Government of Northwest Territories
Gouvernement des Territoires du Nord-Ouest

MARCH 2020 LATE WINTER COMPOSITION SURVEYS OF BATHURST, BLUENOSE-EAST AND BEVERLY BARREN-GROUND CARIBOU HERDS

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Environment and Natural Resources
Government of Northwest Territories

October 2020

Manuscript Report No. 283

ABSTRACT

This report describes the results of late-winter composition surveys of the Bathurst, Bluenose-East and Beverly barren-ground caribou herds conducted in March 2020. The main purpose of these surveys was to estimate the proportion of females in the herd that were still accompanied by a calf, which is an index of calf survival through the first nine to ten months of life.

Flying was carried out on March 8, 9, 10, 12 and 13, 2020 with a total of 33.5 hours flown. The survey crew of Judy Williams, Jan Adamczewski and pilot Tom Frith flew in an A-Star helicopter operated by Great Slave Helicopters Inc. In general, weather was good during the survey with mostly blue skies and good light conditions. The survey was focused on flying to locations of female and male collared Bathurst, Bluenose-East and Beverly caribou, and classifying caribou (cows, calves, young bulls and prime bulls) nearby. Caribou were classified using motion-stabilized binoculars from the helicopter.

For the Bathurst herd, surveying in areas with only Bathurst collars resulted in an estimated ratio of 30.4 calves: 100 cows (95% confidence interval (CI) upper 35.0, lower 28.5), based on 1,384 caribou in 55 groups. This ratio was similar to the ratio of 32.0 calves: 100 cows estimated in early November 2019 in this herd. Overall, the results for the Bathurst herd from June 2019 to March 2020 suggested that initial productivity was high in June (86.0% breeding cows), but well over half these calves had died by fall, and over-winter calf survival was relatively high. Overall Bathurst calf survival 2019-2020 to nine to ten months was moderate, but insufficient for a stable herd at recently estimated cow survival rates of 78-82%.

For the Bluenose-East herd, the survey focused in areas with only Bluenose-East collars north of Wekweètì, resulted in an estimated ratio of 41.8 calves: 100 cows (95% CI Upper 45.2, Lower 38.6), based on 2,123 caribou in 74 groups. This ratio was similar to the ratio of 37.8: 100 cows estimated in November 2019 in this herd. The results for June 2019 to March 2020 suggested there was high initial productivity (87.5% breeding cows), about half or more of the calves had died by fall, and over-winter calf survival was relatively high. Overall Bluenose-East calf survival to nine to ten months was better than in the Bathurst herd, however at recently estimated Bluenose-East cow survival rates of 72-79%, a calf:cow ratio of 41 calves: 100 cows would not be sufficient for a stable population.

An area mostly south and east of Wekweètì had a number of mixed Bluenose-East and Bathurst collars. The estimated calf:cow ratio of 31.8: 100 cows (95% CI Upper 35.3, Lower 28.5) based on 1,603 caribou in 90 groups in this area was very similar to the ratio estimated for Bathurst-only collared caribou. As this mixed area contained a portion of the

Bluenose-East herd and the calf:cow ratio was substantially lower than in the area further north that had only Bluenose-East collars, this may indicate that the herd-wide Bluenose-East calf:cow ratio was slightly less than 41.8 calves: 100 cows.

For the Beverly herd, a ratio of 45.4 calves: 100 cows (95%CI Upper 49.0, Lower 42.2) was estimated based on 3,611 caribou in 47 groups, which suggested very good calf recruitment in at least part of this herd 2019-2020. The areas flown included less than half of the existing collars (12 of 29) on the Beverly herd at the time of the survey, thus the results should be used with caution.

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INTRODUCTION

The Bathurst and Bluenose-East caribou herds have calving grounds west of Bathurst Inlet (Bathurst) and west of Kugluktuk (Bluenose-East) in Nunavut (NU), with portions of the summer range in NU and the remainder of the ranges in the Northwest Territories (NWT) (Figure 1). The Beverly[1] herd has a calving ground in the Queen Maud Gulf lowlands and also has much of its range in NU and the NWT.

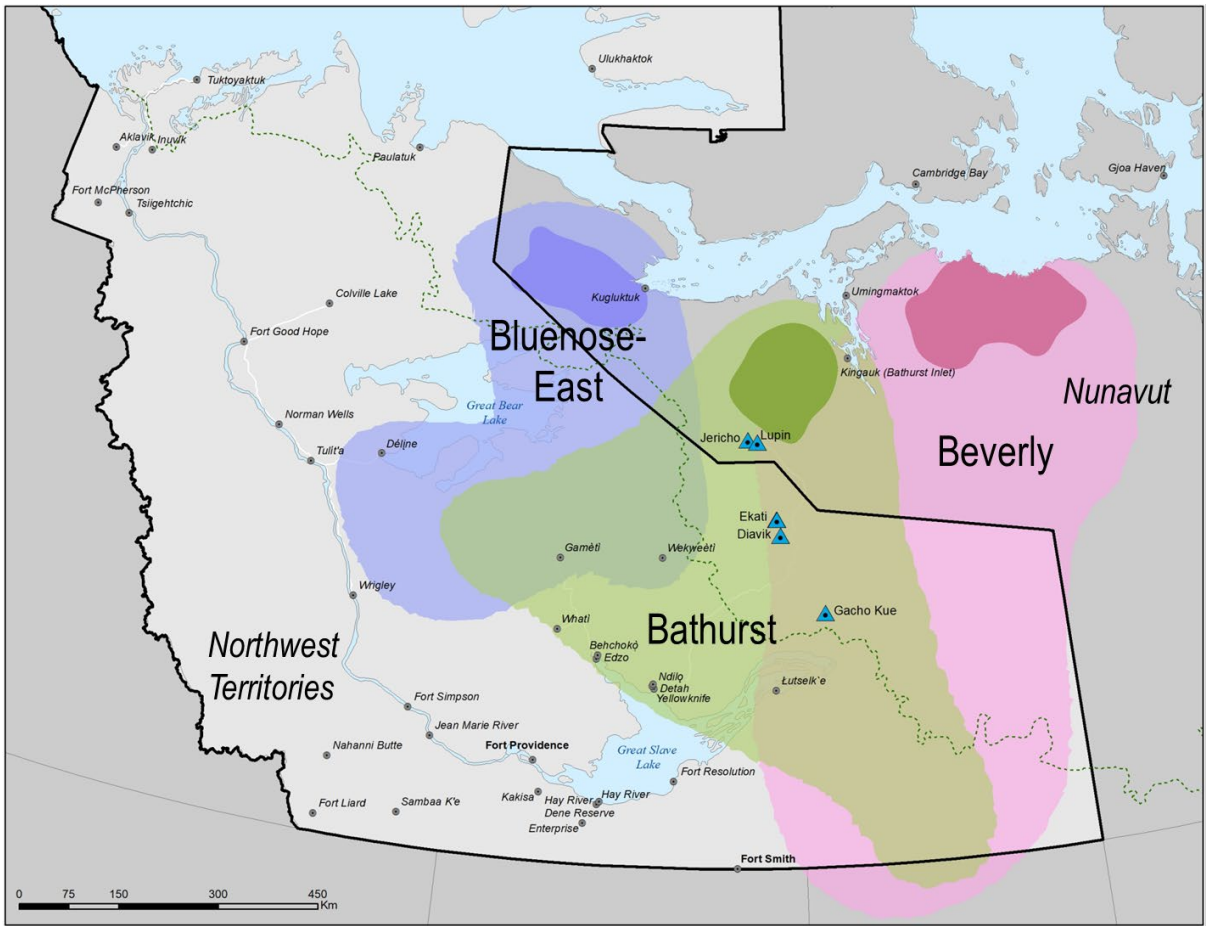

Figure 1. Annual ranges and calving grounds of the Bluenose-East, Bathurst, and Beverly herds, based on accumulated radio collar locations of cows (Nagy et al. 2011). The Ekati, Diavik and Gahcho Kue mines were active in March 2020 and the Jericho and Lupin mines were closed, with some maintenance staff.

Calving ground photo surveys of the Bathurst and Bluenose-East herd were flown in June 2018, with previous surveys in June 2015. The 2018 survey demonstrated a decline of

[1] The Beverly herd described in this report is the herd defined by the Government of NU as calving in the central and western Queen Maud Gulf. This herd may not correspond exactly to the Beverly herd defined prior to 2009 with an inland calving ground south of Garry Lakes (Adamczewski et al. 2015).

about 50% in three years for the Bluenose-East herd to 19,294±3,230 (95% confidence interval, CI) adults (Boulanger et al. 2019). There was a decline of about 57% (8,207±2,624 adults) in the Bathurst herd during the same time period (95% CI) (Adamczewski et al. 2019a). A part of the reduced Bathurst numbers on the calving ground may have been due to emigration to the Beverly calving ground in the Queen Maud Gulf lowlands in 2018 and 2019 (Adamczewski et al. 2019a). As these declines were a continuation of declines before 2015 in both herds, more intensive monitoring and management of both herds were considered through collaborative processes in 2018-2019. In joint management proposals from the Tłı̨chǫ Government (TG) and ENR to the Wek'èezhìi Renewable Resources Board (WRRB) in early 2019, increased monitoring proposed for the two herds included annual composition surveys of both herds in June, late October, and March/April (TG and ENR 2019 a, b). The WRRB approved these changes (WRRB 2019a, b).

A calving ground visual survey of the Beverly herd was flown in June 2018 by Government of NU staff and resulted in an estimate of 103,608±5,109 (SE) caribou in the herd (Campbell et al. 2019). This indicated a slow decline from the revised estimate for 2011 using a similar survey of 136,608±6,603 (SE) (Campbell et al. 2019). As part of monitoring this herd, periodic late-winter recruitment surveys have been conducted by the GNWT.

The main purpose of these composition surveys in March or April is to estimate the proportion of cows that still have a calf in late winter, which is an index of calf survival through the first nine to ten months of life. Where calf:cow ratios are also available for the previous fall period (October-November), a comparison can be used as an indicator of over-winter calf survival. In March 2020, maps of collared caribou from the three herds indicated that there were areas where only collared caribou of each herd were found, along with areas where the Bathurst herd overlapped with the Bluenose-East herd and some areas where Bathurst collars were mixed with Beverly collars. This distribution suggested that estimates of the calf:cow ratio could be derived for each herd, with some interpretation of results from overlap areas. Collared caribou from the Beverly herd were widespread, with some collared caribou in the Queen Maud Gulf lowlands and out of reach for this survey. However, portions of the herd were within reach of the Ekati and Lupin mines, which allowed a portion of the herd to be classified.

METHODS

Movements of collared Bathurst, Beverly and Bluenose-East females and males were monitored throughout March 2020. Additional collars were placed on caribou from these herds in late winter 2020 (March and April) but were not used in planning the survey as their identity would not be known until June (cows) or October (bulls).

Caribou were classified from the front of the helicopter using motion-stabilized binoculars. Caribou were identified as calves (based on small body size, short face and "spike" antlers), cows (based on presence of a vulva patch), young bulls (based on presence of hard antlers) and prime bulls (based on size of hard antlers or their absence and white mane). For larger groups of caribou, an effort was made to classify a representative cross-section of caribou while recognizing that not all caribou could be classified. In most cases, caribou were on frozen lakes or in open areas.

Trimble Yuma 2 tablet computers were used to record observations with a GPS waypoint taken for each observation. Garmin GPS model 276Cx units were used to plan flights and record flight lines. In addition to caribou, we also recorded observations of other large mammals, including moose, muskoxen and wolves. Although we included some bull collars in the survey flight planning, the main priority was to assess the calf:cow ratios in each herd, and proportions of bulls recorded are not representative of herd sex ratios because of their tendency to segregate after the rut through much of the winter.

RESULTS

Survey Conditions

In general, survey conditions were good through much of the survey, with generally blue skies (Figure 2) and good light that allowed ground conditions to be clearly visible, which made caribou and caribou sign relatively easy to see. Overcast conditions and some low cloud on March 8 created flat light conditions that made caribou and caribou sign somewhat more difficult to see. Temperatures varied from a high of about -18°C to a low of about -34°C. Winds were generally light during the survey, with the exception of the afternoon of March 13 when winds increased to more than 30 km/hr. These winds appeared to be the edge of a winter storm that came in from the northwest on March 14 and signaled the end of the flying on March 13

Figure 2. Survey helicopter (top left) Great Slave Helicopters A-star C-GHMZ; snow conditions below treeline (top right); snow conditions above treeline (bottom left), and caribou feeding craters on tundra (bottom right) during March 8-13, 2020 caribou composition surveys.

A daily summary of flying hours and tasks for each day is shown in Table 1.

Table 1. Daily summary of flying hours and tasks accomplished on Bathurst, Bluenose-East and Beverly March 2020 late-winter composition surveys.

Date	Flying Hours and Tasks
March 8	Leave Yellowknife 10:36; survey near Bathurst collars MacKay Lake and west; land Wekweètì 16:33. Flying hours 5.0
March 9	Leave Wekweètì 10:46; survey near Bathurst and Bluenose-East collars east and south of Wekweètì; land Wekweètì 18:00. Flying hours 6.4.
March 10	Leave Wekweètì 8:54; survey near Bluenose-East collars north and northeast of Wekweètì, fuel at Little Crapeau and Point Lakes; land Wekweètì 19:52. Flying hours 7.8.
March 11	No flying, on ground in Wekweètì; poor weather at Ekati mine (next destination)
March 12	Leave Wekweètì 9:38; survey Bathurst and Beverly collars Lac De Gras area, land Ekati 16:32. Flying hours 5.4.
March 13	Leave Ekati 8:13; survey Beverly collars north to Lupin and west of Bathurst Inlet; south to Yellowknife, land 19:06. Flying hours 8.9
	Total flying hours 33.5 (31.2 hours on survey, 2.3 hours on ferry flights)

Overview of areas sampled, and numbers classified

The overall sampling effort and locations of collared caribou during the surveys are shown in Figure 3. Based on locations of collared caribou and survey flying, results were summarized individually in five areas. Three of these were areas where only collars of one herd (Bathurst, Bluenose-East and Beverly) were found. A fourth area south and east of Wekweètì had a mix of Bathurst and Bluenose-East collars and survey results were summarized separately for that area. There were two small areas with overlap of Bathurst and Beverly collars, and results for those areas are listed separately.

Numbers of collared male and female caribou from each herd available at the time of the survey are listed in Table 2, along with numbers of collared caribou in the areas sampled. Several of the collared caribou were seen during the survey and those numbers are also provided. The proportion of collars found within sampled areas provides an index of the proportion of the herd sampled during the survey flying. Overall, 24 of 25 Bathurst collars were in areas sampled, along with 22 of 31 Bluenose-East collars and 12 of 29 Beverly collars.

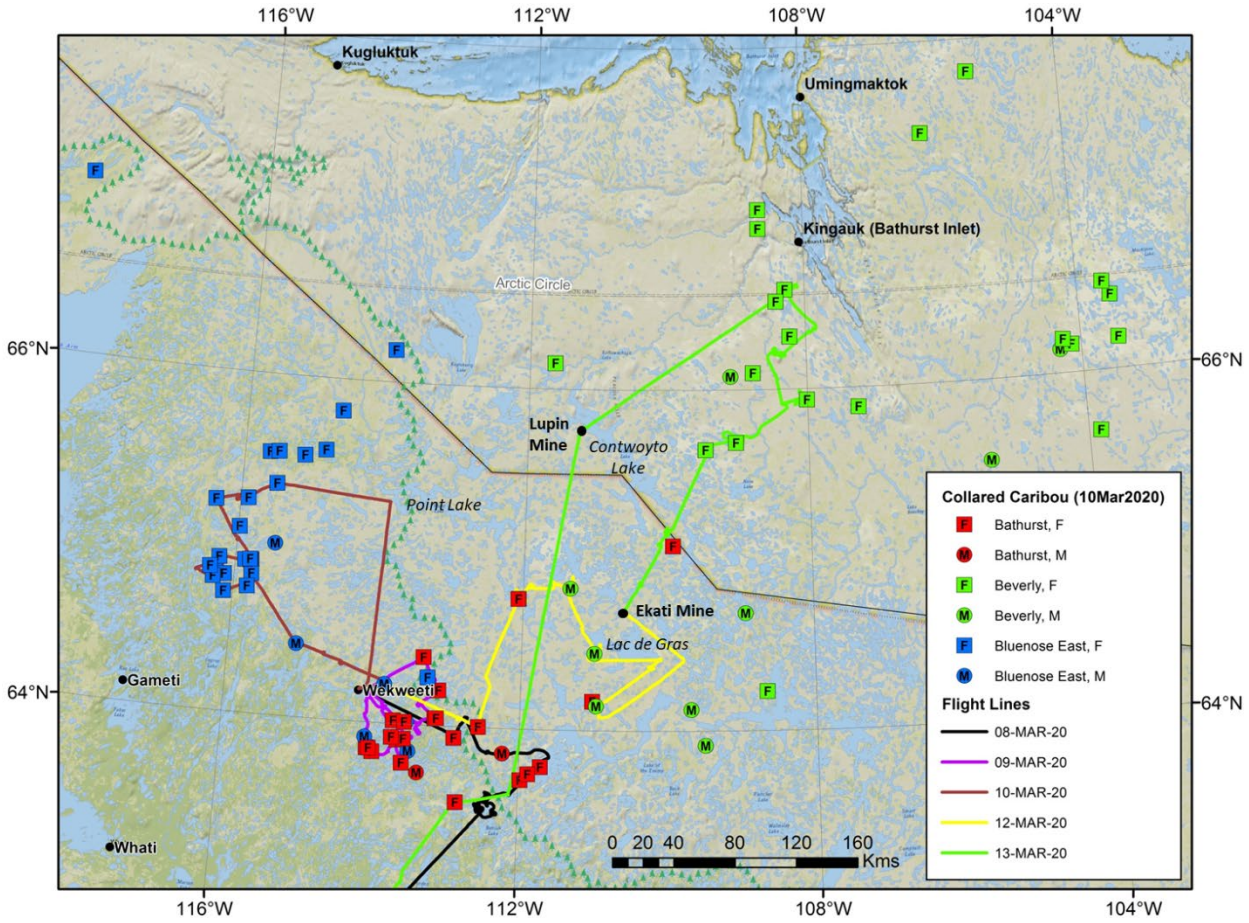

Figure 3. Overview of flight lines March 8-13, 2020 and collared caribou locations during late-winter composition surveys of Bathurst, Bluenose-East and Beverly caribou herds. Collar locations are for March 10. There was day-to-day variation in collared caribou locations but little directional movement over the survey period.

Table 2. Numbers of collared cow and bull caribou from the Bathurst, Bluenose-East and Beverly herds (placed in 2019 or earlier) during March 2020 composition surveys. Total numbers of collars for each herd are shown, along with the numbers of collars in surveyed areas and the numbers of collared caribou seen during the survey. Collars newly placed in winter 2019-2020 are not included.

Collar Numbers	Bathurst			Bluenose-East			Beverly		
	F	**M**	**Total**	**F**	**M**	**Total**	**F**	**M**	**Total**
Total	23	2	25	25	6	31	20	9	29
In Areas Flown	23	1	24	17	5	22	8	4	12
Seen on Survey	7	0	7	5	2	9	1	1	2

Bluenose-East-Only Area

An area north and northwest of Wekweètì had only Bluenose-East collared caribou and was flown on March 10 (Figure 4). Groups surveyed in this area were considered representative of the Bluenose-East herd. This resulted in an estimated ratio of 41.8 calves:100 cows (95% CI, CI Upper 45.2, Lower 38.6), based on 2,125 caribou in 74 groups (Table 3). Overall, 22 of 31 collared Bluenose-East caribou were in areas sampled in March 2020, which suggested that coverage included about 2/3 of the herd's distribution.

Table 3. Summary of composition survey results for March 2020 for Bathurst, Bluenose-East and Beverly caribou herds. Note that group size was recorded as the number of caribou classified. In small groups (<30), often a high percentage of the caribou was classified, but in larger groups, group size would be a small proportion of the actual number of caribou present.

Measurement	Bluenose-East Herd	Bathurst Herd	Bathurst-Bluenose-East Mixed	Beverly Herd	Bathurst-Beverly Mixed
# Caribou	2,123	1,384	1,603	3,611	1,838
# Cows	1,429	827	1,022	2,131	1,010
# Calves	597	251	325	967	348
# Young Bulls	44	60	40	217	104
# Prime Bulls	53	246	216	296	376
# Groups	74	55	90	47	62
Mean Group Size	28.7	25.1	17.8	76.8	29.6
Median Group Size	17	14	11.5	43	15.5
Calves: 100 Cows	41.8	30.4	31.8	45.4	34.5
SE Calves: 100 Cows	1.7	2.3	1.7	1.7	2.8
95% CI Upper and Lower	45.2, 38.6	35.0, 26.2	35.3, 28.5	49.0, 42.2	40.2, 29.3

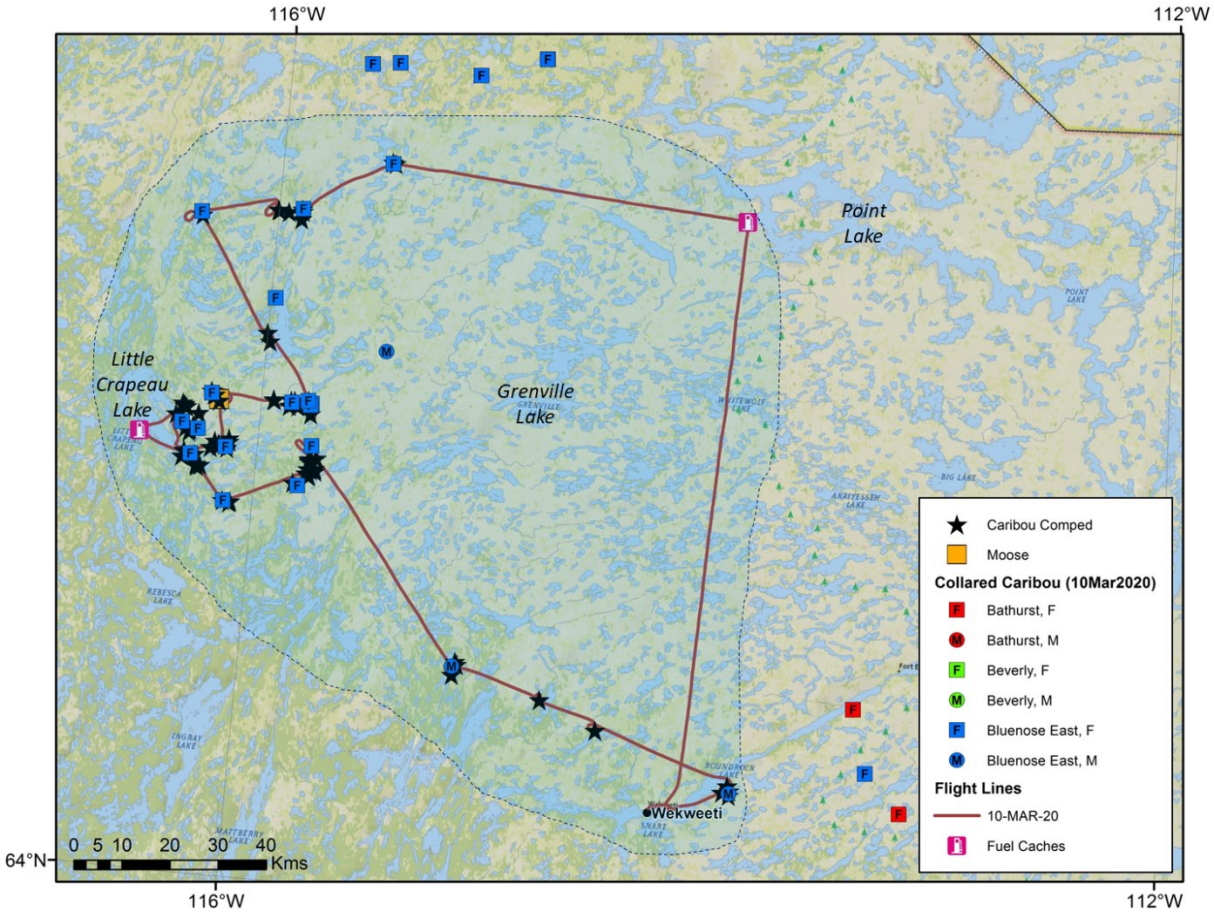

Figure 4. Area surveyed March 10, 2020 north and northwest of Wekweètì. This area had only Bluenose-East collared caribou and results were considered representative of this herd. Stars show locations of groups surveyed and locations of moose observed on this day.

Bathurst-only Area

For the Bathurst herd, an area central to the survey flying had only Bathurst collared caribou (Figure 5). Results in this area were an estimated ratio of 30.4 calves: 100 cows (95% CI Upper 35.0, Lower 26.2), based on 1,384 caribou in 55 groups. Overall, 24 of 25 total Bathurst collared caribou in the herd were in areas surveyed in March 2020, suggesting that the March 2020 survey included a substantial proportion of the herd's distribution.

Bathurst-Bluenose-East overlap area

An area mostly south and east of Wekweètì had four Bluenose-East and 11 Bathurst collars during the survey. In a few cases, collared caribou from both herds were in relatively close proximity. This mixing, in combination with relatively low collar numbers for both herds

and a size disparity in the two herds (about 19,300 Bluenose-East and about 8,200 for Bathurst in 2018) created challenges in interpreting calf:cow ratios in the overlap area.

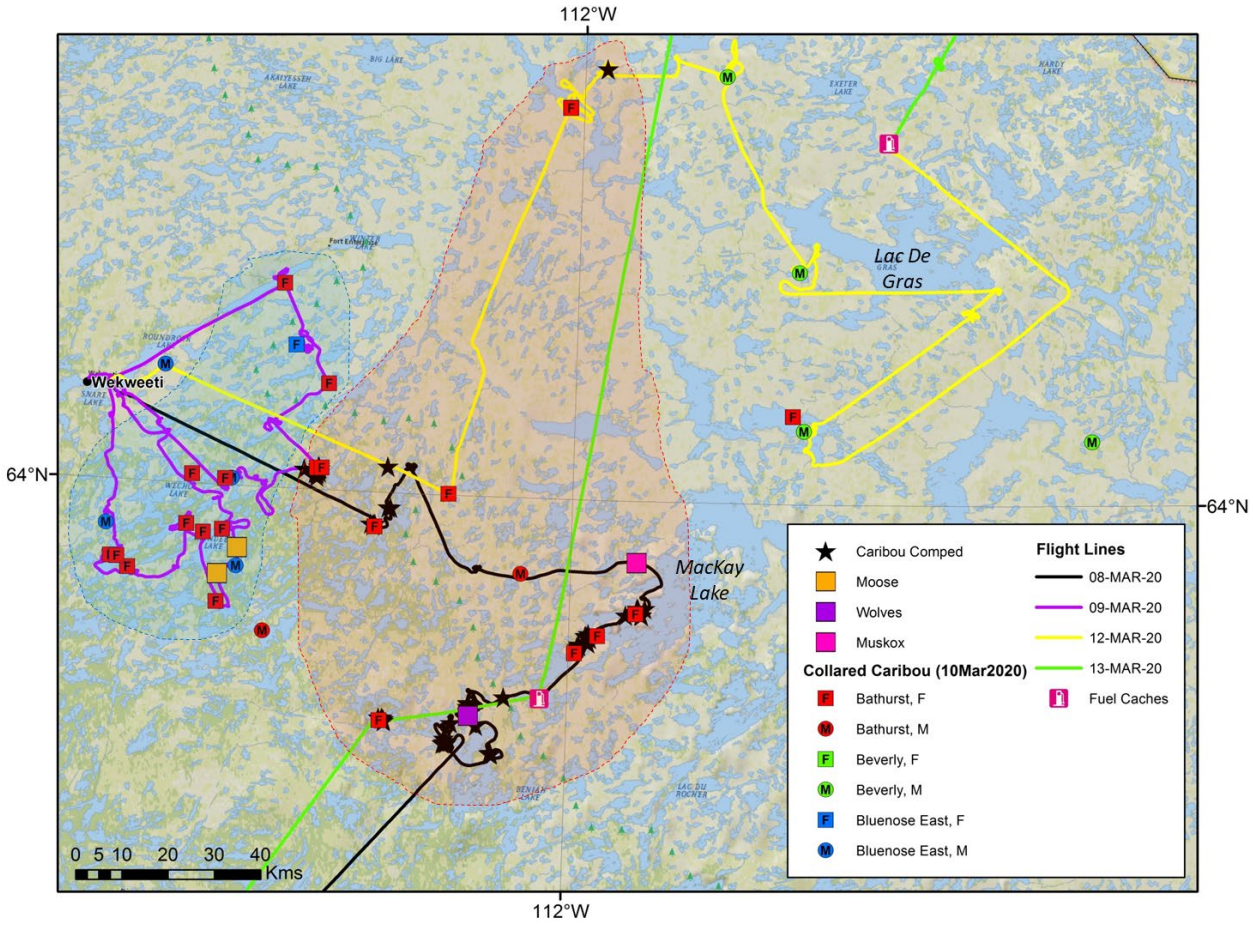

Figure 5. Areas surveyed March 8 and 9, 2020, and part of areas surveyed March 12 and 13, 2020. Larger area in red outline had only Bathurst collars and was considered representative of that herd. Smaller area outlined in blue had mixed Bathurst and Bluenose-East collared caribou and was considered to represent a mix of these herds. Stars show locations of caribou groups surveyed and locations of moose, muskoxen and wolves observed on this day.

In this mixed area, the composition survey resulted in an estimated calf:cow ratio of 31.8:100 (95% CI Upper 35.3, Lower 28.5) cows based on 1,603 caribou in 90 groups. This calf:cow ratio for the mixed herds was very similar to the ratio estimated for Bathurst-only collared caribou (30.4), but substantially lower than the ratio in the Bluenose-East-only area further north (41.8). Assuming this ratio is representative of both herds in the overlap area, a possible interpretation is that the Bluenose-East calf:cow ratio, for the portion of the herd in the overlap area, was lower than was recorded north of Wekweètì. In this case, the true herd-wide Bluenose-East calf:cow might have been slightly lower than the 41.8 calves:

100 cows recorded in the more northern part of the herd's distribution where the bulk of the cow collars were.

For the Bathurst herd, the implications of the results from the overlap area are different. Assuming again that the calf:cow ratio in the overlap area represented the calf:cow ratio for both herds in that area, the close similarity in calf:cow ratios for the Bathurst-only area and the Bathurst-Bluenose-East overlap area suggests that the herd-wide Bathurst calf:cow ratio was close to 30-31 calves:100 cows.

Results for Beverly herd

Results for the Beverly herd are based on an overall sample of 3,611 caribou in 47 groups (Figure 6), from a herd estimated at about 103,000 caribou in 2018 (Campbell et al. 2019). The mean and median group sizes of classified groups were substantially greater for this herd than either the Bathurst or Bluenose-East herds. In some areas, the numbers seen overall were estimated in the thousands, as might be expected in a much larger herd. We note that the southernmost Beverly collars were bulls, but we saw from our composition survey that these groups were a mix of cows, calves and bulls, not bull-only groups. Overall, areas flown included 12 of 29 collared Beverly caribou at the time of the survey. These sample numbers indicate that less than half of the herd was surveyed. Caution should be used with respect to be considering the calf:cow ratio estimated in March 2020 as representative of the entire herd. Nonetheless, the calf:cow ratios recorded in areas with Beverly collared caribou were the highest observed for the three herds and suggest very good calf recruitment in at least some portions of this herd in 2019-2020.

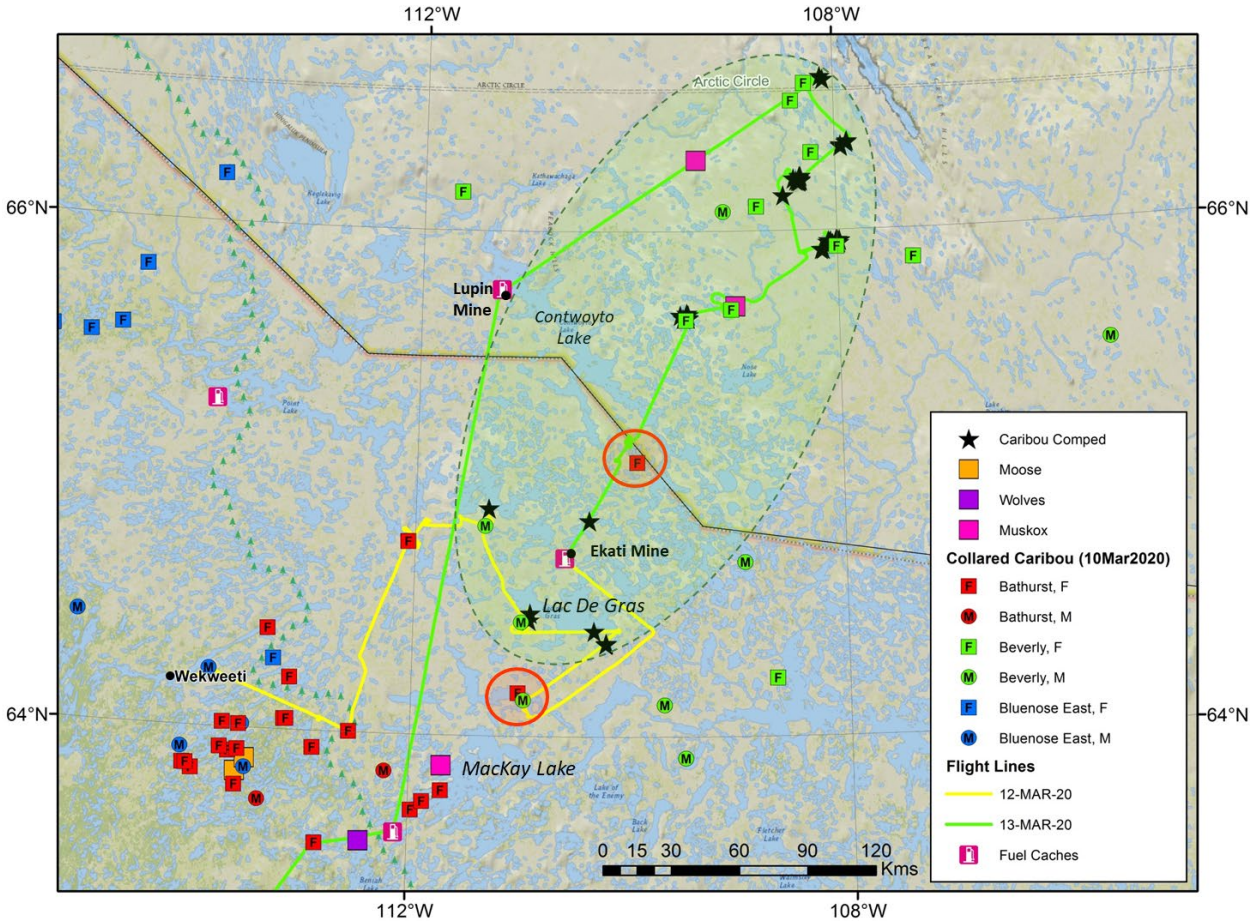

Figure 6. Areas flown March 12 and 13, 2020 on composition surveys. The larger area outlined in green was considered to represent the Beverly herd. The two small areas outlined in red were considered potentially a mix of Beverly and Bathurst collars, thus any groups surveyed in these two areas were assessed separately as Bathurst-Beverly mixed.

Results for Bathurst-Beverly overlap areas

There were two small areas where presence of both Bathurst and Beverly collars indicated a possible mix of the two herds. Given the large disparity in herd sizes (a ratio of about 12:1) and limited collar numbers, interpreting these results was challenging. The calf:cow ratio in these groups was 34.5:100 (95% CI Upper 40.2, Lower 29.3) cows, somewhat higher than the Bathurst-only calf:cow ratio (30.4) and substantially lower than the Beverly-only ratio of 45.4.

The areas surveyed for each herd and the mixed areas are shown in Figure 7.

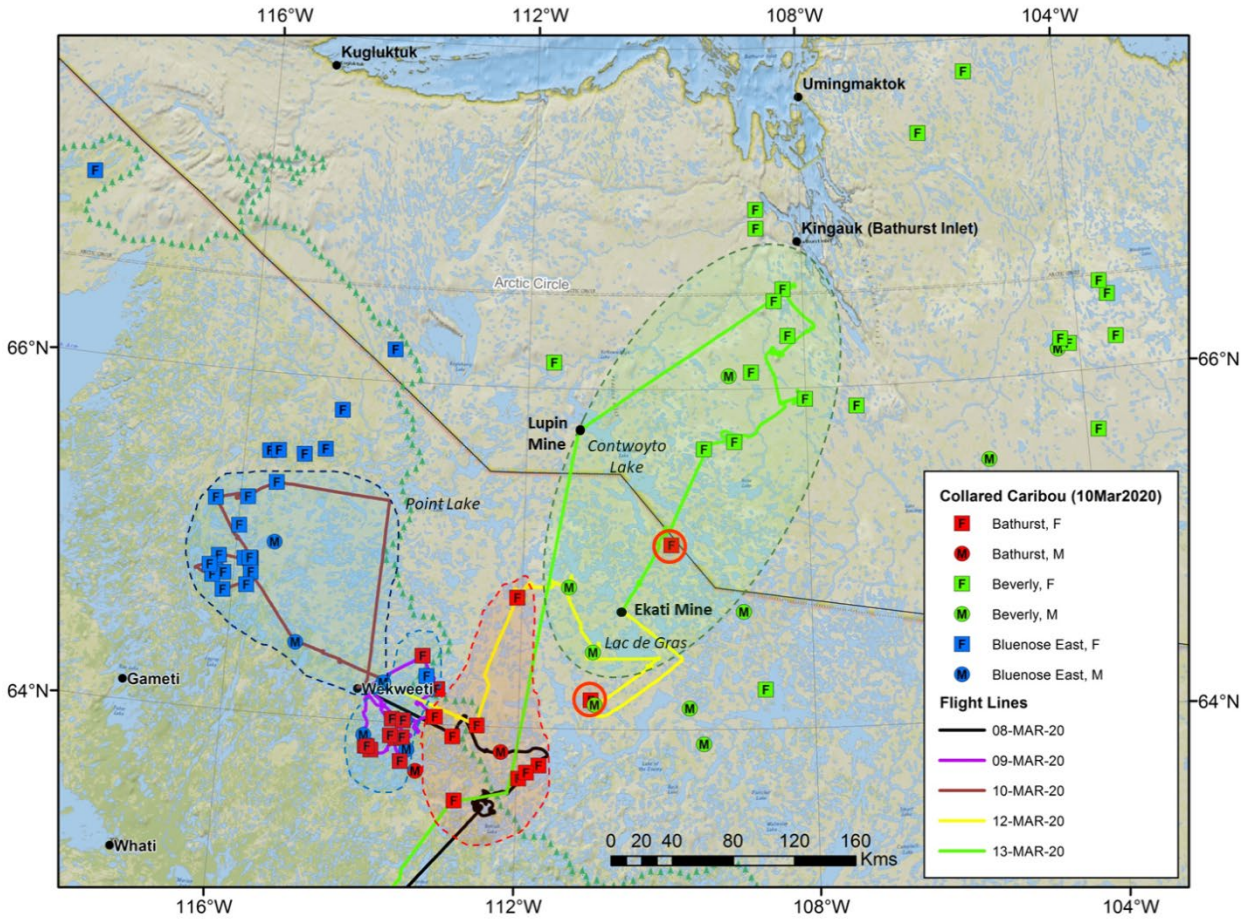

Figure 7. Flight lines, collar locations (March 10) and areas assigned to each herd (Bathurst, Beverly, and Bluenose-East), Bathurst-Bluenose-East mixed and Bathurst-Beverly mixed during March 2020 composition surveys.

Sampling of Caribou Feces for Pregnancy Testing

To assist in monitoring of demography in these three caribou herds, 20 sites (Figure 8) were visited during the composition surveys to collect fecal samples to be tested for pregnancy (elevated progesterone). At each site, 15 or 20 samples were collected, for about 330 samples in total. Individual samples were from individual groups of pellets. Fecal sampling was carried out at sites with predominantly cow-calf groups, and sites with substantial numbers of bulls were avoided.

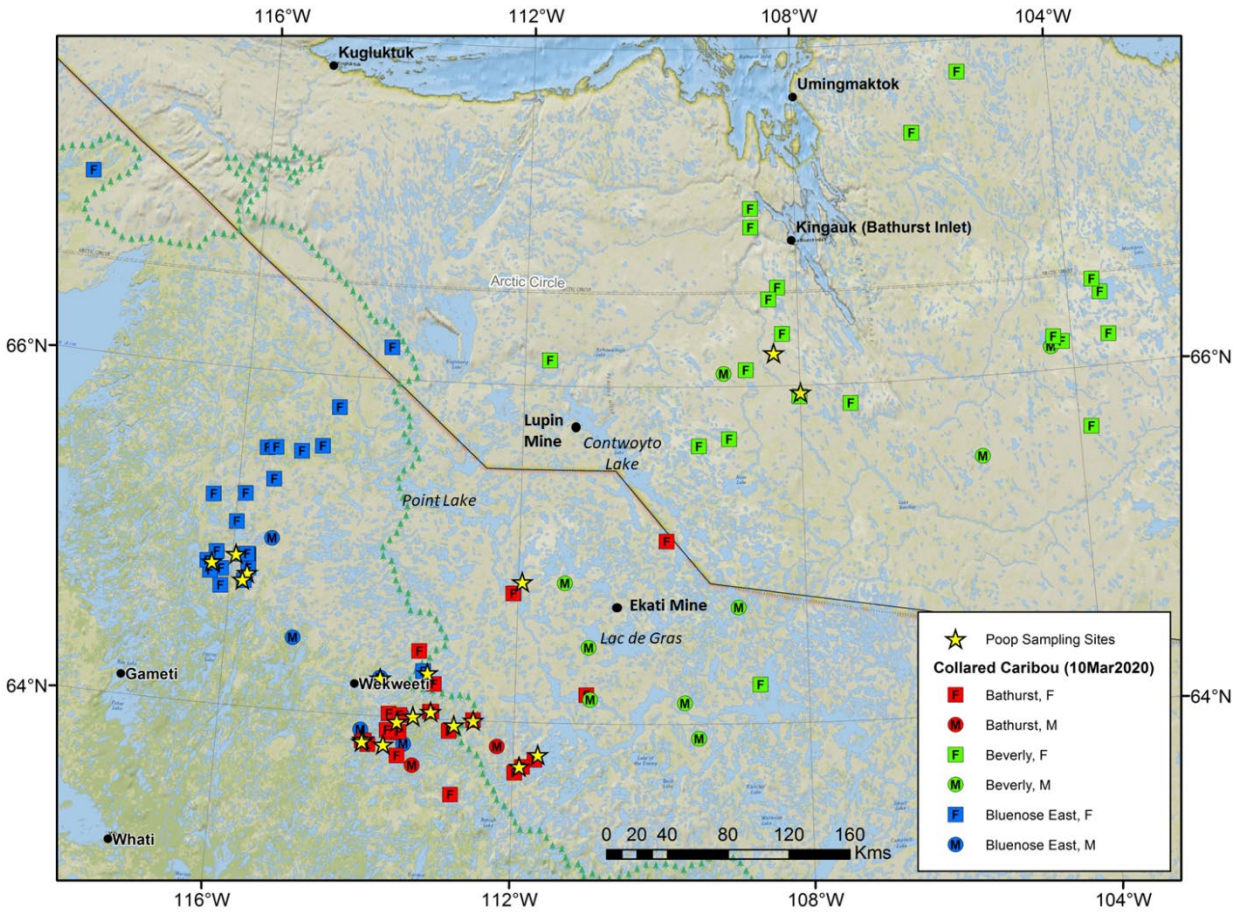

Figure 8. Areas surveyed in March 2020 during composition surveys of Bathurst, Bluenose-East and Beverly caribou herds. Yellow stars indicate sample sites for fecal pellets collected for analysis of fecal progesterone.

Incidental Observations of Other Wildlife

Three groups of muskoxen, six wolves and four moose were seen during the March 2020 caribou composition surveys (Table 4).

Table 4. Sightings of wolves, moose and muskoxen on the Bathurst, Bluenose-East and Beverly March 2020 late-winter composition surveys.

Species	Number Seen
Moose	2, 1, 1
Muskox	Groups of 43, 9, 7
Wolf	1 lone, 1 pack of 5

DISCUSSION

Calf Productivity and Survival in the Bathurst, Bluenose-East and Beverly Caribou Herds 2019-2020

Composition survey results for the Bathurst herd from June 2019 to March 2020 suggested that the pregnancy rate or initial productivity was high in June (86.0% breeding cows, Adamczewski et al. 2019b), but well over half these calves had died by fall (32.0 calves:100 cows, Williams and Cluff 2019). Over-winter calf survival was likely relatively high, with a March ratio of 30.4 calves:100 cows very similar to the ratio recorded in early November. The calf:cow ratio in the Bathurst-Bluenose-East overlap area in March 2020 was very similar to the Bathurst-only ratio. Combined with the high representation of Bathurst collars in sampled areas (24 of 25), this suggests that the herd-wide Bathurst calf:cow ratio was likely close to 30-31 calves:100 cows.

Calf:cow ratios are a commonly used demographic indicator of caribou population trend (Bergerud 2000). However, whether a fall or late-winter calf:cow ratio is linked to a stable population depends on the adult survival rate (Crête et a. 1996, Boulanger et al. 2011, Boulanger and Adamczewski 2016). In population modeling summarized by Boulanger and Adamczewski (2016; Table 1), at a cow survival rate of 85%, fall calf:cow ratios needed to be 49-51 calves:100 cows and late-winter ratios needed to be 38-45 calves:100 cows for stability. At a higher cow survival rate of 90%, fall calf:cow ratios of 44 calves:100 cows and late-winter calf:cow ratios of 29 calves:100 cows were associated with stability (ibid.). At a low cow survival rate of 77%, it was nearly impossible for the herd to produce enough calves for a stable herd (ibid.). At the cow survival rates for the Bathurst herd last estimated in 2018 of 78-82% (Adamczewski et al. 2019a), much higher calf:cow ratios would be needed for a stable herd.

Composition survey results for the Bluenose-East herd for June 2019 to March 2020 suggested there was high initial productivity (87.5% breeding cows), and half or more of the calves had died by fall (37.8 calves:100 cows). The March 2020 calf:cow ratio for the Bluenose-East herd of 41.8 calves:100 cows was similar to the fall 2019 ratio of 37.8. The lower calf:cow ratio from an area with mixed Bluenose-East and Bathurst caribou (31.8 calves:100 cows) suggests that the herd-wide Bluenose-East calf:cow ratio may have been slightly lower than 41.8, and possibly close to the 37.8 estimated in the fall. About a third of the available Bluenose-East collars (nine of 31) were not in areas sampled, thus some caution should be used in interpretation of the results. The similarity of fall and late-winter calf:cow ratios in this herd suggest that over-winter calf survival was relatively high. Overall Bluenose-East calf survival to nine to ten months was better in the Bluenose-East herd than in the Bathurst herd. However, at recently estimated Bluenose-East cow survival

rates of 72-79% (Boulanger et al. 2019), a calf:cow ratio of 41 calves:100 cows would not be sufficient for a stable herd.

For the Beverly herd, a March 2020 ratio of 45.4 calves:100 cows was estimated, which suggested good calf recruitment in at least some portions of this herd 2019-2020. These calf:cow ratios were higher than estimated in the Bathurst and Bluenose-East herds in March 2020. However, the areas flown included only 12 of 29 available collars (41%) on the herd at the time of the survey, thus the results should be used with caution.

Similarity of Fall and Late-winter Calf:cow Ratios in Bathurst and Bluenose-East Herd 2006-2020

Since 2006, there have been six cases of fall composition surveys of Bathurst caribou followed by late-winter composition surveys in the same winter, and five cases of Bluenose-East caribou fall and late-winter composition surveys in the same winter, including 2019-2020. The resulting calf:cow ratios are shown in Figure 9. In general, fall and late-winter calf:cow ratios in the two herds have been very similar, with a trend toward slightly lower ratios in late winter. The average reduction in calf:cow ratio over winter has been small, from an average of 37.8 calves:100 cows in fall to 35.7 calves:100 cows in late winter. Calf:cow ratios have tended to be higher in the Bluenose-East herd than the Bathurst over this period (since 2009).

Occasionally the late-winter calf:cow ratio has been slightly higher than the ratio from the preceding fall (Figure 9). This likely reflects spatial variation in calf:cow ratios and completeness of herd coverage. In these surveys, we rely heavily on locations of collared caribou to guide flight planning. However, sometimes collar numbers have been relatively low, and sometimes weather and accessibility of portions of the herd mean that not all of the herd is sampled. We note also that an estimate of calves:100 cows is a ratio, and ratios can be affected by changes in the denominator (survival rates of cows) as well as changes in the numerator (survival rates of calves). We assume that changes in the ratio primarily reflect relative abundance and survival of calves and that cow survival is relatively constant.

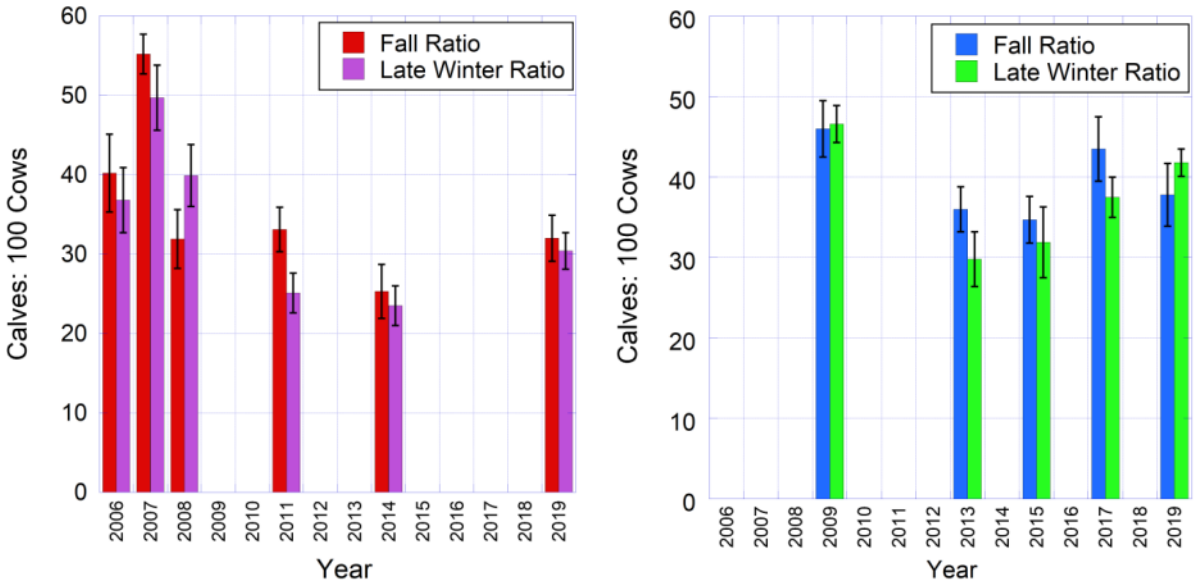

Figure 9. Fall and late-winter calf:cow ratios in the Bathurst (left) and Bluenose-East (right) caribou herds in years when both surveys were recorded for the herd, 2006-2019. Years are shown for the year when the fall survey was carried out (e.g. results for 2006 include a survey in fall 2006 and a survey in late winter 2007).

The consistency of fall and late-winter calf:cow ratios in the Bathurst and Bluenose-East herds 2006-2020 is in contrast to calf:cow ratios recorded at five to six months of age and ten to 12 months of age in George River caribou (Bergerud et al. 2008). In that herd, the average calf:cow ratio at five to six months was 33.1 calves:100 cows 1986-1992 when the herd was beginning its decline, and the average calf:cow ratio at ten to 12 months was 14.8 calves:100 cows over the same period (ibid.). This indicates that over-winter mortality rates of George River herd calves were substantial over this time period.

Closer Assessment of Summer Calf Survival in Bathurst and Bluenose-East Caribou Herds

Consideration should be given to estimating calf:cow ratios in early July to assess the proportion of calf mortality that occurs in the first month, on or near the calving grounds, in the Bathurst and Bluenose-East caribou herds. Mortality rates of caribou calves are usually highest in the first month after birth and predators are responsible for a high proportion of these calf mortalities (Bergerud 2000). In the Porcupine herd, calf mortality averaged 27% in the first month 1983-1992 (Fancy et al. 1994). In some caribou populations, including some mountain herds in British Columbia, calf mortality in the first month can exceed 50% (Bergerud 2000). Observations of grizzly bears and wolves on the Bathurst and Bluenose-East calving grounds only in recent years suggest that grizzly bears are much more common on both calving grounds than wolves (Adamczewski et al. 2019a,

b). Composition surveys of these two herds in early July could provide an assessment of calf mortality in the first month and potentially give insight into which predators are of greatest significance.

ACKNOWLEDGEMENTS

We would like to thank Tom Frith of Great Slave Helicopters, who flew the A-Star helicopter skillfully and safely on these surveys. We greatly appreciated the hospitality and support of Harry O'Keefe and other staff at the Ekati diamond mine (Dominion Diamonds) on March 12-13. We very much appreciated the hospitality of the staff at the Snare Lake Lodge in Wekweètì March 8-12. We would like to thank Bonnie Fournier in the Wildlife Division in Yellowknife for supplying collared caribou locations throughout the survey period. Funding for these surveys was provided by the Government of the Northwest Territories.

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