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Brief Communication

Moose *(Alces alces)* population size and density in the Inuvik Region of the Northwest Territories, Canada

Tracy Davison[1] & Kristen Callaghan[2]

[1] Government of the Northwest Territories, Environment and Natural Resources, P.O. Box # 2749, Inuvik, NT, X0E 0T0, Canada (Corresponding author: Tracy_Davison@gov.nt.ca).
[2] Gwich'in Renewable Resources Board, P.O. Box 2240, Inuvik, NT, X0E 0T0, Canada.

Abstract: Responding to community concerns, the Gwich'in Renewable Resources Board (GRRB) and the Government of the Northwest Territories Department of Environment and Natural Resources (ENR) conducted an aerial moose *(Alces alces)* survey in the Inuvik region of the Northwest Territories, Canada to estimate moose density and distribution. The survey was flown in March 2011 and a random stratified sample design was used. Local knowledge was incorporated in to the stratification of survey cells. Moose density in survey blocks ranged from 9.66 moose/100 km^2 in the Ikhil Pipeline block to 0 in the Peel River block with a coarse overall moose density 2.24 moose/100 km^2. Densities found were low but within expected range for the species in this region of North America based on past surveys.

Key words: *Alces alces;* moose; Northwest Territories; population; survey.

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Introduction

In the Gwich'in Settlement Area (GSA) and the adjacent Inuvialuit Settlement Region (ISR) of the Northwest Territories (NWT), Canada (Fig.1), management of moose (Alces alces) populations is primarily the responsibility of co-management boards and of the territorial government. The Gwich'in Renewable Resources Board (GRRB) is the co-management board for wildlife in the GSA while the Wildlife Management Advisory Council (Northwest Territories) [WMAC (NWT)] is the co-management board for wildlife in the ISR.

A 2006 survey in GSA reported low and declining (from past surveys between 1980 and 2000) moose densities ranging from 0 to 3.78 moose/100 km^2 (Lambert, 2006). Moose in the ISR have not been surveyed since the mid-1980's (Jingfors & Kutny, 1989). Current local knowledge suggests moose numbers have increased in the Mackenzie Delta (Fig. 1). Local barren-ground caribou *(Rangifer tarandus groenlandicus)* herd population numbers have been low, in particular the Cape Bathurst herd, resulting in a harvest closure of that herd in 2007. So, despite a perception of current healthy moose population the declining caribou led to community concerns about impacts of possible predators and harvesters switching to moose. In response to these concerns and in order to inform possible management decisions by GRRB and WMAC (NWT), we conducted an aerial survey of moose population density and distribution in northwest NWT in March 2011.

Methods

Population estimates followed the stratified random sampling methods of Gasaway *et al.,* (1986) and was analyzed using the GeoSpatial Population Estimator Software (Delong, 2006). Density estimates (moose/100 km^2) were calculated for each of the eight survey blocks based on total number of moose sighted in selected cells (# moose/area surveyed * 100).

We held workshops with local Renewable Resources Councils (RRCs) and Hunter and Trapper Committees (HTCs) to define the survey region and map areas of expected high and low moose density in the survey period. Local experts were used as a cost-effective way to stratify the survey area while ensuring the involvement of local indigenous people.

Aerial survey methods generally followed those described by Kellie & Delong (2006). The survey region was divided into 2' latitude by 5' longitude (~ 4 km by 4 km) cells using ArcGIS 9.2 (ESRI, 2006). The cells were then stratified as high or low moose density using workshop classifications and habitat data. If cells were not classified as high or low moose density during the workshops vegetation cover maps were used to classify the cells. Area classified as open deciduous, closed deciduous, shrubs, wet herbaceous, emergent vegetation were considered areas were high density of moose would be expected. Areas with closed needle leaf, open needle leaf, non-vegetated soil, sparse vegetation or rock/gravel were considered low moose density classes.

Eight areas of interest were identified based on past surveys and input from HTCs, RRCs, GRRB, and WMAC (NWT) (Fig. 1). Survey blocks in the GSA were similar to the 2006 survey with slight modifications to the Peel River and Arctic Red River survey blocks based on input from the RRCs. This includes adjusting the Arctic Red River survey block (Fig. 1) into a discontinuous block with a portion near the community of Tsiigehtchic and a portion up river. New survey blocks were created in the ISR. Cells were randomly selected for surveying, with 2% of cell selections made manually to ensure good coverage, such as the inclusion of both high and low survey blocks. Surveyed cells represented 4,368 km^2 and 16.1 % of all survey blocks (Table 1).

We flew the survey in March 2011 using a Cessna 206 and Cessna 185 fixed-wing aircraft. Surveyed cells were to be covered in their entirely with the intent to detect all moose in the cell. Search intensity varied by block based on block vegetation cover; heavily treed areas were covered more intensely than open/tundra areas. Snow tracks were circled to determine if the moose was still located in the block. A pilot, navigator, and two observers spotted and classified moose inside each selected cell and noted any moose observed outside selected cells. Locations were recorded using GPS. Wolves and other wildlife observations inside or outside selected cells were also recorded.

Results & Discussion

Survey flights were conducted from March 16-24, 2011 with a total of 61.9 hours flown. We observed a total of 168 moose: 79 within surveyed grid cells and 89 moose outside surveyed cells. We classified 63% of observed moose: 40 cows, 32 calves and 34 bulls, resulting in bull to cow and calf to cow ratios of 85:100 and 80:100, respectively. Composition estimates may be biased as the presence of calves aided in classification of cows, such that cows without calves may have been more often unclassified than by chance. Other wildlife observed included; moose, 33 sheep, 38 wolves, and five caribou.

A total area of 3519 km^2 was surveyed

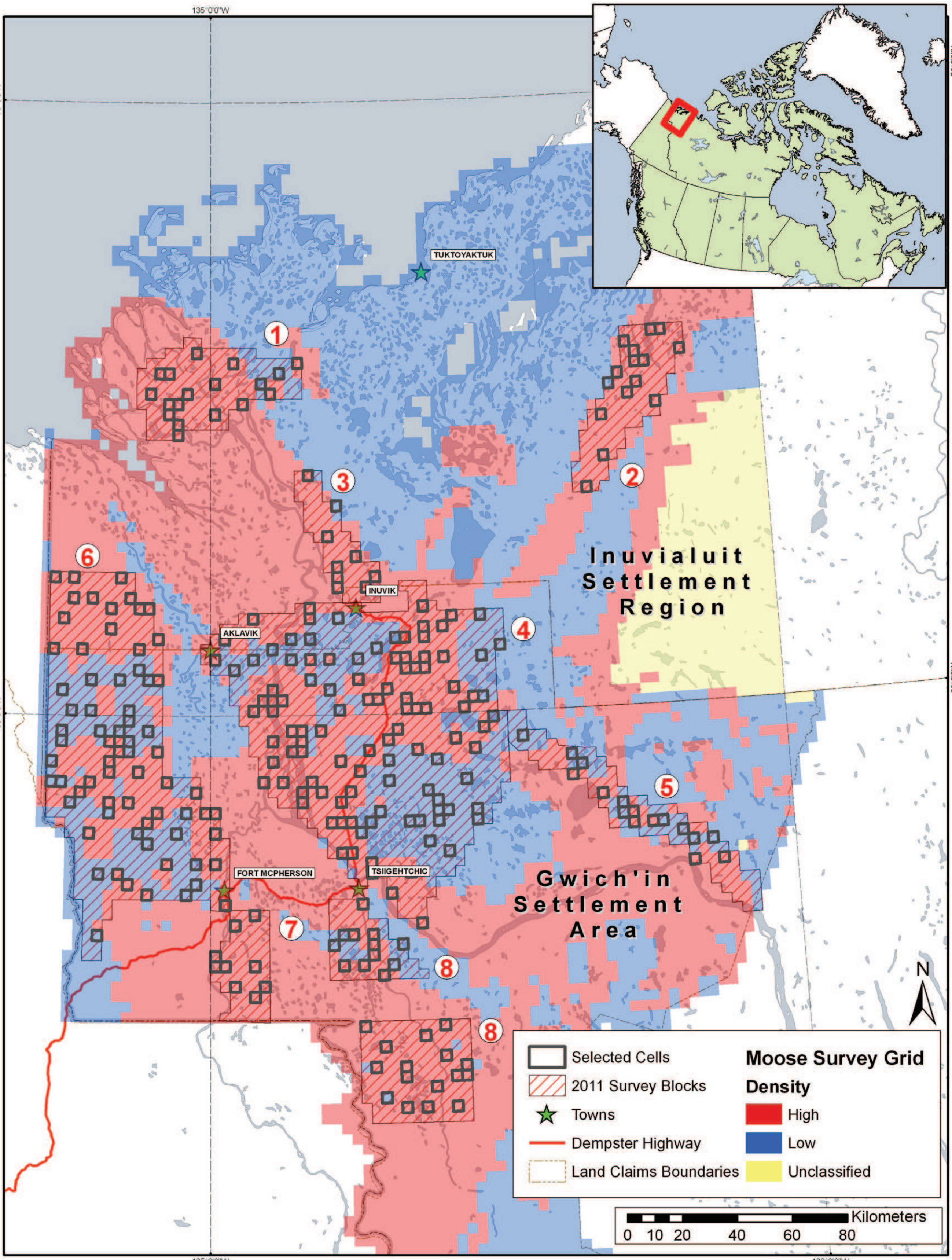

Fig. 1. Stratification and surveyed cells in eight survey blocks: 1) Delta North, 2) Kugaluk-Miner Rivers, 3) Ikhil Pipeline, 4) Inuvik-Tsiigehtchic, 5) Mackenzie Gas pipeline route, 6) Richardson Mountains, 7) Peel River, and 8) Arctic Red River.

Table 1. Number (#) of moose observations, moose densities, and population estimates by survey block.

Survey Block	Survey Block Area (km²)	Percent Surveyed	# of Moose observed	Population estimate	SE[1]	Density (Moose/ 100 km²)	2006 Density (Moose/ 100 km²)
Delta North	1448.1	15.5	10	61.21	28,19	4.49	NA
Kugaluk-Miner Rivers	1155.9	16.0	2	NA[2]	-	1.08	NA
Ikhil Pipeline	671.6	17.0	11	NA[2]	-	9.66	NA
Inuvik-Tsiigehtchic	8611.5	16.0	27	170.88	43.30	1.94	1.62
Mackenzie Gas Pipeline Route	1286.2	16.5	7	41.47	28.40	3.33	2.31
Richardson Mountains	5705.6	15.8	20	126.24	64.68	2.23	3.54
Peel River	704.1	17.0	0	-	-	0.00	0.84
Arctic Red River	2196.3	17.2	2	12.19	7.70	0.53	0.00

[1] Standard Error.
[2] Could not compute estimate – insufficient samples in one stratum.

making the coarse overall moose density 2.24 moose/100 km². The highest density, 9.66 moose/100 km², was found in the Ikhil Pipeline survey block (Table 1). The Arctic Red River block was found to have very low densities with 0.53 moose/100 km². No moose were observed in the Peel River block; however we do not believe there are no moose in the area, as there were tracks observed. The Peel River block was the smallest survey area and we believe that the sample size was too small to detect moose at the low densities they occur in this area. The densities found in the other blocks were: 4.49 moose/100 km² in Delta North, 1.08 moose/100 km² in Kugaluk-Miner Rivers, 1.94 moose/100 km² in Inuvik-Tsiigehtchic, 3.33 moose/100 km² in the Mackenzie Gas Pipeline Route, and 2.23 moose/100 km² in the Richardson Mountains (Table 1).

A sightability correction was not determined for our survey. Moose sightability varies by season, snow cover, habitat, and size of the survey unit (Gasaway *et al.*, 1986). Habitat in the study region ranged from alpine/tundra to semi-open coniferous forest with sightability higher in more open habitats. It is possible to estimate a sightability correction factor using radio-collared moose (Gasaway *et al.,* 1986). However, since there were no collared moose in our study area we could not obtain a correction factor.

The Delta North and Ikhil Pipeline survey blocks had not been previously surveyed. The Kugaluk-Miner river area was surveyed in 1988, with an overall density of 6 moose/100 km^2 (Jingfors & Kutny, 1989) which is higher than the density found in this survey (1.08 moose/100 km^2). It is not known if this is a real trend because we only have two data points that were obtained using different survey methods. The survey block area in 2011 was not as large as the 1988 survey. Compared to the 2006 survey in the GSA, the Richardson Mountains and Peel River blocks were found to have lower densities in 2011. The densities for the Richardson Mountain block were also lower than a 2000 helicopter survey of the Richardson Mountains that included the Yukon where a density of 4.8 moose/100 km^2 was found (Yukon Government, unpublished data). Methods for the 2000 survey were quite different, as optimal habitat was flown instead of randomly sampling areas. The Inuvik-Tsiigehtchic, Mackenzie Gas Pipeline route, and Arctic Red River survey blocks had higher densities in 2011 compared to the 2006 survey (Table 1).

Moose in the ISR and GSA are at the northern edge of their range. As such, environmental factors and range conditions may partially explain observed lower densities than in other portions of the species' range. Observed densities appear generally consistent with those reported for other subarctic regions. Franzmann & Schwartz (1998) summarized general densities (moose/100 km2) across the species range as < 12 in subarctic areas, 12-31 in better ranges, and 40-100 in excellent ranges.

Densities in the Inuvik Region appear lower than other areas of the NWT, except the North Slave region where density ranged from 2.0 to 3.5 moose/100 km2 in 2005 (Cluff, 2005). The highest densities recorded in the NWT have been 17 moose/100 km^2 around Fort Good Hope and Norman Wells (Maclean, 1994; Veitch *et al.,* 1995).

Participation of knowledgeable community members and harvesters in the stratification of survey areas was important to improve accuracy of population estimates. Natural low densities make it difficult to detect trends between surveys. Composition estimates could be improved if surveys were conducted before moose bulls shed their antlers. We advocate that information on moose habitat, recruitment, and mortality, as well as increased coverage of future surveys would help to increase precision and confidence of estimates and would help to explain changes in moose distribution, density and number.

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