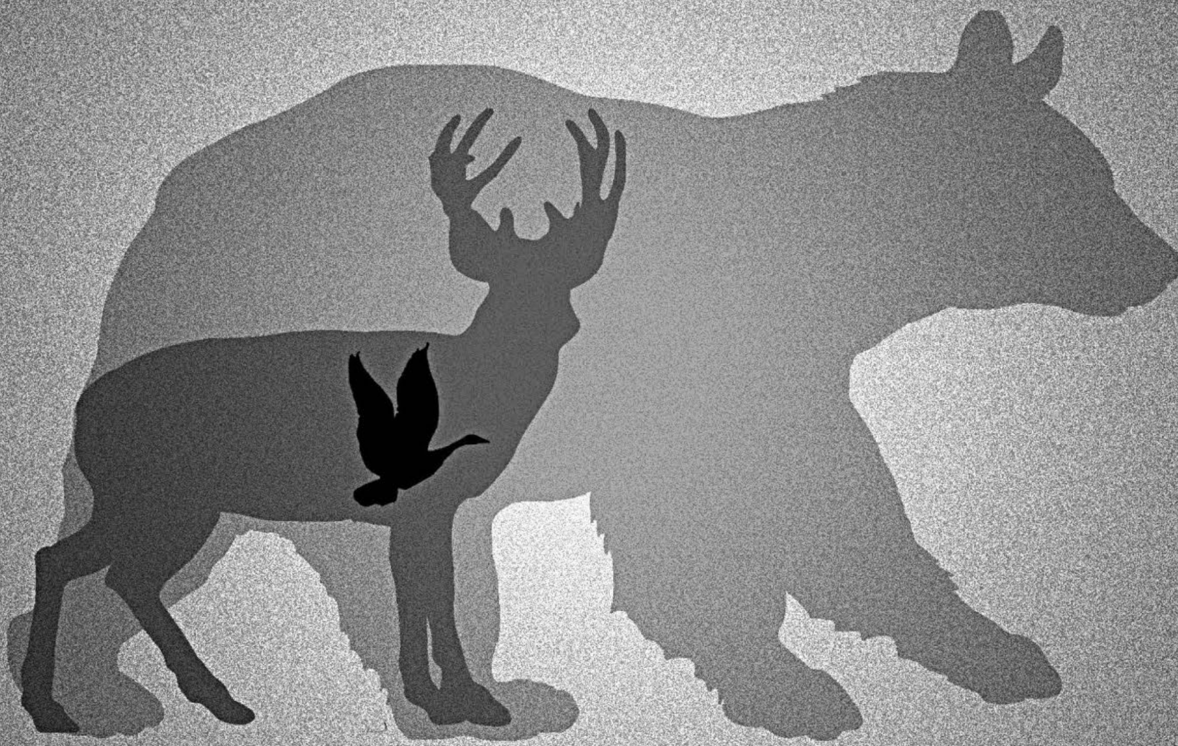

Status of Wildlife Populations

Fall 2020

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 2020

(Including 2010-2020 Hunting and Trapping Harvest Statistics)

edited by
Margaret H. Dexter

Minnesota Department of Natural Resources
Division of Fish and Wildlife
Wildlife Research Unit
Saint Paul, Minnesota
1 (888) 646-6367
http://www.mndnr.gov

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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 2020

(Including 2010-2020 Hunting and Trapping Harvest Statistics)

This is the 44th year that the DNR has compiled this booklet; it is primarily an administrative document intended for DNR personnel. Since 1984 we have also generated a companion volume, *Summaries of Wildlife Research Findings*, containing annual summaries of activities and findings from ongoing research projects in the Wildlife Policy and Research Unit. This publication will be posted on the DNR website and available in other formats upon request. In the on-line format links are available to the U.S. Fish and Wildlife Service Division of Migratory Bird Management to access their reports for Waterfowl Population Status; Migratory Bird Harvest Information Preliminary Estimates; American Woodcock Population Status; and Mourning Dove Population Status.

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

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

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

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Hunting and Trapping Harvest Statistics

CONTACT INFORMATION

Farmland Wildlife Populations and Research Group
35365 800th Avenue
Madelia, MN 56062-9744
(507) 578-8910

Forest Wildlife Populations and Research Group
1201 East Highway 2
Grand Rapids, MN 55744
(218) 328-8875

Wetland Wildlife Populations and Research
102 23rd Street
Bemidji, MN 56601
(218) 308-2282

Division of Fish and Wildlife
Wildlife Policy and Research Unit
500 Lafayette Road, Box 20
Saint Paul, MN 55155 - 4020
(651) 259-5203

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FARMLAND WILDLIFE POPULATIONS

Farmland Wildlife Populations and Research Group
35365 800th Avenue
Madelia, MN 56062-9744
(507) 578-8910

2020 MINNESOTA AUGUST ROADSIDE SURVEY

Timothy P. Lyons

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 cotton-tail 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 August Roadside Survey report (e.g. Lyons 2020).

OBJECTIVES

1. Index game birds and other wildlife within the historic "pheasant range" of Minnesota.
2. Analyze results provide public information about population trends of focal species.
3. Summarize weather and habitat conditions that may impact 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 including information on sex and age of these species. Surveys are only performed on mornings with dew, cloud cover less than 60%, and wind speeds under 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. These data provide an index of relative abundance that are used to monitor annual changes and long-term trends in regional and range-wide populations. Results are reported by agricultural region 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 the females were present with a brood, and the estimated age of the chicks in the 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 MNDNR GIS database files of Wildlife Management Areas 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 habitat (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 and Waterfowl Production Areas from the U.S. Fish and Wildlife Service. Finally, we obtained estimates of potential upland habitat on private lands from the Minnesota Board of Water and Soil Resources. These lands were enrolled in state or federal programs that retire cropland temporarily (e.g. Conservation Reserve Program) or permanently (e.g. Conservation Reserve Enhancement Program, Reinvest in Minnesota, etc.).

Weather data collection

We obtained precipitation and temperature data summaries from the Midwest Regional Climate Center ([MRCC]; 2020) 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 heavily 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 Students T-distribution.

We calculated additional statics for pheasants, including the mean estimated hatch date and proportion of hens with a brood. We estimated the mean hatch date 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 on private lands increased by almost 16,000 acres in 2020. The availability of a general Conservation Reserve Program (CRP) sign-up led to a 10,000 acre net increase in CRP acres state wide. Reinvest in Minnesota (RIM), Wetland Reserve Program (WRP), and RIM-WRP all saw modest increases in the total number of acres, while the Conservation Reserve Enhancement Program (CREP) experienced a net decrease in habitat acres. Publicly owned habitat also increased in 2020. Federally-managed U.S. Fish and Wildlife Service (USFWS) Waterfowl Production Areas (WPA), wildlife refuges, and conservation easements increased by almost 20,000 acres. Beginning in 2020, a new data source was used to track habitat managed by MN DNR as Wildlife Management Areas (WMA). Therefore, no comparisons or estimates of habitat change are provided for MN DNR-managed property this year. Protected habitat accounts for 6.1% of the landscape within the pheasant range (range by agricultural regions: 3.4-9.8%; Table 1).

Minnesota's Walk-in Access (WIA) program continues to provide public hunting opportunities on private land that is already enrolled in existing conservation programs or has high quality natural habitat. The program has grown each year since inception, and in 2020, features more than 250 sites totaling nearly 30,000 acres across 47 counties in the farmland regions of Minnesota. Sites are open to public hunting 1 September – 31 May where boundary signs are present. Hunters must purchase a $3 WIA Validation which allows access to all WIA lands statewide. For more information, including the code of conduct for WIA lands, a printable atlas of enrolled sites by county, aerial photos of each site, interactive maps, and Global Positioning System (GPS) downloads, visit the on the WIA program website. The WIA program is primarily funded through a grant from the Natural Resources Conservation Service of the U.S. Department of Agriculture. Other funding sources include a surcharge on nonresident hunting licenses, a one-time appropriation from the Minnesota Legislature in 2012, and donations from hunters.

Weather Summary

Overall, the weather conditions for pheasants were favorable in 2020. Winter conditions were milder, with above average temperatures and shallower snowpack compared to 2019 (Table 2). Though spring temperatures were below the 30-year (1981-2010) averages, precipitation was also below average (Table 2). Summer temperatures were above and precipitation was generally near their respective 30-year averages (Table 2). The absence of spring snow storms and generally drier conditions throughout the breeding season enabled game bird populations to rebound from 2019. Weather data were obtained from the Midwest Regional Climate Center ([MRCC]; 2020).

Survey Conditions

Weather conditions during surveys were generally excellent. Surveyors reported heavier dew conditions, clearer skies, less wind, and cooler temperature than previous years. Collectively, detection of pheasants and their broods was higher than average in 2020.

Species Reports

Ring-necked Pheasant

The pheasant index increased 42% in 2020 (53.5 birds/100mi) compared to 2019 (37.6 birds/100mi; Table 3, Figure 2A). Although pheasant counts increased across all sex and age categories from 2019, the increase in the number of broods seen (+47%) was the primary driver of the overall increase in the index (Table 3). The 2020 roadside counts of pheasants within all sex and age categories also exceeded the 10-year averages (range: +21%, +37%; Table 3). The number of broods seen in 2020 also exceeded the 10-year average (+35%; Table 3), though the 10-year average now excludes recent peaks in pheasant abundance during the mid-late 2000s. Still, counts of pheasants among all classes remained below the long-term average (range: -33%, -44%; Table 3, Figure 2A). The ratio of broods per 100 hens, an indicator of breeding success, was greater than 2019 (+25%), the 10-year average (+6%) and the long-term average (+20%; Table 3). The number of chicks per brood also increased compared to 2019 (+6%) but remained below the long-term average (-15%; Table 3). Generally, this suggests that while pheasant numbers overall have declined in the long-term, breeding success of females has increased.

Annual changes in roadside counts among regions generally mirrored statewide trends. Pheasant numbers increased in most regions (range: +9%, +146%) with the greatest increase occurring in the Southwest region (+146%; Table 4). The boom in pheasant counts also resulted in 2020 indices being at or near the 10-year average (range: +35%, +57%), though the East Central and Southeast regions remained below their 10-year averages (-17% and -9%, respectively; Table 4). Hunting opportunities should be excellent throughout the farmland region in 2020.

Gray Partridge

The 2020 range-wide gray partridge index (3.7 birds/100mi) was greater than 2019 (+52%) and the 10-year average (+60%) but remained below the long-term average (-72%; Table 3, Figure 2B). Although the partridge index remained below the long-term averages in all regions, annual changes varied considerably among regions (Table 4). Gray partridge numbers increased in the Southeast (where no partridge were reported in 2019) and South Central regions (+30%), but were greatest in the Southwest region (+649%; Table 4). Gray partridge thrive in more arid grasslands, similar to their native range. Thus, the increase in the partridge index may be attributable to a drier than average breeding season across much of the farmland region. The Southwest, South Central, and Southeast regions will offer the best opportunities for harvesting gray partridge in 2020 (Table 4).

Cottontail Rabbit and White-tailed Jackrabbit

The 2020 eastern cottontail rabbit index (4.7 rabbits/100mi) decreased from 2019 (-23%) and remains below the 10-year average (-15%) and the long-term average (-22%; Table 3, Figure 3A). Most regions reported declines in the cottontail index (range: -16%, -42%; Table 4). Only the Southwest region reported an increase in 2020 (+225%; Table 4). The best rabbit hunting opportunities will be in the East Central and Southeast regions, though hunters may also find good opportunities in the Central and Southwest Regions.

Single white-tailed jackrabbits were recorded on three survey routes in the West Central and Southwest regions in 2020 (Table 3) yielding a range-wide index of 0.1/100 mi. Although similar to 2019 when two jackrabbits were reported, the index remains >90% below the long-term average of 1.5 rabbits/100 mi (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 loss of preferred habitats (e.g., pasture, hayfields, and small grains).

White-tailed Deer

The 2020 white-tailed deer index (30.0 deer/100 mi) fell slightly (-8%) from 2019 (32.6 deer/100 mi) but remained above the 10-year average (+42%) and the long-term average (+150%; Table 3, Figure 4A). Regional indices for deer declined in the West Central, East Central, Southwest regions (range: -17%, -28%) but remained relatively constant in the Northwest, Southeast, and South Central regions (Table 4). Only the Central region reported an increase in the deer index (Table 4).

Mourning Dove

The 2020 range-wide mourning dove index (110.6 doves/100 mi) increased (+21%) compared to 2019, but remained below the 10-year (-31%) and long-term averages (-56%; Table 3, Figure 4B). The dove index increased across the majority of regions (range: +16%, +34%) compared to 2019, but stayed relatively constant in the East Central region (Table 4). The best opportunities for harvesting doves should be in the Southwest, South Central, and West Central regions.

Sandhill Crane

The 2020 roadside index of sandhill cranes (13.6 total cranes/100mi) decreased (-16%) from 2019 (Table 3). The decrease from 2019 was greater among juvenile cranes (-30%). The total crane index remains above the 10-year average (+14%), while the juvenile index is slightly below (-3%). Though the West Central, South Central, and Southeast regions reported either minor increases or no real change in the index value, the crane index is generally low in these regions (Table 4). The majority of cranes are reported in the Northwest, East Central and Central regions which exhibited either no change or a decline in 2020 (range: -48%, 1.8%;

Table 4). Still, most regional crane indices remain at or above the 10-year average, though the Northwest and East Central regions are now below. Cranes have not yet been reported in roadside counts in the Southwest region.

Other Species

Notable incidental sightings recorded by observers included: Great Egrets (Rice and Watonwan counties), prairie chickens (Clay County), red-headed woodpeckers (Mower, Redwood, Renville, and Watonwan counties), sharp-tailed grouse (Red Lake, Roseau, and Polk counties), trumpeter swans (Kandiyohi and Sibley counties), and upland sandpipers (Murray, Freeborn, and Renville counties). American crows, Canada geese, American kestrels, and wild turkeys were reported in multiple counties.

ACKNOWLEDGMENTS

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

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

	Cropland Retirement (private lands)[a]					Public Lands				
AGREG	CRP	CREP	RIM	RIM-WRP	WRP	USFWS[b]	MNDNR[c]	Total	% of landscape	Density ac/mi^2
WC	290,586	37,951	24,808	18,092	20,840	208,979	120,623	721,878	9.8	62.8
SW	114,563	24,784	20,573	2,553	766	24,954	65,858	254,050	6.7	13.1
C	132,684	14,380	39,966	7,026	3,078	92,508	58,407	348,049	5.4	34.9
SC	102,436	27,633	13,585	10,775	8,942	11,272	36,046	210,689	5.2	33.4
SE	69,820	2,702	7,405	1,070	976	37,028	56,067	175,068	4.7	30.2
EC	3,248	0	7,943	0	4	19,692	168,839	199,726	3.4	21.7
Total	713,337	107,450	114,280	39,516	34,606	394,433	505,840	1,909,460	6.1	39.2

[a] Unpublished data, Tabor Hoek, BWSR, 25 August 2020.
[b] Includes Waterfowl Production Areas (WPA), USFWS refuges, & USFWS conservation easements
[c] MN DNR Wildlife Management Areas (WMA). The data source for this field was changed in 2020 and comparisons to previous years are not valid.

Table 2. Average temperature, snow depth, and precipitation by season and agricultural region in Minnesota, 2020.

	Agricultural Region							
	NW	WC	C	EC	SW	SC	SE	STATE
Winter (December 1 - March 31)								
Temperature (average °F)	14.4	19.6	20.9	20.4	22.8	23.6	23.6	20.8
Departure from normal (°F)[a]	0.7	1.8	2.1	2.5	1.9	2.4	2.4	2
Snow Depth (average inches)	12.9	8.5	6.9	8	4.4	5.1	4.7	7.2
Spring (April 1 - May 31)								
Temperature (average °F)	44.6	47.8	49	47	48.8	50	50	48.2
Departure from normal (°F)[a]	-3.5	-2.8	-1.9	-2.1	-2.9	-2.2	-2.2	-2.5
Precipitation (total inches)	1.3	1.4	1.6	1.6	2.3	2.9	3.5	2.1
Departure from normal (inches)[a]	-0.8	-1.2	-1.3	-1.3	-0.9	-0.6	-0.2	-0.9
Summer (June 1 - July 31)								
Temperature (average °F)	69.6	71.8	71.4	69.6	73	72.8	72.8	71.6
Departure from normal (°F)	3.6	3.4	2.8	2.9	3.5	2.9	2.9	3.1
Precipitation (total inches)	5.7	4.2	4.7	4.7	3.7	4.4	4.7	4.6
Departure from normal (inches)[a]	1.9	0.4	0.5	0.5	-0.3	0	0.2	0.5

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

Table 3. Range-wide trends (% change) in number of wildlife observed per 100 miles driven, Minnesota August roadside survey, 1955-2020.

Species / Subgroup	Change from 2019[a]					Change from 10-year average[b]				Change from long-term average (LTA)[c]			
	n	2019	2020	%	95% CI	*n*	2010-2019	%	95% CI	*n*	LTA	%	95% CI
Ring-necked pheasant													
Total pheasants	153	37.6	53.5	42	±25	149	38.9	37	±20	151	91.4	-42	±10
Cocks	153	6.5	6.9	7	±21	149	5.7	21	±22	151	10.5	-35	±13
Hens	153	6.3	7.5	18	±23	149	5.9	28	±19	151	13.3	-44	±10
Broods	153	5.5	8.1	47	±28	149	6.1	35	±19	151	12.1	-33	±11
Broods per 100 hens	153	84.3	105.2	25			101.5	6			88.4	21	
Chicks per brood[d]	301	4.6	5.0	7			4.6	6			5.7	-15	
Median hatch date[d]	301	20-Jun	8-Jun				12-Jun						
Gray partridge	169	2.4	3.7	52	±82	165	2.3	60	±84	151	13.6	-72	±16
Eastern cottontail	169	6.1	4.7	-23	±32	165	5.7	-15	±34	151	6.6	-22	±30
White-tailed jackrabbit	169	0	0.1	50	±4171	165	0.1	-35	±1756	151	1.5	-95	±129
White-tailed deer	169	32.6	30.0	-8	±6.	165	21.2	42	±9	167	11.9	150	±17
Mourning dove	169	91.3	110.6	21	±2	165	159.7	-31	±1	151	255.1	-56	±1
Sandhill crane[e]													
Total cranes	169	16.2	13.6	-16	±12	165	12.2	14	±16				
Juveniles	169	2.5	1.7	-30	±80	165	1.8	-3	±108				

[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 1955-2019, except for deer (1974-2019). Estimates for all species except deer based on routes (*n*) surveyed ≥40 years; estimates for deer based on routes surveyed ≥25 years. Thus, Northwest region (8 counties in Northwest were added to survey in 1982) included only for deer.

[d] Sample size is the total number of broods observed across all surveys rather than the number of routes run in 2019.

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

Table 4. Regional trends (% change) in number of wildlife observed per 100 miles driven, Minnesota August roadside survey, 1955-2020.

Region	Change from 2019[a]					Change from 10-year average[b]				Change from long-term average (LTA)[c]			
Species	*n*	2019	2020	%	95% CI	*n*	2010-2019	%	95% CI	*n*	LTA	%	95% CI
Northwest[d]													
Gray partridge	16	2.5	2.5	0	±85	16	1.0	145	±209	16	3.2	-23	±66
Eastern cottontail	16	1.5	1.2	-17	±142	16	0.9	32	±225	16	1.0	21	±207
White-tailed jackrabbit	16	0	0			16	0.1	-100	±1426	16	0.5	-100	±416
White-tailed deer	16	61.5	61.0	-1	±4	16	47.7	28	±5	16	34.2	78	±6
Mourning dove	16	69.1	80.0	16	±3	16	94.8	-16	±2	16	116.9	-32	±2
Sandhill crane[e]	16	29.2	29.7	2	±7	16	39.7	-25	±5				
West Central[f]													
Ring-necked pheasant	39	48.8	63.3	30	±4	35	45.4	40	±5	37	93.2	-36	±2
Gray partridge	39	1.3	0.2	-85	±152	35	0.5	-54	±413	37	8.6	-98	±24
Eastern cottontail	39	3.8	2.4	-38	±53	35	2.5	7	±83	37	3.8	-35	±53
White-tailed jackrabbit	39	0.2	0.1	-50	±987	35	0.2	-25	±1334	37	2.0	-95	±100
White-tailed deer	39	43.9	36.5	-17	±5	35	24.5	52	±8	37	12.4	193	±16
Mourning dove	39	122.6	144.3	18	±2	35	205.4	-31	±1	37	349.8	-60	±1
Sandhill crane[e]	39	2.3	6.7	186	±87	35	2.1	253	±96				
Central													
Ring-necked pheasant	30	39.8	55.4	39	±5	30	35.2	57	±6	30	67.9	-18	±3
Gray partridge	30	4.0	2.8	-30	±51	30	1.3	108	±152	30	8.3	-66	±25
Eastern cottontail	30	9.1	5.5	-40	±23	30	5.2	6	±40	30	6.2	-12	±33
White-tailed jackrabbit	30	0	0			30	0.1			30	1.1	-100	±188
White-tailed deer	30	31.5	35.1	11	±7	30	18.7	88	±11	30	8.1	336	±25
Mourning dove	30	78.2	95.8	23	±3	30	143.1	-33	±1	30	216.8	-56	±1
Sandhill crane[e]	30	28.7	26.9	-6	±7	30	20.5	31	±10				
East Central													
Ring-necked pheasant	13	29.3	32	9	±7	13	38.7	-17	±6	13	80.8	-60	±3
Gray partridge	13	0	0			13	0.2			13	0.2	-100	±1423
Eastern cottontail	13	13.2	7.7	-42	±17	13	13.1	-41	±17	13	9.2	-17	±24
White-tailed jackrabbit	13	0	0			13	0			13	0.1	-100	±1493
White-tailed deer	13	41.8	30.7	-27	±5	13	24.2	27	±9	13	11.9	158	±18
Mourning dove	13	49.8	49.5	-1	±4	13	75.2	-34	±3	13	111.6	-56	±2
Sandhill crane[e]	13	89.5	47	-48	±2	13	48.6	-3	±5				

Table 4. Continued.

Region / Species	Change from 2019[a]					Change from 10-year average[b]				Change from long-term average (LTA)[c]			
	n	2019	2020	%	95% CI	*n*	2009-2019	%	95% CI	*n*	LTA	%	95% CI
Southwest													
Ring-necked pheasant	19	36.8	90.5	146	±6	19	60.4	50	±4	19	110.1	-18	±2
Gray partridge	19	1.3	9.5	649	±166	19	4.8	99	±44	19	36.5	-74	±6
Eastern cottontail	19	1.7	5.5	225	±125	19	5.1	7	±41	19	7.7	-29	±27
White-tailed jackrabbit	19	0	0.4			19	0.3	33	±665	19	3.4	-88	±63
White-tailed deer	19	21.7	15.6	-28	±10	19	20.2	-23	±10	19	10.7	45	±20
Mourning dove	19	92.0	123.6	34	±2	19	212.4	-42	±1	19	297.1	-58	±1
Sandhill crane[e]	19	0	0			19	0						
South Central													
Ring-necked pheasant	32	43.7	52.6	21	±5	32	38.9	35	±5	32	118.2	-56	±2
Gray partridge	32	5.4	7	30	±38	32	4.6	51	±44	32	16.9	-59	±12
Eastern cottontail	32	5.4	4.5	-16	±38	32	7.4	-39	±28	32	7.6	-41	±27
White-tailed jackrabbit	32	0	0			32	0.1	-100	±2053	32	1.5	-100	±135
White-tailed deer	32	14.6	14.1	-3	±14	32	7.8	82	±26	32	4.6	209	±45
Mourning dove	32	114.0	138.5	22	±2	32	199.7	-31	±1	32	247.0	-44	±1
Sandhill crane[e]	32	4.4	4.1	-6	±47	32	1.8	129	±113				
Southeast													
Ring-necked pheasant	20	8.7	11.8	37	±24	20	13.0	-9	±16	20	64.9	-82	±3
Gray partridge	20	0	4.2			20	3.6	18	±59	20	12.4	-66	±17
Eastern cottontail	20	10.8	8.8	-18	±19	20	9.3	-5	±23	20	8.0	10	±26
White-tailed jackrabbit	20	0	0			20	0	0		20	0.5	-100	±409
White-tailed deer	20	22.0	23.4	6	±10	20	18.3	28	±12	20	12.1	94	±17
Mourning dove	20	58.0	74.5	29	±4	20	97.3	-23	±2	20	203.7	-63	±1
Sandhill crane[e]	20	0.6	0.8	33	±349	20	0.3	136	±618				

[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 1955-2019, except for Northwest region (1982-2019) and white-tailed deer (1974-2019). Estimates based on routes (*n*) surveyed ≥40 years (1955-2019), 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] Sandhill cranes were added to the survey in 2009; thus, long-term averages are not calculated.
[f] Two routes were added to the West Central region in 2014.

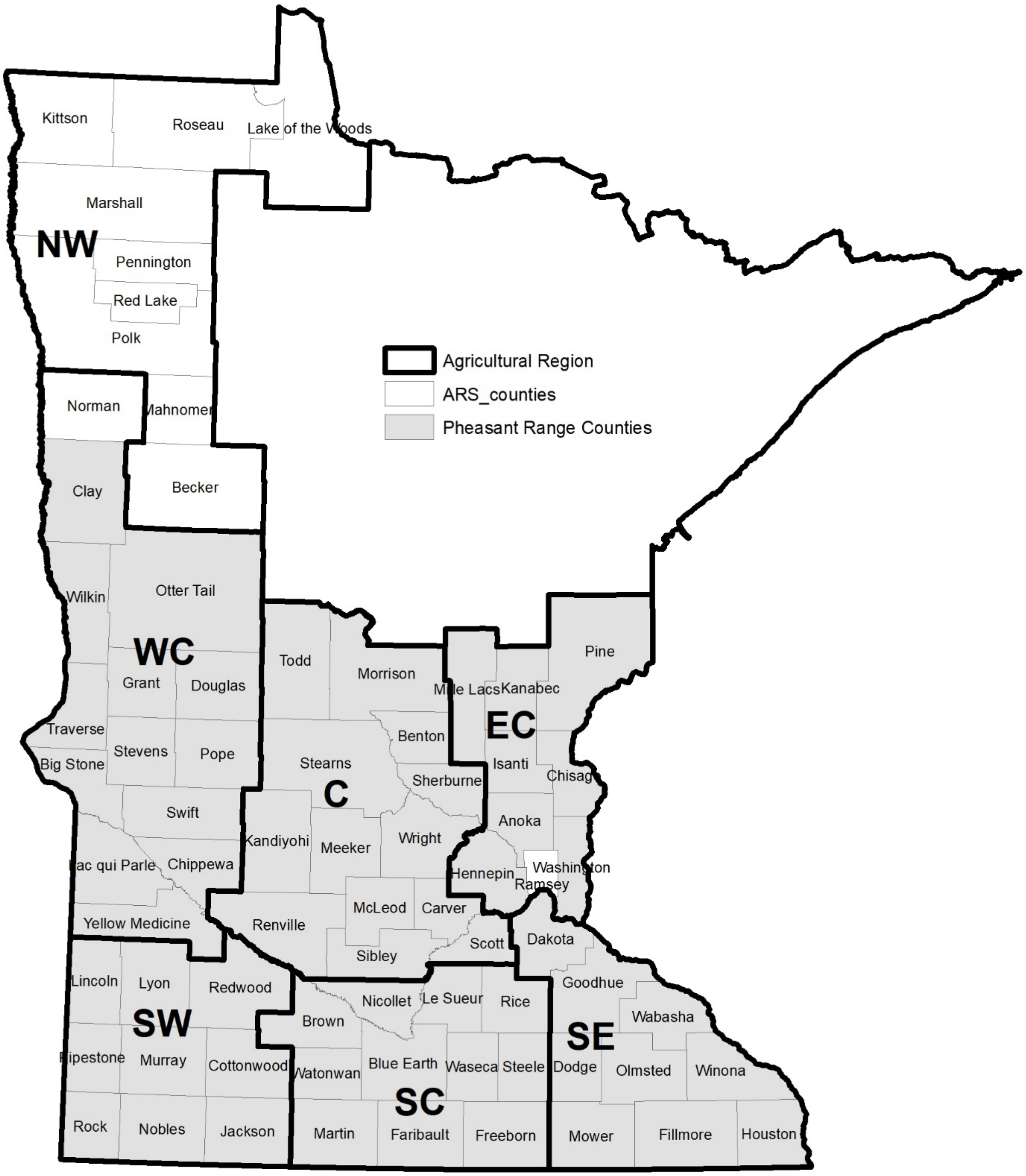
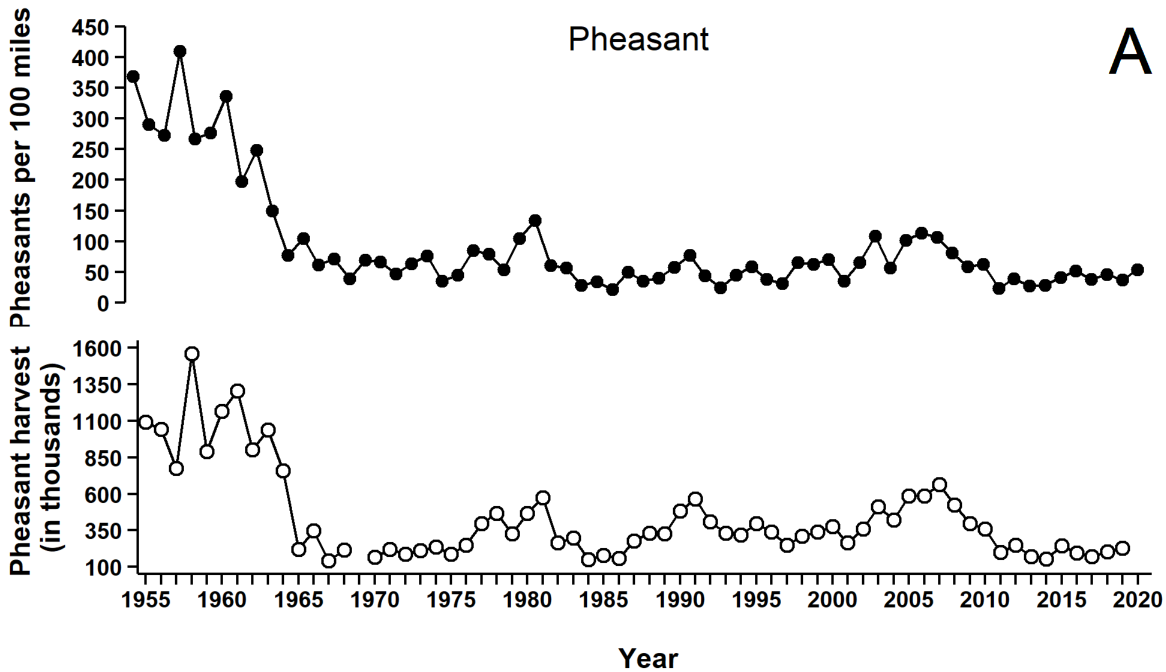


Figure 1. Survey regions and ring-necked pheasant range delineation for Minnesota's August roadside survey, 2020



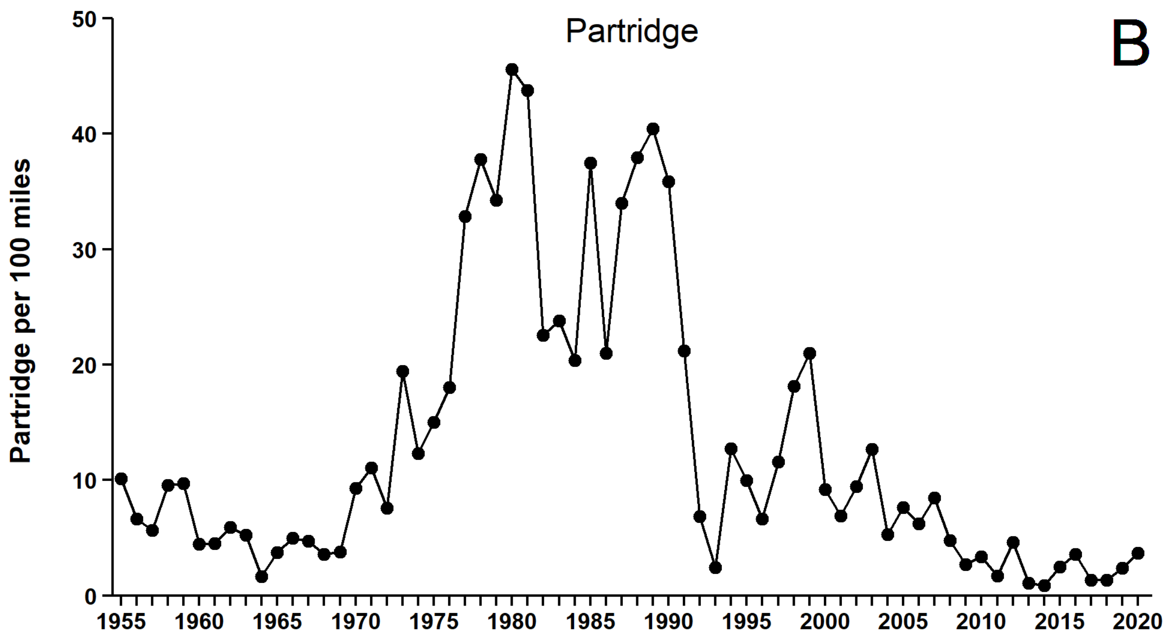


Figure 2. Range-wide index of ring-necked pheasants (A) and gray partridge (B) seen per 100 miles driven in Minnesota, 1955-2020. Does not include the Northwest region. Based on all survey routes completed.

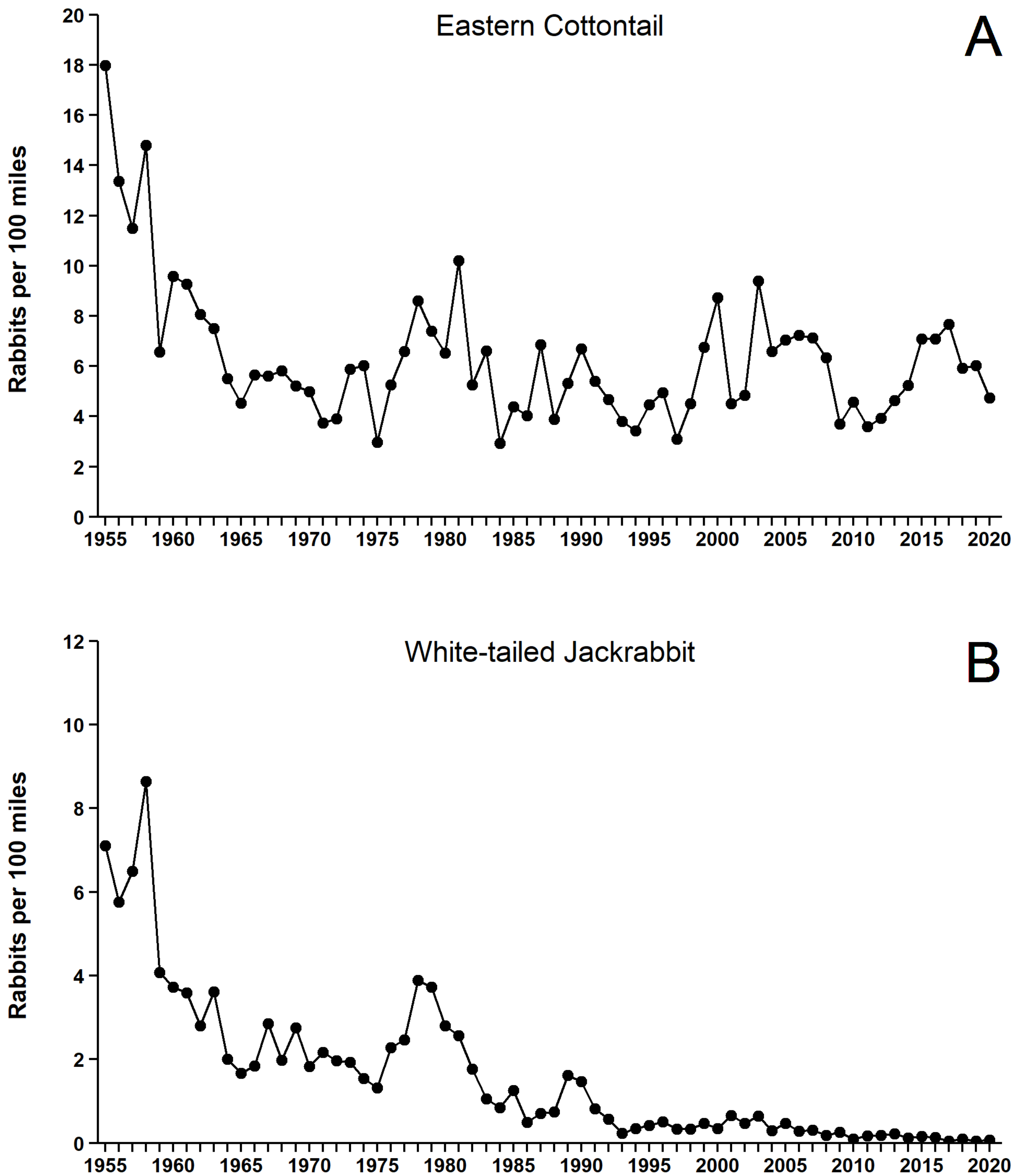


Figure 3. Range-wide index of eastern cottontail (A) and white-tailed jackrabbits (B) seen per 100 miles driven in Minnesota, 1955-2020. Does not include the Northwest region. Based on all survey routes completed.

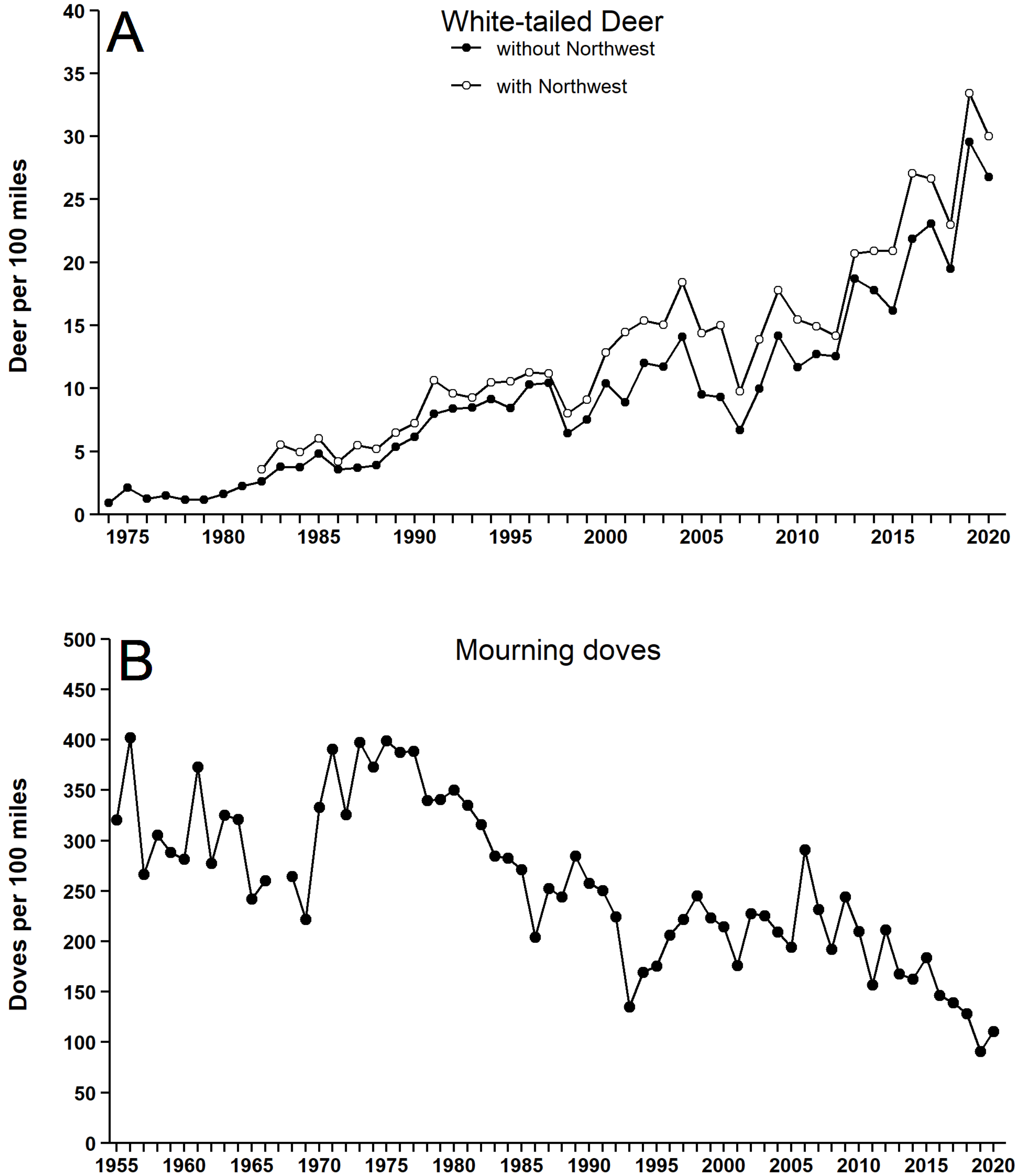


Figure 4. Range-wide index of: (A) white-tailed deer seen per 100 miles driven in Minnesota, 1974-2020, with and without the Northwest region included; and (B) mourning doves seen per 100 miles driven in Minnesota, 1955-2020. Doves were not counted in 1967 and the dove index does not include the Northwest region. Based on all survey routes completed.

MONITORING POPULATION TRENDS OF WHITE-TAILED DEER IN MINNESOTA – 2020

Eric S. Michel, Farmland Wildlife Populations and Research Group

John H. Giudice, Wildlife Biometrics Unit

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 within deer permit areas (DPAs) to understand historical deer herd dynamics, predict population sizes, and to explore the impacts of various hunting regulations on populations. To aid in decision-making, MNDNR Biologists consider output from population modeling along with deer harvest metrics, hunter success rates, surveys of hunter and landowner satisfaction with deer populations, and deer population goals set through a public process. This report summarizes the structure and parameters of the simulation model and provides a description of recent trends in deer populations.

METHODS

We used a stochastic population model to simulate annual variations in deer densities within individual DPAs. We defined ranges of values for fecundity (number of offspring born per female) and survival by sex- and age-classes of deer based on values data obtained from studies conducted within Minnesota and supplemented from primary literature.

Model Structure

We use the spring of the initial year before reproduction occurred (Figure 1) as the starting period for each multi-year simulation. We specified an initial population density (see Modeling Procedures section) and the model then converted the initial population density into a total population size by multiplying the density by the total land area of the DPA. We set the proportion of adult deer by age- and sex-class in the initial population (adult females mean = 0.45 [SD = 0.02], adult males mean = 0.20 [SD = 0.02]). We allocated the remaining proportion (0.35) equally to young-of-year (YOY) males and females.

Within each annual cycle, we applied age-specific fecundity rates to females to estimate reproduction. We subjected all age- and sex-classes to spring/summer mortality, and the result was the pre-hunt fall population. We subtracted hunter-harvested deer from the pre-hunt population. We estimated winter mortality rates by age-class relative to winter severity, and we then applied winter mortality rates to the post-hunt population. The remaining population represented the starting population size for the next stage of the simulation. We assumed that the effects of immigration and emigration on a population within a DPA were equal.

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 $\geq$1 years old [adult] when bred) and allowed rates to vary by 3 eco-geographic zones (northeast, farmland and transition areas, and southeast) that reflected relative differences in climate and habitat quality. We estimated fecundity rates to be lowest in the northeast (YOYs, mean = 0.06 [SD = 0.005]; adults, mean = 1.55 [SD = 0.001]), moderate in the farmland and transition zone (YOYs, mean = 0.07 [SD = 0.017]; adults, mean = 1.71 [SD = 0.022]), and greatest in the southeast (YOYs, mean = 0.13 [SD = 0.029]; adults, mean = 1.81 [SD = 0.055]). Sex ratio of fawns at birth in most deer populations is approximately 50:50 but may vary annually (Ditchkoff 2011). Therefore, we allowed the proportion of male fawns at birth to vary uniformly between 0.48-0.52.

Spring/Summer Survival

Winter survival rates of deer are dependent on the severity of winter conditions (Fuller 1990, DelGiudice et al. 2002). Likewise, the condition of breeding females following winter may directly influence survival of their newborn fawns (Verme 1977, Nixon et al. 1991, Carstensen et al. 2009). MNDNR calculates an annual winter severity index (WSI) in each DPA based on snow depth and minimum daily temperatures. WSI was calculated weekly by staff from Minnesota Information Technology Services at MNDNR. From 1 November through 31 May, 1 point was added to the WSI for each day with snow depths $\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 used estimates reported in the primary literature for deer in Minnesota and populations in similar habitats for fawn spring/summer survival (Wisconsin DNR unpublished data, Huegel et al. 1985, Nelson and Mech 1986a, Nelson and Woolf 1987, Kunkel and Mech 1994, Brinkman et al. 2004, Vreeland et al. 2004, Rohm et al. 2007, Hiller et al. 2008, Carstensen et al. 2009, Warbington et al. 2017). We adjusted fawn survival rates to estimate the effects of winter severity on the condition of adult females during the previous winter. Mean spring/summer fawn survival values were 0.70 (SD = 0.031), 0.55 (SD = 0.037), and 0.45 (SD = 0.037) when WSI<100, 100≤WSI<180, and WSI$\geq$180, respectively.

Spring/summer survival rates reported in the primary literature for adult deer $\geq$1 year old were relatively high and similar for both sexes (DeYoung 2011). We used similar values for summer survival of adult deer from the population model previously used in Minnesota (Grund and Woolf 2004, Grund 2014) and allowed the values to vary randomly (female = 0.97 [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 risk of deer mortality via starvation and predation with fawns being more susceptible than adults (Nelson and Mech 1986b, DelGiudice et al. 2002, Norton 2015). We estimated winter survival rates relative to winter severity based on studies conducted in Minnesota (Nelson and Mech 1986a, DelGiudice et al. 2002, Brinkman et al. 2004, Grund and Woolf 2004, DelGiudice 2006, Grovenburg et al. 2011, Grund 2011). These studies reported survival rates similar to those observed in other deer populations in northern latitudes (Van Deelen et al. 1997, Whitlaw et al. 1998, DePerno et al. 2000, Dumont et al. 2000, Norton 2015).

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

Modeling Procedures

To model each DPA, we tested several initial population densities including: 1) population estimates from field surveys when available (Haroldson 2014); 2) previous estimates from modeling (Grund 2014); or 3) a crude population estimate reconstructed from the reported harvest of adult males in the most recent deer season.

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

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

We ran model simulations for 5 years (2015-2020) with the final population estimate occurring pre-fawning for the spring following the most recent deer hunting season (i.e., spring 2020). 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 run.

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

RESULTS

Deer Population Trends and Management Recommendations

Although we derived the model parameters from studies of deer in Minnesota or from studies from states that have similar habitats and environmental conditions, uncertainty is inherent in modeling wild deer populations. Our modeling allowed input parameters to vary randomly to represent uncertainty that occurs in wild populations, and model outputs included measures of uncertainty reflecting variation among model simulations. However, for ease of interpretation, we present mean pre-fawn deer densities in this document. We conducted simulation modeling in 111 of 132 DPAs in Minnesota to estimate deer densities before reproduction during spring 2020 (Table 1, Figure 2).

Following 3 deer seasons with relatively conservative management designations and 3 winters with mild conditions across most of the state, deer populations in most DPAs increased through 2020. Management designations in 2020 were consistent in most DPAs compared to 2019 in attempt to stabilize or reduce densities that had exceeded goals. Each ecogeographic zone observed some DPAs that were below goal (southwestern farmland zone, n = 2; farmland-forest transition zone, n = 2); however, the northeastern forest region had the most DPAs below goal (n = 11), even with conservative hunting regulations, likely due to resource limitations. Although firearm hunting season conditions across some areas in the state were mostly above average in 2019, antlerless harvest goals were not achieved, resulting in more deer after the hunting season than intended with hunting season regulations. Liberal antlerless seasons in 2020 will be required again to effectively manage deer populations in DPAs with average and above average productivity.

In terms of management intensity, the 2020 designations afford more antlerless deer harvest opportunities to hunters in about 21% of the DPAs versus the 2019 season. For most of the remaining DPAs, designations in 2020 were the same as 2019 and about 12% of DPA designations afforded less antlerless harvest opportunity.

Farmland Zone

We modeled 26 of 37 total farmland zone DPAs. Of those 27 modeled DPAs, 9 were at goal, 2 were below goal, and 16 were above goal based on modeling or buck harvest trends. Modeling deer densities in the farmland with harvest data continues to be a challenge, and relatively stable buck harvests the past 20 years suggests a stable population with limited potential for growth, likely a result of habitat constraints. We selected management designations to stabilize deer numbers with consistent regulations across years whenever possible. Most farmland DPAs (n = 23) were under a Lottery designation. Four of the DPAs required Hunter Choice, 8 were under Managed designations, 1 was under the Intensive designation, and 1 was designated as Unlimited Antlerless, to stabilize or reduce deer numbers at appropriate levels.

Farmland-Forest Transition Zone

Deer populations in the farmland-forest transition zone are highly productive due to excellent habitat and generally milder winters as compared to the forest zone. Historical harvests and modeled population trends suggested that Lottery designations were not sufficient to stabilize deer numbers in most transition zone DPAs as evidenced by few DPAs with Lottery recommendations. We modeled 38 of the 51 transition zone DPAs. Of those 38 modeled DPAs, 17 were at goal, 2 were below goal, and 19 were above goal based on modeling or buck harvest trends. For the 2020 season designations, Lottery will be used for 2 of the DPAs, Hunter Choice for 8 DPAs with an additional antlerless season being available in DPA 344, and Managed for 8 DPAs. In 25 DPAs, Intensive designations will be necessary to continue reducing deer densities toward goal level, 6 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), Unlimited Antlerless opportunity will be available during the legal hunting seasons.

Forest Zone

Many deer populations in the forest zone with adequate habitat have recovered from the severe winter of 2013-14. We modeled 32 of the 44 forest zone DPAs. Of the 32 modeled DPAs, 13 were at goal, 11 were below goal, and 8 were above goal based on modeling or buck harvest trends. For 2020 season designations, Bucks-only will be used in 5 DPAs, Lottery in 18 DPAs, Hunter Choice in 12 DPAs, Managed in 6 DPAs, Intensive in 2 DPAs, and Unlimited Antlerless in 1 DPAs.

ABRIDGED DESCRIPTIONS OF DEER HUNTING SEASON DESIGNATIONS (MNDNR 2019)

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

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

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

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

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

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

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Table 1. Estimated mean pre-fawn deer densities (deer/mi^2) derived from population model simulations in Minnesota deer permit areas, 2015-2020.

		Pre-fawn Deer Density[a]					
Deer Permit Area	Land Area (mi2)	2015	2016	2017	2018	2019	2020
101	496	9	11	12	14	15	17
103	1820	3	4	4	5	5	5
105	740	11	13	14	15	15	16
108	1655	5	6	7	8	8	9
110	529	12	14	15	15	15	16
111	1438	2	3	3	3	3	4
114	123	-	-	-	-	-	-
117	936	7	7	8	8	7	7
118	1239	4	4	4	4	4	4
119	782	5	6	7	7	7	7
126	942	3	3	3	3	3	3
130	747	-	-	3	3	3	3
131	901	-	-	4	4	4	4
132	481	-	-	5	5	5	5
133	352	-	-	8	8	7	6
152	60	-	-	-	-	-	-
155	594	17	20	23	25	25	28
156	819	12	13	15	16	16	18
157	888	20	23	25	19	19	21
159	571	13	15	17	19	21	24
169	1124	9	11	12	13	13	14
171	701	11	13	15	15	15	18
172	692	21	24	27	28	27	31
173	584	9	10	12	13	13	16
176	917	8	9	9	10	9	9
177	491	12	14	15	14	13	13
178	1192	9	11	12	14	13	15
179	857	13	14	16	15	14	15
181	629	10	12	14	15	15	17
182	278	-	-	-	-	-	-
183	664	12	15	18	20	21	22
184	1229	17	19	20	21	20	20
197	957	10	12	13	14	15	17
199	153	-	-	-	-	-	-
201	161	10	12	13	15	16	19
203	118	-	-	-	-	-	-
208	378	5	6	7	8	8	9

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

		Pre-fawn Deer Density[a]					
Deer Permit Area	Land Area (mi2)	2015	2016	2017	2018	2019	2020
209	639	8	9	10	11	11	12
210	615	8	9	10	10	9	10
213	1059	16	17	18	20	20	21
214	553	27	30	33	35	35	38
215	701	20	21	24	26	27	30
218	884	11	13	15	17	19	23
219	392	13	15	17	19	22	26
221	643	14	17	20	22	24	26
222	413	16	18	21	24	26	29
223	377	15	17	18	21	22	24
224	46	-	-	-	-	-	-
225	618	18	20	22	24	26	29
227	471	20	22	25	28	31	35
229	285	10	12	14	15	17	19
230	454	-	-	-	-	-	-
232	377	6	7	8	9	10	12
233	384	6	6	7	8	9	11
234	636	3	3	3	4	4	5
235	35	-	-	-	-	-	-
236	368	18	20	23	26	29	34
237	728	-	-	-	-	-	-
238	95	-	-	-	-	-	-
239	928	13	14	15	16	16	17
240	643	22	24	27	29	29	30
241	997	27	29	30	31	29	29
242	213	22	25	28	29	27	29
246	838	17	20	22	23	23	25
247	229	19	21	21	21	19	19
248	216	16	17	19	19	18	20
249	502	17	19	22	24	25	29
250	712	-	-	-	-	-	-
251	55	-	-	-	-	-	-
252	716	-	-	-	-	-	-
253	974	-	-	-	-	-	-
254	930	4	4	4	5	5	5
255	392	5	6	7	8	10	11
256	654	7	8	9	10	10	11
257	412	9	10	11	13	13	14
258	343	19	21	23	25	24	25
259	490	19	21	22	22	21	24

[a]”-“indicates deer permit area was not modeled

		Pre-fawn Deer Density[a]					
Deer Permit Area	Land Area (mi2)	2015	2016	2017	2018	2019	2020
260	1248	4	5	6	7	7	9
261	793	4	5	6	7	7	9
262	677	3	4	4	5	5	6
263	512	9	11	12	13	14	15
264	669	13	15	17	19	19	22
265	494	10	11	13	14	13	14
266	617	6	6	7	8	9	10
267	472	5	5	6	6	5	5
268	228	10	11	11	10	10	10
269	650	3	4	4	5	6	7
270	736	-	-	-	-	-	-
271	632	3	3	3	4	4	5
272	532	-	-	-	-	-	-
273	572	6	7	7	8	9	11
274	355	6	6	7	8	9	10
275	764	4	4	5	5	6	7
276	542	10	11	13	15	16	19
277	812	14	14	15	17	18	21
278	402	6	7	7	8	9	10
279	344	4	4	4	5	5	5
280	674	3	3	3	3	3	4
281	575	7	9	10	12	13	16
282	778	-	-	-	-	-	-
283	613	4	4	4	4	4	5
284	840	-	-	-	-	-	-
285	546	5	6	6	8	9	10
286	447	5	6	7	8	9	10
287	47	-	-	-	-	-	-
288	624	5	5	6	6	6	7
289	816	2	3	3	3	4	4
290	661	6	6	7	8	9	10
291	799	6	7	7	8	9	11
292	480	10	11	13	14	16	18
293	511	9	10	10	11	12	13
294	687	4	4	5	5	5	6
295	839	5	5	6	7	8	9
296	665	4	4	4	5	6	7
297	438	3	3	4	5	5	5
298	619	10	12	15	16	17	19
299	387	6	6	6	7	8	9

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

		Pre-fawn Deer Density[a]					
Deer Permit Area	Land Area (mi2)	2015	2016	2017	2018	2019	2020
338	454	7	8	10	12	15	18
339	394	7	8	10	12	14	16
341	611	16	18	21	24	27	31
342	351	16	18	20	24	26	31
343	320	14	15	16	18	19	20
344	190	19	19	20	22	24	25
643	351	14	15	16	18	19	21
645	326	14	16	17	19	20	22
646	319	28	28	29	30	30	30
647	434	-	-	-	-	-	-
648	122	-	-	-	-	-	-
649	492	27	29	31	34	38	42
655	387	5	6	7	8	9	12
701	1632	-	-	-	-	-	-

a"-"

indicates deer permit area was not modeled

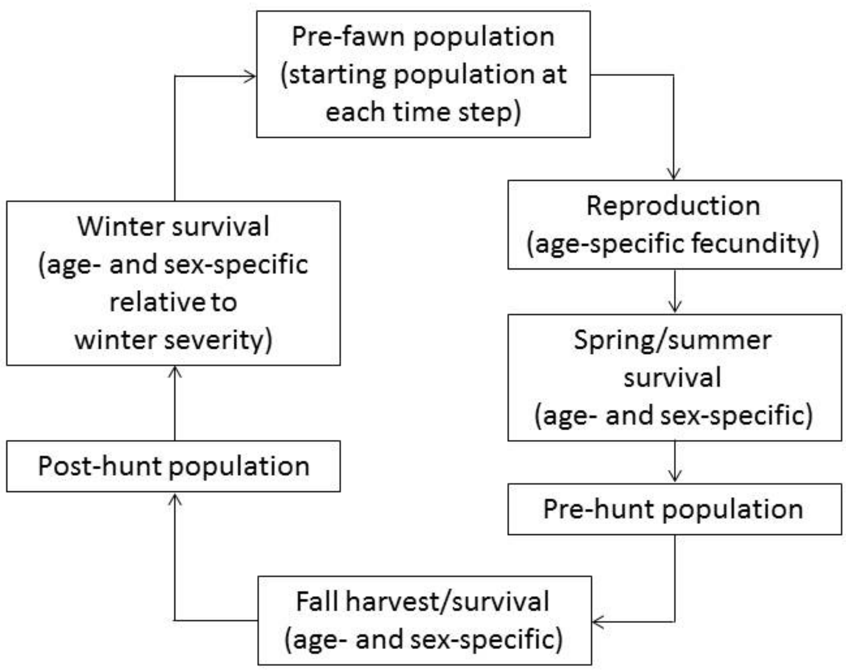

Figure 1. Model structure for simulations of white-tailed deer populations in Minnesota.

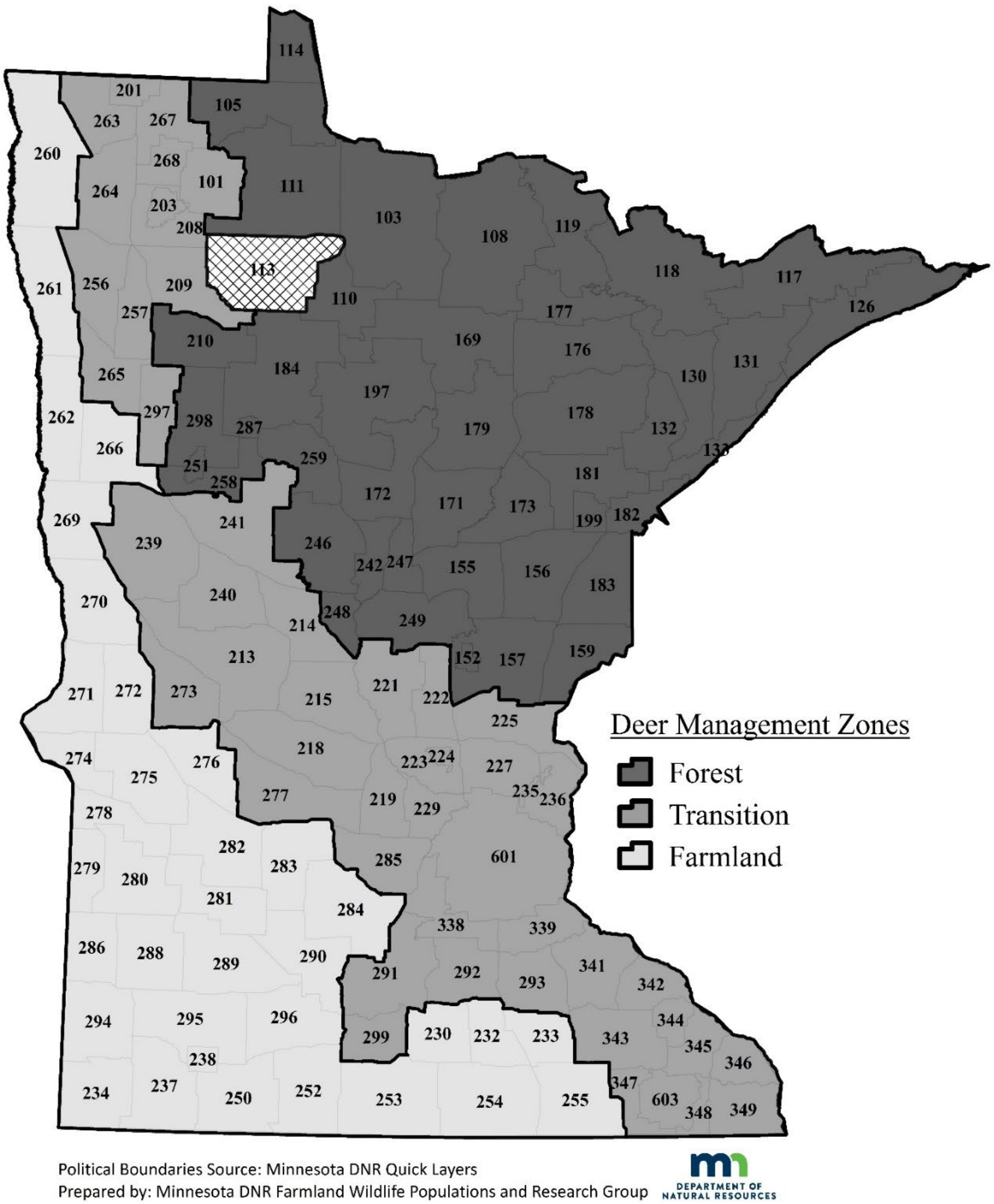

Figure 2. Deer permit areas (DPAs) in Minnesota and deer management zones used to describe deer population and harvest trends, 2018. DPAs were assigned to forest, transition, or farmland zones based on historical land cover and current woody cover. Generally, forested DPAs were composed of ≥60% woody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

2020 WHITE-TAILED DEER AERIAL SURVEYS

Brian S. Haroldson, Farmland Wildlife Populations and Research Group

John H. Giudice, Wildlife Biometrics Unit

INTRODUCTION

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

The Minnesota Department of Natural Resources (MNDNR) uses a harvest-based population model to estimate and track changes in white-tailed deer (*Odocoileus virginianus*) abundance and, subsequently, to aid in developing annual harvest recommendations to manage deer populations toward goal levels (Michel and Giudice 2019). Currently, MNDNR collects annual data on winter severity, hunter-reported harvest, and hunter effort (license sales) at the deer permit area (DPA) scale. Reliability of harvest-based models can be improved by incorporating annual information on spatial and temporal variation in survival and reproduction rates and other model parameters. However, collection of such data is generally cost-prohibitive, especially at the DPA scale.

An alternative approach would be to collect independent recurrent information on population abundance or trends, which could be used to calibrate the population model. One potential approach in the farmland zone is road-based distance-sampling surveys. We used aerial surveys by helicopter to provide independent estimates of deer abundance to compare with a concurrent study of road-based distance-sampling surveys (Giudice et al. 2018).

METHODS

We estimated deer populations in a 4-DPA distance-sampling study area (DSSA) using a quadrat-based, aerial survey design. Quadrat surveys have been used to estimate populations of caribou (*Rangifer tarandus*; Siniff and Skoog 1964), moose (*Alces alces*; Evans et al. 1966), and mule deer (*O. hemionus*; Bartmann et al. 1986) in a variety of habitat types. We delineated quadrats by Public Land Survey (PLS) section (640 ac) boundaries. We used the R programming language (R Core Team 2019) and R package ’stratification’ (Rivest and Baillargeon 2017) to stratify the sampling frame into 3 categories (low, medium, high) based upon abundance of woody cover within each quadrat and the local wildlife manager’s knowledge of winter deer abundance and distribution. We derived woody cover data from the 2011 National Land Cover database (Homer et al. 2015). We used optimal allocation, R package ‘spsurvey’ (Kincaid and Olsen 2019), and a generalized random tessellation stratified procedure (GRTS; Stevens and Olsen 2004) to draw a spatially balanced stratified random sample of quadrats. For the DSSA, we surveyed the same sample of plots in 2019 and 2020.

During both surveys, we used Bell OH-58 and MD-500E helicopters and attempted to maintain flight altitude at 200 ft (60 m) above ground level and airspeed at 50-60 mi/hr (80-97 km/hr). A pilot and 2 observers searched for deer along transects spaced at 0.17-mi (270-m) intervals until they were confident all "available" deer were observed. When animals fled the helicopter, we noted direction of movement to avoid double counting. We used a real-time, moving-map software program (DNRSurvey; Haroldson et al. 2015), coupled to a global positioning system receiver and a convertible tablet computer, to guide transect navigation and record deer locations, direction of movement, and aircraft flight paths directly to ArcGIS (Environmental Systems Research Institute, Inc., Redlands, CA) shapefiles. To maximize sightability, we completed surveys during winter when snow cover measured at least 6 in (15 cm) and we varied survey intensity as a function of cover and deer numbers (Gasaway et al. 1986).

We implemented double sampling (Eberhardt and Simmons 1987, Thompson 2002) on a subsample of quadrats within the DSSA to estimate sightability of deer from the helicopter. We sorted the sample of survey quadrats by woody cover abundance and selected a 4% systematic subsample of sightability quadrats. Immediately after completing the operational survey on each sightability quadrat, a second more intensive survey was flown at reduced speed (40-50 mi/hr [64-80 km/hr) to identify animals that were missed (but assumed available) on the first survey (Gasaway et al. 1986). We used geo-referenced deer locations, group size, and movement information from DNRSurvey (Haroldson et al. 2015) to "mark" deer groups observed in the operational survey and help estimate the number of "new" (missed) animals detected in the sightability survey. We used a binary logistic model to estimate average detection probabilities (i.e., the conditional probability of detection given animals are present in the sampling unit and available for detection) for the DSSA.

We computed population estimates adjusted for both sampling and sightability. We used the R package 'spsurvey' (Kincaid and Olsen 2019) to compute deer abundance and density indices within each stratum, where indices were expanded for sampling but not sightability. We used the local mean variance estimator (Kincaid and Olsen 2019) with a finite population correction to compute stratum-specific estimates of sampling variance. We summed stratum-specific estimates to compute deer abundance and density indices for the DSSA. We used a Horvitz-Thompson estimator (Thompson 2002:53, Fieberg and Giudice 2008) to convert population indices to population estimates (adjusted for sightability), and the Delta method (Seber 1982:9) to compute the variance. We evaluated precision using coefficient of variation (CV), defined as standard deviation of the population estimate divided by the population estimate, and relative error, defined as the 90% confidence interval bound divided by the population estimate (Krebs 1999). Our aerial survey precision goal was having a 90% confidence interval bound that was within 20% of the abundance estimate (Lancia et al. 1994).

RESULTS AND DISCUSSION

We completed surveys within the DSSA during January 2019 and February 2020 (Figure 1). Estimated mean deer density was 7 deer/mi^2 (90% CI = 5–8) during both years. Both estimates exceeded precision goals (relative error ≤ 20%; Table 1). We observed deer in 40-41% of quadrats, with greater occupancy occurring in areas with more woody cover (Table 2). In addition, mean group size and mean number of groups per "occupied" quadrat was similar between years.

Estimates of sightability within the DSSA ranged from 0.779 (SE = 0.069) in 2020 to 0.785 (SE = 0.070) in 2019, which were similar to sightability estimates from historic DPA-level surveys within the farmland zone during 2010-2018 (range = 0.633-0.909; mean = 0.757; Haroldson and Giudice 2019). Correcting for sightability increased relative variance (CV [%]) of population estimates by ~18%, which was a reasonable tradeoff between decreased bias and increased variance, although costs associated with the sightability surveys are also important. However, we caution that our sightability estimates are conditional on animals being available for detection (Johnson 2008, Nichols et al. 2009). Unfortunately, like many other wildlife surveys, we have no estimates of availability or how it varies over space and time. In the event when animals are unavailable, resulting population estimates would be underestimated. Our approach also assumes that sightability is constant across animals and quadrats. Heterogeneity in detection probabilities can lead to biased estimates of abundance. Common methods for correcting for heterogeneous detection probabilities include distance sampling, mark-recapture methods, and logistic-regression sightability models (based on radio-marked animals). Our double-sampling approach is a reasonable alternative to using unadjusted counts or applying more complicated methods whose assumptions are difficult to attain in practice. Nevertheless, our population estimates must still be viewed as approximations to the truth.

ACKNOWLEDGMENTS

We thank T. Obermoller, Tim Koppelman, Stein Innvaer, and Brian Nyborg for conducting the surveys. J. Heineman, B. Maas, and L. Ettl piloted the helicopters during all surveys. E. Michel reviewed an earlier draft of this report. Deer surveys were funded in part under the Federal Aid in Wildlife Restoration Act.

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Table 1. White-tailed deer population and density (deer/quadrat) estimates derived from aerial surveys within the distance sampling study area (DSSA)[a], south-central Minnesota, 2019–2020. Summary statistics (CI, CV) are also presented. Confidence intervals for density estimates were based on α = 0.10.

Year	Sampling rate (%)	Sightability rate	Population estimate		CV (%)	Relative error (%)[b]	Density estimate	
			N	90% CI			$\bar{x}$	90% CI
2019	6	0.785	17,837	13,461–22,213	14.9	24.5	7	5–8
2020	6	0.779	17,884	14,045–21,723	13.0	21.4	7	5–8

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

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

Table 2. Sampling metrics from aerial surveys of white-tailed deer within the distance sampling study area (DSSA)[a], south-central Minnesota, 2019–2020.

Year	Quadrats in deer permit areas	Quadrats sampled	Quadrats occupied[b]	Deer observed	Deer groups observed	Groups / occupied quadrat		Group size / occupied quadrat		Max. quadrat count
						$\bar{x}$	Range	$\bar{x}$	Range	
2019	2,714	162	67	1,652	302	5	1–14	5	1–32	109
2020	2,714	163	66	1,801	247	4	1–12	7	1–87	111

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

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

Figure 1. Deer permit areas (DPAs) flown during aerial surveys of white-tailed deer in southern Minnesota, winter 2019–2020. DPAs 252, 253, 296, and 299 were combined into a single survey area for comparison with a concurrent study using roadside distance-sampling surveys.

FOREST WILDLIFE POPULATIONS

Forest Wildlife Populations and Research Group
1201 East Highway 2
Grand Rapids, MN 55744
(218) 328-8875

CARNIVORE SCENT STATION SURVEY SUMMARY, 2019

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

INTRODUCTION

Monitoring the distribution and abundance of carnivores can be important for understanding the effects of harvest, habitat change, and environmental variability on these populations. However, many carnivores are highly secretive, difficult to repeatedly capture, and naturally occur at low to moderate densities, making it difficult to annually estimate abundance over large areas using traditional methods (e.g., mark-recapture, distance sampling, etc.). Hence, indices of relative abundance are often used to monitor such populations over time (Sargeant et al. 1998, 2003, Hochachka et al. 2000, Wilson and Delahay 2001, Conn et al. 2004, Levi and Wilmers 2012).

In the early 1970's, the U.S. Fish and Wildlife Service initiated a carnivore survey designed primarily to monitor trends in coyote populations in the western U.S. (Linhart and Knowlton 1975). In 1975, the Minnesota DNR began to utilize similar survey methodology to monitor population trends for numerous terrestrial carnivores within the state. This year marks the 45th 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, 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.

RESULTS AND DISCUSSION

A total of 179 routes and 1,638 stations were surveyed this year, the fewest since the survey became fully operational in the early 1980's. Route density varied from 1 route per 901 km^2 in the Forest Zone to 1 route per 1,660 km^2 in the Farmland Zone (Figure 1). The recent decline in survey effort is likely a result of staffing shortages and competing workload demands.

Statewide, route visitation rates (% of routes with detection), in order of increasing magnitude, were opossums (4%), domestic dogs (12%), bobcats (13%), wolves (14%), domestic cats (28%), red foxes (30%), raccoons (32%), skunks (35%), and coyotes (36%). Regionally, route visitation rates were as follows: red fox – TR 22%, FA 24%, FO 37%; coyote – FO 18%, TR 39%, FA 61%; skunk – FO 24%, TR 41%, FA 54%; raccoon – FO 13%, TR 35%, FA 71%; domestic cat – FO 9%, TR 43%, FA 54%; domestic dog – FO 3%, TR 17%, FA 27%; opossum - FO 0%, TR 4%, FA 12%; wolf - FA 0%, TR 0%, FO 27%; and bobcat - FA 0%, TR 15%, FO 17%.

Figures 2-5 show station visitation indices (% of stations visited) from the survey's inception through the current year. 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. Using this approach, the only notable changes this year were increases in bobcat and striped skunk indices in the Transition Zone (Figures 3 and 5).

In the Farmland Zone (Figure 2), red fox indices continue to remain well below their long-term average, as they have for nearly 20 years. Conversely, coyote and raccoon indices continue their increasing trend and are at or near record levels. Low red fox numbers are likely related, in part, to the increased coyote abundance (Levi and Wilmers 2012). No consistent trends are evident for other species in the Farmland Zone over the long term.

Similar to the Farmland, red fox and coyote indices have primarily exhibited inverse patterns in the Transition Zone, with red fox indices remaining low and coyote indices steadily increasing (Figure 3). Although there was a significant increase this year in the striped skunk index in the Transition Zone, long-term data do not show any consistent trend, with current indices near their long-term average. In spite of the large CI for bobcats in the Transition Zone, results suggest a marginally significant increase from last year and a moderate increase over the past decade (Figure 5). Raccoon indices have been comparatively stable and near their long-term averages over the past 2 decades. Wolves had exhibited a mild increase in the Transition Zone over time, but indices have been below the long-term average (and at or near 0) the past 3 years.

No significant changes were observed in the Forest Zone (Figures 4 and 5). Unlike in the Farmland and Transition Zones, the Forest Zone coyote index has not increased over time and has been below average and stable for 2 decades, likely attributable to increased wolf abundance in the Forest Zone (Levi and Wilmers 2012). Red foxes, raccoons, and skunks have not exhibited consistent or notable trends over the past 20 years and all remain near or slightly below their long-term averages. Conversely, wolves and bobcats have exhibited increasing trends over the past 2 decades, though some shorter-term declines have occurred during this period.

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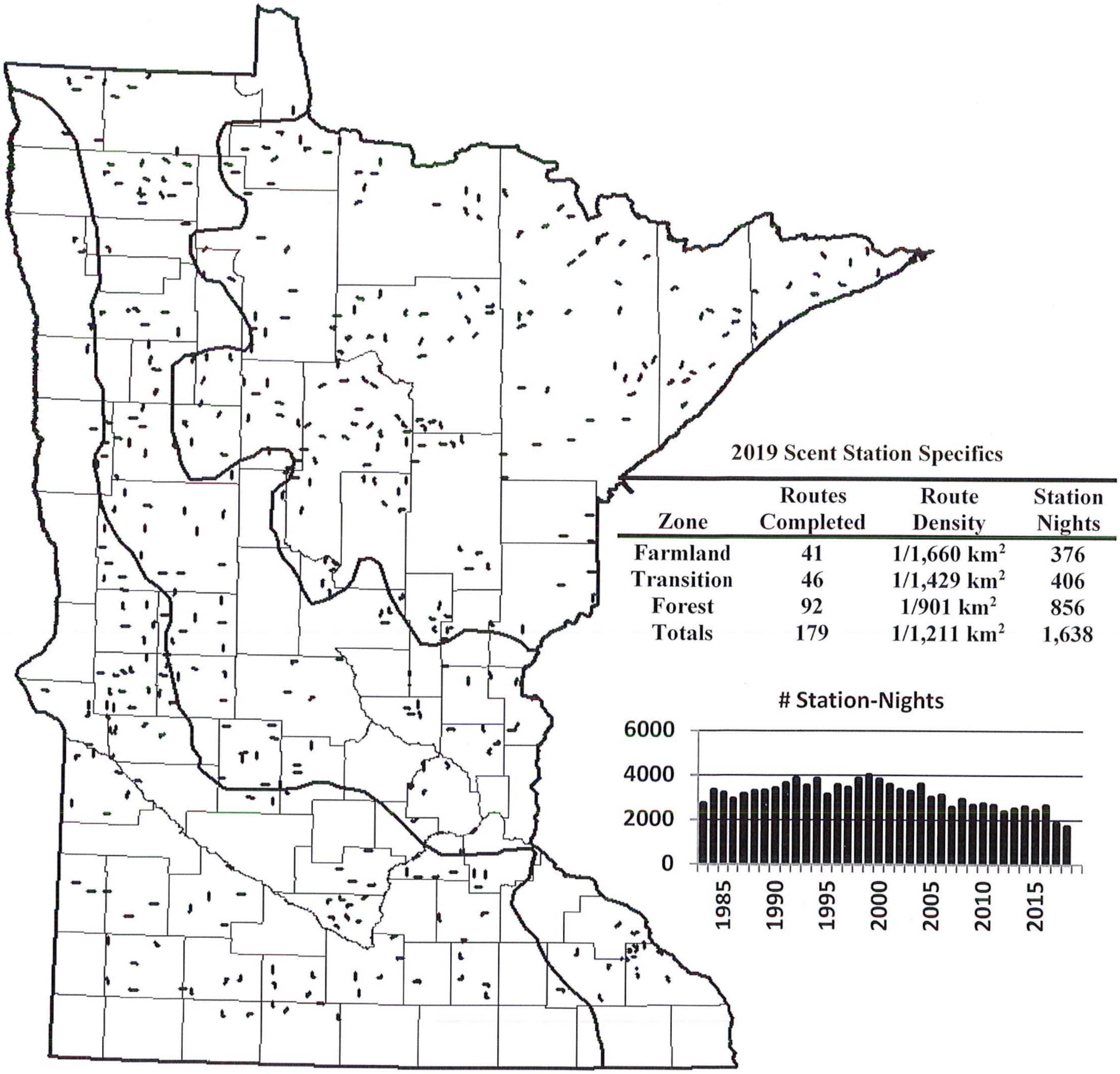

2019 Scent Station Specifics

Zone	Routes Completed	Route Density	Station Nights
Farmland	41	1/1,660 km^2	376
Transition	46	1/1,429 km^2	406
Forest	92	1/901 km^2	856
Totals	179	1/1,211 km^2	1,638

Figure 1. Locations of existing scent station routes (not all completed every year). Insets show 2019 route specifics and the number of station-nights per year since 1983.

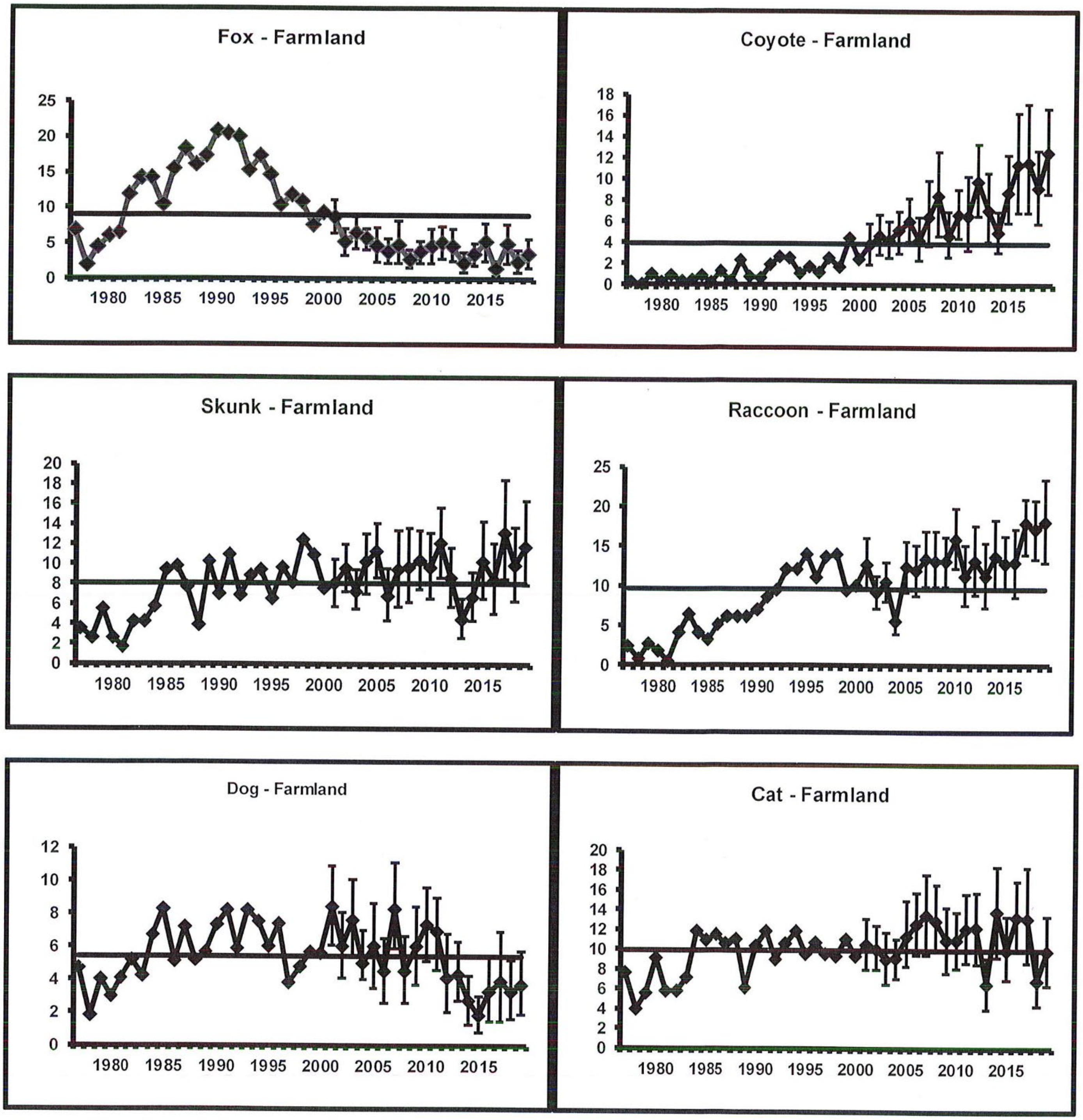

Figure 2. Percentage of scent stations visited by selected species in the Farmland Zone of Minnesota, 1977-2019. Horizontal line represents long-term mean.

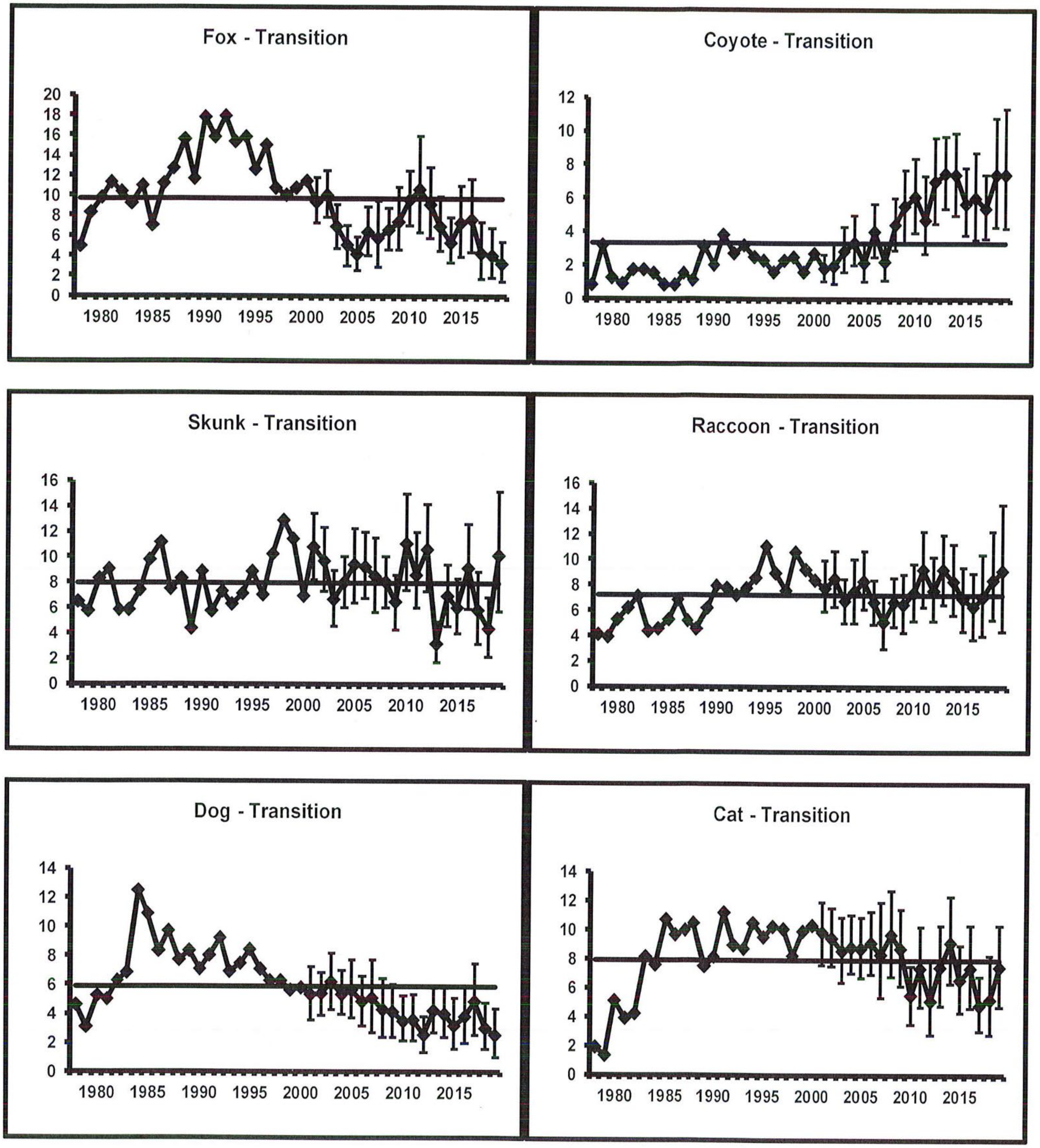

Figure 3. Percentage of scent stations visited by selected species in the Transition Zone of Minnesota, 1978-2019. Horizontal line represents long-term mean.

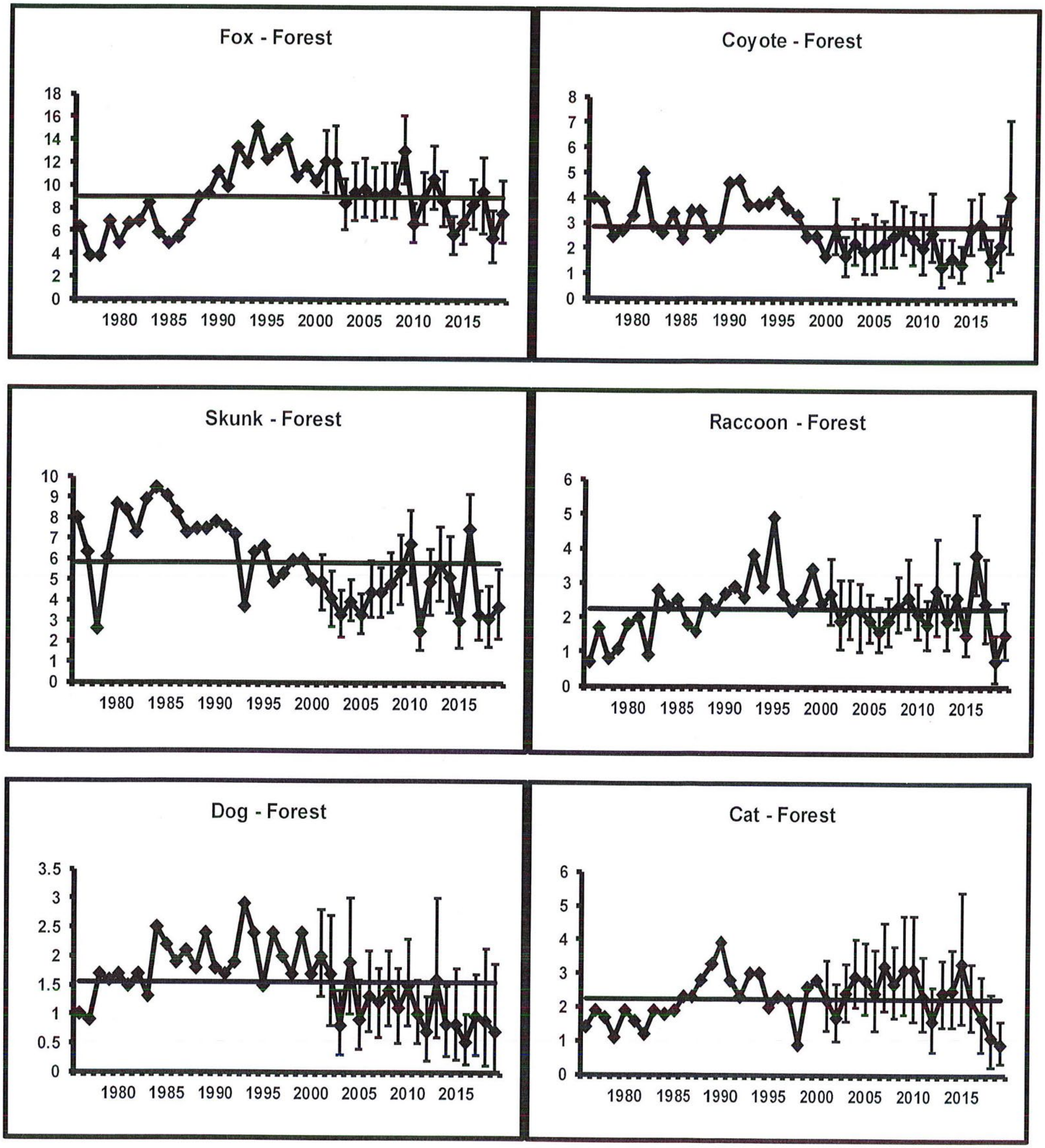

Figure 4. Percentage of scent stations visited by selected species in the Forest Zone of Minnesota, 1976-2019. Horizontal line represents long-term mean.

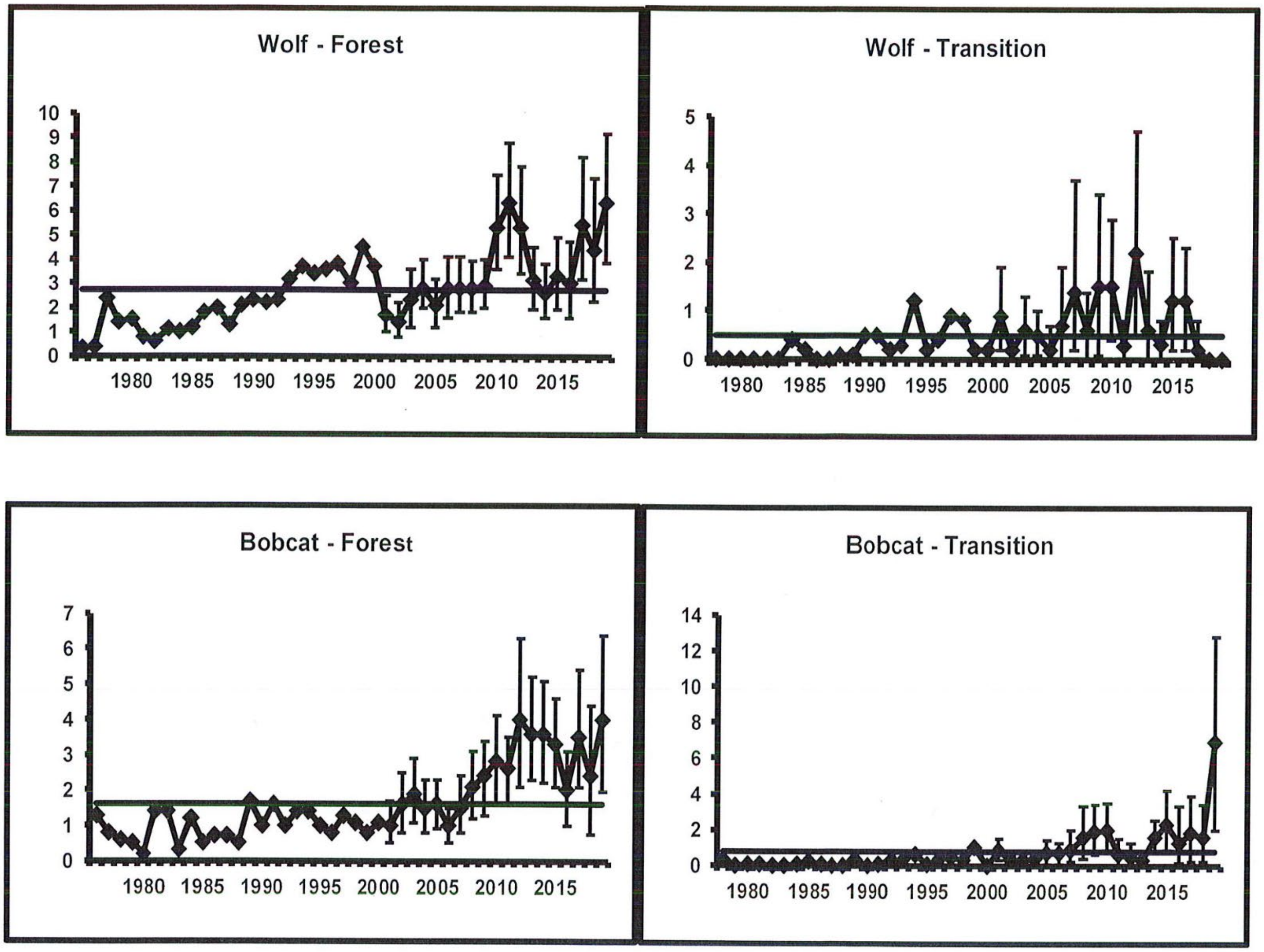

Figure 5. Percentage of scent stations visited by wolves and bobcat in the Forest and Transition Zones of Minnesota, 1976-2019. Horizontal lines represents long-term mean.

FURBEARER WINTER TRACK SURVEY SUMMARY, 2019

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 (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, 57 track survey routes are operational 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 not included in calculation of track indices (see below), recording data in this manner allows for future analysis of animal activity in relation to survey 'plot' size and habitat. Snowshoe hares (*Lepus americanus*) are recorded only as present or absent in the first 0.1 miles of each 0.5-mile segment. 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 days post-snowfall.

Because most species of interest occur throughout the area where survey routes are located, calculated indices for all species prior to 2015 utilize data from all surveyed routes. Starting with the 2015 report, all past marten indices were re-calculated using only those routes that fall within a liberal delineation of marten range (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 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 by definition equivalent. Dating back to 1974, hare survey data has also been obtained via counts of hares observed on ruffed grouse drumming count surveys conducted in spring. Post-1993 data for both the spring and winter hare indices are presented for comparison in this report.

In the second graph for each species, I illustrate the percentage of *routes* where each species was detected (hereafter, the ‘distribution index’). 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 or less 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 50th and 950th 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, 32 of the 57 routes were completed (Figures 1 and 2), the fewest since 2002. Survey routes took an average of 2.1 hours to complete. Snow depths averaged 16” along completed routes, the third deepest since the survey began (Figure 3). Mean overnight low temperature the night preceding the surveys was 2°F, slightly below to the long-term average (Figure 3). Survey routes were completed between November 29th and February 19th, with the mean survey date of January 3rd being close to the long-term average (Figure 3).

Reliable interpretation of 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). Because this remains an untested assumption, 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, notable changes from last winter included significant increases in the percentage of segments and routes where fishers were detected and the percentage of segments where weasels (*Mustela erminea* and *Mustela frenata*) were detected (Figure 4). Conversely, there were significant decreases in the percentage of routes and route segments where bobcats (*Lynx rufus*) were detected and the percentage of routes where coyotes were detected (Figure 4).

Fishers were detected on 5.8% of the route segments and along 69% of the routes (Figure 4). 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 indicative of population trends in only the northern 'core' of fisher range. Although the observed increase from last year was significant, fisher indices have remained below their long-term average for the past 12 years, and far below the long-term peak around 2002; at their peak, fishers were detected on 14% of route segments and 78% of the survey routes.

Within the 'marten zone', martens were detected on 5.8% of the route segments and 48% of the survey routes (Figure 4); neither represented a significant change from last year. At their peak in 1999, martens were detected on 13% of the 'marten zone' route segments and 83% of the 'marten zone' survey routes. Similar to results for fishers, marten indices have declined over the long-term. Although low and without trend over the last 13 years, marten indices during this period do show indications of 3-5 year cycles, consistent in timing with cyclic fluctuations of some of their rodent prey species in Minnesota (e.g., Berg et al. 2017, Oestricher 2018).

Bobcat indices had increased for approximately 15 years through 2014, and then declined to their (now elevated) long-term average by 2016. Indices from 2016-18 showed a quick rebound from the recent decline. However, the percentage of segments with bobcat detection significantly declined this winter to the lowest levels since 1998; bobcats were detected on 1.5% of the segments and 25% of the routes. Snow depths along routes the past 2 winters were the 2nd and 3rd deepest since the survey began (Figure 3). High snow depths can reduce bobcat populations or movements (i.e., cause lower detection rates), either or both of which could explain the significant decline in bobcat track indices this winter. Bobcats appear to have a negative effect on fishers (Erb et al. 2017); the increase in fisher indices this winter suggests a potential decline in bobcat numbers (not just movement) as a partial explanation for the decline in bobcat indices.

Wolves were detected on 8.8% of the route segments and 88% of the survey routes, neither being significant changes from last year (Figure 4). The average number of wolves detected per route was 3. Coyotes were detected on 2.3% of the route segments and 22% of the routes, the latter constituting a significant decline from last winter. The long-term trend in coyote indices has been stable, but as with martens and weasels (see below), coyote winter indices appear to exhibit 3 - 5 year cycles consistent in timing with fluctuations in some rodent populations in MN. Long-term red fox indices display a 'stair-step' decline over time, being lowest and comparatively stable since 2012. Red foxes were detected on approximately 11% of the segments and 69% of the routes (Figure 4), neither being a significant change from last winter. Although it is premature to characterize longer patterns in gray fox detections, data from the past 12 years suggests that similar to coyotes, martens, and weasels, they may fluctuate in concert with cyclic rodent populations. Gray foxes were detected on 1% of the route segments and on 13% of the routes.

The percentage of route segments on which weasels were detected significantly increased from last year. However, fluctuations continue to be characterized by 4 to 5 year cycles or 'irruptions' superimposed on a long-term declining trend (Figure 4). Weasels were detected on 15% of the route segments (peak of 31% in 1995) and on 63% of the routes (peak of 88% in 1999).

There were no significant changes in the percentage of routes or route segments with hare detection. Both spring and winter hare indices steadily increased from 1994 - 2010, generally declined for five years, and have exhibited no trend for the past four years (Figure 4). Both spring and winter indices are near their post-1994 averages (Figure 4). Historic data (pre-1994; not presented here) for the spring snowshoe hare index clearly exhibited 10-year cycles. Since then, only subtle signs of a cycle are apparent in both surveys during the first few years of each decade.

ACKNOWLEDGMENTS

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

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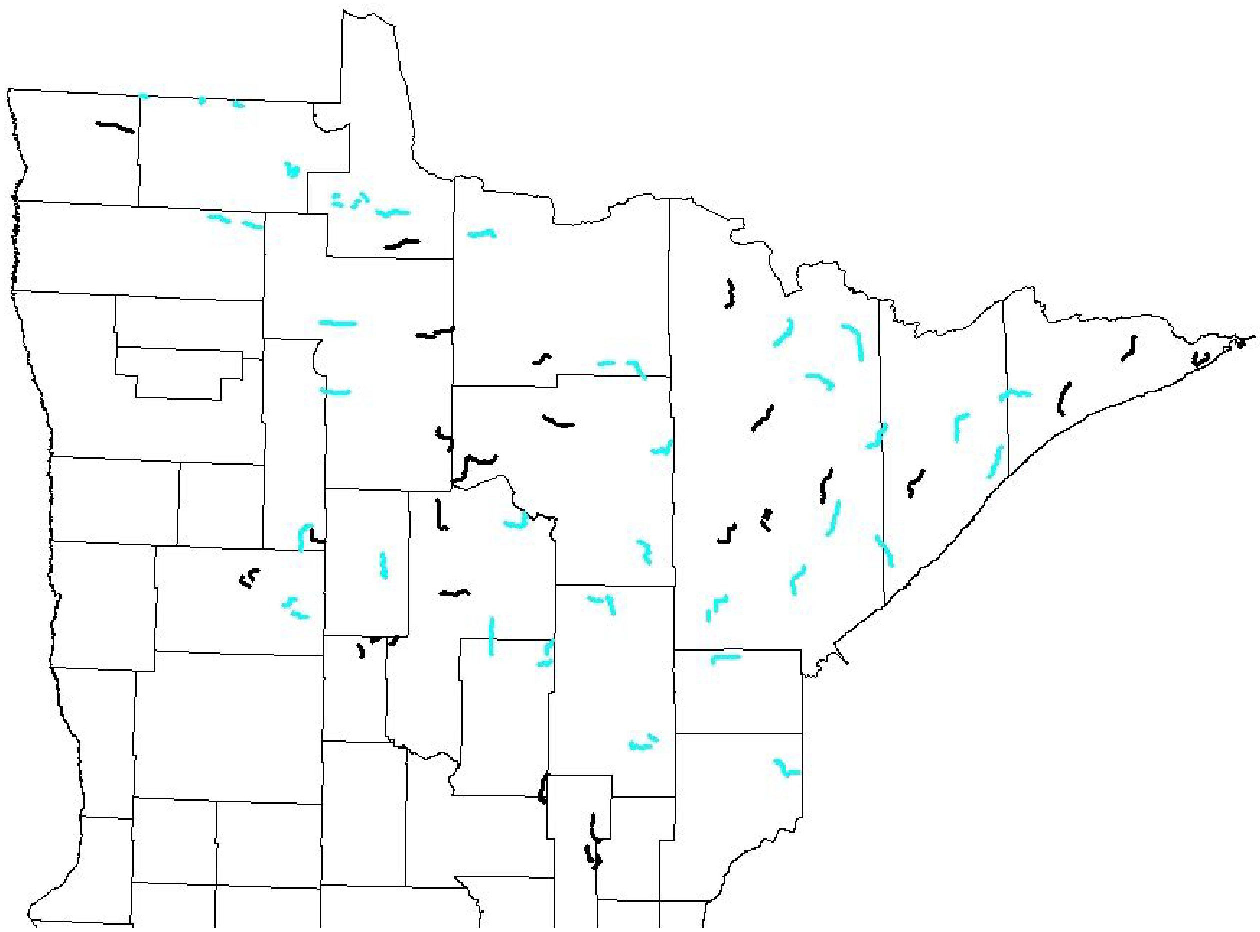

Figure 1. Locations of furbearer winter track survey routes in northern Minnesota. Blue routes are those completed during winter 2019-20.

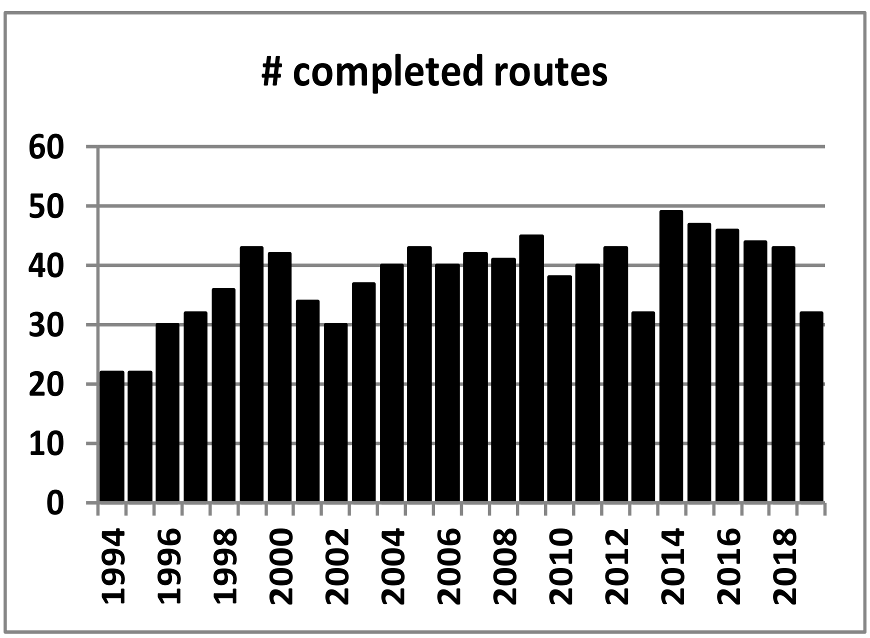

Figure 2. Number of snow track routes surveyed in Minnesota, 1994-2019.

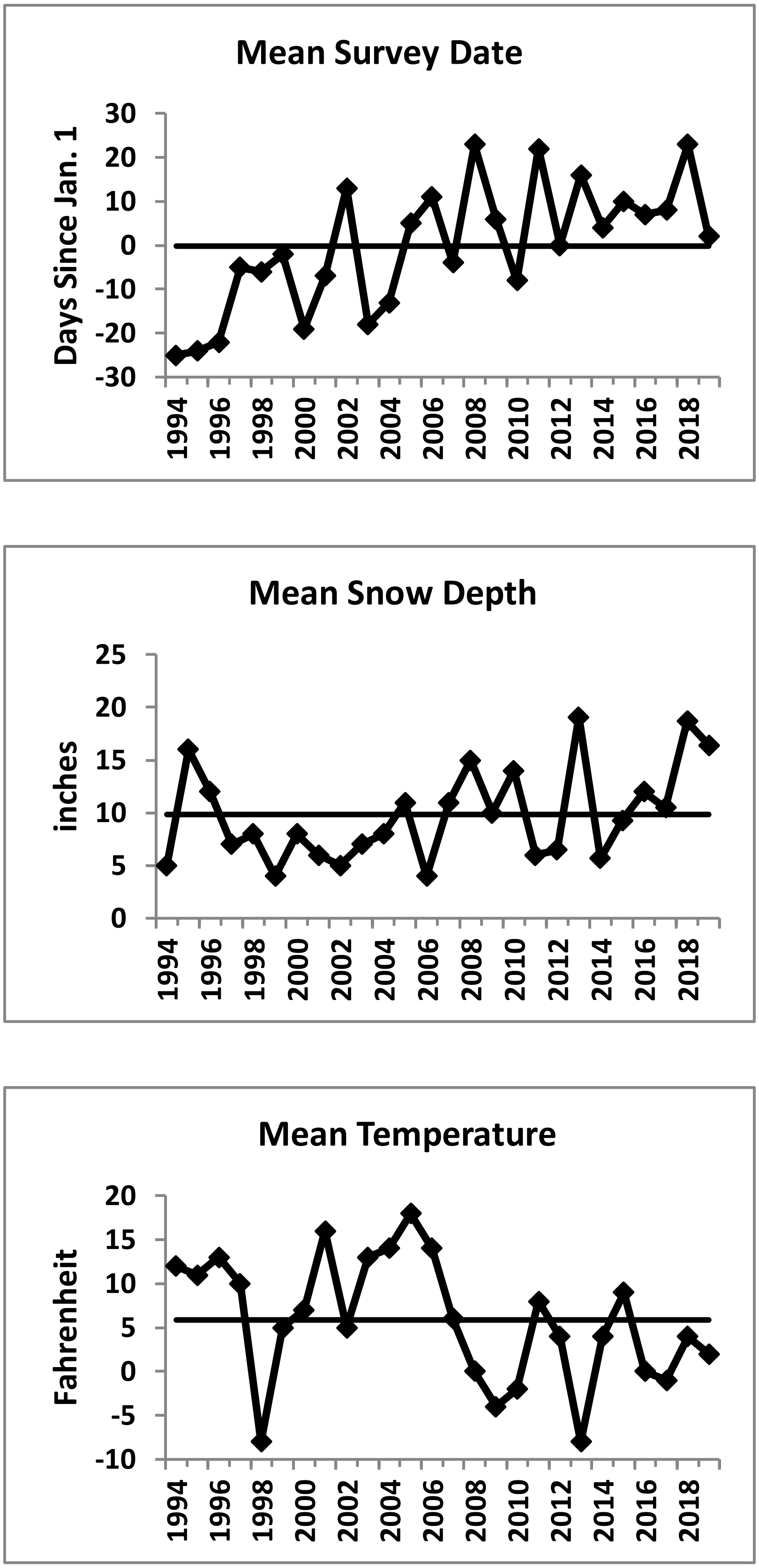

Figure 3. Average survey date, snow depth, and temperature for snow track routes completed in Minnesota, 1994-2019. Horizontal line represents long-term mean.

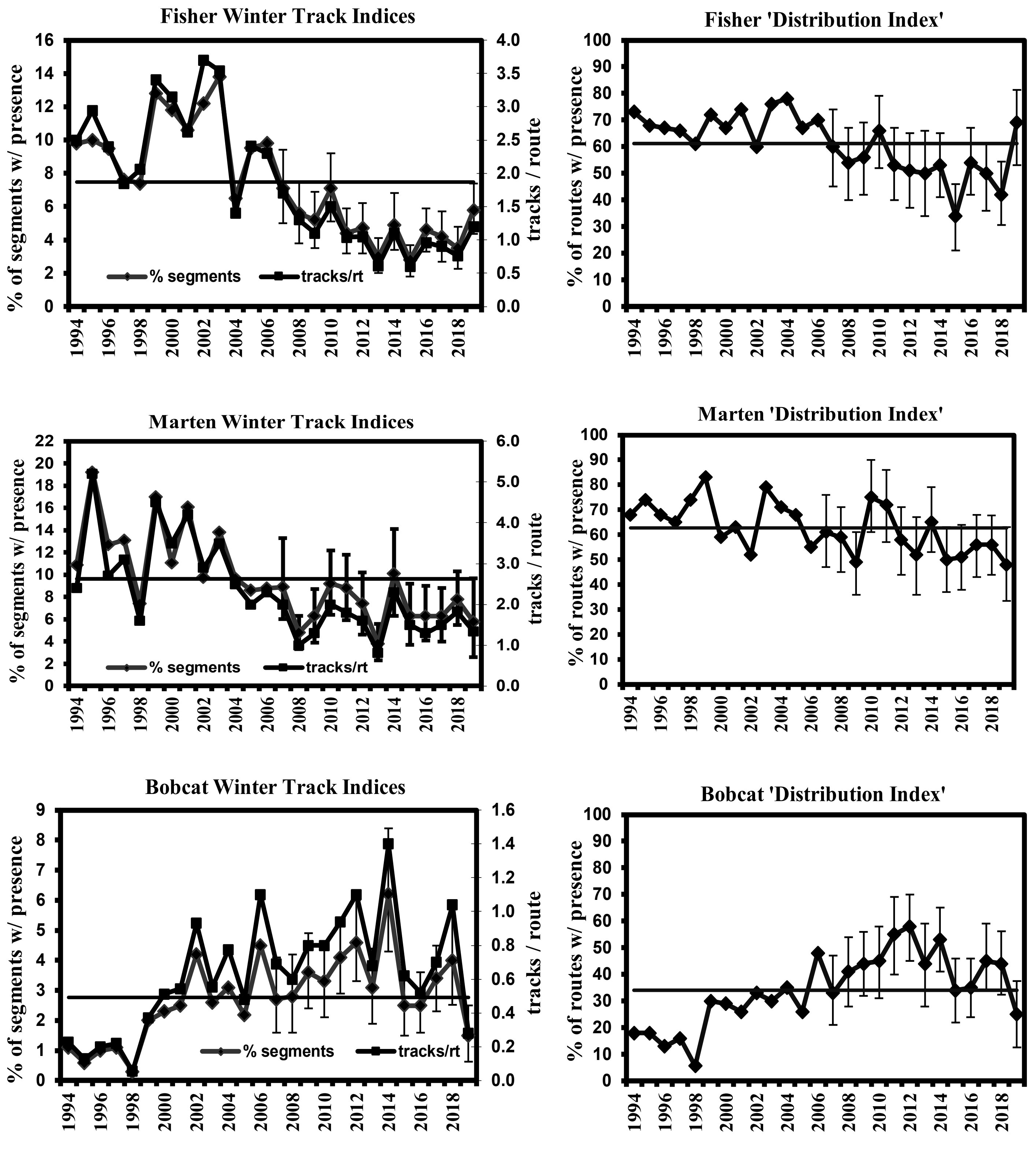

Figure 4. Winter track indices for selected species in Minnesota, 1994-2019. Confidence intervals are presented only for % segments and % routes with track presence; horizontal lines represent their long-term averages.

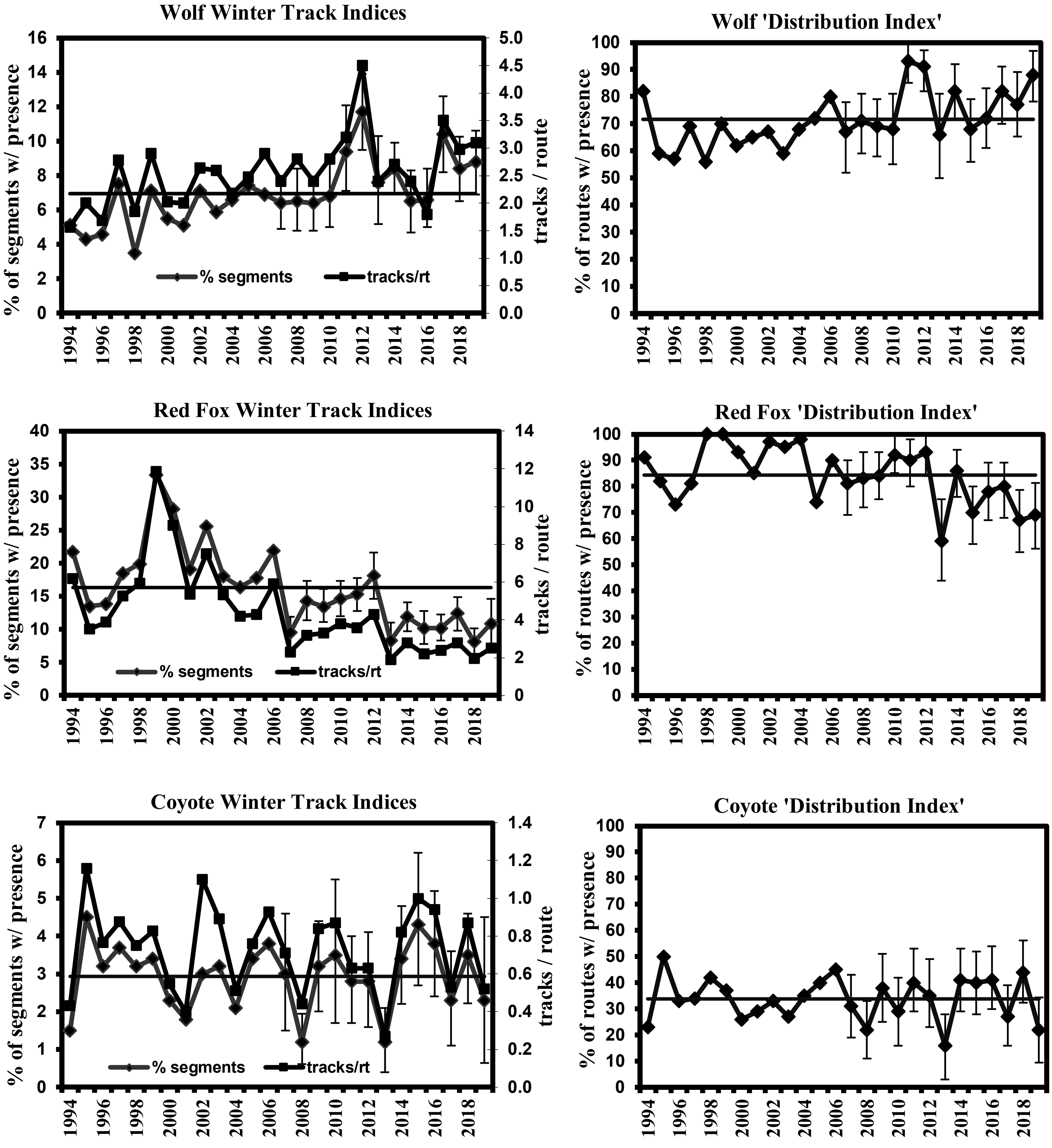

Figure 4 (continued). Winter track indices for selected species in Minnesota, 1994-2019.

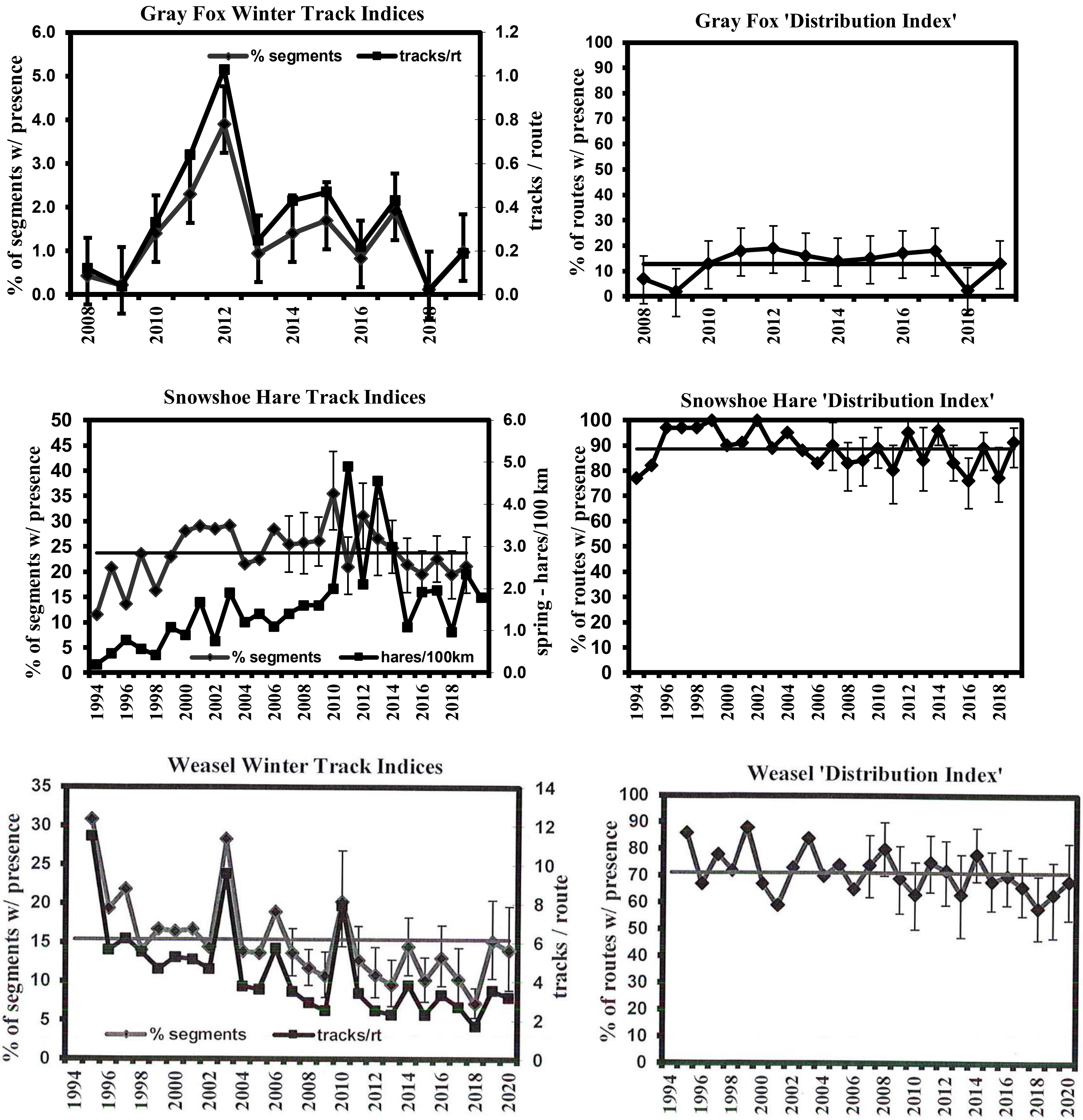

Figure 4 (continued). Winter track indices for selected species in Minnesota, 1994-2019.

REGISTERED FURBEARER POPULATION MODELING UPDATE 2019

John Erb, Forest Wildlife Populations and Research Group

INTRODUCTION

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

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

METHODS

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

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

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

RESULTS AND DISCUSSION

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

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

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

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

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

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

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

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

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

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

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

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Table 1. Bobcat harvest data, 1989 to 2018.

Year	DNR Harvest	Modeled Harvest[1]	% Autumn Pop. Taken[2]	Carcasses Examined	% juveniles	% yearlings	% adults	Juv: Ad. Female ratio	% male juveniles	% male yearlings	% male adults	Overall % males	Mean Pelt Price[3]
1989	129	129	6	119	39	17	44	2.0	49	53	56	53	$48
1990	84	87	4	62	20	34	46	0.8	58	80	44	59	$43
1991	106	110	5	93	35	33	32	3.5	59	55	70	61	$37
1992	167	167	7	151	28	22	50	1.2	55	45	53	53	$28
1993	201	210	8	161	32	20	48	1.4	51	45	52	50	$43
1994	238	270	11	187	26	16	58	0.8	64	43	45	50	$36
1995	134	152	6	96	31	15	54	2.7	57	71	79	71	$32
1996	223	250	10	164	35	20	45	1.8	51	30	49	46	$33
1997	364	401	16	270	35	16	49	1.4	60	37	43	48	$30
1998	103	107	4	77	29	26	45	1.6	59	60	60	60	$28
1999	206	228	8	163	18	24	58	0.8	55	59	62	60	$24
2000	231	250	8	183	31	26	43	1.4	54	59	50	53	$33
2001	259	278	8	213	30	21	49	1.3	46	45	47	52	$46
2002	544	621	15	475	27	25	48	1.1	68	51	48	54	$72
2003	483	518	13	425	25	13	62	0.9	62	48	54	55	$96
2004	631	709	14	524	28	34	38	1.7	52	40	55	49	$99
2005	590	638	13	485	25	13	62	0.8	51	48	47	48	$96

Year	DNR Harvest	Modeled Harvest[1]	% Autumn Pop. Taken[2]	Carcasses Examined	% juveniles	% yearlings	% adults	Juv: Ad. Female ratio	% male juveniles	% male yearlings	% male adults	Overall % males	Mean Pelt Price[3]
2006	890	983	18	813	26	17	57	1.1	60	51	58	57	$101
2007	702	758	14	633	34	14	52	1.2	55	60	47	52	$93
2008	853	928	15	714	26	25	49	1.1	55	52	50	52	$75
2009	884	942	15	844	24	22	54	0.9	57	46	51	51	$43
2010	1012	1042	15	955	38	16	46	1.4	62	55	42	52	$71
2011	1711	1898	26	1626	23	21	55	0.8	61	73	47	56	$98
2012	1875	2026	30	1744	25	19	56	1.0	63	53	54	56	$144
2013	1038	1128	20	634	35	18	47	1.4	59	50	48	52	$89
2014	1384	1453	27	1296	28	16	56	1.3	60	48	60	58	$60
2015	766	803	17	674	24	25	51	1.3	63	63	65	64	$57
2016	484	491	9	464	32	21	47	1.9	66	57	64	63	$36
2017	731	758	12	682	29	25	46	1.5	65	51	58	58	$64
2018	1015	1047	14	984	26	22	52	1.2	59	57	60	59	$60

[1]Includes DNR and Tribal harvests

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

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

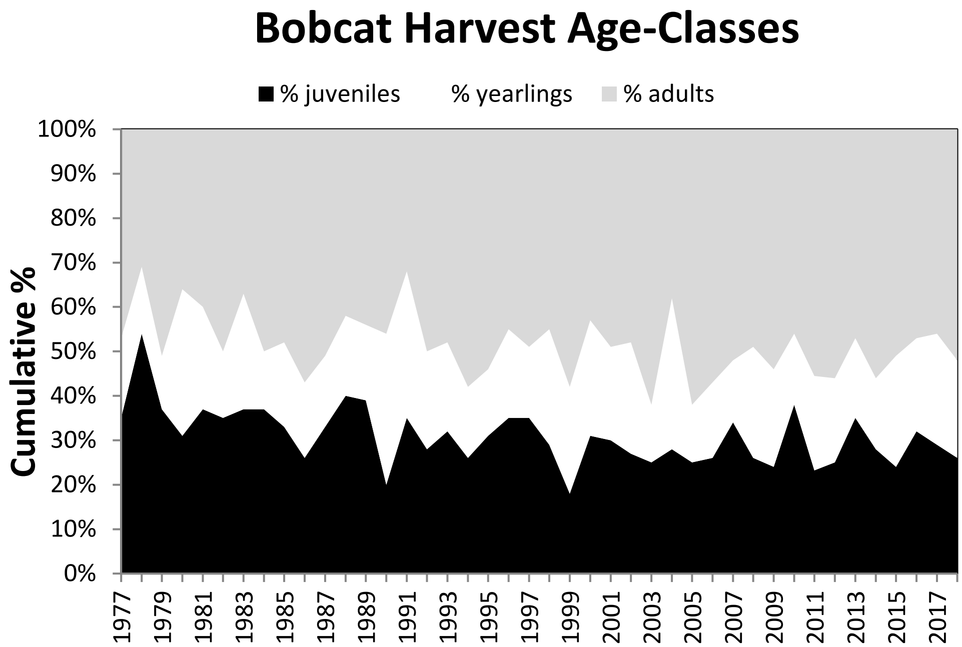


Figure 1. Age-class distribution of bobcats harvested in Minnesota, 1977-2018.

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

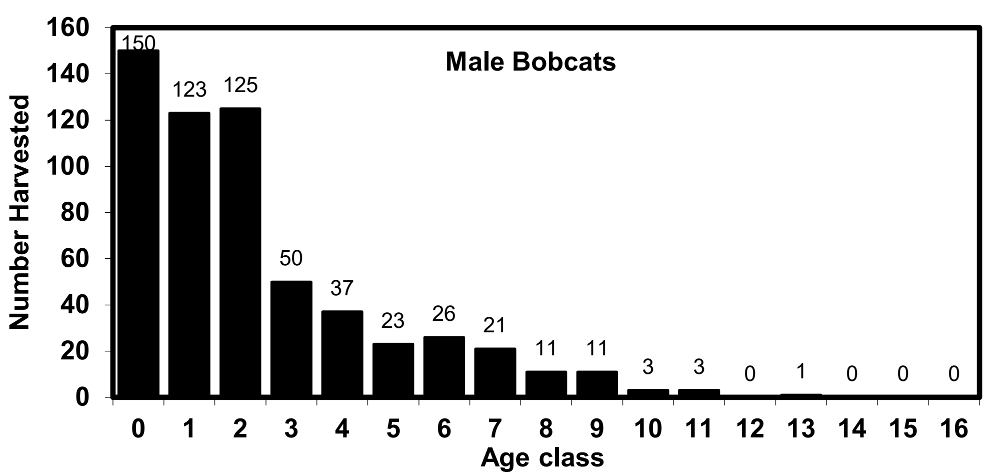


Figure 3. Age structure of male bobcats in the 2018 harvest.

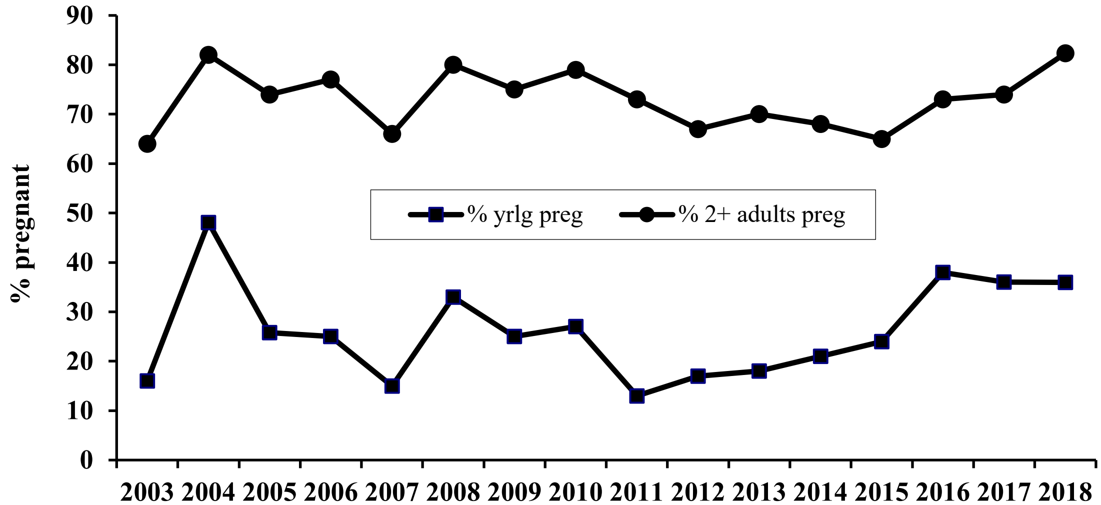


Figure 4. Pregnancy rates for yearling and adult bobcats in Minnesota, 2003-2018.

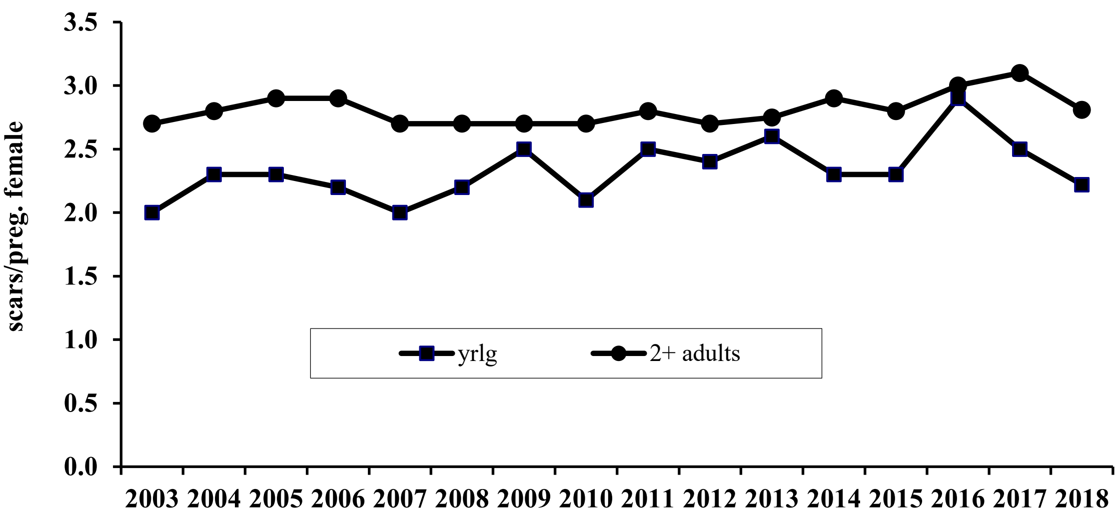


Figure 5. Litter size for parous yearling and adult bobcats in Minnesota, 2003-2018.

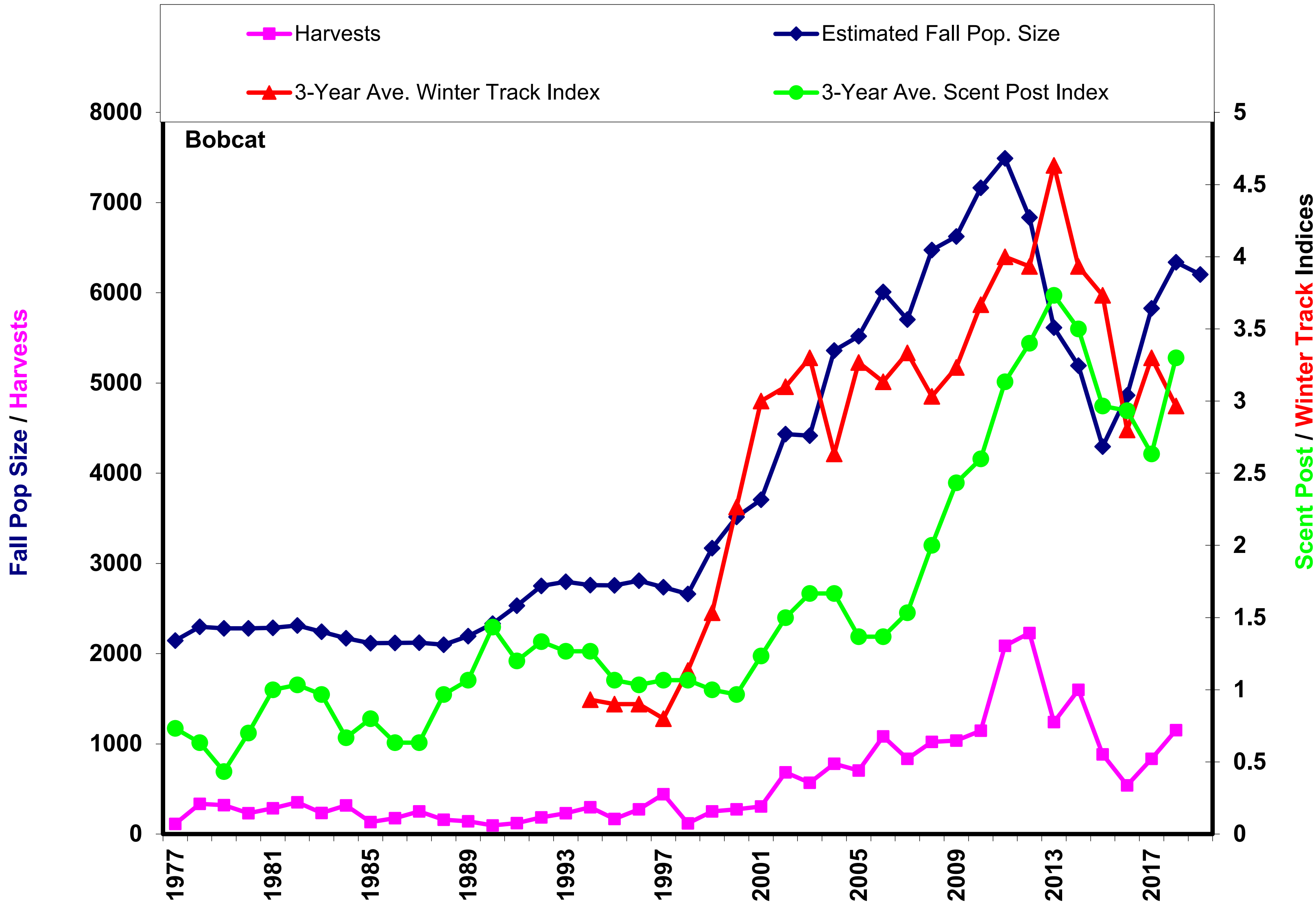


Figure 6. Bobcat population projections, harvests, and survey indices, 1977-2019. Harvests include an estimate of non-reported take.

Table 2. Fisher harvest data, 1989 to 2018.

Year	DNR harvest	Modeled Harvest[1]	% Autumn Pop. Harvested[2]	Carcasses examined	% juveniles	% yearlings	% adults	Juv: Ad. Female ratio	% male juveniles	% male yearlings	% male adults	% males overall	Pelt price Males[3]	Pelt price Females[3]
1989	1243	1243	16	1024	64	19	17	5.8	47	47	36	45	$26	$53
1990	746	756	9	592	65	14	21	4.4	44	55	30	43	$35	$46
1991	528	528	6	410	66	20	14	7.5	50	52	35	48	$21	$48
1992	778	782	8	629	58	21	21	4.8	42	55	45	46	$16	$29
1993	1159	1192	10	937	59	22	19	6.0	47	37	42	44	$14	$28
1994	1771	1932	15	1360	57	18	25	4.0	47	54	44	48	$19	$30
1995	942	1060	8	-	-	-	-	-	-	-	-	45	$16	$25
1996	1773	2000	14	-	-	-	-	-	-	-	-	45	$25	$34
1997	2761	2974	20	-	-	-	-	-	-	-	-	45	$31	$34
1998	2695	2987	20	-	-	-	-	-	-	-	-	45	$19	$22
1999	1725	1880	13	-	-	-	-	-	-	-	-	45	$19	$20
2000	1674	1900	13	-	-	-	-	-	-	-	-	45	$20	$19
2001	2145	2362	15	-	-	-	-	-	-	-	-	54	$23	$23
2002	2660	3028	20	-	-	-	-	-	-	-	-	54	$27	$25
2003	2521	2728	19	-	-	-	-	-	-	-	-	55	$27	$26
2004	2552	2753	20	-	-	-	-	-	-	-	-	52	$30	$27
2005	2388	2454	19	-	-	-	-	-	-	-	-	52	$36	$31
2006	3250	3500	29	-	-	-	-	-	-	-	-	51	$76	$68

Year	DNR harvest	Modeled Harvest[1]	% Autumn Pop. Harvested[2]	Carcasses examined	% juveniles	% yearlings	% adults	Juv: Ad. Female ratio	% male juveniles	% male yearlings	% male adults	% males overall	Pelt price Males[3]	Pelt price Females[3]
2007	1682	1811	18	-	-	-	-	-	-	-	-	52	$63	$48
2008	1712	1828	19	-	-	-	-	-	-	-	-	52	$22	$37
2009	1259	1323	15	-	-	-	-	-	-	-	-	53	$35	$34
2010	903	951	11	759	52	25	23	4.5	55	54	50	54	$38	$37
2011	1473	1651	19	1314	47	28	25	3.2	59	53	42	53	$48	$40
2012	1293	1450	18	1108	51	24	25	3.7	59	53	45	54	$62	$63
2013	1146	1295	17	1040	51	24	25	3.4	55	56	42	52	$74	$68
2014	943	1045	15	881	56	21	23	3.7	57	57	36	52	$44	$55
2015	756	818	12	698	55	19	26	3.8	57	52	44	53	$35	$34
2016	399	434	6	348	56	22	22	4.5	53	56	42	51	$28	$37
2017	477	509	7	440	52	30	18	6.4	65	51	58	58	$31	$38
2018	510	564	7	488	54	24	22	4.5	59	48	46	53	$43	$40

[1] Includes DNR and Tribal harvests

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

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

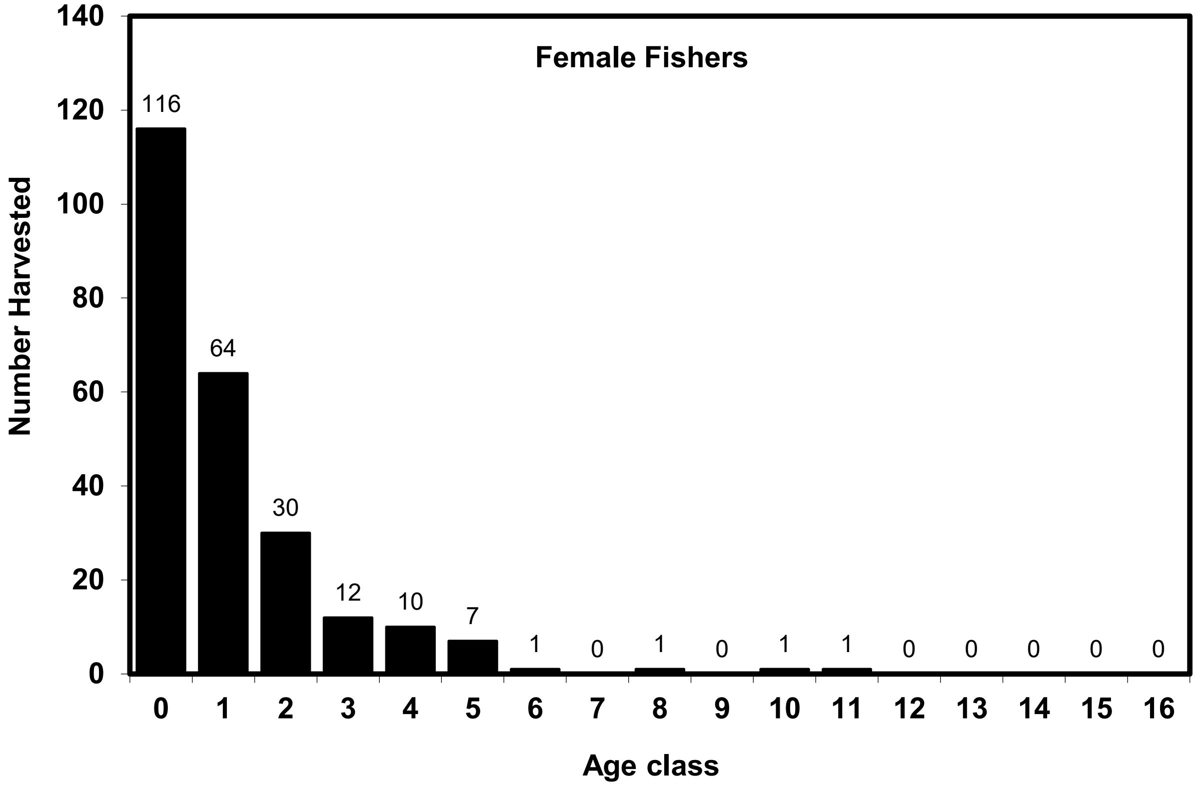


Figure 7. Age structure of female fishers in the 2018 harvest.

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

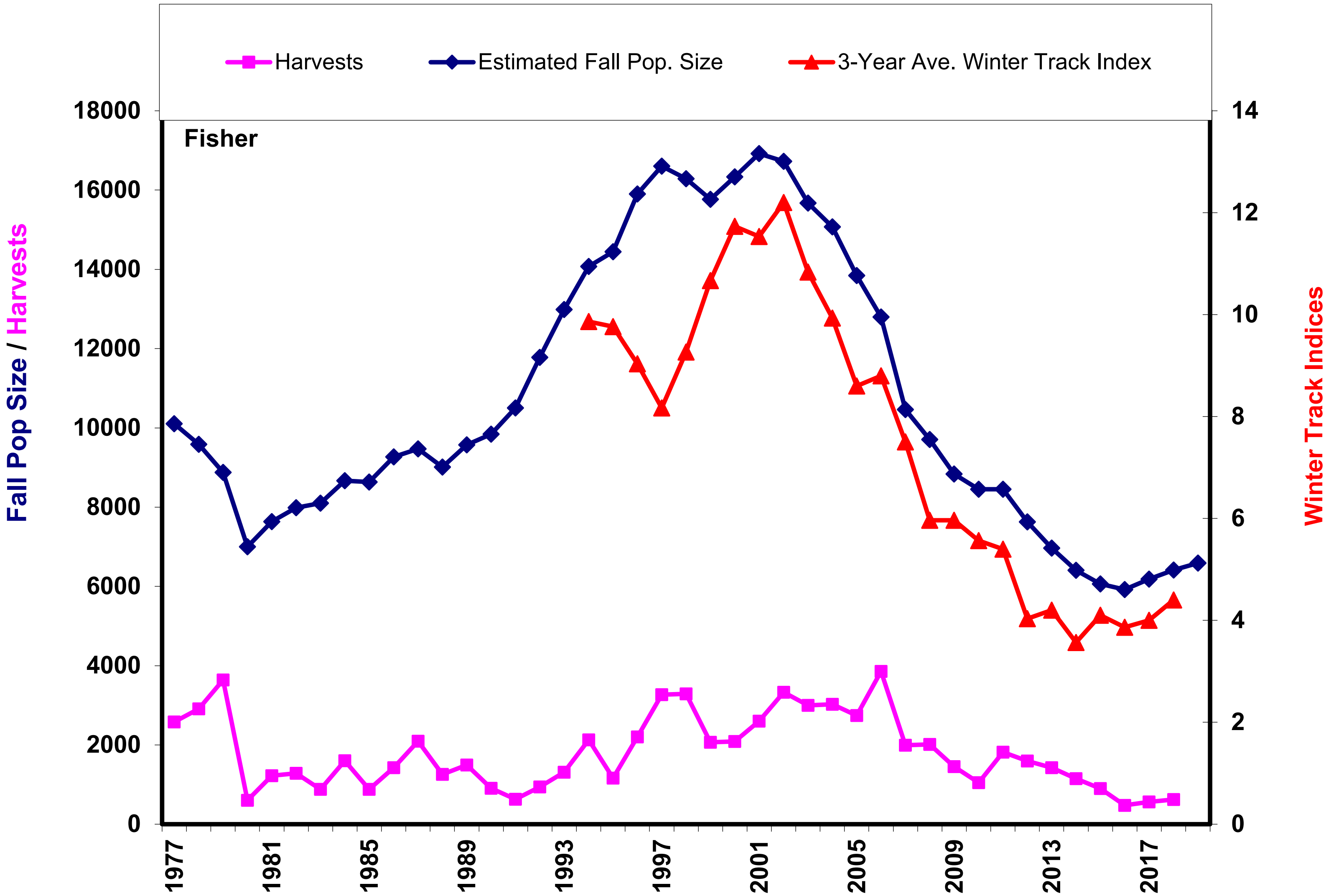


Figure 9. Fisher population projections, harvests, and survey indices, 1977-2019. Harvests include an estimate of non-reported take.

Table 3. Marten harvest data, 1989 to 2018.

Year	DNR harvest	Modeled Harvest[1]	% Autumn Pop. Harvested[2]	Carcasses Examined[3]	% juveniles	% yearlings	% adults	Juv: Ad. Female ratio	% male juveniles	% male yearlings	% male adults	% males overall	Pelt price Males[4]	Pelt price Females[4]
1989	2119	2119	18	1014	68	12	20	9.9	57	63	65	59	$48	$47
1990	1349	1447	12	1375	48	18	34	3.6	59	54	61	59	$44	$41
1991	686	1000	9	716	74	9	17	13.5	69	71	72	70	$40	$27
1992	1602	1802	14	1661	65	18	17	14.8	63	70	75	66	$28	$25
1993	1438	1828	13	1396	57	20	23	7.6	61	71	67	64	$36	$30
1994	1527	1846	13	1452	58	15	27	6.5	62	76	67	66	$34	$28
1995	1500	1774	12	1393	60	18	22	8.2	63	68	66	65	$28	$21
1996	1625	2000	14	1372	48	22	30	4.9	62	69	67	65	$34	$29
1997	2261	2762	19	2238	61	13	26	6.2	60	60	63	61	$28	$22
1998	2299	2795	20	1577	57	18	25	6.5	62	66	65	63	$20	$16
1999	2423	3000	20	2013	67	12	21	9.9	65	66	67	66	$25	$21
2000	1629	2050	14	1598	56	25	19	8.8	62	69	66	64	$28	$21
2001	1940	2250	15	1895	62	15	23	10.7	65	73	74	69	$24	$23
2002	2839	3192	19	2451	38	30	32	3.3	59	65	62	62	$28	$27
2003	3214	3548	22	2391	49	16	35	4.2	59	66	68	64	$30	$27
2004	3241	3592	25	2776	26	28	46	1.4	54	67	59	60	$31	$27
2005	2653	2873	22	1992	62	13	25	7.2	66	64	66	66	$37	$32
2006	3788	4120	31	1914	64	17	19	9.5	67	68	67	67	$74	$66

Year	DNR harvest	Modeled Harvest[1]	% Autumn Pop. Harvested[2]	Carcasses Examined[3]	% juveniles	% yearlings	% adults	Juv: Ad. Female ratio	% male juveniles	% male yearlings	% male adults	% males overall	Pelt price Males[4]	Pelt price Females[4]
2007	2221	2481	22	1355	30	29	41	1.6	60	68	54	60	$59	$50
2008	1823	1953	20	1095	40	21	39	2.4	62	64	57	60	$31	$28
2009	2073	2250	23	1252	55	16	29	5.1	67	49	63	63	$27	$30
2010	1842	1977	20	1202	47	25	28	4.4	71	56	62	65	$40	$37
2011	2525	2744	28	1615	39	25	36	2.7	64	64	60	62	$42	$39
2012	1472	1610	19	1260	34	30	36	2.6	67	57	64	63	$57	$54
2013	1014	1323	16	942	43	20	37	3.5	59	62	68	63	$74	$71
2014	1059	1124	13	991	58	14	28	5.8	65	67	64	65	$45	$34
2015	877	956	11	812	49	25	26	4.9	64	69	60	64	$31	$29
2016	551	677	7	504	56	23	21	8.1	68	73	68	69	$30	$30
2017	979	1076	11	865	50	25	25	5.0	63	72	60	64	$39	$38
2018	665	732	7	638	29	34	37	2.3	63	69	66	66	$42	$33

[1] Includes DNR and Tribal harvests

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

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

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

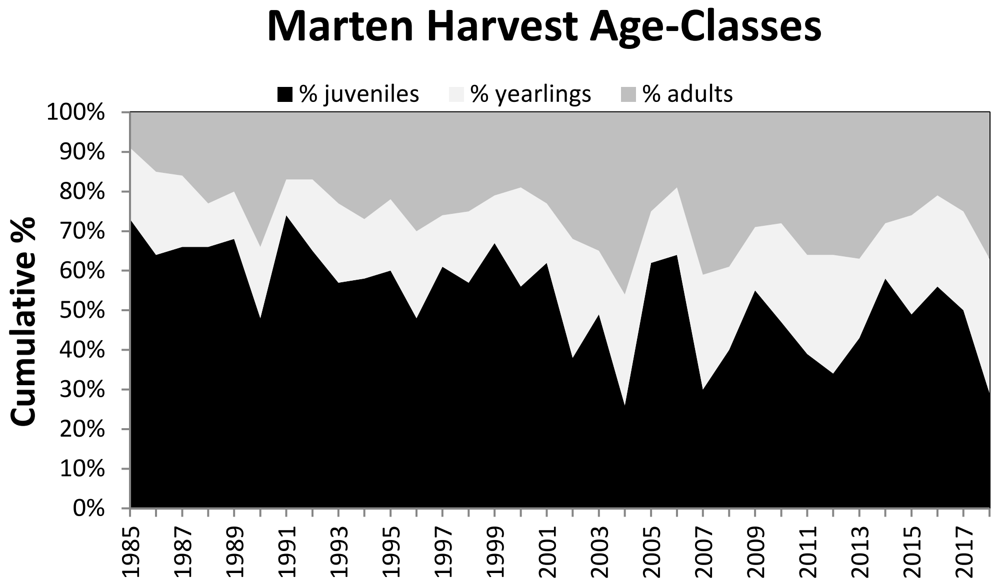


Figure 10. Age-class distribution of martens harvested in Minnesota, 1985 - 2018.

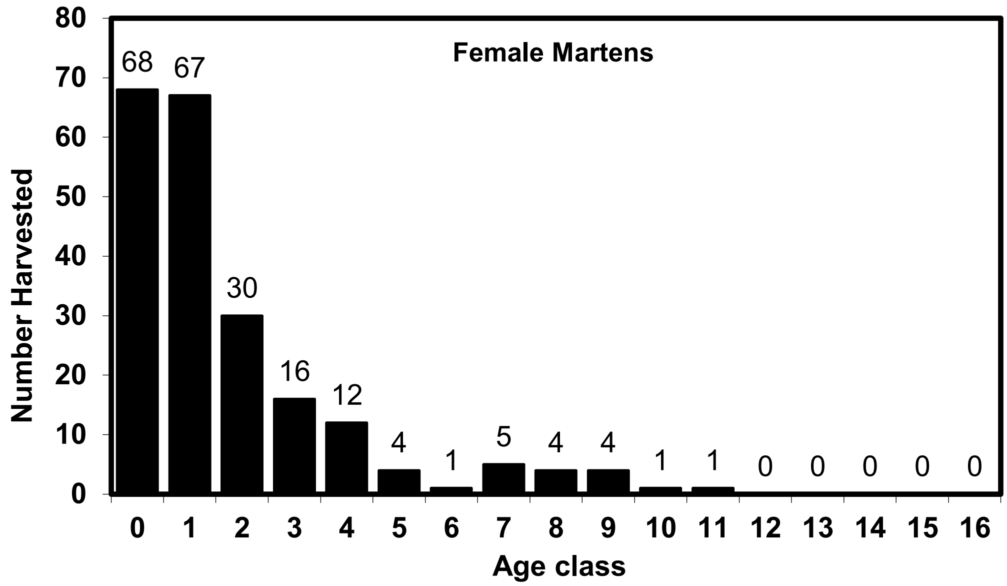


Figure 11. Age structure of female martens in the 2018 harvest.

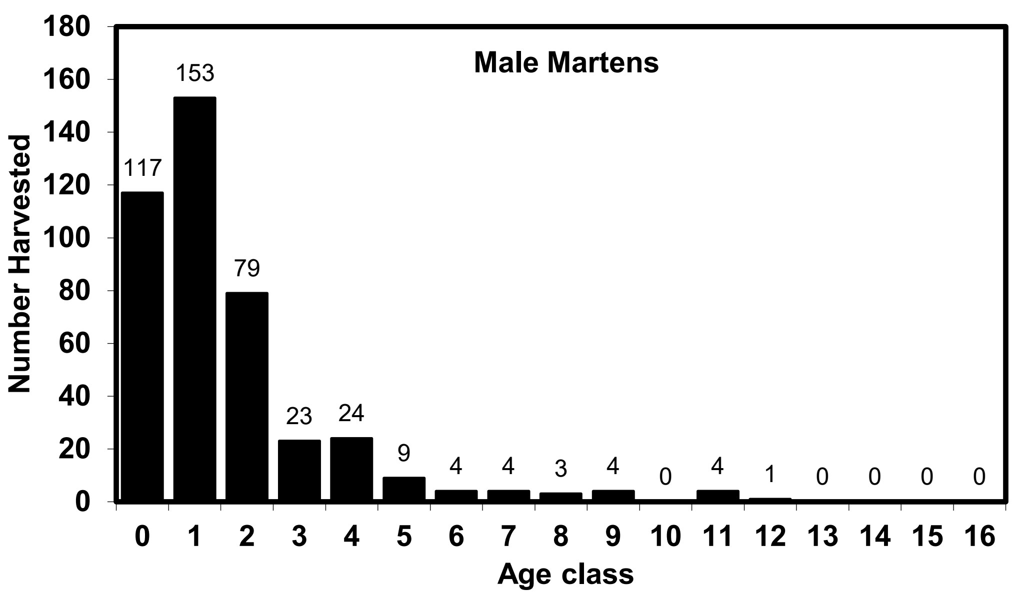


Figure 12. Age structure of male martens in the 2018 harvest.

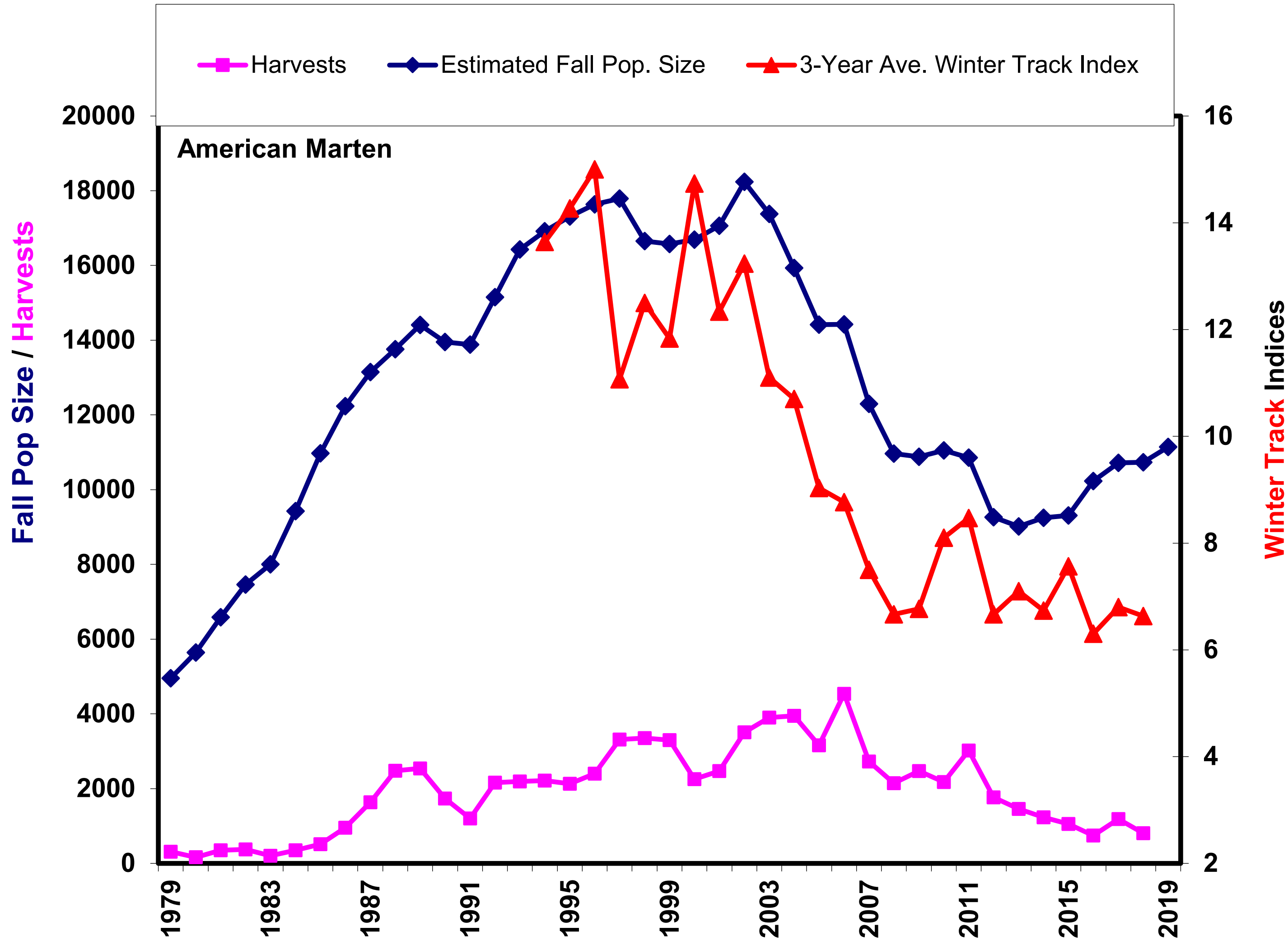


Figure 13. American marten population projections, harvests, and survey indices, 1979-2018. Harvests include an estimate of non-reported take.

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

Year	DNR harvest	Modeled Harvest[1]	% Autumn Pop. Harvested[2]	Carcasses examined	% juveniles	% yearlings	% adults	Juv:ad. females	% male juveniles	% male yearlings	% male adults	% males overall	Pelt price Otter[3]	Pelt price Beaver[3]
1989	1294	1294	12	-	-	-	-	-	-	-	-	52	$22	$12
1990	888	903	8	-	-	-	-	-	-	-	-	52	$24	$9
1991	855	925	8	-	-	-	-	-	-	-	-	51	$25	$9
1992	1368	1365	10	-	-	-	-	-	-	-	-	52	$30	$7
1993	1459	1368	10	-	-	-	-	-	-	-	-	52	$43	$10
1994	2445	2708	18	-	-	-	-	-	-	-	-	52	$48	$14
1995	1435	1646	12	-	-	-	-	-	-	-	-	52	$39	$12
1996	2219	2500	17	-	-	-	-	-	-	-	-	52	$39	$19
1997	2145	2313	16	-	-	-	-	-	-	-	-	52	$40	$17
1998	1946	2139	15	-	-	-	-	-	-	-	-	52	$34	$13
1999	1635	1717	12	-	-	-	-	-	-	-	-	52	$41	$11
2000	1578	1750	12	-	-	-	-	-	-	-	-	52	$51	$14
2001	2301	2531	17	-	-	-	-	-	-	-	-	57	$46	$13
2002	2145	2390	15	-	-	-	-	-	-	-	-	59	$61	$10
2003	2766	2966	19	-	-	-	-	-	-	-	-	57	$85	$12
2004	3450	3700	24	-	-	-	-	-	-	-	-	56	$87	$14
2005	2846	3018	22	-	-	-	-	-	-	-	-	58	$89	$15

Year	DNR harvest	Modeled Harvest[1]	% Autumn Pop. Harvested[2]	Carcasses examined	% juveniles	% yearlings	% adults	Juv:ad. females	% male juveniles	% male yearlings	% male adults	% males overall	Pelt price Otter[3]	Pelt price Beaver[3]
2006	2720	2873	21	-	-	-	-	-	-	-	-	56	$43	$17
2007	1861	1911	15	-	-	-	-	-	-	-	-	55	$29	$16
2008	1938	1983	15	-	-	-	-	-	-	-	-	59	$24	$12
2009	1544	1578	12	-	-	-	-	-	-	-	-	59	$36	$13
2010	1814	1830	13	-	-	-	-	-	-	-	-	57	$35	$13
2011	2294	2490	17	-	-	-	-	-	-	-	-	58	$51	$17
2012	3171	3377	22	-	-	-	-	-	-	-	-	60	$72	$16
2013	2824	2993	21	-	-	-	-	-	-	-	-	48	$61	$17
2014	2154	2235	16	-	-	-	-	-	-	-	-	59	$35	$12
2015	1955	2030	14	-	-	-	-	-	-	-	-	62	$30	$8
2016	1195	1227	8	-	-	-	-	-	-	-	-	62	$21	$8
2017	1295	1336	8	-	-	-	-	-	-	-	-	60	$22	$10
2018	1351	1398	8	-	-	-	-	-	-	-	-	57	$25	$9

[1] Includes DNR and Tribal harvests

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

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

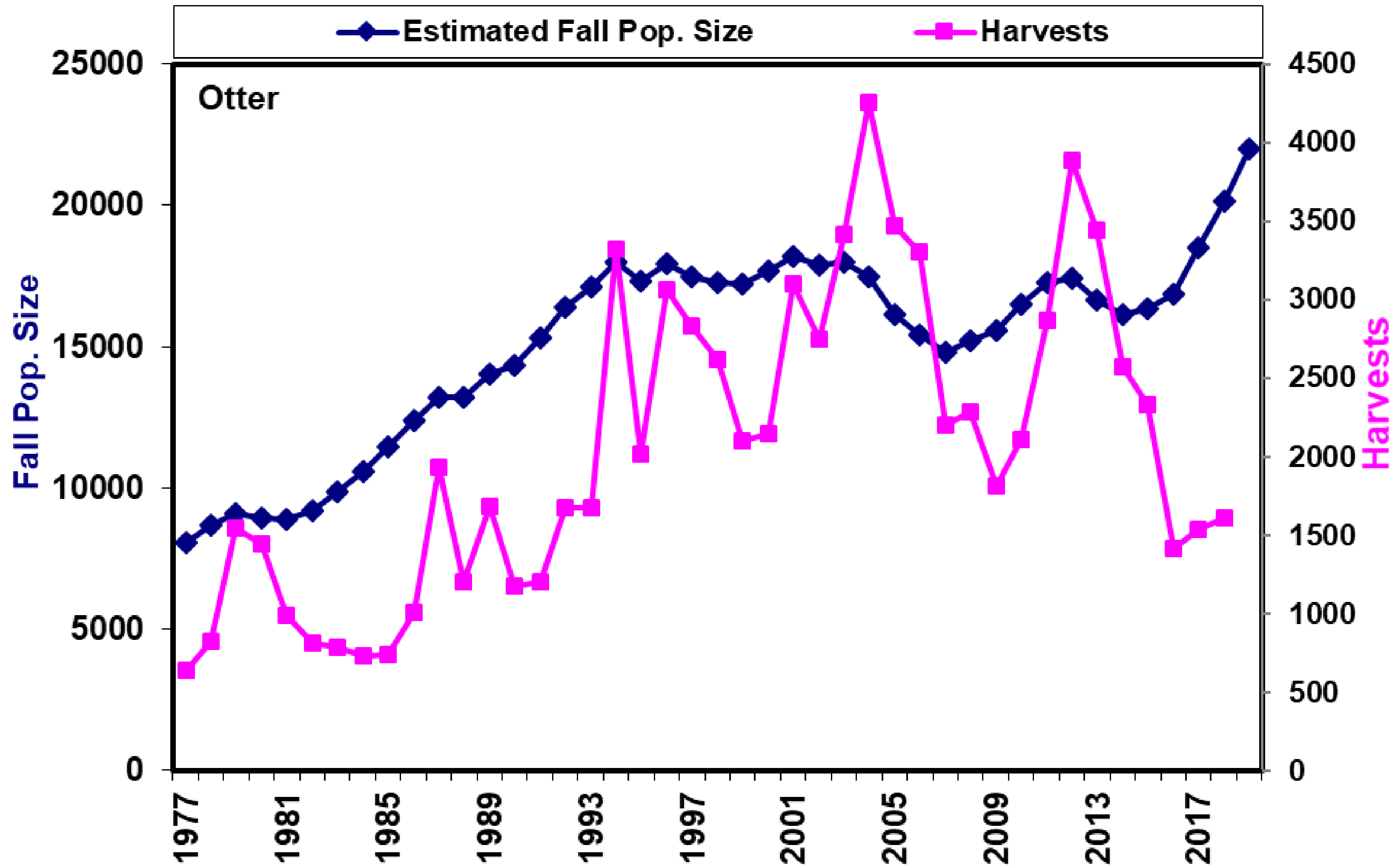


Figure 14. Otter population projections and harvests, 1977-2018. Harvests include an estimate of non-reported take.

STATUS OF MINNESOTA BLACK BEARS, 2019

Dave Garshelis and Andy Tri, Forest Wildlife Research Group

INTRODUCTION

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

METHODS

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

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

RESULTS

Population trend statewide

Ages of harvested bears accumulated since 1980 were used to reconstruct minimum statewide population sizes through time (i.e., the size of the population that eventually died due to hunting) using a technique formulated by Downing. This was scaled upwards (to include bears that died of other causes), using 4 statewide tetracycline mark–recapture estimates as a guide. One trajectory, which assumed non-harvest mortality, was 23% of total mortality (curves elevated x1.3) matched the 1991 tetracycline estimate, but fell below the other tet-estimates. Another trajectory, which assumed non-harvest mortality was 44% of all mortality (curves elevated x1.8) matched the 1997, 2002, and 2008 tet-estimates. The curves show an increasing population from the early 1980s to mid-1990s, leveling off in the late 1990s, followed by a steep decline through the 2000s. Since 2013, quotas were maintained at a low and consistent level (Table 1) in an attempt to reverse the population decline (and also to allow the models to perform better, without the confounding issue of changing hunter effort). The reduced harvest pressure stabilized the population (Figure 1).

Population trend: quota vs no-quota zones

Downing population reconstruction indicated that the quota zone population declined by ~50% from 2000 to 2014 (Figure 2). With reduced quotas and lower harvests since then, the quota zone population increased over 10% from 2014 to 2016, according to this model, but then dipped following the higher than expected harvest in 2016. The Downing model does not produce population estimates for the most recent 2 years, so the effects of lower harvests in 2017–2019 is not yet reflected.

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 (so projections are available to pre-hunt 2020. The trajectory of this model was remarkably similar to that of the Downing model for the quota zone, and indicated that the population there is slowly recovering.

Meanwhile, despite a surge in "overflow" hunters in the no-quota zone (Figure 4) prompted by the more restrictive quota zone permit allocations, harvests in the no-quota zone have not increased, and both the Downing and Allen models show a recent population increase.

Trends in harvest rates

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

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

Nuisance complaints and kills

The total number of recorded bear complaints slowly increased over the past decade, reaching a peak in 2015 and 2016 (Table 2, Figure 8). Number of complaints declined in 2017, despite a higher number of DNR personnel recording complaints, and declined again in 2018, with abundant natural foods all summer (Tables 3 & 4). Average or below-average foods during the summer of 2019 led to higher numbers of complaints. 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. Also, a relatively high number of the reports from officers involved a bear being killed by a private party. In 2018 and 2019, a list was distributed of “area 88” hunters, who expressed interest in taking a nuisance bear in the quota area on a no-quota license. Only 13 hunters purchased an “88” license and 3 hunters were successful (23% success rate).

Food abundance

The composite range-wide, all-season abundance of natural bear foods (fruits and nuts) in 2019 was comparable to 2017 and significantly lower than 2018 (Table 3). Abundance of many summer foods was below the long-term (35-year) average in all but the northwest region. In general, summer food conditions were average and patchy across the state (Table 4); in many areas, especially in the northeast and north-central, summer foods were delayed 2–3 weeks. On the other hand, fall foods tended to be average across the state (Table 5). The statewide fall food index (productivity of dogwood+oak+hazel), which helps predict annual harvest after accounting for hunter effort (Figures 9 & 10), was average in all regions. Hazelnut production was above average in much of the state (with patches near Bemidji, Grand Rapids, and Cloquet with exceptional production). Dogwood production was generally average to above-average across the range. Oak production was average across the state with patches of above-average production near Detroit Lakes and Cloquet. Stations in the North-Central and East-Central regions reported acorn drop nearly 2 weeks later than last year, which may have contributed to the high hunting success (and higher than expected harvest).

Predictions of harvest from food abundance

The 2019 statewide harvest was nearly 20% higher than expected (2340 actual vs. 1959 predicted), based on regression of harvest as a function of hunter numbers and the fall food productivity index (Figure 10). 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 2019 was also nearly 20% higher (1659 actual vs.1391 predicted) than predicted by this regression.

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

Table 1. Number of bear hunting quota area permits available, 2013–2019. Highlighted values show a change from the previous year. BMUs 26 and 44 were divided into 27/28 and 46/47, respectively, in 2016.

BMU	2014	2015	2016		2017	2018	2019
			Before BMU split [a]	After BMU split			
12	200	150	150	150	125	125	125
13	250	250	250	250	225	225	225
22	50	50	50	50	50	50	50
24	200	200	200	200	175	175	175
25	500	500	500	500	400	400	400
26	350	350	325				
27				250	225	225	225
28				75	60	60	60
31	550	550	550	550	500	500	500
41	150	150	125	125	125	125	150
44	450	450	450				
46				400	350	350	350
47				50	40	40	40
45	150	150	250	250	175	175	200
51	900	900	1000	1000	900	900	900
Total	**3750**	**3700**	3850	**3850**	**3350**	**3350**	**3400**

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

Table 2. Number of nuisance bear complaints registered by Conservation Officers and Wildlife Managers during 1999–2019, including number of nuisance bears killed and translocated, and bears killed in vehicular collisions.

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017 [j]	2018 [j]	2019 [j]
Number of personnel participating in survey [a]	52	60	54	50	39	34	42	46	46	37	51	40	34	56	63	64	61	55	86 (51,35)	78 (56,23)	126 (60,66)
Complaints examined on site	189	105	122	75	81	75	61	57	63	59	65	70	37	113	69	79	97	118	71 (22,49)	40 (21,19)	82 (37,45)
Complaints handled by phone [b]	987	618	660	550	424	507	451	426	380	452	535	514	396	722	623	570	840	780	644 (450,194)	438 (369,69)	736 (599,137)
Total complaints received	1176	723	782	625	505	582	512	483	443	511	600	584	433	835	692	649	937	898	715	478	818
• % Handled by phone	84%	85%	84%	88%	84%	87%	88%	88%	86%	88%	89%	88%	91%	86%	90%	88%	90%	87%	90%	92%	90%
Bears killed by: • Private party or DNR	25	25	22	12	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)
• Hunter before season [c]																					
– from nuisance survey	5	7	4	0	3	3	6	2	18	3	4	3	3	11	0	0	1	13	1	2	0
– from registration file	24	43	20	11	8	4	13	6	25	5	15	10	5	12	0	1	4	6	3	11	5
•Hunter during/after season [d]	0	1	1	0	0	0	1	0	0	0	0	0	0	0	1	0	1	1	1	0	0
•Hunter by Area 88 license [e]																			1		3 [m]
• Permittee [f]	7	2	6	4	6	1	5	4	5	1	3	5	0	0	1	0	3	0	0	1	2
Bears translocated	29	1	6	3	1	3	3	3	1	3	2	2	2	0	3	2	0	0	0	0	0
• % bears translocated [g]	15	1	5	4	1	4	5	5	2	5	3	3	5	0	4	3	0	0	0	0	0
Bears killed by cars [h]	60	39	43	26	25	16	22	18	20	27	18	28	15	33	32	28	47 [h]	27	9 (0,9) [h]	25 (15,10) [h]	16 (11,5) [h]

[a] Maximum number of people turning in a nuisance bear report each month. Monthly reports were required beginning in 1984, and included cases of zero complaints. In 2017, the recording system was changed, where 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 nuisance survey and the number registered before the opening of the season indicates incomplete data. Similarity between the two values does not necessarily mean the same bears were reported.

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

[e] In 2017, hunters could choose Area 88 in the quota lottery, and if drawn, could hunt for a nuisance bear, if authorized (11 were authorized, 1 killed a bear). In 2018, Area 88 was only a designation for hunters willing to take a nuisance bear in the quota area on a no-quota license, if so authorized; 116 hunters were on this list. However, none of the 4 hunters with NQ licenses who killed a bear in the quota area (Table 5) were authorized to do so. It is not known from these records if others were authorized but did not kill a bear.

[f] A permit for non-landowners to take a nuisance bear before the bear season was officially implemented in 1992, but some COs individually implemented this program in 1991. Data are based on records from the nuisance survey, not directly from permit receipts. Only 7 bears have been killed by permittees since 2011. In 2019, 7 permits were issued but only 2 bears killed.

[g] Percent of on-site investigations resulting in a bear being captured and translocated. According to DNR nuisance policy, trapped nuisance bears should not be translocated.

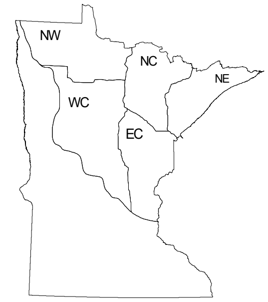
[h] Car kill data were reported on the monthly nuisance form beginning in 2005. In all previous years, car kill data were from Enforcement's confiscation records. In 2015, confiscation records had more car-kills than the nuisance survey (47 vs 33), so the higher number is shown here. In 2017, only 1 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 nuisance bear complaints on an all-species wildlife damage app, whereas Conservation Officers continued to submit monthly nuisance bear 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).

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

[m] 13 NQ hunters were authorized to take nuisance bears in the quota area in 2019, of which 3 were successful.

Table 3. Regional bear food indices[a] in Minnesota's bear range, 1984–2019. Shaded blocks indicate particularly low (<45; pink) or high (≥70; green) values.



	Survey Area					
Year	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[b]
2019	68.8	60.9	64.4	59.8	65.1	63.9

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

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

Table 4. Regional mean index values[a] for bear food species in 2019 compared to the previous 35-year mean (1984-2018) 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	
	35yr mean	2019 (*n* = 10[b])	35yr mean	2019 (*n* = 8)	35yr mean	2019 (*n* = 6)	35yr mean	2019 (*n* = 10)	35yr mean	2019 (*n* = 8)	35yr mean	2019 (*n* = 33)
SUMMER												
Sarsaparilla	4.7	5.3	5.9	6.9	5.3	6.5	4.5	3.5	5.3	3.8	5.0	5.2
Pincherry	3.4	4.3	4.5	3.8	4.3	4.0	3.8	3.1	3.7	3.0	3.9	3.4
Chokecherry	5.8	6.2	5.5	4.0	4.7	4.3	5.4	4.4	4.7	5.0	5.3	4.6
Juneberry	5.2	5.1	4.9	2.6	5.1	3.8	3.7	2.6	4.0	3.8	4.5	3.9
Elderberry	1.6	2.3	3.0	2.6	3.6	5.5	3.1	3.5	3.2	4.3	3.0	3.1
Blueberry	5.1	4.6	5.5	3.7	5.1	6.2	3.7	5.1	3.9	5.0	4.5	4.9
Raspberry	6.5	7.1	7.9	5.9	8.0	7.7	7.1	8.1	7.1	7.1	7.2	6.9
Blackberry	1.3	2.3	2.4	2.6	1.2	0.0	3.6	3.5	4.4	3.2	2.9	2.9
FALL												
Wild Plum	2.3	3.4	1.9	1.6	1.3	1.5	2.7	1.9	2.4	1.1	2.3	2.3
HB Cranberry	5.3	6.9	4.4	4.4	4.0	4.4	3.8	3.5	3.8	6.1	4.2	4.7
Dogwood	6.2	6.9	5.7	4.6	4.9	5.2	5.9	3.9	5.9	4.3	5.8	5.1
Oak	3.5	3.8	3.2	3.9	2.0	2.0	5.9	5.9	5.7	6.9	4.5	5.1
Mountain Ash	1.6	2.5	2.6	3.0	4.7	6.0	1.8	2.5	2.4	4.2	2.7	4.0
Hazel	6.4	8.1	7.4	11.3	7.0	7.3	7.9	8.5	7.7	7.3	7.2	7.9
TOTAL[d]	59.0	68.8	64.6	60.9	61.2	64.4	62.8	59.8	64.2	65.1	63.0	63.9

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

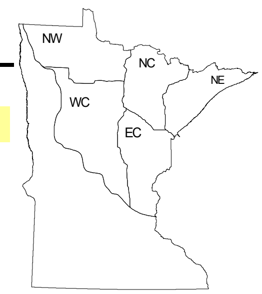
[b] *n* = Number of surveys used to calculate area-specific means

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

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

Table 5. Regional productivity index[a] for important fall bear foods (oak + hazel + dogwood), 1984–2019. 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[b]
1986	7.2	5.0	4.0	7.0	6.2	6.2
1987	8.0	7.8	7.3	7.6	8.0	7.7
1988	5.5	7.2	7.3	6.8	6.1	6.7
1989	6.0	5.3	4.1	5.7	6.4	5.8
1990	3.3[b]	4.2	6.4	5.7	6.4	5.2
1991	6.2	6.2	5.4	7.2	7.7	6.7
1992	4.7	5.0	4.4	4.4[b]	6.8	5.1
1993	5.3	7.1	6.7	6.2	7.7	6.5
1994	7.1	7.8	5.8	7.8	7.1	7.2
1995	4.8	4.8	5.1	4.6	5.3	4.9
1996	8.7	8.6	8.1	9.2	8.5	8.6
1997	5.8	5.4	5.1	6.8	6.5	6.2
1998	5.8	6.0	6.3	7.1	7.8	6.7
1999	6.4	5.1	5.9	6.6	6.0	6.2
2000	5.8	7.7	7.2	7.5	8.5	7.0
2001	3.4	4.1	5.7	6.0	6.5	5.2
2002	8.7	7.1	6.6	8.8	8.2	8.1
2003	6.3	6.0	5.5	6.2	6.0	6.1
2004	6.1	5.4	5.4	6.4	6.1	5.9
2005	5.8	5.8	6.1	6.4	7.0	6.2
2006	6.7	6.1	6.0	6.7	5.8	6.3
2007	6.0	5.8	5.7	6.6	6.4	6.2
2008	6.6	7.3	6.2	7.0	8.9	7.1
2009	5.1	6.2	5.3	6.3	6.5	6.0
2010	7.7	6.4	6.5	6.2	5.4	6.6
2011	5.8	6.5	6.2	7.0	7.4	6.5
2012	6.2	6.3	6.3	6.5	4.8	6.1
2013	6.8	6.0	5.7	6.7	6.9	6.3
2014	7.0	5.6	5.4	7.7	6.1	6.7
2015	5.8	5.9	3.5[b]	8.2	3.7[b]	5.6
2016	5.7	5.2	6.0	5.4	5.2	5.3
2017	6.8	5.6	5.1	7.4	7.1	6.5
2018	5.8	6.1	7.7	8.3	8.4	7.2
2019	6.2	7.1	6.6	6.5	7.1	6.7



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

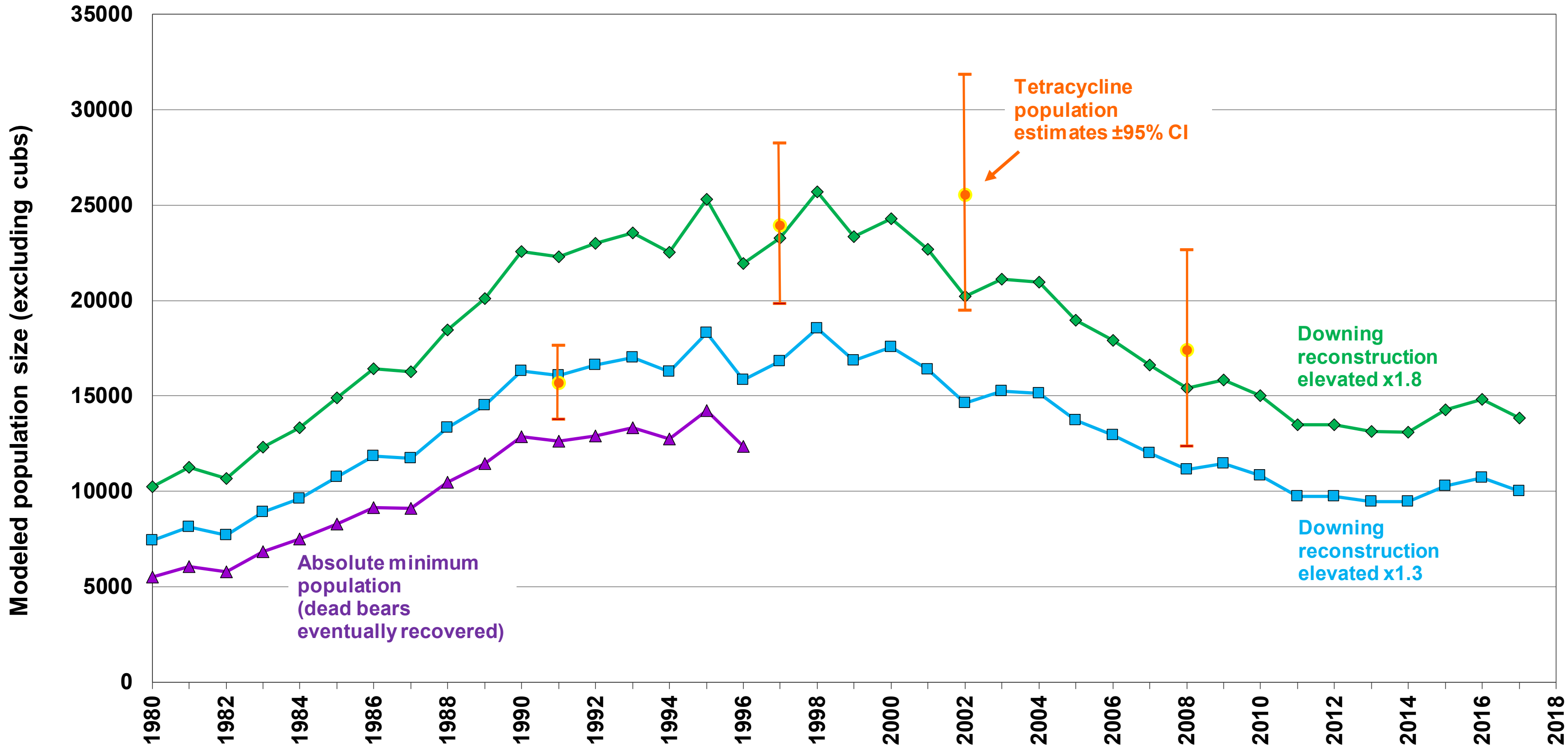


Figure 1. Statewide bear population trend (pre-hunt) derived from Downing reconstruction, scaled (elevated to account for non-harvest mortality) to various degrees to attempt to match the tetracycline-based mark–recapture estimates (2 such curves shown here; estimates beyond 2017 are unreliable).

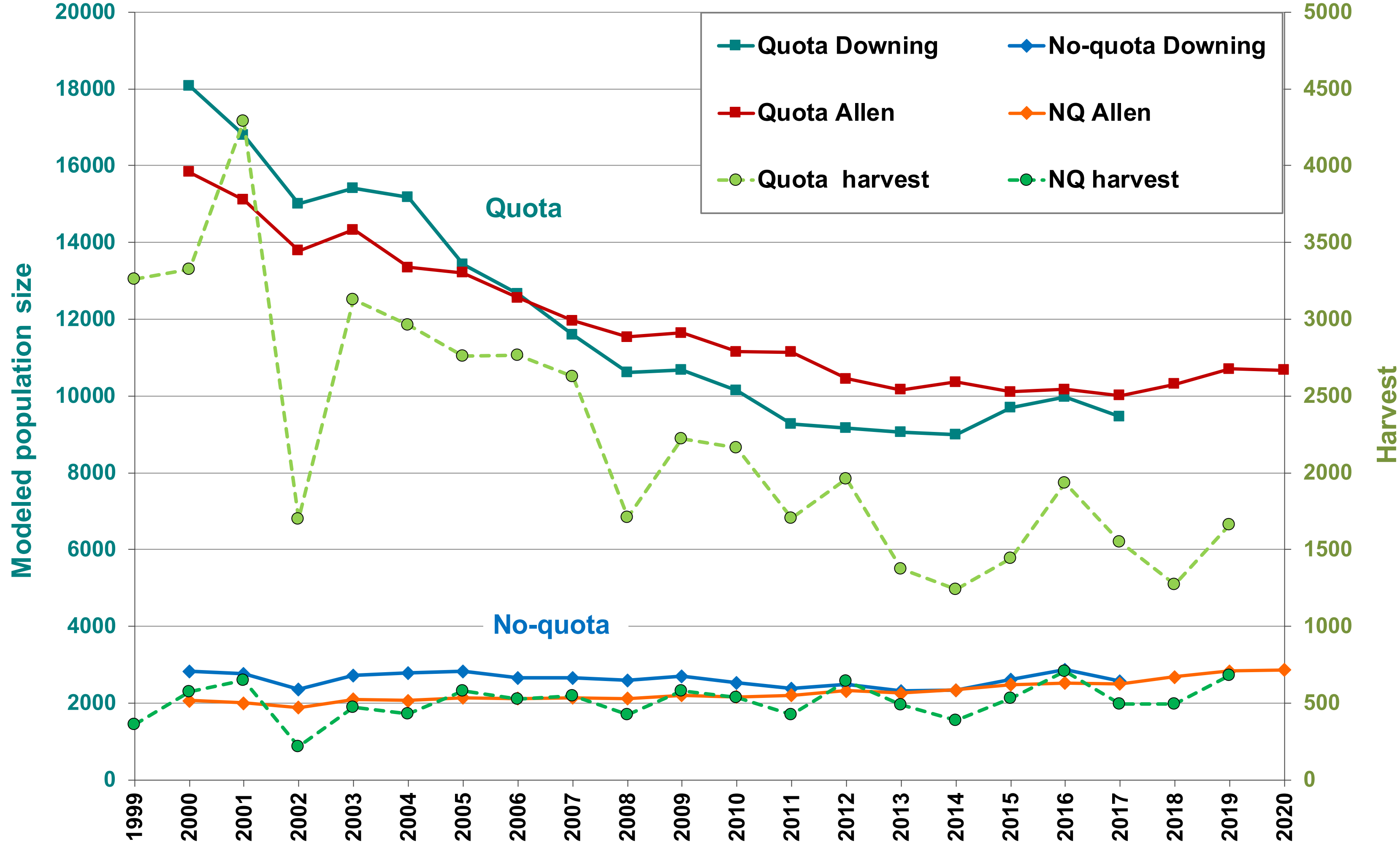


Figure 2. Population trends during 2000s derived from two independent population models (Downing and Allen) for quota and no-quota zones, compared to respective harvests. Downing reconstruction-based estimates <2 years from the most recent harvest age data are unreliable (hence these curves terminate 2017). Downing curves were scaled (elevated to account for non-harvest mortality) to fall between the two curves in Fig. 18 (i.e., the actual scale of the population estimates is not empirically-based, but happens to approximately match the magnitude of the Allen estimates).

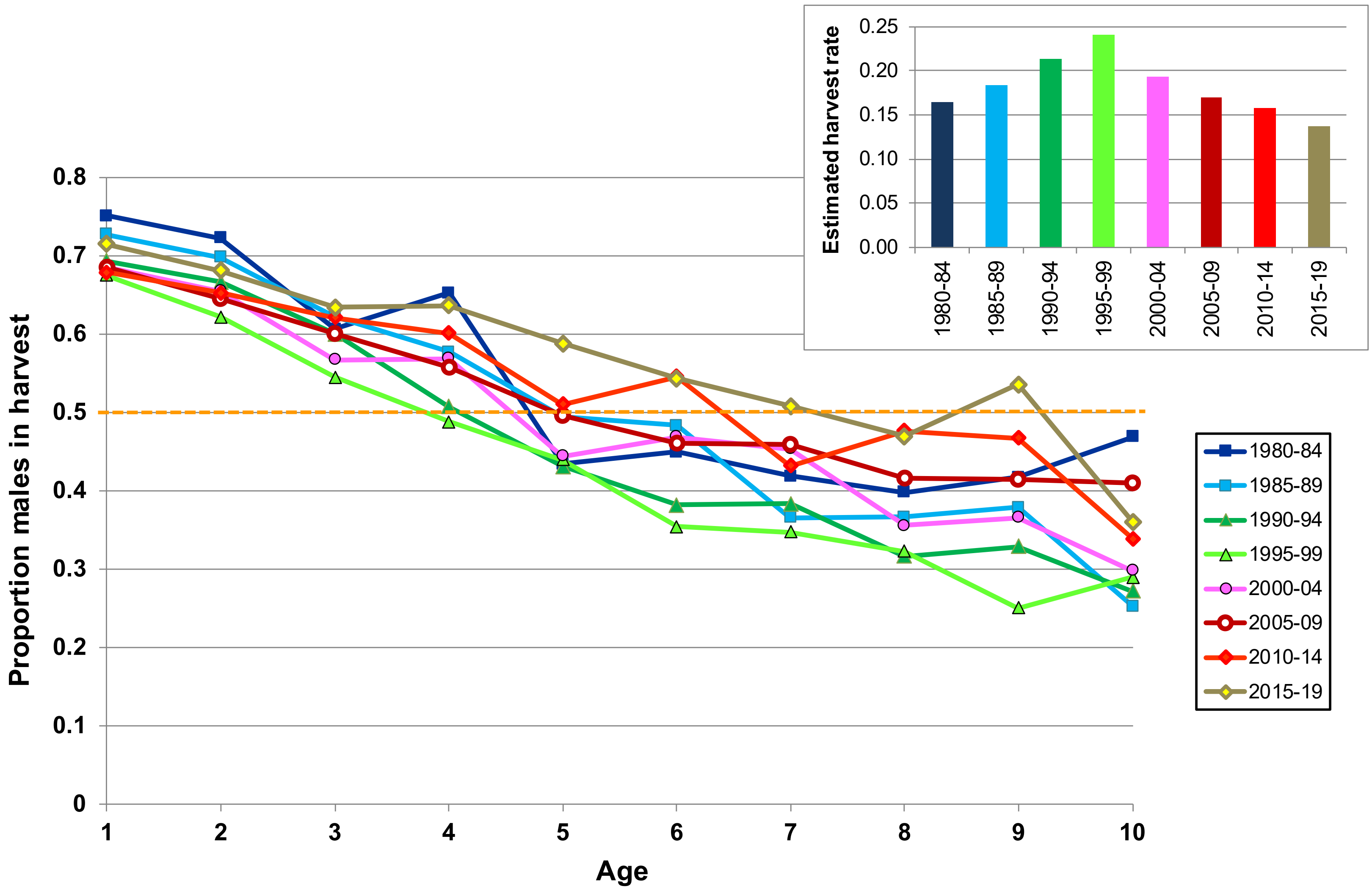


Figure 3. Trends in proportion of male bears in statewide harvest at each age, 1–10 years, grouped in 5-year time blocks, 1980–2019. Higher harvest rates result in steeper curves because males in the living population are reduced faster than females. Fitting a line to the data for each time block and predicting the age at which 50% of the harvest is male (dashed tan 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 (2015–19 lower than 1980–84).

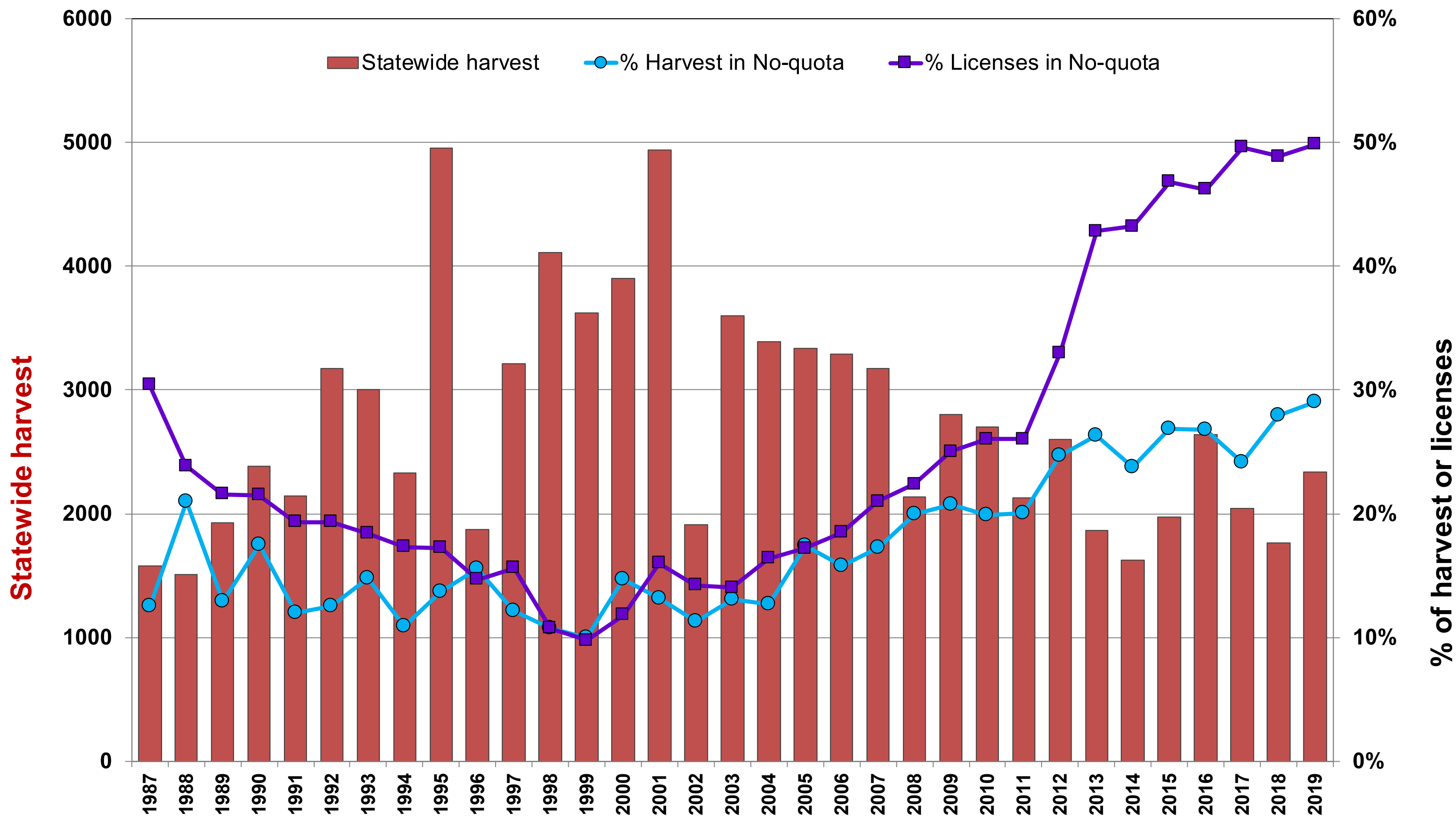


Figure 4. Trends in statewide bear harvest and proportions of harvest and licenses in the no-quota zones, 1987–2019.

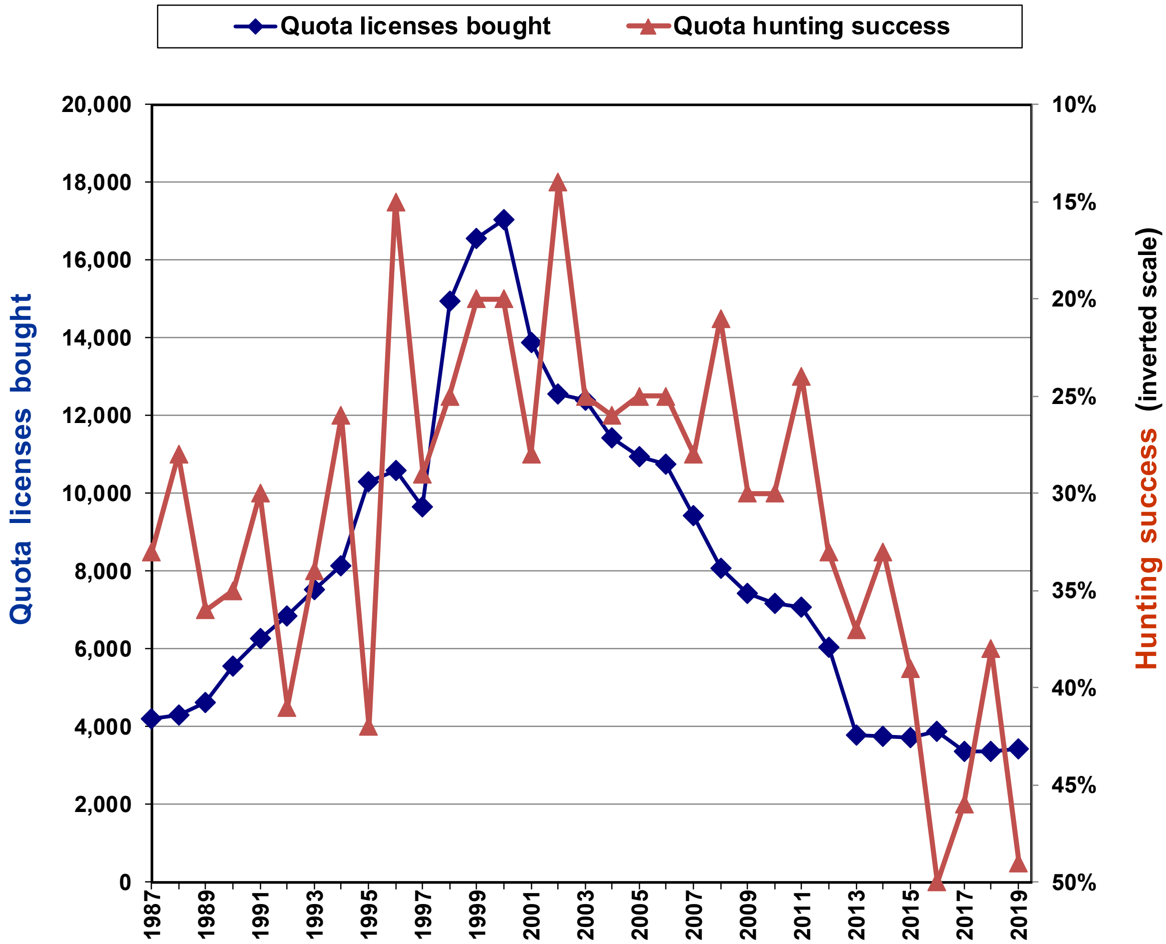


Figure 5. Relationship between licenses sold and hunting success (note inverted scale) in quota zone, 1987–2019 (quota and no-quota zones first partitioned in 1987). Number of licenses explains 53% of variation in hunting success during this period. Large variation in hunting success is also attributable to food conditions (e.g., during 2013–2019, when licenses were held relatively constant).

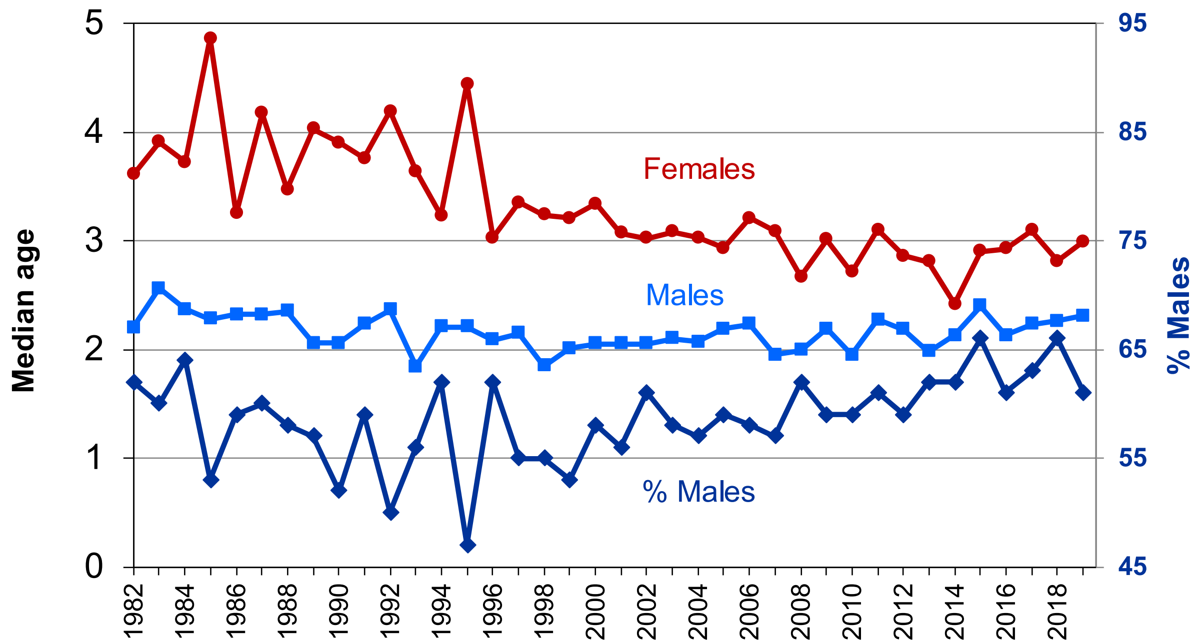


Figure 6. Statewide median ages (years) and sex ratio of harvested bears, 1982–2019.

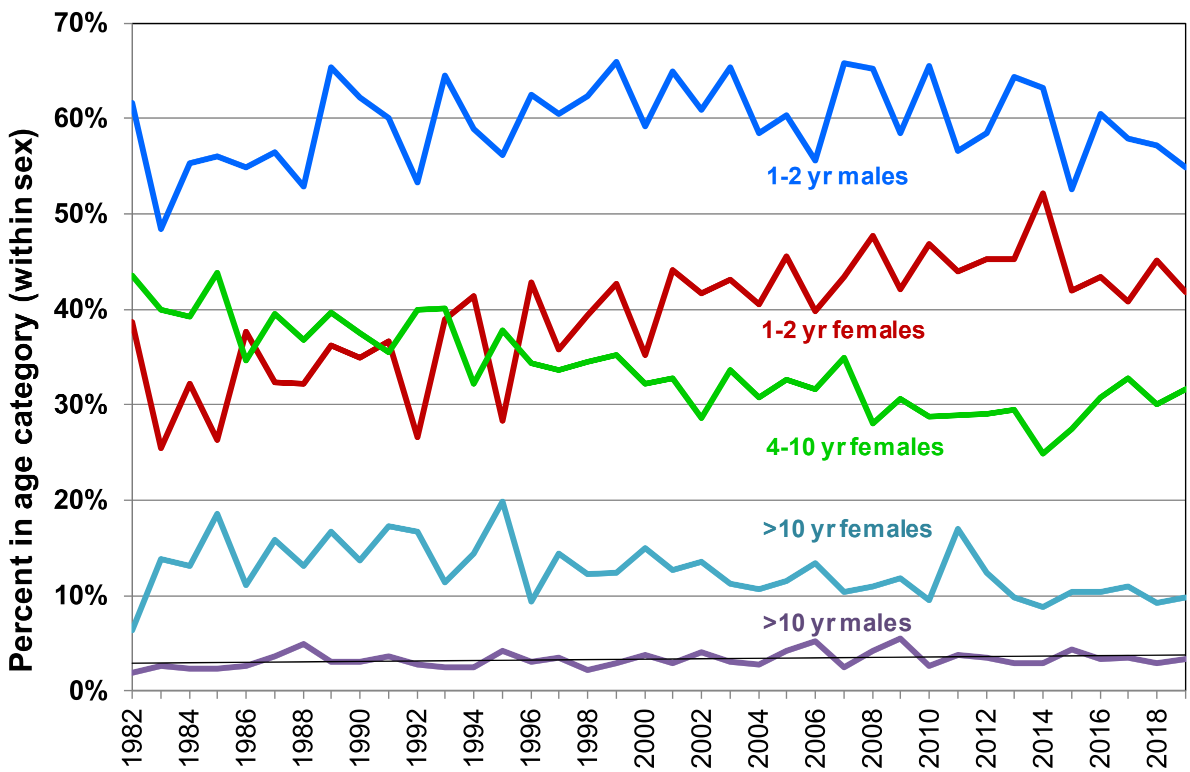


Figure 7. Statewide harvest structure: proportion of each sex in age category, 1982–2019.

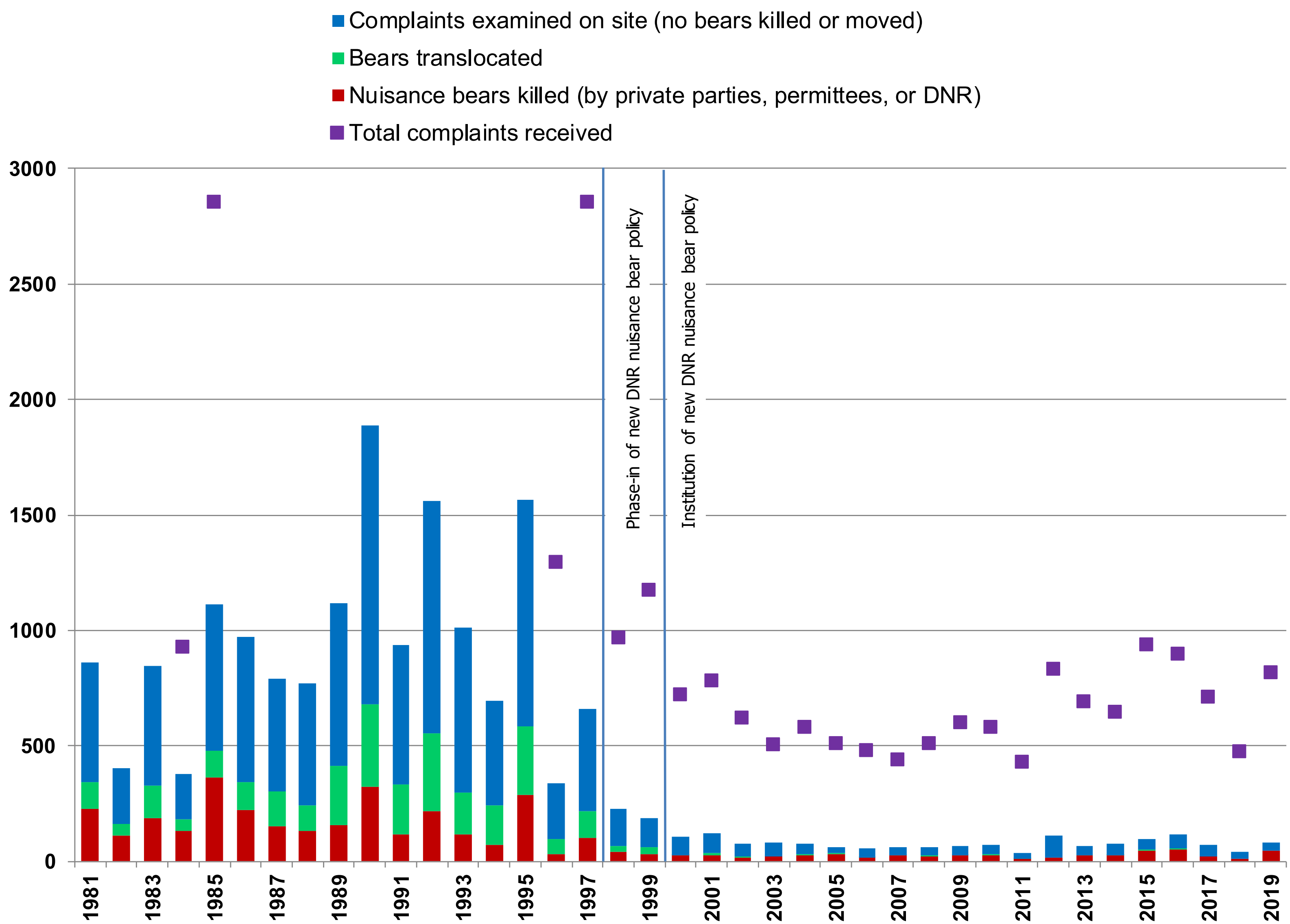


Figure. 8. Trends in nuisance bear complaints, and nuisance bears killed and moved, 1981–2019, showing dramatic effect of change in nuisance bear policy, and slight increasing trend over past decade.

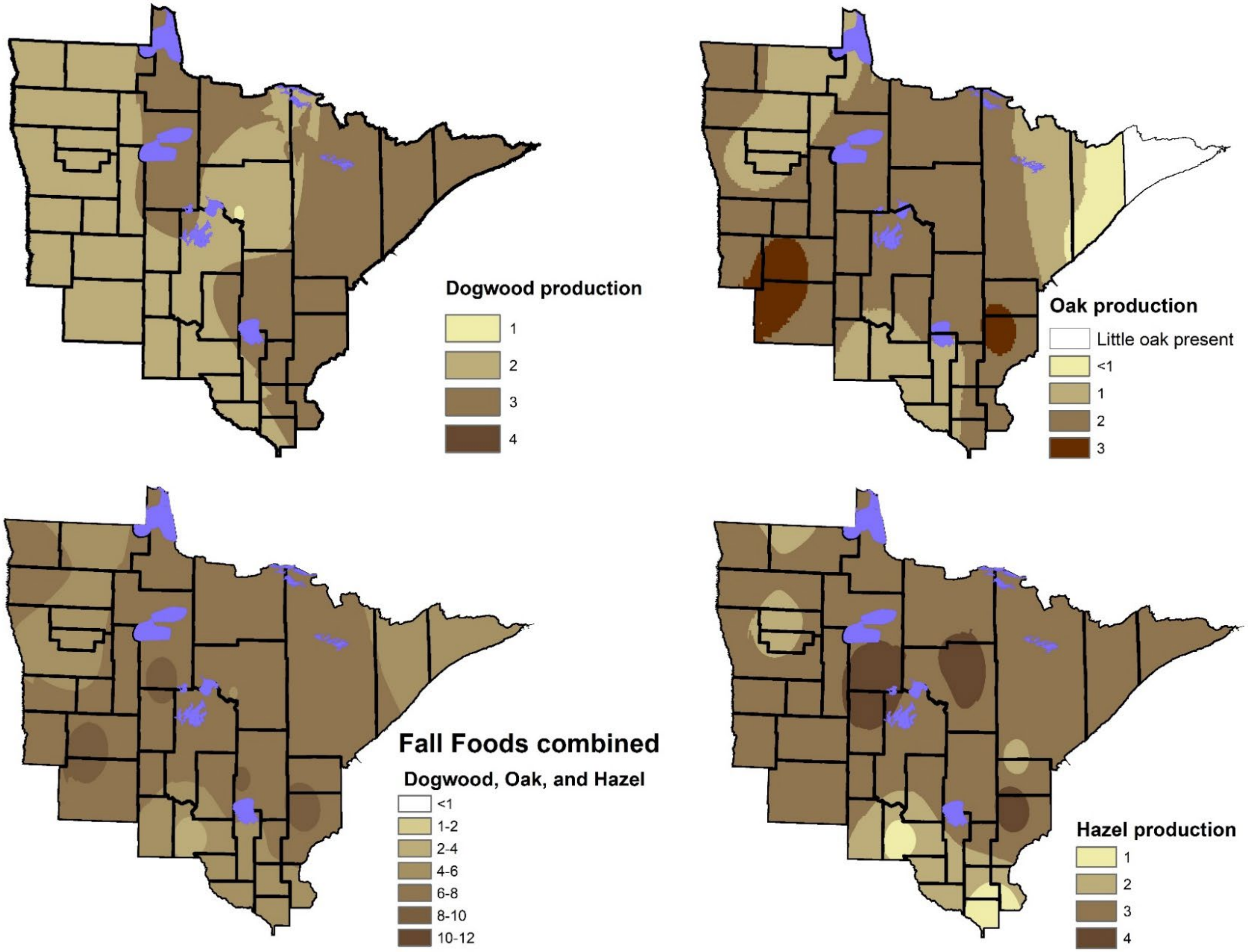


Figure 9. Production of fall bear foods (dogwood, oak, hazel) across Minnesota, 2019.

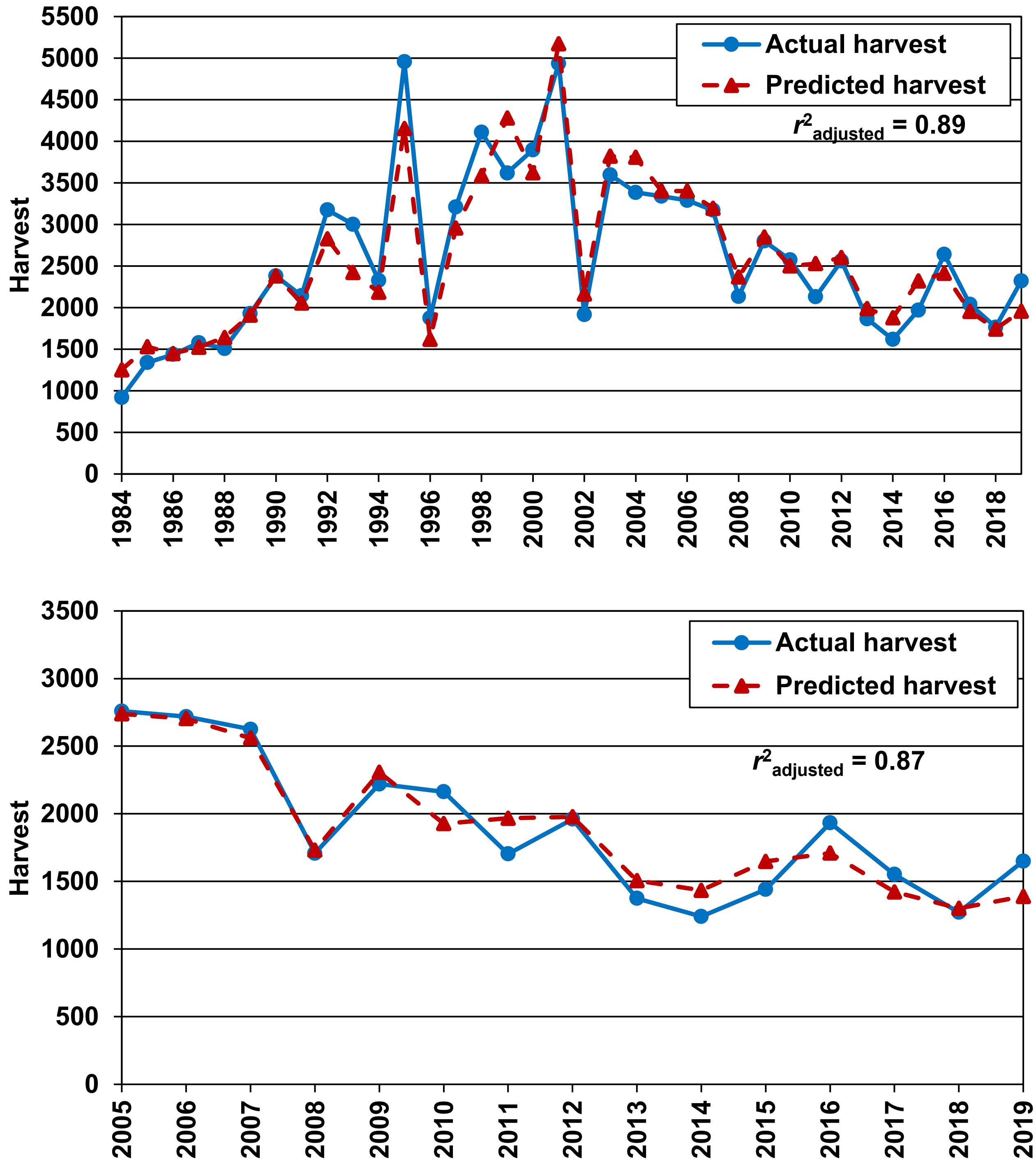


Figure 10. Number of bears harvested vs. number predicted to be harvested based on number of hunters and fall food production — top panel: statewide 1984–2019; bottom panel: quota zone only, most recent 15 years. Regression for both datasets included an interaction term between food and hunters to better predict the drastic changes in harvest when fall foods were extremely high or low.

2020 MINNESOTA SPRING GROUSE SURVEYS

Charlotte Roy, Forest Wildlife Populations and Research Group

SUMMARY OF FINDINGS

The Minnesota DNR coordinates ruffed grouse (*Bonasa umbellus*) and sharp-tailed grouse (*Tympanuchus phasianellus*) surveys each spring with the help of wildlife staff and cooperating federal, tribal, and county biologists. In 2020, Governor Walz issued Executive Orders 20-20 and 20-33, directing state employees to stay home except to perform essential work during 27 March – 4 May because of the COVID-19 pandemic. Federal and tribal biologists were exempted from these Executive Orders and were able to conduct fieldwork while social distancing to prevent the spread of COVID-19. Observers conducted ruffed grouse surveys in the northern portion of the state between 21 April – 13 May, but surveys in southern regions did not occur during the survey window. Mean ruffed grouse drums per stop (dps) were 1.6 statewide (95% confidence interval = 1.2–1.9) which is similar to last year, but the lack of surveys in the southern part of the state, a region where survey counts are usually lower, is likely causing the statewide index to be higher than it would be if southern regions were included. In the northern survey regions, counts were similar to or down from last year. High points in the population cycle occur on average every 10 years, and surveys indicate that the last peak was in 2017. Ruffed grouse in Minnesota are currently in the declining phase of the 10-year cycle.

DNR Wildlife Staff did not conduct sharp-tailed grouse surveys during 2020 due to the Governor's Stay at Home Orders during the COVID-19 pandemic. Thus, sharp-tailed grouse survey data are not available this year.

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. Sharp-tailed grouse (*Tympanuchus phasianellus*) are also popular among hunters, with an annual harvest of 5,000–22,000 birds since the early-1990s and 4,000–10,000 hunters in Minnesota.

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

The first surveys of sharp-tailed grouse 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.

METHODS

Ruffed Grouse

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 System (ECS) section. Routes that traversed section boundaries were included in the means for both sections. Because the number of routes within sections 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.

The COVID-19 pandemic affected the operation of ruffed grouse surveys in 2020. Governor Walz restricted non-essential fieldwork under Executive Orders 20-20 and 20-33 during 27 March – 4 May to prevent the spread of COVID-19. Usually ruffed grouse drumming surveys are completed during 8 – 30 April in the southern part of the state, 15 April – 5 May in the central region, and 20 April – 10 May in the northern part of the state, with some flexibility to match the peak of drumming when it occurs outside these survey windows. Thus, DNR Wildlife Staff missed the entire survey window in the southern region, began at the tail end of the window in the central region, and began in the last quarter of the survey window in the north. Nevertheless, some cooperators were exempt from the Executive Orders (e.g., federal biologists with the Forest Service and tribal biologists), and these cooperators conducted surveys when DNR Wildlife Staff could not. Many external cooperators also ran additional routes to maintain the integrity of the long-term data set, which is of value to their respective natural resource agencies, and because they could perform the survey while adhering to social distancing guidelines. The Governor issued Executive Order 20-48, allowing for “field research, monitoring, and surveying” to resume on 4 May, and the DNR Commissioner approved some DNR Wildlife Staff to conduct ruffed grouse surveys on 4 May. Observers conducted a few ruffed grouse surveys in the southern part of the state after the usual survey window and the peak in drumming, but I did not include these surveys in the analysis to ensure consistency in protocol and better comparability among years. General adherence to these protocols facilitates interpretation of population patterns in the context of the 10-year cycle.

SHARP-TAILED GROUSE

Wildlife staff and volunteers usually survey known sharp-tailed grouse lek locations in the Northwest (NW) and East Central (EC) portions of the state (Figure 2) during the peak in lek attendance, which usually occurs in the latter half of April and the first week of May. Although Governor Walz exempted “field research, monitoring and surveying” on 4 May, staff participation in sharp-tailed grouse surveys was not approved in time to complete the work. Therefore, DNR Wildlife Staff did not conduct any sharp-tailed grouse surveys during the peak in lek attendance in 2020. Unlike ruffed grouse surveys, few external cooperators participate in sharp-tailed grouse surveys.

RESULTS & DISCUSSION

Ruffed Grouse

Observers from 11 cooperating organizations surveyed 102 routes (80% of all routes) between 21 April and 13 May 2020, with 84% of northern routes completed and 42% of southern routes completed. Most routes (89%) were surveyed between 21 April and 10 May, with a median survey date of May 6, which is similar to last year (May 4) and the median survey date for the most recent 10 years (May 3). Observers reported Excellent (61%), Good (37%), and Fair (2%) survey conditions for 95 routes reporting conditions.

Statewide counts of ruffed grouse drums averaged 1.6 dps (95% confidence interval = 1.2–1.9 dps) during 2020 (Figure 3). Drum counts were 1.7 (1.3–2.0) dps in the Northeast survey region (*n* = 92 routes), 1.2 (1.0–1.3) dps in the Northwest survey region (*n* = 5), 1.2 (0.4–2.2) dps in the

Central Hardwoods survey region (n = 10), and no routes were completed during the appropriate survey window in the Southeast survey region (Figure 4a-d).

Statewide drum counts were similar to last year. I received 5 surveys from 2019 after the report was written last year, and updated results are included here. The southern survey regions tend to have lower average counts than the northern regions each year, and because southern regions were not surveyed in 2020, the statewide index is likely higher than it would be if southern routes were included. In the Northeast and Northwest, counts were similar to or down from last year, respectively. In the Central Hardwoods, observers surveyed only the northern portion of the region where counts tend to be higher, which likely explains the slightly higher, although not statistically different, dps in this region in 2020 compared to 2019. The most recent peak in the 10-year cycle occurred in 2017. Although peaks in the cycle occur on average approximately every 10 years, they vary from 8 to 11 years apart (Figure 3). Recent survey data indicate that ruffed grouse are in the declining phase of the 10-year cycle in Minnesota.

Sharp-tailed Grouse

Cooperators and staff did not collect sharp-tailed grouse survey data during the survey window in 2020. Survey data from recent years indicate a declining trend in both the NW and EC survey regions. The EC population has declined the most, with fewer than 300 birds (163 – 286) counted annually since 2013, and a drop in leks counted from 70 in 2010 to 30 in 2019. Continued monitoring of these populations will provide information that wildlife managers can use to make management decisions.

ACKNOWLEDGMENTS

I would like to extend a special thanks to federal biologists from the Superior National Forest (USDA Forest Service), and tribal biologists with 1854 Treaty Authority and White Earth Reservation for surveying additional ruffed grouse routes this spring while exempted from the Governor's Stay at Home Order. The extra efforts of H. Becker, T. Brannock, D. Garrison, D. Grosshuesch, S. Malick-Wahls, D. McArthur, D. Ryan, S. Swanson, M. Swingen, and others ensured that surveys were conducted during the appropriate temporal window, and that survey data collected annually since 1949 and used by numerous natural resource agencies and cooperators to make decisions, could continue during the pandemic. The ruffed grouse survey was also accomplished this year through the combined efforts of staff and volunteers at Chippewa National Forests; Fond du Lac and Red Lake Reservations; Blandin Paper; Beltrami County and Cass County Land Departments; and DNR staff at Baudette, Bemidji, Cloquet, Crookston, Detroit Lakes, Fergus Falls, Grand Rapids, International Falls, Park Rapids, Red Lake WMA, Roseau River WMA, Sauk Rapids, Thief Lake WMA, Thief River Falls, Tower, and Two Harbors work areas. Several other staff and volunteers usually participate in the ruffed grouse drumming survey but were not able to during the appropriate survey window due to the pandemic. These work areas included Aitkin, Brainerd, Carlos Avery Wildlife Management Area, Karlstad, Little Falls, Mille Lacs WMA, Rochester, Whitewater WMA, and Winona work areas, as well as Vermilion Community College, Leech Lake Reservation, and Agassiz National Wildlife Refuge. Gary Drotts, John Erb, and Rick Horton organized an effort to enter the ruffed grouse survey data for 1982–2004, and Doug Mailhot and another volunteer helped enter the data. In 2020, Jackson Bates and Nicole Dotson entered ruffed grouse survey data for 1979-1981. I would also like to thank Lindsey Shartell and Leslie McInenly for making helpful comments on this report. This work was funded in part through the Federal Aid in Wildlife Restoration Act.

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

	Statewide			Northwest[a]			East Central[a]		
Year	Mean	95% CI[b]	n[c]	Mean	95% CI[b]	n[c]	Mean	95% CI[b]	n[c]
2004	11.2	10.1 – 12.3	183	12.7	11.3 – 14.2	116	8.5	7.2 – 9.9	67
2005	11.3	10.2 – 12.5	161	13.1	11.5 – 14.7	95	8.8	7.3 – 10.2	66
2006	9.2	8.3 – 10.1	161	9.8	8.7 – 11.1	97	8.2	6.9 – 9.7	64
2007	11.6	10.5 – 12.8	188	12.7	11.3 – 14.1	128	9.4	8.0 – 11.0	60
2008	12.4	11.2 – 13.7	192	13.6	12.0 – 15.3	122	10.4	8.7 – 12.3	70
2009	13.6	12.2 – 15.1	199	15.2	13.4 – 17.0	137	10.0	8.5 – 11.7	62
2010	10.7	9.8 – 11.7	202	11.7	10.5 – 12.9	132	8.9	7.5 –10.5	70
2011	10.2	9.5 – 11.1	216	11.2	10.2 – 12.2	156	7.8	6.7 – 8.9	60
2012	9.2	8.2 – 10.3	153	10.7	9.3 – 12.3	100	6.3	5.4 – 7.3	53
2013	9.2	8.2 – 10.2	139	10.5	9.3 – 11.7	107	4.8	3.8 – 5.9	32
2014	9.8	8.8 – 10.9	181	10.9	9.8 – 12.1	144	5.4	4.5 – 6.4	37
2015	9.8	8.9 – 10.7	206	10.8	9.9 – 11.9	167	5.3	4.4 – 6.4	39
2016	9.5	8.6 – 10.5	182	10.2	9.2 – 11.4	152	6.0	4.9 – 7.3	30
2017	9.7	8.7 – 10.8	181	10.4	9.2 – 11.8	141	7.2	5.8 – 8.6	40
2018	9.3	8.4 – 10.3	161[d]	9.8	8.8 – 10.9	130	7.3	5.4 – 9.6	30
2019	10.2	9.1 – 11.4	152	11.0	9.7 – 12.3	122	7.2	5.4 – 9.5	30
2020	NA[e]	NA	NA	NA	NA	NA	NA	NA	NA

[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

[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.

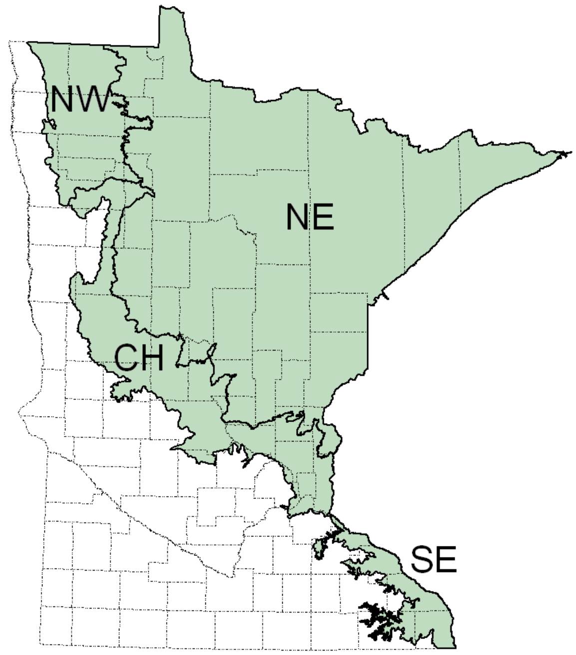


Figure 1. Survey regions for ruffed grouse in Minnesota. Northwest (NW), Northeast (NE), Central Hardwoods (CH), and Southeast (SE) survey regions are depicted relative to county boundaries (dashed lines) and influenced by the Ecological Classification System.

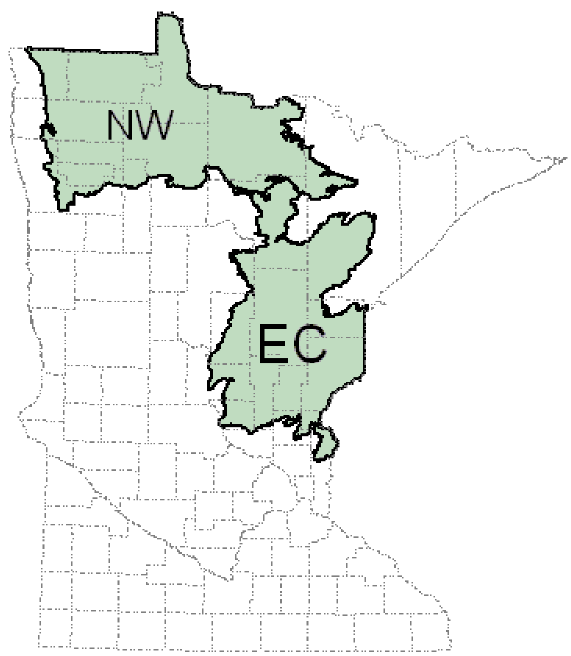


Figure 2. Survey regions for sharp-tailed grouse in Minnesota. Northwest (NW) and East Central (EC) survey regions are depicted relative to county boundaries (dashed lines) and influenced by Ecological Classification System Subsection boundaries.

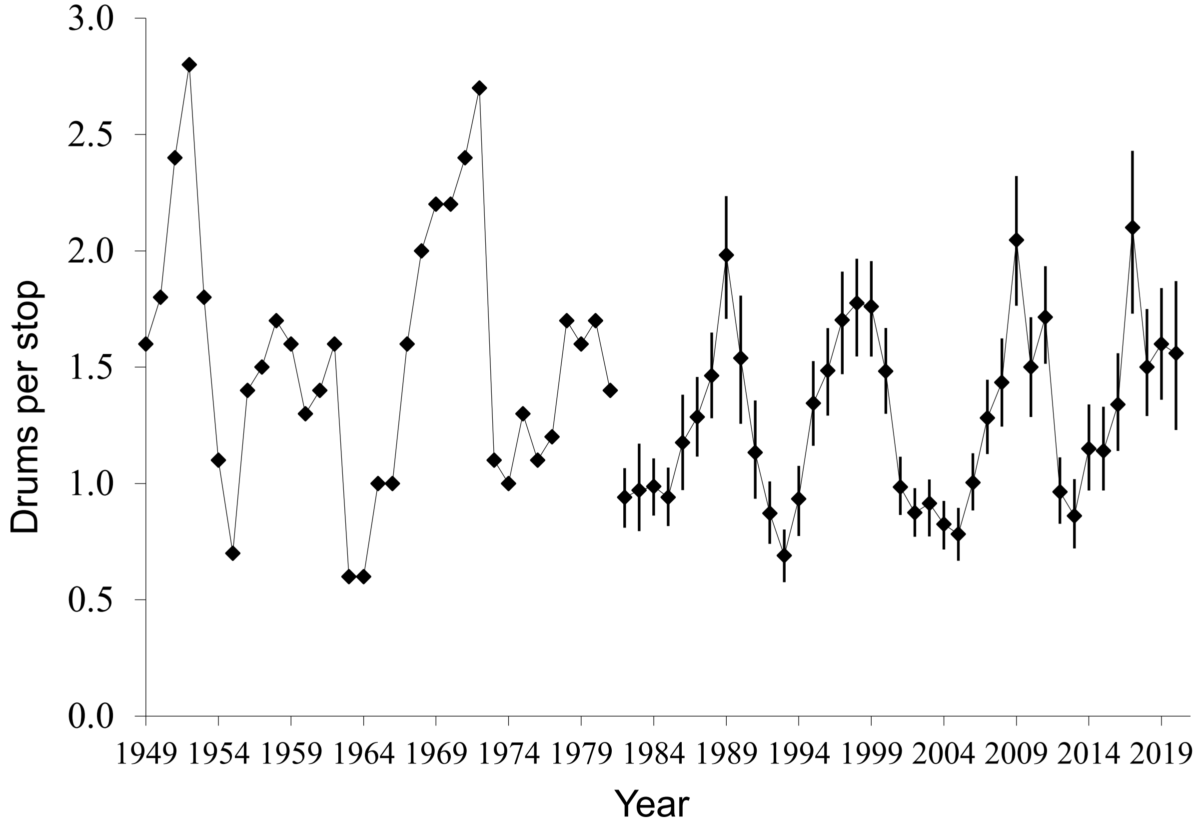
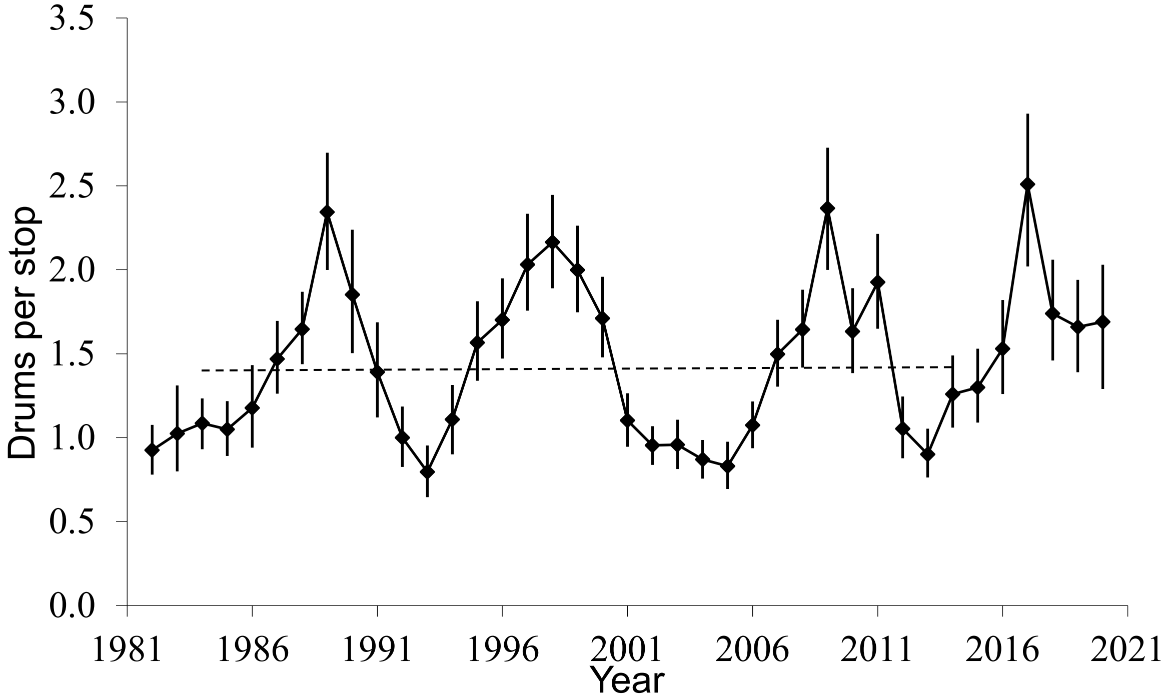
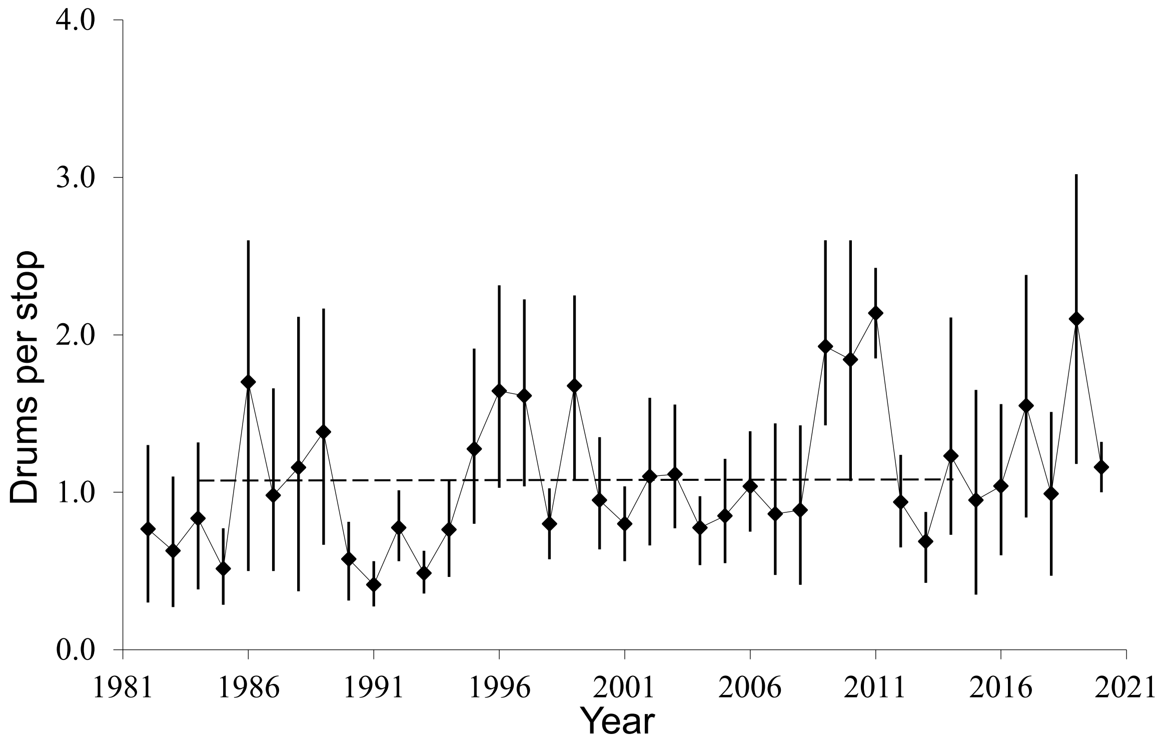


Figure 3. Statewide **ruffed grouse** population index values in Minnesota. Bootstrap (95%) confidence intervals (CI) are provided after 1981, but different analytical methods were used prior to this and thus CI are not available for earlier years. The difference between 1981 and 1982 is biological and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



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

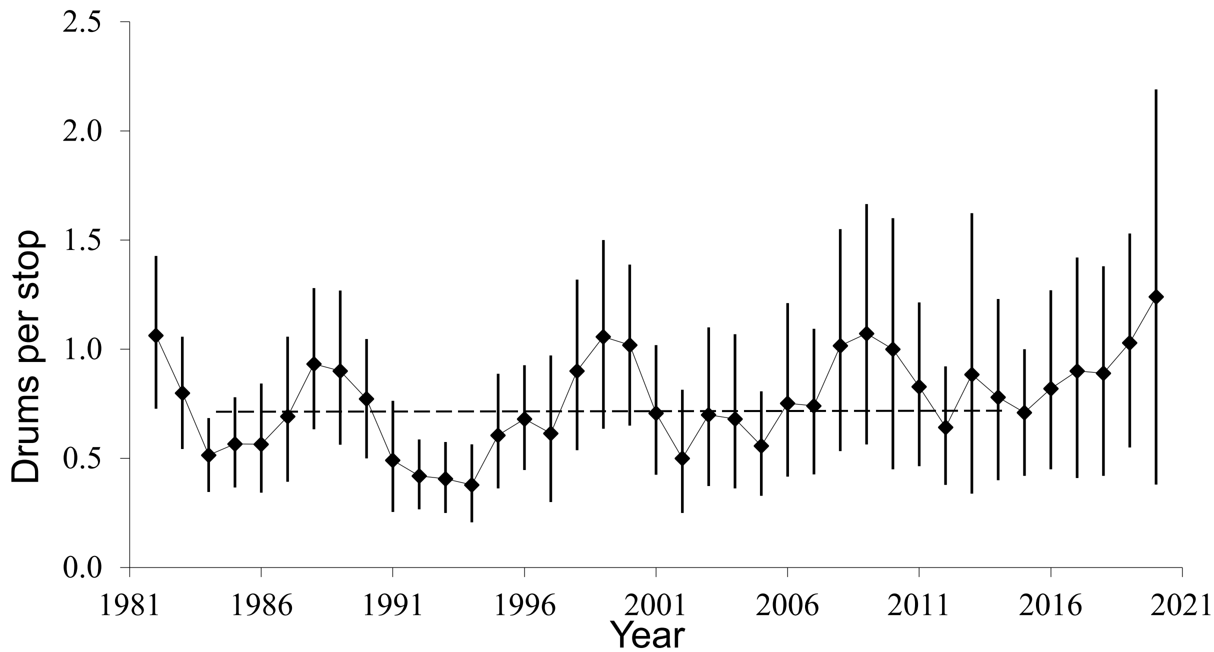
a.



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

b.

c.



d.

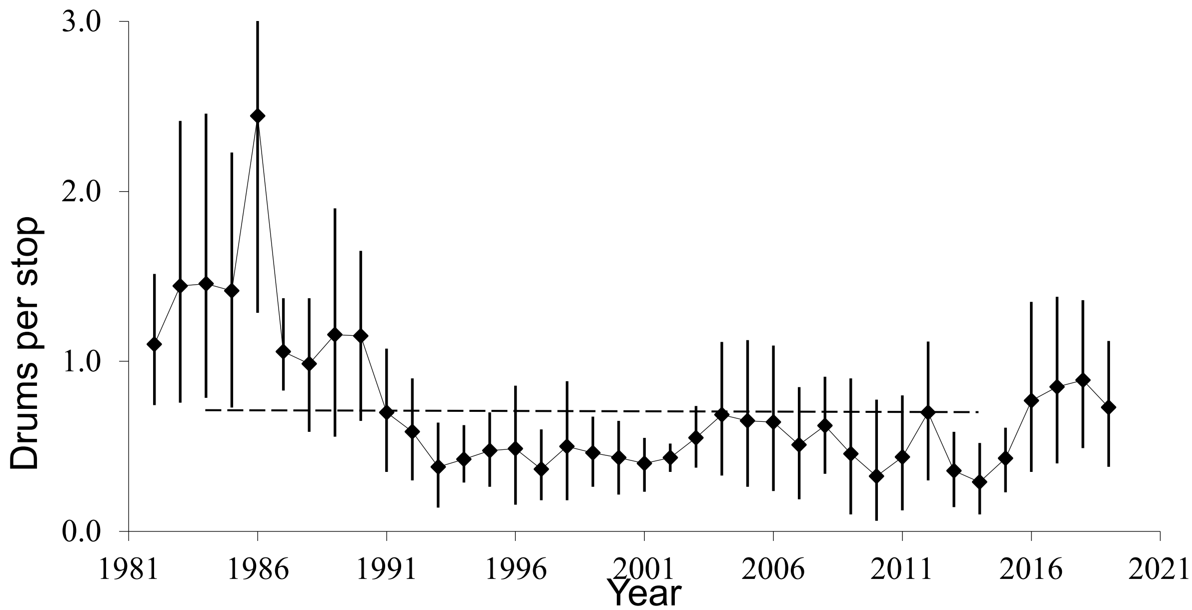


Figure 4a,b,c,d. **Ruffed grouse** population index values in the **Northeast** (a), **Northwest** (b), **Central Hardwoods** (c), and **Southeast** (d) survey regions of Minnesota. The mean for 1984-2014 is indicated by the dashed line. Bootstrap (95%) confidence intervals are provided for each mean. In the bottom panel, the CI for 1986 extends beyond area depicted in the figure. Data were not collected during the survey window in the Southeast during the COVID-19 pandemic in 2020, so the last point is from 2019.

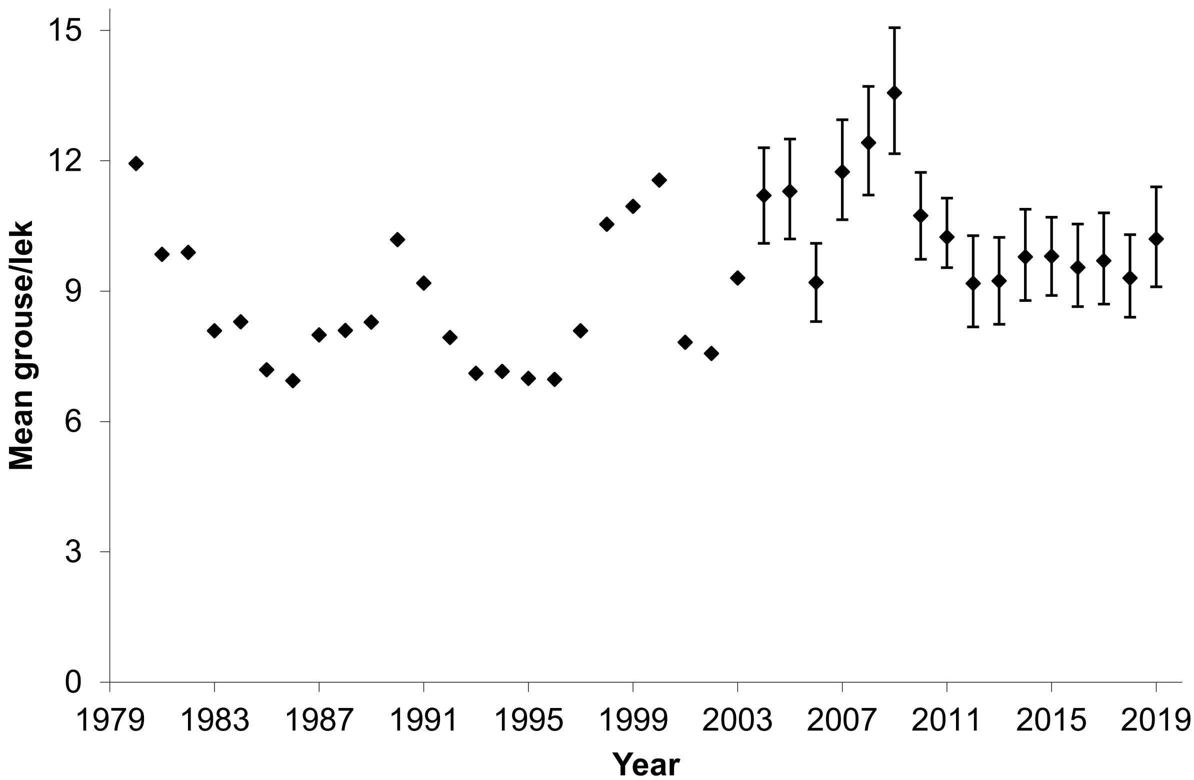


Figure 5. **Sharp-tailed grouse** counted in spring lek surveys statewide in Minnesota during 1980–2019. Bootstrap (95%) confidence intervals are provided for recent years. Annual means are not connected by lines because the same leks were not surveyed every year. No data were collected in 2020 due to the Governor’s Stay at Home Order during the COVID-19 pandemic, so data are presented through 2019.

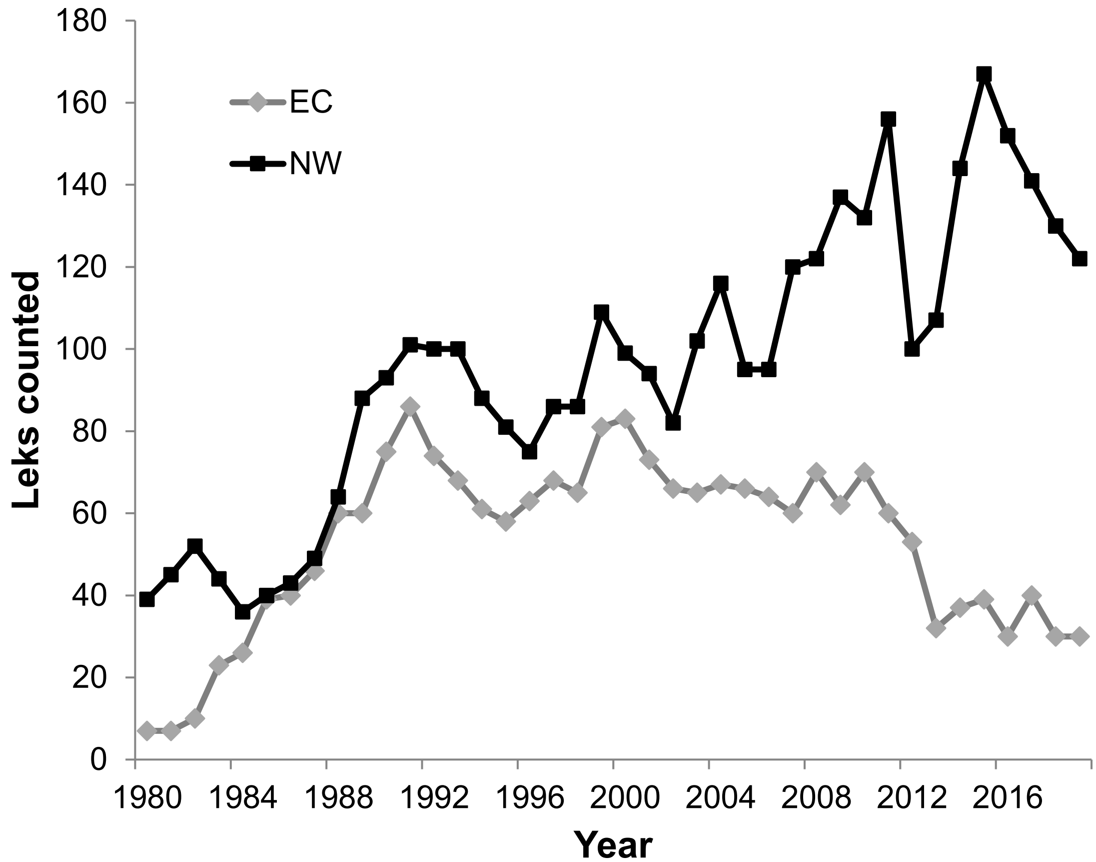


Figure 6. The number of **sharp-tailed grouse** leks with 2 or more birds counted in spring lek surveys in the Northwest (NW) and East Central (EC) survey regions of Minnesota during 1980-2019. Survey data were not collected in 2020 due to the Governor's Stay at Home Order during the COVID-19 pandemic, so data are presented through 2019.

2020 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 13 of 17 survey blocks during the spring of 2020. Observers located 39 booming grounds and counted 452 males and birds of unknown sex in the survey blocks, which is fewer than last year when all 17 blocks were surveyed. Including areas outside the survey blocks, observers located 98 booming grounds, 920 male prairie-chickens, and 84 birds of unknown sex throughout the prairie-chicken range. Estimated densities of 0.07 (0.04–0.10) booming grounds/km^2 and 11.6 (9.3–13.9) 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). However, in 2020, 4 of 7 peripheral survey blocks were not surveyed due to restrictions on nonessential fieldwork during the COVID-19 pandemic, and counts in these peripheral blocks are typically lower, which may have caused estimates of prairie-chicken densities this year to be biased high. Both population indices began to decline in 2008, with greater declines in booming grounds/km^2 and more stable estimates of males/booming ground.

INTRODUCTION

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

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

METHODS

Cooperating biologists and volunteers surveyed booming grounds in 13 of 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 $\geq$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 2020, the COVID-19 pandemic affected the implementation of the prairie-chicken survey. Four survey blocks in the periphery of the survey region, survey blocks 1 and 2 in Otter Tail County and survey blocks 2 and 3 in Wilkin County, could not be surveyed due to cooperator restrictions on nonessential field work during the pandemic. Furthermore, the 3 Norman County survey blocks and 1 block in each of Becker and Wilkin Counties were surveyed later than usual because prairie-chicken surveys were not exempted from restrictions on field work for MNDNR Wildlife Staff until May 7. For the analysis, I only used the surveyed blocks to calculate densities for the periphery of the survey region.

RESULTS & DISCUSSION

Observers from MNDNR Section of Wildlife, the U.S. Fish & Wildlife Service, and The Nature Conservancy, as well as many unaffiliated volunteers counted prairie-chickens between 10 March and 15 May 2020. Observers located 98 booming grounds and observed 920 male prairie-chickens and 84 birds of unknown sex within and outside the survey blocks (Table 1). These counts represent a minimum number of prairie-chickens in Minnesota during 2020, 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, 452 males and birds of unknown sex were counted on 39 booming grounds during 2020 (Table 2). These counts are the lowest since the standardized survey began in 2004 when 1,566 males and 95 booming grounds were counted. This contrasts with the high count of 1,618 males and 114 booming grounds in 2007. Each lek was observed an average of 3.6 times (median = 2), with 28% 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 (0.05–0.12) booming grounds/km^2 and 11.4 (9.0–13.9) males/booming ground which is similar to recent years (Table 2, Figure 2). In the 3 of the 7 peripheral survey blocks that were surveyed in 2020, densities were 0.04 (0.02–0.06) booming grounds/km^2 and 12.6 (5.7–19.5) males/booming ground. These estimates were likely biased high by the lack of surveys in 4 peripheral survey blocks during the COVID-19 pandemic; these blocks usually have low densities. For all survey blocks, the density of 0.07 (0.04–0.10) booming grounds/km^2 during 2020 was similar to densities during recent years (Table 2, Figure 3) and the average of 0.08 (0.06–0.09) booming grounds/km^2 during the 10 years preceding recent hunting seasons (i.e., 1993–2002). Similarly, the density of 11.6 (9.3–13.9) males/booming ground in all surveyed blocks during 2020 was comparable to densities during recent years and similar to the average of 11.5 (10.1–12.9) males/booming ground observed during 1993–2002 (Table 2, Figure 3). However, due to a lack of surveys in 4 peripheral survey blocks during the pandemic, estimates for all survey blocks combined are likely biased high this year.

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. 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*

ACKNOWLEDGMENTS

I would like to thank cooperators who conducted and helped coordinate the prairie-chicken survey, with a special thanks to those that stepped up to complete extra surveys this year when many were restricted from fieldwork during the pandemic. Cooperators with The Nature Conservancy included Brian Winter, Travis Issendorf, and volunteers Pat Beauzay, Matt Mecklenburg, Casey Reep, Derek Savage, and Carl Altenbernd; cooperators within MNDNR included Emily Hutchins, Rob Baden, Greg Henderson, Mark Palm, Michael Oehler, and Matt Morin; cooperators with the US Fish and Wildlife Service usually include Shawn Papon, Chad Raitz, Ben Walker, Erin Lentz, Traver Fields, and Stacy Salvevold; and numerous additional volunteers participate, including Dan Svedarsky, Doug Wells, Jon Voz, Ross Hier, Phil Doll, and Doug Hedtke. This survey was funded in part by the Wildlife Restoration (Pittman-Robertson) Program. Lindsey Shartell provided assistance and comments which improved this report.

Table 1. Minimum abundance of prairie-chickens within and outside hunting permit areas in Minnesota during spring 2020. Lek and bird counts are not comparable among permit areas or years.

Permit Area	Area (km^2)	Leks	Males	Unknown[a]
803A	1,411	11	72	0
804A	435	0	0	0
805A	267	12	90	0
806A	747	8	29	45
807A	440	17	166	0
808A	417	21	269	0
809A	744	11	130	0
810A	505	3	36	5
811A	706	1	7	0
812A	914	3	23	0
813A	925	3	44	3
PA subtotal	7,511	90	866	53
Outside PAs[b]	NA[c]	8	54	31
Grand total	NA[c]	98	920	84

[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 2020, and change in counts compared to 2019.

			2020		Change from 2019[a]	
Range[b]	Survey Block	Area (km^2)	Booming grounds	Males[c]	Booming grounds	Males[c]
Core	Polk 1	41.2	4	21	-1	-5
	Polk 2	42.0	3	35	0	3
	Norman 1	42.0	2	15	1	12
	Norman 2	42.2	1	17	-2	-3
	Norman 3	41.0	5	46	2	21
	Clay 1	46.0	8	125	1	-1
	Clay 2	41.0	3	39	1	-16
	Clay 3	42.0	6	56	2	-5
	Clay 4	39.0	0	0	-2	-7
	Wilkin 1	40.0	2	35	0	-3
	Core subtotal	415.0	34	389	2	-4
Periphery	Mahnomen	41.7	2	42	0	0
	Becker 1	41.4	2	15	-2	-2
	Becker 2	41.7	1	6	0	0
	Wilkin 2	NA	NA[d]	NA	NA	NA
	Wilkin 3	NA	NA	NA	NA	NA
	Otter Tail 1	NA	NA	NA	NA	NA
	Otter Tail 2	NA	NA	NA	NA	NA
	Periphery subtotal	124.8	5	63	-2	-2
Grand total		539.8	39	452	0	-6

[a] The 2019 count was subtracted from the 2020 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.

[d] NA = not applicable because 4 survey blocks were not completed in 2020 due to cooperator restrictions on nonessential field work during the COVID-19 pandemic.

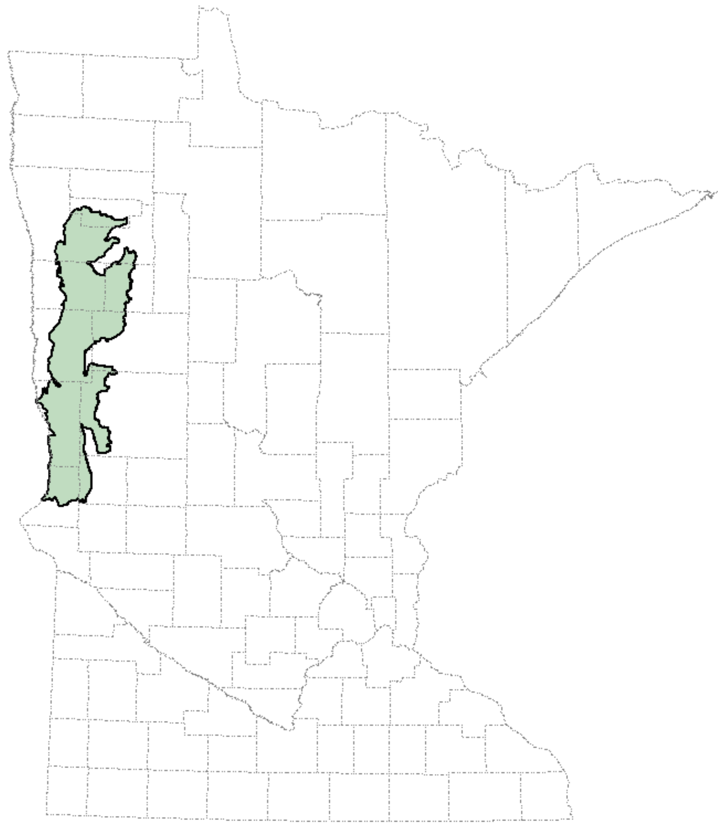


Figure 1. Primary greater prairie-chicken range in Minnesota (shaded area) relative to county boundaries. The range boundary was based on Ecological Classification System Land Type Associations and excludes some areas known to be occupied by prairie-chickens.

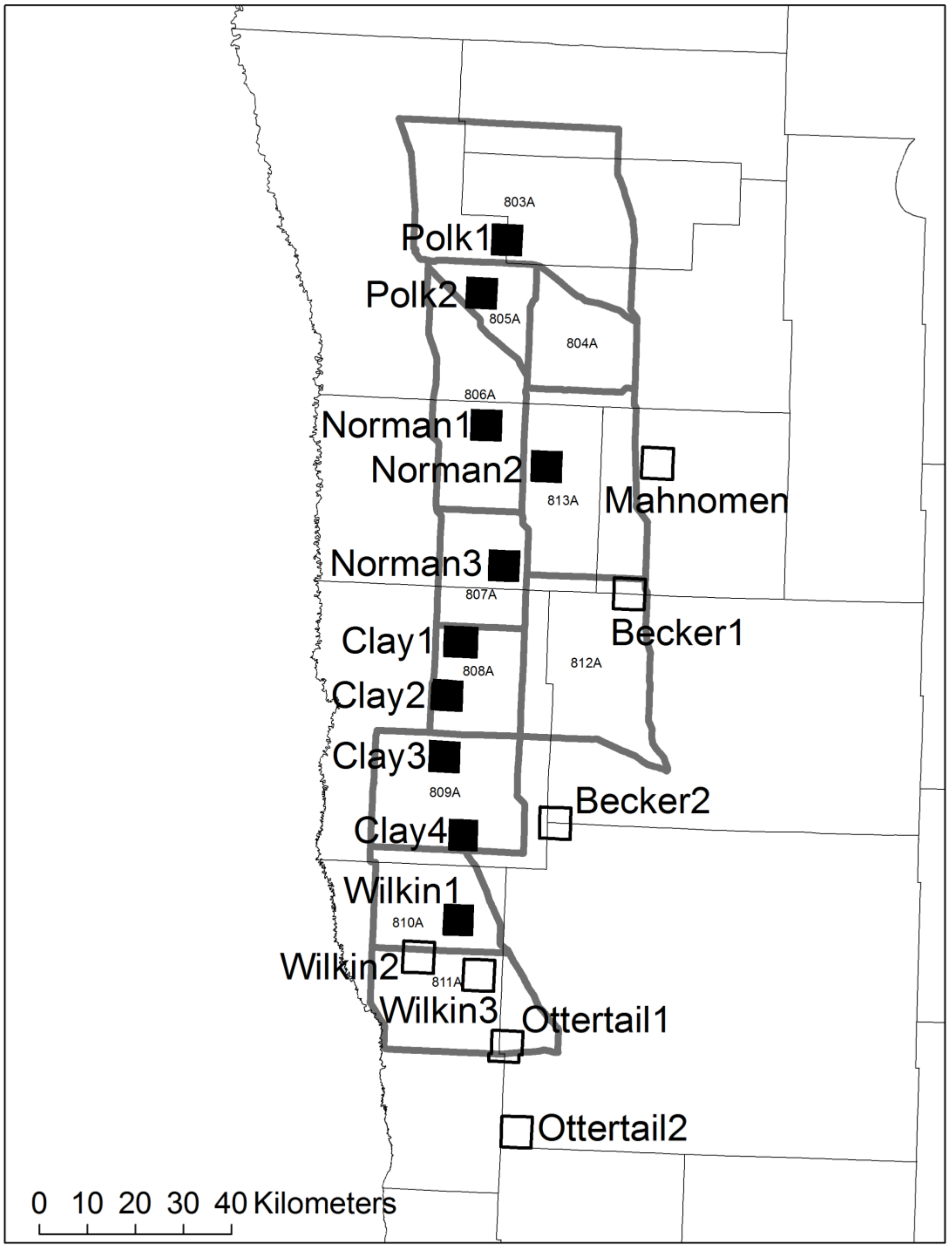


Figure 2. Prairie-chicken lek survey blocks (41 km^2, labeled squares) and hunting permit areas (thick grey lines) in western Minnesota. Survey blocks were either in the core (black) or periphery (white) of the range with a threshold of 1.0 male/km^2 in 2010, and were named after their respective counties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

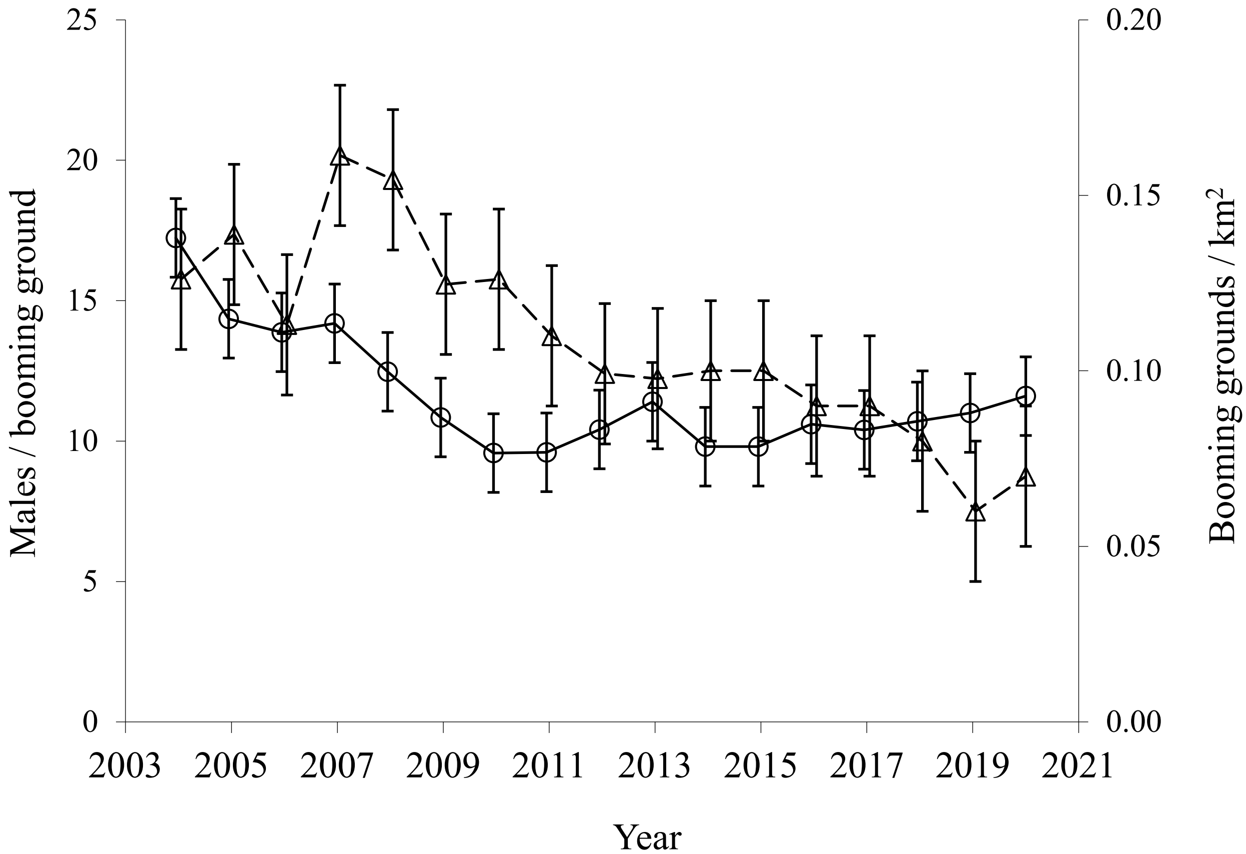


Figure 3. Mean prairie-chicken males/booming ground (circles connected by solid line) and booming grounds/km^2 (triangles connected by dashed line) in survey blocks in Minnesota with 95% confidence intervals.

DEPARTMENT OF NATURAL RESOURCES

2020 NW MN ELK SURVEYS

Doug Franke, Area Wildlife Manager, Thief River Falls

INTRODUCTION

Minnesota DNR Fish and Wildlife and Enforcement staff used a single fixed-wing aircraft (Cessna 185 Skywagon) to conduct aerial elk surveys for the Grygla and Lancaster elk herds between February 11th and February 19th, 2020. As in the past, survey transects were spaced 1/5 mile apart and flown at an altitude of 300 to 400 feet and speeds of 80-90 mph. A pilot and two observers recorded elk locations and documented antlerless and antlered elk. Cow and calf elk were combined and recorded as antlerless since differentiating the two is difficult due to moving animals and the altitude and speed of the fixed-wing aircraft. Antlered elk were recorded as either branch antlered or spike bulls.

The Thief Lake Area Wildlife Manager requested to exclude the lower 22 survey plots of the Grygla survey block this year and in future years due to the large number of cattle farms and lack of elk observations in that area for the past decade. The same predetermined transects used in 2019 were flown for the Lancaster survey block. The Caribou-Vita elk survey block has not been completed at the time of this report pending improved snow conditions in Manitoba.

Observability conditions were considered very good this year. Snow depths and snow condition were fairly consistent and considered very good for both elk survey blocks. Snow depths ranged from 12 inches in the Grygla area and 16 to 20 in the Lancaster area. Weather conditions were average for this time of the year with temperatures ranging from a low of -20°F to a high of 28°F with sunny to cloudy skies. There was a one-day weather delay between the first and second days of the Grygla survey; and there was a two-day weather delay between the first and second days of the Lancaster survey and due to snow, low ceilings, and high winds.

Grygla Survey Block

This survey started on February 11th and after a one-day weather delay was completed on February 13, 2020. The area surveyed was 122 mi^2 (22 square miles were not flown this year as previously mentioned). Total aircraft engine time to complete this survey (takeoff to landing) was 9.8 hours. The fixed-wing crew recorded elk at 5 separate locations within the survey boundary--all elk were observed on the second survey day. Total elk observed was 24 and included: 14 antlerless and 10 bulls (9 branch antlered and 1 spike). Of special note is that all but one of the elk were located on State Wildlife Management Area land at the time of the survey.

Lancaster Survey Block—Water Tower and Percy WMA herds

This survey started on February 16th and was completed on February 19, 2020. The area surveyed was the same 167 mi^2 area that has been flown the past several years. Total aircraft time to complete the survey was 14.7 hours (takeoff to landing). The fixed-wing crew recorded elk at 10 separate locations within the survey boundary. Total elk recorded within the Lancaster block was 102 and included: 69 antlerless and 33 bulls (27 branch antlered and 6 spikes).

The Water Tower herd had 41 antlerless elk and was again located in the same exact woodlot that the antlerless group was recorded in during the 2019 and 2018 surveys. This group was located one mile east of this woodlot in 2017. In addition, there were 12 branch antlered and 3 spike bulls located within 1 to 7 miles of the antlerless group.

The Percy WMA herd had 29 antlerless that were located approximately 0.5 miles east of the Percy WMA (about 5 miles southeast of where they had spent the winters of 2018 and 2019). For the first time since I have been surveying these elk (2013), the antlerless herd was actually split into two groups of 19 and 9 animals separated by 1.25 miles. The antlerless groups for all the elk herds in the recent past have always been observed together during winter months. There were 13 branch antlered and 3 spike bulls observed 3.5 miles north of the antlerless group(s). Two branch antlered bulls were located 3.5 miles west of Lancaster.

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

This survey block was not completed this year. Poor snow conditions in Manitoba and lack of funding precluded the Manitoba Wildlife staff from initiating the survey. Table 2 was included again this year as a reference—it details the age/sex breakdown for these two populations in Canada for 2017 and 2018.

Table 1 on page three summarizes MN DNR elk observations during the past five years of NW MN aerial elk surveys. The maps on pages 4 and 5 show the 2020 locations of elk within each survey block. The map on page 6 shows elk observations during surveys conducted from 2004 to 2018.

ACKNOWLEDGMENTS

I would like again to thank all those that helped with the survey this year, especially the fixed-wing pilot Bob Geving who provided safe flying and A+++ landings for all of us (we won't hold the flat tire on the last landing against you!). Observers this year included: Kyle Arola (Thief Lake Area Wildlife Manager), Jason Wollin (Karlstad Assistant Area Wildlife Manager), and myself. Special thanks again to Brian Haroldson who put together all of the survey materials and computer used during the survey—much appreciated!

Table 1. Comparison of aerial survey elk observations between 2016 and 2020 for the Lancaster, Caribou-Vita, and Grygla herds.

	Lancaster					**Caribou-Vita (US side of border)**					**Grygla**				
	2016	2017	2018	2019	2020	2016	2017	2018	2019*	2020*	2016	2017	2018	2019	2020
Spike bull	6	2	5	11	6	0	0	1	-	-	2	4	2	1	1
Branch antlered bull	12	14	13	22	27	6	1	6	-	-	9	6	6	10	9
Total bulls	**18**	**16**	**18**	**33**	**33**	**6**	**1**	**7**	**-**	**-**	**11**	**10**	**8**	**11**	**10**
Antlerless	**34**	**45**	**57**	**61**	**69**	**4**	**0**	**0**	**-**	**-**	**10**	**7**	**7**	**8**	**14**
Total elk	**52**	**61**	**75**	**94**	**102**	**10**	**1**	**7**	**-**	**-**	**21**	**17**	**15**	**19**	**24**

* Survey was not completed in 2019 or 2020

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

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

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

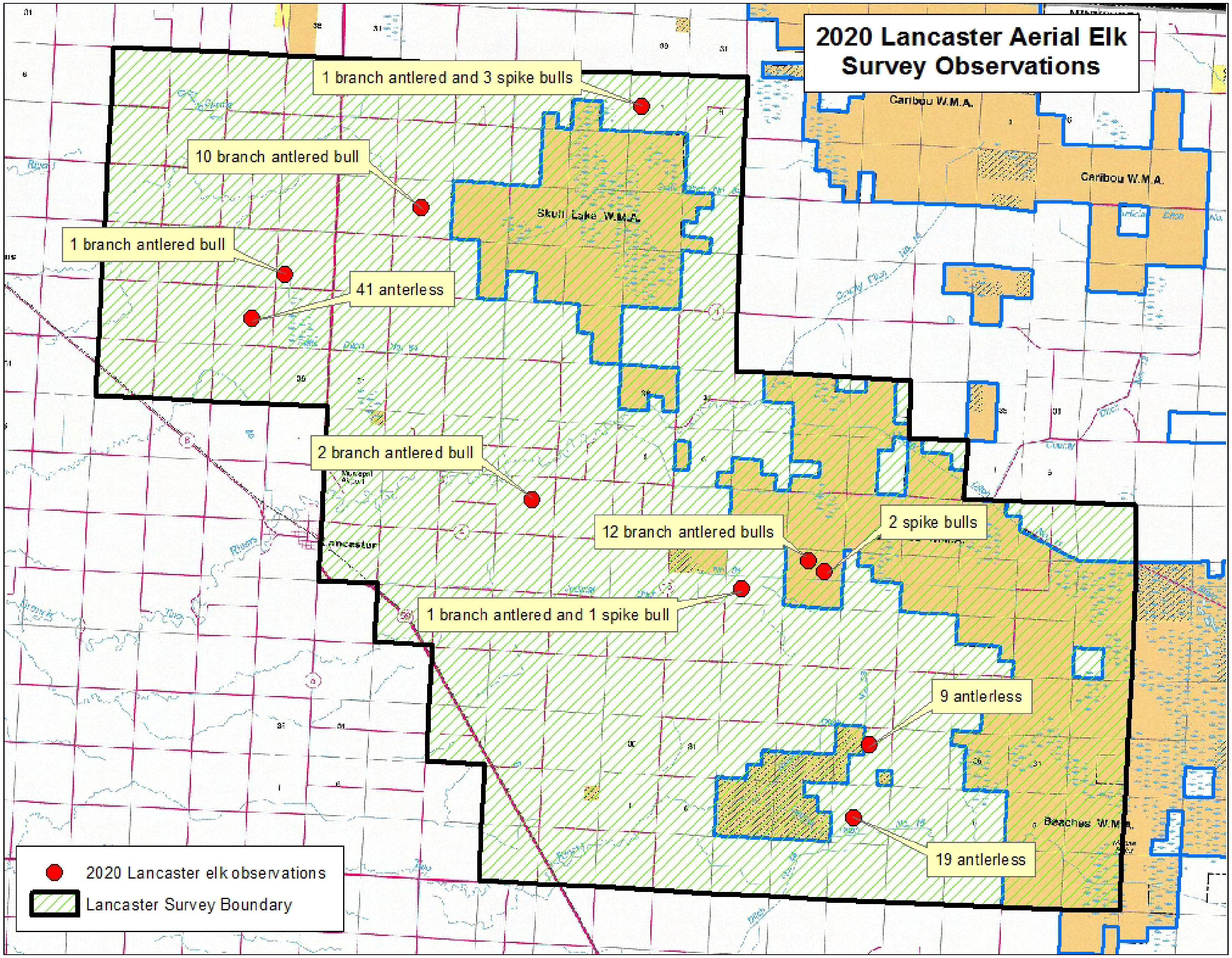


Figure 1. Locations of elk observed within the Lancaster area survey blocks, 2020

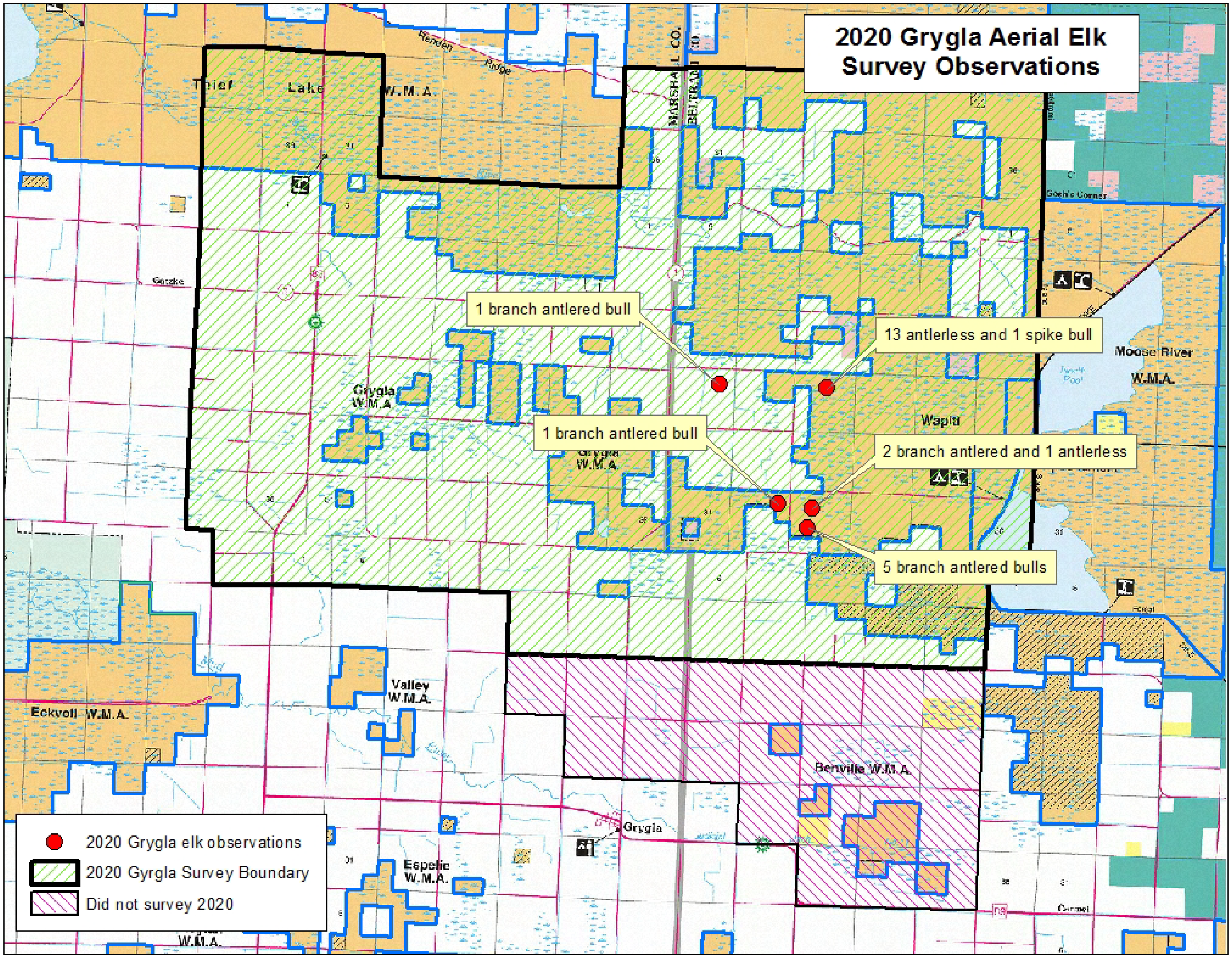


Figure 2. Locations of elk observed within the Grygla area survey blocks, 2020

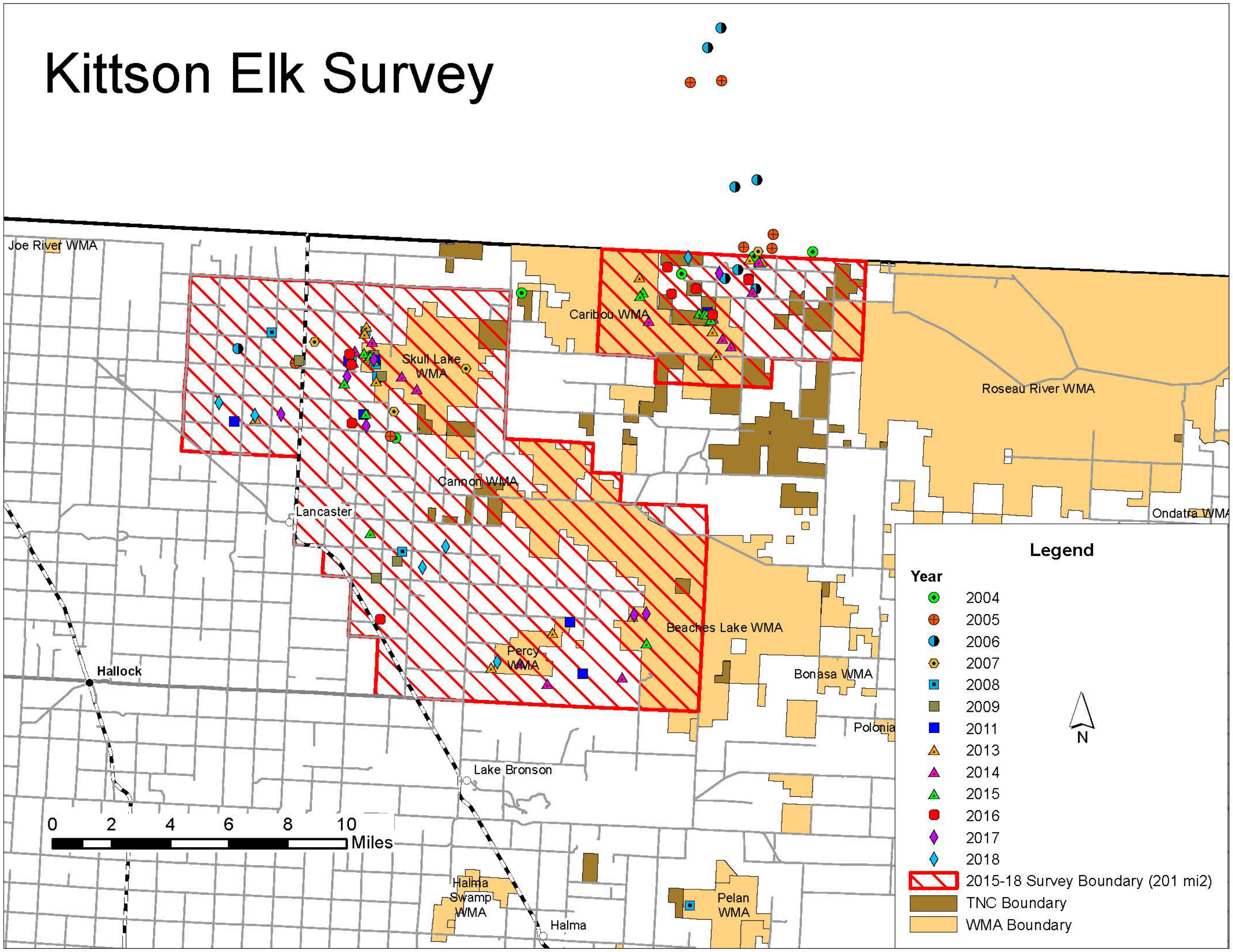


Figure 3. Locations of elk observed within the Kittson area survey blocks, 2020

2020 AERIAL MOOSE SURVEY

Glenn D. DelGiudice, Forest Wildlife Populations and Research Group

INTRODUCTION

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

METHODS

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

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

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

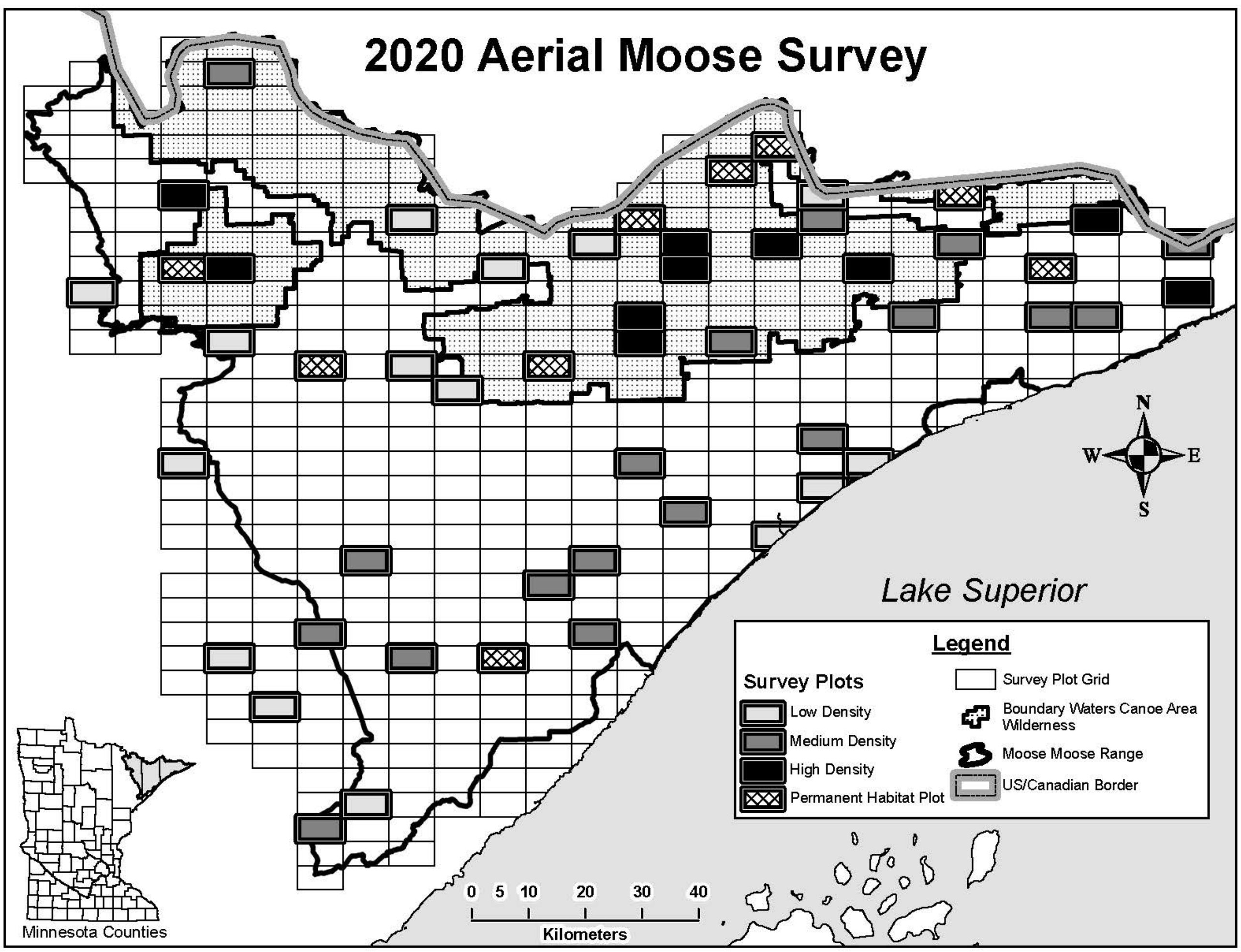


Figure 1. Moose survey area and 52 sample plots flown in the 2020 aerial moose survey.

RESULTS AND DISCUSSION

The survey was conducted from 6 to 17 January 2020. It consisted of 9 actual survey days, and as from 2014 to 2019, it included a sample of 52 survey plots. This year, based on optimal allocation analyses, we surveyed 15 low-, 18 medium-, and 10 high-density plots, and the 9 permanent or habitat plots (Giudice 2020). Generally, 8” of snow cover is our minimum threshold depth for conducting the survey. Snow depths were greater than 16” on 100% of the sample plots. Overall, survey conditions were rated as good for 88%, fair for 12%, and poor for 0% of the plots when surveyed. Average survey intensity was 48 minutes/plot (13.9 mi^2) and ranged from 25 to 60 minutes/plot (Giudice 2020).

This year 308 moose were observed on 39 (75%) of the 52 plots surveyed (a total 723 mi^2), less than the 429 moose observed on 43 of 52 plots during the 2019 survey. An average of 7.9 moose (range = 1–28) were observed per “occupied” plot. Plot occupancy during the past 16 years averaged 81% (range = 65–95%) with a mean 11.6 moose observed per occupied plot. The average group size was 2.1 moose, similar to the previous 16 years (2 moose) and ranged from 1 to 8 moose per group. This year’s 308 observed moose included 131 bulls, 138 cows, 37 calves, and 2 unclassified adults. Overall, estimated VO averaged 44% (range = 0−85%) and average estimated detection probability was 0.55 (range = 0.23−0.85). Both VO and detection probability have remained relatively constant since 2005.

After adjusting for sampling and sightability, we estimated the population in northeastern Minnesota at 3,150 (2,400–4,320, 90% confidence interval [CI]) moose (Table 1, Figure 2). As can be noted from the 90% confidence intervals associated with the population point estimates, statistical uncertainty inherent in aerial wildlife surveys can be quite large, even when surveying large, dark, relatively conspicuous animals such as moose against a white background during winter. This is attributable to the varied (1) occurrence of dense vegetation, (2) habitat use by moose, (3) behavioral responses to aircraft, (4) effects of annual environmental conditions (e.g., snow depth, ambient temperature) on their movements, and (5) interaction of these and other factors. Consequently, year-to-year statistical comparisons of population estimates are *not* supported by these surveys. These data are best suited to establishing long-term trends; even short-term trends must be viewed cautiously.

Past aerial survey and research results have indicated that the long-term trend of the population in northeastern Minnesota has been declining since 2006 (Lenarz et al. 2010, DelGiudice 2019). The current population estimate is 64% less than the estimate in 2006 and the declining linear trend during the past decade remains statistically significant (r^2 = 0.762, P< 0.001, Figure 2). However, the leveling since 2012 persists, and a piecewise polynomial curve indicates that the trend from 2012 to 2020 is not declining (Figure 3). While this recent short-term trend (9 years) is noteworthy, it applies only to the existing survey estimates, and does not forecast the future trajectory of the population (Giudice 2020).

The January 2020 calf:cow ratio of 0.36 is similar to the 15-year average since 2005 (0.35, Table 1, Figure 4). Calves were 12% of the total 308 moose actually observed and represented 18% of the estimated population (Table 1, Figure 4). Twin calves were observed with 3 of the 138 (2%) cow moose (Table 1). Although we know from recent field studies that fertility (pregnancy rates) of the population’s adult females has been robust, overall, survey results indicate calf survival to January 2020 remains low, typical compared to most years since the population decline began following the 2006 survey (Table 1). Calf survival during the January−April interval can decline markedly (Schrage et al., unpublished data), and annual spring recruitment of calves (survival to 1 year old) can have a significant influence on the population’s performance and dynamics. Findings of a recent field study documented similar low calf survival (0.442−0.485) to early winter in 2015−16 and 2016−17 (Obermoller 2017, Severud 2017). Calf survival by spring 2017 (recruitment) had declined to just 0.33. But it is also important to note that adult moose survival has the greatest long-term impact on annual changes in the moose population (Lenarz et al. 2010). Consistent with the recent relative stability of the population trend, the annual survival rate of adult GPS-collared moose has changed little (85–88%) during 2014−2017 (Carstensen et al. 2017, unpublished data), but is slightly higher than the previous long-term (2002−2008) average of 81% (Lenarz et al. 2009).

The January 2020 estimated bull:cow ratio (0.90, Table 1; Figure 5) is similar to the long-term average of 1.00 during 2005–2019 and compared to the mean ratio of 2009−2012 (0.87), when the population decline was steepest. However, this ratio has been as low as 0.64 (2011) during the steep decline. During the recent 9-year trend of stability, the average bull:cow ratio has been 1.12. However, due to the notable annual variability associated with the bull:cow ratios, the apparent upward trend line is not statistically meaningful (Figure 5).

Table 1. Estimated moose abundance, 90% confidence intervals, calf:cow ratios, percent calves in the population, percent cows with twins, and bull:cow ratios estimated from aerial surveys in northeastern Minnesota, 2005–2020.

Survey	Estimate	90% Confidence Interval	Calf: Cow	% Calves	% Cows w/ twins	Bull: Cow
2005	8,160	6,090 – 11,410	0.52	19	9	1.04
2006	8,840	6,790 – 11,910	0.34	13	5	1.09
2007	6,860	5,320 – 9,150	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

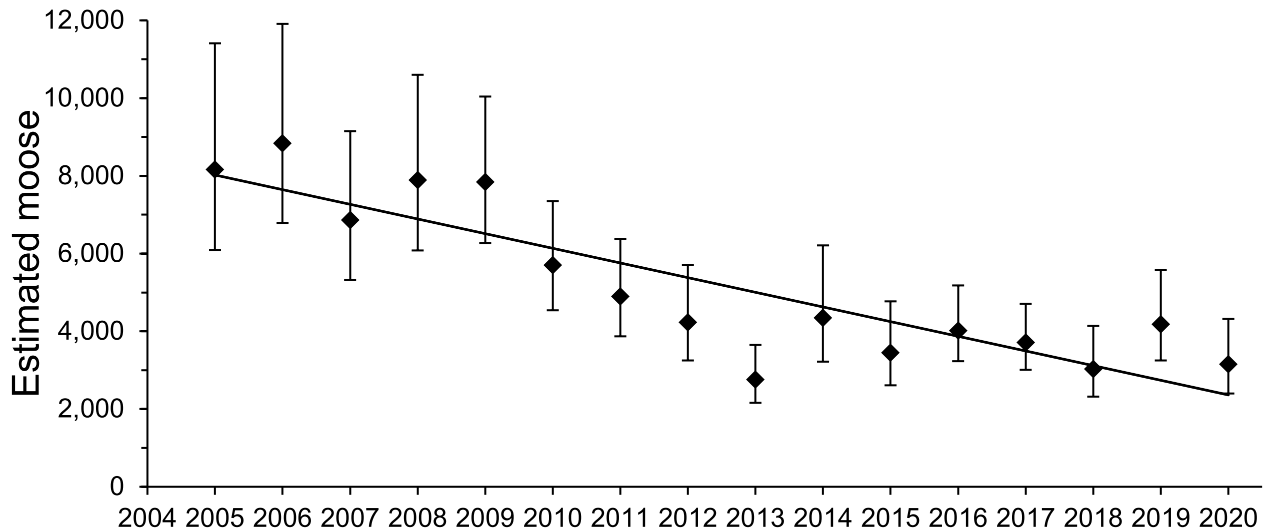


Figure 2. Point estimates, 90% confidence intervals, and a linear trend line of estimated moose abundance in northeastern Minnesota, 2005–2020 ($y = -377x + 764585$, $r^2 = 0.762$, $P < 0.001$). Note: The 2005 survey was the first to be flown with helicopters, and to include a sightability model and a uniform grid of east-west oriented, rectangular 13.9-mi^2 plots.

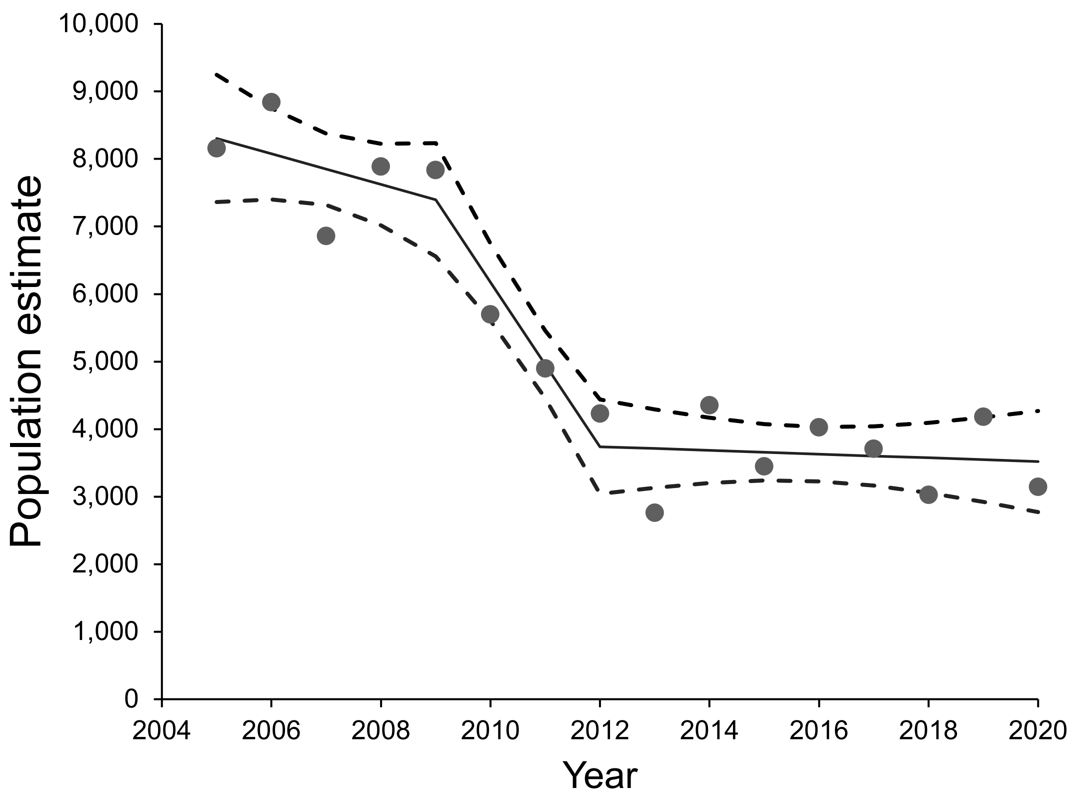


Figure 3. Point estimates, 95% confidence intervals (dashed lines), and a piecewise polynomial curve of moose abundance in northeastern Minnesota, 2005–2020 (Giudice 2020). This curve shows a change in the short-term slope of the trend from 2012 to 2020 compared to 2009 to 2012.

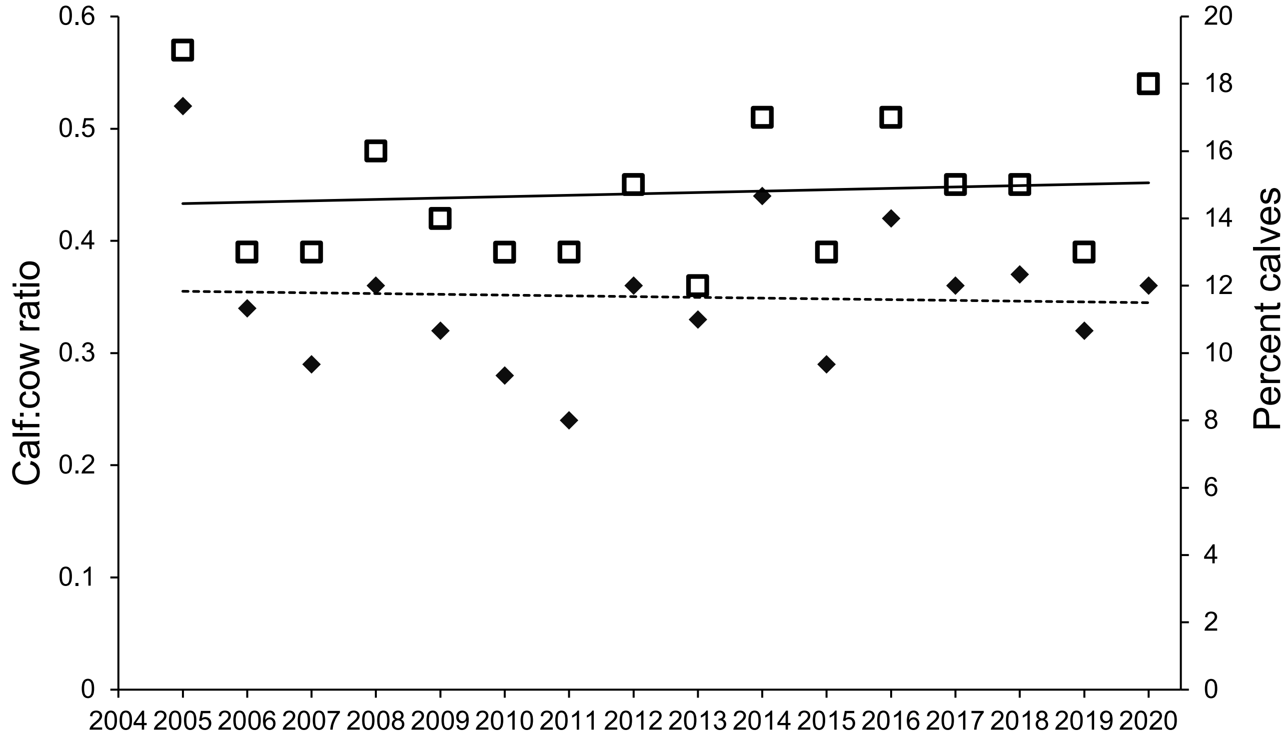


Figure 4. Estimated calf:cow ratios (solid diamonds, dashed trend line) and percent calves (open squares, solid trend line) of the population from aerial moose surveys in northeastern Minnesota, 2005–2020.

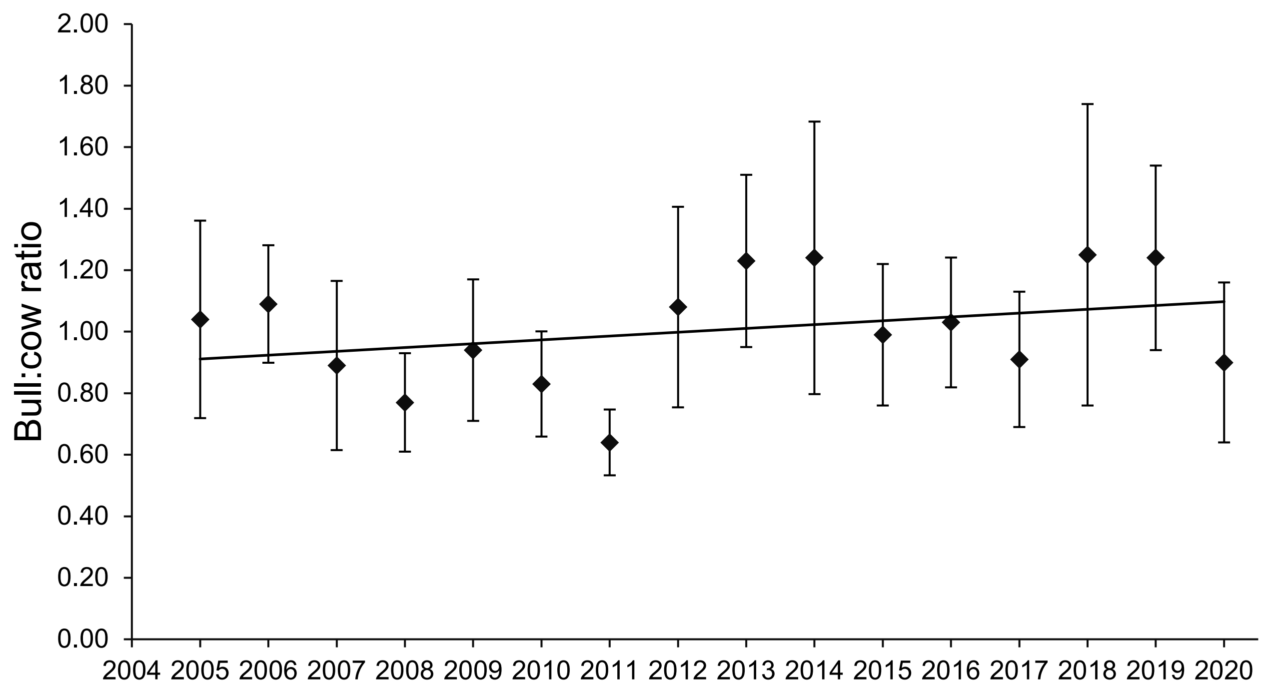


Figure 5. Estimated bull:cow ratios, 90% confidence intervals, and trend line from aerial moose surveys in northeastern Minnesota, 2005–2020.

ACKNOWLEDGMENTS

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MINNESOTA WOLF POPULATION UPDATE 2020

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

INTRODUCTION

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

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

After federal de-listing in 2012, wolf harvest seasons were established and population surveys have been conducted annually to better inform annual management decisions. In the first three winters after de-listing, wolf population point estimates varied from approximately 2,200 to 2,400 (Erb et al. 2014). In December 2014, following the third consecutive wolf harvest season, wolves in Minnesota were returned to the list of federally threatened species as a result of a court ruling. Since that time, wolf surveys have continued on an annual basis. Herein we provide an update of population status from the 2019-20 winter survey.

METHODS

The methodology used to estimate wolf population size in Minnesota utilizes three primary pieces of information: 1) an estimate of the total area of land occupied by wolf packs; 2) an estimate of average wolf pack territory size; and 3) an estimate of average mid-winter pack size. It is likely that occupied range changes on a comparatively slow timescale compared to fluctuations in average territory and pack size. As such, occupied range is estimated only once every 5 years, with the last being during winter 2017-18; we assume that occupied range has remained unchanged (i.e., 73,972 km^2; Erb et al. 2018) and use that in our population calculations for winter 2019-20.

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

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, the antagonist Yohimbine and an antibiotic were typically administered to all animals prior to release.

Various models of radio-collars were deployed depending on study area and collar availability. Most GPS radio-collars were programmed to take 3-6 locations per day, and wolves fitted with VHF-only radio-collars were relocated at approximately 7- to 10-day intervals throughout the year, or in some cases, primarily from early winter through spring.

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

In past surveys where all or the majority of territories were delineated using VHF radiolocations, raw territory sizes were increased 37% to account for the average amount of interstitial space between delineated wolf pack territories, as estimated from several Minnesota studies (Fuller et al. 1992:50) where the number of radiolocations per pack typically averaged 30-60. Interstitial spaces are a combination of small voids created by landscape geometry and wolf behavior, but can also be an artifact of territory underestimation when there are comparatively sparse radiolocations. Hence, for packs with < 100 radiolocations (n = 9; mean number of radiolocations = 21), we multiplied each estimated territory size by 1.37 as in the past. For packs with > 100 radiolocations (n = 35; mean number of radiolocations = 2,904), territories were assumed to be fully delineated and were not re- scaled.

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

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

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

Using the accelerated bias-corrected method (Manly 1997), the population size confidence interval (90%) was generated from 9,999 bootstrapped re-samples of the pack and territory size data and does not incorporate uncertainty in estimates of occupied range or percent lone wolves. 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 data on 48 packs that were monitored during all or part of the survey period (April 2019 to April 2020). We obtained territory and winter pack size data from 31 radio-marked wolf packs (Figure 1). Thirteen additional wolf packs had adequate radiolocation data to delineate territories, but we were unable to obtain mid-winter pack counts, and we obtained pack counts on 4 packs for which there was insufficient data to delineate a territory.

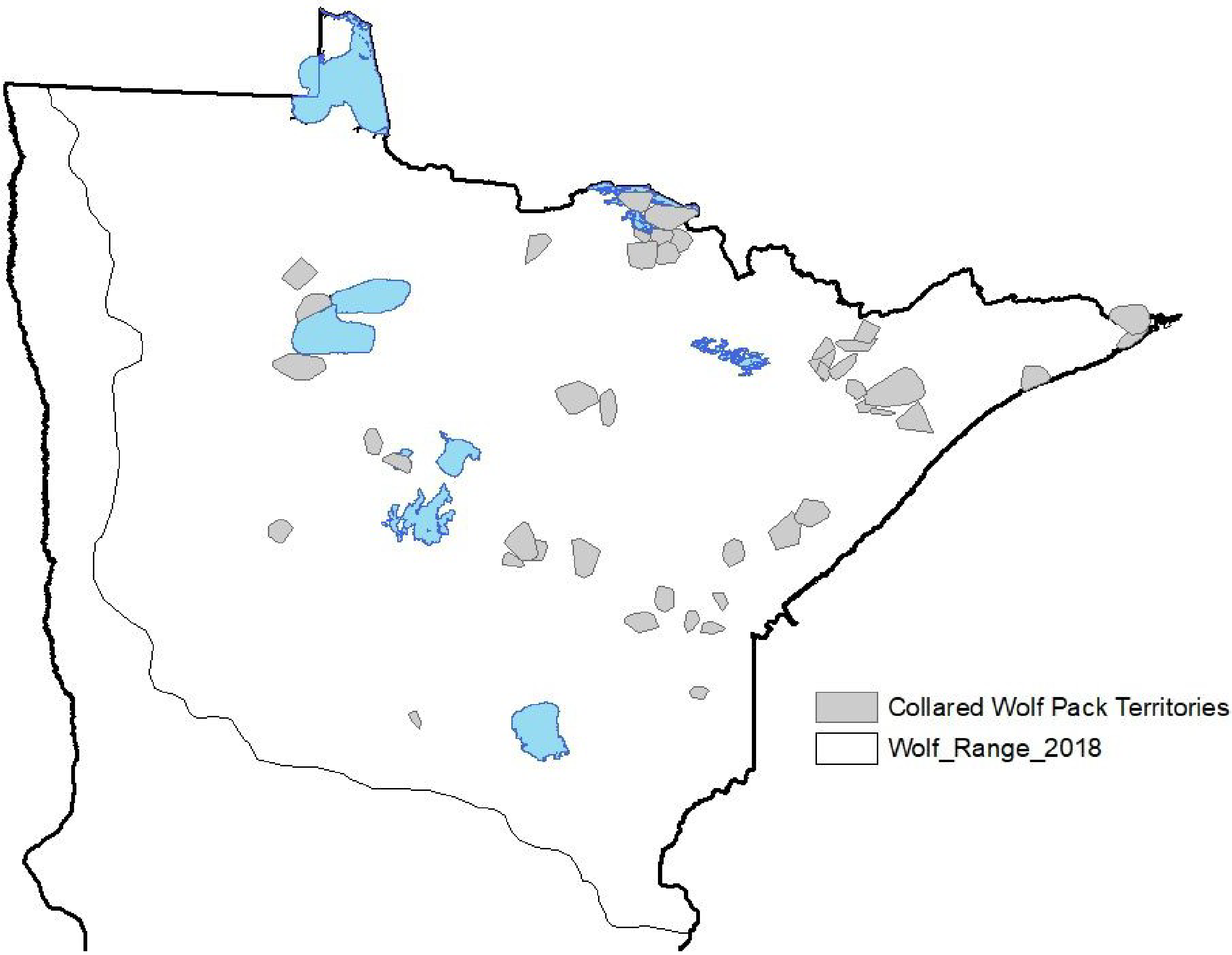

Figure 1. Location of radio-marked wolf packs during the 2019-20 survey.

A land cover comparison using the 2011 National Land Cover Database suggests that the location of collared packs this winter led to some under-representation of cover types classified as woody wetlands (Table 1), likely a result of under-sampling of packs in portions of northwest MN around Red Lake where territories tend to be larger. There was also under-representation of cover types classified as pasture-hay-grassland (Table 1), likely a result of fewer collared packs in our south and southwest study areas where territories tend to be closer to, or smaller than, the statewide average. Using spring 2019 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 9.2 deer/mi^2 (pre-fawn) in territories of radio-marked packs during spring 2019. In comparison, 2019 spring deer density for the entirety of occupied wolf range (weighted by permit area) in Minnesota was approximately 13 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.

Land Cover Category	Overall Occupied Wolf range % Area	Radio-collared Wolf Territories % Area
Woody Wetlands	32.6	31.5
Deciduous Forest	23.6	21.4
Emergent Herbaceous Wetlands	9.9	5.3
Mixed Forest	7.2	11.2
Evergreen Forest	7.0	12.7
Open Water	5.4	6.4
Shrub/Scrub	4.5	6.8
Pasture/Hay/Grassland/Crops	7.7	2.9
Developed, All	2.2	1.8

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

The point estimate for average territory size in winter 2019-20 declined 21% from the previous winter. This represents a marginally significant decline and the lowest point estimate for average territory size since surveys began (Figure 2). After applying the territory scaling factors, average estimated territory size for radio-marked packs during the 2019-20 survey was 117 km^2 (range = 33 – 378 km^2).

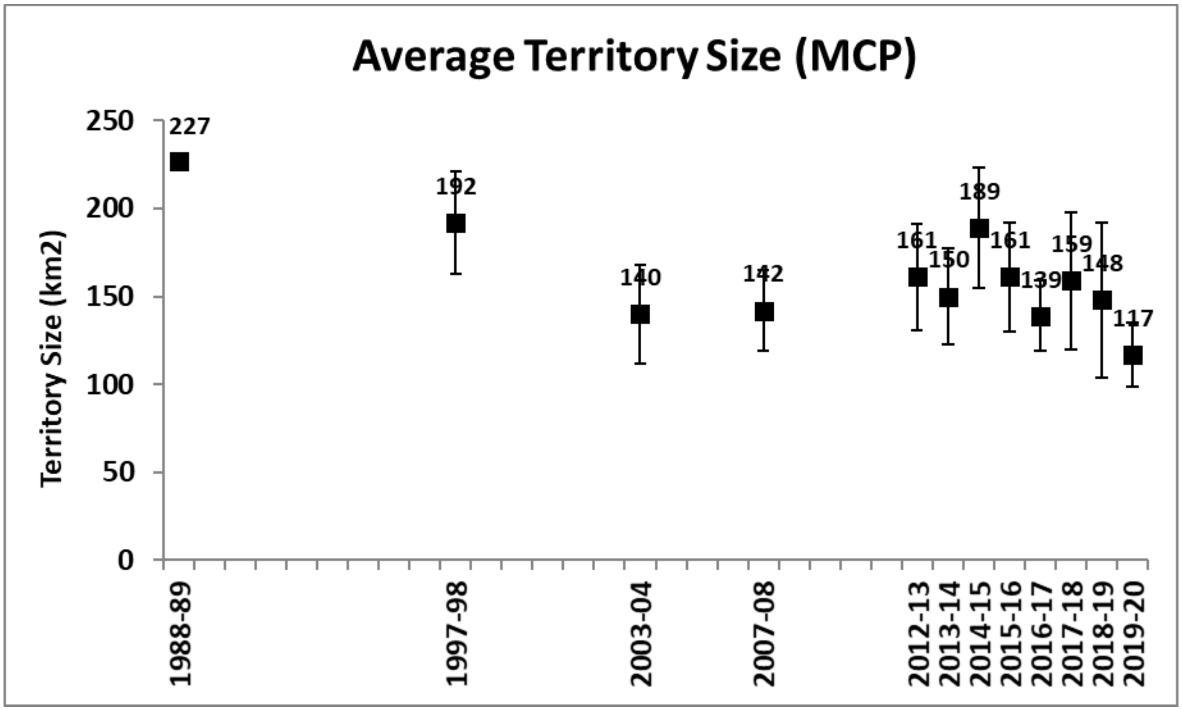

Figure 2. Average scaled territory size for radio-marked wolf packs in Minnesota from winter 1988-89 to 2019-20.

The point estimate for average winter pack size also declined by 21%, a significant decline and the lowest average pack size since surveys began. Average winter pack size in 2019-20 was estimated to be 3.6 (range = 2 – 7, Figure 3).

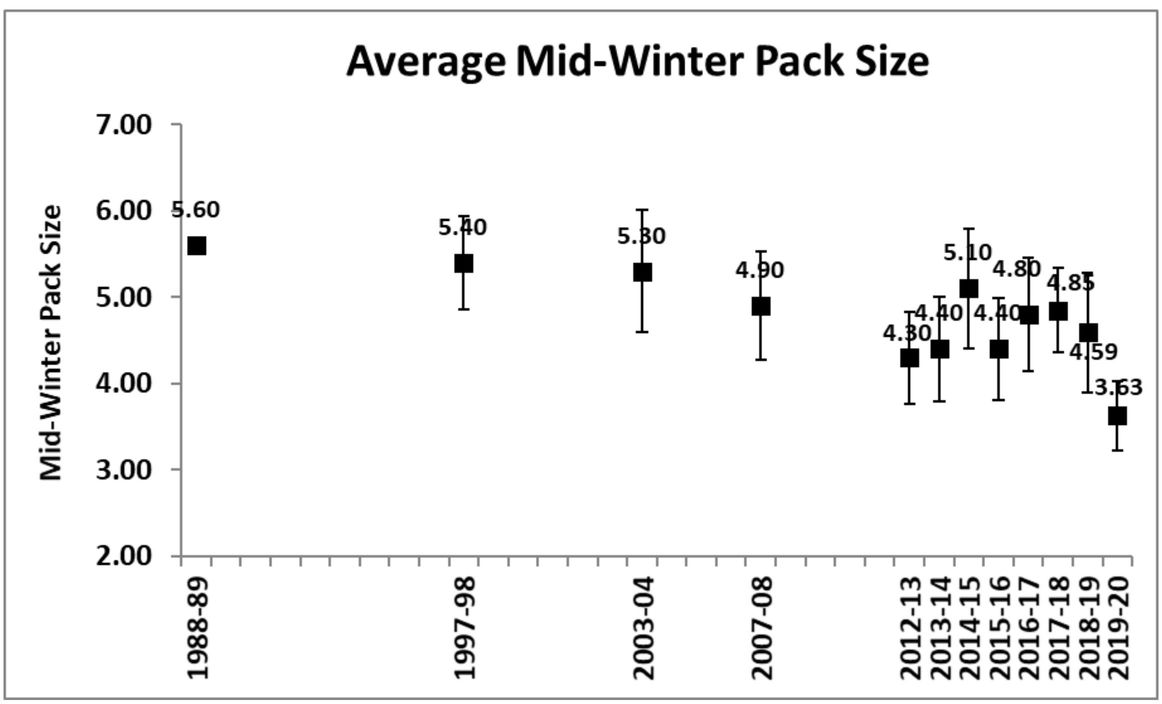

Figure 3. Average mid-winter pack size for radio-marked wolf packs in Minnesota from winter 1988- 89 to 2019-20.

Wolf Numbers

Given 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 estimated a total of 631 wolf packs in Minnesota during winter 2019-20. 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).

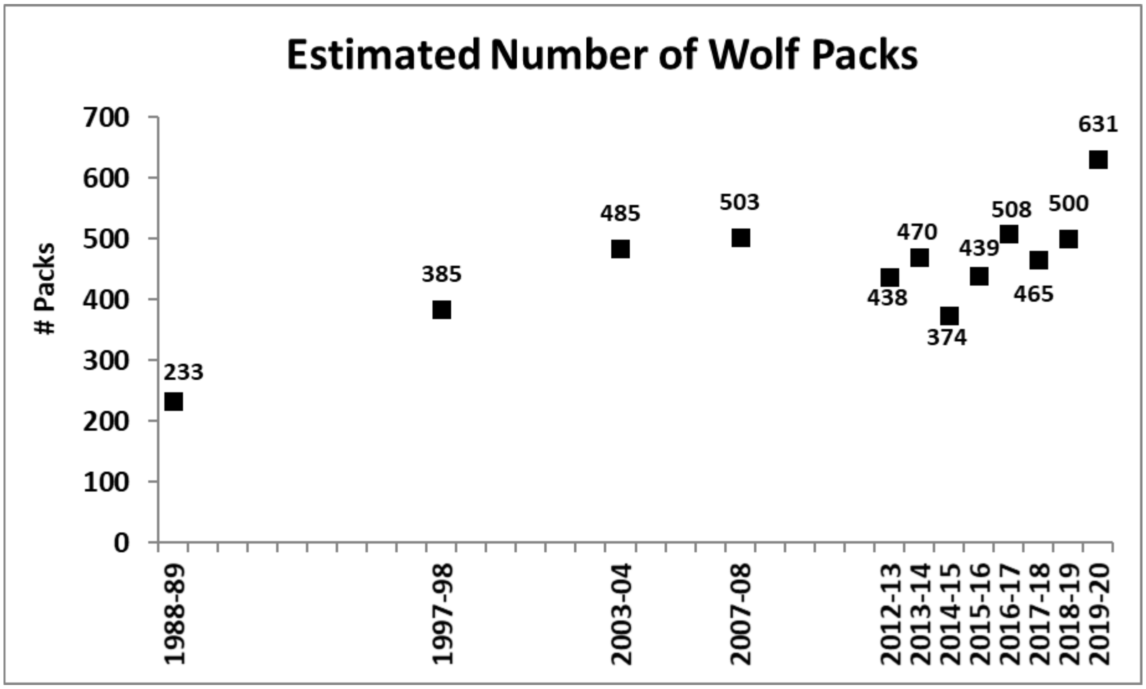

Figure 4. Estimated number of wolf packs in Minnesota at periodic intervals from winter 1988-89 to 2019-20.

After accounting for the assumed 15% lone wolves in the population, we estimated the 2019-20 mid- winter wolf population at 2,696 wolves, or 3.64 wolves per 100 km^2 of occupied range. The 90% confidence interval was approximately +/- 500 wolves, specifically 2,244 to 3,252. Given the nearly complete overlap with the 2019-20 confidence interval, we conclude that the 2019-20 statewide wolf population size was unchanged from the previous winter, but with results suggesting more but smaller packs.

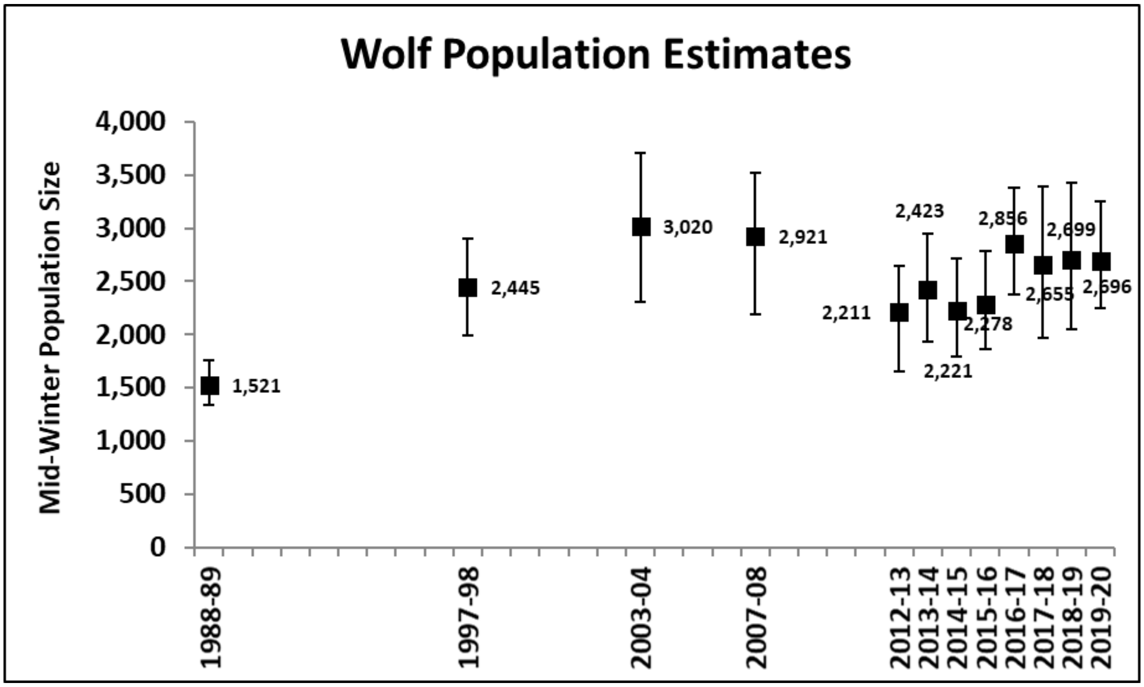

Figure 5. Wolf population estimates from periodic standardized surveys in Minnesota from winter 1988-89 to 2019-20.

From spring 2018 to spring 2019, overall average deer density within wolf range remained stable. Over the past 8 years, the trend in winter wolf population size has been positively correlated with average deer density within wolf range the preceding spring (Figure 6).

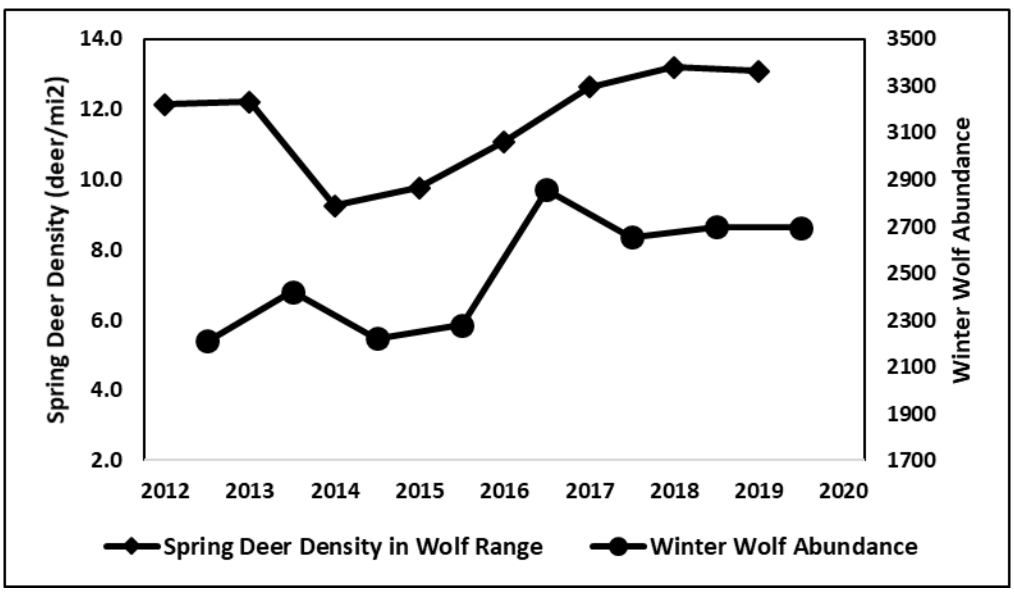

Figure 6. Comparison of estimated spring (pre-fawn) deer density and winter wolf abundance in Minnesota, 2012-2019.

ACKNOWLEDGMENTS

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

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WETLAND WILDLIFE POPULATIONS

Wetland Wildlife Populations and Research
102 23rd Street
Bemidji, MN 56601
(218) 308-2282

2020 WATERFOWL BREEDING POPULATION SURVEY MINNESOTA

Due to Covid-19 restrictions this survey was not conducted.

WATERFOWL POPULATION STATUS, 2020.

Waterfowl information is taken from the U.S. Fish and Wildlife Service report Waterfowl Population Status, 2020 by Joshua Dooley and Nathan Zimpfer. The entire report is available on the Division of Migratory Bird Management website https://www.fws.gov/birds/surveys-and-data/reports-and-publiccations.php

Note: Due to the COVID-19 (SARS-CoV-2) pandemic, most migratory breeding surveys (e.g., the Breeding Waterfowl Population and Habitat Survey, Breeding Bird Survey, and others) conducted by the U.S. Fish and Wildlife Service, Canadian Wildlife Service, US Geological Survey, as well as state and provincial agencies were canceled in spring 2020. We therefore present no status information on any duck species as all the estimates or indices for ducks rely on these surveys. We refer the reader to the 2019 Waterfowl Status report for more detailed historical data.

MOURNING DOVE POPULATION STATUS, 2020

Mourning dove information is taken from the U.S. Fish and Wildlife Service report by Seamans, M.E. 2020. Mourning dove population status, 2020. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 23 pp. The entire report is available on the Division of Migratory Bird Management web site

([Mourning Dove Population Status 2020 (fws.gov)]()).

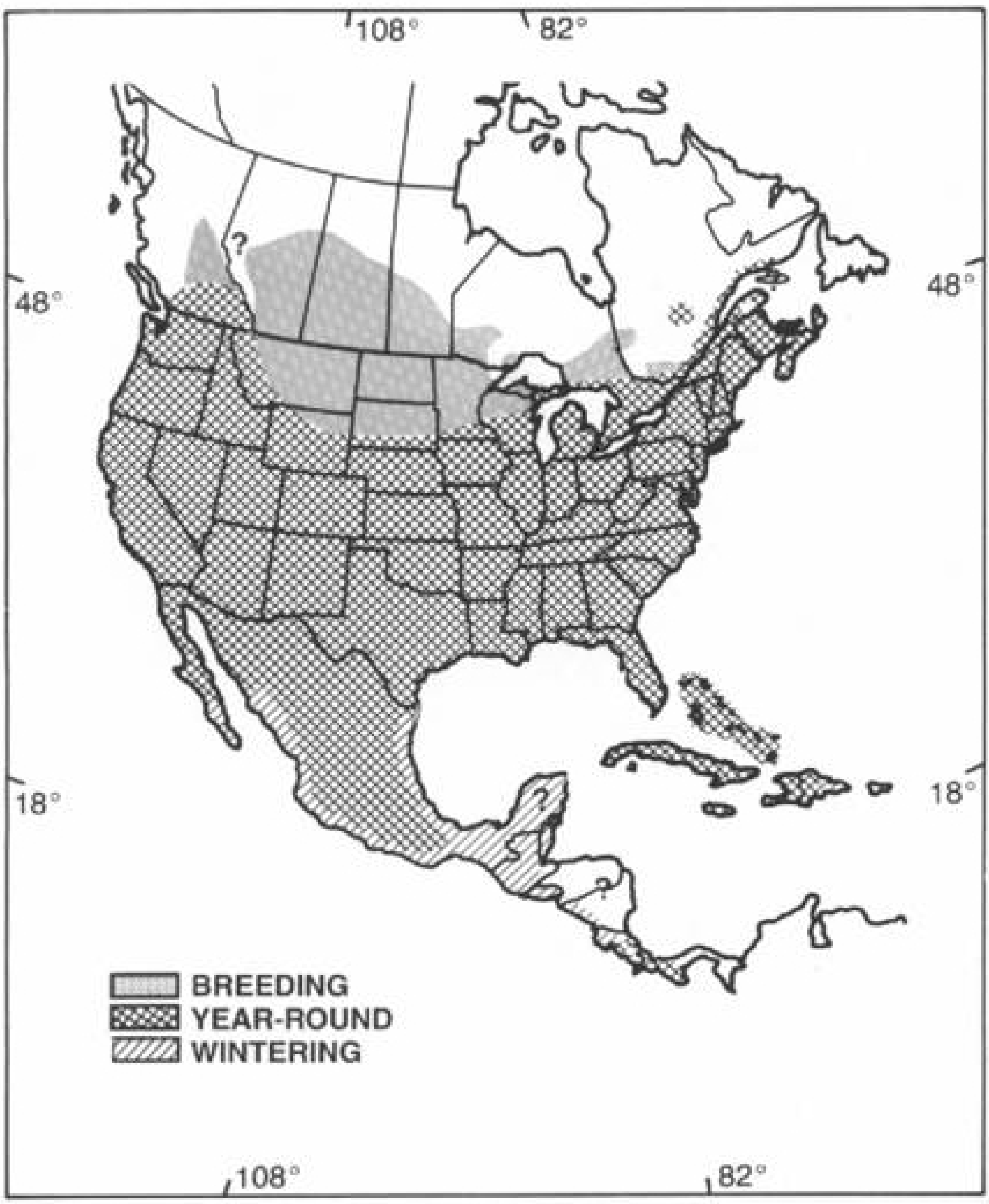

Figure 1. Breeding and wintering ranges of the mourning dove (adapted from Mirarchi and Baskett 1994). (From: Seamans, M.E. 2020. Mourning dove population status, 2020. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 23 pp.)

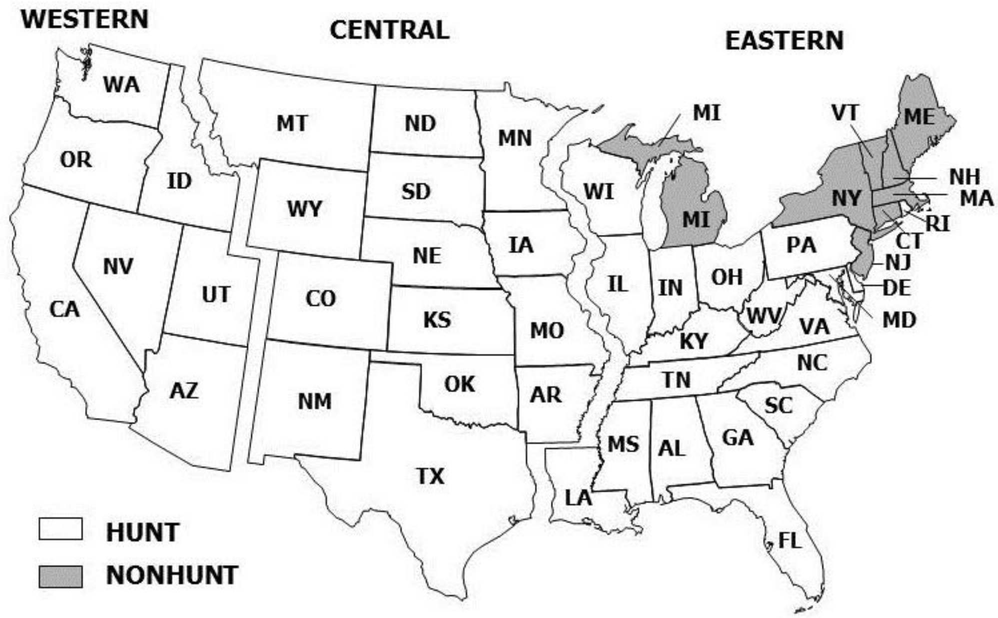

Figure 2. Mourning dove management units with 2019 -20 hunting and non-hunting states. (From: Seamans, M.E. 2020. Mourning dove population status, 2020. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 23 pp.)

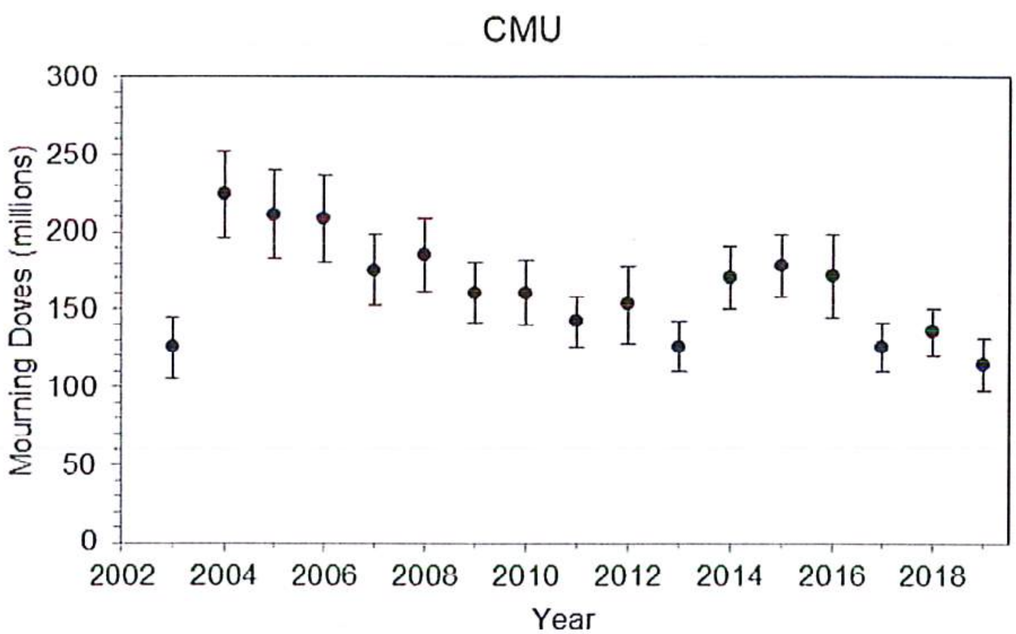

Figure 3. Estimates and 95% confidence intervals of mourning dove absolute abundance by in the Central Management Unit (CMU), 2003-19. Estimates based on band recovery and harvest data. (From: Seamans, M.E. 2020. Mourning dove population status, 2020. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 23 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 2017, 2018 and 2019 seasons [a]. (From: Seamans, M.E. 2020. Mourning dove population status, 2020. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C. 23 pp.)

Management unit / State	Active Hunters			Hunter Days Afield			Total Harvest		
	2017	2018	2019	2017	2018	2019	2017	2018	2019
CENTRAL	332,200 [a]	332,900	337,700[a]	1,058,800 ±11	852,100 ±53,100	986,800 ±50,800	5,462,800 ±10	4,749,100 ±283,900	5,266,400 ±335,500
AR	16,200 ±29	12,400 ±2,700	14,200 ±2,200	35,500 ±30	24,500 ±5,200	37,500 ±7,100	287,100 ±35	170,600 ±44,700	328,100 ±74,800
CO	11,300 ±19	10,000 ±1,200	10,700 ±800	24,100 ±20	20,200 ±2,700	22,800 ±2,000	117,600 ±25	121,500 ±17,300	106,300 ±9,50
IA	11,200 ±13	9,000 ±1,000	3,600 ±400	28,300 ±17	23,500 ±3,100	11,000 ±1,800	134,900 ±16	107,800 ±12,300	29,900 ±4,700
KS	21,800 ±24	22,900 ±4,100	22,300 ±1,900	58,300 ±35	44,300 ±7,800	64,800 ±8,500	290,600 ±34	337,600 ±75,000	389,800 ±64,200
MN	6,800 ±63	7,100 ±2,500	3,900 ±1,400	16,200 ±45	16,900 ±5,500	9,400 ±2,300	39,100 ±30	55,300 ±14,000	40,200 ±11,800
MO	27,400 ±13	26,000 ±2,300	21,100 ±1,500	65,700 ±16	48,300 ±4,400	47,100 ±3,800	367,200 ±18	309,400 ±37,800	268,000 ±28,400
MT	1,300 ±57	1,200 ±400	1,600 ±400	2,200 ±63	3,500 ±1,100	3,600 ±800	8,900 ±45	9,800 ±2,200	16,600 ±4,600
NE	12,300 ±16	11,600 ±1,300	10,700 ±1,000	31,000 ±15	33,700 ±4,900	24,500 ±2,500	177,900 ±16	189,100 ±33,800	137,700 ±14,100
NM	5,500 ±57	9,900 ±1,000	8,300 ±700	16,800 ±70	28,200 ±3,400	28,800 ±4,100	73,900 ±51	126,900 ±20,100	125,400 ±22,000
ND	4,100 ±26	3,900 ±600	4,100 ±500	11,400 ±31	11,800 ±2,800	11,900 ±2,000	59,400 ±26	65,200 ±15,100	75,000 ±19,500
OK	17,500 ±16	13,600 ±2,100	14,800 ±1,200	45,600 ±24	29,200 ±4,600	38,000 ±4,200	315,600 ±29	181,300 ±30,500	247,900 ±26,700
SD	5,700 ±22	4,900 ±600	4,700 ±600	18,400 ±26	11,500 ±1,600	15,500 ±2,700	111,600 ±31	69,400 ±10,600	103,300 ±19,100
TX	190,500 ±13	199,100 ±18,100	216,300 ±13,100	703,300 ±17	553,200 ±51,000	669,000 ±48,800	3,469,500 ±14	2,990,400 ±260,900	3,385,000 ±315,600
WY	700 ±42	1,400 ±300	1,300 ±200	2,200 ±84	3,200 ±700	2,800 ±500	9,400 ±57	14,800 ±3,100	13,200 ±2,200

[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, 2020

American Woodcock information is taken from the U.S. Fish and Wildlife Service report American Woodcock Population Status, 2020. Seamans, M.E. and R.D. Rau. U.S. Fish and Wildlife Service, Laurel, MD. 8 pp.

Note: Due to SARS-CoV-2 (i.e., coronavirus) related restrictions in Canada and the U.S. only a small portion of Singing-ground Survey routes were surveyed in 2020. The small and spatially uneven sample was not thought to be a representative sample, therefore no results from the 2020 survey are presented in this report.

The entire report is available on the Division of Migratory Bird Management home page [U.S. Fish & Wildlife Service - Migratory Bird Program | Conserving America's Birds (fws.gov)]

Figure 1. Woodcock management regions, breeding range, singing-ground survey coverage. (from: Seamans, M.E. and R.D. Rau. 2020. American woodcock population status, 2020. U.S. Fish and Wildlife Service, Laurel, MD. 8 pp.).

Table 1. Short term (2018–19), 10 –year (2009-2019), and long-term (1968-2019) trends (% change per year [a]) in the number of American woodcock heard during the Singing-ground Survey as determined by using the hierarchical log-linear modeling technique (Sauer et al. 2008) (from: Seamans, M.E. and R.D. Rau. 2019. American woodcock population status, 2019. U.S. Fish and Wildlife Service, Laurel, MD. 20 pp.).

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

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

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

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

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

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

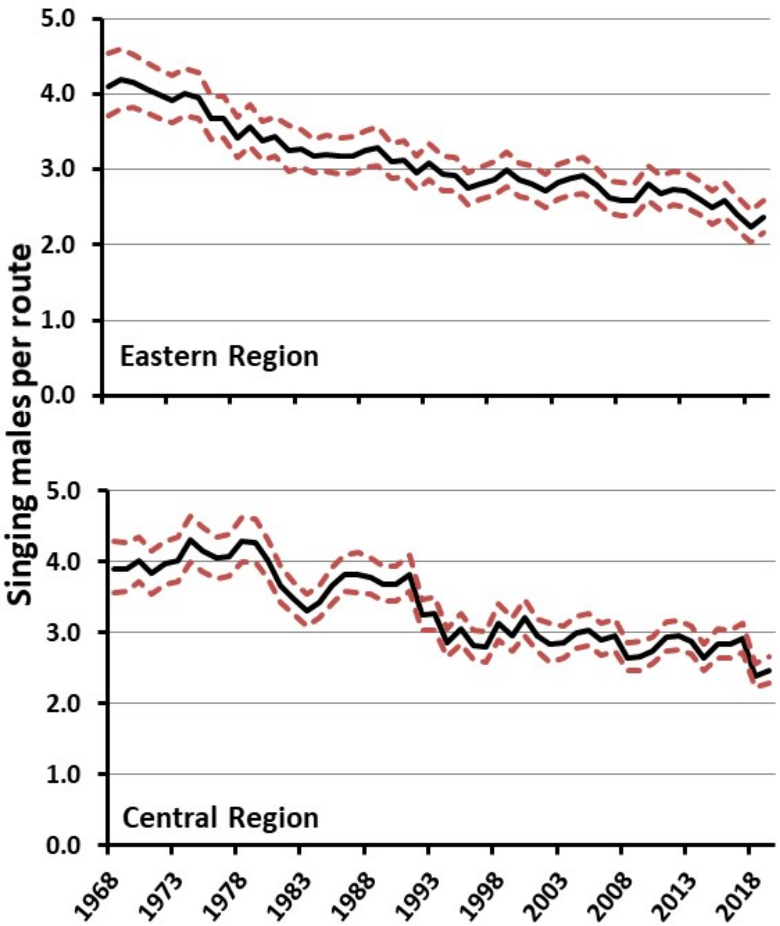

Figure 2. Annual indices of the number of woodcock heard on the Singing-ground Survey, 1968-2019. The dashed lines represent the 95 % credible interval. (from: Seamans, M.E. and R.D. Rau. 2019. American woodcock population status, 2019. U.S. Fish and Wildlife Service, Laurel, MD. 20 pp.).

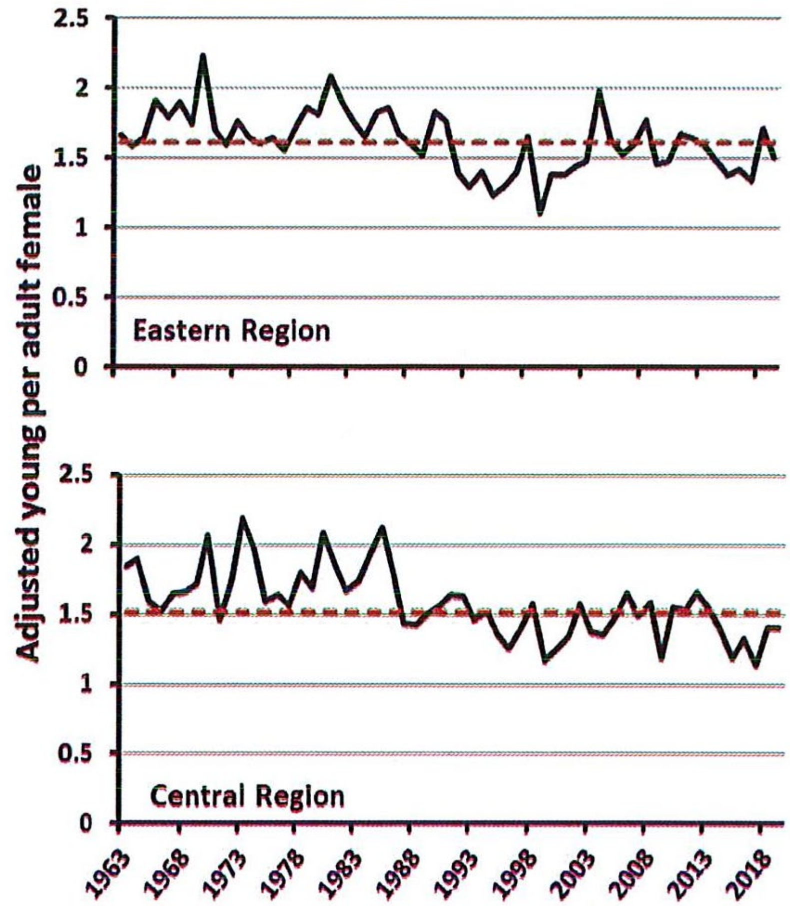

Figure 3. Weighted annual indices of American woodcock recruitment, 1963-2018. Dashed line is the 1963-2018 average. (from: Seamans, M.E. and R.D. Rau. 2020. American woodcock population status, 2020. U.S. Fish and Wildlife Service, Laurel, MD. 8 pp.).

Table 2. Preliminary estimates of woodcock hunter numbers, days afield, and harvest for selected states, from the 2016-17, 2017-18, 2018-19 and 2019-20 Harvest Information Program surveys. (from: Seamans, M.E. and R.D. Rau. 2020. American woodcock population status, 2020. U.S. Fish and Wildlife Service, Laurel, MD. 8 pp.).

Management Unit / State	Active woodcock hunters ([a])				Days afield ([a, c])				Harvest ([a, c])			
	2016-17	2017-18	2018-19	2019-20	2016-17	2017-18	2018-19	2019-20	2016-17	2017-18	2018-19	2019-20
Central Region	n.a. [b]	n.a. [b]	n.a. [b]	n.a. [b]	300,200 ±32,500	272,400 ±22,800	246,000 ±35,800	216,600 ±24,500	158,000 ±16,300	140,900 ±15,500	130,600 ±16,400	136,000 ±18,900
IL	1,500 ±1,000	100 <100	<100 <100	2,300 ±1,600	13,200 ±11,000	300 ±100	100 ±100	11,300 ±9,300	1,600 ±1,400	400 ±300	0 0	3,400 ±3,400
IN	300 ±200	1,100 ±400	100 <100	500 ±300	1,300 ±500	2,900 ±1,000	200 ±100	1,100 ±500	900 ±200	1,500 ±1,100	200 ±100	400 ±100
MI	24,100 ±2,300	24,100 ±2,300	29,300 ±3,700	19,100 ±2,400	107,100 ±11,600	122,800 ±15,200	135,800 ±31,900	86,100 ±12,600	64,900 ±8,600	66,100 ±10,300	59,600 ±10,400	64,500 ±15,200
MN	13,500 ±2,300	11,900 ±2,100	10,400 ±2,100	8,700 ±1,900	46,000 ±8,200	45,700 ±8,200	41,500 ±9,700	29,300 ±5,700	25,900 ±4,700	26,700 ±5,000	22,500 ±3,900	20,800 ±4,500
OH	2,600 ±900	1,900 ±800	500 ±100	1,100 ±900	8,200 ±3,700	5,000 ±1,800	800 ±300	2,400 ±1,000	3,200 ±1,300	400 ±200	600 ±400	700 ±300
WI	11,700 ±1700	11,700 ±1,800	10,800 ±2,100	9,500 ±1,700	55,100 ±8,900	52,400 ±7,700	45,900 ±9,300	47,000 ±9,400	35,100 ±4,400	31,100 ±4,600	25,500 ±4,300	26,800 ±5,300

[a] All 95% Confidence Intervals are expressed as a % of the point estimate.

[b]. Regional estimates of hunter numbers cannot be obtained due to the occurrence of individual hunters being registered in the Harvest Information Program in more than one state.

[c]. Days afield and Harvest estimates are for the entire 18 state Central Region.

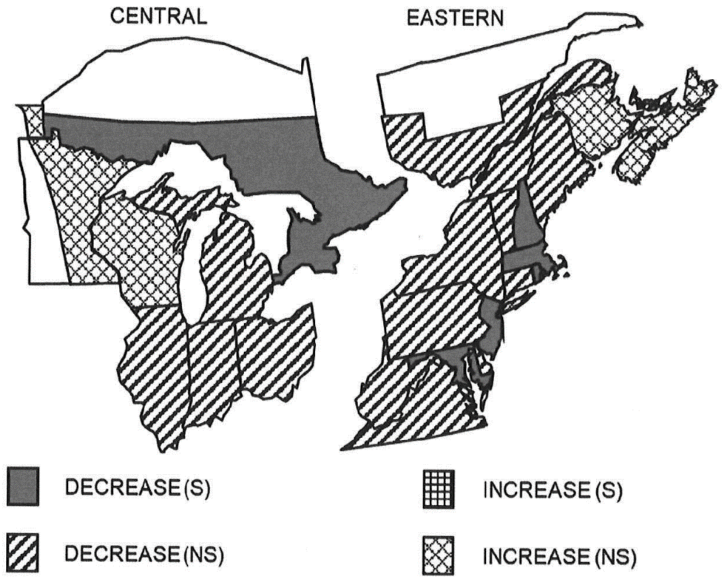

Figure 4. Ten-year trends in number of American woodcock heard on the Singing-ground Survey; 2009-19, as determined by the hierarchical modeling method. A significant trend (S) does not include zero in the 95% credible interval, while a non-significant (NS) trend does include zero. (from: Seamans, M.E.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

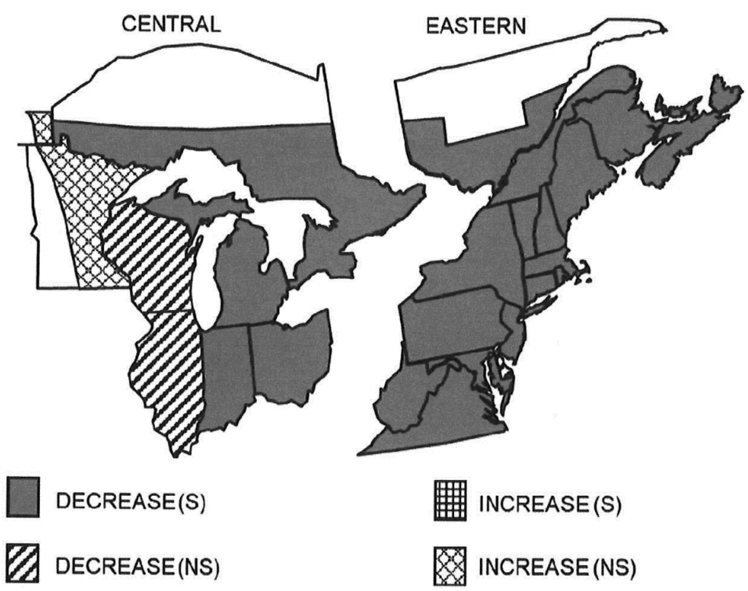

Figure 5. Long-term trends in number of American woodcock heard on the Singing-ground Survey; 1968-2019, as determined by the hierarchical modeling method. A significant trend (S) does not include zero in the 95% credible interval, while a non-significant (NS) trend does include zero. (from: Seamans,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

HUNTING HARVEST STATISTICS

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

2019 SMALL GAME HUNTER MAIL SURVEY

Nicole Davros and Margaret Dexter, 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 following the close of the small game hunting season. Hunters who returned it within three weeks were eliminated from a follow-up mailing to non-respondents. The sampling frame consisted of individuals who purchased a small game hunting license (any type) for the 2019-20 small game hunting season (N=224,413). A stratified random sample (n=7,000, 3.1%), 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, Nonresident Youth, and Nonresident Adult. For analysis, license types were pooled into "Resident" (N=217,526) and "Nonresident" (N=6,887) (Figure 2). A free youth license was added to the sampling frame for 2010-13 but that license has since been discontinued. Estimates for those years have been recalculated without the youth license so harvest estimates and license sales are comparable among years. Also, beginning in 2017, license holders <18-yrs old at the time of the survey were excluded from the sampling frame but included in the overall expansion for sampling. This group comprised <3% of license holders and thus estimates should be comparable among years.

Recipients were asked if they hunted small game in 2019-20 and if not, they were instructed to return the survey. Respondents who hunted were asked: (1) total number of days they hunted small game, (2) number bagged by species, (3) number of days hunted by species and (4) the county in which they hunted most for each species listed. Returned surveys were checked for completeness, consistency, and biological practicability. Dual key-entry and quality control checks were used to minimize transcription errors. Data were tabulated using Viking Data Entry VDE+ software and analyzed using R programming language (R version 4.0.0 (2020-04-24); 2; R Core Team 2020).

RESULTS

Survey Response and Overall License Sales Trends

Statewide (resident and nonresident) small game license sales and survey response rate are shown in Figure 2. Of the 7,000 mailed surveys, 126 surveys were returned as undeliverable; 3,435 surveys were completed and returned for an adjusted response rate of 50%. The percent of respondents who said they hunted or did not hunt is reported in Table 1. Overall, statewide license sales (224,413 small game licenses) declined 0.7% from the previous year and were 14% below the 10-year average (259,736 licenses; Figure 2, Table 2). Nonresident small game license sales (6,887 licenses) increased 2.5% in 2019 and was slightly above the 10-year average (6,551 licenses; Table 3).

Estimates by Species

Harvest trends for the four most sought-after small game species (ducks – all species, Canada geese, ruffed grouse, and ring-necked pheasants) in Minnesota since 2002 are shown in Figure 3 and discussed separately below. For most other species, estimated harvest (Table 2) and number of statewide hunters (Table 4) showed increases compared to 2018. Similarly, the estimated harvest per active hunter increased for most species except crow and gray partridge, which decreased slightly (Table 5).

Ducks – all species

The number of state duck stamps sold in 2019 (86,568 stamps) was similar to 2017 but still below the 10-year average (89,572 stamps; Table 2). The 2019 duck harvest (949,928 ducks) was significantly higher than 2018 (614,780 ducks; Table 2) or any harvest since the early 2000s. This may be due in part to a “luck of the sample” draw that resulted in more waterfowl hunters being surveyed this year than in previous years. An estimated 84,801 hunters pursued ducks in 2019 compared to an average of 72,782 duck hunters in the previous 10 years (Table 4). The estimated harvest was 11.2 ducks/active hunter which was higher than the 10-year average of 9.2 ducks/active hunter (Table 5). Duck hunter success rate (85%) was similar to the 10-year average, but successful hunters harvested more ducks in 2019 than their 10-year average (13.1 vs. 10.9 ducks/successful hunter, respectively; Table 6). More non-residents (3,040) hunted ducks in 2019, an 81% increase from 2018, and the nonresident duck harvest (21,228 ducks) also increased 34% as a result (Table 3).

Canada geese

The 2019 Canada goose harvest (457,192 geese) was well-above the 10-year average (236,322 geese; Table 2) and was the highest harvest total in at least 25 years. An estimated 65,985 hunters pursued geese in 2019 compared to the 10-year average of 49,431 goose hunters (Table 4). The estimated harvest per active hunter was 6.9 geese/hunter which was higher than the 10-year average (4.8 geese/hunter; Table 5). The hunter success rate (81%) and the mean harvest per successful hunter (8.5 geese) were also higher than their respective 10-year averages (75%; 6.3 geese/successful hunter; Table 6). The number of nonresident goose hunters increased by 148% and their estimated goose harvest (15,060 geese; Table 3) exceeded the 2001 record high of 13,400 geese.

Ruffed grouse

The 2019 ruffed grouse harvest increased 15% from the 2018 estimate (225,200 vs. 195,515 grouse, respectively; Table 2) while the estimated number of grouse hunters (61,608; Table 4) was the lowest on record (spanning more than 40 years). The harvest per active hunter (3.7 grouse/hunter) was above the 2018 estimate (2.9 grouse/hunter) and close to the 10-year average (3.8 grouse/hunter; Table 5), and the mean harvest for successful hunters (5.2 grouse/successful hunter) was above the 2018 estimate (4.3 grouse/successful hunter) and the 10-year average (5.3 grouse/successful hunter; Table 6). The 2019 ruffed grouse hunter success rate was 71%, which was above 2018 (67%) but the same as the 10-year average (71%; Table 6). Although fewer nonresidents hunted ruffed grouse in 2019 (1,760 hunters) compared to the previous year (2,270 hunters), they harvested 51% more grouse (4,325 grouse in 2019 compared to 2,856 grouse in 2018; Table 3).

Ring-necked pheasants

Pheasant stamp sales increased 3.8% in 2019 from the previous year (74,921 vs. 72,192 stamps, respectively) but were still 11% below the 10-year average (84,283 stamps; Table 2). The pheasant harvest increased 10% with 226,639 roosters harvested in 2019 compared to 205,395 roosters the previous year and was closer to the 10-year average (234,467 roosters; Table 2). The estimated number of pheasant hunters (52,854) decreased slightly from 2018 (55,861 hunters) and was still well-below the 10-year average of 68,251 hunters (Table 4). The estimated harvest per active hunter was 4.3 pheasants/hunter which was higher than 2018 (3.7 pheasants/hunter) and above the 10-year average (3.4 pheasants/hunter; Table 5). The mean harvest per successful hunter in 2019 was slightly higher than 2018 (6.0 vs. 5.4 roosters, respectively) and above the 10-year average (5.1 roosters; Table 6). Pheasant hunter success in 2019 (71%) was slightly higher than 2018 (68%) and the 10-year average (67%; Table 6). The number of nonresident pheasant hunters decreased 52% (1,120 hunters in 2019 vs. 2,350 hunters in 2018) and their harvest also declined 56% from last year (2,645 roosters in 2019 vs. 6,048 roosters in 2018; Table 3).

ACKNOWLEDGMENTS

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

Dear Small Game Hunter:

You have been selected at random from among Minnesota's small game hunting license buyers to assist us in evaluating the 2019-2020 small game hunting season **(March 2019-February 2020)**. We need information to estimate the season's harvest and to help set future small game seasons. Answer only for your Minnesota 2019 hunting experience.

YOUR RESPONSE IS NEEDED
EVEN IF YOU DID NOT HUNT OR HARVEST SMALL GAME

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

THANK YOU FOR YOUR COOPERATION

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

2019 Small Game Hunter Report

1. Did you hunt small game, listed below, in Minnesota this year (March 2019 - Feb 2020)? ☐ 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.

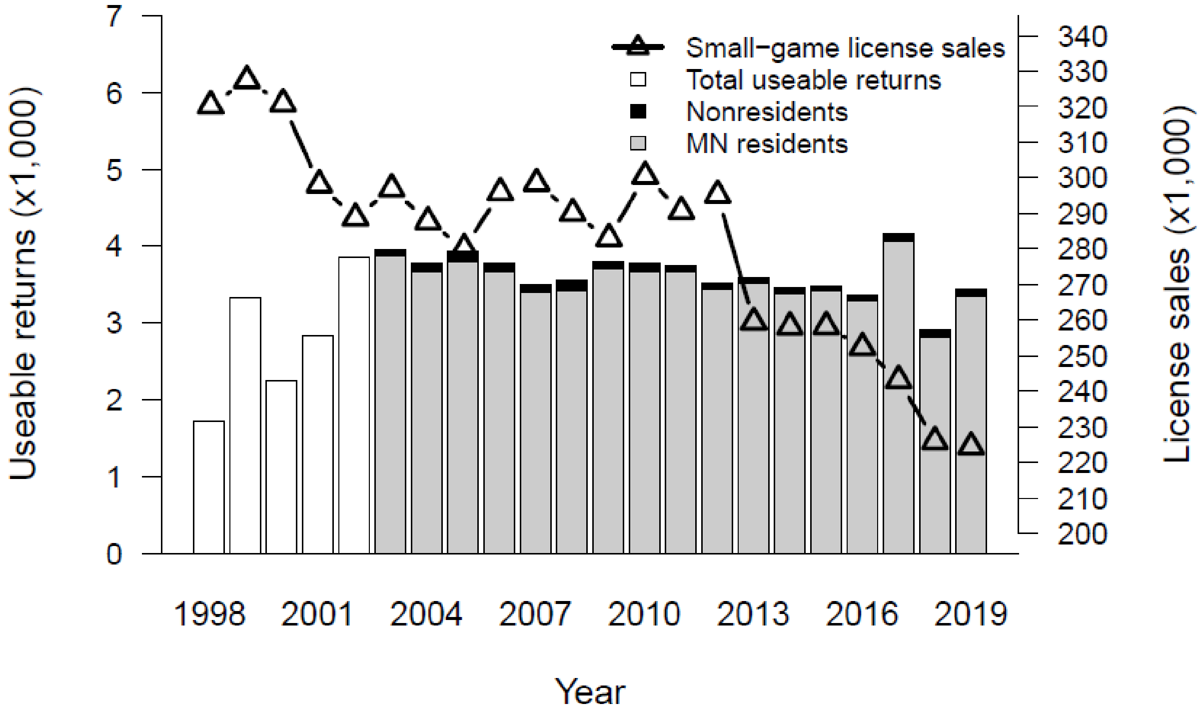

Figure 1. Number of Minnesota small game licenses sold and usable returned surveys, 1998-2019. Includes resident and non-resident licenses, and excludes duplicate and free licenses.

Harvest trends for top four small game species harvested in Minnesota, 2002-2019. Top left - Ducks (all species), Top right - Canada goose, Bottom left - Ring-necked pheasant, Bottom right - Ruffed grouse.

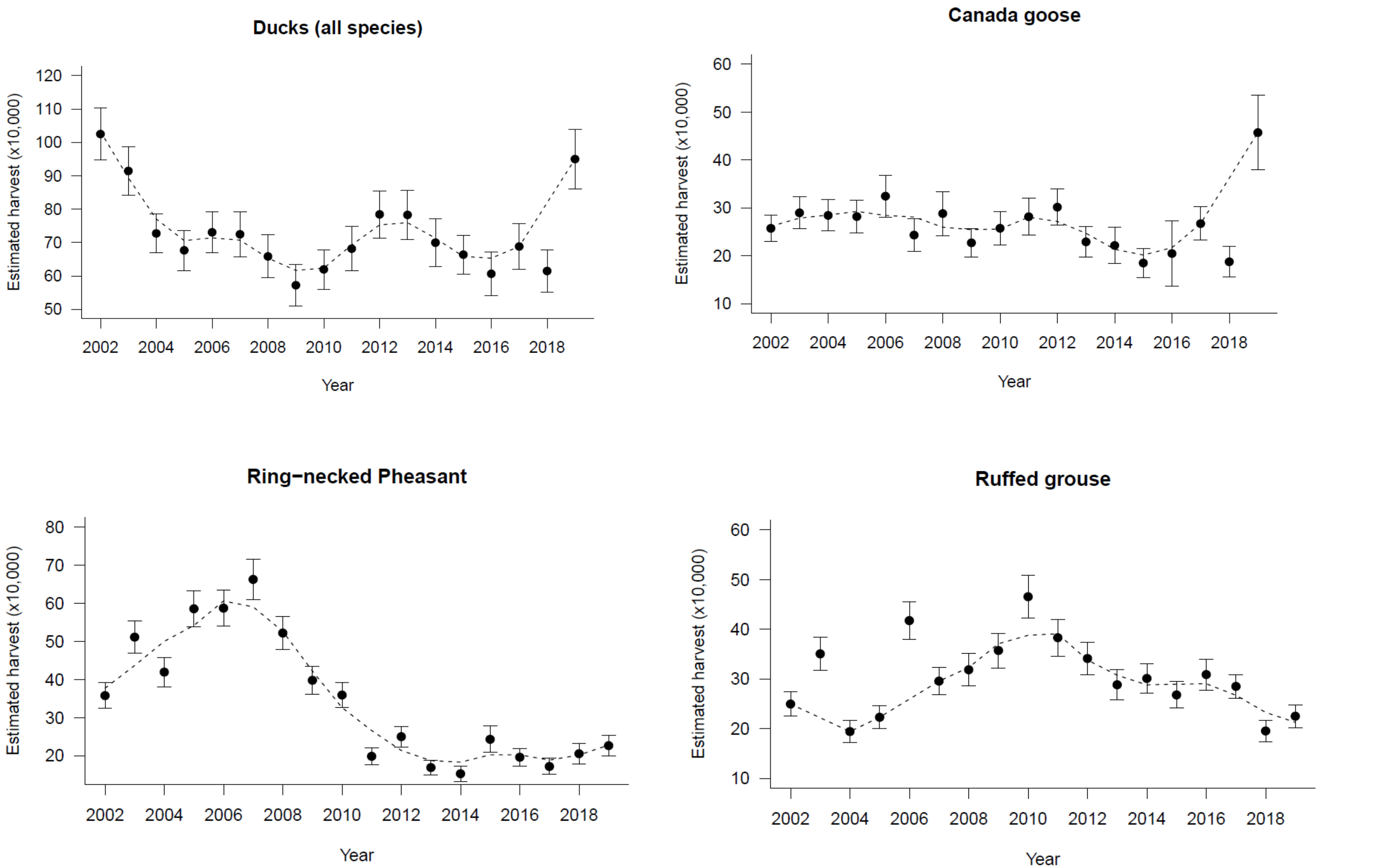

Figure 3. Harvest trends for top four small game species harvested in Minnesota, 2002-2019.

Table 1. Percent of respondents who hunted small game, 2009-10 through 2019-2020[a].

		Returns from mail survey	Projections from license sales
2009-10	Hunted Did not hunt	2,850 (75%) 952 (25%) 3,802 (100.0%)	212,126 70,857 282,983
2010-11	Hunted Did not hunt	2,824 (75%) 953 (25%) 3,777 (100.0%)	210,129 70,911 281,040
2011-12	Hunted Did not hunt	2,761 (74%) 987 (26%) 3,748 (100.0%)	214,137 76,549 290,686
2012-13	Hunted Did not hunt	2,669 (76%) 851 (24%) 3,520 (100%)	223,808 71,360 295,168
2013-14	Hunted Did not hunt	2,586 (72%) 1,003 (28%) 3,589 (100%)	186,317 72,264 258,581
2014-15	Hunted Did not hunt	2,476 (72%) 975 (28%) 3,451 (100%)	185,186 72,923 258,109
2015-16	Hunted Did not hunt	2,505 (72%) 980 (28%) 3,485 (100%)	185,604 72,612 258,216
2016-17	Hunted Did not hunt	2,426 (72%) 945 (28%) 3,371 (100%)	181,614 70,744 252,358
2017-18	Hunted Did not hunt	2,768 (66%) 1,395 (34%) 4,163 (100%)	161,658 81,472 243,130
2018-19	Hunted Did not hunt	2,000 (69%) 904 (31%) 2,904 (100%)	155,601 70,331 225,932
2019-20	Hunted Did not hunt	2,524 (73%) 911 (27%) 3,435 (100%)	164,896 59,517 224,413

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

Table 2[a]. Statewide (resident and non-resident) small game hunting license sales and estimated hunter harvest, 2009-10 through 2019-20.

	2009-10	2010-11	2011-12[b]	2012-13[b]	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Small game license sales[c]	282,983	282,227	271,768	264,063	258,581	258,109	258,208	252,358	243,130	225,932	224,413
State duck stamp sales	89,942	88,069	89,681	90,052	93,412	94,265	92,176	88,905	86,258	82,955	86,568
Pheasant stamp sales	110,456	104,286	86,868	90,541	77,597	74,295	77,750	76,920	71,925	72,192	74,921
Estimated harvest[d]											
Ducks	572,220	619,600	681,550	784,360	782,810	699,620	663,811	606,458	688,225	614,780	949,928
Canada geese	227,160	257,530	281,630	301,550	229,120	221,620	185,012	204,825	267,192	187,578	457,192
Other geese	6,250	3,940	4,800	8,820	7,130	6,510	4,448	7,188	8,062	1,557	11,566
American coot	14,810	26,340	10,520	16,720	15,130	17,050	15,861	21,564	19,976	10,663	15,680
Common snipe	1,490	1,940	1,390	1,420	2,310	520	223	1,948	1,928	1,401	1,764
Rails / gallinules	300	80	390	80	70	80	1,039	n.a.[e]	1,697	n.a.[f]	n.a.[g]
Crow	56,350	57,300	81,500	90,260	67,440	56,020	57,576	48,590	110,034	34,940	27,377
American woodcock	35,430	29,770	24,980	30,360	31,920	25,810	37,270	46,867	38,546	30,500	27,116
Mourning dove	109,940	100,230	74,000	92,760	80,480	103,370	96,552	58,618	88,021	54,623	89,834
Ring-necked pheasant	398,130	359,400	198,500	250,140	169,100	152,800	243,176	196,141	171,883	205,395	226,639
Ruffed grouse	357,420	465,580	383,150	341,320	288,410	301,190	267,997	308,955	285,180	195,515	225,200
Spruce grouse	19,130	14,960	18,640	11,980	13,110	14,590	9,856	15,348	12,032	7,081	7,319
Sharp-tailed grouse	9,530	16,820	11,600	10,650	7,130	8,530	7,929	8,610	11,097	5,681	6,273
Gray partridge	8,040	9,150	3,950	5,160	2,380	3,590	3,187	3,745	4,557	3,893	3,399
Gray squirrel	109,790	138,920	115,840	126,110	84,010	91,250	96,400	95,374	105,712	71,888	101,069
Fox squirrel	53,970	61,690	48,100	49,750	33,940	40,840	46,383	39,603	41,994	28,398	35,672
Eastern cottontail	57,760	53,870	34,640	64,140	40,710	38,820	41,716	49,187	47,135	32,057	33,647
White-tailed jack rabbit	2,610	7,220	5,180	1,910	1,870	1,050	742	1,124	585	623	393
Snowshoe hare	5,360	6,770	8,430	16,800	6,200	7,860	6,374	5,990	10,864	3,191	3,855
Raccoon	66,700	77,690	44,080	48,340	46,690	52,800	38,387	22,312	68,685	29,332	33,908
Red fox	10,270	8,780	7,120	7,990	5,190	3,220	3,780	2,247	9,229	1,868	5,358
Gray fox	1,860	2,380	1,160	250	430	600	816	225	3,798	78	1,438
Coyote	46,070	44,050	33,410	51,990	23,630	17,430	35,123	24,481	56,184	22,408	41,095
Badger	750	600	230	330	290	80	149	375	760	78	66

[a] Harvest estimates in this table, and the number of hunters and mean take per hunter in Table 4, are calculated from different questions on the survey form. The sample used in calculations differs from one estimator to the next. This is because some respondents give specific answers to one question but not to a related one. A formula is used to calculate the total estimated take for each species that appear in this table. In most years the formula produces results rather close to those obtained by multiplying the average take per hunter times the number of hunters. However, in other years results of the two methods are quite divergent, perhaps as a result of an unusual sample. This is being investigated further, and as a result, numbers may change somewhat in future reports. The most current report of survey findings will have the best data available at that time.

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

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

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

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

[f] No respondents indicated they hunted rails.

[g] Only 3 respondents indicated they hunted rails and they reported 0 bagged.

Table 3. Mail survey results of nonresident small game hunters, 2009-10 through 2019-20.

	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Nonresident licenses issued [a]	6,934	6,695	6,312	6,456	6,031	6,056	6,755	6,701	6,854	6,718	6,887
Questionnaires:											
Number mailed	196	163	169	166	162	165	169	190	200	200	213
Number not delivered	10	6	11	11	10	12	5	15	19	16	18
Number (percent) returned	105 (54)	107 (66)	91 (54)	71 (43)	81 (50)	70 (42)	73 (43)	78 (41)	99 (50)	80 (40)	86 (40)
Estimated nonresidents and (percent) of all licensed nonresidents hunting:											
Ducks	1,849 (27)	2,003 (29.9)	2,430 (38.5)	2,360 (36.6)	2,010 (33.3)	2,340 (38.6)	1,850 (27.4)	2,320 (34.6)	2,350 (34.3)	1,680 (25)	3,040 (44.2)
Canada goose	726 (10)	1,314 (19.6)	1,620 (25.6)	1,360 (21.1)	1,270 (21.0)	1,300 (21.4)	650 (9.6)	770 (11.5)	1,730 (25.3)	1,260 (18.8)	3,120 (45.3)
Ruffed grouse	1,915 (28)	2,503 (37.4)	1,460 (23.1)	2,820 (43.7)	2,010 (33.3)	2,600 (42.9)	2,870 (42.5)	3,520 (52.6)	2,280 (33.3)	2,270 (33.8)	1,760 (25.6)
Ring-necked pheasant	1,519 (22)	2,003 (29.9)	1,780 (28.2)	1,910 (29.6)	1,420 (23.5)	1,380 (22.9)	1,480 (21.9)	1,550 (23.1)	1,520 (22.2)	2,350 (35)	1,120 (16.3)
Raccoon[b,c]	0 (0)	63 (0.9)	0 (0)	0 (0)	80 (1.2)	0 (0)	0 (0)	170 (2.6)	70 (1.0)	0	0
Estimated nonresident take:											
Ducks	11,755	17,055	13,840	20,380	20,410	13,060	16,863	17,701	15,717	15,792	21,228
Canada goose	3,698	6,334	4,050	2,270	3,650	2,680	1,484	1,462	6,994	2,940	15,060
Ruffed grouse	8,651	12,600	8,980	10,090	4,990	9,090	13,805	11,772	6,994	2,856	4,325
Ring-necked pheasant	6,274	8,076	4,860	6,820	3,430	3,720	6,581	4,040	7,274	6,048	2,645
Raccoon [b, c]	0	593	0	0	1,280	0	0	172	770	0	0

[a] Excludes duplicate licenses and nonresident shooting preserve licenses.
[b] In 2009, 2011, 2012, 2014, 2015, 2018 and 2019 no non-residents reported hunting/harvesting raccoons.
[c] In 2013 and 2017 only one non-resident reported hunting/harvesting raccoons. The extrapolated estimate is not reliable.

Table 4. Estimated number of statewide hunters by species, 2009-10 through 2019-20.

	2009-10	2010-11	2011-12[a]	2012-13[a]	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Ducks	77,480	72,770	76,090	80,770	76,950	75,170	76,243	67,301	63,426	61,618	84,801
Canada goose	55,520	53,430	57,220	58,900	51,160	48,240	45,938	40,950	44,678	38,278	65,985
Other geese	3,280	3,650	2,710	3,830	2,810	2,770	2,520	2,321	2,512	1,323	3,071
American coot	4,090	4,610	3,480	3,990	3,820	4,410	3,261	3,519	3,446	3,113	3,332
Common snipe	1,340	1,340	1,160	1,160	1,370	820	667	899	1,285	934	1,176
Rails / gallinules	370	220	230	500	140	300	445	75	234	n.a.[b]	196
Crow	10,640	9,380	10,360	11,480	8,570	7,400	7,410	7,412	11,564	4,669	5,227
American woodcock	11,760	10,790	9,430	13,310	12,030	9,650	12,596	12,877	12,615	10,737	9,866
Mourning dove	10,500	10,640	8,970	9,230	10,380	9,950	8,966	7,636	8,878	6,536	10,780
Ring-necked pheasant	99,440	89,140	72,840	76,950	62,110	57,590	63,350	59,965	45,263	55,861	52,854
Ruffed grouse	87,230	92,490	88,620	91,260	81,130	83,020	79,058	82,348	80,654	67,765	61,608
Spruce grouse	9,750	8,860	10,210	7,400	10,810	10,320	8,225	9,658	8,819	7,314	6,142
Sharp-tailed grouse	5,510	7,140	6,190	6,570	6,700	5,460	5,113	6,214	5,198	4,202	4,443
Gray partridge	4,240	3,720	2,400	3,080	2,450	2,540	2,075	2,097	2,103	1,479	2,614
Gray squirrel	22,260	23,740	23,280	24,710	21,690	21,240	22,303	23,806	20,967	17,972	18,097
Fox squirrel	13,180	15,630	12,060	14,220	12,030	12,790	13,411	13,625	11,798	9,803	10,192
Eastern cottontail	16,300	15,030	12,300	16,390	14,550	13,160	11,633	16,096	14,368	12,449	11,368
White-tailed jackrabbit	1,790	2,230	2,320	1,750	1,220	1,350	890	1,423	643	623	523
Snowshoe hare	3,500	3,800	3,250	4,820	3,750	4,560	4,076	3,369	4,439	2,101	1,960
Raccoon	7,300	8,260	8,040	8,570	7,640	6,880	5,632	5,840	8,936	4,746	5,880
Red fox	7,820	7,220	6,030	5,820	5,910	4,560	4,150	3,594	5,549	3,035	4,247
Gray fox	1,790	1,640	1,390	1,580	1,730	1,050	1,186	899	2,103	623	1,176
Coyote	19,280	19,420	17,940	21,050	17,650	17,580	18,302	15,871	22,193	14,394	16,464
Badger	370	600	310	330	500	80	297	375	701	234	66

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

Table 5. Estimated harvest per active hunter by species, 2009-10 through 2019-20.

	2009-10	2010-11	2011-12[a]	2012-13[a]	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Ducks	7.4	8.5	9.0	9.7	10.2	9.3	8.7	9.0	10.9	10.0	11.2
Canada geese	4.1	4.8	4.9	5.1	4.5	4.6	4.0	5.0	6.0	4.9	6.9
Other geese	1.9	1.1	1.8	2.3	2.5	2.4	1.8	3.1	3.2	1.2	3.8
American coot	3.6	5.7	3.0	4.2	4.0	3.9	4.9	6.1	5.8	3.4	4.7
Common snipe	1.1	1.4	1.2	1.2	1.7	0.6	0.3	2.2	1.5	1.5	1.5
Rails/gallinules	0.8	0.3	1.7	0.2	0.5	0.2	2.3	n.a.[b]	7.2	n.a.[c]	n.a.[d]
Crow	5.3	6.1	7.9	7.9	7.9	7.6	7.8	6.6	9.5	7.5	5.2
American woodcock	3.0	2.8	2.6	2.3	2.7	2.7	3.0	3.6	3.1	2.8	2.7
Mourning dove	10.5	9.4	8.2	10.0	7.8	10.4	10.8	7.7	9.9	8.4	8.3
Ring-necked pheasant	4.0	4.0	2.7	3.3	2.7	2.7	3.8	3.3	3.8	3.7	4.3
Ruffed grouse	4.1	5.0	4.3	3.7	3.6	3.6	3.4	3.8	3.5	2.9	3.7
Spruce grouse	2.0	1.7	1.8	1.6	1.2	1.4	1.2	1.6	1.4	1.0	1.2
Sharp-tailed grouse	1.7	2.4	1.9	1.6	1.1	1.6	1.6	1.4	2.1	1.4	1.4
Gray partridge	1.9	2.5	1.6	1.7	1.0	1.4	1.5	1.8	2.2	2.6	1.3
Gray squirrel	4.9	5.9	5.0	5.1	3.9	4.3	4.3	4.0	5.0	4.0	5.6
Fox squirrel	4.1	3.9	4.0	3.5	2.8	3.2	3.5	2.9	3.6	2.9	3.5
Eastern cottontail	3.5	3.6	2.8	3.9	2.8	2.9	3.6	3.1	3.3	2.6	3.0
White-tailed jackrabbit	1.5	3.2	2.2	1.1	1.5	0.8	0.8	0.8	0.9	1.0	0.8
Snowshoe hare	1.5	1.8	2.6	3.5	1.7	1.7	1.6	1.8	2.4	1.5	2.0
Raccoon	9.1	9.4	5.5	5.6	6.1	7.7	6.8	3.8	7.7	6.2	5.8
Red fox	1.3	1.2	1.2	1.4	0.9	0.7	0.9	0.6	1.7	0.6	1.3
Gray fox	1.0	1.5	0.8	0.2	0.2	0.6	0.7	0.2	1.8	0.1	1.2
Coyote	2.4	2.3	1.9	2.5	1.3	1.0	1.9	1.5	2.5	1.6	2.5
Badger	2.0	1.0	0.8	1.0	0.6	1.0	0.5	1.0	1.1	0.3	1.0

[a] Estimates from these years were recomputed without license type 99- free youth license to be consistent with other years of data.
[b] Only 1 respondent indicated they hunted rails and they reported 0 bagged.
[c] No respondents indicated they hunted rails.
[d] Only 3 respondents indicated they hunted rails and they reported 0 bagged.

Table 6. Mean harvest for successful hunters and hunter success rates (%), 2009-10 through 2019-20.

	2009-10	2010-11	2011-12 [a]	2012-13 [a]	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Ducks	9.2(80)	10.3 (83)	10.5 (85)	11.1 (87)	11.7 (87)	11.0 (85)	10.6 (82)	10.9 (83)	12.5 (87)	11.3 (89)	13.1 (85)
Canada geese	5.6 (73)	6.1 (80)	6.3 (78)	6.5 (78)	5.8 (77)	6.6 (69)	5.7 (71)	7.1 (70)	7.4 (81)	6.3 (77)	8.5 (81)
Other geese	3.5 (55)	2.6 (41)	3.4 (51)	4.4 (52)	5.5 (46)	4.3 (54)	4.0 (44)	8.0 (39)	8.6 (37)	3.3 (35)	8.0 (47)
American coot	5.5 (65)	7.2 (79)	4.4 (69)	5.2 (81)	5.2 (75)	5.0 (78)	6.7 (73)	7.6 (81)	8.1 (71)	5.3 (65)	7.5 (63)
Common snipe	1.8 (61)	2.2 (67)	1.6 (73)	2.1 (57)	2.1 (79)	1.4 (45)	1.0 (33)	3.2 (67)	2.5 (59)	2.6 (58)	1.9 (78)
Rails / gallinules	1.3 (60)	1.0 (33)	5.0 (33)	1.0 (17)	1.0 (50)	1.0 (25)	3.5 (67)	n.a. [b]	14.5 (50)	n.a. [c]	n.a. [d]
Crow	5.9 (90)	6.7 (91)	8.9 (88)	8.8 (90)	9.4 (84)	8.7 (87)	8.3 (94)	7.6 (86)	11.0 (86)	9.4 (80)	6.1 (86)
American woodcock	4.1 (73)	3.6 (76)	3.8 (70)	3.4 (68)	3.8 (70)	4.2 (64)	4.4 (67)	5.4 (67)	4.5 (69)	4.4 (65)	3.8 (72)
Mourning dove	11.4 (92)	11.1 (85)	10.5 (78)	12.5 (80)	9.2 (85)	12.5 (83)	13.3 (81)	10.3 (75)	11.6 (86)	10.2 (82)	10.3 (81)
Ring-necked pheasant	5.8 (69)	5.6 (72)	4.4 (63)	4.9 (67)	4.2 (64)	4.3 (61)	5.4 (71)	5.0 (65)	5.5 (69)	5.4 (68)	6.0 (71)
Ruffed grouse	5.5 (74)	6.6 (76)	5.9 (74)	5.2 (71)	5.2 (68)	5.1 (71)	4.9 (69)	5.3 (70)	4.8 (73)	4.3 (67)	5.2 (71)
Spruce grouse	3.1 (64)	2.4 (71)	3.0 (61)	2.8 (57)	2.4 (51)	2.5 (56)	2.4 (50)	2.7 (58)	2.4 (57)	1.9 (50)	2.3 (51)
Sharp-tailed grouse	3.0 (58)	3.5 (68)	3.1 (61)	3.4 (48)	3.2 (33)	3.8 (41)	3.1 (51)	2.9 (47)	4.0 (53)	3.0 (44)	2.5 (56)
Gray partridge	3.3 (58)	4.2 (58)	3.2 (52)	3.1 (54)	2.5 (38)	4.4 (32)	2.7 (57)	3.3 (54)	4.3 (50)	4.5 (58)	3.7 (35)
Gray squirrel	5.8 (86)	7.0 (84)	6.3 (78)	6.3 (80)	5.0 (77)	5.5 (78)	5.3 (81)	5.1 (79)	5.7 (89)	4.8 (83)	6.2 (90)
Fox squirrel	4.8 (85)	4.6 (86)	5.4 (74)	4.4 (80)	3.7 (75)	4.3 (75)	4.9 (71)	3.8 (76)	4.3 (83)	3.6 (81)	4.4 (80)
Eastern cottontail	4.3 (83)	4.4 (81)	4.1 (69)	5.5 (71)	3.5 (79)	4.1 (73)	5.0 (72)	4.0 (77)	4.0 (83)	3.6 (71)	3.6 (83)
White-tailed jackrabbit	2.1 (71)	4.6 (70)	3.5 (63)	2.3 (48)	5.2 (29)	1.8 (44)	2.0 (42)	1.9 (42)	1.7 (55)	1.6 (62)	1.5 (50)
Snowshoe hare	2.6 (60)	2.6 (69)	3.8 (69)	5.0 (69)	2.9 (58)	3.0 (57)	3.0 (53)	3.2 (56)	3.9 (63)	2.7 (56)	2.8 (70)
Raccoon	9.6 (95)	10.0 (94)	6.1 (89)	6.1 (93)	6.9 (89)	8.5 (90)	7.7 (88)	4.1 (92)	8.2 (93)	7.4 (84)	6.2 (93)
Red fox	2.4 (54)	2.3 (54)	2.4 (49)	2.7 (50)	2.0 (44)	1.7 (41)	1.6 (57)	1.4 (44)	2.6 (63)	1.2 (51)	2.2 (58)
Gray fox	2.5 (42)	4.0 (36)	2.5 (33)	1.0 (16)	1.5 (17)	2.0 (29)	1.4 (50)	1.0 (25)	2.8 (64)	1.0 (12)	3.1 (39)
Coyote	4.6 (52)	4.0 (57)	4.0 (47)	5.1 (49)	2.7 (50)	2.4 (41)	3.4 (57)	3.1 (49)	4.3 (59)	2.9 (53)	4.3 (58)
Badger	2.5 (80)	1.0 (100)	1.5 (50)	1.0 (100)	1.0 (57)	1.0 (100)	1.0 (50)	1.2 (80)	1.6 (67)	1.0 (33)	1.0 (100)

[a] Estimates from these years were recomputed without license type 99- free youth license to be consistent with other years of data.
[b] Only 1 respondent indicated they hunted rails and they reported 0 bagged.
[c] No respondents indicated they hunted rails.
[d] Only 3 respondents indicated they hunted rails and they reported 0 bagged.

MIGRATORY BIRD HUNTING ACTIVITY AND HARVEST DURING THE 2018 - 2019 AND 2019-20 HUNTING SEASONS.

The following information has been excerpted from: U.S. Fish and Wildlife Service. Migratory bird hunting activity and harvest during the 2018 - 2019 and 2019-20 hunting seasons. U.S. Fish and Wildlife Service, Laurel, Maryland, U.S.A. The entire report is available on-line at

https://www.fws.gov/library/collections/migratory-bird-hunting-activity-and-harvest-reports

Table 1. Species composition of the Minnesota waterfowl harvest, 2018 and 2019. (from: Raftovich, R.V., K.K. Fleming, S.C. Chandler, and C.M. Cain. 2020. Migratory bird hunting activity and harvest during the 2018-19 and 2019-20 hunting seasons. U.S. Fish and Wildlife Service, Laurel, Maryland. USA August, 2020. 75 pp).

	Minnesota Harvest					Mississippi Flyway Harvest		
Species	2018	% of Harvest	2019	% of Harvest	Percent change in Harvest 18-19	2018	2019	Percent change Harvest 18-19
Mallard	105,149	21.79	98,723	22.18	- 6	1,407,353	1,454,937	3
Domestic mallard	212	0.04	0	0.00	-100	1,397	839	-67
American black duck	212	0.04	636	0.14	200	16,032	20,357	21
Black x mallard	0	0.00	0	0.00		1,186	982	-21
Gadwall	22,471	4.66	29,447	6.62	31	421,296	537,060	22
American wigeon	10,812	2.24	11,652	2.62	8	65,348	69,814	6
Green-winged teal	37,947	7.86	22,668	5.09	-40	452,685	435,290	-4
Blue-winged /cinnamon teal	61,479	12.74	64,191	14.42	4	399,992	383,088	-4
Northern shoveler	5,724	1.19	6,356	1.43	11	127,236	141,962	10
Northern pintail	5,300	1.10	5,084	1.14	-4	68,949	74,589	8
Wood duck	85,010	17.62	80,716	18.13	-5	407,754	488,166	16
Redhead	13,144	2.72	11,016	2.47	-16	60,193	52,298	-15
Canvasback	6,148	1.27	4,661	1.05	-24	30,592	29,990	-2
Greater scaup	3,180	0.66	1,271	0.29	-60	35,375	23,101	-53
Lesser scaup	10,812	2.24	6,356	1.43	-41	86,568	75,001	-15
Ring-necked duck	81,618	16.92	66,945	15.04	-18	182,667	174,603	-5
Goldeneye	5,936	1.23	5,508	1.24	-7	44,721	27,855	-61
Bufflehead	16,960	3.52	16,313	3.67	-4	98,519	83,493	-18
Ruddy duck	848	0.18	847	0.19	0	6,721	15,506	57
Scoters	424	0.09	0	0.00	-100	5,740	3,125	-84
Hooded merganser	8,904	1.85	11,228	2.52	26	33,738	46,569	28
Other mergansers	212	0.04	1,483	0.33	600	7,334	7,916	7
Total Duck Harvest [a] (retrieved kill)	482,500 ±16%		445,100 ±15%		-8	3,979,000 ±9%	4,172,100 ±9%	5

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

Table 2. Top 10 states in number of **adult duck hunters**, 2019, and number of hunter-days and retrieved duck kill. (from: Raftovich, R.V., K.K. Fleming, S.C. Chandler, and C.M. Cain. 2020. Migratory bird hunting activity and harvest during the 2018-19 and 2019-20 hunting seasons. U.S. Fish and Wildlife Service, Laurel, Maryland. USA August, 2020. 75 pp).

State	Number of active duck hunters	Duck hunter days afield	Total duck harvest	Seasonal duck harvest per hunter
Arkansas	75,400 ± 10%	496,800 ± 17%	1,091,000 ± 12%	14.5 ± 16%
Texas	69,000 ± 24%	332,600 ± 21%	787,800± 13%	11.4 ± 28%
Minnesota	50,900 ± 13%	263,500 ± 12%	445,100 ± 15%	8.8 ± 20%
Louisiana	50,000 ± 14%	287,100 ± 23%	572,400 ± 20%	11.5 ± 24%
California	45,500 ± 13%	342,100 ± 12%	962,200 ± 12%	21.1 ± 18%
Wisconsin	43,100 ± 17%	254,500 ± 17%	365,300 ± 24%	8.5 ± 30%
Michigan	33,000 ± 16%	164,100 ± 14%	235,300 ± 14%	7.1 ± 21%
North Dakota	30,500 ± 10%	135,100 ± 12%	406,900 ± 15%	13.3 ± 18%
North Carolina	29,200 ± 17%	172,400 ± 22%	232,600 ± 20%	8.0 ± 26%
Missouri	26,600 ± 15%	158,200 ± 17%	273,600 ± 18%	10.3 ±23%
Mississippi Flyway		2,348,200 ± 6%	4,172,100 ± 9%	
United States		5,002,200 ± 4%	9,720,800 ± 5%	

Table 3. Top 10 states in number of **adult goose hunters**, 2019, and number of hunter-days and retrieved goose kill (from: Raftovich, R.V., K.K. Fleming, S.C. Chandler, and C.M. Cain. 2020. Migratory bird hunting activity and harvest during the 2018-19 and 2019-20 hunting seasons. U.S. Fish and Wildlife Service, Laurel, Maryland. USA August, 2020. 75 pp).

State	Number of active goose hunters	Goose hunter days afield	Total goose harvest	Seasonal goose harvest per hunter
Minnesota	40,000 ± 12%	203,200 ± 20%	200,200 ± 29%	5.0 ± 32%
Texas	39,200 ± 19%	111,800 ± 27%	173,700 ± 29%	4.4 ± 35%
Wisconsin	36,700 ± 10%	225,900 ± 15%	131,100 ± 15%	3.6 ± 19%
California [b]	32,400 ± 10%	200,100 ± 13%	181,300 ± 15%	5.6 ± 18%
Michigan	31,000 ± 15%	191,200 ± 35%	153,000 ± 20%	4.9 ± 25%
Arkansas	30,700 ± 14%	127,000 ± 19%	128,700 ± 19%	4.2 ± 24%
North Dakota	22,100 ± 8%	88,400 ± 11%	159,600 ± 21%	7.2 ± 22%
Pennsylvania	18,600 ± 19%	91,100 ± 21%	99,300 ± 32%	5.3 ± 37%
North Carolina [b]	17,100 ± 22%	58,700 ± 28%	50,200 ± 65%	2.8 ± 68%
Illinois	16,700 ± 17%	128,200 ± 22%	105,000 ± 45%	6.3 ± 48%
Mississippi Flyway		1,291,100 ± 8%	1,023,200 ± 9%	
United States [b]		2,780,600 ± 5%	2,691,900 ± 5%	

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

2020 LIGHT GOOSE CONSERVATION ORDER HARVEST IN MINNESOTA

Steve Cordts, Wildlife Populations and Regulations Unit

Margaret Dexter, Wildlife Populations and Research Unit

J. Giudice, MNDNR Biometrics Unit

INTRODUCTION

This report documents results of the 2020 Light Goose Conservation Order hunter mail questionnaire survey.

METHODS

Minnesota held a light goose Conservation Order harvest from 18 February - 30 April 2020. 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 1,002 permits were issued and 434 responses (44%) to the questionnaire were obtained (Table 1, Figure 2). In calculating harvest estimates, we assume that the 568 non-respondents participated in the conservation action and took light geese in the same manner as respondents. An estimated 430 hunters attempted to take light geese during the conservation order period. Active participants pursued light geese for 1,529 days and 785 light geese were shot and retrieved. This was an average retrieved take of 2 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.

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MINNESOTA 2020 LIGHT GOOSE HARVEST SURVEY
For the Period of February 18 - April 30, 2020 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, 2020. 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 2020 hunting experience.**
THANK YOU! Lou Cornicelli, Wildlife Research Program Manager, Division of Fish and Wildlife, MN DNR.

1. Did you hunt light geese in Minnesota during February 18 - April 30, 2020? 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, 2020? ________

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, 2020.

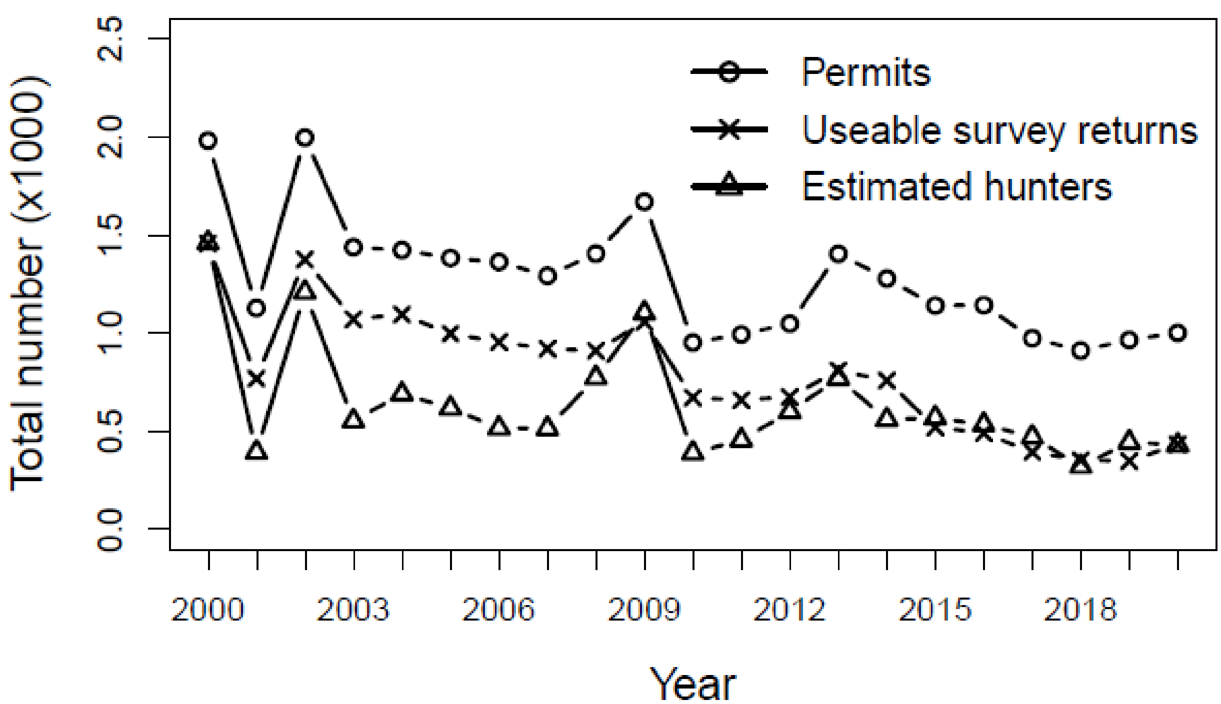


Figure 2. Light goose permits issued, survey response, and estimated hunters in Minnesota, 2000-2020.

Table 1. Summary of Light Goose Conservation Order harvest in Minnesota, 2008 – 2020.

	Year												
Statistic	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total permits sold	1,406	1,670	952	994	1,048	1,405	1,278	1,141	1,143	974	912	965	1,002
Useable returns	910	1,057	671	659	675	810	759	520	491	393	353	348	434
Response rate (%)	65.0	63.0	72.3	67.1	65.3	58.3	60.0	46	43	41	43	41	44
Active hunters (%)	54.9	66.0	40.8	45.7	56.9	54.9	44.0	50	47	48	35	46	43
Estimated total hunters	773	1,103	389	455	600	770	560	569	534	471	321	444	430
Estimated hunter days	3,404	4,647	1,475	1,830	2,270	3,070	2,580	2,434	2,605	1,966	1,204	1,537	1,529
Mean days/hunter	4.4	4.2	3.8	4.0	3.8	4.0	4.6	4	5	4	3.8	4	4
Estimated harvest (shot & retrieved)	2,409	4,366	559	1,554	2,620	2,430	2,880	3,266	2,121	1,713	1,021	1612	785
Mean harvest/hunter	3.1	4.0	1.4	3.4	4.4	3.2	5.1	6	4	4	3.2	4	2
Estimated crippling losses	302	640	70	145	210	370	210	349	215	298	78	206	54
Percent using unplugged guns	46.7	46.8	44.9	44.2	43.0	49.4	48.8	NA	NA	NA	NA	NA	NA
Est. number hunters using unplugged guns	361	516	175	201	260	380	270	NA	NA	NA	NA	NA	NA
Est. number geese **shot** with unplugged guns	1,275	2,413	348	742	1,510	1,670	2,060	NA	NA	NA	NA	NA	NA
Est. harvest with shell 4-5-6	339	822	131	311	460	620	770	NA	NA	NA	NA	NA	NA
Percent using electronic calls	19.1	23.5	25.9	21.3	22.2	24.5	27.8	NA	NA	NA	NA	NA	NA
Est. number hunters using e-calls	148	260	101	97	130	190	160	NA	NA	NA	NA	NA	NA
Est. harvest while using e-calls	566	1,171	192	531	460	620	1,710	NA	NA	NA	NA	NA	NA
Percent hunting 1/2-hr after sunset	42.3	43.1	39.7	39.7	42.4	33.4	36.2	NA	NA	NA	NA	NA	NA
Est. number hunting after 1/2-hr sunset	326	475	154	180	250	260	200	NA	NA	NA	NA	NA	NA
Est. harvest 1/2-hr after sunset	511	713	87	238	240	260	550	NA	NA	NA	NA	NA	NA

MINNESOTA'S WILD TURKEY HARVEST – FALL 2019, SPRING 2020

Tim Lyons, Farmland Wildlife Populations and Research Group

Summary of Season Structure

The fall 2019 turkey season opened on September 28, 2019 and closed October 27, 2019. Though an unlimited number of permits were available, regulations limited hunters to the harvest of a single turkey (any sex) and required hunters to harvest their bird within a specific turkey permit area (TPA; Figure 1) declared at the time of purchase.

The spring 2020 hunting season was open April 14, 2020 through May 31, 2020. The season was comprised of 6 week-long time periods (A-F). General license hunters declared a TPA and were limited to a single time period during the first 5 weeks but unsuccessful hunters were able to hunt during the final (F) time period. Archery-only and youth licenses were valid during all time periods. All hunters were limited to a single bearded turkey (any sex). Beginning in 2020, the A and B lotteries were discontinued (with the exception of select Wildlife Management Area major units) and an unlimited number of general permits were available (C-F time periods already had unlimited permits available). Additionally, hunters had to declare a TPA at the time of purchase, but could harvest a bird within any TPA. Archery-only and youth licenses had already been valid in any permit area.

FALL 2019 SEASON

Permits Issued

The number of fall turkey hunters in 2019 (6,481) was very similar to the 2018 fall season (6,719, declining only 3.5% (Table 1). The number of fall turkey hunters remains below the 10-year average (7,634; -16%). The proportion of youth licenses (23%) remained similar to 2018 (21%).

Harvest

The fall 2019 turkey harvest (855) and hunter success (13.2%) increased slightly compared to the previous season (Table 1). Permit areas 501, 507, 508, and 510 comprised 77% of the total fall harvest with total permit sales, harvest, and success being greatest in area 507 (Table 2). The fall 2019 total harvest (855) remained below the 10-year average (1,150) though success was only slightly lower than the 10-year average (15%). Long term, the number of permits has fallen since the quota system was ended in 2012, but still remain above the number issued following the permit area and quota increase enacted for the fall 2008 season (Figure 2). The total fall harvest has increased since the first fall season in 1990, but has fallen since its peak in 2012 (Figure 2).

SPRING 2020 SEASON

Permits Issued

The number of permits issued across all license types increased in 2020 (Tables 3 and 4). The number of general permits issued increased by nearly 6,000 to 34,173 compared to 2019 and exceeded the 10-year average (32,555; Table 4). The increase in permits issued was greatest for youth permits, which more than doubled, while the number of archery permits increased by 25% (Table 4). There were a similar total number of permits issued for youth and archery in 2020 (14,292 and 14,729, respectively; Table 3). The total number of permits issued in 2020 set a new record high for participation since the modern turkey season began in 1978 (Figure 3). All hunters had to declare a permit area in 2020, but were no longer restricted to harvesting a bird in the declared area. General permits issued increased in all TPA's, but increases were smaller in the three TPA's (502, 511, 512) that still instituted a lottery during the A/B time periods (Table 5.)

Harvest

The 2020 spring turkey season set a new record high for total harvest for the modern turkey season (since 1978; Table 4, Figure 3). Harvest increased among most TPA's, but the increase was greatest in TPA's 507, 506, and 510 (Table 5). Harvest increased among all permit types and only general permits saw a slight decrease in success (Table 3). The number of youth permits issued in 2020 nearly doubled and youth harvest increased by more than 1,000 turkeys to 2,850 (Table 3) compared to 2019 (1,835) and success increased to almost 20% (Table 3). Although archery permit sales increased by 25%, harvest also increased by a similar amount and the success rate remained nearly the same (Table 3).

The number of hunters and harvest for each time period changed dramatically in 2020. Most of the increase in the number of general permit holders in 2020 occurred during the A and B periods (Table 6). Though the termination of the A and B period lottery in 2020 likely contributed to some of this increase, better weather and the increase in hunters due to COVID-19 may account for the majority of this pattern as many permit areas held unsold surplus permits during these two periods in previous years. The shift in time period selection by general permit holders resulted in a similar shift in the timing of harvest. Harvest during the A period increased to 41.7 % of the total spring 2020 harvest (Table 6) compared to 33.7% in 2019. Total harvest and the proportion of total harvest also increased during the B and F seasons but were offset by declines in both variables during C, D, and E (Table 6).

Factors influencing spring season participation and harvest

Weather often has the greatest impact on spring turkey season participation and harvest. Long periods of deep snow can reduce overwinter survival of turkeys and spring snowstorms can lead to reductions in turkey activity and hunter participation. The winter across much of the turkey range in Minnesota was milder than the long-term average and the state was generally snow-free by the start of the spring turkey season. This likely contributed to greater hunter success and participation in spring 2020 compared to previous years. Regulation changes which allowed unlimited general permits during the A and B time periods may have led to greater hunter participation as well. Still, the greatest factor underlying the large increase in hunter participation was likely the COVID-19 safety orders. Closures of businesses, schools, and a state-wide "stay-at-home" order may have given many previous and new hunters more personal time to harvest a bird.

Table 1. Permits available, number of applicants, permits issued, registered harvest, and hunter success rates for the ten most recent fall wild turkey seasons in Minnesota, 2010-2019.

Year	Permits available	Applicants	Permits issued	Registered harvest	Hunter success (%)[a]
2010	10,430	6,869	6,607	1,353	20.5
2011	10,430	3,538	5,382	953	17.7
2012[b]	Unlimited	N/A	10,628	1,752	16.5
2013[b]	Unlimited	N/A	8,060	1,137	14.1
2014[b]	Unlimited	N/A	8,236	1,216	14.8
2015[b]	Unlimited	N/A	8,109	1,213	15.0
2016[b]	Unlimited	N/A	8,469	1,176	13.9
2017	Unlimited	N/A	7,650	1,015	13.3
2018	Unlimited	N/A	6,719	834	12.4
2019	Unlimited	N/A	6,481	855	13.2

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

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

Table 2. Permits issued, registered harvest and hunter success rates (non-youth licenses), total registered harvest, and registered harvest by sex during the 2019 fall wild turkey season in Minnesota.

Permit area	General permits issued[a]	General permit harvest[b]	General permit success rates (%)[b]	Total registered harvest[c]	Toms[c]	Jakes[c]	Hens[c]
501	703	89	12.7	100	43	14	43
502	79	13	16.5	13	4	2	7
503	468	59	12.6	75	25	9	41
504	119	13	10.9	18	5	4	9
505	249	36	14.5	41	12	6	23
506	184	25	13.6	27	10	3	14
507	1252	191	15.3	237	77	42	118
508	1164	159	13.7	193	73	31	89
509	168	38	22.6	59	19	11	29
510	502	72	14.3	88	37	13	38
511	58	1	1.7	1	0	0	1
512	30	2	6.7	3	1	0	2
TOTAL	**4,976**	**698**	**12.9**	**855**	**306**	**135**	**414**

[a] Youth permits were not included as there is no declared permit area (valid in all permit areas). No separate license type for archery hunters was available so archery hunters are included in general permits issued.

[b] All firearm and archery harvest, excluding youth.

[c] Total harvest for all license types.

Table 3. Total permits issued, harvest, and success rate by permit type during the spring 2020 wild turkey season in Minnesota.

	Total permits issued	Harvest	Success (%)[a]
General	34,173	9,007	26.4
Youth	14,292	2,850	19.9
Archery	14,729	2,139	14.5
Total	63,194	13,996	22.1

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

Table 4. Permits issued, registered harvest, and hunter success rates for the ten most recent spring wild turkey hunting seasons in Minnesota, 2011-2020.

Year	General permits issued	Youth permits issued	Archery permits issued	Registered harvest[a]	Success (%)[b]
2011[c]	34,835	8,828	2,246	10,055	21.9
2012[c]	30,238	8,839	3,441	11,276	27.2
2013[c]	35,202	5,965	4,014	10,321	23.3
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

[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 TPA during the 2020 spring wild turkey season in Minnesota[a].

Permit area	Archery permits declared	General permits declared	Youth permits declared	Total registered harvest
501	2,130	6,714	2,227	2,363
502	229	549	167	185
503	1,373	3,850	1,416	1,424
504	486	907	412	371
505	747	2,099	696	712
506	625	1,394	696	532
507	3,911	8,615	4,347	3,960
508	2,571	6,200	2,578	2,426
509	468	812	516	498
510	1,827	2,676	1,023	1,350
511	216	199	111	77
512	146	158	103	39

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

Table 6. Permits available and issued by license type and time period for the spring 2020 wild turkey season in Minnesota.

Time period	Archery permits issued[a]	Youth permits issued[a]	General permits issued	Registered harvest[b]	Percent of total harvest[b]
Any	14,729	14,292			
A			12,395	5,833	41.7
B			10,398	3,504	25.0
C			6,112	1,919	13.7
D			2,520	830	5.9
E			1,900	529	3.8
F			848	1,381	9.9

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

[b] Includes harvest from all license types.

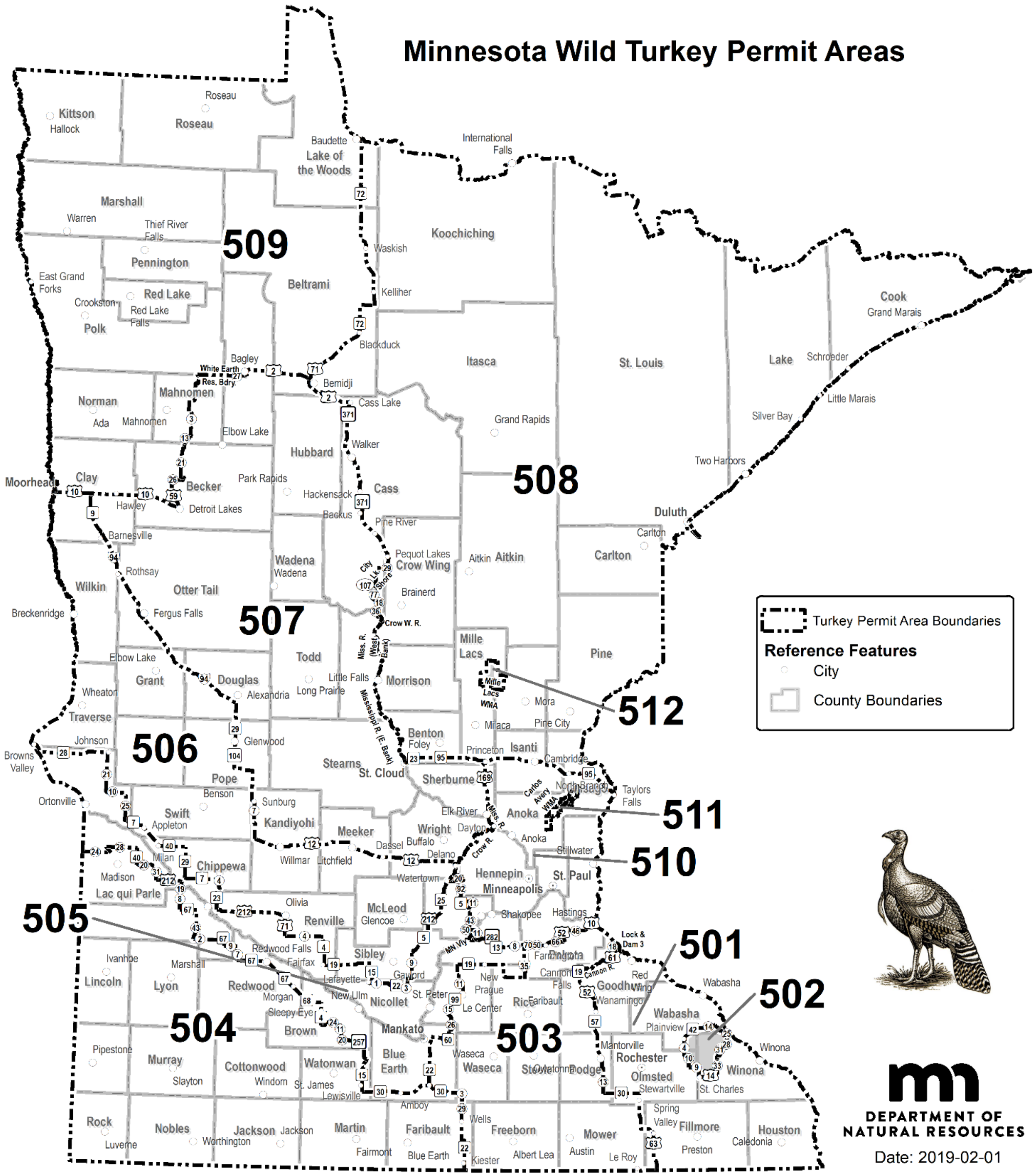


Figure 2. Permit areas open for hunting, fall 2019 and spring 2020 wild turkey seasons in Minnesota.

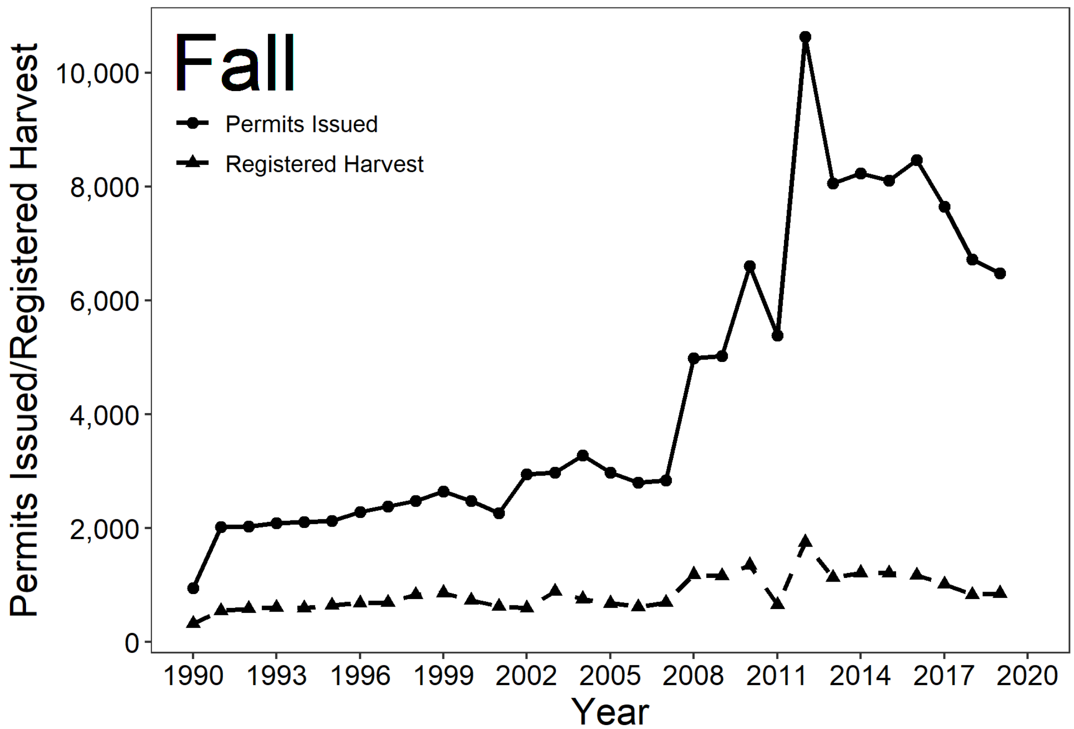


Figure 3. Permits issued and registered harvest for fall wild turkey seasons in Minnesota, 1990-2019.

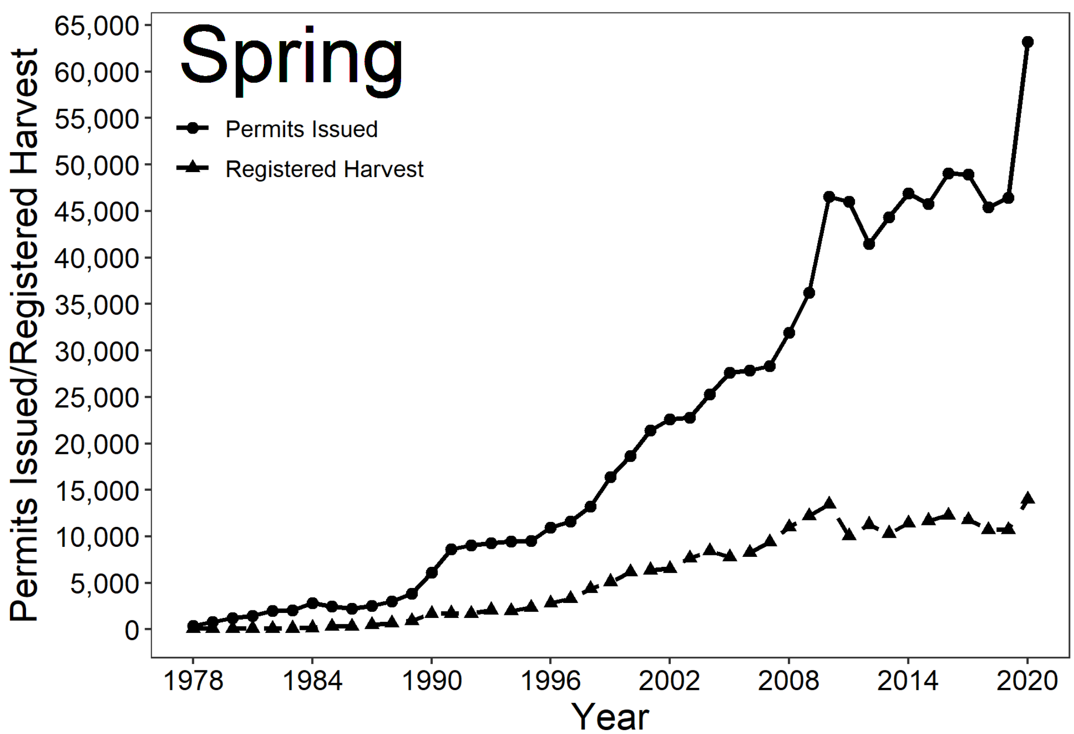


Figure 4. Permits issued and registered harvest for spring wild turkey seasons in Minnesota, 1978-2020.

2019 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 2019, 100 hunters were estimated to have gone afield and harvested 64 prairie-chickens and 25 sharp-tailed grouse (*Tympanuchus phasianellus*) during prairie-chicken hunts. Hunter success (0.37) was lower than recent years but satisfaction (3.8 on a scale of 1-5) was similar to recent years and consistent with improvement following changes to the permit areas and season (i.e., longer length and earlier dates) in 2013.

INTRODUCTION

Prairie-chicken (*Tympanuchus cupido pinnatus*) hunting in Minnesota was closed in 1943 because of population declines resulting from habitat loss. However, hunting was reopened in 2003 because prairie-chicken populations were considered robust enough to allow a limited season. During 2003-2005, a limited-entry 5-day hunting season was opened in 7 permit areas in western Minnesota. Permits were awarded through a lottery system, with a bag and season limit of 2 prairie-chickens. In 2006, 4 new permit areas were added and the number of permits was increased in some areas. Surplus licenses were offered for sale after the lottery for the first time in 2011, and in 2013, the permit areas were revised again. These most recent changes eliminated 801A and 802A, modified 803A to include portions of the former 802A and 803A, and added 812A and 813A to expand hunting eastward (Figures 1 and 2). The number of available permits was also reduced in some permit areas to more closely reflect opportunities to harvest prairie-chickens in each permit area. The season was lengthened from 5 days to 9 days to provide hunting opportunity on >1 weekend and was moved from mid-October to open in late-September. The earlier season was an attempt to improve hunter success and satisfaction by providing hunting opportunities before pheasant season opened (to reduce hunter interference and flushing distance). These changes were based on hunter comments received by DNR Wildlife Managers during prior years and input received during a public input survey during March 2013. Responses of surveyed prairie-chicken hunters in 2015 provided additional evidence that the earlier season is preferred by most, although hunter preferences were clearly divided. In 2019, the prairie-chicken season opened 28 September and closed 6 October.

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

METHODS

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

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

RESULTS & DISCUSSION

The combined quota for the 11 permit areas during 2019 was 125 permits, and 354 individuals applied in the lottery (Table 1). Of the 130 lottery winners, 101—including 2 landowners—later purchased a permit. All permit areas had more applicants than permits available, so surplus permits were not available.

Eighty-nine purchasers (88%, n = 101) responded to the survey; 71 (70%) responded to the first mailing and 18 (18%) to the second mailing. This response rate is similar to survey response rates since 2010 (mean: 87%; range: 83-95%). Respondents to the first mailing reported harvesting prairie-chickens at higher rates (45% vs. 22%) and reported harvesting more chickens (0.8 vs. 0.3 birds per hunter). Thus, hunters that were more successful were more likely to respond to the survey. Respondents to the first mailing were as likely as respondents to the second mailing to have hunted (99% vs. 100% of respondents), they hunted a similar number of days (2.1 vs. 2.0), harvested a similar number of sharp-tailed grouse (0.3 vs. 0.2 birds per hunter), and reported similar satisfaction (mean 3.8 vs. 3.8, median 4.0 vs. 4.5), with 88% and 72% of respondents reporting satisfaction scores ≥3, respectively.

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

Eighty-eight respondents reported that they hunted prairie-chickens (Table 2). I estimated the total number of hunters to be 100 (i.e., purchasers who went afield) after accounting for hunting by non-respondents. Hunters reported harvesting 61 prairie-chickens and total harvest after accounting for non-respondents was estimated as 64 prairie-chickens. An estimated 37 hunters bagged $\geq$1 chicken. Prairie-chicken hunter success during 2019 was lower than during 2013–2018, but comparable to 2010 and 2012. Lower success might be due in part to the 20% decline in number of active leks counted during spring surveys earlier this year, and perhaps also to rainy weather reported by respondents. Survey respondents also reported harvesting 25 sharp-tailed grouse while hunting prairie-chickens from permit areas 803A, 804A, 805A, 806A, and 807A (Figure 1). Successful hunters reported higher average satisfaction (4.4) than respondents that were not successful (3.4), but satisfaction of prairie-chicken hunters was high overall.

Prairie-chicken hunter satisfaction was similar to 2013-2018, 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. Supporters of the early season indicated that the birds were less wary early in the season and pheasant hunting did not affect the hunt. Reasons provided in support of a later season included cooler weather for hunters and dogs, better plumage on birds, fewer standing crops, opportunity to harvest pheasants while hunting chickens, and no conflict with the waterfowl opener. Although a large minority still indicated a preference for a later season, the current season meets the timing preferences of the majority of responding prairie-chicken hunters.

ACKNOWLEDGMENTS

This survey was funded in part by the Wildlife Restoration (Pittman-Robertson) Program. I would like to thank Laura Gilbert for preparing and mailing the postcards and entering data. I would also like to thank Lindsey Shartell for commenting on the report.

Table 1. Prairie-chicken hunt lottery applicants, winners, and hunting permit purchasers in Minnesota during 2019.

Permit	Permits	No. of	Lottery winners		Permit purchasers[a]		Surplus
area	available	applicants	No.[b]	Proportion	No.	Proportion	purchasers[c]
803A	8	20	9	0.45	9	1.00	0
804A	10	23	10	0.43	6	0.60	0
805A	10	55	11	0.20	8	0.72	0
806A	12	41	12	0.29	8	0.67	0
807A	20	50	20	0.40	15	0.75	0
808A	20	70	21	0.30	17	0.81	0
809A	15	25	16	0.64	15	0.94	0
810A	15	27	16	0.59	10	0.63	0
811A	5	9	5	0.56	4	0.80	0
812A	5	21	5	0.24	4	0.80	0
813A	5	13	5	0.38	5	1.00	0
All	125	354	130	0.37	101	0.78	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 2019, because more people applied for permits in each area than there were permits available.

Table 2. Prairie-chicken harvest in Minnesota during 2019.

Permit area	No. of hunters[a]		Birds harvested		Birds per harvester[b]	Success rate[c]
	Self-reported	Estimated	Self-reported	Estimated		
803A	8	9	1	1	1.0	0.11
804A	6	6	0	0	NA	0.00
805A	6	8	1	2	1.2	0.13
806A	7	8	5	5	1.7	0.38
807A	11	15	12	13	1.9	0.47
808A	16	16	19	19	1.9	0.63
809A	14	15	17	17	1.7	0.67
810A	10	10	3	3	1.0	0.30
811A	4	4	0	0	NA	0.00
812A	2	4	1	2	1.2	0.25
813A	4	5	2	2	1.9	0.20
All	88	100[d]	61	64[d]	1.7[d]	0.37[d]

[a] Permit purchasers who hunted.

[b] Estimated number of birds harvested per successful hunter, assuming non-respondents had success similar to that of respondents to the second mailing.

[c] Proportion of estimated hunters harvesting ≥1 prairie-chicken.

[d] Assumed that non-respondents were represented by respondents in the second mailing.

Table 3. Summary of prairie-chicken hunting in Minnesota during 2003–2019.

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]

[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, and 2019.

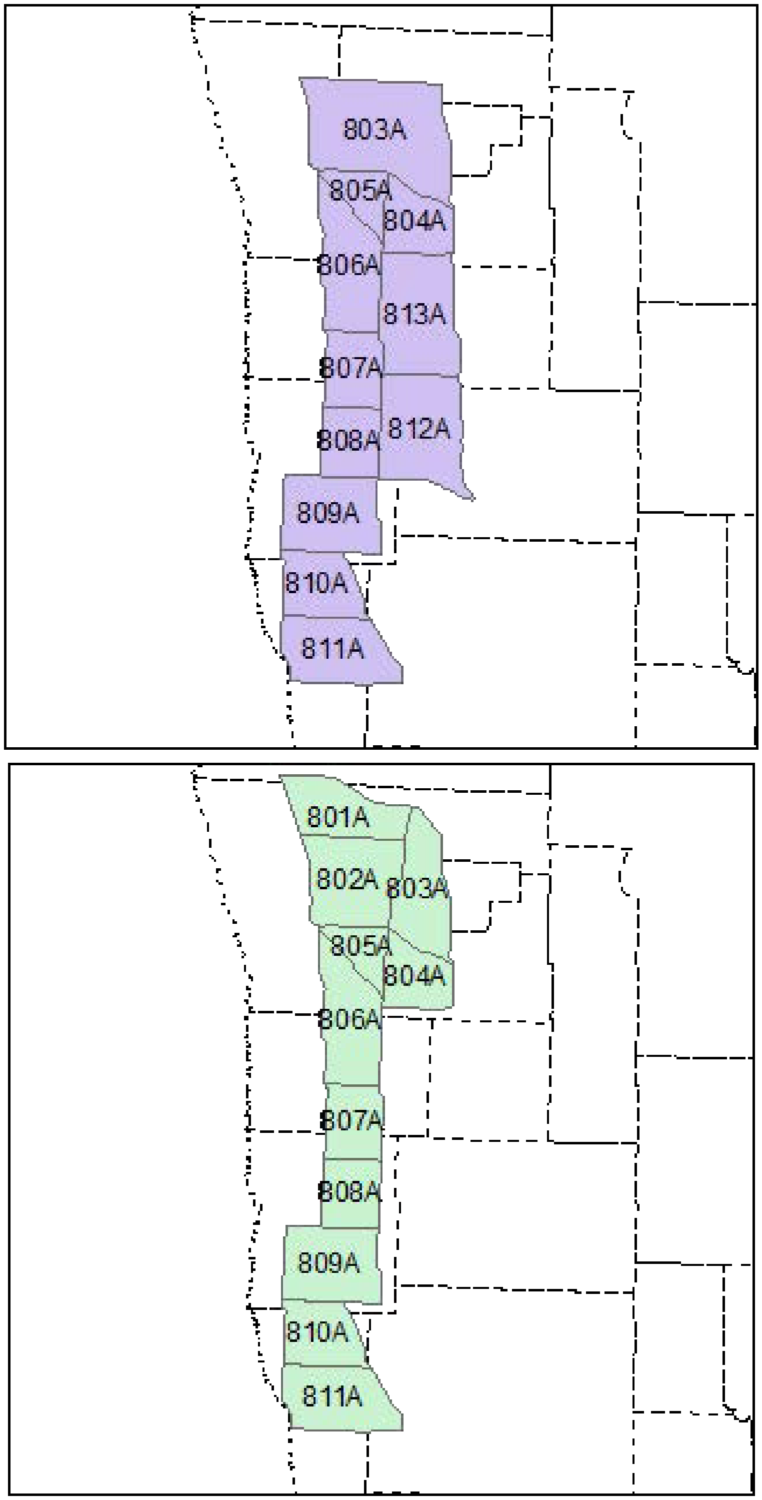


Figure 1. Prairie-chicken hunting permit area boundaries in northwestern Minnesota since 2013 (top) compared to during 2006–2012 (bottom). County boundaries are indicated by dashed lines. Permit areas 812A and 813A were added, 801A was eliminated, and 802A and portions of 803A were combined into a revised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

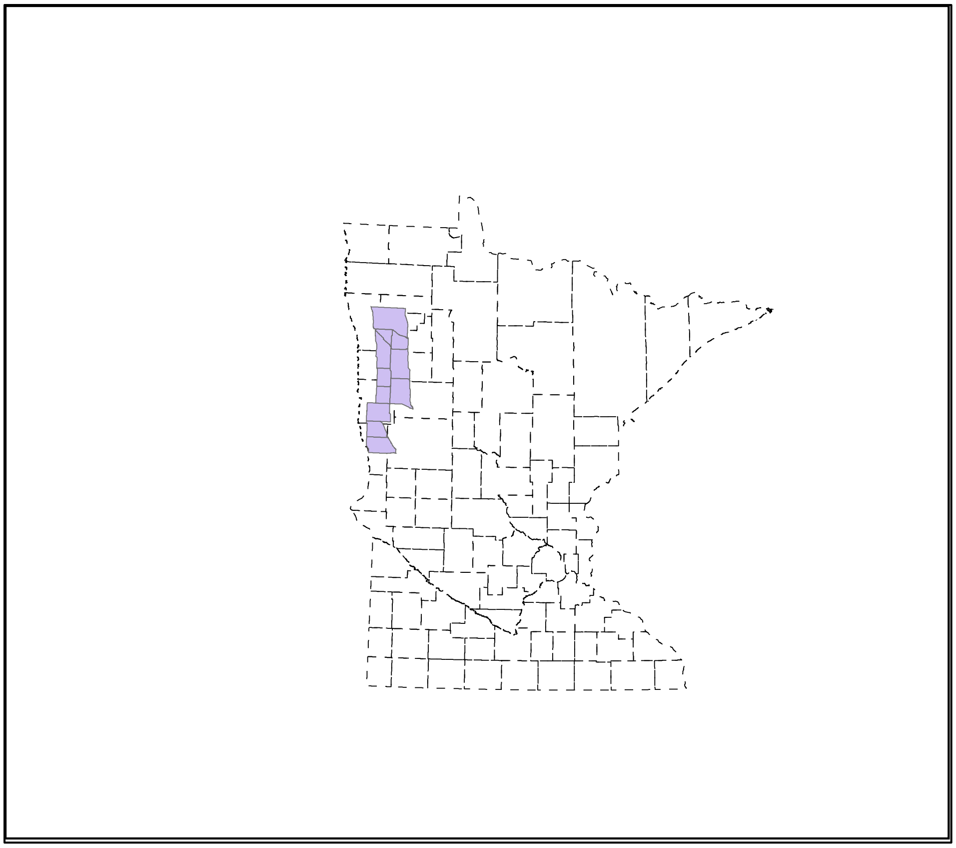


Figure 2. Northwestern location of prairie-chicken hunting permit areas within the state relative to county boundaries (dashed lines).

STATUS OF MINNESOTA BLACK BEARS, 2019

Dave Garshelis and Andy 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 third straight year (although a slight drop from 2017 and 2018). Of these, >3,400 (16%), 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 higher than 2018 (increased in BMUs 41 and 45). Hunting success in the quota zone was the second highest ever. Hunting success is inversely related to the number of hunters but also strongly affected by fall foods (Figure 1).

Bear Management Units

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

Quota zone permits and licenses

The number of quota zone permits available in 2019 was slightly higher than in 2017 and 2018 (25 permit increase in each of BMUs 41 and 45; Table 2). This is the 7th year (since 2013) that permits have been kept low (<3,900). This was the 9th 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 (Table 3)

Quota zone applicants

Statewide, quota zone applications increased 11% over the past 10 years, but much of that increase was for area 99 (preference level application). Among applications for specific BMUs, only BMU 45 showed a significant, steady increase over the past 10 years, but this too has leveled out since 2017 (Figure 3).

Quota zone lottery

The low quota zone permit availability over the past 7 years has made it increasingly difficult to succeed in the lottery (Table 4). This year, although quotas were about the same as last year, a higher level of preference was needed to secure a permit because a large number of hunters who had accumulated preference points by previously applying to area 99 entered the lottery for a BMU. First-time and second-time applicants were successful only in BMU 22 (wilderness area hunt). Four BMUs required a preference level of at least 4 for a chance of success, and BMU 45 required a preference level of 5 or above. This high threshold for BMU 45 is due to the increasing number of applicants (Figure 3), not a reduced number of available permits (Table 2).

Harvest by BMU

The statewide harvest in 2019 was 33% higher than 2018 (Table 5). Most of this increase occurred in the southern portion of the bear range (BMUs 45, 51, and 52); harvest in these BMUs was 2–3 times higher than in 2018. The sex ratio of the harvest was ≥60% males in all BMUs except BMUs 45, 46, 47, and 51. BMUs with the highest increases in harvests tended to have a higher proportion of females in the harvest. The statewide harvest sex ratio has exceeded 60% in all years since 2013 (Table 1), when permits were reduced. However, these same highly male-biased sex ratios have also occurred in the no-quota area, suggesting that it is not just due to low hunter density.

Harvest by quota vs no-quota zones

Permit availability continuously declined during the decade 2003–2013 (Table 1), and with that, total harvests declined and the percent of the harvest in the no-quota zone increased. The percent harvest in the no-quota zone has leveled off in recent years, with stabilization of the number of quota-zone permits available, but nevertheless was a record high this year (29%), most of it occurring in BMU 52 (16% of statewide harvest; Table 5). Nearly half the bear hunters were hunting with a no-quota license since 2017.

Hunting success by BMU

Record-breaking success was experienced by hunters in 2016 and 2017, but dipped for most BMUs in 2018 (Table 6). In 2019, success was generally higher, reaching record or near-record levels in all but a few northern BMUs of the quota zone (>50% in BMUs 25, 27, 41, 45, 46, and 47; 65% in BMU 28 [which has a high proportion of guided hunters]). Success rate in the no-quota zone as a whole (20%) was less than one-half that in the quota zone (49%). The distribution of hunters within the no-quota zone is gleaned from where they said they would hunt when they purchased their license: a growing proportion indicated that they planned to hunt in BMU 10 (although the hunting success rate in this area is lowest in the state).

Harvest by date

During years of normal fall food abundance, about 70% of the harvest occurs during the 1st week of the bear season, and ~83% occurs by the end of the 2nd week (Table 7). This year followed this normal pattern (whereas the harvest was delayed in 2018, due to more abundant foods).

Predictions of harvest

The 2019 statewide harvest was nearly 20% higher than expected (2340 actual vs. 1959 predicted), based on regression of harvest as a function of hunter numbers and the fall food productivity index (Figure 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 2019 was also nearly 20% higher (1659 actual vs.1391 predicted) than predicted by this regression.

Harvest sex ratios

Harvest sex ratios within BMUs varied considerably year-to-year over the past 2 decades. In 2019, four BMUs in the northwestern part of the state (BMU 11, 12, 13, 41) all had harvest sex ratios very skewed to males (68–73%). Four BMUs farther east (BMU 24, 25, 26 [now 27, 28]), 31) had consistently lower sex ratios (62–63%), yet still much higher than a decade ago, when it rarely exceeded 60% male. The southern tier of BMUs (BMU 44 [now 46, 47], 45, 51, 52) all had much lower harvest sex ratios in 2019 than in 2018. Statewide, the percent males in the harvest has been climbing since the late 1990s; it has exceeded 60% in all years since 2013. Sex ratios of harvested bears reflect both the sex ratio of the living population (which varies with harvest pressure) as well as the relative vulnerability of the sexes to hunters (which varies with natural food conditions, hunter selectivity, and possibly density of baits; Figure 6).

Harvest ages

On a BMU-basis, median ages of harvested females has not shown an obvious temporal trend over the past 20 years (Figure 7). In 2019, median ages of females harvested in northwestern BMUs (BMU 11, 12, 13, 41) was only about 3 years old, whereas those farther east (BMU 24, 25, 26 [now 27, 28], 31) were 0.5–1.5 years older, and those in the southern tier of BMUs (BMU 44 [now 46, 47], 45, 51, 52) were about a half year younger (all <3 years old; Figure 8). Statewide, the median age of harvested females showed a steady drop until 2014. Since then it has climbed to 3.0 years old. Likewise, the proportion of harvested females aged 4–10 years has risen since 2014, while the proportion 1–2 years old has declined. The median age of harvested males has been creeping upward since 2013 (2.3 years in 2019; Figure 9)

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 85–87% (Figure 10). Since 2013, hunters could register by phone or internet, and pick up a tooth submission envelope later: tooth submission compliance by these hunters has been significantly less (83%) than for hunters who registered their bear in person and picked up a tooth envelope at that time (92% compliance). A decreasing proportion of hunters are registering their bear at a registration station (Figure 11). Compliance with tooth submission was higher in the quota zones than in the no-quota area, but was especially low (<80%) in BMUs 10 and 41 (in both 2018 and 2019).

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 (Figure 12). However, older-aged harvested bears (≥8 years) are nearly always dominated by females, because, although old females continue to be less vulnerable as individuals, there are far more of them than old males in the living population. The age at which the line fitted to these proportions crosses the 50:50 sex ratio is approximately the inverse of the harvest rate. Segregating the data into time blocks showed harvest rates increasing from 1980–1999, then declining with reductions in hunter numbers (Figure 1). Based on this method, harvest rates since 2015 have been significantly less than what they were in the early 1980s, when the bear population was increasing.

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

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

Table 1. Bear permits, licenses, hunters, harvests, and success rates, 1999–2019.

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Permit applications[a]	29384	29275	26824	21886	16431	16466	16153	15725	16345	17362	17571	18647	19184	18103	18107	18885	18422	19958	21034	21184	20632
Permits available[b]	20840	20710	20710	20610	20110	16450	15950	14850	13200	11850	10000	9500	7050	6000	3750	3750	3700	3850	3350	3350	3400
Licenses purchased (total)	18355	19304	16510	14639	14409	13669	13199	13164	11936	10404	9892	9689	9555	8986	6589	6620	6962	7177	6655	6550	6801
Quota zone[c]	16563	17021	13632	12350	9833	10063	9340	9169	8905	7842	7342	7086	5684	4951	3188	3177	3257	3420	2954	2922	2988
Quota surplus/military[c]			235	209	2554	1356	1591	1561	526	233	77	83	1385	1070	578	583	446	441	401	428	417
No-quota zone[c]	1792	2283	2643	2080	2022	2238	2268	2434	2505	2329	2473	2520	2486	2965	2823	2860	3259	3316	3300	3200	3396[h]
% Licenses bought																					
Of permits available[d]	79.5	82.2	67.0	60.9	61.6	69.4	68.5	72.3	71.4	67.7	73.4	74.6	100	100	100	100	100	100	100	100	100
Of permits issued[d]	87.2	83.9	69.8	66.3	65.7	68.3	67.1	68.9	70.0	67.2	73.8	74.5	80.7	82.7	85.0	84.7	87.9	88.7	88.2	87.2	87.8
Estimated no. hunters[e]	15900	16800	15500	13800	13600	12900	12500	12500	11300	9900	9400	9200	9200	8600	6300	6300	6700	6900	6400	6300	6700
Harvest	3620	3898	4936	1915	3598	3391	3340	3290	3172	2135	2801	2699	2131	2604	1866	1627	1971	2641	2040	1766	2340
Harvest sex ratio (%M)[f]	53	58	56	61	58	57	59	58	57	62	59	59	61	59	62	62	66[i]	61	63	66[i]	61
Success rate (%)																					
Total harvest/hunters[g]	23	23	29	14	26	26	26	26	28	21	30	29	23	30	30	26	30	38	32	28	35
Quota harvest/licenses	20	20	28	14	25	26	25	25	28	21	30	30	24	33	37	33	39[j]	50[j]	46	38	49[j]

[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 (record high); additionally, area 88 nuisance-only bear license applications counted in this total in 2017=3, 2018=6, 2019= 5 (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 2011–19, all unpurchased licenses were put up for sale and were bought.

[e] Number of licensed hunters x percent of license-holders hunting. Percent hunting is based on data from bear hunter surveys conducted during 1981–91, 1998 (86.8%), 2001 (93.9%), 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.

[h] Record high number of no-quota zone licenses purchased in 2019; record high % of licenses in no-quota zone in 2017 (nearly 50%; see Fig. 4).

[i] Record high % males in statewide harvest.

[j] 2015: highest success rate in quota zone since very poor food year of 1995; 2016: record high success rate; 2019: second-highest success rate.

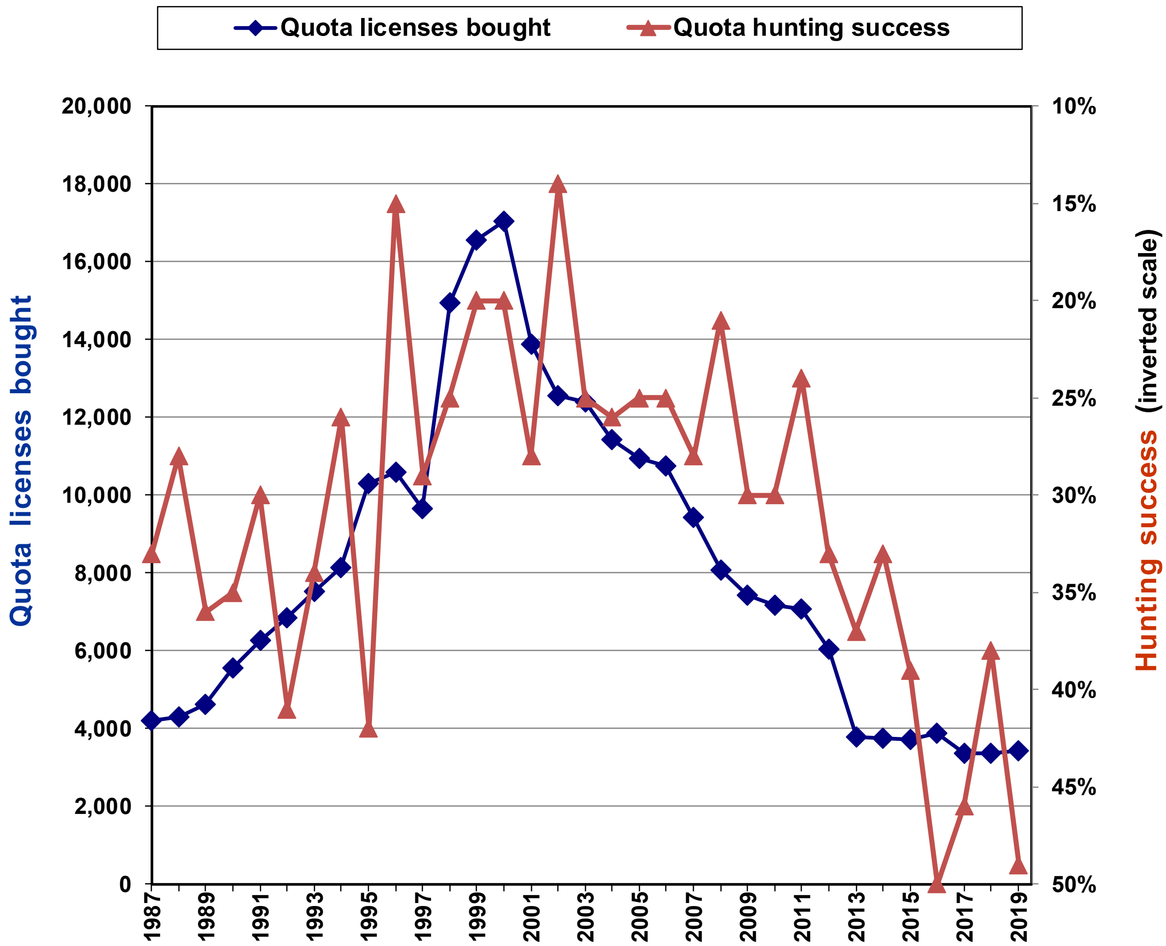


Figure 1. Relationship between licenses sold and hunting success (*note inverted scale*) in quota zone, 1987–2019 (quota and no-quota zones first partitioned in 1987). Number of licenses explains 53% of variation in hunting success during this period. Large variation in hunting success is also attributable to food conditions (e.g., during 2013–2019, when licenses were held relatively constant).

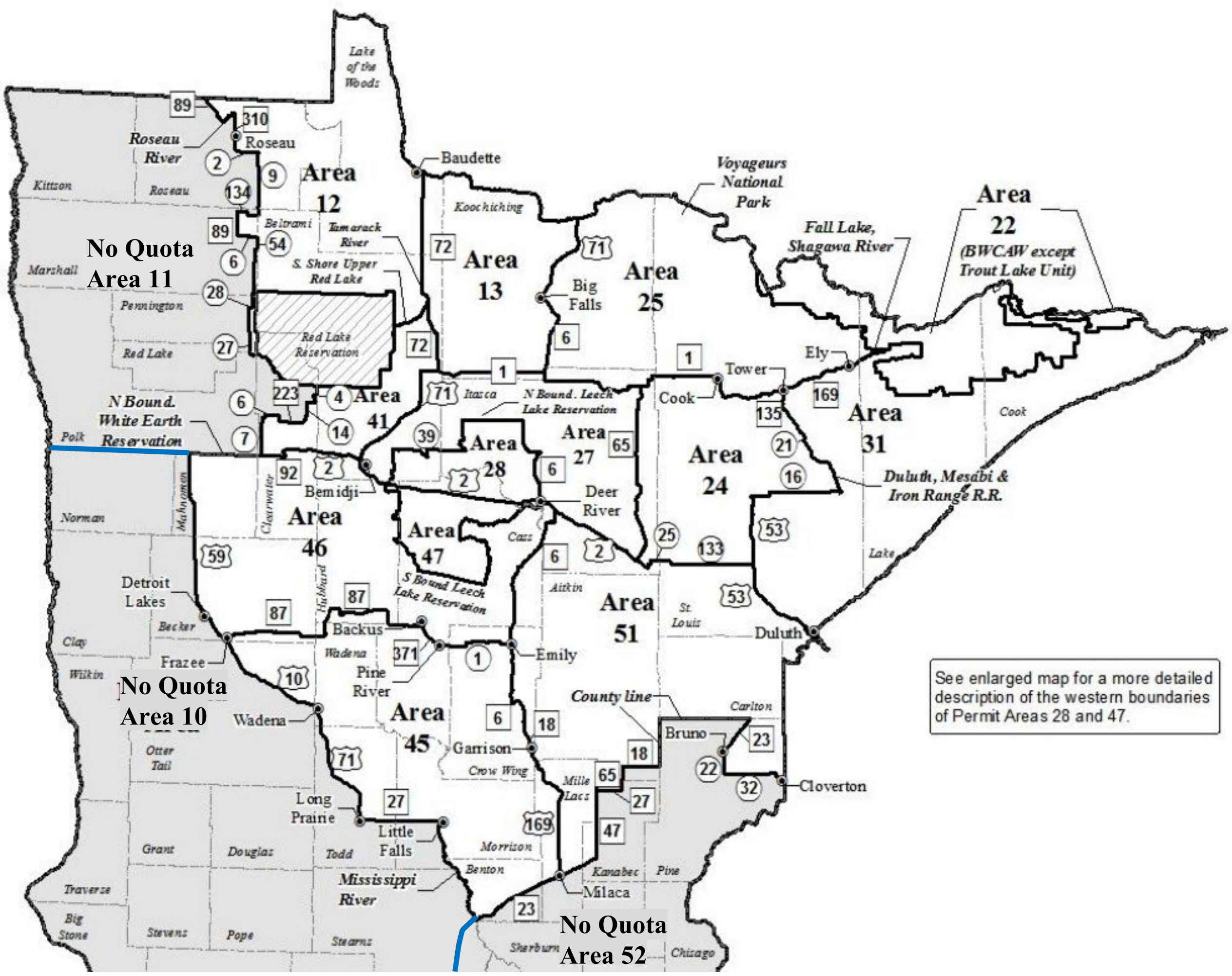


Figure 2. Bear management units (BMUs) within quota (white) and no-quota (gray) zones. Hunters in the quota zone are restricted to a single BMU. In 2016, BMU 26 was divided into 27 and 28, and BMU 44 was split into 46 and 47 (BMUs 28 and 47 comprise the Leech Lake Reservation). No-quota hunters can hunt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

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

BMU	2014	2015	2016		2017	2018	2019
			Before BMU split [a]	After BMU split			
12	200	150	150	150	125	125	125
13	250	250	250	250	225	225	225
22	50	50	50	50	50	50	50
24	200	200	200	200	175	175	175
25	500	500	500	500	400	400	400
26	350	350	325				
27				250	225	225	225
28				75	60	60	60
31	550	550	550	550	500	500	500
41	150	150	125	125	125	125	150
44	450	450	450				
46				400	350	350	350
47				50	40	40	40
45	150	150	250	250	175	175	200
51	900	900	1000	1000	900	900	900
Total	**3750**	**3700**	3850	**3850**	**3350**	**3350**	**3400**

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

Table 3. Number of quota BMU permit applicants (Apps), licenses bought (after permits drawn) and surplus licenses bought, 2014–2019[a]. Shaded values indicate undersubscribed (applications less than permits available).

BMU	2014			2015			2016			2017			2018			2019		
	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	661	164	36	612	130	20	624	133	17	774	113	12	703	109	16	711	104	21
13	703	218	32	692	210	40	716	221	29	772	200	25	682	177	47	712	199	26
22	65	33	17	48	36	9[b]	52	37	13	47	34	16	76	36	14	61	35	14
24	875	174	26	771	171	29	884	173	27	945	158	17	928	155	20	840	153	22
25	1533	424	76	1396	433	67	1443	440	60	1651	354	46	1561	355	44	1520	348	52
26	1696	298	52	1650	309	42												
27							1224	219	31	1297	197	28	1265	204	21	1280	200	25
28							325	72	3	330	52	8	309	52	8	318	51	9
31	2257	468	82	2021	488	62	2180	489	62	2076	441	59	2074	428	71	1907	432	67
41	561	129	21	570	129	21	618	114	11	614	109	16	648	114	11	661	143	7
44	2751	393	57	2626	402	48												
46							2690	370	30	2774	319	31	2769	317	33	2662	313	37
47							194	45	5	214	33	7	182	35	5	198	34	6
45	1403	127	23	1703	139	11	2046	227	23	2323	161	14	2383	160	15	2351	178	22
51	4003	748	152	3878	810	90	4321	880	121	4411	783	117	4344	779	123	3956	798	102
Total[c]	16508	3176	574	15967	3257	439	17317	3420	432	18228	2954	396	17924	2921	428	17177	2988	410

[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).

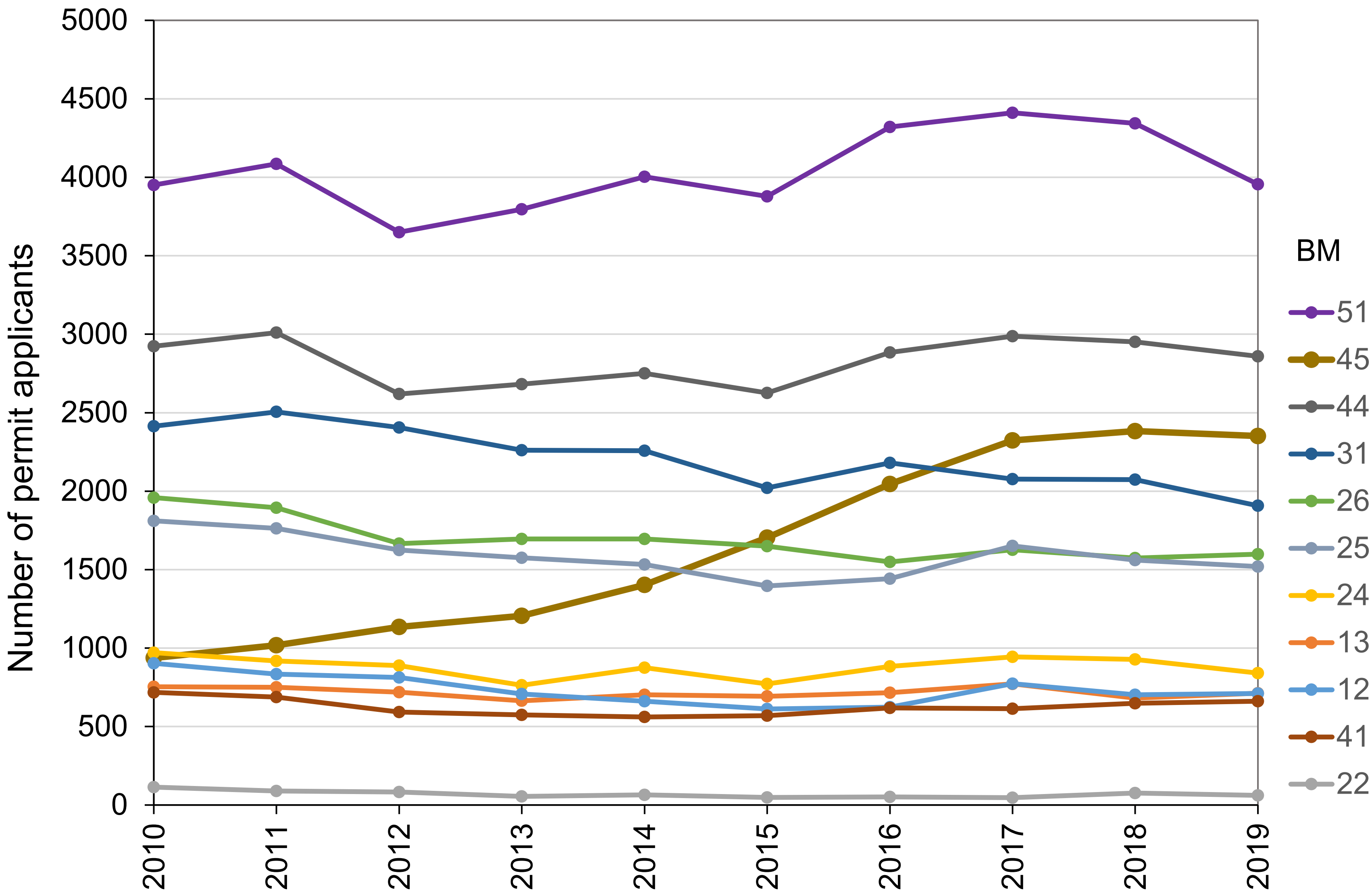


Figure 3. Trends in number of applicants for quota zone permits by BMU over past 10 years, 2010–2019. For 2016–2019, BMUs 27 and 28 were grouped into old BMU 26 and BMUs 46 and 47 were grouped into old BMU 44. BMU 45 is highlighted because applications there surged over this time period.

Table 4. 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 2015–2019. Blank spaces indicate 100% of applicants were drawn. All preference level 2 applicants were drawn, except where 0 preference level 1 applicants were drawn. Likewise, all preference level 3 applicants were drawn, except where 0 preference level 2 applicants were drawn[a].

BMU	2015				2016				2017				2018					2019				
	Pref 1	Pref 2	Pref 3	Pref 4	Pref 1	Pref 2	Pref 3	Pref 4	Pref 1	Pref 2	Pref 3	Pref 4	Pref 1	Pref 2	Pref 3	Pref 4	Pref 5	Pref 1	Pref 2	Pref 3	Pref 4	Pref 5
12	0	17			0	0	98		0	0	57		0	0	41			0	0	13		
13	0	56			0	38			0	16			0	11				0	0	92		
22	100				98				100				60					76				
24	0	2			0	0	86		0	0	57		0	0	26			0	0	11		
25	0	44			0	42			0	6			0	0	80			0	0	58		
26[b]	0	0	51																			
27					0	0	30		0	0	2		0	0	0	85		0	0	0	66	
28					0	0	0	99	0	0	0	76	0	0	0	46		0	0	0	5	
31	0	0	87		0	0	75		0	0	67		0	0	48			0	0	38		
41	0	0	99		0	0	77		0	0	56		0	0	27			0	0	6		
44[b]	0	0	18																			
46					0	0	0	85	0	0	0	51	0	0	0	24		0	0	0	1	
47					0	0	10		0	0	0	49	0	0	0	26		0	0	0	50	
45	0	0	0	81	0	0	0	63	0	0	0	16	0	0	0	0	72	0	0	0	0	42
51	0	0	89		0	0	72		0	0	54		0	0	35			0	0	22		

[a] As an example, in 2019: BMU 12: 0% of pref. level 1 and 2 applicants were drawn, 13% of pref. level 3, and 100% of pref. level 4 and above were drawn for a permit; BMU 22: 76% pref. level 1 applicants were selected, 100% all higher pref. levels; BMU 45: no pref. level 1–4 applicants were drawn, 42% of hunters with pref. 5 were drawn, and all with pref. 6 were drawn.

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

Table 5. Minnesota bear harvest tally for 2019 by Bear Management Unit (BMU)[a] and sex[b] compared to harvests during 2014–2018 and record high and low harvests (since establishment of each BMU, not counting current year).

BMU	2019 M	2019 (%M)	2019 F	2019 Total	2018	2017	2016	2015	2014	5-year mean	Record low harvest (yr)	Record high harvest (yr)
Quota												
12	45	73	17	62	66	54	78	60	38[d]	59	38 (14)	263 (01)
13	71	68	34	105	119	100	147	72[e]	91	106	71 (88)	258 (95)
22	2	67	1	3[r]	4	8	5	7	5	6	3 (03)	41 (89)
24	53	62	33	86	60	81	96	97	50[f]	77	50 (14)	288 (95)
25	142	63	82	224	223	212	287	227	168[g]	223	149 (96)	584 (01)
26	105	62	64	[169]	[141]	[162]	[171]	121	117[h]	142	117 (14)	513 (95)
27	77	60	51	128	105	120	131					
28	28	68	13	41	36	42	40					
31	132	62	80	212	211	262	312	307	221	260	157 (88)	697 (01)
41	52	68	24	76	58	61	57	35[i]	36	46	35 (15)	201 (01)
44	116	57	87	[203]	[154]	[158]	[215]	158	170	176	130 (11)	643 (95)
46	103	57	78	181	139	141	190					
47	13	59	9	22	15	17	25					
45	54	50	54	108	51	77	102[m]	55	54	67	32 (11)	178 (01)
51	226	55	185	411	185[d]	372	463	302	291	355	185 (18)	895 (01)
Total	998	60	661	1659	1272	1547	1933	1441	1241[j]	1507	1192 (88)	4288 (01)
No-Quota												
11	182	68	87	269	287	179	291	195	77[k]	176	38 (87)	351 (05)
10	18	68	8	26[n]	21	18	15	11	8	12		26 (19)
52	233	60	153	386	186[p]	295	402	324	301	334	105 (02)	405 (12)
60[c]	0		0	0	0	1	0	0	0			
Total	433	64	248	681	494	493	708[n]	530	386	522	198 (87)	708 (16)
State	1431	61	909	**2340**	1766	2040	2641	1971	1627[j]	2029	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
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
*None were authorized NQ license-holders hunting in quota zone.
Some quota area hunters also apparently hunted in the wrong BMU, based on the block where they said they killed a bear, but these were recorded in the BMU where they were assigned (presuming most were misreported kill locations).

[b] Sex recorded on tooth envelopes may differ from the registered sex. Sex shown on table is the registered sex.
[c] BMU 60 designates SE Minnesota, which is within No-quota zone. The only hunter-harvested bear in this area was in 2017.

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

[r] Tie for record low harvest.only hunter-harvested bear in this area was in 2017.

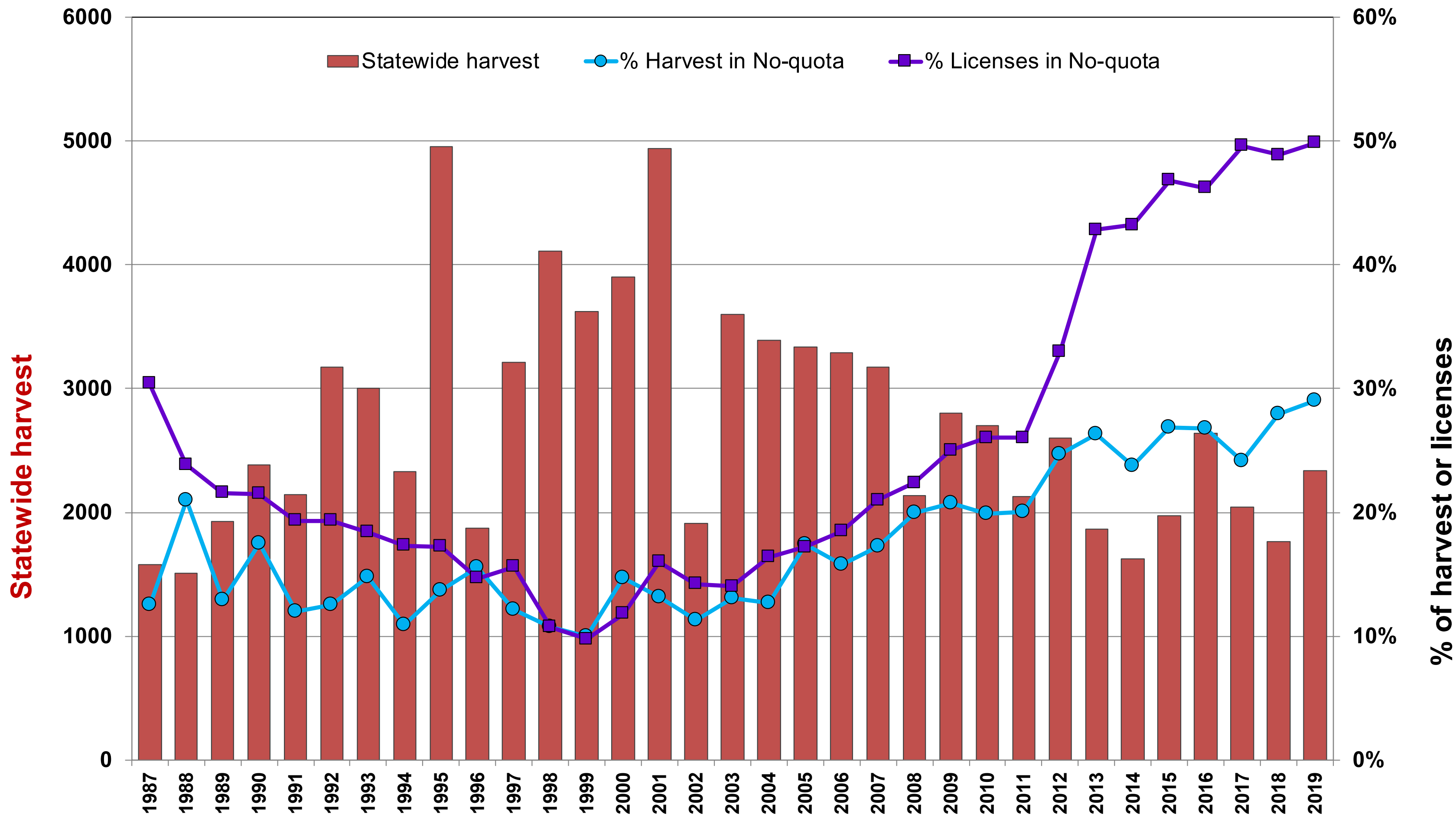


Figure 4. Trends in statewide bear harvest and proportions of harvest and licenses in the no-quota zones, 1987–2019.

Table 6. Bear hunting success (%) by BMU, measured as the registered harvest divided by the number of licenses sold[a], 2014–2019.

BMU	Max success (yr) before 2019		Mean success 2014–2018	2019	2018	2017	2016	2015	2014
12	53	(18)	41	50	53[b]	43	52[c]	40	19[e]
13	59	(95,16)	43	46	53[c]	45	59[b]	29	36
22	18	(92)	11	6	8	16	10	13	10
24	48	(15,16)	43	49[b]	34	46[c]	48	48	25
25	57	(16)	49	56[c]	56[c]	53	57[b]	45	34
26	59	(95)	47	59[b]	49	57	52	34	33
27				57[b]	47	53	52		
28				65[c]	60	70[d]	53		
31	56	(15,16)	49	42	42	52	56[b]	56[b]	40
41	50	(95)	38	51[b]	46	49[c]	46	23	24
44	48	(16)	42	52[b]	39	41	48[c]	35	38
46				51[b]	39	40	47		
47				55[b]	38	43	50		
45	44	(17)	42	53[b]	29	44[c]	40	36	36
51	46	(16)	40	46[b]	21	41[c]	46[b]	33	32
Quota	50	(16)	**43**	**49[c]**	**38**	**46[c]**	**50[b]**	**39**	**33**
11[f]			**20**	23	25	17	28	20	9
10[f]			**8**	12	9	8	9	7	7
52[f]			**15**	19	10	14	19	15	16
No Quota	32	(95)	**16**	20	15	15	21	16	13
Statewide	40	(95)	**30**	**34**	**27**	**31**	**37[c]**	**28**	**25**

[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] Tied record lowest success.

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

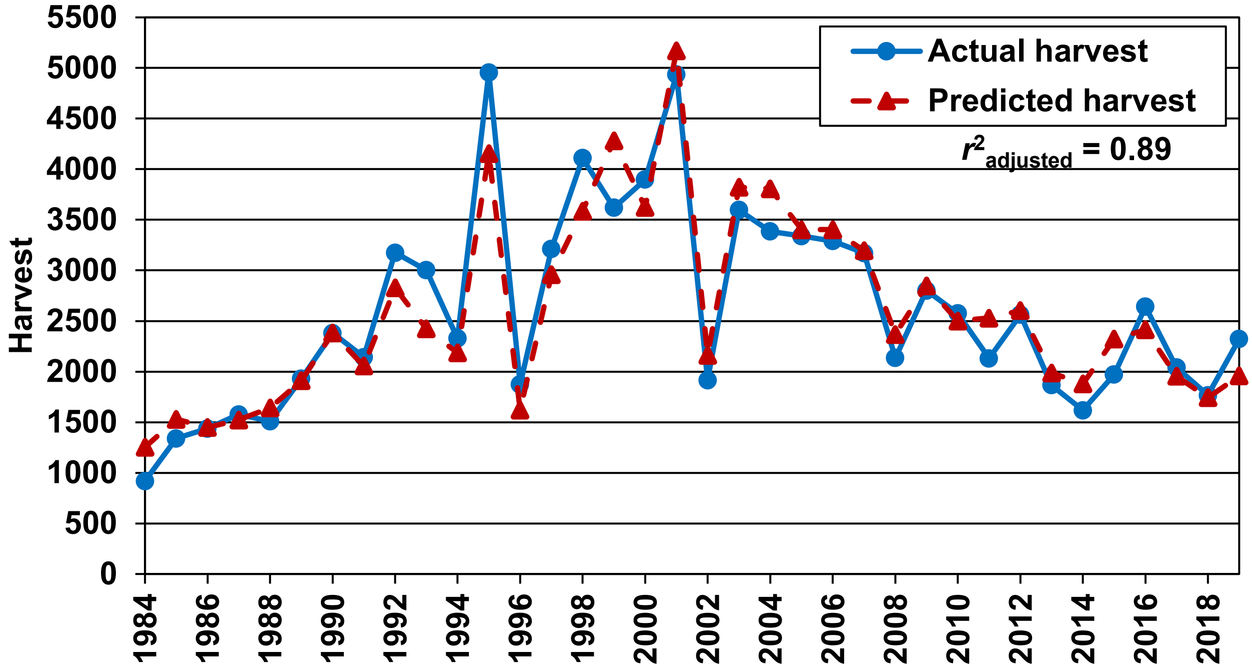
BMU	2019		2018		2017		2016		2015		2014	
11	30.9		34.6		29.8		30.3		29.3		28.5	
10	14.3		7.4		6.6		4.9		4.4		4.1	
52	52.0		55.3		59.2		61.2		63.9		64.7	
60 (n)	0.3	(11)	0.1	(4)	0.1	(4)	0.4	(12)	0.2	(8)	0.6	(17)
Quota zone (n)	2.5	(94)	2.6	(83)	4.2	(137)	3.2	(105)	3.1	(101)	2.1	(60)

Table 7. Cumulative bear harvest (% of total harvest) by date, 1998–2019.

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

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

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



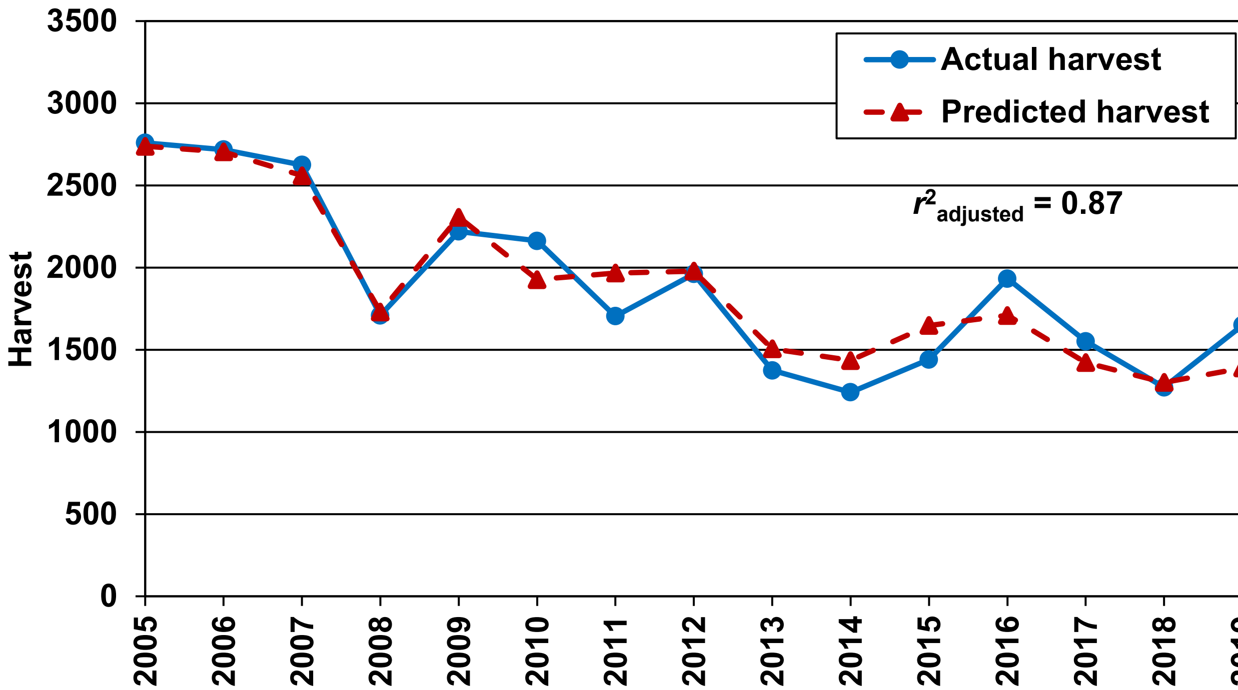
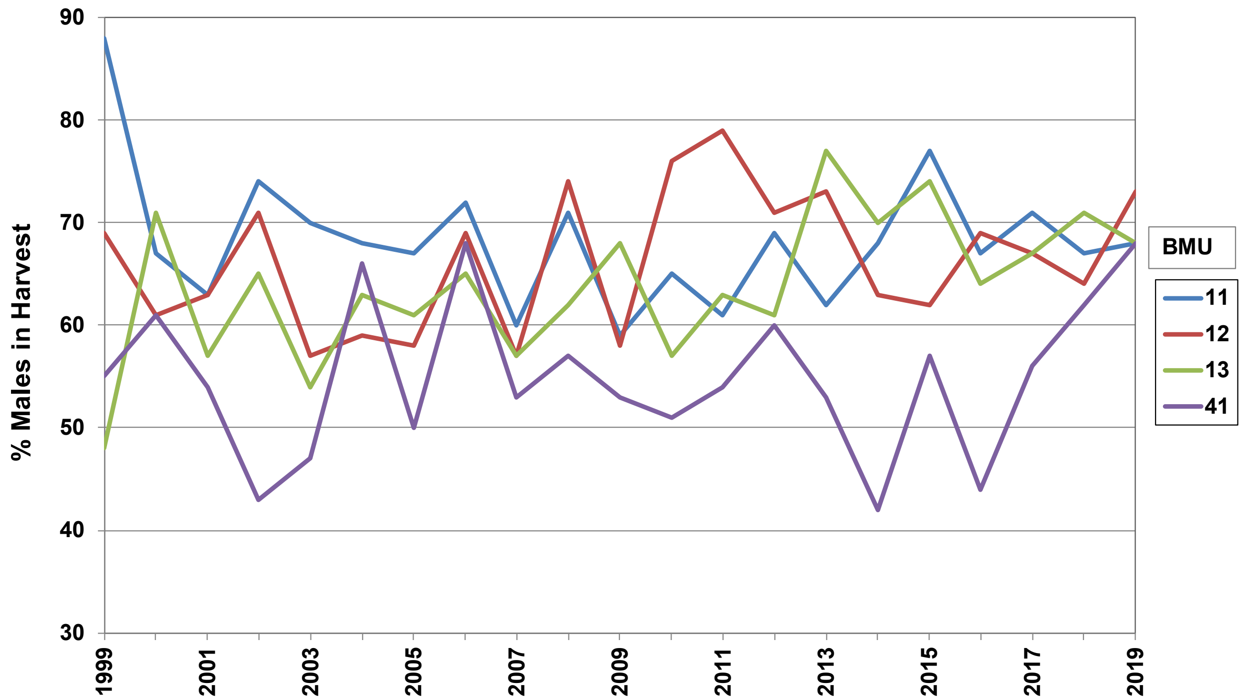


Figure 5. Number of bears harvested vs. number predicted to be harvested based on number of hunters and fall food production — top panel: statewide 1984–2019; bottom panel: quota zone only, most recent 15 years. Regression for both datasets included an interaction term between food and hunters to better predict the drastic changes in harvest when fall foods were extremely high or low.



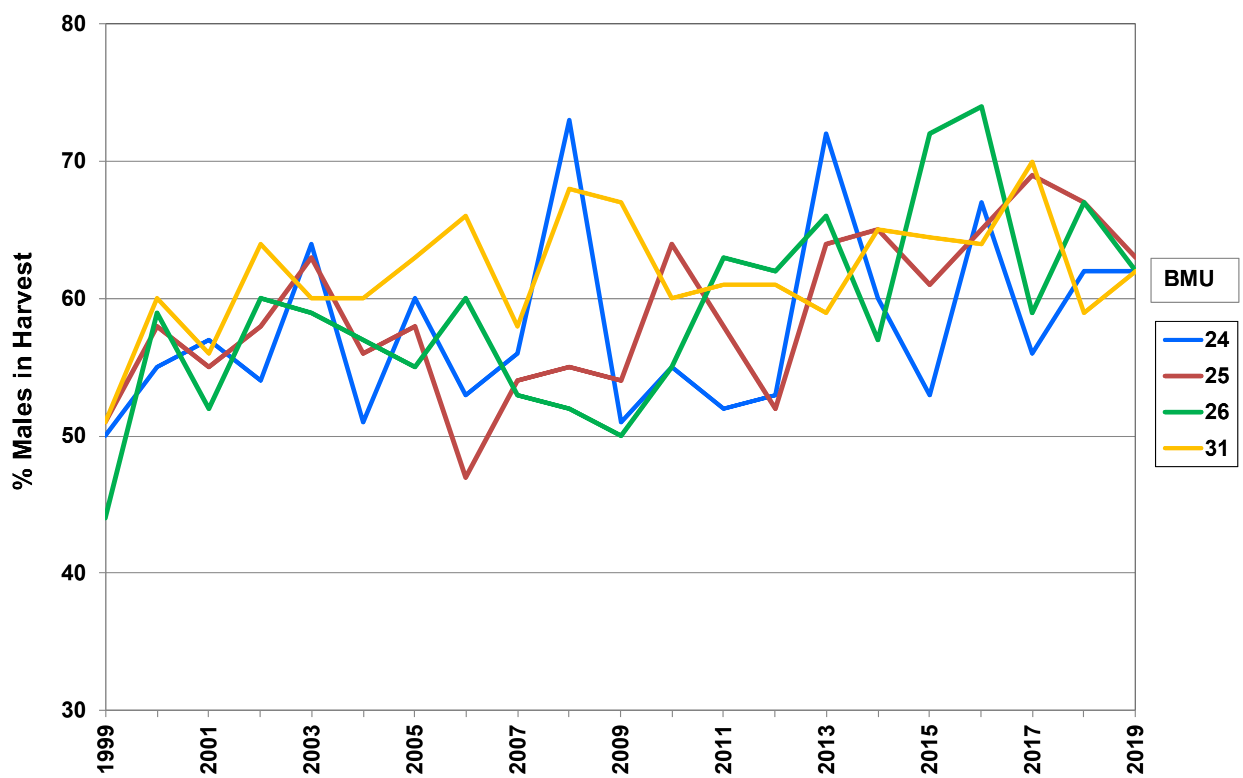


Figure 6. Sex ratios of harvested bears by BMU, 1999–2019. Thick lines show significant increasing trend across this period.

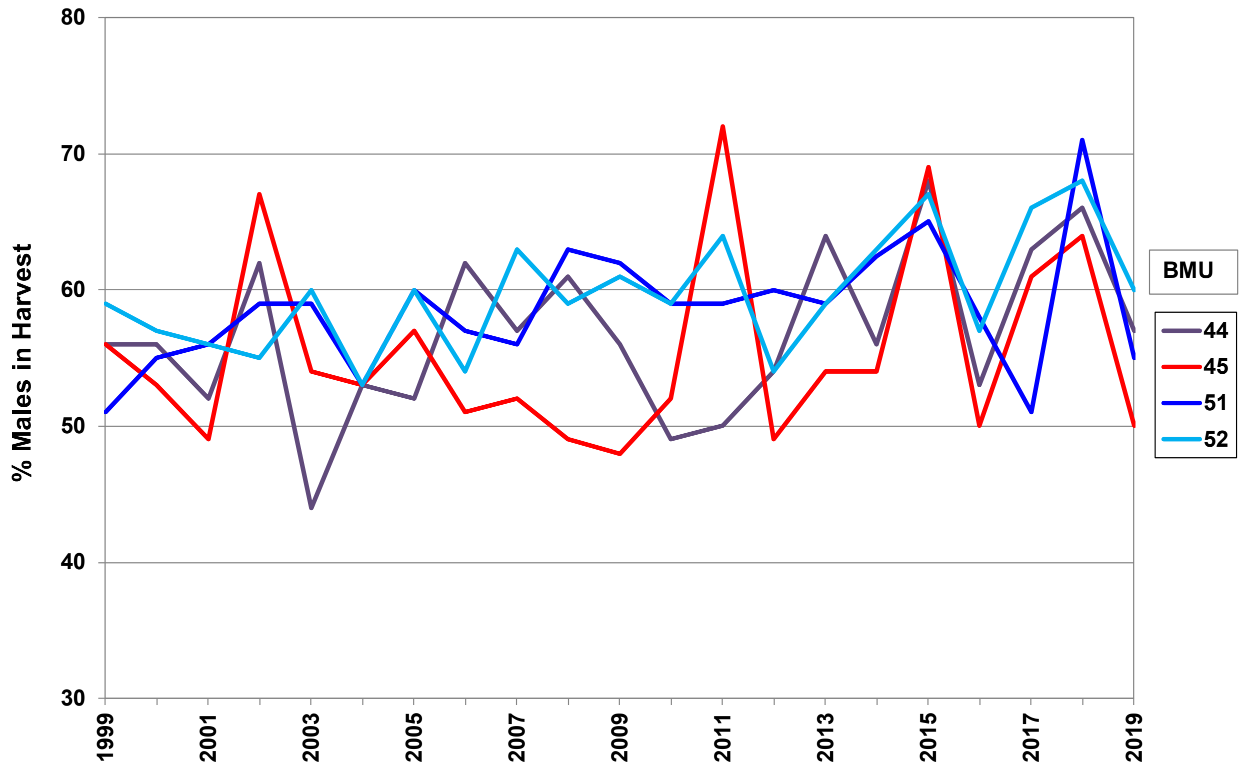
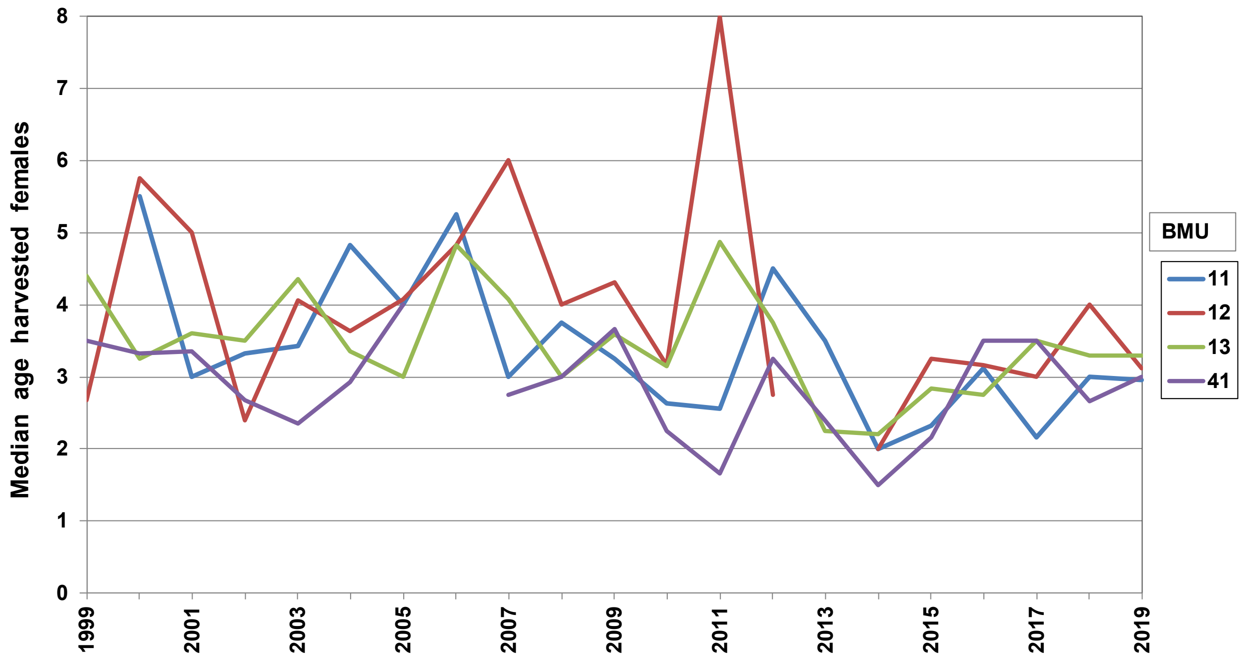


Figure 6 (continued)



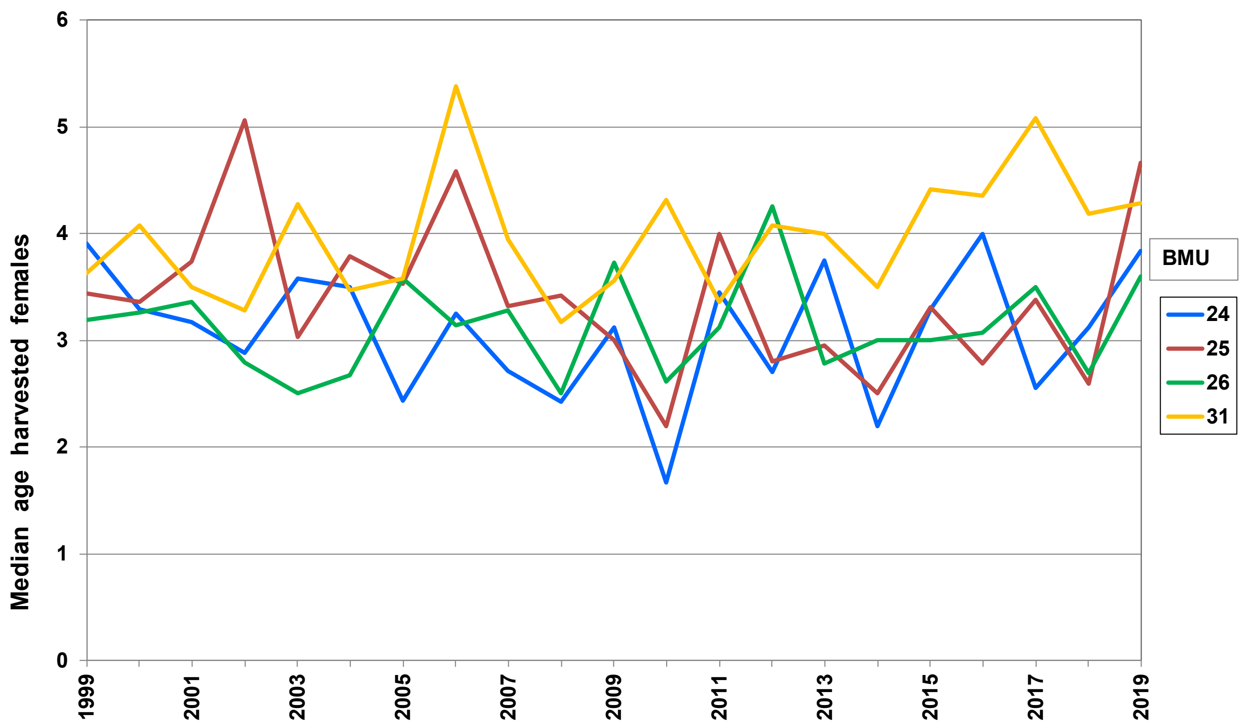


Figure 7. Median ages of harvested female bears by BMU, 1999–2019. Breaks in line occur when sample sizes were too small to calculate a meaningful median.

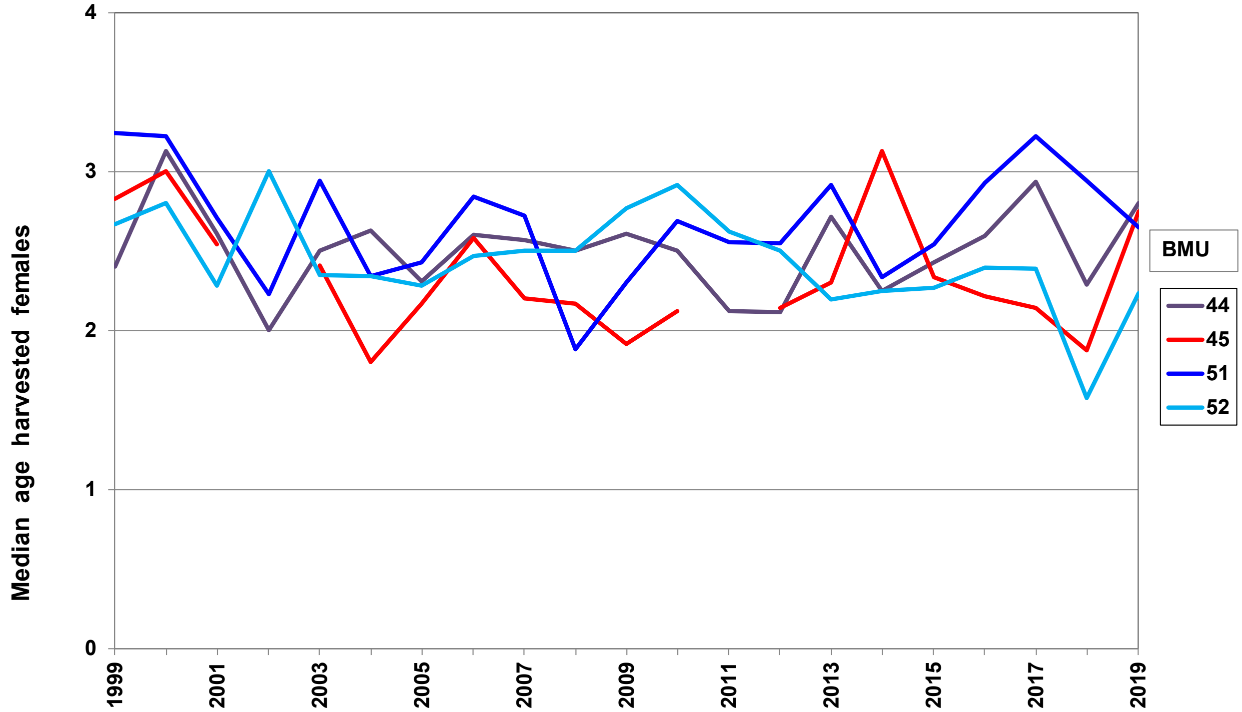


Figure 7. (continued)

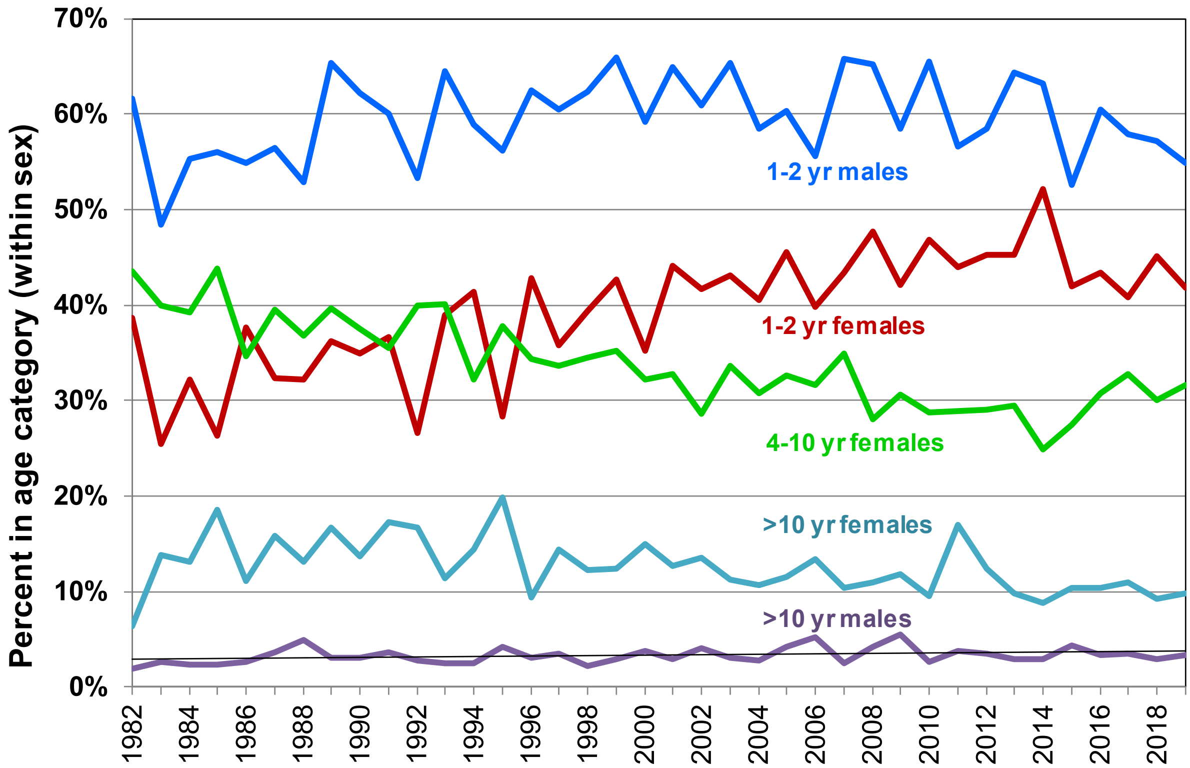


Figure 8. Statewide harvest structure: proportion of each sex in age category, 1982–2019.

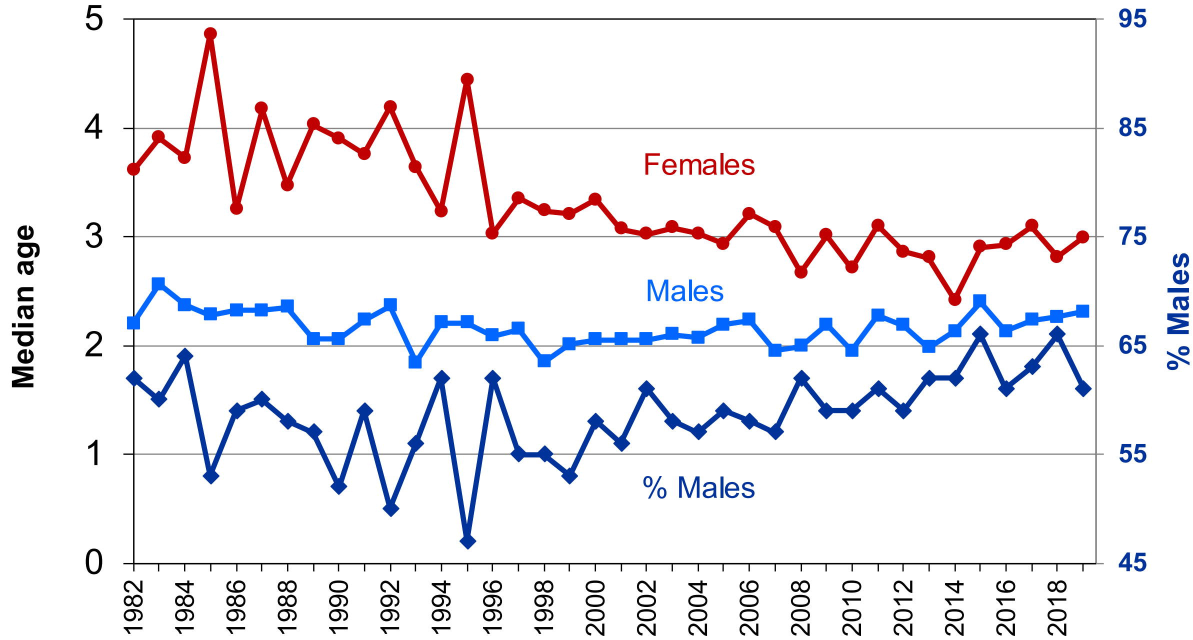


Figure 9. Statewide median ages (years) and sex ratio of harvested bears, 1982–2019.

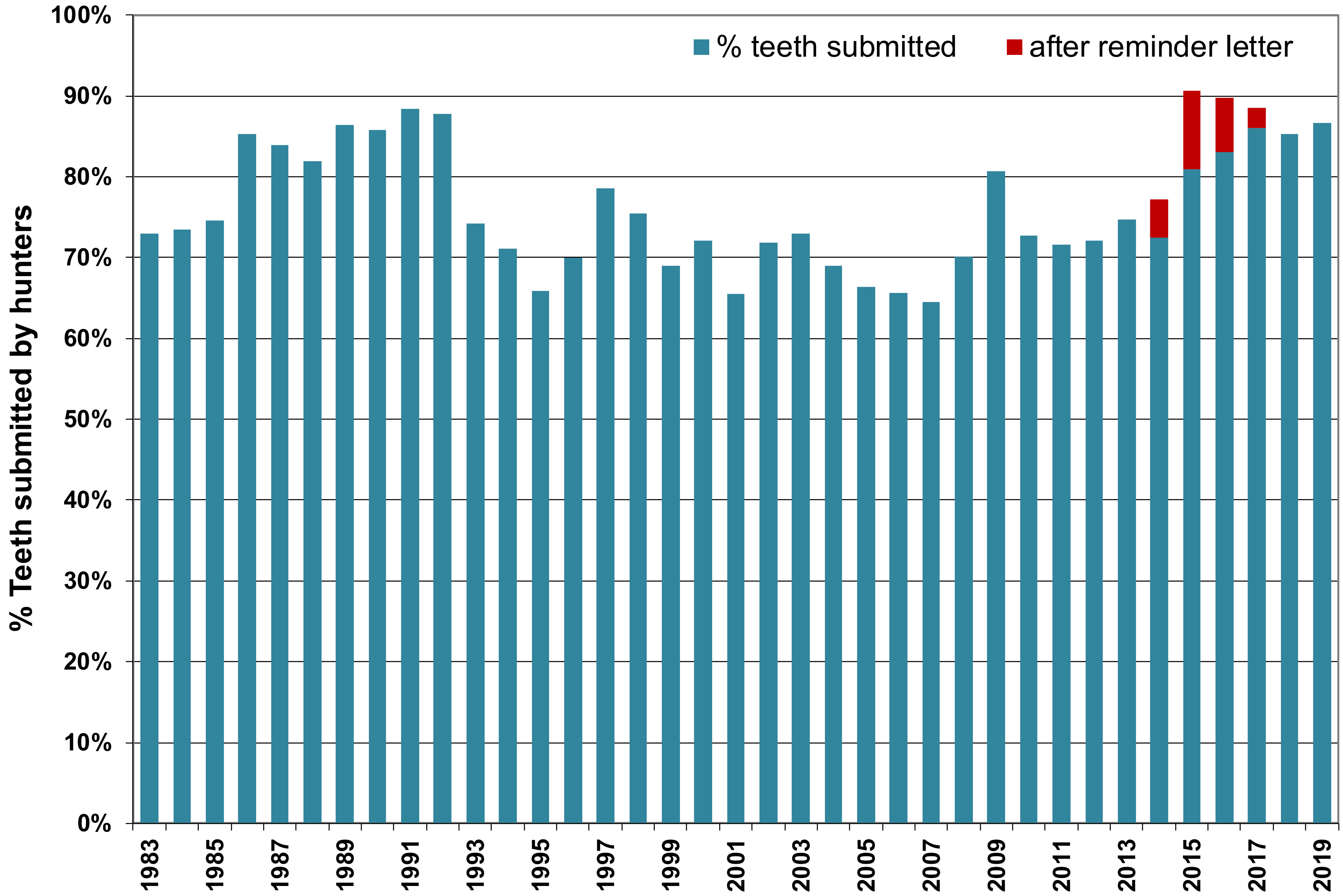
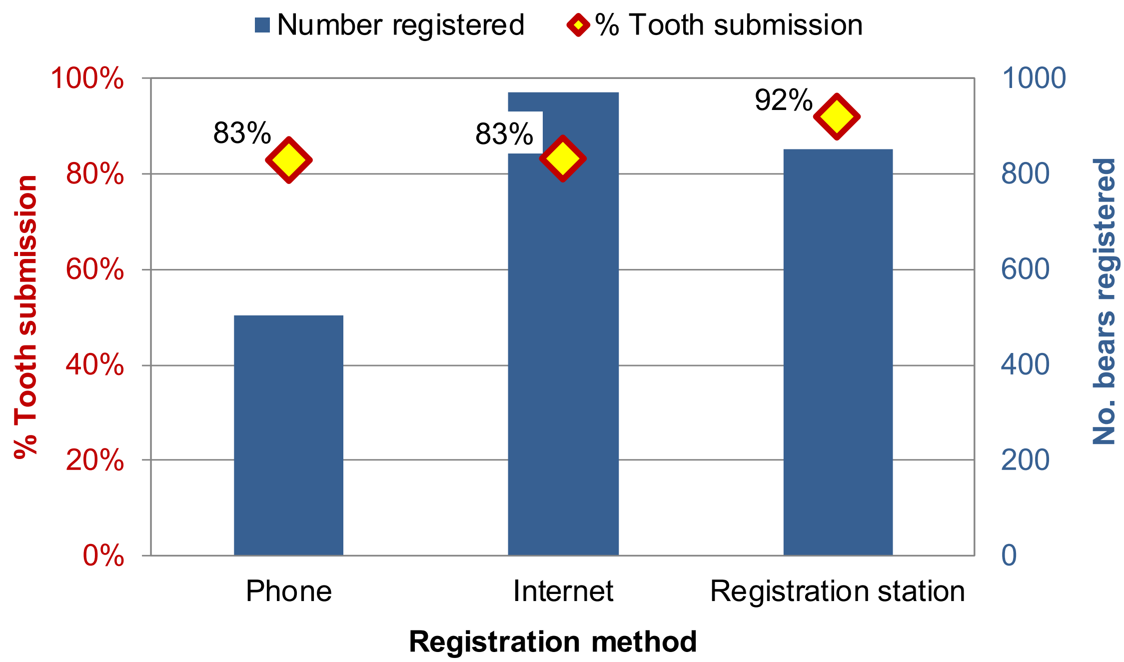


Figure 10. Percent of hunters submitting useable bear teeth for aging. Cooperation levels exceeded 80% when registration stations were paid to extract teeth (this practice ended in 1993), and in recent years after a series of reminder letters (no letter was sent in 2018 or 2019).



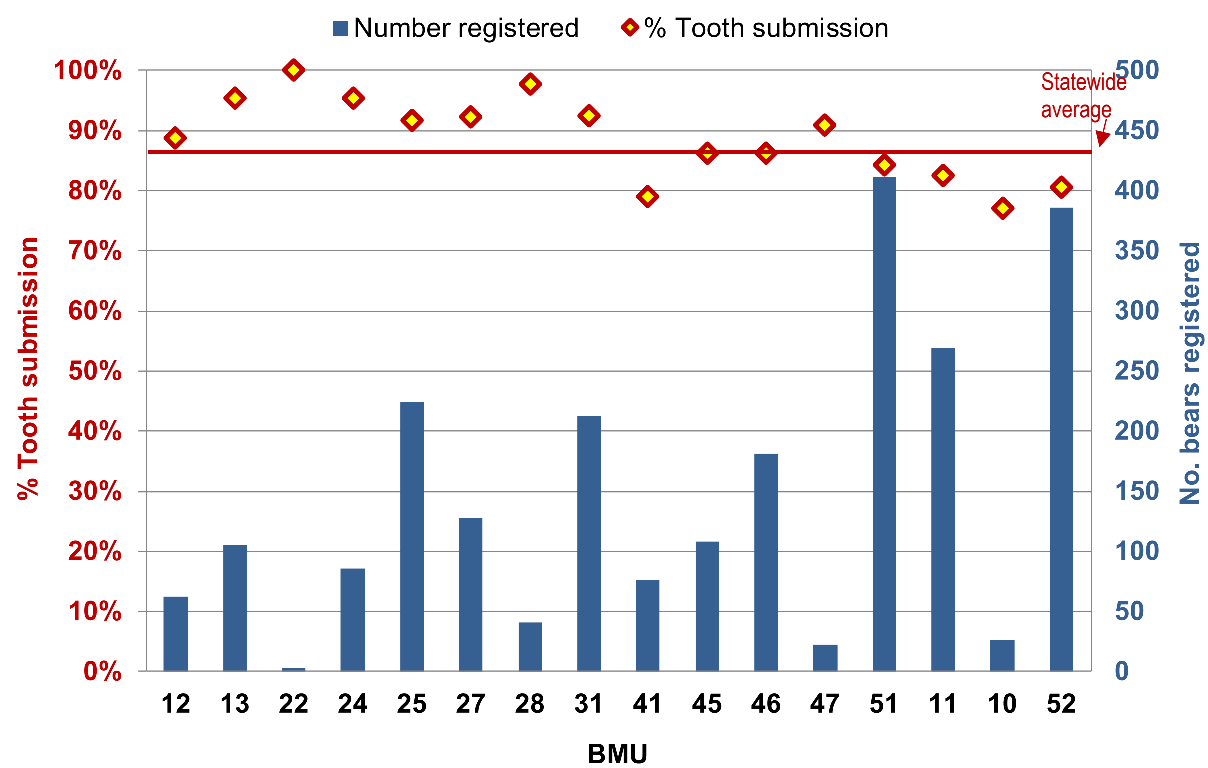


Figure 11. Percent of hunters who submitted a bear tooth in 2019 by method of registration (top panel) and by BMU (bottom panel). Beginning in 2013, hunters could register their bear by phone or internet, as well as in person at a station.

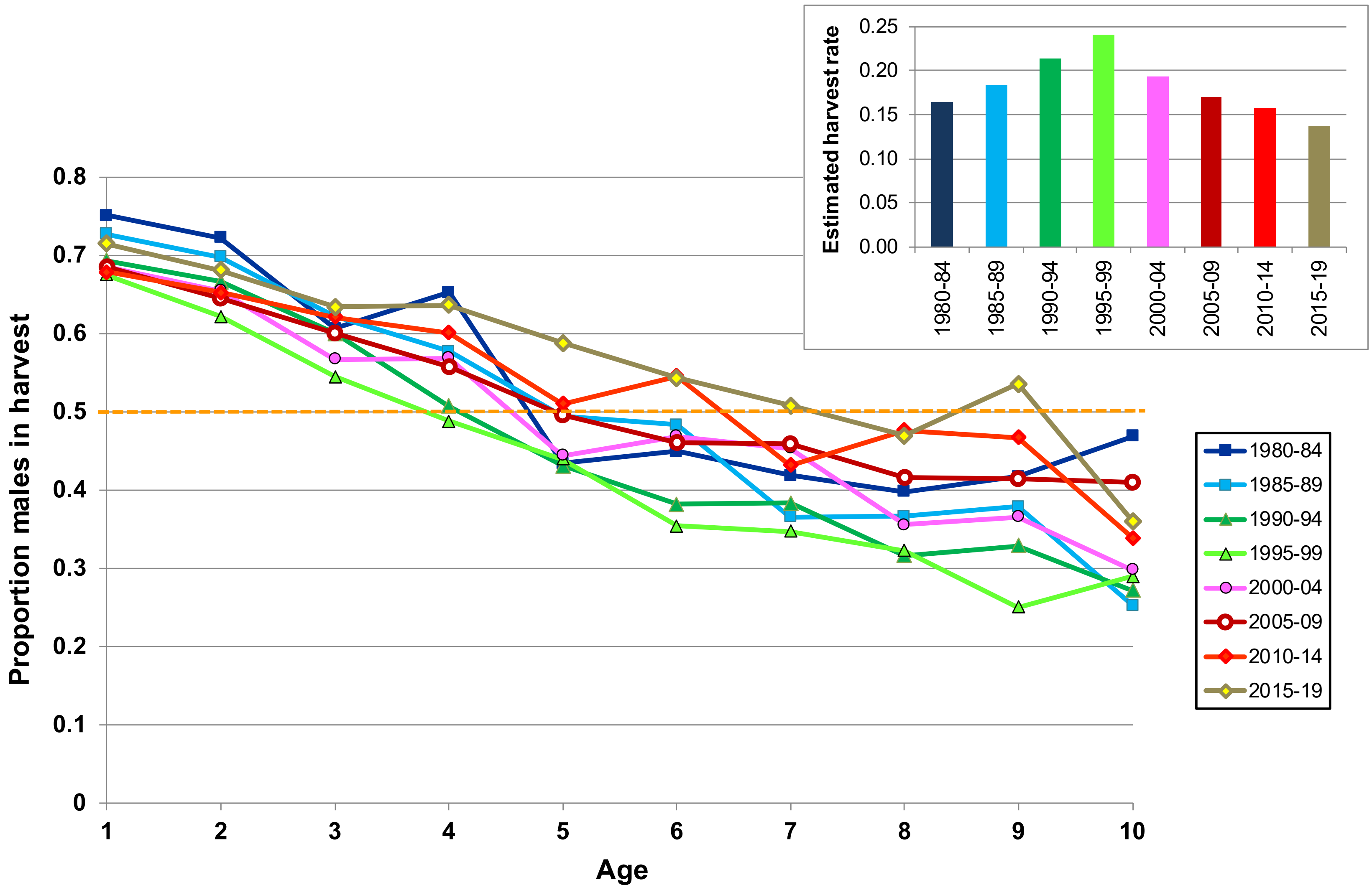


Figure 12. Trends in proportion of male bears in statewide harvest at each age, 1–10 years, grouped in 5-year time blocks, 1980–2019. Higher harvest rates result in steeper curves because males in the living population are reduced faster than females. Fitting a line to the data for each time block and predicting the age at which 50% of the harvest is male (dashed tan 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 (2015–19 lower than 1980–84).

2019 MINNESOTA DEER HARVEST REPORT

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

INTRODUCTION

The white-tailed deer may be considered Minnesota's most popular wildlife species. In 2019, nearly 465,000 hunters participated in the season. 2019 was a generally liberal season designed to stabilize or reduce deer population growth across much of central Minnesota along the transition zone where there is exceptional deer habitat provided by deciduous forests interspersed with prairie and agriculture. The southeastern portion of the state, known as the driftless region also provides exceptional deer habitat and ample hunting opportunities. Management of deer populations in the coniferous forests of the northcentral and northeastern portions of the state remained conservative, this an area where populations tend to have slower population growth rates. Likewise, the southwestern portion of the state, an area in an agriculturally dominated landscape had a conservative management strategy. During the archery, firearms and muzzleloader seasons, hunters registered 183,637 deer.

METHODS

Every deer taken by hunting in Minnesota must be registered. Deer may be registered at any of the 825 to nearly 900 "Big Game Registration" stations available throughout the state. Beginning in 2011, deer could also be registered using the internet and telephone. Implementation of electronic licensing (ELS) has improved the efficiency and accuracy of deer harvest estimates and provides a more timely release of harvest information. Registered deer are recorded as adult buck, fawn buck, adult doe, or fawn doe. Additional information gathered at the time of registration includes date of kill, deer permit area, and season. In 2016, carcass import restrictions were instituted to help prevent the spread of Chronic Wasting Disease (CWD). CWD was detected in three deer in Fillmore County during routine surveillance efforts. This prompted additional late season deer harvest opportunities for sample collection in southeast Minnesota. Additionally, deer farms in Crow Wing, Meeker, and Winona counties tested positive for CWD in 2017 prompting more areas of surveillance. During 2018 mandatory testing of all deer > 1 year old was instituted for the opening weekend of firearms season in three areas of the state and for the entire hunting season in the newly created CWD disease management zone 603. Due to the outward radial spread of CWD in southeast Minnesota and new detections of a wild deer near a positive deer farm in Crow Wing County, during the 2019 fall hunting seasons mandatory surveillance was implemented for the newly formed CWD Management Zones, known as 600-series DPAs.

RESULTS

Outcomes of the 2019 deer harvest are presented in the following tables.

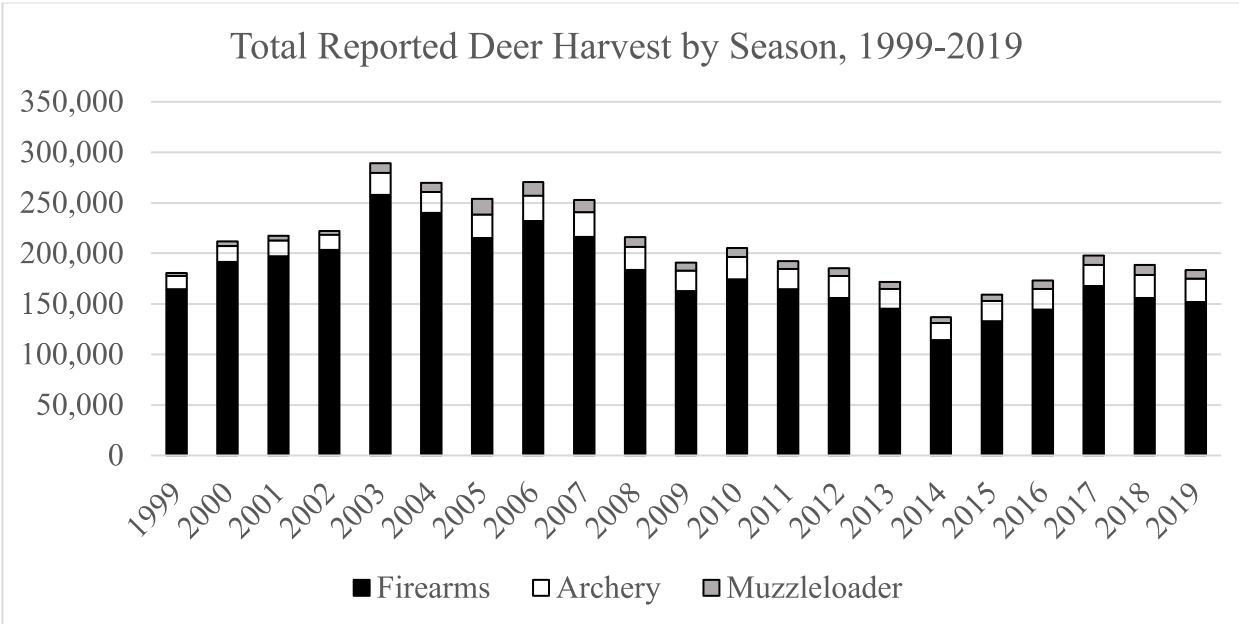

Total Reported Deer Harvest by Season, 1999-2019
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
Firearms
Archery
Muzzleloader

Table 1. Statewide firearms, archery, and muzzleloader harvest, license sales, and success rates, 2009 – 2019.

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
REGULAR FIREARMS											
Resident License Sales	377,077	379,866	382,668	391,822	391,967	374,314	371,612	372,645	368,407	360,873	351,659
Non-Resident License Sales	11,759	11,908	11,955	12,483	12,496	11,674	13,501	12,540	12,923	12,928	12,239
Bonus Permit Sales	140,920	143,763	142,049	89,750	97,402	29,642	31,065	44,365	93,309	117,640	131,804
Youth License Sales	56,678	59,726	60,943	62,949	64,748	62,488	62333	61138	58779	56,989	57,575
Total License Sales	586,434	595,263	597,615	557,004	566,613	478,118	478,511	490,688	533,418	548,430	553,277
Registered Buck Harvest[1]	83,820	88,027	76,003	84,729	70,627	69,851	83,939	87,855	88,467	81,772	83,772
Antlerless Permits Offered	60,100	60,083	15,525	32,854	36,816	26,332	31,065	39,646	20,540	14,023	14,111
Antlerless Permits Issued	60,100	60,083	15,525	32,854	36,816	26,332	31,065	39,646	20,385	13,971	13,777
Antlerless Permits App.	90,882	86,783	21,071	67,308	68,811	96,580	95,656	97,056	45,001	29,302	33,191
Registered AL Harvest[1]	78,525	86,077	88,197	71,140	67,885	44,038	48,758	52,338	79,033	74,203	66,971
Registered Total Harvest[1]	162,345	174,104	164,200	155,869	145,449	113,889	132,697	144,470	167,500	155,975	150,743
Registered % Successful[2]	33.8	35.9	32.9	32.0	29.7	25.3	28.9	31.2	33.7	31.7	31.2
ARCHERY											
Resident License Sales	88,707	91,156	90,252	95,259	92,717	92,301	93,462	92,076	91,875	89,292	85,343
Non-Resident License Sales	1,610	1,638	1,718	1,814	1,952	1,946	2,032	2,062	2,016	2,020	2,129
Youth Archery Sales	9,157	9,577	10,306	11,276	12,212	11,965	11,905	10,846	9,961	9,052	8,267
Total License Sales	99,474	102,371	102,276	108,349	106,881	106,212	107399	104984	103852	100,364	95,739
Total Archery Harvest	20,629	22,057	20,444	21,605	19,388	17,119	20,074	20,360	21,058	22,665	24,250
Registered % Successful[2]	17.5	17.8	17.0	18.8	14.5	15.3	16.5	18.5	18.7	20.3	21.1
MUZZLELOADER											
Total Muzzleloader License Sales	63,282	55,640	59,384	58,363	51,092	43,946	50,176	53,097	51,961	48,589	43,126
Total Muzzleloader Harvest	7,929	9,023	7,416	7,779	7,045	5,847	6,572	8,383	9,210	10,066	8,644
Registered % Successful[2]	11.3	14.4	11.6	12.4	12.7	12.7	12.0	15.2	16.6	19	20.0
Antlerless Permits Offered		5,792	1,997	1,626	2,144	1,593	1,434	1,352	935	874	689
Antlerless Permits App.		7,260	2,615	3,743	3,544	4,588	3,393	2,930	1,902	1,592	1,485
TOTAL Registered Harvest	194,186	207,313	192,331	186,634	172,781	139,442	159,343	173,213	197,768	188,706	183,637

Table 2. Deer Harvest by Season, 2019.

Season	Total Hunters	Buck Harvest	Antlerless Harvest	Total Harvest	Successful Hunters[2]	Overall Success
Archery	95,656	11,000	13,250	24,250	20,225	21.1%
100 Series A	149,406	24,846	17,566	42,412	40,812	27.3%
200 Series A	221,798	47,930	36,581	84,511	76,341	34.4%
300-600 Series A[1]	36,431	6,082	4,678	10,760	9,250	25.4%
300-600 Series B[1]	8,352	1,235	2,690	3,925	3,326	39.8%
Metro Firearms (701)	2,391	553	350	903	835	34.9%
Muzzleloader	43,138	3,188	5,456	8,644	7,627	17.7%
Youth	N/A	2,665	3,194	5,859	5,829	N/A
Early Antlerless	3,950	0	892	4,842	755	19.1%
Special Firearms Hunts	3,117	283	540	823	662	21.2%
Late CWD	N/A	178	480	658	525	N/A
Total	**464,086**	**97,960**	**85,677**	**183,637**	**166,462**	**35.9%**

[1]does not include deer harvested in permit area 604; in 2019 a person could hunt either the A or B season in the 600 series regardless of license type and thus hunter numbers and success rates are only an estimate; [2] Number of hunters that harvested at least one deer

Figure 1. Deer Permit Area management designations, 2019.

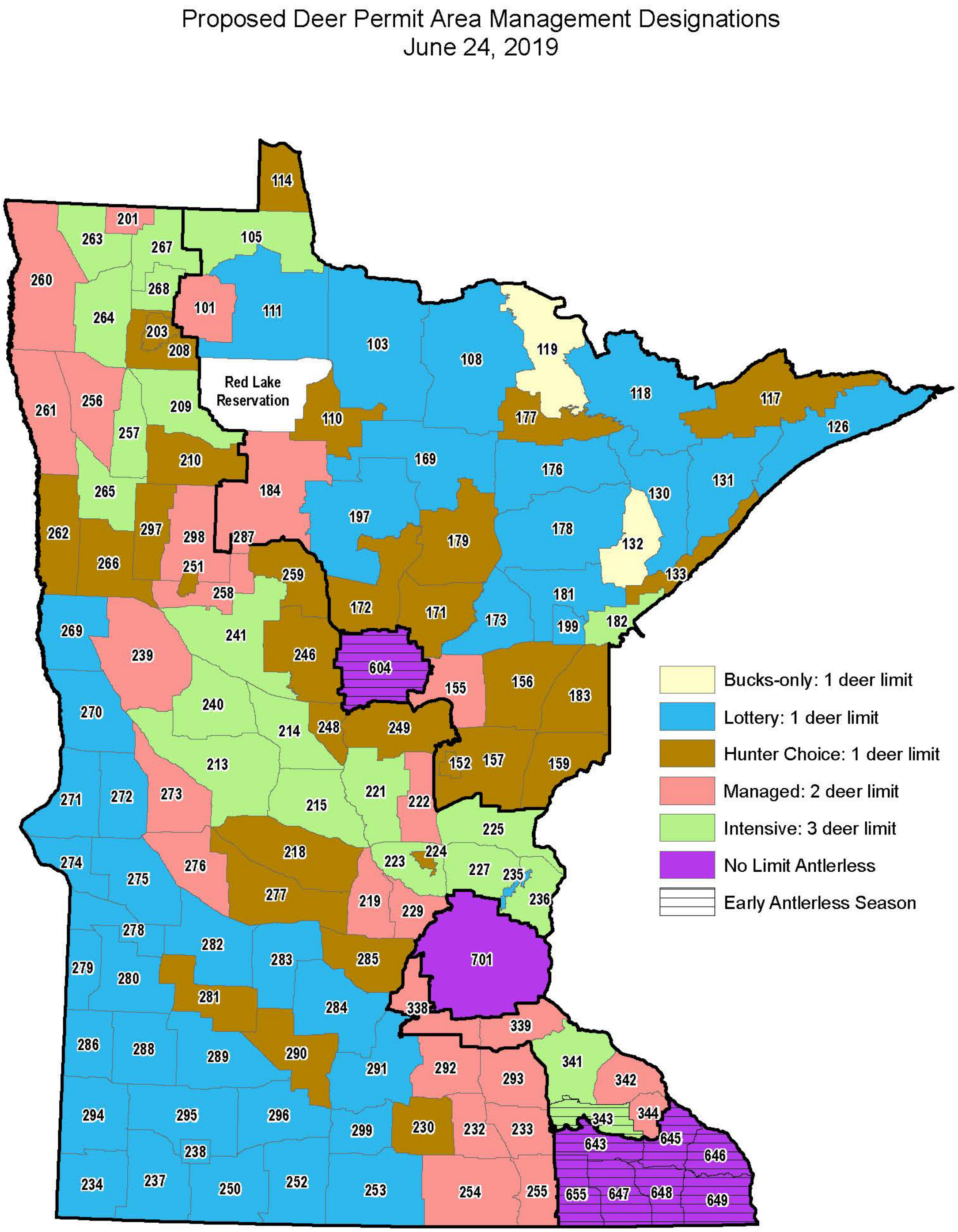


Table 3. Total deer harvest in each deer permit area for the 2019 deer season.

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	447	35	228	32	742	496	0.90	0.60	1.50	81
103	622	34	275	23	954	1,820	0.34	0.18	0.52	117
105	1066	116	802	102	2086	740	1.44	1.38	2.82	45
108	866	18	176	24	1084	1,651	0.52	0.13	0.66	106
110	903	72	475	60	1510	529	1.71	1.15	2.86	44
111	326	21	107	8	462	1,438	0.23	0.09	0.32	124
114	17	2	9	1	29	116	0.15	0.10	0.25	128
117	17	1	11	1	30	927	0.02	0.01	0.03	130
118	649	7	85	6	747	1,220	0.53	0.08	0.61	111
119	348	4	14	2	368	770	0.45	0.03	0.48	120
126	233	6	52	0	291	942	0.25	0.06	0.31	125
130	190	5	28	0	223	746	0.25	0.04	0.30	126
131	64	2	14	0	80	899	0.07	0.02	0.09	129
132	235	0	7	0	242	482	0.49	0.01	0.50	119
133	410	29	201	21	661	352	1.16	0.71	1.88	65
152	69	15	28	4	116	61	1.13	0.77	1.90	63
155	782	171	744	109	1806	499	1.57	2.05	3.62	34
156	1300	198	819	116	2433	825	1.58	1.37	2.95	43
157	2128	310	1145	196	3779	888	2.40	1.86	4.26	26
159	1171	114	660	76	2021	571	2.05	1.49	3.54	36
169	1335	49	331	36	1751	1,124	1.19	0.37	1.56	75
171	626	103	490	58	1277	627	1.00	1.04	2.04	59
172	1174	250	1048	145	2617	687	1.71	2.10	3.81	32
173	546	56	299	32	933	584	0.93	0.66	1.60	73
176	795	21	158	21	995	921	0.86	0.22	1.08	92
177	588	69	436	42	1135	480	1.23	1.14	2.37	53
178	1340	40	305	32	1717	1,195	1.12	0.32	1.44	82
179	1401	220	1082	139	2842	862	1.63	1.67	3.30	40
181	835	71	377	49	1332	629	1.33	0.79	2.12	56
182	486	81	374	57	998	278	1.75	1.84	3.59	35
183	1139	160	872	86	2257	663	1.72	1.69	3.40	37
184	2515	412	1924	359	5210	1,229	2.05	2.19	4.24	28
197	851	49	254	34	1188	955	0.89	0.35	1.24	86
199	105	2	32	4	143	153	0.69	0.25	0.94	97

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	133	10	76	11	230	161	0.83	0.60	1.43	83
203	44	1	24	7	76	118	0.37	0.27	0.65	108
208	271	14	101	11	397	379	0.72	0.33	1.05	93
209	708	85	441	75	1309	640	1.11	0.94	2.05	58
210	900	77	325	54	1356	615	1.46	0.74	2.20	55
213	2965	563	2312	483	6323	1,057	2.81	3.18	5.98	12
214	2061	470	1628	430	4589	554	3.72	4.56	8.28	3
215	1877	511	1451	371	4210	701	2.68	3.33	6.00	11
218	1362	167	684	120	2333	884	1.54	1.10	2.64	50
219	855	137	582	91	1665	391	2.18	2.07	4.25	27
221	1821	399	1460	323	4003	642	2.84	3.40	6.24	8
222	1250	248	788	217	2503	413	3.02	3.03	6.05	10
223	1009	193	769	131	2102	376	2.69	2.91	5.60	15
224	140	8	43	9	200	47	2.96	1.27	4.23	29
225	1993	376	1313	305	3987	618	3.23	3.23	6.45	7
227	1527	245	997	172	2941	472	3.24	3.00	6.24	9
229	420	53	244	35	752	284	1.48	1.17	2.65	48
230	343	46	141	23	553	452	0.76	0.46	1.22	87
232	366	46	206	30	648	377	0.97	0.75	1.72	68
233	334	49	184	30	597	381	0.88	0.69	1.57	74
234	269	8	50	5	332	636	0.42	0.10	0.52	118
235	100	14	40	6	160	34	2.97	1.78	4.75	20
236	979	155	584	95	1813	370	2.65	2.26	4.90	18
237	333	11	71	8	423	728	0.46	0.12	0.58	113
238	96	6	15	4	121	95	1.01	0.26	1.27	85
239	2106	357	1229	247	3939	919	2.29	1.99	4.29	25
240	2351	513	1817	360	5041	643	3.66	4.19	7.84	4
241	3744	760	3172	615	8291	996	3.76	4.57	8.33	2
246	1824	309	1229	225	3587	784	2.33	2.25	4.58	23
248	426	52	203	35	716	214	1.99	1.35	3.34	39
249	1430	222	717	139	2508	496	2.88	2.17	5.06	17
250	394	17	111	13	535	713	0.55	0.20	0.75	102
251	60	14	46	8	128	55	1.09	1.24	2.33	54
252	405	8	123	11	547	715	0.57	0.20	0.77	100
253	539	28	161	12	740	974	0.55	0.21	0.76	101

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
254	691	83	421	63	1258	924	0.75	0.61	1.36	84
255	335	43	196	27	601	392	0.85	0.68	1.53	78
256	548	64	317	59	988	654	0.84	0.67	1.51	79
257	542	73	316	67	998	412	1.31	1.11	2.42	52
258	924	162	702	162	1950	343	2.70	2.99	5.69	14
259	1043	147	630	121	1941	490	2.13	1.83	3.96	30
260	466	46	247	23	782	1,249	0.37	0.25	0.63	109
261	258	21	139	17	435	795	0.32	0.22	0.55	116
262	277	17	78	20	392	677	0.41	0.17	0.58	114
263	540	54	324	59	977	512	1.05	0.85	1.91	62
264	904	104	659	104	1771	669	1.35	1.30	2.65	47
265	607	121	480	97	1305	494	1.23	1.41	2.64	49
266	477	44	177	32	730	617	0.77	0.41	1.18	88
267	390	43	256	39	728	472	0.83	0.72	1.54	77
268	440	45	251	31	767	228	1.93	1.43	3.36	38
269	334	14	89	4	441	650	0.51	0.16	0.68	105
270	272	6	53	6	337	748	0.36	0.09	0.45	123
271	266	13	84	16	379	632	0.42	0.18	0.60	112
272	231	15	45	9	300	531	0.44	0.13	0.57	115
273	617	67	370	63	1117	571	1.08	0.88	1.95	61
274	300	11	92	12	415	354	0.85	0.32	1.17	89
275	416	12	102	8	538	764	0.54	0.16	0.70	104
276	728	73	490	75	1366	542	1.34	1.18	2.52	51
277	1873	167	912	141	3093	812	2.31	1.50	3.81	33
278	512	15	143	17	687	402	1.27	0.44	1.71	69
279	228	20	79	13	340	344	0.66	0.33	0.99	95
280	218	13	72	7	310	675	0.32	0.14	0.46	122
281	630	58	281	25	994	575	1.10	0.63	1.73	67
282	176	6	26	3	211	778	0.23	0.04	0.27	127
283	333	13	91	8	445	613	0.54	0.18	0.73	103
284	397	24	113	8	542	838	0.47	0.17	0.65	107
285	535	55	259	33	882	549	0.98	0.63	1.61	72
286	318	20	143	20	501	446	0.71	0.41	1.12	91
287	39	6	41	9	95	46	0.85	1.23	2.08	57
288	403	24	207	14	648	625	0.65	0.39	1.04	94

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
289	250	15	105	14	384	815	0.31	0.16	0.47	121
290	575	55	332	37	999	662	0.87	0.64	1.51	80
291	888	65	355	42	1350	800	1.11	0.58	1.69	70
292	761	109	492	76	1438	479	1.59	1.41	3.00	42
293	776	121	458	60	1415	511	1.52	1.25	2.77	46
294	398	28	116	22	564	686	0.58	0.24	0.82	98
295	591	32	159	23	805	839	0.70	0.26	0.96	96
296	361	21	146	6	534	667	0.54	0.26	0.80	99
297	176	11	68	14	269	438	0.40	0.21	0.61	110
298	604	107	376	74	1161	618	0.98	0.90	1.88	64
299	427	22	135	16	600	386	1.11	0.45	1.55	76
338	339	60	296	35	730	454	0.75	0.86	1.61	71
339	381	57	297	53	788	394	0.97	1.03	2.00	60
341	1214	232	1126	208	2780	606	2.00	2.58	4.59	22
342	795	150	628	127	1700	350	2.27	2.59	4.86	19
343	688	98	498	101	1385	320	2.15	2.18	4.33	24
344	509	104	338	113	1064	186	2.74	2.98	5.72	13
604	1630	568	1844	423	4465	673	2.42	4.21	6.63	6
643	686	121	452	113	1372	351	1.95	1.95	3.91	31
645	740	151	513	131	1535	330	2.24	2.41	4.65	21
646	1398	321	994	327	3040	319	4.38	5.15	9.53	1
647	706	124	452	98	1380	434	1.63	1.55	3.18	41
648	838	165	572	141	1716	332	2.52	2.64	5.17	16
649	1723	440	1211	397	3771	492	3.50	4.16	7.66	5
655	213	43	148	39	443	387	0.55	0.59	1.14	90
701	1448	208	1118	140	2914	1625	0.89	0.90	1.79	66
Total	97,397	14,042	59,313	10,828	181,580	78,860	1.24	1.07	2.30	

Table 4. Archery season harvest by DPA, excluding special hunts, 2019.

Permit Area	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
101	17	0	14	2	33
103	5	0	11	1	17
105	39	6	45	3	93
108	25	5	14	3	47
110	20	1	9	0	30
111	8	0	1	0	9
114	4	0	2	0	6
117	1	1	1	0	3
118	25	2	17	0	44
119	2	0	2	0	4
126	12	2	10	0	24
130	5	1	5	0	11
131	6	1	5	0	12
132	6	0	1	0	7
133	35	2	21	1	59
152	4	0	3	1	8
155	46	16	73	7	142
156	57	9	45	8	119
157	126	18	81	7	232
159	82	4	45	3	134
169	41	10	63	2	116
171	23	4	22	1	50
172	52	7	61	3	123
173	18	2	19	2	41
176	32	7	14	3	56
177	18	0	24	0	42
178	66	4	53	6	129
179	98	9	65	8	180
181	34	1	14	3	52
182	117	21	176	18	332
183	66	7	41	4	118
184	168	24	202	20	414
197	43	3	23	3	72
199	2	0	1	0	3
201	4	1	5	1	11
203	0	0	2	1	3
208	8	0	3	0	11

Table 4., continued.

Permit Area	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
209	31	3	31	5	70
210	35	1	19	2	57
213	203	54	438	48	743
214	180	37	270	33	520
215	284	78	366	51	779
218	171	9	92	17	289
219	153	24	173	13	363
221	207	38	288	35	568
222	109	17	123	15	264
223	252	40	309	34	635
224	41	1	7	1	50
225	234	48	253	33	568
227	387	60	371	49	867
229	104	10	76	8	198
230	47	2	21	0	70
232	57	7	39	2	105
233	65	11	57	3	136
234	42	1	15	1	59
235	32	6	21	1	60
236	317	49	255	26	647
237	31	3	20	0	54
238	10	0	0	0	10
239	152	23	138	9	322
240	211	28	286	22	547
241	299	51	440	54	844
246	114	9	59	7	189
248	52	6	15	5	78
249	112	8	38	4	162
250	50	2	22	5	79
251	3	0	2	0	5
252	44	1	26	0	71
253	88	7	50	3	148
254	106	13	81	6	206
255	87	11	68	6	172
256	29	4	19	2	54
257	29	6	20	2	57
258	39	5	57	6	107

Table 4., continued.

Permit Area	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
259	44	1	26	1	72
260	15	0	11	0	26
261	26	4	26	1	57
262	34	2	13	2	51
263	15	3	23	1	42
264	29	3	53	5	90
265	36	10	56	5	107
266	25	2	13	1	41
267	8	2	19	0	29
268	17	3	24	1	45
269	38	2	13	0	53
270	20	3	15	0	38
271	19	1	7	1	28
272	15	1	3	1	20
273	60	3	70	6	139
274	23	3	18	0	44
275	26	2	26	1	55
276	71	8	106	10	195
277	267	12	132	7	418
278	46	1	31	3	81
279	12	1	15	3	31
280	17	3	16	1	37
281	75	5	43	2	125
282	25	1	6	0	32
283	46	1	26	2	75
284	48	3	20	2	73
285	88	4	35	2	129
286	25	1	17	0	43
287	2	0	1	0	3
288	42	1	52	0	95
289	29	3	13	1	46
290	74	6	37	4	121
291	135	14	73	9	231
292	96	17	99	11	223
293	132	18	111	6	267
294	38	1	12	2	53
295	67	9	42	3	121

Table 4., continued.

Permit Area	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
296	29	4	28	0	61
297	5	0	4	0	9
298	21	4	19	0	44
299	78	6	34	1	119
338	72	3	84	9	168
339	96	13	79	15	203
341	277	31	308	47	663
342	147	18	122	18	305
343	218	25	190	24	457
344	84	15	35	9	143
604	181	84	373	66	704
643	163	21	106	10	300
645	144	17	108	19	288
646	253	34	138	32	457
647	121	12	65	7	205
648	147	6	76	20	249
649	338	51	193	35	617
655	21	5	23	5	54
701	853	138	833	98	1922
Total	10755	1482	9879	1128	23244

Table 5. Total 2019 firearms season harvest by DPA. Does not include youth season, early antlerless season, 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	1891	3.8	404	28	191	27	650	0.82	0.50	1.31
103	1,820	2907	1.6	599	27	234	18	878	0.33	0.15	0.48
105	740	4106	5.5	960	93	672	86	1811	1.30	1.15	2.45
108	1,651	4197	2.5	808	10	129	17	964	0.49	0.09	0.58
110	529	3796	7.2	845	67	427	57	1396	1.60	1.04	2.64
111	1,438	1868	1.3	297	17	86	7	407	0.21	0.08	0.28
114	116	116	1.0	13	1	5	0	19	0.11	0.05	0.16
117	927	120	0.1	16	0	10	1	27	0.02	0.01	0.03
118	1,220	2906	2.4	606	4	43	5	658	0.50	0.04	0.54
119	770	1967	2.6	340	3	11	2	356	0.44	0.02	0.46
126	942	1387	1.5	215	4	38	0	257	0.23	0.04	0.27
130	746	1734	2.3	184	2	16	0	202	0.25	0.02	0.27
131	899	809	0.9	55	1	8	0	64	0.06	0.01	0.07
132	482	1858	3.9	228	0	5	0	233	0.47	0.01	0.48
133	352	2190	6.2	370	24	173	20	587	1.05	0.62	1.67
152	61	650	10.6	64	14	22	3	103	1.05	0.64	1.69
155	499	5389	10.8	714	146	643	94	1597	1.43	1.77	3.20
156	825	8171	9.9	1199	183	726	101	2209	1.45	1.22	2.68
157	888	12094	13.6	1932	278	1010	181	3401	2.18	1.66	3.83
159	571	6267	11.0	1057	109	576	70	1812	1.85	1.32	3.17
169	1,124	7878	7.0	1265	31	224	30	1550	1.13	0.25	1.38
171	627	4895	7.8	583	94	436	51	1164	0.93	0.93	1.86
172	687	9299	13.5	1093	222	905	130	2350	1.59	1.83	3.42
173	584	4396	7.5	507	49	268	30	854	0.87	0.59	1.46
176	921	5171	5.6	739	12	124	13	888	0.80	0.16	0.96
177	480	3843	8.0	556	67	374	40	1037	1.16	1.00	2.16
178	1,195	8171	6.8	1237	28	213	25	1503	1.04	0.22	1.26
179	862	8492	9.9	1248	196	922	125	2491	1.45	1.44	2.89
181	629	5118	8.1	773	65	346	42	1226	1.23	0.72	1.95
182	278	2253	8.1	362	58	182	34	636	1.30	0.99	2.29
183	663	6989	10.5	1051	145	784	81	2061	1.58	1.52	3.11
184	1,229	12951	10.5	2261	361	1594	324	4540	1.84	1.85	3.69
197	955	4990	5.2	788	44	213	29	1074	0.83	0.30	1.13
199	153	537	3.5	97	2	26	4	129	0.64	0.21	0.84
201	161	421	2.6	115	7	60	7	189	0.71	0.46	1.17
203	118	234	2.0	43	1	20	6	70	0.37	0.23	0.59
208	379	979	2.6	230	14	77	8	329	0.61	0.26	0.87
209	640	2556	4.0	606	77	361	65	1109	0.95	0.79	1.73

Table 5., continued.

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
210	615	3652	5.9	823	69	275	49	1216	1.34	0.64	1.98
213	1,057	10003	9.5	2562	464	1556	388	4970	2.42	2.28	4.70
214	554	7153	12.9	1784	402	1199	365	3750	3.22	3.55	6.77
215	701	7115	10.1	1457	378	892	267	2994	2.08	2.19	4.27
218	884	5441	6.2	1103	131	472	86	1792	1.25	0.78	2.03
219	391	3533	9.0	640	88	309	71	1108	1.64	1.20	2.83
221	642	6123	9.5	1476	333	1015	260	3084	2.30	2.51	4.81
222	413	4948	12.0	1084	209	594	185	2072	2.62	2.39	5.01
223	376	3465	9.2	704	134	380	82	1300	1.87	1.59	3.46
224	47	553	11.7	99	7	35	7	148	2.09	1.04	3.13
225	618	7457	12.1	1686	304	960	243	3193	2.73	2.44	5.17
227	472	4676	9.9	1064	163	519	102	1848	2.26	1.66	3.92
229	284	1503	5.3	290	32	141	24	487	1.02	0.69	1.71
230	452	1352	3.0	274	38	97	22	431	0.61	0.35	0.95
232	377	1358	3.6	277	32	122	24	455	0.74	0.47	1.21
233	381	905	2.4	233	27	90	23	373	0.61	0.37	0.98
234	636	722	1.1	204	6	29	3	242	0.32	0.06	0.38
235	34	412	12.2	62	6	16	3	87	1.84	0.74	2.58
236	370	3056	8.3	616	91	297	58	1062	1.67	1.21	2.87
237	728	1093	1.5	252	7	39	4	302	0.35	0.07	0.41
238	95	314	3.3	78	5	13	3	99	0.82	0.22	1.04
239	919	7592	8.3	1853	305	983	220	3361	2.02	1.64	3.66
240	643	7829	12.2	2015	445	1316	306	4082	3.14	3.22	6.35
241	996	13889	13.9	3223	645	2368	485	6721	3.24	3.51	6.75
246	784	9894	12.6	1649	286	1086	200	3221	2.10	2.01	4.11
248	214	1891	8.8	354	39	164	27	584	1.65	1.07	2.73
249	496	5717	11.5	1260	193	613	125	2191	2.54	1.88	4.42
250	713	1360	1.9	298	12	68	7	385	0.42	0.12	0.54
251	55	399	7.3	54	12	38	8	112	0.98	1.05	2.04
252	715	1271	1.8	322	7	81	8	418	0.45	0.13	0.58
253	974	1794	1.8	390	18	88	6	502	0.40	0.11	0.52
254	924	2412	2.6	514	58	258	40	870	0.56	0.39	0.94
255	392	1083	2.8	218	24	88	19	349	0.56	0.33	0.89
256	654	2029	3.1	478	53	246	49	826	0.73	0.53	1.26
257	412	1798	4.4	470	58	262	61	851	1.14	0.92	2.06
258	343	4110	12.0	844	147	585	141	1717	2.46	2.55	5.01

Table 5., continued.

Permit Area	Land Area (Sq. Mile)	Firearms Hunters	Hunters / sq. mile	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest	Bucks / sq. mile	Antlerless / sq. mile	Total / sq. mile
259	490	6479	13.2	970	139	551	112	1772	1.98	1.64	3.62
260	1,249	1516	1.2	390	46	193	19	648	0.31	0.21	0.52
261	795	773	1.0	203	16	95	16	330	0.26	0.16	0.42
262	677	864	1.3	210	14	52	18	294	0.31	0.12	0.43
263	512	1803	3.5	468	43	244	48	803	0.91	0.65	1.57
264	669	3390	5.1	780	87	506	86	1459	1.17	1.01	2.18
265	494	2080	4.2	520	98	347	85	1050	1.05	1.07	2.13
266	617	1888	3.1	404	38	126	29	597	0.66	0.31	0.97
267	472	1222	2.6	328	39	201	36	604	0.69	0.58	1.28
268	228	1273	5.6	376	36	187	28	627	1.65	1.10	2.75
269	650	1258	1.9	261	8	56	4	329	0.40	0.10	0.51
270	748	929	1.2	216	1	31	6	254	0.29	0.05	0.34
271	632	1011	1.6	215	10	60	13	298	0.34	0.13	0.47
272	531	955	1.8	197	13	38	8	256	0.37	0.11	0.48
273	571	2582	4.5	505	57	254	48	864	0.88	0.63	1.51
274	354	1144	3.2	249	8	57	8	322	0.70	0.21	0.91
275	764	1739	2.3	348	9	54	5	416	0.46	0.09	0.54
276	542	2958	5.5	585	57	289	52	983	1.08	0.73	1.81
277	812	6743	8.3	1441	133	609	117	2300	1.78	1.06	2.83
278	402	1760	4.4	415	10	93	13	531	1.03	0.29	1.32
279	344	1058	3.1	179	16	45	8	248	0.52	0.20	0.72
280	675	1233	1.8	176	9	51	4	240	0.26	0.09	0.36
281	575	2311	4.0	491	42	185	19	737	0.85	0.43	1.28
282	778	604	0.8	129	5	19	2	155	0.17	0.03	0.20
283	613	1378	2.2	260	10	49	5	324	0.42	0.10	0.53
284	838	1715	2.0	310	18	73	5	406	0.37	0.11	0.48
285	549	2274	4.1	410	43	187	25	665	0.75	0.46	1.21
286	446	1223	2.7	253	15	97	15	380	0.57	0.28	0.85
287	46	400	8.8	35	6	36	8	85	0.77	1.09	1.86
288	625	1861	3.0	311	20	116	14	461	0.50	0.24	0.74
289	815	1125	1.4	187	10	70	11	278	0.23	0.11	0.34
290	662	2305	3.5	450	42	206	24	722	0.68	0.41	1.09
291	800	3451	4.3	668	39	222	27	956	0.83	0.36	1.19
292	479	3007	6.3	611	83	314	49	1057	1.28	0.93	2.21
293	511	2542	5.0	584	88	280	46	998	1.14	0.81	1.95
294	686	1263	1.8	300	24	92	17	433	0.44	0.19	0.63

Table 5., continued.

Permit Area	Land Area (Sq. Mile)	Firearms Hunters	Hunters / sq. mile	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest	Bucks / sq. mile	Antlerless / sq. mile	Total / sq. mile
295	839	2122	2.5	455	18	93	17	583	0.54	0.15	0.69
296	667	1524	2.3	290	16	95	6	407	0.44	0.18	0.61
297	438	965	2.2	159	10	55	13	237	0.36	0.18	0.54
298	618	3552	5.8	557	99	332	66	1054	0.90	0.80	1.71
299	386	1426	3.7	326	16	81	14	437	0.84	0.29	1.13
338	454	2005	4.4	235	43	183	24	485	0.52	0.55	1.07
339	394	1733	4.4	256	38	179	30	503	0.65	0.63	1.28
341	606	4801	7.9	854	179	691	138	1862	1.41	1.66	3.07
342	350	3295	9.4	564	106	442	94	1206	1.61	1.83	3.45
343	320	2214	6.9	418	62	239	58	777	1.31	1.12	2.43
344	186	2568	13.8	391	77	259	94	821	2.10	2.31	4.41
604	673	8444	12.5	1384	414	1192	298	3288	2.06	2.83	4.89
643	351	1813	5.2	454	80	241	66	841	1.29	1.10	2.40
645	330	2724	8.3	546	110	314	91	1061	1.65	1.56	3.22
646	319	3693	11.6	1003	209	577	200	1989	3.14	3.09	6.24
647	434	2324	5.4	505	83	287	59	934	1.16	0.99	2.15
648	332	2958	8.9	634	115	361	81	1191	1.91	1.68	3.59
649	492	5455	11.1	1282	311	811	274	2678	2.61	2.84	5.44
655	387	755	2.0	175	30	105	28	338	0.45	0.42	0.87
701	1625	2391	1.5	553	64	252	34	903	0.34	0.22	0.56
Total	78860	418377	5.3	80646	11124	42322	8419	142511	1.02	0.78	1.81

Table 6. Muzzleloader deer season harvest by DPA, 2019.

Permit Area	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
101	9	4	8	1	22
103	9	1	15	0	25
105	18	7	29	6	60
108	6	0	2	0	8
110	8	1	11	0	20
111	5	0	2	0	7
114	0	0	1	1	2
118	8	0	1	0	9
119	3	0	0	0	3
126	2	0	3	0	5
131	1	0	1	0	2
132	1	0	0	0	1
133	1	1	2	0	4
152	0	0	1	0	1
155	7	3	10	3	23
156	14	3	15	2	34
157	19	2	20	3	44
159	12	1	25	2	40
169	10	1	5	1	17
171	8	1	15	1	25
172	11	14	46	8	79
173	2	1	3	0	6
176	4	0	2	0	6
177	5	2	12	1	20
178	10	1	5	0	16
179	17	6	41	1	65
181	10	0	1	1	12
182	0	0	8	1	9
183	3	4	12	1	20
184	33	11	71	7	122
197	10	0	5	1	16
199	2	0	2	0	4
201	6	0	5	0	11
208	13	0	8	2	23
209	25	5	29	3	62

Table 6., continued.

Permit Area	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
210	22	1	14	3	40
213	108	32	220	35	395
214	42	11	86	15	154
215	79	31	143	33	286
218	61	12	98	8	179
219	44	19	71	4	138
221	48	13	87	16	164
222	18	7	38	8	71
223	29	13	68	13	123
224	0	0	1	0	1
225	31	13	64	15	123
227	50	19	92	16	177
229	18	7	21	1	47
230	16	3	19	0	38
232	24	6	40	4	74
233	25	7	27	2	61
234	22	1	4	1	28
235	3	0	2	1	6
236	28	15	25	7	75
237	48	0	8	2	58
238	8	1	2	1	12
239	40	15	59	8	122
240	43	9	132	19	203
241	56	36	229	39	360
246	22	5	45	9	81
248	5	4	12	0	21
249	23	7	23	6	59
250	38	2	16	0	56
251	1	0	2	0	3
252	34	0	10	0	44
253	55	2	19	1	77
254	55	11	71	16	153
255	24	7	36	2	69
256	13	3	24	1	41
257	26	7	19	2	54
258	13	5	29	7	54

Table 6., continued.

Permit Area	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
259	13	5	34	5	57
260	14	0	23	2	39
261	18	0	14	0	32
262	22	1	10	0	33
263	32	4	39	6	81
264	32	9	60	7	108
265	24	8	59	3	94
266	28	1	28	2	59
267	28	2	18	2	50
268	20	5	27	1	53
269	31	2	11	0	44
270	30	1	4	0	35
271	29	0	16	2	47
272	12	1	0	0	13
273	37	6	32	7	82
274	21	0	10	1	32
275	25	0	15	1	41
276	55	5	75	10	145
277	109	13	126	11	259
278	43	2	13	1	59
279	34	3	16	1	54
280	22	0	2	2	26
281	50	9	46	3	108
282	15	0	1	0	16
283	21	1	7	0	29
284	34	2	11	1	48
285	22	5	29	3	59
286	34	3	21	3	61
287	2	0	4	1	7
288	43	2	27	0	72
289	30	2	15	2	49
290	39	5	72	7	123
291	63	10	36	2	111
292	38	6	59	13	116
293	41	13	56	7	117
294	56	2	10	3	71

Table 6., continued.

Permit Area	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
295	58	1	15	2	76
296	39	0	18	0	57
297	8	0	2	0	10
298	11	1	15	3	30
299	20	0	12	0	32
338	20	9	20	1	50
339	15	4	34	7	60
341	40	15	95	15	165
342	46	14	55	11	126
343	27	6	46	11	90
344	16	6	30	7	59
604	13	6	49	9	77
643	23	2	29	8	62
645	20	9	44	7	80
646	42	13	76	22	153
647	14	2	21	7	44
648	12	1	30	4	47
649	62	25	100	24	211
655	13	4	12	5	34
701	23	3	22	5	53
Total	3153	642	4023	598	8416

Table 7. Youth deer season harvest by DPA, 2019.

Permit Area	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
101	17	3	15	2	37
103	9	6	15	4	34
105	49	10	56	7	122
108	27	3	31	4	65
110	30	3	28	3	64
111	16	4	18	1	39
114	0	1	1	0	2
118	10	1	24	1	36
119	3	1	1	0	5
126	4	0	1	0	5
130	1	2	7	0	10
131	2	0	0	0	2
132	0	0	1	0	1
133	4	2	5	0	11
152	1	1	2	0	4
155	15	6	18	5	44
156	30	3	33	5	71
157	51	12	34	5	102
159	20	0	14	1	35
169	19	7	39	3	68
171	12	4	17	5	38
172	18	7	36	4	65
173	19	4	9	0	32
176	20	2	18	5	45
177	9	0	26	1	36
178	27	7	34	1	69
179	38	9	54	5	106
181	18	5	16	3	42
182	7	2	8	4	21
183	19	4	35	0	58
184	53	16	57	8	134
197	10	2	13	1	26
199	4	0	3	0	7
201	8	2	6	3	19
203	1	0	2	0	3

Table 7., continued.

Permit Area	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
208	20	0	13	1	34
209	46	0	20	2	68
210	20	6	17	0	43
213	92	13	98	12	215
214	55	20	73	17	165
215	57	24	50	20	151
218	27	15	22	9	73
219	18	6	29	3	56
221	90	15	70	12	187
222	39	15	33	9	96
223	24	6	12	2	44
224	0	0	0	1	1
225	42	11	36	14	103
227	26	3	15	5	49
229	8	4	6	2	20
230	6	3	4	1	14
232	8	1	5	0	14
233	11	4	10	2	27
234	1	0	2	0	3
235	3	2	1	1	7
236	18	0	7	4	29
237	2	1	4	2	9
239	61	14	49	10	134
240	82	31	83	13	209
241	166	28	135	37	366
246	39	9	39	9	96
248	15	3	12	3	33
249	35	14	43	4	96
250	8	1	5	1	15
251	2	2	4	0	8
252	5	0	6	3	14
253	6	1	4	2	13
254	16	1	11	1	29
255	6	1	4	0	11
256	28	4	28	7	67
257	17	2	15	2	36

Table 7., continued.

Permit Area	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
258	28	5	31	8	72
259	16	2	19	3	40
260	47	0	20	2	69
261	11	1	4	0	16
262	11	0	3	0	14
263	25	4	18	4	51
264	63	5	40	6	114
265	27	5	18	4	54
266	20	3	10	0	33
267	26	0	18	1	45
268	27	1	13	1	42
269	4	2	9	0	15
270	6	1	3	0	10
271	3	2	1	0	6
272	7	0	4	0	11
273	15	1	14	2	32
274	7	0	7	3	17
275	17	1	7	1	26
276	17	3	20	3	43
277	56	9	45	6	116
278	8	2	6	0	16
279	3	0	3	1	7
280	3	1	3	0	7
281	14	2	7	1	24
282	7	0	0	1	8
283	6	1	9	1	17
284	5	1	9	0	15
285	15	3	8	3	29
286	6	1	8	2	17
288	7	1	12	0	20
289	4	0	7	0	11
290	12	2	17	2	33
291	22	2	24	4	52
292	16	3	20	3	42
293	19	2	11	1	33
294	4	1	2	0	7

Table 7., continued.

Permit Area	Adult Male Harvest	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
295	11	4	9	1	25
296	3	1	5	0	9
297	4	1	7	1	13
298	15	3	10	5	33
299	3	0	8	1	12
338	12	5	9	1	27
339	14	2	5	1	22
341	43	7	32	8	90
342	38	12	9	4	63
343	25	0	4	4	33
344	18	6	14	3	41
604	52	2	19	6	79
643	12	2	7	0	21
645	30	2	4	2	38
646	33	1	10	3	47
647	11	2	6	1	20
648	23	1	4	5	33
649	41	5	6	3	55
655	4	1	0	0	5
701	19	3	11	3	36
Total	2665	516	2271	407	5859

Table 8. Early-season antlerless deer harvest by DPA, 2019.

Permit Area	Fawn Male Harvest	Adult Female Harvest	Fawn Female Harvest	Total Harvest
343	5	19	4	28
604	62	211	44	317
643	0	14	3	17
645	13	43	12	68
646	35	67	29	131
647	3	15	4	22
648	13	52	22	87
649	48	101	61	210
655	3	8	1	12
Total	182	530	180	892

Table 9. 300 Series A and B Firearms Harvest by Permit Area, 2019.

Permit Area	Zone	Adult Male	Fawn Male	Adult Female	Fawn Female	Total
338	3A	214	29	133	14	390
	3B	20	13	49	10	92
339	3A	228	29	136	22	415
	3B	28	7	41	8	84
341	3A	721	115	437	80	1353
	3B	127	63	247	56	493
342	3A	488	68	279	60	895
	3B	76	37	167	35	315
343	3A	357	47	167	43	614
	3B	58	16	70	15	159
344	3A	339	60	178	78	655
	3B	52	17	80	16	165
643	3A	371	57	170	39	637
	3B	83	25	74	27	209
645	3A	422	68	184	51	725
	3B	124	42	133	40	339
646	3A	806	131	338	119	1394
	3B	197	79	242	82	600
647	3A	413	56	186	19	674
	3B	91	27	101	41	260
648	3A	557	86	252	63	958
	3B	76	30	111	18	235
649	3A	1003	177	441	136	1757
	3B	279	134	371	138	922
655	3A	153	21	88	21	283
	3A	22	9	18	8	57
Total		**7305**	**1443**	**4693**	**1239**	**14680**

Table 10. Free Landowner License Harvest by Permit Area, 2019.

Permit Area	Fawn Male	Adult Female	Fawn Female	Total
101	5	1	1	7
105	9	1	1	11
110	16	0	1	17
131	0	0	1	1
155	3	1	0	4
156	11	1	1	13
157	34	7	5	46
159	7	1	0	8
171	2	0	0	2
172	6	0	0	6
177	9	0	0	9
179	9	0	2	11
183	3	0	0	3
184	16	3	4	23
201	2	0	0	2
208	3	4	0	7
209	3	1	2	6
210	18	2	5	25
213	73	17	22	112
214	71	17	22	110
215	28	11	12	51
218	8	3	5	16
219	5	0	0	5
221	29	4	8	41
222	10	0	0	10
223	2	0	0	2
225	18	4	3	25
227	7	1	1	9
229	1	0	0	1
230	2	0	1	3
232	4	0	1	5
233	2	0	0	2
236	3	0	2	5
239	21	8	6	35

Table 10., Continued.

Permit Area	Fawn Male	Adult Female	Fawn Female	Total
240	48	13	19	80
241	94	15	21	130
246	30	4	8	42
248	6	0	1	7
249	47	11	17	75
254	3	1	0	4
255	3	0	1	4
256	18	0	3	21
257	15	7	3	25
258	10	2	1	13
259	6	0	0	6
260	6	0	0	6
261	2	0	0	2
262	1	0	2	3
263	1	0	0	1
264	26	4	2	32
265	9	2	5	16
266	5	1	0	6
267	3	0	0	3
268	4	0	0	4
276	1	0	0	1
277	14	2	2	18
281	3	0	1	4
290	4	1	0	5
292	9	1	1	11
293	3	1	2	6
297	2	1	0	3
298	6	0	2	8
338	4	0	0	4
339	2	1	0	3
341	16	4	8	28
342	9	3	3	15
343	2	1	2	5
344	8	1	3	12

Table 10., Continued.

Permit Area	Fawn Male	Adult Female	Fawn Female	Total
604	4	0	2	6
643	1	0	0	1
645	7	1	0	8
646	3	3	3	9
647	1	0	0	1
648	5	0	2	7
649	8	2	4	14
Total	889	169	224	1,270

Table 11. Summary of special firearms hunts, 2019. Includes regular, youth, and bonus permits.

Area	Dates	Permits Issued	Harvest Adult Male	Fawn Male	Adult Female	Fawn Female	Total
893 - Carver Park Reserve	11/16-11/17	110*	20	5	14	5	44
900 - Cascade River State Park	11/9-11/24	100*	4	1	14	1	20
901 - Rice Lake NWR	11/16-11/24	40*	2	0	2	0	4
902 - St. Croix State Park	11/21-11/24	350*	24	11	42	4	81
903 - Lake Louise State Park	11/16-11/17	25*	5	0	14	3	22
904 - Gooseberry Falls State Park	11/9-11/24	40*	8	3	8	2	21
905 - Split Rock Lighthouse State Park	11/9-11/24	40*	4	1	3	1	9
906 - Tettegouche State Park	11/9-11/24	125*	3	0	2	0	5
907 - Scenic State Park	11/9-11/24	30*	1	2	4	1	8
908 - Hayes Lake State Park	11/9-11/24	75*	5	1	3	1	10
909 - Lake Bemidji State Park	11/9-11/12	30***	1	1	5	1	8
910 - Zippel Bay State Park	11/9-11/24	75***	10	8	15	4	37
911 - Judge CR Magney State Park	11/9-11/24	75*	6	0	5	0	11
912 - Schoolcraft State Park	11/9-11/24	NA*	0	1	1	0	2
913 - Lake Carlos State Park	11/9-11/12	20**	0	3	7	1	11
914 - William O'Brien State Park	11/9-11/10	50*	17	2	15	3	37
915 - Lake Bronson State Park	11/9-11/17	30***	3	6	10	2	21
916 - Maplewood State Park	11/9-11/12	100*	34	6	20	5	65
917 - Miesvile Ravine Park Reserve	11/9-1/17	40**	0	6	28	5	39
918 - Beaver Creek Valley State Park	11/9-11/10	25*	8	0	6	0	14
919 - Glacial Lakes State Park	11/14-11/17	20**	0	1	7	1	9
920 - Zumbro Falls Woods SNA	11/9-11/17	12*	3	1	3	0	7
922 - Old Mill State Park	11/9-11/12	10*	3	0	0	0	3
923 - Zumbro Falls Woods SNA	11/23-12/1	12*	2	2	2	0	6
925 - Vermillion Highlands Research, Recreation and WMNA	11/9-11/22	20*	2	0	2	1	5
927 - Whitewater State Park	11/23-11/24	50*	8	3	7	0	18
928 - Wild River State Park	11/9-11/10	75*	21	11	24	7	63
931 - City of Grand Rapids	11/9-11/24	N/A*	9	7	19	4	39
933 - Forestville/ Mystery Cave State Park	11/9-11/10	130*	13	4	15	3	35
934 - Whitewater State Game Refuge	11/23-12/1	100**	0	1	16	4	21
940 - Frontenac State Park	11/23-11/24	60#	8	3	12	2	25
962 - Great River Bluffs State Park	11/23-11/24	50*	4	1	1	3	9
Total			**228**	**91**	**326**	**64**	**709**

Table 12. Summary of special muzzleloader deer hunts, 2019. Includes regular, youth, and bonus permits.

			Harvest				
Area	**Dates**	**Permits Issued**	**Adult Male**	**Fawn Male**	**Adult Female**	**Fawn Female**	**Total**
894 - Sakatah State Park	12/7-12/8	**15****	0	3	4	0	7
929 - McCarthy Beach State Park	11/30-12/8	25*	2	0	6	1	9
930 - Nerstrand Big Woods State Park	12/7-12/8	50***	4	4	19	3	30
932 - Rice Lake State Park	12/7-12/8	20**	1	1	11	1	14
935 - Jay Cooke State Park	12/7-12/13	75*	0	2	1	2	5
936 - Crow Wing State Park	12/7-12/11	25*	5	1	5	0	11
937 - Lake Vermillion - Soudan Underground Mine State Park	11/30-12/15	25*	3	1	4	0	8
938 - City of Tower	11/30-12/15	20*	3	4	6	2	15
939 - Myre-Big Island State Park	12/7-12/8	50**	0	10	22	5	37
942 - Sibley State Park	11/30-12/1	60**	0	4	4	3	11
943 - Miesville Ravine Park Reserve	12/7-12/15	40**	1	5	9	3	18
944 - Vermillion Highlands Research, Recreation and WMA	11/30-12/15	20*	2	1	2	0	5
946 - City of Grand Rapids	11/30-12/15	N/A*	2	2	2	1	7
947 - Lake Bemidji State Park	12/6-12/8	30*	0	1	4	1	6
948 - Savanna Portage State Park	11/30-12/8	30*	0	1	3	0	4
949 - St. Croix State Park	12/4-12/8	100*	0	0	12	4	16
		Totals	23	40	114	26	203

Table 13. Summary of special youth and Camp Ripley archery hunts.

Area	Dates	Permits Issued	Harvest Adult Male	Fawn Male	Adult Female	Fawn Female	Total
899 - Minneopa State Park	10/26-10/27	**5***	1	0	0	0	1
950 - Camp Ripley Youth Archery	10/12-10/13	175*	0	0	1	0	1
951 - Afton State Park	11/9-11/10	30*	10	1	11	0	22
952 - Sibley State Park	10/26-10/27	10*	2	0	1	0	3
953 - Zippel Bay State Park	10/19-10/20	20*	1	0	1	1	3
954 - Lake Bemidji State Park	10/18-10/20	20*	1	0	0	0	1
956 - St. Croix State Park	11/2-11/3	90*	21	3	8	2	34
957 - Rydell National Wildlife Refuge	10/26-10/27	15*	1	0	1	0	2
958 - Savanna Portage State Park	10/26-10/27	25*	2	0	1	0	3
959 - Buffalo River State Park	11/9-11/10	12***	1	1	2	1	5
960 - Tettegouche State Park	11/2-11/3	10*	1	0	0	0	1
961 - Itasca State Park	10/12-10/13	75*	2	0	0	0	2
963 - Kilen Woods State Park	10/26-10/27	6*	1	0	0	1	2
965 - Banning State Park	11/2-11/3	6*	1	0	2	0	3
966 - Blue Mounds State Park	11/23-11/24	10***	0	0	2	0	2
967 - Camden State Park	10/26-10/27	12***	1	0	3	4	8
968 - Lake Shetek State Park	11/23-11/24	12***	4	0	8	1	13
969 - Lake Bronson State Park	10/26-10/27	10*	0	0	2	0	2
		Total	**50**	**5**	**43**	**10**	**108**
970 - Camp Ripley First Hunt	10/17-10/18	2,000*	31	6	28	3	68
971 - Camp Ripley Second Hunt	10/26-10/27	2,000*	105	17	71	19	212
		Total	**136**	**23**	**99**	**22**	**280**

Table 14. 2019 Firearm Lottery Distribution Report

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
103	1	864	4	276	588	991
	2	293	1	0	293	
	3	73	0	0	73	
	4	25	0	0	25	
	5	7	0	0	7	
	6	5	0	0	5	
	Total	**1267**	**5**	**276**	**991**	
108	1	220	0	220	0	99
	2	217	0	217	0	
	3	220	0	220	0	
	4	181	0	181	0	
	5	152	0	152	0	
	6	115	0	38	77	
	7	22	0	9	22	
	Total	**1127**	**0**	**1037**	**99**	
111	1	264	0	37	227	498
	2	134	1	0	134	
	3	125	0	0	125	
	4	12	0	0	12	
	Total	**535**	**1**	**37**	**498**	
118	1	388	2	388	0	49
	2	215	2	215	0	
	3	126	0	126	0	
	4	42	1	11	31	
	5	17	0	0	17	
	9	1	0	0	1	
	Total	**789**	**5**	**740**	**49**	
126	1	237	0	237	0	145
	2	186	3	45	141	
	3	4	0	0	4	
	Total	**427**	**3**	**282**	**145**	
130	1	288	3	288	0	49
	2	152	0	146	6	
	3	42	0	0	42	
	4	1	0	0	1	
	Total	**483**	**3**	**434**	**49**	

Table 14., continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
131	1	122	1	88	34	50
	2	12	0	0	12	
	3	3	0	0	3	
	4	1	0	0	1	
	Total	**138**	**1**	**88**	**50**	
169	1	1403	2	1403	0	494
	2	1673	9	1673	0	
	3	669	6	192	477	
	4	14	2	0	14	
	5	3	1	0	3	
	Total	**3762**	**20**	**3268**	**494**	
173	1	1373	3	517	856	1481
	2	516	3	0	516	
	3	96	2	0	96	
	4	13	2	0	13	
	5	0	1	0	0	
	Total	**1998**	**11**	**517**	**1481**	
176	1	1093	6	1093	0	297
	2	538	1	434	104	
	3	191	1	0	191	
	4	2	0	0	2	
	Total	**1824**	**8**	**1527**	**297**	
178	1	1199	2	1199	0	297
	2	773	2	773	0	
	3	567	5	275	292	
	4	5	0	0	5	
	Total	**2544**	**9**	**2247**	**297**	
181	1	1439	6	0	1439	1984
	2	197	2	0	197	
	3	26	1	0	26	
	4	2	0	0	2	
	Total	**1664**	**9**	**0**	**1664**	

Table 14., Continued.

Permit Area Number	Preference Level	Applications Total	Applications Rejected	Unsuccessful	Winners	Permits Available
197	1	814	1	814	0	740
	2	656	1	560	96	
	3	523	1	0	523	
	4	120	0	0	120	
	5	1	2	0	1	
	Total	**2114**	**5**	**1374**	**740**	
199	1	154	1	70	84	99
	2	13	0	0	13	
	3	2	0	0	2	
	Total	**169**	**1**	**70**	**99**	
234	1	113	4	113	0	94
	2	101	0	24	77	
	3	15	0	0	15	
	4	2	0	0	2	
	Total	**231**	**4**	**137**	**94**	
235	1	74	0	41	33	69
	2	33	0	0	33	
	3	3	0	0	3	
	Total	**110**	**0**	**41**	**69**	
237	1	94	0	94	0	47
	2	84	0	84	0	
	3	70	1	70	0	
	4	50	0	3	47	
	5	0	1	0	0	
	Total	**298**	**2**	**251**	**47**	
238	1	58	0	58	0	49
	2	46	0	3	43	
	3	5	0	0	5	
	4	1	0	0	1	
	Total	**110**	**0**	**61**	**49**	
250	1	306	2	294	12	276
	2	251	0	0	251	
	3	13	0	0	13	
	Total	**570**	**2**	**294**	**276**	

Table 14., Continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
252	1	346	1	123	223	373
	2	147	0	0	147	
	3	3	0	0	3	
	Total	**496**	**1**	**123**	**373**	
253	1	376	2	376	0	266
	2	275	0	71	204	
	3	62	1	0	62	
	Total	**713**	**3**	**447**	**266**	
269	1	292	0	168	124	319
	2	167	1	0	167	
	3	27	0	0	27	
	4	1	0	0	1	
	Total	**487**	**1**	**168**	**319**	
270	1	150	0	150	0	141
	2	64	0	7	57	
	3	52	0	0	52	
	4	30	0	0	30	
	5	2	0	0	2	
	Total	**298**	**0**	**157**	**141**	
271	1	311	0	0	311	418
	2	92	4	0	92	
	3	1	1	0	1	
	Total	**404**	**5**	**0**	**404**	
272	1	186	1	186	0	193
	2	147	0	0	147	
	3	44	0	0	44	
	4	1	1	0	1	
	9	1	0	0	1	
	Total	**379**	**2**	**186**	**193**	
274	1	228	0	228	0	227
	2	231	0	63	168	
	3	58	0	0	58	
	4	1	0	0	1	
	Total	**518**	**0**	**291**	**227**	

Table 14., Continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
275	1	261	0	261	0	141
	2	247	0	247	0	
	3	177	0	36	141	
	6	0	1	0	0	
	Total	**685**	**1**	**544**	**141**	
278	1	364	2	364	0	361
	2	251	0	131	120	
	3	216	0	0	216	
	4	23	0	0	23	
	5	0	1	0	0	
	7	1	0	0	1	
	9	1	0	0	1	
	Total	**856**	**3**	**495**	**361**	
279	1	247	1	247	0	267
	2	255	1	6	249	
	3	15	1	0	15	
	4	3	0	0	3	
	Total	**520**	**3**	**253**	**267**	
280	1	154	0	154	0	93
	2	124	0	124	0	
	3	121	0	52	69	
	4	23	0	0	23	
	9	1	0	0	1	
	Total	**423**	**0**	**330**	**93**	
282	1	45	0	45	0	24
	2	37	0	37	0	
	3	29	0	29	0	
	4	31	0	7	24	
	Total	**142**	**0**	**118**	**24**	
283	1	211	1	211	0	189
	2	182	0	116	66	
	3	121	1	0	121	
	4	2	0	0	2	
	Total	**516**	**2**	**327**	**189**	

Table 14., Continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
284	1	264	2	264	0	191
	2	235	0	235	0	
	3	213	2	64	149	
	4	42	0	0	42	
	Total	**754**	**4**	**563**	**191**	
286	1	283	1	229	54	269
	2	192	0	0	192	
	3	21	0	0	21	
	4	2	0	0	2	
	Total	**498**	**1**	**229**	**269**	
288	1	451	0	276	175	460
	2	269	0	0	269	
	3	16	0	0	16	
	4	0	1	0	0	
	Total	**736**	**1**	**276**	**460**	
289	1	380	1	165	215	271
	2	41	0	0	41	
	3	14	0	0	14	
	4	1	0	0	1	
	Total	**436**	**1**	**165**	**271**	
291	1	782	2	661	121	911
	2	656	2	0	656	
	3	131	1	0	131	
	4	3	1	0	3	
	Total	**1572**	**6**	**661**	**911**	
294	1	383	0	200	183	280
	2	94	0	0	94	
	3	2	0	0	2	
	6	1	0	0	1	
	Total	**480**	**0**	**200**	**280**	

Table 14., Continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
295	1	330	0	330	0	271
	2	275	0	201	74	
	3	195	2	0	195	
	4	1	2	0	1	
	5	1	0	0	1	
	6	0	1	0	0	
	Total	**802**	**5**	**531**	**271**	
296	1	278	0	278	0	272
	2	250	0	95	155	
	3	117	0	0	117	
	Total	**645**	**0**	**373**	**272**	
299	1	363	2	305	58	366
	2	301	1	0	301	
	3	7	0	0	7	
	4	0	2	0	0	
	Total	**671**	**5**	**305**	**366**	
	Total	**33,191**	**133**	**19,423**	**13,777**	**14,111**

Table 15. 2019 Muzzleloader Season Lottery Distribution Report.

Permit Area Number	Preference Level	Applications Total	Applications Rejected	Unsuccessful	Winners	Permits Available
103	1	8	0	3	5	9
	2	3	0	0	3	
	4	1	0	0	1	
	Total	**12**	**0**	**3**	**9**	
108	1	1	0	1	0	1
	2	3	0	3	0	
	3	2	0	2	0	
	4	2	0	2	0	
	5	3	0	2	1	
	Total	**11**	**0**	**10**	**1**	
111	1	2	0	0	2	2
	Total	**2**	**0**	**0**	**2**	
118	1	10	0	10	0	1
	2	4	0	4	0	
	3	2	0	1	1	
	Total	**16**	**0**	**15**	**1**	
126	1	10	0	9	1	5
	2	4	0	0	4	
	Total	**14**	**0**	**9**	**5**	
130	1	3	0	3	0	1
	2	5	0	4	1	
	Total	**8**	**0**	**7**	**1**	
169	1	25	0	25	0	6
	2	17	0	14	3	
	3	3	0	0	3	
	Total	**45**	**0**	**39**	**6**	
173	1	22	0	7	15	19
	2	3	0	0	3	
	3	1	0	0	1	
	Total	**26**	**0**	**7**	**19**	
176	1	16	0	16	0	3
	2	6	0	4	2	
	3	1	0	0	1	
	Total	**23**	**0**	**20**	**3**	

Table 15., Continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
178	1	16	0	16	0	3
	2	6	0	4	2	
	3	1	0	0	1	
	Total	**23**	**0**	**20**	**3**	
181	1	11	0	0	11	16
	2	2	0	0	2	
	Total	**13**	**0**	**0**	**13**	
197	1	13	0	13	0	10
	2	12	0	5	7	
	3	3	0	0	3	
	Total	**28**	**0**	**18**	**10**	
199	1	1	0	1	0	1
	2	1	0	0	1	
	Total	**2**	**0**	**1**	**1**	
234	1	13	0	9	4	6
	2	2	0	0	2	
	Total	**15**	**0**	**9**	**6**	
235	1	10	0	4	6	6
	Total	**10**	**0**	**4**	**6**	
237	1	9	0	9	0	3
	2	5	0	5	0	
	3	2	0	0	2	
	4	1	0	0	1	
	Total	**17**	**0**	**14**	**3**	
238	1	2	0	2	0	1
	2	1	0	0	1	
	Total	**3**	**0**	**2**	**1**	
250	1	35	0	25	10	24
	2	14	0	0	14	
	Total	**49**	**0**	**25**	**24**	
252	1	29	0	9	20	27
	2	7	0	0	7	
	Total	**36**	**0**	**9**	**27**	

Table 15., Continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
253	1	50	0	50	0	34
	2	39	0	7	32	
	3	2	0	0	2	
	Total	**91**	**0**	**57**	**34**	
269	1	36	0	16	20	31
	2	10	0	0	10	
	3	1	0	0	1	
	Total	**47**	**0**	**16**	**31**	
270	1	10	0	10	0	9
	2	6	0	0	6	
	3	1	0	0	1	
	4	2	0	0	2	
	Total	**19**	**0**	**10**	**9**	
271	1	22	0	0	22	32
	2	9	0	0	9	
	Total	**31**	**0**	**0**	**31**	
272	1	8	0	7	1	7
	2	5	0	0	5	
	3	1	0	0	1	
	Total	**14**	**0**	**7**	**7**	
274	1	21	0	21	0	23
	2	30	0	9	21	
	3	2	0	0	2	
	Total	**53**	**0**	**30**	**23**	
275	1	21	0	21	0	9
	2	19	0	16	3	
	3	6	0	0	6	
	Total	**46**	**0**	**37**	**9**	
278	1	53	0	53	0	39
	2	25	0	0	25	
	3	14	1	0	14	
	Total	**92**	**1**	**53**	**39**	

Table 15., Continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
279	1	45	0	31	14	33
	2	19	0	0	19	
	Total	**64**	**0**	**31**	**33**	
280	1	13	0	13	0	7
	2	14	0	13	1	
	3	6	0	0	6	
	Total	**33**	**0**	**26**	**7**	
282	1	3	0	3	0	1
	3	1	0	0	1	
	Total	**4**	**0**	**3**	**1**	
283	1	21	0	20	1	11
	2	10	0	0	10	
	Total	**31**	**0**	**20**	**11**	
284	1	18	0	18	0	9
	2	11	0	8	3	
	3	6	0	0	6	
	Total	**35**	**0**	**26**	**9**	
286	1	34	0	27	7	31
	2	24	0	0	24	
	Total	**58**	**0**	**27**	**31**	
288	1	49	0	24	25	40
	2	15	0	0	15	
	Total	**64**	**0**	**24**	**40**	
289	1	41	0	18	23	29
	2	5	0	0	5	
	3	1	0	0	1	
	Total	**47**	**0**	**18**	**29**	
291	1	100	0	64	36	89
	2	47	0	0	47	
	3	5	0	0	5	
	4	1	0	0	1	
	Total	**153**	**0**	**64**	**89**	

Table 15., Continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
294	1	33	0	15	18	20
	2	2	0	0	2	
	Total	**35**	**0**	**15**	**20**	
295	1	45	0	45	0	29
	2	27	0	12	15	
	3	13	0	0	13	
	4	1	0	0	1	
	Total	**86**	**0**	**57**	**29**	
296	1	37	0	37	0	28
	2	28	0	2	26	
	3	2	0	0	2	
	Total	**67**	**0**	**39**	**28**	
299	1	40	0	28	12	34
	2	21	0	0	21	
	3	1	0	0	1	
	Total	**62**	**0**	**28**	**34**	
Total		**1,485**	**1**	**800**	**685**	**689**

Table 16. 2019 Special Firearms Hunt Lottery Distribution Report.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
893- Carver Park Reserve A Season	1	157	0	157	0	103
	2	125	0	78	47	
	3	52	0	0	52	
	4	2	0	0	2	
	6	1	0	0	1	
	9	1	0	0	1	
	Total	338	0	235	103	
893 - Carver Park Reserve B Season	1	8	0	8	0	7
	2	13	0	4	9	
	3	1	0	0	1	
	Total	22	0	12	10	
900- Cascade River S. P.	1	34	0	0	34	100
	2	6	0	0	6	
	Total	40	0	0	40	
903 - Lake Louise S. P.	1	47	0	47	0	25
	2	15	0	3	12	
	3	15	0	0	15	
	Total	77	0	50	27	
901 - Rice Lake Wildlife Refuge	1	55	28	30	25	40
	2	14	10	0	14	
	3	1	1	0	1	
	Total	70	39	30	40	
902 - St. Croix S. P.	1	405	0	169	236	350
	2	102	0	0	102	
	3	10	0	0	10	
	9	2	0	0	2	
	Total	519	0	169	350	
903 - Lake Louise S. P.	1	27	0	27	0	25
	2	25	0	2	23	
	3	2	0	0	2	
	Total	54	0	29	25	
904 - Gooseberry Falls S. P.	1	37	0	1	36	40
	2	4	0	0	4	
	Total	41	0	1	40	
905 - Split Rock Lighthouse S. P.	1	35	0	0	35	40
	2	1	0	0	1	
	Total	**36**	**0**	**0**	**36**	

Table 16., Continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
906 - Tettegouche S. P.	1	91	0	0	91	125
	2	4	0	0	4	
	Total	95	0	0	95	
907 - Scenic S. P.	1	35	0	12	23	30
	2	7	0	0	7	
	Total	42	0	12	30	
908 - Hayes Lake S. P.	1	39	0	0	39	50
	3	1	0	0	1	
	Total	40	0	0	40	
909 - Lake Bemidji S. P.	1	27	0	4	23	30
	2	6	0	0	6	
	3	1	0	0	1	
	Total	34	0	4	30	
910 - Zippel Bay S. P.	1	74	0	8	66	75
	2	6	0	0	6	
	3	3	0	0	3	
	Total	83	0	8	75	
911 - Judge C. R. Magney S. P.	1	18	0	0	18	75
	2	3	0	0	3	
	Total	21	0	0	21	
913 - Lake Carlos S. P.	1	28	0	16	12	20
	2	10	0	0	10	
	Total	38	0	16	22	
914 - William O'Brien S. P.	1	70	0	66	4	50
	2	31	0	0	31	
	3	12	0	0	12	
	4	3	0	0	3	
	9	1	0	0	1	
	Total	117	0	66	51	
915 - Lake Bronson S. P.	1	37	0	31	6	30
	2	23	0	0	23	
	9	1	0	0	1	
	Total	61	0	31	30	

Table 16., Continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
916 - Maplewood S. P.	1	138	0	138	0	100
	2	110	0	110	0	
	3	100	0	30	70	
	4	26	0	0	26	
	6	2	0	0	2	
	9	3	0	0	3	
	Total	379	0	278	101	
917 - Miesville Ravine S. P.	1	72	0	57	15	40
	2	22	0	0	22	
	3	4	0	0	4	
	Total	98	0	57	41	
918 - Beaver Creek Valley S. P.	1	32	0	25	7	25
	2	17	0	0	17	
	3	4	0	0	4	
	Total	53	0	25	28	
919 - Glacial Lakes S. P.	1	36	0	27	9	20
	2	8	0	0	8	
	3	3	0	0	3	
	Total	47	0	27	20	
920 - Zumbro Falls SNA	1	44	0	42	2	12
	2	8	0	0	8	
	3	1	0	0	1	
	9	1	0	0	1	
	Total	54	0	42	12	
922 - Old Mill S. P.	1	12	0	8	4	10
	2	6	0	0	6	
	3	1	0	0	1	
	Total	19	0	8	11	
923 - Zumbro Falls SNA	1	16	0	6	10	12
	2	2	0	0	2	
	Total	18	0	6	12	

Table 16., Continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
925 - Vermillion Highlands Research, Recreation, and Wildlife Management Area A Season	1	43	0	43	0	19
	2	23	0	17	6	
	3	12	0	0	12	
	4	1	0	0	1	
	Total	**79**	**0**	**60**	**19**	
925 - Vermillion Highlands Research, Recreation, and Wildlife Management Area B Season	1	1	0	1	0	1
	3	2	0	0	2	
	Total	3	0	1	2	
927 - Whitewater S. P.	1	46	0	23	23	50
	2	28	0	0	28	
	Total	74	0	23	51	
928 - Wild River S. P.	1	102	0	102	0	75
	2	89	0	46	43	
	3	29	0	0	29	
	4	1	0	0	1	
	9	2	0	0	2	
	Total	223	0	148	75	
931 - Grand Rapids	1	56	0	0	56	66
	2	8	0	0	8	
	3	2	0	0	2	
	Total	66	0	0	66	
933 - Forestville Mystery Cave S. P.	1	58	0	0	58	130
	2	8	0	0	8	
	3	1	0	0	1	
	Total	67	0	0	67	
934 - Whitewater State Game Refuge	1	71	0	0	71	100
	2	17	0	0	17	
	Total	88	0	0	88	
940 - Frontenac S. P.	1	44	0	11	33	60
	2	25	0	0	25	
	3	4	0	0	4	
	Total	73	0	11	62	
962 - Great River Bluffs S. P.	1	45	0	6	39	
	2	11	0	0	11	
	3	2	0	0	2	
	Total	58	0	6	52	50
	Total	**3086**	**39**	**1354**	**1732**	**1985**

Table 17. 2019 Muzzleoader Special Hunts Distribution Report.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
894 - Sakatah Lake S. P.	1	17	0	8	9	15
	2	1	0	0	1	
	3	5	0	0	5	
	Total	23	0	8	15	
929 - McCarthy Beach S. P.	1	8	0	0	8	25
	2	2	0	0	2	
	Total	10	0	0	10	
930 - Nerstrand Big Woods S. P.	1	88	0	88	0	50
	2	62	0	19	43	
	3	6	0	0	6	
	9	1	0	0	1	
	Total	157	0	107	50	
932 - Rice Lake S. P.	1	27	0	23	4	20
	2	17	0	0	17	
	Total	44	0	23	21	
935 - Jay Cooke S. P.	1	87	0	56	31	75
	2	37	0	0	37	
	3	7	0	0	7	
	Total	131	0	56	75	
936 - Crow Wing S. P.	1	50	0	50	0	25
	2	19	0	1	18	
	3	7	0	0	7	
	Total	76	0	51	25	
937 - Lake Vermillion-Soudan Underground Mine S. P.	1	36	0	15	21	25
	2	4	0	0	4	
	Total	40	0	15	25	
938 - City of Tower	1	12	0	0	12	20
	Total	12	0	0	12	

Table 17., Continued.

Permit Area Number	Preference Level	Applications		Unsuccessful	Winners	Permits Available
		Total	Rejected			
939 - Myre-Big Island S. P.	1	74	0	74	0	50
	2	47	0	3	44	
	3	6	0	0	6	
	9	1	0	0	1	
	Total	128	0	77	51	
942 - Sibley S. P.	1	92	0	84	8	60
	2	50	0	0	50	
	3	1	0	0	1	
	9	1	0	0	1	
	Total	144	0	84	60	
943 - Miesville Ravine Park Reserve	1	50	0	20	30	40
	2	8	0	0	8	
	3	1	0	0	1	
	4	1	0	0	1	
	Total	60	0	20	40	
944 - Vermillion Highlands Research, Recreation, and WMA	1	35	0	30	5	20
	2	15	0	0	15	
	Total	50	0	30	20	
946 - City of Grand Rapids	1	12	0	0	12	13
	2	1	0	0	1	
	Total	13	0	0	13	
947 - Lake Bemidji S. P.	1	15	0	0	15	30
	2	1	0	0	1	
	Total	16	0	0	16	
948 - Savanna Portage S. P.	1	13	0	0	13	30
	2	3	0	0	3	
	Total	16	0	0	16	
949 - St. Croix S. P.	1	82	0	0	82	100
	2	7	0	0	7	
	9	1	0	0	1	
	Total	**90**	**0**	**0**	**90**	
Total		**1010**	**0**	**471**	**539**	**598**

2019 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

A limited number of licenses are offered to Minnesota residents to hunt elk. In 2019, there were two established zones open for elk hunting: 1) Zone 20 - Kittson County Central and 2) Zone 30 - Kittson County Northeast (Figure 1). Elk hunting in Zone 10, near Grygla, Minnesota, has been closed since 2013 because the population is below goal (Figure 2). In 2019, there were four regular season hunts held in Zone 20: 1) Season A - September 7 through September 15, 2) Season B – September 21 through September 29, 3) Season C - October 5 through October 13, and 4) Season D – December 7 through December 15. There was one regular season hunt in Zone 30: 1) Season A - September 7 through September 15. The first three hunts were structured to fall within the breeding season when bull elk are most vulnerable and elk can be located by vocalizations. The late season is used as a mechanism to harvest antlerless elk because patterns are more predictable and elk are in larger groups. All of the seasons were 9 days in length. Hunter success rates wre lower this year. These dates were also chosen to not conflict with the Youth Firearm Deer Season on October 17 through October 20 and the Regular Firearm Deer Season November 9 through November 17.

METHODS

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

RESULTS

A total of 27 licenses were available and 2,819 individuals or parties (up to two hunters) applied for the opportunity to hunt elk for both zones and all seasons (Table 1). Applicants were given the opportunity to select both zone and season in which to hunt. First, random drawings were held for landowner names in Zone 20 (20% = 5 tags offered). Once landowner names were drawn and selected, the second round was for names of applicants that had applied for 10 years or more (20% of remaining tags = 5 tags offered). All remaining landowner names were then placed into the general drawing with all the other applicant names for the remaining elk tags available in the zone and season they had selected on their application. Lastly, after all names were picked, there was a random drawing from the names to determine the Either-Sex tags and Antlerless tags. Zone 30 only had two Bull-Only tags available, so no landowner tags were offered.

In 2019, a total of 15 elk were harvested in zones 20 and 30 (Table 2). This gives us a total hunter success rate of 56% for Zone 20 and 50% for Zone 30. Long-term elk harvest for all zones is depicted in Tables 3 and 4.

Table 1. License allocation and application numbers of the 2019 Minnesota elk seasons

Kittson County Season A

Zone	Either-Sex	Antlerless	Bull-only	Total	Total Applicants
Zone 20 – Kittson Central	2	5	0	7	747
Zone 30 – Kittson Northeast	0	0	2	2	781
Total	**2**	**5**	**2**	**9**	**1,528**

Kittson County Season B

Zone	Either-Sex	Antlerless	Bull-only	Total	Total Applicants
Zone 20 – Kittson Central	1	6	0	7	569
Total	**1**	**6**	**0**	**7**	**569**

Kittson County Season C

Zone	Either-Sex	Antlerless	Bull-only	Total	Total Applicants
Zone 20 – Kittson Central	1	5	0	6	435
Total	**1**	**5**	**0**	**6**	**435**

Kittson County Season D

Zone	Either-Sex	Antlerless	Bull-only	Total	Total Applicants
Zone 20 – Kittson Central	0	5	0	5	287
Total	**0**	**5**	**0**	**5**	**287**

Table 2. Distribution of the 2019 Minnesota elk harvest.

Kittson County Central Hunt Zone (20)

Season	Bulls-only Licenses	Antlerless Licenses	Bulls taken	Antlerless taken	Total elk taken
Season A (Sept 7-15)	2	5	2	3	5
Season B (Sept 21-29)	1	6	1	2	3
Season C (Oct 5 – 13)	1	5	1	3	4
Season D (Dec 7-15)	0	5	0	2	2
Total	**4**	**21**	**4**	**10**	**14**

Kittson County Northeast Hunt Zone (30)

Season	Bulls-only Licenses	Antlerless Licenses	Bulls taken	Antlerless taken	Total elk taken
Season A (Sept 7 – 15)	2	0	1	0	1
Total	**2**	**0**	**1**	**0**	**1**

Table 3. Grygla elk harvests, 1987-2019

	Grygla Elk Harvests			
	Bulls (or Either-Sex)		Antlerless	
Year	Permits	Harvest	Permits	Harvest
1987	2	1	2	1
1996	2	2	7 (1 alternate)	6
1997	5 (2 alternate)	1	5 (2 alternate)	2
1998	4 (2 alternate)	2	0	0
2004	1	1	4	2
2005	1	0	4	0
2006	2	2	6	2
2007	0	0	6	6
2008	2	2	10	6
2009	2	3*	12	11
2010	2	1	5	3
2011	2	2	3	0
2012	2	1	3	0
2013	Closed	0	Closed	0
2014	Closed	0	Closed	0
2015	Closed	0	Closed	0
2016	Closed	0	Closed	0
2017	Closed	0	Closed	0
2018	Closed	0	Closed	0
2019	Closed	0	Closed	0
Total	**27**	**18**	**67**	**39**

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

Table 4. Kittson County elk harvests, 2008-2019

	Kittson County (Combined Zone 20 & 30)			
	Bulls (or Either-Sex)		Antlerless	
Year	Permits	Harvest	Permits	Harvest
2008	1	1	10	10
2009	12	9[a]	4	5
2010	1	1	3	3
2011	2	3[b]	8[c]	4
2012	5	4[d]	13	3
2013	8	6	15	6
2014	9	6	0	0
2015	7	5	0	0
2016	7	5	0	0
2017	11	9	2	1
2018	6	5	16	12[e]
2019	6	5	21	10
Total	**75**	**59**	**92**	**54**

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

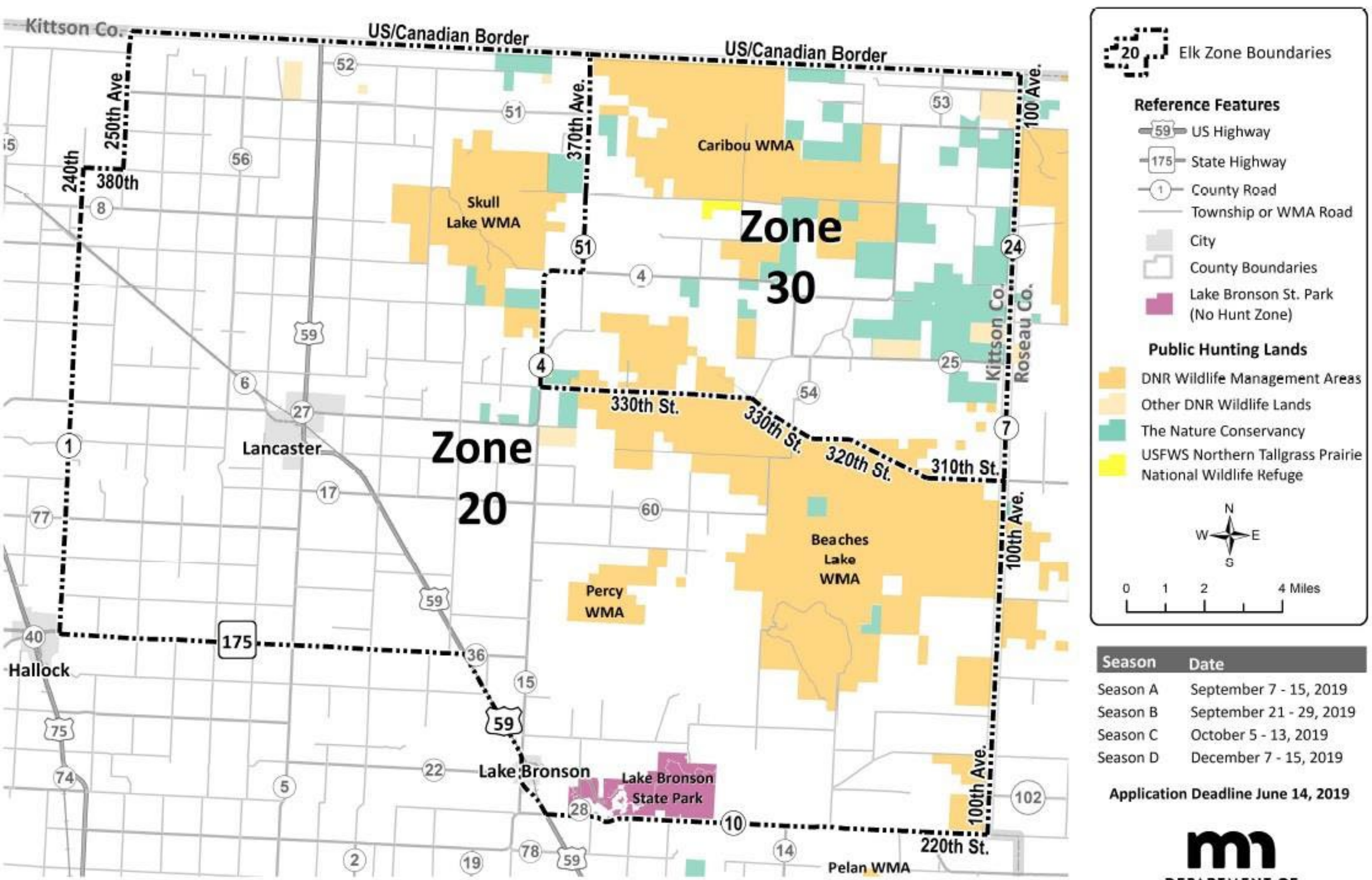
[b] One bull was a male calf and was legally tagged as an antlerless animal.

[c] Three unsuccessful hunters from the Grygla zone were invited to participate in the January extended season in Kittson County, however only 2 participated and were included in the number of antlerless permits issued.

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

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

Minnesota 2019 Elk Hunt Zones



Season	Date
Season A	September 7 - 15, 2019
Season B	September 21 - 29, 2019
Season C	October 5 - 13, 2019
Season D	December 7 - 15, 2019

Application Deadline June 14, 2019

DEPARTMENT OF NATURAL RESOURCES

Date: 2019-05-15

Figure 1. Kittson County Elk Hunt zones.

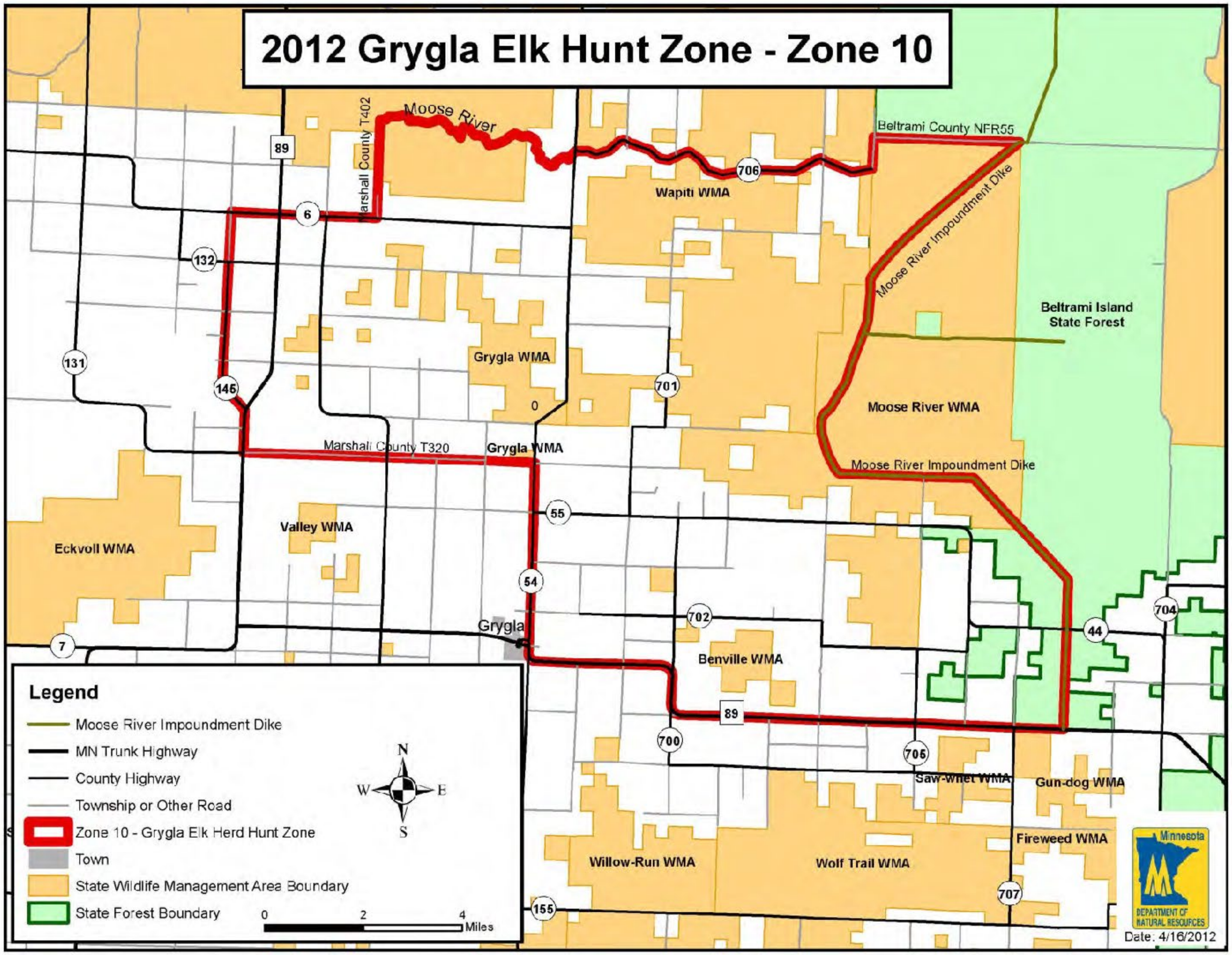


Figure 2. Grygla Elk Hunt zone.

MINNESOTA SANDHILL CRANE HARVEST REPORT, 2019

Margaret Dexter, Wildlife Research Unit

Two distinct populations of sandhill cranes (*Grus Canadensis*) occur in Minnesota. Sandhill cranes that breed and stage during fall in NW Minnesota are part of the Mid-continent population whereas sandhill cranes in the remainder of the state are part of the Eastern population. The Mid-continent population, including cranes in NW Minnesota is managed via a cooperative management plan with the U.S. Fish and Wildlife Service, Mississippi, Central, and Pacific Flyway Councils.

A limited season for Mid-continent sandhill cranes was opened in Minnesota's Northwest Goose Zone (Figure 1) beginning in 2010. The season was open from the first Saturday in September through the second Sunday in October for the first two years with a daily limit of 2 and a possession limit of 4 (Table 1). In 2012 the season was shifted to a week later but the limits remained the same. The possession limit increased from 4 to 6 in 2013. In 2014 limits were reduce to 1 daily and 3 in possession. In 2017 the season was shifted to open the third Saturday in September and close the fourth Sunday in October with no changes to the daily and possession limits. This remained the same for the 2018 and 2019 seasons. Hunters were required to purchase a $3.00 sandhill crane permit. A sample of sandhill crane permit holders were selected to receive a harvest survey from the U.S. Fish and Wildlife Service after the season. This survey is used to monitor harvest levels and hunting activity (Table 2).

LITERATURE CITED

Central Flyway Webless Migratory Bird Technical Committee. 2006. Management Guidelines for the Mid-Continent Population of Sandhill Cranes. Special Report in files of the Central Flyway Representative. Denver, Colorado.

Dubovsky, J.A. 2016. Status and harvests of sandhill cranes:Mid-Continent, Rocky Mountain, Lower Colorado River Valley and Eastern Populations. Administrative Report, U.S. Fish and Wildlife Service, Denver, Colorado. 15pp.) http://www.fws.gov/migratorybirds/NewReportsPublications/PopulationStatus.html

Table 1. Sandhill Crane season dates and limits in Minnesota, 2010 – 2019.

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 zoct	1	3

Table 2. Sandhill crane permit sales, estimated number of active hunters and harvest for NW Minnesota, 2010-2019. (Kruse, K.L. et al. 2020).

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

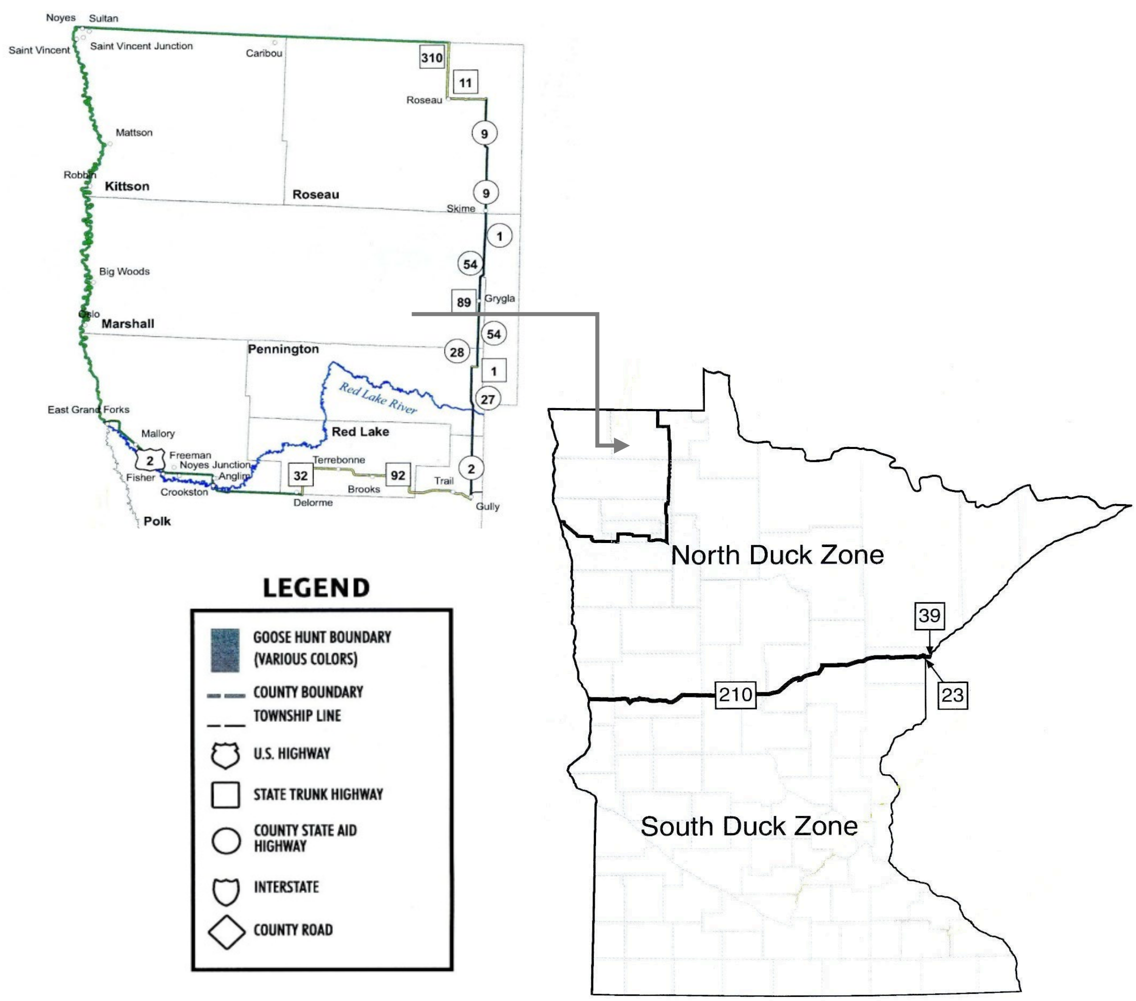


Figure 1. Sandhill crane hunting zone in Minnesota, 2010-2018.

TRAPPING HARVEST STATISTICS

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

2019 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 2020. There were 6,386 active trapping licenses in the ELS database, which consisted of 4,448 Resident Regular Trappers, 16 age - eligible (of 166) Resident Junior Trappers, 1,176 Resident Senior Trappers, 567 “active” Lifetime Trappers, and 10 Nonresident (MN landowners) license holders. License type was reclassified as “adult” (regular, lifetime, and non-resident) or “youth” for analysis purposes.

The MNDNR Trapper Harvest Survey is a census but the response rate is <100% (mean = 68%, range: 56–79%). Thus, uncertainty in harvest estimates is strictly a function of non-response (missing data) rather than random sampling. However, if non-response (unit and item) is completely random then data from respondents can be treated as a random sample, which is how the Trapper Harvest Survey has been analyzed historically. The critical assumption is that non-response is completely random (e.g., if you repeated the survey, non-respondents would be a random subset of licensed trappers). For consistency with previous analyses, the response data was treated as a random sample.

A postcard survey (Figure 1) was sent to all trapping license holders (>=18-yr old) with a valid mailing address at the close of the license year. Trappers that returned the survey questionnaire within three weeks were marked returned and eliminated from follow-up mailings. A single follow-up mailing was sent to non-respondents. Returned questionnaires were checked for completeness, consistency, and biological practicability. Cards were marked with numeric county codes corresponding to the trapper’s written information. Data from each usable card was converted to an electronic database. Duel key-entry and quality control checks were used to minimize transcription errors. Data were tabulated using Viking Data Entry VDE+ software, and then summarized using the R programming language (R version 4.0.0 (2020-04-24); R Development Core Team 2018).

RESULTS

We mailed out 6,218 surveys, 71 surveys were undeliverable and 3,431 were returned for an adjusted response rate of 55.8%. Among respondents, 64% 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 2019-2020 trapping season (**March 2019-February 2020**). For Spring Beaver, please report only animals taken between March 1, 2019 and May 15, 2019. We need this information to estimate the season's harvest and to help set future furbearer trapping seasons. Similar to past years we are also asking for the **average number of traps you checked per day** for each species. If a trap is set for multiple species, count the trap for both species when answering the question. For example, if you ran 20 mink/coon traps each day, enter 20 traps/day for both mink and coon.

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

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

THANK YOU FOR YOUR COOPERATION

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

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

RETURN SERVICE REQUESTED

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

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

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL
FIRST-CLASS MAIL PERMIT NO. 171 ST. PAUL, MN
POSTAGE WILL BE PAID BY ADDRESSEE

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

2019 Trapper Report

1. Did you set traps / snares in Minnesota during the 2019-2020 trapping season?
   ☐ No ☐ Yes (Please check one)
2. Indicate your harvest, the number of days you trapped for each species, the average number of traps you checked PER DAY for each species, and the county in which you trapped **most** for each species. Report only animals **YOU personally** trapped in Minnesota. Animals taken by hunting should **NOT** be reported here.

Species Trapped		*Number YOU Trapped All Season*	*# Days Trapped All Season*	*Average # Traps/Snares Checked Per Day*	*County You Trapped In Most*
Muskrat	90				
Mink	32				
Gray Fox	96				
Striped skunk	34				
Coyote (brush wolf)	97				
Beaver (Mar-May '19)	81				
Beaver (Oct '19-Feb '20)	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 2019.

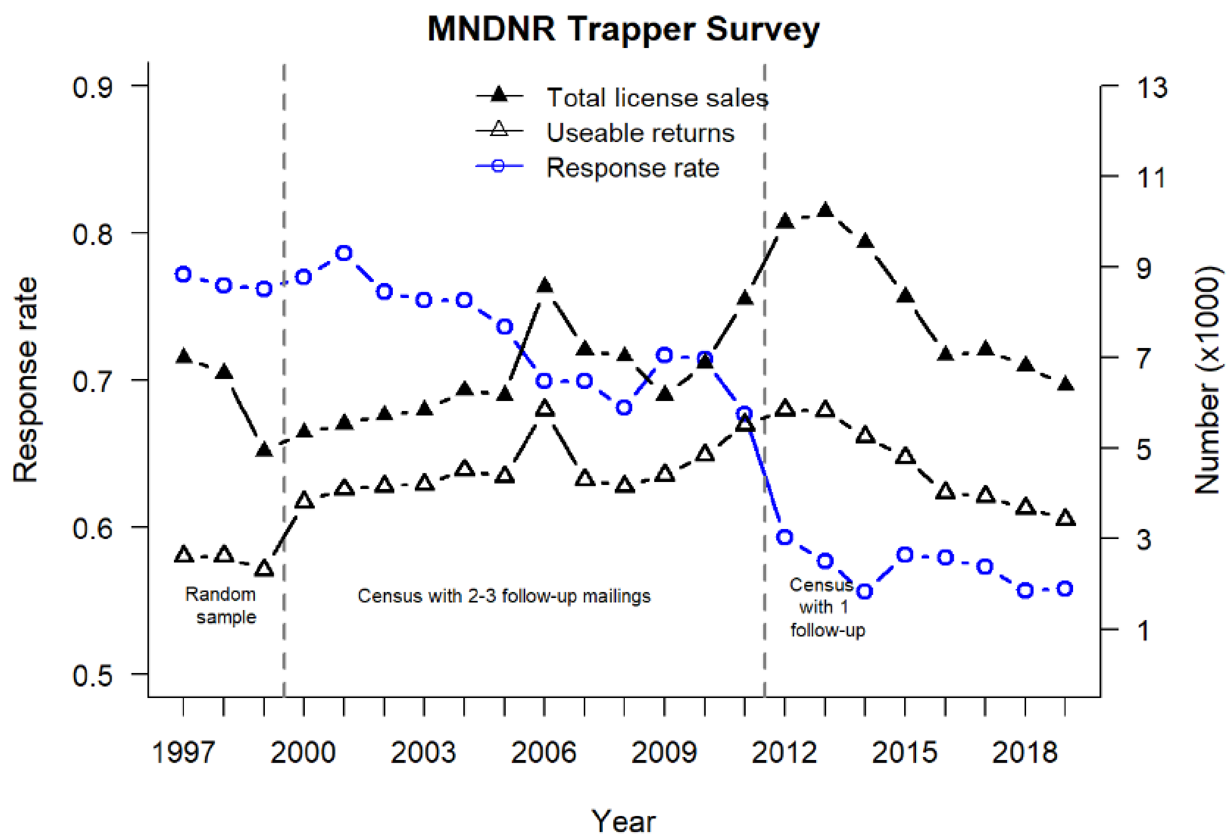


Figure 2. Trapper annual license sales and mail survey response, 1997-98 through 2019-20.

Table 1. Use of trapper licenses, 2008-09 through 2019-20.

Year		Returns from mail survey	Projections from license sales
2008-09	Trapped Did not trap	3,154 (75.7%) 1,012 (24.3%) 4,166 (100.0%)	5,319 1,708 7,027[a]
2009-10	Trapped Did not trap	3,202 (72.7%) 1,202 (27.3%) 4,404 (100.0%)	4,467 1,677 6,144[a]
2010-11	Trapped Did not trap	3,546 (73.2%) 1,298 (26.8%) 4,844 (100.0%)	5,032 1,843 6,875[a]
2011-12	Trapped Did not trap	4,498 (81.5%) 1,019 (18.5%) 5,517 (100.0%)	6,748 1,532 8,280[a]
2012-13	Trapped Did not trap	4,537 (77.6%) 1,307 (22.4%) 5,844 (100.0%)	7,747 2,236 9,983[a]
2013-14	Trapped Did not trap	4,342 (74.6%) 1,480 (25.4%) 5,822 (100.0%)	7,627 2,597 10,224[a]
2014-15	Trapped Did not trap	3,786 (72.2%) 1,459 (27.8%) 5,245 (100.0%)	6,888 2,652 9,540[a]
2015-16	Trapped Did not trap	3,296 (68.8%) 1,496 (31.2%) 4,792 (100.0%)	5,734 2,600 8,334[a]
2016-17	Trapped Did not trap	2,558 (63.7%) 1,458 (36.3%) 4,016 (100.0%)	4,487 2,557 7,044[a]
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]

[a] excludes duplicates.

Table 2. Estimated number of trappers of various furbearers, 2008-09 through 2019-20.

	Estimated number of trappers											
	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Muskrat	2394	2088	2760	4,320	4,110	3,410	2,902	2,218	1,797	1,882	1,583	1.225
Mink	2045	1541	1847	2,470	3,110	2,780	2,158	1,587	1,049	1,084	995	795
Short-tailed weasel	512	417	546	800	690	510	666	289	195	283	166	261
Long-tailed weasel	346	254	333	560	540	480	519	265	174	190	151	168
Raccoon	3150	2320	2567	4,060	4,680	4,660	4,182	2,781	2,032	2,168	1,952	1.806
Striped skunk	1488	949	1130	1,800	1,940	1,610	1,541	1,234	907	840	798	739
Badger	293	206	229	310	360	390	284	247	193	167	164	161
Opossum	1170	701	645	830	1,100	1,110	575	463	469	785	646	548
Red fox	1233	1006	1068	1,900	2,240	2,080	2,012	1,434	1,048	1,258	1,091	955
Gray fox	657	529	555	970	1,180	1,060	1,035	684	446	458	381	241
Coyote	1141	888	998	1,720	2,360	2,200	2,396	1,981	1,479	1,781	1,586	1.344
Beaver (Oct - Feb)	1877	1650	1722	2,360	2,620	2,710	2,189	1,894	1,642	1,495	1,535	1.333
Beaver (previous Spring)	1258	1260	1367	1,510	1,810	1,150	1,305	1,145	1,130	1,194	1,000	1.153

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, 2008-09 through 2019-2020.

	Estimated take per successful trapper reporting that species											
	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Muskrat	34	48	66	82	59	36	39	51	49	45	40	32
Mink	9	9	8	7	6	6	5	5	6	5	5	5
Short-tailed weasel	7	8	10	10	7	5	8	4	5	5	6	5
Long-tailed weasel	4	4	6	6	4	3	5	3	3	3	3	3
Raccoon	23	20	23	25	18	16	15	11	12	14	13	17
Striped skunk	7	7	8	7	7	6	6	6	7	6	5	6
Badger	2	2	2	2	2	2	2	2	2	2	2	2
Opossum	10	8	7	6	7	7	7	4	5	8	9	7
Red fox	3	3	4	4	4	3	4	3	3	4	4	4
Gray fox	3	3	2	3	3	2	2	2	2	2	2	2
Coyote	4	5	5	6	5	5	5	6	5	7	8	7
Beaver (Oct –Feb)	12	12	10	12	10	9	8	8	8	8	9	8
Beaver (previous Spring)	23	20	22	20	20	9	16	14	17	19	19	23

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, 2008-09 through 2019-2020[a]

	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Trapper license sales [b]	7,027	6,158	6,885	8,280	9,998	10,224	9,540	8,334	7,044	7,163	6,815	6,386
Estimated harvest [c]												
Muskrat	80,158	98,524	180,480	352,030	242,120	120,500	111,998	112,219	87,958	83,844	63,021	38,777
Mink	16,647	13,207	13,837	15,770	18,460	14,710	10,211	7,745	5,439	5,218	4,412	3,483
Short-tailed weasel	3,515	3,128	4,939	7,300	4,500	2,360	4,806	1,083	930	1,305	995	1,245
Long-tailed weasel	1,118	838	1,728	3,020	2,030	1,410	2,568	734	466	554	340	379
Raccoon	71,893	45,118	57,189	98,240	79,800	70,380	58,868	29,963	22,874	28,899	24,845	29,297
Striped skunk	10,355	6,194	7,979	12,250	12,620	9,430	7,956	6,349	5,458	4,476	3,961	4,078
Badger	424	316	337	490	570	600	347	376	286	278	221	231
Opossum	11,297	4,963	4,194	4,400	6,780	6,720	3,524	1,814	2,124	6,160	5,248	3,548
Red fox	3,501	2,984	3,303	7,250	7,540	5,710	6,040	4,061	2,707	4,500	3,530	2,896
Gray fox	1,321	1,084	1,093	2,100	2,550	1,940	1,902	1,161	715	736	611	336
Coyote	4,533	3,797	4,264	8,780	11,130	9,010	11,703	10,084	7,308	12,303	11,359	8,630
Beaver (Oct- Feb)	21,076	18,178	17,114	26,620	24,590	23,220	15,671	14,181	13,070	11,223	12,937	9,900
Beaver (previous Spring)	27,816	25,008	29,148	29,500	34,600	10,110	20,820	15,966	19,004	22,293	18,649	26,368
Registered harvest [d]												
Otter	1,938	1,544	1,814	2,294	3,171	2,824	2,148	1,955	1195	1,295	1,351	1,050
Lynx [e]	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
Bobcat [g]	853	884	1,012	1,711	1,875	1,038	1,380	766	485	731	1,015	695
Fisher	1,712	1,259	903	1,473	1,293	1,146	919	756	399	477	510	463
Marten	1,823	2,073	1,842	2,525	1,472	1,014	1,055	877	551	979	665	585

[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, 2020- 6,386 trapping licenses were sold in 2019: 166 (2.6%) were junior licenses, 4,451 (69.7%) were regular adult licenses, 1,177 (18.4%) were senior licenses, 582 (9.1%) were Lifetime licenses, and 10 (<1%) were Nonresident (MN Landowner) licenses. Duplicate licenses excluded.
[c] Based upon trappers' responses to mail surveys. [d] Raccoon and red fox season continuous May 1994 thru March 15, 2006.
[e] Lynx (1984) and Eastern spotted skunk (1996) listed as Special Concern and threatened species (respectively) and are fully protected.
[f.] Registered harvest information as reported from annual, mandatory registration. [g] Registered harvest for bobcat includes animals taken by hunting.

Minnesota Fur Buyers Survey for the 2019-2020 Hunting and Trapping Season

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

INTRODUCTION

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

METHODS

In September 2020, 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 and the "average price" paid to those hunters and trappers based on all furs purchased. A total of 18 usable surveys were received, for a return rate of 71 percent.

Calculations of average pelt price for each species were weighted according to the number of pelts purchased by each buyer. Total estimated value of the furbearer harvest to trappers and hunters in 2019-20 was $953,951.88.

Table 1. Minnesota fur prices as reported by licensed fur dealers, 2019-20.

Species	Number Pelts	Minimum Price	Maximum Price	Weighted Mean
Muskrat	18405	1.25	3.50	2.84
Mink Female	789	1.00	7.00	3.07
Mink male	843	1.03	10.00	3.46
Raccoon	15133	1.25	9.60	6.66
Red Fox	671	5.00	27.00	9.95
Gray Fox	77	7.50	18.00	12.70
Coyote	14451	12.00	45.00	38.71
Bobcat	116	35.17	97.50	61.97
River Otter	323	10.00	27.50	20.64
Beaver 10-12	5889	3.00	15.17	7.66
Beaver 3-4	8604	4.00	13.03	7.86
L.T. Weasel	0	0.00	0.00	0.00
S.T. Weasel	264	0.94	5.00	2.08
Striped Skunk	329	2.00	8.16	6.30
Badger	78	2.00	18.00	8.14
Opossum	53	0.50	2.00	0.83
Fisher Male	71	18.67	35.00	21.02
Fisher Female	75	18.67	40.00	19.84
Marten Male	67	20.00	40.00	27.35
Marten Female	58	20.00	40.00	23.75
Deer Hides	33354	1.00	4.20	2.91
Bear Hides	58	22.50	48.00	32.72

Table 2. Average price per pelt paid to hunters and trappers in Minnesota, 2009-10 through 2019-20

	Average pelt prices paid hunters and trappers in Minnesota (dollars)										
Species	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Muskrat	4.43	5.33	5.86	7.91	8.72	4.85	2.28	2.65	2.59	2.38	2.84
Mink (female)	8.02	9.33	11.54	17.53	13.72	7.45	4.99	6.20	5.80	6.02	3.07
Mink (male)	9.37	13.66	14.68	18.27	18.11	10.50	6.18	7.47	7.29	7.61	3.46
Raccoon	9.18	10.87	12.57	16.60	16.58	8.64	5.11	4.92	5.76	7.30	6.66
Red Fox	10.85	13.35	22.87	33.52	30.90	20.41	11.86	10.52	13.30	10.93	9.95
Gray Fox	11.55	14.64	15.11	19.20	21.27	14.17	10.64	10.33	11.32	13.42	12.70
Coyote	8.62	9.47	17.99	22.04	21.30	25.10	21.48	17.39	25.15	36.20	38.71
Bobcat	42.77	71.44	98.18	144.79	88.63	66.67	57.46	35.88	63.52	60.33	61.97
Otter	35.65	34.53	51.40	72.12	61.32	34.57	30.03	21.05	21.98	25.07	20.64
Beaver (fall-winter)	12.49	11.95	14.29	18.47	16.52	12.40	8.77	8.14	8.32	8.30	7.66
Beaver (spring)	14.47	14.50	19.96	12.80	14.77	10.69	8.24	7.33	10.39	8.95	7.86
L.T. Weasel	3.12	2.87	4.02	4.10	2.35	1.78	1.46	1.41	0.00	0.00	0.00
S.T. Weasel	3.02	1.50	2.10	2.51	0.00	2.00	1.41	0.00	2.79	2.45	2.08
Striped Skunk	3.66	3.29	3.55	5.00	4.14	3.86	3.65	4.00	7.12	5.25	6.30
Badger	8.81	10.43	13.47	14.54	13.72	9.52	9.57	7.86	9.09	7.94	8.14
Opossum	1.30	2.64	5.80	1.52	1.52	1.17	1.98	1.32	1.34	0.96	0.83
Fisher (male)	34.45	38.19	47.69	62.38	61.32	41.76	34.88	28.00	29.87	43.03	21.02
Fisher (female)	34.90	37.31	39.59	63.02	67.73	50.87	34.39	37.07	36.75	39.57	19.84
Marten (male)	26.76	39.80	42.32	56.57	74.10	38.92	30.83	29.94	36.90	41.81	27.35
Marten (female)	29.95	36.57	39.49	54.29	70.94	32.20	28.89	30.41	33.96	33.06	23.75
Deer Hides	4.44	4.41	3.95	5.18	6.09	5.59	5.62	4.00	4.14	3.18	2.91
Bear Hides	43.00	33.38	28.79	30.28	42.63	32.94	46.03	32.97	25.91	32.33	32.72

REGISTERED FURBEARER HARVEST STATISTICS

Forest Wildlife Populations and Research Group
1201 East Highway 2
Grand Rapids, MN 55744
(218) 328-8875

REGISTERED FURBEARER HARVEST STATISTICS 2019-20

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

INTRODUCTION

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

In Minnesota, detailed harvest information is collected on 4 carnivores – fishers (*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 42 years to help ensure sustainable harvests and populations.

METHODS

Hunters and trappers are required to bring pelts from harvested animals (fishers, martens, bobcats, and otters) in to fur registration stations usually within 48 hours of the close of the season. Upon registration, information is collected on the sex, date, method of take, and harvest location (township) 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 otter harvest is allowed statewide (Figure 1). There were changes to season structures for all four registered species this year compared to the 2018 season. The starting date for the fisher-marten-bobcat season was delayed approximately one month (to December 21); the fisher-marten season was also lengthened from 6 days to 9 days (bobcat season length did not change). Otter season length was increased by three weeks on the back end, with the season closure coinciding with the end of the revised bobcat season. Individual hunter-trapper quotas did not change for any species. Compared to the previous year, bobcat harvest decreased 32%, fisher harvest decreased 9%, marten harvest declined 12%, and otter harvest decreased 22%. Detailed harvest summaries are provided in the following tables and graphs. Data for years prior to those presented in this report is available (back to 1977) by contacting the Minnesota DNR.

ACKNOWLEDGMENTS

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

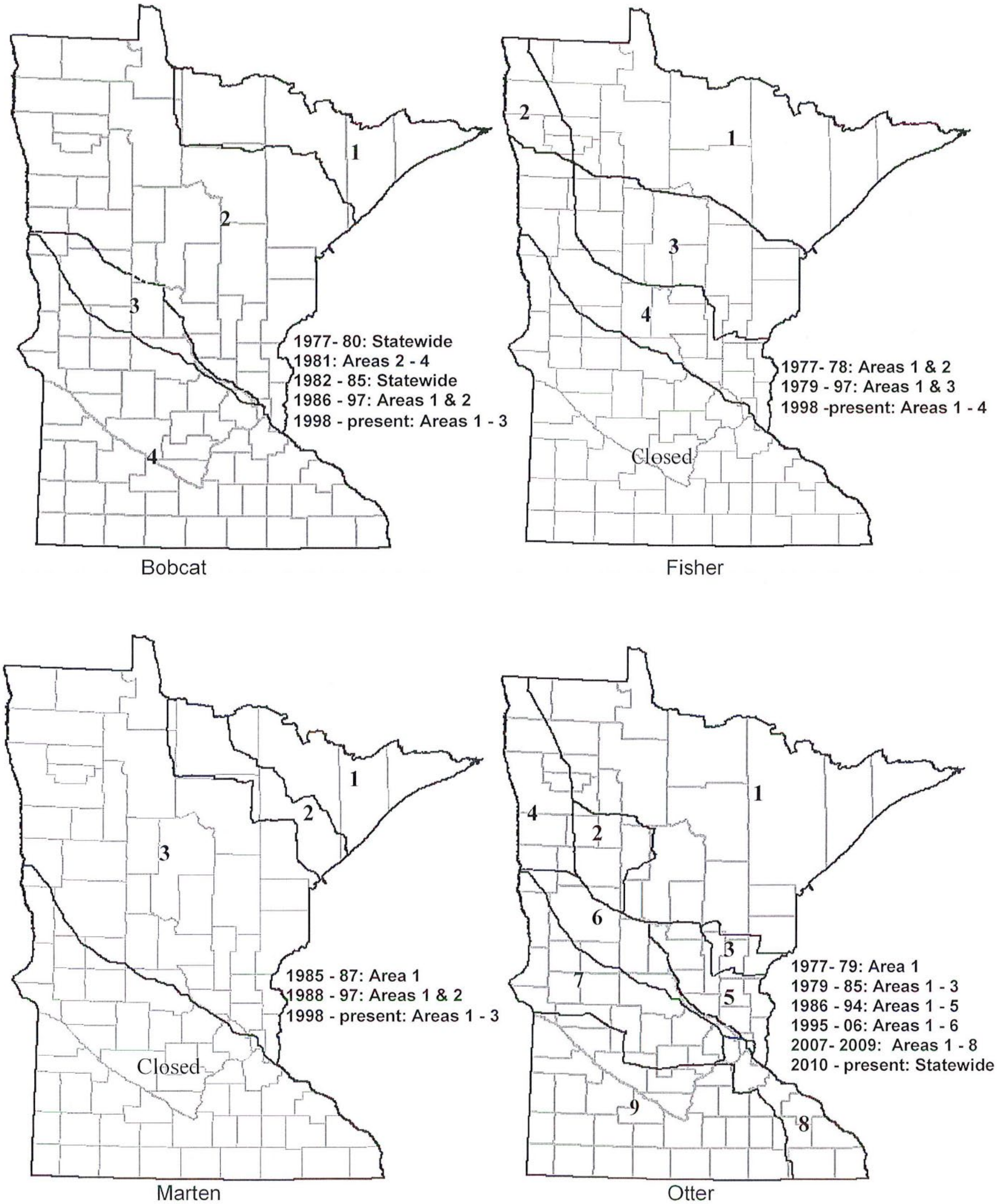


Figure 1. Open trapping areas for fisher, marten, bobcat, and otter, 1977 - present.

Table 1. Registered furbearer seasons and harvests, 1989-2019.

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

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

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

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

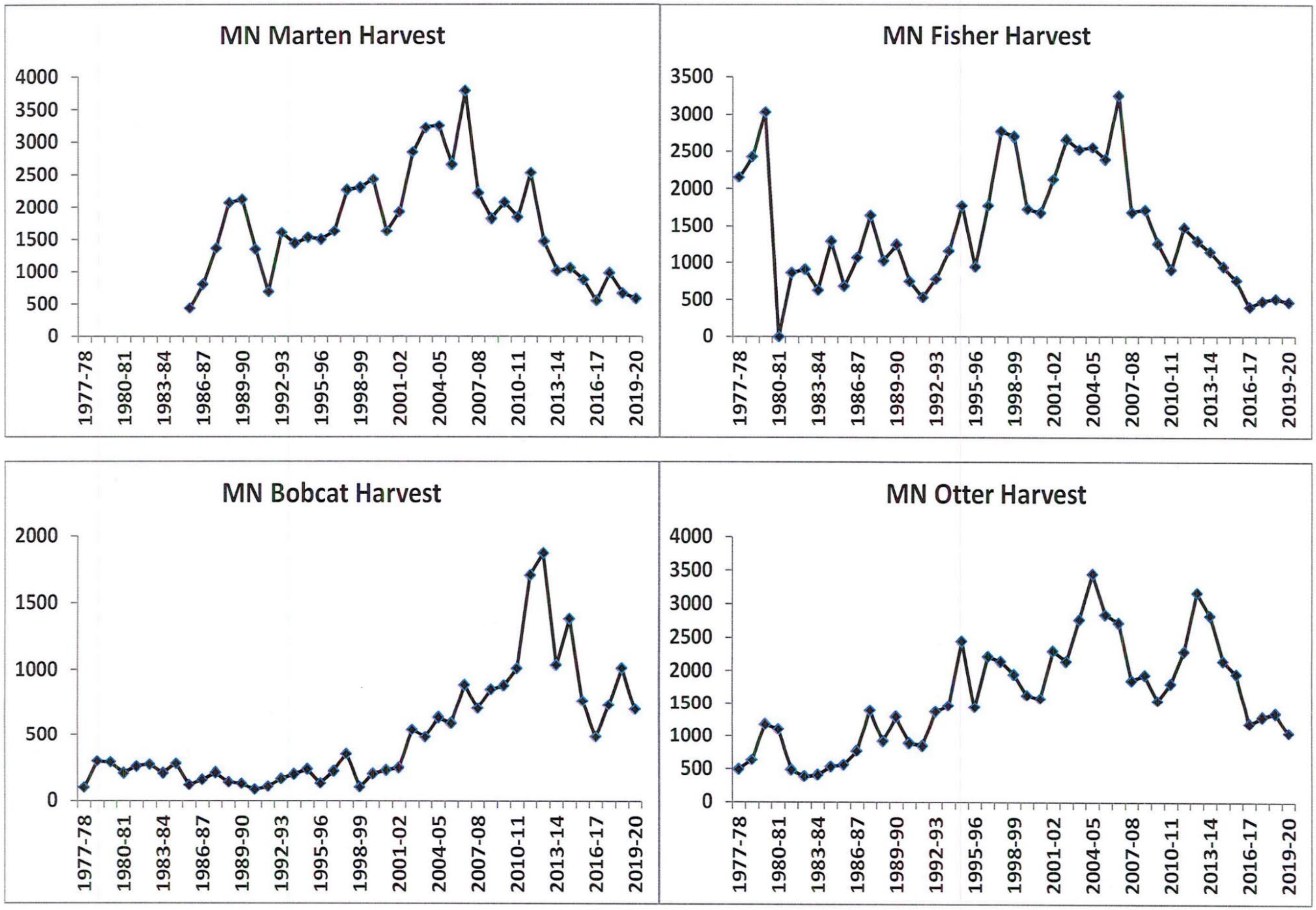


Figure 2. Harvest of registered furbearers in Minnesota, 1977-present.

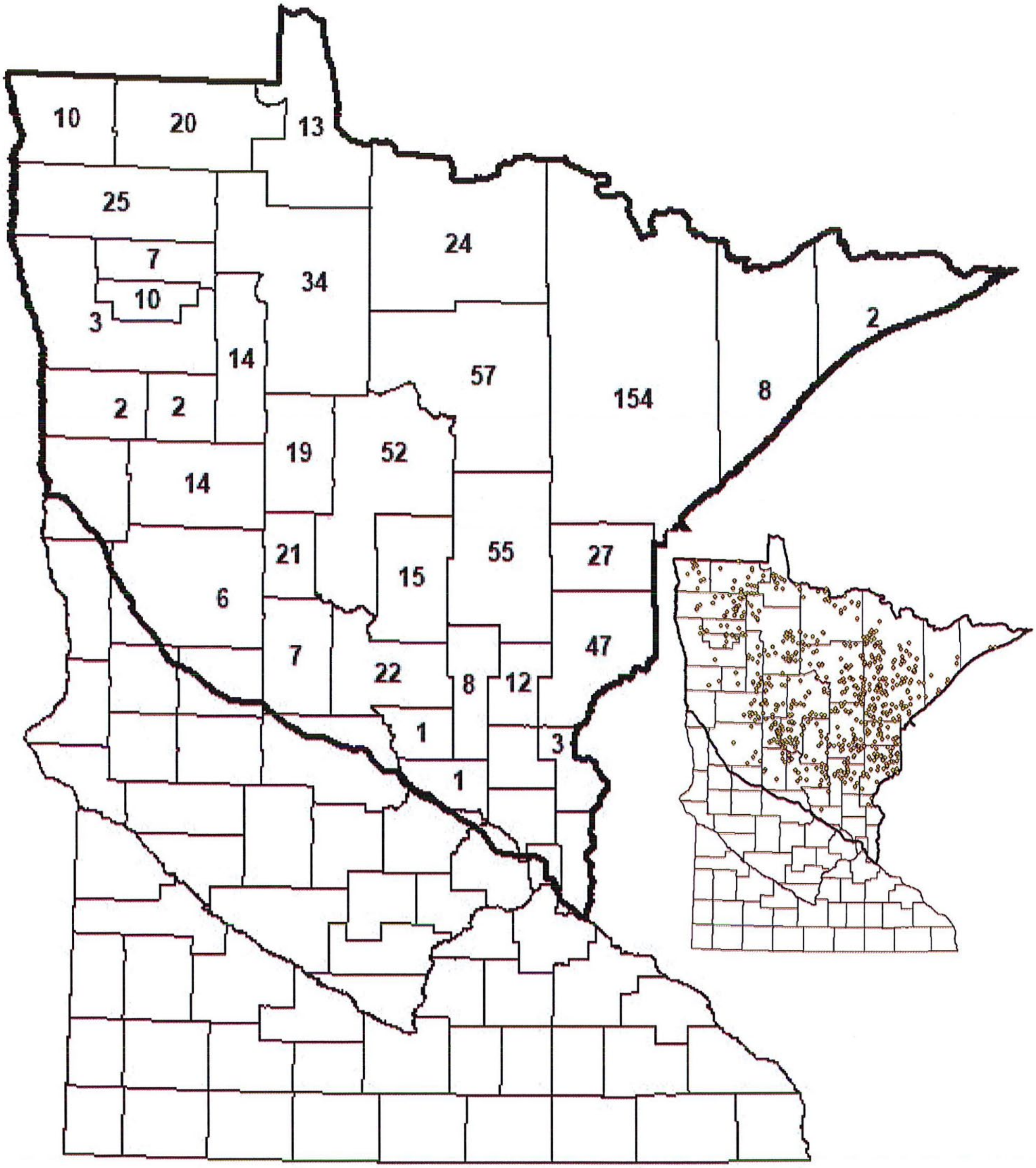


Figure 3. Bobcat harvest by county, 2019-20. Inset shows spatial distribution of harvest locations.

Table 2. Bobcat harvest by county and sex, 2019-20.

County	Sex*			Total	Harvest/ 100 Mile^2
	Female	Male	Unknown		
Aitkin	28	27		55	2.76
Anoka	0	0		0	0.00
Becker	7	7		14	0.97
Beltrami	17	17		34	1.11
Benton	1	0		1	0.24
Carlton	13	14		27	3.09
Cass	34	18		52	2.16
Chisago	1	2		3	0.68
Clay	0	0		0	0.00
Clearwater	4	10		14	1.36
Cook	0	2		2	0.12
Crow Wing	9	6		15	1.30
Douglas	0	0		0	0.00
Hubbard	9	10		19	1.90
Isanti	0	0		0	0.00
Itasca	36	21		57	1.95
Kanabec	6	6		12	2.25
Kittson	6	4		10	0.90
Koochiching	17	7		24	0.76
Lake	4	4		8	0.35
Lake of the Woods	8	4	1	13	0.73
Mahnomen	1	1		2	0.34
Marshall	13	12		25	1.38
Mille Lacs	6	2		8	1.18
Morrison	14	8		22	1.91
Norman	.	2		2	0.23
Otter Tail	2	4		6	0.27
Pennington	4	3		7	1.13
Pine	28	19		47	3.28
Polk	2	1		3	0.15
Red Lake	4	6		10	2.31
Roseau	16	4		20	1.19
Sherburne	1	.		1	0.22
St. Louis	103	51		154	2.29
Stearns	0	0		0	0.00
Todd	4	3		7	0.71
Wadena	11	10		21	3.87
Unknown	0	0		0	
Total	409	285	1	695	

* 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, 2009-2019.

County	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Aitkin	82	73	121	142	65	105	39	22	41	51	55
Anoka	0	0	1	0	0	1	0	0	0	0	0
Becker	25	39	70	58	36	48	36	10	31	22	14
Beltrami	70	108	139	139	59	73	49	30	37	60	34
Benton	2	0	4	3	3	0	0	1	2	3	1
Carlton	44	37	94	63	42	88	25	16	33	42	27
Cass	115	117	164	150	76	126	73	44	72	91	52
Chisago	0	1	0	3	1	1	3	4	2	5	3
Clay	1	3	1	3	2	3	1	0	0	2	0
Clearwater	27	30	58	40	19	29	15	13	14	18	14
Cook	0	1	3	3	9	17	1	0	2	0	2
Crow Wing	38	29	64	65	19	32	21	7	24	28	15
Douglas	0	0	0	1	1	0	0	0	0	1	0
Hubbard	81	59	129	105	51	50	45	21	44	41	19
Isanti	0	0	0	0	1	0	1	1	0	0	0
Itasca	106	132	186	194	93	110	50	19	54	86	57
Kanabec	11	16	21	46	16	46	12	11	16	24	12
Kittson	4	9	10	7	5	5	7	6	3	3	10
Koochiching	25	54	66	82	50	40	22	25	26	62	24
Lake	2	7	15	21	13	15	8	4	8	24	8
Lake of the Woods	16	10	28	13	20	26	10	7	5	14	13
Mahnomen	4	2	9	7	4	4	3	5	2	4	2
Marshall	15	31	42	44	15	21	19	14	12	30	25
Mille Lacs	10	10	13	23	7	14	5	2	10	19	8

County	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Morrison	13	23	25	35	15	25	16	17	19	37	22
Norman	1	0	3	6	3	8	4	1	4	7	2
Otter Tail	7	14	21	38	18	17	16	15	22	12	6
Pennington	6	5	4	13	7	3	4	1	4	8	7
Pine	49	50	94	135	54	87	56	37	43	46	47
Polk	9	9	17	20	10	16	15	10	9	5	3
Red Lake	7	16	20	25	6	11	3	1	15	10	10
Roseau	19	26	46	60	38	27	20	23	23	45	20
Sherburne	1	0	3	0	0	0	0	0	0	0	1
St. Louis	56	81	202	283	255	307	156	91	123	182	154
Stearns	0	0	0	0	2	0	1	0	0	0	0
Todd	10	9	14	16	5	8	8	9	13	10	7
Wadena	21	9	17	23	18	18	10	18	18	23	21
Unknown	7	2	7	9	0	3	12	0	0	0	0
Total	884	1012	1711	1875	1038	1384	766	485	731	1015	695

Table 4. Bobcat harvest by sex and week, 2019-20 season.

	Sex*				% of	Cumulative
Date	Female	Male	Unknown	Total	Total	%
Dec.21 - Dec.27	121	88		209	30.07	30.07
Dec.28 - Jan.3	90	72		162	23.31	53.38
Jan.4 - Jan.10	64	38		102	14.68	68.06
Jan.11 - Jan.17	71	37		108	15.54	83.60
Jan.18 - Jan.26**	51	48	1	100	14.39	97.99
Unknown	12	2		14	2.01	100.00
Total	409	285	1	695	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, 1994-2019.

Number (%) of Takers	Number Taken					Total Takers
	1	2	3	4	5	
1994-95	103 (68)	25 (17)	12 (8)	6 (4)	5 (3)	151
1995-96	67 (74)	13 (14)	5 (6)	4 (4)	2 (2)	91
1996-97	115 (73)	28 (18)	85 (5)	2 (1)	4 (3)	157
1997-98	129 (61)	43 (20)	17 (8)	12 (6)	9 (5)	210
1998-99	59 (77)	11 (14)	2 (3)	3 (4)	1 (2)	76
1999-00	113 (76)	21 (14)	10 (6)	4 (3)	1(1)	149
2000-01	99 (69)	23 (16)	7 (5)	5 (4)	9 (6)	143
2001-02	101 (71)	23 (16)	12 (8)	1 (1)	5 (4)	142
2002-03	185 (60)	64 (21)	33 (10)	15 (5)	12 (4)	309
2003-04	171 (64)	40 (15)	25 (10)	20 (7)	11 (4)	267
2004-05	193 (59)	55 (17)	32 (10)	25 (7)	24 (7)	329
2005-06	198 (60)	67 (20)	33 (10)	15 (5)	18 (5)	331
2006-07	265 (57)	90 (19)	44 (9)	25 (5)	42 (9)	466
2007-08	212 (58)	71 (19)	30 (8)	16 (4)	38 (10)	367
2008-09	236 (55)	88 (21)	43 (10)	25 (6)	37 (9)	429
2009-10	223 (53)	80 (19)	40 (9)	30 (7)	51 (12)	424
2010-11	242 (50)	103 (21)	58 (12)	35 (7)	49 (10)	487
2011-12	351 (47)	126 (17)	86 (12)	62 (8)	118 (16)	743
2012-13	380 (45)	167 (20)	108 (13)	82 (10)	100 (12)	837
2013-14	350 (60)	112 (19)	51 (9)	44 (8)	26 (4)	583
2014-15	383 (54)	131 (19)	84 (12)	49 (7)	58 (8)	705
2015-16	248 (59)	87 (21)	33 (8)	29 (7)	25 (6)	422
2016-17	126 (58)	47 (22)	26 (12)	6 (3)	11 (5)	216
2017-18	257 (61)	95 (22)	31 (7)	16 (4)	25 (6)	424
2018-19	260 (53)	87 (18)	59 (12)	42 (8)	47 (9)	495
2019-20	214 (57)	77 (21)	37 (10)	19 (5)	27 (7)	374

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

Table 6. Bobcat harvest by method of take, 1992-2019.

	Total	Trapping					Hunting				
Year	Harvest[a]	Harvest	% of Total	# Takers	Ave. Take	% Males[b]	Harvest	% of Total	# Takers	Ave. Take	% Males[b]
1992-93	168	133	79	85	1.6		35	21	23	1.5	
1993-94	201	147	73	88	1.7		54	27	41	1.3	
1994-95	238	189	79	120	1.6		49	21	31	1.6	
1995-96	134	73	54	53	1.4		61	46	38	1.6	
1996-97	203	133	66	91	1.5		70	34	53	1.3	
1997-98	357	313	88	176	1.8		44	12	34	1.3	
1998-99	103	95	92	67	1.4		8	8	8	1.0	
1999-00	206	155	75	114	1.4		51	25	36	1.4	
2000-01	231	140	61	85	1.6		91	39	58	1.6	
2001-02	250	208	83	116	1.8	41	42	17	27	1.6	68
2002-03	544	500	92	279	1.8	38	44	8	32	1.4	57
2003-04	483	415	86	230	1.8	46	68	14	40	1.7	65
2004-05	631	542	86	279	1.9	43	89	14	53	1.7	60
2005-06	583	435	75	250	1.7	37	148	25	85	1.7	65
2006-07	890	779	88	391	2.0	45	111	12	81	1.4	57
2007-08	702	524	75	266	2.0	40	178	25	110	1.6	48
2008-09	853	689	81	334	2.1	42	164	19	99	1.7	59
2009-10	884	736	83	340	2.2	43	148	17	91	1.6	58
2010-11	1012	817	81	372	2.2	40	195	19	123	1.6	50
2011-12	1708	1606	94	670	2.4	47	102	6	74	1.4	60
2012-13	1875	1681	90	721	2.3	46	194	10	130	1.5	52
2013-14	1038	879	85	490	1.8	40	159	15	107	1.5	55
2014-15	1384	1260	91	622	2.0	44	124	9	86	1.4	56
2015-16	766	657	86	355	1.9	49	109	14	68	1.6	70
2016-17	485	377	78	215	1.8	41	108	22	69	1.6	54
2017-18	731	606	83	335	1.8	45	125	17	93	1.3	59
2018-19	1015	865	85	406	2.1	48	150	15	98	1.5	58
2019-20	692	570	82	297	1.9	36	122	18	84	1.5	66

[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

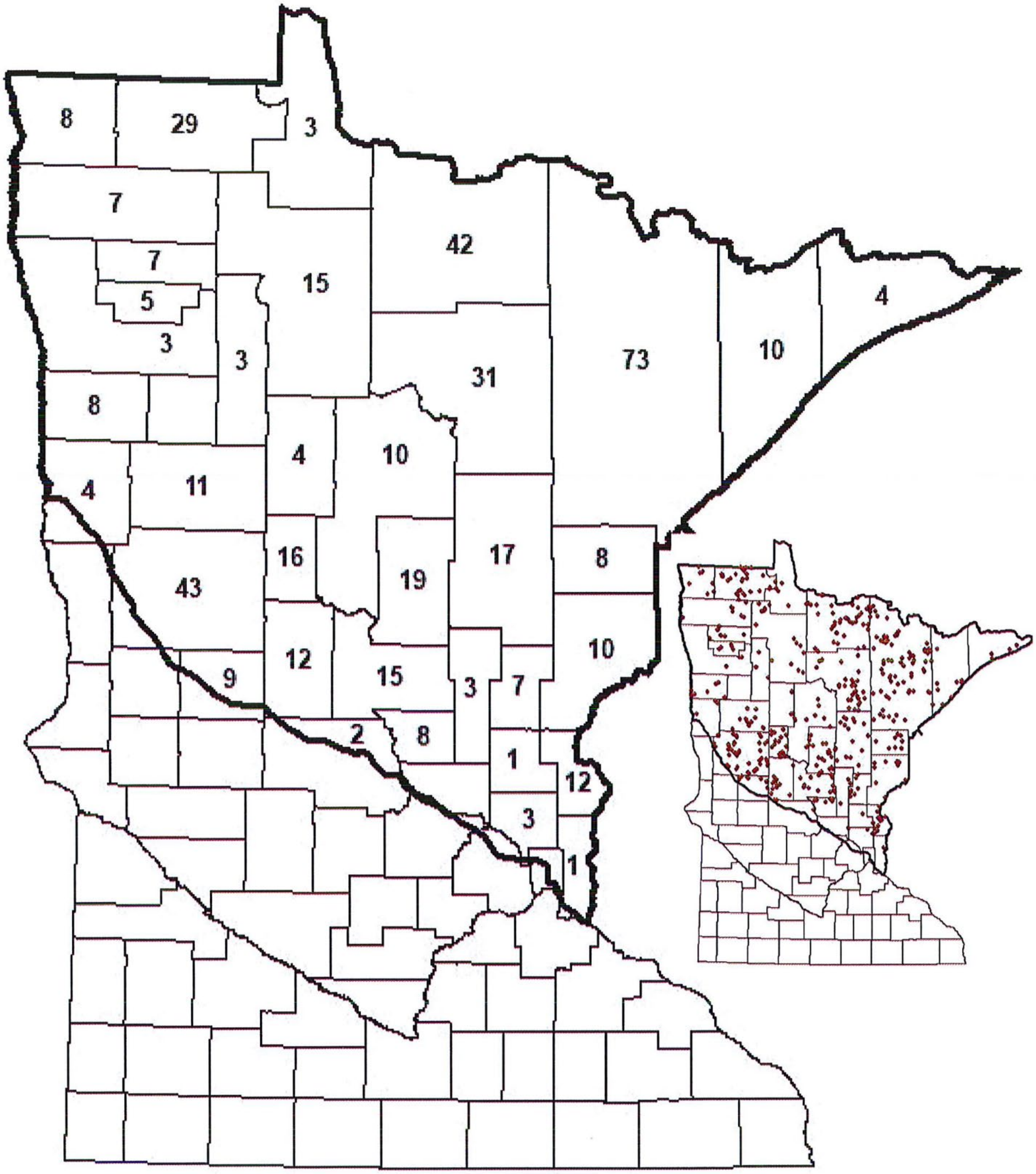


Figure 4. Fisher harvest by county, 2019. Inset shows spatial distribution of harvest locations.

Table 7. Fisher harvest by county and sex, 2019 season.

County	Sex			Total	Harvest/ 100 Mile^2
	Female	Male	Unknown		
Aitkin	6	11		17	0.85
Anoka	1	2		3	0.67
Becker	2	9		11	0.76
Beltrami	6	9		15	0.49
Benton	0	8		8	1.94
Carlton	3	5		8	0.91
Cass	4	6		10	0.41
Chisago	4	8		12	2.71
Clay	1	3		4	0.38
Clearwater	1	2		3	0.29
Cook	1	3		4	0.25
Crow Wing	8	11		19	1.64
Douglas	4	5		9	1.25
Grant	0	0		0	0.00
Hubbard	1	3		4	0.40
Isanti	1	0		1	0.22
Itasca	15	16		31	1.06
Kanabec	4	3		7	1.31
Kittson	5	3		8	0.72
Koochiching	19	21	2	42	1.33
Lake	5	5		10	0.44
Lake of the Woods	1	2		3	0.17
Mahnomen	0	0		0	0.00
Marshall	3	4		7	0.39
Mille Lacs	2	1		3	0.44
Morrison	7	8		15	1.30
Norman	5	3		8	0.91
Otter Tail	21	22		43	1.93
Pennington	4	3		7	1.13
Pine	7	3		10	0.70
Polk	2	1		3	0.15
Red Lake	1	4		5	1.15
Roseau	12	17		29	1.73
Sherburne	0	0		0	0.00
St. Louis	36	37		73	1.08
Stearns	0	2		2	0.14
Todd	5	7		12	1.23
Wadena	6	10		16	2.95
Washington	0	1		1	0.24
Wilkin	0	0		0	0.00
Unknown	0	0		0	
Total	203	258	2	463	

Table 8. Comparison of fisher harvest by county, 2008-2019.

County	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Aitkin	75	50	35	55	52	47	24	38	16	10	15	17
Anoka	2	0	0	1	2	1	2	7	4	0	4	3
Becker	36	44	30	32	45	38	21	23	3	18	10	11
Beltrami	15	22	10	25	21	17	4	8	9	6	6	15
Benton	3	2	0	5	5	2	4	3	7	4	7	8
Carlton	19	15	12	12	14	8	14	13	6	1	9	8
Cass	77	57	43	41	37	23	30	24	11	12	16	10
Chisago	4	10	6	10	3	4	16	18	11	8	23	12
Clay	3	0	6	10	6	5	6	4	4	2	8	4
Clearwater	37	13	6	8	5	12	3	2	3	0	7	3
Cook	10	11	17	28	11	13	11	5	4	3	8	4
Crow Wing	116	42	48	64	55	51	34	31	13	17	17	19
Douglas	5	2	6	15	24	8	20	12	6	2	8	9
Grant	0	0	1	0	0	0	0	0	0	0	0	0
Hubbard	38	18	13	10	11	10	8	6	5	6	8	4
Isanti	5	9	1	4	6	11	11	12	3	13	6	1
Itasca	195	166	88	142	105	116	78	47	13	34	30	31
Kanabec	26	20	13	21	27	30	9	10	6	2	6	7
Kittson	8	5	7	5	9	11	2	3	5	7	6	8
Koochiching	115	96	51	116	80	51	67	45	23	40	31	42
Lake	54	49	45	56	53	35	28	14	14	12	16	10
Lake of the Woods	42	21	9	33	21	13	12	15	6	9	3	3
Mahnomen	6	3	0	3	0	4	2	0	0	0	0	0
Marshall	26	6	7	13	14	17	22	22	6	5	12	7
Mille Lacs	17	18	18	17	20	17	12	6	13	7	8	3
Morrison	14	10	8	10	24	25	23	15	16	11	25	15
Norman	12	7	4	10	19	21	12	5	9	3	6	8
Otter Tail	152	67	100	138	121	117	102	77	41	53	59	43
Pennington	8	2	4	8	8	11	19	11	4	9	10	7
Pine	74	30	26	22	42	46	44	35	18	17	7	10
Polk	49	31	25	54	58	45	32	22	11	9	11	3
Red Lake	23	23	10	17	16	24	18	6	8	18	14	5
Roseau	89	58	20	79	61	42	32	26	15	24	18	29
Sherburne	0	3	1	6	2	2	2	2	0	0	6	0
St. Louis	283	296	186	350	233	220	171	125	61	72	66	73
Stearns	1	1	0	4	1	4	2	3	3	5	2	2
Todd	33	22	18	15	29	22	15	19	12	20	7	12
Wadena	37	23	23	31	25	23	21	26	9	17	11	16
Washington	0	0	0	1	1	0	2	2	1	1	4	1
Wilkin	0	0	0	1	0	0	0	0	0	0	0	0
Unknown	3	7	6	1	27	0	8	14	0	0	0	0
Total	1,712	1,259	903	1,473	1,293	1,146	943	756	399	477	510	463

Table 9. Fisher harvest by date and sex, 2019 season.

	Sex				% of Known	Cumulative
Date	Female	Male	Unknown	Total	Total	%
Dec. 21	0	3		3	0.65	0.65
Dec. 22	20	27	1	48	10.37	11.02
Dec. 23	34	55	1	90	19.44	30.45
Dec. 24	33	33		66	14.25	44.71
Dec. 25	19	33		52	11.23	55.94
Dec. 26	22	29		51	11.02	66.95
Dec. 27	28	28		56	12.10	79.05
Dec. 28	27	35		62	13.39	92.44
Dec. 29	19	13		32	6.91	99.35
Unknown	1	2		3	0.65	100%
Total	203	258	2	463	100%	

Table 10. Distribution of fisher harvest* among trappers, 1993-2019.

Number (%) of Takers	Number Taken						
	1	2	3	4	5	Total Takers	Ave. Take
1993	239 (34)	460 (66)	----	----	----	699	1.7
1994	321 (31)	725 (69)	----	----	----	1046	1.7
1995	232 (40)	355 (60)	----	----	----	587	1.6
1996	321 (31)	726 (69)	----	----	----	1047	1.7
1997	351 (23)	1205 (77)	----	----	----	1556	1.8
1998	443 (28)	1141 (72)	----	----	----	1584	1.7
1999	397 (37)	664 (63)	----	----	----	1061	1.6
2000	301(38)	251 (31)	129 (16)	121 (15)	----	802	2.1
2001	294 (33)	271 (31)	146 (17)	168 (19)	----	879	2.2
2002	336 (35)	234 (25)	138 (15)	117 (12)	123 (13)	948	1.8
2003	403 (39)	249 (24)	150 (15)	107 (11)	115 (11)	1024	1.7
2004	390 (37)	260 (25)	184 (17)	95 (9)	132 (12)	1061	1.7
2005	407 (40)	251 (24)	150 (15)	102 (10)	118 (11)	1028	1.7
2006	510 (37)	328 (24)	208 (15)	150 (11)	171 (13)	1367	1.7
2007	416 (50)	193 (23)	104 (12)	68 (8)	57 (7)	838	1.7
2008	382 (48)	182 (23)	91 (11)	65 (8)	79 (10)	799	1.6
2009	372 (55)	156 (23)	69 (10)	42 (6)	38 (6)	677	1.6
2010	330 (54)	279 (46)	----	----	----	609	1.5
2011	553 (55)	451 (45)	----	----	----	1004	1.4
2012	453 (52)	415 (48)	----	----	----	868	1.5
2013	501 (61)	316 (39)	----	----	----	817	1.4
2014	434 (63)	254 (37)	----	----	----	688	1.4
2015	346 (63)	203 (37)	----	----	----	549	1.4
2016	177 (61)	111 (39)	----	----	----	288	1.4
2017	246 (68)	114 (32)	----	----	----	360	1.3
2018	253 (66)	128 (34)	----	----	----	381	1.3
2019	259 (72)	101 (28)	----	----	----	360	1.3

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

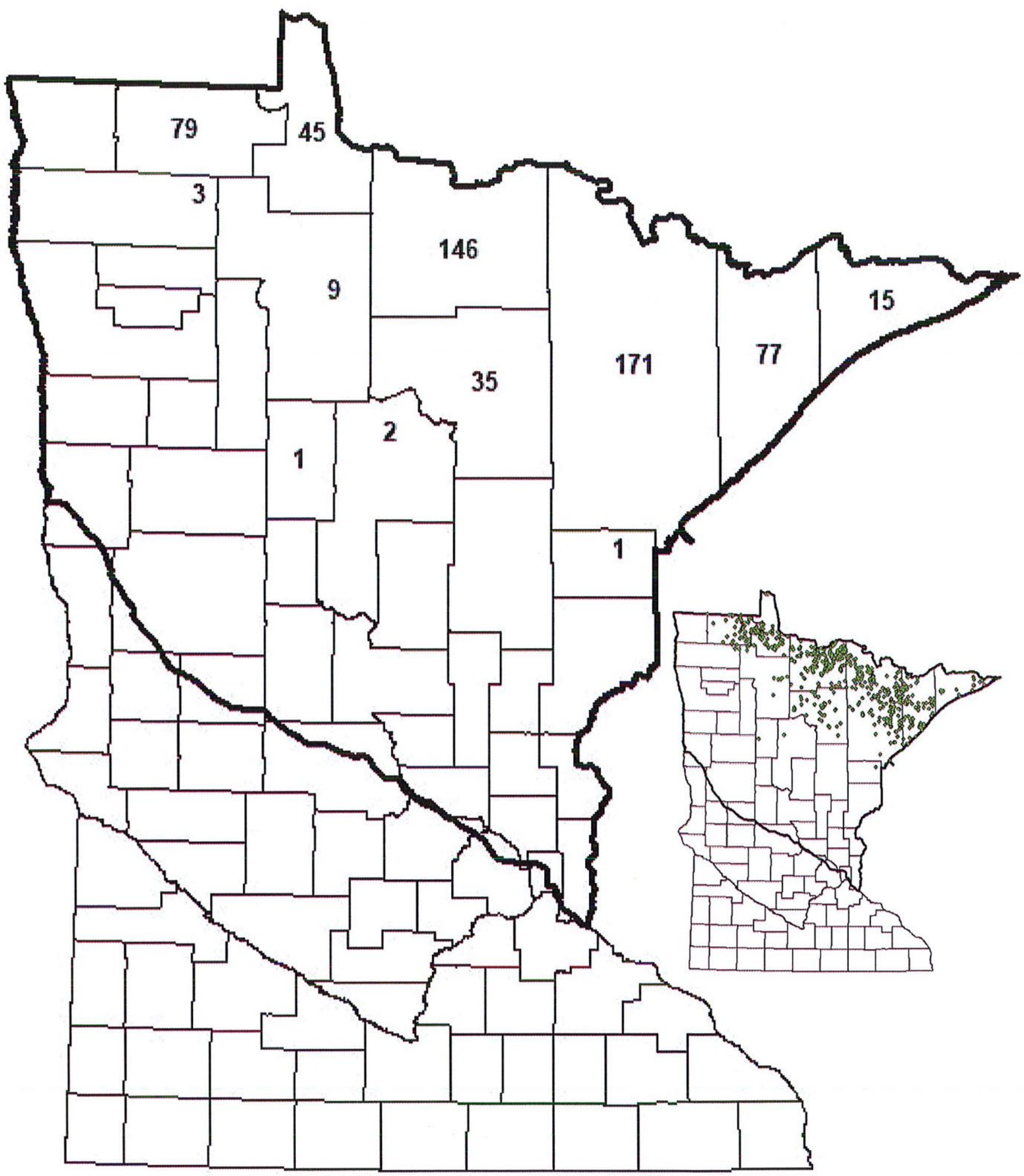


Figure 5. Marten harvest by county, 2019. Inset shows spatial distribution of harvest locations.

Table 11. Marten harvest by county and sex, 2019 season.

County	Sex: Female	Male	Unknown	Total	Harvest/ 100 Mile^2
Aitkin	0	0		0	0.00
Becker	0	0		0	0.00
Beltrami	4	5		9	0.29
Carlton	0	1		1	0.11
Cass	1	1		2	0.08
Clearwater	0	0		0	0.00
Cook	6	9		15	0.93
Crow Wing	0	0		0	0.00
Hubbard	1	0		1	0.10
Itasca	9	26		35	1.20
Kanabec	0	0		0	0.00
Kittson	0	0		0	0.00
Koochiching	50	93	3	146	4.63
Lake	22	56		78	3.41
Lake of the Woods	12	33		45	2.53
Mahnomen	0	0		0	0.00
Marshall	1	2		3	0.17
Otter Tail	0	0		0	0.00
Pennington	0	0		0	0.00
Pine	0	0		0	0.00
Red Lake	0	0		0	0.00
Roseau	22	57		79	4.71
St. Louis	58	113		171	2.54
Unknown	0	0		0	
Total	186	396	3	585	

Table 12. Comparison of marten harvest by county in Minnesota, 2008-2019.

County	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Aitkin	12	5	4	13	10	8	12	4	1	7	2	0
Becker	0	0	0	0	0	0	0	1	0	0	0	0
Beltrami	6	10	2	11	20	15	7	15	7	16	2	9
Carlton	4	8	5	6	3	1	1	0	0	7	7	1
Cass	1	2	1	2	0	0	3	2	2	2	2	2
Clearwater	0	0	0	0	0	0	0	0	0	0	0	0
Cook	151	244	191	205	148	78	43	39	23	40	44	15
Crow Wing	0	1	0	1	0	0	1	0	2	0	0	0
Hubbard	0	0	0	0	0	0	0	1	0	0	0	1
Itasca	72	91	73	118	46	62	79	64	28	52	35	35
Kanabec	0	0	0	0	0	0	0	0	0	0	0	0
Kittson	0	0	1	0	4	0	1	0	0	3	1	0
Koochiching	300	354	336	516	276	218	265	169	107	176	117	146
Lake	438	496	491	577	290	185	149	138	109	172	131	78
Lake of the Woods	17	17	13	49	32	18	23	25	21	32	16	45
Mahnomen	0	0	0	0	0	0	0	0	0	0	0	0
Marshall	0	4	0	3	3	5	5	3	1	1	1	3
Otter Tail	0	0	0	0	0	0	1	0	0	0	0	0
Pennington	0	0	0	0	0	0	0	1	0	0	0	0
Pine	0	0	1	0	0	0	1	0	0	0	0	0
Red Lake	0	0	0	0	1	1	0	0	0	0	0	0
Roseau	46	32	13	98	77	37	40	33	31	74	41	79
St. Louis	769	803	709	926	562	386	421	377	219	397	266	171
Unknown	7	6	2	0	0	0	7	5	0	0	0	0
Total	1,823	2,073	1,842	2,525	1,472	1,014	1,059	877	551	979	665	585

Table 13. Marten harvest by date and sex, 2019 season.

Date	Sex			Total	% of Known	Cumulative
	Female	Male	Unknown		Total	%
Dec. 21	2	1		3	0.51	0.51
Dec. 22	35	68		103	17.61	18.12
Dec. 23	35	77	2	114	19.49	37.61
Dec. 24	28	70		98	16.75	54.36
Dec. 25	15	26		41	7.01	61.37
Dec. 26	25	33		58	9.91	71.28
Dec. 27	18	63	1	82	14.02	85.30
Dec. 28	20	38		58	9.91	95.21
Dec. 29	8	19		27	4.62	99.83
Unknown	0	1		1	0.17	100%
Total	186	396	3	585	100%	

Table 14. Distribution of marten harvest* among trappers, 1993-2019.

Number (%) of Takers	Number Taken						
	1	2	3	4	5	Total Takers	Ave. Take
1993	76 (10)	681 (90)	----	----	----	757	1.9
1994	165 (20)	681 (80)	----	----	----	846	1.8
1995	78 (10)	711 (90)	----	----	----	789	1.9
1996	157 (18)	734 (82)	----	----	----	891	1.8
1997	161 (13)	1050 (87)	----	----	----	1211	1.9
1998	187 (15)	1056 (85)	----	----	----	1243	1.8
1999	164 (17)	318 (34)	213 (23)	246 (26)	----	941	2.6
2000	188 (28)	190 (28)	123 (18)	173 (26)	----	674	2.4
2001	147 (23)	175 (27)	138 (21)	187 (29)	----	647	2.6
2002	149 (21)	138 (19)	147 (21)	123 (17)	160 (22)	717	1.9
2003	126 (15)	135 (16)	159 (19)	170 (20)	265 (31)	855	1.8
2004	165 (17)	153 (16)	171 (18)	164 (18)	282 (30)	935	1.8
2005	191 (22)	158 (18)	139 (16)	156 (18)	215 (25)	859	1.8
2006	206 (18)	201 (17)	226 (19)	203 (17)	335 (29)	1171	1.8
2007	176 (23)	160 (21)	147 (19)	141 (18)	142 (19)	766	2.0
2008	153 (24)	139 (22)	108 (17)	110 (17)	122 (19)	632	1.9
2009	121 (19)	105 (16)	106 (17)	134 (21)	173 (27)	639	1.9
2010	95 (17)	77 (14)	120 (22)	92 (17)	170 (31)	554	1.8
2011	154 (19)	131 (16)	179 (22)	166 (20)	181 (22)	811	2.0
2012	198 (33)	134 (22)	131 (22)	73 (12)	64 (11)	600	1.9
2013	341 (51)	332 (49)	----	----	----	673	1.5
2014	307 (45)	376 (55)	----	----	----	683	1.6
2015	247 (44)	309 (56)	----	----	----	556	1.6
2016	142 (41)	202 (59)	----	----	----	344	1.6
2017	233 (39)	365 (61)	----	----	----	598	1.6
2018	200 (46)	231 (54)	----	----	----	431	1.5
2019	200 (51)	191 (49)	----	----	----	391	1.5

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

Table 15. Number of trappers with different fisher/marten combinations, 2019. (Combined limit = 2)

<table>
<tr><td colspan="2" rowspan="2">Number of Takers</td><td colspan="6">Number of Marten</td></tr>
<tr><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td rowspan="6">Number of Fisher</td><td>0</td><td></td><td>113</td><td>191</td><td></td><td></td><td></td></tr>
<tr><td>1</td><td>173</td><td>86</td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>102</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>5</td><td></td><td></td><td></td><td colspan="2">Total takers of at least 1 fisher or marten</td><td>665</td></tr>
</table>

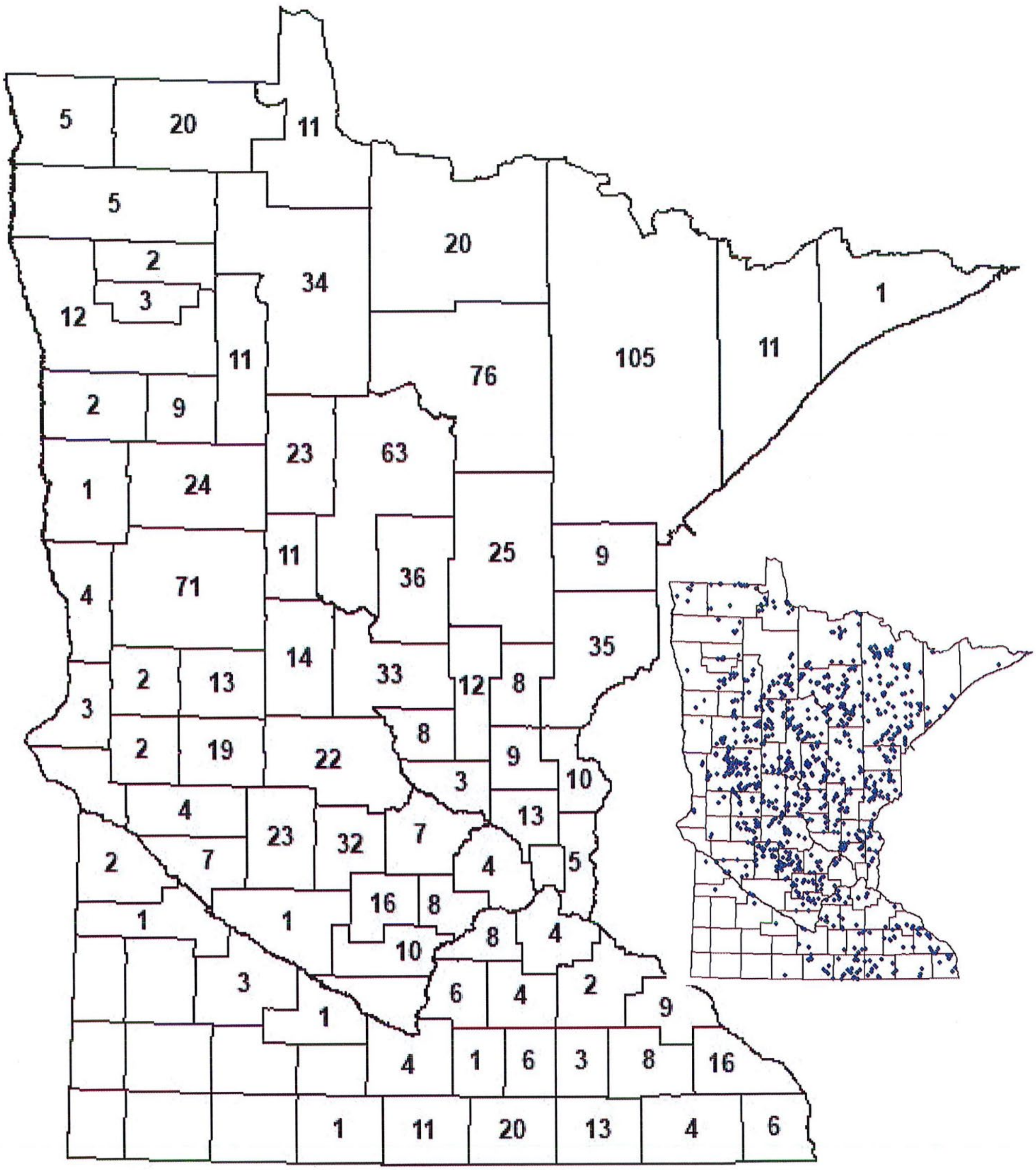


Figure 6. Otter harvest by county, 2019-20. Inset shows spatial distribution of harvest locations.

Table 16. Otter harvest by county and sex, 2019-20 season.

County	Sex: Female	Male	Unknown	Total	Harvest/ 100 Mile^2
Aitkin	10	15		25	1.25
Anoka	8	5		13	2.92
Becker	13	11		24	1.66
Beltrami	14	20		34	1.11
Benton	4	4		8	1.94
Big Stone	0	0		0	0.00
Blue Earth	1	3		4	0.52
Brown	1	0		1	0.16
Carlton	3	6		9	1.03
Carver	4	4		8	2.13
Cass	30	33		63	2.61
Chippewa	2	5		7	1.19
Chisago	5	5		10	2.26
Clay	1	0		1	0.09
Clearwater	6	5		11	1.07
Cook	1	0		1	0.06
Cottonwood	0	0		0	0.00
Crow Wing	19	17		36	3.11
Dakota	1	3		4	0.68
Dodge	.	3		3	0.68
Douglas	6	7		13	1.80
Faribault	4	7		11	1.53
Fillmore	3	1		4	0.46
Freeborn	12	8		20	2.77
Goodhue	1	1		2	0.26
Grant	2	.		2	0.35
Hennepin	1	3		4	0.66
Houston	4	2		6	1.06
Hubbard	9	14		23	2.30
Isanti	4	5		9	1.99
Itasca	36	39	1	76	2.60
Jackson	0	0		0	0.00
Kanabec	4	4		8	1.50
Kandiyohi	9	14		23	2.67
Kittson	4	1		5	0.45
Koochiching	5	14	1	20	0.63
Lac Qui Parle	0	2		2	0.26
Lake	2	9		11	0.48
Lake of the Woods	7	4		11	0.62
Le Sueur	2	4		6	1.27
Lincoln	0	0		0	0.00
Lyon	0	0		0	0.00
Mahnomen	3	6		9	1.54
Marshall	2	3		5	0.28
Martin	1	.		1	0.14
McLeod	4	12		16	3.17
Meeker	13	19		32	4.97
Mille Lacs	7	5		12	1.76
Morrison	13	20		33	2.86
Mower	8	5		13	1.83
Murray	0	0		0	0.00
Nicollet	0	0		0	0.00
Nobles	0	0		0	0.00

	Sex				Harvest/
County	Female	Male	Unknown	Total	100 Mile[2]
Norman	1	1		2	0.23
Olmsted	6	2		8	1.22
Otter Tail	29	42		71	3.19
Pennington	1	1		2	0.32
Pine	17	18		35	2.44
Pipestone	0	0		0	0.00
Polk	6	6		12	0.60
Pope	8	11		19	2.65
Ramsey	0	0		0	0.00
Red Lake	1	2		3	0.69
Redwood	2	1		3	0.34
Renville	0	1		1	0.10
Rice	0	4		4	0.78
Rock	0	0		0	0.00
Roseau	10	10		20	1.19
Scott	4	3	1	8	2.17
Sherburne	2	1		3	0.67
Sibley	2	8		10	1.67
St. Louis	42	63		105	1.56
Stearns	9	13		22	1.58
Steele	3	3		6	1.39
Stevens	1	1		2	0.35
Swift	.	4		4	0.53
Todd	6	8		14	1.43
Traverse	2	1		3	0.51
Wabasha	3	6		9	1.64
Wadena	5	6		11	2.03
Waseca	1	0		1	0.23
Washington	1	4		5	1.18
Watonwan	0	0		0	0.00
Wilkin	2	2		4	0.53
Winona	7	9		16	2.50
Wright	2	5		7	0.98
Yellow Medicine	0	1		1	0.13
Unknown	0	0		0	
Total	462	585	3	1,050	

Table 17. Comparison of otter harvest by county, 2008-2019.

County	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Aitkin	65	54	59	107	111	90	67	74	61	33	34	25
Anoka	18	26	8	13	31	25	23	20	12	18	15	13
Becker	55	39	53	95	127	87	77	83	21	27	42	24
Beltrami	80	74	77	112	120	98	74	76	43	40	51	34
Benton	11	3	13	13	21	17	8	1	3	3	6	8
Big Stone	2	1	0	3	3	9	8	3	1	6	3	0
Blue Earth	0	0	0	2	3	1	2	1	3	3	2	4
Brown	0	0	0	0	0	0	0	2	2	0	0	1
Carlton	29	30	35	29	38	37	26	42	32	9	12	9
Carver	5	6	5	15	8	9	17	11	8	8	12	8
Cass	160	90	135	140	183	161	193	172	74	92	98	63
Chippewa	0	0	5	7	8	12	6	4	3	8	8	7
Chisago	15	18	23	19	24	32	26	20	12	18	12	10
Clay	14	7	23	42	23	16	14	18	10	10	11	1
Clearwater	35	19	38	41	46	47	23	38	21	33	21	11
Cook	12	16	19	36	55	57	28	9	4	0	4	1
Cottonwood	0	0	0	0	0	0	0	0	0	0	1	0
Crow Wing	99	76	66	107	117	96	83	59	35	41	55	36
Dakota	5	7	1	0	11	10	6	13	3	8	10	4
Dodge	0	0	3	1	1	3	4	2	0	3	2	3
Douglas	28	11	14	34	37	23	33	22	21	15	15	13
Faribault	0	0	0	1	12	3	1	3	5	9	3	11
Fillmore	1	1	5	5	10	6	13	3	3	4	1	4
Freeborn	0	0	5	10	10	1	7	6	2	11	7	20
Goodhue	3	7	11	7	18	2	2	11	4	9	0	2
Grant	3	6	1	8	12	6	13	4	3	5	2	2
Hennepin	3	6	2	3	4	5	6	3	2	2	9	4
Houston	15	11	11	10	26	22	14	9	2	8	10	6
Hubbard	72	41	52	42	67	61	36	32	26	39	30	23
Isanti	17	18	14	9	18	28	23	13	17	13	10	9
Itasca	201	191	247	281	346	345	184	159	67	84	123	76
Jackson	0	0	0	0	0	0	0	1	0	0	1	0
Kanabec	29	23	17	22	52	45	34	26	20	29	7	8
Kandiyohi	6	6	8	8	10	20	20	23	17	18	19	23
Kittson	2	3	8	2	9	7	4	0	8	8	5	5

County	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Koochiching	95	61	81	62	127	115	55	68	19	16	13	20
Lac Qui Parle	0	0	2	6	15	6	1	7	0	8	0	2
Lake	34	45	28	36	66	67	45	26	23	12	13	11
Lake of the Woods	17	8	15	27	27	27	31	31	8	16	20	11
Le Sueur	0	0	3	0	9	5	2	2	4	3	4	6
Lincoln	0	0	0	0	4	0	0	0	0	2	0	0
Lyon	0	0	0	0	0	0	0	0	0	1	0	0
Mahnomen	7	7	9	20	15	25	7	6	3	9	16	9
Marshall	2	0	13	13	15	15	4	9	12	15	10	5
Martin	0	0	0	0	1	0	0	1	1	1	1	1
McLeod	6	8	12	18	19	22	18	16	14	16	26	16
Meeker	13	16	12	28	19	32	35	23	11	26	29	32
Mille Lacs	26	28	19	15	30	39	28	16	13	26	14	12
Morrison	43	31	29	29	52	52	50	31	22	24	35	33
Mower	0	0	8	20	14	9	8	2	13	7	11	13
Murray	0	0	0	0	0	0	0	1	0	0	0	0
Nicollet	0	0	2	1	5	7	1	0	0	4	3	0
Nobles	0	0	0	0	0	0	4	0	0	0	0	0
Norman	17	11	12	21	45	27	19	13	9	8	5	2
Olmsted	2	3	2	3	0	7	7	5	3	5	4	8
Otter Tail	82	32	65	109	173	154	97	87	92	100	82	71
Pennington	0	1	4	2	12	5	8	8	11	2	7	2
Pine	74	37	38	44	66	98	59	86	48	20	36	35
Pipestone	0	0	0	0	0	0	0	0	1	1	0	0
Polk	25	19	36	49	83	71	47	37	20	12	14	12
Pope	12	12	11	20	22	14	19	8	19	8	14	19
Ramsey	0	0	0	0	3	1	1	1	0	0	0	0
Red Lake	8	20	22	19	26	11	10	14	13	1	3	3
Redwood	0	0	0	2	4	6	8	3	0	2	4	3
Renville	0	0	0	1	6	0	3	1	1	6	1	1
Rice	0	0	1	9	4	8	1	2	6	3	8	4
Rock	0	0	0	0	2	0	0	0	2	0	2	0
Roseau	53	23	32	33	64	48	44	23	24	22	20	20
Scott	3	1	4	2	4	3	2	4	5	4	7	8
Sherburne	10	17	7	19	12	9	10	10	11	8	9	3
Sibley	0	0	6	6	6	3	2	3	2	2	5	10
St. Louis	251	233	253	239	363	293	258	260	109	146	127	105
Stearns	38	24	13	41	53	53	41	50	45	28	34	22

County	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Steele	0	0	1	0	3	1	0	1	3	3	4	6
Stevens	3	1	6	1	3	12	4	2	1	1	3	2
Swift	4	5	2	11	10	10	9	3	7	7	13	4
Todd	37	32	41	63	55	55	19	28	22	24	18	14
Traverse	0	2	0	1	4	1	0	3	7	4	11	3
Wabasha	7	18	7	8	20	21	19	9	11	11	17	9
Wadena	19	15	16	20	43	30	30	19	5	8	8	11
Waseca	0	0	0	0	0	0	2	2	0	0	1	1
Washington	19	11	16	18	12	24	27	9	12	20	13	5
Watonwan	0	0	0	0	0	1	0	0	0	0	1	0
Wilkin	0	0	0	0	3	2	0	3	1	2	2	4
Winona	19	13	15	20	21	17	5	17	6	13	7	16
Wright	9	8	11	17	23	26	21	21	11	22	33	7
Yellow Medicine	0	0	0	0	7	9	0	3	0	2	2	1
Unknown	18	12	2	17	40	2	18	18	0	0	0	0
Totals	1,938	1,544	1,814	2,294	3,171	2,824	2,154	1,955	1,195	1,295	1,351	1,050

Table 18. Otter harvest by sex and week, 2019-20 season.

Date	Sex			Total	% of	Cumulative
	Female	Male	Unknown	Harvest	Total	%
Oct.26 - Nov.1	34	49		83	7.90	7.90
Nov.2 - Nov.8	105	119	1	225	21.43	29.33
Nov.9 - Nov.15	53	62	1	116	11.05	40.38
Nov.16 - Nov.22	46	76		122	11.62	52.00
Nov.23 - Nov.29	54	72		126	12.00	64.00
Nov.30 - Dec.6	40	44		84	8.00	72.00
Dec.7 - Dec.13	24	28		52	4.95	76.95
Dec.14 - Dec.20	17	19		36	3.43	80.38
Dec.21 - Dec.27	33	36		69	6.57	86.95
Dec.28 - Jan.3	25	30	1	56	5.33	92.29
Jan.4 - Jan.10	14	20		34	3.24	95.52
Jan.11 - Jan.17	7	14		21	2.00	97.52
Jan.18 - Jan.26*	8	12		20	1.90	99.43
Unknown	2	4		6	0.57	100.00
Total	462	585	3	1,050	100%	

* 9-day interval.

Table 19. Distribution of otter harvest* among trappers, 1993-2019.

Number (%) of Takers	Number Taken					
	1	2	3	4	Total Takers	Ave. Take
1993-94	193 (33)	115 (19)	100 (17)	184 (31)	592	2.5
1994-95	250 (27)	185 (20)	143 (15)	349 (38)	927	2.6
1995-96	183 (31)	134 (23)	88 (15)	180 (31)	585	2.5
1996-97	257 (29)	205 (23)	140 (16)	283 (32)	885	2.5
1997-98	304 (33)	235 (26)	117 (13)	255 (28)	911	2.4
1998-99	263 (32)	183 (23)	139 (17)	226 (28)	811	2.4
1999-00	222 (33)	124 (19)	99 (15)	217 (33)	662	2.5
2000-01	206 (32)	122 (19)	108 (17)	201 (32)	637	2.5
2001-02	147 (23)	175 (27)	138 (21)	187 (29)	647	2.6
2002-03	253 (33)	147 (19)	122 (16)	241 (32)	763	2.5
2003-04	269 (27)	201 (20)	152 (16)	361 (37)	983	2.6
2004-05	302 (25)	235 (19)	182 (15)	498 (41)	1217	2.7
2005-06	291 (27)	213 (20)	186 (17)	386 (36)	1076	2.6
2006-07	372 (34)	216 (19)	194 (17)	328 (30)	1110	2.4
2007-08	308 (39)	153 (19)	119 (15)	207 (26)	787	2.3
2008-09	293 (37)	157 (20)	121 (15)	216 (27)	787	2.3
2009-10	237 (38)	131 (21)	93 (15)	171 (27)	632	2.3
2010-11	263 (34)	166 (22)	130 (17)	206 (27)	765	2.4
2011-12	438 (42)	227 (22)	149 (14)	236 (22)	1050	2.2
2012-13	468 (35)	330 (24)	175 (13)	376 (28)	1349	2.3
2013-14	561 (43)	291 (22)	196 (15)	271 (21)	1319	2.1
2014-15	424 (42)	231 (23)	154 (15)	200 (20)	1009	2.1
2015-16	337 (39)	183 (21)	142 (16)	203 (23)	865	2.2
2016-17	270 (46)	135 (23)	80 (14)	101 (17)	586	2.0
2017-18	243 (41)	139 (23)	77 (13)	135 (23)	594	2.2
2018-19	276 (44)	134 (21)	78 (12)	142 (23)	630	2.1
2019-20	206 (42)	107 (22)	59 (12)	113 (23)	485	2.2

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