MONITORING POPULATION TRENDS OF ELK IN NORTHWESTERN MINNESOTA - 2023

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INTRODUCTION

Historically, elk inhabited much of Minnesota (O'Gara and Dundas 2002) but today are limited to three relatively small herds found in Kittson, Roseau, Marshall, and Beltrami counties in the northwestern portion of the state (Figure 1). Row crops are a dominant land use in this part of the state and subsequently, there is potential for crop depredation caused by elk. Elk management in Minnesota is therefore mandated to prevent populations from increasing in accordance with Minnesota Statute 97B.516. Specifically, the Grygla herd must be managed for 30-38 elk, the Kittson County herd for 50-60 elk, and the Caribou-Vita herd for 150-200 elk (Interim Strategic Management Plan for Elk 2016-2019). Since the mid-1990s, Minnesota Department of Natural Resources (MNDNR) personnel have conducted an annual aerial elk survey from mid-January to mid-March in northwest Minnesota. Our primary objective is to estimate elk abundance within each herd. MNDNR staff use this data to monitor long-term trends, document changes in spatial distribution and sex ratios, and help set harvest quotas for potential hunting seasons.

OBJECTIVE

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

METHODS

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

During all surveys, we used a Cessna 185 fixed-wing aircraft and attempted to maintain flight altitude at 350 ft above ground level (AGL) and airspeed at 85 mi/hr. The pilot and two observers searched for elk along parallel, east-west transects spaced at 0.2-mi intervals. When an elk was sighted, we left the transect line and circled the observed animal(s) to determine group size and classify antlerless (cow, calf) and antlered animals. We did not attempt to differentiate between cows and calves because differentiation is difficult under existing flight protocols. Antlered elk were classified as either adult (branch-antlered) bulls or spike bulls. We used a real-time, moving-map software program (DNRSurvey; Haroldson et al. 2015), coupled

to a global positioning system receiver and a tablet computer, to guide transect navigation and record survey data and aircraft flight paths directly to ArcGIS (Environmental Systems Research Institute, Inc., Redlands, CA) shapefiles. To maximize sightability, we completed surveys during winter when snow cover measured at least 8 in.

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

RESULTS

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

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

Grygla Survey Block

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

Kittson Central Survey Block

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

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

Caribou-Vita Survey Block

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

DISCUSSION

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

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

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

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

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TABLES AND FIGURES

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

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

[a]Average proportions reported.

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

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

[a]Counts recorded from helicopter flights.

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

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

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

[a]Counts recorded from helicopter flights.

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

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

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

[a]Counts recorded from helicopter flights.

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

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

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

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

[a]Counts recorded from helicopter flights.

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

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

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

[a]Counts recorded from helicopter flights.

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

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

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

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

[a]Counts recorded from helicopter flights.

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

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

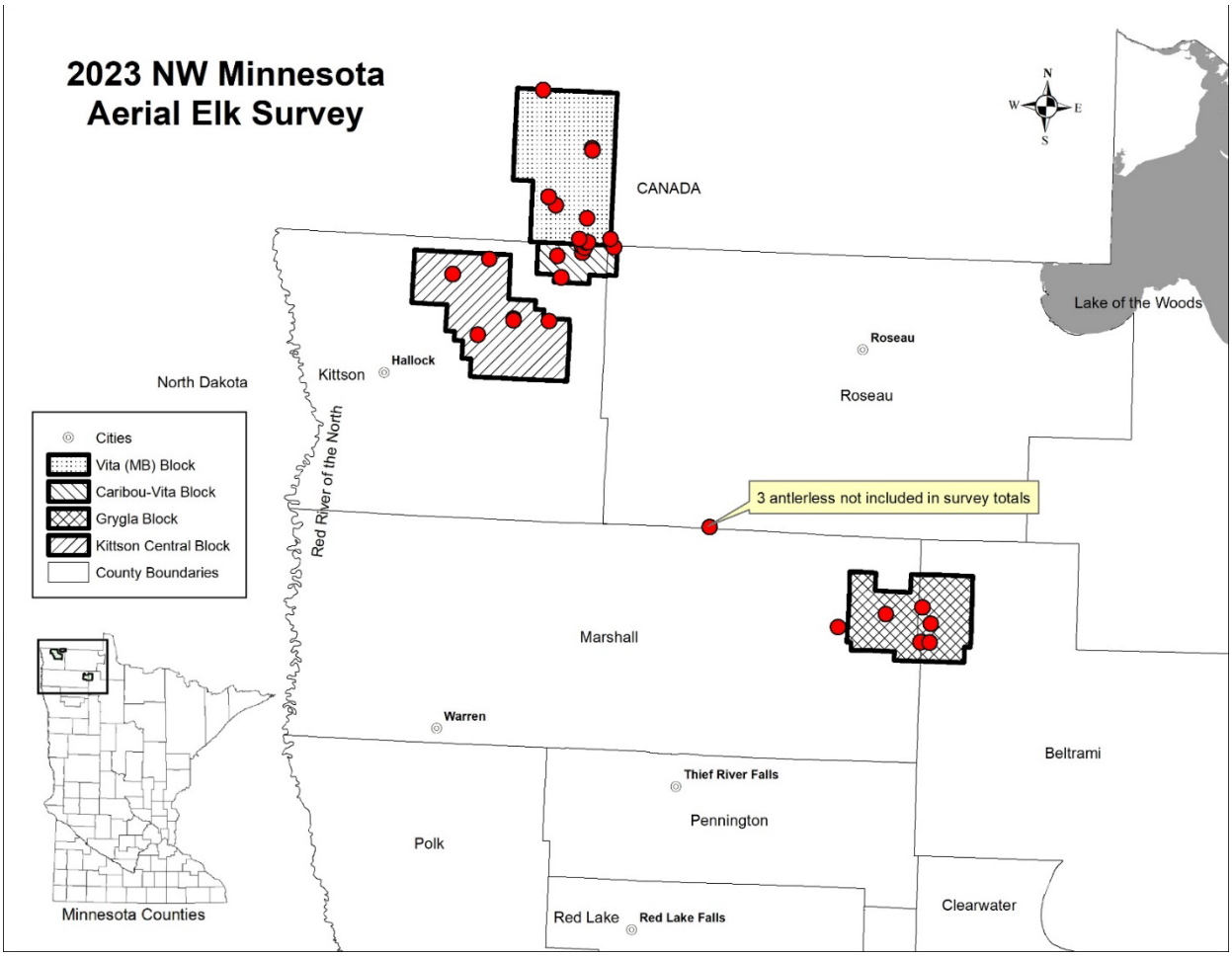

Figure 1. Aerial survey blocks for the Grygla, Kittson Central, and Caribou-Vita herds flown during 2023 in northwestern Minnesota, USA, and Manitoba, Canada. Red dots indicate locations where MNDNDR staff observed elk.