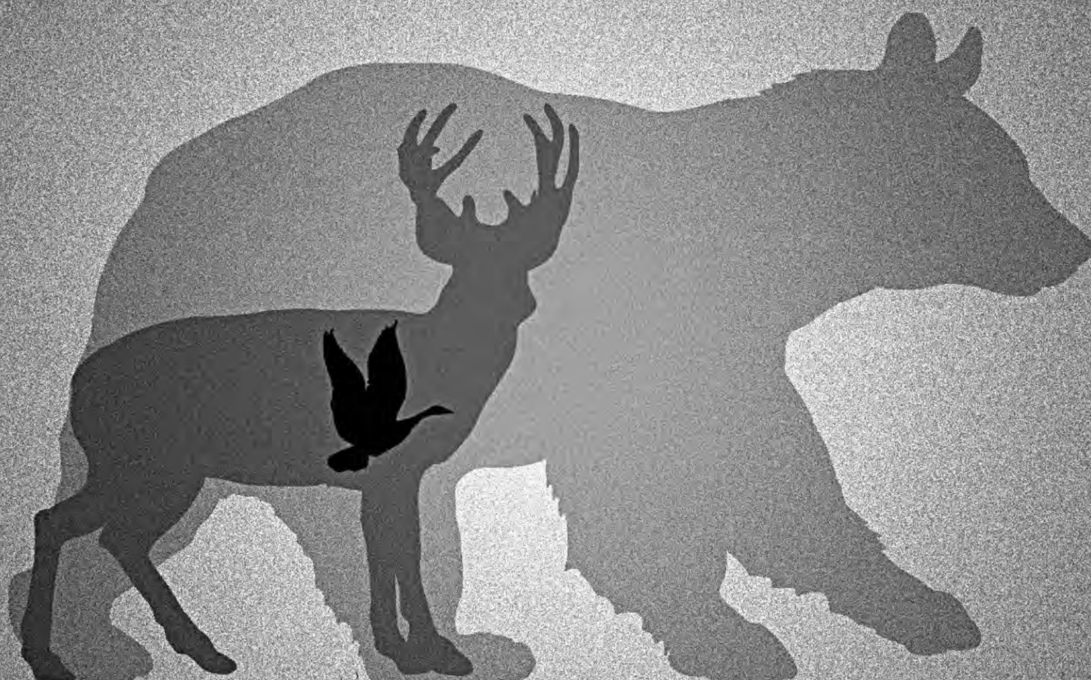

Status of Wildlife Populations

Fall 2023

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 2023

(Including 2013-2023 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 2023

(Including 2013-2023 Hunting and Trapping Harvest Statistics)

This is the 47th 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.

WILDLIFE RESTORATION

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FARMLAND WILDLIFE POPULATIONS

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2023 MINNESOTA AUGUST ROADSIDE SURVEY

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Timothy Lyons, Farmland Wildlife Populations and Research

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 172 survey routes in 70 counties throughout Minnesota. The results of the annual survey are made publicly available in the annual ARS report (e.g., Woodley and Lyons 2023).

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 upland habitats (i.e. closed-canopy forest). 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]; 2023) and Minnesota Department of Natural Resources ([MDNR]; 2023) 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, 10-yr, and long-term (since 1955) trend statistics for each of the 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 declined by approximately 9,000 acres in 2023 due to an 18,000 acre decline in lands enrolled in the Conservation Reserve Program (CRP, Table 1). The decline in CRP land was partially offset by increases in lands enrolled in state and federal easements and publicly owned land. There was an approximately 1,000 acre increase in lands in the Conservation Reserve Enhancement Program (CREP), Reinvest in Minnesota (RIM), and Wetland Reserve program (RIM-WRP) each (Table 1). Federally managed U.S. Fish and Wildlife Service (USFWS) Waterfowl Production Areas, wildlife refuges and conservation easements increased by almost 4,000 acres, and Wildlife Management Areas managed by the DNR increased by approximately 1,300 acres (Table 1). Protected lands account for 6.6% of lands within the pheasant range, similar to the value in 2022 (6.7%). The Southwest and West Central regions have the highest proportion of protected lands (public and private) in the region and account for nearly 50% 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. Weather conditions for pheasants were mixed in 2022-2023. Winter conditions across the state were more challenging than average, primarily because of exceptional amounts of snowfall throughout the state (Table 2). The average snow depth was near or greater than 6 inches throughout the winter in all regions. All regions, except the Southeast, experienced cooler-than-average winter temperatures (Table 2). Spring and summer were generally drier and warmer than average across the state (Table 2). Whereas most of the pheasant range was abnormally dry or under drought conditions throughout the spring and summer, the South Central region was an exception. It experienced above-average rainfall (0.2 inches above normal) during the spring, associated with a single heavy rainfall event in early May that caused flooding in some areas within the region (Table 2).

Survey Conditions

Weather conditions during surveys were very good in 2023. Temperature, dew, wind, and sky cover conditions were all similar to 10-year averages. Thus, weather conditions in 2023 were unlikely to have a substantial influence on survey results.

Species Reports

Ring-necked Pheasant

The total pheasant index increased by 10% in 2023 (53.3 birds/100 mi) compared to 2022 (48.3 birds/100 mi; Table 3, Figure 2A). Indices of hens, roosters, and broods also increased (20%, 22%, and 13%, respectively) compared to 2022 (Table 3). The number of chicks per brood (5.0) and broods per 100 hens (92.1) declined slightly compared to 2022 (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 was slightly below the 10-year average. The number of chicks per brood in 2023 (5.0) was slightly greater than the 10-year average (4.7, Table 3). Though most indices of pheasants remain below the long-term average (Table 3), the number of broods per 100 hens in 2023 (92.1) is near the long-term average (89.7; Table 3). The index of chicks per brood in 2023 (5.0) is slightly less than the long-term average (5.6; Table 3). Collectively, this suggests good nesting and brood-rearing success in 2023.

Despite the increase state-wide, trends in the pheasant index varied greatly among regions. The pheasant index exhibited triple-digit increases in the Southwest region, where the index grew 101% (Table 4). The pheasant index exhibited a more modest increase in the West Central region (38%, Table 4). Indices in the Central, East Central, South Central, and Southeast regions decreased by 39%, 63%, 11%, and 50%, respectively (Table 4). Pheasant indices remain well below their long-term averages in all regions except the Southwest, but they are near or above their ten-year averages except for the East Central and Southeast regions (Table 4). The Southwest (116.8 birds/100 mi) and West Central (63.2 birds/100 mi) regions had the highest indices, followed by the South Central region (54.5 birds/100 mi). These regions should provide the best hunting opportunities in the state.

Gray Partridge

The 2023 range-wide gray partridge index (4.5 birds/100 mi) was greater than 2022 (3.8 birds/100 mi) and the 10-year average (2.4 birds/100 mi). The partridge index remains below the long-term average (-65%; Table 3, Figure 2B). Partridge are generally rare throughout the state but may be locally abundant. Gray partridge appear to have benefited from consecutive dry years in parts of their range. In 2023, the Northwest (14.9 birds/100 mi) region had the greatest number of partridge observed, while the Southwest (7.6 birds/100 mi), South Central (4.8 birds/100 mi), and Southeast (6.1 birds/100 mi) had more modest index values. These regions should provide the best opportunities for harvesting gray partridge (Table 4).

Cottontail Rabbit and White-tailed Jackrabbit.

Range-wide, the 2023 eastern cottontail rabbit index (5.5 rabbits/100 mi) decreased slightly from 2022 (6.2 rabbits/100 mi) and is slightly below the 10-year average (5.8 rabbits/100 mi) and the long-term average (5.9 rabbits/100 mi; Table 3, Figure 3A). The West Central, East Central, and Southwest regions saw increases in their cottontail index (Table 4). The greatest increase was in the Southwest, where the cottontail index increased 45% to 11.0 rabbits/100 mi. The best rabbit hunting opportunities will be in the Southwest, Southeast, East Central, and Central regions (Table 4).

White-tailed jackrabbits were observed on eight routes in the Southwest and West Central regions (Table 3). Five routes reported a single jackrabbit, while two or more jackrabbits were observed on three other routes. Jackrabbits are rarely detected, making annual or short-term trend comparisons difficult. Still, the jackrabbit index remains >90% 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 2023 white-tailed deer range-wide index (25.7 deer/100 mi) decreased by 26% compared to 2022 (34.6 deer/100 mi) and was 7% below the 10-year average (Table 3, Figure 4A). However, the range-wide index was 86% above the long-term average (13.5 deer/100 mi; Table 3, Figure 4A). Regional indices for deer decreased (range -23% to -46%) everywhere except the South Central and Southeast regions, which were similar to last year (Table 4).

Mourning Dove

The 2023 range-wide mourning dove index (234.1 doves/100 mi) increased 88% compared to the 2022 index (124.8 doves/100 mi) and was 66% above the 10-year average (138.6 doves/100 mi); however, the index this year was heavily influenced by a few observations of abnormally large flocks (>100 birds) of mourning doves. The individuals in these large flocks might be transitory and may not represent an increase in the breeding population. Still, the dove index was 5% below the long-term average (239.5 doves/100 mi; Table 3, Figure 4B). The dove index showed large increases in the Northwest, West Central, Central, Southwest, and South Central regions (Table 3). The East Central and Southeast regions saw a 19% and 3% decline, respectively (Table 4). Dove indices were greatest in the Southwest (318.3 doves/100 mi), West Central (297.5 doves/100 mi), and South Central (288.4 doves/100 mi) regions; opportunities for harvesting doves should be greatest there as well.

Sandhill Crane

The 2023 statewide index of sandhill cranes (10.6 total cranes/100 mi) was 15% lower than in 2022 (12.5 total cranes/100 mi; Table 3). Annual changes in regional indices varied greatly. The

Northwest and East Central regions saw a 16% and 7% increase in the total crane index, respectively, whereas the Central region had a 34% decline (Table 4). Statewide, the crane index was slightly below the 10-year average (8% decline, Table 3). Regionally, the Northwest and Central indices were 51% and 17% below their 10-year averages, respectively, but the East Central region was 63% above the 10-year index (Table 4). Crane observations during the August roadside surveys are less frequent in the West Central, South Central, and Southeast regions and have yet to be reported in the Southwest region.

Other Species

Notable incidental sightings recorded by observers included: sharp-tailed grouse (Lac qui Parle and Marshall counties), red-headed woodpecker (Freeborn, Wabasha, and Mower counties), upland sandpiper (Rock and Martin counties), and a black bear (Red Lake county).

ACKNOWLEDGMENTS

We thank the many cooperators for completing the routes required for this survey; without their efforts, this survey would not be possible. Tonya Klinkner was invaluable in providing logistical assistance and entering route data. 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. John Giudice, Nicole Davros, and Seth Gorham (MN DNR Wildlife Research) reviewed an earlier draft of this report. This work was funded in part through the Federal Aid in Wildlife Restoration Act.

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Table 1. Abundance (total acres) and density (acres/mi²) of undisturbed grassland habitat within Minnesota's pheasant range, 2023, 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/mi²
WC	250,375	42,296	22,733	14,275	20,207	217,176	115,695	682,757	10.0%	64.3
SW	124,324	35,861	21,143	2,553	766	26,940	69,213	280,800	7.4%	47.5
C	127,199	20,941	48,736	7,265	3,158	93,765	55,540	356,604	5.9%	37.8
SC	105,182	35,186	13,664	10,779	9,107	12,315	38,905	225,138	5.6%	35.7
SE	77,943	3,780	7,294	1,070	1,577	37,136	58,714	187,514	5.1%	32.4
EC	2,373	0	1,257	0	4	4,994	97,178	105,806	3.3%	21.1
Total	687,396	138,064	114,827	35,942	34,819	392,326	435,245	1,838,619	6.7%	42.7

[a] Unpublished data, BWSR, 30 August 2022.
[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 not valid.

Table 2. Average temperature, snow depth, and precipitation by season and agricultural region in Minnesota, 2023.

	Agricultural Region							
	NW	WC	C	EC	SW	SC	SE	STATE
Winter (December 1 - March 31)								
Temperature (average °F)	11.1	15.3	17.5	17.7	18.1	19.9	21.9	17.4
Departure from normal (°F)[a]	-2.8	-2.8	-1.6	-0.7	-3.0	-1.7	0.1	-1.8
Snow Depth (average inches)	14.7	11.9	12.2	13.7	9.8	8.6	5.8	11.0
Spring (April 1 - May 31)								
Temperature (average °F)	47.0	50.0	50.8	48.7	52.6	53.1	52.5	50.7
Departure from normal (°F)[a]	-0.4	0.1	0.7	0.2	1.6	1.4	1.3	0.7
Precipitation (total inches)	1.8	1.9	2.4	2.4	3.0	4.1	3.5	2.7
Departure from normal (inches)[a]	-0.4	-0.8	-0.8	-0.7	-0.4	0.2	-0.6	-0.5
Summer (June 1 - July 31)								
Temperature (average °F)	67.7	70.4	70.5	68.2	71.0	70.9	69.7	69.8
Departure from normal (°F)	1.5	1.8	1.8	1.4	1.4	0.9	0.6	1.4
Precipitation (total inches)	2.3	2.0	1.7	1.9	2.1	1.8	2.5	2.1
Departure from normal (inches)[a]	-1.6	-2.0	-2.5	-2.6	-2.1	-2.9	-2.4	-2.3

[a] Departures calculated using 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, 1955-2023.

Species	Change from 2022[a]					Change from 10-year average[b]				Change from long-term average (LTA)[c]			
Subgroup	*n*	2022	2023	%	95% CI	*n*	2013-2022	%	95% CI	*n*	LTA	%	95% CI
Ring-necked pheasant													
Total pheasants	143	48.3	53.3	10	±21	148	41.5	26	±21	147	89.3	-43	±11
Cocks	143	7.0	8.5	22	±21	148	5.9	44	±24	147	10.3	-18	±15
Hens	143	6.5	7.8	20	±24	148	6.3	23	±21	147	13.0	-42	±11
Broods	143	6.7	7.6	13	±23	148	6.3	15	±20	147	11.9	-40	±12
Broods per 100 hens	258	97.4	92.1	-5			99.4	-7			89.7	3	
Chicks per brood[d]	258	5.4	5.0	-7			4.7	5			5.6	-12	
Median hatch date[d]	258	19-Jun	16-Jun				15-Jun				9-Jun		
Gray partridge	161	3.8	4.5	19	±53	166	2.4	84	±84	165	12.4	-65	±16
Eastern cottontail	161	6.2	5.5	-11	±32	166	5.8	-2	±34	165	5.9	-5	±33
White-tailed jackrabbit[e]	161	0.1	0.2			166	0.1			165	1.4		
White-tailed deer	161	34.6	25.7	-26	±6	166	27.0	-7	±7	165	13.5	86	±15
Mourning dove	161	124.8	234.1	88	±2	166	138.6	66	±2	165	239.5	-5	±1
Sandhill crane[f]													
Total cranes	161	12.5	10.6	-15	±16	166	12.7	-8	±16				
Juveniles	161	1.6	0.6	-62	±126	166	1.6	-62	±123				

[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 1955-2023, except for deer (1974-2023). Estimates for all species except deer based on routes (*n*) surveyed $\geq$40 years; estimates for deer based on routes surveyed $\geq$25 years. Thus, Northwest region (8 counties in Northwest were added to survey in 1982) included only for deer.
[d] Sample size is the total number of broods observed across all surveys rather than the number of routes run in 2023.
[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, 1955-2023.

Region	Change from 2022[a]					Change from 10-year average[b]				Change from long-term average (LTA)[c]			
Species	*n*	2022	2023	%	95% CI	*n*	2013-2022	%	95% CI	*n*	LTA	%	95% CI
Northwest[d]													
Gray partridge[e]	18	2.2	14.9	572	±95	18	1.4			18	3.3	359	±65
Eastern cottontail[e]	18	0.9	1.3			18	1.1			18	0.9		
White-tailed jackrabbit[e]	18	0.0	0.7			18	0.1			18	0.5		
White-tailed deer	18	63.1	48.7	-23	±3	18	57.4	-15	±4	18	36.3	34	±6
Mourning dove	18	45	194.2	332	±5	18	91.4	112	±2	18	118.3	64	±2
Sandhill crane[f]	18	16.2	18.8	16	±13	18	38.2	-51	±6				
West Central[g]													
Ring-necked pheasant	39	45.7	63.2	38	±4	39	47.7	33	±4	37	91.2	-34	±2
Gray partridge[e]	39	2.1	0.1	-95	±99	39	0.4			37	8.3	-99	±25
Eastern cottontail	39	2.5	3.0	21	±82	39	2.8	7	±73	37	3.8	-20	±54
White-tailed jackrabbit[e]	39	0.1	0.2			39	0.1			37	1.9	-89	±104
White-tailed deer	39	37.7	26.6	-30	±5	39	30.0	-11	±7	37	13.5	86	±15
Mourning dove	39	144.2	297.5	106	±1	39	172.7	72	±1	37	342.4	-16	±1
Sandhill crane[f]	39	4.8	3.0	-38	±42	39	3.4	-11	±60				
Central													
Ring-necked pheasant	28	52.7	32.4	-39	±4	30	36.7	-12	±7	30	66.6	-51	±3
Gray partridge[e]	28	4.4	1.3	-71	±46	30	1.7			30	8.0	-85	±26
Eastern cottontail	28	6.7	5.9	-13	±31	30	5.7	-1	±36	30	6.2	-9	±33
White-tailed jackrabbit[e]	28	0.0	0.1			30	0.1			30	1.0		
White-tailed deer	28	40.0	21.4	-46	±5	30	26.9	-24	±8	30	9.7	112	±21
Mourning dove	28	118.5	185.9	57	±2	30	114.6	61	±2	30	212.8	-14	±1
Sandhill crane[f]	28	30.9	20.3	-34	±7	30	24.0	-17	±9				
East Central													
Ring-necked pheasant	6	23.3	8.7	-63	±11	8	29.7	-70	±8	9	83.5	-82	±3
Gray partridge[e]	6	0.0	0.0			8	0.3			9	0.2		
Eastern cottontail	6	5.3	6.0	13	±48	8	11.4	-39	±21	9	9.8	-37	±24
White-tailed jackrabbit[e]	6	0.0	0.0			8	0.0			9	0.2	0.0	
White-tailed deer	6	61.7	45.3	-27	±4	8	36.6	5	±7	9	15.3	162	±15
Mourning dove	6	86.0	69.3	-19	±3	8	63.9	10	±4	9	105.9	-28	±2
Sandhill crane[f]	6	90.6	96.7	7	±3	8	58.7	63	±4				

Table 4. Continued.

Region Species	Change from 2022[a]					Change from 10-year average[b]				Change from long-term average (LTA)[c]			
	n	2022	2023	%	95% CI	*n*	2013-2022	%	95% CI	*n*	LTA	%	95% CI
Southwest													
Ring-necked pheasant	19	58.1	116.8	101	±4	19	64.0	83	±3	19	108.7	8	±2
Gray partridge	19	2.7	7.6	176	±77	19	4.3	76	±49	19	35.1	-79	±6
Eastern cottontail	19	7.6	11.0	45	±28	19	5.8	90	±36	19	7.7	42	±27
White-tailed jackrabbit[e]	19	0.6	0.6			19	0.3			19	3.2	-80	±65
White-tailed deer	19	29.7	19.9	-33	±7	19	22.0	-10	±10	19	11.5	73	±18
Mourning dove	19	166.4	318.3	91	±1	19	191.2	67	±1	19	293.4	9	±1
Sandhill crane[e,f]	19	0.0	0.0			19	0.0						
South Central													
Ring-necked pheasant	32	61.1	54.5	-11	±3	32	43.8	24	±5	32	115.3	-53	±2
Gray partridge	32	6.2	4.8	-24	±33	32	4.6	4	±45	32	16.4	-71	±12
Eastern cottontail	32	5.4	4.8	-12	±38	32	7.6	-38	±27	32	7.5	-37	±27
White-tailed jackrabbit[e]	32	0.0	0.0			32	0.0			32	1.4		
White-tailed deer	32	12.0	12.4	3	±17	32	10.0	24	±20	32	5.0	146	±41
Mourning dove	32	153.9	288.4	87	±1	32	163.2	77	±1	32	244.4	18	±1
Sandhill crane[f]	32	4.0	2.5	-37	±51	32	2.7	-6	±76				
Southeast													
Ring-necked pheasant	19	23.9	12.0	-50	±9	20	16.0	-26	±13	20	62.7	-81	±3
Gray partridge	19	5.8	6.1	6	±37	20	3.5	67	±60	20	12.1	-52	±17
Eastern cottontail	19	18.7	9.9	-47	±11	20	10.7	1	±20	20	8.2	32	±26
White-tailed jackrabbit[e]	19	0.0	0.0			20	0.0			20	0.5		
White-tailed deer	19	27.7	30.1	9	±8	20	22.4	27	±9	20	13.1	119	±16
Mourning dove	19	91.6	88.8	-3	±2	20	91.3	-2	±2	20	199.1	-55	±1
Sandhill crane[e,f]	19	0.0	1.5			20	0.7						

[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 (1982-2023) and white-tailed deer (1974-2023). Estimates based on routes (*n*) surveyed ≥40 years (1955-2023), 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.

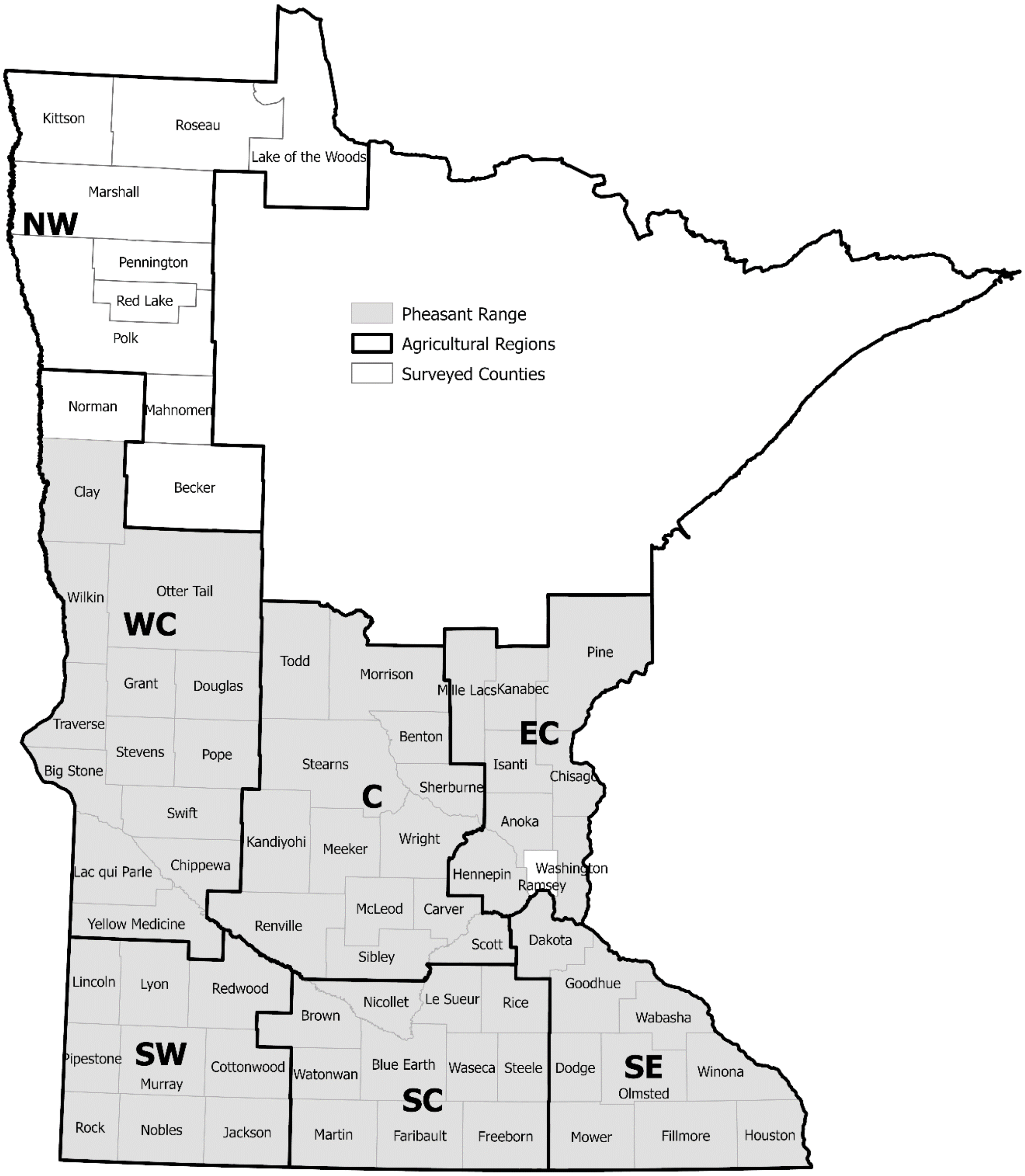

Figure 1. Survey regions and ring-necked pheasant range delineation for Minnesota's August roadside survey, 2023.

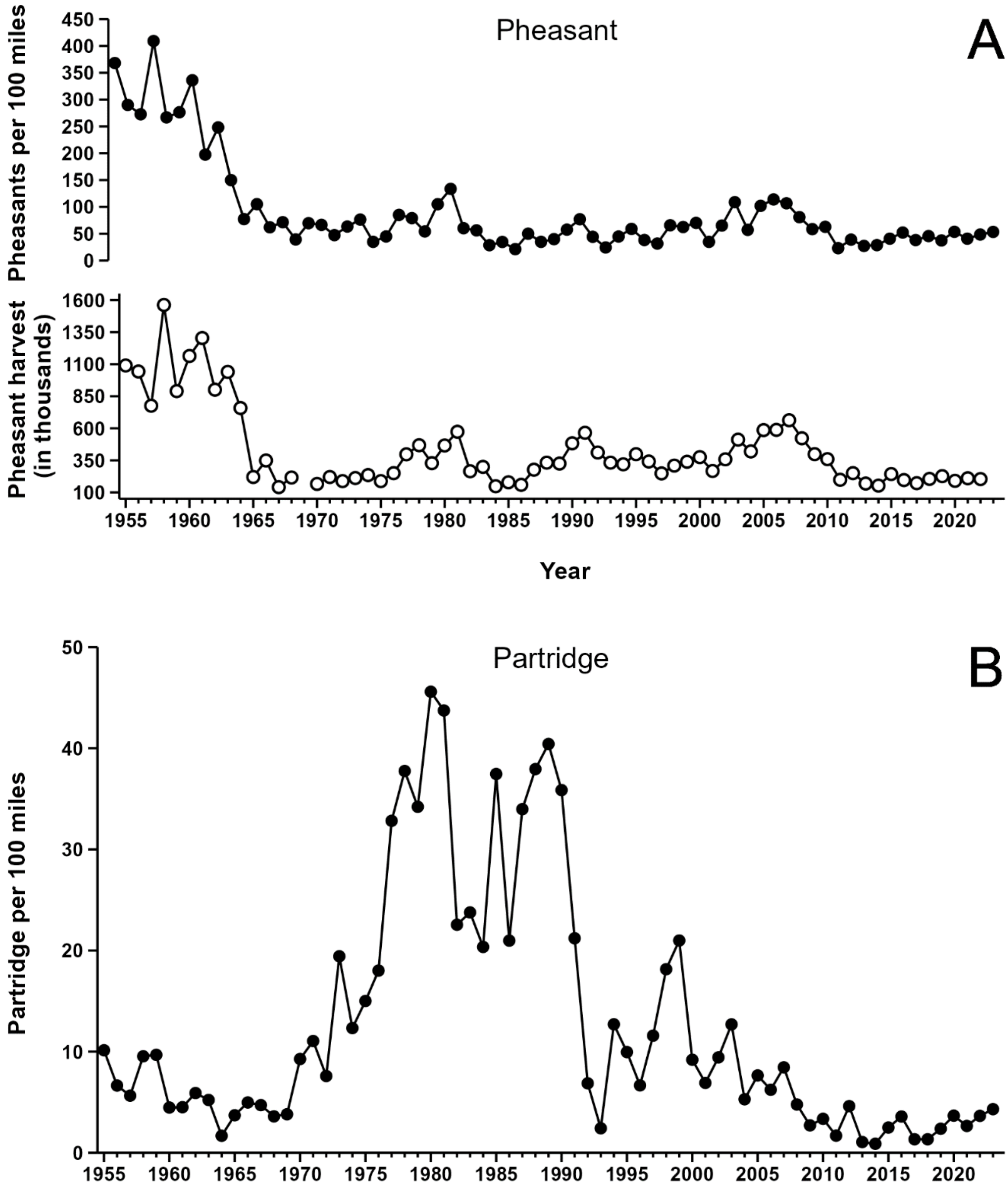

Figure 2. Range-wide index of ring-necked pheasants (A) and gray partridge (B) seen per 100 miles driven in Minnesota, 1955-2023. Based on all survey routes completed.

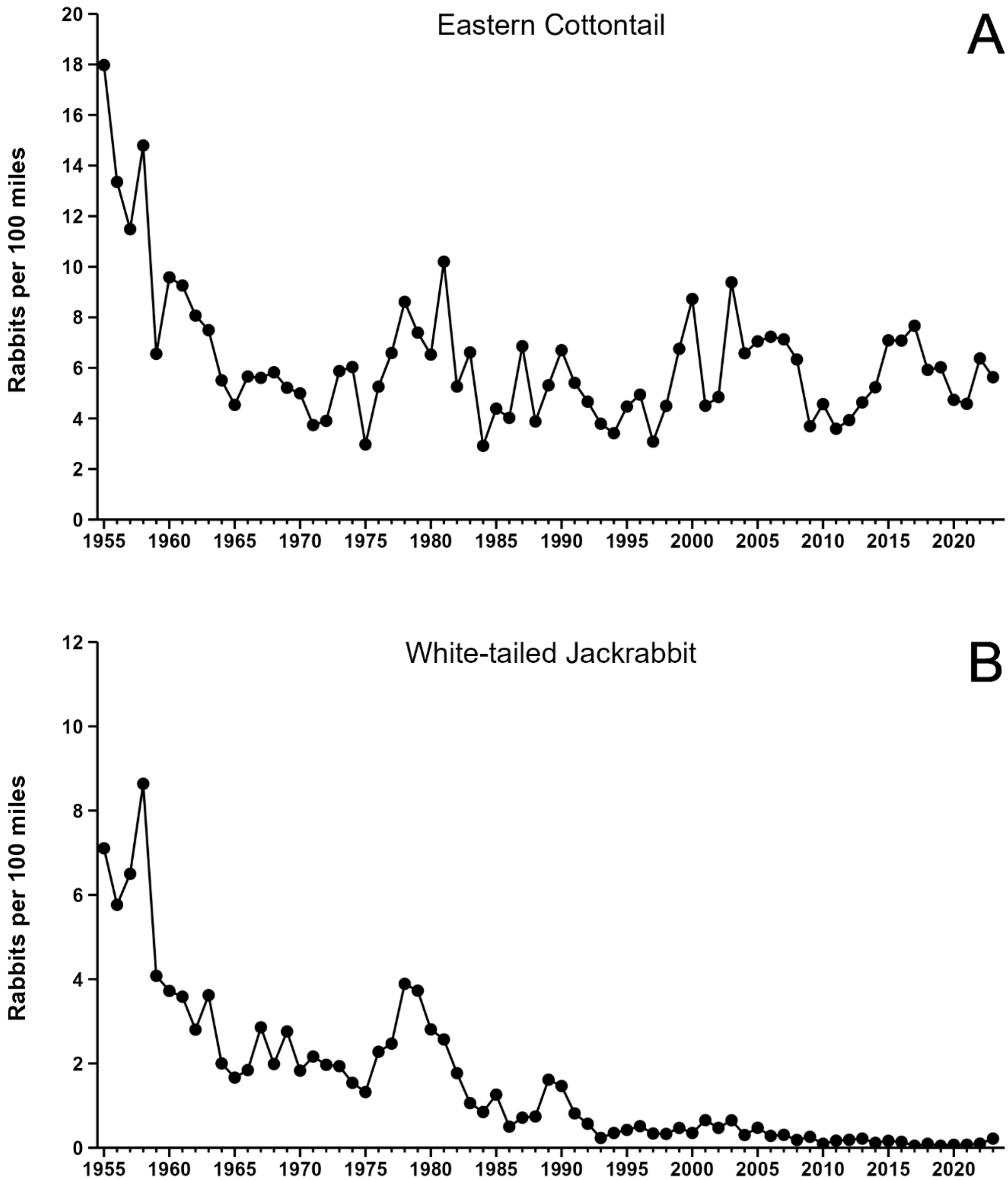

Figure 3. Range-wide index of eastern cottontail (A) and white-tailed jackrabbits (B) seen per 100 miles driven in Minnesota, 1955-2023. Based on all survey routes completed.

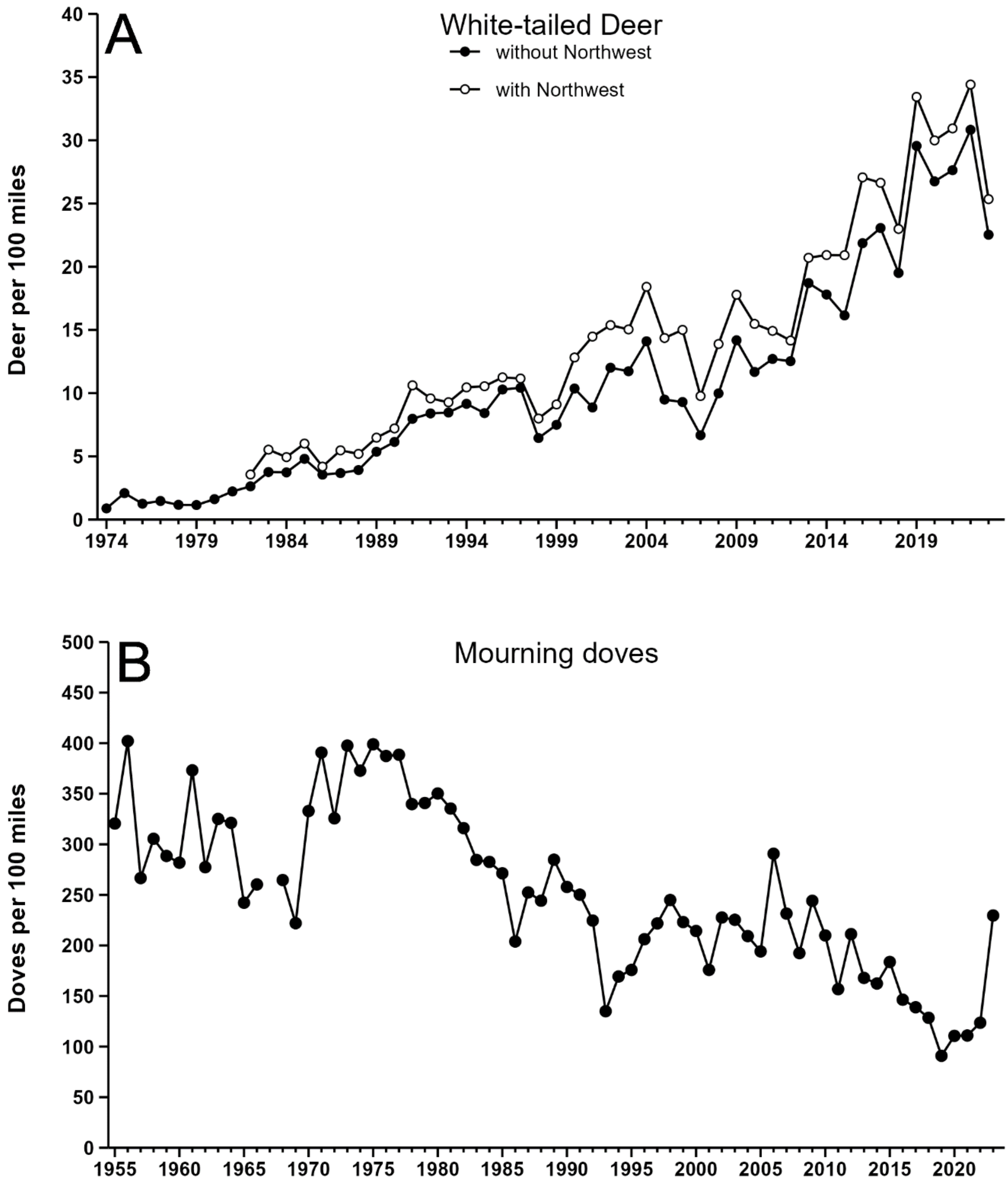

Figure 4. Range-wide index of: (A) white-tailed deer seen per 100 miles driven in Minnesota, 1974-2023, with and without the Northwest region included; and (B) mourning doves seen per 100 miles driven in Minnesota, 1955-2023. Doves were not counted in 1967. Based on all survey routes completed.

MONITORING POPULATION TRENDS OF WHITE-TAILED DEER IN MINNESOTA – 2023

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 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). Similar to winter survival rates of deer being dependent on the severity of winter conditions (Fuller 1990, DelGiudice et al. 2002), the condition of breeding females following winter may directly influence survival of their newborn fawns (Verme 1977, Nixon et al. 1991, Carstensen et al. 2009). Therefore, we adjusted fawn survival rates to estimate the effects of winter severity on the condition of adult females during the previous winter. Mean spring/summer fawn survival values were 0.70 (SD = 0.031), 0.55 (SD = 0.037), and 0.45 (SD = 0.037) when WSI<100, 100≤WSI<180, and WSI≥180, respectively.

Spring/summer survival rates reported in the primary literature for adult deer ≥1 year old were relatively high and similar for both sexes (DeYoung 2011). We used similar values for summer survival of adult deer from the population model previously used in Minnesota (Grund and Woolf 2004, Grund 2014) and allowed the values to vary stochastically (female = 0.97 [SD = 0.011], male = 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).

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 each day in a 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 (2018-2023) with the final population estimate occurring pre-fawning for the spring following the most recent deer hunting season (i.e., spring 2023). 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 100 of 130 DPAs in Minnesota to estimate deer densities before reproduction during spring 2023 (Table 2; Figure 3).

Management designations in 2023 were consistent in most DPAs compared to 2022 in an attempt to stabilize or reduce densities that had exceeded goals; though, the number of DPAs recommending the Bucks Only designation nearly doubled in 2023 (n = 9) compared to 2022 (n = 5) due to the severe winter. Two of 3 ecogeographic zones observed some DPAs below goal (farmland-forest transition zone, n = 1; northeastern forest region, n = 8). Total harvest decreased by about 7% from 2021 to 2022. 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, particularly given the severe winter experienced this past winter.

In terms of management intensity, the 2023 designations afford more antlerless deer harvest opportunities to hunters in about 5% of the DPAs versus the 2022 season. About 19% of DPA designations afford less antlerless harvest opportunity in 2023 compared to 2022, while a majority (75%) of designations provide the same antlerless opportunity as 2022.

Farmland Zone

We produced density estimates for 28 of 36 total farmland zone DPAs. Of the 28 DPAs modeled in the farmland zone, 5 were at goal, 0 were below goal, and 23 were above goal based on modeling. Modeling deer densities in the farmland with harvest data continues to be a challenge, and relatively stable buck harvests over the past 10 years suggest a stable population with limited potential for growth, likely a result of habitat constraints; however, populations in some DPAs appear to be increasing, which is a concern for some managers. Regardless, we selected management designations to either stabilize densities for DPAs at goal or to decrease densities for DPAs above goal. We attempt to maintain consistent regulations across years whenever possible to improve model performance. For the 2023 season designations (see abridged descriptions below), most farmland DPAs (n = 18) were under an Antlerless Permit Lottery designation. Six DPAs required Either Sex, 6 were under a Two-deer Limit designation, 5 were under a Three-deer Limit designation, and 1 was designated as Three-deer Limit with an Early Antlerless season to stabilize or reduce deer numbers at appropriate levels.

Farmland-Forest Transition Zone

Deer populations in the farmland-forest transition zone are highly productive due to excellent habitat and generally milder winters 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 39 of the 49 transition zone DPAs. Of those 39 DPAs in the farmland-forest transition zone that were modeled, 10 were at goal, 1 was below goal, and 28 were above goal based on modeling or buck harvest trends. 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 2023 season designations, Bucks Only was used in 1 DPA, Antlerless Permit Lottery was used for 1 DPA, Either Sex for 4 DPAs, and a Two-deer Limit designation was used for 13 DPAs. In 22 DPAs, a Three-deer Limit designation was necessary to continue reducing deer densities toward goal level, 14 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. We produced density estimates for 33 of 44 forest zone DPAs. Of the 33 DPAs in the forest zone, 20 were at goal, 8 were below goal, and 4 were above goal based on modeling. A goal density was not established for 1 DPA. 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 2023 season designations, Bucks-only was used in 8 DPAs, Antlerless Permit Lottery in 22 DPAs, Either Sex in 8 DPAs, a Two-deer Limit designation in 4 DPAs, and a Three-deer Limit designation in 2 DPAs.

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 management units (DMUs) derived from population model simulations in Minnesota, 2018-2023.

		Pre-fawn Deer Density					
Deer Modeling Unit	Land Area (mi^2)	2018	2019	2020	2021	2022	2023
1	1,470	6	7	8	10	12	14
2	2,026	13	13	15	18	19	20
3	2,166	5	5	6	7	7	8
4	2,467	5	5	4	5	5	6
5	2,779	3	3	3	3	3	3
6	3,750	11	12	13	16	18	20
7	3,932	21	21	23	26	29	33
8	3,573	14	13	14	16	17	18
9	3,466	12	11	10	10	9	9
10	2,348	29	30	34	39	43	47
11	2,334	33	34	38	43	48	55
12	3,331	26	27	30	34	37	42
13	2,550	5	6	7	8	10	12
14	1,456	18	21	25	31	37	43
15	3,647	24	27	31	35	39	44
16	546	12	14	16	18	21	23
17	840	6	7	8	9	10	11
18	2,822	7	7	8	9	9	10
19	2,102	5	5	6	6	7	8
20	4,314	5	6	7	8	9	11
21	3,497	10	12	15	18	22	27
22	603	22	26	29	34	39	46
23	1,677	28	31	35	39	45	54

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, 2018-2023.

		Pre-fawn Deer Density					
Deer Permit Area	Land Area (mi^2)	2018	2019	2020	2021	2022	2023
101	496	11	11	12	13	16	16
[a]104	1,414	-	-	-	-	-	-
[a]105	1,199	-	-	-	-	-	-
[a]107	472	-	-	-	-	-	-
[a]109	1,182	-	-	-	-	-	-
110	529	19	18	22	25	28	36
111	1,384	4	4	4	5	6	7
[a]114	123	-	-	-	-	-	-
117	936	0	0	0	0	0	1
118	1,239	5	5	5	6	6	6
119	782	6	7	8	9	9	10
126	942	6	6	6	8	7	7
130	747	4	3	2	3	3	3
131	901	2	2	2	1	2	2
132	481	6	6	5	6	7	7
133	352	8	7	7	6	6	6
152	60	13	14	17	20	20	24
[a]155	499	-	-	-	-	-	-
156	819	12	10	10	9	10	8
157	888	32	33	36	44	49	57
159	571	15	13	13	14	13	12
[a]169	939	-	-	-	-	-	-
[a]171	740	-	-	-	-	-	-
172	688	28	27	25	24	31	33
[a]173	471	-	-	-	-	-	-
176	917	12	11	11	13	12	12
177	491	14	15	15	16	16	18
178	1,192	14	12	14	17	18	19
181	629	10	10	8	8	6	6
182	278	12	13	12	13	12	11
183	664	13	11	10	10	10	9
197	973	17	16	16	17	20	23
199	153	6	5	5	5	4	5
201	161	10	12	11	12	14	12
203	118	6	8	6	8	10	7
208	378	8	10	10	14	16	19

[a]Indicates deer permit area was not included in DMU population model.

Table 2. Continued

Deer Permit Area	Land Area (mi²)	Pre-fawn Deer Density					
		2018	2019	2020	2021	2022	2023
209	639	13	13	16	18	22	23
210	615	15	16	19	25	25	28
213	1,059	26	26	30	34	35	39
214	553	36	38	44	55	56	68
215	701	27	27	29	35	38	48
218	884	21	24	29	36	42	50
219	391	20	21	24	26	28	35
221	643	24	27	31	35	40	42
222	413	27	28	33	37	44	47
223	377	23	26	30	33	36	44
224	46	24	27	34	33	37	43
225	618	30	33	36	42	46	52
227	471	28	31	36	41	48	54
229	285	13	14	16	18	19	24
230	454	9	11	14	17	22	26
232	377	12	16	18	22	26	35
233	381	11	13	16	20	25	29
234	636	4	5	6	7	8	8
235	35	18	23	31	38	44	40
236	368	23	27	30	33	39	45
[a]237	608	-	-	-	-	-	-
238	95	12	12	14	17	18	17
239	928	21	23	25	27	29	32
240	643	33	35	39	44	50	53
241	997	36	40	45	49	54	61
246	784	28	26	28	31	37	41
248	216	29	32	40	46	50	47
249	496	28	29	42	48	47	54
250	712	6	7	8	9	10	12
251	55	13	14	14	18	23	25
252	716	5	6	8	9	10	10
253	974	8	9	10	13	16	20
254	924	9	12	14	18	23	26
[a]255	392	-	-	-	-	-	-
256	654	12	11	12	15	17	20
257	412	15	15	19	22	24	29
258	343	26	29	34	42	40	44
259	489	32	24	27	30	37	41

[a]Indicates deer permit area was not included in DMU population model.

Table 2. Continued

		Pre-fawn Deer Density					
Deer Permit Area	Land Area (mi^2)	2018	2019	2020	2021	2022	2023
[a]260	1,055	-	-	-	-	-	-
262	677	7	7	9	11	13	17
[a]263	706	-	-	-	-	-	-
264	669	16	16	18	22	23	25
265	494	15	15	18	21	23	28
266	617	9	10	11	14	14	17
267	472	9	10	11	14	13	15
268	228	21	19	26	26	29	32
269	650	6	7	8	10	11	12
270	736	4	4	6	7	7	9
271	632	6	6	7	9	11	14
272	532	5	5	7	8	11	12
273	572	14	16	20	24	28	32
274	355	6	5	6	8	8	8
[a]275	957	-	-	-	-	-	-
[a]277	1,058	-	-	-	-	-	-
278	402	8	9	10	10	11	11
279	344	5	5	6	6	8	9
280	674	4	4	5	6	8	8
281	605	7	8	8	10	10	11
[a]282	1,126	-	-	-	-	-	-
[a]283	337	-	-	-	-	-	-
284	840	6	6	7	9	10	11
285	546	12	14	16	18	21	23
286	447	6	6	6	7	8	9
287	47	18	14	11	17	15	17
288	624	6	6	6	7	7	8
289	816	4	3	4	5	6	7
290	661	6	6	7	7	8	9
291	799	8	8	9	9	9	10
[a]292	362	-	-	-	-	-	-
[a]293	278	-	-	-	-	-	-
294	687	4	5	5	5	6	6
[a]295	959	-	-	-	-	-	-
296	665	6	6	8	10	12	14
297	438	6	6	6	6	8	8
298	619	12	11	12	14	16	15
299	387	14	16	21	26	29	36

[a]Indicates deer permit area was not included in DMU population model.

Table 2. Continued

Deer Permit Area	Land Area (mi²)	Pre-fawn Deer Density					
		2018	2019	2020	2021	2022	2023
[a]338	316	-	-	-	-	-	-
341	603	22	26	29	34	40	46
342	350	25	26	25	34	40	51
[a]604	673	-	-	-	-	-	-
[a]605	1,192	-	-	-	-	-	-
[a]643	351	-	-	-	-	-	-
644	186	21	25	30	31	37	47
645	330	20	22	25	29	34	40
646	319	38	47	50	52	59	72
[a]647	434	-	-	-	-	-	-
[a]648	332	-	-	-	-	-	-
649	492	33	33	39	44	51	56
[a]655	387	-	-	-	-	-	-
661	793	6	6	7	9	11	11
[a]679	1,024	-	-	-	-	-	-
684	1,235	25	26	26	29	31	36
[a]701	1,324	-	-	-	-	-	-

[a]Indicates deer permit area was not included in DMU population model.

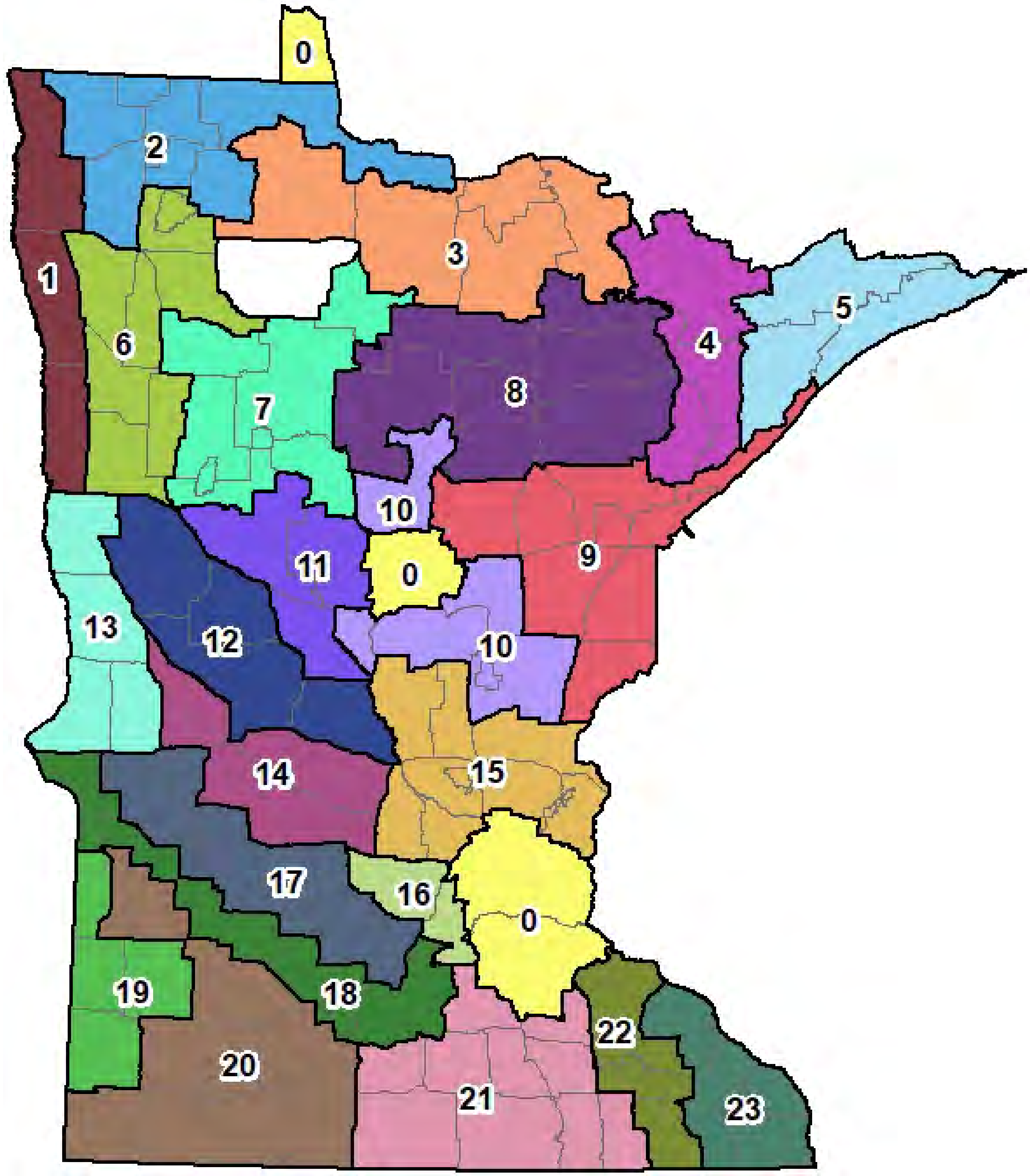

Figure 1. Deer permit areas aggregated into deer modeling units (DMUs; 1 through 23) in Minnesota. Areas colored yellow are DPAs that were not included in aggregated units.

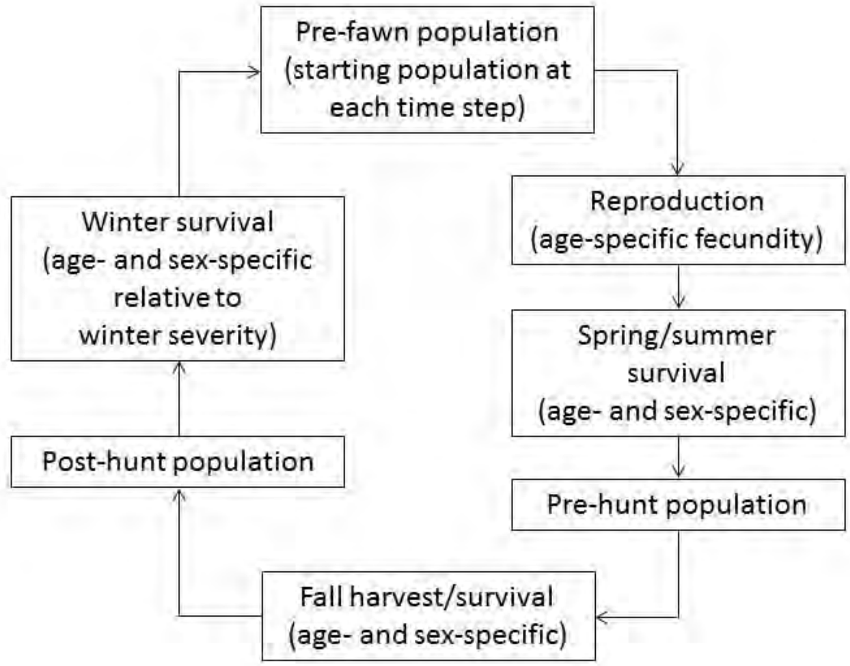

Figure 2. Model structure for simulations of white-tailed deer populations in Minnesota.

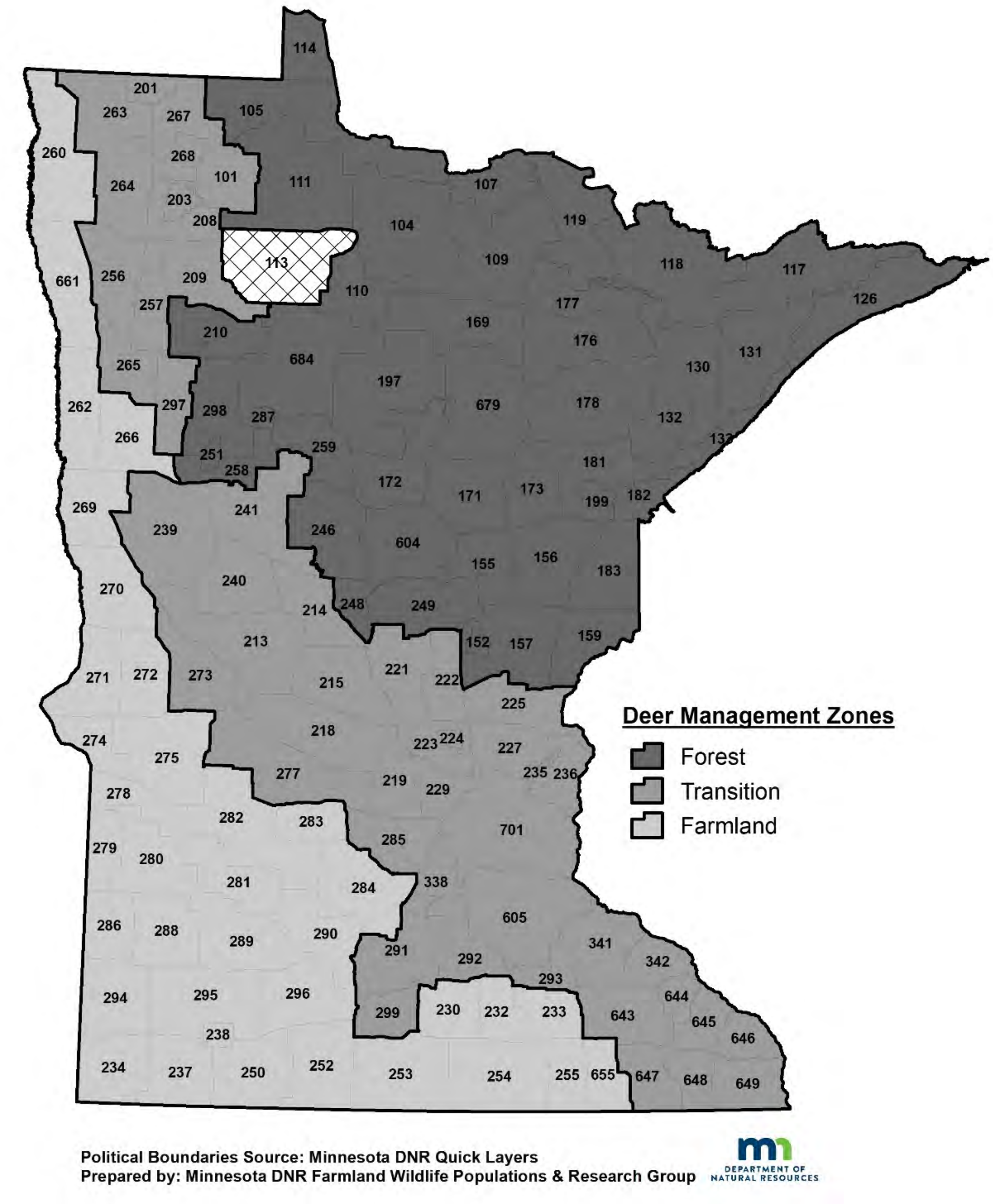

Figure 3. Deer permit areas (DPAs) in Minnesota and deer management zones used to describe deer population and harvest trends, 2023. DPAs were assigned to forest, transition, or farmland zones based on historical land cover and current woody cover. Generally, forested DPAs were composed of ≥60% woody cover, transition DPAs were composed of 6%-50% woody cover, and farmland DPAs were composed of ≤5% woody cover.

2022 MINNESOTA DEER HUNTER OBSERVATION PROJECT 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, agencies require current information. 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 = 130) 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 these annual decisions, 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 MNDNR biologists 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. Our primary objective was to evaluate this community science approach for monitoring trends in white-tailed deer and other wildlife populations. Our secondary objective was to estimate fawn:adult female deer ratios from deer hunter observations. 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.

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 recorded emails, 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 (total deer observed per hour and antlered deer observed per hour), and calculated the fawn-to-adult female deer ratio as a representation of recruitment.

RESULTS

We sent two direct emails to 177,719 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 2022 for comparison to previous years, we determined the total number of recorded observations. We recorded 4,644 observations from hunters representing 127 of 130 DPAs in 2022, which represented a 2400% increase from 2021 (Table 1). All DMUs and ecozones were represented with the 2022 observations. Hunters recorded 2,295 observations in 14,010 hours in the forest zone, 1,916 observations in 8,506 hours in the transition zone, and 433 observations in 1,891 hours in the farmland zone. Statewide observations for each species ranged from 9 observations of badgers to 17,397 observations of deer (Table 2). Firearms hunters submitted 2,862 observations, archery hunters submitted 1,657 observations, and muzzleloader hunters submitted 95 observations; 40 observations did not indicate weapon type. Most hunters recorded observations while hunting out of a tree stand (3,593) or a ground blind (622; Table 3).

In 2022, there were 1,632, 1,133, and 576 observations of antlered deer for the transition, forest, and farmland zones, respectively. Hunters observed 9,224, 4,582, and 3,586 total deer (bucks, adult females, antlerless, and unidentified combined; Table 4) for the transition, forest, and farmland zones, respectively. Fawn-to-adult female deer ratio was 0.68, 0.58, and 0.57 in the farmland, forest, and transition zones, respectively. Antlered bucks observed per hour was 0.30, 0.08, and 0.19 in the farmland, transition, and forest zones, respectively. Total deer observed per hour was 1.90, 1.08, and 0.33 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

Using a combination of direct emails and advertising via social media and radio interviews resulted in a drastic increase from total observations collected in 2021, but was still a 75% decrease from 2019, which was the final year of the bowhunter survey. Regardless, this increase indicates our modified methodology was successful. The total number of observations may also increase in subsequent years of data collection. For example, the total number of observations from the bowhunter survey increased throughout the three-year study period. We will continue to improve our outreach by directly working with conservation groups (e.g., National Deer Association, Backcountry Hunters and Anglers, etc) to promote this project.

The goal of this project is to derive an independent index to evaluate population trends for comparison to 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 6 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 gained using similar methodology and adequate sample sizes 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 time period.

Although we were able to increase the total number of observations in 2022, we will 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 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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Table 1. Deer hunter observations by year for each ecozone from 2017 to 2022 in Minnesota, USA.

	Ecozone		
Year	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	2,66
2021[b]	37	107	42
2022[c]	542	1,807	2,295

[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 2022 for each ecozone in Minnesota, USA.

	Species								
Ecozone	Deer	Wild Turkey	Badger	Grey Fox	Black Bear	Fisher	Bobcat	Coyote	Wolf
Farmland	3,586	1,016	3	2	0	3	1	76	0
Transition	9,224	4,550	4	57	22	26	18	244	46
Forest	4,587	2,907	2	53	110	39	52	239	730
Statewide total	17,397	8,473	9	112	132	68	71	559	776

Table 3. Hunting methods used by deer hunters submitting observations in 2022, by ecozone, in Minnesota, USA.

	Ecozone		
Hunting Method	Farmland	Transition	Forest
Treestand	268	1,489	1,836
Ground blind	98	262	262
Stalking	22	50	121
Deer drive	17	23	10
Other	27	88	60

Table 4. Total deer hunter observations of antlered deer, adult females, fawns, and unknown by ecozone for 2022 in Minnesota, USA.

Ecozone	Antlered Deer	Adult Females	Fawns	Unknown
Farmland	576	1,682	1,147	181
Transition	1,632	4,214	2,422	956
Forest	1,133	1,982	1,149	323

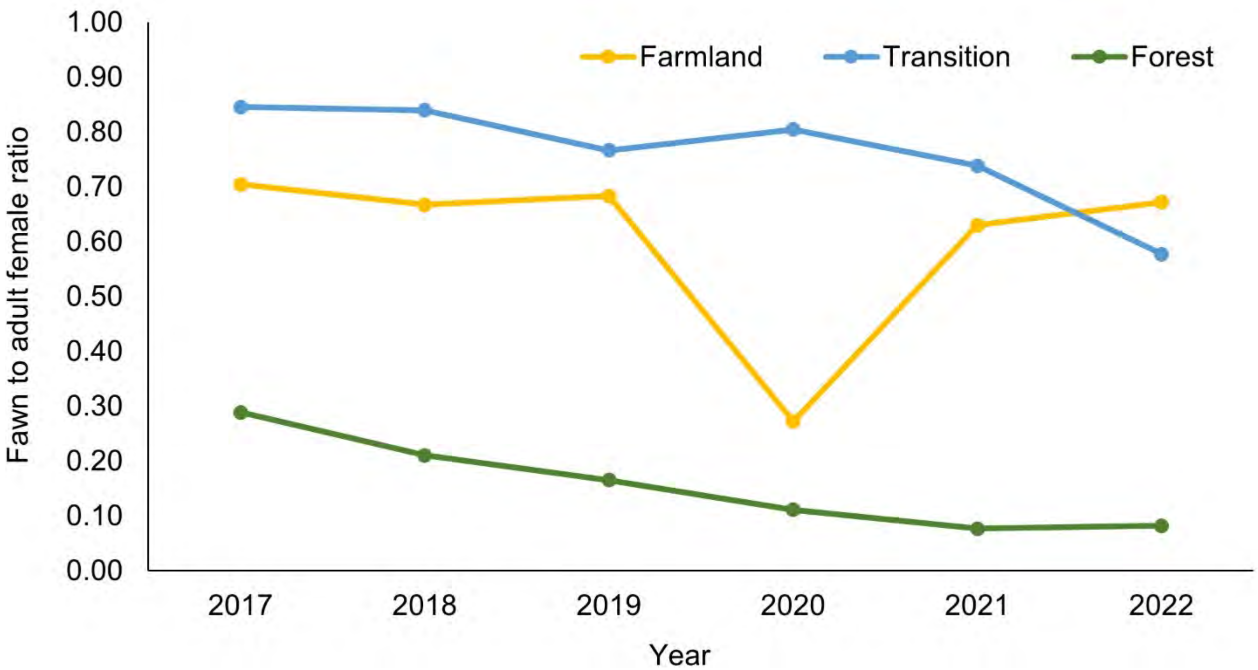

Figure 1. Index of the number of fawns-to-adult female deer for the farmland, transition, and forest ecozones from 2017 to 2022 in Minnesota, USA.

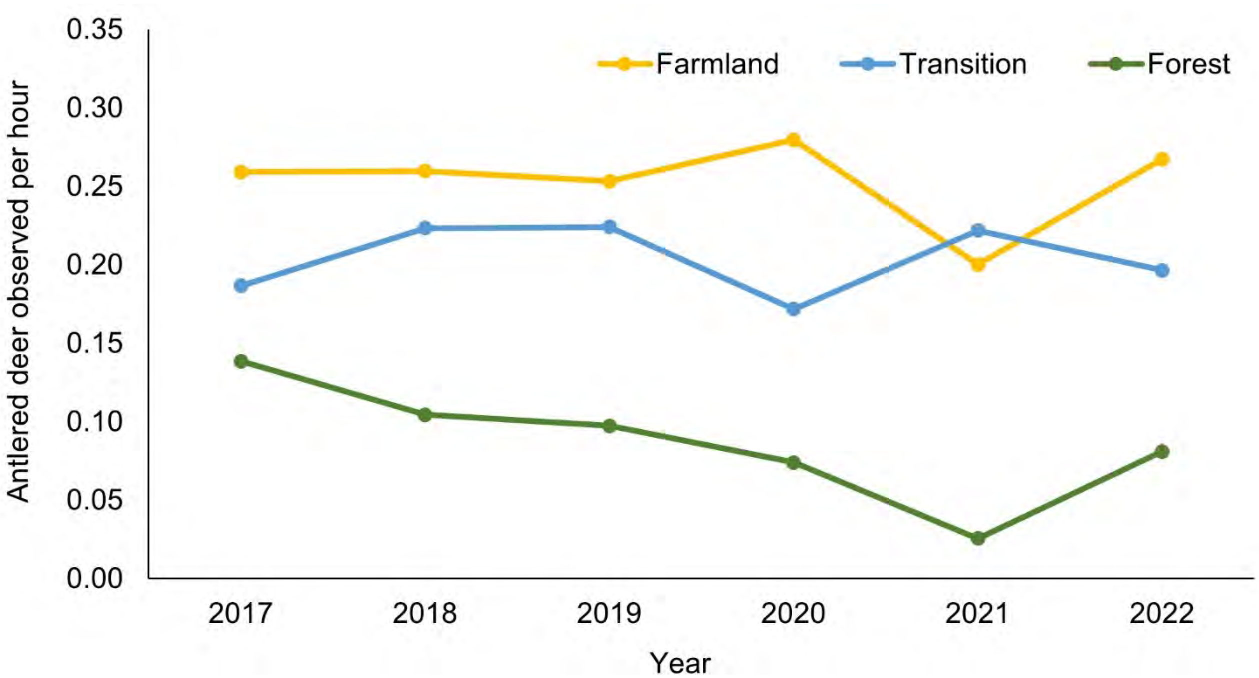

Figure 2. Total number of antlered deer observed per hour for the farmland, transition, and forest zones from 2017 to 2022 in Minnesota, USA.

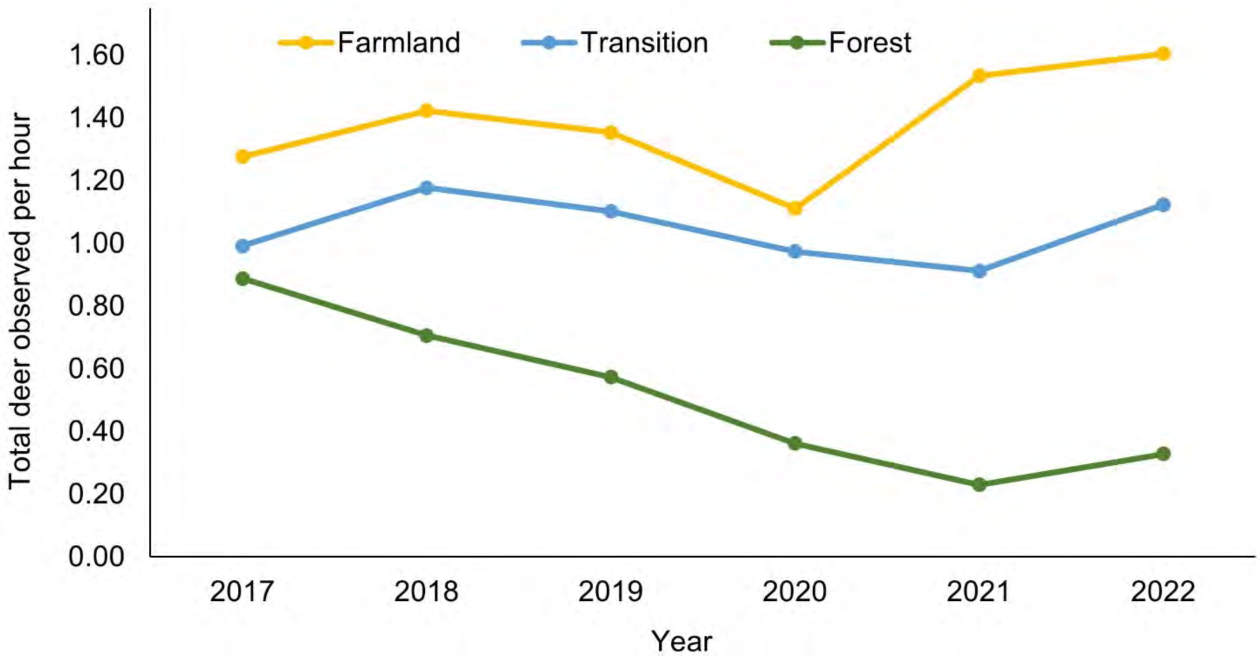

Figure 3. Total number of deer observed per hour in the farmland, transition, and forest zones from 2017 to 2022 in Minnesota, USA

FOREST WILDLIFE POPULATIONS

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CARNIVORE SCENT STATION SURVEY SUMMARY, 2022

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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 48th 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 199 routes and 1,796 stations were surveyed this year, similar to last year but the fifth fewest since the survey became fully operational in the early 1980's. Route density varied from 1 route per 747 km^2 in the Forest Zone to 1 route per 1,792 km^2 in the Farmland Zone (Figure 1).

Statewide, route visitation rates (% of routes with detection), in order of increasing magnitude, were opossums (9%), wolves (11%), bobcats (12%), domestic dogs (16%), domestic cats (25%), skunks (26%), coyotes (33%), red foxes (33%), and raccoons (37%). 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	26	71	32	74	16	3	0	21	44
Transition	28	36	28	58	22	12	4	30	29
Forest	38	18	23	14	0	14	20	8	14

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 increase in raccoon detections in the Transition zone (Figure 3).

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 continue to increase to 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 this year were the lowest ever recorded.

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 above the long-term average the last 4 years, the latter 2 of which coincide with wolf indices dropping below their long-term average. Red foxes, raccoons, and striped skunks have not exhibited consistent or notable trends over the past 20 years, and all are currently near their long-term averages. 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).

ACKNOWLEDGMENTS

I wish to thank all the cooperators who participated in the 2022 survey: DNR Division of Wildlife staff; Superior National Forest Aurora District; Rydell, Agassiz, 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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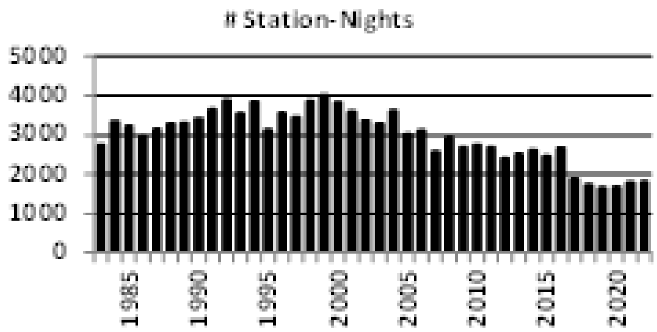

2022 SCENT STATION SPECIFICS

Zone	Routes Completed	Route Density	Station Nights
Farmland	38	1/1,792 km²	341
Transition	50	1/1,315 km²	427
Forest	111	1/747 km²	1,028
Totals	199	1/1,089 km²	1,796

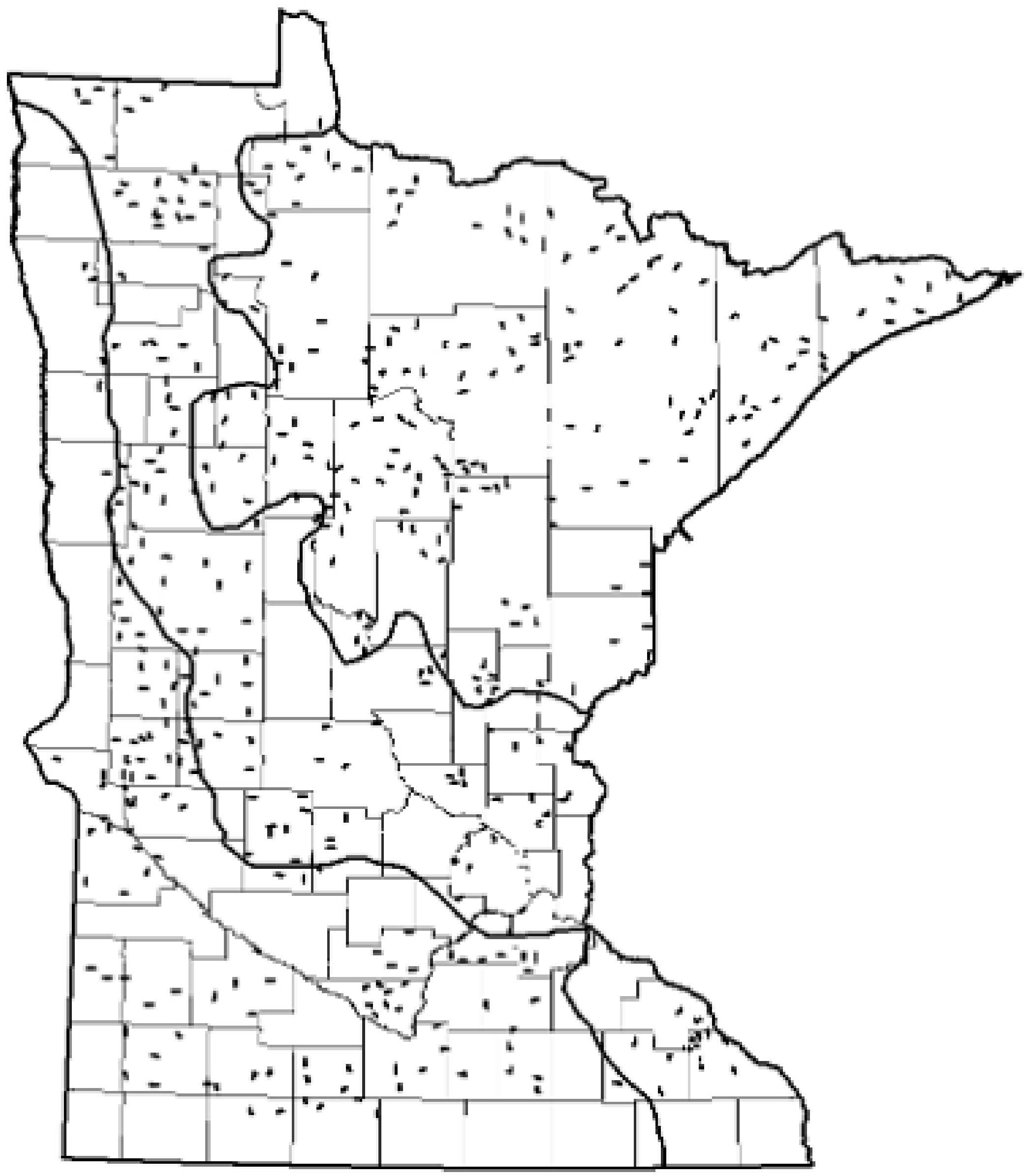

Figure 1. Locations of existing scent station routes (not all completed every year). Insets show 2022 route specifics and the number of station-nights per year since 1983.

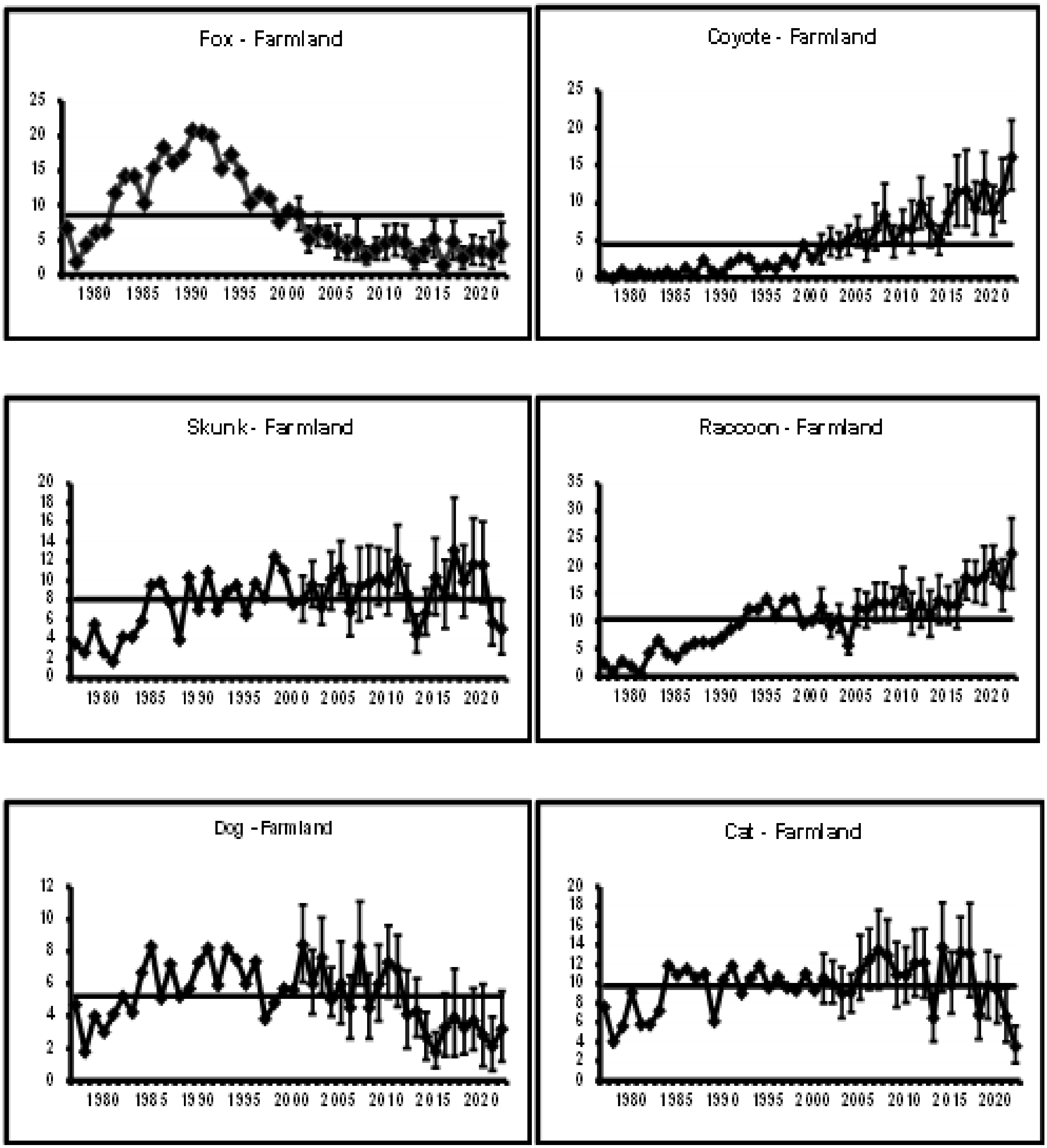

Figure 2. Percentage of scent stations visited by selected species in the Farmland Zone of Minnesota, 1977-2022. Horizontal lines represent long-term means.

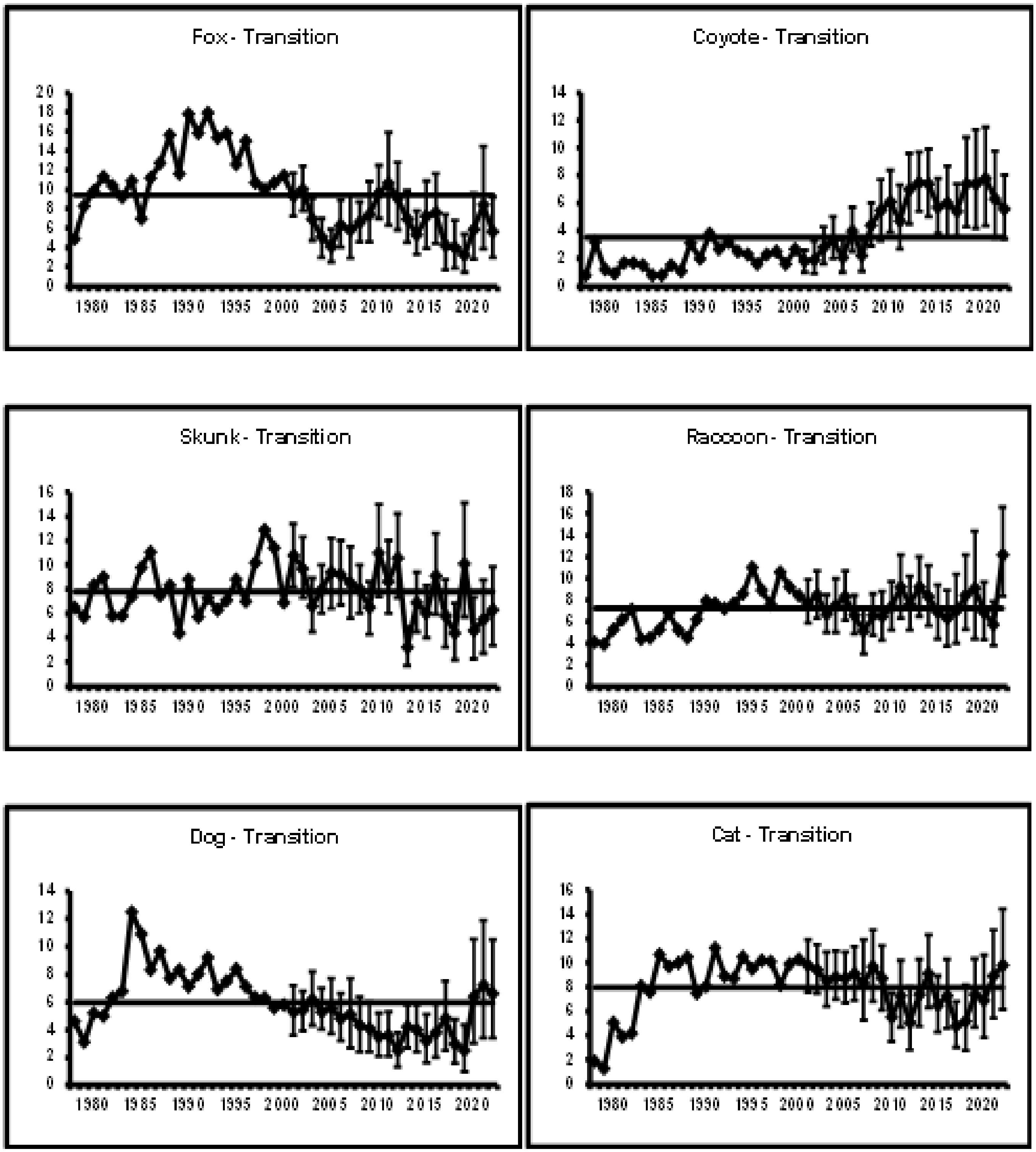

Figure 3. Percentage of scent stations visited by selected species in the Transition Zone of Minnesota, 1978-2022. Horizontal lines represent long-term means.

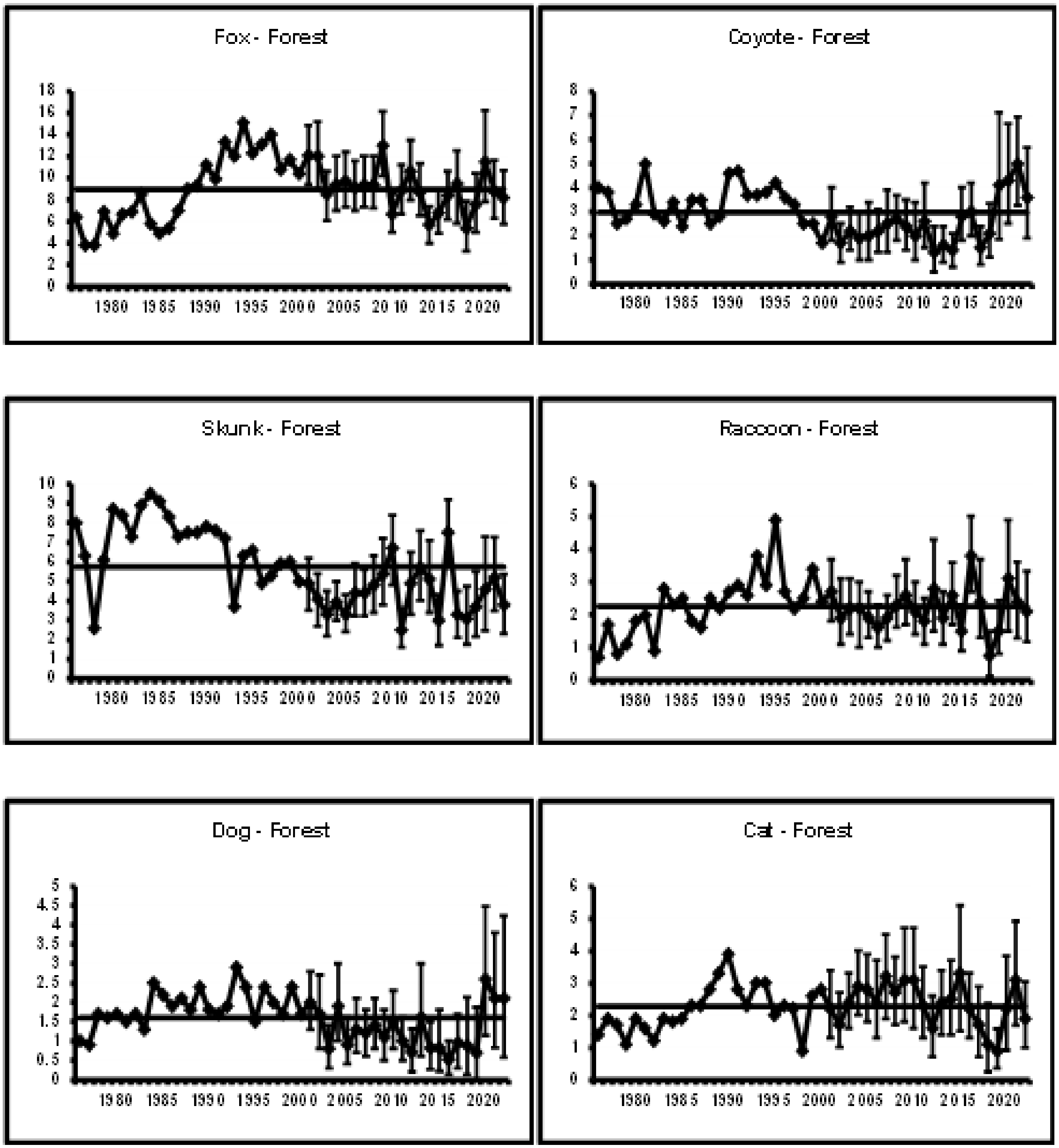

Figure 4. Percentage of scent stations visited by selected species in the Forest Zone of Minnesota, 1976-2022. Horizontal lines represent long-term means.

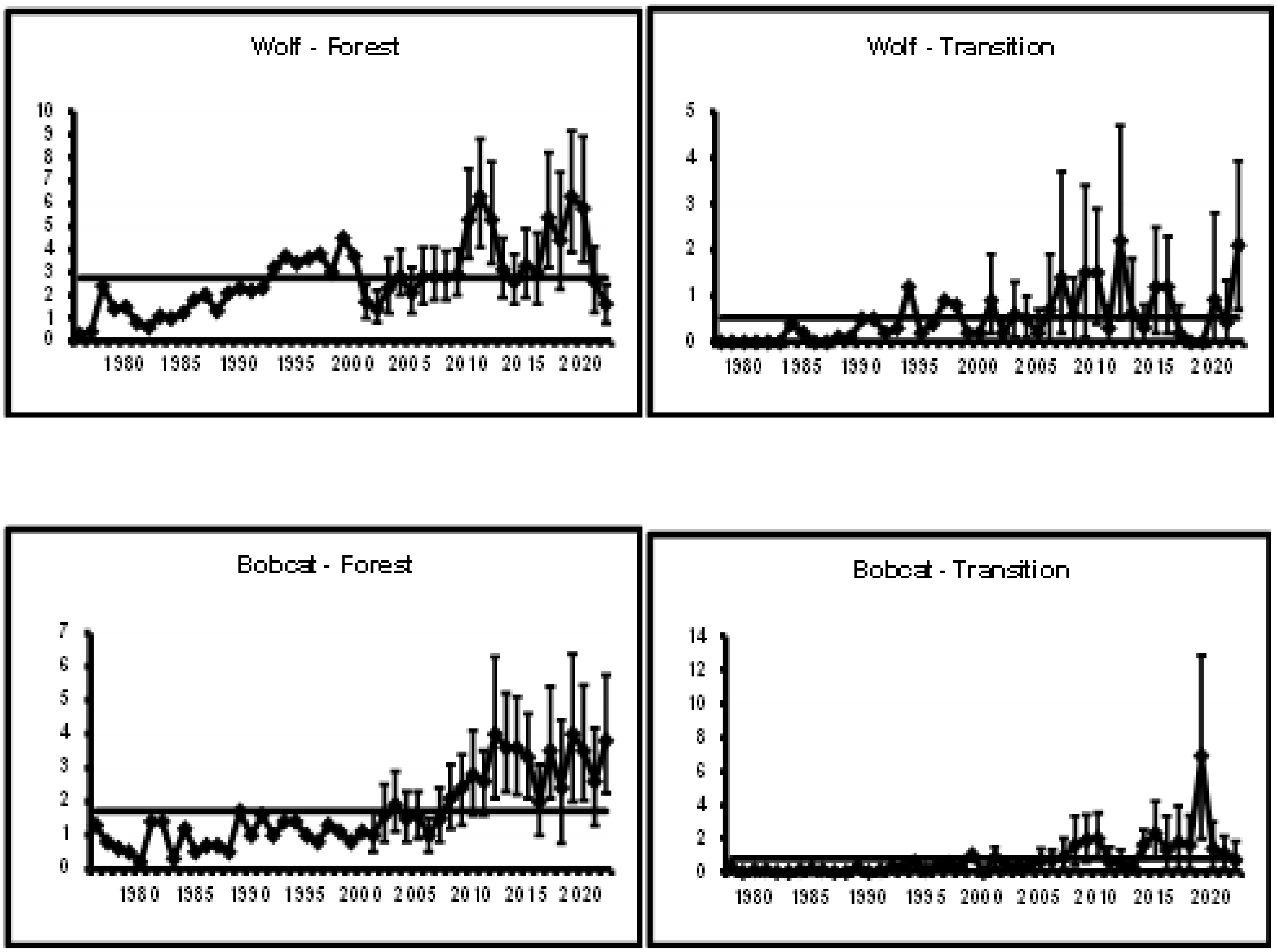

Figure 5. Percentage of scent stations visited by wolves and bobcat in the Forest and Transition Zones of Minnesota, 1976-2022. Horizontal lines represent long-term means.

FURBEARER WINTER TRACK SURVEY SUMMARY, 2022

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

This winter, 33 of the 58 routes were completed (Figures 1 and 2). Survey routes took an average of 2.4 hours to complete. Snow depths averaged 12" along completed routes, near the long-term mean (Figure 3). Mean overnight low temperature the night preceding the surveys was 2°F, slightly below the long-term mean (Figure 3). Survey routes were completed between November 16th and March 13th, with the mean survey date of January 3rd (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 4.9% of the route segments and along 61% of the routes (Figure 4), both non-significant changes from last 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 5.1% of the route segments and 58% 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 13-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 another low 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 4.6% of the segments and 52% of the routes, both above their long-term averages but representing non-significant changes from last winter (Figure 4).

Wolves were detected on 7.8% of the route segments and 76% of the survey routes, both near their long-term averages and representing non-significant declines from last winter (Figure 4); the average number of wolves detected per route was 3.2. Coyotes were detected on 4.5% of the route segments and 42% 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 4 years, indices have slowly climbed to near the long-term average. Red foxes were detected on approximately 12% of the segments and 79% of the routes (Figure 4), both representing non-significant declines 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% of the route segments and on 12% of the routes.

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 2013 (Figure 4). Weasels were detected on 12% of the route segments (peak of 31% in 1995) and on 70% of the routes (peak of 88% in 1999).

Both spring and winter hare indices steadily increased from 1994 – 2010. Since then, there has been less consistency between the 2 indices though both had generally declined for five years and were near their post-1994 averages in 2020 (Figure 4). This year, neither the spring or winter hare index changed appreciably, and both indices are below their long-term average (Figure 4). 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 in an upswing). Recent data suggests hare cycling has dampened or disappeared, with minimal connection to the more distinct grouse cycles.

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

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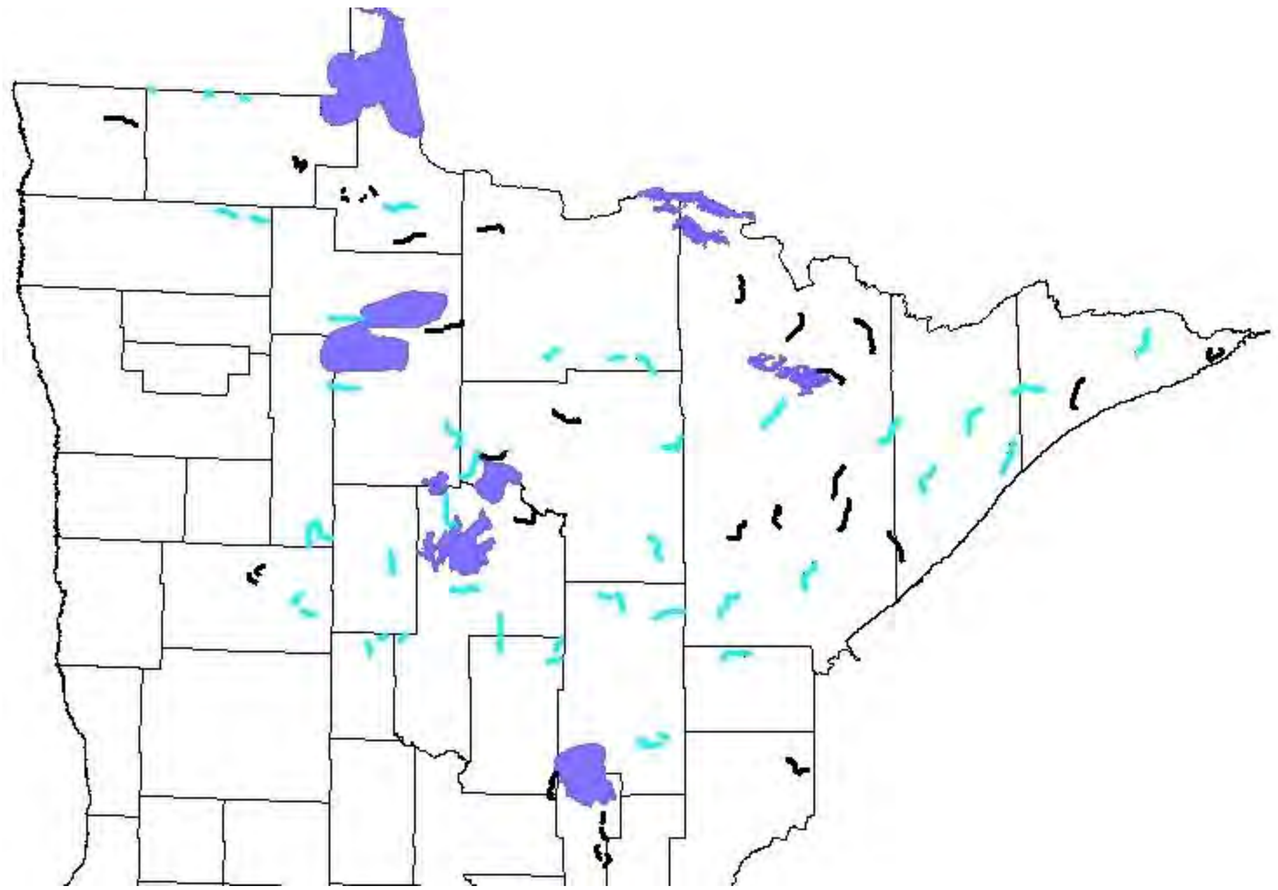

Figure 1. Locations of furbearer winter track survey routes in northern Minnesota. Blue routes are those completed during winter 2022-23.

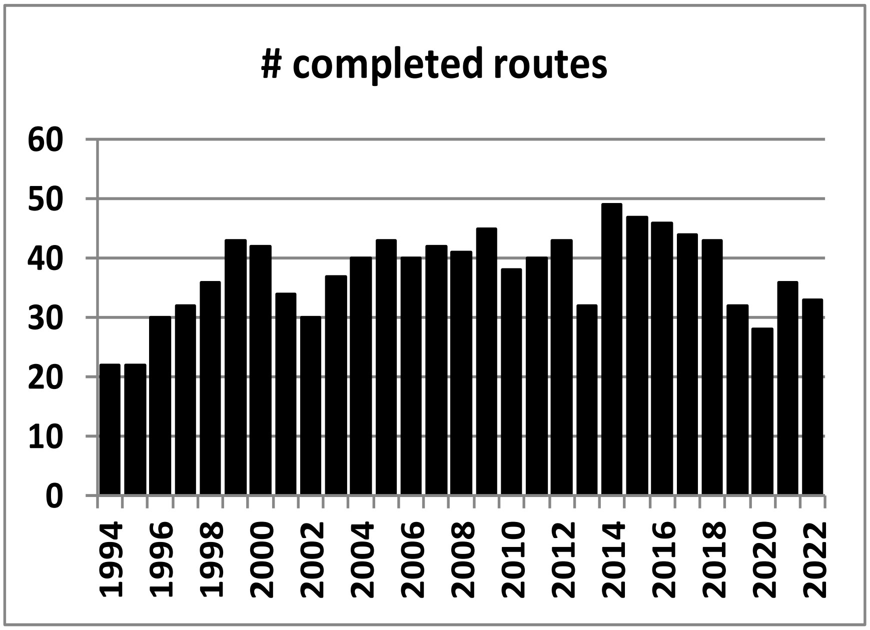

Figure 2. Number of snow track routes surveyed in Minnesota, 1994-2022.

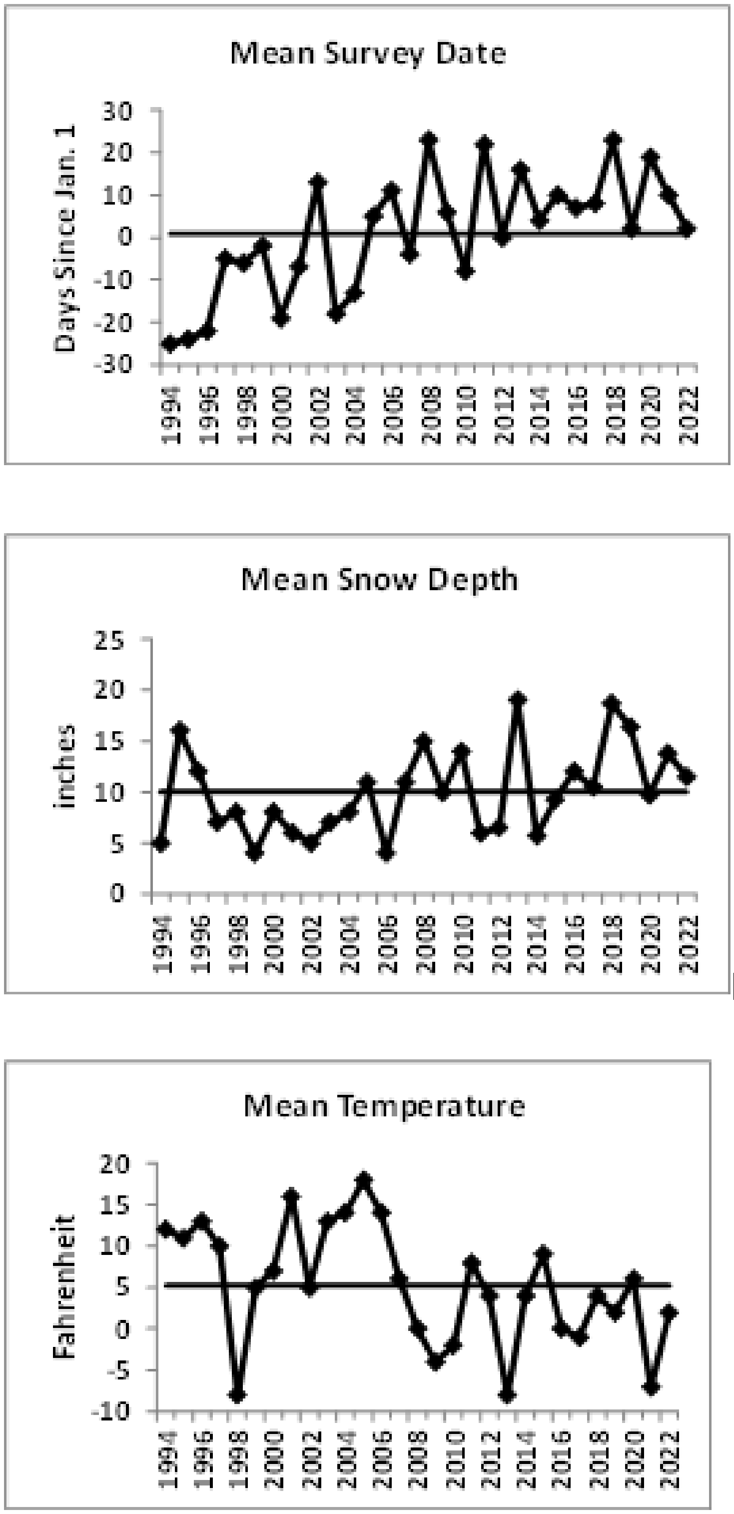

Figure 3. Average survey date, snow depth, and temperature for snow track routes completed in Minnesota, 1994-2022. Horizontal line represents long-term mean.

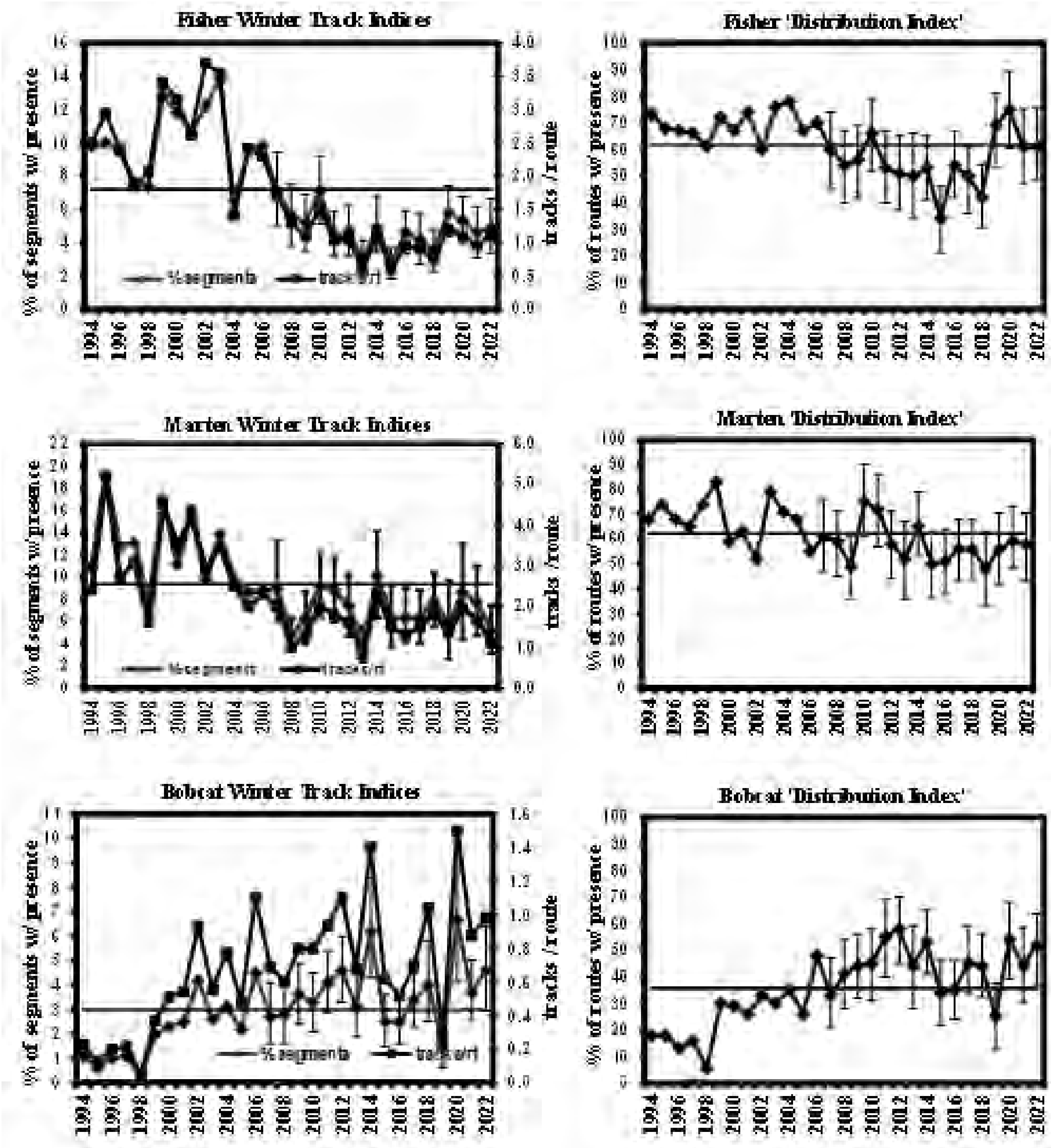

Figure 4. Winter track indices for selected species in Minnesota, 1994-2022. Confidence intervals are presented only for % segments and % routes with track presence; horizontal lines represent their long-term averages.

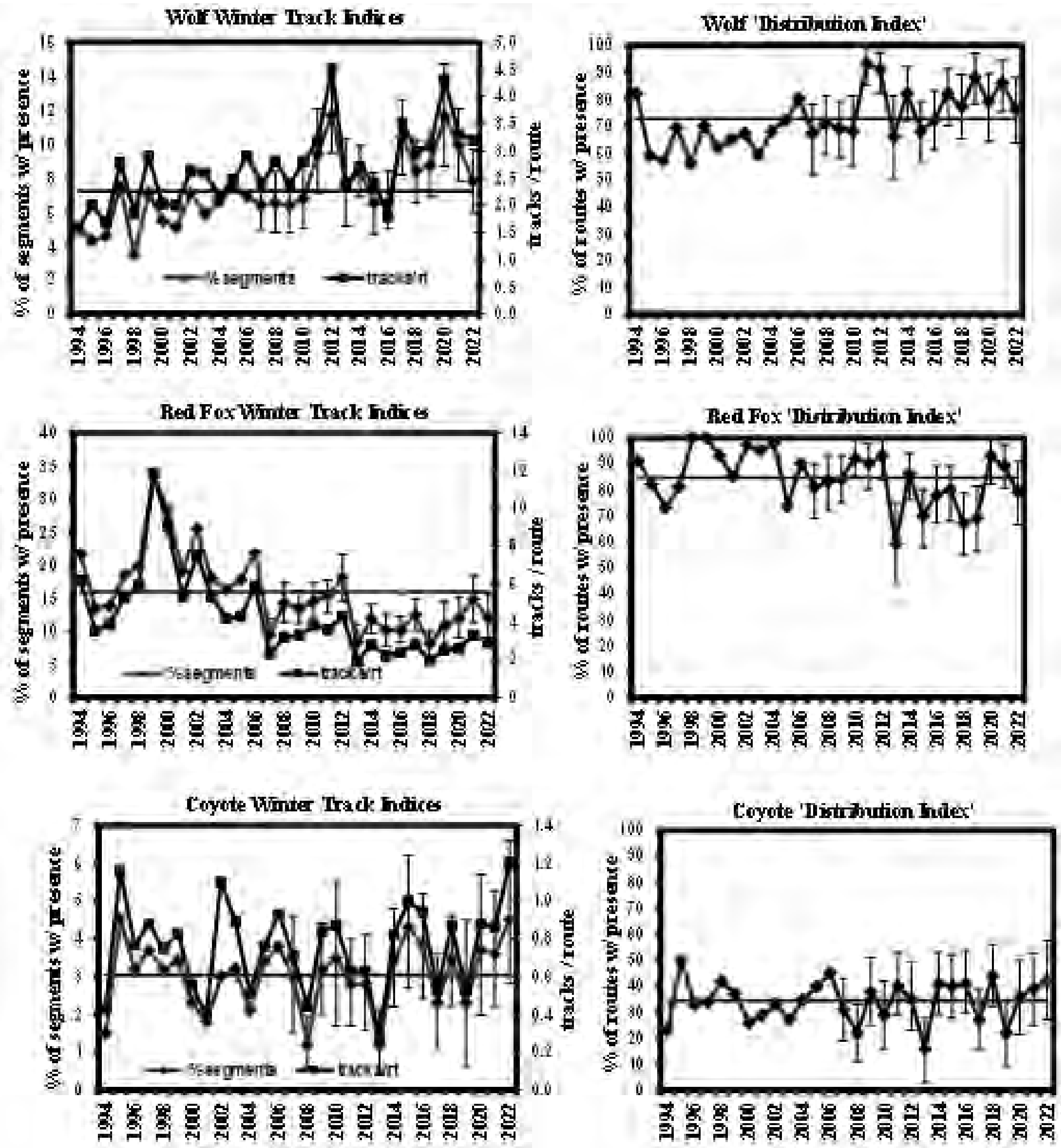

Figure 4 (continued). Winter track indices for selected species in Minnesota, 1994-2022.

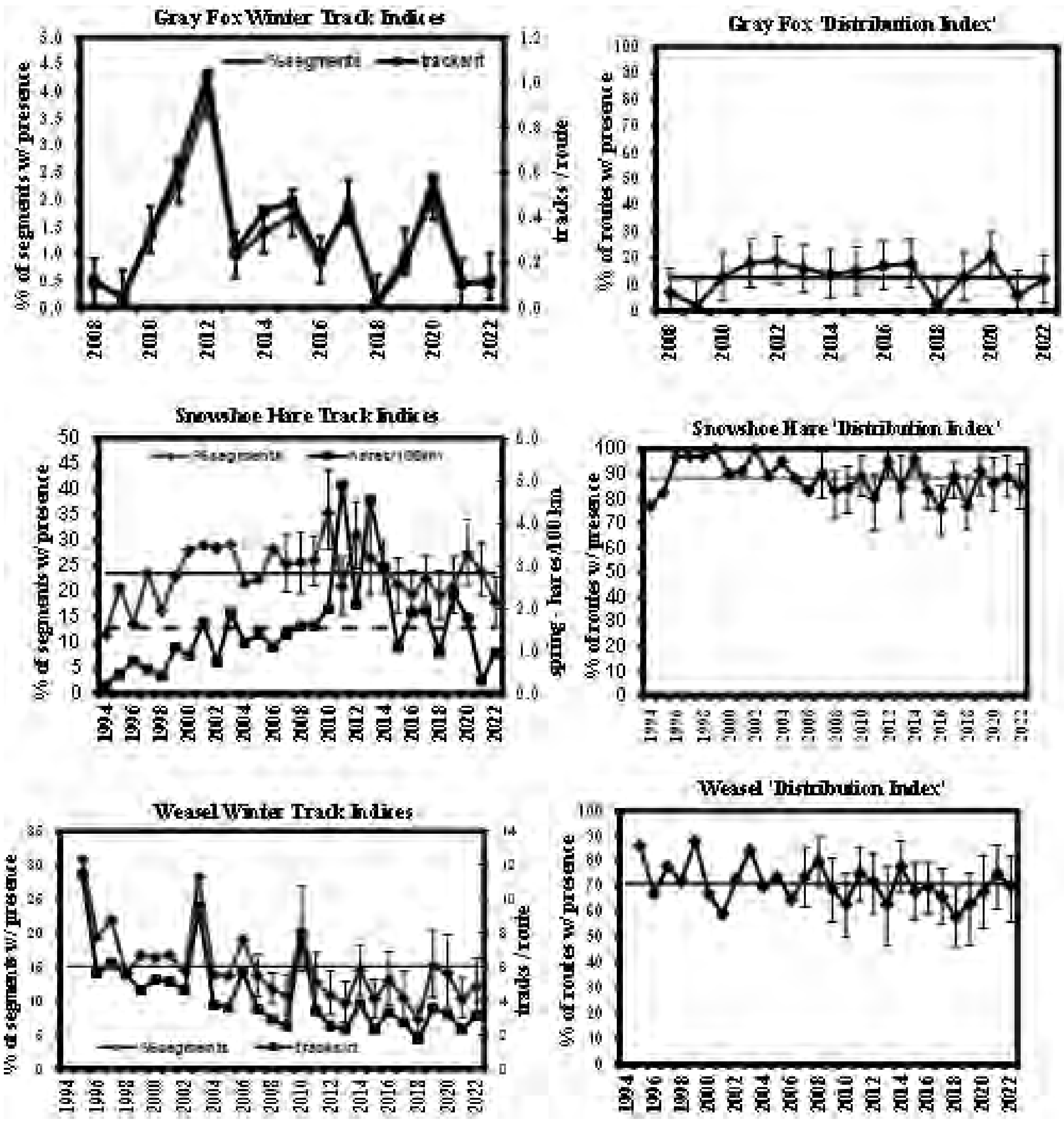

Figure 4 (continued). Winter track indices for selected species in Minnesota, 1994-2022.

STATUS OF MINNESOTA BLACK BEAR POPULATIONS, 2022*

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). 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. 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 (Fig. 1). The credible intervals for these 2 estimates are not included for ease of reading.

Population trend: BMU-level

Using the Allen et al. (2018) population model, we were able to estimate population trend for each BMU (Figs. 2, 3). 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. The poor soils in NE Minnesota BMUs produce less bear food and subsequently, have much worse bear reproduction (BMUs 12, 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 our 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.

Acknowledging that these results are post-hunt 2022, 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). 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 a few BMUs. 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, 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 BMU 41 has had a very minor decline over the past few years.

The no-quota BMUs have been increasing rather quickly since 2012. Estimates of growth are 7.0% (BMU 11) and 3.9% (BMU 52) annually from 2012–2022. 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 (Fig. 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 (Fig. 5). 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. 4).

Human bear conflicts

The total number of recorded bear complaints(Table 9; fig. 6) has been stable for a decade but has fluctuated with natural food abundance. 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 number of officers reporting bear complaints. Complaints were similar to 2018, and this year had the second lowest level of bear complaints in a decade.

Food abundance

The composite range-wide, all-season abundance of natural bear foods (fruits and nuts) in 2022 was the second-best on record. Abundance of many summer foods was above the long-term (37-year) average for all regions (Tables 2, 3, 4). In general, summer food conditions were exceptionally good across the state, and in most regions rivaled peak food year in 1996. Fall foods were also above average. The statewide fall food index (productivity of dogwood + oak + hazel), which helps predict annual harvest after accounting for hunter effort (Fig. 7), was the 4^{th} best year on record. Hazelnuts, acorns, and dogwood berries were above average in many areas of the state.

Predictions of harvest from food abundance

The 2022 statewide harvest was 10% higher than expected, based on regression of harvest as a function of hunter numbers and the fall food productivity index. This regression is nearly as strong (and has accurately predicted previous harvests) when only the past 15 years are considered. For the quota zone, the actual harvest in 2022 was also 15% higher than predicted by this regression (Fig. 8).

Submission of bear teeth for aging

Ages of harvested bears are used as the principal means of monitoring population trends. Although hunters are required to submit a tooth from their harvested bear, historically >25% did not comply. Reminder notices were sent to non-compliant hunters each year during 2014–2017, which spurred a higher initial compliance the following years (>80%). Since 2018, with no reminder mailing, compliance has been 82–87% (Fig. 9). Since 2013, hunters could register by phone or internet, and pick up a tooth submission envelope later: tooth submission compliance by these hunters has equalized across all registration types. A decreasing proportion of hunters are registering their bear at a registration station over the past years (Fig. 10). 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, 22, 41, and 52).

Hunter opinions of status of bear population

A bear hunter survey was employed to assess changes in hunter effort and hunting methods over time, comparing periodic hunter surveys conducted over a 30-year period, 1988–2022. A random sample of 74% of all hunters were surveyed this year (6,000 total surveys), of which responses were received from 60% in the quota zone and 29% in the no-quota zone (the remaining 11% of respondents did not indicate which area they hunted). In total, 165 surveys were address returns, and 1614 hunters responded, indicating a 28% response rate. Nearly 80% of hunters expressed an opinion of the status of the bear population in the general area where they hunted. Among these, 37% thought the local population was stable, nearly 31% thought it was increasing, and 11% thought it was declining (Fig. 11). Opinions of population status differed by BMU. Roughly half the hunters in quota BMUs 28 and 45 thought local populations of bears were increasing. When comparing with 2018, about half as many hunters indicated the population was increasing in their zones (with 28 and 45 being the exception) in 2022. However, in all BMUs (except 22), $\geq$50% of all hunters surveyed thought that their local bear population was increasing or stable (Fig. 12).

**Population data extracted from the Status of Minnesota Black Bears, 2022 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.*

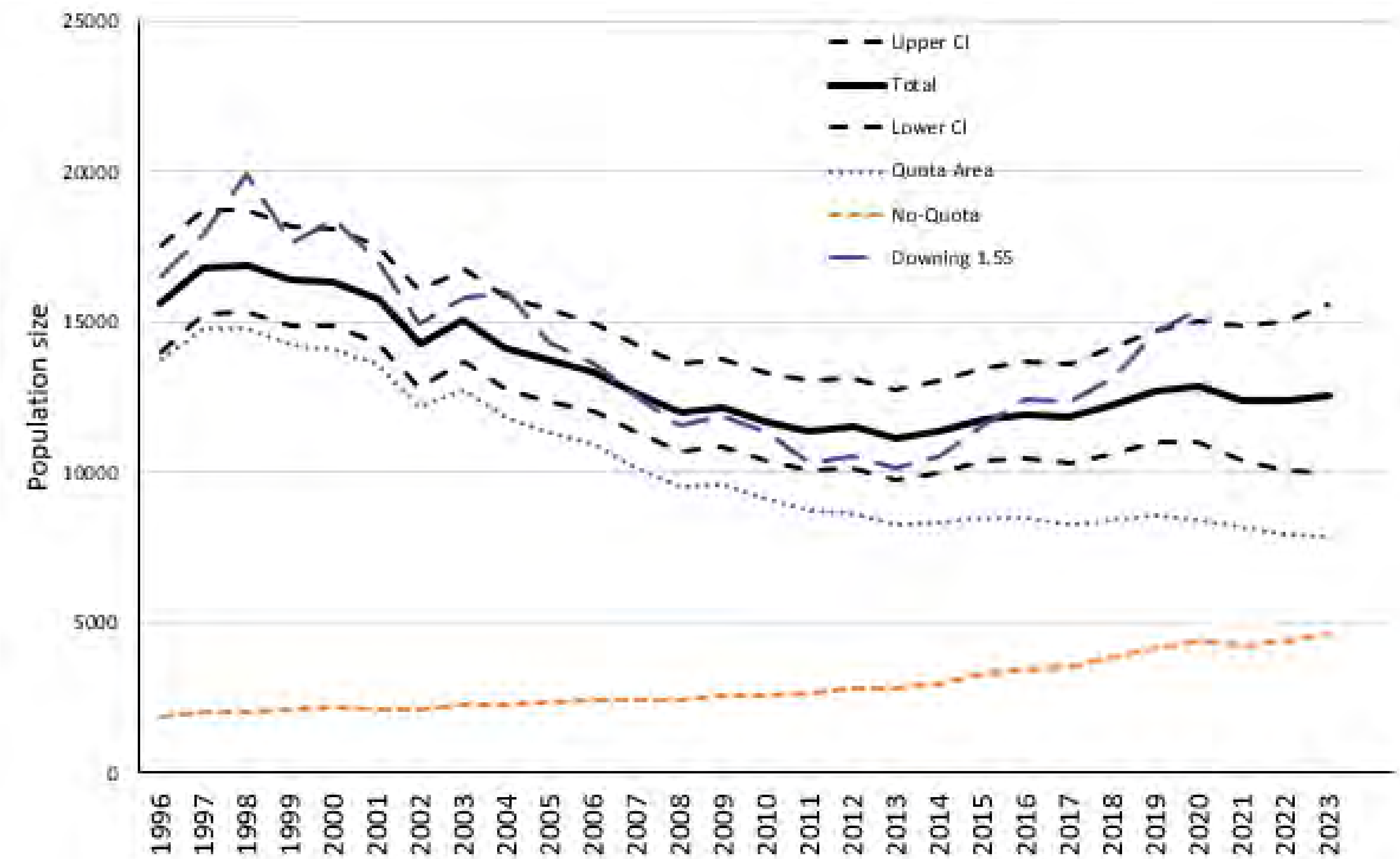

Figure 1. Population trends during 2000s derived from Allen model statewide estimates (± 95% credible intervals) and population estimates for quota and no-quota zones. Note the actual scale of the population estimates is an underestimate to true population size (based on previous tetracycline estimates), but population trend seems consistent with the BMU-level models and the Downing.

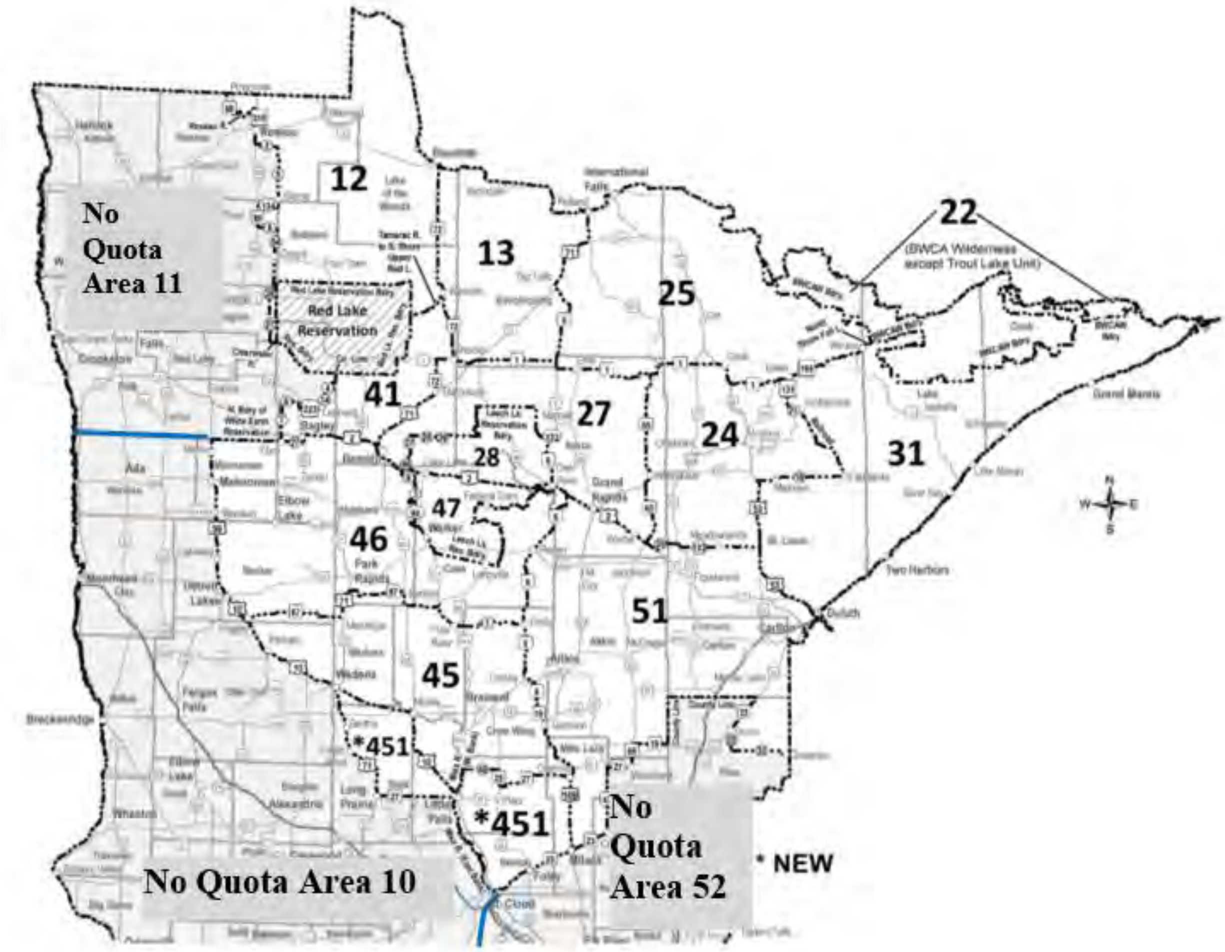

Figure 2. Bear management units (BMUs) within quota (white) and no-quota (gray) zones. Hunters in the quota zone are restricted to a single BMU. In 2016, BMU 26 was divided into 27 and 28, and BMU 44 was split into 46 and 47 (BMUs 28 and 47 comprise the Leech Lake Reservation). No-quota hunters can hunt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

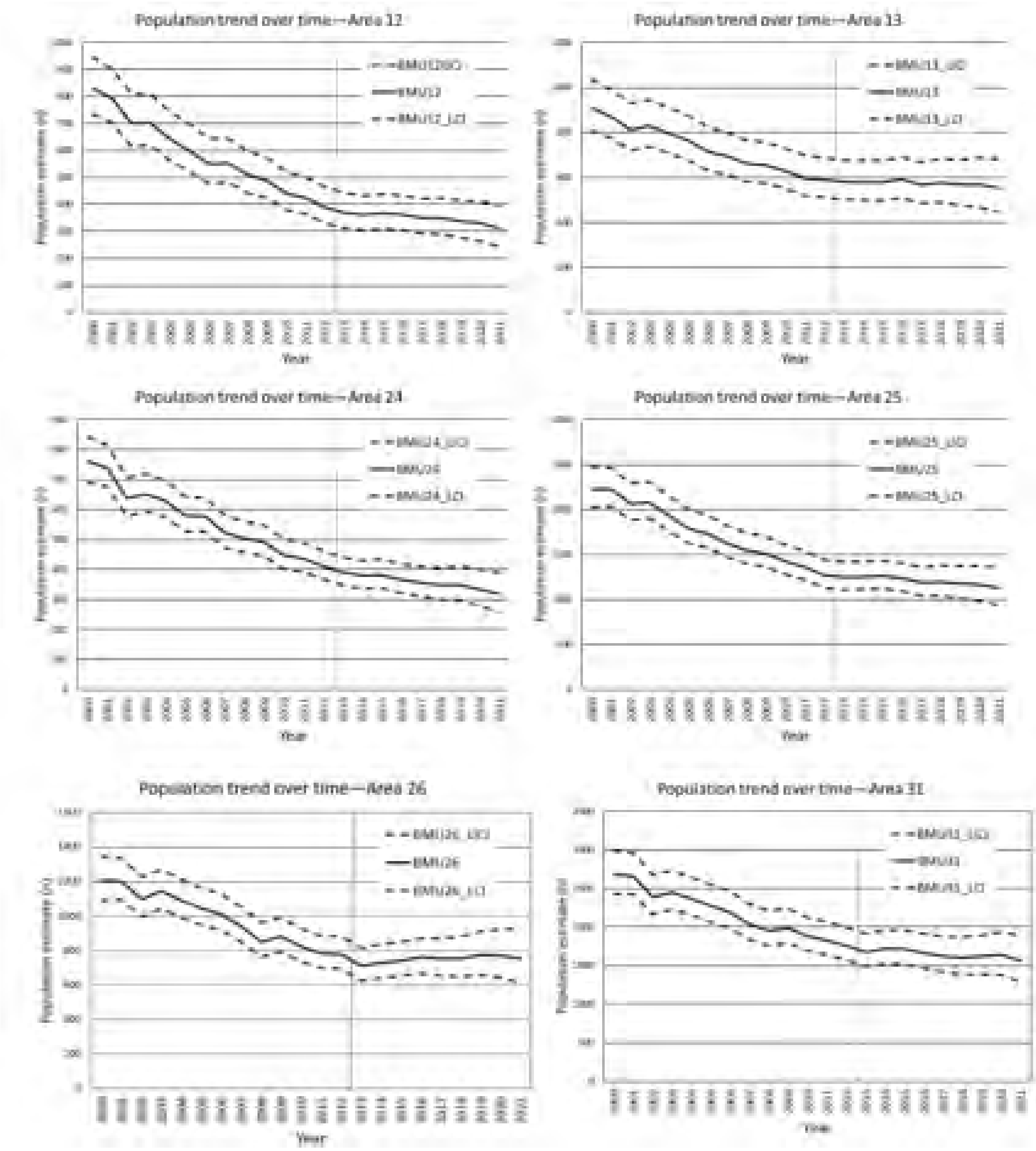

Figure 3. Allen et al. (2018) BMU-level, pre-hunt estimates 2000–2022. The vertical black line in 2012-2013 represents when quota permits were cut by >50% and have remained stable at low levels since then. The dashed lines represent the 95% pointwise credible intervals of the population estimate. With 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).

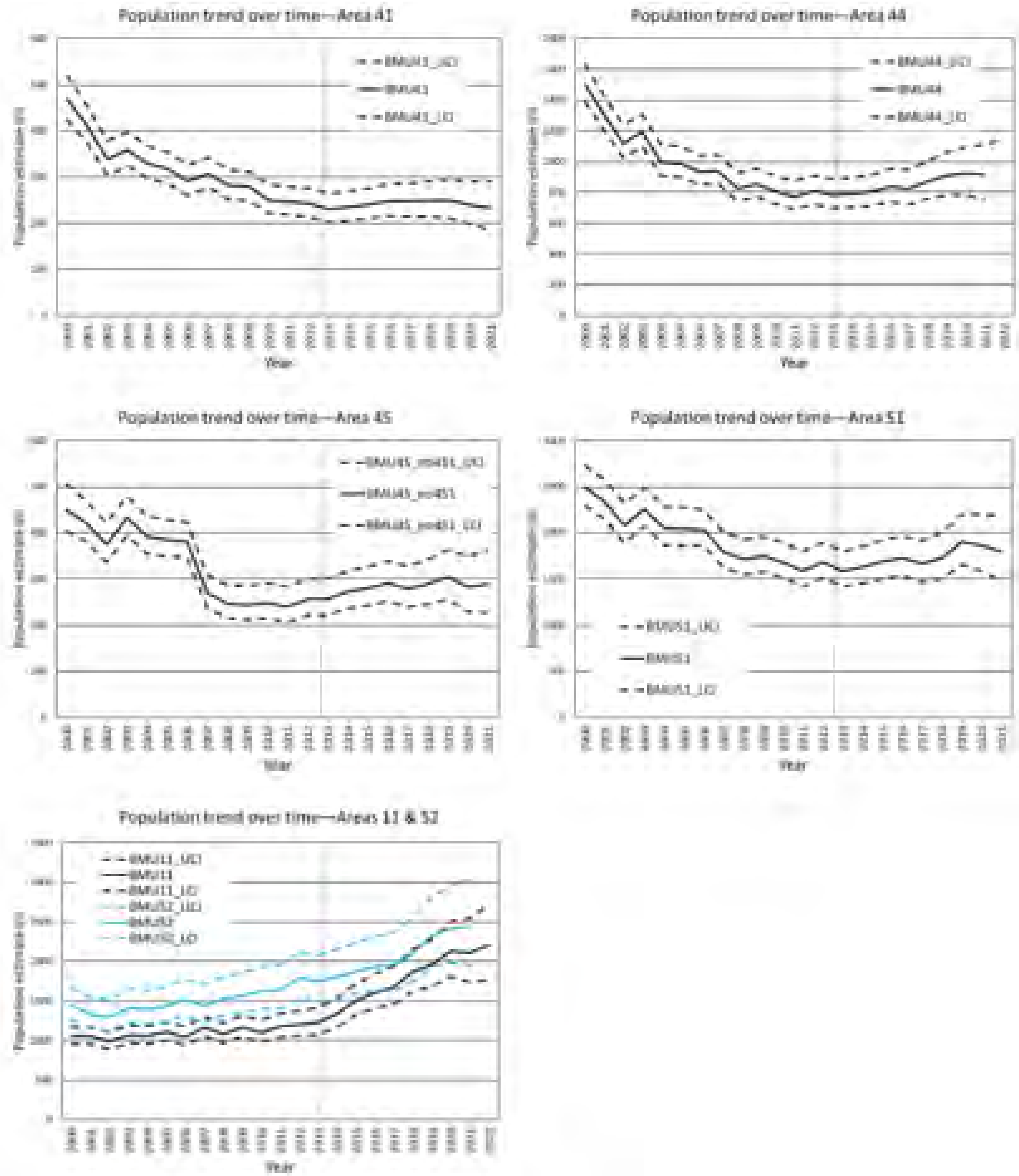

Figure 3 cont.

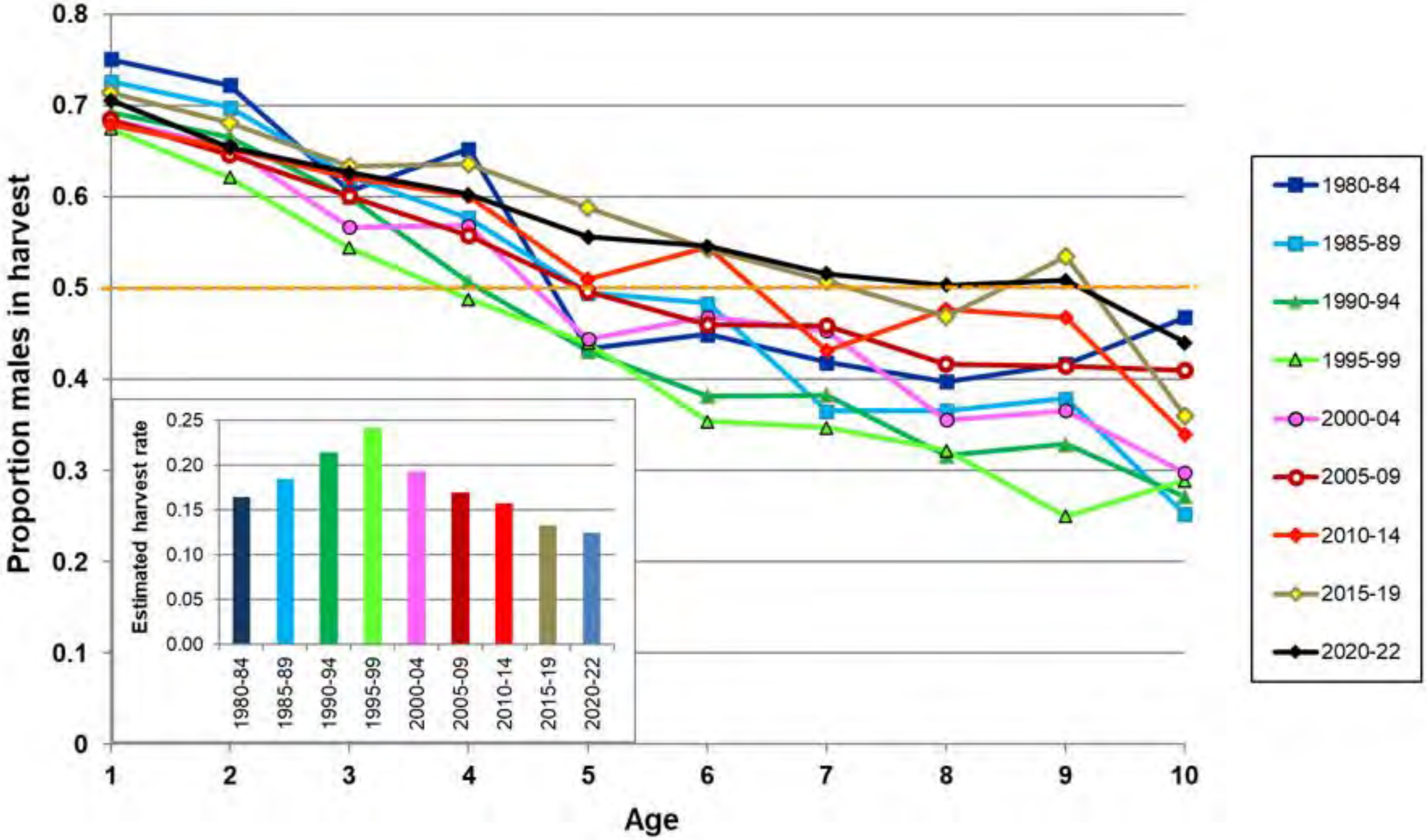

Figure 4. Trends in proportion of male bears in statewide harvest at each age, 1–10 years, grouped in 5-year time blocks, 1980–2022. Higher harvest rates result in steeper curves because males in the living population are reduced faster than females. Fitting a line to the data for each time block and 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., 2015–20 lower than 1980–84), but a slight increase in recent years.

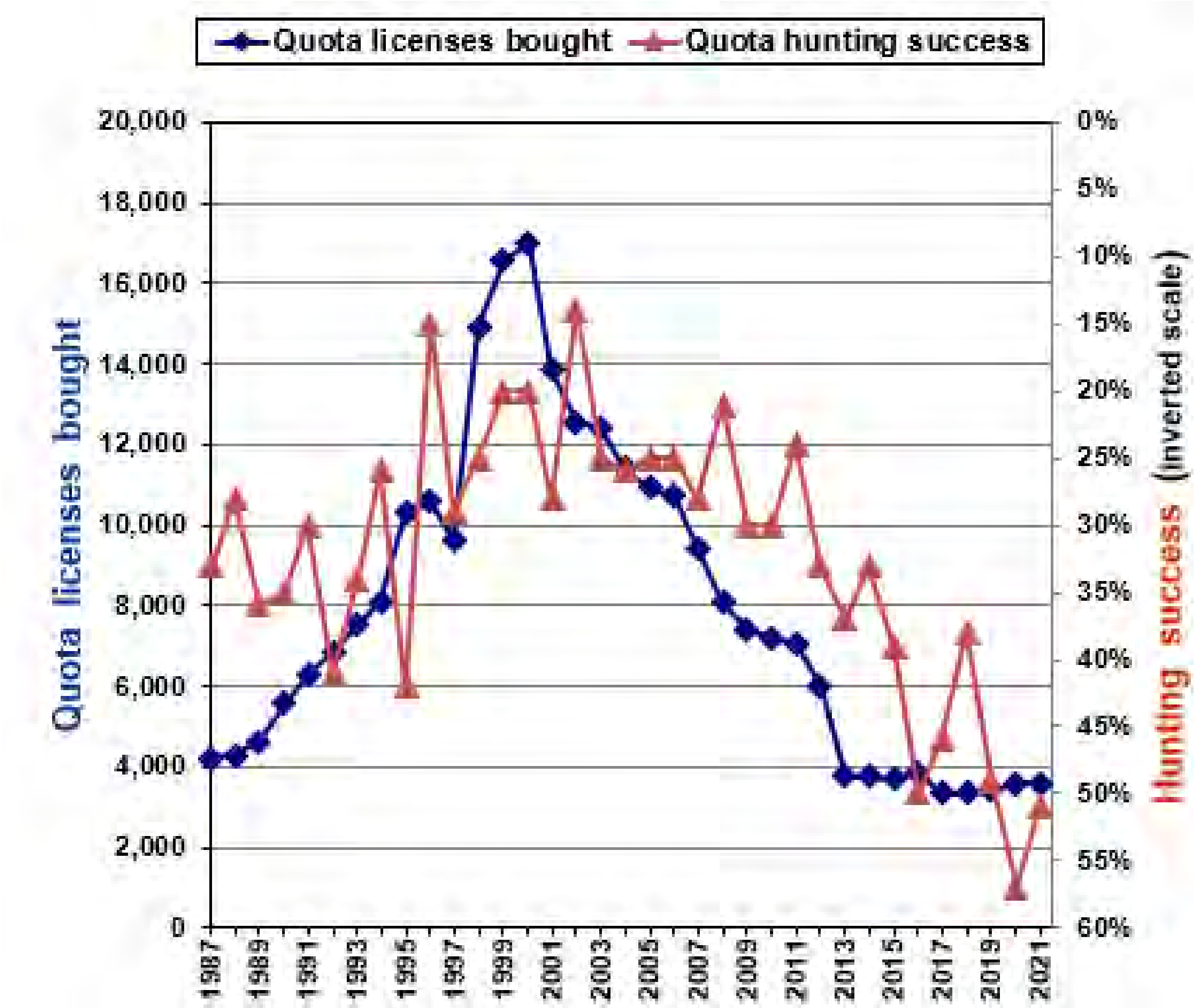

Figure 5. Relationship between licenses sold and hunting success (*note inverted scale*) in quota zone, 1987–2021 (quota and no-quota zones first partitioned in 1987). Number of licenses explains 59% of variation in hunting success during this period. Large variation in hunting success is also attributable to food conditions (e.g., during 2013–2021, 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.

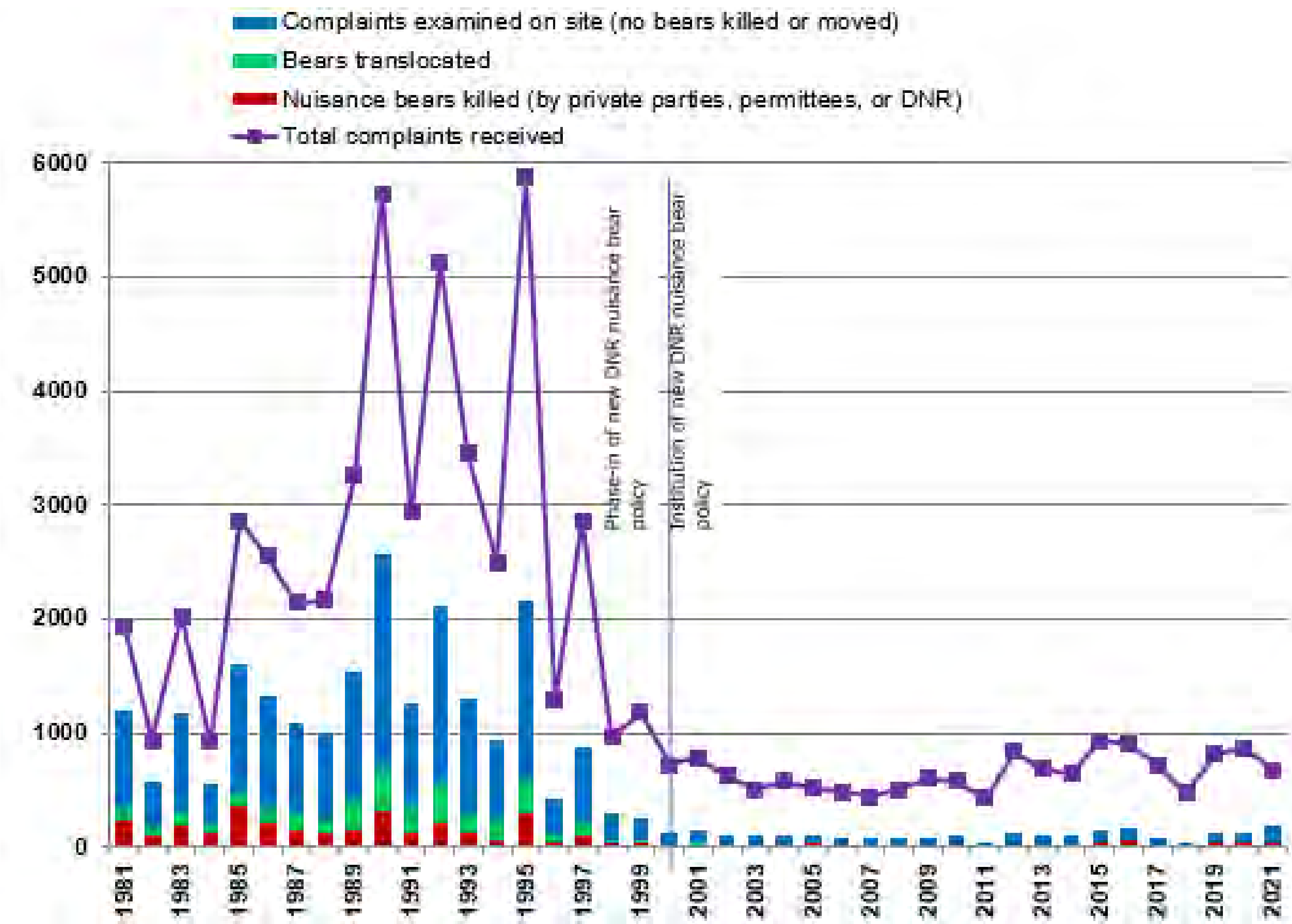

Figure 6. Trends in human-bear conflict complaints, and conflict bears killed and moved, 1981–2022, showing dramatic effect of change in human-bear conflict policy, and a stable trend over the past decade.

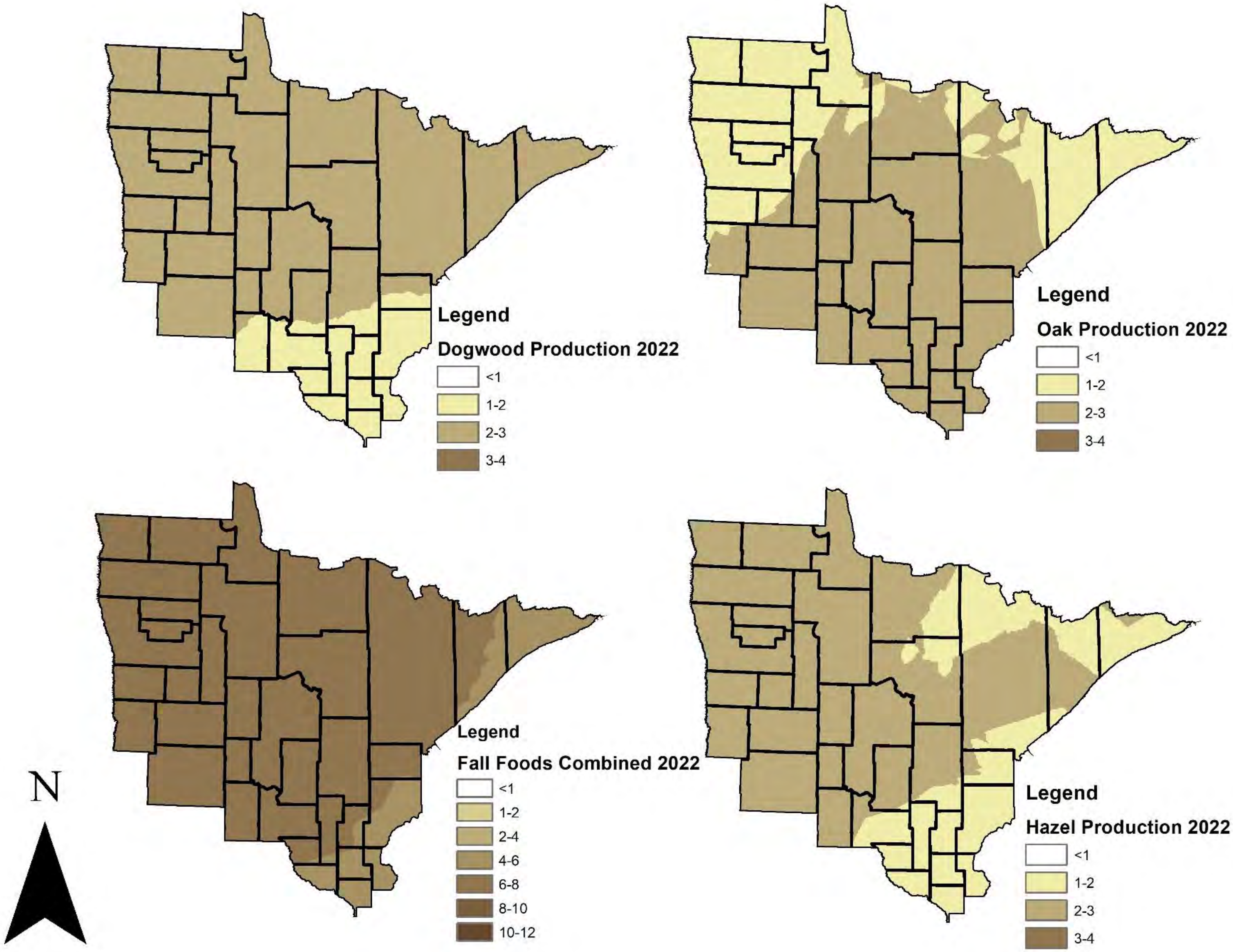

Figure 7. Production of fall bear foods (dogwood, oak, hazel) across Minnesota, 2022.

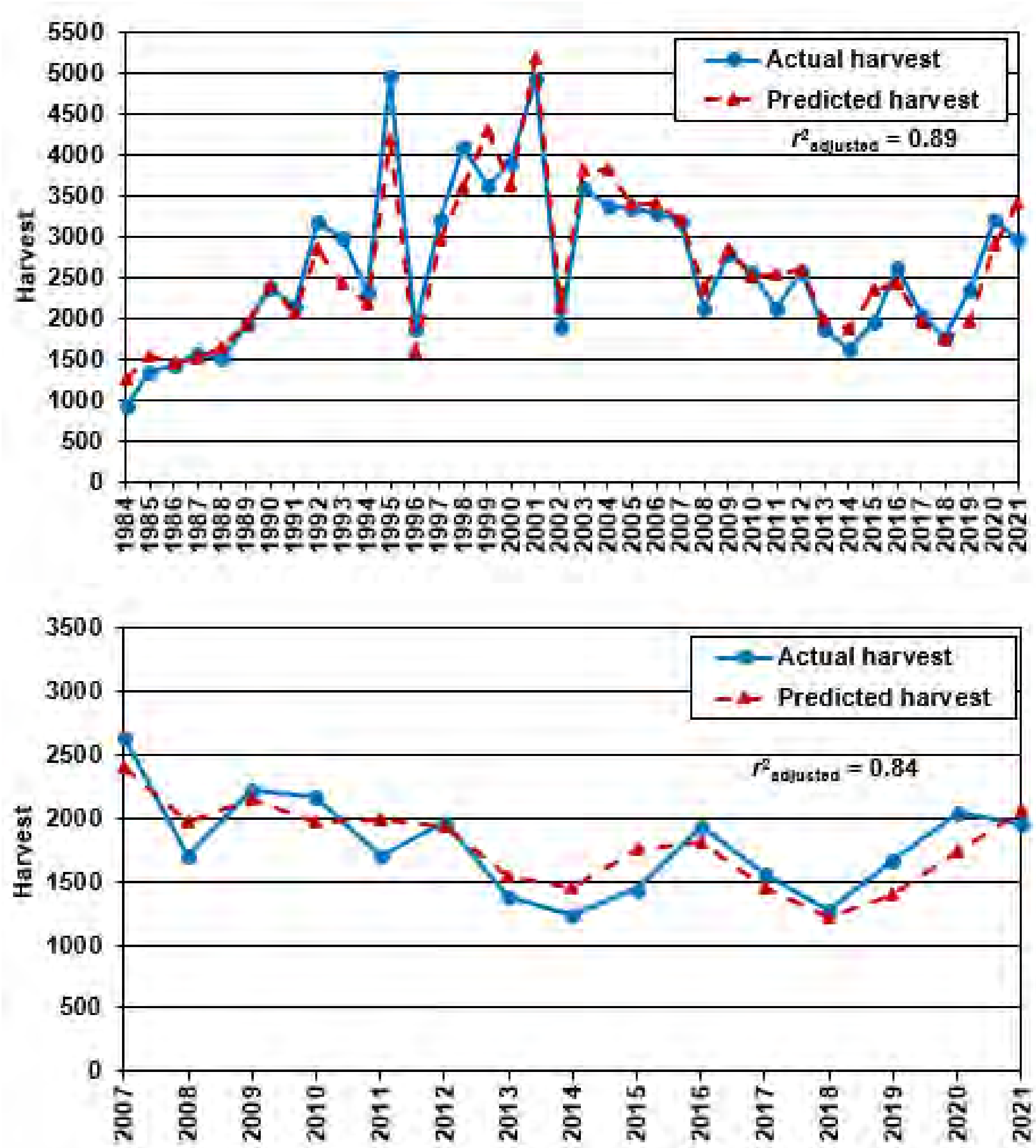

Figure 8. Number of bears harvested vs. number predicted to be harvested based on number of hunters and fall food production — top panel: statewide 1984–2021; bottom panel: quota zone only (including area 451 hunters and harvest), most recent 15 years. Regression for both datasets included an interaction term between food and hunters to better predict the drastic changes in harvest when fall foods were extremely high or low.

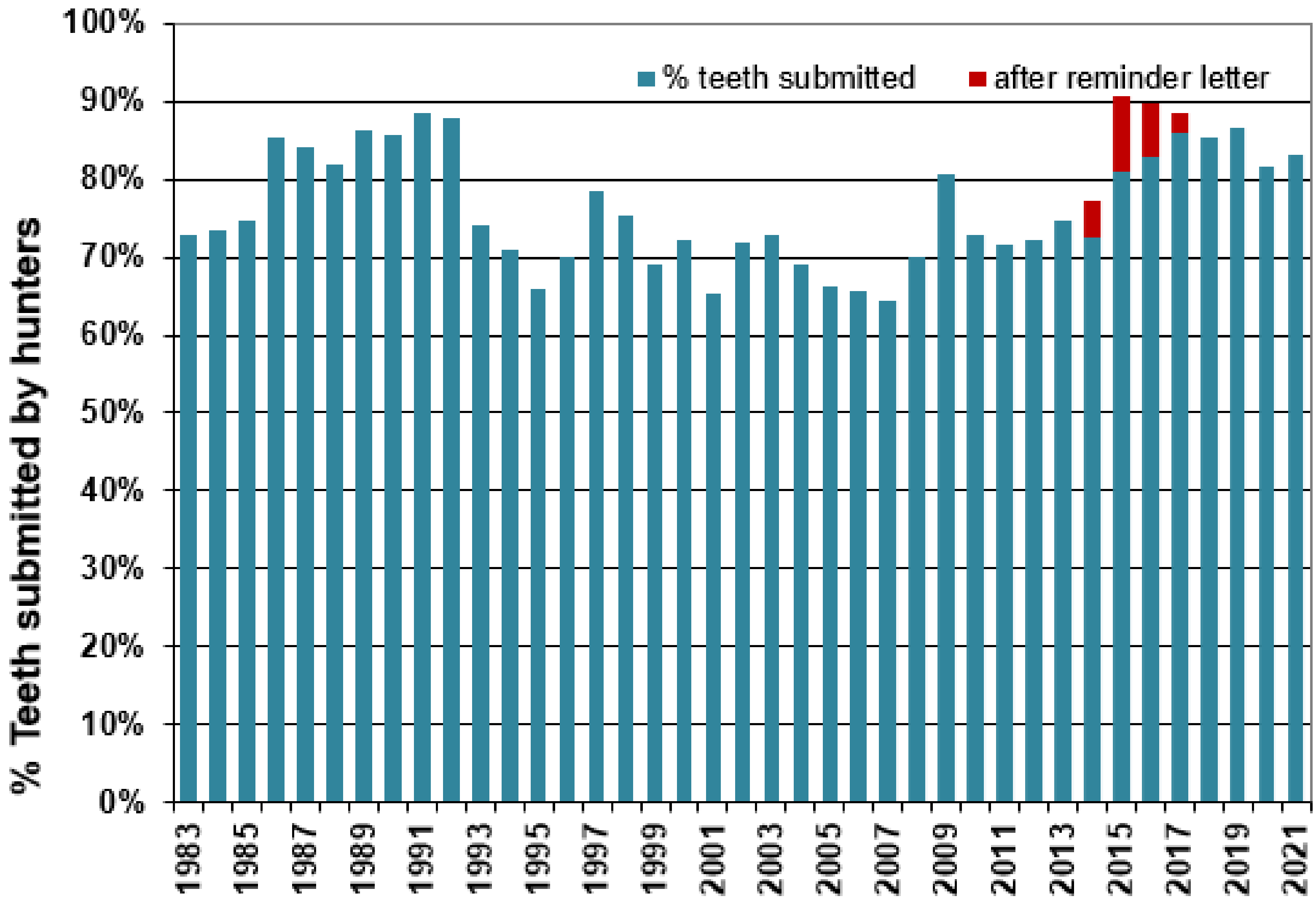

Figure 9. Percent of hunters submitting useable bear teeth for aging (vital for population monitoring. Cooperation levels exceeded 80% when registration stations were paid to extract teeth (this practice ended in 1993), and in recent years after a series of reminder letters (no letter was sent after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

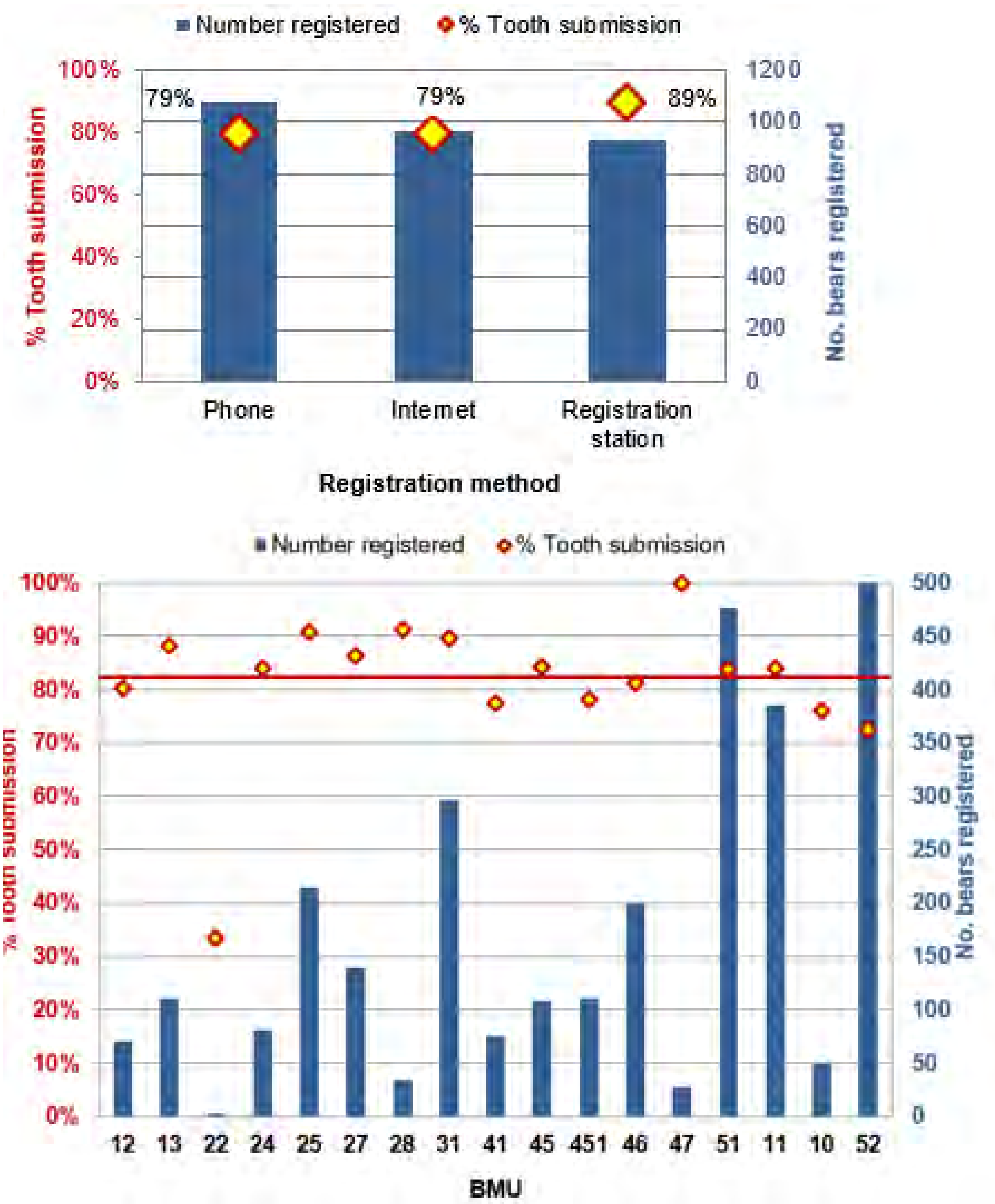

Figure 10. Percent of hunters who submitted a bear tooth in 2021 by method of registration (top panel) and by BMU (bottom panel). Beginning in 2013, hunters could register their bear by phone or internet, as well as in person at a station. The 2021 statewide submission average (83%) was above the long-term average (76%).

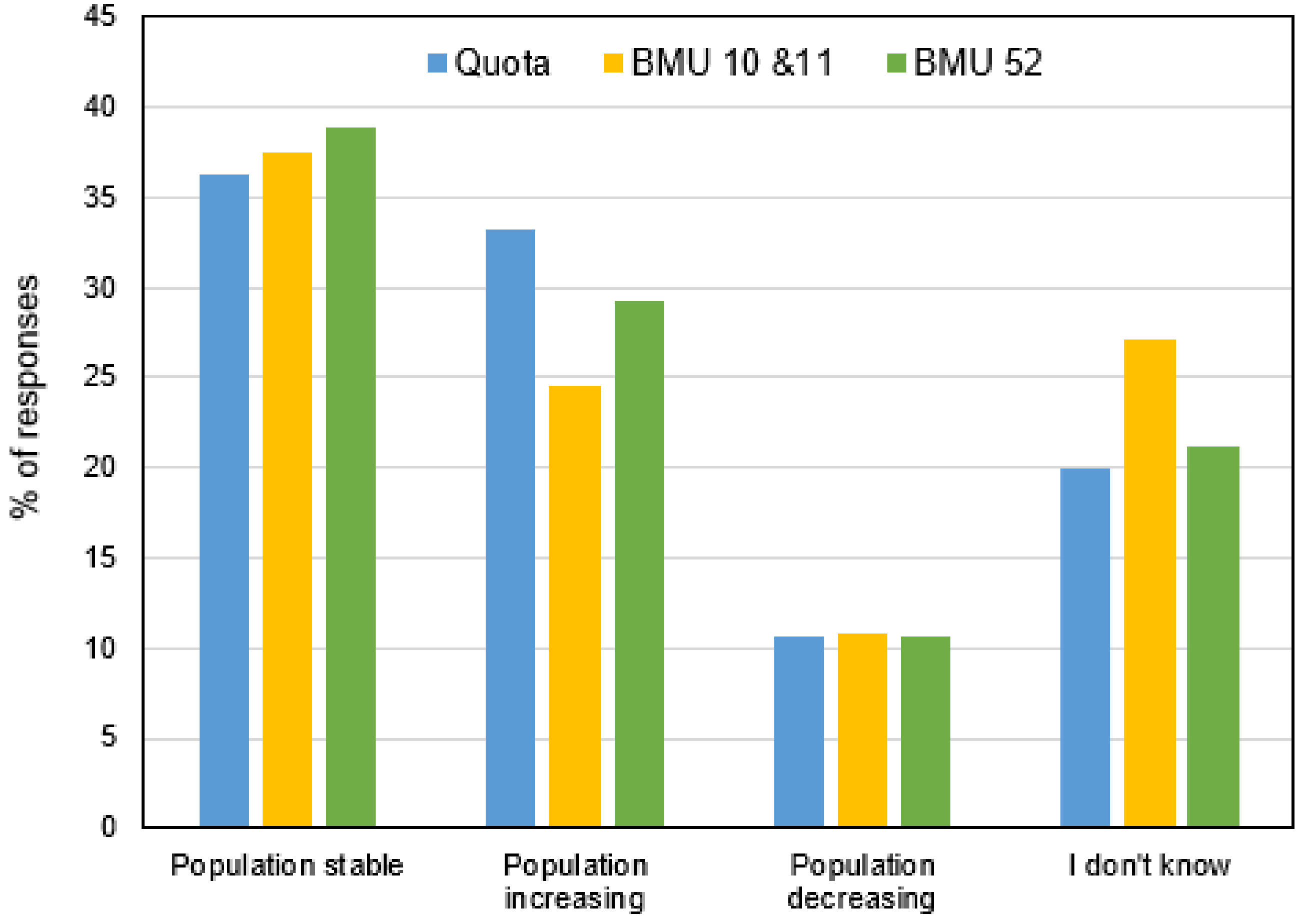

Figure 11. Opinions of hunters about the status of the bear population in the area where they hunted, based on a 2022 survey.

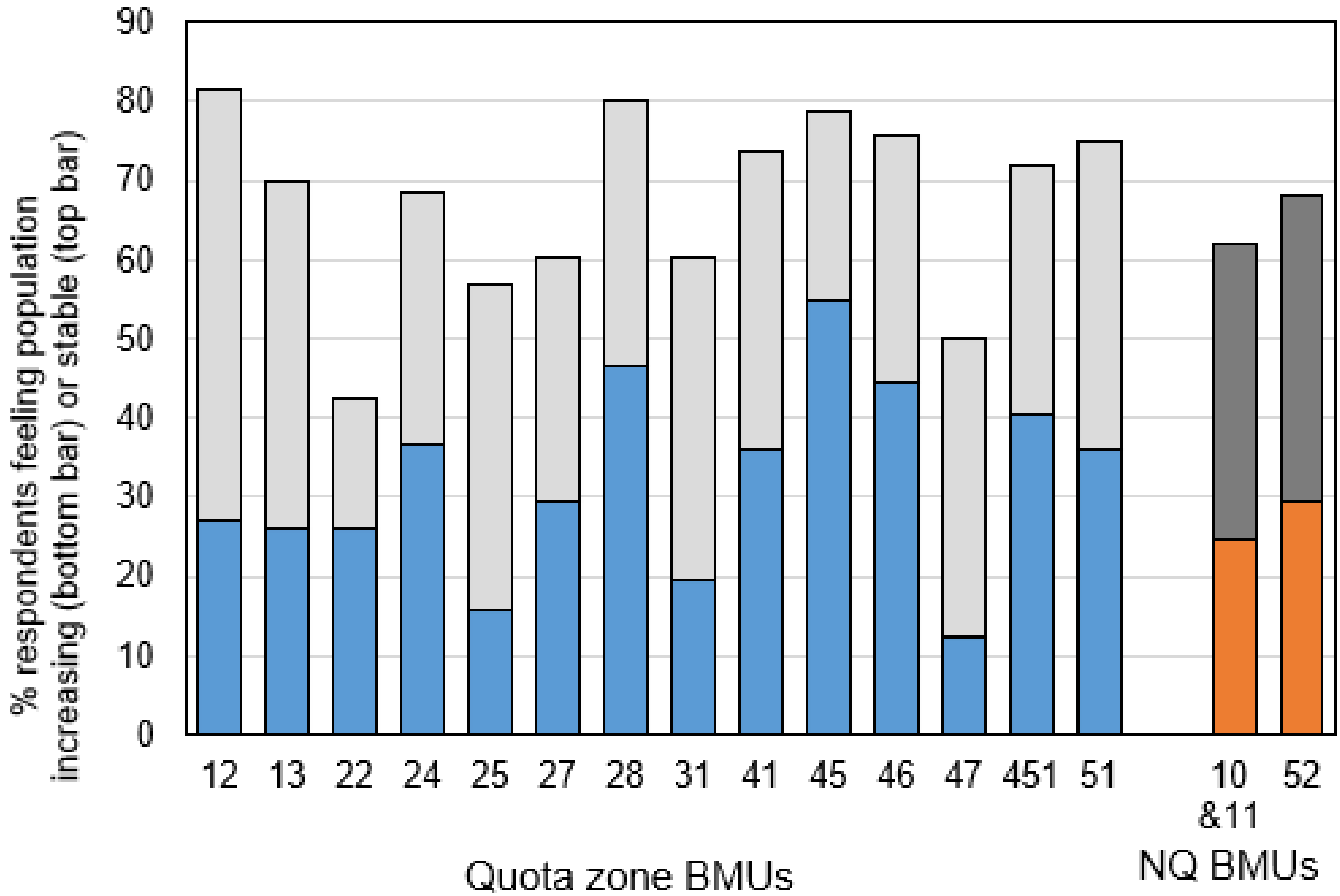

Figure 12. Percent of hunters in each BMU who consider the population in their hunting area to be increasing (bottom bars) or stable (top bars), based on a 2022 survey. Percentages exclude hunters who had no opinion of population trend.

Table 1. Number of human-bear conflict complaints registered by Wildlife Managers and Conservation Officers during April–October during 2003–2022, including number of conflict bears killed and translocated, and bears killed in vehicular collisions.

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017 [j]	2018 [j]	2019 [j]	2020 [j]	2021 [j]	2022 [j]
Number of personnel participating in survey [a]	39	34	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)
Complaints examined on site	81	75	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)
Complaints handled by phone [b]	424	507	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)
Total complaints received	505	582	512	483	443	511	600	584	433	835	692	649	937	898	715	478	818	871	753	529
• % Handled by phone	84	87	88	88	86	88	89	88	91	86	90	88	90	87	90	92	90	90	79	87
Calls handled by the information center [n]																		281	364	281
Bears killed by:																				
• Private party or DNR	13	25	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)
• Hunter before season [c]																				
– from nuisance survey	3	3	6	2	18	3	4	3	3	11	0	0	1	13	1	2	0	20	4	4
– from registration file	8	4	13	6	25	5	15	10	5	12	0	1	4	6	3	11	5	34	24	8
• Hunter during/after season [d]	0	0	1	0	0	0	0	0	0	0	1	0	1	1	1	0	0	3	23	1
• Hunter by Area 888 license [e]															1		3 [m]	40 [m]	45 [m]	9 [m]
• Permittee [f]	6	1	5	4	5	1	3	5	0	0	1	0	3	0	0	1	2	5	2	2
Bears translocated [g]	1	3	3	3	1	3	2	2	2	0	3	2	0	0	0	0	0	3	2	2
Bears killed by cars [h]	25	16	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)

[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). 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] 29 hunters were authorized to take conflict bears in the quota area in 2022, of which 9 (31%) were successful. Data are from the registration files only until 2020. After which, it was cross-validated with validation letters.

[n] 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, 1984–2022. 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]

[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.

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Table 3. Regional mean index values[a] for bear food species in 2022 compared to the previous 37-year mean (1984-2021) 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		NC		NE		WC		EC		Rangewide	
	37yr mean	2022 (*n* = 13[b])	37yr mean	2022 (*n* = 7)	37yr mean	2022 (*n* = 8)	37yr mean	2022 (*n* = 7)	37yr mean	2022 (*n* = 11)	37yr mean	2021 (*n* = 36[c])
SUMMER												
Sarsaparilla	4.7	4.6	5.8	8.0	5.2	4.3	4.4	4.0	5.2	4.5	5.0	5.4
Pincherry	3.4	4.3	4.4	6.0	4.3	6.5	3.7	3.0	3.7	4.8	3.9	4.9
Chokecherry	5.9	9.8	5.4	8.4	4.7	10.0	5.4	9.7	4.6	5.9	5.3	8.7
Juneberry	5.1	3.6	4.7	4.0	4.9	5.8	3.6	4.3	3.9	3.3	4.4	4.0
Elderberry	1.7	7.0	2.9	5.7	3.7	7.3	3.1	5.6	3.2	6.6	3.0	6.4
Blueberry	5.0	2.5	5.3	4.5	5.0	7.0	3.6	4.0	3.9	6.7	4.4	5.3
Raspberry	6.4	7.3	7.8	9.3	7.8	7.0	7.0	5.0	6.9	5.3	7.1	7.1
Blackberry	1.4	7.1	2.5	9.8	1.4	9.0	3.6	7.3	4.5	6.8	3.0	7.7
FALL												
Wild Plum	2.4	3.0	1.9	4.5	1.5	4.5	2.8	5.3	2.5	4.8	2.3	4.4
HB Cranberry	5.2	7.4	4.3	5.1	4.0	6.1	3.7	6.2	3.8	5.0	4.1	6.0
Dogwood	6.2	7.4	5.6	6.4	4.9	5.1	5.9	6.7	5.9	7.4	5.7	6.8
Oak	3.6	5.9	3.2	6.9	2.1	4.0	5.9	7.7	5.7	7.3	4.5	6.4
Mountain Ash	1.6	2.7	2.6	4.8	4.7	6.3	1.8	3.5	2.4	3.6	2.7	4.2
Hazel	6.4	7.7	7.3	8.0	6.8	6.5	7.6	6.7	7.4	6.7	7.1	7.3
TOTAL[d]	58.9	80.2	64.0	91.4	60.9	89.4	62.1	78.9	63.6	78.5	62.6	84.7

[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), 1984–2022. 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

[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.

2023 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, with 2023 being its fifth year. Staff and cooperators kept a log of time spent in the forest and any grouse observations while on foot or while driving. In 2023, 39 observers submitted data for time spent afield and grouse observed during June, July, and August, which is a 25% decrease in participation from last year. The total number of grouse observed was 1028, including 286 adults, 644 chicks, and 98 grouse of unknown age. Participants reported observing 64 broods during 1180 hrs on foot in the forest and 189 broods during 1779 hrs driving in the forest. The annual brood indices were 5.4 broods/100 person-hrs on foot (95% confidence interval [CI]: 0.0–12.7) and 10.6 broods/100 person-hrs driving (95% CI: 0.0–31.1) in 2023, which was similar to last year (3.7 broods/100 person-hrs on foot (95% confidence interval [CI]: 0–14.9) and 7.1 broods/100 person-hrs driving (95% CI: 0–23.1)). A peak in brood observations occurred in July this year, which is later than the usual peak in hatching during late June, likely due to the cold spring in much of the forested part of Minnesota this year. The number of adult grouse with broods increased from 63.0% in June, to 80.5% in July, and remained steady in August at 78.8%, consistent with strong brood survival after a later nesting effort. This is also the highest proportion of adults reported with broods in August since the survey started. The number of chicks (mean ± SE) in broods where chick counts were attempted was 3.9 ± 0.4 in June (n = 39), 3.9 ± 0.3 in July (n = 72), and 4.4 ± 0.3 in August (n = 47), which is smaller than last year during June and July, but similar for August (5.7 ± 0.6 in June (n = 32), 5.0 ± 0.6 in July (n = 46), and 4.1 ± 0.5 in August (n = 46)). We did not see the expected decline in brood size over time with chick mortality this year, suggesting that chick survival was better in 2023 than during 2020-2022 in much of the survey area. Counties with the most brood observations per unit of survey effort included Carlton, Cook, Itasca, Lake, and St. Louis. 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 3.5-3.7 during 2019-2022. I will continue to recruit observers in upcoming years because increased participation will allow more robust data collection and interpretation.

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 hunting is compensatory, although hunters might see and harvest fewer birds in the fall during years of low production. Lower production 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 (3), Leech Lake Band of Ojibwe (1), Red Lake Nation (3), Fond du Lac Reservation (1), Superior National Forest (2), Chippewa National Forest (1), county foresters (1), private foresters (2), Cloquet Forestry Center (1), Ruffed Grouse Society (1), DNR Ecological and Water Resources staff (1), DNR Forestry staff (2), and DNR Wildlife staff and volunteers (20) submitted data in 2023. Observations occurred while doing other work between 1 June and 31 August for a total of 1180 hrs on foot and 1779 hrs driving in the forest. Reported time afield was 320, 431, 429 hrs on foot in June, July, and August, and 574, 543, and 663 hrs driving in the forest during June, July, and August, respectively. Consistent participation assists with interpretation of patterns over time.

Observers recorded 253 ruffed grouse broods and 71 broods of other species while working in the forest, including 49 turkey broods, 5 woodcock broods, and infrequent sightings of broods of numerous other species. The total number of grouse observed was 1028, including 286 adults, 644 chicks that could be counted, and 98 grouse of unknown age (i.e., a mix of juveniles and adults). 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 less related to survey effort over time this year, perhaps reflecting more consistent survey effort than in some previous years (Figure 2).

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 2023 was 5.4 broods/100 person-hrs on foot (95% confidence interval [CI]: 0–12.7, Table 1) and was 10.6 broods/100 person-hrs driving (95% CI: 0–31.1), which is similar to 2022. Looking at weekly and monthly patterns in brood metrics provides additional insights. The weekly brood index rose markedly in 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). Broods/100 hrs effort in August and the proportion of adults with broods was high in August (Tables 1 and 2). 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 the actual loss of chicks and broods throughout the summer to some degree. The number of adults reported with broods increased with hatch from 63.0% in June to 80.5% in July but did not decline in August (78.8%, Table 1).

The number of chicks (mean $\pm$ SE) per brood, when counted, was 3.9 $\pm$ 0.4 in June (n = 39), 3.9 $\pm$ 0.3 in July (n = 72), and 4.4 $\pm$ 0.3 (n = 47) in August. A decline in this metric over time is consistent with chick mortality and partial brood loss during summer, however, brood size did not decline over the summer suggesting better chick survival in 2023 than during 2020-2022. The 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.

The brood index was highest in the northeastern forested counties this year. Carlton, Cook, Itasca, Lake, and St. Louis counties had the most brood observations of those counties with ≥100 hrs of reported time afield (on foot and driving combined). Other counties with ≥100 hrs of reported time afield included Aitkin, Beltrami, Cass, Clearwater, and Crow Wing counties, but fewer brood observations per unit effort were reported in these counties. All other counties had ≤100 hrs of observations submitted.

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 2019–2023 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	

[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 (2023).

Table 2. Ruffed grouse brood indices in Minnesota by month during 2019-2023.

	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

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

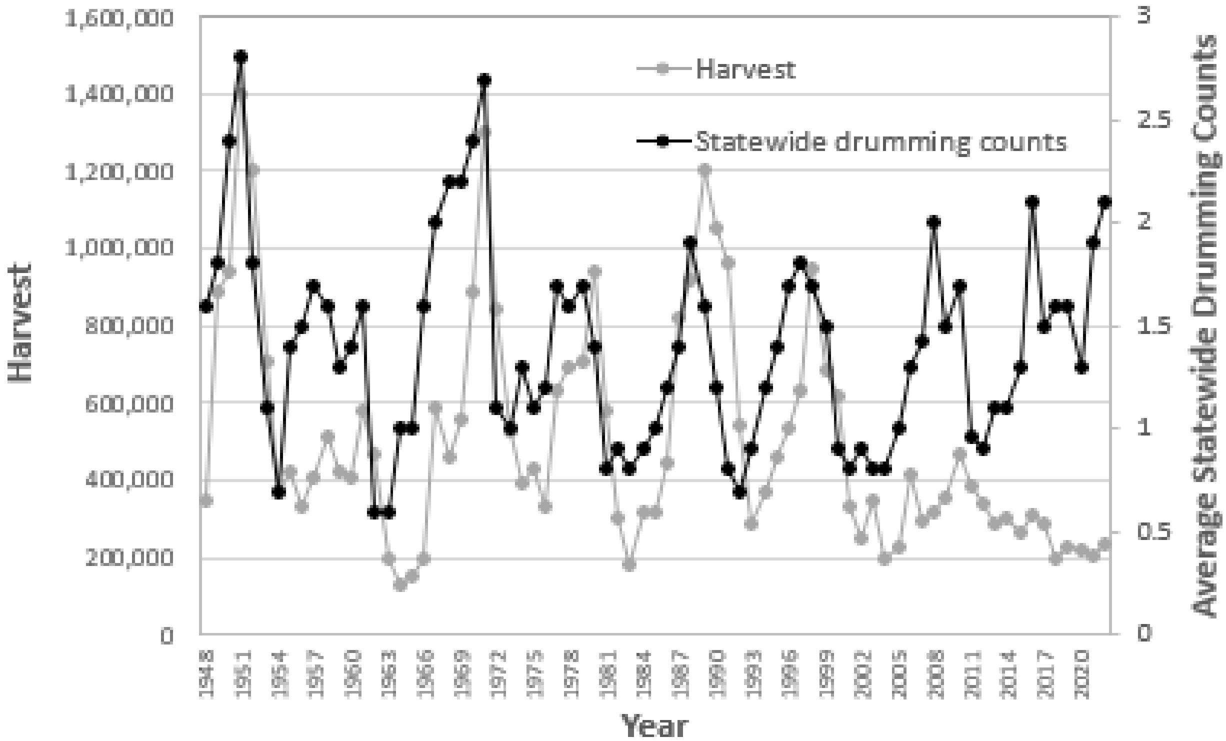

Figure 1. Comparison of average statewide ruffed grouse drumming survey data (Roy 2023) and data on harvest of ruffed grouse from the Small Game Hunter Harvest Survey (Minnesota Department of Natural Resources 2023) in Minnesota during 1948–2023. The two metrics were correlated more strongly prior to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

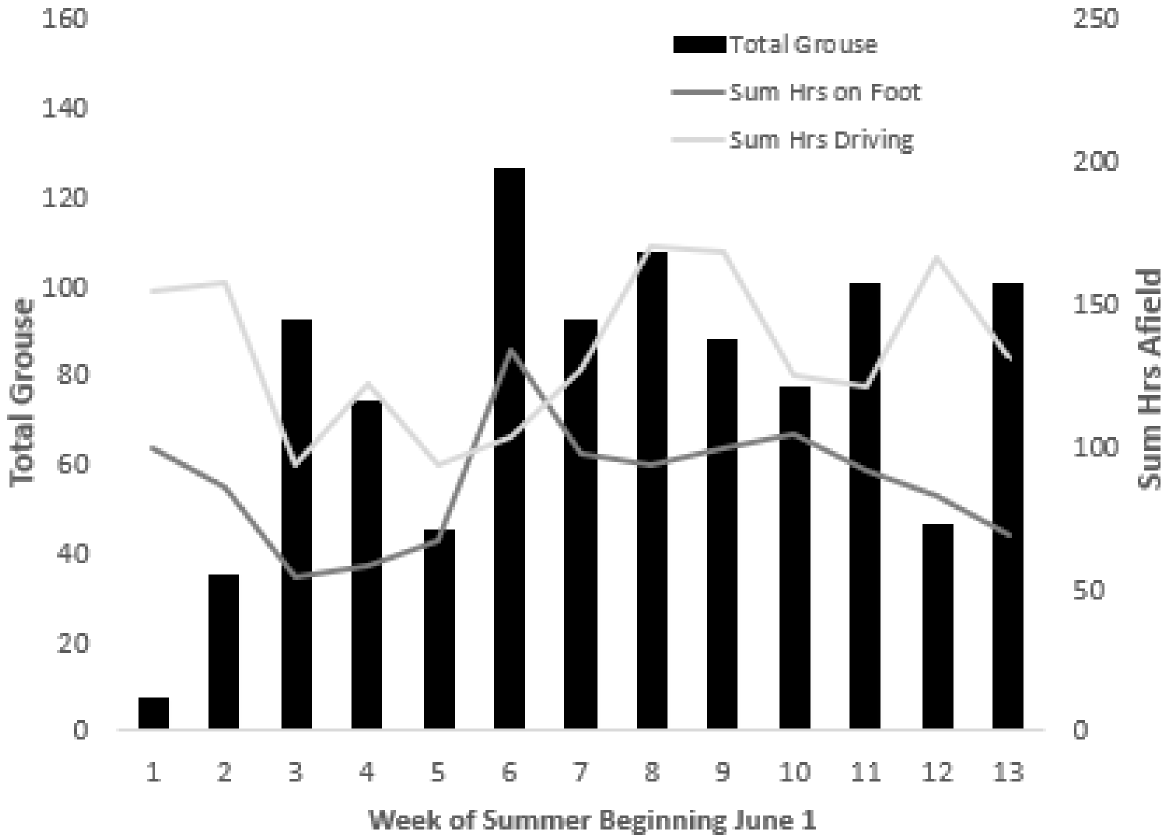

Figure 2. The chronology of ruffed grouse brood survey effort in the forest on foot and while driving and total number of grouse observed (young, adults, and birds of unknown age) by participating staff and cooperators during summer 2023 in Minnesota. Survey effort varied throughout the 13-week season.

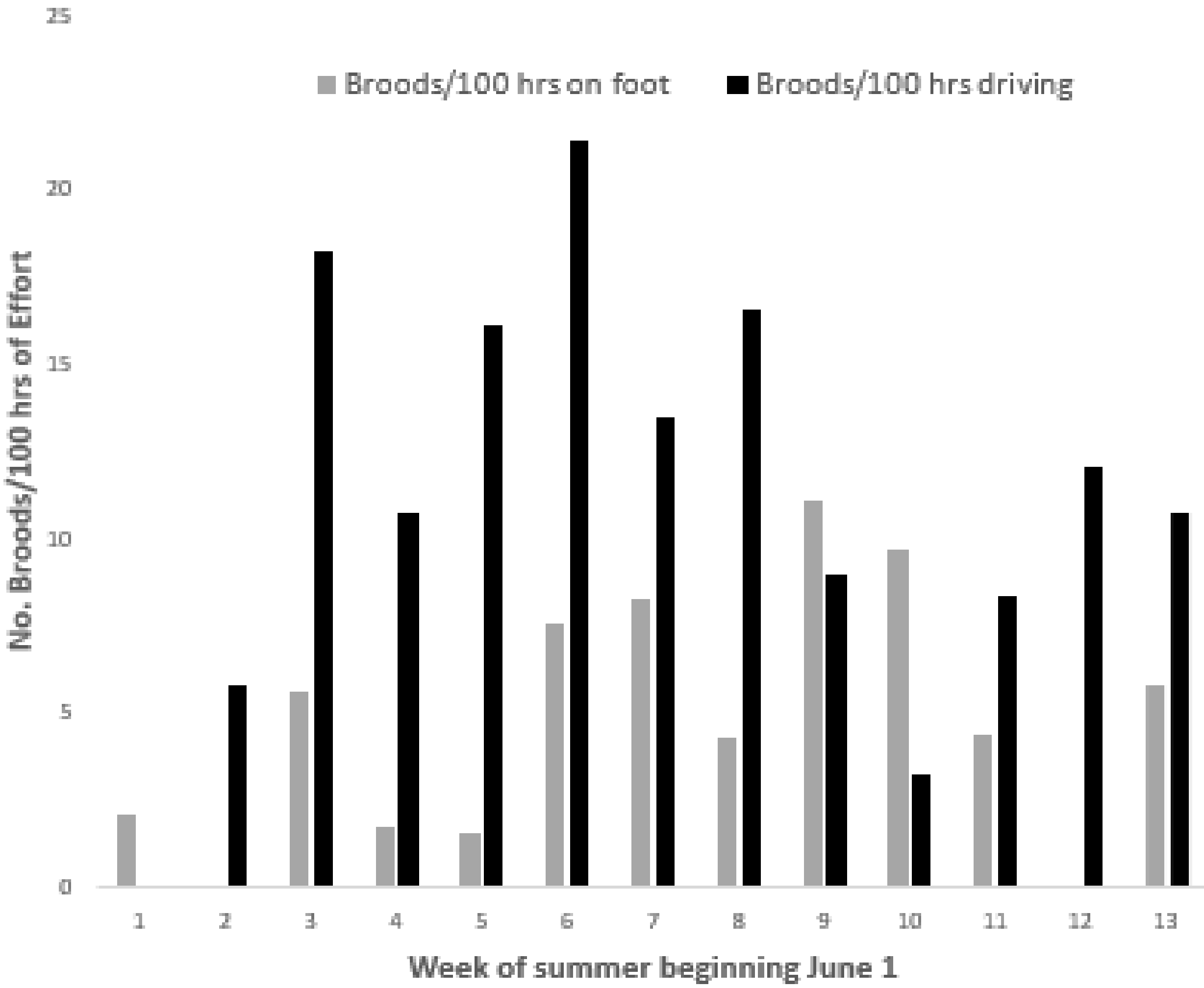

Figure 3. Ruffed grouse broods/100 person-hrs afield each week while either on foot or while driving in Minnesota during June, July, and August 2023. This index is adjusted for effort so that comparisons can be made among years in which time spent afield varies.

2023 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 2.1 statewide (95% confidence interval = 1.8 – 2.6), which is up from last year and similar to recent peaks in the population cycle, which usually vary from 8-11 years apart. However, dps were not up in all survey regions, and increases were most notable in the Northeast, where 1 route with particularly high dps had a large influence. Statewide counts near peak values this year might indicate that the low in the population cycle occurred in 2021 (1.3), but that the cycle did not dip as low as it has in the past. The ruffed grouse drumming survey assumes that only the number of grouse varies among years. However, we have had a lot of changes in survey observers the last few years as many observers retired and new staff were hired. New observers 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 2 years including an extreme summer drought in 2021, spring flooding in 2022, and 2 successive winters of good snow roosting conditions which may have increased production and overwinter survival of ruffed grouse the last few years. Additional data collected in the upcoming years will be necessary to interpret the recent counts in the context of the population cycle. 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, private, and student 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. 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 17 April and 25 May 2023. Many observers reported a later spring than usual and completed surveys when they believed the peak of drumming occurred in their local area. Most routes (94%) were surveyed between 19 April and 18 May, with a median survey date of 4 May, which is similar to most years when the median survey date is close to May 3. Observers reported Excellent (59%), Good (36%), and Fair (4%) survey conditions for 118 routes reporting conditions.

Statewide ruffed grouse drums were up from last year, although patterns were not consistent among regions, unlike last year when dps were generally up in all regions. Statewide counts of ruffed grouse drums averaged 2.1 dps (95% confidence interval = 1.8 – 2.6 dps) (Figure 2). Drum counts were 2.4 (2.0 – 3.0) dps in the Northeast (*n* = 97 routes), 1.5 (1.1 – 2.0) dps in the Northwest (*n* = 8), 1.6 (0.8 – 2.6) dps in the Central Hardwoods (*n* = 11), and 0.6 (0.3 – 1.0) dps in the Southeast region (*n* = 9) (Figure 3a-d). Although dps were highest in the Northeast, 1 route with particularly high dps had a large influence on the average, so a lower value would be more representative of the region.

The ruffed grouse population in Minnesota cycles on average every 10 years, but peaks in the cycle vary from 8-11 years apart (Figure 2). 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). Counts near peak values this year might indicate that the low in the population cycle occurred in 2021 (1.3 dps), but that the cycle did not dip as low as it has in the past. 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 have 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 have also had numerous extreme weather events including prolonged summer drought in 2021, spring flooding in 2022, and good snow roosting conditions the last 2 years that may have influenced production and survival. Warm temperatures and 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). More years of data collection will be necessary to understand the recent counts in the context of the grouse population cycle.

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; 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, Crookston, Detroit Lakes, 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. M. Larson reviewed this report. This work was funded in part by the Federal Aid in Wildlife Restoration Act.

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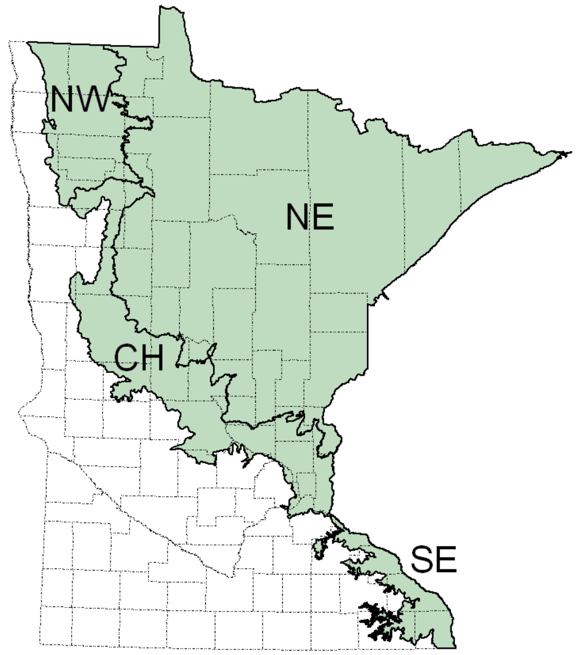


Figure 1. Survey regions for ruffed grouse in Minnesota. Northwest (NW), Northeast (NE), Central Hardwoods (CH), and Southeast (SE) survey regions are depicted relative to county boundaries (dashed lines) and influenced by the Ecological Classification System.

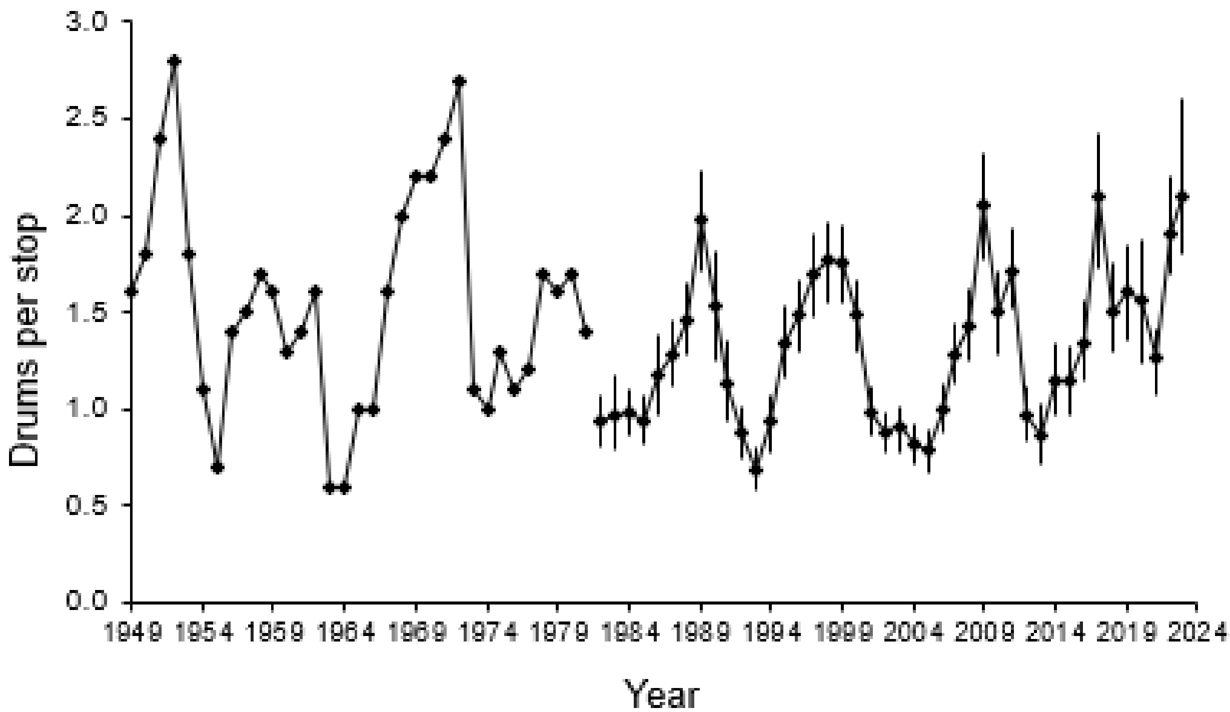
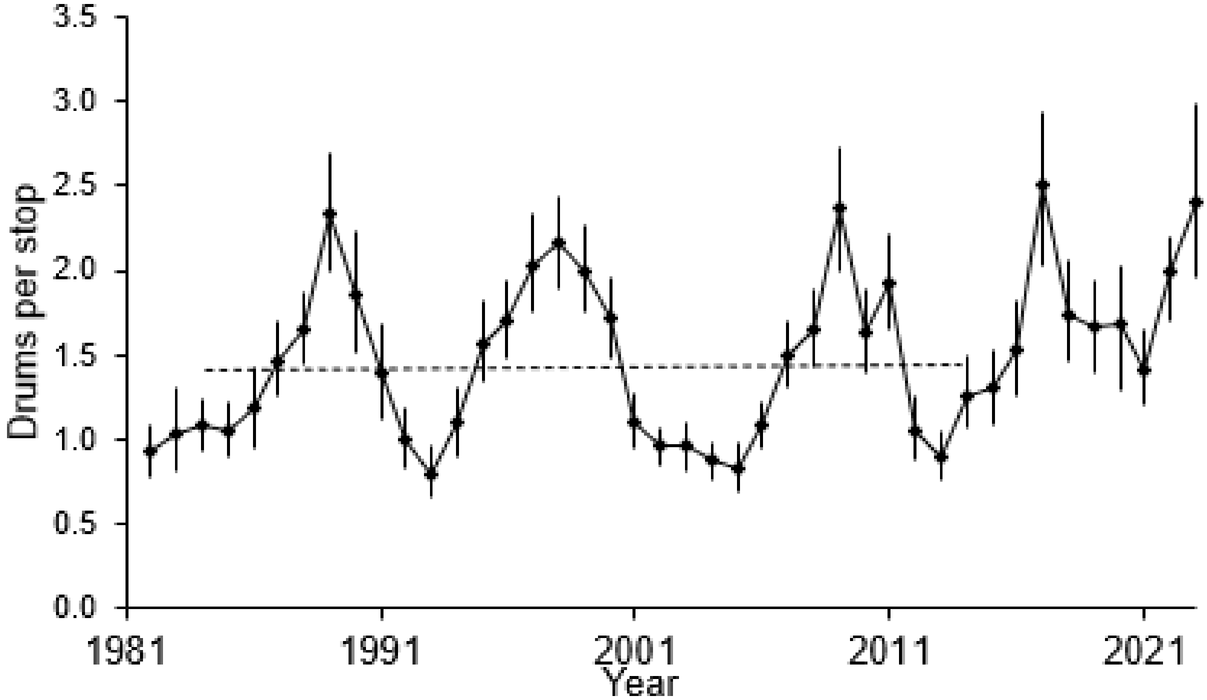
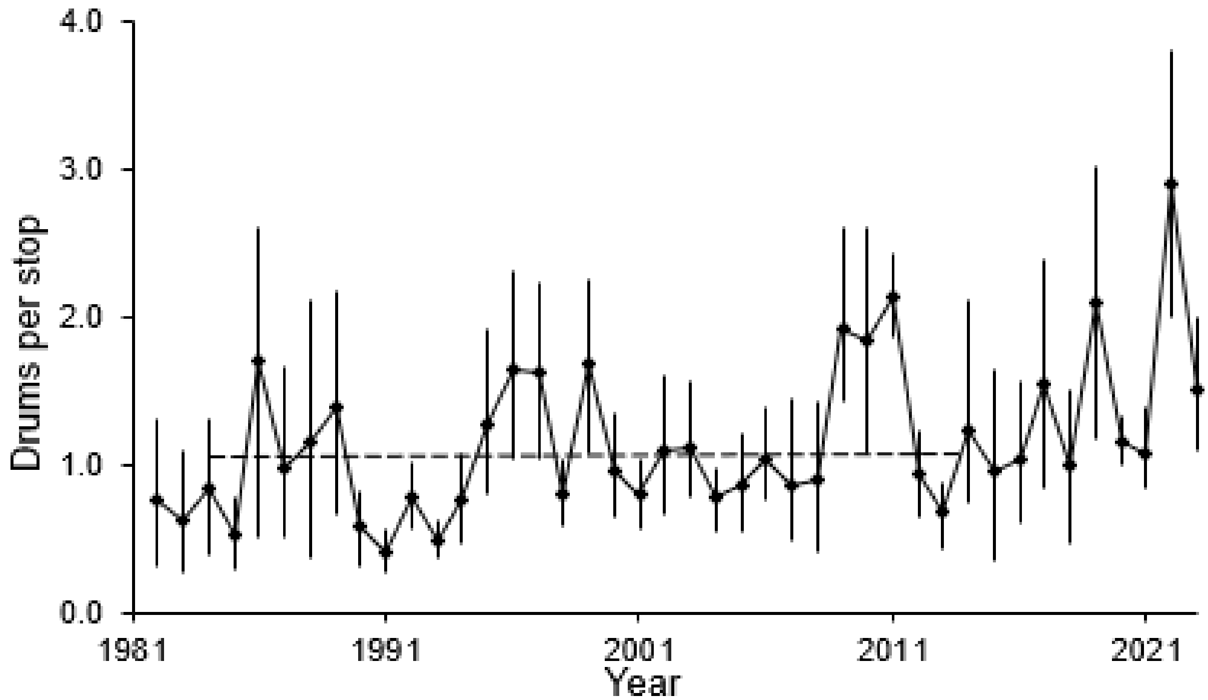


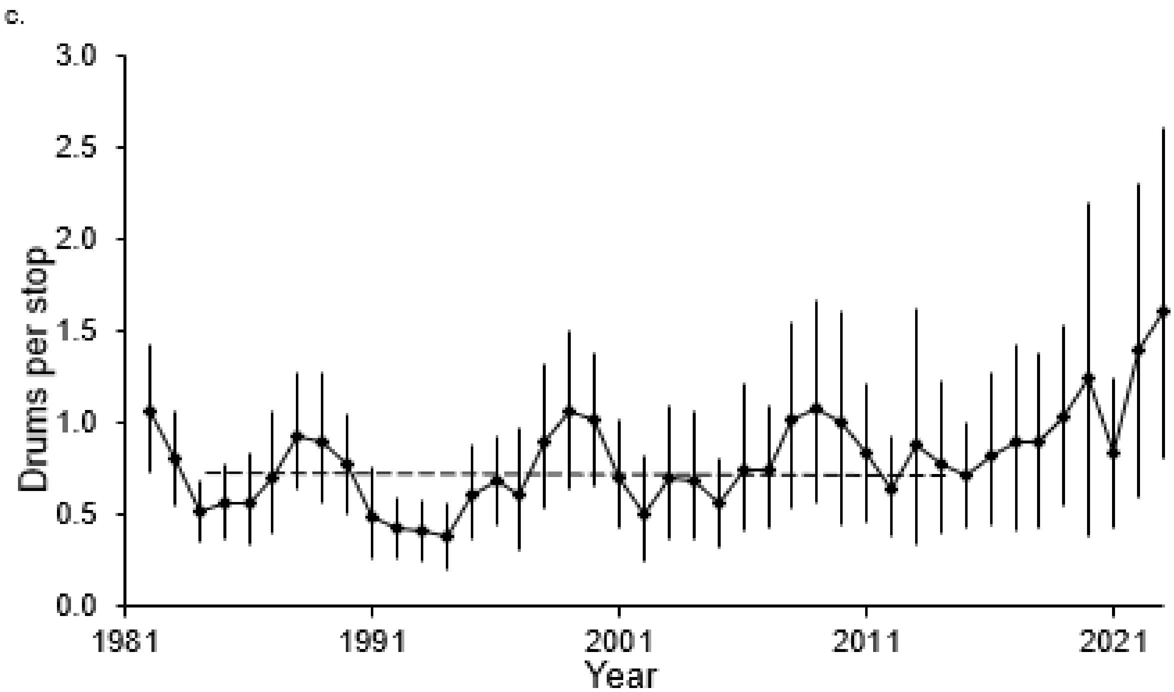
Figure 2. Statewide ruffed grouse population index values in Minnesota. Bootstrap (95%) confidence intervals (CIs) are provided after 1981, but different analytical methods were used prior to this and thus CIs are not available for earlier years. The difference between 1981 and 1982 is biological and 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
1991
2001
2011
2021
Year

b.


4.0
3.0
2.0
1.0
0.0
Drums per stop
1981
1991
2001
2011
2021
Year



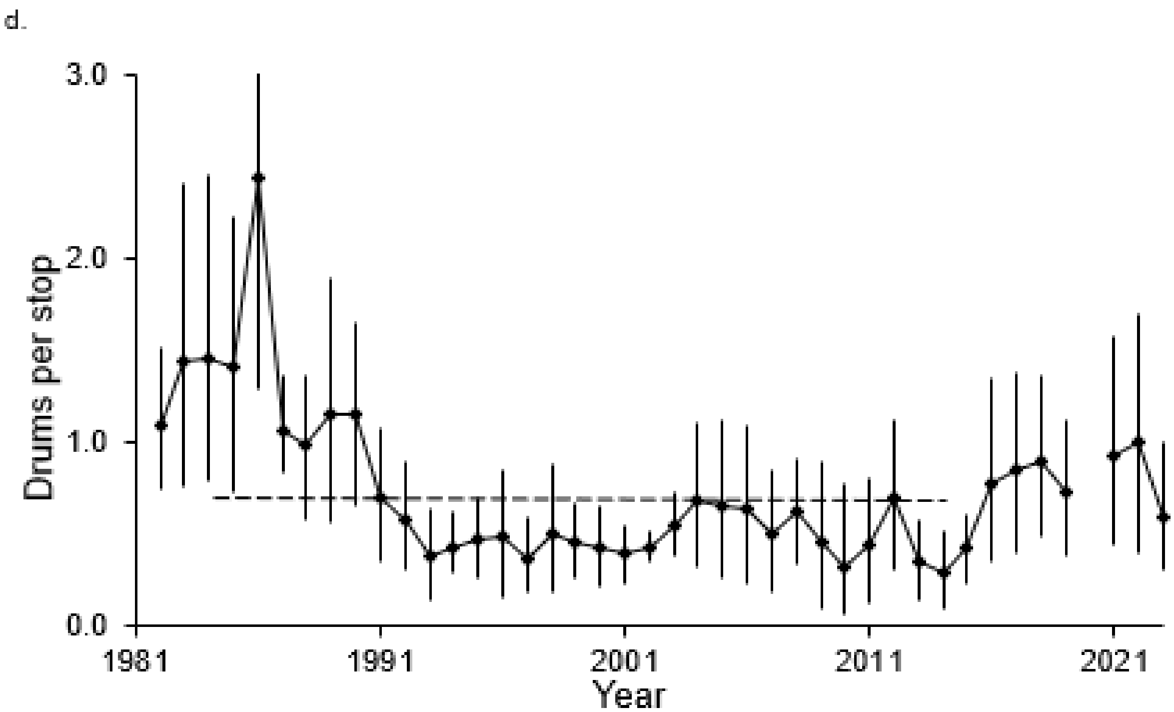


Figure 3 a,b,c,d. Ruffed grouse population index values in the **Northeast** (a), **Northwest** (b), **Central Hardwoods** (c), and **Southeast** (d) survey regions of Minnesota. The mean for 1984-2014 is indicated by the dashed line. Bootstrap (95%) confidence intervals are provided for each mean. In 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.

DEPARTMENT OF NATURAL RESOURCES

2023 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 20 March and 13 May 2023, with 1,777 birds (males and birds of unknown sex) observed at 154 leks. Additionally, 2 birds were observed at 1 lek in southwestern Minnesota. The mean numbers of sharp-tailed grouse/lek were 8.0 (6.3 – 9.9) in the EC survey region, 12.4 (11.1 – 13.8) in the NW region, and 11.5 (10.4 – 12.7) statewide (EC and NW combined). Comparisons between leks observed in both 2022 and 2023 indicated similar numbers of birds/lek were observed in the EC region ($t = 0.38$, $P = 0.71$), in the NW region ($t = 0.19$, $P = 0.85$), and statewide ($t = 0.08$, $P = 0.93$). The number of leks in the EC region remains low ($n = 31$) 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 1,777 male sharp-tailed grouse and grouse of unknown sex were counted statewide at 155 leks, including 2 birds at 1 lek found in Lac Qui Parle County by MSGS volunteers (Table 1). Surveys were conducted during 20 March to 13 May 2023. Leks with $\geq$2 grouse were observed an average of 1.5 times. The statewide index value of 11.5 (10.4 – 12.7) grouse/lek was centrally located among values observed since 1980 (Figure 2) and leks observed statewide in 2022 and 2023 were similar ($t = 0.08$, $P = 0.93$).

In the EC survey region, 247 sharp-tailed grouse were counted on 31 leks in 2023, which was an 87% 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 Stay at Home Order), when 216 grouse were counted on 30 leks (Figure 3). The grouse/lek index in the EC region was similar (8.0, CI: 6.3 – 9.9) to last year, and counts at leks surveyed in both 2022 and 2023 were also similar ($t = 0.4$, $P = 0.71$; Table 2). However, the distribution and number of leks in the EC region is localized and small. Most (77%) leks reported in the EC region were in the Aitkin Wildlife work area, and 9 of the 10 additional leks counted in the EC region this year resulted from greater survey effort in the Aitkin work area. No leks were reported in the Cambridge work area, and this has been the case since 2018, despite fairly consistent survey effort. The Tower work area reported 3 leks in 2022 and 2023 in contrast to 2021 when none were observed. Five birds were reported at St. Croix State Park, which is the second year that birds have been at the park in the spring, with 2 additional leks observed in the Cloquet work area. 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. Moreover, the increase in leks counted in the EC region this year illustrates how changes in survey effort can influence the number of leks observed in the annual survey.

In the NW survey region, 1,528 grouse were counted on 123 leks with 12.4 (11.1 – 13.8) grouse/lek. Fewer leks were observed in 2023 than 2022 (123 compared to 142), in part due to continuing staff vacancies in at least one work area, again reflecting the importance of consistent survey effort in population monitoring (Figure 3). Counts at leks that were observed during both 2022 and 2023 were similar in the NW survey region ($t = 0.19$, $P = 0.85$). Thus, sharp-tailed grouse appear to be stable in the NW region, although they may be increasing in some parts of the region and declining in others. For example, biologists in the greater prairie-chicken survey regions (the southern part of the NW survey region for sharp-tailed grouse) recently have reported more sharp-tailed grouse in areas that used to hold primarily 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 Agassiz and Glacial Ridge National Wildlife Refuges 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

[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

[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.

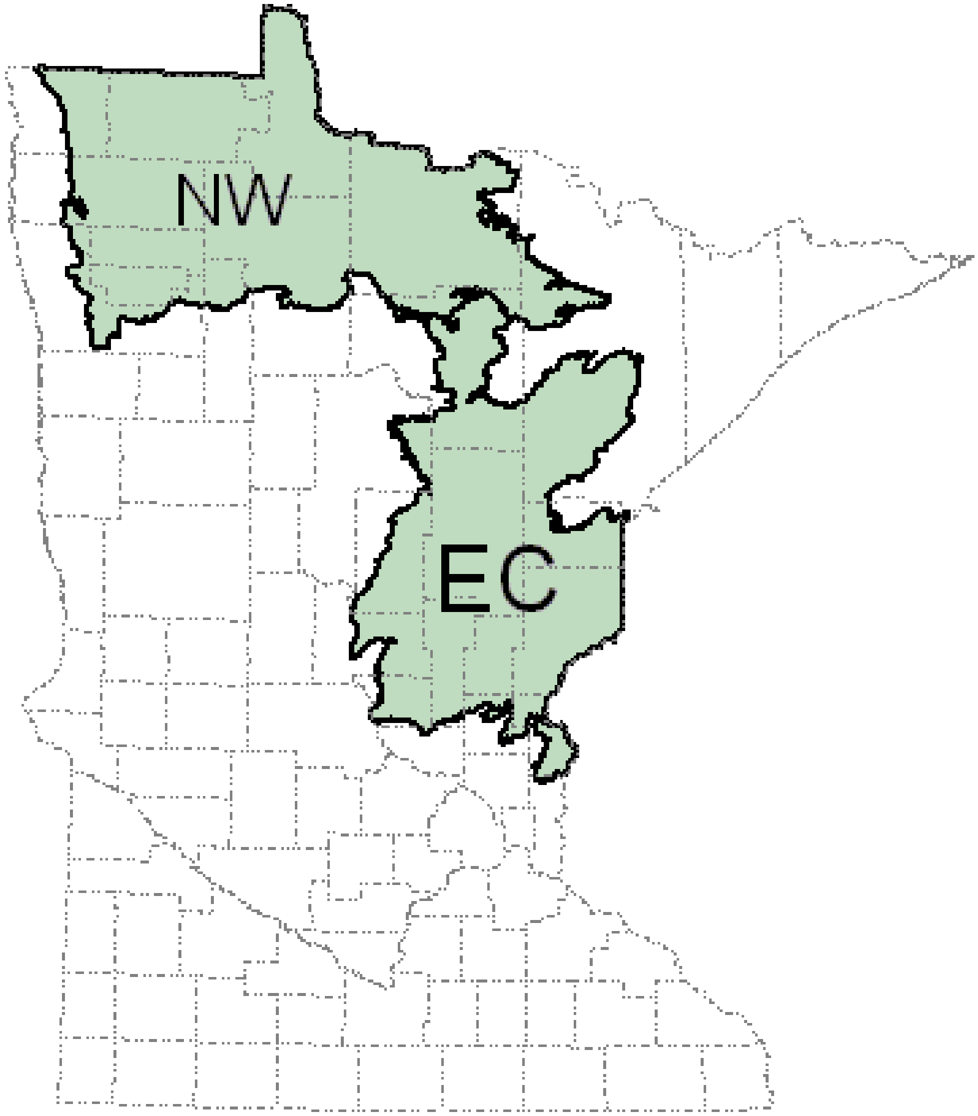

Figure 1. Survey regions for **sharp-tailed grouse** in Minnesota. Northwest (NW) and East Central (EC) survey regions are depicted relative to county boundaries (dashed lines) and influenced by Ecological Classification System Subsection boundaries.

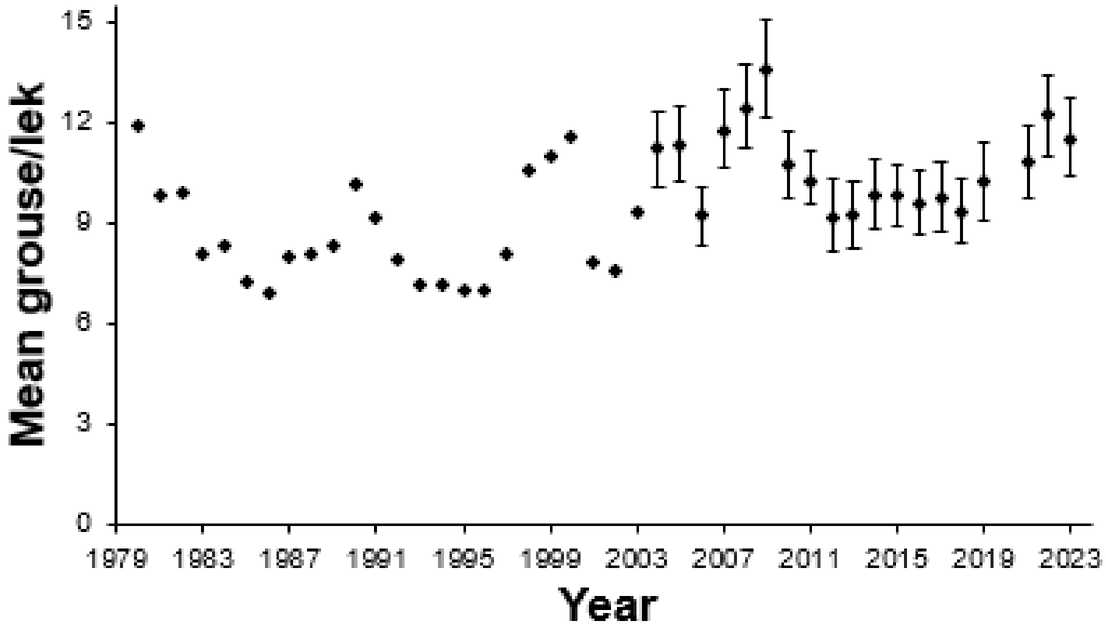

Figure 2. **Sharp-tailed grouse** counted in spring lek surveys statewide in Minnesota during 1980–2023. Bootstrap (95%) confidence intervals are provided for recent years. Annual means are not connected by lines because the same leks were not surveyed every year. No data were collected in 2020 due to the Governor's Stay at Home Order during the COVID-19 pandemic.

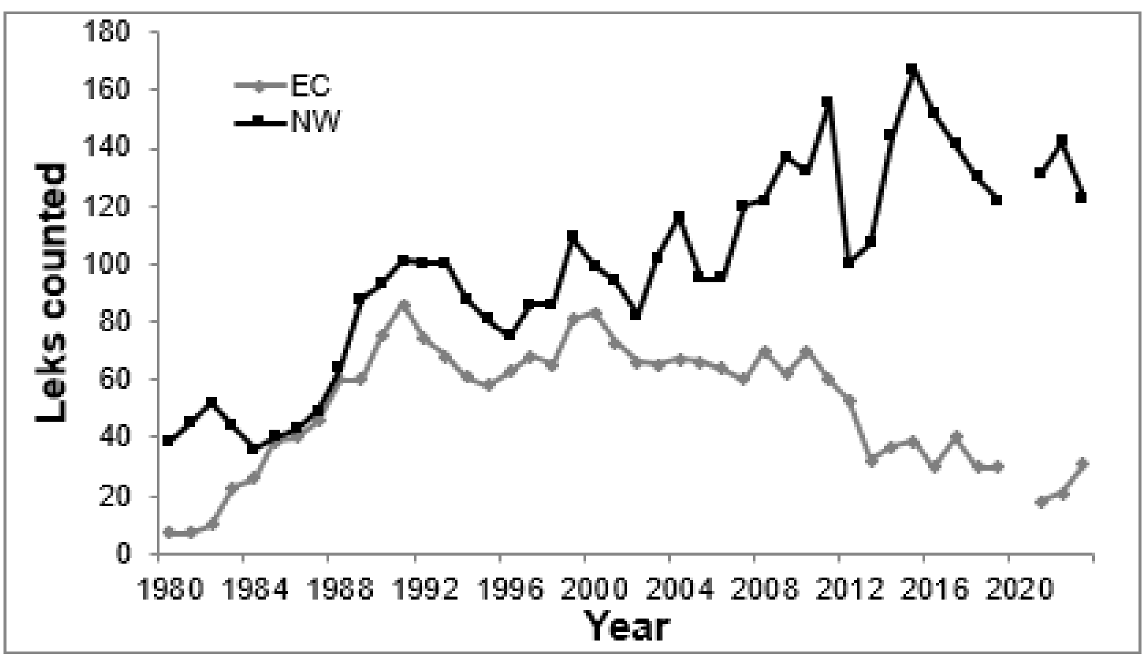

Figure 3. The number of **sharp-tailed grouse** leks with 2 or more birds counted in spring lek surveys in the Northwest (NW) and East Central (EC) survey regions of Minnesota during 1980 – 2023. Survey data were not collected in 2020 due to the Governor's Stay at Home Order during the COVID-19 pandemic.

2023 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 (*Falcipennis canadensis*) survey in 2018 with the help of dozens of cooperators and citizen volunteers. The survey is composed of 319 road-based sites organized into 67 routes with 4-5 sites/route. Observers walk a circular transect and record grouse pellets within 1 m of the transect. During 2018-2021, we used replicate surveys to quantify variation in the pellet detection process. Beginning in 2022, we conducted single-effort surveys (i.e., each site was surveyed once). Participants surveyed an average of 288 (90%) sites/year (range: 240 to 314 sites). However, due to the pandemic and occasional accessibility issues, only 55% of sites were surveyed every year. Spruce grouse pellets were detected at an average of 30% of sites (range: 26 to 36) 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. Observers counted an average of 16.6 spruce-grouse pellet groups (single pellets or roost piles) at "used" sites during 2018-2023, but it varied greatly among sites and years (range: 1 to 212 pellet groups). The mean conditional pellet count in 2023 (14.2 pellets/used site) increased slightly compared to 2022 (12.6), whereas the proportion of used sites (33%) and used routes (62%) decreased slightly compared to 2022 (36% and 64%, respectively). A trend analysis did not find evidence of a statistically significant change (slope coefficient) in rangewide mean pellet counts (adjusted for zero-inflation) during 2018-2023. Conversely, at the ecosection level, count indices (unadjusted for probability of detection) suggest a possible decrease in the Minnesota Drift and Lake Plains, which is the southern part of spruce grouse range in Minnesota. However, we have relatively few routes (10) and survey sites (44) in this ecosection and the counts are dominated by zeros, which makes inference challenging. 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 Minnesota).

INTRODUCTION

Spruce grouse, *Falcipennis canadensis*, 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. 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). 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). 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 (Dexter 2016). 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 (*Bonasa umbellus*) and snowshoe hares (*Lepus americanus*), and report simple count-based monitoring metrics for these species.

METHODS

The pellet survey is comprised 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 Mar-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 are distinguished from spruce grouse pellets on the basis of length, thickness, uric acid wash, and color. 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 pellets are recorded in a similar manner to spruce grouse pellets, whereas snowshoe hare pellets are recorded in ordinal categories (0, 1-4, 5-11, 12-25, 25+).

For the operational survey, we compute 3 annual count metrics for spruce grouse, ruffed grouse, and snowshoe hare: 1) proportion of waypoints 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 (CIs) for these monitoring metrics by generating 500 bootstrap samples (with replacement using "route" as the sampling unit) for each monitoring metric and year, and then extracted the 0.075 and 0.925 quantiles of the bootstrapped estimates. The bootstrap was conducted using the R Programming Language (R Core Team 2023; R version 4.3.1 (2023-06-16 ucrt)). Although useful for big-picture monitoring, annual and spatial differences in these count indices could be influenced by annual and spatial variation in the detection process. The recommended approach is to use some type of formal population estimator (e.g., mark-recapture, distance sampling, double sampling, revisit surveys, sightability model) to account for the imperfect observation process. 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 zero-inflated mixture model based on single-visit surveys, which attempts to adjust for the extra zeros in our count data (due to probability of detection <1). More specifically, we fit a hurdle model (Feng 2021) to our single-visit count data, which is a special type of mixture model where the binary detection/non-detection data are modeled separately from the truncated count data (positive counts only), and then brought back together to generate a predicted mean count that is adjusted for zero-inflation and, in our case, overdispersion. The latter was necessary because the distribution of our spruce-grouse pellet counts is dominated by small counts, but there are some very large counts in the extreme right tail of the distribution. The binary part of our H hurdle model contained a fixed effect for survey conditions (scale of 1-10) and a random effect for survey route (which also reflects observer effects because they tend to survey the same routes each year). The truncated count part of our model contained fixed effects for time (t = 1, 2, 3, . . . n years) and random effects for year, route, and a temporal trend within each route (i.e., a random-slopes model where we allowed the intercept and temporal trend to vary by route). We used this model structure to examine whether their was evidence of a temporal trend in the mean annual spruce grouse pellet count while adjusting for zero-inflation and annual variation in the sampling process (due to mean survey conditions and random year effects). We also accounted for our overdispersed count data by using the "truncated_nbinom2" family function in the glmmTMB R package (Brooks et al. 2017) to fit our hurdle model.

RESULTS AND DISCUSSION

Spruce Grouse

In 2023, 61 of 67 routes and 282 of 319 sites were surveyed by cooperating biologists (76% of surveys) and citizen volunteers (24% of surveys) between 2 March and 9 June (Table 1). Observers detected spruce grouse pellets at 94 (33%) sites in 2023, compared to an average of 30% of sites during initial visits in 2018-2022 (Figure 2). At the route level, spruce grouse pellets were detected on 38 routes (62%) in 2023 (Figure 3). Observers detected an average of 14.2 (range: 1–141) spruce grouse pellets (singles + roost piles) at used sites in 2023, compared to an average of 17.1 (annual range: 12.6-22) during initial visits in 2018-2022 (Figure 4). After adjusting for zero-inflation and overdispersion, we did not find evidence of a temporal trend (positive or negative) in mean spruce grouse pellet counts (log of estimated slope = -0.009; 85% CI: -0.154 to 0.136; 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 2018-2023 monitoring period (Figure 5). However, there are some indications that spruce grouse abundance in the Minnesota Drift & Lake Plains ecosection may have declined (see Figure 2, 3, and 4). Conversely, there has not been 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, power to detect a meaningful population change may be 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 (singles + roost piles) at 197 (70%) sites in 2023 (Table 1, Figure 2 and 3), with a mean count of 8.8 (range: 1-64) pellets per used site (Figure 4). Observers detected pellets of both spruce grouse and ruffed grouse at 69 sites (24%), whereas we failed to detect pellets of either species at 60 sites (21%).

We detected snowshoe hare pellets at 240 (85%) sites in 2023 (Table 1, Figure 2 and 3). Most (38%) pellet counts were in the 25+ count bin (Figure 4). Observers detected pellets of both spruce grouse and snowshoe hares at 82 sites (29%). Pellets of all 3 species were detected at 61 sites (22%).

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 usually include 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 3 Ecological Classification Sections (ECS) in northern Minnesota in 2023 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 or multiples per used site) during initial visits.

Cooperator	ECS Section[1]	Routes	Sites	SPGR	RUGR	SNHA
Aurora SNF[2]	212N	3	15	0.00	0.73	0.86
Baudette DNR	212M	4	19	0.21	0.84	0.89
Bemidji DNR	212N	1	5	0.00	0.60	0.40
Chippewa National Forest	212N	4	19	0.00	0.53	0.63
Cook SNF	212L	4	20	0.05	0.25	0.85
Duluth DNR	212L	2	9	0.11	0.78	0.89
Ely SNF	212L	5	22	0.55	0.91	0.82
Grand Marais DNR[3]	212L	3	12	0.50	0.83	1.00
Grand Marais SNF	212L	3	14	0.50	0.57	0.86
Grand Portage Reservation	212L	3	15	0.00	0.53	0.93
Grand Rapids DNR	212L	1	4	0.25	1.00	1.00
International Falls DNR	212M	2	9	0.56	0.67	0.89
Orr DNR	212L	4	18	0.33	0.83	0.89
Red Lake Reservation	212N	3	13	0.38	0.46	0.69
Red Lake WMA[4]	212M	5	25	0.24	0.64	1.00
1854 Treaty Authority	212L	2	7	0.86	1.00	1.00
Tofte SNF	212L	6	29	0.69	0.90	0.83
Two Harbors DNR	212L	3	13	0.08	0.85	1.00
Tower DNR	212L	3	14	0.93	0.57	0.71
Not surveyed		6	37	---	---	---
Total		61	282	0.33	0.70	0.85

[1]212L = Northern Superior Uplands, 212M = Northerrn Minnesota and Ontario Peatlands, 212N = Northern Minnesota Drift and Lake Plains

[2]SNF = Superior National Forest

[3]Grand Marias DNR Office has been moved to the Two Harbors DNR Office, but routes remain separated based on their geographic location.

[4]WMA = Wildlife Management Area

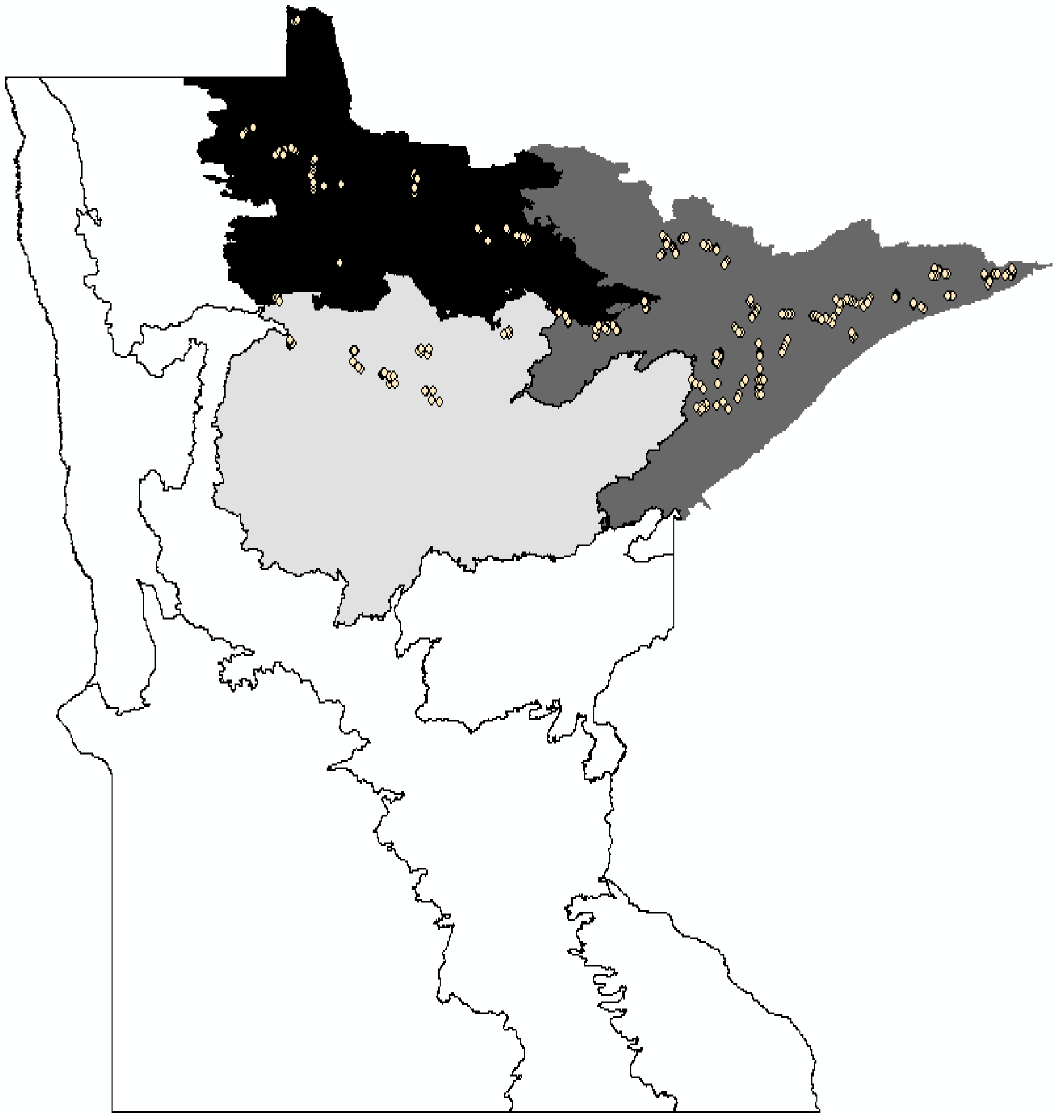

Figure 1. Distribution of sampling sites in northern Minnesota during 2018-2023. Ecological Classification System sections included the Northern Minnesota and Ontario Peatlands (n = 17 routes and 85 sites) in the northwest, the Northern Superior Uplands (n = 40 routes and 190 sites) in the east, and the Northern Minnesota Drift and Lake Plains (n = 10 routes and 44 sites) in the southcentral survey region.

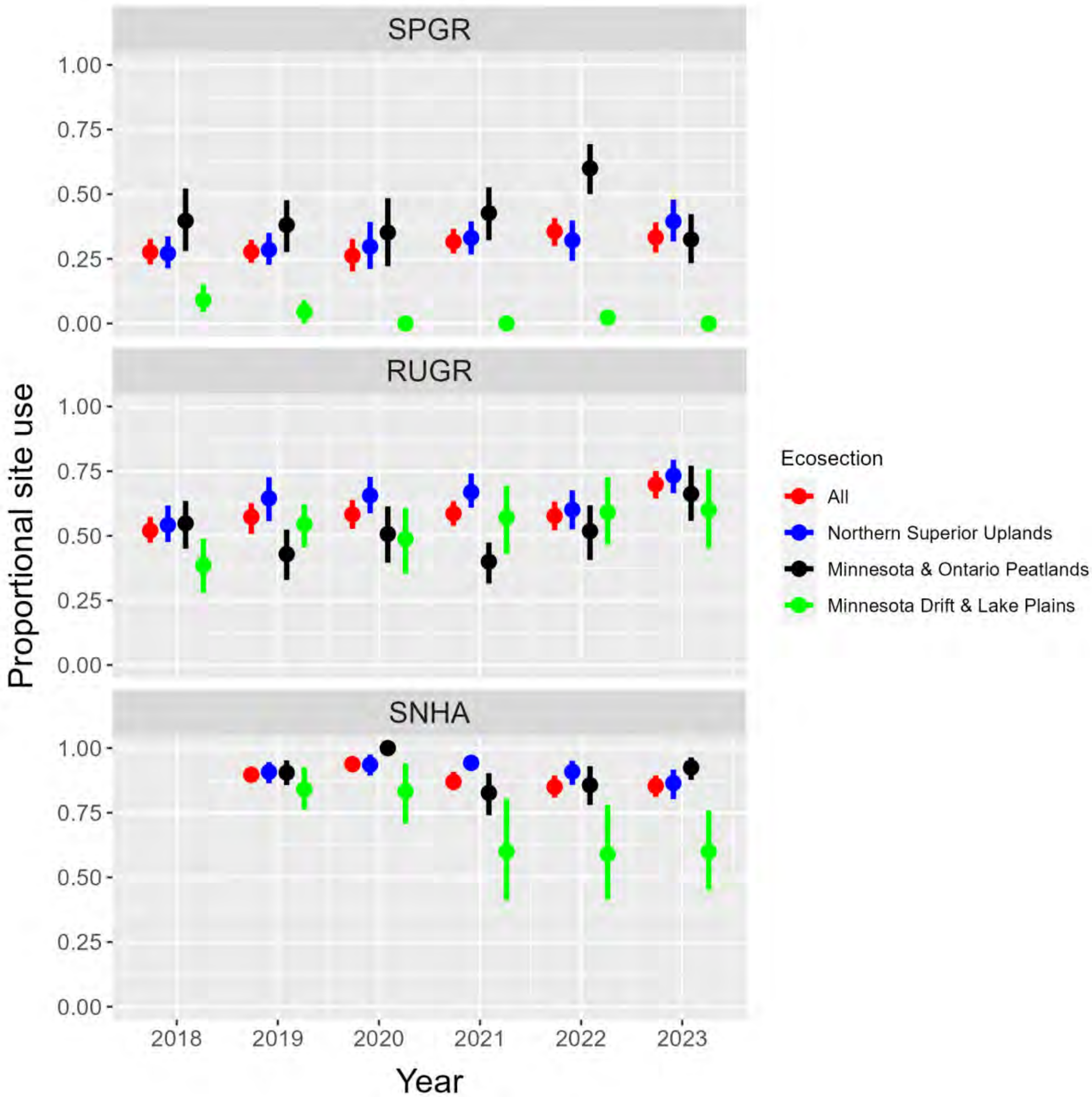

Figure 2. Index of site use in northern Minnesota during 2018-2023 based the proportion of sites surveyed where at least 1 pellet was detected for spruce grouse (SPGR), ruffed grouse (RUGR), or snowshoe hare (SNHA). Error bars are bootstrapped 85% confidence intervals.

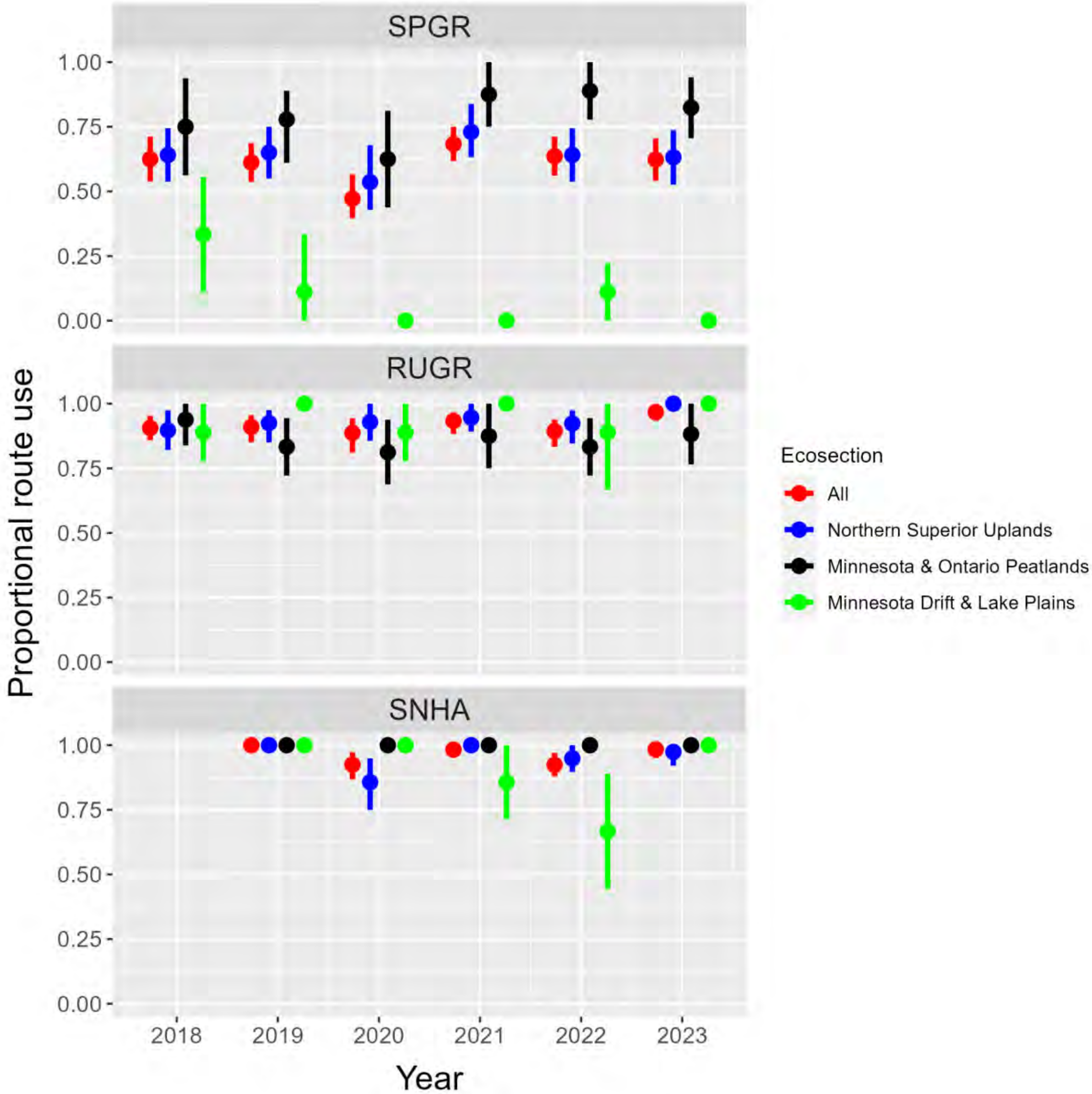

Figure 3. Index of route use in northern Minnesota during 2018-2023 based the proportion of routes surveyed where at least 1 pellet was detected for spruce grouse (SPGR), ruffed grouse (RUGR), or snowshoe hare (SNHA). Error bars are bootstrapped 85% confidence intervals.

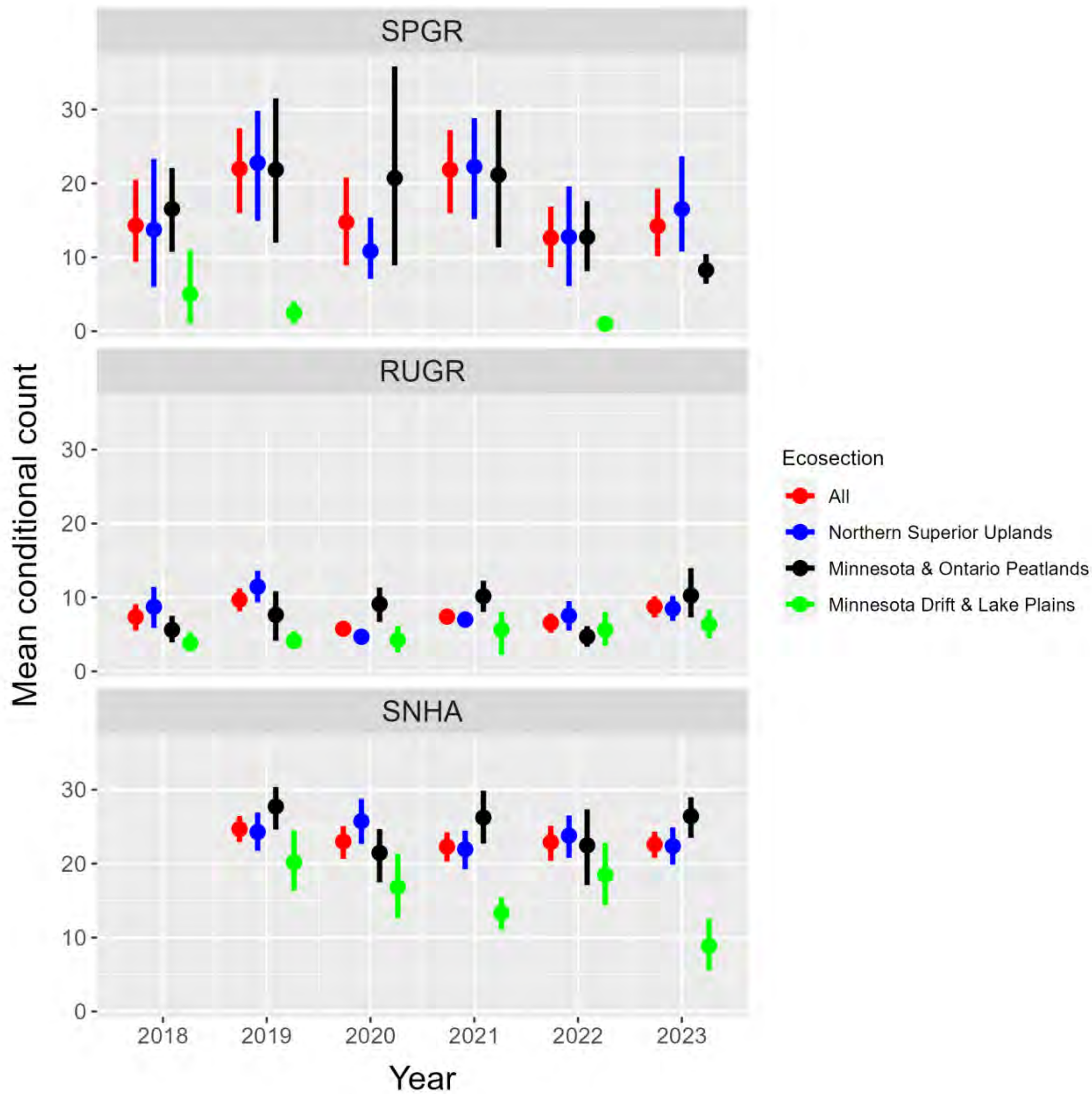

Figure 4. Index of pellet abundance at used sites for spruce grouse (SPGR), ruffed grouse (RUGR), and snowshoe hare (SNHA) in northern Minnesota during 2018-2023. Error bars are bootstrapped 85% confidence intervals.

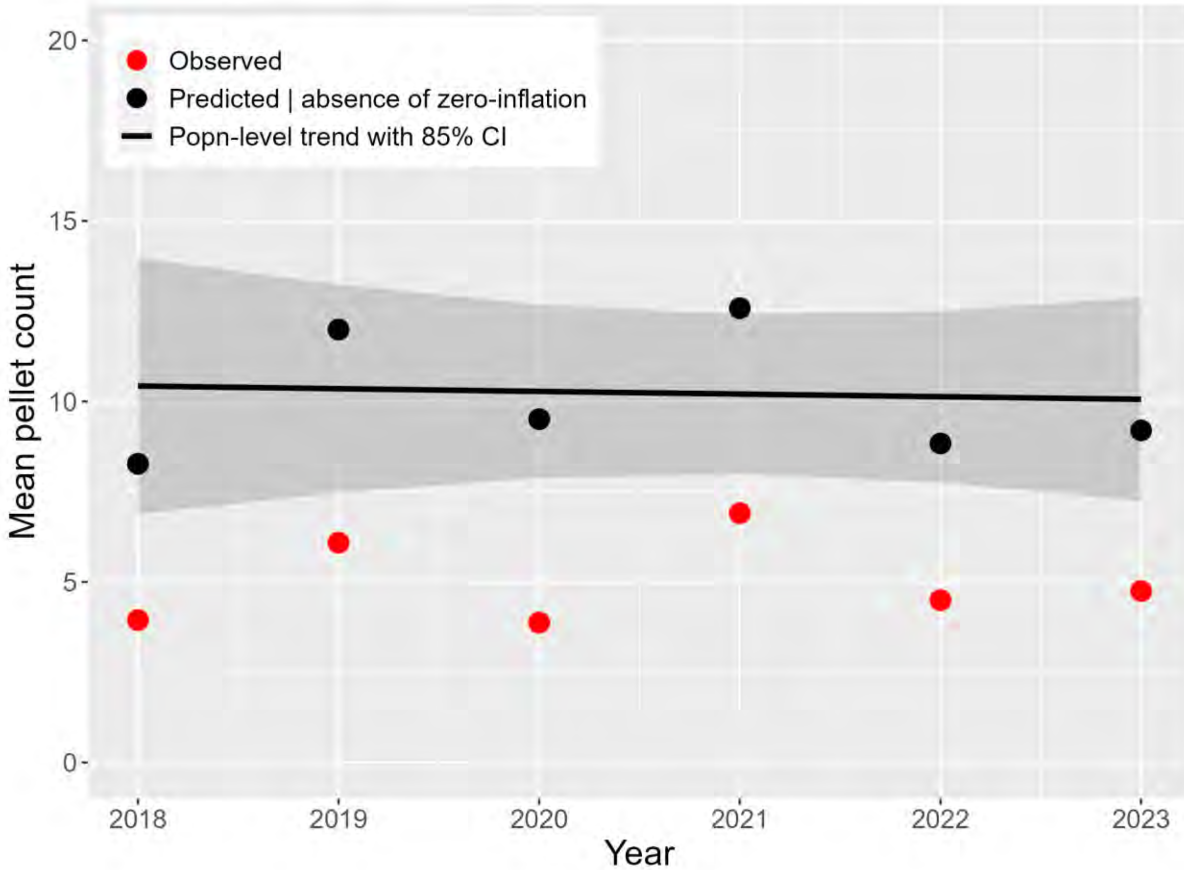

Figure 5. Predicted mean spruce grouse pellet counts in northern Minnesota during 2018-2023 and the estimated temporal population-level (popn-level) trend with 85% confidence intervals (CI) from a hurdle mixture model that adjusts for zero-inflation and overdispersion.

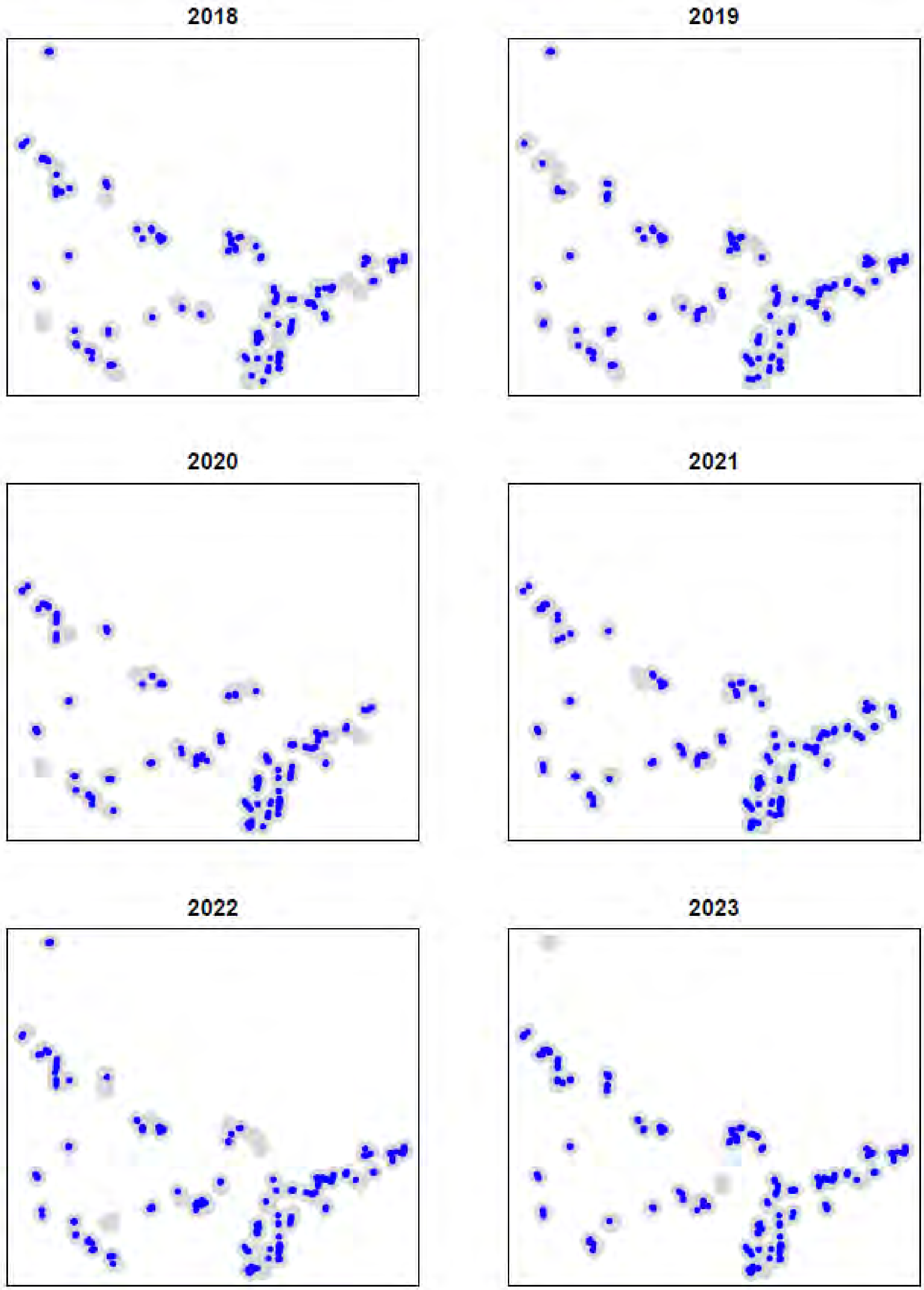

Figure 6. Spatial distribution of sampling effort and spruce grouse pellet detections by year in northern Minnesota during 2018-2023.

2023 MINNESOTA PRAIRIE-CHICKEN POPULATION SURVEY

Charlotte Roy, Forest Wildlife Populations and Research Group

SUMMARY OF FINDINGS

Greater prairie-chickens (*Tympanuchus cupido pinnatus*) were surveyed in all 17 survey blocks during the spring of 2023. Observers located 51 booming grounds and counted 594 males and birds of unknown sex in the survey blocks. Including areas outside the survey blocks, observers located 115 booming grounds, 1,051 male prairie-chickens, and 115 birds of unknown sex. Estimated densities of 0.07 (0.05–0.10) booming grounds/km^2 and 11.6 (9.5–13.8) 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 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 prairie-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 17 designated survey blocks in western Minnesota (Figure 2) during 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 7 April and 11 May 2023. Observers located 115 booming grounds and observed 1,051 male prairie-chickens and 115 birds of unknown sex within and outside the survey blocks (Table 1). These counts represent a minimum number of prairie-chickens in Minnesota during 2023, 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, 594 males and birds of unknown sex were counted on 51 booming grounds during 2023 (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 2.2 times (median = 2), with 35% 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 0.08 (0.05–0.11) booming grounds/km^2 and 12.6 (9.9–15.3) males/booming ground (Figure 3). In the peripheral survey blocks, densities were 0.06 (0.01–0.10) booming grounds/km^2 and 9.7 (6.3–13.1) males/booming ground. For all survey blocks, the density of 0.07 (0.05–0.10) booming grounds/km^2 during 2023 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 11.6 (9.5–13.8) males/booming ground in all surveyed blocks during 2023 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 Conservation Reserve Program. 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 2023. In Polk County, 152 sharp-tailed grouse were counted at 13 sharp-tailed grouse dancing grounds. Additionally, 1 sharptail-chicken hybrid was observed at each of 2 different prairie-chicken booming grounds. In Norman County, a sharp-tailed grouse lek with 13 males and 3 females was observed. In Clay County, 2 sharp-tailed grouse were observed at 1 prairie-chicken booming ground and 3 hybrids were counted on 2 booming grounds (1 and 2 hybrids, respectively). In Mahnomen County, 2 sharp-tailed grouse and a sharptail-chicken hybrid were at a booming ground. In Wilkin county, 1 sharp-tailed grouse was observed at a prairie-chicken booming ground. Research staff observed additional hybrids in Mahnomen (2), Norman (3), and Polk counties (2) as part of a research project.

ACKNOWLEDGMENTS

I would like to thank cooperators who conducted and helped coordinate the prairie-chicken survey. Cooperators with TNC included Travis Issendorf, and volunteers Pat Beauzay, Derek Savage, and Sara Nagel; cooperators within MNDNR included Emily Hutchins, Rob Baden, Greg Henderson, Matt Mecklenburg, Matt Morin, and Nick Snavely; cooperators with USFWS including Shawn Papon, Ben Walker, and Stacy Salvevold; and numerous additional volunteers, including Brian Winter, Dan Svedarsky, Doug Wells, Jon Voz, Ross Hier, Phil Doll, 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 2023. Lek and bird counts are not comparable among permit areas or years.

Permit Area	Area (km^2)	Leks	Males	Unknown[a]
803A	1,411	9	61	0
804A	435	0	0	0
805A	267	15	123	0
806A	747	10	53	18
807A	440	16	159	6
808A	417	19	258	0
809A	744	12	156	0
810A	505	7	70	24
811A	706	5	41	10
812A	914	9	58	10
813A	925	4	24	0
PA subtotal	7,511	106	1003	68
Outside PAs[b]	NA[c]	9	48	47
Grand total	NA[c]	115	1051	115

[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 2023 and change in counts compared to 2022.

			2023		Change from 2022[a]	
Range[b]	Survey Block	Area (km^2)	Booming grounds	Males[c]	Booming grounds	Males[c]
Core	Polk 1	41.2	1	14	0	3
	Polk 2	42.0	3	36	-1	4
	Norman 1	42.0	2	13	0	2
	Norman 2	42.2	3	16	1	4
	Norman 3	41.0	3	36	-2	-29
	Clay 1	46.0	9	106	0	-62
	Clay 2	41.0	3	65	-1	-2
	Clay 3	42.0	4	47	-2	-31
	Clay 4	39.0	2	22	2	22
	Wilkin 1	40.0	4	74	1	41
	Core subtotal	415.0	34	429	-2	-48
Periphery	Mahnomen	41.7	2	33	-1	-19
	Becker 1	41.4	8	64	4	29
	Becker 2	41.7	1	4	-1	1
	Wilkin 2	41.7	2	8	0	-5
	Wilkin 3	42.0	2	29	0	12
	Otter Tail 1	41.0	1	7	0	1
	Otter Tail 2	40.7	1	20	1	NA
	Periphery subtotal	290.6	17	165	3	39
Grand total		705.5	51	594	1	-9

[a] The 2022 count was subtracted from the 2023 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.

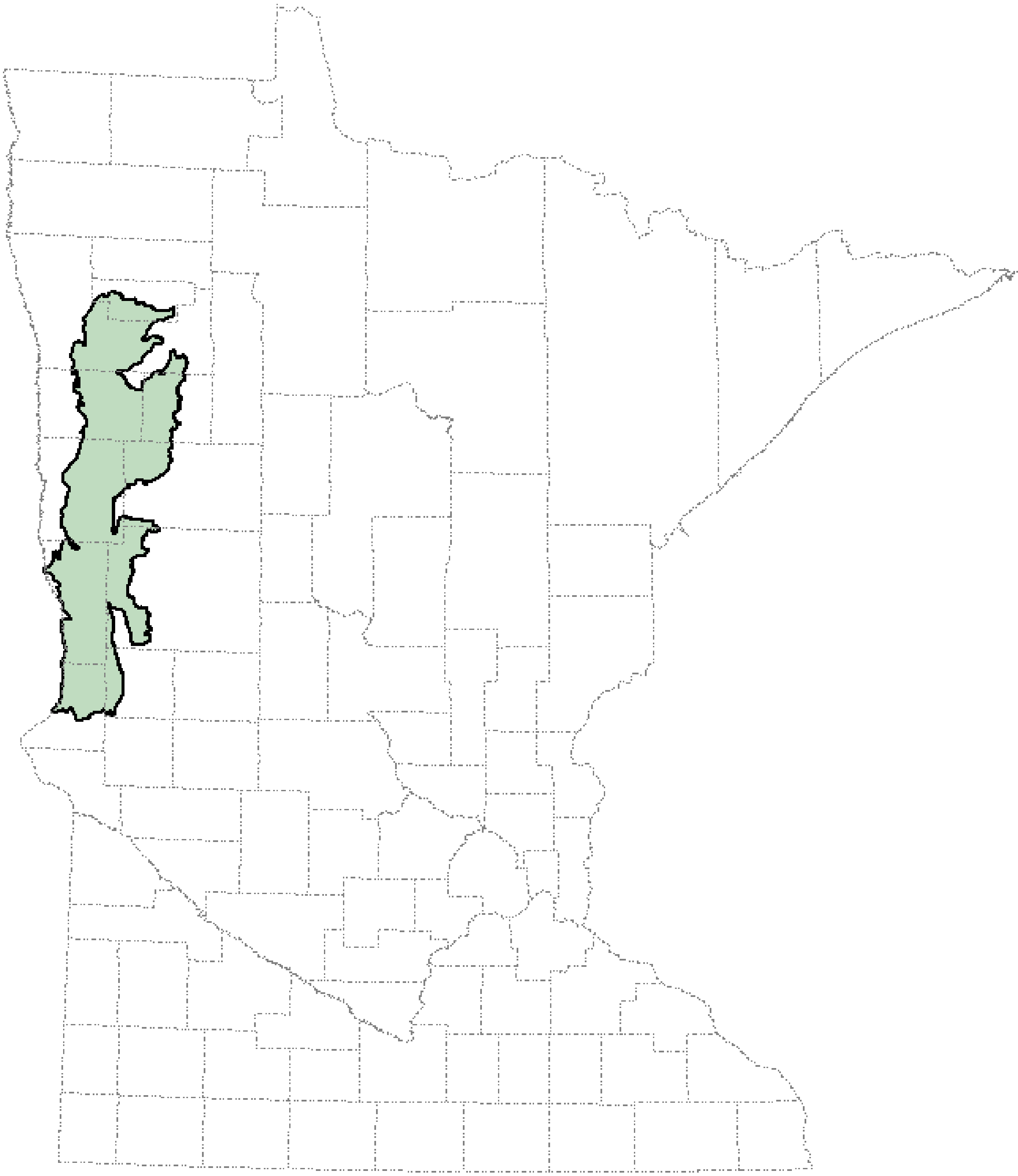

Figure 1. Primary greater prairie-chicken range in Minnesota (shaded area) relative to county boundaries. The range boundary was based on Ecological Classification System Land Type Associations and excludes some areas known to be occupied by prairie-chickens.

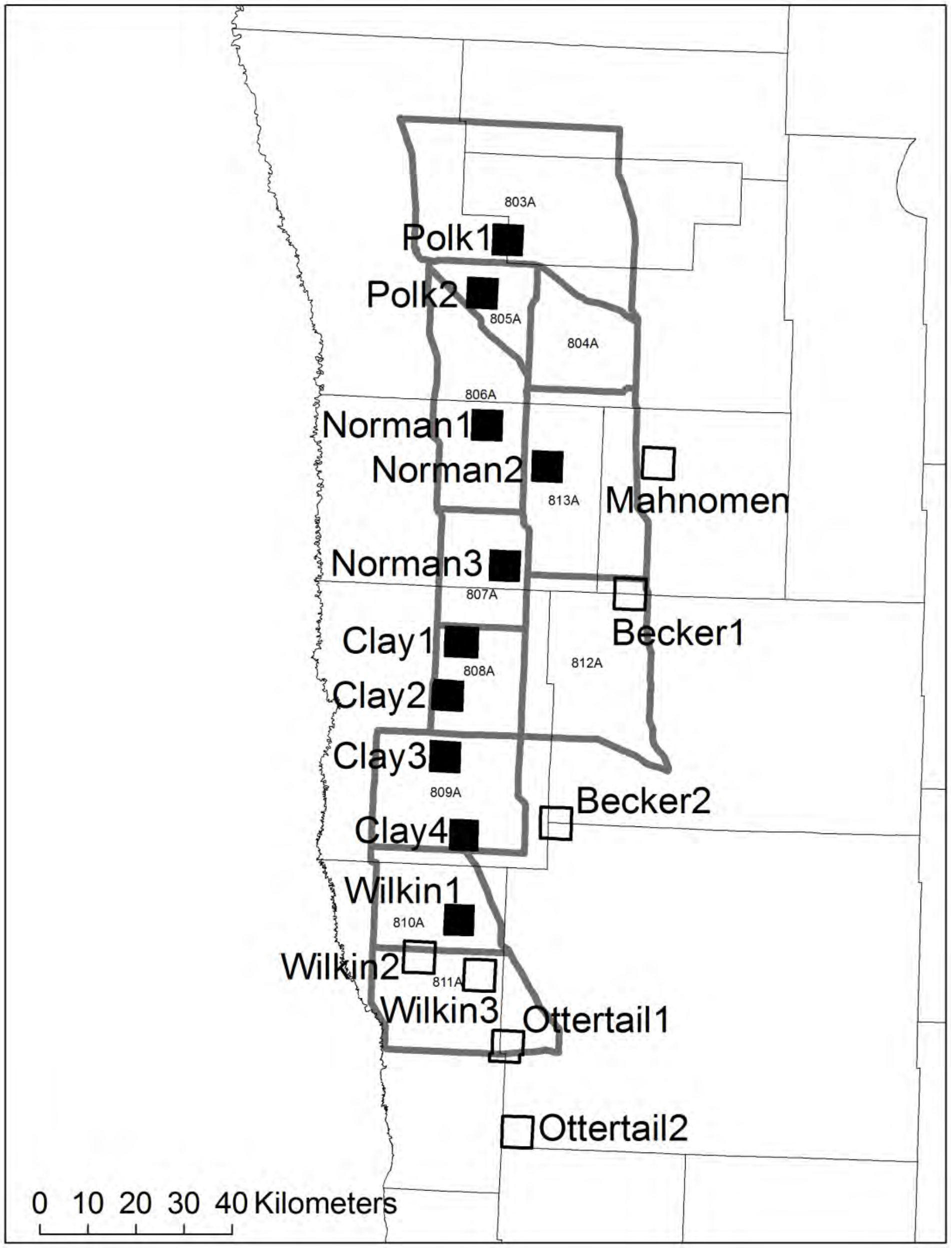

Figure 2. Prairie-chicken lek survey blocks (41 km^2, labeled squares) and hunting permit areas (thick grey lines) in western Minnesota. Survey blocks were either in the core (black) or periphery (white) of the range with a threshold of 1.0 male/km^2 in 2010, and were named after their respective counties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

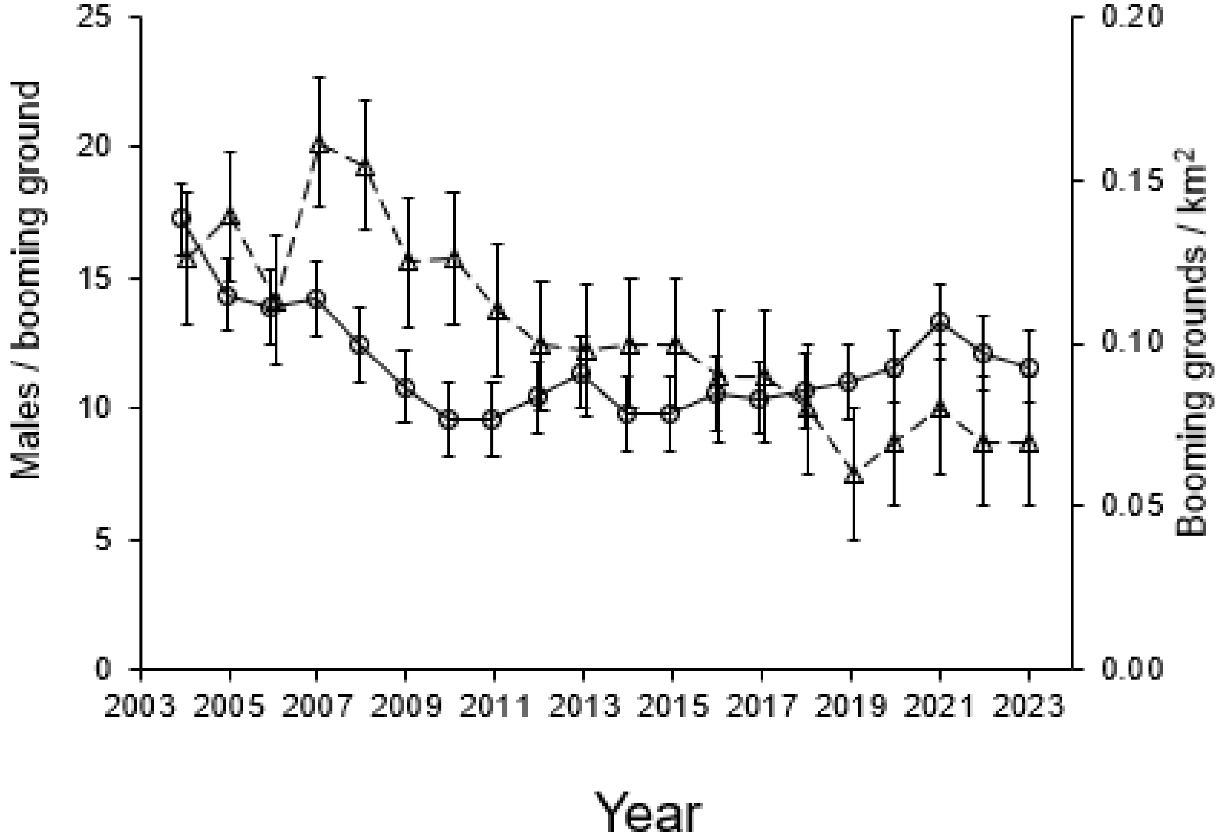

Figure 3. Mean prairie-chicken males/booming ground (circles connected by solid line) and booming grounds/km^2 (triangles connected by dashed line) in survey blocks in Minnesota with 95% confidence intervals.

MONITORING POPULATION TRENDS OF ELK IN NORTHWESTERN MINNESOTA - 2023

Eric S. Michel, Doug Franke, and Brian Haroldson

INTRODUCTION

Historically, elk 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 northwestern 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 30-38 elk, the Kittson County herd for 50-60 elk, and the Caribou-Vita herd for 150-200 elk (Interim Strategic Management Plan for Elk 2016-2019). 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 is 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 potential hunting seasons.

OBJECTIVE

Estimate elk abundance within each herd (i.e., Grygla, Kittson County, Caribou-Vita) in northwest Minnesota.

METHODS

We estimated elk populations in survey blocks encompassing the winter range of each herd. The Grygla survey block covers 122 mi^2 in Marshall and Beltrami counties and includes one herd of elk. The Kittson Central survey block comprises 166 mi^2 in Kittson County and includes two sub-herds of elk (Kittson Central North and Kittson Central South). The Caribou-Vita survey block incorporates approximately 35 mi^2 in Kittson and Roseau Counties and 180 mi^2 in Manitoba and includes one elk herd that frequently alternates on either side of the United States/Canada border. In general, the Caribou-Vita survey is only conducted in years when MNDNR staff can coordinate with Manitoba Conservation staff to complete concurrent surveys on both sides of the border. However, MNDNR Division of Enforcement (ENF) coordinated with US and Canadian border patrol authorities to allow safe flights across the border into Manitoba airspace in 2023.

During all surveys, we used a Cessna 185 fixed-wing aircraft and attempted to maintain flight altitude at 350 ft above ground level (AGL) and airspeed at 85 mi/hr. The pilot and two observers searched for elk along parallel, east-west transects spaced at 0.2-mi intervals. When an elk was sighted, we left the transect line and circled the observed animal(s) to determine group size and classify antlerless (cow, calf) and antlered animals. We did not attempt to differentiate between cows and calves because differentiation is difficult under existing flight protocols. Antlered elk were classified as either adult (branch-antlered) bulls or spike bulls. We used a real-time, moving-map software program (DNRSurvey; Haroldson et al. 2015), coupled to a global positioning system receiver and a tablet computer, to guide transect navigation and record survey data and aircraft flight paths directly to ArcGIS (Environmental Systems Research Institute, Inc., Redlands, CA) shapefiles. To maximize sightability, we completed surveys during winter when snow cover measured at least 8 in.

We did not account for visibility bias in the annual elk surveys. However, during 2014 to 2016, we estimated detection rate using a modified double-sampling method (Gasaway et al. 1986) to determine if our fixed-wing sampling protocol was adequate for enumerating elk. The location of each elk group sighted during the fixed-wing survey, generalized to the corresponding Public Land Survey (PLS) section, was relayed to an awaiting helicopter flight crew. This crew then resurveyed each targeted PLS section, plus the 8 surrounding sections, to obtain a second count of animals. Flight protocol included transect spacing of 0.2 mi, flight altitude of 200 ft AGL, and airspeed of 40-50 mi/hr. We used DNRSurvey (Haroldson et al. 2015) to record survey data.

RESULTS

The 2023 surveys included the Grygla, Kittson Central, and Caribou-Vita survey blocks (Figure 1). Snow depths averaged 15 in across the Grygla block and ranged from 15-20 in in the Kittson Central and Caribou-Vita blocks. Temperatures ranged from a low of -20°F to a high of 34°F with mostly sunny skies. However, high winds and excessive frost resulted in multiple weather delays.

We did not calculate visibility bias in 2023. However, during 2014-16, we observed 40 of 48 elk groups (mean = 0.83; range: 0.82-0.85) and 301 of 322 individual animals (mean = 0.93; range: 0.87-0.98) with the fixed-wing crew compared to the helicopter crew (Table 1).

Grygla Survey Block

This survey was conducted during 8-10 February and consisted of 2 survey days. Total flight time was 12.4 hours. We observed 29 elk, including 18 antlerless and 11 antlered animals (Table 2). We observed elk in 6 groups with a mean of 4.8 elk/group (Table 3).

Kittson Central Survey Block

This survey was conducted during 29-30 January and consisted of 2 survey days. Total flight time was 14.5 hours. We observed 75 elk, including 50 antlerless and 25 antlered animals (Table 4). We observed elk in 6 groups with a mean of 12.5 elk/group (Table 5).

- The Kittson Central North subgroup had 27 total elk (24 antlerless, 2 spike bulls, 1 adult bull). The antlerless group was located approximately 6.8 mi northeast of the wintering location observed in 2021.
- The Kittson Central South subgroup had 48 total elk (26 antlerless elk located 4.3 mi northwest of the Percy WMA, and 20 adult and 2 spike bulls observed 4-8 mi to the east of the antlerless group).

Caribou-Vita Survey Block

This survey was conducted during 31 January – 7 February and consisted of 4 survey days (1 day in MN and 3 days in Manitoba). The total flight time was 23.1 hours. We observed 227 elk, including 187 antlerless and 25 antlered animals (Table 6). On the Minnesota side of the survey, we observed elk in 7 groups with a mean of 13.7 elk/group (Table 7). On the Manitoba side, we observed elk in 10 groups with a mean of 13.1 elk/group.

DISCUSSION

Detection rate estimates from 2014 to 2016 indicate detectability of elk using a fixed-wing aircraft is reasonably constant across years and the survey crew is observing a high proportion of animals present during the survey. Although the likelihood of missing animals increases as group size decreases, current survey design and protocols provide a reasonably good opportunity to enumerate a minimum count of elk within each survey area. In turn, these minimum counts provide baseline information needed on the elk population, which is necessary given that the state mandates hunts to occur at certain population levels. Although minimum counts currently provide adequate information given our current elk management goals, methodology may need to be altered if Minnesota's management goals change (e.g., manage to increase elk numbers).

Aerial surveys are often associated with budgetary and safety concerns, as they are costly to perform and are dangerous for staff performing the flights (Jones et al. 2006, Beaver et al. 2020). Other methodologies such as using non-invasive DNA sampling within a mark-recapture framework or using camera traps may be feasible alternatives. Both methods would be performed from the ground making them safer for staff. These methods would also allow for variance to be estimated allowing for a population range to be reported along with a level of confidence in the estimate.

Several logistical factors also affect aerial survey efficiency. For example, flying aerial surveys during winter can impact the timing of when surveys are completed if inclement weather occurs, with such weather sometimes delaying flights for multiple days. Mechanical issues (e.g., routine maintenance, repairs) can delay surveys, while staffing issues related to having biologists and a pilot available when surveys can be flown may also cause delays. Flight delays lasting for multiple days can also lead to other issues such as the potential for double counting of elk in the sampling plot, counting new elk that have moved onto the plot during the delay, or missing elk that have moved off the plot during the delay. Adult female elk in northwestern MN have an average home range size up to 111 km and are capable of large-scale daily movements (Freeman 2019). Therefore, if flights are delayed for multiple days, there is an inherent risk of double counting and/or missing groups of elk. One solution for improving the efficiency and reducing the potential for double counting and/or missing elk is to fly with two crews. Given the large survey block size, flying with two crews would allow more transects to be flown in a day. This would minimize the chance of error associated with counting elk due to the potential for large daily elk movement. Additionally, flying with two crews would decrease the amount of time taken to fly a survey, in turn reducing the potential for flight delays to impact the completion of a survey block.

This aerial survey is vital to elk management in MN. Therefore, there is a special emphasis on attempting to count all elk within a survey block. However, this effort sometimes leads to counting elk that are observed off plot and/or adding elk to the final count for a given survey block that were observed after the survey was completed. For example, an antlerless group comprised of 2 spike bulls and 22 antlerless elk was observed 5 days after the survey was completed in 2023 for the Kittson Central herd, raising the total count from 51 to 75 elk (Table 4). Given the Kittson Central herd is managed for 50 to 60 total elk, a minimum count of 51 elk would have drastically changed the tag allocation for the 2023 hunt. Regardless, standardization on whether elk observed off plot or after survey completion should be added to the total count is needed.

ACKNOWLEDGMENTS

Special thanks to all those that helped with the survey this year, especially the fixed-wing pilot Bob Geving who provided safe flying for all onboard. Observers this year included Kyle Arola

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Table 1. Detection rate metrics collected from 2014 to 2016 in northwestern Minnesota, USA.

Year	# Groups detected (fixed-wing)	# Groups detected (helicopter)	Proportion detected (fixed-wing)	# Animals detected (fixed-wing)	# Animals detected (helicopter)	Proportion detected (fixed-wing)
2014	15	18	0.83	94	108	0.87
2015	11	13	0.85	126	131	0.96
2016	14	17	0.82	81	83	0.98
Total	40	48	0.83[a]	301	322	0.93[a]

[a]Average proportions reported.

Table 2. Grygla Block aerial survey observations from 2013 to 2023 in northwestern Minnesota, USA.

Year	Spike Bull	Adult Bull	Antlerless	Total Elk	Antlered:Antlerless Ratio
2013[a]	2	10	16	28	0.75
2014[a]	2	4	14	20	0.43
2015[a]	3	6	9	18	1.00
2016[a]	2	9	10	21	1.10
2017	4	6	7	17	1.43
2018	2	6	7	15	1.14
2019	1	10	8	19	1.38
2020	1	9	14	24	0.71
2021[b]	-	-	-	-	-
2022	2	12	15	29	0.93
2023	1	10	18	29	0.61

[a]Counts recorded from helicopter flights.

[b]Survey not completed due to MNDNR COVID-19 restrictions.

Table 3. Total number of elk groups, mean group size, and range of elk per group for the Grygla Block aerial survey observations from 2013 to 2023 in northwestern Minnesota, USA.

Year	Number of Groups	Mean Group Size	Range
2013[a]	3	8.0	4-16
2014[a]	3	6.7	1-16
2015[a]	4	4.5	1-12
2016[a]	7	3.0	1-10
2017	3	5.7	2-8
2018	5	3.0	1-7
2019	5	4.0	1-8
2020	5	4.8	1-14
2021[b]	-	-	-
2022	5	5.8	1-18
2023	6	4.8	1-17

[a]Counts recorded from helicopter flights.

[b]Survey not completed due to MNDNR COVID-19 restrictions.

Table 4. Kittson Central Block aerial survey observations from 2013 to 2023 in northwestern Minnesota, USA.

Year	Spike Bull	Adult Bull	Antlerless	Total Elk	Antlered:Antlerless Ratio
2013[a]	3	14	15	32	1.13
2014[a]	3	14	20	37	0.85
2015[a]	2	16	16	34	1.13
2016[a]	6	12	34	52	0.53
2017	2	14	45	61	0.36
2018	5	13	57	75	0.32
2019	11	22	61	94	0.54
2020	6	27	69	102	0.48
2021[b]	-	-	-	-	-
2022	5	28	51	84	0.65
2023	4 [c]	21	50 [c]	75	0.50

[a]Counts recorded from helicopter flights.

[b]Survey not completed due to MNDNR COVID-19 restrictions.

[c]Second antlerless herd (2 spike bulls, 22 antlerless) was located 5 days after survey completion.

Table 5. Total number of elk groups, mean elk group size, and range of elk per group for the Kittson Central Block aerial survey from 2013 to 2023 in northwestern Minnesota, USA.

Year	Number of Groups	Mean Group Size	Range
2013[a]	5	9.0	1-21
2014[a]	8	4.6	1-17
2015[a]	7	4.9	1-13
2016[a]	4	13.0	2-21
2017	6	10.2	1-31
2018	5	15.0	1-41
2019	8	11.8	1-39
2020	11	9.4	3-28
2021[b]	-	-	-
2022	9	10.0	3-28
2023	6	12.5	2-26

[a]Counts recorded from helicopter flights.

[b]Survey not completed due to MNDNR COVID-19 restrictions.

Table 6. Caribou-Vita Block (Minnesota and Manitoba combined) aerial survey observations from 2013 to 2023 in northwestern Minnesota, USA and southern Manitoba, CA.

	Spike Bull		Adult Bull		Antlerless		Total Elk		Antlered:Antlerless Ratio	
Year	MN	MB	MN	MB	MN	MB	MN	MB	MN	MB
2013a	0	-	15	-	2	-	17	-	7.5	-
2014a	10	-	7	-	34	-	51	-	0.5	-
2015a	5	-	9	-	57	-	79	-	0.25	-
2016a	0	-	6	-	4	-	10	-	1.5	-
2017	0	6	1	24	0	133	1	163	-	0.23
2018	1	5	6	17	0	104	7	126	-	0.28
2019b[b]	-	-	-	-	-	-	-	-	-	-
2020[b]	-	-	-	-	-	-	-	-	-	-
2021[c]	-	-	-	-	-	-	-	-	-	-
2022[b]	-	-	-	-	-	-	-	-	-	-
2023	5	4	12	19	79	108	96	131	0.22	0.21

[a]Counts recorded from helicopter flights.

[b]Survey not completed because Manitoba Conservation was unable to fly Canadian side of border.

[c]Survey not completed due to MNDNR COVID-19 restrictions.

Table 7. Total number of elk groups, mean elk group size, and range of elk per group for the Caribou-Vita Block (Minnesota and Manitoba combined) aerial survey from 2013 to 2023 in northwestern Minnesota, USA and southern Manitoba, CA.

	Number of Groups		Mean Group Size		Range	
Year	MN	MB	MN	MB	MN	MB
2013[a]	6	-	2.8	-	1-6	-
2014[a]	7	-	7.3	-	1-28	-
2015[a]	2	-	39.5	-	9-70	-
2016[a]	6	-	1.8	-	1-3	-
2017	1	-	1.0	-	1-1	-
2018	1	-	7.0	-	7-7	-
2019[b]	-	-	-	-	-	-
2020[b]	-	-	-	-	-	-
2021[c]	-	-	-	-	-	-
2022[b]	-	-	-	-	-	-
2023	7	10	13.7	13.1	1-33	1-35

[a]Counts recorded from helicopter flights.

[b]Survey not completed because Manitoba Conservation was unable to fly Canadian side of the border.

[c]Survey not completed due to MNDNR COVID-19 restrictions.

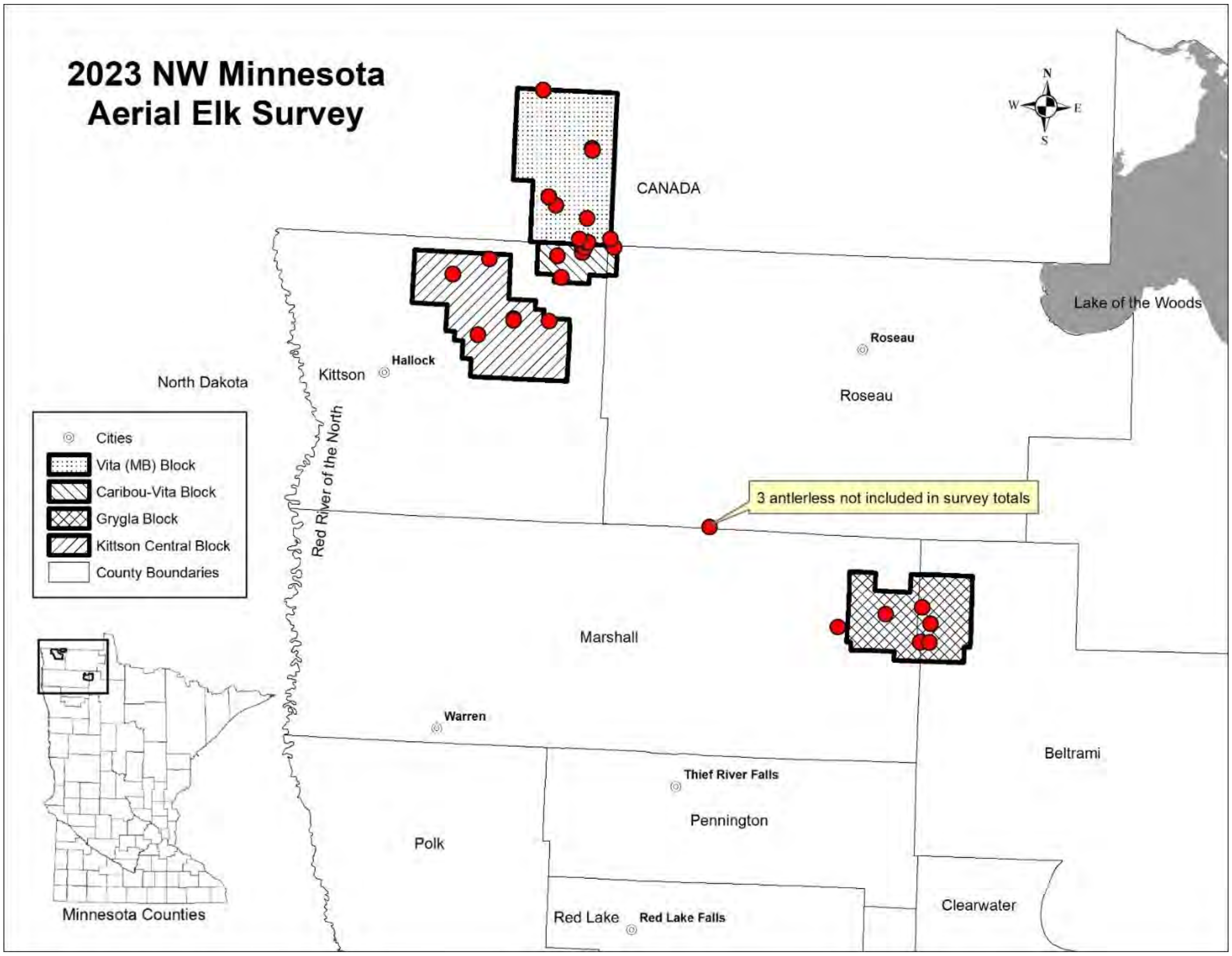

Figure 1. Aerial survey blocks for the Grygla, Kittson Central, and Caribou-Vita herds flown during 2023 in northwestern Minnesota, USA, and Manitoba, Canada. Red dots indicate locations where MNDNDR staff observed elk.

2023 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 5,954 mi^2 (~4 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 the full extent of 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 and MD500E) 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, normally, 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). This model was developed between 2004 and 2007 using adult moose that were radiocollared as part of a study of survival and its impact on dynamics of the population (Lenarz et al. 2009, 2010). Logistic regression indicated that "visual obstruction" (VO) was the most important covariate in determining whether radiocollared moose were observed. We estimated VO within a 30-ft radius (roughly 4 moose lengths) of the observed moose. Estimated VO was the proportion of a circle where vegetation would prevent you from seeing a moose from an oblique angle when circling that spot in a helicopter. If we observed more than 1 moose (a group) at a location, VO was based on the first moose sighted.

Since 2004, we have used the SightabilityModel package (Fieberg 2012) in the R programming language (R Core Team 2022) 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. Rather, 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. Furthermore, low-level aerial surveys involve real risks, and we must constantly weigh these risks against the benefits of the survey. 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 10 surveys days to complete using 1-2 survey crews/day, which is normal (annual mean = 9 days; range: 8 to 10). However, it was longer in duration (6 to 28 January) than usual due to poor weather conditions (i.e., low ceilings and visibility that did not meet visual flight rules). Generally, 8" of snow cover is our minimum threshold depth for conducting the survey. Snow depths were greater than 16" on 93% of the sample plots, which was higher than average (annual mean = 57%; range: 0 to 100). Overall survey conditions were rated as good for 85% of the plot surveys, which is similar to past years (annual mean = 83%; range: 63 to 98). Other survey-condition metrics (e.g., survey intensity, aircraft speed and height, weather variables) were very similar to values observed in previous surveys (see Giudice 2023).

Crews this year observed 267 moose (118 bulls, 109 cows, 34 calves, 6 unclassified adults) on 42 (79%) plots with an average of 6.4 moose per "occupied" plot. For comparison, apparent occupancy (ignoring detectability) in the previous 18 years ranged from 65-95% (mean = 81%), and the mean moose count/occupied plot ranged from 7.0-18.5 (annual mean = 11.3). Crews observed an average of 3.0 moose groups per occupied plot (range: 1-9) in 2023 compared to an average of 5.6 groups/plot (annual range: 3.2-9.3) in the previous 18 years. The average group size in 2023 was 2.1 moose (range: 1-6) compared to a mean of 2.0 (range: 1.8-2.4) in the previous 18 years. Visual obstruction estimates in 2023 averaged 48% (range: 5 to 80) and the average estimated detection probability was 0.52 (range: 0.26 to 0.83). The latter is less than mean values observed in previous years (range: 0.55 to 0.66), which reflects slightly larger and more clustered VO values, on average, in 2023 (see Giudice 2023). The latter suggests that moose in the 2023 survey tended to be associated with more screening cover than usual, which resulted in lower estimated detection probabilities (on average), greater expansion for visibility, and increased sampling uncertainty.

After adjusting for sampling and sightability, the estimated moose population in northeastern Minnesota was 3,290 moose (90% CI: 2,480–4,560) (Table 1, Figure 2). Bulls, cows, and calves accounted for about 45%, 40%, and 15% of the estimated population total, respectively. Estimated bull density was 0.25 bulls/mi^2 overall (90% CI: 0.18 to 0.35). However, it varied by stratum: 0.16 bulls/mi^2 (90% CI: 0.09 to 0.32) in the low stratum, 0.24 bulls/mi^2 (90% CI: 0.15 to 0.46) in the medium stratum, 0.77 bulls/mi^2 (90% CI: 0.57 to 1.10) in the high stratum, and 0.25 bulls/mi^2 (90% CI: 0.19 to 0.43) in the habitat-plot stratum. This year's estimated calf:cow ratio was 0.38 (90% CI: 0.22 to 0.53) and the bull:cow ratio was 1.26 (90% CI: 0.88 to 1.64). This year's calf:cow ratio is slightly lower than last year's estimate, but is comparable to values we have observed over the last 10 years, especially considering moderate-to-high levels of sampling uncertainty (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 34% compared to last year, but precision of the bull:cow ratio is relatively poor (Figure 4). Furthermore, there is a lot of noise 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 recent field studies that fertility (pregnancy rates) of the population's adult females has been robust (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 down 30% 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. For example, this year's 30% difference was not statistically significant (90% CI on intrinsic rate of change: -0.749 to 0.036, where 0 = no change), meaning the direction of the true population change (between 2022 and 2023) was likely a decrease, but the magnitude of change is uncertain. 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 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 Glen DelGiudice for annual survey planning and coordination; Christopher Lofstuen, Chief Pilot, for coordinating all of the aircraft and pilots; Nancy Hansen for coordinating flights, survey crews, and other important components of this effort; 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 Brad Maas and Grace Zeller skillfully piloted the aircraft during this year's surveys; Nancy Hansen, Mike Schrage, Morgan Swingen, and Jessica Holmes flew as observers, and Bailey Petersen, Chris Balzer, Nick Bogyo, and Josh Koelsch served as backup 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. Dan Raleigh and Brian Haroldson 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 Mike Larson, Seth Goreham, Leslie McInenly, Barb Keller, Nancy Hansen, Mike Schrage, and Morgan Swingen. This work was funded in part by the Federal Aid in Wildlife Restoration Act.

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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, 2005–2023. 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

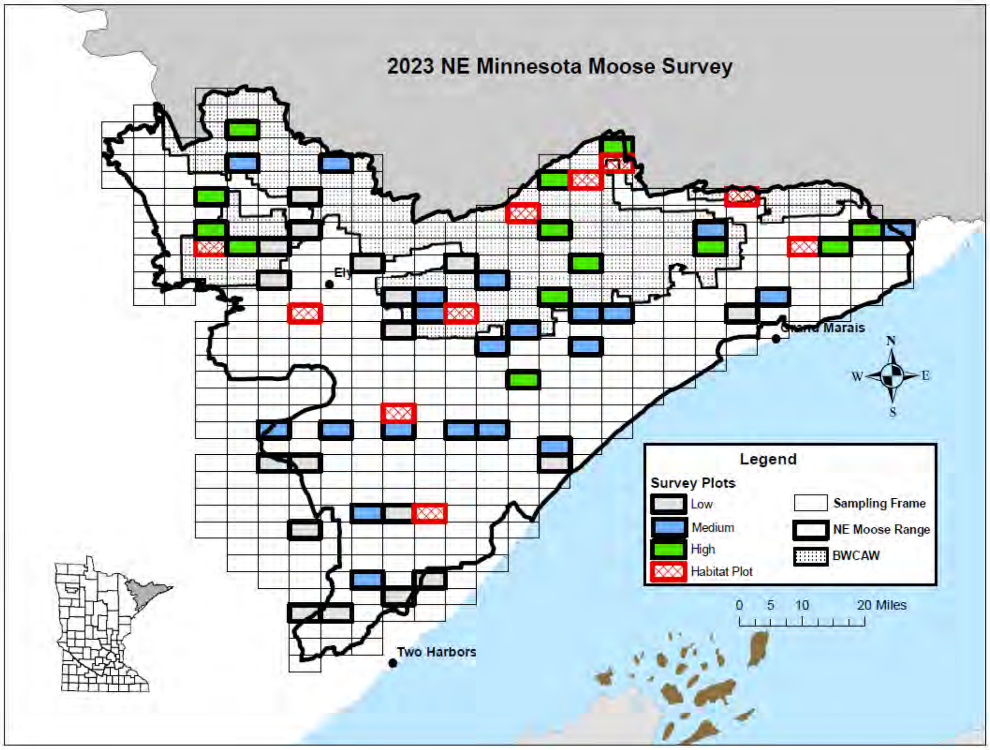

Figure 1. Moose survey area, sampling frame, and the 53 sample plots flown in the 2023 aerial moose survey.

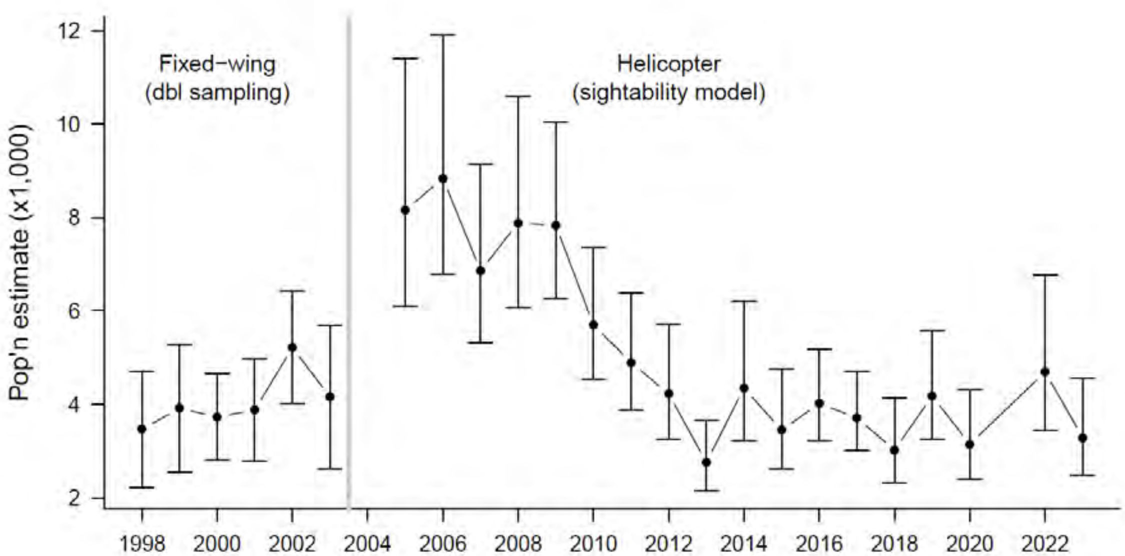

Figure 2. Aerial-survey estimates (with 90% CIs) of moose abundance in northeastern Minnesota, 1998–2023. Note: the 1998-2003 survey period used fixed-wing aircraft, a non-uniform sampling frame, and double sampling to estimate a sightability adjustments, and is not directly comparable to 2005-2023 estimates. It is shown here for documentation.

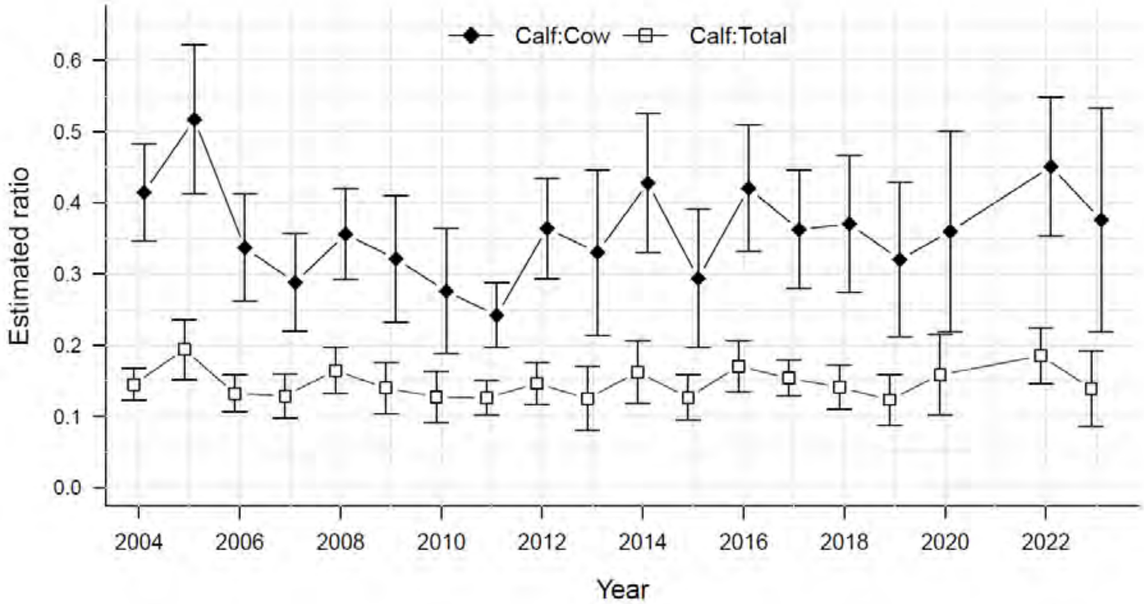

Figure 3. Estimated calf:cow ratios (solid diamonds, with 90% CI) and proportion calves (open squares, with 90% CI) from aerial moose surveys in northeastern Minnesota, 2004–2022. Note: the survey was not conducted in 2021 due to the Covid-19 pandemic.

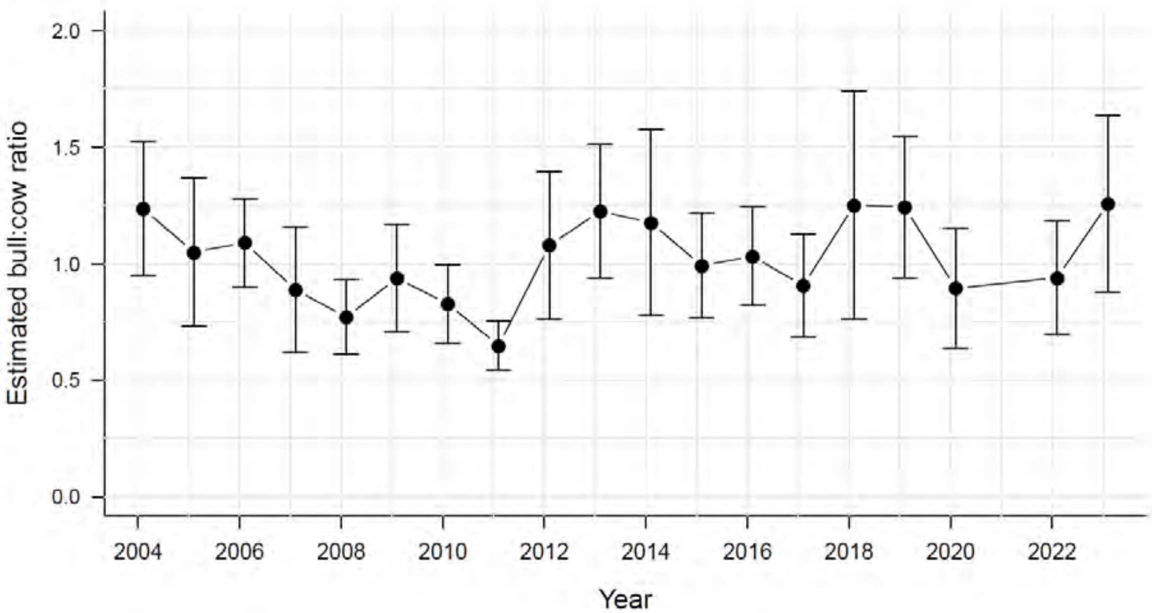

Figure 4. Estimated bull:cow ratios (with 90% CI) from aerial moose surveys in northeastern Minnesota, 2004–2023. Note: the survey was not conducted in 2021 due to the Covid-19 pandemic.

ADDENDUM A: EXPLORING ALTERNATIVE MODES OF INFERENCE

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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 high sampling uncertainty), 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 an unknown parameter that 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 back 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 2005-2023 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 (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 stabilized since 2013 and continues to bounce along at around 3,700 animals. This year's point estimate is down slightly (9%) from last year's estimate, but the magnitude of change is much smaller than suggested by comparing the design-based estimates for 2022 and 2023 (estimated change = 30%). This reflects the fact the 2022 estimate was probably biased high due to sampling uncertainty (i.e., the observed rate of change was not realistic given the estimated statistical distribution from which it was drawn). 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 -0.087 compared to the steep decline during 2010-2013 (mean = -0.165) and the more recent (2014-2023) period of stability (-0.006). 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 = 0.153. 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 trend(s) 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 may 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 and 2017 (Figure A1). The latter may partly explain why the TSM estimator indicated a slight population increase in 2023, whereas both the mHT and state-space estimators indicated a decrease (Figure A1). We are currently working on developing alternative approaches to smoothing that would be less sensitive to the number and location of nodes.

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 2005-2023 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 at least stabilized since then (with annual estimates fluctuating around 3,500-4,000 moose). The trend is 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 or when we switch 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. 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). Dr. Katie Sinclair (Professor of Statistics at Carleton College) and her students are working on developing some alternative approaches for smoothing. 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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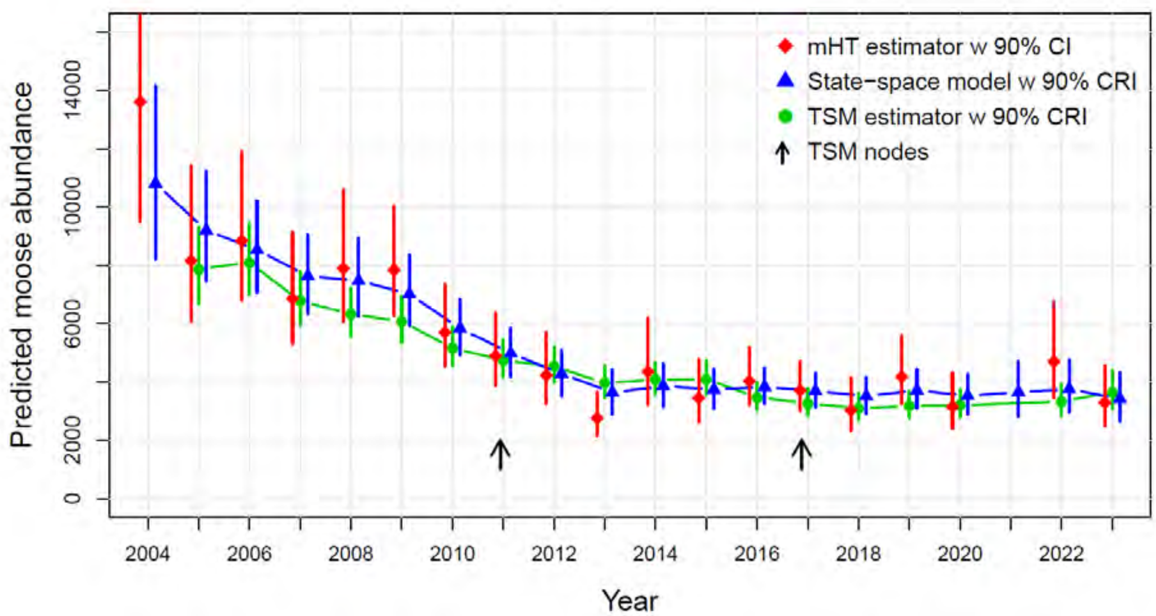

Figure A1. Comparison of moose population estimates (with 90% CIs) from the design-based Horvitz-Thompson estimator (mHT, red diamonds), state-space model (blue triangles), and the TSM estimator (green dots). The location of TSM nodes (change points) are denoted with arrows.

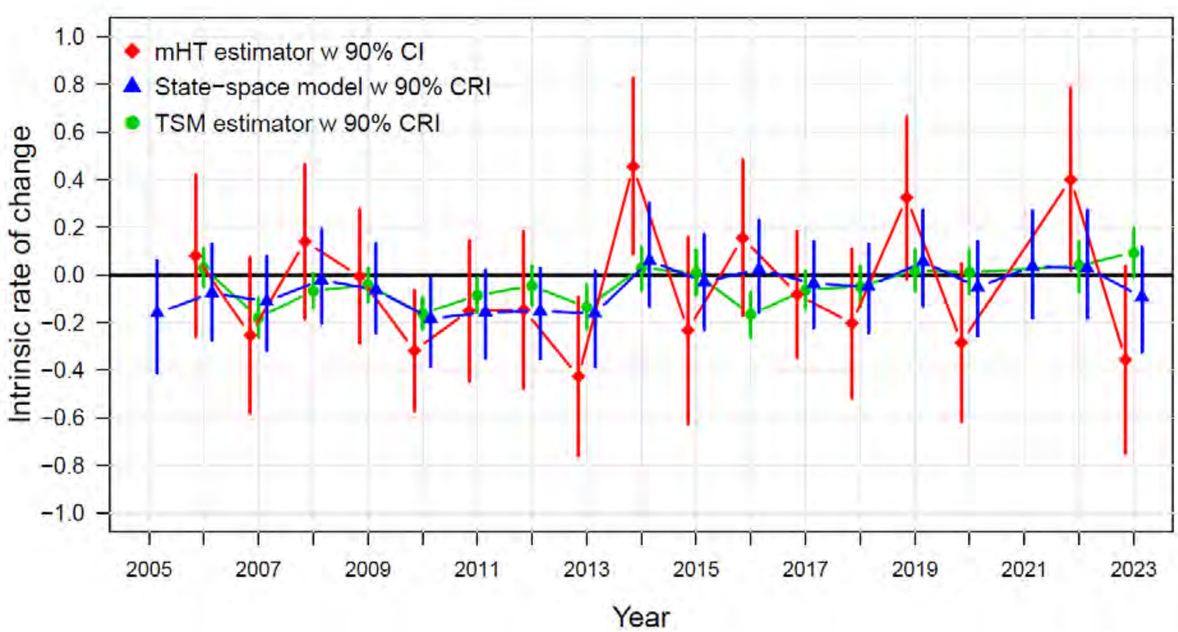

Figure A2. Estimated intrinsic rates of annual population change (0 = no change, + = increase, – = decrease) based on the conventional mHT estimator (red diamonds), state-space model (blue triangles), and TSM estimator (green dots).

MINNESOTA WOLF POPULATION UPDATE 2023

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

INTRODUCTION

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

In 2012, wolves in the Western Great Lakes Distinct Population Segment were removed as a listed species under the federal Endangered Species Act. The de-listing coincided with the normally scheduled (every 5th year) wolf survey as well as survey timeline specifications in the Minnesota Wolf Management Plan (i.e., first and fifth year after delisting; Minnesota Department of Natural Resources 2001). The 2012-13 survey (Erb and Sampson 2013) concluded that overall wolf range had expanded along its south and west edge, but with only minor change in the total amount of land occupied by wolf packs; similar patterns were found 5 years later as part of the winter 2017-18 survey (Erb et al. 2018).

After federal de-listing in 2012, wolf harvest seasons were established and population surveys have been conducted annually to better inform annual management decisions. In the first three winters after de-listing, wolf population point estimates varied from approximately 2,200 to 2,400 (Erb et al. 2014). In December 2014, following the third consecutive wolf harvest season, a court ruling returned wolves in Minnesota to the list of federally threatened species. Since that time, wolf surveys have continued on an annual basis. Herein we provide an update of population status from the 2022-23 winter survey.

METHODS

The methodology used to estimate wolf population size in Minnesota utilizes three primary pieces of information: 1) an estimate of the total area of land occupied by wolf packs; 2) an estimate of average wolf pack territory size; and 3) an estimate of average mid-winter pack size. It is likely that occupied range changes on a comparatively slow timescale compared to fluctuations in average territory and pack size. As such, occupied range is estimated at approximately 5-year intervals, with the last being during winter 2017-18; we assume that occupied range has remained unchanged (i.e., 73,972 km^2; Erb et al. 2018) and use that in our population calculations for winter 2022-23. An updated estimate is anticipated for winter 2023-24.

To track pack movements, we and various collaborators captured wolves using foothold traps (LPC # 4, LPC #4 EZ Grip, or LPC #7 EZ Grip) approved as part of research conducted under the Association of Fish and Wildlife Agencies Best Management Practices for trapping program. Some wolves are also captured with the use of live-restraining neck snares (Gese et al. 2019), and a few by helicopter dart-gun. Wolves were typically immobilized using a mixture of either Ketamine:Xylazine or Telazol:Xylazine. After various project-specific wolf samples and measurements were obtained, an antagonist (Yohimbine or Atipamezole) and an antibiotic were typically administered to all animals prior to release. Various models of tracking collars were deployed depending on study area and collar availability. Most GPS collars were programmed to take 3-6 locations per day, and wolves fitted with VHF-only collars were relocated at approximately 7- to 10-day intervals throughout the year, or in some cases, primarily from early winter through spring.

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

In past surveys where all or the majority of territories were delineated using comparatively few VHF locations, raw territory sizes were increased 37% to account for the average amount of interstitial space between delineated wolf pack territories, as estimated from several Minnesota studies (Fuller et al. 1992:50) where the number of VHF locations per pack typically averaged 30-60. Interstitial spaces are a combination of small voids created by landscape geometry and wolf behavior, but can also be an artifact of territory underestimation when there are fewer locations. Hence, for packs with < 100 locations (n = 3; mean number of locations = 12), we multiplied each estimated territory size by 1.37 as in the past. For packs with > 100 locations (n = 36; mean number of locations = 3,109), territories were assumed to be fully delineated and not re-scaled.

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

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

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

Using the accelerated bias-corrected method (Manly 1997), the population size confidence interval (90%) was generated from 9,999 bootstrapped re-samples of the pack and territory size data and does not incorporate uncertainty in estimates of occupied range or percent lone wolves. For purposes of discussion, we base our informal assessments of significant differences in results across years on visual comparison of the degree of confidence interval overlap (Cumming and Finch 2005).

RESULTS AND DISCUSSION

Pack and Territory Size

We obtained location data on 39 packs (Figure 1) that were monitored during all or part of the survey period (April 2022 to April 2023). Both territory and winter pack size data were available from 27 of the marked wolf packs. Twelve additional wolf packs had adequate location data to delineate territories, but we were unable to obtain a reliable mid-winter pack count. In addition, we used pack count data for 3 packs on which we did not have a collared wolf to delineate a territory.

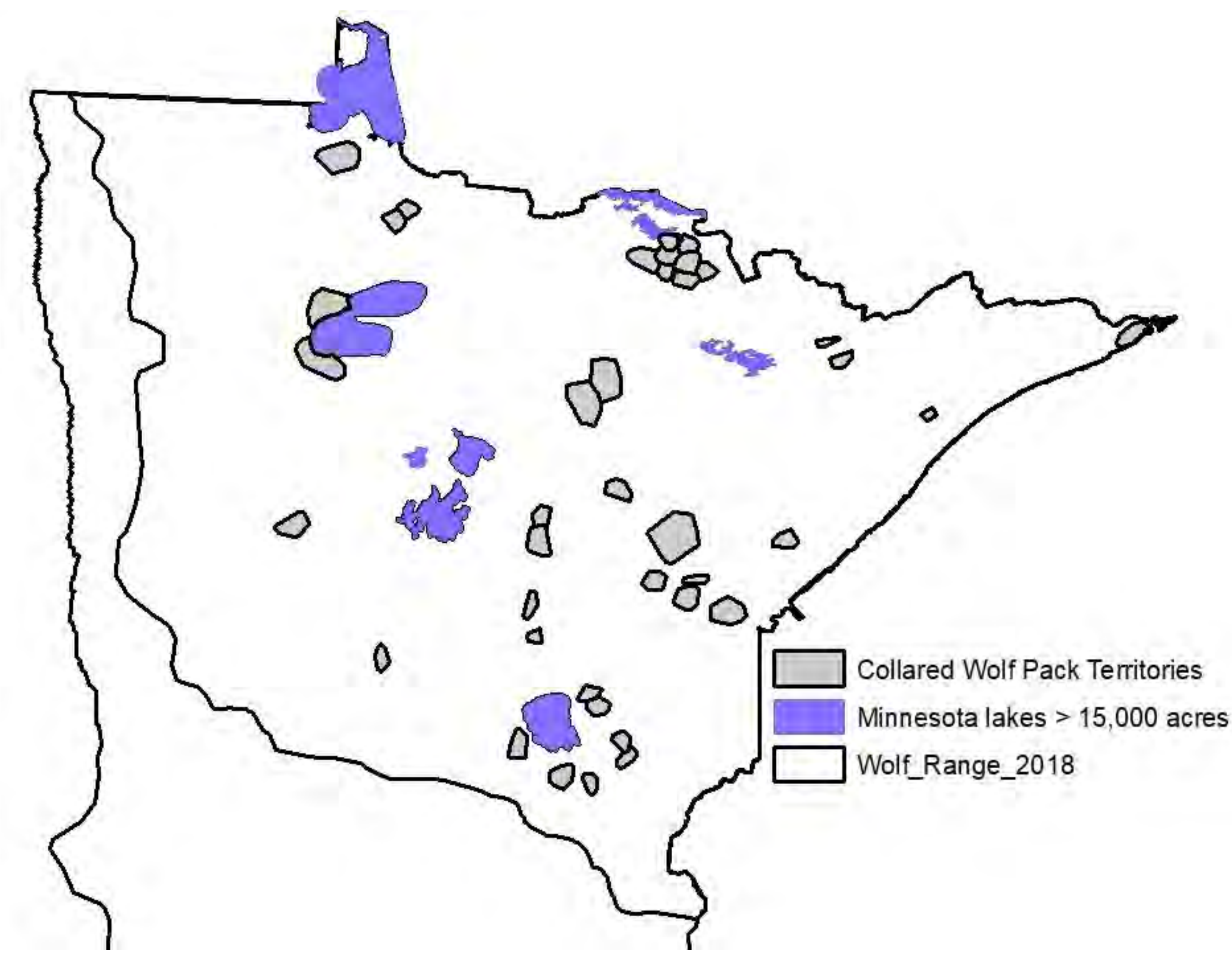

Figure 1. Location of territories for marked wolf packs during the 2022-23 survey.

A land cover comparison using the 2019 National Land Cover Database suggests that land cover in territories of collared packs reasonably reflected habitat in overall occupied wolf range, with some under-representation of agricultural and emergent wetland cover types and over-representation of deciduous forest and woody wetlands in collared pack territories (Table 1). Using spring 2022 deer density data (MNDNR, unpublished data) for deer hunting permit areas, weighted by number of radio-collared wolf packs in a permit area, we estimate an average of approximately 16.2 deer/mi^2 (pre-fawn) in territories of radio-marked packs during spring 2022. In comparison, 2022 spring deer density for the entirety of occupied wolf range, weighted by permit area and excluding permit areas within which a majority of the permit area is not considered pack-occupied, was approximately 19.4 deer/mi^2.

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

	Overall Occupied Wolf range	Radio-collared Wolf Territories
Land Cover Category	% Area	% Area
Woody Wetlands	38.2	42.6
Deciduous Forest	17.5	21.0
Emergent Herbaceous Wetlands	10.9	8.1
Mixed Forest	11.3	11.3
Evergreen Forest	5.3	4.6
Open Water	4.8	3.4
Shrub/Scrub	1.8	2.3
Pasture/Hay/Grassland/Crops	7.8	4.2
Developed, All	2.3	2.5

[a] Land cover data derived from the 2019 National Land Cover Database

Like 2 of the past 3 years, the point estimate for average territory size in 2022-23 was on the low end of previous averages (Figure 2). After applying the territory scaling factors, average estimated territory size for radio-marked packs during the 2022-23 survey was 117.2 km^2 (range = 35 – 429 km^2).

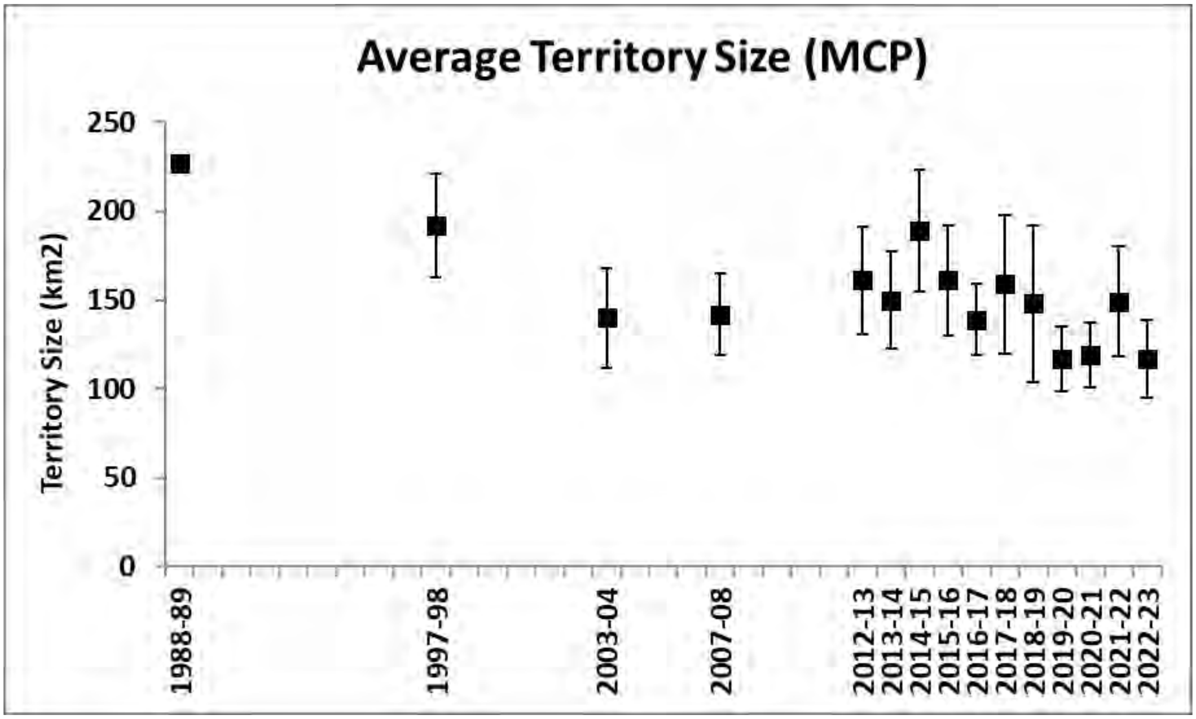

Figure 2. Average scaled territory size for marked wolf packs in Minnesota from winter 1988-89 to 2022-23.

The point estimate for average winter pack size was within the range of variation observed over the past 3 winters, but below the long-term average (Figure 3). Average winter pack size in 2022-23 was estimated to be 3.93 (pack size range = 2 – 9).

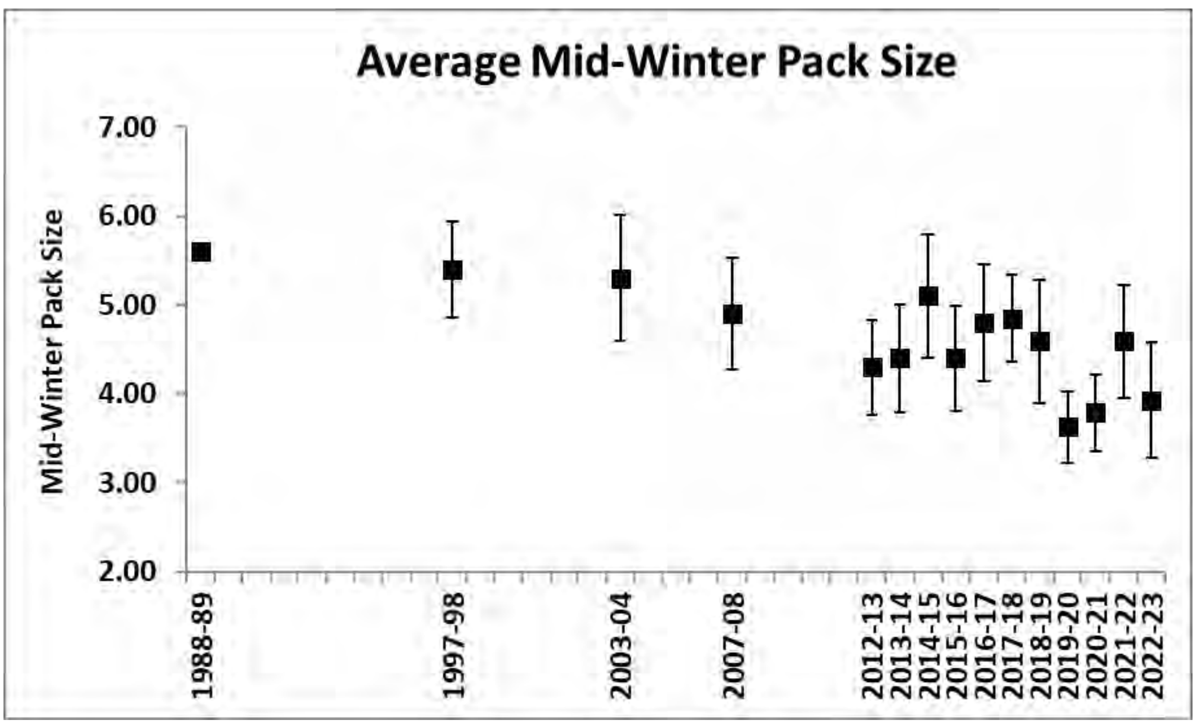

Figure 3. Average mid-winter pack size for marked wolf packs in Minnesota from winter 1988-89 to 2022-23.

Wolf Abundance

With an average territory size of 117 km^2 and assuming occupied range has not changed since the 2017-18 survey (73,972 km^2; Erb et al. 2018), we estimate a total of 631 wolf packs in Minnesota during winter 2022-23 (Figure 4). Although also influenced by the estimated amount of occupied range, trends in the estimated number of packs are inversely correlated with trends in estimated territory size (i.e., for a given amount of occupied range, increases in average territory size yield lower estimates of the number of packs within the state).

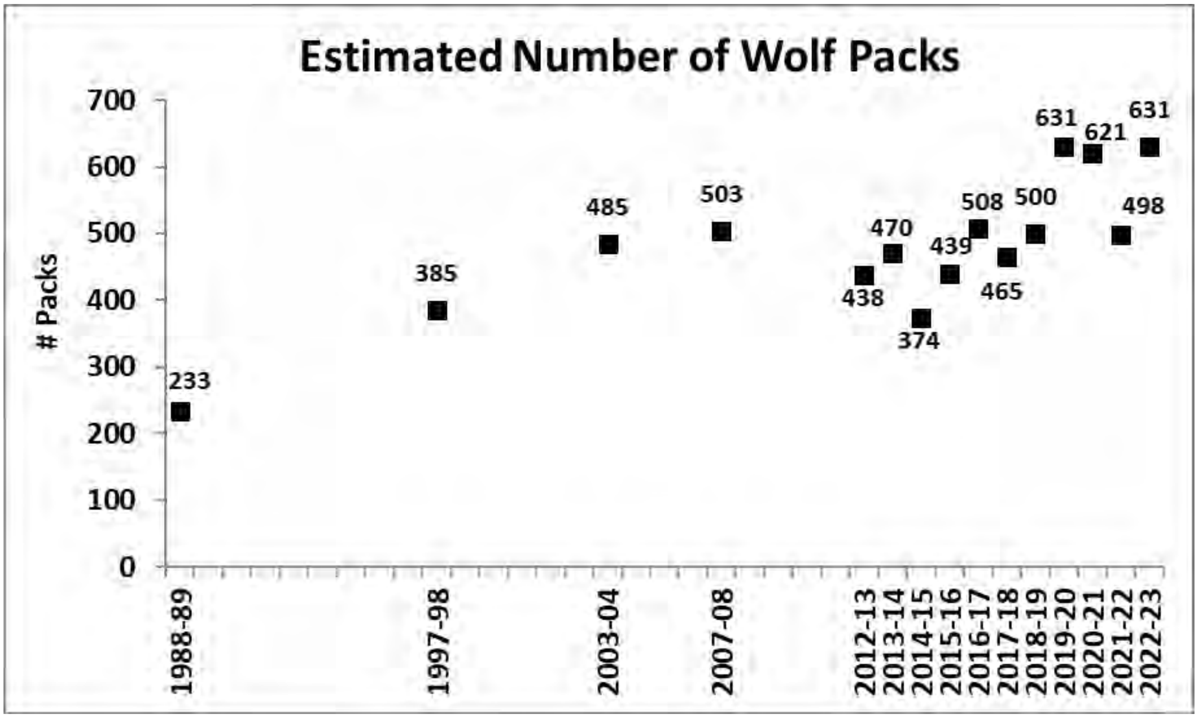

Figure 4. Estimated number of wolf packs in Minnesota at periodic intervals from winter 1988-89 to 2022-23.

After accounting for the assumed 15% lone wolves in the population, we estimate the 2022-23 mid-winter wolf population to be 2,919 wolves, or 3.95 wolves per 100 km^2 of occupied range. The 90% confidence interval was approximately +/- 800 wolves, specifically 2,215 to 3,790. Given the nearly complete overlap with the 2021-22 confidence interval, we conclude that the 2022-23 statewide wolf population size was unchanged from the previous winter. Like 2 of the past 3 years, the population was estimated to be composed of more but smaller packs than in the past (Figures 3 and 4).

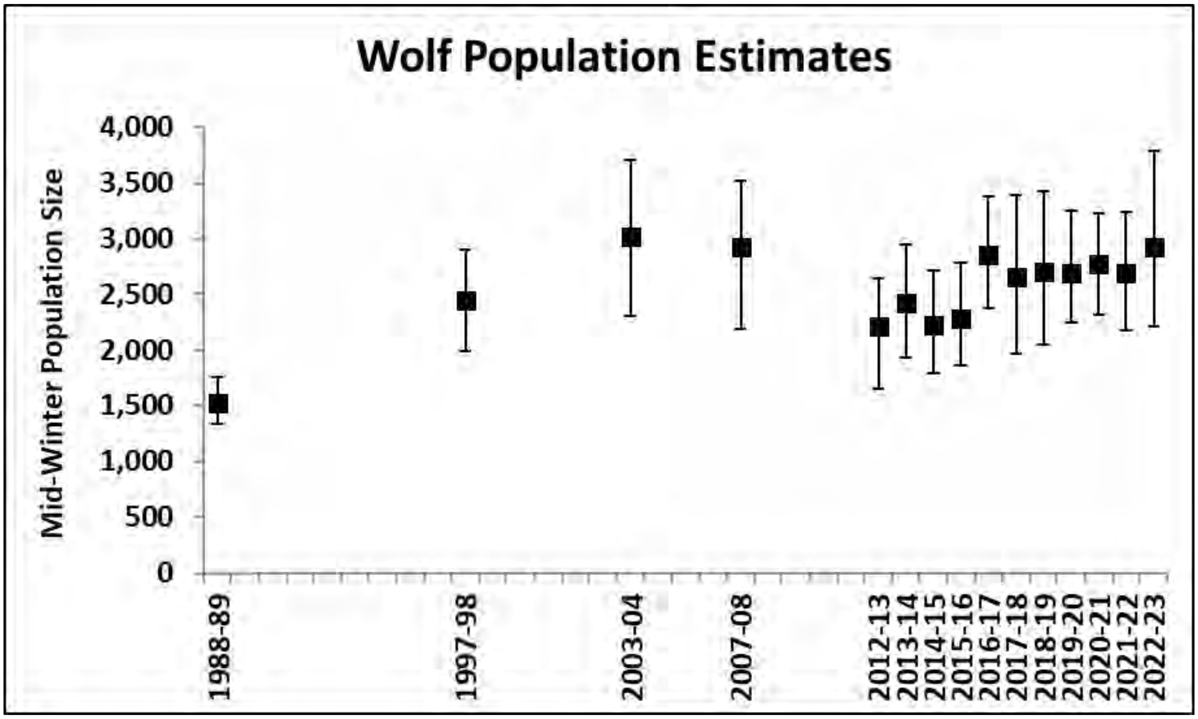

Figure 5. Wolf population estimates from periodic standardized surveys in Minnesota from winter 1988-89 to 2022-23.

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WETLAND WILDLIFE POPULATIONS

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2023 WATERFOWL BREEDING POPULATION SURVEY, MINNESOTA

Steve Cordts, Minnesota DNR, Waterfowl Staff Specialist,

ABSTRACT

The number of breeding waterfowl in a portion of Minnesota has been estimated each year since 1968 as a part of the overall inventory of North American breeding waterfowl. The survey consists of aerial observations in addition to more intensive ground counts on selected routes to determine the proportion of birds counted by the aerial crew. Procedures used are similar to those used elsewhere across the waterfowl breeding grounds. The 2023 aerial survey portion was flown from May 7-23. This year was a late spring across the entire state and ice-out dates were 10-15 days later than median ice-out dates on most lakes. Temperatures in April averaged 3.5°F below normal and precipitation was 0.33 inches above normal statewide. Temperatures in May averaged 4.3°F above normal and precipitation was 0.95 inches below normal statewide. Overall, wetland numbers (Types II-V) were 16% lower than 2022 but 4% above the 10-year and 11% above the long-term average.

The breeding population estimate of mallards was 222,000, which was 4% lower than the 2022 estimate of 231,000 mallards, but statistically unchanged (P = 0.89). Mallard numbers were 10% below the 10-year average and 3% below the long-term average.

The breeding population estimate of blue-winged teal was 126,000, which was 22% lower than the 2022 estimate of 161,000 blue-winged teal but statistically unchanged. Blue-winged teal numbers were 26% below the 10-year average and 40% below the long-term average.

The combined population estimate of other ducks (excluding scaup) was 133,000, which was 24% below the 2022 estimate of 175,000 other ducks, 27% below the 10-year average and 26% below the long-term average. Wood ducks, ring-necked ducks, and gadwall were the most abundant species of other ducks.

The estimate of overall duck abundance, which excludes scaup, was 481,000 ducks and was 15% below the 2022 estimate of 567,000 ducks and 20% below the 10-year average and 22% below the long-term average. The estimated number of Canada geese was 115,000 and unchanged from the 2022 estimate, 18% below the 10-year average and 26% below the long-term average.

The estimated number of swans was 39,000 compared to 25,000 last year. The swan population continues to increase and expand their breeding range across the state and a statewide estimate now likely exceeds 65,000 adults in the spring.

Despite the late spring, wetland habitat conditions were favorable in May and early indications are that production (number of young birds hatched) will be good for ducks, geese, and swans.

METHODS

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

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

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

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

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

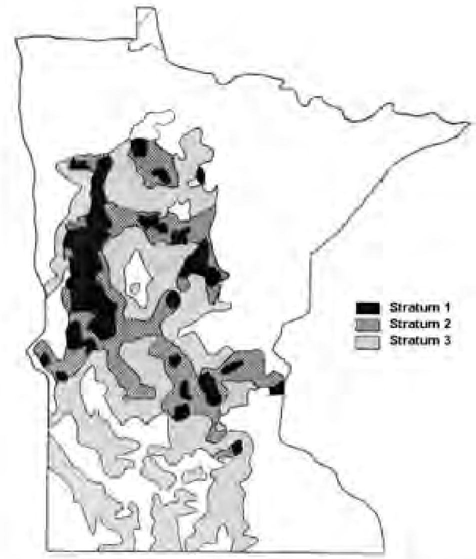

Figure 1. Location of waterfowl breeding population survey strata in Minnesota.

All aerial transects in Strata I-III (Table 1) were flown using an American Champion Scout and 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. There were a number of wetlands on 4 ground transects that were not counted due to lack of permission from landowners. This would lower the VCF, and waterfowl estimates, but an unknown amount.

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 2019 and 2022 were compared using two-tailed Z-tests.

SURVEY CHRONOLOGY

The 2023 aerial survey began on 7 May in southern Minnesota and concluded in northern Minnesota on 23 May. Transects were flown on 10 days (May 7-8, May 10, May 15-17, May 20-23) and completed in 52 flight hours. Flights began near 7 AM and were completed by 12:00 PM each day. The median date for survey completion was May 17, which was similar to recent years. Some larger lakes in northern MN were still ice-covered on May 7 when the survey began. Most flight delays this year were due to smoke/fog.

WEATHER AND HABITAT CONDITIONS

Across most of the state, ice-out was 10-15 days later than median ice-out dates. Temperatures in April averaged 3.5°F below normal and precipitation was 0.33 inches above normal statewide. Temperatures in May averaged 4.3°F above normal statewide and precipitation was 0.95 inches below normal statewide (https://www.dnr.state.mn.us/climate/index.html). Precipitation from early April until the survey was completed showed near average precipitation in most regions of the state (Appendix A).

Overall wetland conditions in spring 2023 were good but slightly worse than last year. In early May 2023, the U.S. drought monitor indicated 60% of the state was under no drought designation, 39% of the state was abnormally dry, and 1% moderate drought. In early May 2022, 94% of the state was under no drought designation and 6% of the state was abnormally dry. Wetland conditions in 2023 declined throughout the nesting season and by early July 2023, 2% of the state had no drought designation, 42% of the state was abnormally dry, 48% under moderate drought, and 8% under severe drought (http://droughtmonitor.unl.edu).

Wetland numbers (Types II-V) in 2023 were an estimated 286,000 wetlands, which was 16% below the 2022 estimate of 341,000 ponds. Wetland numbers were 4% above the 10-year average and 11% above the long-term average (Table 2; Figure 2). The number of temporary (Type 1) sheet water wetlands was 85% below the 2022 estimate and 74% below the long-term estimate.

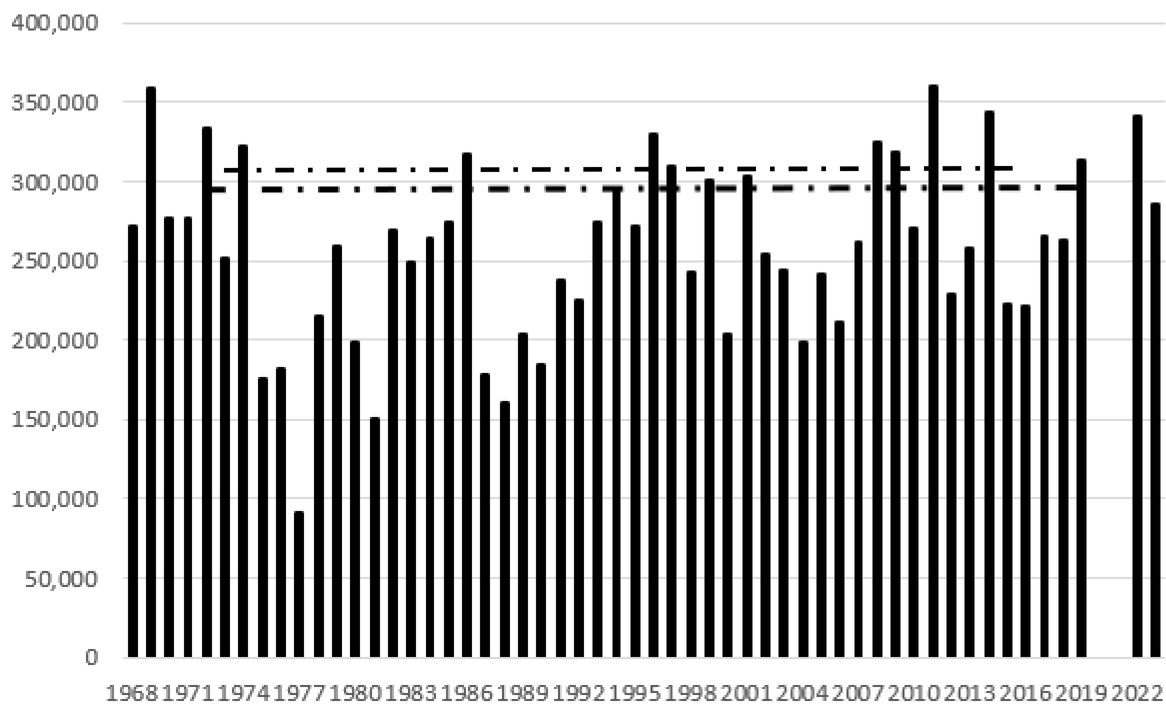

Figure 2. Number of May ponds (Type II-V) and long-term average (dashed line) in Minnesota, 1968-2023.

Planting dates for row crops were earlier than last year and similar to 5-year averages. On May 15, 61% of the corn acres had been planted compared to 31% in 2022. Similarly, 30% of soybean acres had been planted by May 15 compared to 10% in 2022. By June 5th, about 46% of alfalfa hay had been cut compared to 23% last year (Minnesota Agricultural Statistics Service Weekly Crop Weather Reports, (http://www.nass.usda.gov/mn/).

WATERFOWL POPULATIONS

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

Annual Visibility Correction Factors (VCFs) are calculated and used for mallards, blue-winged teal, other ducks combined, and Canada geese (Table 7, Table 8). In 2023, the VCFs were very low for all species, which in part is due to some wetlands on ground routes not being counted due to lack of permission. The mallard VCF (1.79) was 20% below the long-term average and the lowest in over 30 years. The blue-winged teal VCF (3.45) was 11% below the long-term average. The VCF for other ducks (2.52) was 17% below the long-term average. The VCF for Canada geese (1.52) was 30% below the long-term average. Due to the late spring, leaf out and emergence of wetland vegetation did not seem to affect visibility from the air until the final few days of the survey on northern transects.

The 2023 breeding population estimate of mallards was 222,000 (SE = 49,387), which was 4% lower than the 2022 estimate of 231,000 mallards, but statistically unchanged ($Z = 0.14$, $P = 0.89$) (Table 7, Figure 3). Mallard numbers were 10% below the 10-year average and 3% below the long-term average of 230,000 mallards. In 2023, the mallard population was comprised of 69% lone or flocked males, 8% pairs, and 22% flocked mallards. The 5-year average is 77% lone or flocked males, 12% pairs, and 11% flocked mallards. The increase in mallards in flocks this year was in part due to one unusually large flock (>200) of ducks (mainly mallards) on a cultivated rice field.

The 2023 breeding population estimate of blue-winged teal was 126,000 (SE = 65,470), which was 22% lower than the 2022 estimate of 161,000 blue-winged teal but statistically unchanged. Blue-winged teal numbers were 26% below the 10-year average and 40% below the long-term average (Table 7, Figure 4). The blue-winged teal population was comprised of 12% lone males, 49% pairs, and 39% flocks. The 5-year average is 9% lone males, 44% pairs, and 39% flocks.

The combined population estimate of other ducks (excluding scaup) was 133,000 which was 24% below the 2022 estimate of 175,000 other ducks, 27% below the 10-year average and 26% below the long-term average (Table 7, Figure 5). Wood ducks, ring-necked ducks, and gadwall were the most abundant species of other ducks (Table 6). Scaup numbers (15,000) were 63% below the 2022 estimate and 75% below the long-term average.

The estimate of total duck abundance, which excludes scaup, was 481,000 ducks and was 15% below the 2022 estimate of 567,000 ducks and 20% below the 10-year average and 22% below the long-term average (Table 8, Figure 6).

The population index for total ducks was 496,000 ducks, which was 18% below the 2022 estimate, 22% below the 10-year average and 27% below the long-term average.

The population estimate of Canada geese (adjusted for visibility) was 115,000, which was unchanged from the 2022 estimate and 18% below the 10-year average (Table 8, Figure 7). A single Canada goose brood was observed this year compared to the 10-year average of 27 Canada goose broods observed, which is another indication of a very late spring.

The estimated number of swans (likely all trumpeters) was 39,000 compared to the 2022 estimate of 25,000 (Table 6; Figure 8). Lone swans are not doubled and the estimate is expanded for area but not visibility, although visibility of swans is extremely high. Trumpeter swans continue to increase exponentially in numbers and expand their range further south and west from core breeding areas in north central and central Minnesota. In May 2022, a swan survey was flown in northeast Minnesota that estimated 26,000 adult trumpeter swans (Herberg and Rettler, 2022) in that portion of the state. By combining those estimates, the number of swans in Minnesota this spring likely exceeded 65,000 swans.

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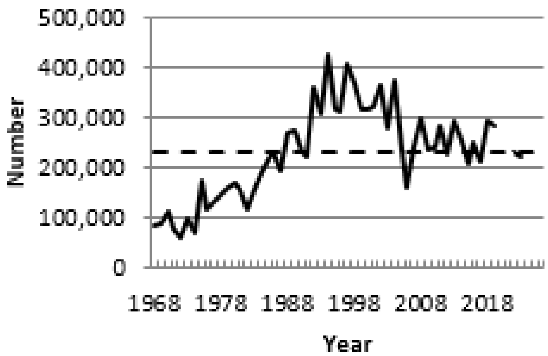


Figure 3. Mallard population estimates (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1968-2023.

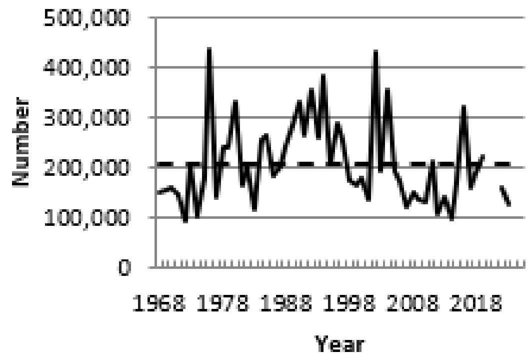


Figure 4. Blue-winged teal population estimates (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1968-2023.

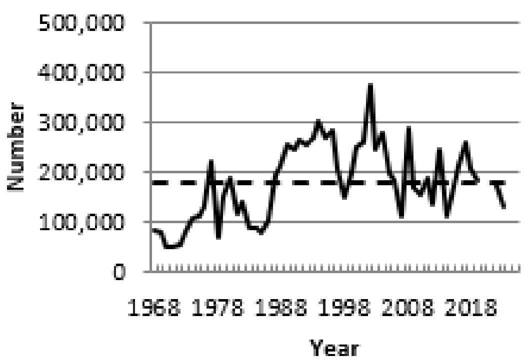


Figure 5. Other duck (excluding scaup) population estimates (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1968-2023

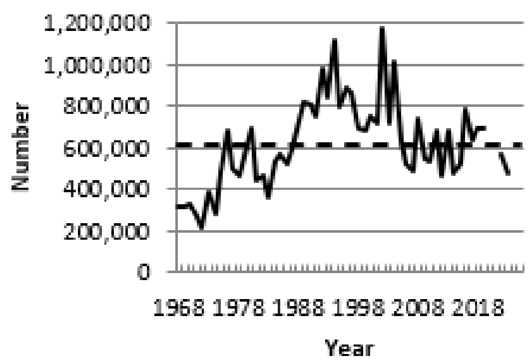


Figure 6. Total duck (excluding scaup) population estimates (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1968-2023

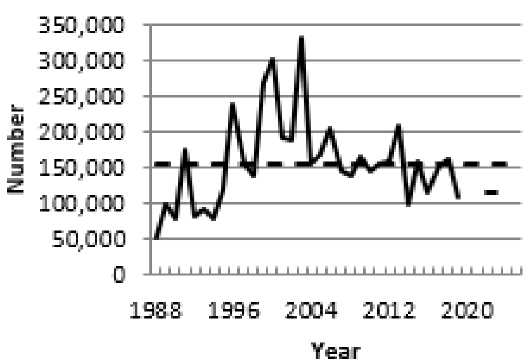


Figure 7. Canada goose population (adjusted for visibility bias) and long-term average (dashed line) in Minnesota, 1988-2023.

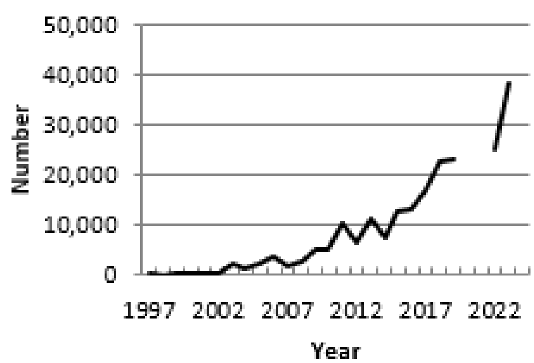


Figure 8. Trumpeter swan population in Minnesota, 1997-2023.

Table 1. Survey design for Minnesota, May 2023.[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), 1968-2023.

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	No survey
			2021	No survey	No survey
			2022	100,000	341,000
			2023	15,000	285,880
		Averages:	10-year	41,000	274,000
			Long-term	58,000	257,000
		% change from:	2022	-85%	-16%
			10-year	-63%	4%
			Long-term	-74%	11%

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

Table 3. Minnesota waterfowl breeding populations by species for Stratum I (high wetland density), expanded for area but not visibility, 2002-2023.

	Year																		
Species	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2022	2023
Dabblers:																			
Mallard	25,937	29,381	19,050	16,829	16,357	25,104	19,467	18,439	19,856	18,911	21,161	19,522	19,633	26,020	21,688	23,160	23,632	22,466	21,966
Black Duck	0	0	56	0	0	0	0	0	0	0	333	167	222	0	56	0	0	0	0
Gadwall	1,250	2,111	1,166	1,444	889	1,166	1,055	1,000	167	1,389	722	555	1,083	1,000	2,138	1,888	167	278	389
American Wigeon	56	555	167	0	56	111	56	56	111	222	222	167	111	111	167	167	111	250	111
Green-winged Teal	222	444	56	56	167	278	167	56	56	56	0	0	56	111	278	0	0	56	0
Blue-winged Teal	9,664	23,771	9,303	5,665	5,332	9,942	5,998	7,304	4,665	5,110	4,193	3,388	4,360	6,998	8,609	4,888	3,860	5,360	4,249
Northern Shoveler	278	1,166	333	167	56	1,000	666	1,027	111	56	333	722	111	666	916	333	500	167	167
Northern Pintail	111	56	0	56	0	56	56	0	111	0	111	167	222	0	111	111	56	0	0
Wood Duck	4,499	8,081	5,498	3,555	2,666	6,665	4,277	3,999	3,416	4,138	3,249	2,527	2,222	5,610	4,971	6,498	5,276	3,971	4,832
Dabbler Subtotal	42,017	65,565	35,629	27,772	25,523	44,322	31,742	31,881	28,493	29,882	30,324	27,215	28,020	40,516	38,934	37,045	33,602	32,548	31,714
Divers:																			
Redhead	333	805	666	666	916	1,389	472	944	805	750	861	1,333	583	2,166	1,000	333	639	417	250
Canvasback	1,333	666	972	833	1,000	2,277	1,333	1,222	833	722	1,555	1,777	1,027	1,944	2,666	1,277	1,250	1,194	1,944
Scaup	2,055	5,971	4,110	111	555	6,276	8,553	2,777	2,222	1,055	1,000	1,250	5,526	10,969	7,359	1,500	2,694	1,250	1,222
Ring-necked Duck	1,361	5,165	1,722	2,055	1,555	21,494	6,859	3,138	4,804	2,666	3,582	4,554	3,110	8,220	12,608	4,221	6,220	2,055	4,277
Goldeneye	0	222	222	56	222	278	278	222	56	56	333	444	278	278	1,000	500	111	222	278
Bufflehead	111	389	167	222	56	1,611	833	389	278	56	611	56	278	500	2,444	611	222	1,027	444
Ruddy Duck	417	305	1,222	305	0	1,027	861	28	56	0	305	111	694	1,500	222	1,722	305	83	305
Hooded Merganser	333	278	333	555	111	666	944	555	500	555	333	666	1,000	1,222	1,222	1,222	2,333	1,111	1,111
Large Merganser	972	0	111	0	278	333	333	333	111	56	222	139	167	56	167	56	56	56	0
Diver Subtotal	6,915	13,801	9,525	4,803	4,693	35,351	20,466	9,608	9,665	5,916	8,802	10,330	12,663	26,855	28,688	11,442	13,830	7,415	9,831
Total Ducks	48,932	79,366	45,154	32,575	30,216	79,673	52,208	41,489	38,158	35,798	39,126	37,545	40,683	67,371	67,622	48,487	47,432	39,963	41,545
Other:																			
Coot	2,666	21,411	2,444	639	139	16,829	2,166	139	2,194	444	10,386	2,360	1,972	10,608	13,191	7,137	83	2,360	666
Canada Goose	22,160	23,160	22,938	21,633	29,797	18,717	16,523	16,440	13,691	26,437	23,771	18,578	23,077	17,995	18,273	25,854	18,717	18,967	14,996
Swan	1,000	305	417	861	389	694	500	694	1,611	1,277	2,944	1,944	2,472	3,693	4,054	3,804	4,665	6,748	10,136

Table 4. Minnesota waterfowl breeding populations by species for Stratum II (medium wetland density), expanded for area but not visibility, 2002-2023.

	Year																		
Species	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2022	2023
Dabblers:																			
Mallard	34,715	44,474	26,883	25,130	24,779	27,935	23,494	21,507	30,974	29,689	27,409	28,987	24,078	32,085	26,299	26,533	33,312	32,903	47,806
Black Duck	0	0	0	0	0	0	0	0	0	0	0	0	117	0	0	117	0	0	117
Gadwall	584	3,565	584	1,052	234	3,039	1,169	1,286	935	1,987	701	234	818	1,286	4,442	2,805	4,091	1,052	584
American Wigeon	0	2,513	117	0	0	351	0	351	0	117	234	0	234	234	1,052	234	468	234	234
Green-winged Teal	234	234	0	117	0	0	234	117	0	0	117	351	584	0	0	0	117	117	234
Blue-winged Teal	15,955	30,624	11,513	9,000	8,416	12,740	11,104	8,474	12,390	9,000	4,383	7,364	5,026	10,753	15,487	8,007	9,760	8,240	11,162
Northern Shoveler	1,403	1,753	234	584	351	468	701	2,513	1,052	0	351	935	877	935	3,857	584	2,279	935	701
Northern Pintail	117	0	0	0	234	0	0	0	234	0	0	117	0	0	0	0	117	234	234
Wood Duck	4,558	8,766	3,273	1,753	2,221	6,546	5,260	6,312	6,955	5,143	4,792	1,636	1,753	4,149	4,851	5,961	4,792	4,442	2,805
Dabbler subtotal	57,566	91,929	42,604	37,636	36,235	51,079	41,962	40,560	52,540	45,936	37,987	39,624	33,487	49,442	55,988	44,241	54,936	48,157	63,877
Divers:																			
Redhead	584	1,110	292	175	935	935	584	760	1,578	468	468	526	468	1,110	818	117	175	117	58
Canvasback	1,052	234	0	0	1,169	468	234	117	584	117	935	1,286	1,169	1,403	2,338	234	701	351	468
Scaup	2,279	7,188	2,981	468	643	3,097	2,104	0	1,929	935	2,045	2,396	4,909	5,318	5,260	1,344	1,052	1,636	4,208
Ring-necked Duck	2,455	5,377	1,929	3,331	1,578	13,149	9,117	2,396	11,455	1,695	6,253	5,143	4,325	4,792	9,292	4,968	3,214	4,675	3,507
Goldeneye	234	351	117	117	0	351	584	468	468	584	935	1,519	935	1,169	818	234	234	1,403	701
Bufflehead	117	468	351	117	117	1,403	818	643	1,403	468	0	818	0	234	2,279	584	234	3,682	1,052
Ruddy Duck	2,688	0	351	58	0	0	175	409	58	234	117	0	351	643	468	0	1,461	0	0
Hooded Merganser	701	234	234	351	234	584	701	117	2,221	1,636	701	234	1,169	2,455	3,448	1,403	2,045	1,403	584
Large Merganser	0	234	351	0	0	351	0	0	234	0	234	117	234	117	0	117	117	234	0
Diver subtotal	10,110	15,196	6,606	4,617	4,676	20,338	14,317	4,910	19,930	6,137	11,688	12,039	13,560	17,241	24,721	9,001	9,233	13,501	10,578
Total Ducks	67,676	107,125	49,210	42,253	40,911	71,417	56,279	45,470	72,470	52,073	49,675	51,663	47,047	66,683	80,709	53,242	64,169	61,658	74,455
Other:																			
Coot	1,519	8,007	584	292	409	23,961	0	117	292	292	2,571	877	0	0	6,370	584	1,169	23,377	0
Canada Goose	22,091	28,461	20,688	26,825	25,890	19,753	22,675	18,935	14,201	23,260	22,442	20,572	24,312	17,533	21,799	27,994	19,286	28,169	21,507
Swan	994	701	1,461	994	468	1,519	2,922	2,279	7,188	3,507	6,604	3,740	5,318	4,325	5,084	10,169	10,344	8,708	19,169

Table 5. Minnesota waterfowl breeding populations by species for Stratum III (low wetland density), expanded for area but not visibility, 2002-2023.

	Year																		
Species	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2022	2023
Dabblers:																			
Mallard	55,156	84,561	36,539	30,884	35,843	50,371	35,408	40,976	51,415	47,848	62,638	62,899	51,154	59,593	56,983	57,505	51,937	70,207	53,938
Black Duck	0	174	0	0	174	174	0	0	0	174	174	0	0	0	0	0	0	174	435
Gadwall	1,566	6,960	2,001	5,568	4,176	870	1,392	1,392	4,089	1,566	5,220	1,914	2,088	9,570	5,046	7,134	6,873	3,045	2,697
American Wigeon	174	1,566	1,044	174	348	348	174	348	1,044	174	348	174	1,566	870	174	0	348	870	348
Green-winged Teal	174	0	174	522	0	0	0	0	174	348	696	0	348	0	348	174	870	2,610	870
Blue-winged Teal	21,140	39,758	27,578	23,663	15,659	18,095	20,183	16,964	44,716	35,669	18,617	21,227	24,098	53,155	39,323	42,455	35,321	31,232	21,227
Northern Shoveler	870	3,828	348	522	870	4,002	2,088	6,873	2,088	8,265	6,786	522	1,914	4,959	3,219	1,392	696	1,740	348
Northern Pintail	174	348	174	174	348	174	0	174	0	174	174	0	174	522	174	522	0	522	174
Wood Duck	12,702	20,705	7,482	7,308	5,394	14,442	10,266	12,354	13,659	10,962	12,180	9,657	8,265	8,700	16,094	11,919	10,875	15,050	12,267
Dabbler subtotal	91,956	157,900	75,340	68,815	62,812	88,476	69,511	79,081	117,185	105,180	106,833	96,393	89,607	137,369	121,361	121,101	106,920	125,450	92,305
Divers:																			
Redhead	174	1,740	1,479	0	522	783	870	174	4,350	3,306	1,827	1,566	1,305	1,044	3,480	1,914	1,131	3,219	783
Canvasback	1,131	2,784	0	0	348	1,566	1,218	348	1,044	1,044	696	522	696	348	1,914	522	696	1,218	0
Scaup	783	17,747	5,307	1,392	696	5,481	1,914	522	5,133	696	8,874	2,871	435	3,915	22,271	8,091	11,919	14,963	435
Ring-necked Duck	1,479	5,133	10,179	6,699	1,392	8,526	6,525	3,045	6,264	9,135	6,960	5,568	3,480	4,089	18,095	6,177	5,742	11,136	4,611
Goldeneye	1,305	696	1,044	1,044	870	348	522	174	870	0	348	174	1,218	870	1,566	1,392	1,044	2,610	1,044
Bufflehead	783	2,088	0	174	696	1,218	870	174	2,871	174	3,915	4,698	522	2,523	1,740	348	3,132	2,610	522
Ruddy Duck	87	2,262	870	696	261	87	348	0	3,828	522	522	174	0	87	1,305	783	1,218	1,131	0
Hooded Merganser	174	1,740	1,218	870	174	696	348	1,218	1,044	1,044	348	348	522	1,392	1,653	3,132	1,914	1,740	1,218
Large Merganser	0	0	261	957	348	348	348	348	174	174	0	0	0	870	957	0	0	870	1,914
Diver subtotal	5,916	34,190	20,358	11,832	5,307	19,053	12,963	6,003	25,578	16,095	23,490	15,921	8,178	15,138	52,981	22,359	26,796	39,497	10,527
Total Ducks	97,872	192,090	95,698	80,647	68,119	107,529	82,474	85,084	142,763	121,275	130,323	112,314	97,785	152,507	174,342	143,460	133,716	164,947	102,831
Other:																			
Coot	7,134	77,427	8,613	14,702	5,742	15,137	7,047	435	1,479	25,664	27,578	15,746	7,917	5,829	10,962	19,139	3,393	31,580	2,610
Canada Goose	43,412	46,717	39,758	27,230	42,629	31,841	28,274	30,710	32,711	37,496	48,022	24,707	43,498	31,145	30,101	38,888	38,192	37,409	39,149
Swan	348	348	522	2,001	1,218	609	1,914	2,175	1,827	1,827	2,088	2,001	4,785	5,394	8,091	8,874	8,178	9,657	9,222

Table 6. Minnesota waterfowl breeding populations by species for Stratum I-III combined, expanded for area coverage but not for visibility, 2002-2023.

	Year																		
Species	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2022	2023
Dabblers:																			
Mallard	115,974	158,416	82,472	72,843	76,979	103,411	78,368	80,922	102,245	96,448	111,208	111,408	94,866	117,698	104,970	107,198	108,881	125,575	123,710
Black Duck	0	174	56	0	174	174	0	0	0	174	507	167	339	0	56	117	0	174	552
Gadwall	3,400	12,635	3,752	8,064	5,298	5,075	3,616	3,677	5,191	4,941	6,643	2,703	3,989	11,855	11,626	11,827	11,130	4,375	3,670
American Wigeon	230	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
Green-winged Teal	630	678	230	694	167	278	400	172	230	404	813	351	988	111	626	174	987	2,782	1,104
Blue-winged Teal	46,759	94,152	48,394	38,328	29,407	40,777	37,286	32,742	61,772	49,779	27,194	31,979	33,484	70,907	63,418	55,349	48,941	44,832	36,638
Northern Shoveler	2,550	6,747	915	1,273	1,276	5,469	3,456	10,413	3,251	8,320	7,470	2,179	2,902	6,560	7,992	2,310	3,475	2,842	1,216
Northern Pintail	402	404	174	230	582	230	56	174	345	174	285	284	396	522	285	633	172	756	408
Wood Duck	21,759	37,553	16,253	12,616	10,281	27,652	19,802	22,664	24,029	20,242	20,221	13,820	12,240	18,459	25,916	24,378	20,943	23,463	19,904
Dabbler subtotal	191,704	315,393	153,573	134,222	124,568	183,876	143,214	151,518	198,218	180,995	175,145	163,232	151,115	227,327	216,282	202,386	195,456	206,153	187,895
Divers:																			
Redhead	1,092	3,656	2,438	842	2,373	3,107	1,926	1,878	6,733	4,523	3,155	3,425	2,356	4,320	5,298	2,364	1,945	3,752	1,091
Canvasback	3,516	3,684	972	833	2,517	4,311	2,785	1,687	2,461	1,883	3,186	3,585	2,892	3,694	6,918	2,033	2,647	2,763	2,411
Scaup	5,117	30,906	12,397	1,971	1,894	14,854	12,571	3,299	9,283	2,686	11,919	6,517	10,870	20,202	34,890	10,934	15,664	17,850	5,865
Ring-necked Duck	5,294	15,675	13,829	12,085	4,525	43,169	22,501	8,579	22,523	13,495	16,795	15,265	10,915	17,101	39,995	15,365	15,177	17,866	12,394
Goldeneye	1,539	1,269	1,383	1,216	1,092	976	1,384	864	1,393	640	1,616	2,138	2,431	2,317	3,384	2,126	1,389	4,235	2,023
Bufflehead	1,011	2,944	517	513	868	4,231	2,521	1,206	4,551	697	4,526	5,572	800	3,257	6,463	1,543	3,588	7,319	2,018
Ruddy Duck	3,192	2,567	2,443	1,060	261	1,114	1,384	437	3,942	756	944	285	1,045	2,229	1,995	2,505	2,984	1,214	305
Hooded Merganser	1,209	2,251	1,785	1,776	519	1,947	1,993	1,890	3,765	3,236	1,383	1,248	2,691	5,068	6,323	5,756	6,292	4,253	2,913
Large Merganser	972	234	723	957	626	1,032	681	681	519	230	456	256	400	1,042	1,124	172	172	1,159	1,914
Diver subtotal	22,942	63,186	36,487	21,253	14,675	74,741	47,746	20,521	55,170	28,146	43,980	38,291	34,400	59,230	106,390	42,798	49,858	60,411	30,934
Total Ducks	214,646	378,579	190,060	155,475	139,243	258,617	190,960	172,039	253,388	209,141	219,125	201,523	185,515	286,557	322,672	245,184	245,314	266,564	218,829
Other:																			
Coot	11,319	106,845	11,641	15,633	6,290	55,927	9,213	691	3,965	26,401	40,535	18,984	9,888	16,437	30,523	26,861	4,645	57,317	3,276
Canada Goose	87,663	98,339	83,384	75,688	98,316	70,311	67,473	66,085	60,603	87,193	94,235	63,857	90,887	66,672	70,172	92,735	76,195	84,545	75,651
Swan	2,341	1,355	2,400	3,855	2,074	2,823	5,336	5,148	10,626	6,611	11,500	7,700	12,575	13,412	17,230	22,847	23,187	25,113	38,527

Table 7. Mallard, blue-winged teal, and other duck (excluding scaup) populations in Minnesota, 1968-2023.

	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	71,258	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
Averages:											
10-year	110,196	2.26	248,025	44,188	46,252	3.78	170,785	56,429	69,797	2.64	182,070
Long-term	103,881	2.22	230,197	38,145	56,618	3.87	209,896	45,952	62,587	3.05	179,038
% change from											
2022	-1%	-3%	-4%	29%	-18%	-4%	-22%	-5%	-33%	13%	-24%
10-year average	12%	-21%	-10%	12%	-21%	-9%	-26%	16%	-25%	-5%	-27%
Long-term average	19%	-20%	-3%	29%	-35%	-11%	-40%	42%	-16%	-17%	-26%

Table 8. Scaup, total ducks (excluding scaup), total ducks, and Canada goose populations in Minnesota, 1968-2023.

	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

	Scaup			Total Ducks (exc. scaup)		Total ducks		Canada geese		
Year	Unad. PI	VCF	PI	Unad. PI	PI	Unad. PI	PI	Unad. PI	VCF	PI
2001	15,743	2.85	44,914	274,892	716,353	290,653	761,267	89,418	2.17	193,887
2002	13,016	4.04	52,606	327,951	1,171,537	340,967	1,224,143	78,200	2.42	189,353
2003	5,117	5.30	27,120	209,529	721,805	214,646	748,925	87,663	3.78	331,094
2004	30,906	2.94	90,926	347,673	1,008,324	378,579	1,099,250	98,339	1.58	155,859
2005	12,397	4.26	52,811	177,663	631,980	190,060	684,791	83,384	2.02	168,469
2006	1,971	4.41	8,692	153,504	521,109	155,475	529,801	75,688	2.73	206,757
2007	1,894	3.73	7,058	137,349	488,517	139,243	495,575	98,316	1.47	144,289
2008	14,854	2.91	43,205	243,763	739,553	258,617	782,758	70,311	1.99	139,708
2009	12,571	2.70	33,979	178,379	541,266	190,950	575,245	67,473	2.44	164,405
2010	3,299	2.84	9,380	168,740	530,744	172,039	540,124	66,085	2.22	146,960
2011	9,283	2.39	22,186	244,105	687,499	253,043	709,685	60,603	2.57	155,750
2012	2,686	2.24	6,021	206,455	468,589	209,141	474,610	87,193	1.81	157,706
2013	11,919	3.57	42,568	207,206	682,895	219,125	725,463	94,235	2.22	208,825
2014	6,517	2.24	14,614	195,006	474,387	201,523	489,001	63,857	1.57	100,255
2015	10,870	3.23	35,062	174,645	524,174	185,515	559,236	90,887	1.77	160,427
2016	20,202	2.74	55,336	266,355	787,087	286,557	842,423	66,672	1.75	117,096
2017	34,890	2.20	76,817	287,782	635,994	322,672	712,811	70,172	2.16	151,740
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
Averages:										
10-year	13,740	2.64	35,691	226,303	600,880	240,042	636,570	80,214	1.74	139,872
Long-term	20,255	3.05	58,797	223,074	619,263	243,324	678,060	51,943	2.18	155,258
% change from										
2022	-67%	13%	-63%	-14%	-15%	-18%	-18%	-11%	12%	0%
10-year average	-57%	-5%	-59%	-6%	-20%	-9%	-22%	-6%	-12%	-18%
Long-term average	-71%	-18%	-75%	-5%	-22%	-10%	-27%	46%	-30%	-26%

Appendix A. Precipitation in selected regions of Minnesota, 1 April - 23 May 2023 (Source: Minnesota DNR; http://www.dnr.state.mn.us/climate/historical/summary.html).

Region	Precipitation	Departure from normal
Northwest	3.42	-0.22
North Central	3.36	-0.47
Northeast	4.45	0.22
West Central	3.65	-0.92
Central	5.81	0.23
East Central	4.88	-0.73
Southwest	4.67	-1.07
South Central	7.60	0.87
Southeast	6.38	-0.44
Statewide	4.80	-0.40

WATERFOWL POPULATION STATUS, 2023.

Waterfowl information is taken from the U.S. Fish and Wildlife Service report Waterfowl Population Status, 2023 by Joshua Dooley, Walt Rhodes, and Nathan Zimpfer. The entire report is available on the Division of Migratory Bird Management website [Waterfowl Population Status, 2023 | FWS.gov]

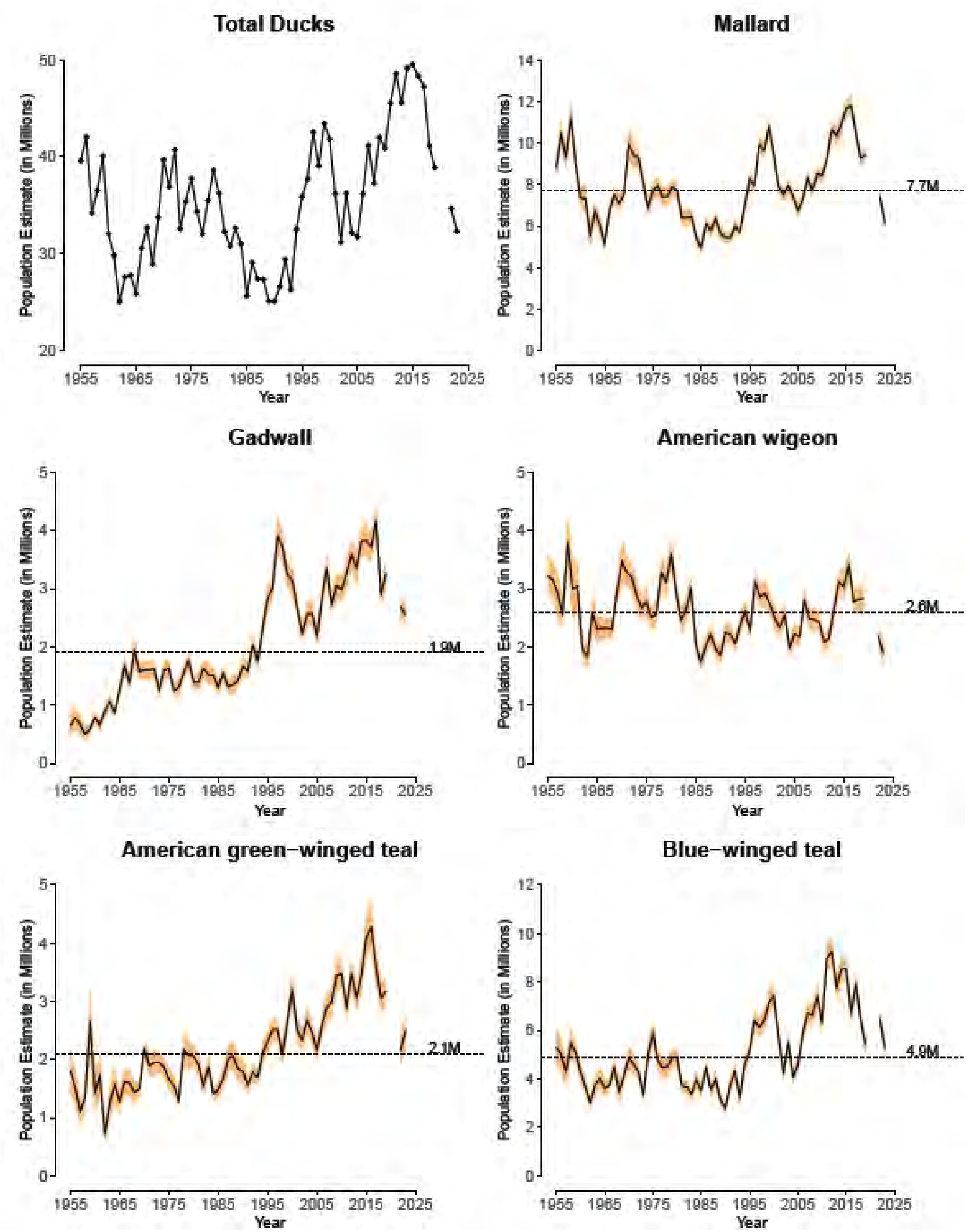


Figure 1. Estimates of North American breeding populations, 90% confidence intervals, and North American Waterfowl Management Plan population goal (dashed line) for selected species and number of water areas in May in Prairie Canada and Northcentral U.S (from: U.S. Fish and Wildlife Service 2023).

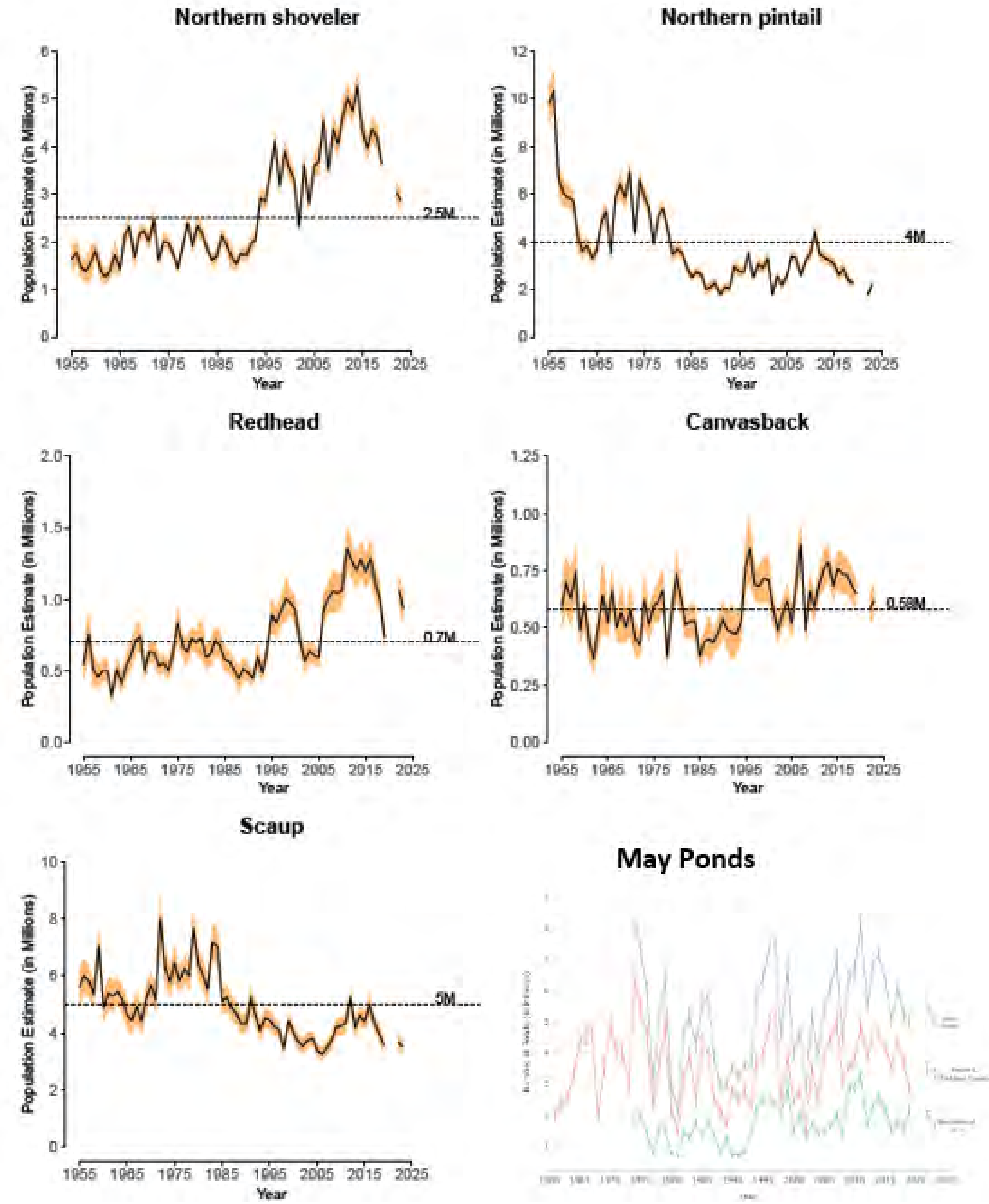


Figure 1. (cont.)

MOURNING DOVE POPULATION STATUS, 2023

Mourning dove information is taken from the U.S. Fish and Wildlife Service report by Seamans, M.E. 2023. Mourning dove population status, 2023. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 20 pp. The entire report is available on the Division of Migratory Bird Management web site

(Mourning Dove Population Status, 2023 | FWS.gov).

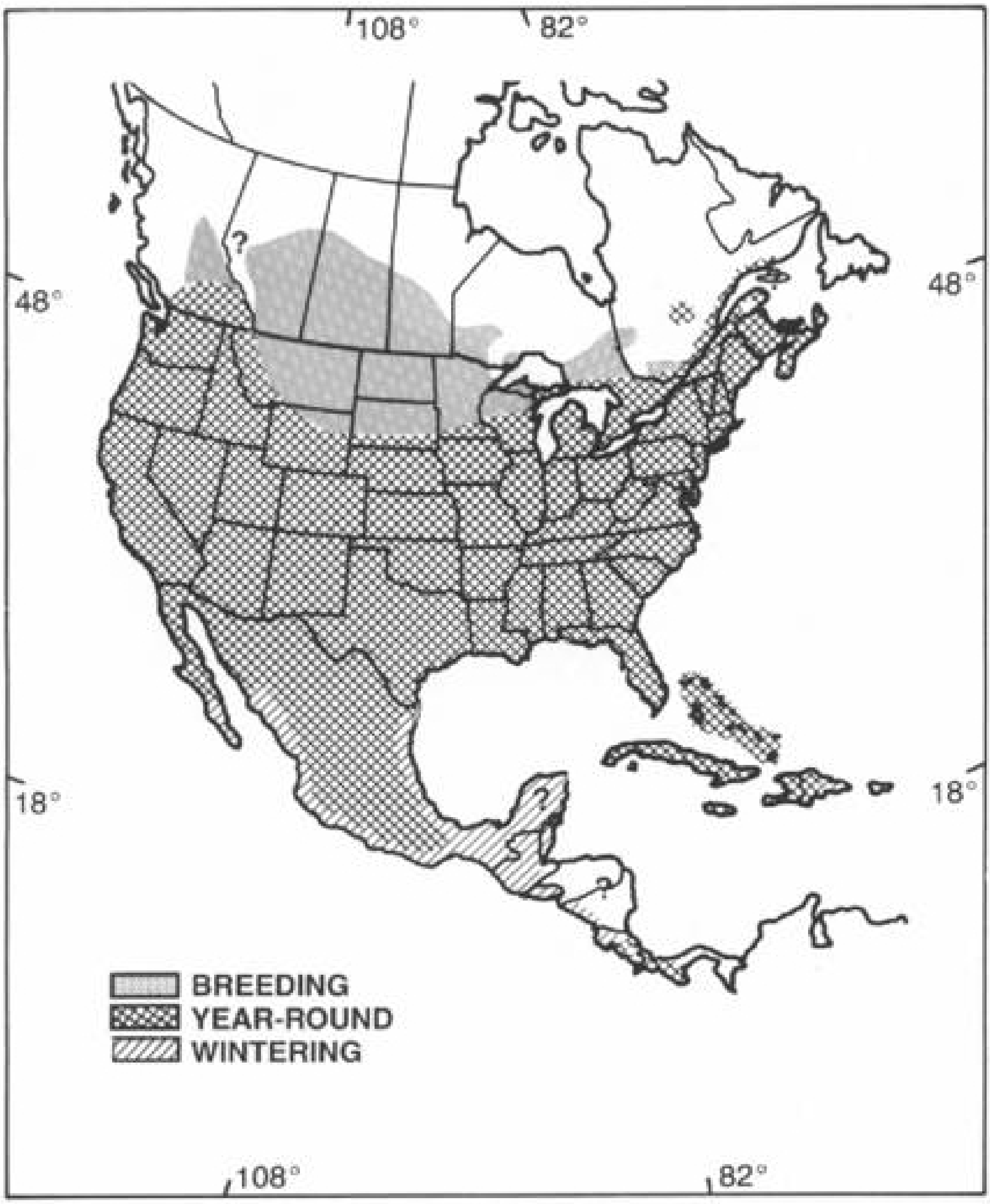


Figure 1. Breeding and wintering ranges of the mourning dove (adapted from Mirarchi and Baskett 1994). (From: Seamans, M.E. 2023. Mourning dove population status, 2023. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 20 pp.)

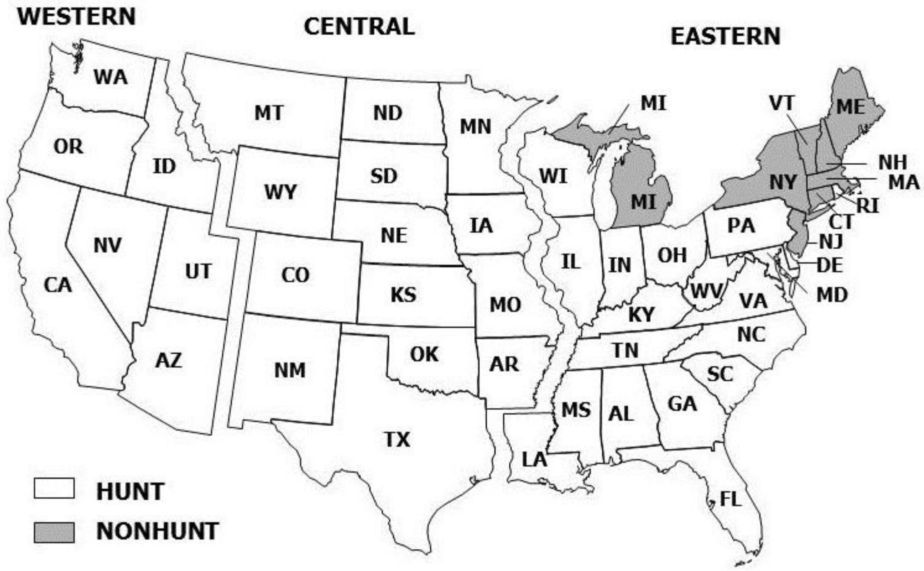


Figure 2. Mourning dove management units with 2022 -23 hunting and non-hunting states. (From: Seamans, M.E. 2022. Mourning dove population status, 2023. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 20 pp.)

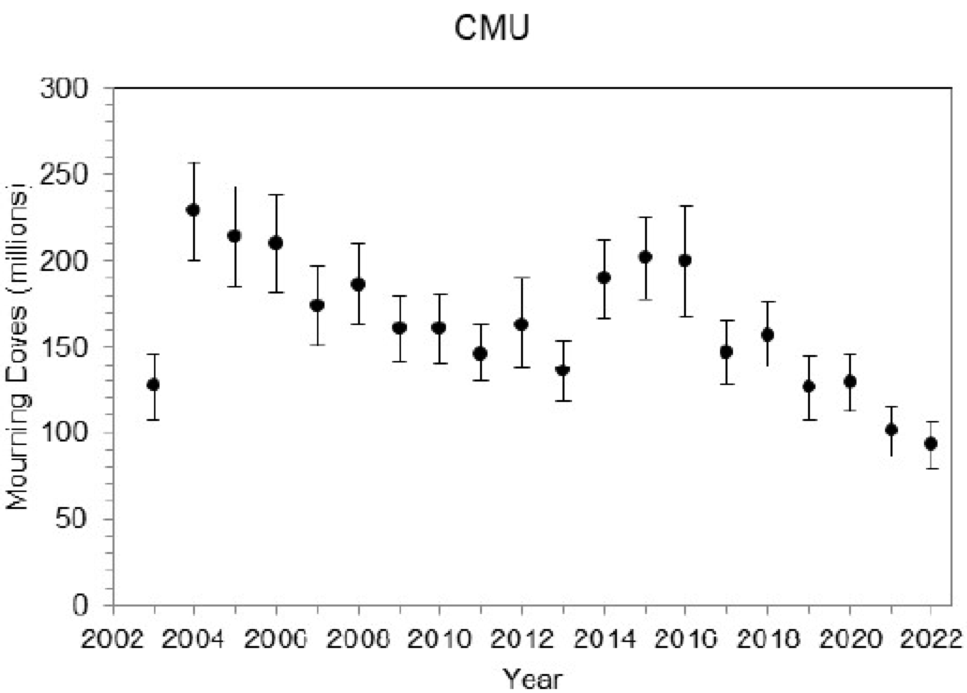


Figure 3. Estimates and 95% confidence intervals of mourning dove absolute abundance by in the Central Management Unit (CMU), 2003-22. Estimates based on band recovery and harvest data. (From: Seamans, M.E. 2023. Mourning dove population status, 2023. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 20 pp.)

Table 1. Preliminary estimates and 95% confidence intervals (CI, expressed as the interval half width in percent) of mourning dove harvest and hunter activity for the Central management unit during the 2020, 2021 and 2022 seasons [a]. (From: Seamans, M.E. 2023. Mourning dove population status, 2023. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 20 pp.)

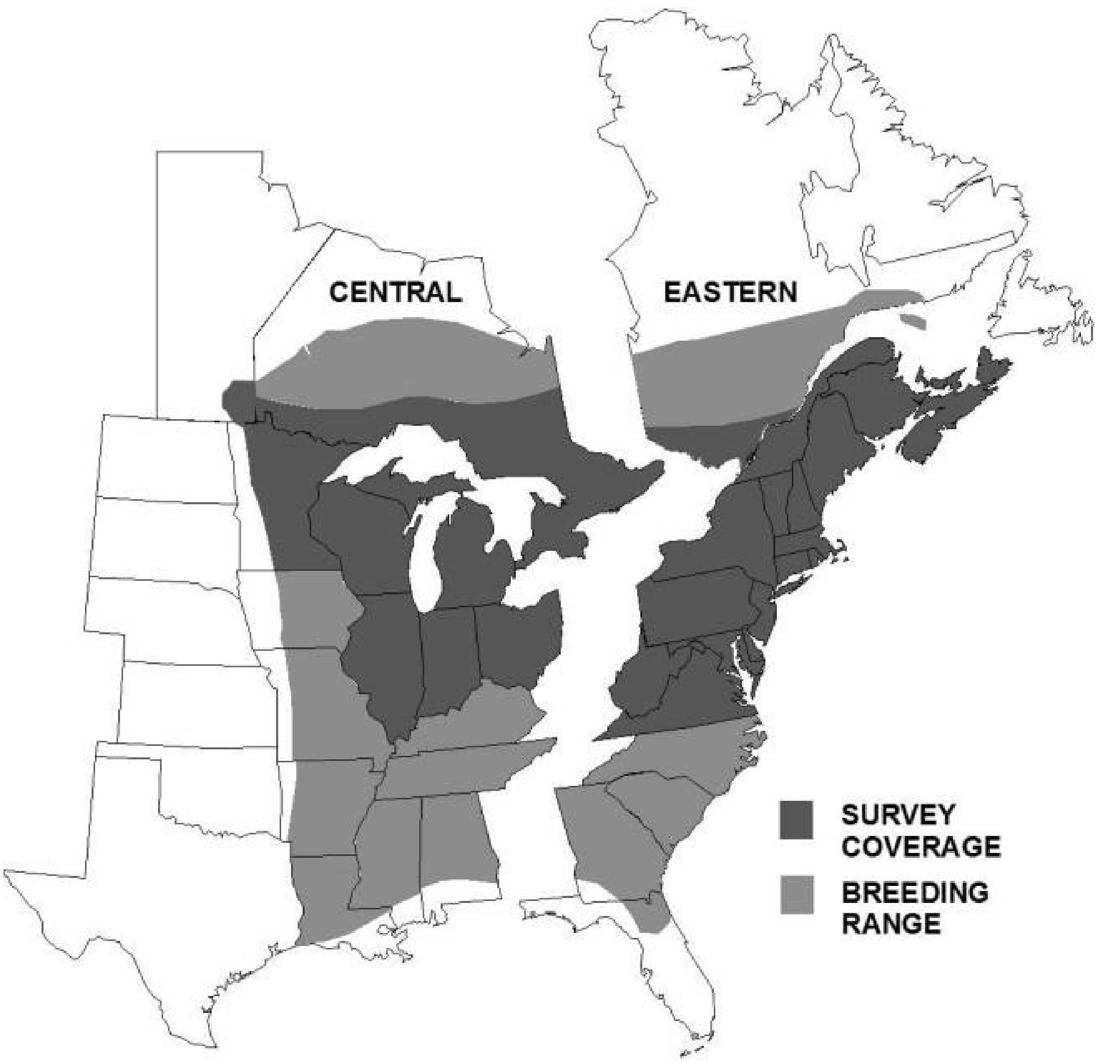
Management unit / State	Active Hunters			Hunter Days Afield			Total Harvest		
	2020	2021	2022	2020	2021	2022	2020	2021	2022
CENTRAL	368,200 [b]	303,500 [b]	281,100 [b]	1,171,000 ±79,800	874,700 ±50,300	659,200 ±28,700	5,885,700 318,100	4,236,600 234,500	4,038,600 239,400
AR	20,000 ±2,300	15,500 ±2,100	10,000 ±1,500	47,600 ±7,300	31,200 ±4,700	20,400 ±4,400	320,300 ±44,600	181,300 ±29,400	123,500 ±24,100
CO	12,700 ±1,000	9,800 ±800	8,700 ±700	27,200 ±2,500	25,700 ±3,000	17,800 ±1,600	124,600 ±11,800	122,900 ±13,900	112,700 ±12,700
IA	9,700 ±700	7,500 ±1,000	6,300 ±700	25,000 ±2,400	20,900 ±4,000	9,300 ±1,400	104,600 ±9,000	61,400 ±10,000	58,300 ±10,700
KS	22,800 ±2,500	25,500 ±2,500	22,000 ±1,600	62,800 ±7,700	64,600 ±6,900	57,000 ±7,300	366,000 ±60,100	400,200 ±44,000	375,600 ±44,300
MN	7,000 ±2,200	4,200 ±2,000	7,200 ±1,300	23,800 ±7,700	9,700 ±2,800	14,800 ±3,000	63,100 ±28,400	22,600 ±6,500	65,800 ±18,500
MO	24,300 ±1,700	19,800 ±2,000	15,600 ±1,600	63,600 ±6,900	51,300 ±6,300	34,900 ±5,300	318,400 ±39,900	259,700 ±39,700	182,600 ±30,800
MT	2,200 ±500	2,100 ±400	1,600 ±600	6,600 ±1,900	4,700 ±1,200	4,000 ±2,000	32,900 ±13,100	18,400 ±4,400	17,900 ±6,700
NE	12,400 ±1,200	10,400 ±1,100	10,000 ±1,200	33,600 ±4,300	27,000 ±3,000	24,500 ±4,100	159,900 ±15,900	148,000 ±15,800	131,000 ±28,000
NM	10,600 ±700	11,500 ±1,400	5,300 ±400	37,000 ±3,400	33,700 ±5,000	14,400 ±1,500	147,400 ±16,600	151,800 ±26,600	77,800 ±10,700
ND	4,500 ±600	5,500 ±900	2,700 ±700	13,900 ±2,800	20,100 ±3,400	4,900 ±1,500	75,400 ±11,400	91,500 ±15,800	33,600 ±15,400
OK	19,000 ±1,800	14,800 ±2,100	14,200 ±1,800	58,200 ±8,800	38,100 ±4,800	30,500 ±6,500	339,600 ±39,300	212,900 ±35,500	149,600 ±38,000
SD	6,000 ±700	5,400 ±900	4,000 ±800	14,500 ±1,600	12,300 ±1,800	9,600 ±2,600	92,800 ±14,800	88,200 ±16,900	50,500 ±17,700
TX	216,100 ±14,000	170,300 ±13,100	172,000 ±6,100	754,800 ±77,400	532,500 ±48,100	412,800 ±25,200	3,729,300 ±300,600	2,467,700 ±218,000	2,640,600 ±224,100
WY	1,000 ±200	1,200 ±300	1,400 ±300	2,300 ±500	2,900 ±800	4,400 ±1,600	11,300 ±2,300	10,000 ±2,600	19,200 ±8,000

[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, 2023

American Woodcock information is taken from the U.S. Fish and Wildlife Service report American Woodcock Population Status, 2023. Seamans, M.E. and R.D. Rau. 2023. U.S. Fish and Wildlife Service, Laurel, MD. 18 pp.



The entire report is available on the Division of Migratory Bird Management website [American Woodcock Population Status, 2023 | FWS.gov]

Figure 1. Woodcock management regions, breeding range, singing-ground survey coverage. (from: Seamans, M.E. and R.D. Rau. 2023. American woodcock population status, 2023. U.S. Fish and Wildlife Service, Laurel, MD. 18 pp.).

Table 1. Short term (2022–23), 10 –year (2013-2023), and long-term (1968-2023) 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. 2023. American woodcock population status, 2023. U.S. Fish and Wildlife Service, Laurel, MD. 18 pp.).

Management Unit/State	Number of Routes[b]	n[c]	2022-23			2013-23			1968-23		
			% Change	95% CI[d] lower	95% CI[d] upper	% Change	95% CI[d] lower	95% CI[d] upper	% Change	95% CI[d] lower	95% CI[d] upper
CENTRAL	441	787	4.64	-1.12	10.82	-1.25	-1.98	-0.49	-0.53	-0.73	-0.33
IL	20	51	-34.94	-69.46	8.98	3.15	-5.92	13.63	-1.08	-3.24	0.97
IN	11	63	0.07	-26.86	36.49	-2.73	-9.86	3.98	-3.73	-5.09	-2.50
MB[e]	13	31	-0.04	-17.76	22.28	-0.38	-3.63	3.01	-0.46	-2.63	1.66
MI	113	161	4.96	-5.29	16.61	-1.64	-2.92	-0.34	-0.65	-0.96	-0.32
MN	78	127	6.26	-6.34	21.21	0.71	-0.94	2.40	0.94	0.44	1.50
OH	34	74	-1.78	-19.38	20.45	-6.04	-9.21	-3.09	-2.24	-2.96	-1.55
ON	89	177	5.86	-6.02	19.67	-2.12	-3.65	-0.52	-1.01	-1.41	-0.60
WI	83	134	4.46	-7.33	18.05	-0.74	-2.39	0.96	-0.01	-0.43	0.41

[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 2023 for which data were received by 27 June, 2023.

[c] Number of routes with at least one year of non-zero data between 1968 and 2023.

[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.

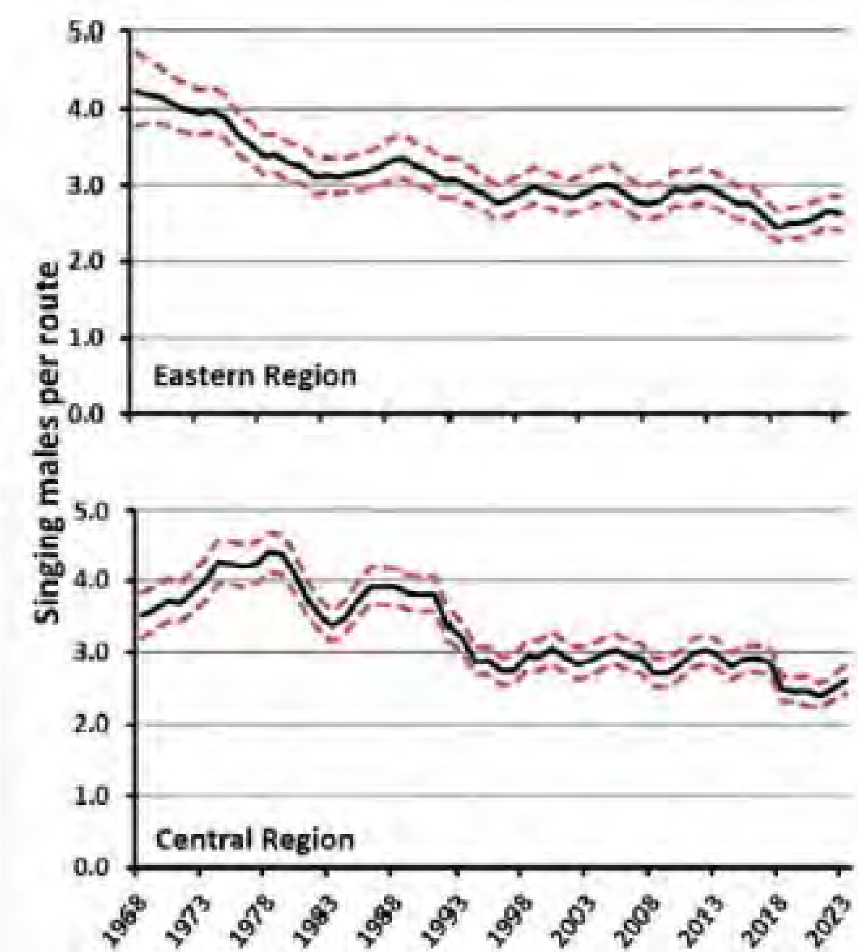


Figure 2. Annual indices of the number of woodcock heard on the Singing-ground Survey, 1968-2023. The dashed lines represent the 95 % credible interval. (from: Seamans, M.E. and R.D. Rau. 2023. American woodcock population status, 2023. U.S. Fish and Wildlife Service, Laurel, MD. 18 pp.).

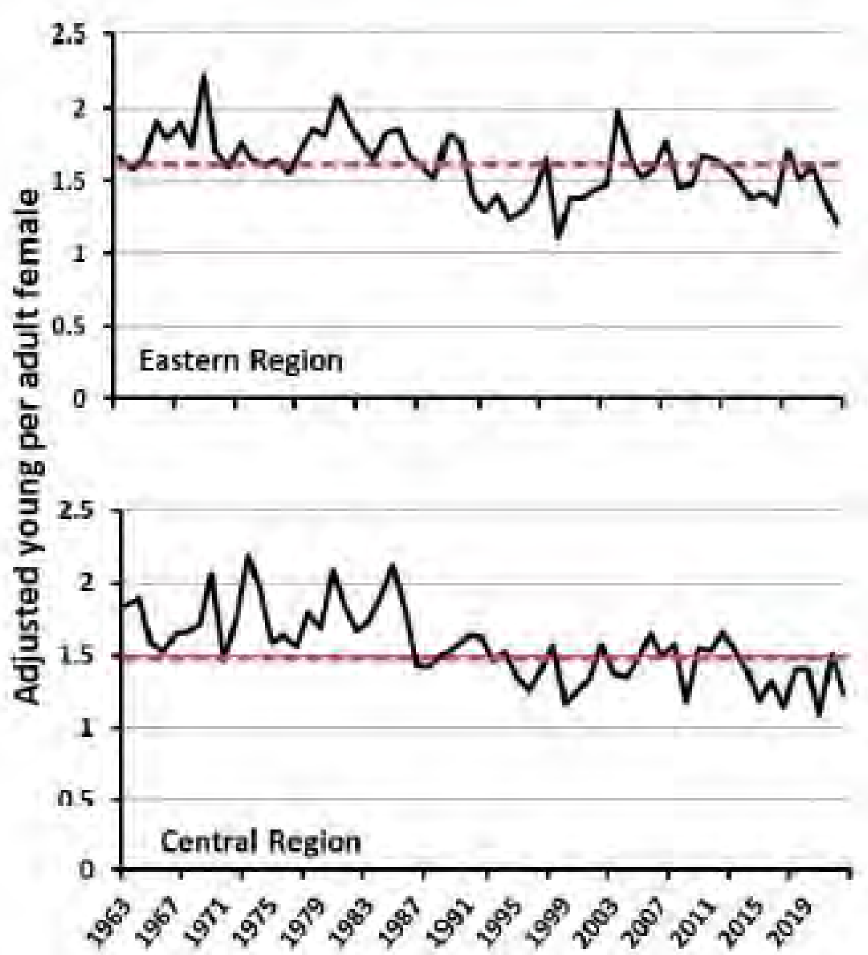


Figure 3. Annual indices of American woodcock recruitment, 1963-2022. Dashed line is the 1963-2021 average. (from: Seamans, M.E. and R.D. Rau. 2023. American woodcock population status, 2023. U.S. Fish and Wildlife Service, Laurel, MD. 18 pp.).

Table 2. Preliminary estimates of woodcock hunter numbers, days afield, and harvest for selected states, from the 2019-20, 2020-21, 2021-22 and 2022-23 Harvest Information Program surveys. (from: Seamans, M.E. and R.D. Rau. 2023. American woodcock population status, 2023. U.S. Fish and Wildlife Service, Laurel, MD. 18 pp.).

Management Unit / State	Active woodcock hunters ([a])				Days afield ([a, c])				Harvest ([a, c])			
	2019-20	2020-21	2021-22	2022-23	2019-20	2020-21	2021-22	2022-23	2019-20	2020-21	2021-22	2022-23
Central Region	n.a. [b]	67,100[d] n.a.[d]	60,700[d] n.a.[d]	68,600[d] n.a.[d]	216,600 ±24,500	260,600 ±23,800	273,100 ±26,900	189,600 ±25,000	136,000 ±18,900	123,700 ±13,300	141,300 ±16,400	112,500 ±8,300
IL	2,300 ±1,600	1,800 ±1,800	1,500 ±1,400	1,800 ±1,700	11,300 ±9,300	5,400 ±5,300	1,500 ±1,400	2,300 ±1,700	3,400 ±3,400	100 ±100	200 ±200	100 ±100
IN	500 ±300	1,100 ±500	800 ±500	1,100 ±900	1,100 ±500	3,200 ±1,600	2,100 ±800	1,400 ±1,000	400 ±100	1,000 ±500	1,700 ±700	300 ±100
MI	19,100 ±2,400	18,500 ±2,100	20,100 ±2,500	23,700 ±5,500	86,100 ±12,600	82,900 ±10,000	93,700 ±11,100	55,800 ±8,700	64,500 ±15,200	37,400 ±5,600	47,500 ±6,000	32,100 ±1,400
MN	8,700 ±1,900	12,000 ±2,100	11,000 ±2,300	14,100 ±4,000	29,300 ±5,700	49,700 ±9,700	47,800 ±10,800	54,700 ±19,200	20,800 ±4,500	25,000 ±4,700	26,300 ±6,600	23,300 ±3,000
OH	1,100 ±900	2,000 ±800	1,500 ±1,100	1,700 ±1,200	2,400 ±1,000	5,200 ±2,200	9,300 ±6,500	3,100 ±1,300	700 ±300	2,900 ±1,300	1,400 ±600	2,100 ±1,300
WI	9,500 ±1,700	17,200 ±2,500	12,900 ±2,200	13,300 ±3,200	47,000 ±9,400	82,300 ±14,800	72,700 ±15,600	45,200 ±10,100	26,800 ±5,300	49,300 ±10,700	42,400 ±12,200	32,600 ±2,900

[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.

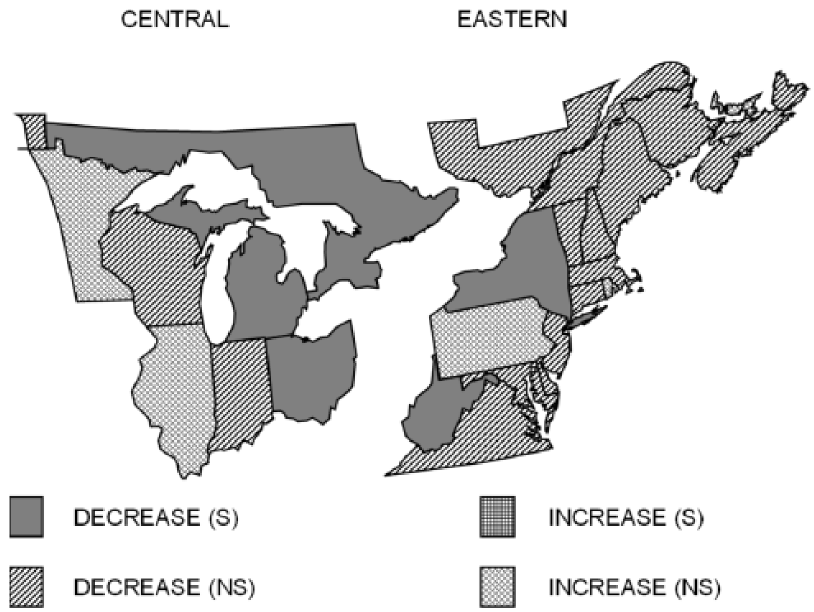


Figure 4. Ten-year trends in number of American woodcock heard on the Singing-ground Survey; 2013-23, as determined by the hierarchical modeling method. A significant trend (S) does not include zero in the 95% credible interval, while a non-significant (NS) trend does include zero. (from: Seamans, M.E. and R.D. Rau. 2023. American woodcock population status, 2023. U.S. Fish and Wildlife Service, Laurel, MD. 18 pp.).

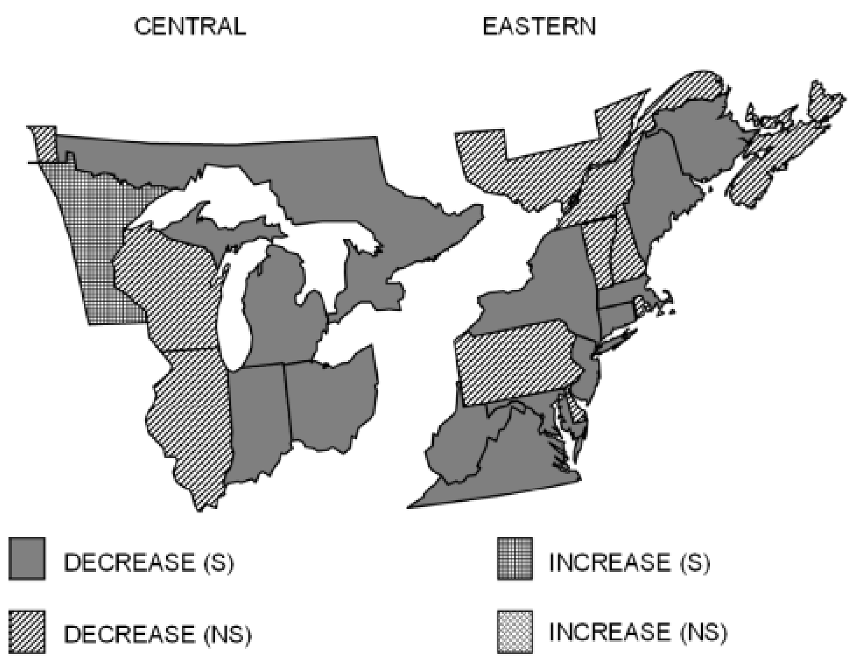


Figure 5. Long-term trends in number of American woodcock heard on the Singing-ground Survey; 1968-2023, as determined by the hierarchical modeling method. A significant trend (S) does not include zero in the 95% credible interval, while a non-significant (NS) trend does include zero. (from: Seamans, M.E. and R.D. Rau. 2023. American woodcock population status, 2023. U.S. Fish and Wildlife Service, Laurel, MD. 18 pp.).

HUNTING HARVEST STATISTICS

Division of Fish and Wildlife
500 Lafayette Road, Box 20
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2022 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 2023 following the close of the 2022-23 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 2022-23 small game hunting season (N=228,143). 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=219,216) and “Non-resident” (N=8,927) (Figure 2). A free youth license was added to the sampling frame for 2010-13 but that license has since been discontinued. Estimates for those years have been recalculated without the youth license so harvest estimates and license sales are comparable among years. Also, beginning in 2017, license holders <18-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 2022-23 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 4.2.3 (2023-03-15 ucrt); R Core Team 2022).

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, 173 surveys were returned as undeliverable; 2,197 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 (228,143 small game licenses) decreased by 2% from the previous year and was 8% below the 10-year average (247,292 licenses; Figure 2, Table 2). Non-resident small game license sales (8,927 licenses) increased 2% in 2022 and was 28% above the 10-year average (6,957 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. For all other species, the estimated number of statewide hunters and harvest for 2022-23, the previous year, and the 10-year averages are shown in Tables 4 and 5, respectively. Non-resident estimates over the past decade are shown in Table 3. 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 2022-23, 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.

Ducks – all species

In 2022, state duck stamp sales (81,864 stamps) were 3% below last year's sales (84,327 stamps) and 8% below the 10-year average (89,092 stamps; Table 2). An estimated 45,172 hunters pursued ducks in 2022 which was 35% below the 10-year average (69,922 hunters; Table 4). The 2022 harvest estimate (470,309 ducks) was 32% below the 10-year average (693,589 ducks; Table 5). Overall, duck hunters harvested an average of 10.4 ducks/hunter, which was slightly greater than the 10-year average (9.9 ducks/hunter; Table 6). Successful hunters bagged more ducks in 2022 (12.6 ducks) compared to the 10-year average (11.7 ducks) despite fairly similar success rates (83% and 85%, respectively; Table 7).

Canada geese

An estimated 27,207 hunters harvested approximately 127,520 Canada geese in 2022 (Tables 4 and 5). These estimates are 42% and 48% below their respective 10-year averages (46,770 hunters and 245,450 geese; Tables 4 and 5). Overall, Canada goose hunters harvested an average of 4.7 geese/hunter last year, which was slightly less than the 10-year average (5.2 geese/hunter; Table 6). The mean harvest per successful hunter (6.6 geese/hunter) was similar to the 10-year average (6.8 geese/hunter) despite a slightly lower success rate (71% versus 76%, respectively; Table 7).

Ruffed grouse

In 2022, an estimated 64,591 hunters harvested an estimated 237,700 ruffed grouse (Tables 4 and 5). These estimates are 14% and 10% below the 10-year averages, respectively (74,756 hunters and 264,221 grouse; Tables 4 and 5). The mean harvest per active hunter was 3.7 grouse, which was similar to the 10-year average (3.5 grouse/hunter; Table 6). Hunter success (69%) and mean harvest per successful hunter (5.4 grouse/hunter) were also similar to their respective 10-year averages (70% and 5.0 grouse, respectively; Table 7).

Ring-necked pheasants

Pheasant stamp sales in 2022 (77,448 stamps) were 1% below 2021 sales (78,538 stamps) and 1% below the 10-year average (78,040 stamps; Table 2). An estimated 52,337 hunters harvested an estimated 204,052 roosters in 2022 (Tables 4 and 5). These estimates represent 9% fewer hunters compared to the 10-year average (57,539 hunters; Table 4) but a harvest similar to the 10-year average (201,573 roosters; Table 5). The mean harvest per active hunter was 3.9 roosters, which was only slightly greater than the 10-year average (3.5 roosters; Table

6). Success rates in 2022 were the same as the 10-year average (68%) whereas successful hunters bagged slightly more roosters (5.8 versus 5.2 roosters, respectively; 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 2022-2023 small game hunting season (**March 2022 - February 2023**). We need information to estimate the season's harvest and to help set future small game seasons. Answer only for your Minnesota 2022 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

2022 Small Game Hunter Report

1. Did you hunt small game, listed below, in Minnesota this year (March 2022 - Feb 2023)? ☐ 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.

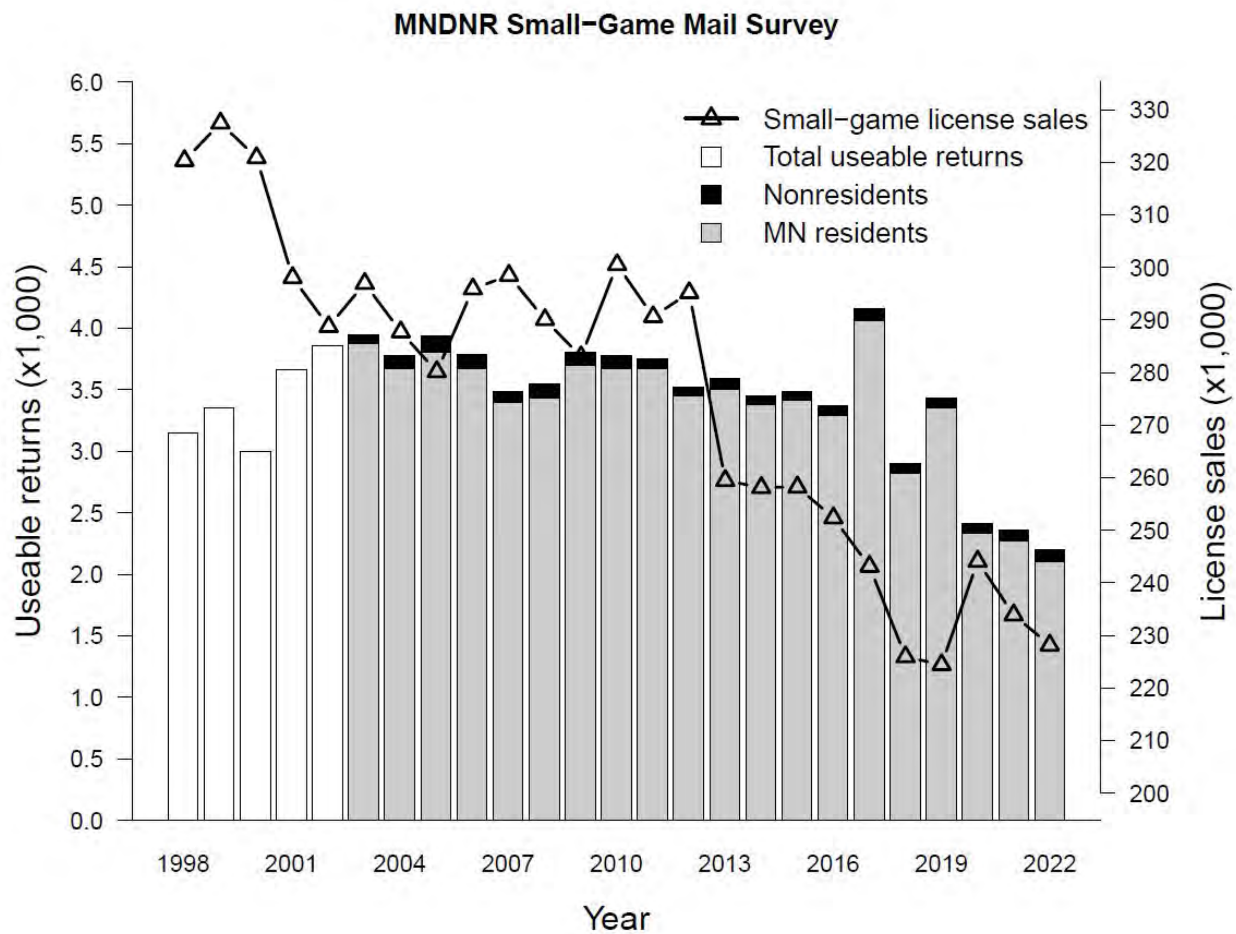

Figure 2. Number of Minnesota small game licenses sold and usable returned surveys, 1998-2022. Includes resident and non-resident licenses and excludes duplicate and free licenses.

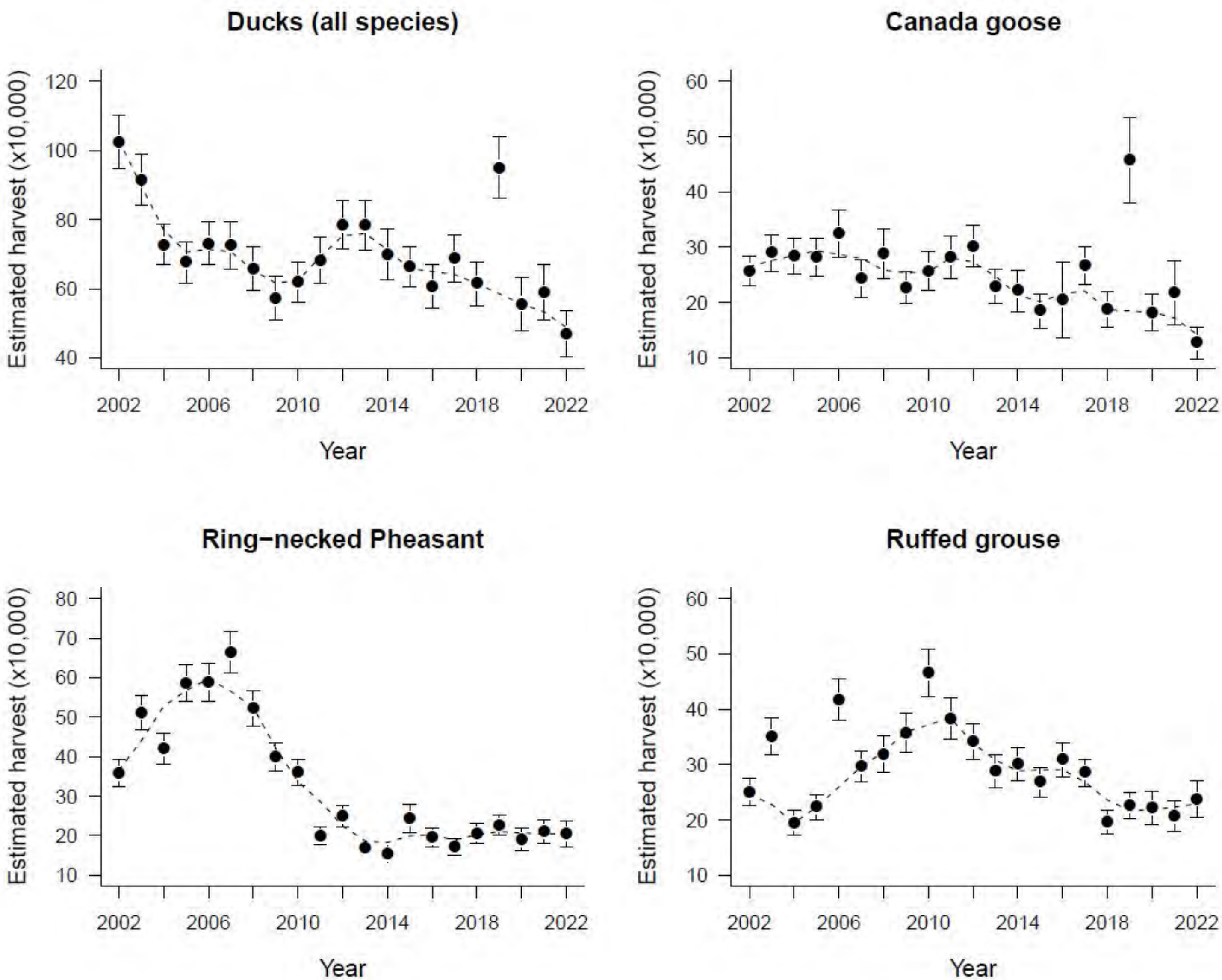

Figure 3. Harvest trends for top four small game species harvested in Minnesota, 2002-2022.

Table 1. Percent of respondents who hunted small game, 2012-13 through 2022-2023[a].

		Returns from mail survey	Projections from license sales
2012-13	Hunted Did not hunt	2,669 (76%) 851 (24%) 3,520 (100%)	223,808 71,360 295,168
2013-14	Hunted Did not hunt	2,586 (72%) 1,003 (28%) 3,589 (100%)	186,317 72,264 258,581
2014-15	Hunted Did not hunt	2,476 (72%) 975 (28%) 3,451 (100%)	185,186 72,923 258,109
2015-16	Hunted Did not hunt	2,505 (72%) 980 (28%) 3,485 (100%)	185,604 72,612 258,216
2016-17	Hunted Did not hunt	2,426 (72%) 945 (28%) 3,371 (100%)	181,614 70,744 252,358
2017-18	Hunted Did not hunt	2,768 (66%) 1,395 (34%) 4,163 (100%)	161,658 81,472 243,130
2018-19	Hunted Did not hunt	2,000 (69%) 904 (31%) 2,904 (100%)	155,601 70,331 225,932
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

[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 estimated hunter harvest, 2012-13 through 2022-23.

	2012-13[a]	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Total small game license sales[b]	264,063	258,581	258,109	258,208	252,358	243,130	225,932	224,413	244,100	233,901	228,143
Non-resident license sales[c]	6,456	6,031	6,056	6,755	6,701	6,854	6,718	6,887	8,375	8,730	8,927
State duck stamp sales	90,052	93,412	94,265	92,176	88,905	86,258	82,955	86,568	88,163	84,327	81,864
Pheasant stamp sales	90,541	77,597	74,295	77,750	76,920	71,925	72,192	74,921	81,850	78,538	77,448

[a] Estimates from these years were recomputed without license type 99- free youth license to be consistent with other years of data.
[b] Includes all types of small game licenses. Duplicate and free licenses not included.
[c] Excludes duplicate licenses and non-resident shooting preserve licenses.

Table 3. Mail survey results[a] of non-resident small game hunters, 2012-13 through 2022-23.

	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Estimated non-residents and (percent) of all licensed non-residents hunting:											
Ducks	2,360 (37)	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)
Canada goose	1,360 (21)	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)
Ring-necked pheasant	1,910 (30)	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)
Ruffed grouse	2,820 (44)	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)
Estimated non-resident harvest:											
Ducks	20,380	20,410	13,060	16,863	17,701	15,717	15,792	21,228	5,810	39,395	7,008
Canada goose	2,270	3,650	2,680	1,484	1,462	6,994	2,940	15,060	4,134	30,039	4,224
Ring-necked pheasant	6,820	3,430	3,720	6,581	4,040	7,274	6,048	2,645	5,141	5,924	14,112
Ruffed grouse	10,090	4,990	9,090	13,805	11,772	6,994	2,856	4,325	24,793	11,020	7,104

[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 (2022-23), previous year (2021-22), and the preceding 10-year (2012-2021) average. Annual and 10-year trends (% change) are also shown.

	2022-23			2021-22			10-yr mean (2012-21)		Change from 2021		Change from 10-yr mean	
	n	Hunters	SE	n	Hunters	SE	Hunters	SE	%	95% CI	%	95% CI
Ducks	435	45,172	1,931	570	56,589	2,054	69,922	618	-20	4	-35	3
Canada geese	262	27,207	1,571	364	36,138	1,734	46,770	535	-25	6	-42	3
Other geese	12	1,247	358	22	2,185	462	2,547	139	-43	20	-51	14
American coot	28	2,908	544	23	2,284	472	3,441	161	27	35	-15	16
Common snipe	9	935	310	7	695	262	1,032	89	35	68	-9	31
Rails & Gallinules	4	416	207	4	398	198	288	46	5	74	44	75
American crow	30	3,116	563	54	5,362	718	7,304	230	-42	13	-57	8
American woodcock	113	11,735	1,071	103	10,226	981	11,453	290	15	15	2	10
Mourning dove	43	4,466	672	63	6,255	774	8,468	248	-29	14	-47	8
Ring-necked pheasant	504	52,337	2,038	493	48,945	1,951	57,539	583	7	6	-9	4
Ruffed grouse	622	64,591	2,183	577	57,284	2,063	74,756	631	13	6	-14	3
Spruce grouse	79	8,204	903	63	6,255	774	8,304	248	31	22	-1	11
Sharp-tailed grouse	40	4,154	648	30	2,979	538	5,123	195	39	33	-19	13
Gray partridge	17	1,766	425	9	894	296	2,126	126	98	81	-17	21
Gray squirrel	133	13,812	1,156	156	15,488	1,193	20,286	377	-11	10	-32	6
Fox squirrel	69	7,166	846	74	7,347	837	11,250	285	-2	16	-36	8
Eastern cottontail	79	8,204	903	85	8,439	895	12,918	305	-3	15	-36	7
White-tailed jackrabbit	8	831	292	10	993	312	1,073	92	-16	39	-23	28
Snowshoe hare	14	1,454	386	17	1,688	406	3,289	156	-14	31	-56	12
Raccoon	36	3,739	616	44	4,369	650	6,517	220	-14	19	-43	10
Red fox	21	2,181	472	27	2,681	511	4,228	177	-19	23	-48	11
Gray fox	5	520	231	5	497	221	1,145	91	5	66	-55	20
Coyote	89	9,243	956	123	12,212	1,067	16,816	344	-24	10	-45	6
Badger	1	104	104	3	298	172	308	48	-65	40	-66	34

Table 5. Estimated hunter harvest (residents and non-residents) by species for current year (2022-23), previous year (2021-22), and the preceding 10-year (2012-2021) average. Annual and 10-year trends (% change) are also shown.

	2022-23			2021-22			10-yr mean (2012-21)		Change from 2021		Change from 10-yr mean	
	n	Harvest	SE	n	Harvest	SE	Harvest	SE	%	95% CI	%	95% CI
Ducks	435	470,309	34,290	570	589,916	40,553	693,589	11,624	-20	8	-32	5
Canada geese	262	127,520	14,697	364	218,218	29,524	245,450	7,594	-42	10	-48	6
Other geese	12	1,767	1,165	22	2,086	832	5,939	849	-15	65	-70	20
American coot	28	5,089	1,718	23	8,342	3,431	14,878	1,363	-39	32	-66	12
Common snipe	9	728	373	7	398	198	1,353	200	83	131	-46	29
Rails & Gallinules	4	104	104	4	498	495	567	149	-79	29	-82	19
American crow	30	10,595	2,374	54	72,884	21,567	58,637	4,567	-85	5	-82	4
American woodcock	113	34,479	6,924	103	35,742	7,115	33,731	1,783	-4	27	2	21
Mourning dove	43	39,883	10,441	63	61,558	12,221	76,770	4,255	-35	21	-48	14
Ring-necked pheasant	504	204,052	16,760	493	210,275	15,872	201,573	4,232	-3	11	1	9
Ruffed grouse	622	237,700	16,446	577	206,699	13,918	264,221	4,496	15	11	-10	6
Spruce grouse	79	13,916	3,363	63	7,248	1,697	11,303	658	92	65	23	31
Sharp-tailed grouse	40	5,401	1,739	30	3,774	1,652	8,556	864	43	78	-37	21
Gray partridge	17	1,766	807	9	398	242	3,213	401	344	337	-45	26
Gray squirrel	133	94,504	14,734	156	92,928	13,170	95,174	3,287	2	21	-1	16
Fox squirrel	69	23,368	4,934	74	29,091	5,592	36,408	1,545	-20	23	-36	14
Eastern cottontail	79	22,951	3,997	85	25,417	5,070	40,075	1,691	-10	24	-43	10
White-tailed jackrabbit	8	624	327	10	795	464	1,375	314	-22	62	-55	26
Snowshoe hare	14	1,247	547	17	2,880	1,139	6,907	704	-57	26	-82	8
Raccoon	36	12,464	2,887	44	37,733	15,986	41,633	3,184	-67	16	-70	7
Red fox	21	2,285	744	27	5,462	2,214	4,829	438	-58	22	-53	16
Gray fox	5	208	207	5	497	408	844	165	-58	54	-75	25
Coyote	89	23,264	4,896	123	53,614	14,533	35,550	2,492	-57	15	-35	15
Badger	1	104	---	3	100	99	243	49	4	---	-57	---

Table 6. Mean harvest per active hunter (residents and non-residents) for current year (2022-23), previous year (2021-22), and the preceding 10-year (2012-2021) average. Annual and 10-year trends (% change) are also shown.

	2022-23			2021-22			10-yr mean (2012-21)		Change from 2021		Change from 10-yr mean	
	n	Mean	SE	n	Mean	SE	Mean	SE	%	95% CI	%	95% CI
Ducks	435	10.4	0.62	570	10.4	0.61	9.9	0.15	0	8	5	6
Canada geese	262	4.7	0.47	364	6.0	0.76	5.2	0.15	-22	13	-10	9
Other geese	12	1.4	0.88	22	1.0	0.33	2.2	0.30	40	99	-36	41
American coot	28	1.8	0.50	23	3.7	1.33	4.3	0.35	-51	22	-58	12
Common snipe	9	0.8	0.32	7	0.6	0.20	1.2	0.15	33	70	-33	28
Rails & Gallinules	4	0.2	0.25	4	1.2	1.24	1.9	0.46	-83	27	-89	13
American crow	30	3.4	0.46	54	13.6	3.62	7.9	0.64	-75	7	-57	7
American woodcock	113	2.9	0.53	103	3.5	0.61	3.0	0.14	-17	21	-3	18
Mourning dove	43	8.9	1.94	63	9.8	1.54	9.0	0.44	-9	24	-1	22
Ring-necked pheasant	504	3.9	0.28	493	4.3	0.28	3.5	0.07	-9	9	11	8
Ruffed grouse	622	3.7	0.22	577	3.6	0.21	3.5	0.05	3	9	6	7
Spruce grouse	79	1.7	0.37	63	1.2	0.23	1.4	0.07	42	41	21	27
Sharp-tailed grouse	40	1.3	0.37	30	1.3	0.51	1.7	0.17	0	49	-24	23
Gray partridge	17	1.0	0.40	9	0.4	0.24	1.5	0.17	150	181	-33	28
Gray squirrel	133	6.8	0.90	156	6.0	0.72	4.7	0.15	13	20	45	20
Fox squirrel	69	3.3	0.58	74	4.0	0.62	3.2	0.12	-18	19	3	18
Eastern cottontail	79	2.8	0.38	85	3.0	0.51	3.1	0.11	-7	20	-10	13
White-tailed jackrabbit	8	0.8	0.31	10	0.8	0.41	1.2	0.23	0	65	-33	29
Snowshoe hare	14	0.9	0.31	17	1.7	0.55	2.0	0.17	-47	25	-55	16
Raccoon	36	3.3	0.55	44	8.6	3.47	6.4	0.51	-62	17	-48	10
Red fox	21	1.0	0.26	27	2.0	0.74	1.1	0.10	-50	23	-9	25
Gray fox	5	0.4	0.40	5	1.0	0.77	0.7	0.12	-60	50	-43	58
Coyote	89	2.5	0.46	123	4.4	1.13	2.2	0.16	-43	18	14	23
Badger	1	1.0	---	3	0.3	0.33	0.8	---	233	---	25	---

Table 7. Hunter success rates and mean harvest per successful hunter (residents and non-residents) for current year (2022-23), previous year (2021-22), and the preceding 10-year (2012-2021) average.

	2022-23				2021-22				10-yr mean (2012-20)		
	n	% Success	Mean	SE	n	% Success	Mean	SE	% Success	Mean	SE
Ducks	359	83	12.6	0.69	474	83	12.5	0.69	85	11.7	0.15
Canada geese	185	71	6.6	0.61	286	79	7.7	0.95	76	6.8	0.15
Other geese	4	33	4.2	2.13	9	41	2.3	0.55	43	5.1	0.30
American coot	17	61	2.9	0.70	17	74	4.9	1.70	73	5.9	0.35
Common snipe	5	56	1.4	0.40	4	57	1.0	0.00	59	2.0	0.15
Rails & Gallinules	1	25	1.0	---	1	25	5.0	---	43	4.1	0.46
American crow	25	83	4.1	0.44	48	89	15.3	4.01	86	9.1	0.64
American woodcock	81	72	4.1	0.70	64	62	5.6	0.89	67	4.4	0.14
Mourning dove	37	86	10.4	2.16	55	87	11.3	1.68	82	11.0	0.44
Ring-necked pheasant	341	68	5.8	0.38	357	72	5.9	0.34	68	5.2	0.07
Ruffed grouse	427	69	5.4	0.29	412	71	5.1	0.26	70	5.0	0.05
Spruce grouse	38	48	3.5	0.65	31	49	2.4	0.36	54	2.5	0.07
Sharp-tailed grouse	16	40	3.2	0.69	13	43	2.9	1.04	46	3.7	0.17
Gray partridge	8	47	2.1	0.66	3	33	1.3	0.33	44	3.3	0.17
Gray squirrel	110	83	8.3	1.04	133	85	7.0	0.81	82	5.7	0.15
Fox squirrel	48	70	4.7	0.74	60	81	4.9	0.71	78	4.2	0.12
Eastern cottontail	60	76	3.7	0.44	63	74	4.1	0.64	76	4.1	0.11
White-tailed jackrabbit	4	50	1.5	0.29	4	40	2.0	0.70	47	2.7	0.23
Snowshoe hare	7	50	1.7	0.42	10	59	2.9	0.73	61	3.3	0.17
Raccoon	30	83	4.0	0.59	40	91	9.5	3.79	91	7.1	0.51
Red fox	14	67	1.6	0.31	17	63	3.2	1.09	54	2.1	0.10
Gray fox	1	20	2.0	---	2	40	2.5	1.49	34	1.7	0.12
Coyote	61	69	3.7	0.62	85	69	6.4	1.59	54	3.9	0.16
Badger	1	100	1.0	---	1	33	1.0	---	72	1.1	0.08

The following information has been excerpted from: U.S. Fish and Wildlife Service. Migratory bird hunting activity and harvest during the 2021 - 2022 and 2022-23 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 2021–22 and 2022–23 Hunting Seasons | FWS.gov

Table 1. Species composition of the Minnesota waterfowl harvest, 2021 and 2022. (from: Raftovich, R.V., K.K. Fleming, S.C. Chandler, and C.M. Cain. 2023. Migratory bird hunting activity and harvest during the 2021-22 and 2022-23 hunting seasons. U.S. Fish and Wildlife Service, Laurel, Maryland. USA August, 2023. 70 pp).

	Minnesota Harvest					Mississippi Flyway Harvest		
Species	2021	% of Harvest	2022	% of Harvest	Percent change in Harvest 21-22	2021	2022	Percent change Harvest 21-22
Mallard	84,070	19.61	63,072	14.38	-25	1,184,216	981,547	-21
Domestic mallard	0	0.00	0	0.00		10,955	3,902	-181
American black duck	0	0.00	0	0.00		14,065	11,589	-21
Black x mallard	0	0.00	0	0.00		837	313	-167
Gadwall	14,253	3.32	7,635	1.74	-46	414,525	371,974	-11
American wigeon	13,287	3.10	11,951	2.73	-10	82,283	64,724	-27
Green-winged teal	71,750	16.73	46,142	10.52	-36	563,327	555,419	-1
Blue-winged /cinnamon teal	81,171	18.93	125,813	28.69	55	424,854	419,913	-1
Northern shoveler	2,657	0.62	6,639	1.51	150	135,760	110,989	-22
Northern pintail	18,843	4.39	6,971	1.59	-63	132,767	75,268	-76
Wood duck	83,587	19.49	62,076	14.16	-26	615,625	384,182	-60
Redhead	2,416	0.56	10,291	2.35	326	21,623	40,922	47
Canvasback	2,899	0.68	3,652	0.83	26	19,435	27,344	29
Greater scaup	1,691	0.39	664	0.15	-61	11,739	11,131	-5
Lesser scaup	4,590	1.07	5,311	1.21	16	54,779	49,530	-11
Ring-necked duck	28,507	6.65	71,703	16.35	152	146,316	160,342	9
Goldeneye	3,141	0.73	7,967	1.82	154	21,212	20,549	-3
Bufflehead	7,731	1.80	5,975	1.36	-23	53,307	53,728	1
Ruddy duck	0	0.00	0	0.00		2,180	4,001	46
Scoters	0	0.00	0	0.00		2,473	3,847	36
Hooded merganser	7,489	1.75	2,656	0.61	-65	38,907	28,178	-38
Other mergansers	725	0.17	0	0.00	-100	5,509	3,331	-65
Total Duck Harvest [a] (retrieved kill)	428,800 ±19%		438,500 ±17%		2	3,978,300 ±5%	3,402,500 ±7	-17

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

Table 2. Top 10 states in number of **adult duck hunters**, 2022, and number of hunter-days and retrieved duck kill (from: Raftovich, R.V., K.K. Fleming, S.C. Chandler, and C.M. Cain. 2023. Migratory bird hunting activity and harvest during the 2021-22 and 2022-23 hunting seasons. U.S. Fish and Wildlife Service, Laurel, Maryland. USA August, 2023. 70 pp).

State	Number of active duck hunters	Duck hunter days afield	Total duck harvest	Seasonal duck harvest per hunter
Texas	73,200 ± 7%	323,500 ± 17%	1,064,400± 21%	14.5 ± 22%
Arkansas	57,400 ± 6%	273,100 ± 16%	721,700 ± 16%	12.6 ± 17%
Minnesota	53,700 ± 6%	214,600 ± 13%	438,500 ± 17%	8.2 ± 18%
Wisconsin	41,000 ± 7%	207,700 ± 13%	344,300 ± 15%	8.4 ± 17%
California	38,100 ± 5%	241,900 ± 22%	727,200 ± 7%	19.1 ± 12%
Louisiana	35,700 ± 8%	153,100 ± 17%	544,200 ± 19%	15.2 ± 21%
North Carolina	30,800 ± 5%	136,800 ± 9%	265,200 ± 11%	8.6 ± 12%
Michigan	27,400 ± 10%	120,900 ± 17%	203,200 ± 20%	7.4 ± 22%
North Dakota	27,000 ± 8%	92,600 ± 11%	336,900 ± 12%	12.5 ± 14%
Missouri	25,600 ± 10%	108,100 ± 26%	250,100 ± 29%	9.8 ± 31%
Mississippi Flyway		1,533,800 ± 6%	3,402,500 ± 7%	
United States		3,504,000 ± 4%	8,272,400 ± 5%	

Table 3. Top 10 states in number of **adult goose hunters**, 2022, and number of hunter-days and retrieved goose kill. (from: Raftovich, R.V., K.K. Fleming, S.C. Chandler, and C.M. Cain. 2023. Migratory bird hunting activity and harvest during the 2021-22 and 2022-23 hunting seasons. U.S. Fish and Wildlife Service, Laurel, Maryland. USA August, 2023. 70 pp).

State	**Number of active goose hunters**	**Goose hunter days afield**	**Total goose harvest**	**Seasonal goose harvest per hunter**
Wisconsin	27,700 ± 10%	134,800 ± 23%	104,100 ± 32%	3.8 ± 34%
Minnesota	34,600 ± 10%	124,900 ± 20%	122,900 ± 26%	3.6 ± 28%
Texas	17,400 ± 17%	45,900 ± 32%	74,800 ± 40%	4.3 ± 43%
California [b]	18,600 ± 8%	97,000 ± 17%	194,100 ± 24%	10.6 ± 25%
Michigan	22,200 ± 12%	78,000 ± 22%	88,400 ± 27%	4.0 ± 30%
North Dakota	18,800 ± 11%	47,800 ± 19%	100,800 ± 34%	5.4 ± 35%
Arkansas	22,100 ± 14%	48,500 ± 20%	107,500 ± 27%	4.9 ± 31%
Kansas	13,400 ± 15%	40,600 ± 31%	81,500 ± 30%	6.1 ± 33%
Maryland [b]	14,000 ± 8%	52,200 ± 14%	44,000 ± 15%	3.1 ± 17%
Illinois	12,600 ± 15%	63,100 ± 36%	57,400 ± 36%	4.6 ± 39%
Mississippi Flyway		674,200 ± 9%	703,600 ± 11%	
United States [b]		1,760,500 ± 22%	1,987,000 ± 11%	

[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.

2023 LIGHT GOOSE CONSERVATION ORDER HARVEST IN MINNESOTA

Steve Cordts, Wildlife Populations and Regulations Unit

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INTRODUCTION

This report documents results of the 2023 Light Goose Conservation Order hunter mail questionnaire survey.

METHODS

Minnesota held a light goose Conservation Order harvest from 18 February - 30 April 2023. 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 1,075 permits were issued. Surveys were sent to 946 license holders and 301 responses (29%) to the questionnaire were obtained (Table 1, Figure 2). In calculating harvest estimates, we assume that the 645 non-respondents participated in the conservation action and took light geese in the same manner as respondents. An estimated 411 hunters attempted to take light geese during the conservation order period. Active participants pursued light geese for 1,675 days and 1,600 light geese were shot and retrieved. This was an average retrieved take of 4 geese per active participant. An estimated 54 light geese were wounded and not retrieved.

ACKNOWLEDGMENTS

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

MINNESOTA 2023 LIGHT GOOSE HARVEST SURVEY

For the Period of February 18- April 30, 2023 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 18 - April 30, 2023. 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 2023 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 18 - April 30, 2023? 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 18 - April 30, 2023? __________

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, 2023.

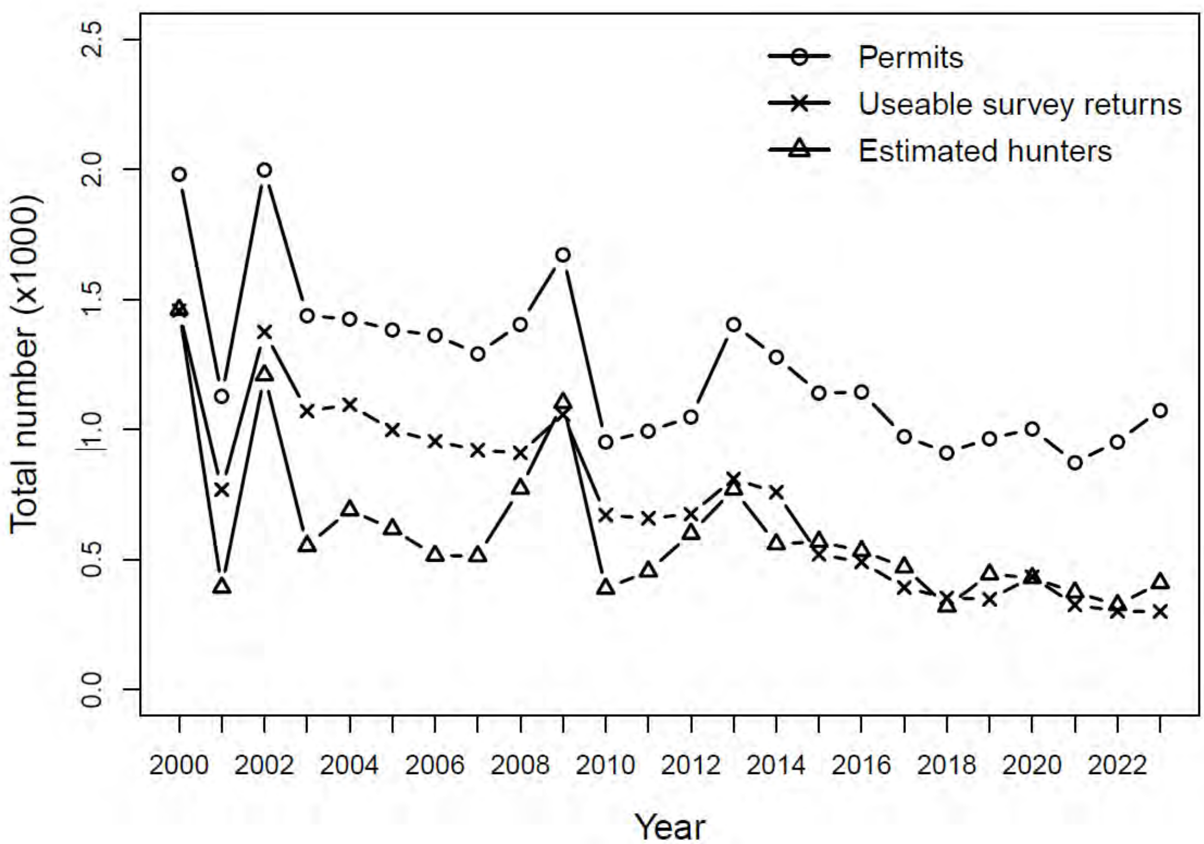


Figure 2. Light goose permits issued, survey response, and estimated hunters in Minnesota, 2000-2023.

Table 1. Summary of Light Goose Conservation Order harvest in Minnesota, 2013 – 2023.

	Year										
Statistic	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Total permits sold	1,405	1,278	1,141	1,143	974	912	965	1,002	873	954	1,075
Useable returns	810	759	520	491	393	353	348	434	326	302	301
Response rate (%)	58.3	60.0	46	43	41	43	41	44	38	32	29
Active hunters (%)	54.9	44.0	50	47	48	35	46	43	43	34	38
Estimated total hunters	770	560	569	534	471	321	444	430	375	326	411
Estimated hunter days	3,070	2,580	2,434	2,605	1,966	1,204	1,537	1,529	1,481	1,122	1,675
Mean days/hunter	4	5	4	5	4	4	4	4	4	3	4
Estimated harvest (shot & retrieved)	2,430	2,880	3,266	2,121	1,713	1,021	1612	785	1,455	967	1,600
Mean harvest/hunter	3	5	6	4	4	3	4	2	4	3	4
Estimated crippling losses	370	210	349	215	298	78	206	54	150	86	54
Percent using unplugged guns	49.4	48.8	NA	NA	NA	NA	NA	NA			
Est. number hunters using unplugged guns	380	270	NA	NA	NA	NA	NA	NA			
Est. number geese **shot** with unplugged guns	1,670	2,060	NA	NA	NA	NA	NA	NA			
Est. harvest with shell 4-5-6	620	770	NA	NA	NA	NA	NA	NA			
Percent using electronic calls	24.5	27.8	NA	NA	NA	NA	NA	NA			
Est. number hunters using e-calls	190	160	NA	NA	NA	NA	NA	NA			
Est. harvest while using e-calls	620	1,710	NA	NA	NA	NA	NA	NA			
Percent hunting 1/2-hr after sunset	33.4	36.2	NA	NA	NA	NA	NA	NA			
Est. number hunting after 1/2-hr sunset	260	200	NA	NA	NA	NA	NA	NA			
Est. harvest 1/2-hr after sunset	260	550	NA	NA	NA	NA	NA	NA			

MINNESOTA'S WILD TURKEY HARVEST- FALL 2022 AND SPRING 2023

Tim Lyons, Farmland Wildlife Populations and Research Group

SUMMARY OF SEASON STRUCTURE

The fall 2022 turkey season opened on October 1st and closed on October 30. 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 2023 hunting season was open April 12 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 2022 SEASON

Permits issued

The number of fall turkey hunters in 2022 (8,999) was similar to the number of hunters in fall 2021 (< 1% difference; Table 1; Figure 2) and was 10% above the 10-year average (8,181). The proportion of youth hunters was consistent with previous seasons (23%).

Harvest

The fall 2022 harvest (1,285) was 3% greater than the fall 2021 harvest (Table 1). Additionally, 2022 was the second-greatest harvest since the inception of a fall hunting season in 1990 (2012; 1,752 turkeys; Figure 2). Hunter success was 14.3% which was similar to the long-term average (14.1%). Hens comprised 53% of the total harvest with jakes and toms comprising 17% and 30% of the total fall harvest, respectively. Two permit areas, 507 and 508, accounted for 51% 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 2022 SEASON

Permits issued

The number of permits issued across all license types in 2023 stayed relatively constant from 54,491 hunters in 2022 to 53,574 in 2023 (Tables 3 and 4, Figure 3). The number of total permits issued fell less than 2.0% in 2023. Permit sales declined only slightly across all permit categories, though the decline was greatest among archery hunters (Table 4). Still, sales remained well above average compared to years prior to 2020 (Table 4; Figure 3). All hunters had to declare a permit area in 2023 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 60% of all permit sales (Table 5).

Harvest

During the 2023 spring turkey season, 13,659 turkeys were harvested. The harvest total increased 11% compared to 2022 and is the second highest season harvest total for the modern turkey season (since 1978; Table 4, Figure 3). Permit areas 507, 501, and 508 saw the greatest harvests and comprised roughly 60% of the total harvest (Table 5). Harvest success increased among all license holders to an average success rate of 25.5% (Table 3).

Persistent snowpack across much of the northern portion of the turkey range at the open of the turkey season led to lower harvest during the A and B periods than has been typical. In 2023, the combined A and B period harvest accounted for approximately 43% of the total spring harvest (Table 6). Collectively, A-C periods accounted for approximately 60% of all spring turkey harvest (Table 6), whereas it accounts for more than 75% of the harvest in most years. The decline in harvest during the A season was compensated by greater proportional harvest during the C and F seasons.

Table 1. Permits available, registered harvest, and hunter success rates for the ten most recent fall wild turkey seasons in Minnesota, 2013-2022.

Year	Permits issued	Registered harvest	Hunter success (%)[a]
2013	8,060	1,137	14.1
2014[b]	8,236	1,216	14.8
2015[b]	8,109	1,213	15.0
2016[b]	8,469	1,176	13.9
2017	7,650	1,015	13.3
2018	6,719	834	12.4
2019	6,481	855	13.2
2020	8,408	1,136	13.5
2021	9,026	1,238	13.7%
2022	8,999	1,285	14.3%

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

Table 2. Permits issued, registered harvest by sex, and total registered harvest during the 2022 fall 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	826	239	42	15	76	133
502	83	26	4	0	8	12
503	630	153	37	21	70	128
504	230	69	10	4	17	31
505	399	111	27	8	25	60
506	295	88	21	8	22	51
507	1,604	546	106	57	178	341
508	1,733	474	68	59	183	310
509	286	193	23	25	47	95
510	673	128	46	20	52	118
511	115	28	3	1	2	6
512	115	28	0	0	0	0
TOTAL	**6,934**	**2,065**	**387**	**218**	**680**	**1,285**

[a] Total harvest for all license types.

Table 3. Total permits issued, harvest, and success rate by permit type during the spring 2023 wild turkey season in Minnesota.

	Total permits issued	Harvest	Success (%)[a]
General	29,543	9,234	31.3
Youth	12,343	2,569	20.8
Archery	11,688	1,856	15.9
Total	53,574	13,659	25.5

[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, 2014-2023.

Year	General permits issued	Youth permits issued	Archery permits issued	Registered harvest[a]	Success (%)[b]
2014[c]	35,451	7,374	4,893	11,425	24.4
2015[c]	34,554	7,042	5,046	11,694	25.6
2016[c]	32,535	7,101	10,336	12,277	25.0
2017[c]	31,605	6,984	11,237	11,803	24.1
2018[c]	28,667	6,022	11,399	10,706	23.6
2019	28,295	6,169	11,794	10,699	23.0
2020	34,173	14,292	14,729	13,996	22.1
2021	32,520	12,598	12,966	12,070	20.8
2022	29,603	12,551	12,337	12,309	22.6
2023	29,543	12,343	11,688	13,659	25.5

[a] Includes all license types.

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

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

Table 5. Permits issued by license type and registered harvest within each permit area during the 2023 spring wild turkey season in Minnesota[a].

Permit area	Archery permits declared	General permits declared	Youth permits declared	Total registered harvest
501	1,426	5,980	1,640	2,530
502	167	703	174	238
503	1,070	3,372	1,237	1,568
504	455	817	425	417
505	700	1,831	643	894
506	558	1,172	638	526
507	3,091	7,207	3,828	3,572
508	2,208	5,223	2,161	2,118
509	369	870	543	503
510	1,409	1,983	827	1,164
511	152	232	142	80
512	95	123	69	34
Total	11,688	29,543	12,343	13,659

[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 2023 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	11,688	12,343			
A			5,632	3,122	22.9%
B			6,196	2,721	19.9%
C			7,048	2,710	19.8%
D			5,667	2,142	15.7%
E			3,022	960	7.0%
F			1,978	2,002	14.7%

[a] Archery and youth permits were valid during any time period.
[b] Includes harvest from all license types.

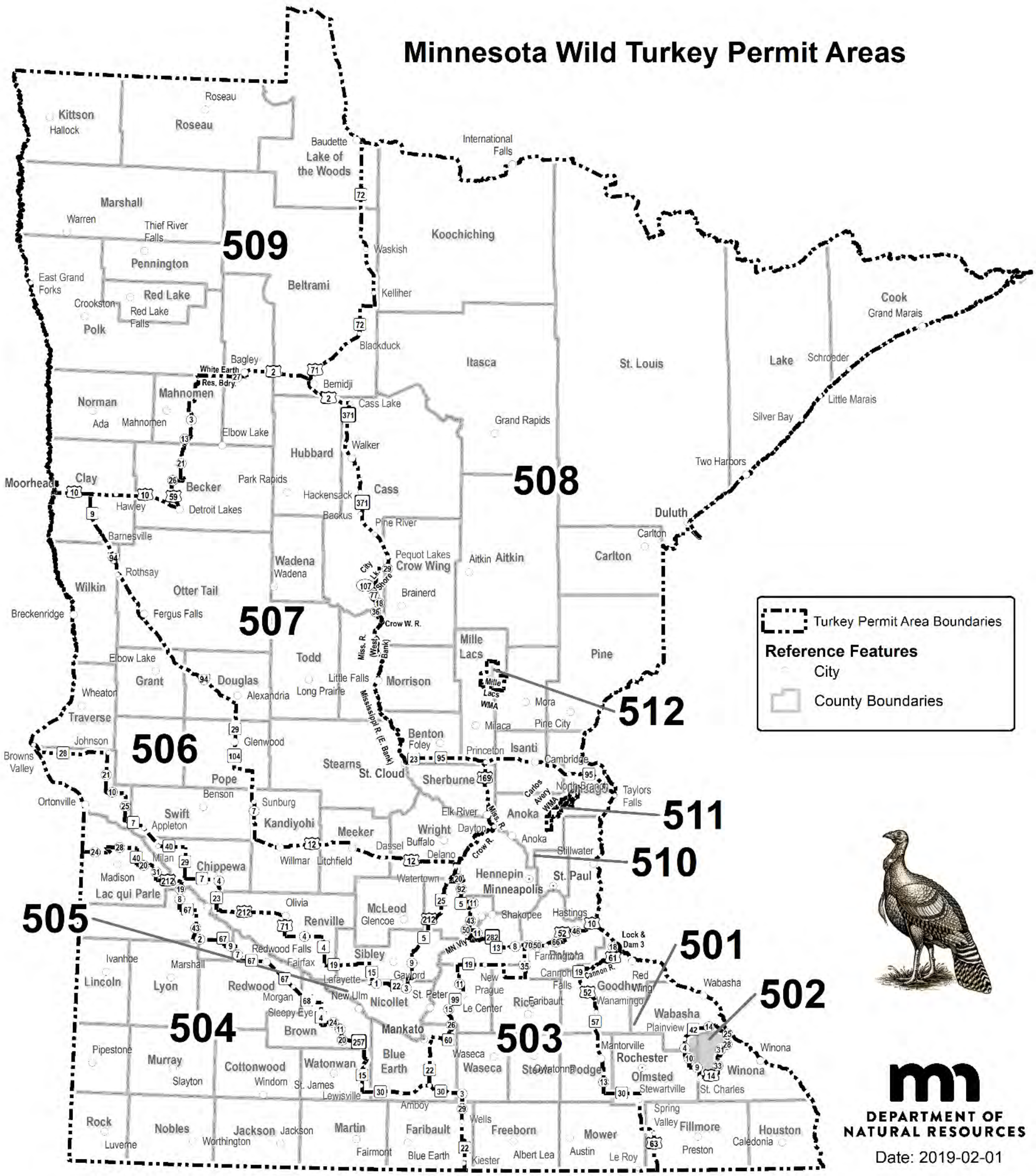


Figure 1. Permit areas open for hunting during fall 2022 and spring 2023 wild turkey seasons in Minnesota.

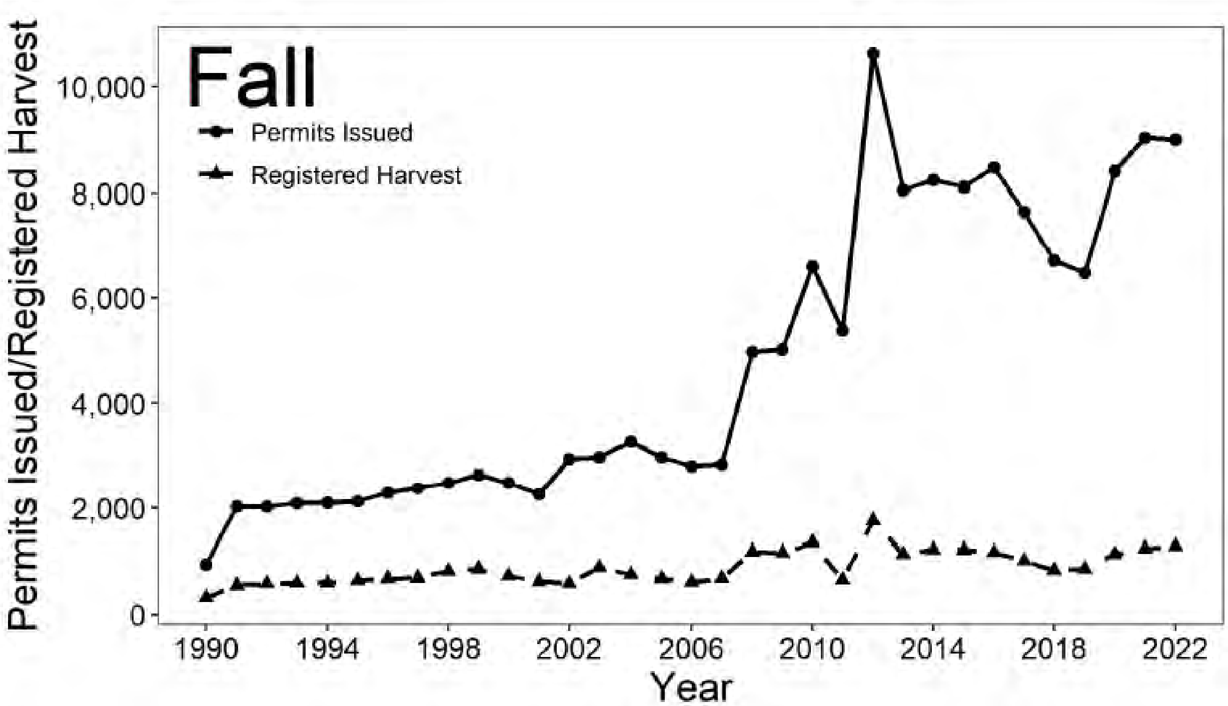


Figure 2. Permits issued and registered harvest for fall wild turkey seasons in Minnesota, 1990-2022.

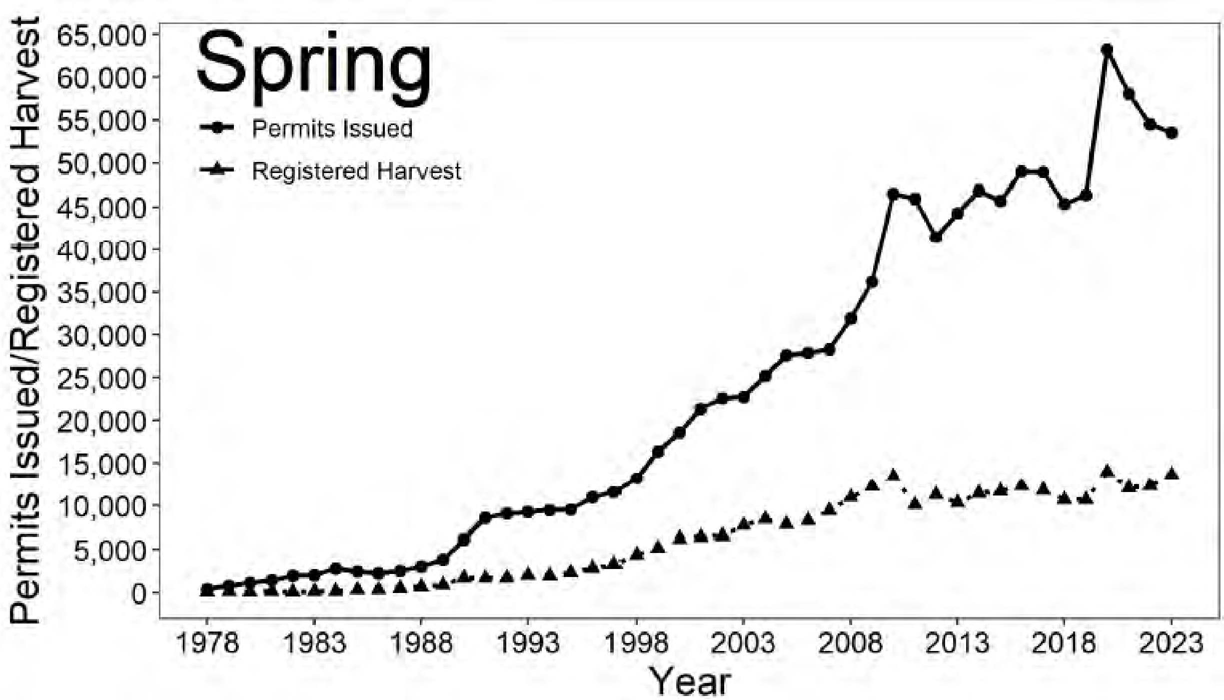


Figure 3. Permits issued and registered harvest for spring wild turkey seasons in Minnesota, 1978-2023.

2022 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 2022, 109 hunters were estimated to have gone afield and harvested 111 prairie-chickens and 46 sharp-tailed grouse (*Tympanuchus phasianellus*) during prairie-chicken hunts. Hunter success (0.60) was higher than last year but 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 2022, the number of applicants 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 2022, the prairie-chicken season opened 24 September and closed 2 October.

Prairie-chicken hunting in Minnesota is a privilege that is only available to residents.

Landowners or tenants of ≥40 acres of grassland within a permit area are eligible to apply for a landowner lottery that awards 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 2022 was 125 permits, and 436 individuals applied in the lottery (Table 1). Of the 125 lottery winners, 112—including 3 landowners—later purchased a permit. All but 2 permit areas, 811A and 813A, had more applicants than permits available, so surplus permits were not available.

Ninety-one purchasers (81%, *n* = 112) responded to the survey; 76 (68%) responded to the first mailing and 15 (13%) to the second mailing. This response rate is the lowest survey response rate since 2010 (mean: 87%; range: 83-95%). I did not detect a response bias in the number of respondents that hunted, which may have been due to the small number of responses to the second mailing and its effect on resolving differences. Respondents to the first mailing were as likely to have hunted as those responding to the second mailing (97% vs. 93% of respondents). Respondents to the first mailing also harvested prairie-chickens at a statistically similar rate to respondents to the second mailing (66% vs. 33%), harvested similar numbers of chickens (1.1 vs. 0.7 birds per hunter), spent a similar number of days afield (2.3 vs. 2.7, respectively), and harvested similar numbers of sharp-tailed grouse (0.6 vs. 0.1 birds per hunter, respectively). Respondents to the first mailing reported similar satisfaction (mean 4.0 vs. 3.5, median 4.0 vs. 4.0), with 86% and 80% of respondents reporting satisfaction scores ≥3,

respectively. Thus, I combined responses from both mailings this year for the analysis. Eighty-eight respondents reported that they hunted prairie-chickens (Table 2). I estimated the total number of hunters to be 109 (i.e., purchasers who went afield) after accounting for hunting by non-respondents. Hunters reported harvesting 96 prairie-chickens, and total harvest after accounting for non-respondents was estimated as 111 prairie-chickens. An estimated 65 hunters bagged ≥1 chicken. Prairie-chicken hunter success during 2022 was higher than 2021 and similar to other years of the survey. Survey respondents also reported harvesting 46 sharp-tailed grouse while hunting prairie-chickens from permit areas 803A (15), 804A (7), 805A (13), and 806A (11) (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 2013-2021, 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 2022.

Permit	Permits	No. of	Lottery winners		Permit purchasers[a]		Surplus
area	available	applicants	No.[b]	Proportion	No.	Proportion	purchasers[c]
803A	8	17	10	0.59	10	1.00	0
804A	10	24	10	0.42	6	0.60	0
805A	10	66	10	0.15	10	1.00	0
806A	12	36	13	0.36	12	0.92	0
807A	20	91	20	0.22	18	0.90	0
808A	20	69	20	0.29	19	0.95	0
809A	15	55	16	0.29	14	0.88	0
810A	15	53	15	0.28	14	0.93	0
811A	5	3	3	1.0	1	0.33	0
812A	5	19	5	0.26	5	1.00	0
813A	5	3	3	1.0	3	1.00	0
All	125	436	125	0.29	112	0.90	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 2022.

Table 2. Prairie-chicken harvest in Minnesota during 2022.

Permit area	No. of hunters[a]		Birds harvested		Birds per harvester[b]	Success rate[c]
	Self-reported	Estimated	Self-reported	Estimated		
803A	7	10	3	4	1.3	0.30
804A	5	6	2	2	2.0	0.17
805A	9	10	9	10	1.7	0.60
806A	7	12	2	3	1.5	0.17
807A	16	18	26	29	1.8	0.89
808A	16	18	25	28	1.8	0.89
809A	11	14	14	18	1.8	0.71
810A	13	14	13	14	1.6	0.64
811A	0	0	0	0	0.0	0.00
812A	3	4	2	3	1.5	0.50
813A	1	3	0	0	0.0	0.00
All	88	109	96	111	1.7	0.60

[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 2003–2022.

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

[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.

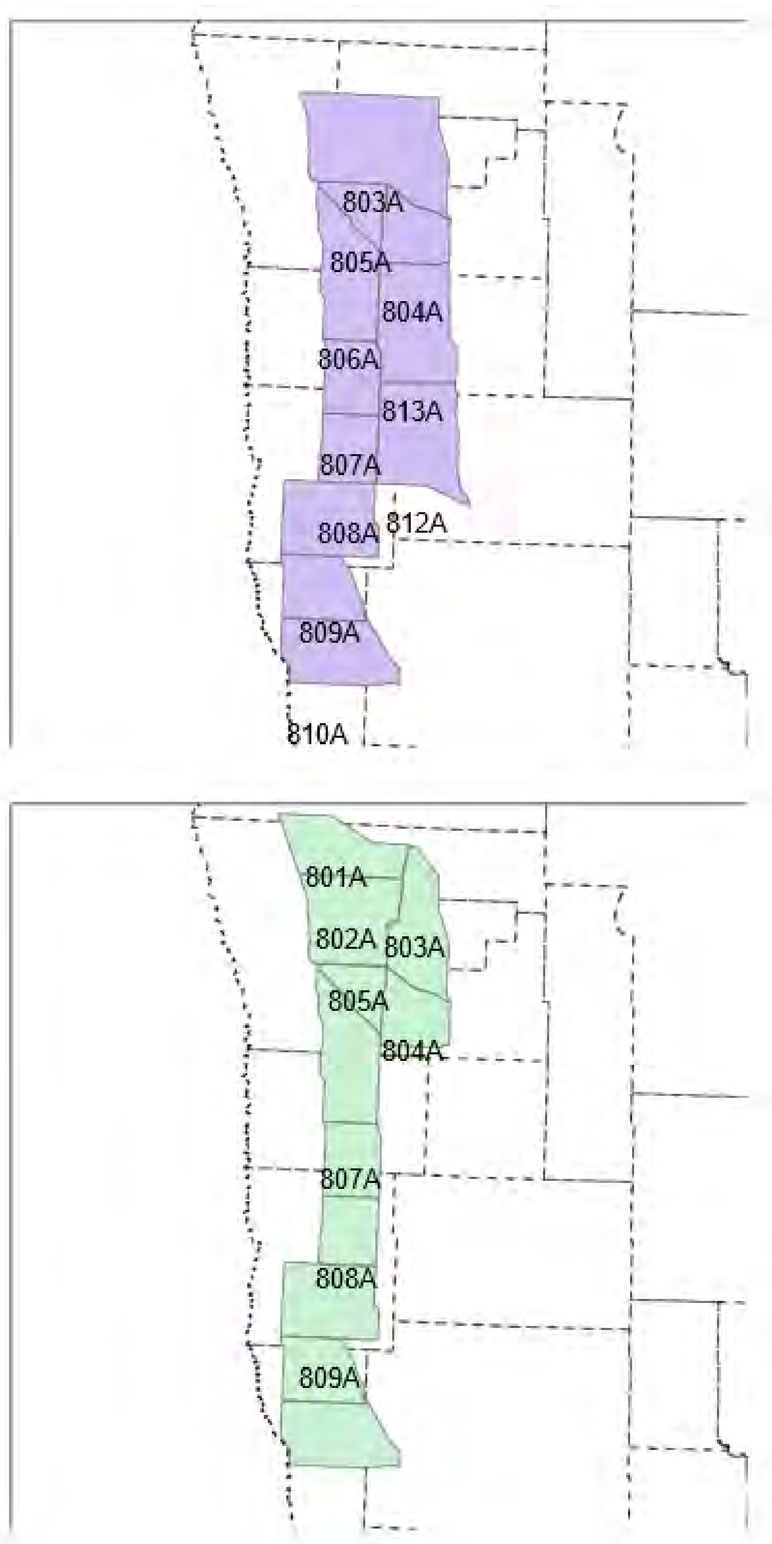


Figure 1. Prairie-chicken hunting permit area boundaries in northwestern Minnesota since 2013 (top) compared to during 2006–2012 (bottom). County boundaries are indicated by dashed lines. Permit areas 812A and 813A were added, 801A was eliminated, and 802A and portions of 803A were combined into a revised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

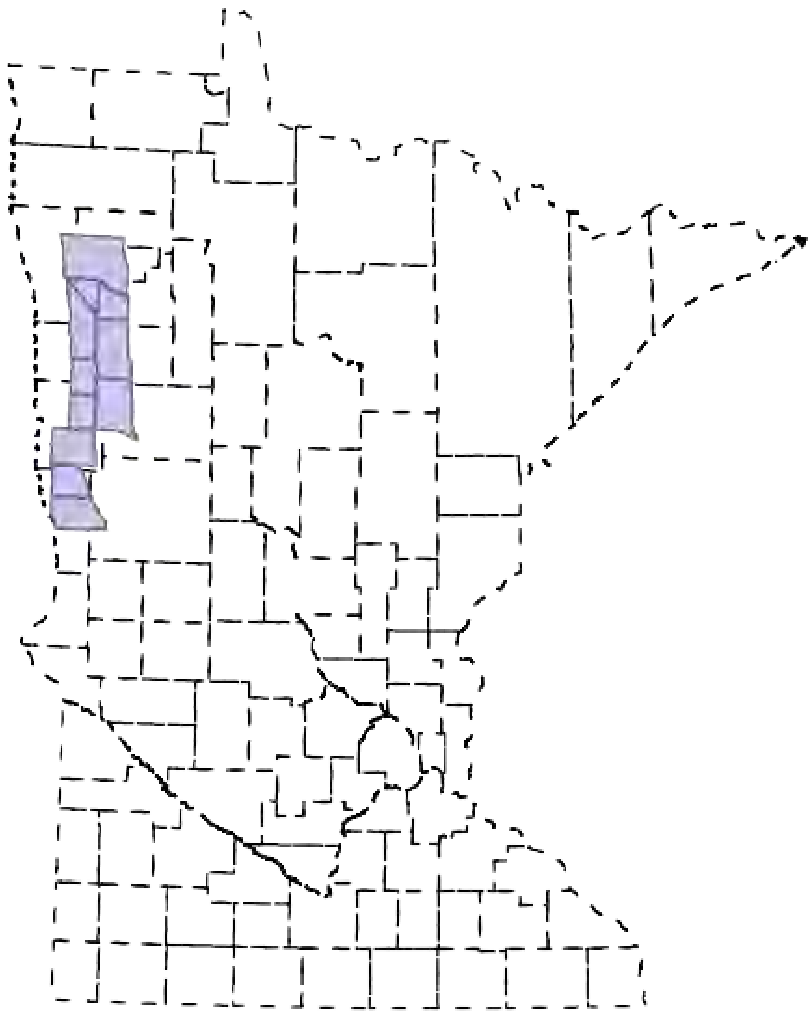


Figure 2. Northwestern location of prairie-chicken hunting permit areas within the state relative to county boundaries (dashed lines).

STATUS OF MINNESOTA BLACK BEAR HARVEST, 2022*

Andrew N. Tri, Forest Wildlife Research Group

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 fifth straight year. Applications have not been this high since 2001. Of these, >4,400 (17%), 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 slightly higher than 2021. Hunting success is inversely related to the number of hunters but also strongly affected by fall foods. The total number of hunters were nearly a 30% increase over the 5-year average and is similar to the increase we saw in 2020 (Table 1).

Quota zone permits and licenses

The number of quota zone permits available in 2022 was very similar to 2021 (Table 2). This is the 10th year (since 2013) that permits have been kept relatively low (<3,900). This was the 12th year (since 2011) of a system whereby licenses for the quota zone that were not purchased by permittees selected in the lottery (>400) 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 (595 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. This area will exist for at least 3 years to understand if there are any reductions in 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 (Fig. 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 3). 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 this year 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 over 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 (11) consistently had the highest proportions of non-resident hunters (21%–30%). Most BMUs had ~10–15% non-resident hunters, except for 11, 13, 25, 28, 31, and 47 which varied between 20%–37% with wide fluctuations annually (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 10 years has made it increasingly difficult to succeed in the lottery and wait times increased again in 2022. 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). This year, although quotas were about the same as last year, a higher level of preference (Table 5) was needed to secure a permit because a large number of hunters who had accumulated preference points by previously applying to area 99 entered the lottery for a BMU. First-time and second-time applicants were successful only in BMU 22 (wilderness area hunt). Six BMUs required a preference level of 4 for guaranteed success, and BMUs 27, 28, 46, 47, and 45 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 2022 was 25% lower than 2021, and 30% lower than 2020 (Table 6). This was likely due to the range-wide boom in production of natural bear foods for the second year in a row. The sex ratio of the harvest was ≥60% males in BMUs 12, 13, 25, 27, 28, 31, 41, 451, and 51. All others had sex ratios closer to >50% male, expect for BMU 45 (47% male). 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 likelier 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 (Tables 1, 2), and commensurately, total harvests declined and the percent of the harvest in the no-quota zone increased. The percent harvest in the no-quota zone has continued to increase, split evenly between BMUs 11 and 52 (Table 5, Fig. 4). Nearly half of the bear hunters were hunting with a no-quota license this year.

Hunting success by BMU

In 2022, success was at or below the 5-year average in quota zone, with the exception of 45 where success was the second highest ever recorded (Table 7). Success rate in quota zone nearly 2.5 times higher than in the no-quota zone (42% vs. 17%, respectively). Success rates in the no quota were similar to long-term averages, but still good overall (17% average over the last 5 years).

Harvest by date

During years of normal fall food abundance, about 70% of the harvest occurs during the 1st week of the bear season, and ~83% occurs by the end of the 2nd week (Table 8). This year lagged behind this pattern somewhat, likely due to the abundant crops of natural foods across Minnesota this fall.

Predictions of harvest from food abundance

The 2022 statewide harvest was 10% higher than expected, based on regression of harvest as a function of hunter numbers and the fall food productivity index (Fig. 5). This regression is nearly as strong (and has accurately predicted previous harvests) when only the past 15 years are considered. For the quota zone, the actual harvest in 2022 was also 15% higher than 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 (Figs 6 & 7). 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 but was especially low (<80%) in a number of units (BMUs 10, 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 (Fig. 8). 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. 9).

Hunter experience, methods, and effort

A bear hunter survey was employed to assess changes in hunter effort and hunting methods over time, comparing periodic hunter surveys conducted over a 30-year period, 1988–2022 (Table 9). A random sample of 74% of all hunters were surveyed this year (6,000 total surveys), of which responses were received from 60% in the quota zone and 29% in the no-quota zone (the remaining 11% of respondents did not indicate which area they hunted). In total, 165 surveys were address returns, and 1614 hunters responded, indicating a 28% response rate. Hunters have gained bear hunting experience over time and a preponderance of hunters now use trail cameras (88% in quota zone, 78% in no-quota). However, type of weapon, use of bait, and use of guides has remained relatively stable, at least during the 2000s. There was a slight increase in the number of days hunting this survey over the long-term mean (7.2 days this year vs. long-term average of 6.3 days). Fewer hunters indicated passing up a shot at a bear in 2018 and 2022 than in the past (Fig.10). Those that did pass up a shot did so mainly seeking a larger bear or to avoid shooting a female with cubs. The percentage of hunters who passed-up shooting a bear was virtually the same in quota and no-quota zones.

Hunter reactions to hunter density and low quotas

Few hunters indicated that low hunter density (less competition, due to low quotas) made them more selective in the bear they shot. However, quota hunters enjoyed their hunt more than no-quota hunters because the no-quota areas have become more crowded (at least in spots) (Fig. 11).

**Harvest data extracted from the Status of Minnesota Black Bears, 2022: 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, 2002–2022.

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Permit applications[a]	21886	16431	16466	16153	15725	16345	17362	17571	18647	19184	18103	18107	18885	18422	19958	21034	21184	20632	22279	24598	25817
Permits available[b]	20610	20110	16450	15950	14850	13200	11850	10000	9500	7050	6000	3750	3750	3700	3850	3350	3350	3400	3575	3575	3605
Licenses purchased (total)	14639	14409	13669	13199	13164	11936	10404	9892	9689	9555	8986	6589	6620	6962	7177	6655	6550	6801	8882	8990	8153
Quota zone [c]	12350	9833	10063	9340	9169	8905	7842	7342	7086	5684	4951	3188	3177	3257	3420	2954	2922	2988	3178	3187	3146
Quota surplus/military [c]	209	2554	1356	1591	1561	526	233	77	83	1385	1070	578	583	446	441	401	428	417	398	392	505
Quota-no limit area-451																			1038	768	595
No-quota zone [c]	2080	2022	2238	2268	2434	2505	2329	2473	2520	2486	2965	2823	2860	3259	3316	3300	3200	3396	4262[h]	4643	3907
% Licenses bought																					
Of permits available [d]	60.9	61.6	69.4	68.5	72.3	71.4	67.7	73.4	74.6	100	100	100	100	100	100	100	100	100	100	100	100
Of permits issued [d]	66.3	65.7	68.3	67.1	68.9	70.0	67.2	73.8	74.5	80.7	82.7	85.0	84.7	87.9	88.7	88.2	87.2	87.8	80.8	89.1	86.1
Residents in Quota [d]														86.3	88.1	76.6	88.9	87.6	86.6	87.5	88.1
Estimated no. hunters [e]	13800	13600	12900	12500	12500	11300	9900	9400	9200	9200	8600	6300	6300	6700	6900	6400	6300	6700	8400	8500	8100
Harvest	1915	3598	3391	3340	3290	3172	2135	2801	2699	2131	2604	1866	1627	1971	2641	2040	1766	2340	3203	2971	2251
Harvest sex ratio (%M) [f]	61	58	57	59	58	57	62	59	59	61	59	62	62	66[i]	61	63	66[i]	61	56	59	60
Success rate (%)																					
Total harvest/hunters [g]	14	26	26	26	26	28	21	30	29	23	30	30	26	30	38	32	28	35	38	35	35
Quota harvest/licenses [k]	14	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

[a] From 2008 to 2019, 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 (record high in the last two decades)additionally, area 88 nuisance-only bear license applications counted in this total in 2017=3, 2018=6, 2019=5, 2020=11, 2021=4 (people who selected area 88 as 1st preference).

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

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

[d] Quota licenses bought (including surplus)/permits available, or licenses bought (prior to surplus)/permits issued. Beginning in 2008, some permits were issued for area 99; these are no-hunt permits, just to increase preference, and are not included in this calculation. In 2011–20, 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%), and 2018 (92.7%). Beginning in 2011 all unpurchased quota licenses were sold as "surplus" in August, and this process is quick and competitive; thus, for 2011–19 all Surplus and Military license-holders were considered to have hunted.

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

[g] Success rates in 2001–2012 were calculated as number of successful hunters/total hunters, rather than bears killed/total hunters, because no-quota hunters could take 2 bears. After 2012, hunters could take 2 bears only if they bought 2 licenses (1 quota + 1 no-quota). In both 2016 and 2017, 5 hunters legally killed 2 bears. In 2018, 3 hunters shot 2 bears. In 2019, 2 hunters shot 2 bears. In 2020, 5 hunters shot 2 bears.

[h] Record high number of no-quota zone licenses purchased in 2020; record high % of licenses in no-quota zone in 2017 (nearly 50%; see Fig. 4).

[i] Record high % males in statewide harvest.

[j] 2020: highest success rate in quota zone ever; 2016: second highest success rate; 2019: 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 2021 success rate for BMU 451 is listed in Table 6 and the success rate for the quota area with Area 451 included is 45%.

Table 2. Number of bear hunting quota area permits available, 2018–2022. Highlighted values show a change from the previous year.

BMU	2018	2019	2020	2021	2022
12	125	150	125	125	100
13	225	250	225	225	225
14					10
22	50	50	50	50	50
24	175	200	175	175	135
25	400	500	400	400	360
27	225	225	225	225	225
28	60	60	60	60	60
31	500	550	500	500	425
41	125	150	175	175	200
45	175	150	200	200	250
46	350	350	400	400	450
47	40	40	40	40	40
51	900	900	1000	1000	1075
Total	3350	3700	3575	3575	3605

[a] In 2016, the Leech Lake Reservation was split from BMUs 26 and 44 to form BMUs 28 (north) and 47 (south), with the remaining area of BMU 26 renamed BMU 28 and remaining area of BMU 44 renamed BMU 46.

Table 3. Number of quota BMU permit applicants (Apps), licenses bought (after permits drawn) and surplus licenses bought, 2017–2022[a]. Shaded values indicate undersubscribed (applications less than permits available).

BMU	2017			2018			2019			2020			2021			2022		
	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	774	113	12	703	109	16	711	104	21	751	107	18	891	110	15	931	82	18
13	772	200	25	682	177	47	712	199	26	734	195	30	944	198	27	939	192	33
14																51	7	3
22	47	34	16	76	36	14	61	35	14	69	32	18	73	40	10	51	38	12
24	945	158	17	928	155	20	840	153	22	909	155	20	1072	157	18	1144	122	13
25	1651	354	46	1561	355	44	1520	348	52	1627	367	33	1806	356	44	1836	313	47
27	1297	197	28	1265	204	21	1280	200	25	1338	207	18	1532	200	25	1675	203	22
28	330	52	8	309	52	8	318	51	9	312	49	11	358	59	1	351	55	5
31	2076	441	59	2074	428	71	1907	432	67	2022	444	57	2297	428	72	2222	351	74
41	614	109	16	648	114	11	661	143	7	663	154	21	841	155	20	848	167	33
45	2323	161	14	2383	160	15	2351	178	22	1978	186	14	2241	190	10	2308	222	28
451[c]												1038			769			595
46	2774	319	31	2769	317	33	2662	313	37	2853	364	36	3340	364	36	3596	391	59
47	214	33	7	182	35	5	198	34	6	216	33	7	244	33	7	263	34	6
51	4411	783	117	4344	779	123	3956	798	102	4058	885	115	4766	897	105	5106	926	149
Total[b]	18228	2954	396	17924	2921	428	17177	2988	410	18577	3178	1454	20405	3187	1158	21343	31460	1097

[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 (2018–2022) for each bear management unit (BMU) in Minnesota.

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

[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 2019–2022. 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].

	2019					2020					2021					2022					
BMU	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 1	Pref 2	Pref 3	Pref 4	Pref 5	Pref 6
12	0	0	13			0	0	0	72		0	0	58			0	0	0	25		
13	0	0	92			0	0	93			0	0	66			0	0	43			
14																0	0	0	80		
22	76					65					56					60					
24	0	0	11			0	0	0	93		0	0	0	78		0	0	0	35		
25	0	0	58			0	0	45			0	0	32			0	0	97			
27[b]	0	0	0	66		0	0	0	49		0	0	0	20		0	0	0	0	93	
28[b]	0	0	0	5		0	0	0	2		0	0	0	0	77	0	0	0	0	61	
31	0	0	38			0	0	33			0	0	9			0	0	0	91		
41	0	0	6			0	0	26			0	0	26			0	0	15			
46[b]	0	0	0	1		0	0	0	0	83	0	0	0	0	58	0	0	0	0	41	
47[b]	0	0	0	50		0	0	0	18		0	0	0	0	72	0	0	0	0	31	
45	0	0	0	0	42	0	0	0	0	23	0	0	0	0	5	0	0	0	0	0	91
51	0	0	0	22		0	0	24			0	0	18			0	0	20			

[a] As an example, in 2019: BMU 12: 0% of preference level 1 and 2 applicants were drawn, 13% of preference level 3, and 100% of preference level 4 and above were drawn for a permit; BMU 22: 76% preference level 1 applicants were selected, 100% all higher preference levels; BMU 45: no preference level 1–4 applicants were drawn, 42% of hunters with preference 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 2022 by Bear Management Unit (BMU)[a] and sex[b] compared to harvests during 2017–2021 and record high and low harvests (since establishment of each BMU, not counting current year).

BMU	2022 M	2022 (%M)	2022 F	2022 Total	2021	2020	2019	2018	2017	5-year mean	Record low harvest (yr)	Record high harvest (yr)
QUOTA												
12	32	73	13	48	71	84	62	66	54	67	38 (14)	263 (01)
13	87	78	23	110	110	126	105	119	100	119	71 (88)	258 (95)
14	0	0	0	0								
22	1	100	0	1	3	7	3[d]	4	8	5	3 (03)	41 (89)
24	33	57	25	58	81	97	86	60	81	81	50 (14)	288 (95)
25	112	64	64	176	215	251	224	223	212	225	149 (96)	584 (01)
26					[174]	[186]	[169]	[141]	[162]	[163]	117 (14)	513 (95)
27	71	70	30	101	140	148	128	105	120	128	105 (18)	148 (20)
28	26	81	6	32	34	38	41	36	42	38	36 (18)	42 (20)
31	137	70	60	197	296	325	212	211	262	261	157 (88)	697 (01)
41	53	62	32	85	75	74	76	58	61	69	35 (15)	201 (01)
44					[228]	[256]	[203]	[154]	[158]	189	130 (11)	643 (95)
46	119	56	92	211	201	231	181	139	141	179	139 (18)	231 (20)
47	9	56	7	16	27	25	22	15	17	21	15 (18)	25(16,20)
45	57	47	64	121	108	85	108	51	77	86	32 (11)	178 (01)
451	45	61	29	74	110	168						
51	217	62	134	350	477	511	411	185[d]	372	391	185 (18)	895 (01)
Total	999	63	579	1578	1948	2210	1659	1272	1547	1591	1192 (88)	4288 (01)
NO-QUOTA												
11	179	66	89	268	386	487[f]	269	287	179	322	38 (87)	351 (05)
10	30	68	14	44	50	29[f]	26	21	18	29	15 (16)	29 (20)
52	212	61	140	351	587	476[f]	386	186	295	386	105 (02)	476 (20)
60[c]	0	0	0	0	0	1	0	0	1			
888[g]	5	55	4	9								
Total	426	63	247	672	1023	993[e]	681	494	493	674	198 (87)	993 (20)
STATE	1413	63	821	2251	2971	3203	2340	1766	2040	2225	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.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, *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], 2017–2022[a].

BMU	Max success (yr) before 2022		Mean success 2017–2021	2022	2021	2020	2019	2018	2017
12	67	(20)	54	45	55[c]	67[b]	53	43	52
13	59	(95,16)	50	47	49	56[c]	53	45	59[b]
14				0					
22	18	(92)	10	2	6	14	8	16	10
24	55	(20)	46	43	46	55[b]	34	46	48[c]
25	63	(20)	56	49	54	63[b]	56	53	57[c]
26	65	(20)	58	46	61[c]	65[b]	49	57	52
27	66	(20)	56	44	62[c]	66[b]	47	53	52
28	70	(18)	61	53	57	63[c]	60	70[d]	53
31	65	(20)	52	46	59[c]	65[b]	42	52	56
41	50	(95)	46	43	43	42	46	49[c]	46
44	58	(20)	48	46	52[c]	58[b]	39	41	48
46	58	(20)	47	46	50[c]	58[b]	39	40	47
47	63	(20)	53	40	68[b]	63[c]	38	43	50
45	54	(21)	45	48[c]	54[b]	43	29	44	40
451			15	12	14	16			
51	51	(20)	41	33	47[c]	51[b]	21	41	46
QUOTA[E]	57	(20)	45	42	51[C]	57[B]	38	46	50
11[F]			23	21	24	23	25	17	28
10[F]			10	12	12	12	9	8	9
52[F]			17	15	23	19	10	14	19
NO QUOTA	32	(95)	20	17	22	24	15	15	21
STATEWIDE	40	(95)	33	35	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	2022	2021	2020		2019		2018	
11	32.4	34.7	34.3		30.9		34.6	
10	9.1	9.3	8.6		14.3		7.4	
52	58.3	56.0	56.8		52.0		55.3	
60 (n)	0.3 (10)	0	0.3	(13)	0.3	(11)	0.1	(4)
Quota zone (n)	0	0	0.6	(27)	2.5	(94)	2.6	(83)

Table 8. Cumulative bear harvest (% of total harvest) by date, 1998–2021.

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

[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.

Table 9. Results of 2022 hunter survey versus hunter surveys conducted over the past 30 years, on issues that may relate to hunter selectivity. Blank spaces represent questions not asked in that year (or data not obtainable).

	1988	1991	1998	2001	2009	2018	2022
% 1st year bear hunter	47%	45%	32%	25%	25%	24%	25%
% >5 years previous bear hunting			18%	21%	35%	36%	47%
% License-holders hunting	91.0%	92.6%	86.8%	93.9%	95.3%	92.7%	92.8%
Mean days hunted[a]	6.3	6.1	6.3	8.3[e]	6.8	6.3	7.2
% Used bait	74%	78%	82%	92%	89%	91%	91% [c]
Pounds of bait/hunter (median)			100	200	150	150	100
% Used guide	7%	11%	10%	15%	17%	13%	12%
% Used bow	21%	21%		21%	32%	25%	19%
Bears seen (excl cubs)/hunter-day[b]	0.20	0.22	0.19	0.19		0.23	0.23
Bears seen (excl cubs)/hunter			1.1	1.2		1.5 (0–40)	1.6 (0–20)
% Passed up shot		73%[d]		70%[e]		37% (42%[d])	40%[f] (39%[d])
% Used trail camera						83%	85%[c]
Est. no. bears at bait: mean (median)						5 (4)	6 (4)

[a] This line and all lines below pertain only to those who hunted.

[b] Total bears (excluding cubs) seen by all hunters/total hunter-days (not the mean number of bears seen per hunter-day for individual hunters).

[c] Excluding guided hunts. Used bait: Quota zone 95%, No-quota 84%. Used trail camera: Quota zone 88%, No-quota 78%. Average number of stations per hunter was 1.8.

[d] Calculated as: % hunters seeing more bears than they shot (among hunters seeing at least 1 bear).

[e] Hunters could kill 2 bears on 1 license this year; this was designed to discourage passing up a shot at small bears, and allow continued hunting (hence unusually high number of days hunted). Nevertheless, only 30% of hunters said they shot at first bear that presented a good shot.

[f] % of hunters who said they passed up shooting a legal bear for any reason: 40% in quota zone, 41% in no-quota zone.

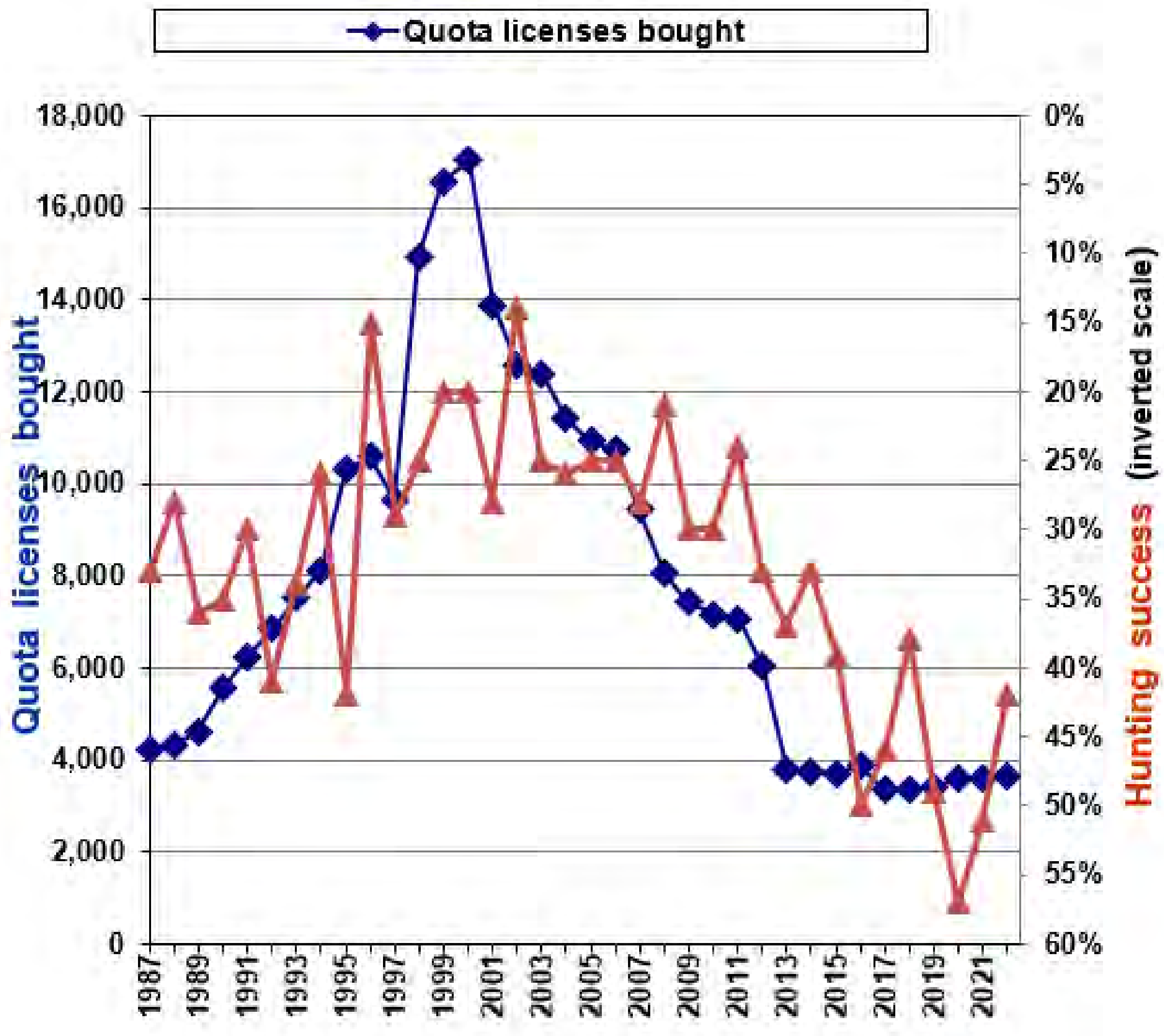


Figure 1. Relationship between licenses sold and hunting success (*note inverted scale*) in quota zone, 1987–2022 (quota and no-quota zones first partitioned in 1987). Number of licenses explains 60% of variation in hunting success during this period. Large variation in hunting success is also attributable to food conditions (e.g., during 2013–2022, 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.

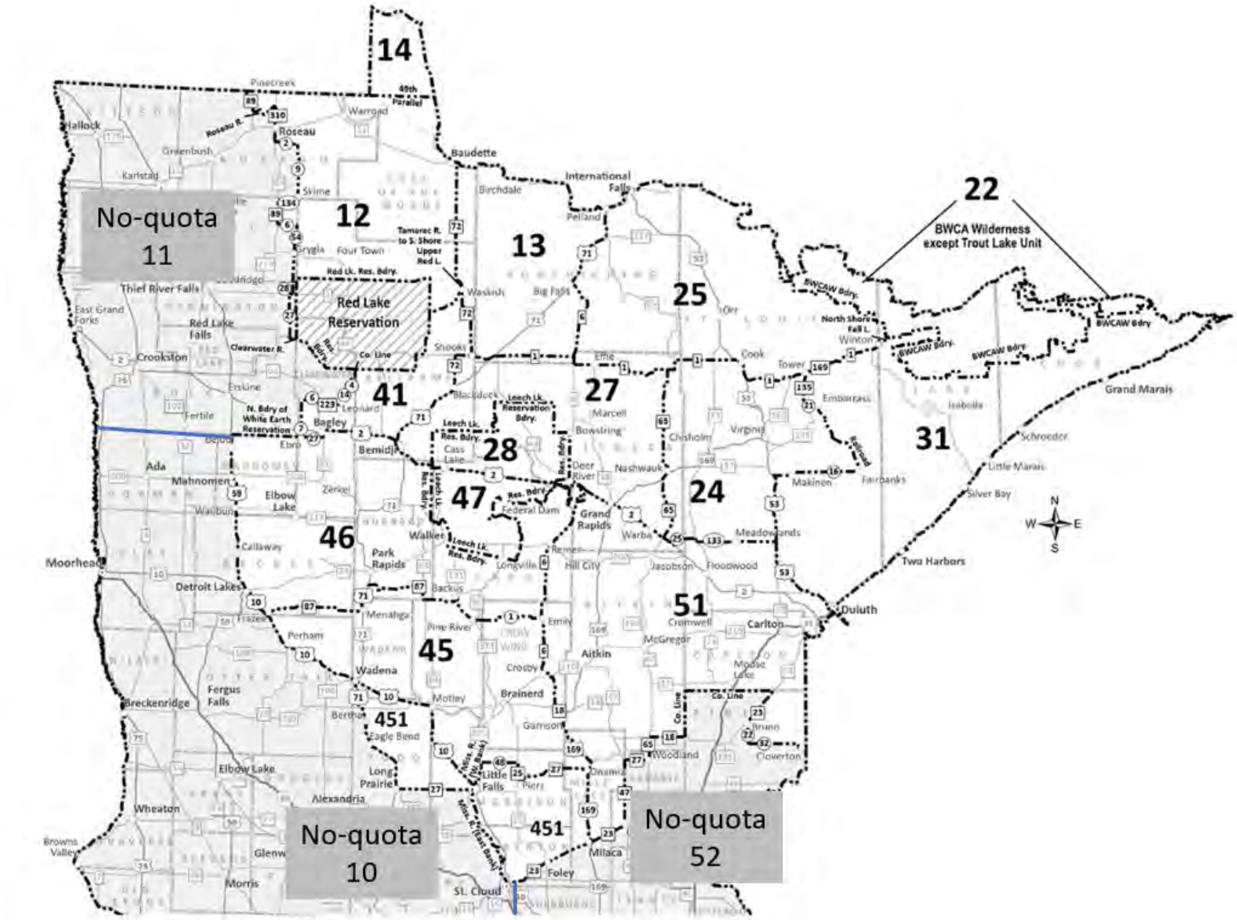


Figure 2. Bear management units (BMUs) within quota (white) and no-quota (gray) zones. Hunters in the quota zone are restricted to a single BMU. In 2016, BMU 26 was divided into 27 and 28, and BMU 44 was split into 46 and 47 (BMUs 28 and 47 comprise the Leech Lake Reservation). No-quota hunters can hunt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

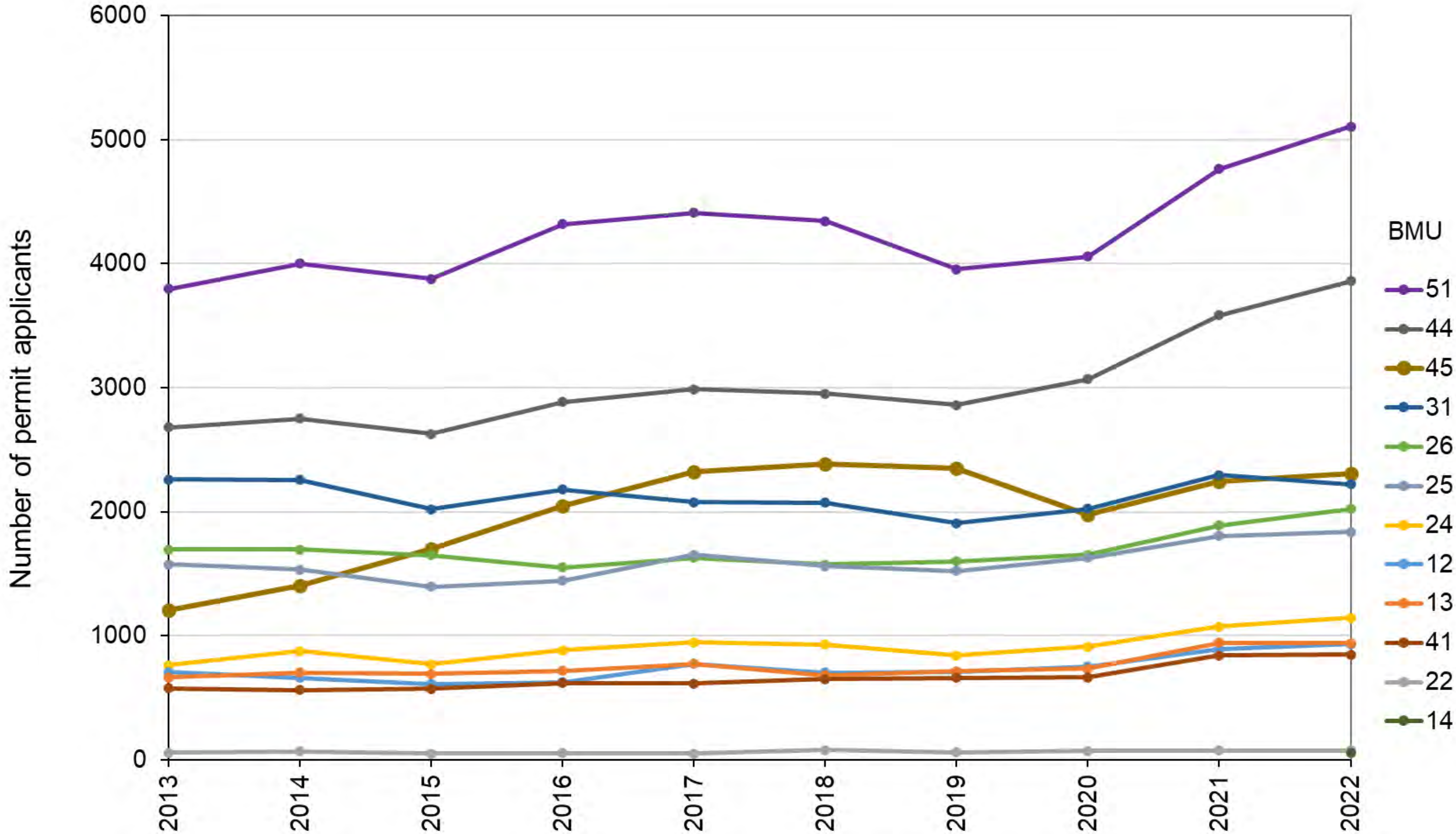


Figure 3. Trends in number of applicants for quota zone permits by BMU over past 10 years, 2013–2022. For 2016–2022, BMUs 27 and 28 were grouped into old BMU 26 and BMUs 46 and 47 were grouped into old BMU 44. BMU 45 has a thicker line because applications there surged over this period. The number of applications in all areas (except 31) increased or remained stable in 2022 from 2021.

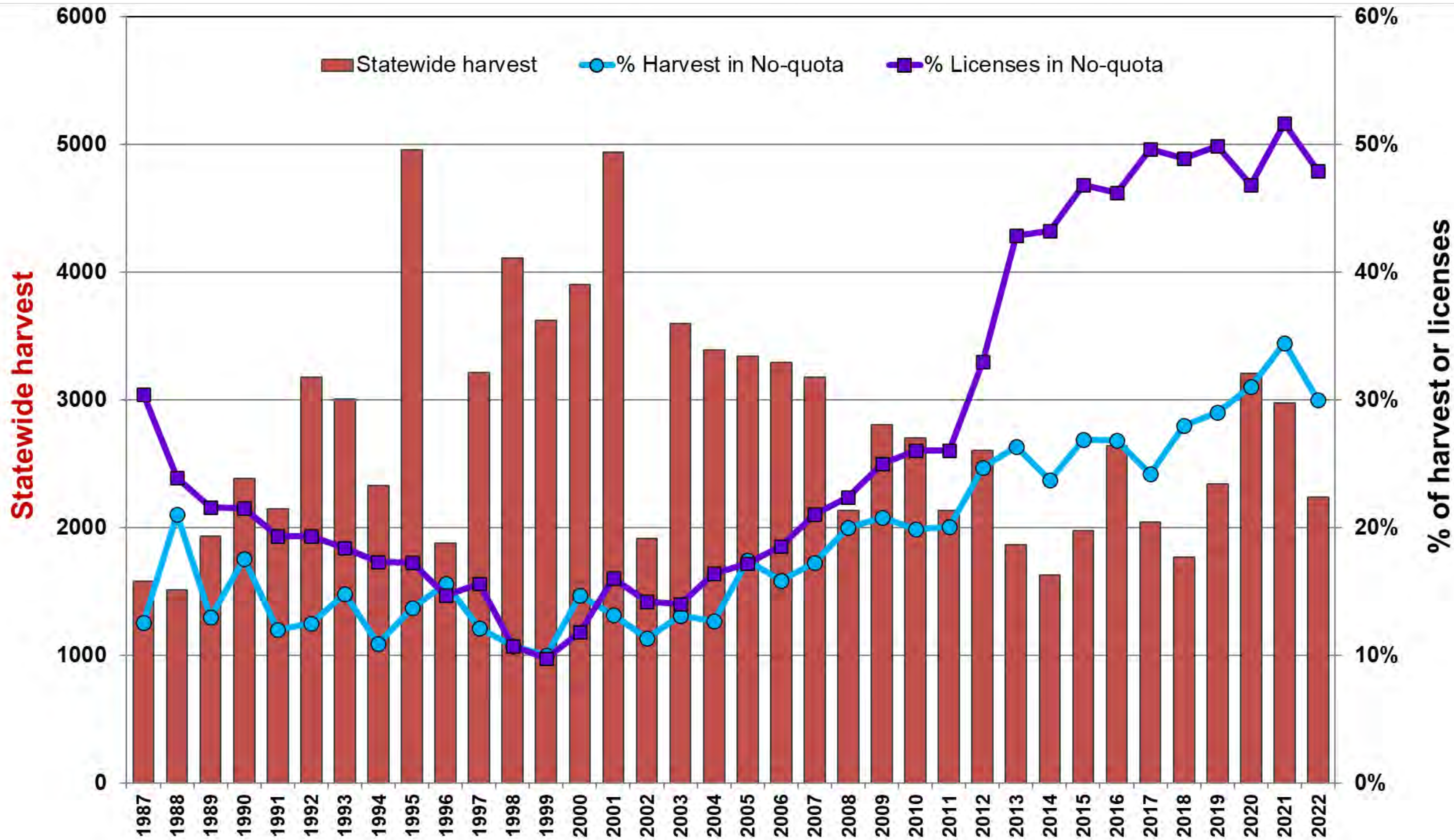
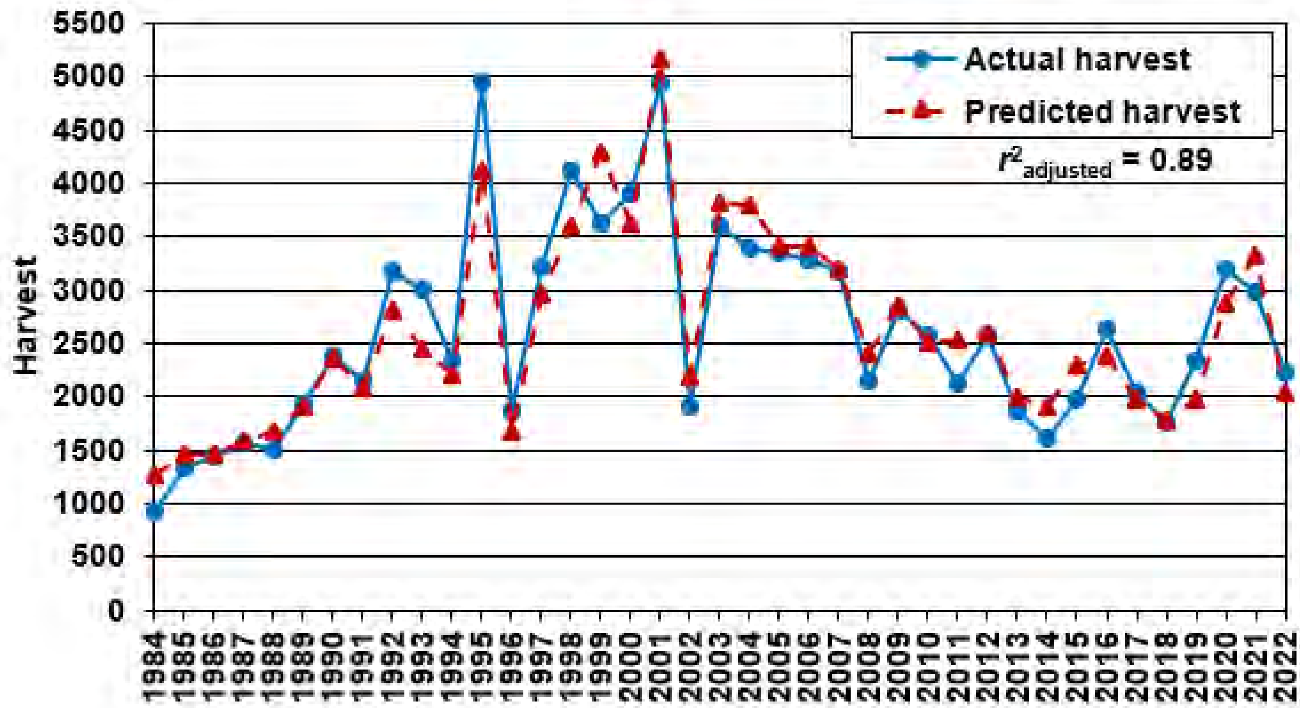


Figure 4. Trends in statewide bear harvest and proportions of harvest and licenses in the no-quota zones, 1987–2022.



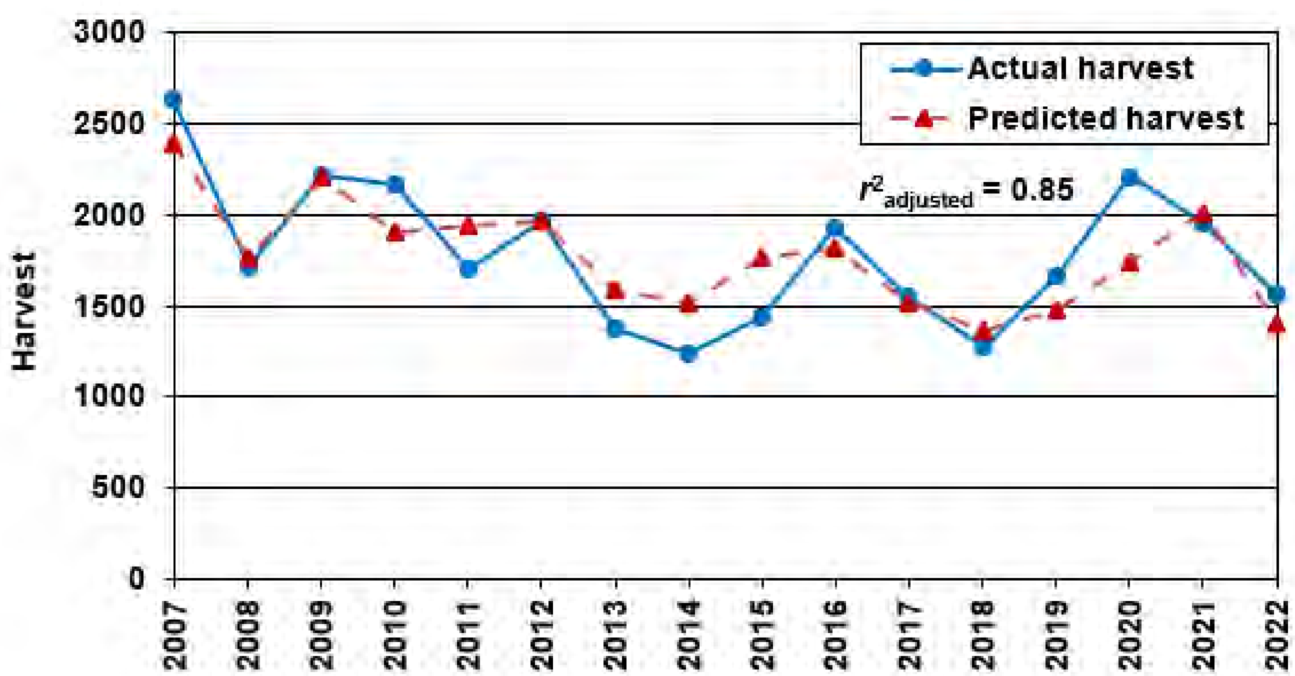


Figure 5. Number of bears harvested vs. number predicted to be harvested based on number of hunters and fall food production — top panel: statewide 1984–2022; bottom panel: quota zone only (including area 451 hunters and harvest), most recent 15 years. The regression has been less effective explaining overall harvest in the last 15 years. Regression for both datasets included an interaction term between food and hunters to better predict changes in harvest when foods were extremely high or low.

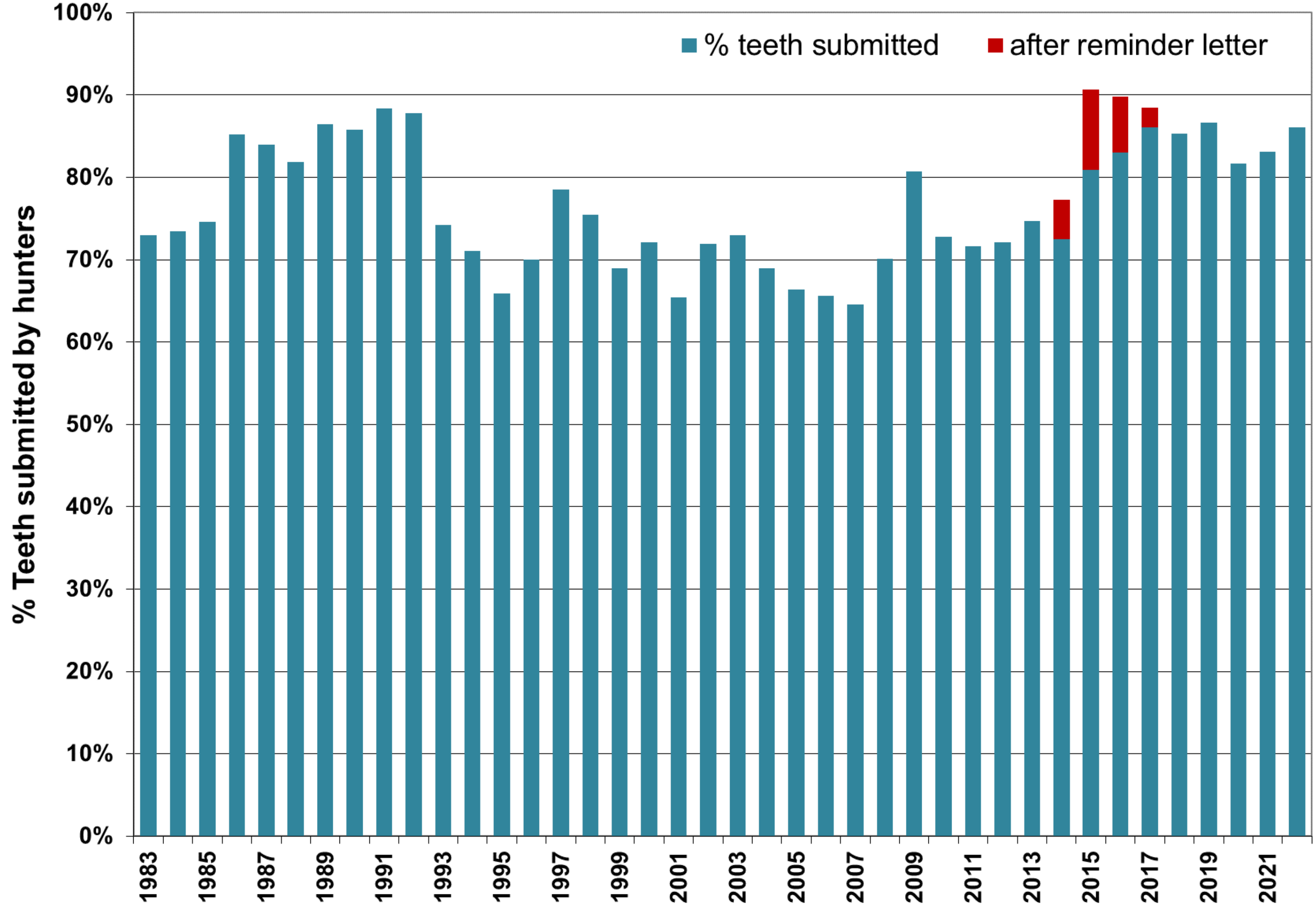
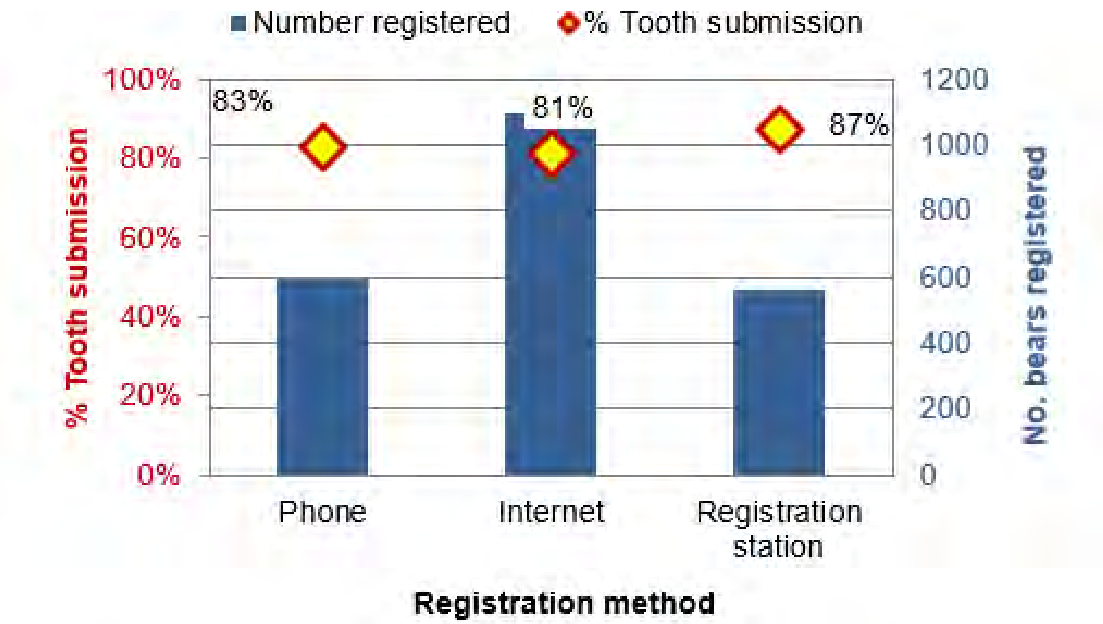


Figure 6. Percent of hunters submitting useable bear teeth for aging (vital for population monitoring, see Figs. 10–12). Cooperation levels exceeded 80% when registration stations were paid to extract teeth (this practice ended in 1993), and in recent years after a series of reminder letters (no letter was sent after 2017).



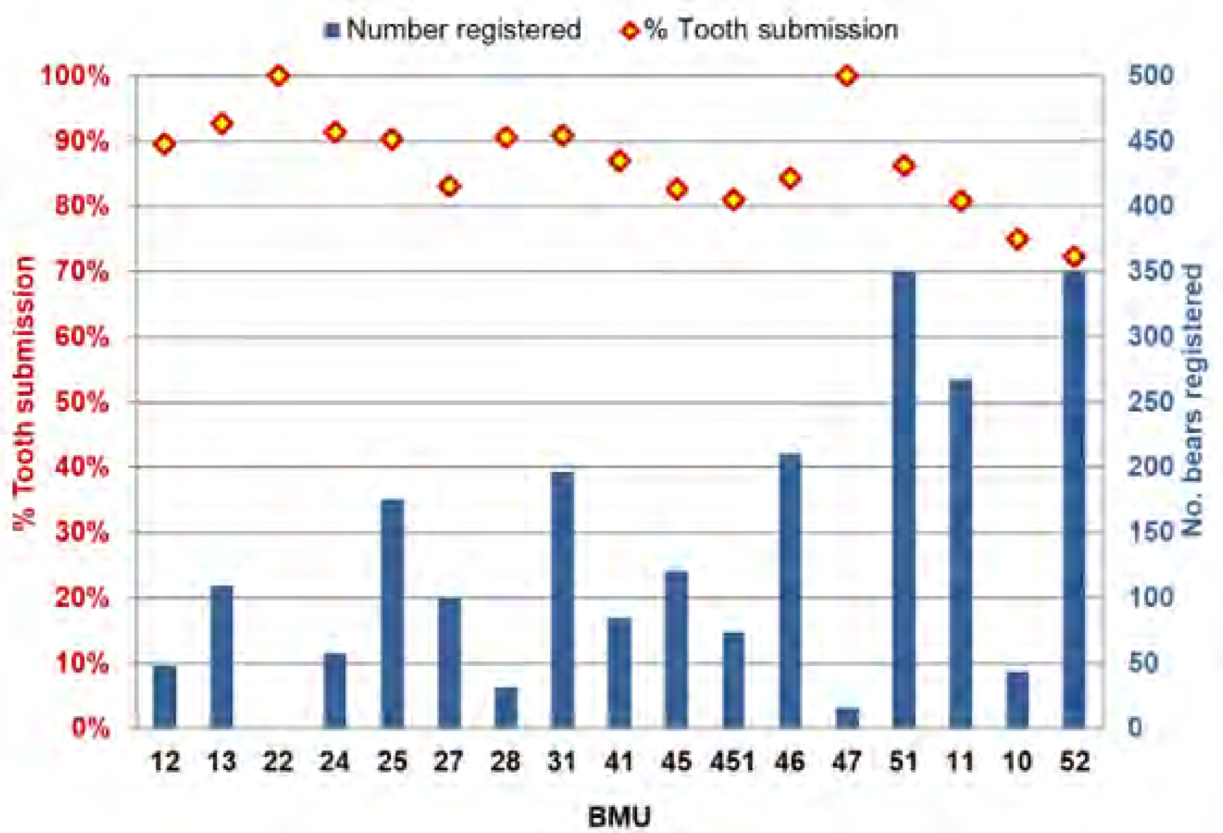


Figure 7. Percent of hunters who submitted a bear tooth in 2022 by method of registration (top panel) and by BMU (bottom panel). Beginning in 2013, hunters could register their bear by phone or internet, as well as in person at a station. The 2022 statewide submission average (84%) was above the long-term average (77%).

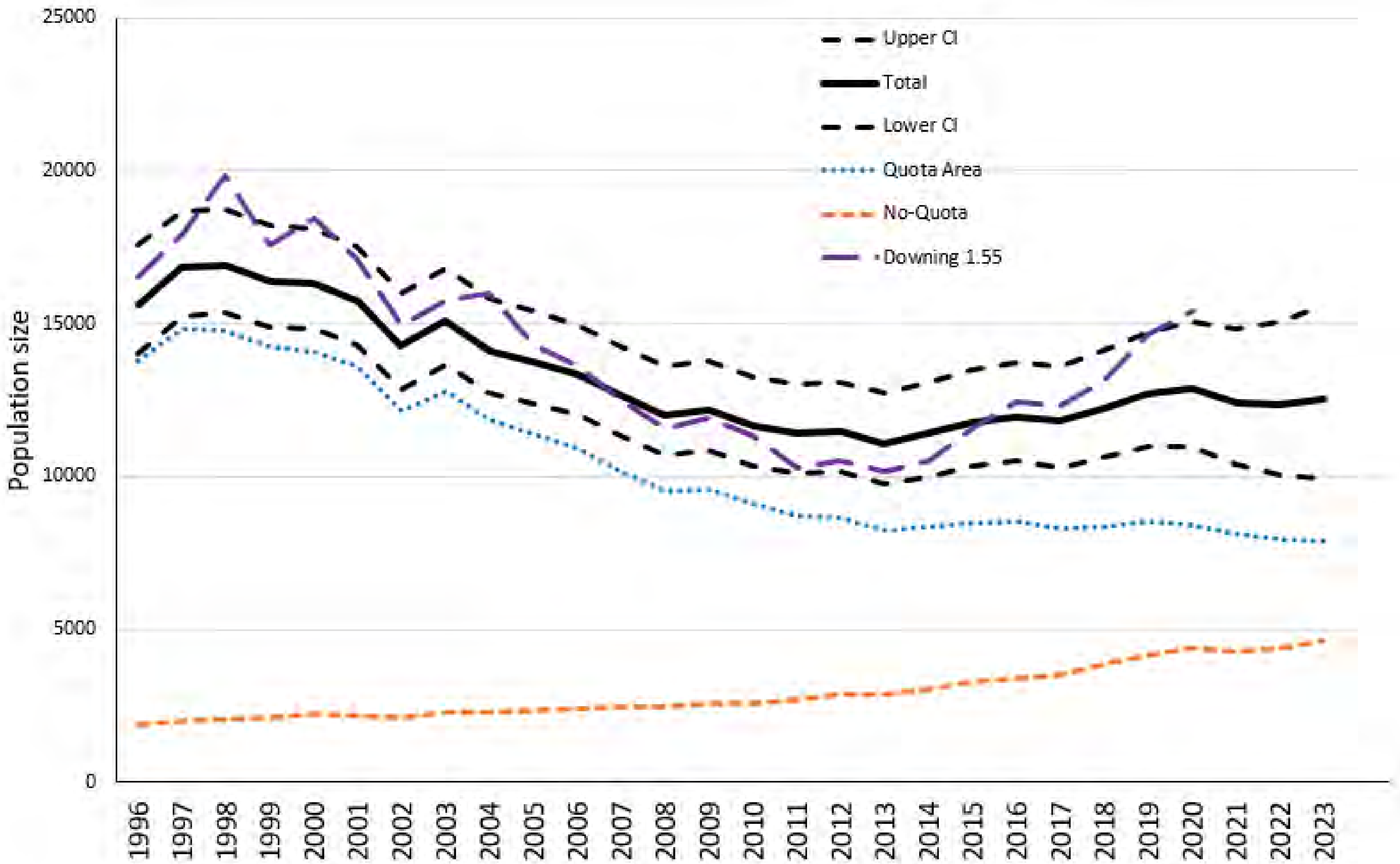


Figure 8. Population trends during 2000s derived from Allen et al. (2018) model statewide estimates (± 95% credible intervals), Downing population reconstruction, and population estimates for quota and no-quota zones. Note the actual scale of the population estimates is an underestimate to true population size (based on previous tetracycline estimates), but population trend seems consistent with the BMU-level models and the Downing.

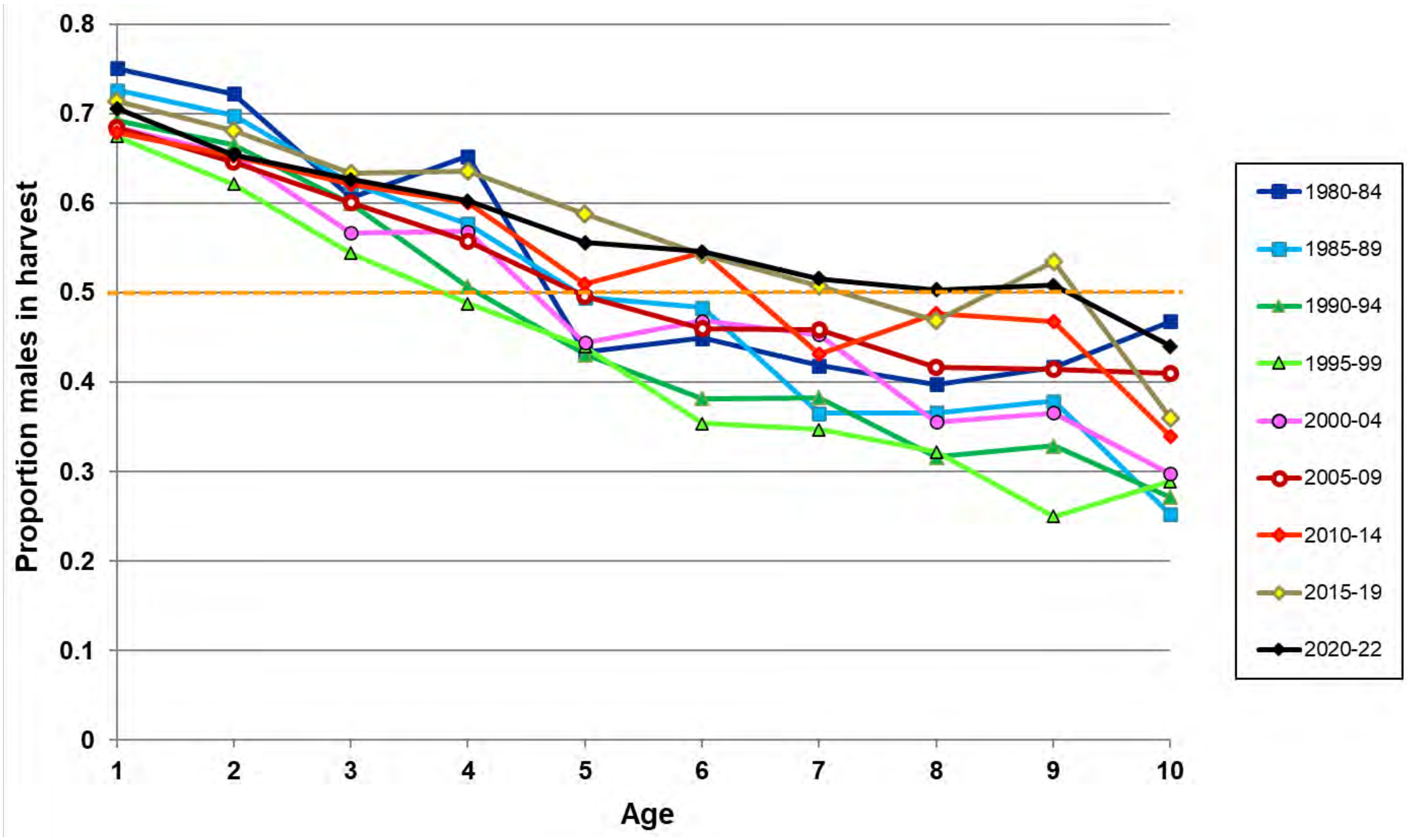


Figure 9. Trends in proportion of male bears in statewide harvest at each age, 1–10 years, grouped in 5-year time blocks, 1980–2022. Higher harvest rates result in steeper curves because males in the living population are reduced faster than females. Fitting a line to the data for each time block and 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., 2015–20 lower than 1980–84), but a slight increase in recent years.

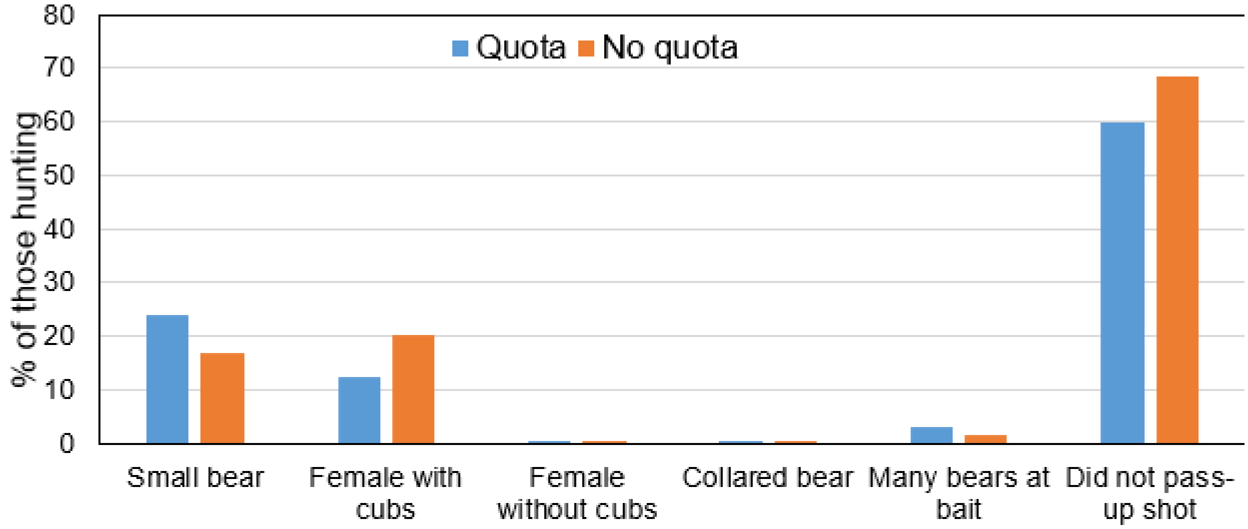


Figure 10. Hunters who indicated they passed up a shot at a legal bear for various reasons, in quota and no-quota zones, based on 2022 hunter survey. The same proportion (74%) of licensed hunters were surveyed in each area, although response rates differed: 60% quota, 29% no-quota.

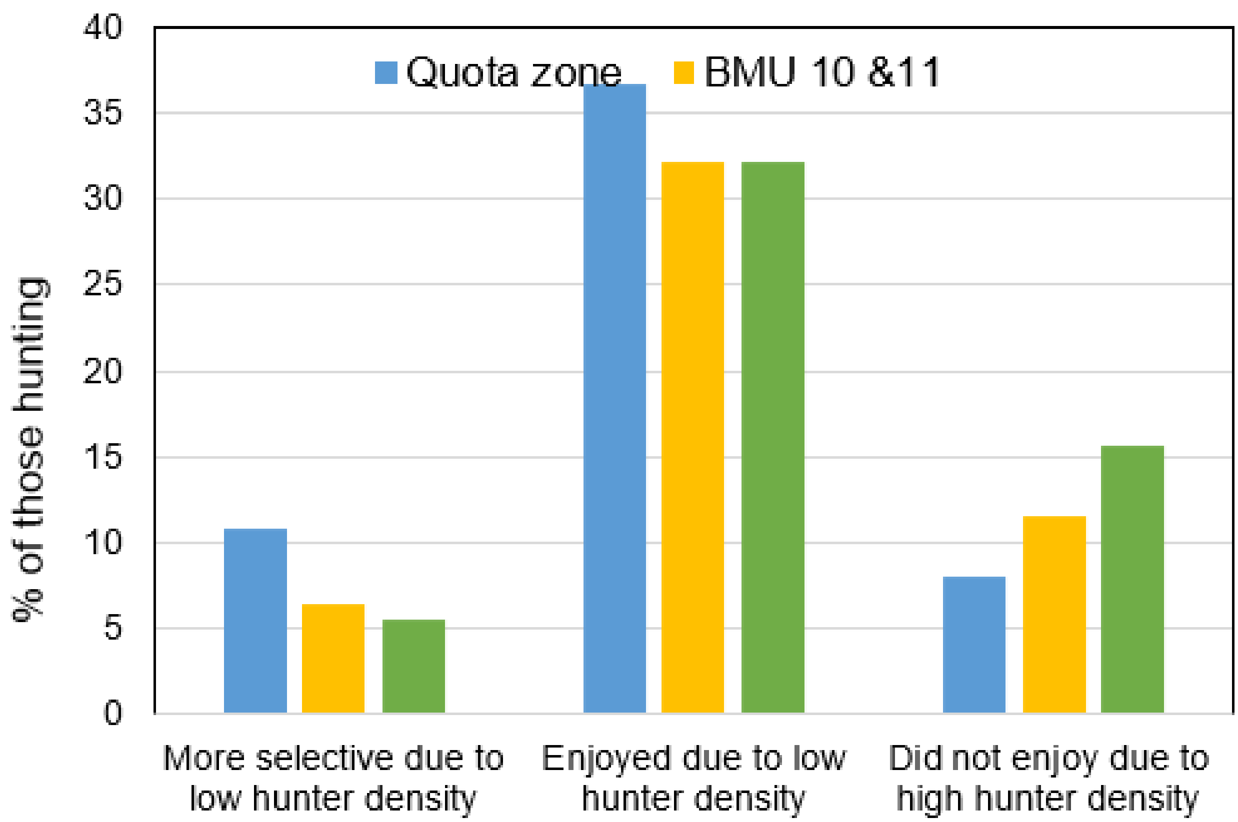


Figure 11. Hunters' opinions about number of other hunters in their general hunting area, based on 2022 bear hunter survey, comparing quota zone versus BMUs in the no-quota zone.

2022 MINNESOTA DEER HARVEST REPORT

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

The white-tailed deer may be considered Minnesota's most popular wildlife species In 2022, more than 455,000 hunters participated in the season. Harvest opportunities in 2022 were largely steady or improving, with increased bag limits in 28 (21%) deer permit areas, decreased bag limits in 12 areas (9%), and no change in 90 (69%) areas compared to 2021. The early antlerless season was also expanded to include 8 additional permit areas, bringing the total to 28 areas included in this season. The 2022 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 deer habitat exists due to the mix of deciduous forest, prairie, and agriculture. In contrast, management remained conservative in the coniferous forests of northcentral and northeastern Minnesota, where deer populations tend to have slower growth rates and are more impacted by winter severity. Similarly, southwestern Minnesota, dominated by agricultural landscapes, followed a conservative management strategy. Across the archery, firearms, and muzzleloader seasons, hunters registered a total of 172,265 deer.

METHODS

Every deer taken by hunting in Minnesota must be registered. Hunters may complete registration in person at one of just over 500 "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 2022 season, 11 deer permit areas were designated as CWD management zones, an increase of two areas compared to 2021, due to confirmed cases of the disease. During the 2022 fall hunting seasons, mandatory CWD sampling was required only during the opening weekend of the firearms A season, rather than during both the A and B season openers as in previous years. Sampling was mandatory in the CWD Management Zone, designated as the 600-series deer permit areas, as well as in the surrounding control zone in southeastern Minnesota and in seven designated surveillance areas. Minnesota's DNR CWD management response within the management and control zones allowed for increased harvest through liberalized hunting opportunities to reduce deer densities and control the movement of deer carcasses through carcass movement restrictions, which helps to prevent further spread of disease to new areas of the state, and deer feeding and attractant bans in counties where both wild and farmed deer have tested positive.

RESULTS

Outcomes of the 2022 deer harvest are presented in the following tables.

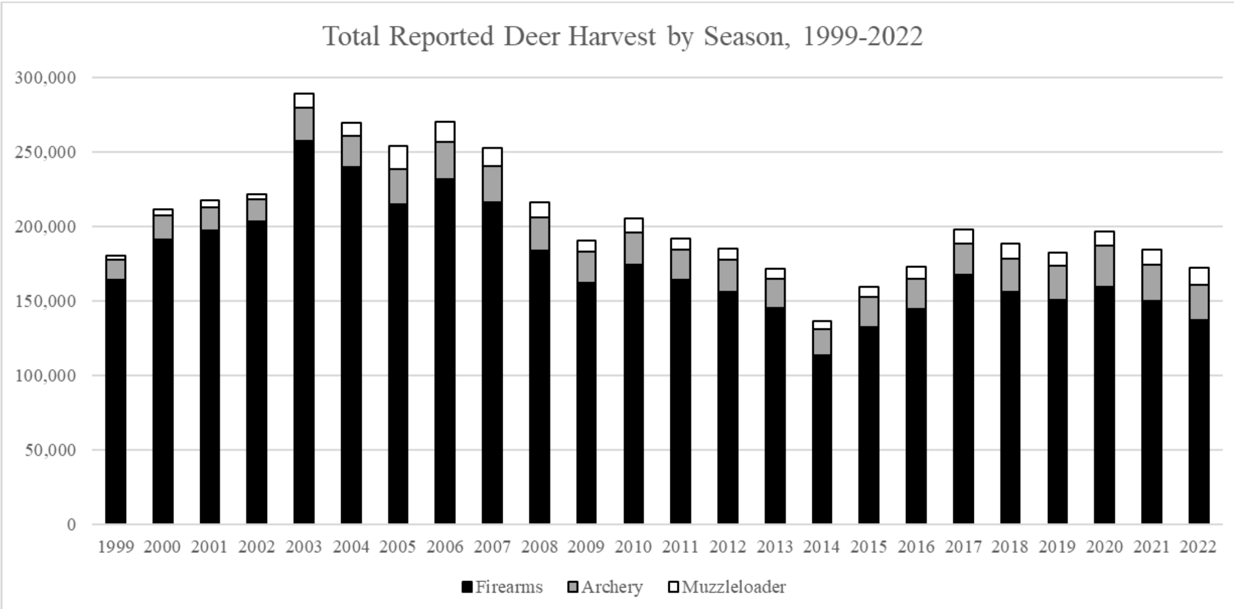

Figure 1. Total deer harvest by season, 1999-2022.

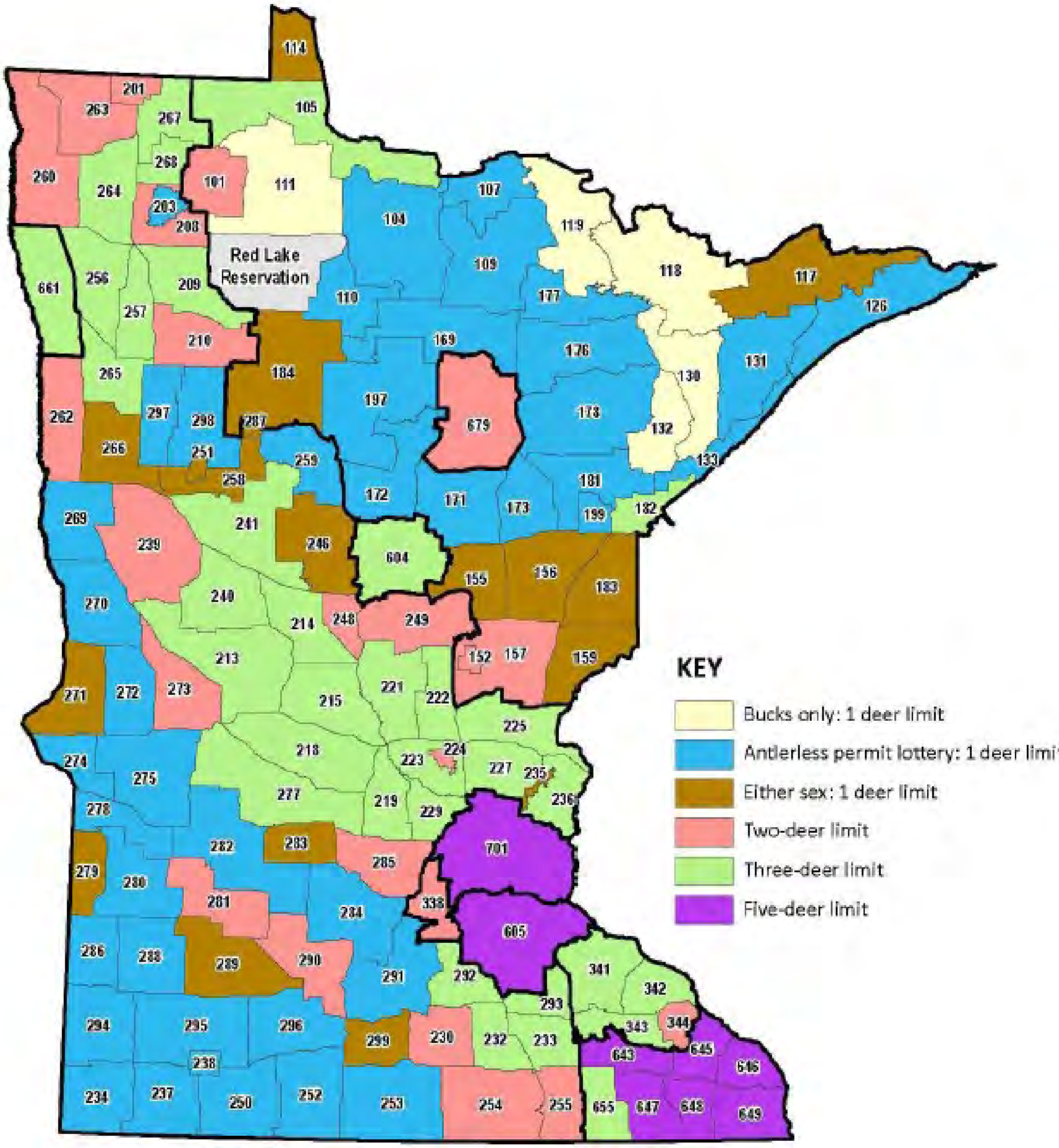

Figure 2. Figure 1. Bag limit designations for deer permit areas in Minnesota for the 2022 deer season.

Table 1. Statewide firearms, archery, and muzzleloader harvest, license sales, and success rates, 2011 – 2022

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
REGULAR FIREARMS												
Resident License Sales	382,668	391,822	391,967	374,314	371,612	372,645	368,407	360,873	351,659	354,023	349,387	342,010
Non-Resident License Sales	11,955	12,483	12,496	11,674	13,501	12,540	12,923	12,928	12,239	12,576	13,392	13,534
Bonus Permit Sales[1]	142,049	89,750	97,402	29,642	31,065	44,365	93,309	117,640	131,804	168,814	166,864	171,602
Youth License Sales[2]	60,943	62,949	64,748	62,488	62333	61138	58779	56,989	57,575	58,601	57,320	56,752
Total License Sales[3]	597,615	557,004	566,613	478,118	478,511	490,688	533,418	548,430	553,277	594,014	586,963	583,898
Registered Buck Harvest	76,003	84,729	70,627	69,851	83,939	87,855	88,467	81,772	83,772	85,564	85,737	74,290
Antlerless Permits Offered	15,525	32,854	36,816	26,332	31,065	39,646	20,540	14,023	14,111	20,021	20,773	17,352
Antlerless Permits Issued	15,525	32,854	36,816	26,332	31,065	39,646	20,385	13,971	13,777	20,021	20,773	17,352
Antlerless Permits App.	21,071	67,308	68,811	96,580	95,656	97,056	45,001	29,302	33,191	39,821	42,156	37,386
Registered AL Harvest	88,197	71,140	67,885	44,038	48,758	52,338	79,033	74,203	66,971	74,198	64,399	62,744
Registered Total Harvest	164,200	155,869	145,449	113,889	132,697	144,470	167,500	155,975	150,743	159,762	150,136	137,034
Registered % Successful[4]	32.9	32.0	29.7	25.3	28.9	31.2	33.7	31.7	31.2	33.1	31.8	29.7
ARCHERY												
Resident License Sales	90,252	95,259	92,717	92,301	93,462	92,076	91,875	89,292	85,343	97,399	93,376	90,589
Non-Resident License Sales	1,718	1,814	1,952	1,946	2,032	2,062	2,016	2,020	2,129	2,592	2,668	2,610
Youth Archery Sales	10,306	11,276	12,212	11,965	11,905	10,846	9,961	9,052	8,267	9,312	8,667	8,306
Total License Sales	102,276	108,349	106,881	106,212	107399	104984	103852	100,364	95,739	109,303	104,711	101,505
Total Archery Harvest	20,444	21,605	19,388	17,119	20,074	20,360	21,058	22,665	24,250	27,803	24,443	24,095
Registered % Successful[4]	17.0	18.8	14.5	15.3	16.5	18.5	18.7	20.3	21.1	21.6	19.9	20.0
MUZZLELOADER												
Total Muzzleloader License Sales	59,384	58,363	51,092	43,946	50,176	53,097	51,961	48,589	43,126	55,523	49,833	49,414
Total Muzzleloader Harvest	7,416	7,779	7,045	5,847	6,572	8,383	9,210	10,066	8,644	9,750	10,119	11,136
Registered % Successful[4]	11.6	12.4	12.7	12.7	12.0	15.2	16.6	19	20.0	15.9	18	20
Antlerless Permits Offered	1,997	1,626	2,144	1,593	1,434	1,352	935	874	689	724	907	798
Antlerless Permits App.	2,615	3,743	3,544	4,588	3,393	2,930	1,902	1,592	1,485	1,281	1,511	1,305
TOTAL Registered Harvest	192,331	186,634	172,781	139,442	159,343	173,213	197,768	188,706	183,637	197,315	184,698	172,265

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, 2022.

Season	Total Hunters	Antlered Buck Harvest	Antlerless Harvest	Total Harvest	Successful Hunters[3]	Overall Success
Archery	101,505	9,495	14,569	24,064	20,317	20.0%
100 Series A	144,698	20,500	13,324	33,824	32,245	22.3%
200 Series A	225,391	42,224	33,571	75,798	68,044	30.2%
300-600 Series A[1]		6,200	4,357	10,557	9,085	
300-600 Series B[1]	37,616	1,523	3,072	4,595	3,789	34.2%
Metro Firearms (701)	1,767	522	327	849	759	43.0%
Muzzleloader	49,414	4,303	6,758	11,061	9,844	19.9%
Youth[2]	N/A	2,950	3,508	6,458	6,425	N/A
Early Antlerless	N/A	0	3,761	3,761	3,210	N/A
Special Firearms Hunts	1,416	236	452	688	545	38.5%
Late CWD[2]	N/A	158	452	610	503	N/A
Total	**456,008**	**88,114**	**84,151**	**172,265**	**145,824**	**32.0%**

[1]Does not include deer harvested in permit area 604 and 679 (included in 100 Series) or 661 (included in the 200 series); in 2022 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, 2022.

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	356	31	224	23	634	496	0.72	0.56	1.28	81
104	330	4	53	2	389	1,414	0.23	0.04	0.28	122
105	1203	124	957	104	2388	1,199	1.00	0.99	1.99	56
107	515	26	172	16	729	472	1.09	0.45	1.54	70
109	265	5	41	7	318	1,182	0.22	0.04	0.27	123
110	797	32	218	25	1072	529	1.51	0.52	2.03	54
111	281	1	8	0	290	1,384	0.20	0.01	0.21	125
114	17	1	8	1	27	116	0.15	0.09	0.23	124
117	10	0	2	1	13	927	0.01	0.00	0.01	130
118	382	1	5	0	388	1,220	0.31	0.00	0.32	120
119	225	1	1	0	227	770	0.29	0.00	0.29	121
126	75	0	19	1	95	942	0.08	0.02	0.10	128
130	101	2	0	0	103	746	0.14	0.00	0.14	127
131	28	0	7	0	35	899	0.03	0.01	0.04	129
132	170	0	5	0	175	482	0.35	0.01	0.36	119
133	322	9	49	2	382	352	0.91	0.17	1.09	89
152	70	13	52	11	146	61	1.15	1.24	2.39	50
155	737	84	431	40	1292	499	1.48	1.11	2.59	44
156	1117	154	734	101	2106	825	1.35	1.20	2.55	46
157	2462	436	1623	357	4878	888	2.77	2.72	5.50	15
159	1078	136	623	101	1938	571	1.89	1.51	3.39	33
169	702	24	178	15	919	940	0.75	0.23	0.98	93
171	632	57	253	38	980	740	0.85	0.47	1.32	79
172	1103	96	507	66	1772	688	1.60	0.97	2.58	45
173	345	24	147	19	535	471	0.73	0.40	1.14	87
176	544	21	135	14	714	921	0.59	0.18	0.78	104
177	421	30	180	18	649	480	0.88	0.48	1.35	78
178	1065	43	341	25	1474	1,195	0.89	0.34	1.23	84
181	674	22	114	15	825	629	1.07	0.24	1.31	80
182	463	67	336	37	903	278	1.67	1.58	3.25	34
183	992	128	682	94	1896	663	1.50	1.36	2.86	38
184	1815	259	1107	187	3368	1,235	1.47	1.26	2.73	43
197	714	34	180	22	950	973	0.73	0.24	0.98	94
199	85	0	19	2	106	153	0.56	0.14	0.69	107

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	91	13	98	21	223	161	0.56	0.82	1.38	75
203	49	4	12	3	68	118	0.42	0.16	0.58	111
208	268	25	170	21	484	379	0.71	0.57	1.28	82
209	569	93	524	93	1279	640	0.89	1.11	2.00	55
210	762	111	534	75	1482	615	1.24	1.17	2.41	49
213	2433	593	2300	498	5824	1,057	2.30	3.21	5.51	14
214	1759	454	1505	415	4133	554	3.17	4.28	7.46	3
215	1856	472	1611	407	4346	701	2.65	3.55	6.20	11
218	1426	291	1317	238	3272	884	1.61	2.09	3.70	30
219	898	154	711	124	1887	391	2.29	2.53	4.82	21
221	1778	484	1654	370	4286	642	2.77	3.91	6.68	8
222	1297	309	1115	230	2951	413	3.14	4.00	7.14	4
223	1096	210	920	163	2389	376	2.92	3.44	6.36	10
224	132	16	80	19	247	47	2.79	2.43	5.22	18
225	2116	402	1552	326	4396	618	3.42	3.69	7.11	5
227	1696	328	1260	236	3520	472	3.60	3.87	7.46	2
229	444	73	301	53	871	284	1.56	1.50	3.06	37
230	339	43	234	38	654	452	0.75	0.70	1.45	73
232	387	49	252	30	718	377	1.03	0.88	1.91	58
233	323	41	248	37	649	381	0.85	0.86	1.70	64
234	226	11	78	11	326	636	0.36	0.16	0.51	114
235	93	13	42	6	154	34	2.76	1.81	4.57	23
236	1088	151	713	122	2074	370	2.94	2.67	5.61	13
237	271	5	83	5	364	608	0.45	0.15	0.60	109
238	74	4	29	5	112	95	0.78	0.40	1.18	85
239	1619	255	1141	201	3216	919	1.76	1.74	3.50	31
240	1915	406	1783	367	4471	643	2.98	3.98	6.96	7
241	2882	641	2911	540	6974	996	2.89	4.11	7.00	6
246	1523	247	983	169	2922	784	1.94	1.78	3.73	29
248	410	67	295	48	820	214	1.91	1.91	3.83	28
249	1289	269	917	188	2663	496	2.60	2.77	5.37	16
250	411	11	132	7	561	713	0.58	0.21	0.79	101
251	58	10	24	9	101	55	1.05	0.78	1.84	60
252	419	14	138	17	588	715	0.59	0.24	0.82	99

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	559	28	160	15	762	974	0.57	0.21	0.78	102
254	707	75	412	65	1259	924	0.77	0.60	1.36	76
255	316	49	212	35	612	392	0.81	0.76	1.56	68
256	501	77	360	74	1012	654	0.77	0.78	1.55	69
257	445	61	337	48	891	412	1.08	1.08	2.16	53
258	625	83	405	80	1193	343	1.82	1.66	3.48	32
259	842	74	415	51	1382	490	1.72	1.10	2.82	40
260	259	13	127	24	423	1,055	0.25	0.16	0.40	118
262	253	20	178	23	474	677	0.37	0.33	0.70	106
263	543	56	347	48	994	706	0.77	0.64	1.41	74
264	793	87	651	90	1621	669	1.19	1.24	2.42	48
265	520	90	499	69	1178	494	1.05	1.33	2.38	51
266	393	30	173	24	620	617	0.64	0.37	1.01	91
267	332	52	302	36	722	472	0.70	0.83	1.53	71
268	346	62	251	43	702	228	1.52	1.56	3.07	36
269	308	22	85	15	430	650	0.47	0.19	0.66	108
270	246	12	48	3	309	748	0.33	0.08	0.41	117
271	328	20	135	8	491	632	0.52	0.26	0.78	103
272	252	5	41	9	307	531	0.47	0.10	0.58	110
273	604	80	362	62	1108	571	1.06	0.88	1.94	57
274	301	20	110	9	440	354	0.85	0.39	1.24	83
275	624	23	168	27	842	957	0.65	0.23	0.88	97
277	2085	411	1961	318	4775	1,058	1.97	2.54	4.51	24
278	467	27	169	17	680	402	1.16	0.53	1.69	66
279	242	28	104	18	392	344	0.70	0.44	1.14	86
280	254	8	85	7	354	675	0.38	0.15	0.52	113
281	693	66	517	53	1329	575	1.21	1.11	2.31	52
282	172	6	30	2	210	1,127	0.15	0.03	0.19	126
283	333	24	124	15	496	337	0.99	0.48	1.47	72
284	453	18	136	11	618	838	0.54	0.20	0.74	105
285	544	62	352	36	994	549	0.99	0.82	1.81	62
286	317	20	131	21	489	446	0.71	0.39	1.10	88
287	34	1	22	5	62	46	0.74	0.61	1.36	77
288	383	31	196	16	626	625	0.61	0.39	1.00	92
289	272	23	139	17	451	815	0.33	0.22	0.55	112
290	629	78	413	55	1175	662	0.95	0.82	1.78	63

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
291	865	69	388	24	1346	800	1.08	0.60	1.68	67
292	521	90	352	59	1022	362	1.44	1.38	2.82	39
293	410	62	271	37	780	278	1.47	1.33	2.81	41
294	355	29	135	27	546	686	0.52	0.28	0.80	100
295	595	31	212	18	856	959	0.62	0.27	0.89	96
296	447	16	135	12	610	667	0.67	0.24	0.92	95
297	140	5	38	8	191	438	0.32	0.12	0.44	116
298	393	25	108	14	540	618	0.64	0.24	0.87	98
299	405	28	199	22	654	386	1.05	0.65	1.69	65
338	351	30	186	34	601	316	1.11	0.79	1.90	59
341	1420	257	1141	229	3047	603	2.35	2.70	5.05	19
342	890	186	745	180	2001	350	2.54	3.17	5.72	12
343	597	117	489	95	1298	320	1.87	2.19	4.06	26
344	438	93	294	102	927	186	2.35	2.63	4.98	20
604	1465	362	1407	294	3528	673	2.18	3.07	5.24	17
605	1326	277	1104	225	2932	1192	1.11	1.35	2.46	47
643	629	119	480	128	1356	351	1.79	2.07	3.86	27
645	659	181	515	154	1509	330	2.00	2.58	4.57	22
646	1122	222	869	205	2418	319	3.52	4.06	7.58	1
647	584	108	416	88	1196	434	1.35	1.41	2.76	42
648	692	140	459	160	1451	332	2.08	2.29	4.37	25
649	1376	342	1201	348	3267	492	2.80	3.84	6.64	9
655	221	35	127	23	406	387	0.57	0.48	1.05	90
661	195	27	155	15	392	795	0.25	0.25	0.49	115
679	1232	299	1381	245	3157	1024	1.20	1.88	3.08	35
701	1255	182	868	115	2420	1324	0.95	0.88	1.83	61
Total	**87,651**	**13,308**	**58,910**	**10,746**	**170,615**	**78,843**	**1.11**	**1.05**	**2.16**	

Table 4. Archery season harvest by DPA, excluding special hunts, 2022.

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	190	0.38	12	1	17	1	31
104	1,414	119	0.08	5	0	5	0	10
105	1,199	669	0.56	34	4	74	6	118
107	472	280	0.59	26	2	13	2	43
109	1,182	101	0.09	5	0	3	1	9
110	529	302	0.57	14	2	15	0	31
111	1,384	80	0.06	4	0	0	0	4
114	116	27	0.23	2	0	0	0	2
117	927	17	0.02	3	0	0	0	3
118	1,220	211	0.17	13	0	0	0	13
119	770	70	0.09	4	0	0	0	4
126	942	141	0.15	3	0	8	0	11
130	746	108	0.14	5	0	0	0	5
131	899	56	0.06	0	0	1	0	1
132	482	115	0.24	8	0	1	0	9
133	352	334	0.95	34	1	19	1	55
152	61	128	2.09	1	0	6	0	7
155	499	676	1.35	23	7	27	2	59
156	825	986	1.20	39	3	50	3	95
157	888	2190	2.47	136	35	175	23	369
159	571	1050	1.84	63	7	54	6	130
169	940	490	0.52	17	2	27	0	46
171	740	600	0.81	24	0	21	1	46
172	688	1061	1.54	53	8	60	4	125
173	471	287	0.61	16	2	11	0	29
176	921	453	0.49	14	2	32	3	51
177	480	297	0.62	21	1	17	1	40
178	1,195	896	0.75	50	8	47	2	107
181	629	543	0.86	34	2	27	3	66
182	278	1258	4.53	101	17	114	12	244
183	663	848	1.28	58	3	44	1	106
184	1,235	1777	1.44	111	8	83	7	209
197	973	428	0.44	24	1	21	1	47
199	153	50	0.33	4	0	2	0	6

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
201	161	70	0.43	2	0	6	2	10
203	118	20	0.17	0	1	0	0	1
208	379	123	0.32	6	0	10	0	16
209	640	329	0.51	33	7	45	5	90
210	615	507	0.82	23	3	45	5	76
213	1,057	2664	2.52	272	45	409	43	769
214	554	1687	3.04	109	36	224	27	396
215	701	2616	3.73	229	64	388	50	731
218	884	2087	2.36	166	32	346	35	579
219	391	1760	4.50	159	24	213	18	414
221	642	1951	3.04	153	38	299	38	528
222	413	1508	3.65	126	32	198	26	382
223	376	2474	6.59	263	54	352	55	724
224	47	334	7.06	25	3	20	2	50
225	618	2648	4.29	244	40	326	32	642
227	472	3036	6.44	334	99	444	77	954
229	284	1060	3.73	87	19	106	10	222
230	452	442	0.98	51	0	46	6	103
232	377	517	1.37	45	7	59	6	117
233	381	456	1.20	64	7	76	8	155
234	636	247	0.39	41	2	12	0	55
235	34	313	9.29	25	5	24	2	56
236	370	2091	5.65	297	53	317	39	706
237	608	313	0.51	25	0	14	0	39
238	95	84	0.88	9	0	8	0	17
239	919	1584	1.72	116	13	155	11	295
240	643	1718	2.67	110	32	277	25	444
241	996	3149	3.16	201	50	438	36	725
246	784	1249	1.59	74	10	54	4	142
248	214	578	2.70	34	7	40	11	92
249	496	1227	2.47	79	15	119	14	227
250	713	386	0.54	51	0	35	0	86
251	55	40	0.73	1	2	3	2	8
252	715	400	0.56	59	2	22	4	87
253	974	538	0.55	78	4	43	1	126

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
254	924	738	0.80	110	6	94	10	220
255	392	565	1.44	70	10	72	7	159
256	654	314	0.48	21	5	27	4	57
257	412	253	0.61	24	3	44	5	76
258	343	560	1.63	32	1	24	3	60
259	490	746	1.52	40	4	44	4	92
260	1,055	150	0.14	14	0	15	1	30
262	677	242	0.36	36	1	27	2	66
263	706	293	0.42	19	4	25	1	49
264	669	398	0.59	26	6	52	6	90
265	494	385	0.78	33	5	62	3	103
266	617	353	0.57	28	0	12	0	40
267	472	209	0.44	17	6	26	2	51
268	228	177	0.78	14	7	29	5	55
269	650	351	0.54	48	4	19	3	74
270	748	229	0.31	27	1	9	0	37
271	632	236	0.37	35	1	17	0	53
272	531	189	0.36	15	1	3	2	21
273	571	686	1.20	59	10	82	6	157
274	354	249	0.70	37	1	17	0	55
275	957	532	0.56	56	4	24	0	84
277	1,058	2658	2.51	254	53	464	46	817
278	402	342	0.85	40	3	33	2	78
279	344	134	0.39	17	2	6	0	25
280	675	203	0.30	27	1	22	1	51
281	575	712	1.24	90	5	103	8	206
282	1,127	199	0.18	20	0	9	0	29
283	337	350	1.04	43	0	20	0	63
284	838	541	0.65	53	3	26	2	84
285	549	932	1.70	80	4	88	7	179
286	446	252	0.56	28	5	10	2	45
287	46	15	0.33	3	0	1	1	5
288	625	500	0.80	44	3	47	0	94
289	815	249	0.31	10	1	18	3	32
290	662	664	1.00	65	7	77	8	157

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
291	800	1184	1.48	125	9	86	3	223
292	362	910	2.51	69	19	95	9	192
293	278	477	1.72	66	11	70	8	155
294	686	225	0.33	36	2	17	2	57
295	959	578	0.60	44	7	50	3	104
296	667	426	0.64	55	0	15	2	72
297	438	91	0.21	6	1	2	2	11
298	618	288	0.47	15	1	6	1	23
299	386	532	1.38	74	3	37	0	114
338	316	634	2.01	61	6	49	7	123
341	603	2035	3.37	238	39	273	42	592
342	350	1194	3.41	135	40	163	26	364
343	320	1330	4.16	133	18	176	20	347
344	186	733	3.94	54	11	50	9	124
604	673	2432	3.61	170	30	326	44	570
605	1192	3255	2.73	306	66	378	69	819
643	351	1066	3.04	161	24	198	35	418
645	330	896	2.72	93	22	101	21	237
646	319	1219	3.82	167	25	154	20	366
647	434	784	1.81	80	9	84	6	179
648	332	933	2.81	105	23	99	21	248
649	492	1798	3.65	201	34	223	35	493
655	387	238	0.61	33	3	22	7	65
661	795	173	0.22	15	4	28	2	49
679	1024	1382	1.35	85	22	135	17	259
701	1324	3924	2.96	698	105	603	73	1479
Total	**78,843**	**101,387**	**1.29**	**9,312**	**1,523**	**11,235**	**1,302**	**23,372**

Table 5. Total 2022 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	1892	3.8	308	28	173	20	529	0.62	0.45	1.07
104	1,414	1584	1.1	314	3	38	2	357	0.22	0.03	0.25
105	1,199	5409	4.5	1070	108	777	88	2043	0.89	0.81	1.70
107	472	2323	4.9	458	21	147	10	636	0.97	0.38	1.35
109	1,182	1707	1.4	246	3	29	4	282	0.21	0.03	0.24
110	529	3591	6.8	734	23	161	17	935	1.39	0.38	1.77
111	1,384	1204	0.9	261	1	7	0	269	0.19	0.01	0.19
114	116	103	0.9	13	0	6	1	20	0.11	0.06	0.17
117	927	109	0.1	7	0	2	1	10	0.01	0.00	0.01
118	1,220	2458	2.0	347	1	5	0	353	0.28	0.00	0.29
119	770	1853	2.4	212	1	0	0	213	0.28	0.00	0.28
126	942	1041	1.1	70	0	10	1	81	0.07	0.01	0.09
130	746	1126	1.5	92	2	0	0	94	0.12	0.00	0.13
131	899	616	0.7	27	0	5	0	32	0.03	0.01	0.04
132	482	1542	3.2	157	0	4	0	161	0.33	0.01	0.33
133	352	1832	5.2	279	8	27	1	315	0.79	0.10	0.89
152	61	591	9.7	68	13	46	11	138	1.11	1.15	2.26
155	499	4763	9.5	687	74	379	36	1176	1.38	0.98	2.36
156	825	7767	9.4	1033	143	633	93	1902	1.25	1.05	2.31
157	888	12047	13.6	2211	377	1329	313	4230	2.49	2.27	4.77
159	571	6338	11.1	971	125	539	86	1721	1.70	1.31	3.01
169	940	5597	6.0	656	19	129	14	818	0.70	0.17	0.87
171	740	5336	7.2	580	52	211	36	879	0.78	0.40	1.19
172	688	8315	12.1	997	82	390	50	1519	1.45	0.76	2.21
173	471	2817	6.0	317	20	122	16	475	0.67	0.34	1.01
176	921	4677	5.1	511	16	71	11	609	0.55	0.11	0.66
177	480	3396	7.1	380	26	148	15	569	0.79	0.39	1.19
178	1,195	7597	6.4	973	28	247	20	1268	0.81	0.25	1.06
181	629	4392	7.0	617	18	69	8	712	0.98	0.15	1.13
182	278	2061	7.4	352	44	207	20	623	1.27	0.98	2.24
183	663	6561	9.9	896	115	593	88	1692	1.35	1.20	2.55
184	1,235	11846	9.6	1597	224	892	154	2867	1.29	1.03	2.32
197	973	4636	4.8	668	31	136	19	854	0.69	0.19	0.88
199	153	465	3.0	78	0	16	2	96	0.51	0.12	0.63
201	161	457	2.8	77	10	82	17	186	0.48	0.68	1.15

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
203	118	189	1.6	29	2	5	3	39	0.25	0.08	0.33
208	379	1071	2.8	207	21	130	20	378	0.55	0.45	1.00
209	640	2497	3.9	456	65	335	68	924	0.71	0.73	1.44
210	615	3816	6.2	676	94	435	62	1267	1.10	0.96	2.06
213	1,057	10171	9.6	1931	376	1228	305	3840	1.83	1.81	3.63
214	554	7433	13.4	1524	320	913	291	3048	2.75	2.75	5.50
215	701	7527	10.7	1427	274	798	248	2747	2.04	1.88	3.92
218	884	5907	6.7	1100	189	661	144	2094	1.24	1.12	2.37
219	391	3646	9.3	648	93	348	74	1163	1.66	1.32	2.97
221	642	6538	10.2	1467	315	924	244	2950	2.29	2.31	4.60
222	413	5592	13.5	1090	212	681	145	2128	2.64	2.51	5.15
223	376	3634	9.7	742	108	382	72	1304	1.98	1.50	3.47
224	47	582	12.3	103	11	53	16	183	2.18	1.69	3.87
225	618	7870	12.7	1726	274	929	232	3161	2.79	2.32	5.12
227	472	5013	10.6	1228	171	544	119	2062	2.60	1.77	4.37
229	284	1630	5.7	325	40	118	25	508	1.14	0.64	1.79
230	452	1425	3.2	250	36	152	29	467	0.55	0.48	1.03
232	377	1476	3.9	312	35	142	15	504	0.83	0.51	1.34
233	381	894	2.3	211	23	111	20	365	0.55	0.40	0.96
234	636	797	1.3	160	7	54	9	230	0.25	0.11	0.36
235	34	366	10.9	65	7	17	4	93	1.93	0.83	2.76
236	370	2975	8.0	720	73	293	63	1149	1.95	1.16	3.11
237	608	1066	1.8	207	5	54	4	270	0.34	0.10	0.44
238	95	280	2.9	55	4	16	5	80	0.58	0.26	0.84
239	919	7769	8.5	1397	218	860	168	2643	1.52	1.36	2.88
240	643	7994	12.4	1661	279	1070	249	3259	2.58	2.49	5.07
241	996	13473	13.5	2496	522	2050	444	5512	2.51	3.03	5.54
246	784	9857	12.6	1364	214	797	150	2525	1.74	1.48	3.22
248	214	1888	8.8	358	49	225	35	667	1.67	1.44	3.11
249	496	5737	11.6	1142	226	709	159	2236	2.30	2.21	4.51
250	713	1332	1.9	290	11	77	5	383	0.41	0.13	0.54
251	55	391	7.1	52	7	19	7	85	0.95	0.60	1.55
252	715	1293	1.8	323	10	97	11	441	0.45	0.17	0.62
253	974	1849	1.9	403	22	85	11	521	0.41	0.12	0.53
254	924	2464	2.7	525	56	232	41	854	0.57	0.36	0.92
255	392	1122	2.9	222	36	102	27	387	0.57	0.42	0.99

Permit Area	Land Area (sq. mile)	Firearms Hunters	Hunters/ sq. mile	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest	Bucks/ sq. mile	Antlerless/ sq. mile	Total/ sq. mile
256	654	2170	3.3	397	64	280	66	807	0.61	0.63	1.23
257	412	1810	4.4	374	48	243	39	704	0.91	0.80	1.71
258	343	4166	12.2	543	73	335	70	1021	1.58	1.39	2.98
259	490	6111	12.5	749	64	320	44	1177	1.53	0.87	2.40
260	1,055	1168	1.1	191	11	92	20	314	0.18	0.12	0.30
262	677	941	1.4	177	18	121	15	331	0.26	0.23	0.49
263	706	2294	3.2	454	48	267	38	807	0.64	0.50	1.14
264	669	3431	5.1	640	68	489	67	1264	0.96	0.93	1.89
265	494	2236	4.5	428	72	350	52	902	0.87	0.96	1.83
266	617	1767	2.9	294	24	112	23	453	0.48	0.26	0.73
267	472	1332	2.8	236	38	226	32	532	0.50	0.63	1.13
268	228	1334	5.8	277	51	191	35	554	1.21	1.21	2.43
269	650	1217	1.9	205	15	51	11	282	0.32	0.12	0.43
270	748	1010	1.4	177	9	27	3	216	0.24	0.05	0.29
271	632	1160	1.8	249	11	85	7	352	0.39	0.16	0.56
272	531	1104	2.1	207	3	30	5	245	0.39	0.07	0.46
273	571	2785	4.9	478	61	225	50	814	0.84	0.59	1.42
274	354	1097	3.1	218	17	72	9	316	0.62	0.28	0.89
275	957	2585	2.7	485	15	108	22	630	0.51	0.15	0.66
277	1,058	8708	8.2	1558	261	911	186	2916	1.47	1.28	2.76
278	402	1840	4.6	355	19	97	14	485	0.88	0.32	1.21
279	344	1244	3.6	189	22	74	16	301	0.55	0.33	0.88
280	675	1154	1.7	199	7	52	5	263	0.29	0.09	0.39
281	575	2746	4.8	520	50	288	40	898	0.90	0.66	1.56
282	1,127	795	0.7	134	4	16	2	156	0.12	0.02	0.14
283	337	1257	3.7	247	16	79	12	354	0.73	0.32	1.05
284	838	1814	2.2	338	11	82	8	439	0.40	0.12	0.52
285	549	2324	4.2	417	53	220	23	713	0.76	0.54	1.30
286	446	1470	3.3	251	14	95	18	378	0.56	0.28	0.85
287	46	303	6.6	31	1	20	3	55	0.68	0.53	1.20
288	625	1836	2.9	273	19	114	10	416	0.44	0.23	0.67
289	815	1189	1.5	209	21	91	13	334	0.26	0.15	0.41
290	662	2487	3.8	468	59	256	33	816	0.71	0.53	1.23
291	800	3336	4.2	639	46	230	17	932	0.80	0.37	1.
292	362	2556	7.1	395	57	202	37	691	1.09	0.82	1.91
293	278	1277	4.6	289	40	141	24	494	1.04	0.74	1.78

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
294	686	1241	1.8	266	25	93	22	406	0.39	0.20	0.59
295	959	2198	2.3	445	17	118	13	593	0.46	0.15	0.62
296	667	1684	2.5	340	11	82	6	439	0.51	0.15	0.66
297	438	976	2.2	121	4	26	5	156	0.28	0.08	0.36
298	618	2998	4.9	351	19	86	9	465	0.57	0.18	0.75
299	386	1540	4.0	294	24	127	15	460	0.76	0.43	1.19
338	316	1315	4.2	261	17	111	21	410	0.83	0.47	1.30
341	603	4906	8.1	1066	178	658	153	2055	1.77	1.64	3.41
342	350	3249	9.3	665	116	428	118	1327	1.90	1.89	3.79
343	320	2142	6.7	419	82	234	59	794	1.31	1.17	2.48
344	186	2225	12.0	357	69	206	80	712	1.92	1.91	3.83
604	673	8357	12.4	1226	285	926	221	2658	1.82	2.13	3.95
605	1192	4856	4.1	919	167	520	114	1720	0.77	0.67	1.44
643	351	1942	5.5	429	73	207	65	774	1.22	0.98	2.21
645	330	2511	7.6	524	134	332	111	1101	1.59	1.75	3.34
646	319	3390	10.6	846	162	554	142	1704	2.65	2.69	5.34
647	434	2265	5.2	452	78	269	75	874	1.04	0.97	2.01
648	332	2790	8.4	537	95	272	106	1010	1.62	1.42	3.04
649	492	5250	10.7	1076	256	782	256	2370	2.19	2.63	4.82
655	387	775	2.0	172	26	89	14	301	0.44	0.33	0.78
661	795	679	0.9	150	20	83	11	264	0.19	0.14	0.33
679	1024	8749	8.5	1087	264	1123	214	2688	1.06	1.56	2.63
701	1324	1767	1.3	522	71	225	31	849	0.39	0.25	0.64
Total	**78,843**	**409,472**	**5.2**	**70,972**	**9,624**	**37,419**	**7,608**	**125,628**	**0.90**	**0.69**	**1.59**

Table 6. Muzzleloader season harvest by DPA, 2022, 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	131	0.26	10	1	8	1	20
104	53	0.04	5	0	1	0	6
105	416	0.35	26	5	42	4	77
107	118	0.25	3	0	4	0	7
109	61	0.05	8	2	0	0	10
110	152	0.29	16	0	6	1	23
111	31	0.02	5	0	1	0	6
114	11	0.09	0	0	1	0	1
117	9	0.01	0	0	0	0	0
118	130	0.11	11	0	0	0	11
119	86	0.11	7	0	0	0	7
126	48	0.05	1	0	1	0	2
130	33	0.04	4	0	0	0	4
131	28	0.03	1	0	1	0	2
132	29	0.06	1	0	0	0	1
133	83	0.24	6	0	1	0	7
152	25	0.41	1	0	0	0	1
155	221	0.44	8	2	3	0	13
156	302	0.37	13	1	21	3	38
157	720	0.81	44	8	69	10	131
159	258	0.45	13	0	9	1	23
169	153	0.16	12	0	2	0	14
171	206	0.28	11	0	3	1	15
172	327	0.48	24	0	17	4	45
173	79	0.17	4	0	2	0	6
176	153	0.17	11	0	4	0	15
177	108	0.23	5	1	1	0	7
178	259	0.22	13	0	7	0	20
181	156	0.25	7	1	3	0	11
182	160	0.58	6	3	8	2	19
183	251	0.38	10	4	14	0	28
184	630	0.51	44	5	37	5	91
197	178	0.18	14	0	6	0	20
199	20	0.13	1	0	0	0	1
201	74	0.46	5	2	4	2	13
203	15	0.13	19	1	6	0	26
208	156	0.41	32	3	19	0	54
209	317	0.50	35	9	39	3	86

Permit Area	Muzzleloader hunters	Hunters per sq mile	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
210	344	0.56	29	5	27	5	66
213	1832	1.73	160	48	275	37	520
214	1006	1.82	70	23	114	20	227
215	1566	2.23	144	39	205	35	423
218	1238	1.40	108	24	182	22	336
219	860	2.20	57	14	80	12	163
221	958	1.49	76	31	159	18	284
222	729	1.76	39	24	71	7	141
223	805	2.14	67	16	104	15	202
224	60	1.27	3	2	7	1	13
225	1012	1.64	83	26	108	22	239
227	1132	2.40	103	22	155	17	297
229	367	1.29	24	6	34	4	68
230	285	0.63	23	4	26	1	54
232	336	0.89	19	6	45	8	78
233	272	0.71	41	10	56	8	115
234	161	0.25	22	1	9	1	33
235	75	2.23	2	1	1	0	4
236	560	1.51	57	13	60	10	140
237	235	0.39	32	0	8	1	41
238	62	0.65	7	0	3	0	10
239	1051	1.14	52	11	80	13	156
240	956	1.49	58	23	156	17	254
241	1741	1.75	84	42	268	41	435
246	698	0.89	40	8	73	9	130
248	255	1.19	9	5	19	1	34
249	487	0.98	27	11	57	7	102
250	307	0.43	57	0	16	1	74
251	30	0.55	4	0	0	0	4
252	254	0.36	29	2	15	1	47
253	453	0.47	65	2	23	2	92
254	540	0.58	58	10	75	12	155
255	252	0.64	17	3	32	1	53
256	261	0.40	33	4	30	2	69
257	215	0.52	20	6	32	0	58
258	322	0.94	27	2	26	4	59
259	419	0.86	27	3	26	0	56
260	199	0.19	22	1	4	2	29
262	166	0.25	28	1	25	6	60

Permit Area	Muzzleloader hunters	Hunters per sq mile	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
263	368	0.52	42	3	32	7	84
264	516	0.77	62	4	72	9	147
265	351	0.71	31	9	65	10	115
266	374	0.61	47	5	28	1	81
267	190	0.40	25	7	30	2	64
268	192	0.84	29	1	23	2	55
269	312	0.48	44	0	11	1	56
270	191	0.26	36	0	7	0	43
271	218	0.35	34	5	29	1	69
272	177	0.33	21	1	2	1	25
273	488	0.85	42	5	49	3	99
274	231	0.65	34	1	14	0	49
275	444	0.46	59	1	19	1	80
277	1985	1.88	208	46	328	26	608
278	409	1.02	66	1	29	1	97
279	290	0.84	33	4	17	2	56
280	168	0.25	18	0	4	0	22
281	686	1.19	67	6	112	4	189
282	101	0.09	13	1	2	0	16
283	238	0.71	31	5	15	2	53
284	315	0.38	42	1	13	1	57
285	393	0.72	27	2	32	3	64
286	273	0.61	31	0	19	0	50
287	12	0.26	0	0	1	1	2
288	378	0.61	55	5	25	3	88
289	244	0.30	40	1	24	1	66
290	631	0.95	69	8	70	10	157
291	639	0.80	66	6	40	2	114
292	560	1.55	46	10	47	10	113
293	320	1.15	44	7	52	4	107
294	231	0.34	44	1	20	3	68
295	511	0.53	86	1	35	1	123
296	321	0.48	44	2	27	2	75
297	89	0.20	6	0	4	0	10
298	176	0.28	12	0	3	0	15
299	321	0.83	31	1	33	4	69
338	207	0.66	15	4	18	2	39
341	739	1.23	60	15	121	9	205
342	511	1.46	43	7	79	11	140

Permit Area	Muzzleloader hunters	Hunters per sq mile	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
343	328	1.03	25	3	45	9	82
344	310	1.67	15	8	32	9	64
604	583	0.87	21	11	45	9	86
605	544	0.46	39	14	87	12	152
643	282	0.80	17	7	17	11	52
645	318	0.96	16	9	35	3	63
646	461	1.45	36	8	53	10	107
647	287	0.66	20	5	24	2	51
648	224	0.67	9	4	16	4	33
649	652	1.33	43	14	81	11	149
655	92	0.24	4	2	10	0	16
661	139	0.17	23	1	28	2	54
679	549	0.54	14	5	62	6	87
701	189	0.14	21	1	27	8	57
Total	**48,446**	**0.61**	**4,265**	**765**	**5,139**	**636**	**10,805**

Table 7. Youth deer season harvest by DPA, 2022. Special hunts excluded.

Permit Area	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
101	26	1	26	1	54
104	6	1	9	0	16
105	73	7	64	6	150
107	28	3	8	4	43
109	6	0	9	2	17
110	33	7	36	7	83
111	11	0	0	0	11
114	2	1	1	0	4
117	0	0	0	0	0
118	11	0	0	0	11
119	2	0	1	0	3
126	1	0	0	0	1
130	0	0	0	0	0
131	0	0	0	0	0
132	4	0	0	0	4
133	3	0	2	0	5
152	0	0	0	0	0
155	19	1	22	2	44
156	32	7	30	2	71
157	71	16	50	11	148
159	31	4	21	8	64
169	17	3	20	1	41
171	17	5	18	0	40
172	29	6	40	8	83
173	8	2	12	3	25
176	8	3	28	0	39
177	15	2	14	2	33
178	29	7	40	3	79
181	16	1	15	4	36
182	4	3	7	3	17
183	28	6	31	5	70
184	36	13	40	8	97
197	8	2	17	2	29
199	2	0	1	0	3

Permit Area	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
201	7	1	6	0	14
203	1	0	1	0	2
208	23	1	11	1	36
209	45	3	39	6	93
210	34	9	27	3	73
213	70	29	68	16	183
214	56	14	75	14	159
215	56	27	55	23	161
218	52	19	44	11	126
219	34	5	17	6	62
221	82	34	73	20	209
222	42	10	44	8	104
223	24	9	22	8	63
224	1	0	0	0	1
225	63	16	54	17	150
227	31	9	22	4	66
229	8	2	20	3	33
230	15	3	10	2	30
232	11	1	6	1	19
233	7	1	5	1	14
234	3	1	3	1	8
235	1	0	0	0	1
236	14	2	12	3	31
237	7	0	7	0	14
238	3	0	2	0	5
239	54	13	46	9	122
240	86	23	96	22	227
241	101	27	155	19	302
246	45	15	59	6	125
248	9	6	11	1	27
249	41	17	32	8	98
250	13	0	4	1	18
251	1	1	2	0	4
252	8	0	4	1	13
253	13	0	9	1	23
254	14	3	11	2	30
255	7	0	6	0	13
256	50	4	23	2	79

Permit Area	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
257	27	4	18	4	53
258	23	7	20	3	53
259	26	3	25	3	57
260	32	1	16	1	50
262	12	0	5	0	17
263	28	1	23	2	54
264	65	9	38	8	120
265	28	4	22	4	58
266	24	1	21	0	46
267	54	1	20	0	75
268	26	3	8	1	38
269	11	3	4	0	18
270	6	2	5	0	13
271	10	3	4	0	17
272	9	0	6	1	16
273	25	4	6	3	38
274	12	1	7	0	20
275	24	3	17	4	48
277	65	14	65	17	161
278	6	4	10	0	20
279	3	0	7	0	10
280	10	0	7	1	18
281	16	5	14	1	36
282	5	1	3	0	9
283	12	3	10	1	26
284	20	3	15	0	38
285	20	3	12	3	38
286	7	1	7	1	16
287	0	0	0	0	0
288	11	4	10	3	28
289	13	0	6	0	19
290	27	4	10	4	45
291	35	8	32	2	77
292	11	4	8	3	26
293	11	4	8	1	24
294	9	1	5	0	15
295	20	6	9	1	36
296	8	3	11	2	24
297	7	0	6	1	14

Permit Area	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
298	15	5	13	4	37
299	6	0	2	3	11
338	14	3	8	4	29
341	56	8	40	8	112
342	47	3	24	8	82
343	20	4	9	2	35
344	12	5	6	4	27
604	48	8	22	3	81
605	38	4	23	4	69
643	10	4	12	3	29
645	14	4	8	4	30
646	41	2	15	3	61
647	20	4	9	0	33
648	27	2	17	0	46
649	38	6	15	8	67
655	9	0	2	0	11
661	7	1	11	0	19
679	46	8	61	8	123
701	14	4	4	1	23
Total	**2,948**	**599**	**2,464**	**444**	**6,455**

Table 8. Early Antlerless Season harvest by DPA, 2022.

Permit Area	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
209	9	66	11	86
213	95	320	97	512
214	61	179	63	303
215	68	165	51	284
218	27	84	26	137
219	18	53	14	85
221	66	199	50	315
222	31	121	44	196
223	23	60	13	96
225	46	135	23	204
227	27	95	19	141
229	6	23	11	40
236	10	31	7	48
240	49	184	54	287
277	37	193	43	273
341	17	49	17	83
342	20	51	17	88
343	10	25	5	40
604	28	88	17	133
605	12	47	12	71
643	4	18	6	28
645	5	16	7	28
646	13	49	16	78
647	5	13	2	20
648	11	33	19	63
649	23	55	26	104
661	1	5	0	6
701	1	9	2	12
Total	**723**	**2,366**	**672**	**3,761**

Table 9. 300 Series A and B Season Harvest by DPA, 2022

Permit Area	Zone	Adult Male	Fawn Male	Adult Female	Fawn Female	Total
338	3A	224	11	77	20	332
	3B	37	6	34	1	78
341	3A	865	107	396	83	1,451
	3B	201	71	262	70	604
342	3A	526	62	245	74	526
	3B	139	54	183	44	420
343	3A	352	52	163	38	605
	3B	67	30	71	21	189
344	3A	307	47	146	63	563
	3B	50	22	60	17	149
605	3A	740	130	367	86	1,323
	3B	179	37	153	28	179
643	3A	342	47	141	38	568
	3B	87	26	66	27	206
645	3A	404	71	173	61	709
	3B	120	63	159	50	392
646	3A	673	91	275	75	1,114
	3B	173	71	279	67	590
647	3A	349	49	145	39	582
	3B	103	29	124	36	292
648	3A	448	61	170	76	755
	3B	89	34	102	30	255
649	3A	823	118	343	124	1,408
	3B	253	138	439	132	962
655	3A	147	24	62	7	240
	3B	25	2	27	7	61
Total		**7,723**	**1,453**	**4,662**	**1,314**	**15,152**

Table 10. Harvest by DPA during first late CWD hunt, Dec 16-18, 2022.

Permit Area	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
184	27	9	55	13	104
605	24	14	49	14	101
643	12	7	28	8	55
645	12	7	23	8	50
646	32	12	44	14	102
647	12	7	17	3	39
648	14	5	22	10	51
649	18	9	45	12	84
655	3	4	4	2	13
801	2	0	2	1	5
802	1	1	0	1	3
807	1	0	0	0	1
809	0	0	1	0	1
925	0	1	0	0	1
Total	**158**	**76**	**290**	**86**	**610**

Table 11 Free landowner permit harvest by DPA, 2022.

Permit Area	Fawn Male	Adult Female	Fawn Female	Total
101	0	4	0	4
105	0	15	0	15
152	0	1	0	1
155	0	4	0	4
156	1	11	0	12
157	6	26	7	39
159	2	12	1	15
183	1	1	0	2
184	4	21	3	28
197	0	0	1	1
201	0	2	1	3
208	0	6	0	6
209	3	7	2	12
210	3	16	1	20
213	26	74	11	111
214	14	63	16	93
215	12	37	7	56
218	4	15	1	20
219	0	2	0	2
221	8	26	8	42
222	2	11	2	15
223	1	4	0	5
225	1	14	2	17
227	0	7	0	7
229	0	1	1	2
230	0	2	0	2
232	0	3	0	3
233	0	3	0	3
236	1	1	2	4
239	7	28	2	37
240	8	49	10	67
241	24	96	19	139
246	4	32	6	42
248	1	6	1	8
249	10	42	14	66
254	1	6	0	7
255	0	8	0	8
256	6	11	5	22
257	4	12	1	17
258	1	4	0	5
260	0	4	1	5

Permit Area	Fawn Male	Adult Female	Fawn Female	Total
262	0	3	1	4
263	1	1	1	3
264	1	26	2	29
265	1	14	1	16
266	0	3	1	4
267	0	8	0	8
268	1	3	0	4
269	0	0	1	1
271	0	2	0	2
273	0	1	0	1
277	2	12	4	18
280	0	1	0	1
281	0	5	0	5
283	0	1	0	1
285	0	1	0	1
290	0	7	1	8
291	0	1	0	1
292	0	9	3	12
293	1	5	1	7
297	0	1	0	1
298	1	1	0	2
299	0	1	0	1
338	0	5	0	5
341	7	31	11	49
342	5	15	6	26
343	0	10	2	12
344	3	8	4	15
604	0	2	0	2
605	0	4	1	5
643	0	2	0	2
645	1	10	1	12
646	1	6	4	11
647	0	4	1	5
648	1	8	0	9
649	2	17	4	23
655	0	1	0	1
661	0	1	0	1
679	0	1	0	1
Total	**183**	**918**	**175**	**1,276**

Table 12. Summary of special firearms hunt deer harvest, 2022.

Area	Dates	Permits Available	Adult Male	Fawn Male	Adult Female	Fawn Female	Total
900 - Cascade River State Park	11/5-11/20	100*	6	0	3	1	10
901 - Rice Lake NWR	11/12-11/20	40*	5	1	3	0	9
902 - St. Croix State Park	11/17-11/20	350*	36	9	42	9	96
903 - Lake Louise State Park	11/12-11/13	25***	6	9	8	5	28
904 - Gooseberry Falls State Park	11/5-11/20	35*	2	1	2	0	5
905 - Split Rock Lighthouse State Park	11/5-11/20	30*	3	3	0	0	6
906 - Tettegouche State Park	11/5-11/20	100*	2	0	4	2	8
907 - Scenic State Park	11/5-11/20	30*	1	1	3	1	6
908 - Hayes Lake State Park	11/5-11/20	50*	8	1	1	0	10
909 - Lake Bemidji State Park	11/5-11/8	30*	8	1	5	0	14
910 - Zippel Bay State Park	11/5-11/20	75***	3	1	11	3	18
911 - Judge CR Magney State Park	11/5-11/20	60*	2	1	2	0	5
913 - Lake Carlos State Park	11/5-11/8	20**	0	1	2	2	5
914 - William O'Brien State Park	11/12-11/13	50*	11	2	6	7	26
915 - Lake Bronson State Park	11/5-11/13	30***	2	1	12	2	17
916 - Maplewood State Park	11/5-11/8	100*	21	3	10	3	37
917 - Miesvile Ravine Park Reserve	11/5-11/13	40***	7	7	9	8	31
918 - Beaver Creek Valley State Park	11/5-11/6	25*	4	0	2	0	6
919 - Glacial Lakes State Park	11/10-11/13	20**	0	1	4	0	5

[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
920 - Zumbro Falls Woods SNA	11/5-11/13	12*	3	1	4	2	10
921 - Lawrence Unit Minnesota Valley State Recreation Area	11/12-11/13	30*	7	2	9	1	19
922 - Old Mill State Park	11/5-11/8	10*	1	0	1	0	2
923 - Zumbro Falls Woods SNA	11/19-11/27	12*	1	0	2	0	3
925 - Vermillion Highlands Research, Recreation and WMNA	11/5-11/18	20*	2	0	1	0	3
927 - Whitewater State Park	11/19-11/20	50*	4	3	9	7	23
931 - City of Grand Rapids	11/5-11/20	n/a#	9	3	6	3	21
933 - Forestville/ Mystery Cave State Park	11/5-11/6	75*	18	1	17	5	41
934 - Whitewater State Game Refuge	11/19-11/27	100**	1	7	20	6	34
940 - Frontenac State Park	11/19-11/20	60*	7	5	7	6	25
941 - Elm Creek Park Reserve	11/5-11/6	125*	33	7	21	9	70
962 - Great River Bluffs State Park	11/19-11/20	50*	1	0	1	0	2
991 - Kilen Woods State Park	12/24-1/1	10**	0	0	7	0	7
999- Rosemoen Island Lac qui Parle Wildife Management Area[1]	10/8-10/16	20*	0	0	4	1	5
Total			**214**	**72**	**238**	**83**	**607**

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

Table 13 Summary of special muzzleloader hunt deer harvest, 2022[1].

Area	Dates	Permits Issued	Adult Male	Fawn Male	Adult Female	Fawn Female	Total
929 - McCarthy Beach State Park	11/26-12/11	10*	1	2	4	0	7
930 - Nerstrand Big Woods State Park	12/3-12/4	50***	0	0	1	0	1
932 - Rice Lake State Park	12/3-12/4	20**	0	3	6	1	10
935 - Jay Cooke State Park	12/3-12/7	80*	7	6	6	2	21
936 - Crow Wing State Park	12/3-12/7	25*	1	0	3	1	5
937 - Lake Vermillion - Soudan Underground Mine State Park	11/26-12/11	25*	3	1	5	2	11
939 - Myre-Big Island State Park	12/3-12/4	50**	0	11	30	7	48
942 - Sibley State Park	11/26-11/27	60**	0	6	21	2	29
943 - Miesville Ravine Park Reserve	12/3-12/11	40***	3	0	11	4	18
944 - Vermillion Highlands Research, Recreation and WMA	11/26-12/11	20*	2	0	3	0	5
946 - City of Grand Rapids	11/26-12/11	N/A*	0	2	2	0	4
947 - Lake Bemidji State Park	12/2 - 12/4	30*	1	1	5	0	7
948 - Savanna Portage State Park	12/3-12/11	30*	0	0	2	0	2
949 - St. Croix State Park	11/30-12/4	100*	7	2	7	2	18
960 - Lake Maria State Park	12/2-12/4	25***	2	4	10	2	18
964 - Afton State Park	12/6-12/8	30**	0	6	20	3	29
		Totals	**17**	**29**	**90**	**19**	**186**

[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, 2022[1].

Area	Dates	Permits Issued	Adult Male	Fawn Male	Adult Female	Fawn Female	Total
899 - Minneopa State Park	11/19-11/20	12*	1	2	4	1	8
951 - Afton State Park	11/5-11/6	30*	12	1	8	2	23
952 - Sibley State Park	10/29-10/30	10*	1	0	1	0	2
953 - Zippel Bay State Park	10/21-10/23	20*	0	0	0	0	0
954 - Lake Bemidji State Park	10/21-10/23	20*	0	0	1	0	1
956 - St. Croix State Park	10/29-10/30	90*	3	2	1	0	6
957 - Rydell National Wildlife Refuge	10/29-10/30	15*	1	0	0	0	1
958 - Savanna Portage State Park	10/29-10/30	25*	0	0	0	0	0
959 - Buffalo River State Park	10/29-10/30	12***	1	0	5	0	6
961 - Itasca State Park	10/8-10/9	75*	0	0	0	0	0
963 - Kilen Woods State Park	10/29-10/30	6*	0	1	0	2	3
965 - Banning State Park	10/29-10/30	6*	0	0	1	0	1
966 - Blue Mounds State Park	11/19-11/20	10***	2	2	5	1	10
967 - Camden State Park	10/29-10/30	12***	1	2	5	0	8
968 - Lake Shetek State Park	11/19-11/20	15**	0	1	9	2	12
969 - Lake Bronson State Park	10/15-10/16	10*	0	0	0	0	0
		Total	**21**	**9**	**36**	**7**	**73**

[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, 2022.

Area	Dates	Permits Available	Adult Male	Fawn Male	Adult Female	Fawn Female	Total
895 - Minnesota Landscape Arboretum	10/22 - 11/6	5***	0	0	1	1	2
896 - City of Two Harbors	9/17 - 12/31	20***	2	0	14	0	16
897 - City of Blue Earth	9/17 - 12/31	20***	0	1	10	2	13
924 - City of Lake Benton	9/17 - 12/31	40***	2	0	20	1	23
926 - Pin Oak Prairie SNA	9/17 - 12/15	8*	2	0	0	0	2
928 - City of Jackson	9/17 - 12/31		0	0	15	1	16
971 - Camp Ripley Second Hunt	10/28 - 10/30	2,500*	73	12	78	15	178
972 - Carlton Game Refuge	11/24 - 12/31	40***	1	2	6	4	13
973 - City of Austin	11/1 - 11/30	50***	2	6	10	8	26
974 - City of Warroad	9/17 - 12/31	10*	0	0	3	0	3
975 - Vermillion Highlands Wildlife Management Area	9/17-10/28	60*	0	1	2	0	3
976 - City of New Ulm	10/8 - 12/31	56***	1	9	38	10	58
977 - City of Red Wing	9/17 - 12/31	20***	0	3	9	0	12
978 - City of Redwood Falls	9/17 - 12/31	20***	0	3	9	0	12
980 - City of Duluth	9/17 - 12/31	400*	67	7	76	8	15
981 - City of Mankato	9/17 - 12/31	40***	3	4	17	5	29
982 - City of Granite Falls	9/17 - 12/31	10**	0	0	3	0	3
983 - City of Ortonville	9/17 - 12/31	30***	2	0	6	1	9
984 - City of Canby	9/17 - 12/31	20*	0	1	4	2	7

[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
985 - City of Bemidji	9/17 - 12/31	44*	7	1	12	1	21
986 - Bemidji Regional Airport	9/17 - 12/31	20*	4	1	6	4	15
988 - Lake Vermilion - Soudan Underground Mine State Park	11/26-12/31	20*	0	0	1	0	1
990 - City of Owatonna	10/23-11/20; 11/21-12/18	38***	4	4	18	2	28
992- City of Hallock	9/17-10/21; 10/22-11/25; 11/26-12/31	15**	0	1	1	0	2
995 - City of Grand Rapids	9/17 - 12/31	N/A*	1	4	18	1	24
998 - City of Red Lake Falls	9/17 - 12/31	10**	0	0	2	0	2
		Total	**180**	**57**	**379**	**66**	**682**

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	138	0	138	0	49
	2	134	0	134	0	
	3	241	3	235	6	
	4	43	2	0	43	
	Total	**556**	**5**	**507**	**49**	
107	1	416	0	177	239	494
	2	172	0	0	172	
	3	43	0	0	43	
	4	15	1	0	15	
	5	11	0	0	11	
	6	92	0	0	9	
	7	5	0	0	5	
	Total	**671**	**1**	**177**	**494**	
109	1	94	2	94	0	25
	2	80	0	80	0	
	3	62	0	62	0	
	4	54	0	54	0	
	5	48	0	48	0	
	6	49	0	49	0	
	7	39	0	18	21	
	8	3	0	0	3	
	9	1	0	0	1	
	Total	**430**	**2**	**405**	**25**	
110	1	548	1	548	0	496
	2	476	2	201	275	
	3	205	1	0	205	
	4	16	1	0	16	
	5	0	2	0	0	
	Total	**1,245**	**7**	**749**	**496**	
126	1	103	0	103	0	25
	2	94	1	94	0	
	3	47	0	22	25	
	Total	**244**	**1**	**219**	**25**	

Permit Area Number	Preference Level	Total Applicants	Rejected Applicants	Unsuccessful	Winners	Permits Available
131	1	47	2	47	0	25
	2	42	0	42	0	
	3	25	0	0	25	
	Total	**114**	**2**	**89**	**25**	
133	1	185	0	185	0	49
	2	177	1	177	0	
	3	50	0	1	49	
	Total	**412**	**1**	**363**	**49**	
169	1	519	0	519	0	247
	2	555	0	555	0	
	3	533	2	533	0	
	4	558	4	519	39	
	5	208	4	0	208	
	6	0	2	0	0	
	Total	**2,373**	**12**	**2,126**	**247**	
171	1	1,519	3	742	777	1489
	2	552	5	0	552	
	3	121	5	0	121	
	4	37	2	0	37	
	5	0	1	0	0	
	9	2	0	0	2	
	Total	**2,231**	**16**	**742**	**1,489**	
172	1	2,140	15	1,774	366	1971
	2	1,187	7	0	1,187	
	3	298	9	0	298	
	4	118	1	0	118	
	5	1	0	0	1	
	6	0	1	0	0	
	9	1	0	0	1	
	Total	**3,745**	**33**	**1,774**	**1,971**	
173	1	615	0	615	0	493
	2	601	2	126	475	
	3	15	2	0	15	
	4	3	2	0	3	
	Total	**1,234**	**6**	**741**	**493**	

Permit Area Number	Preference Level	Total Applicants	Rejected Applicants	Unsuccessful	Winners	Permits Available
176	1	364499	2	364	0	149
	2	390	0	390	0	
	3	385	1	385	0	
	4	396	1	248	148	
	9	1	0	0	1	
	Total	**1,536**	**4**	**1,387**	**149**	
177	1	612	3	513	99	791
	2	611	3	0	611	
	3	59	1	0	59	
	4	18	0	0	18	
	5	1	0	0	1	
	6	1	0	0	1	
	9	2	0	0	2	
	Total	**1,304**	**7**	**513**	**791**	
178	1	710	4	710	0	397
	2	688	5	688	0	
	3	622	3	622	0	
	4	556	2	163	393	
	5	0	1	0	0	
	9	4	0	0	4	
	Total	**2,580**	**15**	**2,183**	**397**	
181	1	1,324	5	1,270	54	296
	2	239	1	0	239	
	3	32	0	0	3	
	4	0	1	0	0	
	5	0	3	0	0	
	Total	**1,566**	**10**	**1,270**	**296**	
197	1	643	1	643	0	494
	2	677	3	677	0	
	3	548	2	74	474	
	4	18	1	0	18	
	5	2	0	0	2	
	6	0	1	0	0	
	Total	**1,888**	**8**	**1,394**	**494**	

Permit Area Number	Preference Level	Total Applicants	Rejected Applicants	Unsuccessful	Winners	Permits Available
199	1	110	0	94	16	50
	2	34	0	0	34	
	Total	**144**	**0**	**94**	**50**	
203	1	21	1	21	0	25
	2	26	0	7	19	
	3	61	0	0	6	
	Total	**53**	**1**	**28**	**25**	
234	1	187	0	187	0	25
	2	28	0	28	19	
	3	8	0	8	6	
	Total	**223**	**0**	**223**	**25**	
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	0	0	79	121
	2	21	0	0	21	
	3	4	0	0	4	
	Total	**104**	**0**	**0**	**104**	
250	1	344	3	85	259	423
	2	160	0	0	160	
	3	4	0	0	4	
	4	0	1	0	0	
	Total	**508**	**4**	**85**	**423**	
252	1	471	1	20	451	518
	2	63	1	0	63	
	3	4	0	0	4	
	Total	**538**	**2**	**20**	**518**	
253	1	420	4	233	187	445
	2	236	3	0	236	
	3	22	1	0	22	
	4	0	1	0	0	
	Total	**678**	**9**	**233**	**445**	

Permit Area Number	Preference Level	Total Applicants	Rejected Applicants	Unsuccessful	Winners	Permits Available
259	1	1,946	6	769	1,177	1,951
	2	698	9	0	698	
	3	71	2	0	71	
	4	5	0	0	5	
	Total	**2,720**	**17**	**769**	**1,951**	
269	1	302	2	100	202	320
	2	115	0	0	115	
	3	3	1	0	3	
	Total	**420**	**3**	**100**	**320**	
270	1	147	0	136	11	140
	2	120	1	0	120	
	3	9	0	0	9	
	Total	**276**	**1**	**136**	**140**	
272	1	168	1	168	0	146
	2	143	0	65	78	
	3	65	1	0	65	
	4	3	0	0	3	
	Total	**379**	**2**	**233**	**146**	
274	1	258	1	207	51	274
	2	205	0	0	205	
	3	15	0	0	15	
	4	3	0	0	3	
	Total	**481**	**1**	**207**	**274**	
275	1	327	0	327	0	429
	2	288	2	96	192	
	3	195	1	0	195	
	4	42	0	0	42	
	Total	**852**	**3**	**423**	**429**	
278	1	514	1	303	211	536
	2	303	1	0	303	
	3	21	0	0	21	
	6	1	0	0	1	
	Total	**839**	**2**	**303**	**536**	

Permit Area Number	Preference Level	Total Applicants	Rejected Applicants	Unsuccessful	Winners	Permits Available
280	1	150	0	150	0	140
	2	77	0	77	0	
	3	81	0	13	68	
	4	65	0	0	65	
	5	7	0	0	7	
	Total	**380**	**0**	**240**	**140**	
282	1	55	0	55	0	24
	2	53	0	53	0	
	3	33	1	29	4	
	4	20	0	0	20	
	Total	**161**	**1**	**137**	**24**	
284	1	147	3	147	0	194
	2	141	0	141	0	
	3	197	1	186	11	
	4	157	1	0	157	
	5	26	0	0	26	
	Total	**668**	**5**	**474**	**194**	
286	1	450	0	112	338	450
	2	106	1	0	106	
	3	4	0	0	4	
	4	2	1	0	2	
	Total	**562**	**2**	**112**	**450**	
288	1	457	1	279	178	455
	2	271	0	0	271	
	3	6	0	0	6	
	Total	**734**	**1**	**279**	**455**	
291	1	921	0	534	387	922
	2	518	5	0	518	
	3	16	1	0	16	
	4	1	0	0	1	
	6	0	2	0	0	
	Total	**1,456**	**8**	**534**	**922**	

Permit Area Number	Preference Level	Total Applicants	Rejected Applicants	Unsuccessful	Winners	Permits Available
294	1	389	2	0	389	455
	2	34	0	0	34	
	3	1	1	0	1	
	Total	**424**	**3**	**0**	**424**	
295	1	480	1	405	75	450
	2	340	0	0	340	
	3	34	1	0	34	
	4	1	1	0	1	
	5	0	1	0	0	
	Total	**855**	**4**	**405**	**450**	
296	1	337	1	161	176	444
	2	239	0	0	239	
	3	28	0	0	28	
	4	1	0	0	1	
	Total	**605**	**1**	**161**	**444**	
297	1	96	0	69	27	96
	2	53	1	0	53	
	3	16	0	0	16	
	Total	**165**	**1**	**69**	**96**	
298	1	435	5	76	359	596
	2	134	0	0	134	
	3	95	0	0	95	
	4	7	0	0	7	
	9	1	0	0	1	
	Total	**672**	**5**	**76**	**596**	
	Total	**37,386**	**212**	**20,107**	**17,304**	**17,352**

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	1
	2	1	0	1	0	
	3	2	0	1	1	
	Total	**6**	**0**	**5**	**1**	
107	1	7	0	2	5	6
	2	1	0	0	1	
	Total	8	0	2	6	
109	1	1	0	1	0	0
	4	1	0	1	0	
	Total	**2**	**0**	**2**	**0**	
110	1	6	0	6	0	4
	2	5	0	1	4	
	Total	**11**	**0**	**7**	**4**	
126	1	3	0	3	0	0
	2	1	0	1	0	
	Total	**4**	**0**	**1**	**2**	
131	2	1	0	1	0	0
	3	1	0	1	0	
	Total	**2**	**0**	**2**	**0**	
133	1	5	0	5	0	1
	2	2	0	2	0	
	3	4	0	3	1	
	Total	**11**	**0**	**10**	**1**	
169	1	13	0	13	0	3
	2	6	0	6	0	
	3	3	0	3	0	
	4	3	0	0	3	
	Total	**25**	**0**	**22**	**3**	
171	1	11	0	6	5	11
	2	6	0	0	6	
	Total	**17**	**0**	**6**	**11**	
172	1	39	0	26	13	29
	2	15	0	0	15	
	3	1	0	0	1	
	Total	**55**	**0**	**26**	**29**	
173	1	10	0	10	0	7
	2	8	0	1	7	
	Total	**18**	**0**	**11**	**7**	

Permit Area Number	Preference Level	Total applicants	Rejected applicants	Unsuccessful	Winners	Permits Available
176	1	3	0	3	0	1
	2	3	0	3	0	
	3	1	0	1	0	
	4	2	0	1	1	
	Total	**9**	**0**	**8**	**1**	
177	1	9	0	6	3	9
	2	6	0	0	6	
	Total	**15**	**0**	**6**	**9**	
178	1	8	0	8	0	3
	2	4	0	4	0	
	3	4	0	3	1	
	4	2	0	0	2	
	Total	**18**	**0**	**15**	**3**	
181	1	16	0	16	0	4
	2	4	0	0	4	
	Total	**20**	**0**	**16**	**4**	
197	1	11	0	11	0	6
	2	9	0	7	2	
	3	4	0	0	4	
	Total	**24**	**0**	**18**	**6**	
234	1	18	0	0	18	25
	2	2	0	0	2	
	Total	**20**	**0**	**0**	**20**	
237	1	14	0	8	6	12
	2	4	0	0	4	
	3	2	0	0	2	
	Total	**20**	**0**	**8**	**12**	
238	1	3	0	0	3	4
	Total	**3**	**0**	**0**	**3**	
250	1	24	0	6	18	27
	2	9	0	0	9	
	Total	**33**	**0**	**6**	**27**	
252	1	25	1	0	25	32
	2	7	0	0	7	
	Total	**32**	**1**	**0**	**32**	
253	1	56	0	30	26	55
	2	29	0	0	29	
	Total	**85**	**0**	**30**	**55**	

Permit Area Number	Preference Level	Total applicants	Rejected applicants	Unsuccessful	Winners	Permits Available
259	1	54	0	20	34	49
	2	13	0	0	13	
	3	1	0	0	1	
	4	1	0	0	1	
	Total	**69**	**0**	**20**	**49**	
269	1	29	0	10	19	30
	2	10	0	0	10	
	3	1	0	0	1	
	Total	**40**	**0**	**10**	**30**	
270	1	11	0	9	2	10
	2	7	0	0	7	
	3	1	0	0	1	
	Total	**10**	**0**	**6**	**4**	
272	1	7	0	6	1	4
	2	3	0	0	3	
	Total	**10**	**0**	**6**	**4**	
274	1	31	0	20	11	26
	2	15	0	0	15	
	Total	**46**	**0**	**20**	**26**	
275	1	25	0	20	5	21
	2	10	0	0	10	
	3	6	0	0	6	
	Total	**41**	**0**	**20**	**21**	
278	1	71	0	35	36	64
	2	28	0	0	28	
	3	0	1	0	0	
	Total	**99**	**1**	**35**	**64**	
280	1	14	0	14	0	10
	2	4	0	4	0	
	3	6	0	0	6	
	4	3	0	0	3	
	5	1	0	0	1	
	Total	**28**	**0**	**18**	**10**	
282	1	2	0	2	0	1
	2	3	0	3	0	
	3	1	0	0	1	
	Total	**6**	**0**	**5**	**1**	

Permit Area Number	Preference Level	Total applicants	Rejected applicants	Unsuccessful	Winners	Permits Available
284	1	10	0	10	0	6
	2	7	0	6	1	
	3	4	0	0	4	
	4	1	0	0	1	
	Total	**22**	**0**	**16**	**6**	
286	1	55	0	13	42	50
	2	7	0	0	7	
	3	1	0	0	1	
	Total	**63**	**0**	**13**	**50**	
288	1	46	1	26	20	45
	2	23	0	0	23	
	3	1	0	0	1	
	9	1	0	0	1	
	Total	**71**	**1**	**26**	**45**	
291	1	85	0	45	40	78
	2	36	0	0	36	
	3	2	0	0	2	
	Total	**123**	**0**	**45**	**78**	
294	1	38	0	0	38	45
	2	4	0	0	4	
	Total	**42**	**0**	**0**	**42**	
295	1	61	0	45	16	50
	2	33	0	0	33	
	3	1	0	0	1	
	Total	**95**	**0**	**45**	**50**	
296	1	60	0	21	39	61
	2	21	0	0	21	
	3	1	0	0	1	
	Total	**82**	**0**	**21**	**61**	
297	1	5	0	3	2	4
	2	2	0	0	2	
	Total	**7**	**0**	**3**	**4**	
298	1	4	0	0	4	4
	Total	4	0	0	4	
	Total	**1,305**	**3**	**516**	**789**	**798**

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	29	0	0	29	100
	2	5	0	0	5	
	Total	34	0	0	34	
901 - Rice Lake Wildlife Refuge	1	39	0	22	17	40
	2	23	0	0	23	
	Total	62	0	22	40	
902 - St.Croix SP	1	369	0	94	275	350
	2	73	0	0	73	
	3	1	0	0	1	
	9	1	0	0	1	
	Total	444	0	94	350	
903 - Lake Louise SP	1	30	0	30	0	25
	2	22	0	19	4	
	3	20	0	0	20	
	4	1	0	0	1	
	Total	73	0	49	25	
904 - Gooseberry Falls SP	1	37	0	3	34	35
	3	1	0	0	1	
	Total	38	0	3	35	
905 - Split Rock Lighthouse SP	1	19	0	0	19	30
	2	9	0	0	9	
	Total	28	0	0	28	
906 - Tettegouche SP	1	52	0	0	52	100
	2	2	0	0	2	
	9	1	0	0	1	
	Total	55	0	0	55	
907 -Scenic SP	1	8	0	0	8	30
	2	10	0	0	10	
	3	2	0	0	2	
	Total	20	0	0	20	
908 -Hayes Lake SP	1	40	0	0	40	50
	2	4	0	0	4	
	Total	44	0	0	44	

Table 18., Continued.

Permit Area Number	Preference Level	Total Applicants	Rejected Applicants	Unsuccessful	Winners	Permits Available
909 - Lake Bemidji SP	1	28	0	1	27	30
	2	4	0	0	4	
	9	2	0	0	2	
	Total	34	0	1	33	
910 - Zippel Bay SP	1	74	0	3	71	75
	2	4	0	0	4	
	Total	78	0	0	75	
911 – Judge C. R. Magney SP	1	10	0	0	10	60
	Total	10	0	0	10	
913 - Lake Carlos SP	1	22	0	3	19	20
	2	1	0	0	1	
	Total	23	0	3	20	
914 -William O'Brien SP	1	109	0	109	0	50
	2	74	0	55	19	
	3	31	0	0	31	
	9	1	0	0	1	
	Total	215	0	164	51	
915 - Lake Bronson SP	1	34	0	28	6	30
	2	21	0	0	21	
	3	1	0	0	1	
	9	2	0	0	2	
	Total	58	0	28	30	
916 - Maplewood SP	1	129	0	129	0	100
	2	115	0	115	0	
	3	93	0	21	72	
	4	25	0	0	25	
	5	1	0	0	1	
	9	2	0	0	2	
	Total	365	0	265	100	
917 -Miesville Ravine SP	1	100	0	100	0	40
	2	57	0	23	34	
	3	5	0	0	5	
	4	2	0	0	2	
	Total	164	0	123	41	

Table 18., Continued.

Permit Area Number	Preference Level	Total Applicants	Rejected Applicants	Unsuccessful	Winners	Permits Available
918 – Beaver Creek Valley S.P.	1	44	0	39	1	25
	2	14	0	0	14	
	3	9	0	0	9	
	9	1	0	0	1	
	Total	68	0	39	25	
919 - Glacial Lakes SP	1	19	0	2	17	20
	2	6	0	0	6	
	Total	25	0	2	23	
920 - Zumbro Falls SNA	1	20	0	20	0	12
	2	13	0	6	7	
	3	5	0	0	5	
	Total	38	0	26	12	
921 - Lawrence Unit MN Valley Rec. Area	1	49	0	27	22	25
	2	8	0	0	8	
	3	1	0	0	1	
	Total	58	0	27	31	
922 – Old Mill SP	1	9	0	2	7	10
	2	3	0	0	3	
	Total	12	0	2	10	
923 - Zumbro Falls SNA	1	17	0	9	8	12
	2	4	0	0	4	
	Total	21	0	9	12	
925 - Vermillion Highlands Research, Recreation, and Wildlife Management Area A Season	1	23	0	23	0	19
	2	19	0	19	0	
	3	15	0	1	14	
	4	4	0	0	4	
	Total	61	0	43	18	
925 -Vermillion Highlands Research, Recreation, and Wildlife Management Area B Season	1	2	0	2	0	2
	2	3	0	3	0	
	3	2	0	0	2	
	Total	7	0	5	2	

Table 18, Continued.

Permit Area Number	Preference Level	Total Applicants	Rejected Applicants	Unsuccessful	Winners	Permits Available
927 – Whitewater SP	1	69	0	30	39	50
	2	10	0	0	10	
	3	1	0	0	1	
	Total	80	0	30	50	
933 – Forestville Mystery Cave SP	1	88	0	33	55	75
	2	18	0	0	18	
	3	2	0	0	2	
	Total	108	0	33	75	
934 - Whitewater State Game Refuge	1	71	0	0	71	100
	Total	71	0	0	71	
940 – Frontenac SP	1	52	0	0	52	60
	2	6	0	0	6	
	3	1	0	0	1	
	Total	59	0	0	59	
941 – Elm Creek Park Reserve	1	152	0	152	0	125
	2	123	0	42	81	
	3	45	0	0	45	
	Total	320	0	194	126	
962 - Great River Bluffs SP	1	31	0	0	31	50
	Total	31	0	0	31	
991 – Kilen Woods S.P.	1	1	0	0	1	10
	2	4	0	0	4	
	3	1	0	0	1	
	Total	6	0	0	6	
	Total	**2,390**	**0**	**971**	**1,416**	**1,750**

Table 19. Muzzleloader special hunts lottery distribution report.

Permit Area Number	Preference Level	Total Applicants	Rejected Applicants	Unsuccessful	Winners	Permits Available
929 - McCarthy Beach SP	1	9	0	0	9	10
	Total	9	0	0	9	
930 - Nerstrand Big Woods SP	1	61	0	61	0	50
	2	35	0	13	22	
	3	26	0	0	26	
	4	1	0	0	1	
	5	1	0	0	1	
	Total	124	0	74	50	
932 - Rice Lake SP	1	25	0	25	0	20
	2	22	0	3	19	
	3	1	0	0	1	
	Total	48	0	28	20	
935 – Jay Cooke SP	1	72	0	39	33	80
	2	47	0	0	47	
	Total	119	0	39	80	
936 - Crow Wing SP	1	26	0	26	0	25
	2	25	0	9	16	
	3	8	0	0	8	
	9	1	0	0	1	
	Total	60	0	35	25	
937 - Lake Vermillion- Soudan Underground Mine SP	1	23	0	0	23	25
	2	2	0	0	2	
	Total	25	0	0	25	
939 - Myre- Big Island SP	1	48	0	48	0	50
	2	50	0	2	48	
	3	1	0	0	1	
	4	1	0	0	1	
	9	1	0	0	1	
	Total	101	0	50	51	
942 - Sibley SP	1	52	0	40	12	60
	2	39	0	0	39	
	3	7	0	0	7	
	4	1	0	0	1	
	9	1	0	0	1	
	Total	100	0	40	60	

Permit Area Number	Preference Level	Total Applicants	Rejected Applicants	Unsuccessful	Winners	Permits Available
943 - Miesville Ravine Park Reserve	1	65	0	51	14	40
	2	20	0	0	20	
	3	6	0	0	6	
	Total	91	0	51	40	
944 - Vermillion Highlands Research, Recreation, and WMA	1	13	0	9	4	20
	2	17	0	0	17	
	Total	30	0	9	21	
947 – Lake Bemidji SP	1	14	0	0	14	30
	Total	14	0	0	14	
948 – Savanna Portage SP	1	16	0	0	16	30
	2	1	0	0	1	
	Total	17	0	0	17	
949 – St Croix SP	1	83	0	0	83	100
	2	2	0	0	2	
	9	1	0	0	1	
	Total	86	0	0	86	
960 – Lake Maria S.P.	1	42	0	42	0	25
	2	34	0	34	0	
	3	25	0	0	25	
	Total	101	0	76	25	
964 - Afton S.P.	1	23	0	0	23	30
	2	2	0	0	2	
	4	2	0	0	2	
	5	1	0	0	1	
	Total	28	0	0	28	
Total		**955**	**0**	**402**	**553**	**595**

2022 MINNESOTA ELK HARVEST REPORT

Barbara Keller, Big Game Program Leader

Jason Wollin, Acting 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, which consists of a minimum count of all elk observed during the survey. The survey was not completed in 2021 due to COVID restrictions, but was resumed in 2022. DNR staff use a single 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 2022, 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 2022 was 84 and included: 51 antlerless and 33 bulls. Given the minimum elk count was above the population goal of 50-60 elk, the DNR continued with implementation of higher quotas and additional seasons for 2022 consistent with past seasons.

In 2022, there were two established zones open for elk hunting in Minnesota: 1) Zone 20 - Kittson Central and 2) Zone 30 - Kittson Northeast (Figure 1). 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 four regular season hunts. For the Zone 20 - Kittson Central there were eight license/season date options: 1) Season A/E - August 27 through September 4, 2) Season B/F - September 10 through September 18, 3) Season C/G - September 24 through October 2, 4) Season D/H - October 8 through October 16. There was one regular season hunt in Zone 30 - Kittson Northeast for two bull-only licenses: 1) Season I - September 10 through September 18. All of the seasons were 9 days in length, including two weekends. These dates were also chosen to avoid conflict with the Youth Firearm Deer Season on October 20 through October 23 and the Regular Firearm Deer Season November 5 through November 13. Overall, hunter success rates were lower this year.

HUNTING SEASON OPTIONS AND LICENSE LOTTERY

A total of 30 licenses were available and 3,691 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% = 5 licenses offered in 2022) 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% = 5 licenses offered in 2022). 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 in 2022, but not Zone 30. 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 2022, a total of 17 elk were harvested in Zones 20 and 30 (Table 3), for an overall hunter success rate of 54% 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. Seven bull elk were taken from hunters using either-sex licenses for Zone 20, and 8 antlerless elk were taken by hunters using antlerless-only licenses. Two bull elk were taken by hunters using bull-only licenses for Zone 30. Long-term elk harvest for all zones is depicted in Tables 4, 5, and 6.

Table 1. Kittson Central (Zone 20) elk survey count, 2008-2021

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

Table 2. License allocation and application numbers of the 2022 Minnesota elk seasons

Zone	Season Dates	Bull-Only	Either-Sex	Antlerless-Only	Total	Total Applicants
Zone 20	A: Aug 27 Sept 4	0	2	0	**2**	516
Zone 20	E: Aug 27-Sept 4	0	0	5	**5**	107
Zone 20	B: Sept 10-18	0	2	0	**2**	875
Zone 20	F: Sept 10-18	0	0	5	**5**	106
Zone 20	C: Sept 24-Oct 2	0	2	0	**2**	621
Zone 20	G: Sept 24-Oct 2	0	0	5	**5**	126
Zone 20	D: Oct 8-16	0	2	0	**2**	445
Zone 20	H: Oct 8-16	0	0	5	**5**	120
Zone 30	I: Sept 10-18	2	0	0	**2**	775
OVERALL	**TOTAL**	**2**	**8**	**20**	**30**	**3,691**

Table 3. Distribution of the 2022 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 & E (Aug 27-Sept 4)	2	5	2	3	**5**	71%
Season B & F (Sept 10-18)	2	5	2	2	**4**	57%
Season C & G (Sept 24-Oct 2)	2	5	1	2	**3**	43%
Season D & H (Oct 8-16)	2	5	2	1	**3**	43%
Total	**8**	**20**	**7**	**8**	**15**	**54%**

Kittson County Northeast Hunt
Zone 30

Season	Bulls-only Licenses	Antlerless Licenses	Bulls taken	Antlerless taken	Total elk taken	Success rate
Season I (Sept 10-18)	2	0	2	0	**2**	100%
Total	**2**	**0**	**2**	**0**	**2**	**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, 2008-2022

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%

Table 6. Kittson Northeast (Zone 30) elk harvests, 2012-2022

Year	Total Bull Licenses	Total Bulls Harvested	Hunter Success Rate
2012	2	1	50%
2013	2	2	100%
2014	2	2	100%
2015	2	2	100%
2016	2	2	100%
2017	5	4	80%
2018	2	2	100%
2019	2	1	50%
2020	2	2	100%
2021	2	2	100%
2022	2	2	100%

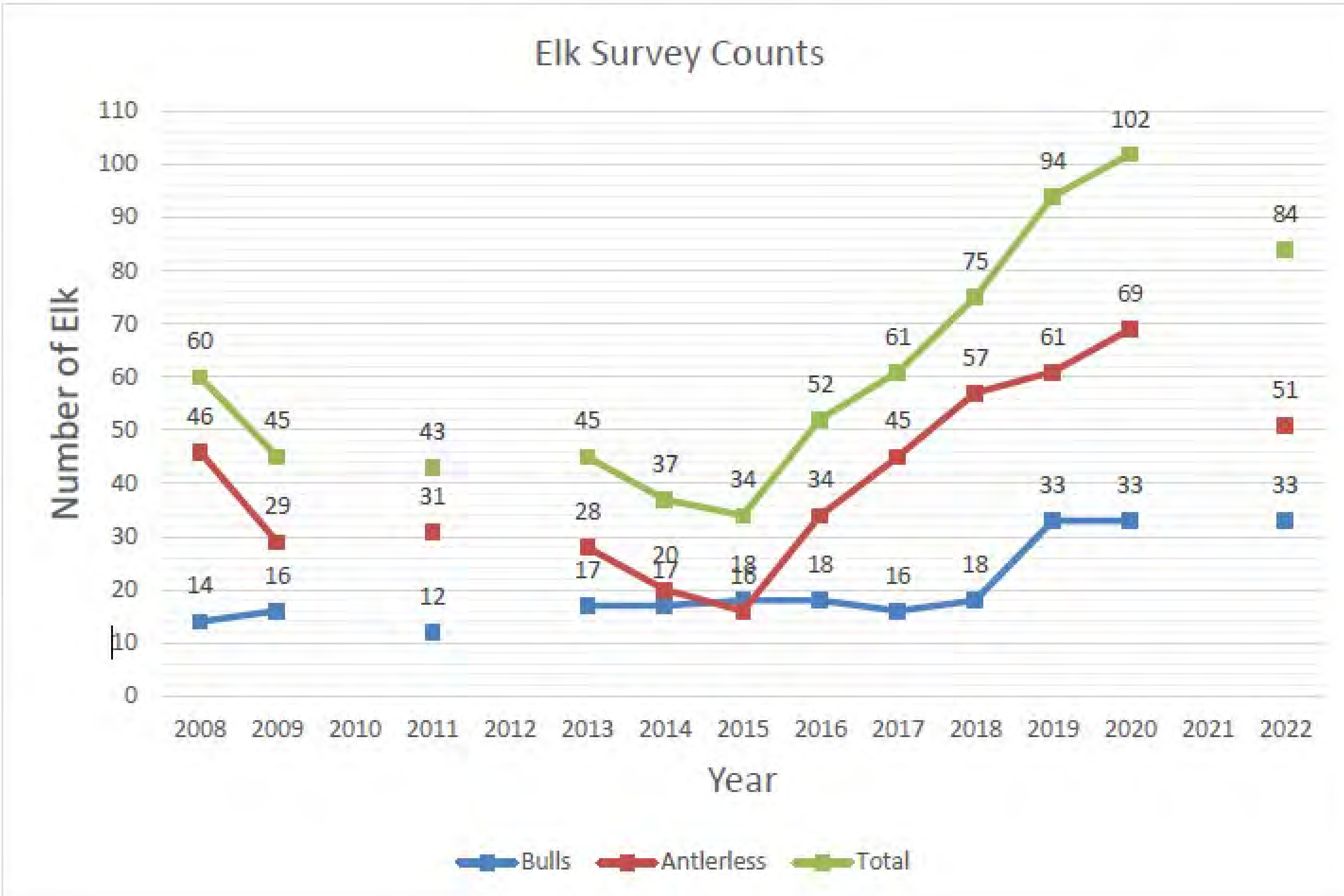

Figure 1. Kittson Central (Zone 20) elk survey count, 2008-2022

Minnesota Elk Hunt Zones

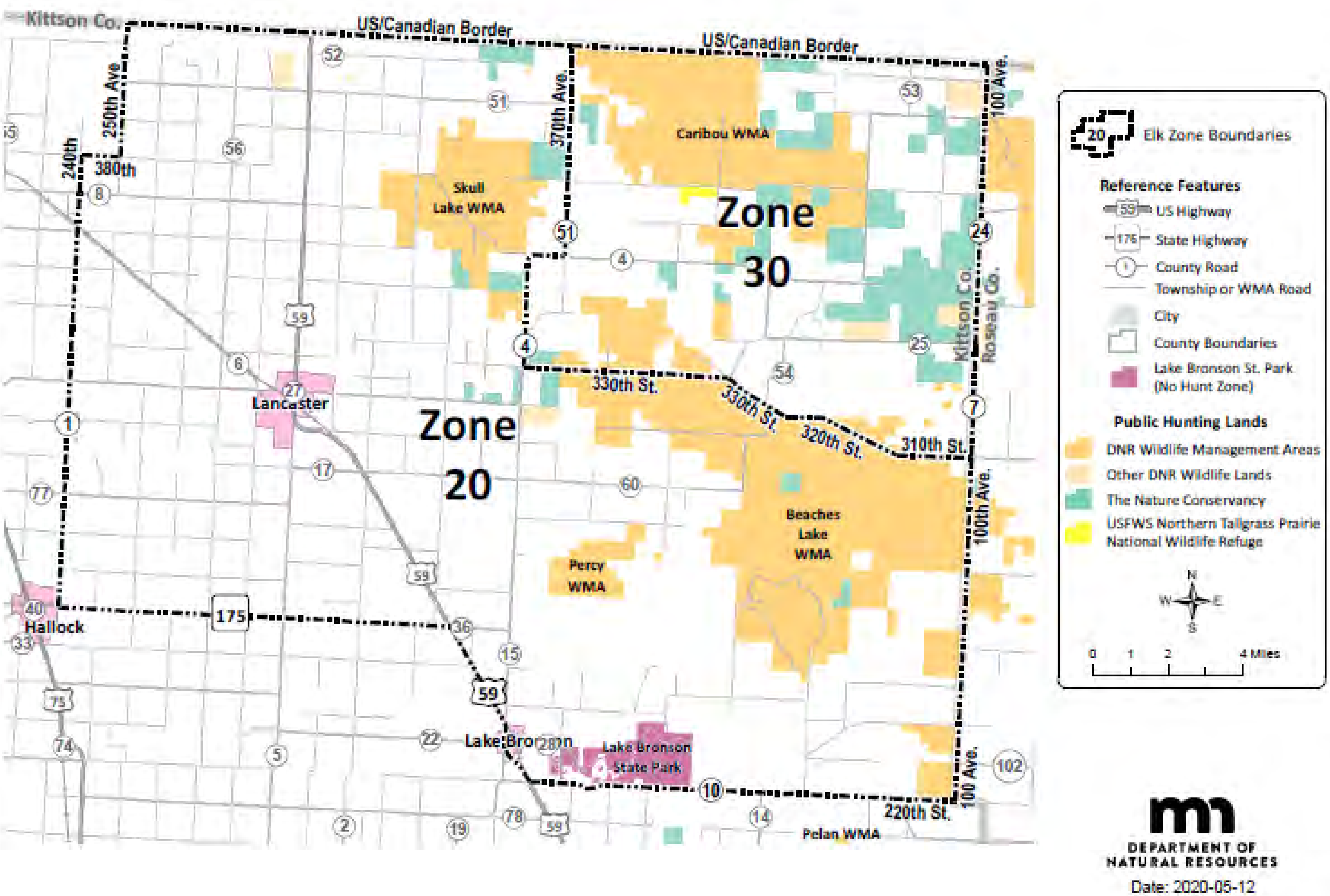

Figure 2. Kittson County Elk Hunt zones.

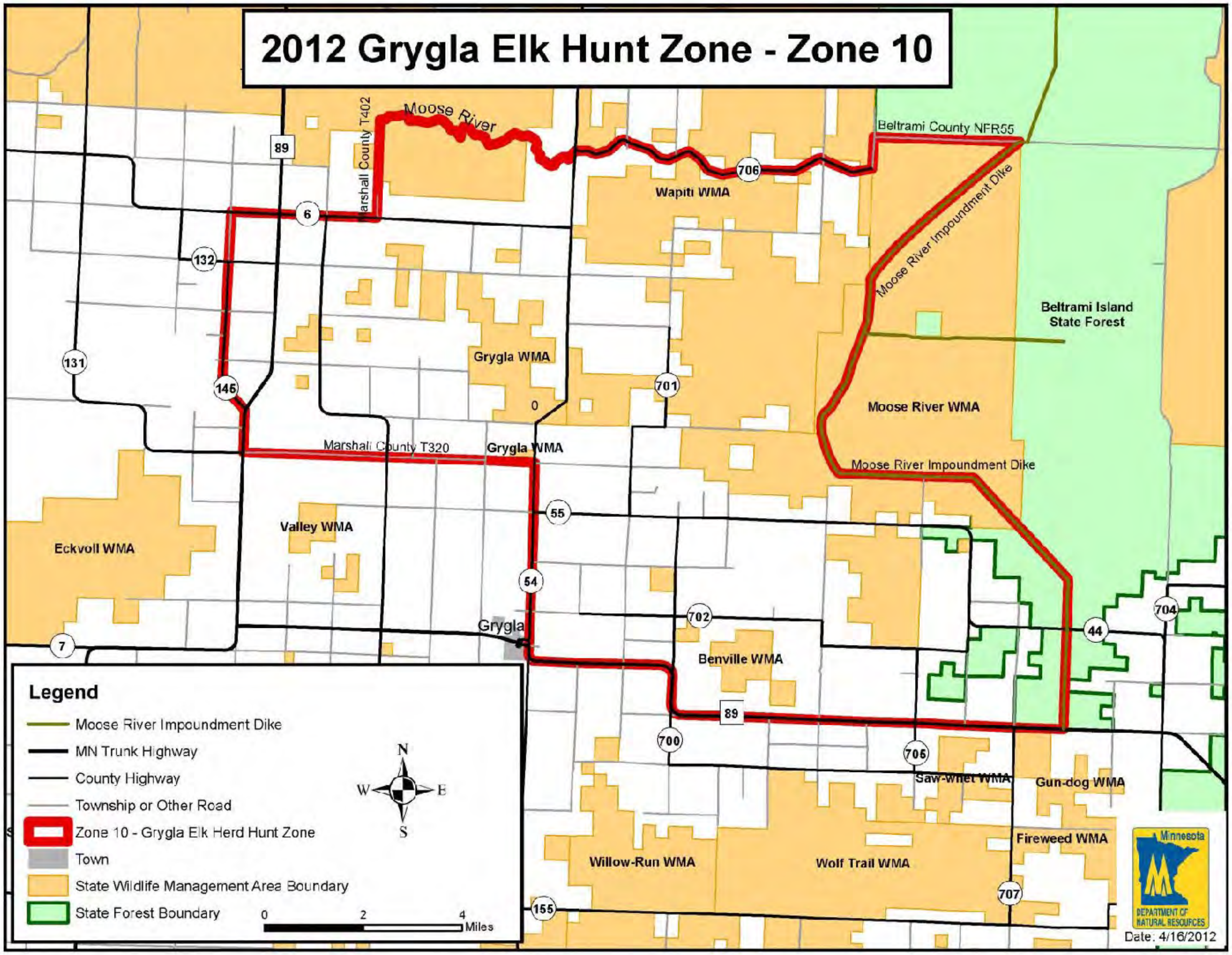

Figure 3. Grygla Elk Hunt zone.

MINNESOTA SANDHILL CRANE HARVEST REPORT, 2022

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. 2023. 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. 17pp + tables and figures.) Status and Harvests of Sandhill Cranes, 2023 | FWS.gov

Table 1. Sandhill Crane season dates and limits in Minnesota, 2010 – 2022.

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

Table 2. Sandhill crane permit sales, estimated number of active hunters and harvest for NW Minnesota, 2010-2022. (Seamans, M.E. 2023)

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

Figure 1. Sandhill crane hunting zone in Minnesota, 2010-2022.

TRAPPING HARVEST STATISTICS

Division of Fish and Wildlife
500 Lafayette Road, Box 20
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2022 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 2023. There were 5,637 active trapping licenses in the ELS database, which consisted of 3,767 Resident Regular Trappers, 6 age - eligible Resident Junior Trappers, 1,157 Resident Senior Trappers, 561 "active" Lifetime Trappers, and 19 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 = 66%, 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 4.2.3 (2023-03-15 ucrt); R Development Core Team 2022).

RESULTS

We mailed out 5,510 surveys, 79 surveys were undeliverable and 2,634 were returned for an adjusted response rate of 48.5%. Among respondents, 55% 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 2022-2023 trapping season (**March 2022-February 2023**). For Spring Beaver, please report only animals taken between March 1, 2022 and May 15, 2022. We need this information to estimate the season's harvest and to help set future furbearer trapping seasons. Similar to past years we are also asking for the **average number of traps you checked per day** for each species. If a trap is set for multiple species, count the trap for both species when answering the question. For example, if you ran 20 mink/coon traps each day, enter 20 traps/day for both mink and coon.

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

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

THANK YOU FOR YOUR COOPERATION

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

2022 Trapper Report

1. **Did you set traps/snares in Minnesota this year during the 2022-2023 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'22)	81				
Beaver (Oct'22-Feb'23)	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, 2022.

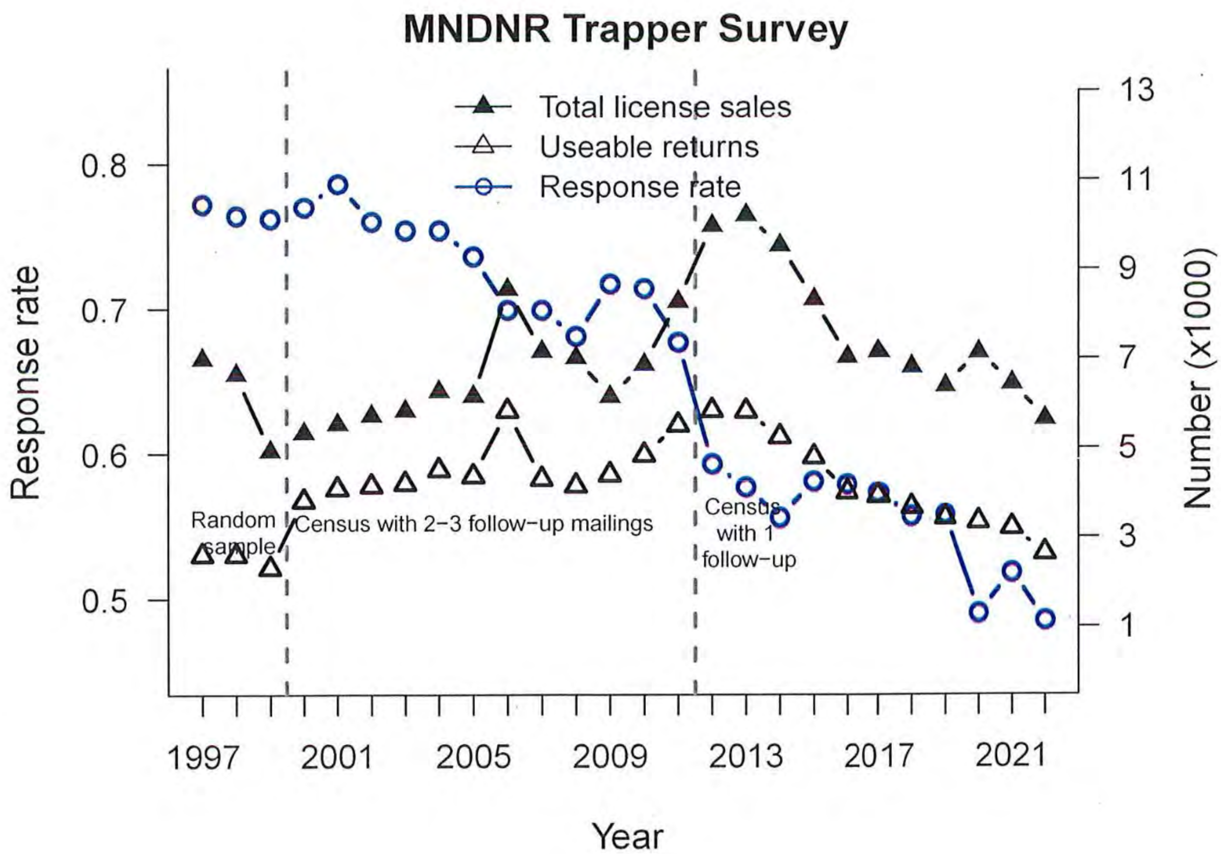

Figure 2. Trapper annual license sales and mail survey response, 1997-98 through 2022-23.

Table 1. Use of trapper licenses, 2011-12 through 2022-23.

Year		Returns from mail survey	Projections from license sales
2011-12	Trapped Did not trap	4,498 (81.5%) 1,019 (18.5%) 5,517 (100.0%)	6,748 1,532 8,280[a]
2012-13	Trapped Did not trap	4,537 (77.6%) 1,307 (22.4%) 5,844 (100.0%)	7,747 2,236 9,983[a]
2013-14	Trapped Did not trap	4,342 (74.6%) 1,480 (25.4%) 5,822 (100.0%)	7,627 2,597 10,224[a]
2014-15	Trapped Did not trap	3,786 (72.2%) 1,459 (27.8%) 5,245 (100.0%)	6,888 2,652 9,540[a]
2015-16	Trapped Did not trap	3,296 (68.8%) 1,496 (31.2%) 4,792 (100.0%)	5,734 2,600 8,334[a]
2016-17	Trapped Did not trap	2,558 (63.7%) 1,458 (36.3%) 4,016 (100.0%)	4,487 2,557 7,044[a]
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]

[a] excludes duplicates.

Table 2. Estimated number of trappers of various furbearers, 2011-12 through 2022-23.

	Estimated number of trappers											
	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Muskrat	4,320	4,110	3,410	2,902	2,218	1,797	1,882	1,583	1,225	1,296	998	668
Mink	2,470	3,110	2,780	2,158	1,587	1,049	1,084	995	795	905	598	409
Short-tailed weasel	800	690	510	666	289	195	283	166	261	345	171	155
Long-tailed weasel	560	540	480	519	265	174	190	151	168	238	139	101
Raccoon	4,060	4,680	4,660	4,182	2,781	2,032	2,168	1,952	1,806	1,925	1,435	1,186
Striped skunk	1,800	1,940	1,610	1,541	1,234	907	840	798	739	789	683	610
Badger	310	360	390	284	247	193	167	164	161	146	147	127
Opossum	830	1,100	1,110	575	463	469	785	646	548	606	498	373
Red fox	1,900	2,240	2,080	2,012	1,434	1,048	1,258	1,091	955	1,181	875	555
Gray fox	970	1,180	1,060	1,035	684	446	458	381	241	261	181	131
Coyote	1,720	2,360	2,200	2,396	1,981	1,479	1,781	1,586	1,344	1,683	1,321	959
Beaver (Oct - Feb)	2,360	2,620	2,710	2,189	1,894	1,642	1,495	1,535	1,333	1,561	1,379	1,178
Beaver (previous Spring)	1,510	1,810	1,150	1,305	1,145	1,130	1,194	1,000	1,153	1,347	1,214	1,038

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, 2011-12 through 2022-2023.

	Estimated take per successful trapper reporting that species											
	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Muskrat	82	59	36	39	51	49	45	40	32	36	36	29
Mink	7	6	6	5	5	6	5	5	5	4	4	3
Short-tailed weasel	10	7	5	8	4	5	5	6	5	4	3	5
Long-tailed weasel	6	4	3	5	3	3	3	3	3	3	3	3
Raccoon	25	18	16	15	11	12	14	13	17	11	9	9
Striped skunk	7	7	6	6	6	7	6	5	6	6	6	5
Badger	2	2	2	2	2	2	2	2	2	2	2	2
Opossum	6	7	7	7	4	5	8	9	7	6	6	7
Red fox	4	4	3	4	3	3	4	4	4	4	3	3
Gray fox	3	3	2	2	2	2	2	2	2	2	2	2
Coyote	6	5	5	5	6	5	7	8	7	7	6	5
Beaver (Oct –Feb)	12	10	9	8	8	8	8	9	8	11	9	10
Beaver (previous Spring)	20	20	9	16	14	17	19	19	23	20	21	22

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, 2011-12 through 2022-2023[a]

	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Trapper license sales [b]	8,280	9,998	10,224	9,540	8,334	7,044	7,163	6,815	6,386	7,139	6,435	5,637
Estimated harvest [c, d, e]												
Muskrat	352,030	242,120	120,500	111,998	112,219	87,958	83,844	63,021	38,777	46,224	35,310	18,890
Mink	15,770	18,460	14,710	10,211	7,745	5,439	5,218	4,412	3,483	3,024	2,066	970
Short-tailed weasel	7,300	4,500	2,360	4,806	1,083	930	1,305	995	1,245	1,359	513	720
Long-tailed weasel	3,020	2,030	1,410	2,568	734	466	554	340	379	689	287	277
Raccoon	98,240	79,800	70,380	58,868	29,963	22,874	28,899	24,845	29,297	19,740	12,571	10,455
Striped skunk	12,250	12,620	9,430	7,956	6,349	5,458	4,476	3,961	4,078	4,023	3,665	3,025
Badger	490	570	600	347	376	286	278	221	231	280	230	175
Opossum	4,400	6,780	6,720	3,524	1,814	2,124	6,160	5,248	3,548	3,143	2,942	2,331
Red fox	7,250	7,540	5,710	6,040	4,061	2,707	4,500	3,530	2,896	3,953	2,401	1,388
Gray fox	2,100	2,550	1,940	1,902	1,161	715	736	611	336	321	200	180
Coyote	8,780	11,130	9,010	11,703	10,084	7,308	12,303	11,359	8,630	10,183	7,157	4,640
Beaver (Oct- Feb)	26,620	24,590	23,220	15,671	14,181	13,070	11,223	12,937	9,900	15,823	11,188	10,626
Beaver (previous Spring)	29,500	34,600	10,110	20,820	15,966	19,004	22,293	18,649	26,368	26,464	24,911	22,083
Registered harvest [e, f]												
Otter	2,294	3,171	2,824	2,148	1,955	1195	1,295	1,351	1,050	1,304	1,155	855
Bobcat [g]	1,711	1,875	1,038	1,380	766	485	731	1,015	695	1,325	724	489
Fisher	1,473	1,293	1,146	919	756	399	477	510	463	712	577	200
Marten	2,525	1,472	1,014	1,055	877	551	979	665	585	765	434	211
Wolf [h]	Closed	413	238	272	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, 2023 5,637 trapping licenses were sold in 2022: 108 (1.9%) were junior licenses, 3,773 (66.9%) were regular adult licenses, 1,160 (20.6%) were senior licenses, 577 (10.2%) were Lifetime licenses, and 19 (<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 2023, questionnaires were mailed to licensed fur buyers in Minnesota. The survey asked them to report the number and type of fur purchased from Minnesota trappers and hunters in 2022-23 and the "average price" paid to those hunters and trappers based on all furs purchased. A total of 14 usable surveys were received, for a return rate of 87 percent.

Calculations of average pelt price for each species were weighted according to the number of pelts purchased by each buyer. Total estimated value of the furbearer harvest to trappers and hunters in 2022-23 was $397,192.75.

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

Species	Number Pelts	Minimum Price	Maximum Price	Weighted Mean
Muskrat	5147	1.00	2.50	2.24
Mink Female	167	2.00	5.00	2.81
Mink male	287	4.27	9.00	5.58
Raccoon	6086	3.00	55.00	6.09
Red Fox	314	3.00	14.00	10.76
Gray Fox	33	8.00	15.00	12.85
Coyote	1562	4.00	20.00	9.15
Bobcat	64	45.00	80.00	69.84
River Otter	253	15.00	30.00	16.30
Beaver 10-12	4243	8.00	22.50	17.77
Beaver 3-4	10220	12.00	22.00	19.97
L.T. Weasel	5	0.00	5.00	0.00
S.T. Weasel	280	1.00	5.00	4.64
Striped Skunk	547	4.50	7.00	5.98
Badger	35	10.00	20.00	13.43
Opossum	34	0.50	2.00	1.37
Fisher Male	22	25.00	35.00	29.55
Fisher Female	26	20.00	30.00	24.23
Marten Male	39	20.00	35.00	32.05
Marten Female	37	5.00	25.00	23.24
Deer Hides	11215	1.00	5.50	3.15
Bear Hides	12	35.00	50.00	47.50

Table 2. Average price per pelt paid to hunters and trappers in Minnesota, 2012-13 through 2022-23

	Average pelt prices paid hunters and trappers in Minnesota (dollars)										
Species	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21*	2021-22	2022-23
Muskrat	7.91	8.72	4.85	2.28	2.65	2.59	2.38	2.84	NA	2.66	2.24
Mink (female)	17.53	13.72	7.45	4.99	6.20	5.80	6.02	3.07	NA	3.87	2.81
Mink (male)	18.27	18.11	10.50	6.18	7.47	7.29	7.61	3.46	NA	5.50	5.58
Raccoon	16.60	16.58	8.64	5.11	4.92	5.76	7.30	6.66	NA	4.39	6.09
Red Fox	33.52	30.90	20.41	11.86	10.52	13.30	10.93	9.95	NA	10.74	10.76
Gray Fox	19.20	21.27	14.17	10.64	10.33	11.32	13.42	12.70	NA	14.77	12.85
Coyote	22.04	21.30	25.10	21.48	17.39	25.15	36.20	38.71	NA	10.96	9.15
Bobcat	144.79	88.63	66.67	57.46	35.88	63.52	60.33	61.97	NA	55.38	69.84
Otter	72.12	61.32	34.57	30.03	21.05	21.98	25.07	20.64	NA	19.72	16.30
Beaver (fall-winter)	18.47	16.52	12.40	8.77	8.14	8.32	8.30	7.66	NA	8.11	17.77
Beaver (spring)	12.80	14.77	10.69	8.24	7.33	10.39	8.95	7.86	NA	10.63	19.97
L.T. Weasel	4.10	2.35	1.78	1.46	1.41	0.00	0.00	0.00	NA	0.00	0.00
S.T. Weasel	2.51	0.00	2.00	1.41	0.00	2.79	2.45	2.08	NA	4.35	4.64
Striped Skunk	5.00	4.14	3.86	3.65	4.00	7.12	5.25	6.30	NA	9.24	5.98
Badger	14.54	13.72	9.52	9.57	7.86	9.09	7.94	8.14	NA	19.50	13.43
Opossum	1.52	1.52	1.17	1.98	1.32	1.34	0.96	0.83	NA	2.20	1.37
Fisher (male)	62.38	61.32	41.76	34.88	28.00	29.87	43.03	21.02	NA	26.61	29.55
Fisher (female)	63.02	67.73	50.87	34.39	37.07	36.75	39.57	19.84	NA	24.63	24.23
Marten (male)	56.57	74.10	38.92	30.83	29.94	36.90	41.81	27.35	NA	28.91	32.05
Marten (female)	54.29	70.94	32.20	28.89	30.41	33.96	33.06	23.75	NA	24.09	23.24
Deer Hides	5.18	6.09	5.59	5.62	4.00	4.14	3.18	2.91	NA	2.30	3.15
Bear Hides	30.28	42.63	32.94	46.03	32.97	25.91	32.33		32.72NA	30.56	47.50

*No pelt price survey was conducted.

REGISTERED FURBEARER HARVEST STATISTICS

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REGISTERED FURBEARER HARVEST STATISTICS 2022-23

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). There were no changes to season structures for any of the four registered species this year compared to the 2021-22 season. Bobcat harvest decreased 32%, fisher harvest decreased 65% to the lowest level since seasons were re- established in 1977, marten harvest decreased 51% to the lowest level since seasons were re- established in 1985, and otter harvest decreased 26% (lowest since 1991). 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

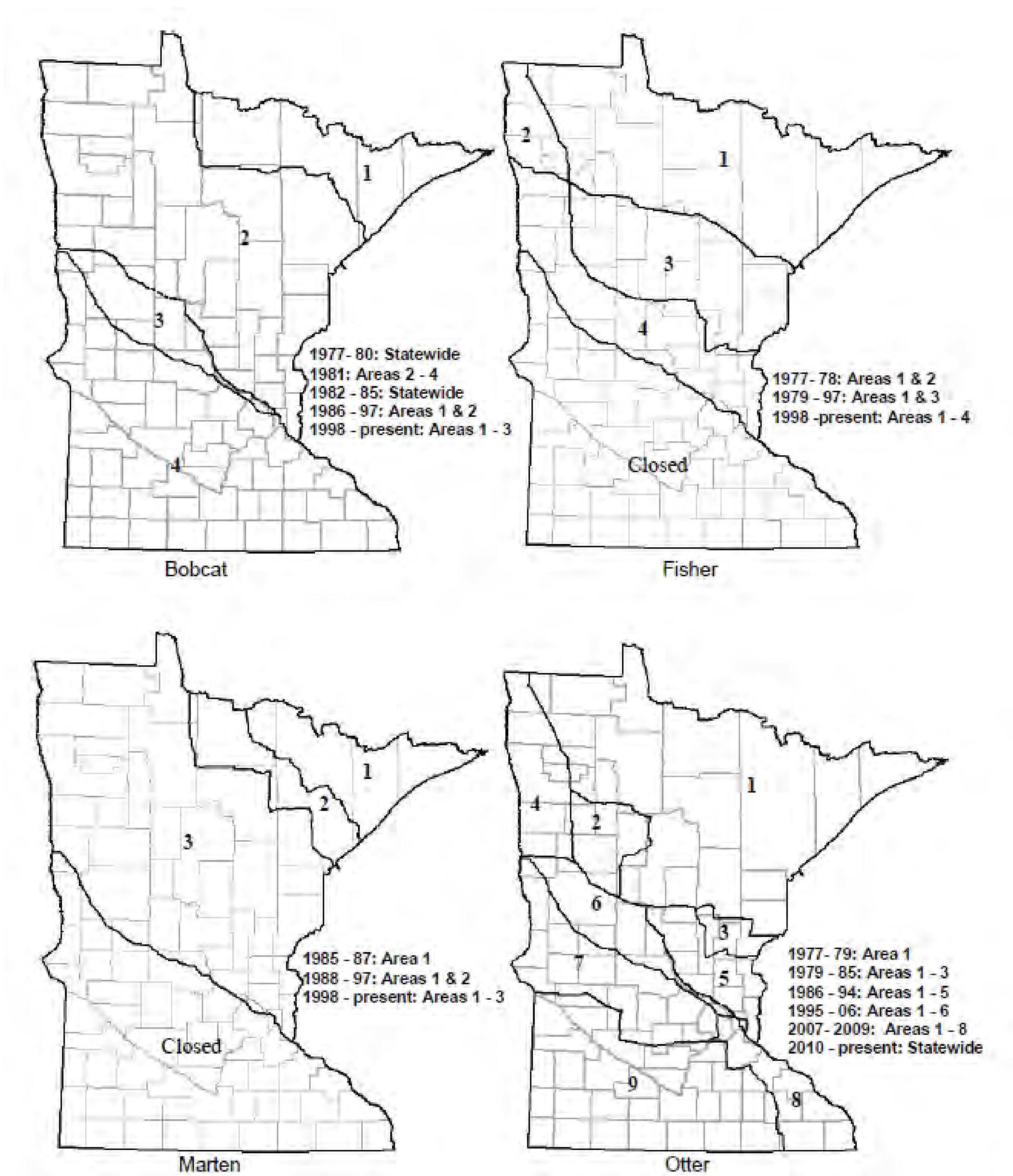

Figure 1. Open trapping areas in Minnesota for fisher, marten, bobcat, and river otter, 1977 - present.

Table 1. Registered furbearer seasons and harvests, 1992-2022.

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

[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).

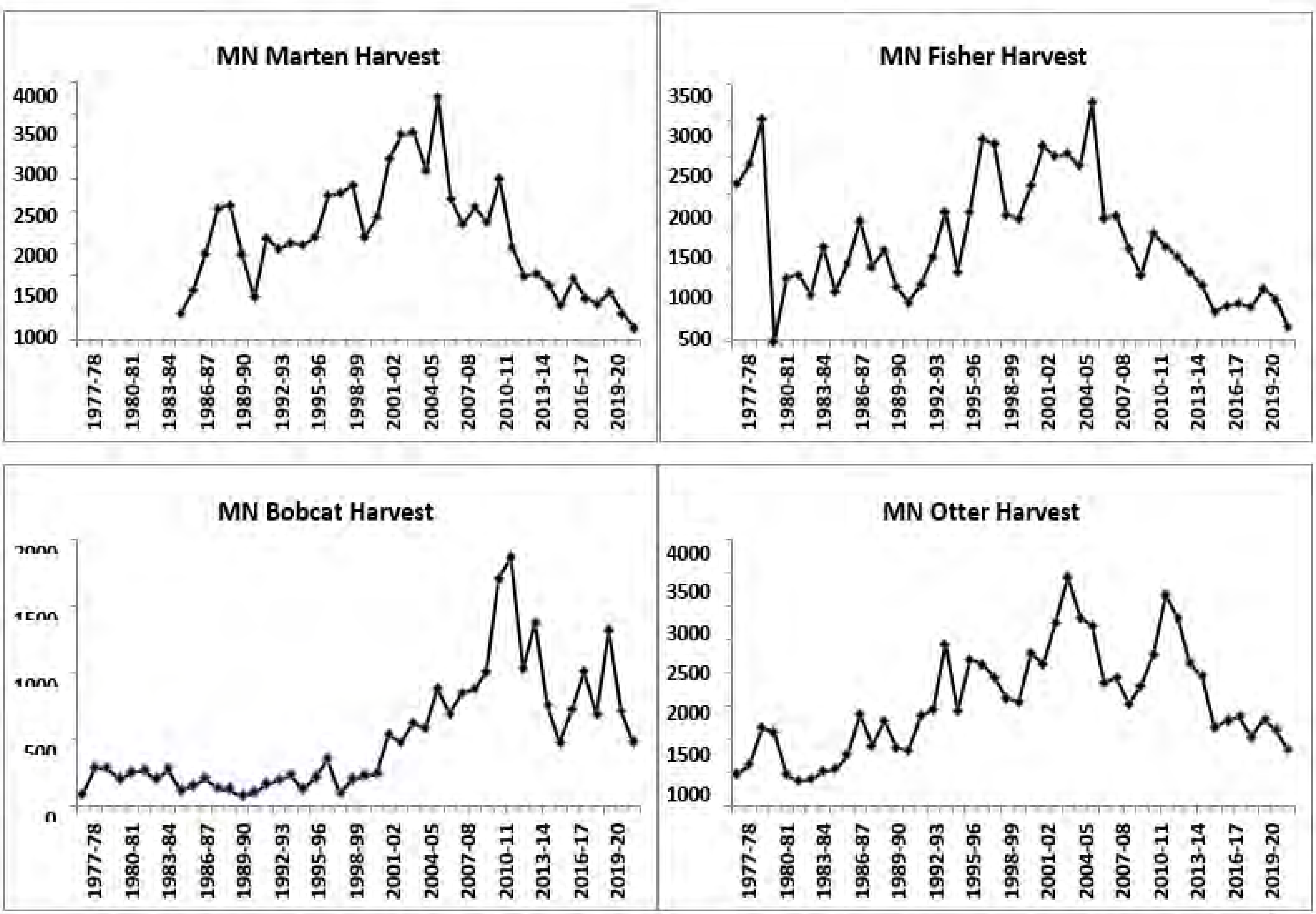

Figure 2. Harvest of registered furbearers in Minnesota, 1977-present.

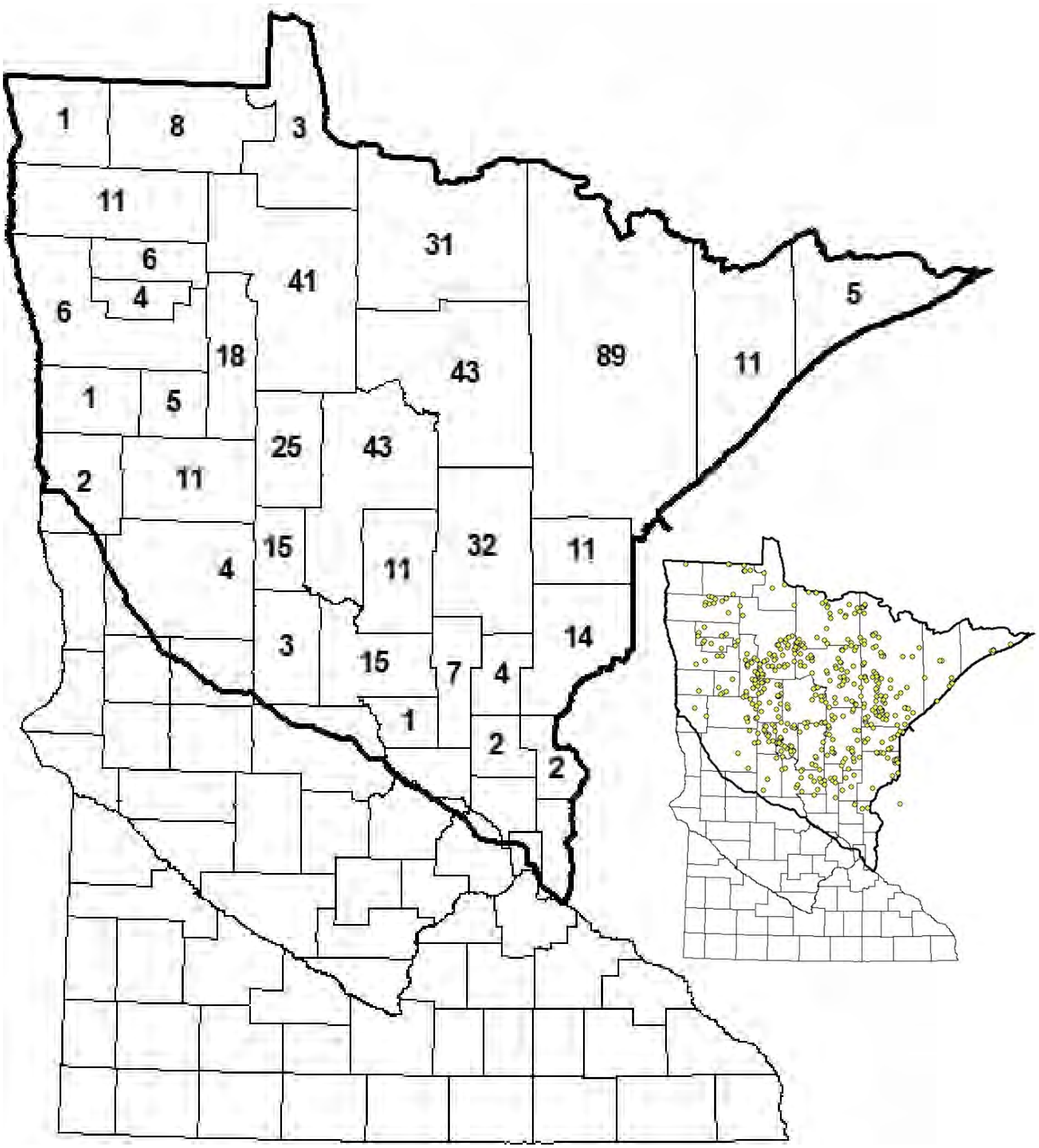

Figure 3. Bobcat harvest by county, 2022-23. Inset shows spatial distribution of harvest locations.

Table 2. Bobcat harvest by county and sex, 2022-23.

County	Sex* Female	Male	Unknown	Total	Harvest/ 100 Mile^2
Aitkin	16	16		32	1.61
Anoka	0	0		0	0.00
Becker	4	7		11	0.76
Beltrami	24	17		41	1.34
Benton	0	1		1	0.24
Carlton	8	3		11	1.26
Cass	20	23		43	1.78
Chisago	1	1		2	0.45
Clay	0	2		2	0.19
Clearwater	10	8		18	1.75
Cook	4	1		5	0.31
Crow Wing	4	7		11	0.95
Douglas	16	9		25	3.47
Hubbard	0	0		0	0.00
Isanti	2	0		2	0.44
Itasca	33	10		43	1.47
Kanabec	2	2		4	0.75
Kittson	0	1		1	0.09
Koochiching	19	11	1	31	0.98
Lake	5	6		11	0.48
Lake of the Woods	3	0		3	0.17
Mahnomen	0	5		5	0.86
Marshall	7	4		11	0.61
Mille Lacs	4	3		7	1.03
Morrison	8	7		15	1.30
Norman	0	1		1	0.11
Otter Tail	2	2		4	0.18
Pennington	5	1		6	0.97
Pine	7	7		14	0.98
Polk	5	1		6	0.30
Red Lake	1	3		4	0.92
Roseau	5	3		8	0.48
Sherburne	0	0		0	0.00
St. Louis	59	30		89	1.32
Stearns	0	0		0	0.00
Todd	1	2		3	0.31
Wadena	6	9		15	2.76
Unknown	0	4		4	
Total	281	207	1	489	

* 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, 2012-2022.

County	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Aitkin	142	65	105	39	22	41	51	55	109	59	32
Anoka	0	0	1	0	0	0	0	0	0	0	0
Becker	58	36	48	36	10	31	22	14	32	9	11
Beltrami	139	59	73	49	30	37	60	34	94	52	41
Benton	3	3	0	0	1	2	3	1	2	0	1
Carlton	63	42	88	25	16	33	42	27	68	47	11
Cass	150	76	126	73	44	72	91	52	113	53	43
Chisago	3	1	1	3	4	2	5	3	4	1	2
Clay	3	2	3	1	0	0	2	0	1	2	2
Clearwater	40	19	29	15	13	14	18	14	41	18	18
Cook	3	9	17	1	0	2	0	2	4	2	5
Crow Wing	65	19	32	21	7	24	28	15	38	24	11
Douglas	1	1	0	0	0	0	1	0	0	0	25
Hubbard	105	51	50	45	21	44	41	19	66	28	0
Isanti	0	1	0	1	1	0	0	0	1	1	2
Itasca	194	93	110	50	19	54	86	57	114	52	43
Kanabec	46	16	46	12	11	16	24	12	18	9	4
Kittson	7	5	5	7	6	3	3	10	8	3	1
Koochiching	82	50	40	22	25	26	62	24	47	38	31
Lake	21	13	15	8	4	8	24	8	21	9	11
Lake of the Woods	13	20	26	10	7	5	14	13	14	11	3
Mahnomen	7	4	4	3	5	2	4	2	10	0	5
Marshall	44	15	21	19	14	12	30	25	13	9	11
Mille Lacs	23	7	14	5	2	10	19	8	21	10	7
Morrison	35	15	25	16	17	19	37	22	28	14	15
Norman	6	3	8	4	1	4	7	2	4	5	1
Otter Tail	38	18	17	16	15	22	12	6	21	13	4
Pennington	13	7	3	4	1	4	8	7	6	6	6
Pine	135	54	87	56	37	43	46	47	62	81	14
Polk	20	10	16	15	10	9	5	3	14	15	6
Red Lake	25	6	11	3	1	15	10	10	25	5	4
Roseau	60	38	27	20	23	23	45	20	21	25	8
Sherburne	0	0	0	0	0	0	0	1	0	1	0
St. Louis	283	255	307	156	91	123	182	154	275	106	89
Stearns	0	2	0	1	0	0	0	0	0	0	0
Todd	16	5	8	8	9	13	10	7	7	2	3
Wadena	23	18	18	10	18	18	23	21	23	14	15
Unknown	9	0	3	12	0	0	0	0	0	0	4
Total	1875	1038	1384	766	485	731	1015	695	1325	724	489

Table 4. Bobcat harvest by sex and week, 2022-23 season.

Date	Sex* Female	Male	Unknown	Total	% of Total	Cumulative %
Dec.17 - Dec.23	51	39		90	18.40	18.40
Dec.24 - Dec.30	52	37		89	18.20	36.61
Dec.31 - Jan.6	61	37		98	20.04	56.65
Jan.7 - Jan.13	42	34	1	77	15.75	72.39
Jan.14 - Jan.22**	68	50		118	24.13	96.52
Unknown	7	10		17	3.48	100.00
Total	281	207	1	489	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, 1997-2022.

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

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

Table 6. Bobcat harvest by method of take, 1995-2022.

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

[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

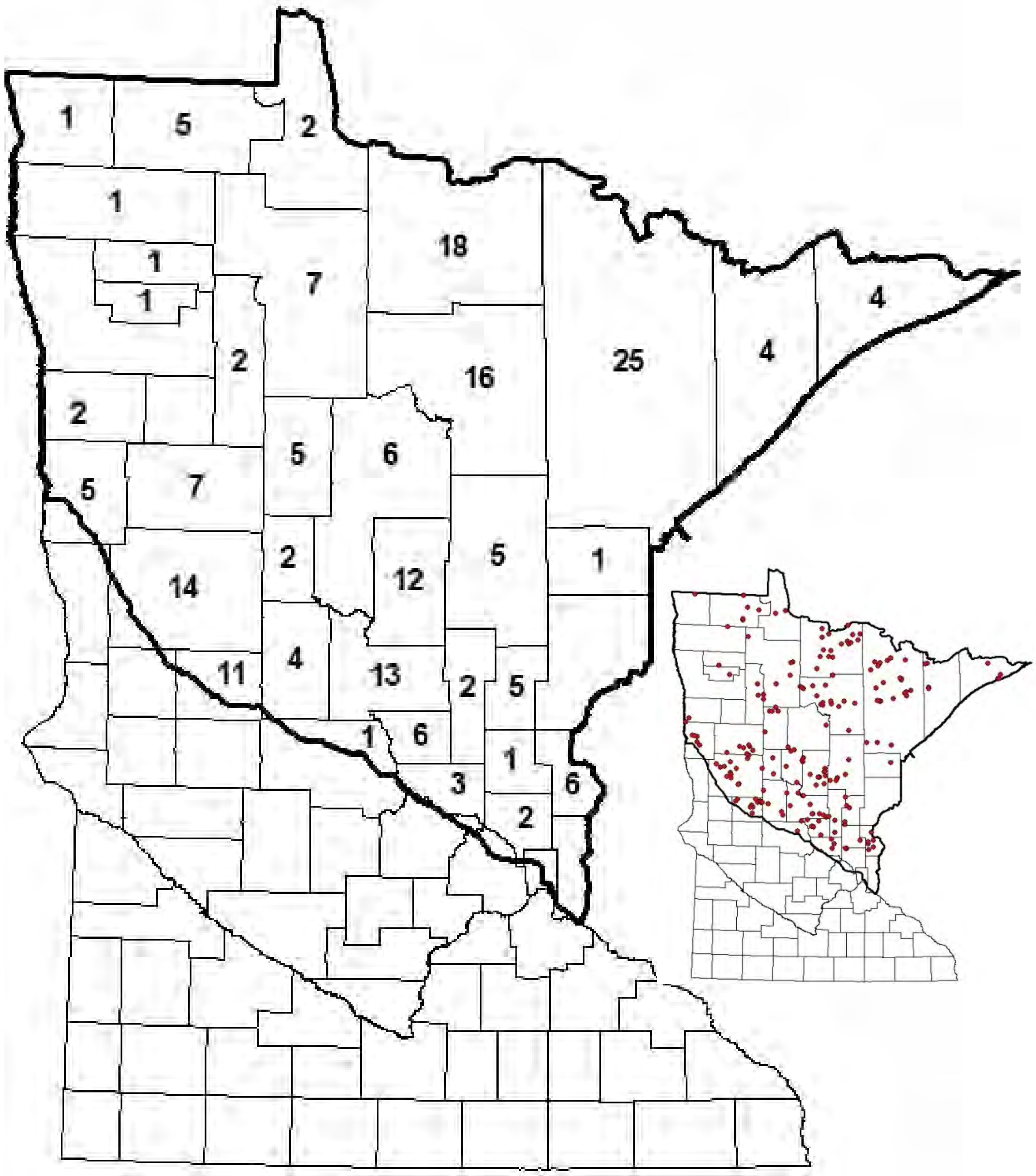

Figure 4. Fisher harvest by county, 2022. Inset shows spatial distribution of harvest locations.

Table 7. Fisher harvest by county and sex, 2022 season.

County	Female	Male	Unknown	Total	Harvest / 100 Mile^2
Aitkin	1	4		5	0.25
Anoka	1	1		2	0.45
Becker	4	3		7	0.48
Beltrami	1	6		7	0.23
Benton	3	3		6	1.45
Carlton	0	1		1	0.11
Cass	1	5		6	0.25
Chisago	1	5		6	1.36
Clay	4	1		5	0.47
Clearwater	1	1		2	0.19
Cook	3	1		4	0.25
Crow Wing	4	8		12	1.04
Douglas	4	7		11	1.53
Grant	0	0		0	0.00
Hubbard	3	2		5	0.50
Isanti	0	1		1	0.22
Itasca	8	7	1	16	0.55
Kanabec	1	4		5	0.94
Kittson	1	0		1	0.09
Koochiching	7	11		18	0.57
Lake	4	0		4	0.17
Lake of the Woods	1	1		2	0.11
Mahnomen	0	0		0	0.00
Marshall	1	0		1	0.06
Mille Lacs	2	0		2	0.29
Morrison	5	8		13	1.13
Norman	1	1		2	0.23
Otter Tail	4	10		14	0.63
Pennington	1	0		1	0.16
Pine	0	0		0	0.00
Polk	0	0		0	0.00
Red Lake	0	1		1	0.23
Roseau	3	2		5	0.30
Sherburne	1	2		3	0.67
St. Louis	11	14		25	0.37
Stearns	0	1		1	0.07
Todd	2	2		4	0.41
Wadena	2	0		2	0.37
Washington	0	0		0	0.00
Wilkin	0	0		0	0.00
Unknown	0	0		0	
Total	86	113	1	200	

Table 8. Comparison of fisher harvest by county, 2011-2022.

County	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Aitkin	55	52	47	24	38	16	10	15	17	24	25	5
Anoka	1	2	1	2	7	4	0	4	3	6	5	2
Becker	32	45	38	21	23	3	18	10	11	21	18	7
Beltrami	25	21	17	4	8	9	6	6	15	24	17	7
Benton	5	5	2	4	3	7	4	7	8	5	8	6
Carlton	12	14	8	14	13	6	1	9	8	10	6	1
Cass	41	37	23	30	24	11	12	16	10	29	19	6
Chisago	10	3	4	16	18	11	8	23	12	11	13	6
Clay	10	6	5	6	4	4	2	8	4	5	5	5
Clearwater	8	5	12	3	2	3	0	7	3	9	4	2
Cook	28	11	13	11	5	4	3	8	4	8	5	4
Crow Wing	64	55	51	34	31	13	17	17	19	39	33	12
Douglas	15	24	8	20	12	6	2	8	9	14	10	11
Grant	0	0	0	0	0	0	0	0	0	0	0	0
Hubbard	10	11	10	8	6	5	6	8	4	10	7	5
Isanti	4	6	11	11	12	3	13	6	1	8	12	1
Itasca	142	105	116	78	47	13	34	30	31	44	35	16
Kanabec	21	27	30	9	10	6	2	6	7	11	9	5
Kittson	5	9	11	2	3	5	7	6	8	4	3	1
Koochiching	116	80	51	67	45	23	40	31	42	40	25	18
Lake	56	53	35	28	14	14	12	16	10	15	16	4
Lake of the Woods	33	21	13	12	15	6	9	3	3	1	6	2
Mahnomen	3	0	4	2	0	0	0	0	0	4	1	0
Marshall	13	14	17	22	22	6	5	12	7	12	5	1
Mille Lacs	17	20	17	12	6	13	7	8	3	13	5	2
Morrison	10	24	25	23	15	16	11	25	15	41	28	13
Norman	10	19	21	12	5	9	3	6	8	14	6	2
Otter Tail	138	121	117	102	77	41	53	59	43	105	67	14
Pennington	8	8	11	19	11	4	9	10	7	6	3	1
Pine	22	42	46	44	35	18	17	7	10	27	28	0
Polk	54	58	45	32	22	11	9	11	3	12	13	0
Red Lake	17	16	24	18	6	8	18	14	5	6	11	1
Roseau	79	61	42	32	26	15	24	18	29	23	17	5
Sherburne	6	2	2	2	2	0	0	6	0	5	2	3
St. Louis	350	233	220	171	125	61	72	66	73	58	77	25
Stearns	4	1	4	2	3	3	5	2	2	8	11	1
Todd	15	29	22	15	19	12	20	7	12	15	9	4
Wadena	31	25	23	21	26	9	17	11	16	25	10	2
Washington	1	1	0	2	2	1	1	4	1	0	1	0
Wilkin	1	0	0	0	0	0	0	0	0	0	0	0
Unknown	1	27	0	8	14	0	0	0	0	0	2	0
Total	1,473	1,293	1,146	943	756	399	477	510	463	712	577	200

Table 9. Fisher harvest by date and sex, 2022 season.

Date	Sex			Total	% of Known Total	Cumulative %
	Female	Male	Unknown			
Dec. 17	1	0		1	0.50	0.50
Dec. 18	10	16		26	13.00	13.50
Dec. 19	14	22	1	37	18.50	32.00
Dec. 20	22	22		44	22.00	54.00
Dec. 21	13	12		25	12.50	66.50
Dec. 22	2	10		12	6.00	72.50
Dec. 23	11	12		23	11.50	84.00
Dec. 24	5	8		13	6.50	90.50
Dec. 25	7	8		15	7.50	98.00
Unknown	1	3		4	2.00	100%
Total	86	113	1	200	100%	

Table 10. Distribution of fisher harvest* among trappers, 1996-2022.

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

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

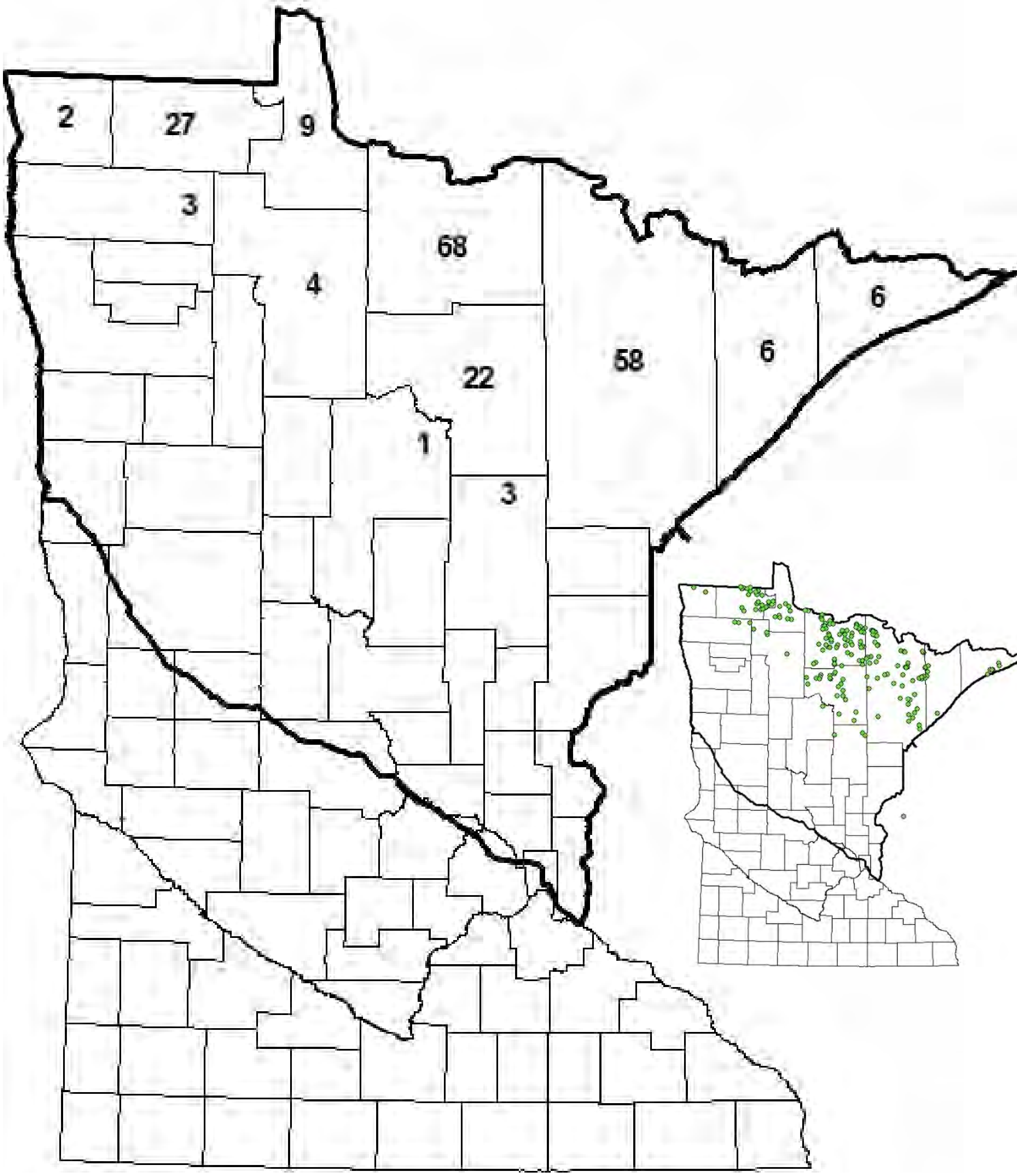

Figure 5. Marten harvest by county, 2022. Inset shows spatial distribution of harvest locations.

Table 11. Marten harvest by county and sex, 2022 season.

County	Sex: Female	Sex: Male	Sex: Unknown	Total	Harvest/ 100 Mile^2
Aitkin	1	2		3	0.15
Becker	0	0		0	0.00
Beltrami	1	3		4	0.13
Carlton	0	0		0	0.00
Cass	0	1		1	0.04
Clearwater	0	0		0	0.00
Cook	1	5		6	0.37
Crow Wing	0	0		0	0.00
Hubbard	0	0		0	0.00
Itasca	5	16	1	22	0.75
Kanabec	0	0		0	0.00
Kittson	1	1		2	0.18
Koochiching	36	32		68	2.16
Lake	0	6		6	0.26
Lake of the Woods	3	6		9	0.51
Mahnomen	0	0		0	0.00
Marshall	2	1		3	0.17
Otter Tail	0	0		0	0.00
Pennington	0	0		0	0.00
Pine	0	0		0	0.00
Polk	0	0		0	0.00
Red Lake	0	0		0	0.00
Roseau	11	15	1	27	1.61
St. Louis	18	40		58	0.86
Unknown	2	0	0	2	
Total	81	128	2	211	

Table 12. Comparison of marten harvest by county in Minnesota, 2011-2022.

County	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Aitkin	13	10	8	12	4	1	7	2	0	5	3	3
Becker	0	0	0	0	1	0	0	0	0	0	0	0
Beltrami	11	20	15	7	15	7	16	2	9	40	23	4
Carlton	6	3	1	1	0	0	7	7	1	1	3	0
Cass	2	0	0	3	2	2	2	2	2	1	0	1
Clearwater	0	0	0	0	0	0	0	0	0	0	0	0
Cook	205	148	78	43	39	23	40	44	15	22	30	6
Crow Wing	1	0	0	1	0	2	0	0	0	0	0	0
Hubbard	0	0	0	0	1	0	0	0	1	0	0	0
Itasca	118	46	62	79	64	28	52	35	35	66	31	22
Kanabec	0	0	0	0	0	0	0	0	0	0	0	0
Kittson	0	4	0	1	0	0	3	1	0	1	0	2
Koochiching	516	276	218	265	169	107	176	117	146	155	88	68
Lake	577	290	185	149	138	109	172	131	78	99	47	6
Lake of the Woods	49	32	18	23	25	21	32	16	45	28	9	9
Mahnomen	0	0	0	0	0	0	0	0	0	0	0	0
Marshall	3	3	5	5	3	1	1	1	3	2	1	3
Otter Tail	0	0	0	1	0	0	0	0	0	0	0	0
Pennington	0	0	0	0	1	0	0	0	0	0	1	0
Pine	0	0	0	1	0	0	0	0	0	0	0	0
Polk	0	0	0	0	0	0	0	0	0	1	0	0
Red Lake	0	1	1	0	0	0	0	0	0	0	0	0
Roseau	98	77	37	40	33	31	74	41	79	84	29	27
St. Louis	926	562	386	421	377	219	397	266	171	260	168	58
Unknown	0	0	0	7	5	0	0	0	0	0	1	2
Total	2,525	1,472	1,014	1,059	877	551	979	665	585	765	434	211

Table 13. Marten harvest by date and sex, 2022 season.

Date	Sex			Total	% of Known	Cumulative
	Female	Male	Unknown		Total	%
Dec. 17	0	2		2	0.95	0.95
Dec. 18	20	25		45	21.33	22.27
Dec. 19	10	33		43	20.38	42.65
Dec. 20	15	14	1	30	14.22	56.87
Dec. 21	10	8		18	8.53	65.40
Dec. 22	8	11	1	20	9.48	74.88
Dec. 23	6	11		17	8.06	82.94
Dec. 24	6	8		14	6.64	89.57
Dec. 25	4	14		18	8.53	98.10
Unknown	2	2		4	1.90	100%
Total	81	128	2	211	100%	

Table 14. Distribution of marten harvest* among trappers, 1996-2022.

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

* 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, 2022. (Combined limit = 2)

Number of Takers		Number of Marten 0	1	2	3	4	5
Number of Fisher	0		60	57			
	1	79	37				
	2	42					
	3						
	4						
	5				Total takers of at least 1 fisher or marten		275

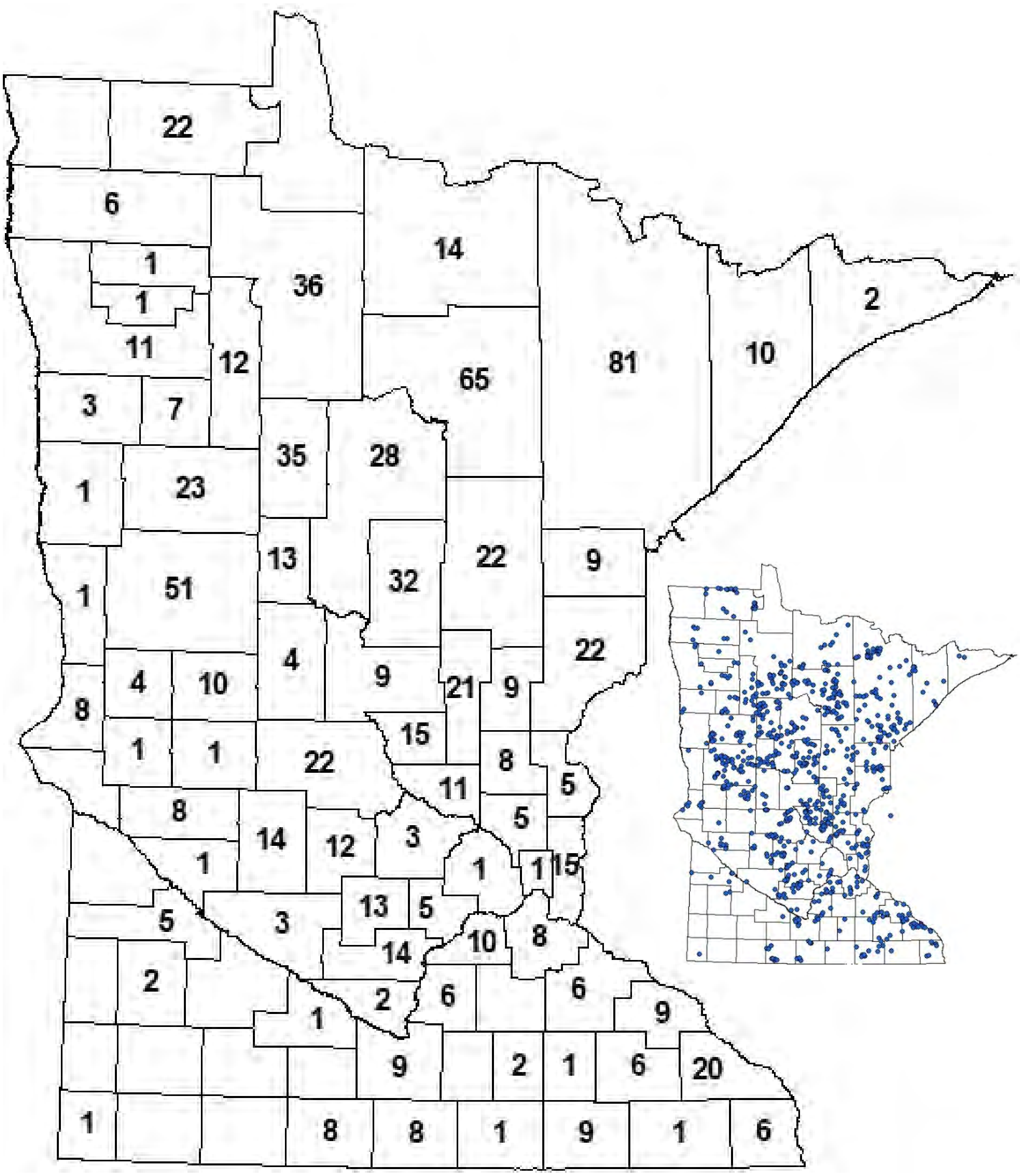

Figure 6. Otter harvest by county, 2022-23. Inset shows spatial distribution of harvest locations.

Table 16. Otter harvest by county and sex, 2022-23 season.

County	Sex: Female	Sex: Male	Sex: Unknown	Total	Harvest / 100 Mile^2
Aitkin	11	11		22	1.10
Anoka	2	3		5	1.12
Becker	7	16		23	1.59
Beltrami	12	24		36	1.18
Benton	7	8		15	3.63
Big Stone	0	0		0	0.00
Blue Earth	4	5		9	1.18
Brown	0	1		1	0.16
Carlton	3	6		9	1.03
Carver	2	3		5	1.33
Cass	8	20		28	1.16
Chippewa	1	0		1	0.17
Chisago	4	1		5	1.13
Clay	0	1		1	0.09
Clearwater	2	10		12	1.17
Cook	0	2		2	0.12
Cottonwood	0	0		0	0.00
Crow Wing	14	18		32	2.77
Dakota	3	5		8	1.37
Dodge	1	0		1	0.23
Douglas	2	8		10	1.39
Faribault	3	5		8	1.11
Fillmore	0	1		1	0.12
Freeborn	0	1		1	0.14
Goodhue	2	4		6	0.77
Grant	2	2		4	0.69
Hennepin	0	1		1	0.16
Houston	2	4		6	1.06
Hubbard	16	19		35	3.50
Isanti	3	5		8	1.77
Itasca	33	32		65	2.22
Jackson	0	0		0	0.00
Kanabec	3	6		9	1.69
Kandiyohi	7	7		14	1.62
Kittson	0	0		0	0.00
Koochiching	8	6		14	0.44
Lac Qui Parle	0	0		0	0.00
Lake	4	6		10	0.44
Lake of the Woods	0	0		0	0.00
Le Sueur	3	3		6	1.27
Lincoln	0	0		0	0.00
Lyon	1	1		2	0.28
Mahnomen	4	3		7	1.20
Marshall	1	5		6	0.33
Martin	2	6		8	1.10
McLeod	6	7		13	2.57
Meeker	9	3		12	1.86
Mille Lacs	9	12		21	3.08
Morrison	3	6		9	0.78
Mower	4	5		9	1.27
Murray	0	0		0	0.00
Nicollet	1	1		2	0.43
Nobles	0	0		0	0.00
Norman	2	1		3	0.34
Olmsted	2	4		6	0.92
Otter Tail	20	30	1	51	2.29

Table 16 (continued). Otter harvest by county and sex, 2022-23 season.

County	Sex			Total	Harvest / 100 Mile^2
	Female	Male	Unknown		
Pennington	1	0		1	0.16
Pine	8	14		22	1.54
Pipestone	0	0		0	0.00
Polk	1	10		11	0.55
Pope	0	1		1	0.14
Ramsey	0	1		1	0.59
Red Lake	0	1		1	0.23
Redwood	0	0		0	0.00
Renville	1	2		3	0.30
Rice	0	0		0	0.00
Rock	0	1		1	0.21
Roseau	9	13		22	1.31
Scott	3	7		10	2.72
Sherburne	3	8		11	2.44
Sibley	7	7		14	2.33
St. Louis	36	44	1	81	1.20
Stearns	4	18		22	1.58
Steele	1	1		2	0.46
Stevens	0	1		1	0.17
Swift	3	5		8	1.06
Todd	3	1		4	0.41
Traverse	7	1		8	1.36
Wabasha	4	5		9	1.64
Wadena	3	10		13	2.39
Waseca	0	0		0	0.00
Washington	9	6		15	3.54
Watonwan	0	0		0	0.00
Wilkin	0	1		1	0.13
Winona	9	11		20	3.12
Wright	1	2		3	0.42
Yellow Medicine	2	3		5	0.65
Unknown	1	2		3	
Total	349	504	2	855	

Table 17. Comparison of otter harvest by county, 2011-2022.

County	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Aitkin	107	111	90	67	74	61	33	34	25	22	39	22
Anoka	13	31	25	23	20	12	18	15	13	9	13	5
Becker	95	127	87	77	83	21	27	42	24	19	22	23
Beltrami	112	120	98	74	76	43	40	51	34	67	48	36
Benton	13	21	17	8	1	3	3	6	8	3	8	15
Big Stone	3	3	9	8	3	1	6	3	0	10	1	0
Blue Earth	2	3	1	2	1	3	3	2	4	8	2	9
Brown	0	0	0	0	2	2	0	0	1	0	0	1
Carlton	29	38	37	26	42	32	9	12	9	18	14	9
Carver	15	8	9	17	11	8	8	12	8	3	4	5
Cass	140	183	161	193	172	74	92	98	63	56	62	28
Chippewa	7	8	12	6	4	3	8	8	7	6	6	1
Chisago	19	24	32	26	20	12	18	12	10	20	19	5
Clay	42	23	16	14	18	10	10	11	1	3	1	1
Clearwater	41	46	47	23	38	21	33	21	11	12	6	12
Cook	36	55	57	28	9	4	0	4	1	1	3	2
Cottonwood	0	0	0	0	0	0	0	1	0	0	0	0
Crow Wing	107	117	96	83	59	35	41	55	36	52	47	32
Dakota	0	11	10	6	13	3	8	10	4	6	2	8
Dodge	1	1	3	4	2	0	3	2	3	6	0	1
Douglas	34	37	23	33	22	21	15	15	13	18	17	10
Faribault	1	12	3	1	3	5	9	3	11	10	17	8
Fillmore	5	10	6	13	3	3	4	1	4	8	1	1
Freeborn	10	10	1	7	6	2	11	7	20	10	3	1
Goodhue	7	18	2	2	11	4	9	0	2	7	7	6
Grant	8	12	6	13	4	3	5	2	2	7	4	4
Hennepin	3	4	5	6	3	2	2	9	4	7	0	1
Houston	10	26	22	14	9	2	8	10	6	14	4	6
Hubbard	42	67	61	36	32	26	39	30	23	31	23	35
Isanti	9	18	28	23	13	17	13	10	9	14	17	8
Itasca	281	346	345	184	159	67	84	123	76	79	79	65
Jackson	0	0	0	0	1	0	0	1	0	0	0	0
Kanabec	22	52	45	34	26	20	29	7	8	20	13	9
Kandiyohi	8	10	20	20	23	17	18	19	23	17	35	14
Kittson	2	9	7	4	0	8	8	5	5	2	0	0
Koochiching	62	127	115	55	68	19	16	13	20	12	16	14
Lac Qui Parle	6	15	6	1	7	0	8	0	2	10	2	0

Table 17 (continued). Comparison of otter harvest by county, 2011-2022.

County	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Lake	36	66	67	45	26	23	12	13	11	22	6	10
Lake of the Woods	27	27	27	31	31	8	16	20	11	9	8	0
Le Sueur	0	9	5	2	2	4	3	4	6	3	4	6
Lincoln	0	4	0	0	0	0	2	0	0	1	3	0
Lyon	0	0	0	0	0	0	1	0	0	4	3	2
Mahnomen	20	15	25	7	6	3	9	16	9	12	9	7
Marshall	13	15	15	4	9	12	15	10	5	7	10	6
Martin	0	1	0	0	1	1	1	1	1	1	0	8
McLeod	18	19	22	18	16	14	16	26	16	25	13	13
Meeker	28	19	32	35	23	11	26	29	32	18	16	12
Mille Lacs	15	30	39	28	16	13	26	14	12	14	18	21
Morrison	29	52	52	50	31	22	24	35	33	32	33	9
Mower	20	14	9	8	2	13	7	11	13	14	6	9
Murray	0	0	0	0	1	0	0	0	0	0	1	0
Nicollet	1	5	7	1	0	0	4	3	0	6	0	2
Nobles	0	0	0	4	0	0	0	0	0	0	1	0
Norman	21	45	27	19	13	9	8	5	2	2	5	3
Olmsted	3	0	7	7	5	3	5	4	8	8	8	6
Otter Tail	109	173	154	97	87	92	100	82	71	89	69	51
Pennington	2	12	5	8	8	11	2	7	2	4	3	1
Pine	44	66	98	59	86	48	20	36	35	24	34	22
Pipestone	0	0	0	0	0	1	1	0	0	1	1	0
Polk	49	83	71	47	37	20	12	14	12	38	30	11
Pope	20	22	14	19	8	19	8	14	19	4	13	1
Ramsey	0	3	1	1	1	0	0	0	0	0	0	1
Red Lake	19	26	11	10	14	13	1	3	3	13	11	1
Redwood	2	4	6	8	3	0	2	4	3	1	0	0
Renville	1	6	0	3	1	1	6	1	1	6	4	3
Rice	9	4	8	1	2	6	3	8	4	8	5	0
Rock	0	2	0	0	0	2	0	2	0	2	0	1
Roseau	33	64	48	44	23	24	22	20	20	39	32	22
Scott	2	4	3	2	4	5	4	7	8	14	11	10
Sherburne	19	12	9	10	10	11	8	9	3	7	2	11
Sibley	6	6	3	2	3	2	2	5	10	7	12	14
St. Louis	239	363	293	258	260	109	146	127	105	134	105	81
Stearns	41	53	53	41	50	45	28	34	22	29	15	22
Steele	0	3	1	0	1	3	3	4	6	4	2	2

Table 17 (continued). Comparison of otter harvest by county, 2011-2022.

County	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Stevens	1	3	12	4	2	1	1	3	2	0	3	1
Swift	11	10	10	9	3	7	7	13	4	12	6	8
Todd	63	55	55	19	28	22	24	18	14	12	30	4
Traverse	1	4	1	0	3	7	4	11	3	4	5	8
Wabasha	8	20	21	19	9	11	11	17	9	10	8	9
Wadena	20	43	30	30	19	5	8	8	11	27	17	13
Waseca	0	0	0	2	2	0	0	1	1	2	0	0
Washington	18	12	24	27	9	12	20	13	5	11	19	15
Watonwan	0	0	1	0	0	0	0	1	0	0	0	0
Wilkin	0	3	2	0	3	1	2	2	4	2	1	1
Winona	20	21	17	5	17	6	13	7	16	15	13	20
Wright	17	23	26	21	21	11	22	33	7	14	18	3
Yellow Medicine	0	7	9	0	3	0	2	2	1	6	5	5
Unknown	17	40	2	18	18	0	0	0	0	0	2	3
Totals	2,294	3,171	2,824	2,154	1,955	1,195	1,295	1,351	1,050	1,304	1,155	855

Table 18. Otter harvest by sex and week, 2022-23 season.

Date	Sex			Total	% of	Cumulative
	Female	Male	Unknown	Harvest	Total	%
Oct.29 - Nov.4	69	98	1	168	19.65	19.65
Nov.5 - Nov.11	44	72		116	13.57	33.22
Nov.12 - Nov.18	35	70		105	12.28	45.50
Nov.19 - Nov.25	34	51		85	9.94	55.44
Nov.26 - Dec.2	47	50	1	98	11.46	66.90
Dec.3 - Dec.9	39	27		66	7.72	74.62
Dec.10 - Dec.16	23	46		69	8.07	82.69
Dec.17 - Dec.23	17	22		39	4.56	87.25
Dec.24 - Dec.30	11	19		30	3.51	90.76
Dec.31 - Jan.6	10	12		22	2.57	93.33
Jan.7 - Jan.13	7	12		19	2.22	95.56
Jan.14 - Jan.20*	13	23		36	4.21	99.77
Unknown	0	2		2	0.23	100.00
Total	349	504	2	855	100%	

* 9-day interval.

Table 19. Distribution of otter harvest* among trappers, 1996-2022.

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

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