



## Executive Summary

Barren-ground caribou (*Rangifer tarandus groenlandicus*) occur across Baffin Island and are distributed roughly into north, south and central groupings across Baffin, and ancillary Islands. Local hunters, trappers, and community members began to suspect a decline in the Baffin Island caribou population in the mid to late 1990s. In February and March of 2014, the Government of Nunavut, Department of Environment (DOE), conducted aerial surveys on Baffin Island, Melville Peninsula and surrounding islands, to estimate the number of caribou on Baffin Island. The 2014 survey effort estimated 4,652 (95%CI=3,462-6,250; SE=702.79; CV=0.15) adult and yearling caribou across Baffin Island and ancillary islands. This finding confirmed a major decline of caribou on Baffin Island from the estimates of caribou in the 1990s based on Inuit Qaujimagatuqangit.

The 2014 survey results and community-based observations led to the establishment of an eight-month moratorium beginning on January 1, 2015. Following a round of intensive consultations with all Baffin Island communities, and a letter submitted for decision to the NWMB, recommending the establishment of a TAH of caribou be established on Baffin Island, a decision was reached to establish a Total Allowable Harvest (TAH) of 250 male caribou.

Since the 2014 survey, the DOE has conducted fall and/or spring aerial composition surveys from 2015 to 2021 as a means to monitor productivity and relative densities of caribou across Baffin Island. The objectives of these monitoring indices were to:

- 1) Estimate the overall composition of the subpopulations including the north Baffin grouping, south Baffin grouping, and central Baffin grouping (Figure 1); i.e., what proportion of the population are young bulls, old bulls, cows, yearlings, and calves.
- 2) Estimate the trajectory of abundance of the three main groupings of the Baffin Island caribou population, based on demographic composition. Using spring composition results, determine through a comparison between fall composition results, and where possible, similar tundra-wintering barren-ground subpopulations, if an index of calf productivity (measured as calves per 100 cows) suggests an increasing or decreasing population trend.
- 3) Monitor the proportion of bulls in the population to ensure that the bull only harvest is not reducing bulls to a proportion that could interfere with breeding (rutting) success.
- 4) Build a database with which to estimate the current population trend through demographic modeling, utilizing all demographic composition data to project a trend from the 2014 population estimate.
- 5) Provide information for discussions regarding management actions (including TAH) and monitoring plans and intensity.

In the spring of 2021, we classified 1,734 and 192 caribou (bulls, cows, yearlings, and calves) in south and north Baffin Island, respectively. Calf:cow ratios for south Baffin varied from the lowest ratio of 41 calves:100 cows on Hall Peninsula to the highest ratio of 55 calves:100 cows on Loks Land, suggesting good productivity in south Baffin in the spring of 2021. The calf:cow ratio for north Baffin was 63 calves:100 cows. All regions combined or separated, produced ratios within or above the suggested 30 calves per 100 cow baseline for taiga-wintering populations. However, there is risk associated with using baseline values from taiga-wintering populations to identify population trend in tundra-wintering caribou.

## Introduction

Baffin Island caribou are of the barren-ground subspecies, *Rangifer tarandus groenlandicus*. This subspecies can be further divided into two separate ecotypes: taiga wintering and tundra wintering. Baffin Island caribou generally remain on Baffin Island and ancillary Islands year-round and therefore are of the tundra wintering ecotype. Tundra wintering caribou generally occur in small groups and vary widely in their migratory behaviour. This can make surveying more difficult as the animals tend to be distributed unevenly across the landscape and occur in smaller groups than the taiga wintering ecotypes, particularly when their abundance is low.

There has been some scientific research conducted on Baffin Island caribou, however, many of these previous studies occur at relatively small spatial scales due to the remoteness and high cost associated with conducting research on Baffin Island. Fortunately, there is a wealth of Inuit Qaujimagatuqangit (IQ) that depicts the long-term population and distributional trends for the region. Due to the lack of quantitative data available, historical population estimates of caribou on the island are largely speculative. Telemetry studies (2008-2011) in North Baffin along with past survey findings, IQ studies (Ferguson, 1993; Ferguson and Gauthier, 1992; Ferguson and Messier, 1997; Ferguson et al 1998), and an island-wide collaring program from the late 80s to early 90s, point to the existence of potential sub-populations on the island (Figure 1). When all previous telemetry collar data was analyzed by Campbell et al. (2015) there is evidence that subpopulation structure exists on Baffin Island, but it has been determined that long-term spatial analysis is required to delineate subpopulations. Instead, spatial affiliations are referred to as “groupings” until further information is collected. Due to variation in habitat use and distribution at different population levels, further research is required to delineate specific groupings and/or subpopulations across Baffin Island. To aid in identifying the presence of these subpopulations, the DOE initiated a GPS telemetry program in North Baffin beginning in March 2021.

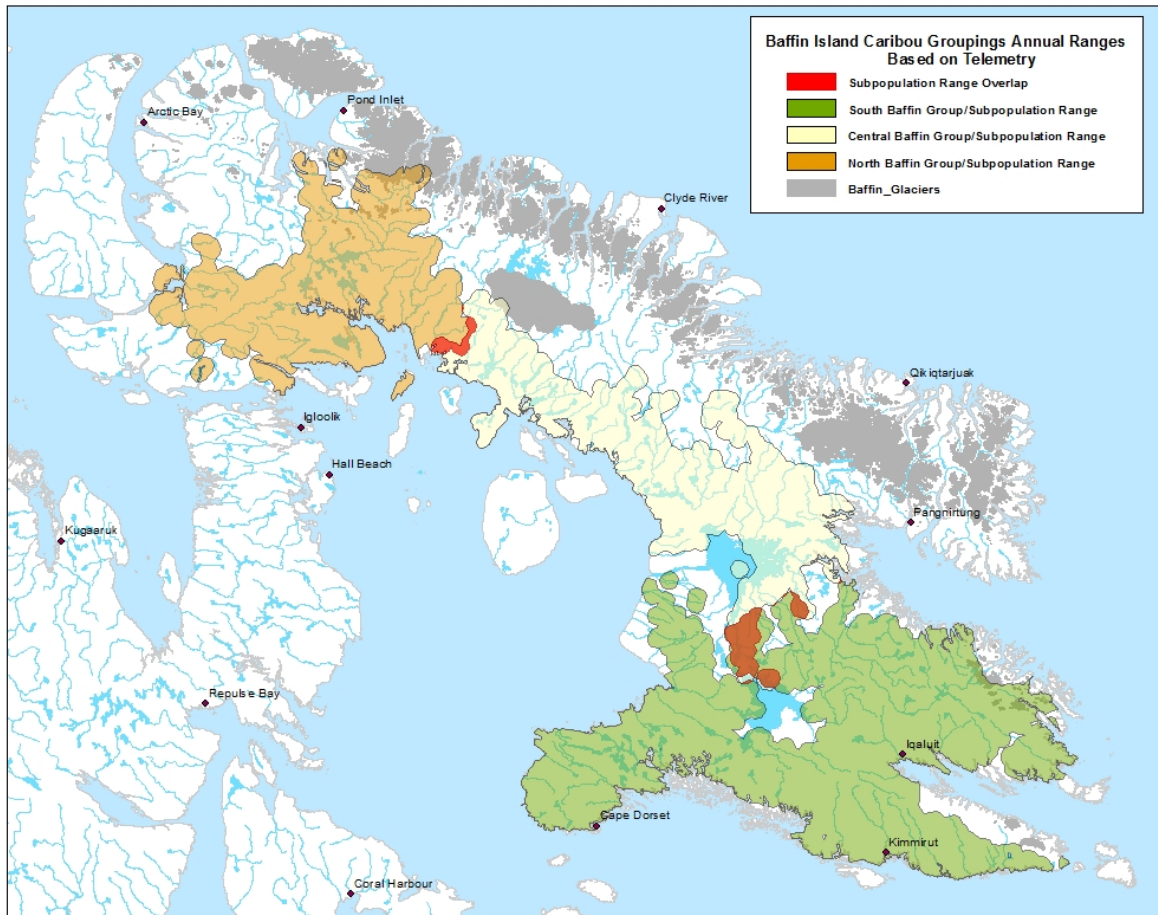


Figure 1. Caribou grouping annual range delineation based on telemetry studies from 1987 to 1994 (primarily South Baffin), and 2008 to 2011 (North Baffin). Polygons created utilizing a kernel analysis (See methods) of telemetry point data collected for 107 collars (North=35; Central = 17; South = 55). Excerpt from Campbell et al. 2015. Used to delineate survey area during composition studies.

Local hunters, trappers, and community members began to detect declines in the caribou population on the island in the mid to late 1990s (Jenkins et al 2012; Ferguson, 1993; Ferguson and Gauthier, 1992; Ferguson et al. 1998). In February/March 2014, the Government of Nunavut, Department of Environment (DOE) conducted aerial surveys across Baffin Island, Melville Peninsula, and surrounding islands to estimate the abundance and general distribution of caribou. Aerial surveys were conducted in February and March of 2014 using a combined double observer pair and distance sampling method (Campbell et al, 2015). This survey estimated the number of caribou within different geographic locations, including: 1) North Baffin Island 2) South Baffin Island 3) Baffin Island in its entirety 4) Baffin Island and its ancillary islands, and 5) Baffin Island and northern Melville Peninsula. A total of 1,157 Caribou were observed during the survey, 50 caribou in 8 groups in North Baffin, 347 in 104 groups in South Baffin, 557 caribou in 164 groups on Prince Charles Island, and 31 caribou in 7 groups on Melville Peninsula (Campbell et al. 2015). From these results, it was estimated that 315 (95% CI=159-622; SE=109; CV=0.35) caribou were in North Baffin, 2,734 (95% CI=1,777-4,207; SE=607; CV=0.22) caribou in South Baffin (including Foxe Peninsula and Central Baffin), 1,603 (95% CI=1,158-2,220; SE=250; CV=0.16) caribou on Prince Charles Island, and 220 (95% CI=88-551; SE=101; CV=0.46) caribou within northern Melville Peninsula, yielding a

Baffin wide estimate of 4,872 (95% CI=3,462-6,484; SE=712.23; CV=0.15) caribou. Campbell et al. (2015) also re-analyzed results from surveys flown in North Baffin in April 2009, and South Baffin in 2012, and found no statistically significant change in abundance between these and the 2014 surveys.

As a result of the low abundance of caribou on Baffin Island estimated in 2014, an eight-month moratorium was put in place on January 1, 2015. Following this moratorium, a Total Allowable Harvest (TAH) and a non-quota limitation (NQL) of a male-only harvest (250 TAH) was implemented by the Nunavut Wildlife Management Board (NWMB) in 2015. The annual caribou harvest season on Baffin Island is open from July 1- June 30. If the annual TAH (Table 1) is achieved prior to June 30 the season is ultimately closed and no additional harvest allowed. During the 2015/16, 2016/17, 2017/18 and 2018/19 harvest seasons the harvest was restricted to male-only. However, females were harvested illegally in each season. Starting in the 2019/20 season, the non-quota harvest restrictions were modified to allow harvest of up to 25 female caribou (cows) without calves. Communities are further allocated a set TAH for each harvest season by the Qikiqtaaluk Wildlife Board (QWB).

Table 1. Seasonal harvest allocations and caribou harvested by season and region.

Year	TAH	Harvest Allocation			Caribou Harvested			Total Caribou Harvested	Females Harvested*
		North Baffin <sup>1</sup>	Central Baffin <sup>2</sup>	South Baffin <sup>3</sup>	North Baffin <sup>1</sup>	Central Baffin <sup>2</sup>	South Baffin <sup>3</sup>		
2015/16	170	50	60	60	42	71	74	187	19**
2016/17	250	67	92	91	56	87	90	233	10
2017/18	250	66	90	94	52	88	92	233	14
2018/19	250	66	90	94	54	89	93	236	7
2019/20	250	63	89	98	58	75	118	251	18
2020/21	250	63	76	98	68	80	99	247***	21
2021/22	250	67	84	99	N/A	N/A	N/A	N/A	N/A

\* Females harvested are included in the "Total Caribou Harvested"

\*\* 5 of the females harvested are suspected and not confirmed

\*\*\* not including 9 additional suspected harvests.

<sup>1</sup>North Baffin allocation divided between communities of Pond Inlet, Igloolik, Arctic Bay and Sanirajak (Hall Beach). Sanirajak had an allocation of zero for 2019-2021.

<sup>2</sup>Central Baffin allocation divided between communities of Clyde River, Pangnirtung and Qikiqtarjuaq.

<sup>3</sup>South Baffin allocation divided between communities of Iqaluit, Kimmirut and Kinngait (Cape Dorset).

Since the 2014 survey the DOE has conducted fall and/or spring aerial composition surveys from 2015-2021, excluding spring of 2020, as a means to monitor productivity and relative densities of caribou across Baffin Island. The objectives of these monitoring indices were to:

- 1) Estimate the overall composition of the subpopulations, including the north Baffin grouping, south Baffin grouping, and central Baffin grouping (Figure 1); i.e. what proportion of the population are young bulls, old bulls, cows, yearlings, and calves.
- 2) Estimate the trajectory of abundance of the three main groupings of the Baffin Island caribou population based on demographic composition. Using spring composition results, determine through a comparison between fall composition results, and where possible, similar tundra-wintering barren-ground subpopulations, if an index of calf productivity (measured as calves per 100 cows) suggests an increasing or decreasing population trend.

- 3) Monitor the proportion of bulls in the population to ensure that the bull only harvest is not reducing bulls to a proportion that could interfere with breeding (rutting) success.
- 4) Build a database with which to estimate the current population trend through demographic modeling, utilizing all demographic composition data to project a trend from the 2014 population estimate.
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## Methods

Surveys were conducted in the spring of 2021 (March 18-April 9) on Baffin Island, Nunavut. Weather and logistical constraints limited the extent of surveying to key areas where a greater chance of caribou encounters were suspected based on past telemetry studies, surveys, and IQ for the spring season (Figures 2 & 3). Surveys were conducted using a Eurocopter AS350 B2 rotary wing aircraft, and a survey crew consisting of a biologist, wildlife technician, an observer, and a pilot. Study areas were selected based on previous aerial surveys and telemetry programs, and information gathered from hunters from each of the Baffin communities during consultations conducted in 2012, 2013, 2014, and 2015 (DOE 2013, 2014, 2015a, 2015b; Jenkins and Goorts 2013). Study areas were surveyed using two to three transects evenly spaced, bisecting appropriate habitat, or until tracks were observed. The method relied on tracking groups and/or individual caribou until they were sighted; however, visual sighting methods were used when tracking was either difficult or not possible. Once tracks were observed, they were followed until the group was located. Once a group was located and individuals identified, transects through the study area would be tightened up to 1 to 2 km apart to take advantage of clustering behaviour observed during previous survey and tracking studies where many caribou groups were observed in small geographic clusters during late winter and spring. Once sighted, caribou would be classified into 5 categories; 1) Cow (based on the presence of a visible vulva patch), 2) Calf (based on body characteristics), 3) Yearling (based on body characteristics), 4) Mature Bull (based on absence of vulva patch, body characteristics and antler size) and 5) Young Bull (based on absence of vulva patch, body characteristics and antler size). When possible, image stabilizing binoculars were used to reduce approach distances as much as possible to limit disturbance to animals. In cases where groups could not be located due to fuel and/or weather-related issues, and where time allowed, tracking was resumed the following day or after refuelling, where possible.

Observations were record by hand and waypoints taken for each group using a Garmin 78S. Daily flight track logs were recorded using a Garmin 78s and a Garmin Montana 610 (as a backup). Priority was given to cow and calf observations; however, bulls were recorded when possible. Although preference was given to caribou observations, predators were documented when observed.

## Results

We flew a total of 38.4 hours in South Baffin from March 18-23, 2021 and 31.6 hours from March 30 to April 9, 2021 in North Baffin (Table 2). The South Baffin crew consisted of John Ringrose (GN), Amelie Roberto-Charron (GN), Christopher Mutch (GN), and Jason Aliqatuqtuq (Nunavut Tunngavik Incorporated). The North Baffin crew consisted of Nathan Ootoova (Mittimatalik HTO), Gordon Carl

(Panorama Helicopters) John Ringrose (GN) or Chris Mutch (GN). The aircraft used was an A-Star B2 helicopter piloted by Daniel Belanger of Panorama helicopters in South Baffin and Glen Sibbeston in North Baffin. Flights were focused in similar locations to previous spring and fall surveys (Figures 2 & 3).

**Survey dates, flight hours and conditions**

*Table 2. Survey dates and general flight locations in south and North Baffin during spring composition surveys in 2021.*

<b>Date</b>	<b>Location (general)</b>	<b>Flight Hours</b>
<b>South Baffin</b>		
March 18, 2021	Iqaluit local	6.3
March 19, 2021	Bond Inlet	8.4
March 20, 2021	No flight due to weather	
March 21, 2021	Loks Land	7.8
March 22, 2021	Hall Peninsula	8.2
March 23, 2021	McKeand River Valley	
March 24, 2021	No flight due to weather	
March 25, 2021	Markham Bay	7.7
<i>Total</i>		<b>38.4</b>
<b>North Baffin</b>		
March 30, 2021	Short flight due to weather	
March 31, 2021	No flight due to weather	
April 1, 2021	Mary river	6.6
April 2, 2021	No flight due to weather	
April 3, 2021	Mary River/Steensby Inlet	6.0
April 4, 2021	No flight due to weather	
April 5, 2021	Coats Inlet (weather delay)	3.0
April 6, 2021	Southeast of Pond Inlet	8.0
April 7, 2021	South of Pond Inlet (weather delay)	2.7
April 8, 2021	No flight due to weather	
April 9, 2021	Steensby Inlet	5.1
<i>Total</i>		<b>31.6</b>

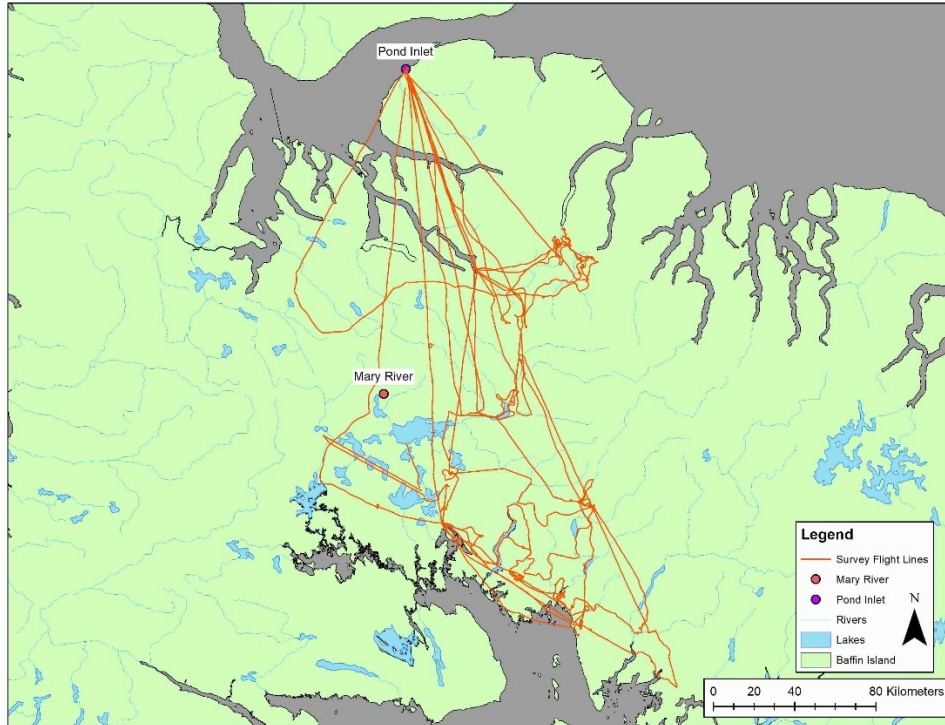


Figure 2. Composition survey flight lines in North Baffin in spring 2021.

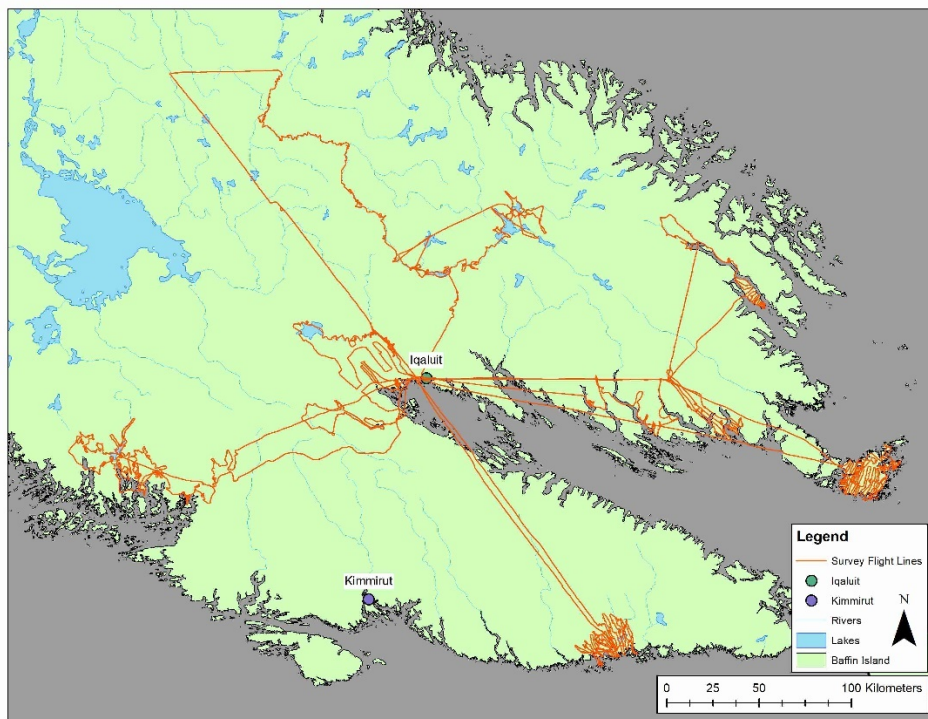


Figure 3. Composition survey flight lines in South Baffin in spring 2021.

Across the South Baffin survey area, we observed a total of 1,734 caribou and in the North Baffin survey area we observed a total of 192 caribou (bulls, cows, yearlings and calves) (Table 3). The southern survey areas were further divided into Lockland, Hall Peninsula and Meta Incognita Peninsula. The purpose of this further division was to identify regional variation in the demographics and total number of caribou observed in each area. Search effort was focused on locating cow and calf caribou and not maximizing the number of total individuals therefore the number of caribou observed is not representative of the overall population size. No wolves or wolf tracks were observed.

### Calf to Cow Ratio

In South Baffin, calf to cow ratios varied from 41 calves:100 cow in Hall Peninsula to 55 calves:100 cow in Loks Land. When all regions of south Baffin were combined the ratio was 47 calves:100 cow. In north Baffin there were 63 calves:100 cows (Table 3).

### Bull to cow Ratio

No bull to cow ratio was calculated for this survey due to preference given to locating calves and cows. Surveys completed in the fall are most effective in determining bull to cow ratios because of aggregation and mixing of the sexes at this time.

Table 3 Number of observed caribou by sex/age group during Baffin Island composition surveys in South and North Baffin 2021

Year	2021								
Season	Spring								
Location	North	Central	Prince Charles Island	Central Baffin + Prince Charles Island	South (Meta + Hall +Loks Land)	Meta Incognita Peninsula	Hall Peninsula	Loks Land	Hall + Loks Land
<b>Calves Observed</b>	55				379	220	58	100	159
<b>Cows Observed</b>	87				805	480	140	183	324
<b>Calves/100 Cows</b>	63				47	46	41	55	49
<b>Yearlings Observed</b>	6				158	92	44	22	65
<b>Bulls Observed</b>	44	not completed	not completed	not completed	392	248	108	36	130
<b>Bulls/100 Cows</b>	N/A				N/A	N/A	N/A	N/A	N/A
<b>Bull + Cows</b>	131				1197	728	248	219	454
<b>Adults + Yearlings Observed</b>	137				1355	820	292	241	519
<b>Total Observed (Calves, Yearlings and Adults)</b>	192				1734	1040	350	341	678

## Discussion

### Calf to Cow Ratio

Calf ratios can be used to indicate the likely population trend and help ensure effective management actions are used during population increases or declines. Calf recruitment is an important factor in the rate and success of population growth (Boulanger and Adamczewski 2015). It is important to compare the observed calf ratios to baseline values to determine the population trajectory. There has been little research conducted on tundra wintering caribou and as a result there is no baseline value that exists for either calf:cow ratio or bull:cow ratio for this ecotype. However, we believe until a baseline is developed for Baffin Island caribou, it is reasonable to use the baselines for taiga wintering barren-ground caribou. It has been suggested that calf:cow ratios in barren-ground caribou in the Northwest Territories can be as high 70-90 at calving, 50-70 in the fall and 30-50 following winter when populations are stable or increasing (Adamczewski et al. 2009; Tobey 2001; Gunn et al 2005).

Ratios in South Baffin, whether combined or further separated by area, were within 30-50 calves:100 cow, which suggests a stable or increasing population. Although these ratios are commonly used to indicate population trend, there is an inherent amount of risk associated with using baseline values from different populations.

Calf:cow ratios can be extremely valuable to wildlife managers when combined with multiple additional sources of information such as survival rates, Cow:Calf ratios from different seasons, distribution, harvest rates and overall population change. For example, with this information the impacts of harvest and what amount of harvest a population can withstand without declining can be determined. Unfortunately, much of this information is currently unavailable for Baffin Island.

### Limitations of the data

All types of wildlife surveys have limitations in their power to predict changes to abundance or long-term trends. Composition surveys are limited in their ability to predict short-term trends when multiple factors, such as increases in disease or overharvesting, are influencing the population structure. These same surveys, over the longer term can provide a useful index of population trend, offering a useful tool with which to determine the most effective timing of abundance estimates. Composition surveys on Baffin Island were separated by survey region (possible subpopulations), and without definitive delineations of subpopulations, it is higher risk to manage populations or base management decisions on trends at this scale. These types of long-term trends are more useful as an index to advise abundance survey frequency and timing. Identified trends must be taken with caution as sampling is completed within a relatively small geographic area. There are many factors that contribute to population growth and decline in addition to calf survival and demographics. Therefore, in order to accurately predict population growth or decline, it is important to use results from these surveys in conjunction with other sources of data, such as local knowledge, IQ and regular reconnaissance and abundance surveys.

The impact of predation is expected to be low at this time due to the limited observations or reports of wolves from hunters.

One observation of particular interest is that in recent years, locating caribou the spring has been generally easier on Meta Incognita Peninsula than on Hall Peninsula. It is unclear if this reflects a distributional shift between these areas or an increase in abundance in one region and a decrease in the

other. The impacts of shifts in distribution or changes in regional abundance can be identified using a combination of telemetry programs and abundance surveys.

### **Consultation progress**

Due to travel restrictions associated with the COVID-19 pandemic in 2020 and early 2021 there were minimal in-person consultations conducted prior to this survey. Once finalized, this report will be provided to communities and in-person consultations are expected in the Fall of 2021.

### **Management implications and next steps**

Long-term management of Baffin caribou relies on the active participation of all co-management partners. Current information gaps exist for Baffin caribou and are needed to ensure a quick and successful recovery. Although the GN has initiated a GPS collaring program on Baffin Island, there is a current lack of data available to identify changes in distribution. As previously mentioned, the adequacy of the observed calf:cow ratios to indicate population trend is unknown. However, the composition surveys and the information collected as a result is invaluable and adds to our knowledge of Baffin caribou. To assess the adequacy of Calf:cow ratios, results from composition surveys must be combined with the results of the next abundance survey. A second quantitative abundance estimate can be used to identify the change in abundance since the first estimate in 2014. Maintaining a consistent harvest and reporting regime between estimates and documenting calf:cow ratios will help identify the impact of harvest over this period.

Although composition survey results may indicate a stable or increasing population trend, it is important to use these results in combination with IQ, distribution data, and complete another abundance survey to validate the composition survey trends and ensure a successful population recovery is occurring. After a new abundance survey is completed an assessment can be made of the accuracy of the NWT baseline values as an indicator of calf productivity for Baffin Island. Once assessed the composition surveys may be a stronger tool that can be used for future management.

### **Support provided**

Hunters and Trappers Organizations (HTOs) provided valuable local knowledge and locational information that contributed to the success of this survey. A special thanks to Jason Aliqatuqtuq from Nunavut Tunngavak Inc. (NTI) and our pilot Daniel Belanger. Financial support was provided by Nunavut Wildlife Management Board (NWMB). In-Kind and logistical support was provided by DeBeers.

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