

Baffin Island Caribou Spring Composition Survey Report 2019

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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 lead 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 2019 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 2019, we classified 1,584 caribou (bulls, cows, yearlings, and calves) on southern Baffin Island. Calf:cow ratios for South Baffin were varied from the lowest ratio of 42 calves:100 cows on Hall Peninsula to the highest ratio of 69 calves:100 cows on Loks Land, suggesting good productivity in the

spring of 2019. All regions combined or otherwise, 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. The regional variation in calf:cow ratios between relatively close areas highlights the importance of surveying multiple regions to determine trends in productivity.

To effectively monitor and manage the successful recovery of caribou on Baffin Island, there are many additional pieces of information required. These include: 1) The total harvest between the 2014 population estimate and the 2019 spring composition survey (legal and illegal), 2) Multiple year estimates of recruitment (over winter calf survival), 3) Productivity and sex ratio trends for the different sampling areas, and 4) Overall health of caribou within the different survey regions.

Delineation of caribou groups on Baffin Island would allow management and monitoring to occur at smaller scales, specific to group/subpopulations. A Global Positioning System (GPS) telemetry program would greatly increase the effectiveness of composition surveys and could provide the information required to delineate subpopulations/groupings of caribou on Baffin.

Table of Contents

Introduction	4
Methods	6
Results	8
Discussion	10
Limitations of the Data.....	11
Consultation Progress	11
Management Implications and Next Steps.....	12
Support Provided	13
Literature Cited	14

Introduction

Caribou on Baffin Island 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 remain on Baffin Island and ancillary Islands year round and are therefore 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 in smaller groups than the taiga wintering ecotypes, particularly when their numbers are low.

There has been limited scientific research conducted on Baffin Island caribou, however, 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). However, further research is required to delineate specific groupings and/or subpopulations across Baffin Island.

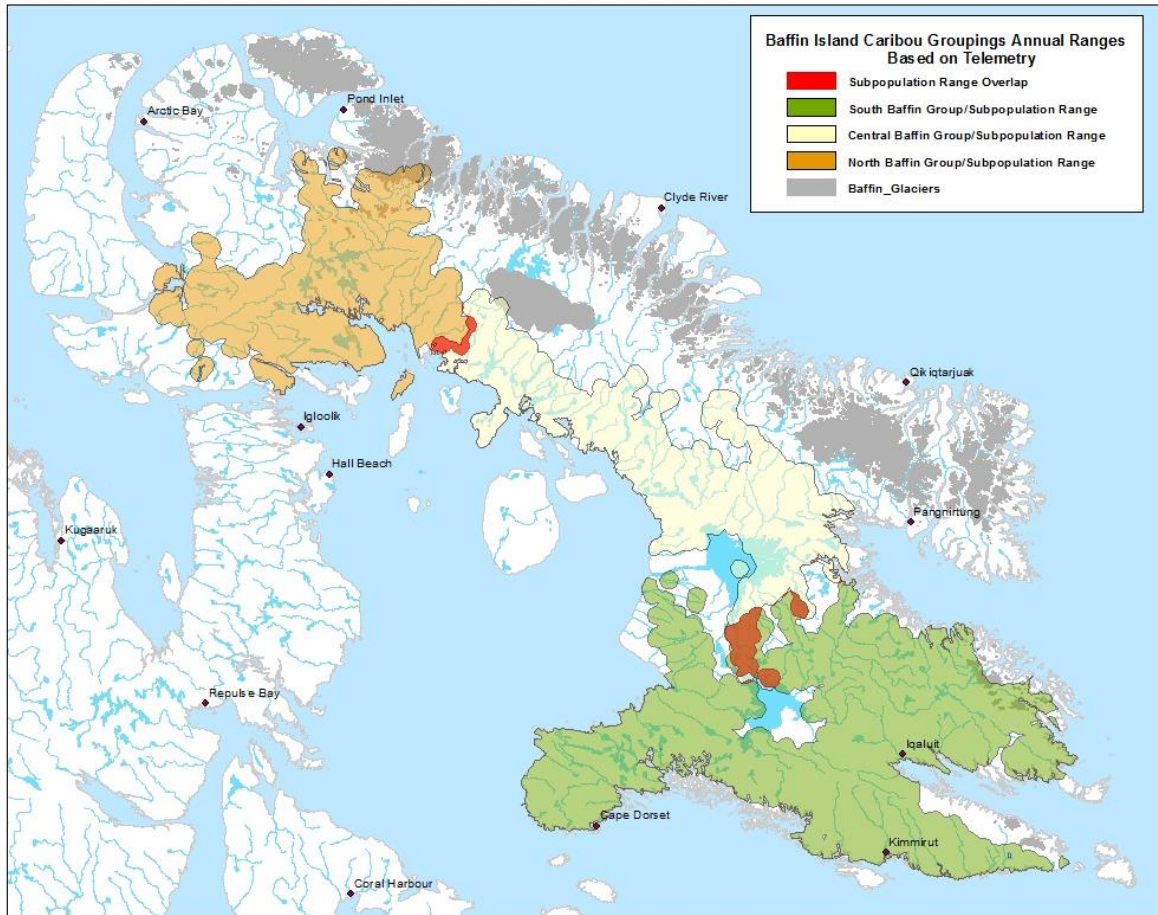


Figure 1. Caribou grouping annual range delineation based on telemetry studies from 1987 to 1994 (primarily South Baffin), and 2008 to 2011 (North Baffin). Polygons created utilizing a kernel analysis (See methods) of telemetry point data collected for 107 collars (North=35; Central = 17; South = 55). Excerpt from Campbell et al. 2015. Used to identify survey area during 2015-2019 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). The survey identified the estimated number of caribou within different geographic locations, including North and South Baffin Island, Baffin Island as a whole, Baffin Island and its ancillary islands, and 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 was implemented by the Nunavut Wildlife Management Board (NWMB) in 2015. The total number of male-only tags allocated to the communities of Baffin Island were 170 in 2015/2016 and 250 in 2016 to present. Allocations of the 250 tags to Baffin communities are controlled by the Qikiqtaaluk Wildlife Board (QWB) and can vary.

Since the 2014 survey the DOE has conducted fall and/or spring aerial composition surveys from 2015-2019 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.

Methods

Surveys were conducted in the spring of 2019 (March 27-April 15) 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 in South Baffin 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 HTO (Hunters and Trappers Organization) appointed 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 12 Baffin communities during consultations conducted in 2012, 2013, 2014, and 2015 (DOE 2013, 2014, 2015a, 2015b; Jenkins and Goorts 2013). Refinement of survey locations was completed based on advice from the HTO observers prior to and during the survey flights. Refined survey study areas were flown through using two to three transects evenly spaced, bisecting riparian habitat, or until a track was sighted. The method mainly 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 sighted, they would be followed until the group was sighted. Once a group was sighted, 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, 2) Calf, 3) Yearling, 4) Mature Bull and 5) Young Bull. We used image stabilizing 14X binoculars to reduce approach distances as much as possible to limit disturbance to animals, however, in the spring of 2019 the binoculars were damaged early in the survey so identifications required closer approach distances to obtain accurate composition data. 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.

Results

We flew a total of 61 hours in South Baffin from 27 March-15 April 2019. Flights were focused in similar locations to previous spring and fall surveys (Figure 2). We observed a total of 1,584 caribou (bulls, cows, yearlings and calves) (Table 1).

Considering the high number of caribou observed within the south Baffin grouping, we suggest the number of caribou observed is sufficient to address our main objectives. With increased sample effort and spatial coverage, more individuals would have been observed, however the current method of high-grading/target areas with high encounter rate probability has been effective and efficient and we suggest continued use of this method.

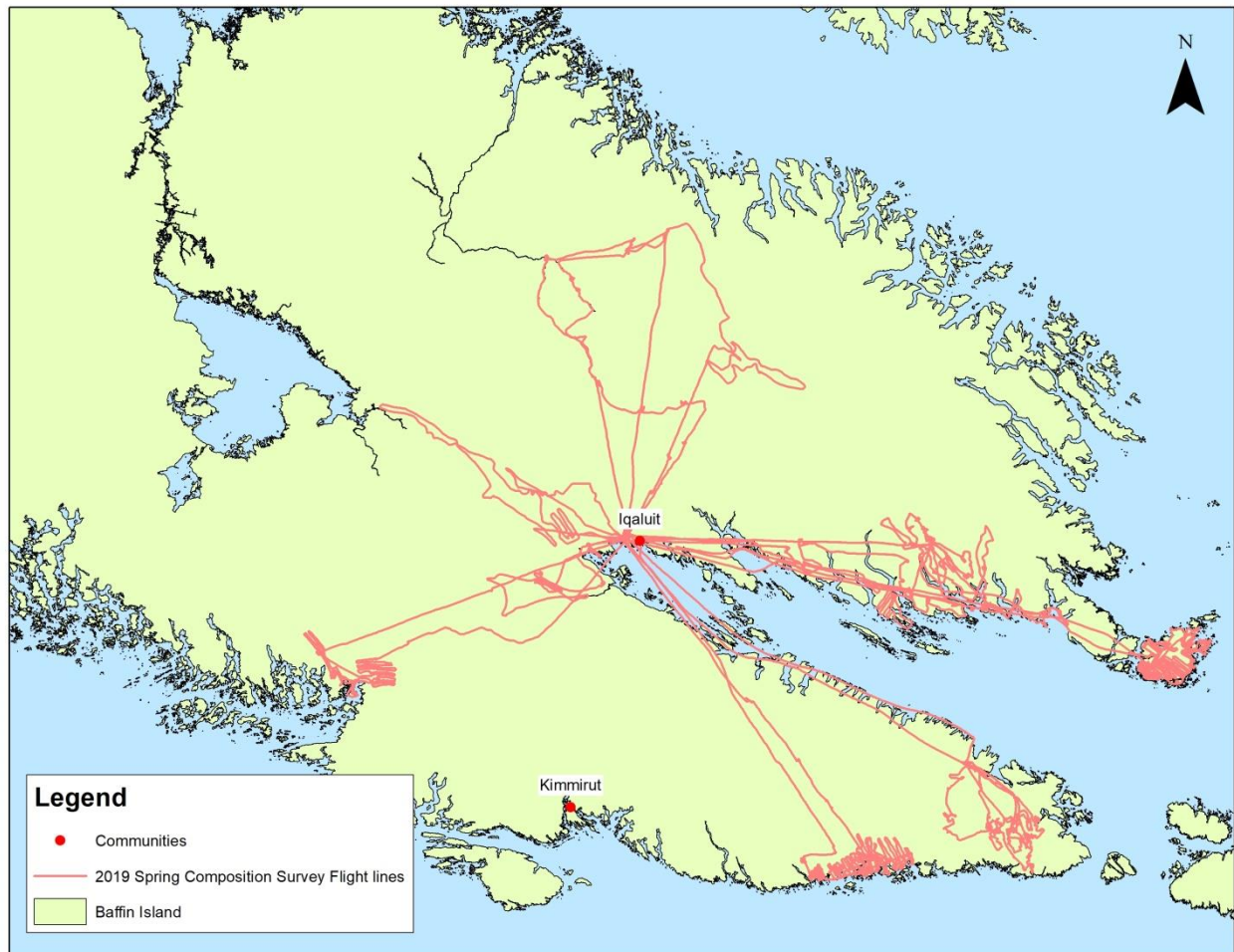


Figure 2. Baffin Island Composition Survey flight lines 2019 in the South Baffin survey area. Search areas based on “high grading” historically and recently known areas with seasonally high to moderate densities of caribou. South Baffin survey area is based on Campbell et al. 2015 (Figure 1).

Table 1 Number of observed caribou by sex/age group during Baffin Island composition surveys in South Baffin 2019.

Year	2019								
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
<i>Calves Observed</i>	not completed	not completed	not completed	not completed	347	203	71	73	144
<i>Cows Observed</i>					664	388	170	106	276
<i>Calves/100 Cows</i>					52	52	42	69	52
<i>Average Group Calves/100Cows</i>					62	63	42	88	61
<i>Yearlings Observed</i>					108	69	22	17	39
<i>Bulls Observed</i>					465	317	116	32	148
<i>Bulls/100 Cows</i>					N/A	N/A	N/A	N/A	N/A
<i>Bull + Cows</i>					1129	705	286	138	424
<i>Adults + Yearlings Observed</i>					1237	774	308	155	463
<i>Total Observed (Calves, Yearlings and Adults)</i>					1584	977	379	228	607

Discussion

Calf recruitment is an important factor in the assessment of population growth for caribou (Boulanger and Adamczewski 2015). Calf:cow ratios can indicate general trends in abundance population trends which in turn provides important information for effective population monitoring and management. It is important to compare the observed calf:cow ratios to baseline values of similar barren-ground caribou populations to determine the population trajectory. There has been little research conducted on tundra-wintering caribou and as a result there is no directly comparable baseline value that exists for either calf:cow ratio or bull:cow ratio for this ecotype. However, we believe until such a baseline is developed for Baffin Island caribou, it is reasonable to use the baselines for taiga wintering barren-ground caribou as a guide. Previous studies suggest that calf:cow ratios in barren-ground caribou can be as high 70-90 calves:100 cows at calving, 50-70 calves:100 cows in the fall and 30-50 calves:100 cows following winter (Adamczewski et al. 2009; Tobey 2001; Gunn et al 2005). These same studies further suggest that spring calf/cow ratios in excess of 30 calves per 100 cows represents an increasing population, and anything under that ratio, a decreasing population. There is an inherent amount of risk associated with using baseline values from a different population and therefore these composition baselines, when used with Baffin Island caribou, should be treated with caution.

Surveys were not completed in South Baffin in the fall of 2018 and therefore estimating the overwinter survival compared to fall ratios is not possible. Due to weather and logistical constraints, some areas had less than desired coverage. As a result, the identification of regional variation in calf:cow ratios in the south Baffin survey area is reported as calf:cow ratios for each of Hall Peninsula, Loks Land and ancillary islands, and Meta Incognita Peninsula (Table 1). Ratios are reported in two different ways; 1) as an average calf:cow ratio for all calves and cows in a particular region; 2) an average calf: cow ratio for observed groups.

Spring calf:cow ratios were 52 calves per 100 cows, 42 calves per 100 cows, and 69 calves per 100 cows on Meta Incognita Peninsula, Hall Peninsula, and Loks Land, respectively. Similarly, average group calf:cow ratios were 63 calves per 100 cows, 42 calves per 100 cows, and 88 calves per 100 cows on Meta Incognita Peninsula, Hall Peninsula and Loks Land. Combining Hall Peninsula and Loks Land resulted in a ratio of 52 calves per 100 cows. Combining all results from spring 2019 resulted in a calf:cow ratio of 52 calves per 100 cows. All regions combined or otherwise, produced ratios within or above the suggested 30 calves per 100 cow baseline, which suggests an increasing population in South Baffin. However, there is risk associated with using baseline values from taiga-wintering populations to identify population trend in tundra-wintering populations.

During spring composition surveys in 2018, the calf:cow ratio for South Baffin was 39 calves per 100 cows, which when compared to spring 2019 results, suggests improved calf survival in 2019. In fact, the spring of 2019 had the highest calf:cow ratio in southern Baffin in the past 4 years.

Of particular interest are regional variations in calf:cow ratio on Hall Peninsula. Although being in relatively close proximity (approximately 100 km apart), calf:cow ratios on Hall Peninsula were 42 calves per 100 cows, whereas the ratio was 68 calves per 100 cows on Loks Land. The regional variation becomes more

evident when comparing the average group calf: cow ratio; 42 calves per 100 cows and 88 calves per 100 cows on Loks Land, and Hall Peninsula, respectively. This difference in calf:cow ratios between relatively close areas highlights the importance of surveying multiple regions to determine an overall trend in productivity.

Limitations of the data

The calf:cow ratios we report from this study should not be taken out of context and applied to the population across Baffin Island in its entirety. A second abundance survey is needed to verify observed trends and the applicability of the taiga wintering caribou baseline values. To limit seasonal and sampling variability, trend indices require long term data sets and therefore caution should be taken until more years of data have been collected.

Since survey areas are being high graded to locations where the highest concentration of caribou are expected, it is possible that seasonal variation in productivity may be influenced by survey timing and location. Therefore, the total number of caribou observed in 2019 could be skewed by large aggregations of caribou that were missed the previous year. Our ability to determine the best areas to conduct these composition surveys would be greatly improved with information collected using a Global Positioning System (GPS) telemetry program.

Because composition surveys mainly provide demographic proportions and indices of productivity, they are limited in their ability to predict short-term trends, particularly when there are external factors, such as disease or overharvest, which influence mortality of age classes other than calves. Over the longer-term, these surveys can provide a useful index of population trend, offering a tool with which to determine the most effective timing of the more costly abundance estimates.

Given that regional variations in calf:cow ratios were observed over relatively short distances (less than 100 kms), and that some evidence supports different groupings or subpopulations across the island, it would be unwise to manage island-wide populations on trends observed at this scale. Trends observed in South Baffin are likely not reflective of trends in North Baffin (1000 kilometres away). Instead, long-term trends should be used as an index to inform on the necessity of abundance surveys, and influence their frequency and timing. Trend assumptions must be taken with caution as sampling is completed within few, relatively small geographic areas. There are also many other factors, in addition to productivity (calf:cow ratios), that contribute to population growth and decline. In order to accurately predict population growth or decline, it is important to use results from these surveys in conjunction with other data driven indices, such as local knowledge, IQ, and semi-regular reconnaissance and abundance surveys.

Consultation progress

HTO consultations are being planned for the fall of 2019 to inform HTOs of the results from the 2019 spring composition surveys on Baffin Island. The intent of these discussions is to inform HTOs of yearly variation in calf:cow ratios as an index for calf survival and associated trends.

Management implications and next steps

There has been relatively limited research on Baffin Island caribou so there are many areas where additional information could be collected through IQ and scientific studies. One limitation to effective caribou management on Baffin Island is the large spatial extent, greater than 500,000 km², of the island. There has been some indication based on IQ, and supported by early telemetry surveys, that Baffin Island caribou form distinct herds or subpopulations, but this delineation has not been verified. If in fact there are distinct caribou herds on Baffin, survey efforts could more efficiently focus their limited resources and timing windows on smaller spatial and temporal scales, ultimately increasing survey effectiveness and decreasing costs associated with monitoring. Successful delineation of caribou groups on Baffin Island would also allow the use of different management techniques and recommended actions, specific to the group/subpopulation being identified. If the suggested delineations are confirmed, harvesting pressure could be allocated proportionally with higher allocations to populations with greater abundance, providing groups with lower populations some relief from excessive harvesting pressure. Shifting harvest pressure will allow faster recovery of groups with low abundance. The most effective method to delineate subpopulations/groupings on Baffin Island would be to utilize GPS tracking collars. Additionally, GPS tracking of caribou would provide valuable information on seasonal movement patterns and key habitats for behaviours such as calving, to help all stake holders have critical information for land use planning, environmental assessment, and wildlife management processes.

Calf productivity, recruitment (over-winter survival), and adult sex ratios can vary by season, and sampling region. Continued island-wide sampling is essential to determine long-term trends and population trajectory. In the absence of a multi-year satellite collaring program or second abundance estimate, additional composition surveys should be completed to determine the long term trend of Baffin Island caribou. Regular aerial reconnaissance surveys should also be considered as a best practice; however, in the absence of a collaring program these surveys could be excessively expensive, and possibly ineffective.

Barren-ground caribou on Baffin Island have experienced a cyclical pattern of abundance lasting 60-80 years from highs through to the current low. Presently, the population is believed to be at the low cycle with recovery expected to take approximately 30-50 years (Ferguson et al. 1998). Caribou on Baffin Island will likely face different factors during recovery that have not been faced previously, including; climate change, increased industrial development, increased harvest pressure and success due to advances in snowmobile technology and navigation, and the establishment of additional road corridors (Campbell et al 2015). In order to effectively monitor and manage the successful recovery of caribou on Baffin Island, there are many key pieces of information required. These include: 1) The total harvest between the 2014 population estimate and the 2019 spring composition survey (legal and illegal), 2) Multiple year estimates of recruitment (over winter calf survival), 3) Productivity and sex ratio trends for the different sampling areas, and 4) Overall health of caribou within the different survey regions. The results of the past 4 years of composition surveys have been extremely helpful in allowing us to begin to understand the basic population dynamics of the Baffin Island caribou groups, however, much more needs to be done if we are to effectively steer harvest management into recovery.

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 volunteer observers Moses Kilabuck, Davidee Qaumariaq, Levi Qaumariaq, Drikus Gissing, and our pilot Daniel Belanger. Amaruq HTO was particularly helpful this year and without their support, we would not have had such high quality HTO observers.

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