

Executive Summary

Barren-ground caribou (*Rangifer tarandus groenlandicus*) occur across Baffin Island and are believed to be distributed 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 estimated abundance of caribou reported in the 1990s, largely based on Inuit Qaujimagatuqangit (IQ).

The 2014 survey results, combined with community-based observations and IQ, 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 Nunavut Wildlife Management Board (NWMB), recommending the establishment of a TAH for caribou on Baffin Island, a decision was reached to establish a Total Allowable Harvest (TAH) of 250 male caribou. Following the 2015 decision, continued consultations and discussions with Baffin Hunters and Trappers Organizations (HTOs) and the Qikiqtaaluk Wildlife Board (QWB) suggested that abundance across Baffin Island was increasing. In response to these discussions and resulting submissions from the QWB and the DOE, the NWMB implemented an increase to the TAH from 250 to 350 for the 2022-2023 harvest season. Followed by annual increases to the TAH of 50 for the next 8 years or until there is new information available.

Since the 2014 survey, the DOE has conducted fall and/or spring aerial composition surveys from 2015 to 2022 as a means to monitor productivity and monitor relative densities of caribou within specific areas across Baffin Island.

In the spring of 2022, we classified 2,641 caribou (bulls, cows, yearlings, and calves) within high-graded search areas in southern Baffin Island. Calf:cow ratios for south Baffin varied from a low of 49 calves:100 cows on Hall Peninsula to a high of 61 calves:100 cows on Loks Land (Southeastern Hall Peninsula), suggesting good productivity in south Baffin in the spring of 2022. All the selected areas of south Baffin combined or separated, produced ratios within or above the suggested 30 calves per 100 cow baseline for stability within taiga-wintering barren-ground caribou on mainland Nunavut. Although results suggest good productivity, there is still some risk associated with using baseline values from taiga-wintering populations to identify population trend in tundra-wintering caribou until there another abundance survey has been completed for verification of their applicability.

Additional findings included a potential distributional shift eastward within one the most extensive grouping of south Baffin caribou on the Meta Incognita Peninsula. These observations were based on the presence of fresh tracks, clearly showing a large directional movement of caribou out of areas showing evidence of heavy winter use to an area of higher elevation and deep snow. This type of movement event highlights the importance of telemetry collar data to track these types of novel movements, and account for them within research and management strategies. Without this kind of real-time geographic data, the development of effective research programs and management goals, can be extremely challenging.

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 mainland migratory ecotypes, particularly when their abundance is low.

Though there has been relatively limited long-term scientific research conducted on Baffin Island caribou, most have occurred 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 Qaujimajatuqangit (IQ) that depicts the long-term population and distributional trends for the region. Additionally, in recent years there has been extensive investment and effort put into monitoring Baffin caribou recovery.

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 Baffin Island telemetry (collar) data was analyzed by Campbell et al. (2015), there was supporting evidence found that subpopulation structure likely exists on Baffin Island. However, without long-term spatial data, necessary to confirm and monitor the geological and temporal extents of this apparent demographic structure, we have no way of knowing if these earlier associations persist through abundance cycling, and/or spatially change through time. Instead, spatial affiliations are referred to as “groupings” until further information can be collected. Further research is required to delineate specific groupings and/or subpopulations of Baffin Island caribou and monitor their range use range. This is due to variation in habitat use and distribution at different abundances, the need to ensure future population assessments can be focused on areas of importance, validated by both IQ and science, and focus on managing impacts with Industrial developments and infrastructure. To aid in identifying the presence of these subpopulations, the DOE initiated a GPS telemetry program in North Baffin beginning in March 2021 and had planned to expand the project to south and central Baffin in 2022 but was subsequently cancelled due to Covid related cancellations.

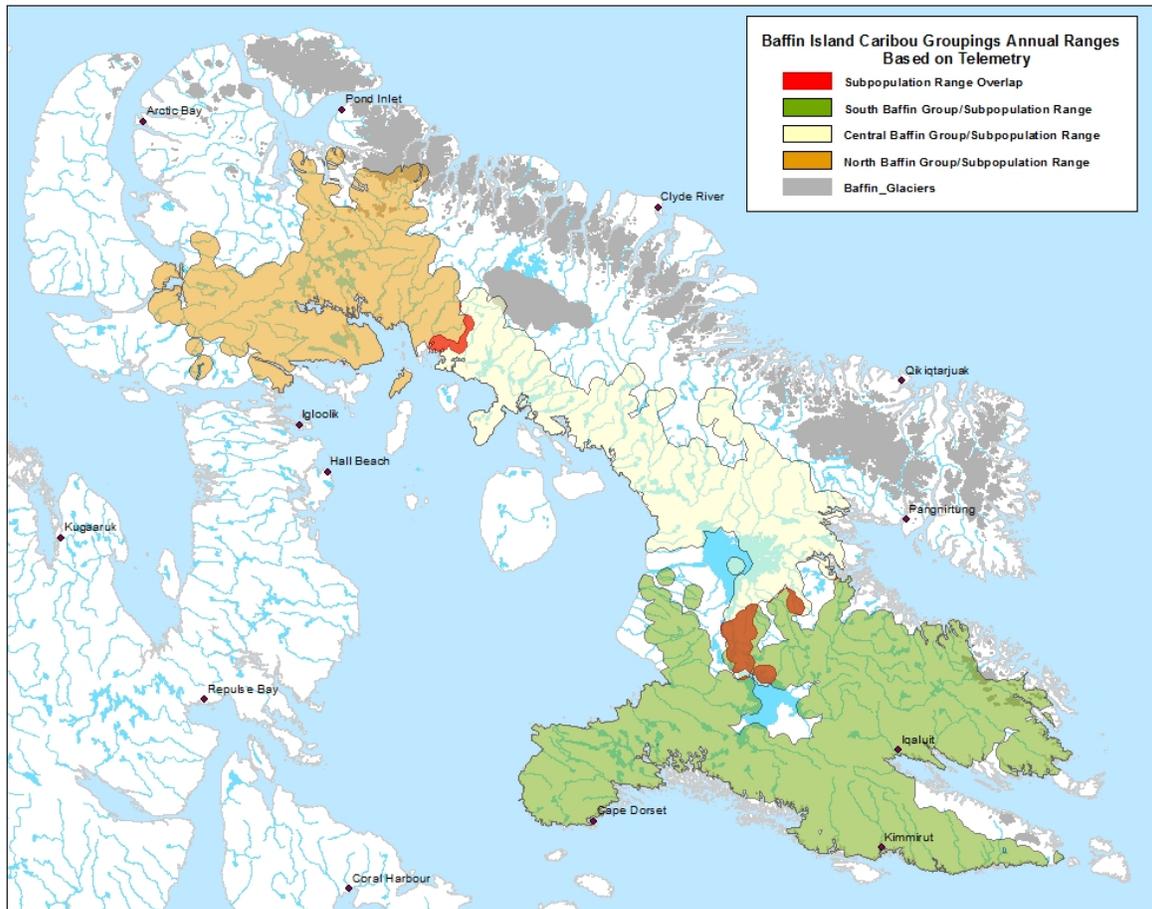


Figure 1. Caribou grouping annual range delineation based on telemetry studies from 1987 to 1994 (primarily South Baffin), and 2008 to 2011 (North Baffin). Polygons created utilizing a kernel analysis (See methods) of telemetry point data collected for 107 collars (North=35; Central = 17; South = 55).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

Local hunters and trappers Organizations, and community members as a whole 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 reached 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. In 2022 the Nunavut Wildlife Management Board (NWMB) implemented an increase to the TAH from 250 to 350 for the 2022-2023 harvest season and increases of 50 each year for the next 8 years or until there is new information available. The decision to increase the TAH was based on recent discussions, and ongoing consultations with Baffin HTOs and the QWB, both of which suggested that abundance across Baffin Island was increasing. Though GN DOE research results couldn't definitively confirm an increase, results did show increases in area-specific relative densities of caribou, most notably within the South Baffin. Following the NWMB approved increase, community specific allocations were then allocated 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 ¹	Central Baffin ²	South Baffin ³	North Baffin ¹	Central Baffin ²	South Baffin ³		
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	72	77	101	250	21
2022/23	350	105	101	144	63	48	128	239 ⁴	17

* 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.

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

²Central Baffin allocation divided between communities of Clyde River, Pangnirtung and Qikiqtarjuaq.

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

⁴As of October 17, 2022

Since the 2014 survey the DOE has conducted fall and/or spring aerial composition surveys from 2015-2022, excluding spring of 2020, 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 area specific relative densities 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 productivity trend through demographic modeling, to act as an index of population trend.
- 5) Provide information to inform management actions (including TAH) and monitoring plans and intensity.

Methods

The most recent composition surveys were conducted in the spring of 2022 (March 19-April 8) on Southern 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 (Figure 2). Surveys were conducted using a Eurocopter AS350 B2 rotary wing aircraft, and a survey crew consisting of a biologist, two local Inuit observers, 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 known 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 to limit disturbance to animals. In cases where groups could not be located due to fuel and/or weather-related issues, and when time allowed, tracking was resumed the following day or after refuelling.

Observations were recorded 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 67.6 hours in South Baffin from March 19-April 8, 2022 (Table 2). Substantial weather delays were encountered during the survey period which reduced the overall flyable hours due to cost implications of non-flying days. The crew consisted of John Ringrose (GN- Wildlife Biologist), Jason Aliqatuqtuq (GN-Director of Wildlife Operations) and an HTO selected observer. The aircraft used was an A-Star B2 helicopter piloted by Glen Sibbeston (March 19-21) or Francis Mathieu (March 29-April 8) of Panorama helicopters. Flights were focused in similar locations to previous spring and fall surveys (Figure 2).

Survey dates, flight hours and conditions

Table 2. Survey dates and general flight locations in South Baffin during spring composition surveys in 2022

Date	Location (general)	Flight Hours
South Baffin		
March 19, 2022	Markham Bay	7.4
March 20, 2022	Lower Mckeand River	7
March 21, 2022	Iqaluit local/ Hall Peninsula	3
March 29, 2022	Iqaluit local/Meta Incognita Peninsula	3.2
March 30, 2022	Weather Day	0
March 31, 2022	Weather Day	0
April 1, 2022	Weather Day	0
April 2, 2022	Iqaluit local/ Hall Peninsula	5.2
April 3, 2022	Iqaluit local/Meta Incognita Peninsula	3.2
April 4, 2022	Bond Inlet	8.6
April 5, 2022	Hall Peninsula	7.6
April 6, 2022	Upper McKeand River/ Amadjuak Lake	6.3
April 7, 2022	Meta Incognita Peninsula	9.1
April 8, 2022	Loks Land	7
<i>Total</i>		67.6

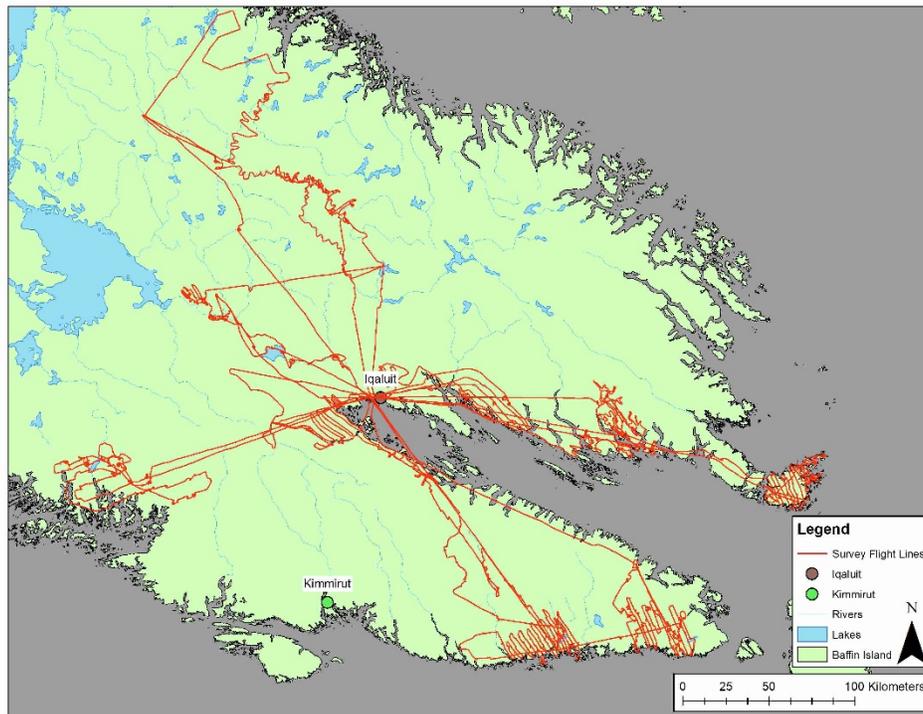


Figure 2. Composition survey flight lines in South Baffin in spring 2022.

Across the South Baffin survey area, we observed a total of 2,641 caribou (bulls, cows, yearlings and calves) (Table 3). The southern survey area was 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. A conscious effort was made to leave a reasonable distance between observations from previous days to reduce the likelihood of double counts. No wolves or wolf tracks were observed.

Calf to Cow Ratio

In South Baffin, calf to cow ratios varied from 49 calves:100 cow in Hall Peninsula to 61 calves:100 cow in Loks Land. When all regions of south Baffin were combined the ratio was 54 calves:100 cow (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 during the rut.

Table 2 Number of observed caribou by sex/age group during Baffin Island composition surveys in South and North Baffin 2022

Year	2022								
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
Calves Observed	not completed	not completed	not completed	not completed	618	376	133	109	242
Cows Observed					1137	686	271	180	451
Calves/100 Cows					54	55	49	61	54
Yearlings Observed					212	116	47	49	96
Bulls Observed					674	394	241	39	280
Bull + Cows					1811	1080	512	219	731
Adults + Yearlings Observed					2023	1196	559	268	827
Total Observed (Calves, Yearlings and Adults)					2641	1572	692	377	1069

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 provide an index of 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 as a general guide. 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 close to or above 50 calves:100 cow, within all regions suggesting a stable or increasing population. Since 2015 the calf:cow

ratios in South Baffin have been above the suggested ratio of 30 calves:100 cows including Hall Peninsula. However, Hall Peninsula consistently has the lowest observed densities, and even with increased effort between years we have not been able to detect any relative changes in observed densities of caribou. It is unclear why the calf:cow ratio in Hall Peninsula is consistently the lowest. 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 as well as from using productivity to determine trend without understanding survival rates.

Calf:cow ratios can be extremely valuable to wildlife managers when combined with additional sources of information such as survival rates, Calf:cow ratios from different seasons, distribution, harvest rates and overall population change. For example, without this information the impacts of harvest and what amount of harvest a population can withstand without declining can not be accurately determined. Unfortunately, much of this information is currently unavailable for Baffin Island.

Limitations of the data

Wildlife surveys have limitations in their power to predict changes to abundance or long-term trends as they are a snapshot of the point in time at which the research was done. 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 an index of population trend and offer a useful tool with which to determine the most effective timing of abundance estimates. Composition surveys on Baffin Island were separated by survey study areas (possible subpopulations) identified in the most recent assessment of existing telemetry data. We suggest that it would be very risky to base survey study areas and extents, management decisions and objectives, or assess risks from industrial development, without confirmation if subpopulations exist on Baffin Island and their seasonal ranges and movements. Using composition studies to assess long-term trends, represents a useful index to advise abundance survey frequency and timing, rather than to quantify abundance of Baffin Island caribou. Identified trends must be used with caution as sampling is completed within a relatively small geographic area that may not be representative of the entire range of Baffin Island caribou. 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 composition surveys in conjunction with other sources of data, such as local knowledge, IQ and regular reconnaissance and abundance surveys. Regarding predation effects, we suggest that the impact of predation as assessed during the years of composition studies will be low based on the limited observations of wolves during surveys, or reports of wolves from hunters.

One observation of particular interest is that in recent years during spring, caribou have been easier to find 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 and/or decrease in the other. The impacts of shifts in distribution or changes in regional abundance can and should be identified using a combination of telemetry programs and abundance surveys.

Additional findings included a potential distributional shift eastward within one the more extensive groupings of south Baffin caribou on the Meta Incognita Peninsula (Figure 3). These observations were based on the presence of extensive linear networks of fresh tracks, clearly showing a large movement of caribou into higher elevations and deep snow with little apparent forage. Three days had elapsed, so it

was unclear if caribou observed on April 7 originated in the Bond inlet area and were previously identified on April 4. Therefore, it is unclear whether this shift in distribution caused double counting of caribou which may ultimately cause inaccurate calf:cow ratios on the Peninsula. After this observation was made we flew to the west and back toward the Bond Inlet area and documented caribou still in this area, but it was unclear what proportion if any had moved into the survey area for April 7. This type of movement event highlights the importance of telemetry collar data to track these types of novel movements, and account for them within research and management strategies. Without this kind of real-time geographic/movement data, the development of effective research programs and management goals, can be extremely challenging.

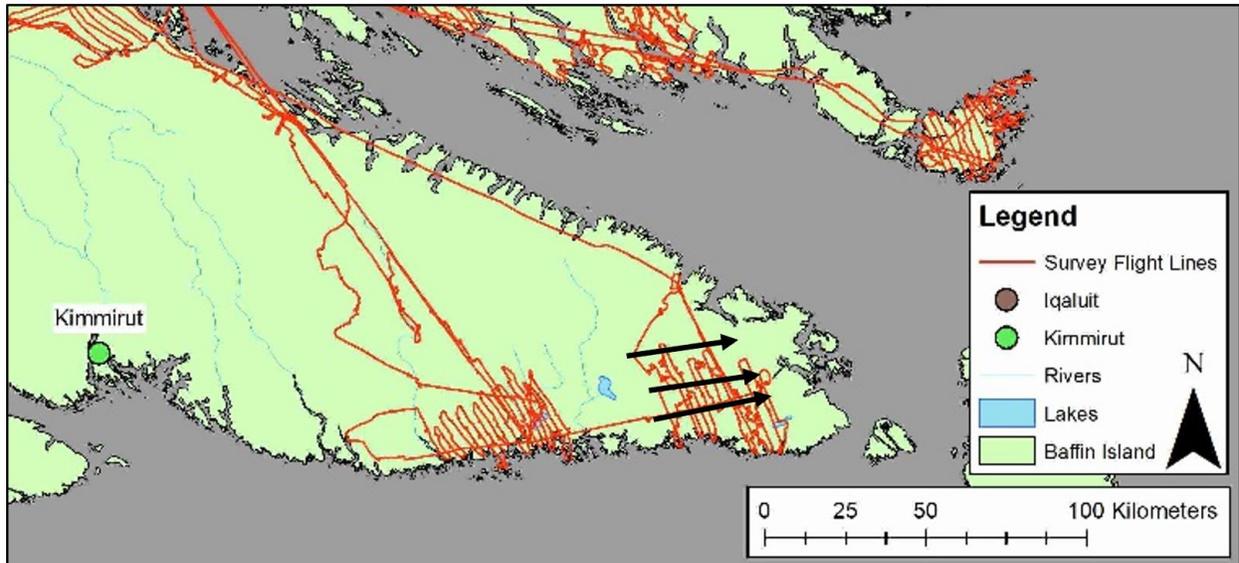


Figure 3. Composition survey flight lines in South Baffin in spring 2022. Black arrows show direction of movement determined by presence of fresh tracks.

Consultation progress

Due to travel restrictions associated with the COVID-19 pandemic in 2020, 2021 and 2022 there were minimal in-person consultations conducted prior to this survey. In-person consultations were planned and attempted on 4 separate occasions during 2021 and early 2022 but were ultimately canceled due to logistical constraints and Covid-19 travel restrictions. We completed consultations by teleconference and video conference prior to the spring survey and completed follow-up consultations throughout the summer of 2022. Once finalized, this report will be provided to communities and in-person consultations planned for fall 2022 and/or winter of 2023.

Management implications and next steps

Long-term management of Baffin caribou relies on the active participation of all co-management partners if we are to ensure a quick and successful recovery. Information gaps continue to persist for Baffin caribou, gaps that could lead to conservation risks moving forward. Although the GN has initiated a GPS collaring program in the north Baffin grouping of Baffin Island caribou, data is still lacking in south and central Baffin.

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 abundance survey data 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 our pilots Glen Sibbeston and Francis Mathieu. Financial support was provided by Nunavut Wildlife Management Board (NWMB). In-Kind and logistical support was provided by DeBeers.

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