2016, Chronic Wasting Disease (CWD) was first detected in three wild deer in Fillmore County during routine surveillance efforts. By the start of the 2023 season, 13 deer permit areas were designated as CWD management zones, an increase of two areas compared to 2022. During the 2023 fall hunting seasons, mandatory CWD sampling was required during the opening weekend of the firearms A season. Sampling was mandatory in all CWD management zones, designated as the 600-series deer permit areas, as well as in the surrounding 19 designated surveillance areas. Minnesota's DNR CWD management response within management zones included liberalized hunting opportunities to increase harvest and reduce deer densities. Carcass movement restrictions were also enforced to help prevent the spread of the disease to new areas. Additionally, deer feeding and attractant bans were implemented in counties where both wild and farmed deer tested positive, as well as in adjacent counties.

RESULTS

Outcomes of the 2023 deer harvest are presented in the following tables.

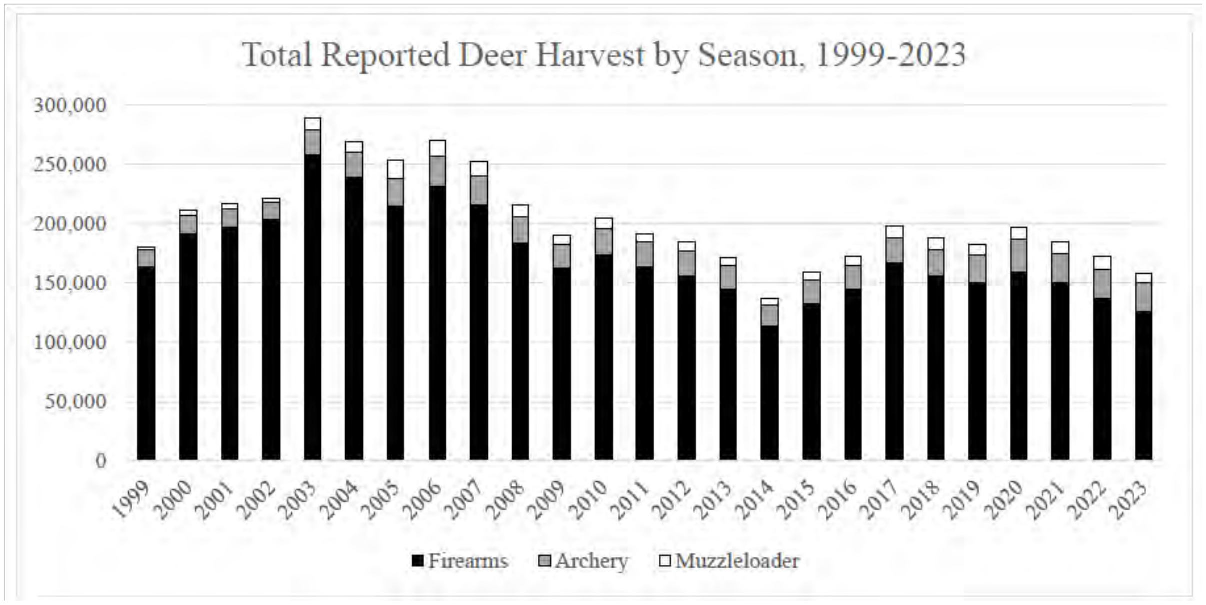

Figure 1. Total deer harvest by season, 1999-2023.

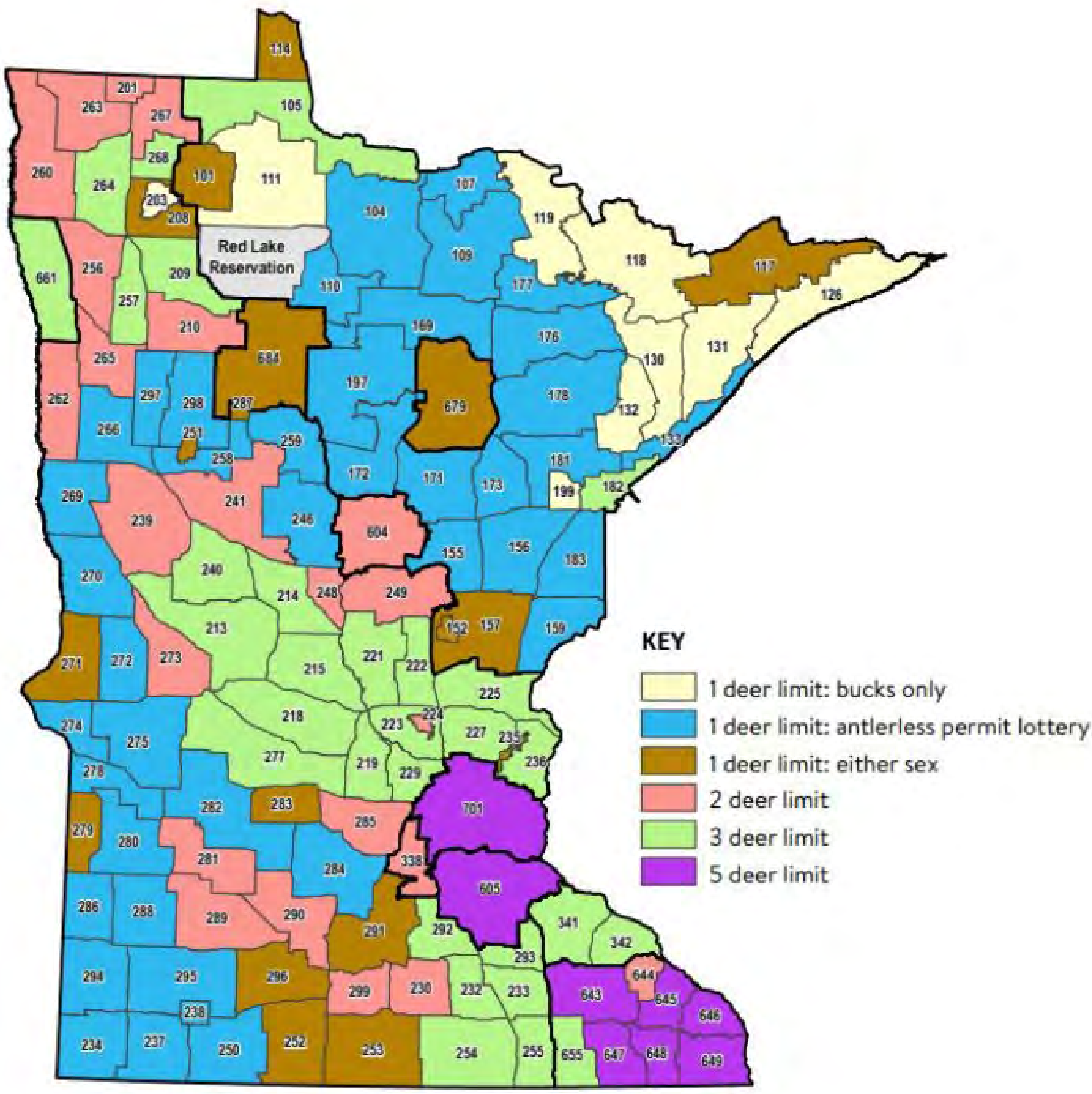

Figure 2. Figure 1. Bag limit designations for deer permit areas in Minnesota for the 2022 deer season.

Table 1. Statewide firearms, archery, and muzzleloader harvest, license sales, and success rates, 2012 – 2023

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
REGULAR FIREARMS												
Resident License Sales	391,822	391,967	374,314	371,612	372,645	368,407	360,873	351,659	354,023	349,387	342,010	331,221
Non-Resident License Sales	12,483	12,496	11,674	13,501	12,540	12,923	12,928	12,239	12,576	13,392	13,534	13,327
Bonus Permit Sales[1]	89,750	97,402	29,642	31,065	44,365	93,309	117,640	131,804	168,814	166,864	171,602	156,795
Youth License Sales[2]	62,949	64,748	62,488	62333	61138	58779	56,989	57,575	58,601	57,320	56,752	54,147
Total License Sales[3]	557,004	566,613	478,118	478,511	490,688	533,418	548,430	553,277	594,014	586,963	583,898	555,490
Registered Buck Harvest	84,729	70,627	69,851	83,939	87,855	88,467	81,772	83,772	85,564	85,737	74,290	72,489
Antlerless Permits Offered	32,854	36,816	26,332	31,065	39,646	20,540	14,023	14,111	20,021	20,773	17,352	16,355
Antlerless Permits Issued	32,854	36,816	26,332	31,065	39,646	20,385	13,971	13,777	20,021	20,773	17,352	15,915
Antlerless Permits App.	67,308	68,811	96,580	95,656	97,056	45,001	29,302	33,191	39,821	42,156	37,386	45,332
Registered AL Harvest	71,140	67,885	44,038	48,758	52,338	79,033	74,203	66,971	74,198	64,399	62,744	53,788
Registered Total Harvest	155,869	145,449	113,889	132,697	144,470	167,500	155,975	150,743	159,762	150,136	137,034	126,277
Registered % Successful[4]	32.0	29.7	25.3	28.9	31.2	33.7	31.7	31.2	33.1	31.8	29.7	28.4
ARCHERY												
Resident License Sales	95,259	92,717	92,301	93,462	92,076	91,875	89,292	85,343	97,399	93,376	90,589	95,619
Non-Resident License Sales	1,814	1,952	1,946	2,032	2,062	2,016	2,020	2,129	2,592	2,668	2,610	2,928
Youth Archery Sales	11,276	12,212	11,965	11,905	10,846	9,961	9,052	8,267	9,312	8,667	8,306	9,466
Total License Sales	108,349	106,881	106,212	107399	104984	103852	100,364	95,739	109,303	104,711	101,505	108,013
Crossbow Harvest												10,439
Vertical Bow Harvest												13,649
Total Archery Harvest	21,605	19,388	17,119	20,074	20,360	21,058	22,665	24,250	27,803	24,443	24,095	24,088
Registered % Successful[4]	18.8	14.5	15.3	16.5	18.5	18.7	20.3	21.1	21.6	19.9	20.0	19.1
MUZZLELOADER												
Total Muzzleloader License Sales	58,363	51,092	43,946	50,176	53,097	51,961	48,589	43,126	55,523	49,833	49,414	49,779
Total Muzzleloader Harvest	7,779	7,045	5,847	6,572	8,383	9,210	10,066	8,644	9,750	10,119	11,136	8,313
Registered % Successful[4]	12.4	12.7	12.7	12.0	15.2	16.6	19	20.0	15.9	18	20	15.2
Antlerless Permits Offered	1,626	2,144	1,593	1,434	1,352	935	874	689	724	907	798	1,295
Antlerless Permits App.	3,743	3,544	4,588	3,393	2,930	1,902	1,592	1,485	1,281	1,511	1,305	2,113
TOTAL Registered Harvest	186,634	172,781	139,442	159,343	173,213	197,768	188,706	183,637	197,315	184,698	172,265	158,678

1 Bonus permits includes disease management and early antlerless permits.
2 Youth license sales include nonresident youth licenses.
3 Total license sales includes bonus permit sales, but does not include free landowner permits.
4 Percentage of unique hunters that harvested at least one deer, calculated by MNDNR number.

Table 2. Deer harvest by season, 2023.

Season	Total Hunters	Antlered Buck Harvest	Antlerless Harvest	Total Harvest	Successful Hunters[3]	Overall Success
Archery	107,991	10,261	13,817	24,078	20,649	19.1%
100 Series A	127,731	18,444	6,723	25,167	24,713	19.3%
200 Series A	228,714	42,753	33,149	75,902	68,543	30.0%
300-600 Series A[1]		6,294	4,550	10,844	9,333	
300-600 Series B[1]	37,691	1,535	2,944	4,479	3,787	34.8%
Metro Firearms (701)	1,709	523	269	792	708	41.4%
Muzzleloader	49,776	3,277	5,036	8,313	7,555	15.2%
Youth[2]	N/A	2,540	3,128	5,668	5,668	N/A
Early Antlerless[2]	N/A	0	2,175	2,175	1,975	N/A
Special Firearms Hunts	2,750	249	422	671	572	20.8%
Late CWD[2]	N/A	153	436	589	370	N/A
Total	**446,213**	**86,029**	**72,649**	**158,678**	**142,790**	**32.0%**

[1]Does not include deer harvested in permit area 679 and 684 (included in 100 Series) or 604, and 661 (included in the 200 series); in 2023 a person could hunt the A or B season in the 600 series regardless of license type and thus hunter numbers and success rates are combined and only an estimate;[2]cannot estimate hunter numbers for youth, early antlerless and late cwd hunts because licenses are not exclusive to those seasons; [3]number of hunters that harvested at least one deer.

Table 3. Total deer harvest per permit area, 2023.

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	391	31	159	13	594	496	0.79	0.41	1.20	80
104	323	4	23	4	354	1,414	0.23	0.02	0.25	123
105	1230	147	1027	141	2545	1,199	1.03	1.10	2.12	49
107	538	25	187	11	761	472	1.14	0.47	1.61	66
109	295	5	40	8	348	1,182	0.25	0.04	0.29	122
110	807	29	227	17	1080	529	1.53	0.52	2.04	51
111	311	1	6	0	318	1,384	0.22	0.01	0.23	125
114	20	1	5	2	28	116	0.17	0.07	0.24	124
117	7	0	1	0	8	927	0.01	0.00	0.01	130
118	364	1	1	0	366	1,220	0.30	0.00	0.30	120
119	228	1	2	0	231	770	0.30	0.00	0.30	120
126	61	0	1	0	62	942	0.06	0.00	0.07	128
130	103	0	2	1	106	746	0.14	0.00	0.14	127
131	18	1	0	0	19	899	0.02	0.00	0.02	129
132	154	1	1	1	157	482	0.32	0.01	0.33	119
133	317	0	31	3	351	352	0.90	0.10	1.00	91
152	81	8	36	2	127	61	1.33	0.75	2.08	50
155	624	22	125	10	781	499	1.25	0.31	1.57	68
156	1066	21	196	16	1299	825	1.29	0.28	1.57	67
157	2309	240	1028	139	3716	888	2.60	1.59	4.19	25
159	1069	46	208	21	1344	571	1.87	0.48	2.35	46
169	653	18	96	15	782	940	0.69	0.14	0.83	98
171	664	33	110	12	819	740	0.90	0.21	1.11	85
172	954	50	227	27	1258	688	1.39	0.44	1.83	57
173	315	7	83	8	413	471	0.67	0.21	0.88	96
176	452	11	103	10	576	921	0.49	0.13	0.63	107
177	423	13	120	7	563	480	0.88	0.29	1.17	82
178	949	45	256	22	1272	1,195	0.79	0.27	1.06	87
181	604	13	85	13	715	629	0.96	0.18	1.14	84
182	438	45	259	30	772	278	1.58	1.20	2.78	39
183	999	32	132	11	1174	663	1.51	0.26	1.77	61
197	667	32	155	17	871	973	0.69	0.21	0.90	93
199	86	3	2	0	91	153	0.56	0.03	0.60	109

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
201	101	7	86	11	205	161	0.63	0.65	1.27	77
203	43	1	3	0	47	118	0.37	0.03	0.40	118
208	228	19	118	13	378	379	0.60	0.40	1.00	90
209	620	91	438	85	1234	640	0.97	0.96	1.93	54
210	733	92	476	82	1383	615	1.19	1.06	2.25	47
213	2320	503	1832	403	5058	1,057	2.20	2.59	4.79	18
214	1685	487	1467	424	4063	554	3.04	4.29	7.33	3
215	1853	552	1510	403	4318	701	2.64	3.52	6.16	9
218	1376	293	1193	230	3092	884	1.56	1.94	3.50	29
219	839	138	629	103	1709	391	2.14	2.22	4.37	24
221	1774	404	1537	335	4050	642	2.76	3.55	6.31	8
222	1262	317	941	214	2734	413	3.05	3.56	6.61	6
223	1087	219	801	142	2249	376	2.89	3.09	5.99	11
224	133	19	58	11	221	47	2.81	1.86	4.67	20
225	2134	384	1510	298	4326	618	3.45	3.55	7.00	4
227	1745	291	1224	210	3470	472	3.70	3.66	7.36	2
229	483	73	294	50	900	284	1.70	1.47	3.17	32
230	326	56	194	30	606	452	0.72	0.62	1.34	76
232	424	63	281	37	805	377	1.13	1.01	2.14	49
233	310	45	224	19	598	381	0.81	0.76	1.57	67
234	194	9	76	4	283	636	0.30	0.14	0.44	114
235	95	11	46	6	158	34	2.82	1.87	4.69	19
236	1092	163	649	82	1986	370	2.95	2.42	5.37	13
237	255	11	88	5	359	608	0.42	0.17	0.59	109
238	84	5	26	1	116	95	0.88	0.34	1.22	79
239	1620	263	1088	214	3185	919	1.76	1.70	3.47	31
240	1876	377	1519	318	4090	643	2.92	3.45	6.36	7
241	2725	559	2343	425	6052	996	2.74	3.34	6.08	10
246	1621	130	557	86	2394	784	2.07	0.99	3.05	35
248	416	54	270	38	778	214	1.94	1.69	3.63	28
249	1198	267	894	180	2539	496	2.42	2.70	5.12	15
250	345	13	131	8	497	713	0.48	0.21	0.70	105
251	47	10	39	9	105	55	0.85	1.05	1.91	55
252	388	25	180	14	607	715	0.54	0.31	0.85	98

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
253	562	34	220	29	845	974	0.58	0.29	0.87	97
254	745	92	466	43	1346	924	0.81	0.65	1.46	72
255	357	45	230	45	677	392	0.91	0.82	1.73	60
256	458	67	290	52	867	654	0.70	0.63	1.33	76
257	440	54	329	49	872	412	1.07	1.05	2.11	48
258	634	37	181	31	883	343	1.85	0.73	2.58	42
259	792	75	355	44	1266	490	1.62	0.97	2.59	41
260	290	30	124	14	458	1,055	0.27	0.16	0.43	116
262	237	28	127	24	416	677	0.35	0.26	0.61	107
263	535	51	376	67	1029	706	0.76	0.70	1.46	71
264	852	91	728	99	1770	669	1.27	1.37	2.65	40
265	479	60	328	63	930	494	0.97	0.91	1.88	55
266	419	20	106	6	551	617	0.68	0.21	0.89	93
267	343	39	273	45	700	472	0.73	0.76	1.48	70
268	334	45	261	36	676	228	1.46	1.50	2.96	34
269	294	15	78	8	395	650	0.45	0.16	0.61	108
270	191	12	37	7	247	748	0.26	0.07	0.33	118
271	293	11	98	12	414	632	0.46	0.19	0.66	104
272	267	4	54	7	332	531	0.50	0.12	0.63	106
273	496	61	341	70	968	571	0.87	0.83	1.69	63
274	265	21	100	16	402	354	0.75	0.39	1.13	82
275	563	20	178	14	775	957	0.59	0.22	0.81	100
277	1905	316	1547	245	4013	1,058	1.80	1.99	3.79	27
278	405	24	138	13	580	402	1.01	0.44	1.44	73
279	213	15	114	16	358	344	0.62	0.42	1.04	86
280	226	9	67	6	308	675	0.34	0.12	0.46	113
281	620	60	437	39	1156	575	1.08	0.93	2.01	51
282	165	5	36	3	209	1,127	0.15	0.04	0.19	126
283	326	25	137	19	507	337	0.97	0.54	1.50	69
284	435	14	139	17	605	838	0.52	0.20	0.72	102
285	531	58	308	33	930	549	0.97	0.73	1.69	61
286	272	25	120	19	436	446	0.61	0.37	0.98	90
287	28	5	21	1	55	46	0.61	0.59	1.20	77
288	344	22	172	18	556	625	0.55	0.34	0.89	92
289	260	26	200	26	512	815	0.32	0.31	0.63	104
290	536	60	374	48	1018	662	0.81	0.73	1.54	67

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
290	536	60	374	48	1018	662	0.81	0.73	1.54	67
291	909	103	444	48	1504	800	1.14	0.74	1.88	56
292	572	84	385	47	1088	362	1.58	1.43	3.01	32
293	410	69	234	68	781	278	1.47	1.33	2.81	35
294	272	22	156	11	461	686	0.40	0.28	0.67	102
295	569	25	211	22	827	959	0.59	0.27	0.86	95
296	402	23	204	13	642	667	0.60	0.36	0.96	89
297	118	3	20	4	145	438	0.27	0.06	0.33	116
298	413	10	58	10	491	618	0.67	0.13	0.79	99
299	403	53	306	35	797	386	1.04	1.02	2.06	48
338	325	46	211	26	608	316	1.03	0.90	1.92	53
341	1451	254	1124	205	3034	603	2.41	2.63	5.03	16
342	924	165	740	153	1982	350	2.64	3.02	5.66	12
604	1439	303	1129	203	3074	673	2.14	2.43	4.57	21
605	1279	299	1034	209	2821	1192	1.07	1.29	2.37	40
643	1409	265	1130	235	3039	671	2.10	2.43	4.53	23
644	470	103	321	83	977	186	2.53	2.73	5.25	14
645	674	156	495	174	1499	330	2.04	2.50	4.54	22
646	1098	222	761	198	2279	319	3.44	3.70	7.14	3
647	606	121	423	97	1247	434	1.40	1.48	2.87	34
648	767	174	565	163	1669	332	2.31	2.72	5.03	17
649	1539	328	1204	312	3383	492	3.13	3.75	6.88	5
655	235	41	130	25	431	387	0.61	0.51	1.11	82
661	224	27	151	27	429	795	0.28	0.26	0.54	111
679	1044	147	757	98	2046	1024	1.02	0.98	2.00	51
684	1578	171	800	137	2686	1,235	1.28	0.90	2.17	43
701	1308	175	851	128	2462	1324	0.99	0.87	1.86	57
Total	**85,502**	**11,802**	**50,590**	**9,066**	**156,960**	**78,843**	**1.08**	**0.91**	**1.99**	

Table 4. Archery season harvest by DPA, excluding special hunts, 2023.

Permit Area	Land Area	Archery Hunters	Archery hunters per sq. mile	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
101	496	218	0.44	6	2	8	0	16
104	1,414	87	0.06	6	1	0	0	7
105	1,199	787	0.66	39	11	79	6	135
107	472	283	0.60	27	1	19	0	47
109	1,182	108	0.09	6	1	4	0	11
110	529	346	0.65	20	3	17	1	41
111	1,384	80	0.06	5	0	0	0	5
114	116	37	0.32	3	0	0	0	3
117	927	16	0.02	1	0	0	0	1
118	1,220	207	0.17	19	0	0	0	19
119	770	77	0.10	4	0	0	0	4
126	942	99	0.11	7	0	1	0	8
130	746	84	0.11	3	0	1	0	4
131	899	64	0.07	2	0	0	0	2
132	482	93	0.19	5	1	0	1	7
133	352	308	0.88	30	0	11	0	41
152	61	151	2.47	7	0	1	0	8
155	499	709	1.42	31	0	28	2	61
156	825	1016	1.23	48	3	46	1	98
157	888	2197	2.48	137	9	70	6	222
159	571	1140	2.00	58	3	30	1	92
169	940	526	0.56	23	3	24	0	50
171	740	659	0.89	25	3	21	3	52
172	688	1088	1.58	40	6	48	3	97
173	471	321	0.68	9	0	16	3	28
176	921	477	0.52	20	5	27	2	54
177	480	290	0.60	21	0	12	2	35
178	1,195	949	0.79	43	4	57	3	107
181	629	592	0.94	28	2	19	2	51
182	278	1302	4.69	115	15	100	11	241
183	663	851	1.28	43	3	27	1	74
197	973	483	0.50	16	2	19	2	39
199	153	52	0.34	5	0	2	0	7
201	161	80	0.50	10	1	8	0	19

Permit Area	Land Area	Archery Hunters	Archery hunters per sq. mile	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
203	118	22	0.19	2	0	0	0	2
208	379	122	0.32	4	0	4	0	8
209	640	393	0.61	38	8	39	5	90
210	615	581	0.94	30	4	38	6	78
213	1,057	2963	2.80	180	44	358	23	605
214	554	1847	3.33	127	40	212	33	412
215	701	2698	3.85	253	70	365	42	730
218	884	2242	2.54	176	31	303	34	544
219	391	1692	4.32	178	32	178	18	406
221	642	2015	3.14	149	20	259	33	461
222	413	1596	3.86	87	16	142	19	264
223	376	2719	7.24	264	48	314	34	660
224	47	328	6.93	31	6	16	2	55
225	618	2872	4.65	234	55	323	36	648
227	472	3256	6.90	418	63	459	57	997
229	284	1153	4.06	112	20	96	12	240
230	452	436	0.96	43	5	43	3	94
232	377	573	1.52	62	7	64	4	137
233	381	515	1.35	63	8	93	3	167
234	636	296	0.47	34	0	10	0	44
235	34	306	9.08	22	3	17	4	46
236	370	2276	6.15	336	53	294	27	710
237	608	307	0.50	24	2	11	1	38
238	95	90	0.95	7	3	6	0	16
239	919	1679	1.83	94	27	130	11	262
240	643	1829	2.85	123	25	203	22	373
241	996	3197	3.21	178	30	322	35	565
246	784	1418	1.81	94	6	56	0	156
248	214	659	3.08	47	8	50	4	109
249	496	1270	2.56	82	16	107	10	215
250	713	397	0.56	57	1	24	1	83
251	55	42	0.76	1	0	4	0	5
252	715	392	0.55	57	2	27	2	88
253	974	566	0.58	93	3	39	2	137
254	924	863	0.93	121	16	101	7	245

Permit Area	Land Area	Archery Hunters	Archery hunters per sq. mile	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
255	392	605	1.54	73	9	72	12	166
256	654	345	0.53	23	5	25	1	54
257	412	301	0.73	31	5	43	8	87
258	343	613	1.79	39	2	28	5	74
259	490	736	1.50	38	2	40	1	81
260	1,055	178	0.17	22	2	9	0	33
262	677	277	0.41	45	4	32	2	83
263	706	302	0.43	16	2	24	3	45
264	669	470	0.70	31	9	51	6	97
265	494	367	0.74	29	3	39	2	73
266	617	368	0.60	30	0	15	1	46
267	472	195	0.41	18	1	12	1	32
268	228	203	0.89	17	1	38	7	63
269	650	393	0.60	40	2	14	1	57
270	748	242	0.32	17	2	11	2	32
271	632	263	0.42	40	2	12	1	55
272	531	180	0.34	18	2	4	0	24
273	571	765	1.34	58	7	80	11	156
274	354	310	0.87	30	2	17	5	54
275	957	574	0.60	49	1	19	2	71
277	1,058	2835	2.68	250	33	376	23	682
278	402	409	1.02	41	3	16	1	61
279	344	148	0.43	23	1	10	1	35
280	675	288	0.43	26	3	13	0	42
281	575	820	1.43	85	10	105	5	205
282	1,127	211	0.19	24	0	14	1	39
283	337	355	1.05	48	1	15	1	65
284	838	589	0.70	71	2	30	3	106
285	549	1022	1.86	113	9	87	6	215
286	446	237	0.53	19	1	12	2	34
287	46	15	0.33	2	1	2	0	5
288	625	581	0.93	45	4	35	2	86
289	815	318	0.39	23	2	43	0	68
290	662	708	1.07	67	6	67	4	144
291	800	1271	1.59	166	9	102	13	290

Permit Area	Land Area	Archery Hunters	Archery hunters per sq. mile	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
292	362	966	2.67	108	10	105	10	233
293	278	549	1.97	59	9	66	17	151
294	686	237	0.35	26	4	14	0	44
295	959	595	0.62	56	3	51	4	114
296	667	427	0.64	53	0	20	2	75
297	438	107	0.24	5	0	1	0	6
298	618	332	0.54	12	0	6	1	19
299	386	687	1.78	58	11	93	4	166
338	316	778	2.46	59	5	68	5	137
341	603	2247	3.73	297	41	315	38	691
342	350	1405	4.01	171	28	179	26	404
604	673	2434	3.62	186	29	231	28	474
605	1192	3398	2.85	355	97	426	67	945
643	671	2379	3.55	390	86	442	61	979
644	186	763	4.10	73	12	36	18	139
645	330	1036	3.14	115	26	123	32	296
646	319	1318	4.13	192	31	179	36	438
647	434	806	1.86	105	15	92	8	220
648	332	1034	3.11	117	33	140	34	324
649	492	1892	3.85	268	43	224	49	584
655	387	309	0.80	32	9	29	2	72
661	795	198	0.25	24	4	29	1	58
679	1024	1374	1.34	76	9	65	4	154
684	1,235	1584	1.28	100	4	61	6	171
701	1324	4131	3.12	757	121	608	94	1580
Total	**78,843**	**107,867**	**1.37**	**10,044**	**1,529**	**10,517**	**1,220**	**23,310**

Table 5. Total 2023 firearms season harvest by DPA. Does not include youth, early antlerless, late CWD, or special firearms 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	1857	3.7	367	24	131	11	533	0.74	0.33	1.08
104	1,414	1489	1.1	301	1	18	4	324	0.21	0.02	0.23
105	1,199	5480	4.6	1102	118	862	123	2205	0.92	0.92	1.84
107	472	2209	4.7	483	19	146	11	659	1.02	0.37	1.40
109	1,182	1691	1.4	276	4	30	7	317	0.23	0.03	0.27
110	529	3579	6.8	741	20	178	12	951	1.40	0.40	1.80
111	1,384	1169	0.8	299	1	4	0	304	0.22	0.00	0.22
114	116	101	0.9	15	1	4	2	22	0.13	0.06	0.19
117	927	91	0.1	6	0	1	0	7	0.01	0.00	0.01
118	1,220	2293	1.9	330	1	1	0	332	0.27	0.00	0.27
119	770	1673	2.2	223	1	2	0	226	0.29	0.00	0.29
126	942	778	0.8	54	0	0	0	54	0.06	0.00	0.06
130	746	984	1.3	97	0	0	1	98	0.13	0.00	0.13
131	899	447	0.5	16	1	0	0	17	0.02	0.00	0.02
132	482	1345	2.8	148	0	1	0	149	0.31	0.00	0.31
133	352	1596	4.5	280	0	19	3	302	0.80	0.06	0.86
152	61	745	12.2	73	8	35	2	118	1.19	0.74	1.93
155	499	4361	8.7	579	21	77	7	684	1.16	0.21	1.37
156	825	7135	8.6	986	15	118	12	1131	1.20	0.18	1.37
157	888	11826	13.3	2097	218	881	125	3321	2.36	1.38	3.74
159	571	6040	10.6	980	40	163	18	1201	1.72	0.39	2.10
169	940	5085	5.4	617	13	48	13	691	0.66	0.08	0.74
171	740	5164	7.0	617	27	77	5	726	0.83	0.15	0.98
172	688	7756	11.3	888	37	155	23	1103	1.29	0.31	1.60
173	471	2638	5.6	299	6	62	5	372	0.63	0.15	0.79
176	921	4128	4.5	419	4	56	6	485	0.45	0.07	0.53
177	480	3136	6.5	384	12	95	5	496	0.80	0.23	1.03
178	1,195	7097	5.9	876	34	163	16	1089	0.73	0.18	0.91
181	629	4157	6.6	561	9	60	7	637	0.89	0.12	1.01
182	278	1949	7.0	315	29	145	18	507	1.13	0.69	1.82
183	663	6070	9.2	920	28	87	7	1042	1.39	0.18	1.57
197	973	4560	4.7	636	23	120	14	793	0.65	0.16	0.82
199	153	416	2.7	78	2	0	0	80	0.51	0.01	0.52
201	161	432	2.7	78	4	70	10	162	0.48	0.52	1.
203	118	177	1.5	39	0	3	0	42	0.33	0.03	0.36

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	1000	2.6	188	17	100	12	317	0.50	0.34	0.84
209	640	2468	3.9	521	68	321	68	978	0.81	0.71	1.53
210	615	3936	6.4	659	80	379	66	1184	1.07	0.85	1.92
213	1,057	9973	9.4	1948	401	1186	332	3867	1.84	1.82	3.66
214	554	7359	13.3	1455	345	921	286	3007	2.63	2.80	5.43
215	701	7452	10.6	1431	367	735	274	2807	2.04	1.96	4.00
218	884	5898	6.7	1085	197	627	149	2058	1.23	1.10	2.33
219	391	3304	8.4	596	85	314	60	1055	1.52	1.17	2.70
221	642	6513	10.1	1473	289	938	232	2932	2.30	2.27	4.57
222	413	5618	13.6	1100	245	591	154	2090	2.66	2.39	5.06
223	376	3747	10.0	765	140	359	80	1344	2.04	1.54	3.58
224	47	561	11.9	99	10	37	8	154	2.09	1.16	3.26
225	618	7927	12.8	1794	273	963	217	3247	2.90	2.35	5.25
227	472	5074	10.8	1227	179	554	106	2066	2.60	1.78	4.38
229	284	1601	5.6	339	36	130	32	537	1.19	0.70	1.89
230	452	1368	3.0	251	42	116	25	434	0.56	0.40	0.96
232	377	1533	4.1	313	47	169	26	555	0.83	0.64	1.47
233	381	868	2.3	215	30	92	15	352	0.56	0.36	0.92
234	636	805	1.3	139	9	60	4	212	0.22	0.11	0.33
235	34	378	11.2	70	8	21	2	101	2.08	0.92	3.00
236	370	2938	7.9	715	93	280	45	1133	1.93	1.13	3.06
237	608	985	1.6	199	7	67	4	277	0.33	0.13	0.46
238	95	267	2.8	66	2	18	1	87	0.69	0.22	0.92
239	919	7687	8.4	1402	202	827	184	2615	1.53	1.32	2.85
240	643	7839	12.2	1641	304	1113	251	3309	2.55	2.60	5.15
241	996	12901	13.0	2386	473	1727	344	4930	2.40	2.55	4.95
246	784	9372	12.0	1459	109	429	79	2076	1.86	0.79	2.65
248	214	1952	9.1	343	42	194	31	610	1.60	1.25	2.85
249	496	5550	11.2	1070	239	712	158	2179	2.16	2.24	4.39
250	713	1288	1.8	243	11	87	6	347	0.34	0.15	0.49
251	55	396	7.2	44	8	35	9	96	0.80	0.95	1.75
252	715	1290	1.8	286	17	131	11	445	0.40	0.22	0.62
253	974	1867	1.9	403	22	135	18	578	0.41	0.18	0.59
254	924	2415	2.6	566	58	284	32	940	0.61	0.40	1.02
255	392	1080	2.8	261	31	126	31	449	0.67	0.48	1.15
256	654	2077	3.2	383	56	223	45	707	0.59	0.50	1.08

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
257	412	1838	4.5	368	43	243	38	692	0.89	0.79	1.68
258	343	3924	11.5	561	34	141	25	761	1.64	0.58	2.22
259	490	5709	11.7	717	70	280	39	1106	1.46	0.79	2.26
260	1,055	1263	1.2	225	23	103	13	364	0.21	0.13	0.35
262	677	873	1.3	161	22	61	16	260	0.24	0.15	0.38
263	706	2233	3.2	438	43	292	58	831	0.62	0.56	1.18
264	669	3540	5.3	702	75	547	87	1411	1.05	1.06	2.11
265	494	2054	4.2	396	48	247	56	747	0.80	0.71	1.51
266	617	1739	2.8	335	16	72	4	427	0.54	0.15	0.69
267	472	1300	2.8	269	33	220	41	563	0.57	0.62	1.19
268	228	1278	5.6	277	34	182	24	517	1.21	1.05	2.26
269	650	1248	1.9	217	10	44	6	277	0.33	0.09	0.43
270	748	959	1.3	147	9	21	5	182	0.20	0.05	0.24
271	632	1112	1.8	209	8	62	10	289	0.33	0.13	0.46
272	531	1086	2.0	218	1	40	7	266	0.41	0.09	0.50
273	571	2769	4.8	400	50	219	50	719	0.70	0.56	1.26
274	354	1060	3.0	206	18	61	9	294	0.58	0.25	0.83
275	957	2577	2.7	451	17	137	12	617	0.47	0.17	0.64
277	1,058	8352	7.9	1453	212	785	157	2607	1.37	1.09	2.46
278	402	1783	4.4	312	18	91	11	432	0.78	0.30	1.08
279	344	1134	3.3	163	10	90	11	274	0.47	0.32	0.80
280	675	1122	1.7	184	6	46	4	240	0.27	0.08	0.36
281	575	2623	4.6	462	40	247	28	777	0.80	0.55	1.35
282	1,127	742	0.7	117	4	16	2	139	0.10	0.02	0.12
283	337	1209	3.6	243	17	90	16	366	0.72	0.36	1.09
284	838	1750	2.1	322	8	86	11	427	0.38	0.13	0.51
285	549	2208	4.0	370	43	183	23	619	0.67	0.45	1.13
286	446	1371	3.1	209	21	94	17	341	0.47	0.30	0.76
287	46	283	6.2	25	4	15	1	45	0.55	0.44	0.98
288	625	1793	2.9	262	17	110	16	405	0.42	0.23	0.65
289	815	1238	1.5	196	18	122	22	358	0.24	0.20	0.44
290	662	2379	3.6	394	47	239	34	714	0.60	0.48	1.08
291	800	3387	4.2	648	71	266	28	1013	0.81	0.46	1.27
292	362	2403	6.6	416	61	209	27	713	1.15	0.82	1.97
293	278	1282	4.6	308	51	125	40	524	1.11	0.78	1.88
294	686	1213	1.8	203	13	119	9	344	0.30	0.21	0.50

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
295	959	2201	2.3	427	20	126	14	587	0.45	0.17	0.61
296	667	1679	2.5	301	18	142	9	470	0.45	0.25	0.71
297	438	928	2.1	105	1	12	2	120	0.24	0.03	0.27
298	618	2949	4.8	381	7	41	7	436	0.62	0.09	0.71
299	386	1573	4.1	312	37	166	24	539	0.81	0.59	1.40
338	316	1332	4.2	241	37	118	16	412	0.76	0.54	1.30
341	603	4902	8.1	1056	183	639	143	2021	1.75	1.60	3.35
342	350	3362	9.6	662	108	404	100	1274	1.89	1.75	3.64
604	673	7939	11.8	1213	259	839	170	2481	1.80	1.88	3.69
605	1192	4663	3.9	840	164	492	110	1606	0.70	0.64	1.35
643	671	3944	5.9	922	145	548	147	1762	1.37	1.25	2.63
644	186	2239	12.0	373	82	260	61	776	2.01	2.17	4.17
645	330	2572	7.8	516	117	313	123	1069	1.56	1.68	3.24
646	319	3415	10.7	822	161	458	143	1584	2.58	2.39	4.97
647	434	2389	5.5	442	91	267	77	877	1.02	1.00	2.02
648	332	2952	8.9	597	114	340	107	1158	1.80	1.69	3.49
649	492	5143	10.5	1174	246	816	211	2447	2.39	2.59	4.97
655	387	778	2.0	184	29	91	23	327	0.48	0.37	0.84
661	795	716	0.9	177	19	91	21	308	0.22	0.16	0.39
679	1024	8196	8.0	941	126	633	87	1787	0.92	0.83	1.75
684	1,235	10491	8.5	1439	153	676	125	2393	1.17	0.77	1.94
701	1324	1709	1.3	523	46	195	28	792	0.40	0.20	0.60
Total	**78,843**	**395,847**	**5.0**	**69,547**	**8,641**	**32,385**	**6,569**	**117,147**	**0.88**	**0.60**	**1.49**

Table 6. Muzzleloader season harvest by DPA, 2023, excluding special hunts.

Permit Area	Muzzleloader hunters	Hunters per sq mile	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
101	160	0.32	6	0	5	0	11
104	64	0.05	8	0	0	0	8
105	460	0.38	31	10	41	3	85
107	133	0.28	2	0	6	0	8
109	64	0.05	7	0	0	0	7
110	185	0.35	14	0	7	0	21
111	56	0.04	2	0	0	0	2
114	13	0.11	1	0	1	0	2
117	19	0.02	0	0	0	0	0
118	103	0.08	10	0	0	0	10
119	57	0.07	0	0	0	0	0
126	28	0.03	0	0	0	0	0
130	17	0.02	1	0	1	0	2
131	17	0.02	0	0	0	0	0
132	14	0.03	1	0	0	0	1
133	71	0.20	3	0	0	0	3
152	42	0.69	0	0	0	0	0
155	172	0.34	1	0	3	0	4
156	248	0.30	4	0	6	0	10
157	633	0.71	21	2	32	6	61
159	211	0.37	7	1	1	0	9
169	176	0.19	6	0	2	0	8
171	185	0.25	6	0	0	0	6
172	288	0.42	6	0	2	0	8
173	58	0.12	1	0	0	0	1
176	132	0.14	4	0	1	0	5
177	100	0.21	7	0	1	0	8
178	254	0.21	8	0	2	0	10
181	160	0.25	6	0	1	1	8
182	123	0.44	4	1	5	0	10
183	221	0.33	9	0	2	0	11
197	164	0.17	6	1	2	0	9
199	29	0.19	2	0	0	0	2
201	68	0.42	9	0	4	1	14
203	9	0.08	0	0	0	0	0
208	139	0.37	22	1	9	1	33
209	361	0.56	33	8	40	11	92
210	400	0.65	22	1	27	2	52

Permit Area	Muzzleloader hunters	Hunters per sq mile	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
213	1912	1.81	130	32	198	28	388
214	1060	1.91	45	22	97	28	192
215	1587	2.26	109	34	189	25	357
218	1253	1.42	82	23	124	14	243
219	871	2.23	41	7	69	9	126
221	979	1.53	57	13	91	15	176
222	782	1.89	33	13	61	8	115
223	776	2.07	36	13	51	10	110
224	56	1.18	2	2	4	1	9
225	1033	1.67	42	20	75	17	154
227	1141	2.42	71	20	97	16	204
229	370	1.30	19	9	26	1	55
230	276	0.61	22	8	24	2	56
232	394	1.05	32	6	38	5	81
233	267	0.70	22	5	32	1	60
234	151	0.24	12	0	6	0	18
235	53	1.57	3	0	6	0	9
236	550	1.49	23	5	39	8	75
237	201	0.33	22	0	4	0	26
238	68	0.72	8	0	2	0	10
239	1084	1.18	61	22	71	5	159
240	1023	1.59	49	26	114	17	206
241	1669	1.68	66	25	163	16	270
246	618	0.79	31	2	20	1	54
248	264	1.23	14	1	11	1	27
249	504	1.02	11	5	45	7	68
250	323	0.45	36	1	14	0	51
251	38	0.69	2	0	0	0	2
252	287	0.40	33	4	13	0	50
253	480	0.49	53	8	40	4	105
254	567	0.61	50	18	67	3	138
255	250	0.64	10	3	29	2	44
256	279	0.43	27	2	23	3	55
257	228	0.55	24	4	28	1	57
258	268	0.78	8	0	1	0	9
259	399	0.81	17	1	16	0	34
260	185	0.18	21	2	4	1	28
262	170	0.25	25	2	30	5	62
263	373	0.53	49	5	39	2	95

Permit Area	Muzzleloader hunters	Hunters per sq mile	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
264	567	0.85	68	4	87	2	161
265	343	0.69	30	5	34	3	72
266	378	0.61	34	2	9	0	45
267	184	0.39	24	1	22	3	50
268	225	0.99	27	8	28	2	65
269	363	0.56	30	0	13	1	44
270	200	0.27	22	1	5	0	28
271	247	0.39	31	0	17	1	49
272	183	0.34	22	0	4	0	26
273	525	0.92	28	2	29	5	64
274	252	0.71	19	1	12	0	32
275	523	0.55	50	1	8	0	59
277	2042	1.93	148	23	192	20	383
278	378	0.94	45	0	23	1	69
279	281	0.82	25	3	12	1	41
280	193	0.29	13	0	3	1	17
281	694	1.21	63	8	70	4	145
282	131	0.12	22	1	0	0	23
283	224	0.66	20	4	21	1	46
284	355	0.42	26	2	10	1	39
285	469	0.85	31	3	23	1	58
286	294	0.66	38	1	11	0	50
287	14	0.31	1	0	3	0	4
288	379	0.61	22	0	18	0	40
289	308	0.38	35	3	22	2	62
290	610	0.92	52	5	59	7	123
291	709	0.89	63	13	49	5	130
292	610	1.69	34	7	57	8	106
293	287	1.03	34	6	36	8	84
294	224	0.33	33	2	13	1	49
295	534	0.56	70	1	20	1	92
296	353	0.53	37	3	28	2	70
297	89	0.20	5	1	0	1	7
298	154	0.25	8	0	1	0	9
299	352	0.91	23	4	33	6	66
338	197	0.62	5	3	15	4	27
341	710	1.18	52	11	82	10	155
342	526	1.50	28	8	48	5	89
604	537	0.80	8	5	31	2	46

Permit Area	Muzzleloader hunters	Hunters per sq mile	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
605	535	0.45	34	19	60	14	127
643	566	0.84	33	12	71	9	125
644	230	1.24	8	4	17	0	29
645	293	0.89	13	4	27	9	53
646	374	1.17	31	11	50	8	100
647	275	0.63	19	6	24	4	53
648	244	0.73	11	8	32	4	55
649	609	1.24	36	18	90	21	165
655	111	0.29	8	1	7	0	16
661	164	0.21	11	1	21	1	34
679	460	0.45	13	3	26	0	42
684	607	0.49	19	5	22	1	47
701	229	0.17	14	4	28	2	48
Total	**48,764**	**0.62**	**3,244**	**626**	**3,785**	**463**	**8,118**

Table 7. Youth deer season harvest by DPA, 2023. Special hunts excluded.

Permit Area	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
101	12	5	15	2	34
104	8	2	5	0	15
105	58	7	43	9	117
107	26	5	16	0	47
109	6	0	6	1	13
110	32	6	25	4	67
111	5	0	2	0	7
114	1	0	0	0	1
117	0	0	0	0	0
118	5	0	0	0	5
119	1	0	0	0	1
126	0	0	0	0	0
130	2	0	0	0	2
131	0	0	0	0	0
132	0	0	0	0	0
133	4	0	1	0	5
152	1	0	0	0	1
155	13	1	16	1	31
156	28	3	26	3	60
157	54	11	45	2	112
159	23	2	14	2	41
169	7	2	22	2	33
171	16	3	12	4	35
172	20	7	22	1	50
173	6	1	5	0	12
176	9	2	19	2	32
177	11	1	12	0	24
178	22	7	34	3	66
181	9	2	5	3	19
182	4	0	8	1	13
183	27	1	16	3	47
197	9	6	14	1	30
199	1	1	0	0	2
201	4	2	4	0	201

Permit Area	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
203	2	1	0	0	3
208	14	1	5	0	20
209	28	7	36	1	72
210	22	7	31	7	67
213	62	23	83	19	187
214	58	20	59	18	155
215	60	24	68	17	169
218	33	20	47	10	110
219	24	5	18	7	54
221	95	33	75	14	217
222	42	14	41	9	106
223	22	5	20	7	54
224	1	1	0	0	2
225	63	10	44	4	121
227	29	5	26	6	66
229	13	3	17	1	34
230	10	1	11	0	22
232	17	2	10	2	31
233	10	2	7	0	19
234	9	0	0	0	9
235	0	0	2	0	2
236	18	6	6	0	30
237	10	2	6	0	18
238	3	0	0	0	3
239	63	12	58	13	146
240	63	20	77	26	186
241	95	31	128	29	283
246	37	12	52	6	107
248	12	3	14	2	31
249	35	6	29	4	74
250	9	0	6	1	16
251	0	1	0	0	1
252	12	2	9	1	24
253	13	1	6	5	25
254	8	0	14	1	23
255	13	2	3	0	18
256	25	3	19	3	50
257	17	2	15	2	36

Permit Area	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
258	26	1	11	1	39
259	20	2	19	4	45
260	22	3	8	0	33
262	6	0	4	1	11
263	32	1	20	4	57
264	51	3	43	3	100
265	24	4	8	2	38
266	20	2	10	1	33
267	32	4	18	0	54
268	13	2	13	2	30
269	7	3	7	0	17
270	5	0	0	0	5
271	13	1	7	0	21
272	9	1	6	0	16
273	10	2	13	3	28
274	10	0	10	2	22
275	13	1	14	0	28
277	54	16	57	11	138
278	7	3	8	0	18
279	2	1	2	3	8
280	3	0	5	1	9
281	10	2	15	2	29
282	2	0	6	0	8
283	15	3	11	1	30
284	16	2	13	2	33
285	17	3	12	3	35
286	6	2	3	0	11
287	0	0	1	0	1
288	15	1	9	0	25
289	6	3	13	2	24
290	22	2	9	3	36
291	32	10	27	2	71
292	14	6	14	2	36
293	9	3	7	3	22
294	10	3	10	1	24
295	16	1	14	3	34
296	11	2	14	0	27
297	3	1	7	1	12
298	12	3	10	2	2

Permit Area	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
299	10	1	13	1	25
338	20	1	10	1	32
341	46	9	29	4	88
342	47	4	23	5	79
604	32	9	23	3	67
605	29	4	17	3	53
643	46	6	19	3	74
644	16	5	7	4	32
645	18	2	9	4	33
646	33	3	19	4	59
647	27	5	9	3	44
648	32	4	15	6	57
649	47	4	20	4	75
655	11	1	3	0	15
661	12	2	3	2	19
679	14	9	33	7	63
684	20	9	41	5	75
701	14	1	3	2	20
Total	**2,540**	**540**	**2,230**	**385**	**5,668**

Table 8. Early Antlerless Season harvest by DPA, 2023.

Permit Area	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
214	60	178	59	297
215	57	153	45	255
218	22	92	23	137
219	9	50	9	68
221	49	174	41	264
222	29	106	24	159
223	13	57	11	81
225	26	105	24	155
227	24	88	25	137
229	5	25	4	34
236	6	30	2	38
277	32	137	34	203
341	10	59	10	79
342	13	57	10	80
605	4	11	0	15
643	6	17	7	30
645	1	4	1	6
646	6	19	3	28
647	0	5	1	6
648	5	14	6	25
649	11	23	12	46
661	1	7	2	10
701	3	17	2	22
Total	**392**	**1,428**	**355**	**2,175**

Table 9. 300 Series A and B Season Harvest by DPA, 2023

Permit Area	Zone	Adult Male	Fawn Male	Adult Female	Fawn Female	Total
338	3A	209	27	89	13	338
	3B	32	10	29	3	74
341	3A	852	103	362	88	1,405
	3B	204	80	277	55	616
605	3A	684	112	343	87	1,226
	3B	156	52	149	23	380
643	3A	709	93	352	108	1,262
	3B	213	52	196	39	500
644	3A	289	49	145	32	515
	3B	289	49	145	32	515
645	3A	396	67	171	79	713
	3B	120	50	142	44	356
646	3A	637	100	241	78	1,056
	3B	185	61	217	65	528
647	3A	369	50	150	51	620
	3B	73	41	117	26	257
648	3A	500	87	225	77	889
	3B	97	27	115	30	269
649	3A	922	133	411	113	1,579
	3B	252	113	405	98	868
655	3A	161	20	73	19	273
	3B	23	9	18	4	54
Total		**7,829**	**1,477**	**4,746**	**1,261**	**15,313**

Table 10. Harvest by DPA during first late CWD hunt, Dec 15-17, 2023.

Permit Area	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
342	21	31	10	6	68
605	23	38	18	12	91
643	24	46	15	13	98
645	13	24	6	6	49
646	22	41	5	10	78
647	18	28	5	5	56
648	10	32	6	11	59
649	15	35	15	7	72
801	4	3	1	3	11
802	2	2	0	1	5
803	0	1	0	0	1
Total	**153**	**281**	**81**	**74**	**589**

Table 11 Free landowner permit harvest by DPA, 2023.

Permit Area	Fawn Male	Adult Female	Fawn Female	Total
101	0	4	0	4
105	1	9	1	11
109	0	1	0	1
156	0	1	1	2
157	6	32	6	44
159	0	2	0	2
201	0	3	0	3
208	0	7	1	8
209	3	13	1	17
210	1	5	3	9
213	20	68	19	107
214	21	63	12	96
215	12	33	10	55
218	1	8	2	11
219	0	1	0	1
221	6	35	6	47
222	2	9	1	12
223	2	2	1	5
225	2	19	6	27
227	0	7	0	7
230	1	0	0	1
232	0	3	2	5
233	1	2	0	3
236	0	2	0	2
239	7	28	5	40
240	8	40	14	62
241	13	90	18	121
246	3	9	3	15
248	0	4	1	5
249	9	28	7	44
253	1	1	0	2
254	1	5	1	7
255	0	5	0	5
256	6	7	3	16
257	3	20	1	24
258	1	3	3	7
260	1	1	0	2
262	0	1	2	3
263	0	3	1	4
264	1	31	3	35
265	2	7	0	9

Permit Area	Fawn Male	Adult Female	Fawn Female	Total
266	0	1	0	1
267	2	8	1	11
268	0	2	1	3
269	0	1	0	1
273	0	1	1	2
277	2	13	1	16
279	0	1	0	1
281	0	2	1	3
290	0	0	2	2
291	0	1	0	1
292	1	6	0	7
293	1	1	1	3
296	0	3	0	3
338	2	2	1	5
341	9	22	7	38
342	2	15	0	17
604	0	1	0	1
605	0	3	0	3
643	2	10	1	13
644	0	6	2	8
645	3	8	2	13
646	4	9	6	19
647	1	2	0	3
648	4	6	2	12
649	6	20	7	33
655	0	1	0	1
661	0	3	0	3
679	0	5	0	5
684	0	15	3	18
Total	**174**	**780**	**173**	**1,127**

Table 12. Summary of special firearms hunt deer harvest, 2023[1].

Area	Dates	Permits Available	Adult Male	Fawn Male	Adult Female	Fawn Female	Total
900 - Cascade River State Park	11/4-11/19	75*	1	0	7	1	9
901 - Rice Lake NWR	11/11-11/19	40*	1	0	3	1	5
902 - St. Croix State Park	11/16-11/19	300*	46	14	32	6	98
903 - Lake Louise State Park	11/11-11/12	25***	9	3	9	2	23
904 - Gooseberry Falls State Park	11/4-11/19	35*	1	0	3	0	4
905 - Split Rock Lighthouse State Park	11/4-11/19	30*	5	0	0	0	5
906 - Tettegouche State Park	11/4-11/19	60*	0	0	5	0	5
907 - Scenic State Park	11/4-11/19	25*	0	0	3	0	3
908 - Hayes Lake State Park	11/4-11/19	50*	13	0	7	1	21
909 - Lake Bemidji State Park	11/4-11/7	30*	11	2	2	0	15
910 - Zippel Bay State Park	11/4-11/19	75***	3	2	11	2	11/4-11/19
911 - Judge CR Magney State Park	11/4-11/19	45*	1	1	2	0	11/4-11/19
912 – Schoolcraft State Park	11/4-11/19	n/a*	0	0	1	0	1
913 - Lake Carlos State Park	11/4-11/7	20**	0	3	4	1	8
914 - William O'Brien State Park	11/11-11/12	50*	12	3	4	4	23
915 - Lake Bronson State Park	11/4-11/12	30***	4	3	12	3	22
916 - Maplewood State Park	11/4-11/7	100*	26	6	15	2	49
917 - Miesvile Ravine Park Reserve	11/4-11/12	40*	10	3	6	0	19
919 - Glacial Lakes State Park	11/9-11/12	20**	0	1	0	0	1
920 - Wild River State Park	11/4-11/5	75*	21	6	14	11	52

[1] Special hunt harvests are frequently misreported as DPA-level harvest and totals are estimates; Key: *Either-sex, **Antlerless-only, ***Earn-a-buck

Table 12., Continued.

Area	Dates	Permits Issued	Adult Male	Fawn Male	Adult Female	Fawn Female	Total
921 - Lawrence Unit Minnesota Valley State Recreation Area	11/11-11/12	30*	6	3	5	1	15
922 - Old Mill State Park	11/4-11/7	10*	2	0	0	0	2
925 - Vermillion Highlands Research, Recreation and WMNA	11/4-11/77	20*	4	1	2	0	7
927 - Whitewater State Park	11/18-11/19	50*	12	2	7	4	25
931 - City of Grand Rapids	11/4-11/19	n/a*	2	4	9	6	21
933 - Forestville/ Mystery Cave State Park	11/4-11/5	75*	21	14	9	9	53
934 - Whitewater State Game Refuge	11/18-11/26	100**	1	1	16	6	24
940 - Frontenac State Park	11/18-11/19	60*	7	5	11	5	28
948 - City of Baxter	11/4-11/19	n/a*	1	0	1	0	2
955 - City of Baxter	10/19-10/22	n/a**	0	0	1	0	1
962 - Great River Bluffs State Park	11/18-11/19	50*	2	0	2	1	5
976 - Carver Park Reserve	11/11-11/12	110*	27	15	49	5	96
991 - Kilen Woods State Park	12/23-01/01/24	10**	0	0	6	1	7
Total			**249**	**92**	**258**	**72**	**671**

Key: [1]Accessible hunt, firearms or archery; *Either-sex; **Antlerless-only; ***Earn-a-buck

Table 13 Summary of special muzzleloader hunt deer harvest, 2023[1].

Area	Dates	Permits Issued	Adult Male	Fawn Male	Adult Female	Fawn Female	Total
918 - Beaver Creek Valley State Park	12/2-12/03	25*	2	0	0	1	3
929 - McCarthy Beach State Park	11/26-12/11	10*	1	1	0	0	2
930 - Nerstrand Big Woods State Park	12/3-12/4	50***	3	7	7	4	21
932 - Rice Lake State Park	12/3-12/4	20**	0	7	3	0	10
935 - Jay Cooke State Park	12/3-12/7	80*	6	10	0	1	17
936 - Crow Wing State Park	12/3-12/7	25*	3	5	0	4	12
937 - Lake Vermillion - Soudan Underground Mine State Park	11/26-12/11	25*	0	6	0	1	7
939 - Myre-Big Island State Park	12/3-12/4	50**	0	13	9	12	34
942 - Sibley State Park	11/26-11/27	60**	0	13	3	1	17
943 - Miesville Ravine Park Reserve	12/3-12/11	40***	2	7	1	5	15
944 - Vermillion Highlands Research, Recreation and WMA	11/26-12/11	20*	3	1	0	0	4
946 - City of Grand Rapids	11/26-12/11	N/A*	1	1	2	0	4
947 - Lake Bemidji State Park	12/2-12/4	30*	2	2	0	0	4
949 - St. Croix State Park	11/30-12/4	100*	1	3	1	0	5
960 - Lake Maria State Park	12/2-12/4	25***	2	9	0	2	13
964 - Afton State Park	12/6-12/8	30**	0	6	2	0	8
		Totals	**18**	**70**	**23**	**28**	**152**

[1] Special hunt harvests are frequently misreported as DPA-level harvest and totals are estimates; *Either- sex; **Antlerless-only; ***Earn-a-buck

Table 14. Summary of youth special deer hunts, 2023[1].

Area	Dates	Permits Issued	Adult Male	Fawn Male	Adult Female	Fawn Female	Total
899 - Minneopa State Park	11/18-11/19	12*	1	0	2	0	3
951 - Afton State Park	11/4-11/5	30*	11	3	8	2	24
952 - Sibley State Park	10/28-10/29	10*	1	0	2	0	3
953 - Zippel Bay State Park	10/20-10/22	20*	0	0	0	0	0
954 - Lake Bemidji State Park	10/20-10/22	20*	0	0	0	0	0
956 - St. Croix State Park	10/28-10/29	90*	3	0	1	0	4
957 - Rydell National Wildlife Refuge	10/28-10/29	15*	1	0	1	0	2
958 - Savanna Portage State Park	10/28-10/29	25*	0	0	0	0	0
959 - Buffalo River State Park	10/28-10/29	12***	0	0	1	0	1
961 - City of Baxter	10/19-10/22	n/a	0	0	0	0	0
963 - Kilen Woods State Park	10/28-10/29	6*	0	0	1	0	1
965 - Banning State Park	10/28-10/29	6*	0	0	0	0	0
966 - Blue Mounds State Park	11/18-11/19	10***	0	0	3	0	3
967 - Camden State Park	10/28-10/29	12***	1	0	1	0	2
968 - Lake Shetek State Park	11/18-11/19	15**	0	0	8	1	9
969 - Lake Bronson State Park	10/14-10/15	10*	0	0	0	0	0
		Total	**17**	**3**	**26**	**3**	**49**

[1] Special hunt harvests are frequently misreported as DPA-level harvest and totals are estimates; *Either- sex; **Antlerless-only; ***Earn-a-buck

Table 15. Summary of special archery deer hunts, 2023.

Area	Dates	Permits Available	Adult Male	Fawn Male	Adult Female	Fawn Female	Total
809 - Cannon River Wilderness Park	12-15 - 12/17	50*	0	0	4	0	4
895 - Minnesota Landscape Arboretum	10/21 - 11/5	5***	0	0	0	0	0
896 - City of Two Harbors	9/16 - 11/30	15***	3	1	11	0	15
897 - City of Blue Earth	9/16 - 12/31	20***	2	4	15	2	23
923 - City of New Ulm	10/14 - 12/31	56***	0	0	1	0	
924 - City of Lake Benton	9/16 - 12/31	40***	2	1	15	1	19
926 - Pin Oak Prairie SNA	10/1 - 11/30	8*	1	0	0	0	1
928 - City of Jackson	9/16 - 12/31	n/a**	0	0	10	1	11
970 - City of Windom	9/16 - 12/31	15**	0	0	5	0	5
971 - Camp Ripley	10/27 - 10/29	2,500*	86	20	86	9	201
972 - Carlton Game Refuge	11/23 - 12/31	40***	1	2	5	2	10
973 - City of Austin	10/1 - 12/31	60***	4	5	28	7	44
974 - City of Warroad	9/16 - 12/31	10*	0	0	3	0	3
975 - Vermillion Highlands Wildlife Management Area	9/16-10/27	60*	0	0	2	0	2
977 - City of Red Wing	9/16 - 12/31	n/a*	8	1	24	4	37
978 - City of Redwood Falls	9/16 - 12/31	20***	0	0	21	1	22
979 - Carver Rapids and Thompson Ferry Units of the Minnesota Valley State Recreation Area	9/16 - 12/31	n/a*	1	0	0	0	1
980 - City of Duluth	9/16 - 12/31	400*	74	15	69	4	162

[1] Special hunt harvests are frequently misreported as DPA-level harvest and totals are estimates; Key: *Either-sex, **Antlerless-only, ***Earn-a-buck

Table 15., Continued.

Area	Dates	Permits Available	Adult Male	Fawn Male	Adult Female	Fawn Female	Total
981 - City of Mankato	9/16 - 12/31	40***	4	4	17	2	27
982 - City of Granite Falls	9/16 - 12/31	10**	0	0	1	0	1
983 - City of Ortonville	9/16 - 12/1	30***	1	0	12	1	14
984 - City of Canby	9/16 - 12/31	20*	0	1	5	2	8
985 - City of Bemidji	9/16 - 12/31	44*	6	4	15	1	26
986 - Bemidji Regional Airport	9/16 - 12/31	20*	3	2	6	1	12
987 - Greenleaf Lake State Recreation Area	9/16 - 12/31	n/a*	0	0	0	0	0
989 - City of Baxter	9/16 - 12/31	n/a*	1	1	8	0	10
990 - City of Owatonna	10/22-11/19; 11/22-12/17	34***	3	4	18	1	26
992- City of Hallock	9/16-10/20; 10/21-11/24; 11/25-12/31	15**	0	1	4	0	5
995 - City of Grand Rapids	9/16 - 12/31	n/a*	5	3	23	4	35
997 - River Bend Nature Center	11/9 - 11/12	30***	10	6	8	8	32
998 - City of Red Lake Falls	9/16 - 12/31	10**	0	0	1	1	2
		Total	**215**	**75**	**413**	**52**	**754**

Key: *Either-sex, **Antlerless-only, ***Earn-a-buck

Table 16. Firearms antlerless permit lottery distribution report.

Permit Area Number	Preference Level	Total Applicants	Rejected Applicants	Unsuccessful	Winners	Permits Available
104	1	89	0	89	0	25
	2	106	0	106	0	
	3	112	0	112	0	
	4	172	1	148	24	
	5	1	0	0	1	
	Total	**480**	**1**	**455**	**25**	
107	1	474	0	301	173	393
	2	162	0	0	162	
	3	31	0	0	31	
	4	13	1	0	13	
	5	7	2	0	7	
	6	6	0	0	6	
	8	1	0	0	1	
	Total	**694**	**3**	**301**	**393**	
109	1	90	3	90	0	25
	2	88	0	88	0	
	3	63	0	63	0	
	4	44	0	44	0	
	5	31	0	31	0	
	6	36	0	36	0	
	7	47	0	32	15	
	8	10	0	0	10	
	Total	**409**	**3**	**384**	**25**	
110	1	577	1	577	0	494
	2	516	2	247	269	
	3	208	1	0	208	
	4	14	2	0	14	
	5	3	2	0	3	
	6	0	2	0	0	
	Total	**1,318**	**10**	**824**	**494**	
133	1	955	0	95	0	25
	2	108	1	108	0	
	3	99	0	76	23	
	4	2	0	0	2	
	Total	**304**	**1**	**279**	**25**	

Permit Area Number	Preference Level	Total Applicants	Rejected Applicants	Unsuccessful	Winners	Permits Available
155	1	880	2	880	0	248
	2	401	7	246	155	
	3	88	0	0	88	
	4	4	0	0	4	
	5	1	0	0	1	
	Total	**1,374**	**9**	**1,126**	**248**	
156	1	856	4	856	0	247
	2	427	1	427	0	
	3	349	1	349	0	
	4	330	1	88	242	
	5	3	0	0	3	
	6	1	0	0	1	
	9	1	0	0	1	
	Total	**1,967**	**7**	**1,720**	**247**	
159	1	930	12	930	0	494
	2	415	6	42	373	
	3	97	1	0	97	
	4	22	0	0	22	
	5	2	0	0	2	
	Total	**1,466**	**19**	**972**	**494**	
169	1	329	4	328	0	25
	2	326	4	326	0	
	3	364	5	364	0	
	4	342	2	342	0	
	5	338	0	314	24	
	6	1	1	0	1	
	7	0	2	0	0	
	Total	**1,699**	**18**	**1,674**	**25**	
171	1	1,390	5	1,390	0	247
	2	658	3	472	186	
	3	48	3	0	48	
	4	10	1	0	10	
	5	1	2	0	1	
	6	1	1	0	1	
	9	1	0	0	1	
	Total	**2,109**	**15**	**1,862**	**247**	

Permit Area Number	Preference Level	Total Applicants	Rejected Applicants	Unsuccessful	Winners	Permits Available
172	1	1,916	16	1,916	0	493
	2	1,462	10	1,126	336	
	3	114	1	0	114	
	4	41	4	0	41	
	5	2	1	0	2	
	Total	**3,535**	**31**	**3,042**	**493**	
173	1	544	1	544	0	149
	2	469	1	426	43	
	3	101	1	0	101	
	4	4	1	0	4	
	5	0	2	0	0	
	6	1	0	0	1	
	Total	**1,119**	**6**	**970**	**149**	
176	1	281	3	281	0	25
	2	248	1	248	0	
	3	284	2	284	0	
	4	248	0	248	0	
	5	165	0	140	25	
	Total	**1,226**	**6**	**1,201**	**25**	
177	1	691	6	691	0	395
	2	449	2	110	339	
	3	33	3	0	33	
	4	15	1	0	15	
	5	6	0	0	6	
	9	2	0	0	2	
	Total	**1,196**	**12**	**801**	**395**	
178	1	533	4	533	0	148
	2	516	4	516	0	
	3	516	2	516	0	
	4	464	1	437	27	
	5	118	0	0	118	
	6	0	1	0	0	
	9	3	0	0	3	
	Total	**2,150**	**12**	**2,002**	**148**	

Permit Area Number	Preference Level	Total Applicants	Rejected Applicants	Unsuccessful	Winners	Permits Available
181	1	531	8	531	0	99
	2	751	3	661	90	
	3	9	1	0	9	
	6	0	1	0	0	
	Total	**1,291**	**13**	**1,192**	**99**	
183	1	954	9	954	0	248
	2	460	0	460	0	
	3	386	4	151	235	
	4	9	0	0	9	
	5	3	0	0	3	
	6	1	0	0	1	
	Total	**1,813**	**13**	**1,565**	**248**	
197	1	641	1	641	0	495
	2	586	0	586	0	
	3	553	4	138	415	
	4	73	1	0	73	
	5	6	1	0	6	
	7	0	2	0	0	
	9	1	0	0	1	
	Total	**1,860**	**9**	**1,365**	**495**	
234	1	177	0	177	0	320
	2	15	0	0	15	
	3	1	0	0	1	
	Total	**193**	**0**	**0**	**193**	
237	1	190	2	116	74	188
	2	79	1	0	79	
	3	28	0	0	28	
	4	7	1	0	7	
	5	0	1	0	0	
	Total	**304**	**5**	**116**	**188**	
238	1	79	1	0	79	114
	2	13	0	0	13	
	3	1	0	0	1	
	Total	**93**	**1**	**0**	**93**	

Permit Area Number	Preference Level	Total Applicants	Rejected Applicants	Unsuccessful	Winners	Permits Available
246	1	2,163	21	1,395	768	1,959
	2	789	5	0	789	
	3	391	4	0	391	
	4	8	1	0	8	
	5	3	0	0	3	
	Total	**3,354**	**31**	**1,395**	**1,959**	
250	1	364	1	0	364	502
	2	104	3	0	104	
	3	5	0	0	5	
	5	0	1	0	0	
	Total	**473**	**5**	**0**	**473**	
258	1	732	8	721	11	495
	2	366	2	0	366	
	3	112	0	0	112	
	4	5	0	0	5	
	5	1	0	0	1	
	Total	**1,216**	**10**	**721**	**495**	
259	1	1,897	5	680	1,217	1,955
	2	697	6	0	697	
	3	40	3	0	40	
	4	1	1	0	1	
	Total	**2,635**	**15**	**680**	**1,955**	
266	1	293	2	0	293	476
	2	90	0	0	90	
	3	6	0	0	6	
	Total	**389**	**2**	**0**	**389**	
269	1	349	4	147	202	320
	2	110	2	0	110	
	3	5	0	0	5	
	4	3	1	0	3	
	6	0	1	0	0	
	Total	**467**	**8**	**147**	**320**	
270	1	145	0	128	17	140
	2	118	0	0	118	
	3	4	0	0	4	
	4	1	0	0	1	
	Total	**268**	**0**	**128**	**140**	

Permit Area Number	Preference Level	Total Applicants	Rejected Applicants	Unsuccessful	Winners	Permits Available
272	1	169	4	169	0	145
	2	139	1	52	87	
	3	58	0	0	58	
	4	0	1	0	0	
	Total	**366**	**6**	**221**	**145**	
274	1	280	2	115	165	372
	2	196	0	0	196	
	3	10	0	0	10	
	4	1	0	0	1	
	Total	**487**	**2**	**115**	**372**	
275	1	415	5	237	178	561
	2	261	1	0	261	
	3	116	0	0	116	
	4	6	1	0	6	
	Total	**798**	**7**	**237**	**561**	
278	1	536	0	291	245	536
	2	278	2	0	278	
	3	11	0	0	11	
	4	2	0	0	2	
	Total	**827**	**2**	**291**	**536**	
280	1	179	0	179	0	143
	2	108	1	49	59	
	3	61	0	0	61	
	4	22	0	0	22	
	5	1	0	0	1	
	Total	**371**	**1**	**228**	**143**	
282	1	42	2	42	0	24
	2	45	1	45	0	
	3	36	0	33	3	
	4	21	0	0	21	
	Total	**144**	**3**	**120**	**24**	

Permit Area Number	Preference Level	Total Applicants	Rejected Applicants	Unsuccessful	Winners	Permits Available
284	1	258	3	258	0	192
	2	157	1	157	0	
	3	133	1	98	35	
	4	151	1	0	151	
	5	6	1	0	6	
	Total	**705**	**7**	**513**	**192**	
286	1	441	2	94	347	454
	2	106	0	0	106	
	3	1	1	0	1	
	4	0	1	0	0	
	5	0	1	0	0	
	Total	**548**	**5**	**94**	**454**	
288	1	452	3	242	210	457
	2	240	0	0	240	
	3	6	0	0	6	
	4	1	0	0	1	
	Total	**699**	**3**	**242**	**457**	
294	1	405	1	0	405	456
	2	24	2	0	24	
	3	3	0	0	3	
	4	0	1	0	0	
	Total	**432**	**4**	**0**	**432**	
295	1	499	1	339	160	507
	2	332	3	0	332	
	3	14	0	0	14	
	4	1	0	0	1	
	5	0	1	0	0	
	Total	**846**	**5**	**339**	**507**	
297	1	108	0	108	0	24
	2	62	3	45	17	
	3	6	1	0	6	
	4	1	0	0	1	
	Total	**177**	**4**	**153**	**24**	
298	1	611	5	611	0	99
	2	155	3	121	34	
	3	60	0	0	60	
	4	5	0	0	5	
	Total	**831**	**8**	**732**	**99**	
	Total	**42,621**	**321**	**28,194**	**14,427**	**14,715**

Table 17. Muzzleloader lottery distribution report.

Permit Area Number	Preference Level	Total applicants	Rejected applicants	Unsuccessful	Winners	Permits Available
104	1	3	0	3	0	0
	2	2	0	2	0	
	3	2	0	2	0	
	4	1	0	1	0	
	Total	**8**	**0**	**8**	**0**	
107	1	10	0	6	4	7
	2	3	0	0	3	
	Total	**13**	**0**	**6**	**7**	
109	1	3	0	3	0	0
	2	1	0	1	0	
	3	2	0	2	0	
	5	1	0	1	0	
	Total	**7**	**0**	**7**	**0**	
110	1	9	0	9	0	6
	2	4	0	0	4	
	3	2	0	0	2	
	Total	**15**	**0**	**9**	**6**	
133	1	3	0	3	0	0
	2	1	0	1	0	
	Total	**4**	**0**	**4**	**0**	
155	1	9	0	9	0	2
	2	3	0	1	2	
	Total	**12**	**0**	**10**	**2**	
156	1	14	0	14	0	3
	2	5	0	5	0	
	3	1	0	1	0	
	4	5	0	2	3	
	Total	**25**	**0**	**22**	**3**	
159	1	16	0	11	5	6
	2	1	0	0	1	
	Total	**17**	**0**	**11**	**6**	
169	1	8	0	8	0	0
	2	3	0	3	0	
	3	2	0	2	0	
	4	2	0	2	0	
	Total	**25**	**0**	**22**	**3**	

Permit Area Number	Preference Level	Total applicants	Rejected applicants	Unsuccessful	Winners	Permits Available
171	1	18	0	18	0	3
	2	5	0	2	3	
	Total	**23**	**0**	**20**	**3**	
172	1	36	0	36	0	7
	2	15	0	9	6	
	3	1	0	0	1	
	Total	**52**	**0**	**45**	**7**	
173	1	8	0	8	0	1
	2	3	0	2	1	
	Total	**11**	**0**	**10**	**1**	
176	1	5	0	5	0	0
	3	1	0	1	0	
	5	1	0	1	0	
	Total	**7**	**0**	**7**	**0**	
177	1	9	0	0	9	5
	2	6	0	1	5	
	Total	**15**	**0**	**10**	**5**	
178	1	16	0	16	0	2
	2	6	0	6	0	
	3	1	0	1	0	
	4	2	0	0	2	
	Total	**25**	**0**	**23**	**2**	
181	1	9	0	9	0	1
	2	3	0	2	1	
	Total	**12**	**0**	**11**	**1**	
183	1	9	0	9	0	2
	2	7	0	6	1	
	3	1	0	0	1	
	Total	**17**	**0**	**15**	**2**	
197	1	10	0	10	0	5
	2	6	0	4	2	
	3	3	0	0	3	
	Total	**19**	**0**	**14**	**5**	
234	1	18	0	0	18	30
	Total	**18**	**0**	**0**	**18**	
237	1	12	0	6	6	11
	2	4	0	0	4	
	3	1	0	0	1	
	Total	**17**	**0**	**6**	**11**	

Permit Area Number	Preference Level	Total applicants	Rejected applicants	Unsuccessful	Winners	Permits Available
238	1	5	0	0	5	11
	2	3	0	0	3	
	3	1	0	0	1	
	Total	**9**	**0**	**0**	**9**	
246	1	60	0	30	30	41
	2	10	0	0	10	
	3	1	0	0	1	
	Total	**71**	**0**	**30**	**41**	
250	1	36	0	0	36	48
	2	9	0	0	9	
	Total	**45**	**0**	**0**	**45**	
258	1	10	0	7	3	5
	2	2	0	0	2	
	Total	**12**	**0**	**7**	**5**	
259	1	44	0	16	28	45
	2	16	0	0	16	
	3	1	0	0	1	
	Total	**61**	**0**	**16**	**45**	
266	1	16	0	0	16	24
	2	4	0	0	4	
	Total	**20**	**0**	**0**	**20**	
269	1	37	0	14	23	30
	2	7	0	0	7	
	Total	**44**	**0**	**14**	**30**	
270	1	13	0	9	4	10
	2	6	0	0	6	
	Total	**19**	**0**	**9**	**10**	
272	1	7	0	7	0	5
	2	6	0	1	5	
	Total	**13**	**0**	**8**	**5**	
274	1	26	0	9	17	28
	2	10	0	0	10	
	3	1	0	0	1	
	Total	**37**	**0**	**9**	**28**	
275	1	34	0	16	18	39
	2	18	0	0	18	
	3	3	0	0	3	
	Total	**55**	**0**	**16**	**39**	

Permit Area Number	Preference Level	Total applicants	Rejected applicants	Unsuccessful	Winners	Permits Available
278	1	65	0	35	30	64
	2	31	0	0	31	
	3	2	0	0	2	
	4	1	0	0	1	
	Total	**99**	**0**	**35**	**64**	
280	1	10	0	10	0	7
	2	9	0	2	7	
	Total	**19**	**0**	**12**	**7**	
282	1	2	0	2	0	1
	2	2	0	2	0	
	3	2	0	1	1	
	Total	**6**	**0**	**5**	**1**	
284	1	14	0	14	0	8
	2	7	0	6	1	
	3	7	0	0	7	
	Total	**28**	**0**	**20**	**8**	
286	1	45	0	9	36	46
	2	10	0	0	10	
	Total	**55**	**0**	**9**	**46**	
288	1	40	0	22	18	43
	2	23	0	0	23	
	3	1	0	0	1	
	4	1	0	0	1	
	Total	**65**	**0**	**22**	**43**	
294	1	40	0	0	40	44
	2	1	0	0	1	
	3	1	0	0	1	
	Total	**42**	**0**	**0**	**42**	
295	1	42	0	28	14	43
	2	28	0	0	28	
	3	1	0	0	1	
	Total	**71**	**0**	**28**	**43**	
297	1	5	0	5	0	1
	2	1	0	0	1	
	Total	**6**	**0**	**5**	**1**	
298	1	7	0	6	1	1
	Total	7	0	6	1	
	Total	**1,116**	**0**	**504**	**612**	**635**

Table 18. Special firearms hunts lottery distribution report.

Permit Area Number	Preference Level	Total Applicants	Rejected Applicants	Unsuccessful	Winners	Permits Available
900 - Cascade River SP	1	27	0	0	27	75
	2	3	0	0	3	
	3	2	0	0	2	
	4	1	0	0	1	
	Total	**33**	**0**	**0**	**33**	
901 - Rice Lake Wildlife Refuge	1	44	0	14	30	40
	2	9	0	0	9	
	3	1	0	0	1	
	Total	**54**	**0**	**14**	**40**	
902 - St.Croix SP	1	347	0	120	227	300
	2	68	0	0	68	
	3	4	0	0	4	
	9	1	0	0	1	
	Total	**420**	**0**	**120**	**300**	
903 - Lake Louise SP	1	35	0	35	0	25
	2	32	0	23	9	
	3	18	0	0	18	
	Total	**85**	**0**	**58**	**27**	
904 - Gooseberry Falls SP	1	28	0	0	28	35
	2	2	0	0	2	
	Total	**30**	**0**	**0**	**30**	
905 - Split Rock Lighthouse SP	1	18	0	0	18	30
	3	1	0	0	1	
	Total	**19**	**0**	**0**	**19**	
906 - Tettegouche SP	1	35	0	0	35	60
	2	3	0	0	3	
	Total	**38**	**0**	**0**	**38**	
907 -Scenic SP	1	21	0	0	21	25
	2	2	0	0	2	
	3	1	0	0	1	
	Total	**24**	**0**	**0**	**24**	
908 -Hayes Lake SP	1	49	0	0	49	50
	Total	**49**	**0**	**0**	**49**	

Table 18., Continued.

Permit Area Number	Preference Level	Total Applicants	Rejected Applicants	Unsuccessful	Winners	Permits Available
909 - Lake Bemidji SP	1	29	0	0	29	30
	2	1	0	0	1	
	Total	**30**	**0**	**0**	**30**	
910 - Zippel Bay SP	1	59	0	0	59	75
	2	5	0	0	5	
	Total	**64**	**0**	**0**	**64**	
911 – Judge C. R. Magney SP	1	11	0	0	11	45
	Total	**11**	**0**	**0**	**11**	
913 - Lake Carlos SP	1	15	0	0	15	20
	2	6	0	0	6	
	Total	**21**	**0**	**0**	**21**	
914 -William O'Brien SP	1	68	0	68	0	50
	2	56	0	35	21	
	3	28	0	0	28	
	9	1	0	0	1	
	Total	**153**	**0**	**103**	**50**	
915 - Lake Bronson SP	1	28	0	10	18	30
	2	9	0	0	9	
	3	1	0	0	1	
	9	2	0	0	2	
	Total	**40**	**0**	**10**	**30**	
916 - Maplewood SP	1	175	0	175	0	100
	2	96	0	96	0	
	3	103	0	35	68	
	4	32	0	0	32	
	9	3	0	0	3	
	Total	**409**	**0**	**306**	**103**	
917 -Miesville Ravine SP A Season	1	70	0	70	0	38
	2	65	0	48	17	
	3	20	0	0	20	
	4	1	0	0	1	
	9	1	0	0	1	
	Total	**157**	**0**	**118**	**39**	
917 – Miesville Ravine SP B Season	1	2	0	2	0	2
	2	3	0	1	2	
	9	1	0	0	1	
	Total	**6**	**0**	**3**	**3**	

Table 18., Continued.

Permit Area Number	Preference Level	Total Applicants	Rejected Applicants	Unsuccessful	Winners	Permits Available
918 – Beaver Creek Valley S.P.	1	3	0	3	0	0
	Total	**3**	**0**	**3**	**0**	
919 - Glacial Lakes SP	1	25	0	5	20	20
	3	2	0	0	2	
	Total	**27**	**0**	**5**	**22**	
920 - Zumbro Falls SNA	1	121	0	121	0	75
	2	78	0	47	31	
	3	36	0	0	36	
	4	4	0	0	4	
	9	4	0	0	4	
	Total	**243**	**0**	**168**	**75**	
921 - Lawrence Unit MN Valley Rec. Area	1	46	0	37	9	30
	2	21	0	0	21	
	Total	**67**	**0**	**37**	**30**	
922 – Old Mill SP	1	21	0	15	6	10
	2	3	0	0	3	
	3	1	0	0	1	
	Total	**25**	**0**	**15**	**10**	
925 - Vermillion Highlands Research, Recreation, and Wildlife Management Area A Season	1	21	1	21	0	19
	2	23	0	23	0	
	3	17	0	0	17	
	4	2	0	0	2	
	Total	**63**	**1**	**44**	**19**	
925 -Vermillion Highlands Research, Recreation, and Wildlife Management Area B Season	1	2	0	2	0	2
	Total	**2**	**0**	**0**	**2**	

Table 18, Continued.

Permit Area Number	Preference Level	Total Applicants	Rejected Applicants	Unsuccessful	Winners	Permits Available
927 – Whitewater SP A Season	1	74	0	60	14	50
	2	38	0	0	38	
	3	1	0	0	1	
	Total	**113**	**0**	**60**	**53**	
933 – Forestville Mystery Cave SP	1	93	0	54	39	75
	2	36	0	0	36	
	Total	**129**	**0**	**54**	**75**	
934 - Whitewater State Game Refuge	1	67	0	0	67	100
	2	3	0	0	3	
	Total	**70**	**0**	**0**	**70**	
940 – Frontenac SP	1	55	0	0	55	60
	2	1	0	0	1	
	9	1	0	0	1	
	Total	**57**	**0**	**0**	**57**	
962 - Great River Bluffs SP	1	43	0	0	43	50
	2	1	0	0	1	
	Total	**44**	**0**	**0**	**44**	
976 – Carver Park Reserve	1	108	1	102	6	110
	2	82	0	0	82	
	3	19	0	0	19	
	4	3	0	0	3	
	Total	**212**	**1**	**102**	**110**	
991 – Kilen Woods S.P.	1	12	0	3	9	10
	2	1	0	0	1	
	Total	**13**	**0**	**3**	**10**	
	Total	**2,711**	**2**	**1,223**	**1,488**	**1,640**

Table 19. Muzzleloader special hunts lottery distribution report.

Permit Area Number	Preference Level	Total Applicants	Rejected Applicants	Unsuccessful	Winners	Permits Available
918- Beaver Creek Valley SP	1	28	0	9	19	25
	2	6	0	0	6	
	Total	34	0	9	25	
929 - McCarthy Beach SP	1	11	0	2	9	10
	2	1	0	0	1	
	Total	12	0	2	10	
930 - Nerstrand Big Woods SP	1	64	0	64	0	50
	2	43	0	1	42	
	3	8	0	0	8	
	Total	115	0	65	50	
932 - Rice Lake SP	1	17	0	11	6	20
	2	11	0	0	11	
	3	4	0	0	4	
	Total	32	0	11	21	
935 – Jay Cooke SP	1	89	0	39	50	85
	2	27	0	0	27	
	Total	116	0	39	77	
936 - Crow Wing SP	1	25	0	20	5	25
	2	15	0	0	15	
	3	7	0	0	7	
	9	1	0	0	1	
	Total	48	0	20	28	
937 - Lake Vermillion- Soudan Underground Mine SP	1	34	0	15	19	20
	2	1	0	0	1	
	Total	35	0	15	20	
938 - Hayes Lake SP	1	3	0	0	3	50
	Total	3	0	0	3	
939 - Myre- Big Island SP	1	68	0	63	5	50
	2	44	0	0	44	
	3	1	0	0	1	
	9	1	0	0	1	
	Total	114	0	63	51	
942 - Sibley SP	1	62	0	45	17	60
	2	41	0	0	41	
	3	1	0	0	1	
	9	1	0	0	1	
	Total	105	0	45	60	

Permit Area Number	Preference Level	Total Applicants	Rejected Applicants	Unsuccessful	Winners	Permits Available
943 - Miesville Ravine Park Reserve	1	73	0	65	8	40
	2	30	0	0	30	
	3	2	0	0	2	
	Total	105	0	65	40	
944 - Vermillion Highlands Research, Recreation, and WMA	1	27	0	13	14	20
	2	6	0	0	6	
	Total	33	0	13	20	
947 – Lake Bemidji SP	1	16	0	0	16	30
	2	1	0	0	1	
	Total	17	0	0	17	
948 – Savanna Portage SP	1	16	0	0	16	30
	2	1	0	0	1	
	3	2	0	0	2	
	Total	19	0	0	19	
949 – St Croix SP	1	57	0	0	57	100
	Total	57	0	0	57	
960 – Lake Maria S.P.	1	47	0	47	0	25
	2	28	0	28	0	
	3	32	0	7	25	
	Total	107	0	82	25	
964 - Afton S.P.	1	39	0	14	25	30
	2	3	0	0	3	
	3	3	0	0	3	
	Total	45	0	14	31	
Total		**955**	**0**	**402**	**553**	**595**

2023 MINNESOTA ELK HARVEST REPORT

Barbara Keller, Big Game Program Leader

Jason Wollin, Karlstad Area Wildlife Supervisor

Kyle Arola, Thief Lake Wildlife Area Supervisor

INTRODUCTION

Legislation passed in 2016 (MN Statute 97B.516b) directed the Department of Natural Resources (DNR) to "…not manage an elk herd in Kittson, Roseau, Marshall, or Beltrami counties in a manner that would increase the size of the herd, including adoption or implementation of an elk management plan designed to increase an elk herd, unless the commissioner of agriculture verifies that crop and fence damages paid under section 3.7371 and attributed to the herd have not increased for at least two years." In response, DNR adopted an Interim Strategic Management Plan for Elk in 2016 that will maintain a status quo in elk numbers at the current population estimates. This set the Kittson Central herd goal at 50-60 elk. Plans will be made to update the Strategic Management Plan for Elk.

DNR conducts an annual aerial elk population survey every winter, when proper survey conditions exist, which consists of a minimum count of all elk observed during the survey. DNR staff use fixed-wing aircraft to conduct aerial elk surveys for the Grygla and Kittson elk herds. The survey for the Kittson Central herd was completed in February of 2023, and the area surveyed was consistent with past years. See Table 1 and Chart 1 for Kittson Central survey results. Total elk recorded within the Kittson Central block in 2023 was 75 and included: 50 antlerless and 25 bulls. Given the minimum elk count was above the population goal of 50-60 elk, the DNR continued with implementation of elk hunting seasons for 2023 consistent with past seasons.

In 2023, there were two established zones open for elk hunting in Minnesota: 1) Zone 20 - Kittson Central and 2) Zone 30 - Kittson Northeast (Figure 1). The Zone 20 – Kittson Central zone was expanded this year to the south and west. Elk hunting in Zone 10 - Grygla, has been closed since 2013 because the population is below goal (Figure 2). In an effort to move the Kittson Central herd towards goal range, this year the number of seasons held in Zone 20 was three regular season hunts. For the Zone 20 - Kittson Central there were six license/season date options: 1) Season A/D – September 9 through September 17; 2) Season B/E - September 23 through October 1, 3) Season C/F - October 7 through October 15. There were two regular season hunts in Zone 30 - Kittson Northeast for five licenses/ season date options: 1) Season G - September 9 through September 17; 2) Season H – September 23 through October 1. All of the seasons were 9 days in length, including two weekends, centered around the elk rut. These dates were also chosen to avoid conflict with the Youth Firearm Deer Season on October 19 through October 22 and the Regular Firearm Deer Season November 4 through November 12. Overall, hunter success rates were lower this year.

HUNTING SEASON OPTIONS AND LICENSE LOTTERY

A total of 17 licenses were available and 3,724 individuals or parties (up to two hunters) applied for the opportunity to hunt elk in Minnesota (Table 2). Applicants were given the opportunity to select both zone and season in which to hunt. Seasons in Zone 20 were also split between either-sex and antlerless-only licenses. This allowed applicants to choose the type of license desired during their application.

The Minnesota elk lottery is a three-step process. First, a lottery for applicants that had applied for 10 years or more (20% = 3 licenses offered in 2023) is conducted. The 10-year lottery is run when total licenses available in all zones combined is equal to or greater than five (20% of 5 licenses = 1 license for 10 year lottery pool). Once the 10 year applicant lottery is run, the second round was for qualifying landowner applicants for Zone 20 (20% = 2 licenses offered in 2023) and landowner applicants for Zone 30 (20% = 1 license offered in 2023). The landowner lottery is run when total licenses within a Zone (Zone 20 or 30) is equal to or greater than five, thus it was run for Zone 20 and Zone 30 in 2023.. All remaining applicants not selected in the first two steps were then placed into the general drawing with all the other applicant names for the remaining elk licenses (60%) available in the zone and season they had selected on their application.

METHODS

All elk hunters are required to attend a mandatory orientation session the Friday before a given hunt. At this session, DNR staff go over the logistics of the elk hunt and explain how we collect biological samples from their harvested animal. 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 collect biological samples. DNR staff collect lymph nodes, the obex (brain stem), muscle, hair, and a tooth so an accurate age can be determined via cementum annuli. 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 the DNR Wildlife Health Program for disease testing and other monitoring projects.

RESULTS

In 2023, a total of 11 elk were harvested in Zones 20 and 30 combined (Table 3), for an overall hunter success rate of 50% for Zone 20 and 100% for Zone 30. Although success rates were lower than in the past, there was a gradual decrease in success rates for Zone 20 as the seasons progressed. Three bull elk were taken from hunters using either-sex licenses for Zone 20, and 3 antlerless elk were taken by hunters using antlerless-only licenses. Five bull elk were taken by hunters using either-sex licenses for Zone 30. Long-term elk harvest for all zones is depicted in Tables 4, 5, and 6.

In 2023, Red Lake Band of Chippewa Indians offered a lottery for 30 permits for tribal members to hunt elk in the area included under the 1863 Old Crossing Treaty. Elk harvest was capped at 15. Hunting season dates were September 15 to December 31, 2023 and permits could be used to harvest either antlered or antlerless elk. Ten elk were reported to be taken during this season.

Table 1. Kittson Central (Zone 20) elk survey count, 2008-2023

Year	Number of bulls surveyed	Number of antlerless surveyed	Total number surveyed
2008	14	46	60
2009	16	29	45
2010	NO SURVEY	NO SURVEY	NO SURVEY
2011	12	31	43
2012	NO SURVEY	NO SURVEY	NO SURVEY
2013	17	28	45
2014	17	20	37
2015	18	16	34
2016	18	34	52
2017	16	45	61
2018	18	57	75
2019	33	61	94
2020	33	69	102
2021	NO SURVEY	NO SURVEY	NO SURVEY
2022	33	51	84
2023	25	50	75

Table 2. License allocation and application numbers of the 2023 Minnesota elk seasons

Zone	Season Dates	Either-Sex	Antlerless-Only	Total	Total Applicants
Zone 20	A: Sept 9-Sept 17	2	0	**2**	818
Zone 20	D: Sept. 9–Sept 17	0	2	**2**	74
Zone 20	B: Sept 23-Oct 1	2	0	**2**	761
Zone 20	E: Sept 23-Oct 1	0	2	**2**	81
Zone 20	C: Oct 7-Oct 15	2	0	**2**	545
Zone 20	F: Oct 7-Oct 15	0	2	**2**	69
Zone 30	G: Sept 9-Sept 17	3	0	**3**	915
Zone 30	H: Sept 23-Oct 1	2	0	**2**	461
OVERALL	**TOTAL**	**11**	**6**	**17**	**3,724**

Table 3. Distribution of the 2023 Minnesota elk harvest.

Kittson County Central Hunt

Zone 20

Season	**Either-Sex Licenses**	**Antlerless Licenses**	**Bulls taken**	**Antlerless taken**	**Total elk taken**	**Success rate**
Season A & D (Sept 9-Sept 17)	2	2	2	1	**3**	75%
Season B & E (Sept 23-Oct 1)	2	2	1	1	**2**	50%
Season C & F (Octt7-Oct 15)	2	2	0	1	**1**	25%
Total	**6**	**6**	**3**	**3**	**6**	**50%**

Kittson County Northeast Hunt Zone 30

Season	**Either-Sex Licenses**	**Antlerless Licenses**	**Bulls taken**	**Antlerless taken**	**Total elk taken**	**Success rate**
Season G (Sept 9-17)	3	0	3	0	**3**	100%
Season H (Sept 23- Oct 1)	2	0	2	0	**2**	100%
Total	**5**	**0**	**5**	**0**	**5**	**100%**

Table 4. Grygla (Zone 10) elk harvests, 1987-2012

Year	Total Bull or Either-Sex Licenses	Total Bulls Harvested	Total Antlerless Licenses	Total Antlerless Harvested	Total Harvest	Hunter Success Rate
1987	2	1	2	1	2	50%
1996	2	2	7	6	8	89%
1997	5	1	5	2	3	30%
1998	4	2	0	0	2	50%
2004	1	1	4	2	3	60%
2005	1	0	4	0	0	0%
2006	2	2	6	2	4	50%
2007	0	0	6	6	6	100%
2008	2	2	10	6	8	67%
2009	2	2	12	12	14	100%
2010	2	1	5	3	4	57%
2011	2	2	3	0	2	40%
2012	2	1	3	0	1	20%

Table 5. Kittson Central (Zone 20) elk harvests, 2008-2023

Year	Total Bull or Either-Sex Licenses	Total Bulls Harvested	Total Antlerless Licenses	Total Antlerless Harvested	Total Harvest	Hunter Success Rate
2008	1	1	10	10	11	100%
2009	12	9	4	5	14	88%
2010	1	1	3	3	4	100%
2011	2	3	6	4	7	88%
2012	3	3	13	3	6	38%
2013	6	4	15	6	10	48%
2014	7	4	0	0	4	57%
2015	5	3	0	0	3	60%
2016	5	3	0	0	3	60%
2017	6	5	2	1	6	75%
2018	4	3	16	12	15	75%
2019	4	4	21	10	14	56%
2020	18	15	24	20	35	83%
2021	8	7	20	16	23	82%
2022	8	7	20	8	15	54%
2023	6	3	6	3	6	50%

Table 6. Kittson Northeast (Zone 30) elk harvests, 2012-2023

Year	Total Bull or Either-sex Licenses	Total Bulls Harvested	Total Antlerless Licenses	Total Antlerless Harvested	Total Harvest	Hunter Success Rate
2012	2	1	0	0	1	50%
2013	2	2	0	0	2	100%
2014	2	2	0	0	2	100%
2015	2	2	0	0	2	100%
2016	2	2	0	0	2	100%
2017	5	4	0	0	4	80%
2018	2	2	0	0	2	100%
2019	2	1	0	0	1	50%
2020	2	2	0	0	2	100%
2021	2	2	0	0	2	100%
2022	2	2	0	0	2	100%
2023	5	5	0	0	5	100%

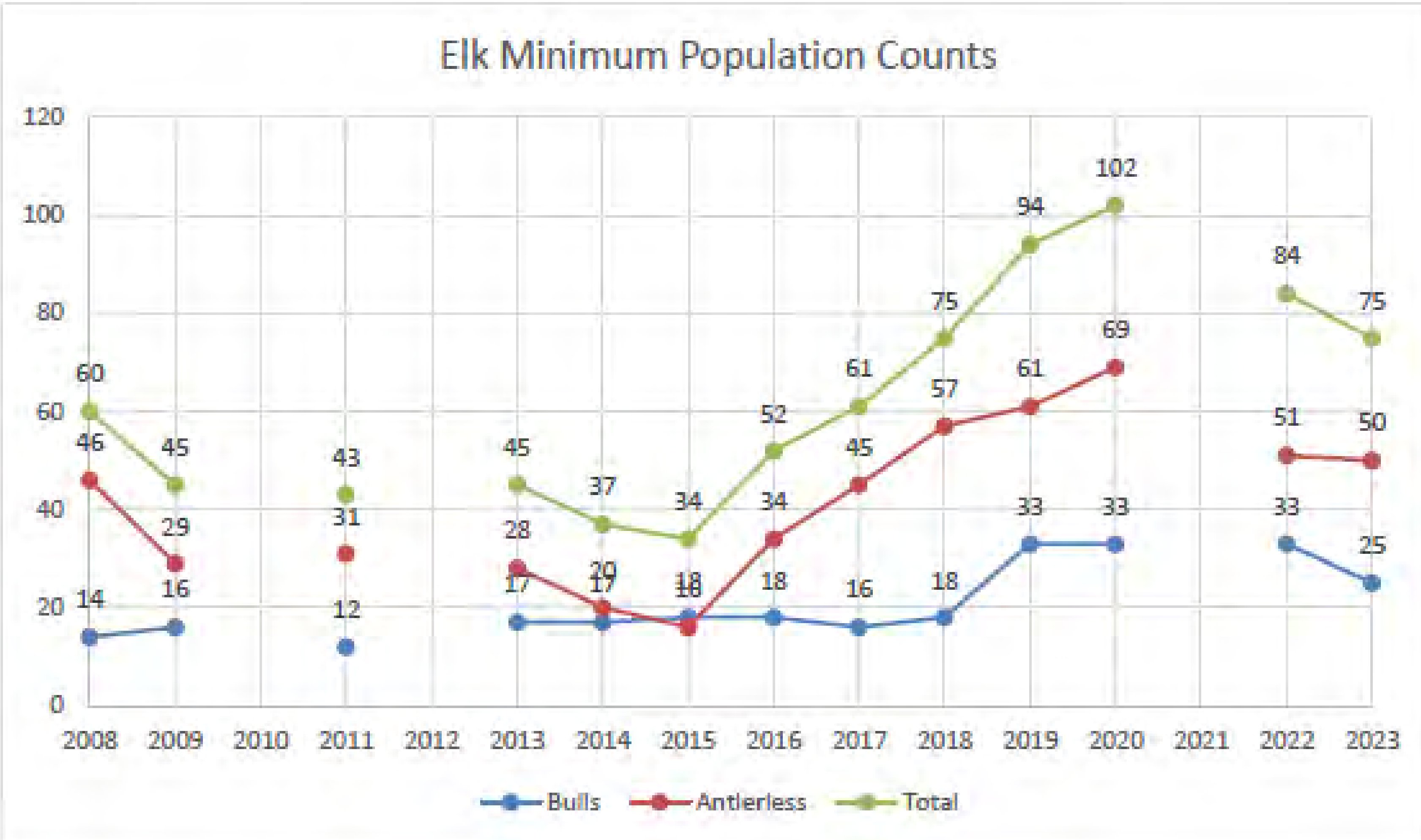

Figure 1. Kittson Central (Zone 20) elk survey count, 2008-2023

Minnesota Elk Hunt Zones

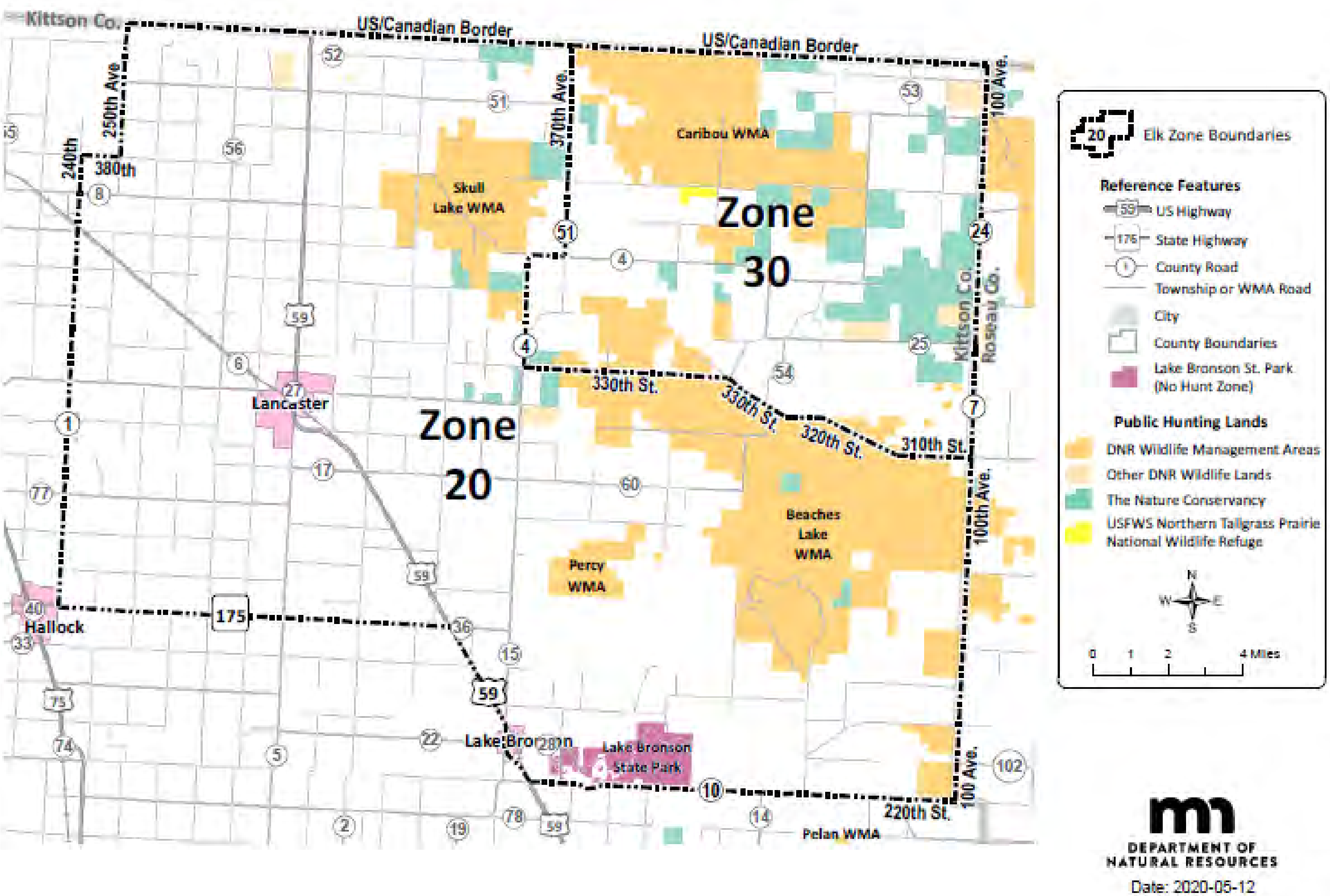

Figure 2. Kittson County Elk Hunt zones.

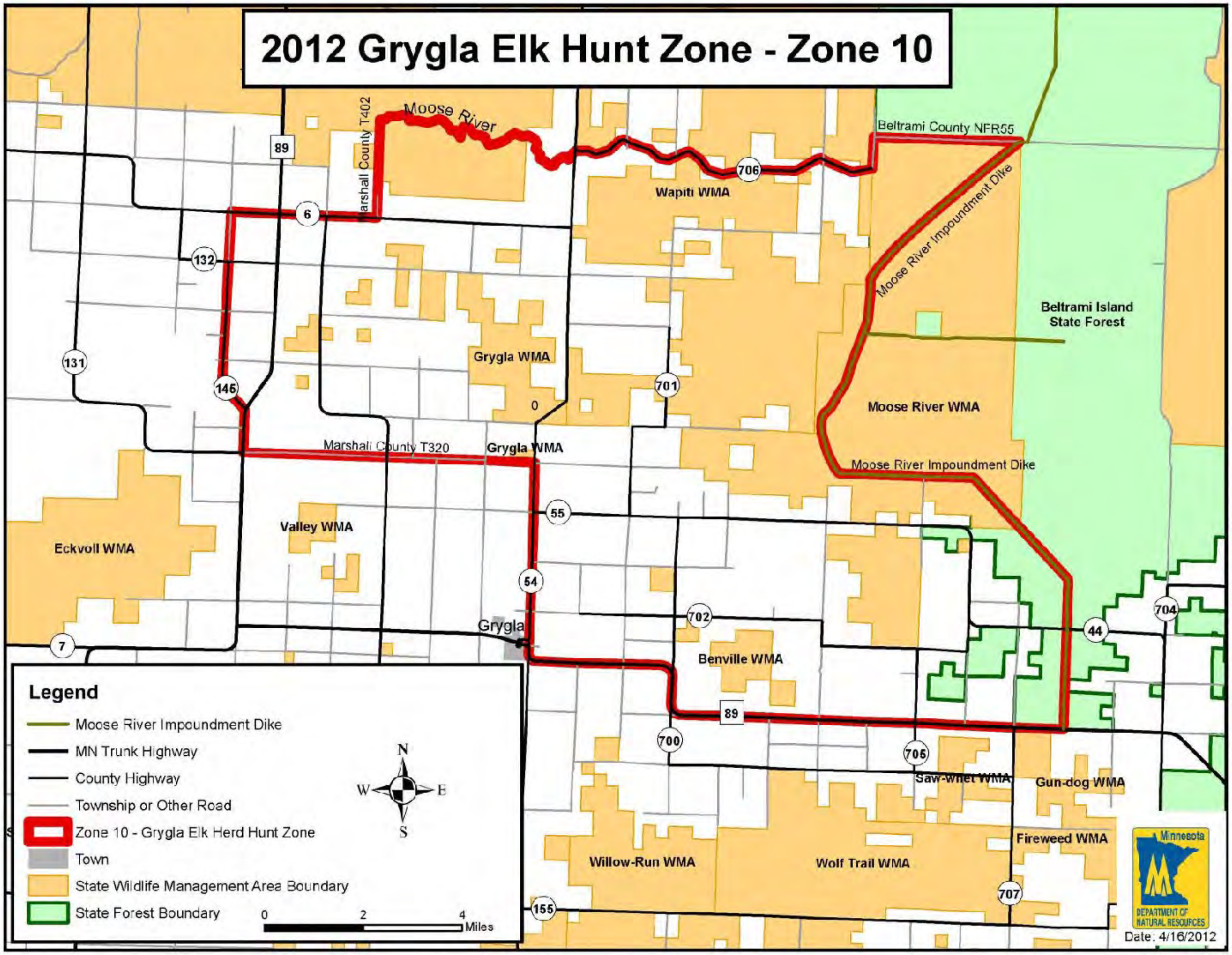

Figure 3. Grygla Elk Hunt zone.

MINNESOTA SANDHILL CRANE HARVEST REPORT, 2023

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 thru the 2019 season. In 2020 the limit was increase to 2 daily and 6 in possession. Hunters were required to purchase a $3.00 sandhill crane permit. A sample of sandhill crane permit holders were selected to receive a harvest survey from the U.S. Fish and Wildlife Service after the season. This survey is used to monitor harvest levels and hunting activity (Table 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.

Seamans, M.E. 2024. 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, Lakewood, Colorado. 46pp + tables and figures.) Status and Harvests of Sandhill Cranes 2024

Table 1. Sandhill Crane season dates and limits in Minnesota, 2010 – 2023.

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
2019	14 Sept – 20 Oct	1	3
2020	19 Sept – 25 Oct	1	3
2021	18 Seot – 24 Oct	1	3
2022	17 Sept – 23 Oct	2	6
2023	16 Sept – 22 Oct	2	6

Table 2. Sandhill crane permit sales, estimated number of active hunters and harvest for NW Minnesota, 2010-2023. (Seamans, M.E. 2024)

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
2019	1,073	333	179
2020	1,288	480	472
2021	1,479	632	563
2022	1,424	898	863
2023	1,560	843	876

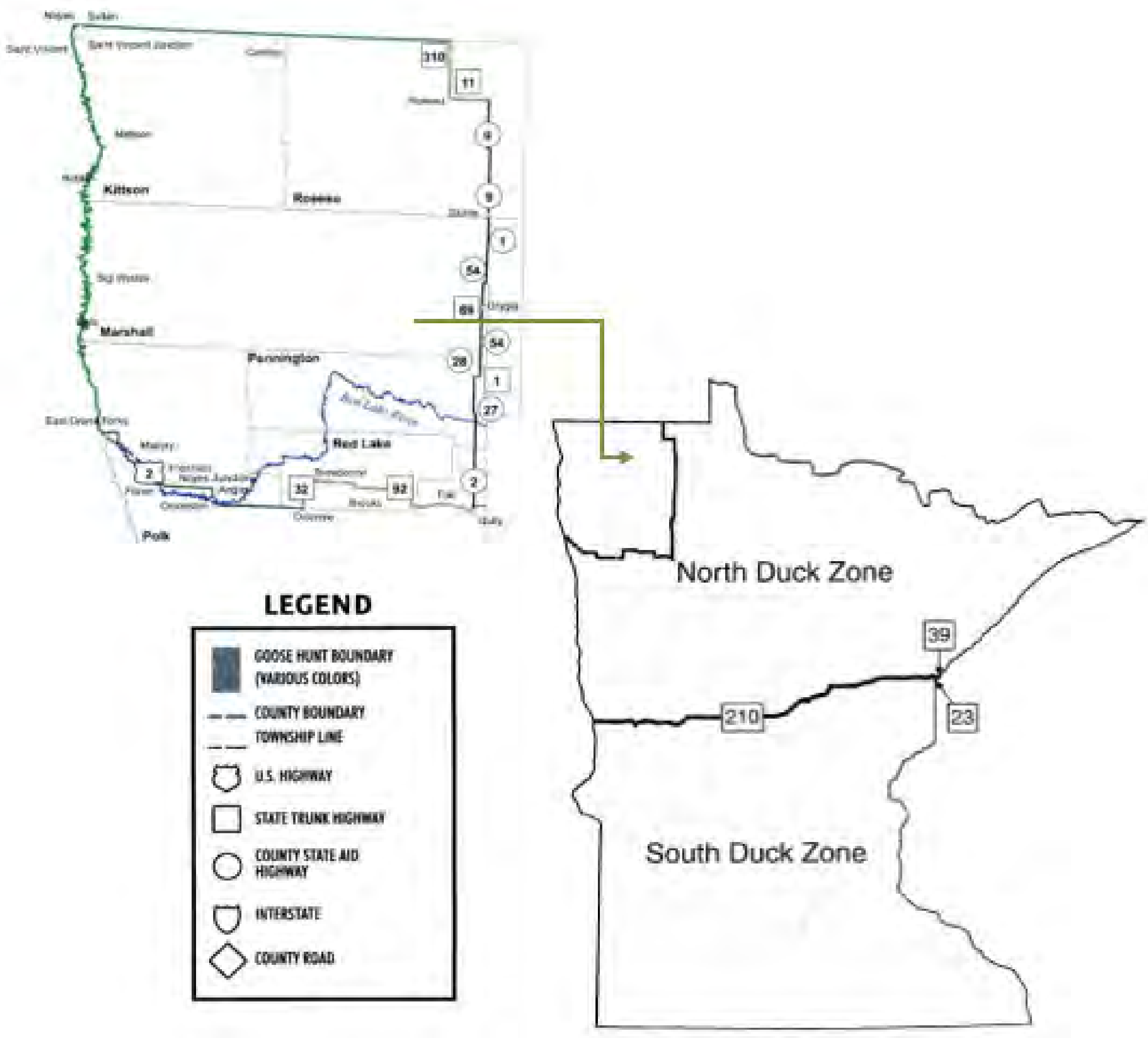

Figure 1. Sandhill crane hunting zone in Minnesota, 2010-2023.

TRAPPING HARVEST STATISTICS

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2023 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 2024. There were 6,019 active trapping licenses in the ELS database, which consisted of 3,993 Resident Regular Trappers, 8 age - eligible Resident Junior Trappers, 1,259 Resident Senior Trappers, 597 "active" Lifetime Trappers, and 15 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 = 65%, range: 48–79%). 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 were tabulated using Viking Data Entry VDE+ software, and then summarized using the R programming language (R version 4.4.0 (2024-04-24 ucrt); R Development Core Team 2024).

RESULTS

We mailed out 5,872 surveys, 79 surveys were undeliverable and 2,802 were returned for an adjusted response rate of 48.4%. Among respondents, 65% 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.

Dear Trapper:

You are being asked as a trapping license buyer to assist us in evaluating the 2023-2024 trapping season (**March 2023-February 2024**). For Spring Beaver, please report only animals taken between March 1, 2023 and May 15, 2023. 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. No envelope or stamp is necessary; just tear along the perforation and drop into a mailbox.

THANK YOU FOR YOUR COOPERATION

Wildlife Research Program Manager
Division of Fish and Wildlife
Department of Natural Resources

2023 Trapper Report

1. Did you set traps/snares in Minnesota this year during the 2023-2024 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 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.

		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'23)	81				
Beaver (Oct'23-Feb'24)	82				
Pine marten	37				
Otter	38				
Fisher	36				
Badger	35				
Long-tailed weasel	31				
Short-tailed weasel	30				
Opossum	10				
Bobcat	98				
Raccoon	94				
Red Fox	95				

Figure 1. Trapper survey card, 2023.

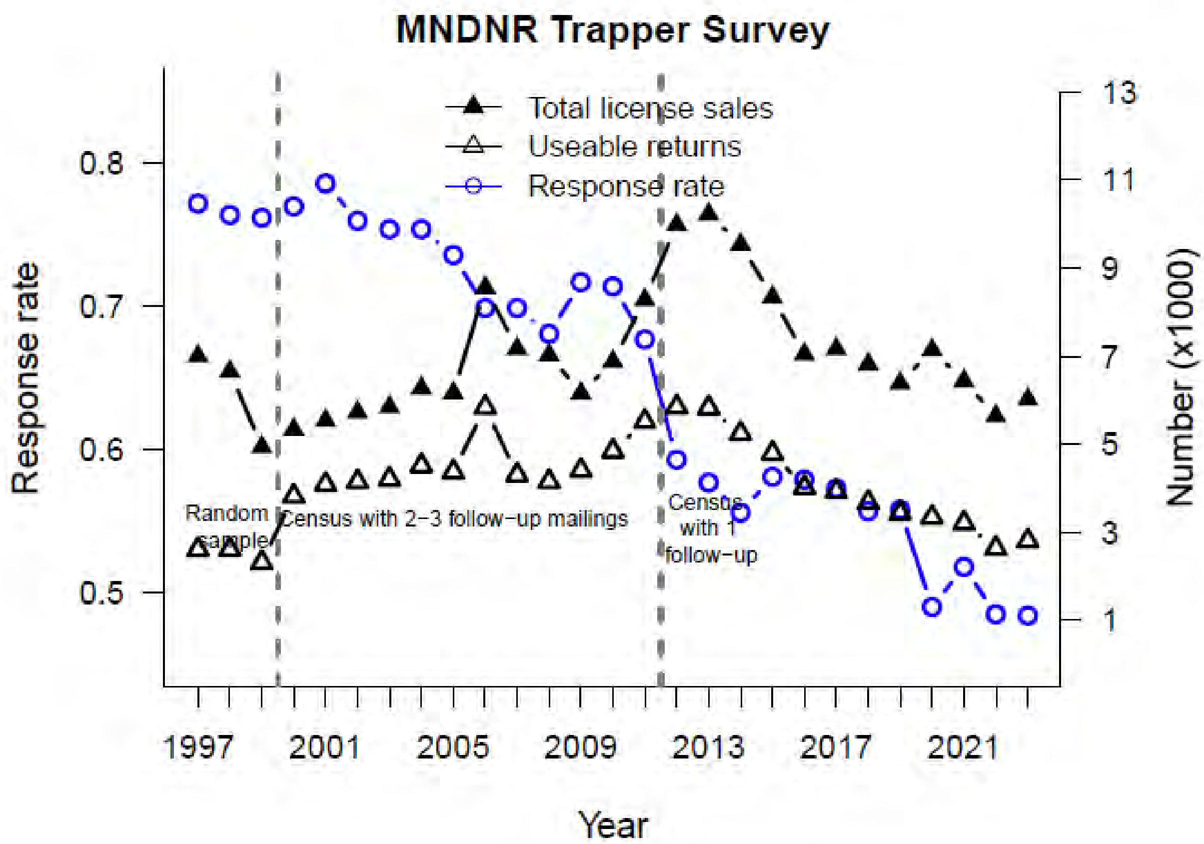

Figure 2. Trapper annual license sales and mail survey response, 1997-98 through 2023-24.

Table 1. Use of trapper licenses, 2012-13 through 2023-24.

Year		Returns from mail survey	Projections from license sales
2012-13	Trapped Did not trap	4,537 (77.6%) 1,307 (22.4%) 5,844 (100.0%)	7,747 2,236 9,983[a]
2013-14	Trapped Did not trap	4,342 (74.6%) 1,480 (25.4%) 5,822 (100.0%)	7,627 2,597 10,224[a]
2014-15	Trapped Did not trap	3,786 (72.2%) 1,459 (27.8%) 5,245 (100.0%)	6,888 2,652 9,540[a]
2015-16	Trapped Did not trap	3,296 (68.8%) 1,496 (31.2%) 4,792 (100.0%)	5,734 2,600 8,334[a]
2016-17	Trapped Did not trap	2,558 (63.7%) 1,458 (36.3%) 4,016 (100.0%)	4,487 2,557 7,044[a]
2017-18	Trapped Did not trap	2,654 (67.6%) 1,272 (32.4%) 3,926 (100.0%)	4,692 2,249 6,941[a]
2018-19	Trapped Did not trap	2,382 (64.8%) 1,292 (35.2%) 3,674 (100%)	4,326 2,350 6,676[a]
2019-20	Trapped Did not trap	2,182 (63.6%) 1,249 (36.4%) 3,431 (100%)	3,954 2,263 6,217[a]
2020-21	Trapped Did not trap	2,214 (66.3%) 1,125 (33.7%) 3,339 (100%)	4,607 2,341 6,948[a]
2021-22	Trapped Did not trap	1,938 (60.4%) 1,269 (39.6%) 3,207 (100%)	3,790 2,485 6,275[a]
2022-23	Trapped Did not trap	1,458 (55.4%) 1,176 (44.6%) 2,634 (100%)	3,053 2,457 5,510[a]
2023-24	Trapped Did not trap	1,812 (64.7%) 990 (35.3%) 2,802 (100%)	3,799 2,073 5,872[a]

[a] excludes duplicates.

Table 2. Estimated number of trappers of various furbearers, 2012-13 through 2023-24.

	Estimated number of trappers											
	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
Muskrat	4,110	3,410	2,902	2,218	1,797	1,882	1,583	1,225	1,296	998	668	840
Mink	3,110	2,780	2,158	1,587	1,049	1,084	995	795	905	598	409	533
Short-tailed weasel	690	510	666	289	195	283	166	261	345	171	155	336
Long-tailed weasel	540	480	519	265	174	190	151	168	238	139	101	209
Raccoon	4,680	4,660	4,182	2,781	2,032	2,168	1,952	1,806	1,925	1,435	1,186	1,760
Striped skunk	1,940	1,610	1,541	1,234	907	840	798	739	789	683	610	881
Badger	360	390	284	247	193	167	164	161	146	147	127	157
Opossum	1,100	1,110	575	463	469	785	646	548	606	498	373	432
Red fox	2,240	2,080	2,012	1,434	1,048	1,258	1,091	955	1,181	875	555	761
Gray fox	1,180	1,060	1,035	684	446	458	381	241	261	181	131	198
Coyote	2,360	2,200	2,396	1,981	1,479	1,781	1,586	1,344	1,683	1,321	959	1,158
Beaver (Oct - Feb)	2,620	2,710	2,189	1,894	1,642	1,495	1,535	1,333	1,561	1,379	1,178	1,620
Beaver (previous Spring)	1,810	1,150	1,305	1,145	1,130	1,194	1,000	1,153	1,347	1,214	1,038	1,201

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, 2012-13 through 2023-2024.

	Estimated take per successful trapper reporting that species											
	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
Muskrat	59	36	39	51	49	45	40	32	36	36	29	21
Mink	6	6	5	5	6	5	5	5	4	4	3	4
Short-tailed weasel	7	5	8	4	5	5	6	5	4	3	5	5
Long-tailed weasel	4	3	5	3	3	3	3	3	3	3	3	4
Raccoon	18	16	15	11	12	14	13	17	11	9	9	12
Striped skunk	7	6	6	6	7	6	5	6	6	6	5	6
Badger	2	2	2	2	2	2	2	2	2	2	2	2
Opossum	7	7	7	4	5	8	9	7	6	6	7	6
Red fox	4	3	4	3	3	4	4	4	4	3	3	3
Gray fox	3	2	2	2	2	2	2	2	2	2	2	2
Coyote	5	5	5	6	5	7	8	7	7	6	5	6
Beaver (Oct –Feb)	10	9	8	8	8	8	9	8	11	9	10	12
Beaver (previous Spring)	20	9	16	14	17	19	19	23	20	21	22	21

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, 2012-13 through 2023-2024[a]

	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
Trapper license sales [b]	9,998	10,224	9,540	8,334	7,044	7,163	6,815	6,386	7,139	6,435	5,637	6,019
Estimated harvest [c, d, e]												
Muskrat	242,120	120,500	111,998	112,219	87,958	83,844	63,021	38,777	46,224	35,310	18,890	17,058
Mink	18,460	14,710	10,211	7,745	5,439	5,218	4,412	3,483	3,024	2,066	970	1,604
Short-tailed weasel	4,500	2,360	4,806	1,083	930	1,305	995	1,245	1,359	513	720	1,355
Long-tailed weasel	2,030	1,410	2,568	734	466	554	340	379	689	287	277	748
Raccoon	79,800	70,380	58,868	29,963	22,874	28,899	24,845	29,297	19,740	12,571	10,455	19,716
Striped skunk	12,620	9,430	7,956	6,349	5,458	4,476	3,961	4,078	4,023	3,665	3,025	5,129
Badger	570	600	347	376	286	278	221	231	280	230	175	239
Opossum	6,780	6,720	3,524	1,814	2,124	6,160	5,248	3,548	3,143	2,942	2,331	2,567
Red fox	7,540	5,710	6,040	4,061	2,707	4,500	3,530	2,896	3,953	2,401	1,388	2,086
Gray fox	2,550	1,940	1,902	1,161	715	736	611	336	321	200	180	233
Coyote	11,130	9,010	11,703	10,084	7,308	12,303	11,359	8,630	10,183	7,157	4,640	6,200
Beaver (Oct- Feb)	24,590	23,220	15,671	14,181	13,070	11,223	12,937	9,900	15,823	11,188	10,626	19,432
Beaver (previous Spring)	34,600	10,110	20,820	15,966	19,004	22,293	18,649	26,368	26,464	24,911	22,083	24,853
Registered harvest [e, f]												
Otter	3,171	2,824	2,148	1,955	1195	1,295	1,351	1,050	1,304	1,155	855	1,716
Bobcat [g]	1,875	1,038	1,380	766	485	731	1,015	695	1,325	724	489	1,009
Fisher	1,293	1,146	919	756	399	477	510	463	712	577	200	543
Marten	1,472	1,014	1,055	877	551	979	665	585	765	434	211	698
Wolf [h]	413	238	272	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed

[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, 2024 6,019 trapping licenses were sold in 2023: 125 (2.0%) were junior licenses, 4,004 (66.5%) were regular adult licenses, 1,263 (20.9%) were senior licenses, 612 (10.2%) were Lifetime licenses, and 15 (<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] There has been no open season in Minnesota on Eastern spotted skunk (Threatened) since 1996 or Lynx (Special Concern) since 1984. They are fully protected.
[f.] Registered harvest information as reported from annual, mandatory registration.
[g] Registered harvest for bobcat includes animals taken by hunting.
[h] A wolf season was opened in 2012, 2013, and 2014. The season was closed pre-2012 and post-2014. Registered harvest includes animals taken by hunting.

MINNESOTA FUR BUYERS SURVEY FOR THE 2022-2023 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 October 2024, questionnaires were mailed to the 16 licensed fur buyers in Minnesota. The survey asked them to report the number and type of fur purchased from Minnesota trappers and hunters in 2023-24 and the "average price" paid to those hunters and trappers based on all fur purchased. A total of 11 usable surveys were received, for a return rate of 68 percent.

Calculations of average pelt price for each species were weighted according to the number of pelts purchased by each buyer.

Table 1. Minnesota fur prices as reported by licensed fur dealers, 2022-23.

Species	Number Pelts	Minimum Price	Maximum Price	Weighted Mean
Muskrat	4084	1.95	3.00	2.70
Mink Female	161	4.53	10.00	8.24
Mink male	148	4.53	9.00	5.05
Raccoon	3,536	4.00	9.62	6.21
Red Fox	215	10.00	15.72	14.87
Gray Fox	21	12.00	15.00	14.86
Coyote	528	10.00	15.30	11.69
Bobcat	69	20.00	105.00	91.96
River Otter	330	22.00	35.00	31.16
Beaver 10-12	4,170	8.00	30.00	27.22
Beaver 3-4	11,572	14.00	25.00	24.38
L.T. Weasel	2	0.00	15.00	15.00
S.T. Weasel	336	2.00	5.00	4.68
Striped Skunk	358	2.00	10.00	9.19
Badger	28	13.00	22.00	16.07
Opossum	68	1.50	2.00	1.67
Fisher Male	28	38.00	50.00	46.57
Fisher Female	25	40.00	40.00	40.00
Marten Male	61	5.00	55.00	50.90
Marten Female	56	35.00	45.00	43.93
Deer Hides	3,790	3.00	6.50	5.35
Bear Hides	8	25.00	50.00	34.38

Table 2. Average price per pelt paid to hunters and trappers in Minnesota, 2013-14 through 2023-24

	Average pelt prices paid hunters and trappers in Minnesota (dollars)										
Species	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21*	2021-22	2022-23	2023-24
Muskrat	8.72	4.85	2.28	2.65	2.59	2.38	2.84	NA	2.66	2.24	2.70
Mink (female)	13.72	7.45	4.99	6.20	5.80	6.02	3.07	NA	3.87	2.81	8.24
Mink (male)	18.11	10.50	6.18	7.47	7.29	7.61	3.46	NA	5.50	5.58	5.05
Raccoon	16.58	8.64	5.11	4.92	5.76	7.30	6.66	NA	4.39	6.09	6.21
Red Fox	30.90	20.41	11.86	10.52	13.30	10.93	9.95	NA	10.74	10.76	14.87
Gray Fox	21.27	14.17	10.64	10.33	11.32	13.42	12.70	NA	14.77	12.85	14.86
Coyote	21.30	25.10	21.48	17.39	25.15	36.20	38.71	NA	10.96	9.15	11.69
Bobcat	88.63	66.67	57.46	35.88	63.52	60.33	61.97	NA	55.38	69.84	91.96
Otter	61.32	34.57	30.03	21.05	21.98	25.07	20.64	NA	19.72	16.30	31.16
Beaver (fall-winter)	16.52	12.40	8.77	8.14	8.32	8.30	7.66	NA	8.11	17.77	27.22
Beaver (spring)	14.77	10.69	8.24	7.33	10.39	8.95	7.86	NA	10.63	19.97	24.38
L.T. Weasel	2.35	1.78	1.46	1.41	0.00	0.00	0.00	NA	0.00	0.00	15.00
S.T. Weasel	0.00	2.00	1.41	0.00	2.79	2.45	2.08	NA	4.35	4.64	4.68
Striped Skunk	4.14	3.86	3.65	4.00	7.12	5.25	6.30	NA	9.24	5.98	9.19
Badger	13.72	9.52	9.57	7.86	9.09	7.94	8.14	NA	19.50	13.43	16.07
Opossum	1.52	1.17	1.98	1.32	1.34	0.96	0.83	NA	2.20	1.37	1.67
Fisher (male)	61.32	41.76	34.88	28.00	29.87	43.03	21.02	NA	26.61	29.55	46.57
Fisher (female)	67.73	50.87	34.39	37.07	36.75	39.57	19.84	NA	24.63	24.23	40.00
Marten (male)	74.10	38.92	30.83	29.94	36.90	41.81	27.35	NA	28.91	32.05	50.90
Marten (female)	70.94	32.20	28.89	30.41	33.96	33.06	23.75	NA	24.09	23.24	43.93
Deer Hides	6.09	5.59	5.62	4.00	4.14	3.18	2.91	NA	2.30	3.15	5.35
Bear Hides	42.63	32.94	46.03	32.97	25.91	32.33	32.72	NA	30.56	47.50	34.38

*No pelt price survey was conducted.

REGISTERED FURBEARER HARVEST STATISTICS

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REGISTERED FURBEARER HARVEST STATISTICS 2023-24

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 monitoring the effects of changes in harvest seasons, harvest techniques, and habitat. The level of detail or accuracy necessary in harvest information varies across species, depending on factors such as population density, harvest pressure, habitat 'sensitivity' of the species, and reproductive potential.

In Minnesota, detailed harvest information is collected on 4 carnivores – fishers (*Pekania pennanti*), martens (*Martes americana*), bobcats (*Lynx rufus*), and river otters (*Lontra canadensis*). 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 has been collected on these species for the past 45 years to help ensure sustainable harvests and populations.

METHODS

Hunters and trappers are required to bring pelts from harvested animals (fishers, martens, bobcats, and river 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) for each animal, 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 river otter harvest is allowed statewide (Figure 1). The only change to season parameters for any of the four registered species this year was a one week shorter otter season compared to 2022-23 (Table 1). Primarily due to substantial declines in last year's harvest due to weather-related reductions in trapper effort, harvests of all species increased significantly this year; bobcat harvest increased 106%, fisher harvest increased 172%, marten harvest increased 231%, and otter harvest increased 101%. Detailed harvest summaries are provided in the following tables and graphs. Data for years prior to those presented in this report are 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 and entry of data contained in this report. This work was funded in part by the Wildlife Restoration Program (Pittman-Robertson).

NOTE: This report does not include tribal harvests, or any confiscations

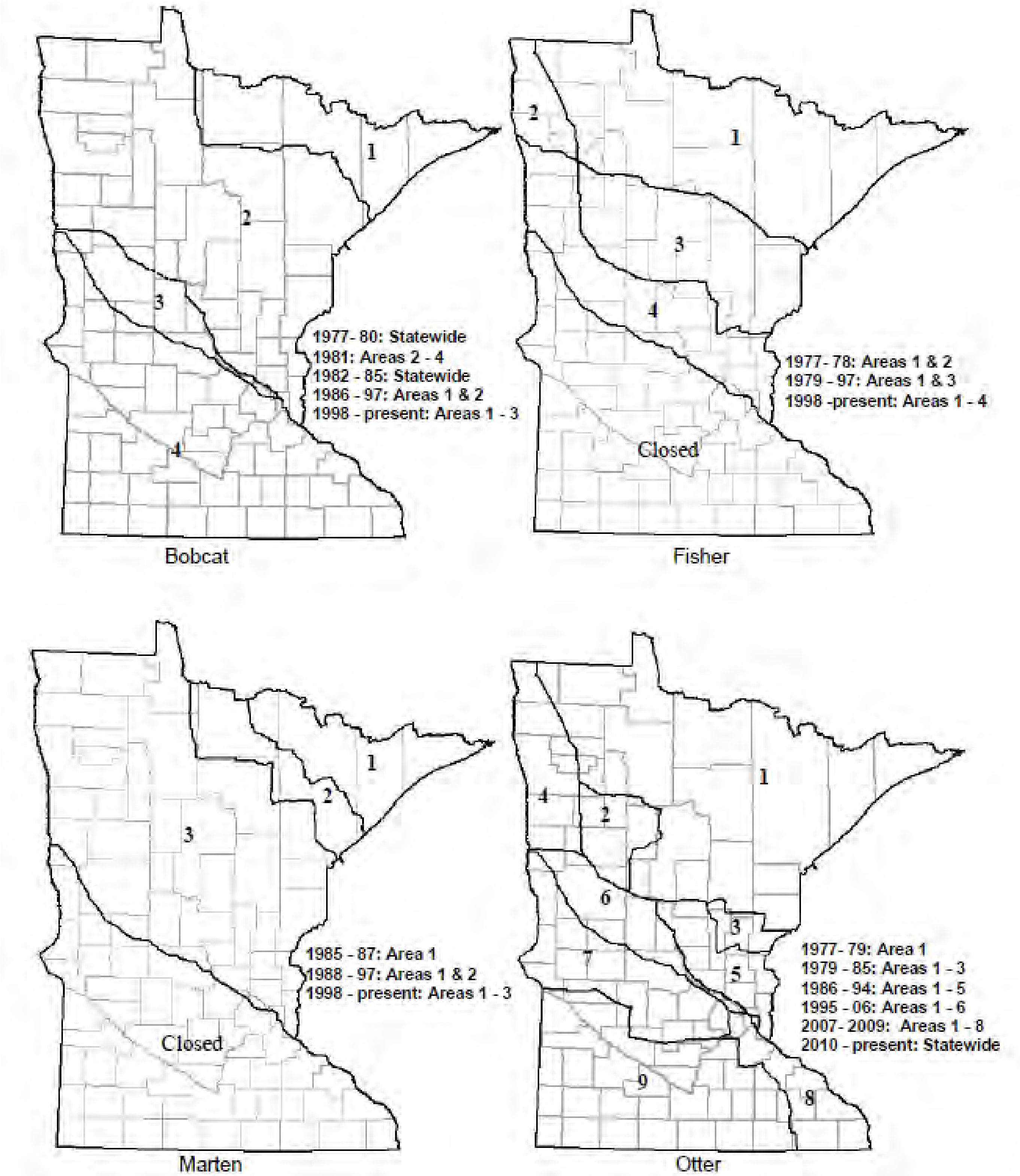

Figure 1. Open trapping areas in Minnesota for fisher, marten, bobcat, and river otter, 1977 - present.

Table 1. Registered furbearer seasons and harvests, 1993-2023.

	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
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
2019-20	12/21-1/26	37	5	695	12/21-12/29	9	2	463	12/21-12/29	9	2	585	10/26-1/26	99	4	1050
2020-21	12/19-1/24	37	5	1325	12/19-12/27	9	2	712	12/19-12/27	9	2	765	10/24-1/24	99	4	1304
2021-22	12/18-1/23	37	5	724	12/18-12-26	9	2	577	12/18-12/26	9	2	434	10/23-1/23	99	4	1155
2022-23	12/17-1/22	37	5	489	12/17-12/25	9	2	200	12/17-12/25	9	2	211	10/29-1/22	92	4	855
2023-24	12/9-1/14	37	5	1009	12/9-12/17	9	2	543	12/9-12/17	9	2	698	10/28-1/14	85	4	1716

[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 than the south zone. Otter season dates in this table reflect the start of the north zone.

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

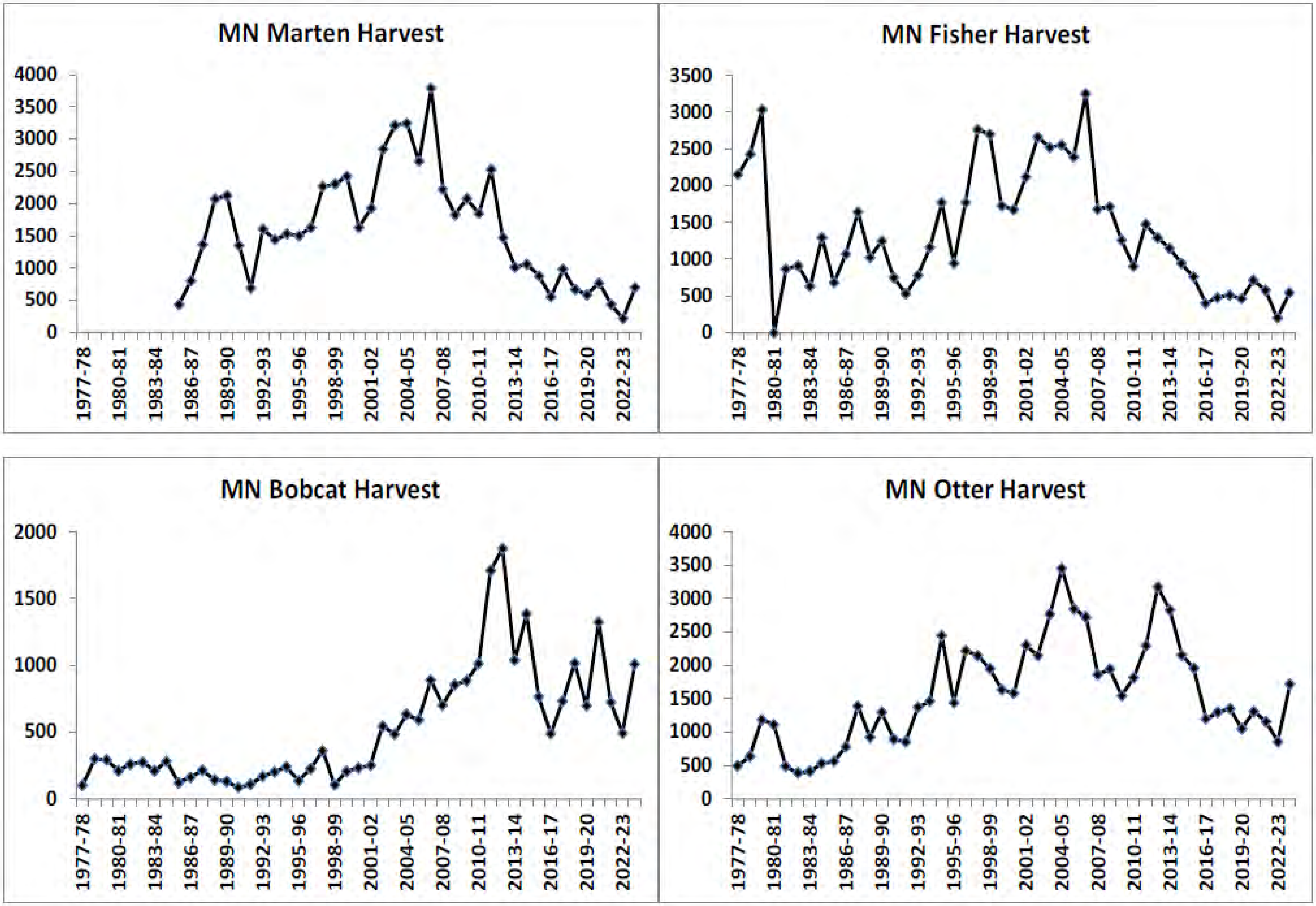

Figure 2. Harvest of registered furbearers in Minnesota, 1977-present.

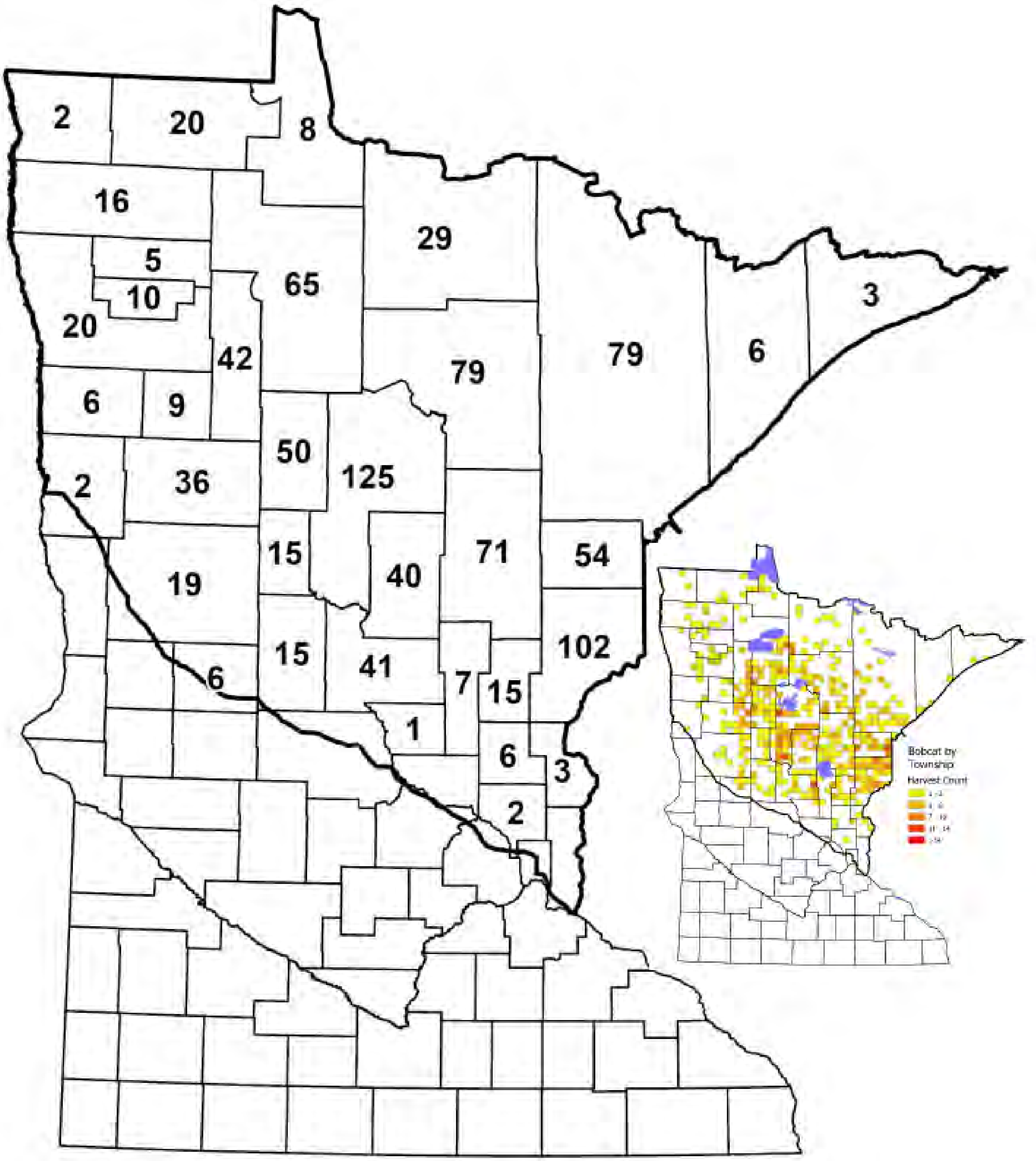

Figure 3. Bobcat harvest by county, 2023-24. Inset shows spatial distribution of harvest locations.

Table 2. Bobcat harvest by county and sex, 2023-24.

County	Sex*			Total	Harvest/ 100 Mile[2]
	Female	Male	Unknown		
Aitkin	32	39		71	3.56
Anoka	0	2		2	0.45
Becker	20	16		36	2.49
Beltrami	32	33		65	2.13
Benton	0	1		1	0.24
Carlton	33	21		54	6.17
Cass	65	60		125	5.18
Chisago	2	1		3	0.68
Clay	2	0		2	0.19
Clearwater	17	25		42	4.08
Cook	2	1		3	0.19
Crow Wing	20	20		40	3.46
Douglas	3	3		6	0.83
Hubbard	29	21		50	5.00
Isanti	3	3		6	1.33
Itasca	34	45		79	2.70
Kanabec	9	6		15	2.81
Kittson	2	0		2	0.18
Koochiching	8	21		29	0.92
Lake	3	3		6	0.26
Lake of the Woods	3	5		8	0.45
Mahnomen	4	5		9	1.54
Marshall	10	6		16	0.88
Mille Lacs	4	3		7	1.03
Morrison	20	21		41	3.56
Norman	3	3		6	0.68
Otter Tail	11	8		19	0.85
Pennington	2	3		5	0.81
Pine	55	46	1	102	7.12
Polk	5	14	1	20	1.00
Red Lake	4	6		10	2.31
Roseau	10	10		20	1.19
Sherburne	0	0		0	0.00
St. Louis	27	52		79	1.17
Stearns	0	0		0	0.00
Todd	9	6		15	1.53
Wadena	5	10		15	2.76
Unknown	0	0		0	
Total	488	519	2	1009	

* 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, 2013-2023.

County	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
Aitkin	65	105	39	22	41	51	55	109	59	32	71
Anoka	0	1	0	0	0	0	0	0	0	0	2
Becker	36	48	36	10	31	22	14	32	9	11	36
Beltrami	59	73	49	30	37	60	34	94	52	41	65
Benton	3	0	0	1	2	3	1	2	0	1	1
Carlton	42	88	25	16	33	42	27	68	47	11	54
Cass	76	126	73	44	72	91	52	113	53	43	125
Chisago	1	1	3	4	2	5	3	4	1	2	3
Clay	2	3	1	0	0	2	0	1	2	2	2
Clearwater	19	29	15	13	14	18	14	41	18	18	42
Cook	9	17	1	0	2	0	2	4	2	5	3
Crow Wing	19	32	21	7	24	28	15	38	24	11	40
Douglas	1	0	0	0	0	1	0	0	0	25	6
Hubbard	51	50	45	21	44	41	19	66	28	0	50
Isanti	1	0	1	1	0	0	0	1	1	2	6
Itasca	93	110	50	19	54	86	57	114	52	43	79
Kanabec	16	46	12	11	16	24	12	18	9	4	15
Kittson	5	5	7	6	3	3	10	8	3	1	2
Koochiching	50	40	22	25	26	62	24	47	38	31	29
Lake	13	15	8	4	8	24	8	21	9	11	6
Lake of the Woods	20	26	10	7	5	14	13	14	11	3	8
Mahnomen	4	4	3	5	2	4	2	10	0	5	9
Marshall	15	21	19	14	12	30	25	13	9	11	16
Mille Lacs	7	14	5	2	10	19	8	21	10	7	7
Morrison	15	25	16	17	19	37	22	28	14	15	41
Norman	3	8	4	1	4	7	2	4	5	1	6
Otter Tail	18	17	16	15	22	12	6	21	13	4	19
Pennington	7	3	4	1	4	8	7	6	6	6	5
Pine	54	87	56	37	43	46	47	62	81	14	102
Polk	10	16	15	10	9	5	3	14	15	6	20
Red Lake	6	11	3	1	15	10	10	25	5	4	10
Roseau	38	27	20	23	23	45	20	21	25	8	20
Sherburne	0	0	0	0	0	0	1	0	1	0	0
St. Louis	255	307	156	91	123	182	154	275	106	89	79
Stearns	2	0	1	0	0	0	0	0	0	0	0
Todd	5	8	8	9	13	10	7	7	2	3	15
Wadena	18	18	10	18	18	23	21	23	14	15	15
Unknown	0	3	12	0	0	0	0	0	0	4	0
Total	1038	1384	766	485	731	1015	695	1325	724	489	1009

Table 4. Bobcat harvest by sex and week, 2023-24 season.

Date	Sex*			Total	% of Total	Cumulative %
	Female	Male	Unknown			
Dec.9 - Dec.15	117	131	1	249	24.68	24.68
Dec.16 - Dec.22	122	108		230	22.79	47.47
Dec.23 – Dec.29	55	71	1	127	12.59	60.06
Dec. 30 – Jan. 5	77	86	1	163	16.15	76.21
Jan.6 - Jan.14**	102	115		217	21.51	97.72
Unknown	15	8		23	2.28	100.00
Total	488	519	2	1009	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, 1998-2023.

Number (%) of Takers	Number Taken					Total Takers
	1	2	3	4	5	
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
2019-20	214 (57)	77 (21)	37 (10)	19 (5)	27 (7)	374
2020-21	319 (50)	138 (22)	67 (11)	35 (6)	76 (12)	635
2021-22	215 (57)	71 (19)	41 (11)	24 (6)	29 (8)	380
2022-23	126 (58)	43 (20)	25 (11)	16 (7)	8 (4)	218
2023-24	286 (55)	101 (20)	48 (9)	35 (7)	47 (9)	517

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

Table 6. Bobcat harvest by method of take, 1996-2023.

	Total	Trapping					Hunting				
Year	Harvest[a]	Harvest	% of Total	# Takers	Ave. Take	% Males[b]	Harvest	% of Total	# Takers	Ave. Take	% Males[b]
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
2019-20	692	570	82	297	1.9	36	122	18	84	1.5	66
2020-21	1325	1124	85	512	2.2	43	201	15	126	1.6	56
2021-22	724	580	80	305	1.9	42	144	20	82	1.8	67
2022-23	489	391	80	218	1.8	38	98	20	62	1.6	60
2023-24	1009	890	88	436	2.0	51	119	12	83	1.4	56

[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

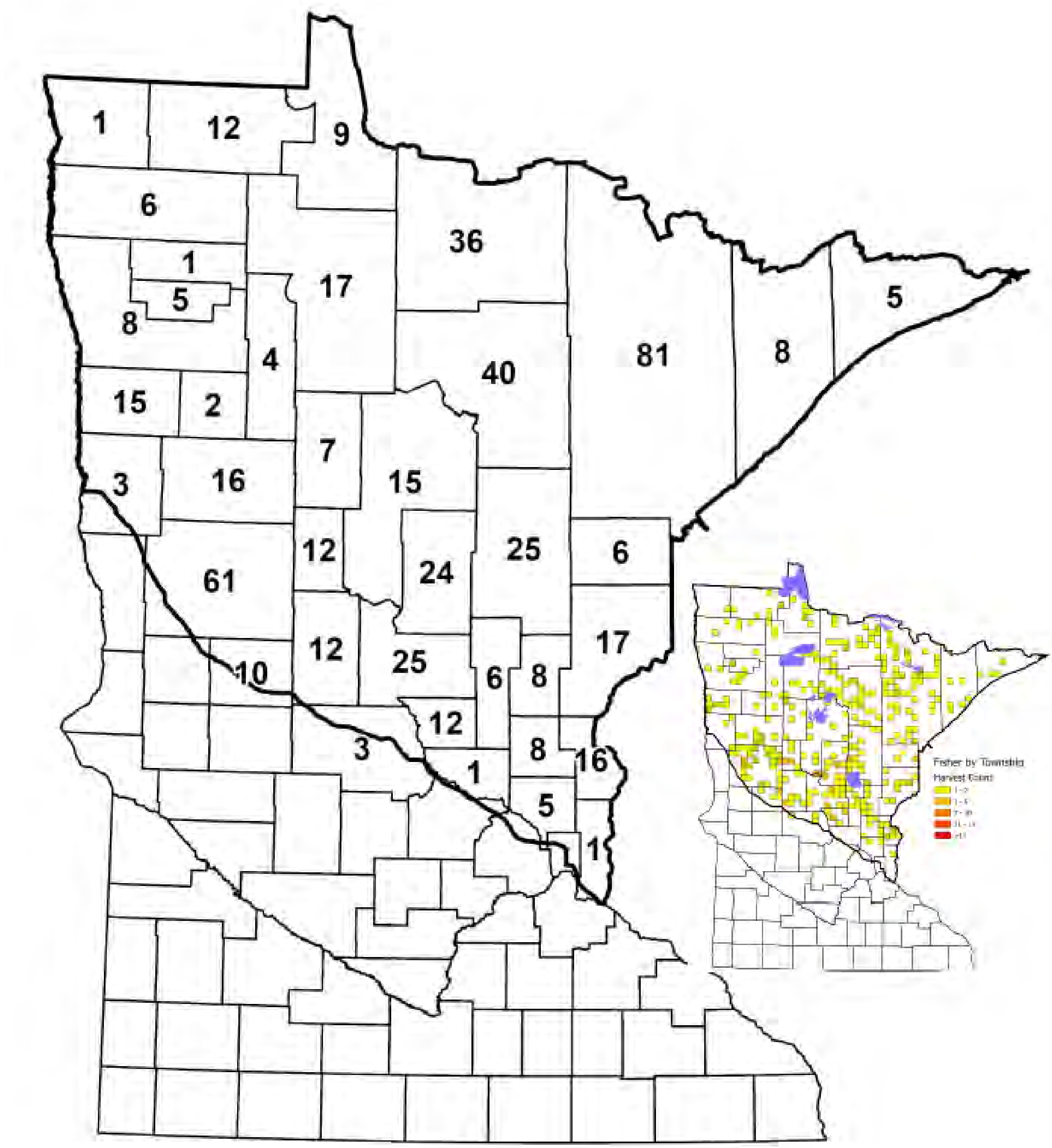

Figure 4. Fisher harvest by county, 2023. Inset shows spatial distribution of harvest locations.

Table 7. Fisher harvest by county and sex, 2023 season.

County	Female	Male	Unknown	Total	Harvest/ 100 Mile^2
Aitkin	8	17		25	1.25
Anoka	2	3		5	1.12
Becker	9	7		16	1.11
Beltrami	9	8		17	0.56
Benton	4	8		12	2.91
Carlton	5	1		6	0.69
Cass	8	7		15	0.62
Chisago	6	10		16	3.62
Clay	1	2		3	0.28
Clearwater	2	2		4	0.39
Cook	2	3		5	0.31
Crow Wing	14	10		24	2.08
Douglas	4	6		10	1.39
Grant	0	0		0	0.00
Hubbard	2	5		7	0.70
Isanti	2	6		8	1.77
Itasca	21	19	1	40	1.37
Kanabec	2	6		8	1.50
Kittson	1	0		1	0.09
Koochiching	15	21		36	1.14
Lake	4	4		8	0.35
Lake of the Woods	4	5		9	0.51
Mahnomen	1	1		2	0.34
Marshall	2	4		6	0.33
Mille Lacs	1	5		6	0.88
Morrison	12	13		25	2.17
Norman	7	8		15	1.71
Otter Tail	27	34		61	2.74
Pennington	0	1		1	0.16
Pine	6	11		17	1.19
Polk	2	6		8	0.40
Red Lake	2	3		5	1.15
Roseau	8	4		12	0.71
Sherburne	1	0		1	0.22
St. Louis	44	37		81	1.20
Stearns	3	0		3	0.22
Todd	4	8		12	1.23
Wadena	4	8		12	2.21
Washington	1	0		1	0.24
Wilkin	0	0		0	0.00
Unknown	0	0		0	
Total	250	293	0	543	

Table 8. Comparison of fisher harvest by county, 2012-2023.

County	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Aitkin	52	47	24	38	16	10	15	17	24	25	5	25
Anoka	2	1	2	7	4	0	4	3	6	5	2	5
Becker	45	38	21	23	3	18	10	11	21	18	7	16
Beltrami	21	17	4	8	9	6	6	15	24	17	7	17
Benton	5	2	4	3	7	4	7	8	5	8	6	12
Carlton	14	8	14	13	6	1	9	8	10	6	1	6
Cass	37	23	30	24	11	12	16	10	29	19	6	15
Chisago	3	4	16	18	11	8	23	12	11	13	6	16
Clay	6	5	6	4	4	2	8	4	5	5	5	3
Clearwater	5	12	3	2	3	0	7	3	9	4	2	4
Cook	11	13	11	5	4	3	8	4	8	5	4	5
Crow Wing	55	51	34	31	13	17	17	19	39	33	12	24
Douglas	24	8	20	12	6	2	8	9	14	10	11	10
Grant	0	0	0	0	0	0	0	0	0	0	0	0
Hubbard	11	10	8	6	5	6	8	4	10	7	5	7
Isanti	6	11	11	12	3	13	6	1	8	12	1	8
Itasca	105	116	78	47	13	34	30	31	44	35	16	40
Kanabec	27	30	9	10	6	2	6	7	11	9	5	8
Kittson	9	11	2	3	5	7	6	8	4	3	1	1
Koochiching	80	51	67	45	23	40	31	42	40	25	18	36
Lake	53	35	28	14	14	12	16	10	15	16	4	8
Lake of the Woods	21	13	12	15	6	9	3	3	1	6	2	9
Mahnomen	0	4	2	0	0	0	0	0	4	1	0	2
Marshall	14	17	22	22	6	5	12	7	12	5	1	6
Mille Lacs	20	17	12	6	13	7	8	3	13	5	2	6
Morrison	24	25	23	15	16	11	25	15	41	28	13	25
Norman	19	21	12	5	9	3	6	8	14	6	2	15
Otter Tail	121	117	102	77	41	53	59	43	105	67	14	61
Pennington	8	11	19	11	4	9	10	7	6	3	1	1
Pine	42	46	44	35	18	17	7	10	27	28	0	17
Polk	58	45	32	22	11	9	11	3	12	13	0	8
Red Lake	16	24	18	6	8	18	14	5	6	11	1	5
Roseau	61	42	32	26	15	24	18	29	23	17	5	12
Sherburne	2	2	2	2	0	0	6	0	5	2	3	1
St. Louis	233	220	171	125	61	72	66	73	58	77	25	81
Stearns	1	4	2	3	3	5	2	2	8	11	1	3
Todd	29	22	15	19	12	20	7	12	15	9	4	12
Wadena	25	23	21	26	9	17	11	16	25	10	2	12
Washington	1	0	2	2	1	1	4	1	0	1	0	1
Wilkin	0	0	0	0	0	0	0	0	0	0	0	0
Unknown	27	0	8	14	0	0	0	0	0	2	0	0
Total	1,293	1,146	943	756	399	477	510	463	712	577	200	543

Table 9. Fisher harvest by date and sex, 2023 season.

Date	Sex			Total	% of Known Total	Cumulative %
	Female	Male	Unknown			
Dec. 9	1	2		3	0.55	0.55
Dec. 10	25	45		70	12.89	13.44
Dec. 11	32	36		68	12.52	25.97
Dec. 12	42	38		80	14.73	40.70
Dec. 13	36	38		74	13.63	54.33
Dec. 14	28	37		65	11.97	66.30
Dec. 15	23	27		50	9.21	75.51
Dec. 16	28	28		56	10.31	85.82
Dec. 17	30	35		65	11.97	97.79
Unknown	5	7		12	2.21	100%
Total	250	293	0	543	100%	

Table 10. Distribution of fisher harvest* among trappers, 1997-2023.

Number (%) of Takers	Number Taken						
	1	2	3	4	5	Total Takers	Ave. Take
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
2019	259 (72)	101 (28)	----	----	----	360	1.3
2020	337 (65)	185 (35)	----	----	----	522	1.4
2021	279 (65)	148 (35)	----	----	----	427	1.3
2022	116 (73)	42 (27)	----	----	----	158	1.3
2023	286 (69)	128 (31)	----	----	----	414	1.3

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

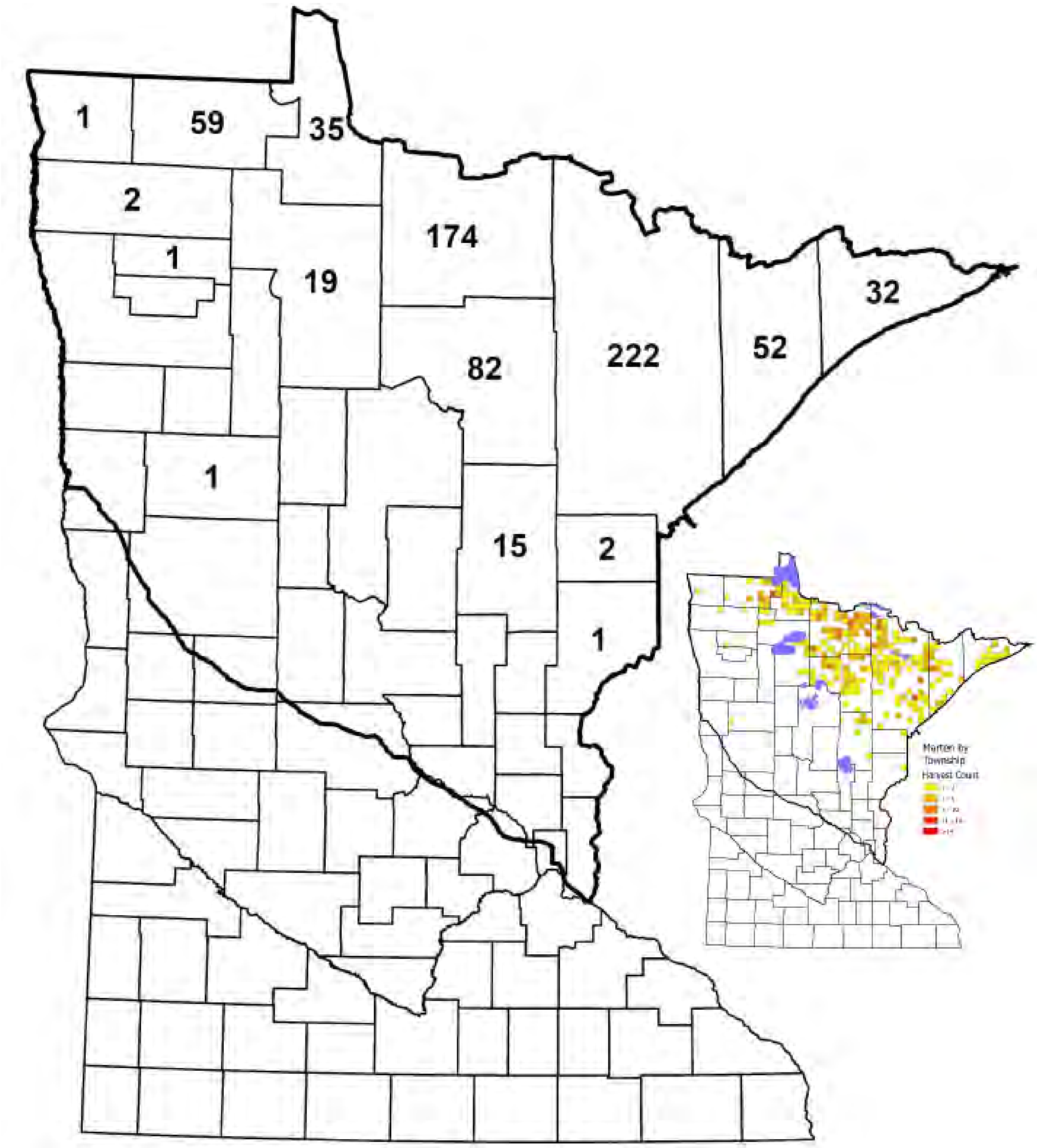

Figure 5. Marten harvest by county, 2023. Inset shows spatial distribution of harvest locations.

Table 11. Marten harvest by county and sex, 2023 season.

County	Sex			Total	Harvest/ 100 Mile^2
	Female	Male	Unknown		
Aitkin	3	12		15	0.75
Becker	1	0		1	0.07
Beltrami	7	12		19	0.62
Carlton	0	2		2	0.23
Cass	0	0		0	0.00
Clearwater	0	0		0	0.00
Cook	5	27		32	1.99
Crow Wing	0	0		0	0.00
Hubbard	0	0		0	0.00
Itasca	24	58		82	2.80
Kanabec	0	0		0	0.00
Kittson	0	1		1	0.09
Koochiching	52	122		174	5.52
Lake	16	36		52	2.27
Lake of the Woods	15	20		35	1.97
Mahnomen	0	0		0	0.00
Marshall	0	2		2	0.11
Otter Tail	0	0		0	0.00
Pennington	1	0		1	0.16
Pine	1	0		1	0.07
Polk	0	0		0	0.00
Red Lake	0	0		0	0.00
Roseau	17	42		59	3.52
St. Louis	62	157	3	222	3.29
Unknown	0	0	0	2	
Total	204	491	3	698	

Table 12. Comparison of marten harvest by county in Minnesota, 2012-2023.

County	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Aitkin	10	8	12	4	1	7	2	0	5	3	3	15
Becker	0	0	0	1	0	0	0	0	0	0	0	1
Beltrami	20	15	7	15	7	16	2	9	40	23	4	19
Carlton	3	1	1	0	0	7	7	1	1	3	0	2
Cass	0	0	3	2	2	2	2	2	1	0	1	0
Clearwater	0	0	0	0	0	0	0	0	0	0	0	0
Cook	148	78	43	39	23	40	44	15	22	30	6	32
Crow Wing	0	0	1	0	2	0	0	0	0	0	0	0
Hubbard	0	0	0	1	0	0	0	1	0	0	0	0
Itasca	46	62	79	64	28	52	35	35	66	31	22	82
Kanabec	0	0	0	0	0	0	0	0	0	0	0	0
Kittson	4	0	1	0	0	3	1	0	1	0	2	1
Koochiching	276	218	265	169	107	176	117	146	155	88	68	174
Lake	290	185	149	138	109	172	131	78	99	47	6	52
Lake of the Woods	32	18	23	25	21	32	16	45	28	9	9	35
Mahnomen	0	0	0	0	0	0	0	0	0	0	0	0
Marshall	3	5	5	3	1	1	1	3	2	1	3	2
Otter Tail	0	0	1	0	0	0	0	0	0	0	0	0
Pennington	0	0	0	1	0	0	0	0	0	1	0	1
Pine	0	0	1	0	0	0	0	0	0	0	0	1
Polk	0	0	0	0	0	0	0	0	1	0	0	0
Red Lake	1	1	0	0	0	0	0	0	0	0	0	0
Roseau	77	37	40	33	31	74	41	79	84	29	27	59
St. Louis	562	386	421	377	219	397	266	171	260	168	58	222
Unknown	0	0	7	5	0	0	0	0	0	1	2	0
Total	1,472	1,014	1,059	877	551	979	665	585	765	434	211	698

Table 13. Marten harvest by date and sex, 2023 season.

Date	Sex			Total	% of Known	Cumulative
	Female	Male	Unknown		Total	%
Dec. 9	0	1		1	0.14	0.14
Dec. 10	32	86	1	119	17.05	17.19
Dec. 11	26	66		92	13.18	30.37
Dec. 12	24	53		77	11.03	41.40
Dec. 13	22	68		90	12.89	54.30
Dec. 14	20	51	2	73	10.46	64.76
Dec. 15	34	50		84	12.03	76.79
Dec. 16	28	51		79	11.32	88.11
Dec. 17	17	60		77	11.03	99.14
Unknown	1	5		6	0.86	100%
Total	204	491	3	698	100%	

Table 14. Distribution of marten harvest* among trappers, 1997-2023.

Number (%) of Takers	Number Taken						
	1	2	3	4	5	Total Takers	Ave. Take
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
2019	200 (51)	191 (49)	----	----	----	391	1.5
2020	221 (45)	268 (55)	----	----	----	489	1.5
2021	162 (54)	136 (46)	----	----	----	298	1.5
2022	96 (63)	57 (37)	----	----	----	153	1.4
2023	243 (52)	222 (48)	----	----	----	465	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, 2023. (Combined limit = 2)

Number of Takers		Number of Marten					
		0	1	2	3	4	5
Number of Fisher	0		125	222			
	1	168	118				
	2	128					
	3						
	4						
	5				Total takers of at least 1 fisher or marten		761

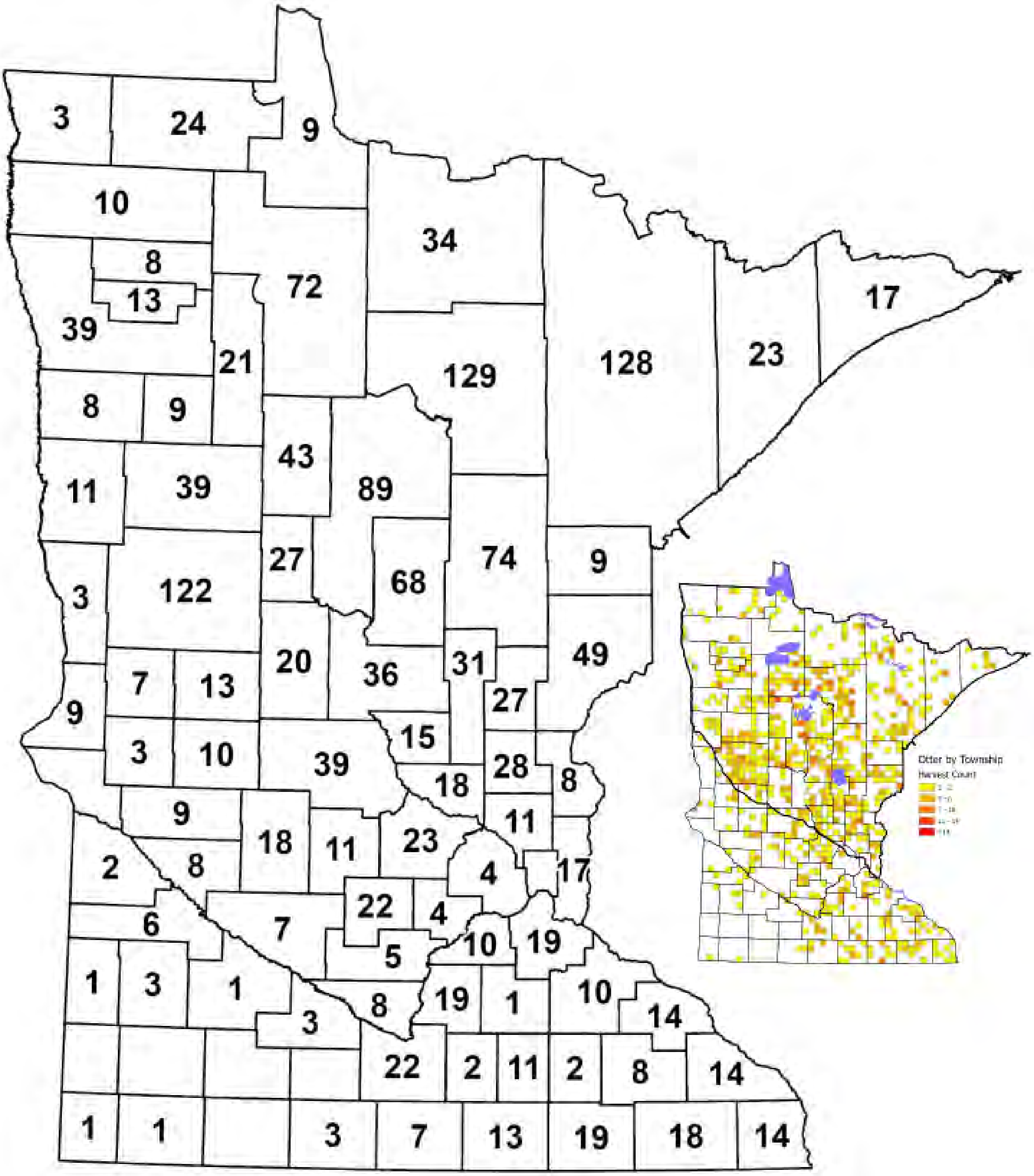

Figure 6. Otter harvest by county, 2023-24. Inset shows spatial distribution of harvest locations.

Table 16. Otter harvest by county and sex, 2023-24 season.

County	Sex: Female	Sex: Male	Unknown	Total	Harvest / 100 Mile^2
Aitkin	31	43		74	3.71
Anoka	3	8		11	2.47
Becker	13	26		39	2.70
Beltrami	25	47		72	2.36
Benton	7	8		15	3.63
Big Stone	0	0		0	0.00
Blue Earth	12	10		22	2.88
Brown	1	2		3	0.49
Carlton	4	5		9	1.03
Carver	0	4		4	1.06
Cass	39	50		89	3.69
Chippewa	4	4		8	1.36
Chisago	3	5		8	1.81
Clay	4	7		11	1.04
Clearwater	7	14		21	2.04
Cook	7	10		17	1.06
Cottonwood	0	0		0	0.00
Crow Wing	28	40		68	5.88
Dakota	7	12		19	3.24
Dodge	1	1		2	0.46
Douglas	4	9		13	1.80
Faribault	3	4		7	0.97
Fillmore	7	10	1	18	2.09
Freeborn	6	7		13	1.80
Goodhue	5	5		10	1.28
Grant	4	3		7	1.22
Hennepin	1	3		4	0.66
Houston	6	8		14	2.46
Hubbard	18	25		43	4.30
Isanti	12	16		28	6.21
Itasca	47	82		129	4.41
Jackson	0	0		0	0.00
Kanabec	8	19		27	5.06
Kandiyohi	5	13		18	2.09
Kittson	0	3		3	0.27
Koochiching	10	24		34	1.08
Lac Qui Parle	1	1		2	0.26
Lake	8	15		23	1.01
Lake of the Woods	2	7		9	0.51
Le Sueur	4	15		19	4.01
Lincoln	0	1		1	0.18
Lyon	0	3		3	0.42
Mahnomen	4	5		9	1.54
Marshall	5	5		10	0.55
Martin	2	1		3	0.41
McLeod	8	14		22	4.35
Meeker	6	5		11	1.71
Mille Lacs	15	16		31	4.55
Morrison	13	23		36	3.12
Mower	8	11		19	2.67
Murray	0	0		0	0.00
Nicollet	2	6		8	1.72
Nobles	0	1		1	0.14
Norman	5	3		8	0.91
Olmsted	3	5		8	1.22
Otter Tail	40	82		122	5.48

Table 16 (continued). Otter harvest by county and sex, 2023-24 season.

County	Sex			Total	Harvest /
	Female	Male	Unknown		100 Mile^2
Pennington	3	5		8	1.29
Pine	17	32		49	3.42
Pipestone	0	0		0	0.00
Polk	14	25		39	1.95
Pope	2	8		10	1.39
Ramsey	0	0		0	0.00
Red Lake	5	8		13	3.00
Redwood	1	0		1	0.11
Renville	2	5		7	0.71
Rice	0	1		1	0.19
Rock	0	1		1	0.21
Roseau	14	10		24	1.43
Scott	6	4		10	2.72
Sherburne	6	11	1	18	4.00
Sibley	1	4		5	0.83
St. Louis	51	77		128	1.90
Stearns	15	24		39	2.81
Steele	5	6		11	2.55
Stevens	0	2	1	3	0.52
Swift	2	7		9	1.20
Todd	9	11		20	2.04
Traverse	4	5		9	1.53
Wabasha	8	6		14	2.55
Wadena	7	20		27	4.97
Waseca	0	2		2	0.46
Washington	9	8		17	4.02
Watonwan	0	0		0	0.00
Wilkin	1	2		3	0.40
Winona	8	6		14	2.18
Wright	8	15		23	3.22
Yellow Medicine	3	3		6	0.79
Unknown	0	0		0	
Total	659	1,054	3	1,716	

Table 17. Comparison of otter harvest by county, 2012-2023.

County	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
Aitkin	111	90	67	74	61	33	34	25	22	39	22	74
Anoka	31	25	23	20	12	18	15	13	9	13	5	11
Becker	127	87	77	83	21	27	42	24	19	22	23	39
Beltrami	120	98	74	76	43	40	51	34	67	48	36	72
Benton	21	17	8	1	3	3	6	8	3	8	15	15
Big Stone	3	9	8	3	1	6	3	0	10	1	0	0
Blue Earth	3	1	2	1	3	3	2	4	8	2	9	22
Brown	0	0	0	2	2	0	0	1	0	0	1	3
Carlton	38	37	26	42	32	9	12	9	18	14	9	9
Carver	8	9	17	11	8	8	12	8	3	4	5	4
Cass	183	161	193	172	74	92	98	63	56	62	28	89
Chippewa	8	12	6	4	3	8	8	7	6	6	1	8
Chisago	24	32	26	20	12	18	12	10	20	19	5	8
Clay	23	16	14	18	10	10	11	1	3	1	1	11
Clearwater	46	47	23	38	21	33	21	11	12	6	12	21
Cook	55	57	28	9	4	0	4	1	1	3	2	17
Cottonwood	0	0	0	0	0	0	1	0	0	0	0	0
Crow Wing	117	96	83	59	35	41	55	36	52	47	32	68
Dakota	11	10	6	13	3	8	10	4	6	2	8	19
Dodge	1	3	4	2	0	3	2	3	6	0	1	2
Douglas	37	23	33	22	21	15	15	13	18	17	10	13
Faribault	12	3	1	3	5	9	3	11	10	17	8	7
Fillmore	10	6	13	3	3	4	1	4	8	1	1	18
Freeborn	10	1	7	6	2	11	7	20	10	3	1	13
Goodhue	18	2	2	11	4	9	0	2	7	7	6	10
Grant	12	6	13	4	3	5	2	2	7	4	4	7
Hennepin	4	5	6	3	2	2	9	4	7	0	1	4
Houston	26	22	14	9	2	8	10	6	14	4	6	14
Hubbard	67	61	36	32	26	39	30	23	31	23	35	43
Isanti	18	28	23	13	17	13	10	9	14	17	8	28
Itasca	346	345	184	159	67	84	123	76	79	79	65	129
Jackson	0	0	0	1	0	0	1	0	0	0	0	0
Kanabec	52	45	34	26	20	29	7	8	20	13	9	27
Kandiyohi	10	20	20	23	17	18	19	23	17	35	14	18
Kittson	9	7	4	0	8	8	5	5	2	0	0	3
Koochiching	127	115	55	68	19	16	13	20	12	16	14	34
Lac Qui Parle	15	6	1	7	0	8	0	2	10	2	0	2
Lake	66	67	45	26	23	12	13	11	22	6	10	23
Lake of the Woods	27	27	31	31	8	16	20	11	9	8	0	9

Table 17 (continued). Comparison of otter harvest by county, 2012-2023.

County	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
Le Sueur	9	5	2	2	4	3	4	6	3	4	6	19
Lincoln	4	0	0	0	0	2	0	0	1	3	0	1
Lyon	0	0	0	0	0	1	0	0	4	3	2	3
Mahnomen	15	25	7	6	3	9	16	9	12	9	7	9
Marshall	15	15	4	9	12	15	10	5	7	10	6	10
Martin	1	0	0	1	1	1	1	1	1	0	8	3
McLeod	19	22	18	16	14	16	26	16	25	13	13	22
Meeker	19	32	35	23	11	26	29	32	18	16	12	11
Mille Lacs	30	39	28	16	13	26	14	12	14	18	21	31
Morrison	52	52	50	31	22	24	35	33	32	33	9	36
Mower	14	9	8	2	13	7	11	13	14	6	9	19
Murray	0	0	0	1	0	0	0	0	0	1	0	0
Nicollet	5	7	1	0	0	4	3	0	6	0	2	8
Nobles	0	0	4	0	0	0	0	0	0	1	0	1
Norman	45	27	19	13	9	8	5	2	2	5	3	8
Olmsted	0	7	7	5	3	5	4	8	8	8	6	8
Otter Tail	173	154	97	87	92	100	82	71	89	69	51	122
Pennington	12	5	8	8	11	2	7	2	4	3	1	8
Pine	66	98	59	86	48	20	36	35	24	34	22	49
Pipestone	0	0	0	0	1	1	0	0	1	1	0	0
Polk	83	71	47	37	20	12	14	12	38	30	11	39
Pope	22	14	19	8	19	8	14	19	4	13	1	10
Ramsey	3	1	1	1	0	0	0	0	0	0	1	0
Red Lake	26	11	10	14	13	1	3	3	13	11	1	13
Redwood	4	6	8	3	0	2	4	3	1	0	0	1
Renville	6	0	3	1	1	6	1	1	6	4	3	7
Rice	4	8	1	2	6	3	8	4	8	5	0	1
Rock	2	0	0	0	2	0	2	0	2	0	1	1
Roseau	64	48	44	23	24	22	20	20	39	32	22	24
Scott	4	3	2	4	5	4	7	8	14	11	10	10
Sherburne	12	9	10	10	11	8	9	3	7	2	11	18
Sibley	6	3	2	3	2	2	5	10	7	12	14	5
St. Louis	363	293	258	260	109	146	127	105	134	105	81	128
Stearns	53	53	41	50	45	28	34	22	29	15	22	39
Steele	3	1	0	1	3	3	4	6	4	2	2	11
Stevens	3	12	4	2	1	1	3	2	0	3	1	3
Swift	10	10	9	3	7	7	13	4	12	6	8	9
Todd	55	55	19	28	22	24	18	14	12	30	4	20
Traverse	4	1	0	3	7	4	11	3	4	5	8	9

Table 17 (continued). Comparison of otter harvest by county, 2012-2023.

County	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
Wabasha	20	21	19	9	11	11	17	9	10	8	9	14
Wadena	43	30	30	19	5	8	8	11	27	17	13	27
Waseca	0	0	2	2	0	0	1	1	2	0	0	2
Washington	12	24	27	9	12	20	13	5	11	19	15	17
Watonwan	0	1	0	0	0	0	1	0	0	0	0	0
Wilkin	3	2	0	3	1	2	2	4	2	1	1	3
Winona	21	17	5	17	6	13	7	16	15	13	20	14
Wright	23	26	21	21	11	22	33	7	14	18	3	23
Yellow Medicine	7	9	0	3	0	2	2	1	6	5	5	6
Unknown	40	2	18	18	0	0	0	0	0	2	3	0
Totals	3,171	2,824	2,154	1,955	1,195	1,295	1,351	1,050	1,304	1,155	855	1,716

Table 18. Otter harvest by sex and week, 2023-24 season.

	Sex			Total	% of	Cumulative
Date	Female	Male	Unknown	Harvest	Total	%
Oct.28 - Nov.3	82	132		214	12.47	12.47
Nov.4 - Nov.10	67	101		168	9.79	22.26
Nov.11 - Nov.17	67	122	1	190	11.07	33.33
Nov.18 - Nov.24	72	109		181	10.55	43.88
Nov.25 - Dec.1	60	88		148	8.62	52.51
Dec.2 - Dec.8	52	87		139	8.10	60.61
Dec.9 - Dec.15	67	113		180	10.49	71.10
Dec.16 - Dec.22	57	81	2	140	8.16	79.25
Dec.23 - Dec.29	42	88		130	7.58	86.83
Dec.30 - Jan.5	48	68		116	6.76	93.59
Jan.6 - Jan.14	44	62		106	6.18	99.77
Unknown	1	3		4	0.23	100.00
Total	659	1,054	3	1,716	100%	

* 9-day interval.

Table 19. Distribution of otter harvest* among trappers, 1997-2023.

Number (%) of Takers	Number Taken					
	1	2	3	4	Total Takers	Ave. Take
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
2019-20	206 (42)	107 (22)	59 (12)	113 (23)	485	2.2
2020-21	258 (42)	135 (22)	90 (15)	126 (21)	609	2.1
2021-22	178 (36)	109 (22)	81 (16)	128 (26)	496	2.3
2022-23	157 (41)	80 (21)	51 (13)	95 (25)	383	2.2
2023-24	242 (34)	145 (21)	100 (14)	219 (31)	706	2.4

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