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Natural Resource Stewardship and Science

Voyageurs National Park Moose Population Survey Report

2019

Natural Resource Report NPS/VOYA/NRR—2019/1885

ON THIS PAGE
A cow and calf moose spotted during the 2019 aerial survey. Moose are well adapted to deep snow, such as we had during the 2019 survey period.
NPS/BRYCE OLSON

ON THE COVER
A bull moose casts a late afternoon shadow during the 2019 aerial survey. Most bulls lose their antlers in December or January, but will occasionally carry them into February and March before shedding them.
NPS/BRYCE OLSON

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Steve K. Windels and Bryce T. Olson

National Park Service
Voyageurs National Park
360 Highway 11 East
International Falls, MN 56649

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Abstract

Moose are at the southern edge of their range in Minnesota, where populations have experienced dramatic declines over the last 10-20 years. Concern for the status of moose in Voyageurs National Park resulted in the establishment of a monitoring program starting in 2009, including an annual estimate of the moose population in winter. The 2019 survey was conducted February 2-11 on the Kabetogama Peninsula, a 305-km^2 roadless area in the center of the park where >90% of the park's moose reside. We counted 35 moose during the survey (9 bulls, 15 cows, 4 yearlings, and 7 calves). After correcting for sightability, the 2019 population estimate for the Kabetogama Peninsula was 47 moose (90% CI = 42–53), or 0.15 moose/km^2 (0.39 moose/mi^2). The 2019 population estimate is similar to those from the 2009–2017 period. Indices of calf production in 2019 were relatively low, similar to 2014–2017. The estimated calf:cow ratio was 0.47, and calves were 20% of the population. The bull:cow ratio observed during the 2019 survey was 0.60. Combined with data from GPS collared moose and other sources, our population estimate is indicative of a low density but stable population of moose in the park.

Acknowledgments

Funding for this project was provided by Voyageurs National Park. Special thanks to Voyageurs National Park Pilot J. Hummel for assistance with data collection for the 2019 survey, and to VOYA Chief Ranger B. Welch and Superintendent B. DeGross for continued support of the VOYA aviation program, without which population monitoring of moose would be very difficult.

Introduction

Voyageurs National Park (Minnesota) was established in 1975 in part to fulfill the National Park Service's mission to preserve and protect wildlife populations and provide opportunities for the public to enjoy them. Moose (Alces alces) are native to Voyageurs National Park (VOYA), but declines among other moose populations in Minnesota and elsewhere in North America raised concerns about the long-term viability of moose in the park. Moose populations in northwestern Minnesota declined precipitously during the period 1984–2000 (Murray et al. 2006). Moose populations in northeastern Minnesota also declined dramatically during the period 2009-2013 though it has stabilized since then (DelGiudice 2018).

Voyageurs National Park is not surveyed as part of the state's systematic annual survey because it lies just outside of primary moose range in northeastern Minnesota (Figure 1; DelGiudice 2018). Voyageurs National Park, in collaboration with the University of Minnesota-Duluth, began more intensive monitoring and research of moose in and adjacent to the park in 2009 to better understand local moose population dynamics. The moose population within VOYA has remained stable since 2009, but, due to the small size and isolation of the park's moose herd, frequent monitoring is needed to ensure the population remains viable. Information from this survey is also important for understanding interactions among other components of the boreal ecosystem, including those concerning the primary predator of moose, the gray wolf (*Canis lupus*). VOYA did not complete a survey in Winter 2018.

Methods

We surveyed the moose population within the boundaries of Voyageurs National Park during 2-11 February 2019. The survey area was limited to the Kabetogama Peninsula, a 305-km^2 roadless area in the center of the park where >90% of the park's moose population occurs (Figure 1). Surveys were conducted using a 2-seat Top Cub aircraft with a pilot and observer searching for moose while the plane flew in overlapping circles at an intensity of at least 3.5 min/km^2. The peninsula was broken down into 23 separate survey units to facilitate the completion of the survey, and all units were surveyed. For each observed moose we recorded location, group size, sex/age class (calf, yearling, adult cow, adult bull, unknown), and whether the animal was standing or bedded. We also recorded all observations of white-tailed deer (*Odocoileus virginianus*) and gray wolves (*Canis lupus*).

There are currently no moose with functioning GPS telemetry collars in the moose study area of Voyageurs National Park. Thus we could not complete sightability (i.e., detection probability) trials for moose using our surveys methods as we were able to do from 2013-2017. The pilot (J. Hummel) and observer (B. Olson) have previously conducted surveys in VOYA using this methodology, with B. Olson conducting all surveys from 2013-2017, and we feel confident that any changes in detection probability between the current (2019) and previous surveys are not a result of observer experience or bias. Therefore, we used the 4-year mean detection probability of 0.75 (mean 90% Confidence Interval [CI] = 0.65–0.84) we estimated during the 2013-2016 surveys to correct our estimates (Windels and Olson 2017).

The number of moose observed during the aerial survey was adjusted with the estimated detection probability described above, giving a population estimate for the Kabetogama Peninsula (± 90% Confidence Intervals) during the survey period. We also estimated other measures of population status, including calf:cow ratio, twinning rates, and bull:cow ratio. No moose were captured in 2019, therefore we did not estimate pregnancy rates (percent of adult females that were pregnant via blood progesterone levels) as was done from 2010–2013.

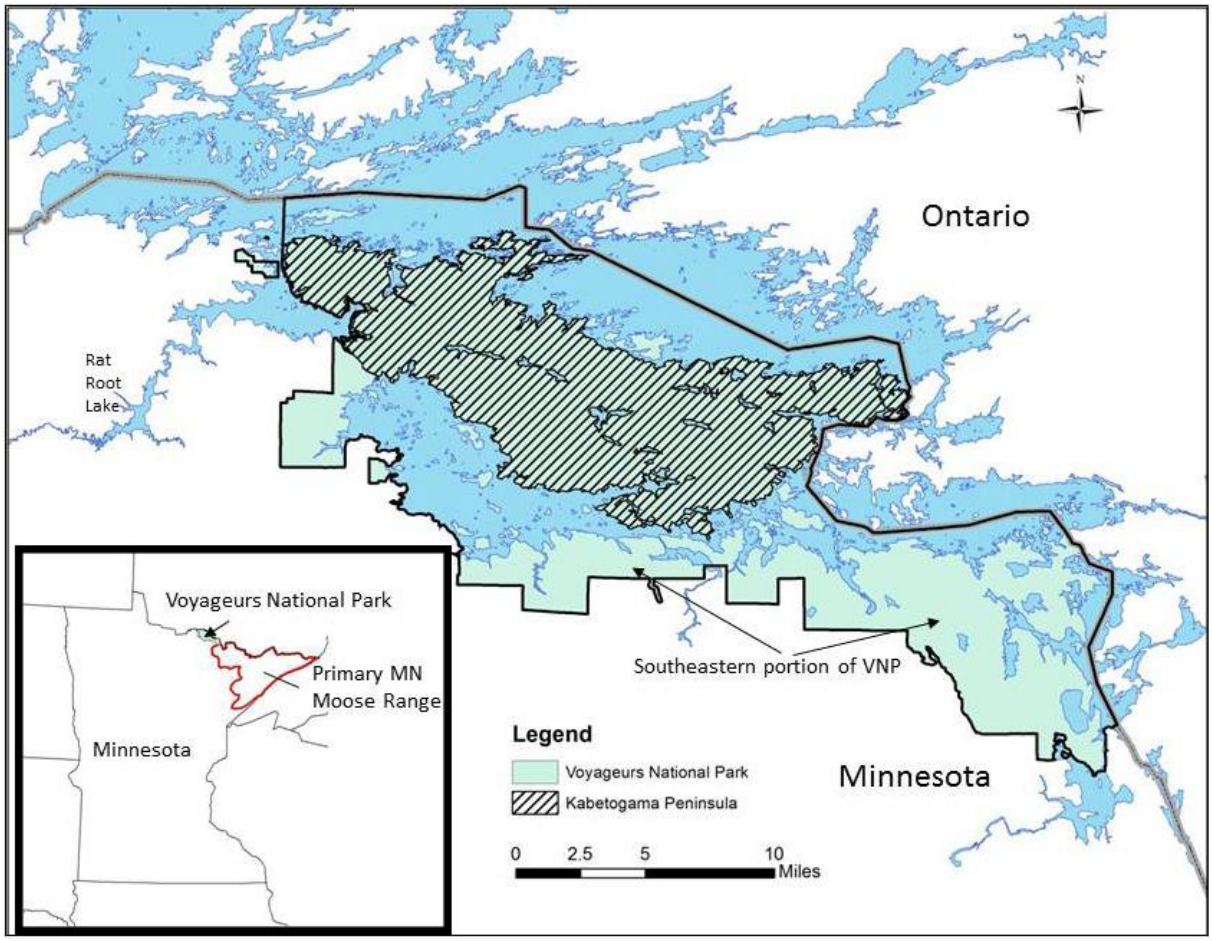

Figure 1. 2019 moose survey area in Voyageurs National Park, Minnesota, USA. The Kabetogama Peninsula (305 km^2) contains >90% of the park's moose population. A small pocket of moose (approx. 10–15 individuals) also exists west of the park in the Rat Root Lake area, and evidence from GPS collars suggests that some moose move seasonally between this area and the Kabetogama Peninsula. Some moose also reside in the southeastern portion of the park but we did not survey this part of the park in 2019. Inset shows Minnesota's primary moose range relative to the park's location.

Results

Survey conditions were considered “good” to “excellent” during the 2019 survey, with snow depths exceeding 40 cm (16 in) throughout the Kabetogama Peninsula. We counted 35 moose during the survey (9 bulls, 15 cows, 4 yearlings, and 7 calves), including 1 cow with ear tags that previously had a GPS collar. After correcting for sightability (i.e., Sightability Correction Factor = 1/Detection Probability), the 2019 population estimate for the Kabetogama Peninsula was 47 moose (90% CI = 42-53), 0.15 moose/km^2 (0.39 moose/mi^2). The minimum number of moose on the Kabetogama Peninsula during the 2019 survey was 35, based on known individuals. The 2019 population estimate of 47 is similar to estimates during from the previous 9 surveys from 2009-2017 which ranged from 41-51 moose (Table 1).

Indices of calf production in 2019 were relatively low, though slightly higher than the period 2014–2017 (Table 1). No twins were observed in 2019; moreover only 3 sets of twins have been observed in the last 11 surveys dating back to 1997. The estimated calf:cow ratio was 0.47, and calves were 20% of the population. The bull:cow ratio observed during the 2019 survey was 0.60, which is similar to the period 2011-2014.

Moose were located primarily in the eastern 2/3 of the study area during the 2019 survey (Fig. 2). We counted 203 white-tailed deer during the survey and documented one wolf-killed deer. VOYA field staff reported several confirmed sightings of moose or moose sign (droppings or tracks) in the southern part of VOYA during 2018-2019 (i.e., south of Lake Kabetogama and Namakan Lake). Our last formal survey of that area in 2010 confirmed very low densities of moose. Anecdotal evidence confirms that moose continue to be present in that part of the park but at very low densities.

Table 1. Population estimates and demographic characteristics for moose in the Kabetogama Peninsula, Voyageurs National Park, Minnesota, USA, derived from aerial surveys and other sources from 1991–2019. NS = not surveyed.

Year	Population Estimate	90% Confidence Interval for Estimate	Calves: Cow	% Calves	% Twins[a]	Bulls: Cow	% Pregnant[b]
1991	31	23–57	–	9	–	–	–
1992	47	35–72	–	9	–	–	–
1997	45	27–74	–	30	ca. 13[c]	–	–
1998	38	23–63	–	9	0	–	–
2009	51	44–58	–	7	0	-	–
2010	41	36–47	0.54	23	0	0.82	60
2011	45	39–51	0.60	28	8	0.53	69
2012	NS	NS	NS	NS	NS	NS	33
2013	46	43–50	0.61	25	6	0.56	63
2014	40	34–48	0.23	11	0	0.46	–
2015	46	41–52	0.38	14	0	1.00	–
2016	41	40–46[d]	0.46	16	0	1.00	–
2017	44	39–50	0.50	15	0	1.30	–
2018	NS	NS	NS	NS	NS	NS	–
2019	47	42-53	0.47	20	0	0.60	–

[a] Percentage of twins observed among all cows.

[b] Estimated from serum progesterone levels from blood samples collected during winter capture for GPS collaring during 2010–2013.

[c] One set of twins recorded; % Twins for 1997 based on assumption of 1:1 adult sex ratio.

[d] Lower end of 90% CI truncated to minimum number of known individuals.

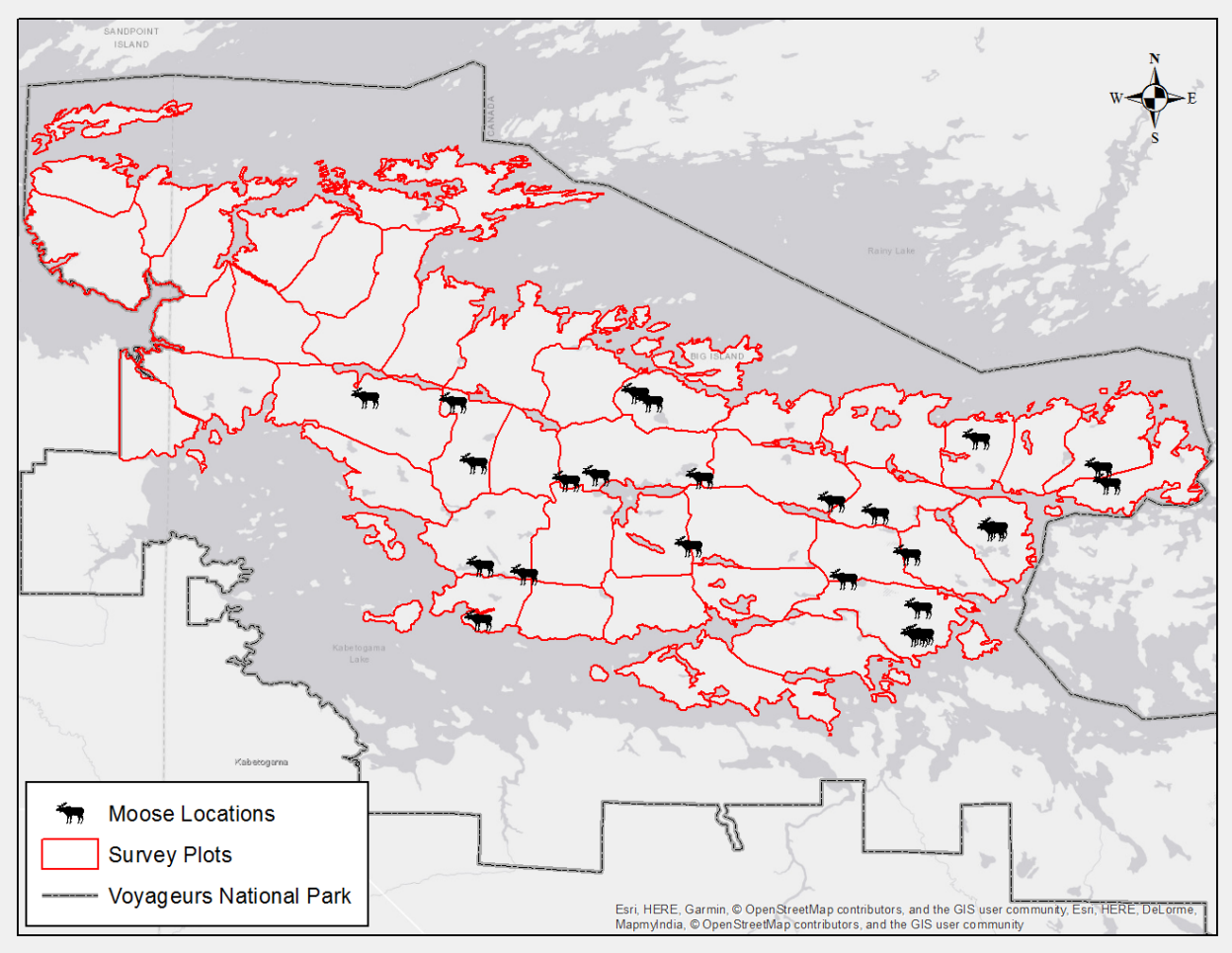

Figure 2. Locations of 35 individual moose observed during the 2019 moose survey in Voyageurs National Park. Some icons represent groups of >1 moose. Red lines denote boundaries of the 46 sub-plots (comprising 23 plots) used as part of the survey methodology.

Discussion

Voyageurs National Park staff have been monitoring the park's moose population since 2009, including conducting aerial surveys to estimate population size and demographics, and monitoring adult moose with GPS collars from 2010-2018 to understand survival, habitat use, and other behaviors. Aerial survey data continue to suggest that VOYA maintains a stable, low density moose population in the Kabetogama Peninsula.

In addition to population monitoring, Voyageurs National Park is currently investigating other aspects of moose ecology in collaboration with the University of Minnesota-Duluth, University of Minnesota-Twin Cities, Minnesota Zoo, and other partners. Recently completed projects that include data from VOYA projects include several investigations of moose habitat selection and behavior in response to temperature, landscape features, and predators (Ditmer et al. 2018) and a review of the role of the thermal environment in wildlife management (Elmore et al. 2017).

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Natural Resource Stewardship and Science
1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525