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JULY 2020 COMPOSITION SURVEYS OF BATHURST AND BLUENOSE-EAST BARREN-GROUND CARIBOU HERDS

Jan Adamczewski, Judy Williams and Dean Cluff

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ABSTRACT

This report describes the results of composition surveys of the Bathurst and Bluenose-East barren-ground caribou herds conducted in July 2020. The main purpose of these surveys was to estimate the proportion of females in the herd that were accompanied by a calf about a month after the peak of calving, as an index of early calf mortality in these herds.

Flying was carried out on July 10, 11, and 13-16, 2020 with a total of 34.7 hours flown. The survey crew of Judy Williams, Jan Adamczewski and pilot Jordan Crook flew in an A-Star B3 helicopter operated by Acasta HeliFlight Incorporated. The Bathurst survey was flown from a base at the GNWT's Tundra Ecological Research Station at Daring Lake in the NWT with re-fueling at the Lupin mine on Contwoyto Lake, and the Bluenose-East survey was flown from Kugluktuk in Nunavut. 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 or Bluenose-East caribou, and classifying caribou (cows, calves, and bulls). A very high proportion of caribou found were in post-calving aggregations of hundreds or thousands. Daily movement rates of collared caribou were high and movements were unpredictable, which created challenges in finding the groups. In addition, the collars were programmed to transmit locations every second day, which added to the challenge of finding caribou groups. We used transect lines in the vicinity of the last locations of collared caribou to increase our chances of finding them. Given that most caribou were in tightly bunched groups, caribou were primarily classified from the ground using a spotting scope. Some smaller groups were classified using motion-stabilized binoculars from the helicopter.

For the Bathurst herd, the survey resulted in an estimated ratio of 44.1 calves: 100 cows (95% Confidence Interval Upper 46.7, Lower 40.0), based on 1,628 caribou in 20 groups. For the Bluenose-East herd, the survey resulted in an estimated ratio of 46.9 calves: 100 cows (95% CI Upper 53.0, Lower 41.1), based on 3,136 caribou in 32 groups.

Composition surveys near the peak of calving were planned as part of calving photo surveys of these two herds in June 2020, but were postponed to 2021 due to travel restrictions resulting from the COVID-19 pandemic. As a result, the proportion of breeding females at the peak of calving in June 2020 was not known. If the proportion of breeding females in June 2020 was about 81% (average for June 2018 and 2019 for the two herds), then the July calf-cow ratios we recorded may suggest substantial calf mortality in the first five weeks after birth in both herds.

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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). Neighbouring herds are the Bluenose-West and Beverly barren-ground caribou herds to the west and east respectively.

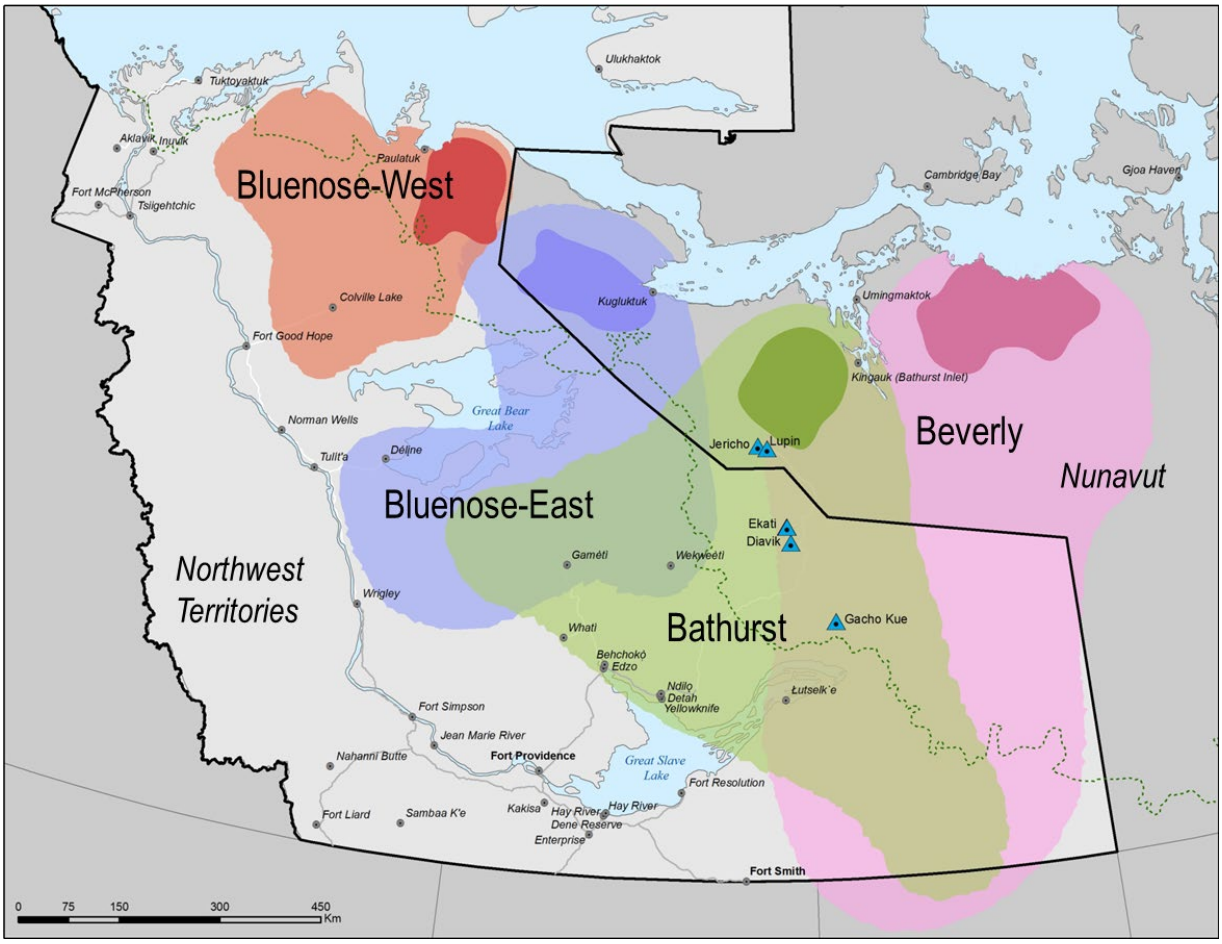

Figure 1. Annual ranges and calving grounds of the Bluenose-West, Bluenose-East, Bathurst, and Beverly[1] herds , based on accumulated radio collar locations of cows (Nagy et al. 2011). The Diavik and Gahcho Kue mines were active in July 2020, the Ekati mine was in maintenance mode, the Jericho mine was closed with minimal maintenance staff, and the Lupin mine was in closure mode with infrastructure being taken down. Map B. Fournier, Environment and Natural Resources.

[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).

Calving ground photo surveys of the Bathurst and Bluenose-East herd were flown in June 2018, with the last previous surveys in June 2015. The 2018 survey demonstrated a decline of about 50% in three years from the 2015 survey for the Bluenose-East herd to 19,294±3,230 (95% Confidence Interval, CI) adults in 2018 (Boulanger et al. 2019). There was a decline of about 57% in the Bathurst herd from 2015 to 8,207±2,624 adults (95% CI) in 2018 (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. Joint management proposals from the Tłı̨chǫ Government (TG) and the Department of Environment and Natural Resources (ENR) to the Wek'èezhìı Renewable Resources Board (WRRB) in early 2019 proposed increased monitoring for the two herds including annual composition surveys of both herds in June, late October, and March/April (ENR and TG 2019a, b). In addition to these composition surveys, additional composition surveys were proposed for the two herds in July 2020, about a month after the peak of calving in early June. The WRRB approved these changes (WRRB 2019a, b).

Previously, June 2019 composition surveys near the peak of calving resulted in estimates of 86.0% (Bathurst) and 87.5% (Bluenose-East) breeding females (Adamczewski et al. 2019b). However, by early November 2019 (calves about five months old), the calf:cow ratios for the two herds were 32.0 calves: 100 cows (Bathurst) and 37.8 calves: 100 cows (Bluenose-East) (Williams and Cluff 2019), indicating that well over half the calves had died in the first five months. In many caribou populations, mortality rates of calves are 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 mountain caribou herds in British Columbia, calf mortality in the first month can exceed 50% (Bergerud 2000). To provide increased insight into the extent of early calf mortality in the Bathurst and Bluenose-East herds, and potentially into the main sources of early calf predation, composition surveys were carried out July 10-16, 2020 for these two herds.

METHODS

Locations of collared Bathurst (40F, 16M) and Bluenose-East (34F, 20M) females and males were monitored through the study period of July 10-16, 2020. The most recent locations were used to plan survey flying. In general, movement rates of collared caribou in both herds were high and the direction of movements was unpredictable. Additional updates on the most recent collar locations during survey days helped identify areas to survey. It became apparent that the herds were in the post-calving period when caribou form large, sometimes densely packed groups of hundreds or thousands of caribou in response to biting flies. Daily movement rates can exceed 20 km/day in NWT barren-ground caribou herds in this period (Nagy 2011). Flight lines were used in the vicinity of the most recent collared caribou locations to increase the likelihood of finding the groups.

Because most of the caribou were in large, relatively tightly packed groups that were often in motion, we found that landing on an elevated site and classifying caribou from the ground with a telescope was more effective, and created less stress to caribou, than classifying from the air. In some smaller groups, caribou were classified from the front of the helicopter using motion-stabilized binoculars. Caribou were identified as calves (based on small body size), cows (based on presence of a vulva patch), and bulls (based on absence of a vulva patch, size and in large males, large velvet antlers). An effort was made to sample caribou from various portions of each group.

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, grizzly bears and wolves, and eagles. Although we included bull collars in the survey flight planning, and some groups had a mix of cows and bulls, the main effort was invested in finding cow collars and the numbers of bulls and cows classified are not representative of the herd overall.

RESULTS

Survey Conditions

Weather conditions were generally good during the survey, with temperatures varying between about +13°C and +24°C and generally averaging +15-18°C. Weather on July 10 and 11 included some low clouds and showers, particularly near Contwoyto Lake, which was still largely frozen on the surface. Local information from Kugluktuk residents indicated that spring and snow-melt were late in 2020. MacKay Lake had some open water but was still mostly frozen on the surface. On July 12 we hoped to fly to Kugluktuk but were prevented by poor weather between Daring Lake and Kugluktuk. Weather July 13-16 in the Kugluktuk area was mostly blue skies and temperatures between +16° and +20°C, which likely promoted the formation and continuation of post-calving aggregations. There were a few scattered late snow-patches, mostly on north-facing slopes.

Post-Calving Aggregations

Most caribou we found in both herds were in post-calving aggregations numbering, in some cases, less than 100, and most were in groups of several hundred, 1,000 or more, and in a few cases, several thousand (Figures 2-6).

Figure 2. Post-calving aggregation on Bathurst range, July 2020

Figure 3. Close-up of a post-calving aggregation, Bathurst range, July 2020. A collared cow is in the foreground.

Figure 4a. A post-calving aggregation on the range of the Bluenose-East caribou herd from the air, July 2020.

Figure 4b. The same Bluenose-East caribou post-calving aggregation seen from the ground, July 2020.

Figure 5a. A post-calving aggregation of several thousand caribou on the range of the Bluenose-East caribou herd from the air, July 2020.

Figure 5b. Part of a densely packed post-calving aggregation of several thousand caribou (same group as Figure 5a) on the Bluenose-East range from the ground, July 2020.

Figure 6. A close-up of part of a post-calving caribou group on the Bluenose-East range, July 2020. A collared cow is visible near the upper right-hand corner.

Daily Flying and Survey Crew

A daily summary of flying hours and tasks for each day is shown in Table 1. The survey aircraft and three-person crew are shown in Figure 7.

Table 1. Daily summary of flying hours and tasks accomplished on Bathurst and Bluenose-East July 2020 composition surveys. Flight from Yellowknife to Daring Lake and Lupin July 10 is included with Bathurst survey as ferry flying. Flights from Daring Lake to Kugluktuk July 13 and from Kugluktuk to Yellowknife July 16 are included with Bluenose-East survey as ferry flying.

Date	Flying Hours and Tasks
July 10	Leave Yellowknife 8:35 am; fly to Diavik to look for problem grizzly bears (not found); arrive Daring Lake 10:45 am; fuel Lupin mine; survey Bathurst herd north of Lupin (one group estimated 500), fuel Lupin, down Daring Lake 5:44 pm. Flying hours 6.5; survey flying 2.2 hours; 4.3 hours ferry.
July 11	Leave Daring 9:43 am; fuel Lupin; survey Bathurst herd north of Lupin; found three large groups (estimated 2,000-3,000, 800-1,000, 1,000-1,500); fuel Lupin, down Daring 6:49 pm. Flying hours 6.2; 4.6 hours survey; 1.6 hours ferry.
	Bathurst survey July 10 and 11: 12.7 hours total, 6.8 hours survey; 5.9 hours ferry
July 12	No survey flying; poor weather between Daring Lake and Kugluktuk.
July 13	Leave Daring Lake 10:12 am; initially low cloud/showers, clearing towards Kugluktuk; arrive Kugluktuk 12:35 pm, fuel; leave Kugluktuk for Bluenose-East survey NW of Kugluktuk 2:34 pm (saw very few caribou), down Kugluktuk 4:43 pm. Flying hours 4.6.
July 14	Leave Kugluktuk 10:06 am; survey Bluenose-East herd NW and W of Kugluktuk; groups estimated 1,000-2,000, 300, 40, 500, 5,000, 300, 500; fuel Lupin 1:40 pm, down Kugluktuk 5:52 pm. Flying hours 4.9.
July 15	Leave Kugluktuk 9:49 am; survey Bluenose-East herd NW of Kugluktuk; fuel Kugluktuk 12:27 pm; survey Bluenose-East herd in Rae and Richardson valleys, groups estimated 5,000, 150, 300; fuel Kugluktuk 4:21 pm; survey towards Dismal Lakes, two groups of about 200 each, nearly all bulls; down Kugluktuk 7:11 pm. Flying hours 6.9.
July 16	Morning flight with observers from Kugluktuk (Albert Anavilok, Amanda Dumond, Russell Akeeagok); leave Kugluktuk 10:10 pm; found group of 2,000-3,000 caribou near Rae River, landed 10:18-11:08 pm to watch caribou; down Kugluktuk 11:16 pm. Leave Kugluktuk 12:51 pm southbound, picking up stationary collars en route; fuel Little Crapeau Lake 3:48 pm; down Yellowknife 7:09 pm. Flying hours 5.6.
	Bluenose-East survey July 13-16: 22.0 hours total, 14.1 hours survey, 7.9 hours ferry
	Total flying hours 34.7; survey 20.9 hours; 13.8 hours ferry

Figure 7. Survey crew on July 2020 Bathurst and Bluenose-East composition surveys, left to right: Jan Adamczewski, Jordan Crook, and Judy Williams.

Bathurst Survey

The Bathurst survey in July 2020 was flown on July 10 and 11 with the helicopter based at Daring Lake, NWT, south of Contwoyto Lake. We relied on a fuel cache at the Lupin mine site on the south side of Contwoyto Lake (Figure 8). Because of the high daily movement rates of the collared caribou and the concentration of much of the herd in post-calving aggregations, we used some east-west transect lines in the vicinity of the most recent collar locations to increase our chances of encountering caribou groups. Incidental sightings of other large mammals and eagles on the Bathurst survey are also shown in Figure 9.

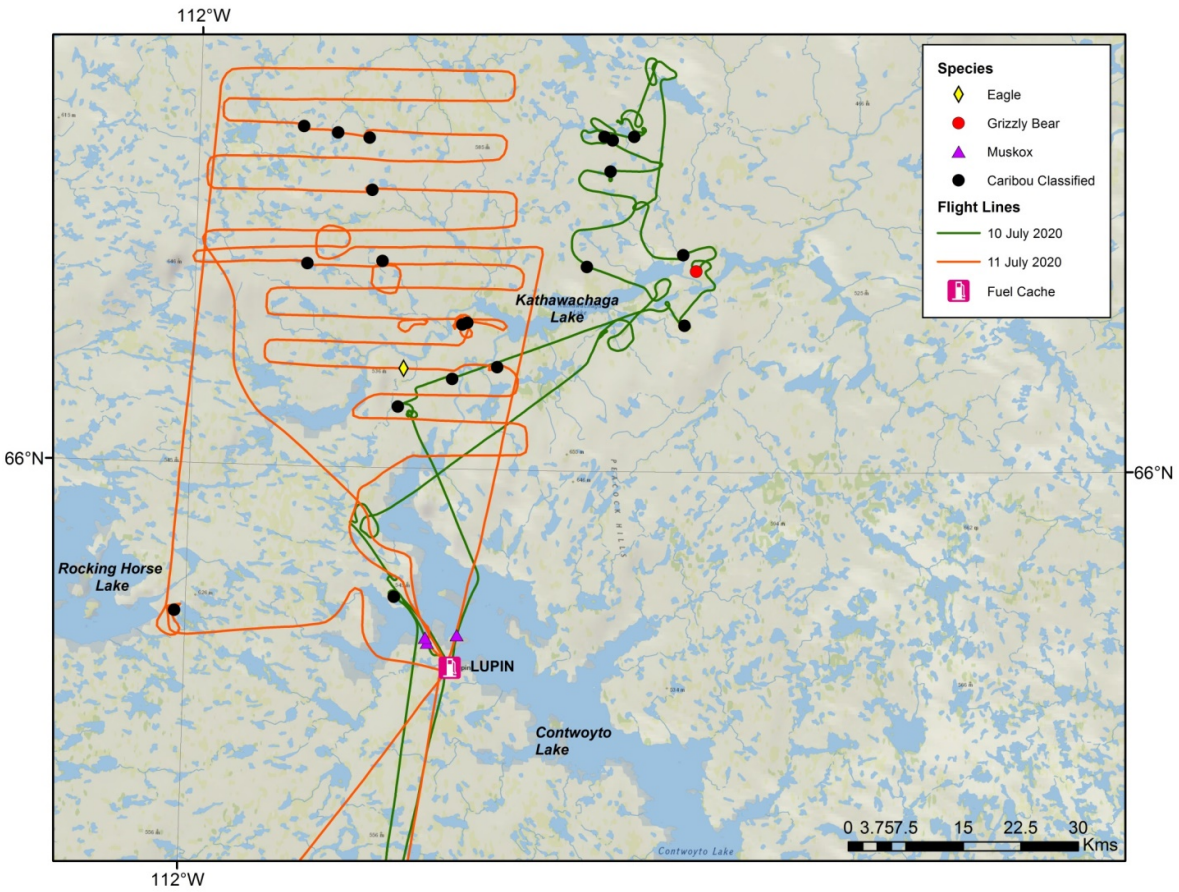

Figure 8. Survey flight lines, locations of Bathurst caribou groups surveyed, and incidental sightings of other mammals and a golden eagle on July 10 and 11, 2020.

Locations of collared Bathurst caribou on July 10, 11 and 12, 2020 are shown in Figure 9. As appears typical of caribou in post-calving aggregations during the insect season, movement rates were high and direction of movements was unpredictable. Although some of the caribou groups we saw numbered hundreds or thousands, their tight concentrations and rapid movements made finding the groups challenging. In addition, the collars were programmed to transmit locations every second day at this time of year, which added to the challenge of finding the caribou groups.

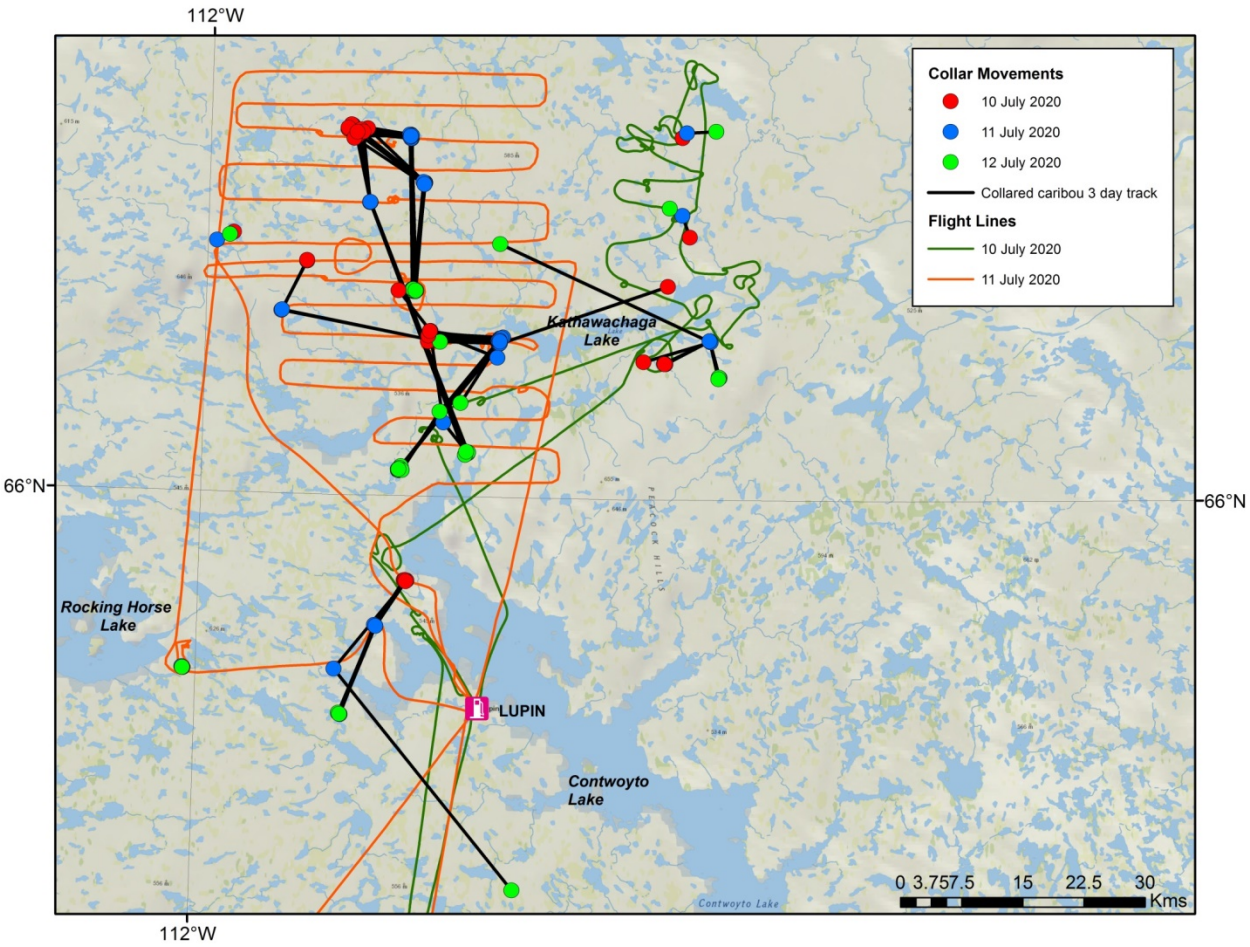

Figure 9. Locations of collared Bathurst caribou on July 10-12, 2020. Flight lines for July 10 and 11 are also shown.

Numbers of collared male and female caribou in the Bathurst and Bluenose-East herds at the time of the July surveys are listed in Table 2, along with the numbers of these collared caribou that were in the vicinity of the surveyed areas. All 40 Bathurst collared cows and nine of 16 collared bulls were in the areas flown. All 34 collared Bluenose-East cows and 17 of 20 collared bulls were in the areas flown.

Table 2. Numbers of active collared cow and bull caribou from the Bathurst and Bluenose-East herds during July 2020 composition surveys. Collared caribou within surveyed areas are noted. Nearly all the collars placed in late winter 2020 are included as they had separated out to their herds by mid-July 2020.

Collar Numbers	Bathurst			Bluenose-East		
	F	**M**	**Total**	**F**	**M**	**Total**
Total	40	16	56	34	20	54
In Areas Flown	40	9	49	34	17	51

Bluenose-East Survey

Flight lines on the Bluenose-East survey July 13-15, locations of caribou groups surveyed, and locations of incidental sightings of other large mammals and eagles seen are shown in Figure 10. Some areas northwest of Kugluktuk were flown more than once due to the unpredictable and substantial movements of collared caribou. Areas near Dismal Lakes southwest of Kugluktuk had a number of bull caribou collars and the relatively small groups found in that area were either mostly bulls or mixed groups. Kugluktuk was the only site for fueling as caribou were generally close enough to the community that a remote fuel cache was not needed.

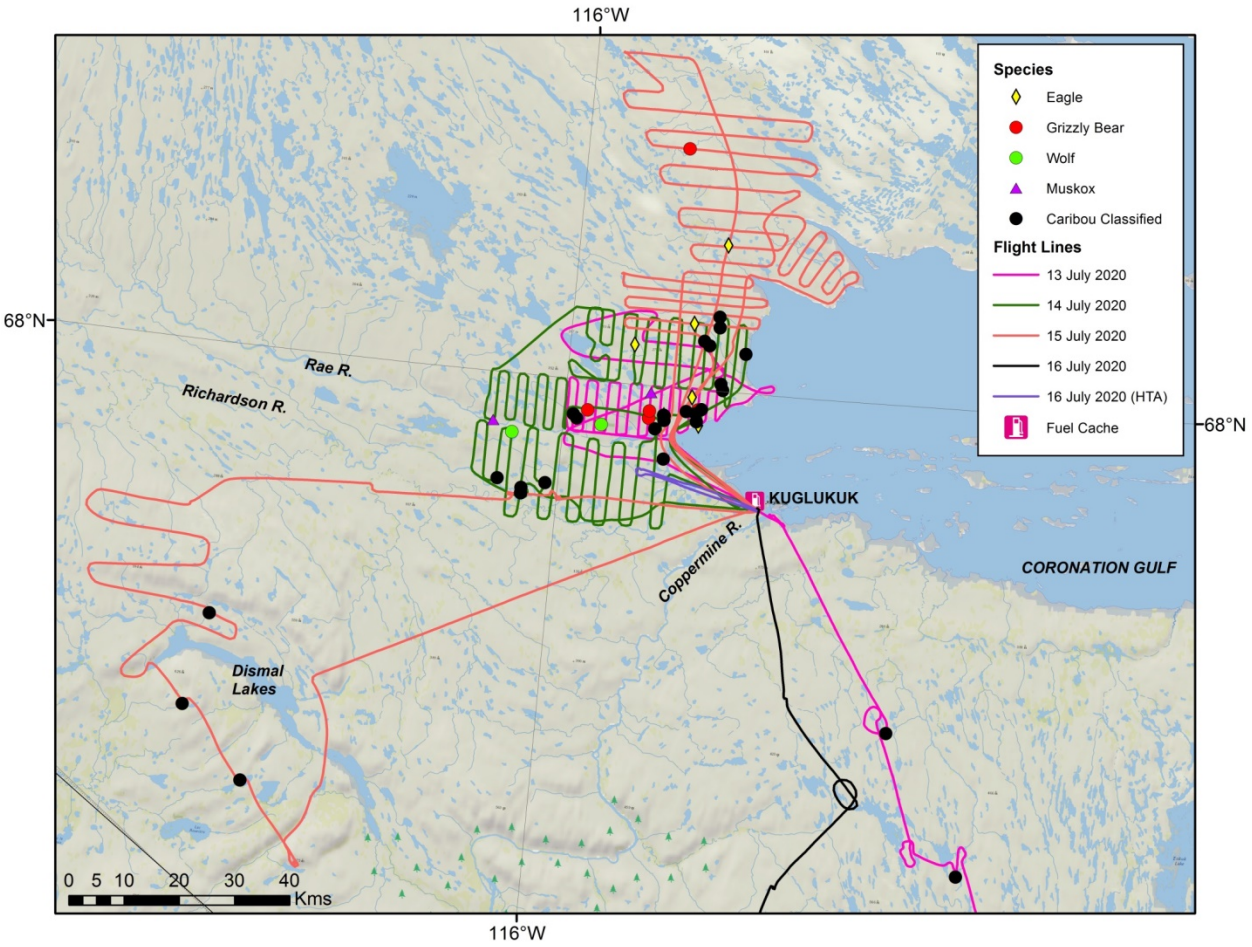

Figure 10. Survey flight lines, locations of Bluenose-East caribou groups surveyed, and incidental sightings of other mammals and eagles on July 13-15, 2020. On July 16 there was a brief morning flight to one site to observe caribou with 3 community members from Kugluktuk, then a flight south to Yellowknife with retrieval of some stationary collars en route home.

Locations of collared Bluenose-East caribou on July 13-15 are shown in Figure 11. As we found with the Bathurst herd, movement rates were high and direction of movements was unpredictable. One collared cow had locations on July 13 and 14 about 20 km apart, and locations on July 14 and 15 about 40 km apart. Although some of the caribou groups we saw numbered hundreds or in some cases thousands, their tight concentrations and rapid movements made finding the groups challenging.

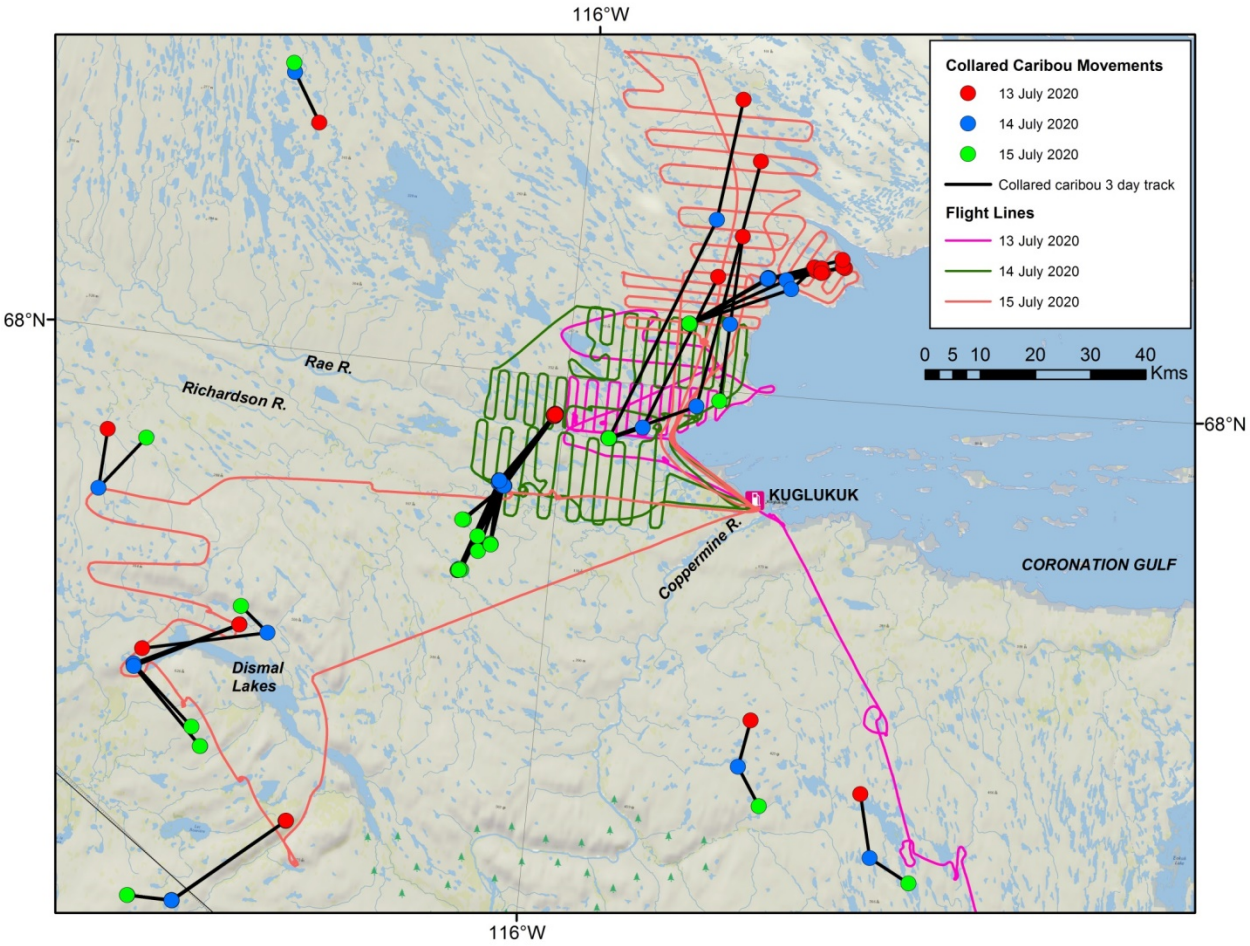

Figure 11. Locations of Bluenose-East collared caribou on July 13-15, 2020. Flight lines for these three days are also shown.

Likely Peak of Calving in June 2020

Graphs of daily movement rates of collared Bathurst and Bluenose-East caribou from late May to late June are shown in Figure 12. As a general guide, a reduction of average daily movement rates of females below 5 km/day has been associated with the peak of calving when cows give birth and move little with newborn calves. For the Bathurst herd, this reduction to less than 5 km/day occurred around June 1-2, with average movement rates remaining below this level until about June 16. Mapping of collared caribou locations in late May indicated that several collared Bathurst cows were on-site on the calving grounds in the last week of May. Given that the herd's range has contracted substantially and shifted northward, several collared cows wintered north of tree-line and their spring migration north was reduced in length. It is possible that the drop below 5 km day preceded calving by a few days. The peak of calving likely occurred in the first week of June for the Bathurst herd, possibly around June 2-4. For the Bluenose-East herd, movement rates remained above 10 km/day until June 3 and dropped to about 5 km/day on June 8. Movement rates

remained below 5 km/day from June 9 to about June 20. These results would suggest that the peak of calving in the Bluenose-East herd was a few days later than in the Bathurst herd and calving may have peaked around June 9-10.

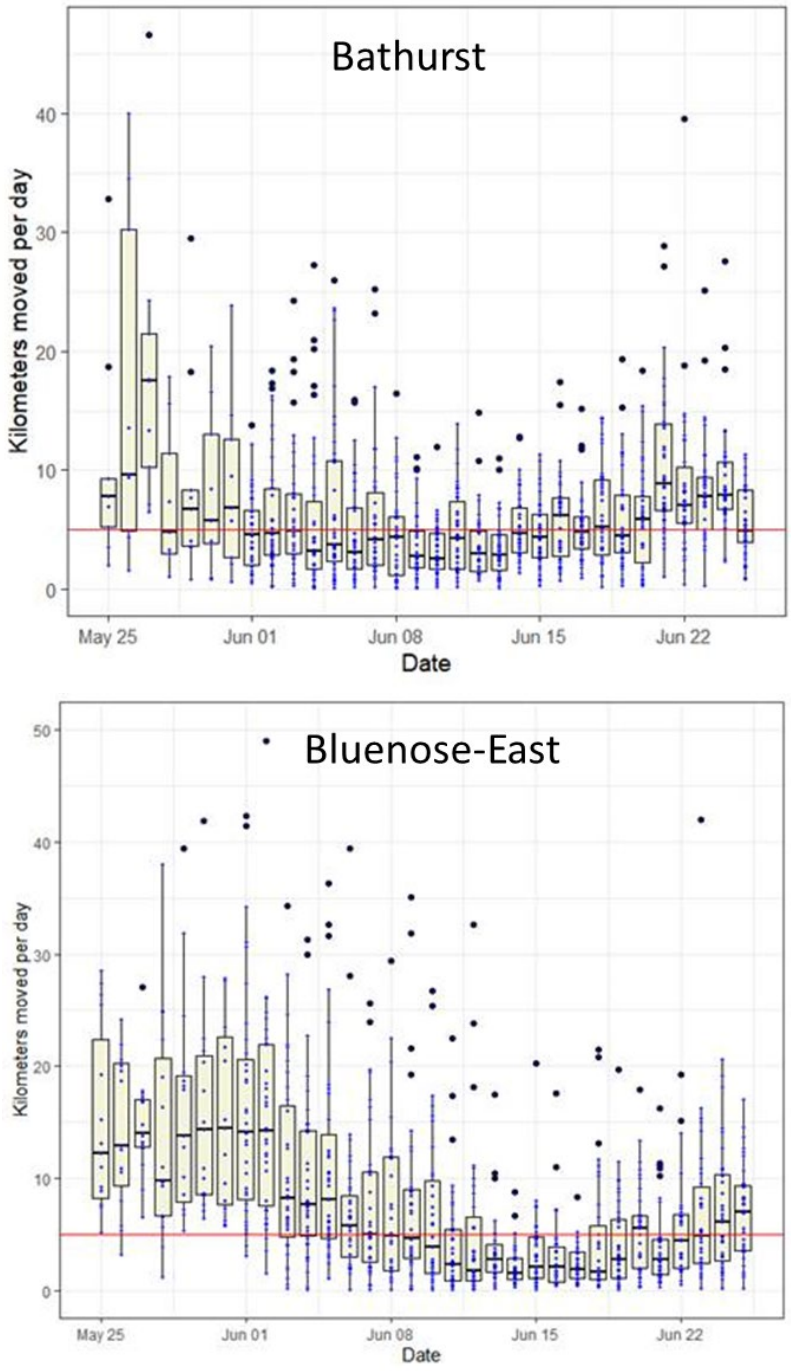

Figure 12a, b. Daily movement rates of Bathurst collared female caribou in late May and June 2020 (top) and daily movement rates of Bluenose-East collared female caribou (bottom). The red line indicates 5 km/day, a threshold associated with cows giving birth. Graphs courtesy of J. Boulanger.

Survey Results for Bathurst and Bluenose-East Herds

For the Bathurst herd, a total of 1,628 caribou were classified in 20 groups on July 10 and 11, 2020. The calf:cow ratio was 44.1 calves: 100 cows (standard error 2.0, lower 40.0 and upper 46.7 95% CI). The mean and median group sizes were 81.4 and 4.5; actual group sizes encountered were generally large groups numbering hundreds or thousands.

For the Bluenose-East herd, a total of 3,136 caribou were classified in 32 groups on July 13, 14 and 15, 2020. The calf:cow ratio was 46.9 calves: 100 cows (Standard Error 3.0, lower 41.1 and upper 53.0 95% CI). The mean group size was 98; as with the Bathurst results, actual group sizes encountered were generally large groups numbering hundreds or thousands. Estimated group sizes encountered are in Table 3, and one group encountered on July 14 may have numbered in the range of 5,000 caribou (Figure 5).

We note that yearling caribou were recorded occasionally rather than systematically, and their numbers do not represent their proportion in the population. Similarly, some young bulls and prime bulls were recorded but the main effort was focused on cows and calves. A few collared bulls in both herds were in areas that were not surveyed. As a result, the relative numbers of bulls and cows are not representative of the herds.

Table 3. Results of July 2020 composition surveys for Bathurst and Bluenose-East caribou herds

Measurement	Bathurst Herd	Bluenose-East Herd
# Caribou	1,628	3,136
# Cows	926	1,850
# Calves	408	868
# Young Bulls	247	248
# Prime Bulls	36	148
Yearlings	11	22
# Groups	20	32
Mean Group Size	81.4	98
Median Group Size	4.5	4
Calves: 100 Cows	44.1	46.9
SE Calves: 100 Cows	2.0	3.0
95% Conf. Interval Upper & Lower	46.7, 40.0	53.0, 41.1

Incidental Observations of Other Wildlife

Incidental sightings of large mammals and eagles are listed in Table 4. We note that the overall area for the Bathurst survey was relatively small and nearly all caribou classified were in four relatively large groups (Table 1). This may have influenced the numbers of sightings of other animals on the Bathurst survey relative to the Bluenose-East survey, where a larger area was surveyed and 12 caribou groups of various sizes were surveyed.

Table 4. Sightings of other large mammals and eagles on the Bathurst and Bluenose-East July 2020 composition surveys. Totals are given with individual group sizes in parentheses. There was one female grizzly bear with cubs listed as 1+2; the rest were single bears and gender was unknown.

Species	Bathurst Herd	Notes Bathurst	Bluenose-East Herd	Notes Bluenose-East
Moose	-		2 (1+1)	Cow and calf
Muskox	61 (3,8,50)	Large group near Lupin mine	13 (5,4,2,2)	
Wolf	1		2 (1,1)	
Grizzly Bear	1		7 (1,1,1,1,1+2)	1 female with 2 cubs
Bald Eagle	-		4 (1,1,1,1)	
Golden Eagle	1		3 (1,2)	

DISCUSSION

July 2020 Calf:Cow Ratios in the Bathurst and Bluenose-East Caribou Herds

The July 2020 calf:cow ratios of 44.0 calves: 100 cows in the Bathurst herd and 46.9 calves: 100 cows in the Bluenose-East herd may suggest relatively high calf mortality in the first few weeks in both caribou herds. Assuming that the 2020 peak of calving in the Bathurst herd was June 2-4 and in the Bluenose-East herd was June 9-10, then the calf: cow ratios we recorded in July 2020 likely occurred at about five weeks of age. We were unable to fly planned calving ground photo surveys in June 2020 due to COVID-19 travel restrictions; these surveys would have included composition surveys to estimate the percentage of breeding females. The overall % breeding females in the Bathurst herd was 72% in June 2018 (Adamczewski et al. 2019a) and 86% in June 2019 (Adamczewski et al. 2019b). In the Bluenose-East herd, the overall % breeding females was 79% in 2018 (Boulanger et al. 2019) and 87.5% in June 2019 (Adamczewski et al. 2019b). The average of these four estimates is 81% breeding females. If we assume a % breeding females of about 81% in June 2020, then by comparison, the calf:cow ratios in the Bathurst and Bluenose-East herds in July 2020 suggest that many calves died through the first five weeks of life. Alternatively, if the proportion of breeding females in June 2020 was lower than in 2018 and 2019, then the July calf:cow ratios in the two herds may in part reflect a low pregnancy rate in 2019-2020.

To our knowledge, calf:cow ratios have not previously been estimated in July for either the Bathurst or Bluenose-East herds. Composition surveys in July 2007 and 2008 flown over the Bluenose-West and Cape Bathurst caribou herds (Davison 2016) resulted in the following calf:cow ratios: Bluenose-West July 12-14, 2007: 77.4 calves: 100 cows; Bluenose-West July 8-12, 2008 59.6 calves: 100 cows; Cape Bathurst July 12-14, 2007 52.6 calves: 100 cows; Cape Bathurst July 7, 2008 49.3 calves: 100 cows. The average for these four surveys was 59.7 calves: 100 cows. These two herds had gone through large declines 2000-2005, but thereafter were roughly stable 2006-2012 (Davison 2016). We note that the July 2020 calf:cow ratios we recorded for the Bathurst and Bluenose-East herds were lower than these four estimates for the Bluenose-West and Cape Bathurst herds in July 2007 and 2008.

For further comparison, a composition survey was carried out June 23-25, 2004 on the Bathurst range (A. Gunn and J. Williams, unpublished data). The Bathurst herd at that time was still much larger than in 2020, as the herd estimate in June 2003 was 186,000 caribou (Gunn et al. 2005) with a slowly declining trend. A calf:cow ratio of 57.8 calves: 100 cows was recorded (A. Gunn and J. Williams, unpublished data). In addition, surveys of the Porcupine herd in late June have been carried out on a nearly annual schedule since 1987;

the average late June calf:cow ratio for 1987-2014 was 58 calves: 100 cows with a minimum of 41 and a maximum of 74 calves: 100 cows (Caikoski 2015). This interval (1987-2014) included periods of slow increase, slow decline, and increase in the Porcupine herd (Caikoski 2015). As our July 2020 surveys were carried out about three weeks after these late June surveys, it is possible that some further calf mortality occurred in the Bathurst and Bluenose-East herds between late June and mid July 2020. It seems unlikely, however, that late-June calf:cow ratios would have been as high as 58 calves in these two herds in late June and 44-47 calves: 100 cows three weeks later. Most commonly, mortality rates of caribou calves are highest in the first month (Bergerud 2000).

Calf:cow ratios are a widely used demographic indicator of caribou population trend (Bergerud 2000, Bergerud et al. 2008). Whether a calf:cow ratio is associated with a stable population depends in part on the cow survival rate (Crête et al. 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 of 38-45 calves: 100 cows for population 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 essentially impossible for the herd to produce enough calves for a stable herd (ibid.).

Fall composition surveys planned for October 2020 will provide further indices of seasonal calf survival and insight into the timing of calf mortality in the Bathurst and Bluenose-East herds. Ratios of 44.1 and 46.9 calves: 100 cows, if they are similar in the fall for these two herds, might be sufficient for a stable herd trend, but this will depend in part on the adult survival rate.

Potential post-calving surveys of Bathurst and Bluenose-East herds

Between 2000 and 2012, seven post-calving surveys of the Bluenose-East herd were attempted by ENR wildlife staff. Several of these were unsuccessful, including 2009 and 2012. In those two years, portions of the herd did not aggregate sufficiently for photos, which meant that a valid population estimate was not possible. Post-calving surveys of the Porcupine herd between 2002 and 2009 similarly failed due to weather and lack of aggregation (Caikoski 2015). After multiple failed Bluenose-East post-calving surveys, ENR switched to the calving photo survey methods for this herd, and in 2010 carried out calving and post-calving surveys for this herd, which resulted in similar population estimates of about 120,000 caribou (Adamczewski et al. 2017). Calving photo surveys for Bluenose-East have been flown successfully in every year attempted (2010, 2013, 2015 and 2018). Post-calving surveys of the Bathurst herd have not been attempted to date. We note, however,

that conditions in July 2020 were nearly ideal for post-calving surveys of both herds. Nearly all caribou seen were in well aggregated post-calving groups of hundreds or thousands. The survey crew and aircraft however were not set up for the telemetry or photography that would have been needed. Post-calving surveys for the Bathurst and Bluenose-East herds remain a viable option for population estimates, although the possibility remains that in some years, those surveys may fail if portions of the herds do not form sufficiently tight groups for photography.

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