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OCTOBER 2021 FALL COMPOSITION SURVEY OF THE BATHURST AND BLUENOSE-EAST BARREN-GROUND CARIBOU HERDS

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ABSTRACT

This report describes the results of a fall composition survey of the Bluenose-East barren-ground caribou herd conducted in October 2021. The main purpose of this survey was to estimate the sex ratio in the herd during the breeding season, and to estimate the proportion of females in the herd that were accompanied by a calf, as an index of calf mortality in the first four and a half months of age. We also attempted to carry out a fall composition survey of the Bathurst herd, but were unsuccessful because the herd was mixed with a portion of the much larger Beverly herd.

The surveys were conducted between October 18 and 23 with a total of 31.7 hours flown. The survey crew of Judy Williams, Jan Adamczewski, Colin Modeste-Burgin and pilot Robert Taylor flew in an A-Star B2 helicopter operated by Acasta HeliFlight Inc. The Government of Northwest Territories (GNWT) Tundra Ecological Research Station at Daring Lake in the Northwest Territories was the base of operations. Survey flying was focused on flying to locations of female and male collared Bathurst or Bluenose-East caribou. Caribou were classified as cows, calves, young bulls and prime bulls using motion-stabilized binoculars from the front seat of the helicopter. Observations were recorded on tablet computers. Multiple observations of bulls fighting and bulls closely following cows suggested that the surveys took place near the peak of the rut.

For the Bluenose-East herd, the survey resulted in an estimated ratio of 49.6 calves:100 cows (95% CI 45.6-53.0). This was similar to the fall 2020 calf:cow ratio for this herd of 51.7 calves:100 cows (95% CI 47.2-55.7) and suggested two consecutive years of good recruitment. Of the 52 collared females and 15 collared males in the Bluenose-East herd at the time of the surveys, 51 females and 14 males (97.4% of total collars) were in the vicinity of caribou groups surveyed. This suggested that the sample was representative of the herd. A total of 4,049 caribou (including calves) were classified in 177 groups. The bull:cow ratio was 68.7 bulls: 100 cows (95% CI 61.3-77.4). This ratio was similar to the bull:cow ratio estimated a year earlier of 63.3 bulls:100 cows (95% CI 50.0-79.0) for this herd.

The attempted Bathurst fall composition survey resulted in estimated ratios of 56.3 calves:100 cows (95% CI 46.8-66.0) and 116.8 bulls:100 cows (95% CI 101.3-139.3), with a total of 2,018 caribou (including calves) surveyed. A bull:cow ratio of more than 100 bulls: 100 cows is not realistic for the Bathurst herd. There was an estimate of 64.1 bulls:100 cows (95% CI 49.6-79.6) in October 2020, when three quarters of the Bathurst collared caribou were in the survey area and no other collared caribou (Beverly or Bluenose-East) were mixed with the Bathurst collars. In October 2021, there were 28 Bathurst collared cows in the survey area, but there were also eight collared Beverly cows in this area. An approximate calculation of likely caribou abundance suggests that there were probably

about three and a half times as many Beverly caribou as Bathurst in the area surveyed, thus the sample likely was mostly Beverly caribou. However, most of the Beverly collared caribou (23 cows and 20 bulls) were in an area far to the east and not surveyed. The survey only sampled a limited proportion of the Beverly herd, thus cannot be considered to represent that herd adequately. These results should be set aside as they are not an adequate sample representative of either herd.

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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). Ranges of the neighbouring Bluenose-West and Beverly herds are also shown.

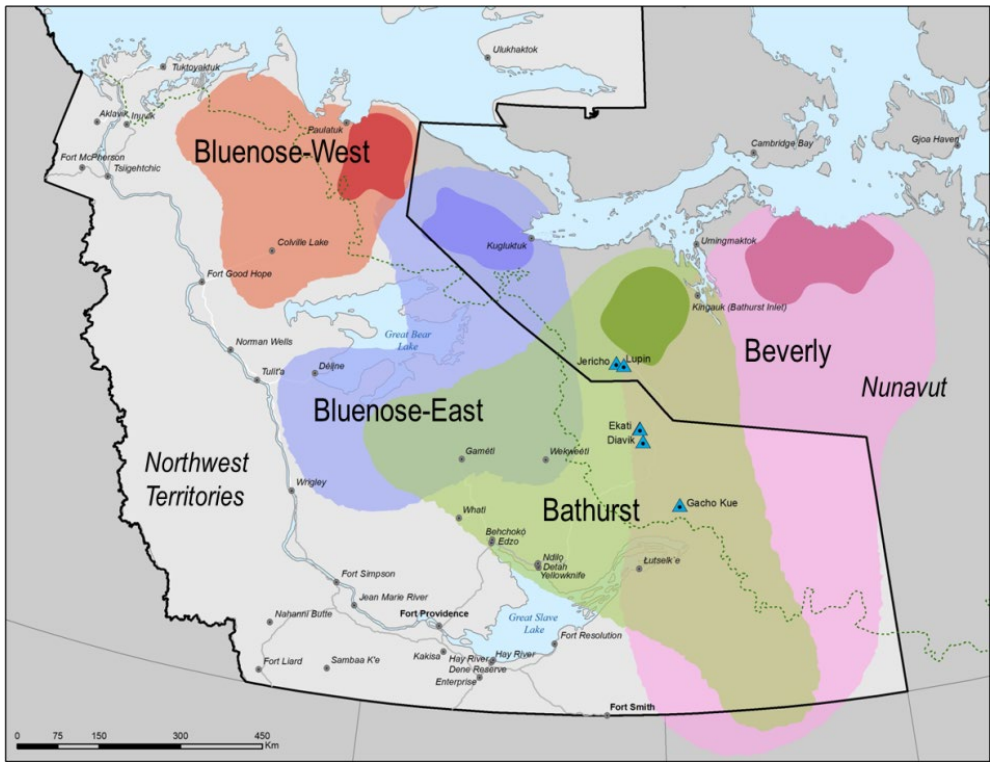

Figure 1. Annual ranges and calving grounds of the Bluenose-West, Bluenose-East, Bathurst, and Beverly[1] herds , based on accumulated radio collar locations of cows (Nagy et al. 2011). Other herd ranges west and east of these four herds were omitted for simplicity.

Population estimates for the Bathurst herd (Adamczewski et al. 2019) and Bluenose-East herd (Boulanger et al. 2019) in 2018 showed large declines from the previous estimates in 2015. In joint management proposals from the Tłı̨chǫ Government and the Department of Environment and Natural Resources (ENR) to the Wek'èezhìı 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 (ENR and Tłı̨chǫ Government 2019a,b).

[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).

Composition surveys during the fall breeding season (usually late October) have been carried out for the Bathurst and Bluenose-East herds in multiple years since 2009-2010. At the peak of the breeding season, all sex and age classes of caribou are mixed in rutting aggregations, thus sampling across the herd's distribution can provide an estimate of the sex ratio (bulls: 100 cows). This is needed to generate an overall herd estimate from the estimated numbers of females on the calving grounds in June (e.g. Boulanger et al. 2019). In addition, a calf:cow ratio can be estimated which gives an index of calf survival in the first four and a half months after birth.

METHODS

Locations of collared Bathurst (31 female (F), 16 male (M)) and Bluenose-East (52 F, 15 M) caribou were monitored through the study period of October 18-23, 2021. In addition, we monitored the locations of Beverly collared caribou (31 F, 20 M). All the Bluenose-East collared caribou were in areas with no other collars (other herds) mixed in. However, the Bathurst and Beverly collars were mixed in two groups (Figure 2), and there were no areas with only Bathurst collars. The western Bathurst group had 28 of 31 collared Bathurst female caribou and ten of 16 Bathurst collared bulls, thus likely contained the bulk of the Bathurst herd. This group also had eight Beverly collared cows. The eastern Beverly group had three Bathurst collared cows and 23 collared Beverly cows; there were also 20 Beverly collared bulls and six collared Bathurst bulls in this area. We attempted to survey the Bathurst herd in the western group.

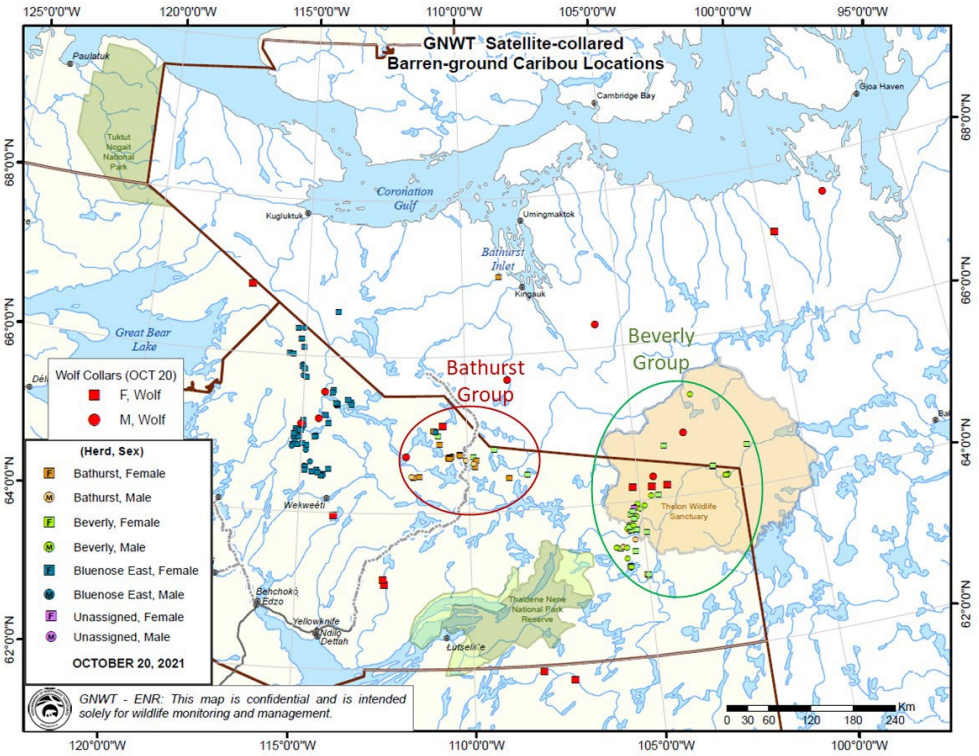

Figure 2. Locations of Bluenose-East, Bathurst and Beverly collared caribou on October 20, 2021. Most of the Bathurst collared caribou were in the western Bathurst group, and most of the Beverly collars were in the eastern Beverly group.

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), prime bulls (based on large body size and large antlers and absence of vulva patch) and young bulls (based on absence of vulva patch, smaller size and smaller antlers).

Identification of young bulls and prime bulls was somewhat subjective; the largest prime bulls and the smallest bulls were unmistakable but intermediate-sized bulls required a judgment call. 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 and locations of other large mammals.

RESULTS

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 crew, pilot Robert Taylor, Judy Williams, Colin Modeste-Burgin and Jan Adamczewski, are shown in Figure 3.

Figure 3. October 2021 fall caribou composition survey crew: Colin Modeste-Burgin, Judy Williams and pilot Robert Taylor (left); Jan Adamczewski, Williams and Taylor (right).

Table 1. Daily summary of flying during the October 2021 fall composition surveys.

Date	Flying Hours and Tasks
Oct. 18	Positioning flight to Daring Lake research station; 1.7 hours ferry flying. Survey Bathurst group; 2.8 hours.
Oct. 19	Survey Bathurst group; 3.5 hours.
Oct. 20	Survey Bluenose-East; 6.2 hours.
Oct. 21	Survey Bluenose-East; 6.3 hours.
Oct. 22	Survey Bathurst group; 6.3 hours.
Oct. 23	Survey Bluenose-East; 3.7 hours. Return to Yellowknife; 1.2 hours ferry flying.
	Bluenose-East survey: 17.4 hours total; 16.2 hours survey; 1.2 hours ferry flying. Bathurst survey 14.3 hours total; 12.6 hours survey; 1.7 hours ferry flying.
	Total flying hours 31.7 hours; 28.8 hours survey; 2.9 hours ferry flying.

Survey Conditions

Temperatures during the surveys were exceptionally mild, varying between -4°C and +10°C. The larger lakes had nearly all open water, with only a few bays with ice on them; some of the smaller ponds were frozen over. Flying on October 18 and 19 was somewhat constrained by low cloud. Weather October 20-23 was mostly blue skies with temperatures above freezing and strong winds. Snow cover was thin and patchy (Figure 4), which made caribou difficult to spot. Snow cover decreased over the survey period.

Caribou Group Composition and Rutting Behaviour

There were multiple observations of prime bulls fighting during the Bathurst and Bluenose-East October 2021 surveys. We also saw many cases of prime bulls closely following cows. Groups of caribou consistently showed a mix of cows, calves, prime bulls and young bulls and some groups were substantial in number (hundreds). These observations suggested that our surveys were timed close to the peak of the breeding season.

Figure 4. Snow conditions during Bathurst survey October 22 (top) and Bluenose-East survey October 21 and 23, 2021 (bottom). Snow cover was generally light and patchy and decreased during the survey period. Most lakes had primarily open water with some bays and smaller ponds frozen over. Photos GNWT/ENR.

Survey Results for Bluenose-East Herd

The Bluenose-East survey was flown on October 20, 21 and 23 with the helicopter based at Daring Lake research station in the NWT, south of Contwoyto Lake (Figure 5). The last day of the survey was October 23 with surveying just north of Wekweètì, followed by return to Yellowknife. Of the 52 collared females and 15 collared males in the Bluenose-East herd at the time of the surveys, 51 females and 14 males (97.4% of total collars) were in the vicinity of caribou groups surveyed. This suggested that the sample was representative of the herd. There were no collars from other herds mixed with the Bluenose-East collars.

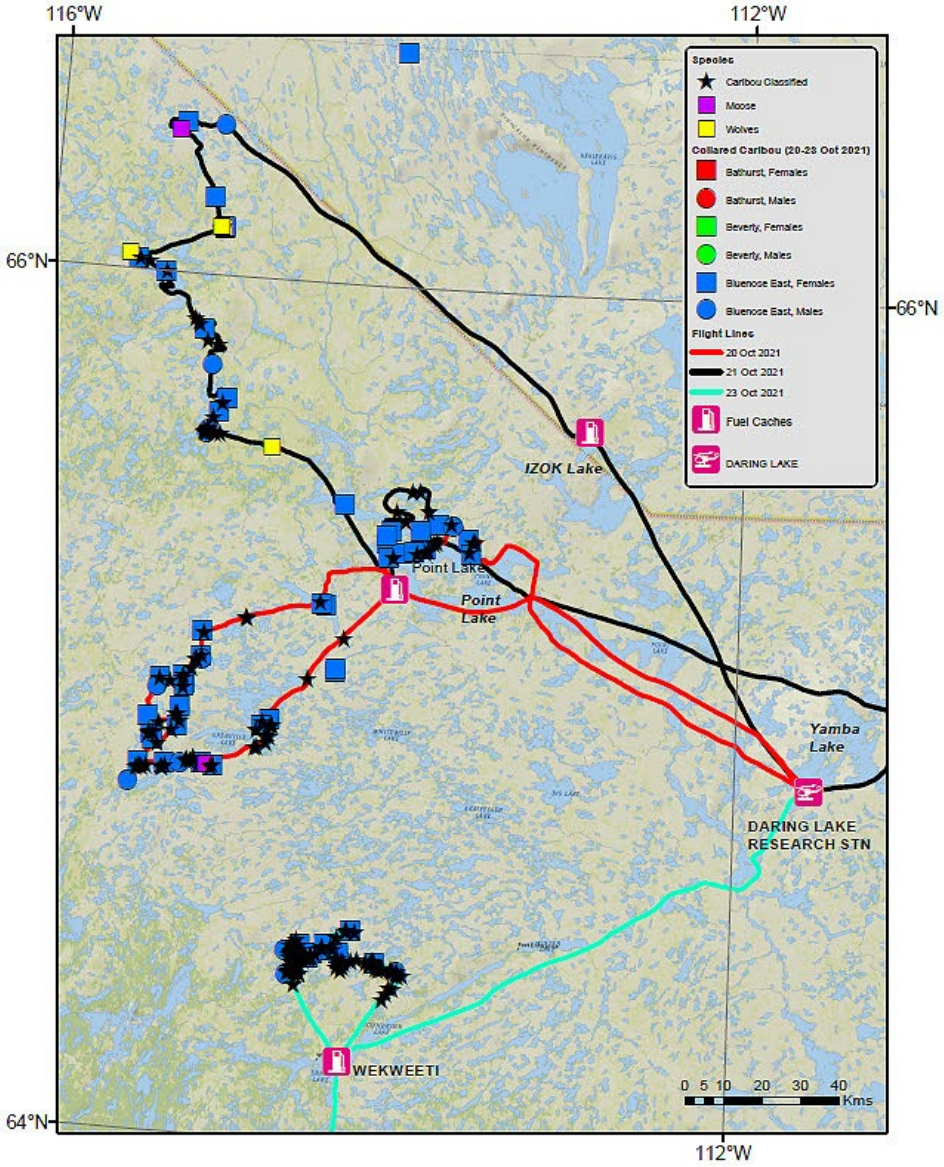

Figure 5. Helicopter flight lines, collared Bluenose-East caribou locations, locations of caribou groups surveyed, and incidental wildlife observations on October 20, 21 and 23, 2021. Collar locations are for each of the three days flown. The main base was the Daring Lake research station with fuel at Point Lake, Izok Mine camp and Wekweètì.

The survey of the Bluenose-East herd included 4,049 caribou (including calves) in 177 groups (Table 2). Groups identified during the survey were more units of convenience than actual group sizes. There were 52 female collared caribou and 15 male collared caribou in the herd, and 51 of the females and 14 of the males were in areas surveyed (Table 3). There were no collars from neighbouring herds mixed in. These results suggested that the survey was a representative herd-wide sample.

Table 2. Overall results and regional variation for October 2021 Bluenose-East fall composition survey in Figure 5. SE = Standard Error; CIU = 95% Confidence Interval Upper; CIL = 95% Confidence Interval Lower.

Measurement	All Areas	North Area (Oct. 21)	Central Area (Oct. 20)	South Area (Oct. 23)
# Caribou	4,049	798	2,292	959
# Cows	1,854	334	1,074	446
# Calves	919	151	511	257
# Young Bulls	734	200	378	156
# Prime Bulls	540	113	329	98
# Groups	177	28	61	88
Mean Group Size	22.9	28.5	37.6	10.9
Calves: 100 Cows	49.6	45.2	47.6	57.6
SE Calves: 100 Cows	1.8	6.1	2.7	1.8
CIU & CIL Calf:Cow	53.0, 45.6	57.2, 33.9	52.2, 41.9	61.3, 54.1
Bulls: 100 Cows	68.7	93.7	65.8	57.0
SE Bulls: 100 Cows	4.0	10.7	5.5	5.8
CIU & CIL Bull:Cow	77.4, 61.3	118.7, 77.2	78.1, 56.0	68.7, 46.9

Table 3. Numbers of collared Bluenose-East, Bathurst and Beverly caribou available and in areas flown, October 2021 fall composition surveys

A. Bluenose-East survey (no other collars mixed in)

	F	M	Total
Collars on Herd	52	15	67
Collars in Areas Flown	51	14	65

B. Bathurst Group (western cluster Figure 2; survey attempted)

	Bathurst			Beverly		
	F	M	Total	F	M	Total
Collars on Herd in Group	28	9	37	8	0	8
Collars in Areas Flown	27	8	35	5	0	5

Note there was also one Bluenose-East bull collar in this area.

C. Beverly Group (eastern cluster Figure 2; no survey attempted)

	Bathurst			Beverly		
	F	M	Total	F	M	Total
Collars on Herd in Group	3	6	9	23	20	43

The overall Bluenose-East calf:cow ratio was 49.6 calves: 100 cows (95%CI 45.6-53.0). Results were calculated separately for each day of the survey to assess regional variation in the calf:cow and bull:cow ratios. The October 20 results were for a central portion of the herd's collared caribou, the October 21 results were for the northern portion of the herd's collared caribou and the October 23 results were for the southern portion of the herd's collared caribou (see Figure 5). The calf:cow ratio was lowest in the northern area (45.2: 100 cows, October 21), highest in the southern area (57.6: 100 cows, October 23) and intermediate in the central area (47.6: 100 cows, October 20).

The overall bull:cow ratio for the Bluenose-East herd was 68.7 bulls: 100 cows (95%CI 61.3-77.4), with a relatively high variance. Regional variation in the bull:cow ratio was greater than variation in the calf:cow ratio. The bull:cow ratio was highest in the northern area (93.7:100 cows, October 21), lowest in the southern area (57.0:100 cows, October 23), and intermediate in the central area (65.8:100 cows, October 23).

To provide context for the 2021 Bluenose-East fall composition survey, fall calf:cow ratios for the herd from 2009-2021 are shown in Figure 6. The calf:cow ratios do not show a clear trend over this period; however, the ratios in October 2020 and 2021 were the highest of the nine surveys conducted over these years. Bull:cow ratios between 2009 and 2019 were variable with a slight downward trend. The ratios recorded in October 2020 and 2021 were higher than those observed in this herd between 2009 and 2019.

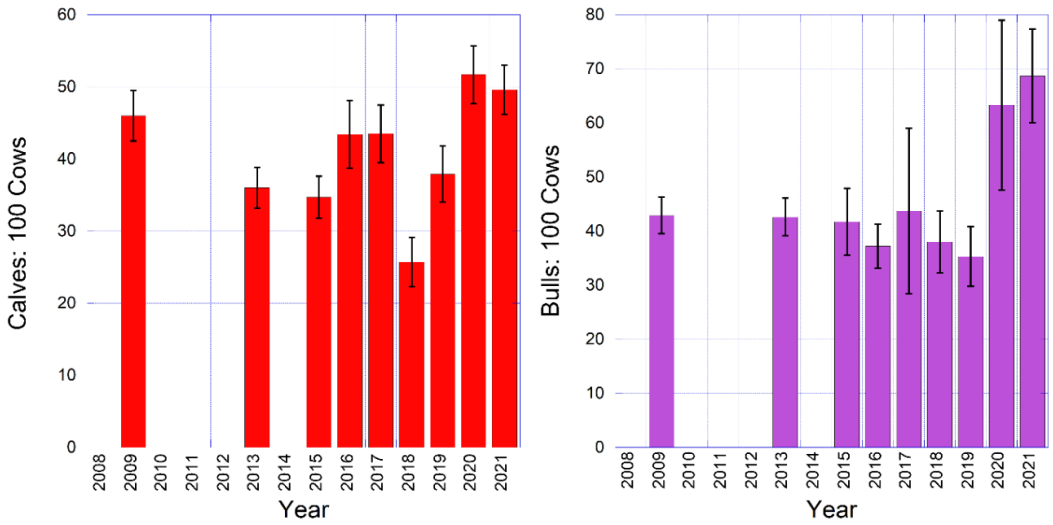

Figure 6. Fall calf:cow ratios (left) and bull:cow ratios (right) for the Bluenose-East herd 2009-2021.

Results for Attempted Bathurst Survey

At the time of the October 2021 composition surveys, most of the Bathurst collared caribou were in a western group (Figure 2, Table 3) that was relatively close to the Daring Lake research station. There were also eight collared Beverly cows in this area. A smaller number of Bathurst collared caribou were in an eastern group that had mostly Beverly collared caribou. No survey was attempted of the eastern group, which was in relatively remote areas and was predominantly Beverly caribou. The Bathurst survey effort was focused on the western group with most of the Bathurst collars.

Flying to Bathurst collared caribou on October 18 and 19 had limited success as we saw relatively few caribou (Figure 7). Collared caribou were still moving substantial distances daily and the patchy snow conditions made caribou difficult to spot. A brief flight was also made to some Bathurst collars late on October 21. A more successful flight occurred on October 22 when multiple collars were flown to and a total of 2,018 caribou (including calves) were classified. Many of these were in the vicinity of the Ekati and Diavik diamond mines. We include the results from the October 22 survey here, as the earlier flights included some of the same collared caribou and classification may have included some of the same caribou groups seen on previous days.

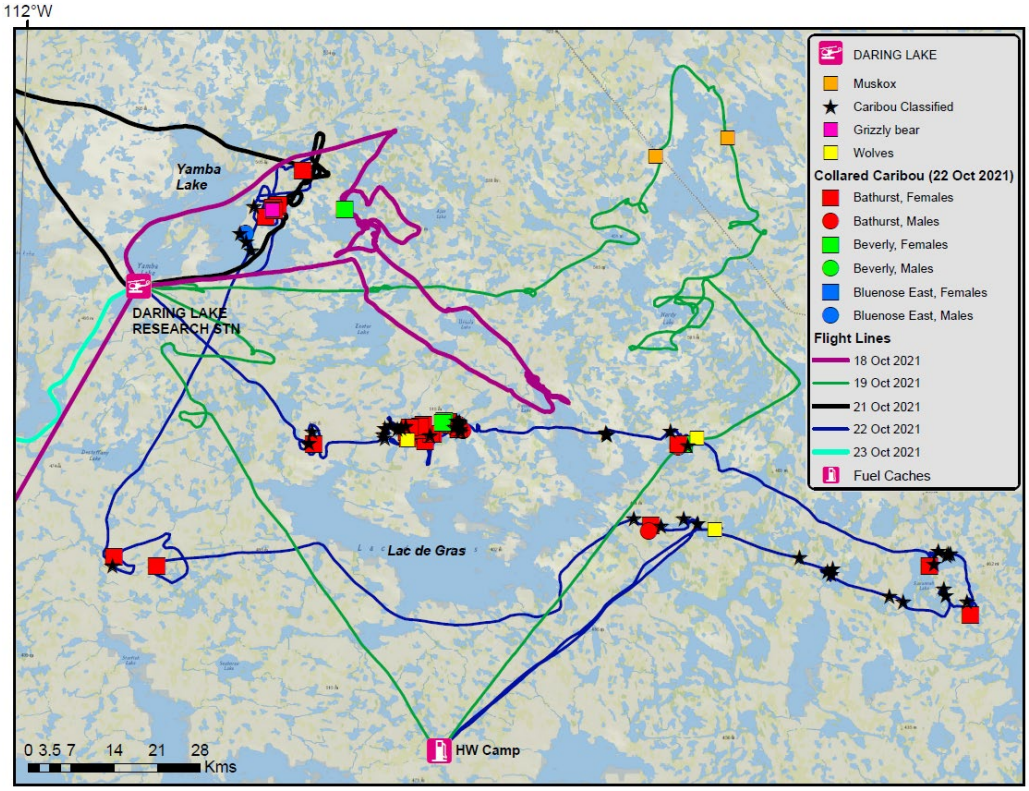

Figure 7. Flight lines October 18, 19, 21 and 22, 2021 on attempted Bathurst fall composition survey. Collar locations are from October 22. Incidental observations of grizzly bears, wolves and muskoxen are included.

Assessment of Attempted Bathurst Composition Survey

More than 2,000 caribou were classified on October 22 in an area that included most of the current Bathurst collared caribou, including 27 of 31 Bathurst collared cows available at the time (Table 4). However, there were also eight of 31 Beverly collared female caribou in the general area (western group on Figure 2) and five of these collars were in the areas sampled on October 22. A rough calculation was made of collared cow numbers and relative herd sizes in 2018: 8/31 female Beverly collars x 103,000 Beverly herd = 26,581 Beverly caribou; 28/31 female Bathurst collars x 8,200 Bathurst herd = 7,406 Bathurst caribou. While only an approximation, this suggests that there were about three and a half times as many Beverly caribou in the area as Bathurst. The caribou classified in this area were thus likely more representative of the Beverly herd than the Bathurst, and this sample cannot be considered representative of the Bathurst herd. The eastern Beverly rutting group had 43 collared Beverly caribou (23 cows and 20 bulls) compared to eight collared Beverly cows and no Beverly bulls in the western Bathurst group, and the bulk of the Beverly herd in the eastern group was not sampled for classification. This classification is not representative of the Beverly herd either, as only a small proportion of the herd was surveyed and there were Bathurst caribou mixed in.

Table 4. Caribou classified October 22, 2021 in attempted Bathurst fall composition survey.

Measurement	All Areas
# Caribou	2,018
# Cows	739
# Calves	416
# Young Bulls	532
# Prime Bulls	331
# Groups	45
Mean Group Size	44.8
Calves:100 Cows	56.3
SE Calves:100 Cows	4.9
CIU & CIL Calf:Cow	66.0, 46.8
Bulls:100 Cows	116.8
SE Bulls:100 Cows	9.6
CIU & CIL Bull:Cow	139.3, 101.3

We also note that a bull:cow ratio of 116.8 bulls:100 cows seems unrealistically high for either herd. In October 2020, a bull:cow of 64.1 bulls:100 cows was estimated for the Bathurst herd at a time when three quarters of the Bathurst collars (cows and bulls) were in the survey area, with no other collars mixed in (Beverly or Bluenose-East). This ratio was similar to the October 2020 Bluenose-East bull:cow ratio of 63.3:100 cows, derived

from classification that involved only Bluenose-East collared caribou and included 92% of the collars in areas surveyed (Adamczewski et al. 2022a). We found substantial regional variation of Bluenose-East bull:cow ratios in October 2021, with one of three regions having a bull:cow ratio of 93.7:100 cows (Table 2). Similarly in October 2020, regional variation in Bluenose-East bull cow ratios included ratios of 52.3, 84.5 and 122.6 in northern, central and southern areas (Adamczewski et al. 2022a). Wide variation in regional bull:cow ratios may also occur in the Beverly herd. The likeliest explanation for the high bull:cow ratio on the attempted Bathurst fall 2021 survey is that it mostly represents a part of the Beverly herd that happened to have a high proportion of bulls, where more complete classification across that herd's full distribution would likely have resulted in a much lower bull:cow ratio.

Based on these considerations, we recommend that the results of the attempted Bathurst fall 2021 composition survey be set aside as not representing either the Bathurst herd or the Beverly herd.

Incidental Sightings of Other Large Mammals

Incidental sightings of wolves, grizzly bears, muskoxen and moose during the Bluenose-East and attempted Bathurst fall composition surveys are listed in Table 5. Grizzly bear sightings at this time of year are relatively rare as most bears are in their dens for the winter by this time. One of the two bears seen appeared to be relatively small and lean. The other bear appeared large and healthy and was on a bull caribou kill. The numbers of wolves seen on the attempted Bathurst survey were higher than expected; however, the flying may have included some duplicate flying of caribou groups and it is possible that some of the wolves were repeat observations. In any case, sightings of wolves on caribou surveys are at best a broad index of relative abundance, given the high variability of the sightings.

Table 5. Incidental sightings of wolves, grizzly bears, muskoxen and moose on the Bathurst and Bluenose-East October 2021 composition surveys.

Species	Bathurst Attempted Survey	Notes Bathurst	Bluenose-East Survey	Notes Bluenose-East
Wolf	21	(7, 6, 6, 1, 1)	12	(4, 3, 3, 2)
Grizzly Bear	2	(1, 1 on kill)	0	
Muskox	53	(46, 7)	0	
Moose	0		3	(2, 1)

DISCUSSION

Increased Fall Bull:Cow Ratios and Calf:Cow Ratios in the Bluenose-East Herd 2020 and 2021

A fall composition survey of the Bluenose-East herd in October 2020 resulted in a bull:cow ratio of 63.3 bulls:100 cows, a higher ratio than had been reported in previous years (Adamczewski et al. 2022a; see Figure 6 this report). That survey had good representation of collared cows and bulls in the herd, and there was no mixing with other herds, based on collars. The October 2021 survey resulted in a similar bull:cow ratio of 68.7:100 cows, and this survey also had good representation of collared cows and bulls in the herd, with no collars from other herds mixed in. We believe that there has been an increase in the herd bull:cow ratio, and this suggests that bull survival has increased in the herd in recent years, which is also suggested by collar-based bull survival estimates (Boulanger et al. 2022). The last period of widespread growth in NWT mainland barren-ground caribou herds was in the early 1980s. The average bull:cow ratio recorded during six fall composition surveys during this period was 66 bulls:100 cows (in Gunn et al. 1997, p. 35), similar to the Bluenose-East ratios for 2020 and 2021.

Fall calf:cow ratios in the Bluenose-East herd showed no clear overall trend from 2009 to2019, although there appeared to be an increasing trend 2018-2021. The calf:cow ratios in 2020 (51.7:100 cows) and 2021 (49.6:100 cows) were higher than had been recorded 2009-2019 (Figure 6). We believe that both surveys were representative of the herd, as noted earlier, and we found much less regional variation in the calf:cow ratio than in the bull:cow ratio.

Overall, recent fall Bluenose-East calf:cow ratios have shown an increasing trend (see Figure 6), collar-based cow survival rates have averaged 85% (Boulanger et al. 2022), and estimates of the proportion of breeding females on the calving grounds (a proxy for pregnancy rate) have shown an increasing trend with an estimate of 92% in June 2021 (Boulanger et al. 2022). This suite of improving trends is consistent with an improving overall trend in the herd and if they continue, herd stabilization is possible, as demonstrated by the estimates from the June 2021 Bluenose-East calving photo survey (Boulanger et al. 2022).

Regional Variation in Bull:Cow Ratios and Representative Fall Composition Surveys

We found substantial variation in regional bull:cow ratios in the Bluenose-East herd in October 2020 (Adamczewski et al. 2022a) with regional estimates of 52.3, 84.5 and 122.6:100 in northern, central and southern areas. We observed a similarly wide regional

variation of 93.7, 65.8 and 57.0:100 bull:cow ratios in northern, central and southern areas in October 2021. This variation may in part reflect variable sample sizes in each area, but some of the regional variation appears to be real. Other biologists have also found that obtaining a herd-wide representative sex ratio during fall surveys can be difficult. For example, Jim Dau (2015) commented on the challenges of sampling a caribou herd's full distribution in the fall, and the importance of timing of these surveys, given that rutting aggregations begin to break up soon after the peak of the rut and a large proportion of the males begin to segregate as winter begins. The range of bull:cow ratios recorded by Dau between 1992 and 2015 for the Western Arctic Herd was between about 38 and 65 bulls:100 cows, similar to the range observed in the Bluenose-East herd between 2009 and 2021. We believe that the fall 2020 and 2021 Bluenose-East were timed near the peak of calving, based on rutting behaviour (bulls fighting and bulls closely following cows). We assumed that gestation would be about 230 days (estimate in Bergerud 2000 of 225-235 days of gestation for caribou); if the peak of calving is about June 7, then the peak of conceptions should be about October 19. Our fall surveys in 2020 and 2021 were timed to target this part of October. The regional variation in bull:cow ratios we found in 2020 and 2021 for the Bluenose-East herd, along with the importance of survey timing noted by Dau (2015) and others, underscores the importance of adequate spatial sampling across the herd's range, with sampling in proportion to relative numbers of caribou, to obtain a representative survey.

ACKNOWLEDGEMENTS

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APPENDIX 1: STATUS AND HISTORY OF COLLARED BATHURST AND BEVERLY COWS AND BULLS IN OCTOBER 2021

New collars are usually placed on barren-ground caribou in the NWT in late winter, often in March. Mixing of neighbouring herds is common in winter, which can create challenges in targeting caribou from a particular herd for capture and collar placement. These collars are not assigned to a particular herd until June for cows; at that time the cows normally separate out to their individual calving grounds. In recent years, bulls have been assigned in July as separation between herds seems to be most reliable at that time. In June the bulls may be close behind the cows on their calving grounds, or they may be scattered further south and herd identity may not be clearly apparent.

In June 2021, ENR carried out calving ground photo surveys of the Bathurst and Bluenose-East caribou herds. The Bathurst survey resulted in some unusual outcomes and movements of collared caribou. These are described fully in the survey report (Adamczewski et al. 2022b), but a brief summary is given here. There were 34 known Bathurst collared cows at the time of the June survey. In this context, "known" means that their location the previous June was on the Bathurst calving ground. Of these, 28 were in a cluster west of Bathurst Inlet in an area where the Bathurst herd had calved for several years previously. The other six collared cows were east of Bathurst Inlet during the survey. Two of these cows had moved a substantial distance toward the Beverly herd's calving ground in the eastern Queen Maud Gulf lowlands by June 10, when aerial photos were taken over the Bathurst calving ground. The other four cows were within the survey blocks east of Bathurst Inlet.

Based on previous Bathurst calving ground surveys and the collar numbers, we expected to find relatively low numbers of caribou east of the Inlet. However, the numbers of caribou found east of the Inlet were much higher than on the west side, and it became apparent that a portion of the Beverly herd was in the survey area east of the Inlet. There was no separation of Bathurst and Beverly caribou east of the Inlet at the time of the June survey. There were substantial proportions of yearlings, bulls and non-breeding cows east of the Inlet, which suggested that many of these caribou were part of the "trailing edge" at the back end of the Beverly migration. After the survey period (June 9-14), all Bathurst collared cows east of the Inlet moved further east into the Beverly calving distribution, along with continued movement east of Beverly cows. In contrast, all collared Bathurst cows that were west of the Inlet moved south and west toward Contwoyto Lake, a movement normally associated with this herd at the beginning of summer. The six Bathurst collared cows were re-assigned to the Beverly herd in the summer, on the assumption that they had joined the much larger Beverly herd. Their movements will be monitored, however, to assess whether they continue to associate with the Beverly herd or potentially return to the Bathurst herd.

The estimates of Bathurst breeding females, adult females and overall herd size were based on the Bathurst-west portions of the survey blocks. A composite set of maps of collared Bathurst and Beverly caribou movements in May, June and early July 2021 is provided in Figure 8 (Figure 12 in Adamczewski et al. 2022b).

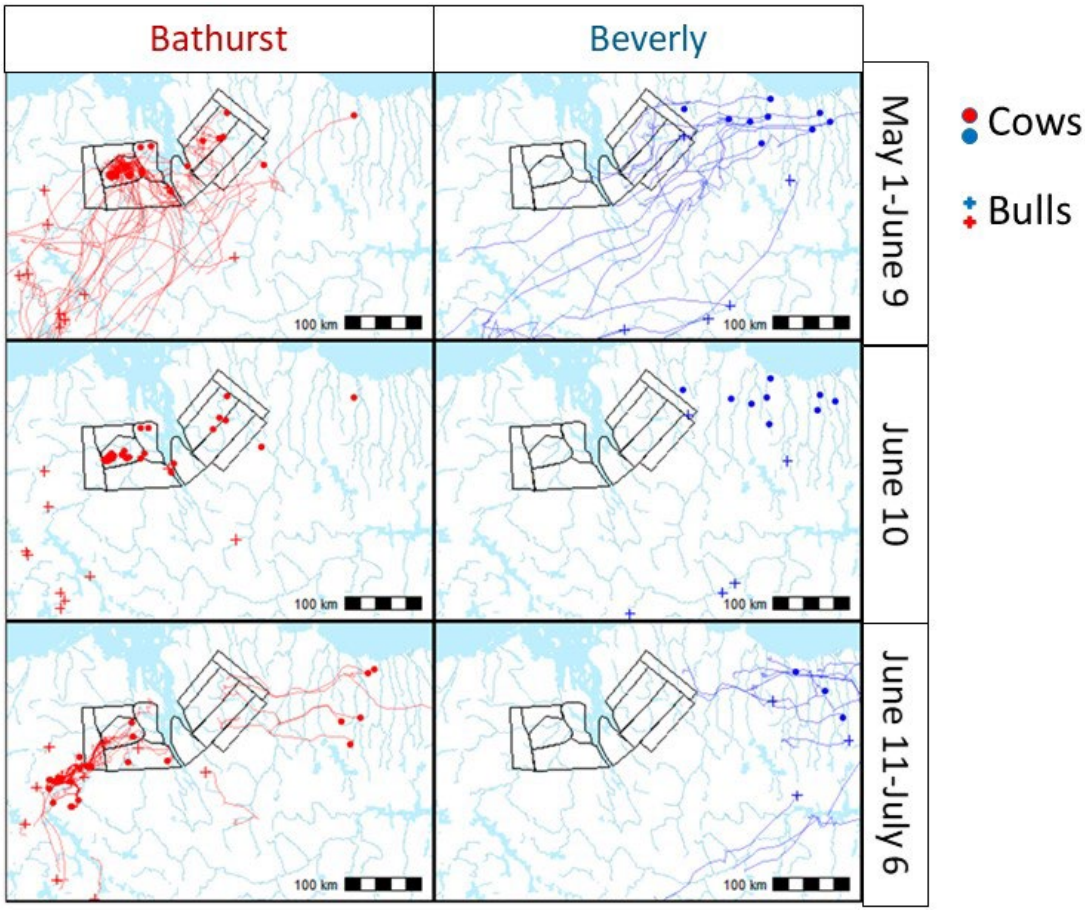

Figure 8. Movements of collared Bathurst (left in red) and Beverly collared caribou (right in blue) May 1 – June 9 (top), at the time of the June photo survey June 10 (middle), and after the survey June 11 – July 6, 2021. Collars newly deployed in March 2021 are not shown.

Because of these unusual survey results in June and the unexpected collar movements after calving, the locations of collared Bathurst and Beverly caribou at the time of the October 2021 surveys were summarized in the schematic diagrams that follow (Figure 9). Both clusters of rutting caribou were a mix of Bathurst and Beverly collared caribou; most of the Bathurst collars were in the western cluster and most of the Beverly collars were in the eastern cluster.

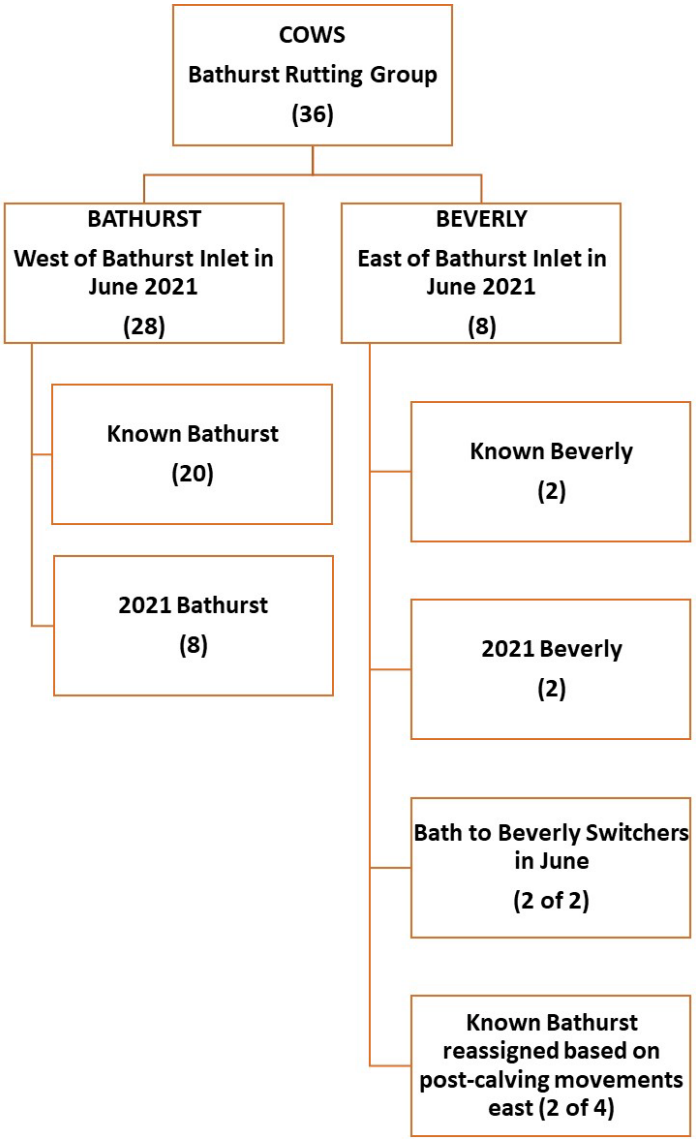

Figure 9a. Collared Bathurst and Beverly caribou females in the (western) Bathurst rutting group in October 2021. They are identified as categories of caribou based on their locations in June/July 2021 during and after the surveys.

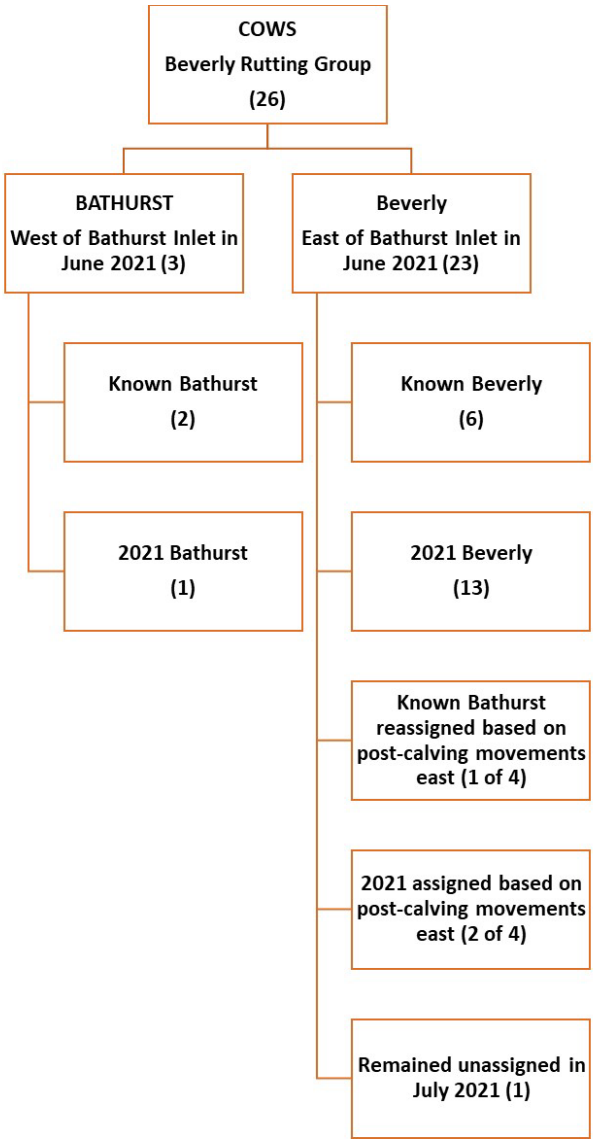

Figure 9b. Collared Bathurst and Beverly caribou females in the (eastern) Beverly rutting group in October 2021. They are identified as categories of caribou based on their locations in June/July 2021 during and after the surveys.

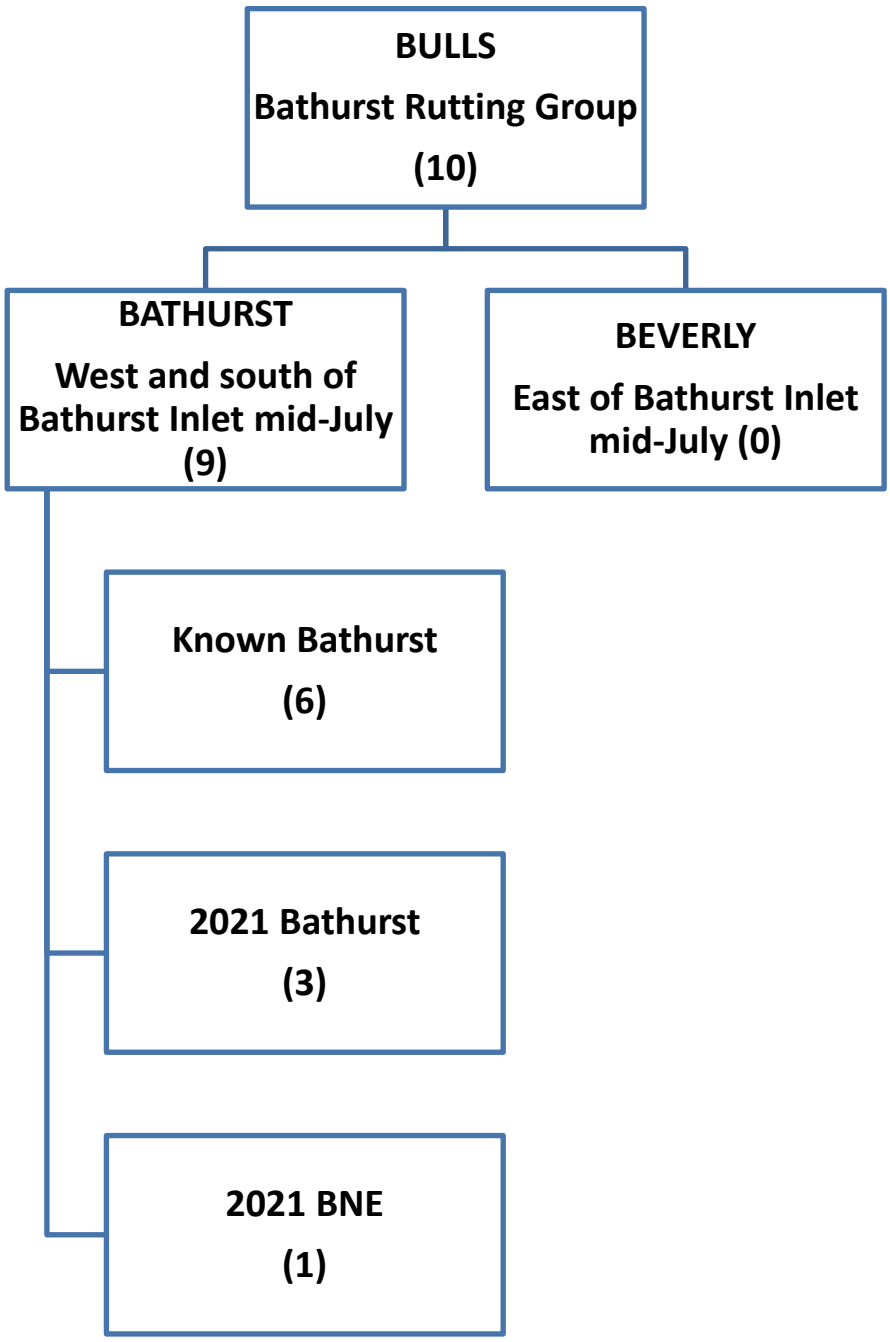

Figure 9c. Collared Bathurst and Beverly caribou males in the (western) Bathurst rutting group in October 2021. They are identified as categories of caribou based on their locations in July 2021.

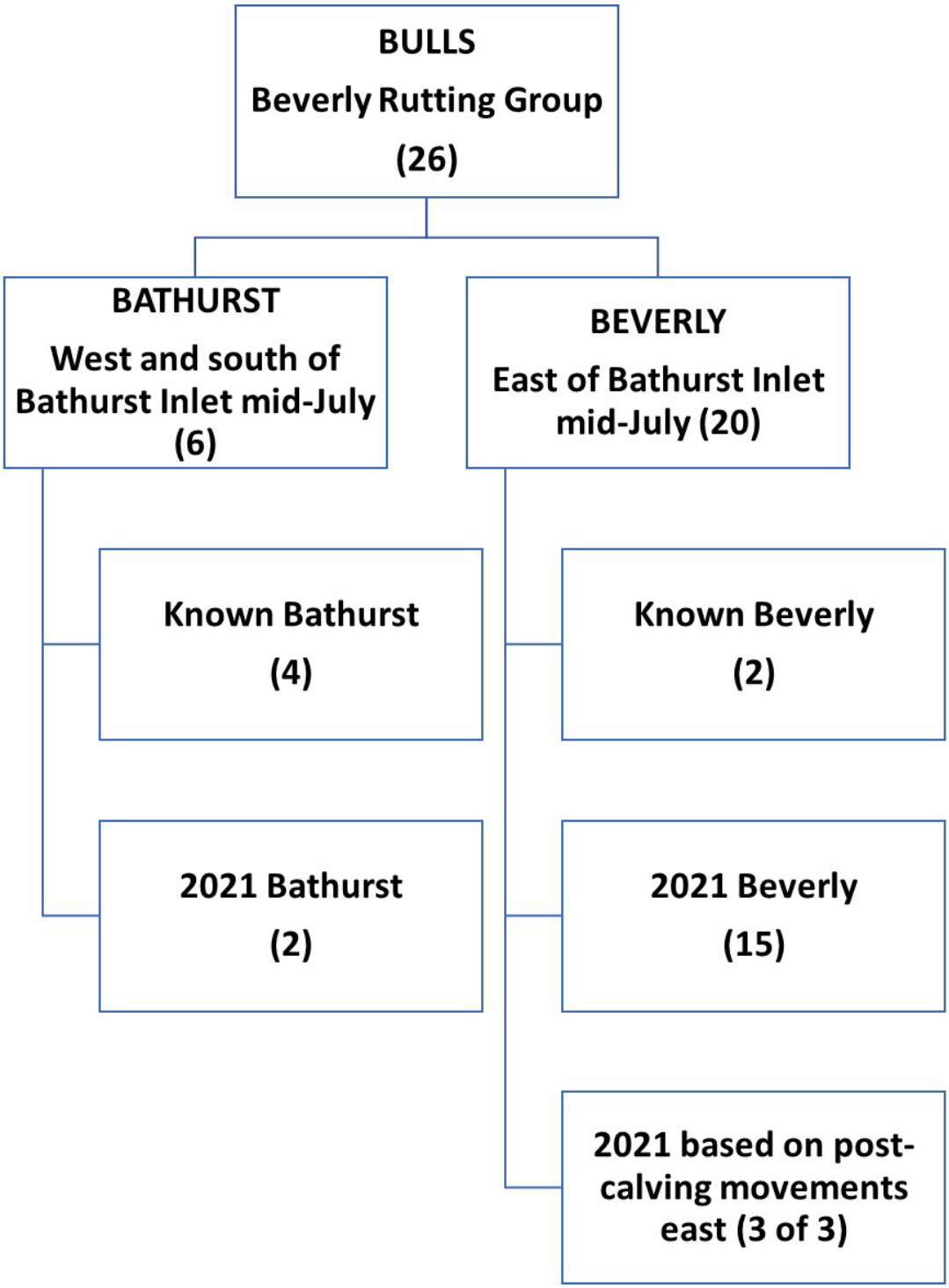

Figure 9d. Collared Bathurst and Beverly caribou males in the (eastern) Beverly rutting group in October 2021. They are identified as categories of caribou based on their locations in July 2021.

APPENDIX 2. GROUP-SPECIFIC CARIBOU CLASSIFICATION RESULTS FOR BLUENOSE-EAST HERD IN OCTOBER 2021

Obs date time	latitude	longitude	Cows	Calves	Yrlgs	Small Bulls	Prime Bulls	Total Bulls	All Caribou	Incidental Species	Comment
10/23/2021 2:15:03 PM	64.341	-113.860	0	1	0	0	0	0	1	0	
10/23/2021 2:14:08 PM	64.356	-113.842	9	7	1	1	1	2	18	0	
10/23/2021 2:12:08 PM	64.371	-113.828	7	5	0	1	1	2	14	0	
10/23/2021 2:11:31 PM	64.366	-113.805	32	19	0	13	6	19	70	0	
10/23/2021 2:04:55 PM	64.400	-113.760	7	4	0	2	1	3	14	0	
10/23/2021 2:01:58 PM	64.398	-113.787	1	1	0	0	0	0	2	0	
10/23/2021 2:01:51 PM	64.399	-113.787	3	1	1	2	0	2	6	0	
10/23/2021 2:01:31 PM	64.401	-113.790	2	1	0	0	0	0	3	0	
10/23/2021 2:00:38 PM	64.407	-113.787	6	3	0	0	0	0	9	0	
10/23/2021 1:59:14 PM	64.409	-113.807	11	7	0	6	3	9	27	0	
10/23/2021 1:58:01 PM	64.409	-113.816	2	2	0	0	1	1	5	0	
10/23/2021 1:57:29 PM	64.411	-113.822	10	3	0	2	0	2	15	0	
10/23/2021 1:54:59 PM	64.414	-113.867	8	6	0	4	3	7	21	0	
10/23/2021 1:53:32 PM	64.412	-113.874	3	2	0	1	1	2	7	0	
10/23/2021 1:53:01 PM	64.412	-113.878	2	1	0	1	0	1	4	0	
10/23/2021 1:51:48 PM	64.411	-113.890	2	1	0	1	0	1	4	0	
10/23/2021 1:50:52 PM	64.413	-113.905	1	1	0	0	0	0	2	0	
10/23/2021 1:49:08 PM	64.429	-113.916	1	0	0	1	0	1	2	0	
10/23/2021 1:48:55 PM	64.427	-113.913	9	5	0	0	0	0	14	0	
10/23/2021 1:47:46 PM	64.431	-113.926	2	0	0	0	0	0	2	0	
10/23/2021 1:46:01 PM	64.422	-113.932	0	0	0	1	0	1	1	0	
10/23/2021 1:45:30 PM	64.420	-113.941	14	10	0	3	4	7	31	0	
10/23/2021 1:43:34 PM	64.426	-113.958	7	5	0	1	1	2	14	0	
10/23/2021 1:41:09 PM	64.431	-114.005	1	0	0	3	1	4	5	0	
10/23/2021 1:38:19 PM	64.426	-114.038	2	2	0	0	0	0	4	0	
10/23/2021 1:36:18 PM	64.412	-114.081	17	10	0	12	9	21	48	0	Collared cow with calf
10/23/2021 1:33:50 PM	64.413	-114.090	1	1	0	1	1	2	4	0	
10/23/2021 1:32:05 PM	64.406	-114.092	1	0	0	0	1	1	2	0	
10/23/2021 1:30:34 PM	64.411	-114.114	1	1	0	1	0	1	3	0	
10/23/2021 1:27:40 PM	64.430	-114.109	2	1	0	1	0	1	4	0	
10/23/2021 1:25:03 PM	64.422	-114.078	0	0	0	1	0	1	1	0	
10/23/2021 1:24:56 PM	64.422	-114.080	1	1	0	0	1	1	3	0	
10/23/2021 1:24:18 PM	64.426	-114.090	0	0	0	2	0	2	2	0	
10/23/2021 1:21:20 PM	64.427	-114.120	0	0	0	2	0	2	2	0	
10/23/2021 1:16:07 PM	64.451	-114.139	2	1	0	0	0	0	3	0	
10/23/2021 1:10:04 PM	64.457	-114.153	1	1	0	4	1	5	7	0	
10/23/2021 1:02:09 PM	64.495	-114.028	1	1	0	0	0	0	2	0	
10/23/2021 12:59:48 PM	64.500	-114.073	3	1	0	0	1	1	5	0	
10/23/2021 12:59:17 PM	64.494	-114.077	1	1	0	2	1	3	5	0	

Obs date time	latitude	longitude	Cows	Calves	Yrlgs	Small Bulls	Prime Bulls	Total Bulls	All Caribou	Incidental Species	Comment
10/23/2021 12:56:15 PM	64.480	-114.124	1	1	0	1	0	1	3	0	
10/23/2021 12:52:02 PM	64.455	-114.202	19	11	0	3	1	4	34	0	
10/23/2021 12:49:10 PM	64.456	-114.195	10	6	0	5	3	8	24	0	
10/23/2021 12:45:08 PM	64.439	-114.232	0	0	0	0	1	1	1	0	
10/23/2021 12:44:31 PM	64.434	-114.258	22	13	0	10	12	22	57	0	
10/23/2021 12:42:51 PM	64.433	-114.254	4	2	0	1	1	2	8	0	
10/23/2021 12:41:55 PM	64.430	-114.253	0	1	0	0	0	0	1	0	
10/23/2021 12:41:38 PM	64.427	-114.261	1	1	0	2	1	3	5	0	
10/23/2021 12:40:01 PM	64.421	-114.294	16	8	0	1	2	3	27	0	
10/23/2021 12:36:52 PM	64.428	-114.290	2	0	0	0	1	1	3	0	
10/23/2021 12:36:25 PM	64.428	-114.284	7	3	0	2	1	3	13	0	
10/23/2021 12:35:53 PM	64.429	-114.282	2	0	0	1	0	1	3	0	
10/23/2021 12:35:23 PM	64.432	-114.284	0	0	0	3	0	3	3	0	
10/23/2021 12:32:52 PM	64.428	-114.334	0	0	0	1	0	1	1	0	
10/23/2021 12:32:32 PM	64.433	-114.330	13	6	0	6	3	9	28	0	
10/23/2021 12:30:59 PM	64.435	-114.316	13	6	0	2	5	7	26	0	
10/23/2021 12:29:50 PM	64.435	-114.298	20	13	0	7	3	10	43	0	
10/23/2021 12:27:24 PM	64.437	-114.297	1	0	0	1	0	1	2	0	
10/23/2021 12:23:32 PM	64.457	-114.371	29	14	0	6	4	10	53	0	
10/23/2021 12:21:01 PM	64.462	-114.361	5	4	0	1	2	3	12	0	
10/23/2021 12:19:19 PM	64.468	-114.340	2	1	0	0	1	1	4	0	
10/23/2021 12:17:13 PM	64.457	-114.323	2	1	0	0	0	0	3	0	
10/23/2021 12:16:01 PM	64.447	-114.348	30	16	0	4	4	8	54	0	
10/23/2021 12:13:55 PM	64.443	-114.355	0	0	0	0	1	1	1	0	
10/23/2021 12:13:50 PM	64.443	-114.355	0	0	0	0	1	1	1	0	
10/23/2021 12:13:43 PM	64.442	-114.356	8	4	0	2	1	3	15	0	
10/23/2021 12:13:15 PM	64.441	-114.358	2	2	0	0	1	1	5	0	
10/23/2021 12:13:01 PM	64.440	-114.360	5	3	0	2	1	3	11	0	
10/23/2021 12:12:11 PM	64.437	-114.361	1	0	0	1	0	1	2	0	
10/23/2021 12:11:51 PM	64.437	-114.364	2	1	0	1	1	2	5	0	
10/23/2021 12:11:14 PM	64.435	-114.373	1	1	0	0	0	0	2	0	
10/23/2021 12:10:06 PM	64.426	-114.370	2	2	0	1	0	1	5	0	
10/23/2021 12:08:55 PM	64.417	-114.361	0	0	0	1	0	1	1	0	
10/23/2021 12:06:47 PM	64.394	-114.346	8	4	0	3	1	4	16	0	
10/23/2021 12:03:35 PM	64.388	-114.332	2	1	0	1	0	1	4	0	

Obs date time	latitude	longitude	Cows	Calves	Yrlgs	Small Bulls	Prime Bulls	Total Bulls	All Caribou	Incidental Species	Comment
10/23/2021 12:02:22 PM	64.392	-114.319	4	3	0	0	1	1	8	0	
10/23/2021 12:01:55 PM	64.391	-114.316	2	1	0	2	0	2	5	0	
10/23/2021 12:01:31 PM	64.391	-114.313	2	1	0	1	0	1	4	0	
10/23/2021 12:00:01 PM	64.408	-114.312	7	2	0	3	1	4	13	0	
10/23/2021 11:58:55 AM	64.409	-114.333	4	2	0	4	1	5	11	0	
10/23/2021 11:58:19 AM	64.407	-114.347	3	3	0	0	1	1	7	0	
10/23/2021 11:57:39 AM	64.406	-114.349	2	2	0	2	0	2	6	0	
10/23/2021 11:56:51 AM	64.404	-114.359	2	1	0	1	1	2	5	0	
10/23/2021 11:56:22 AM	64.403	-114.358	1	1	0	0	1	1	3	0	
10/23/2021 11:55:45 AM	64.397	-114.358	3	1	0	2	0	2	6	0	
10/23/2021 11:54:50 AM	64.397	-114.370	4	3	0	0	0	0	7	0	
10/23/2021 11:54:07 AM	64.397	-114.367	2	2	0	1	0	1	5	0	
10/23/2021 11:53:36 AM	64.393	-114.379	5	2	0	0	2	2	9	0	
10/23/2021 11:52:28 AM	64.364	-114.339	2	2	0	2	0	2	6	0	
10/21/2021 4:16:37 PM	65.413	-113.705	47	30	0	24	5	29	106	0	
10/21/2021 4:12:31 PM	65.410	-113.720	30	24	0	19	12	31	85	0	
10/21/2021 4:04:45 PM	65.484	-113.758	1	1	0	3	0	3	5	0	
10/21/2021 4:00:33 PM	65.528	-113.811	2	2	0	1	0	1	5	0	
10/21/2021 3:57:34 PM	65.527	-113.858	1	1	0	0	0	0	2	0	
10/21/2021 3:51:54 PM	65.479	-113.938	1	1	0	0	1	1	3	0	
10/21/2021 3:48:37 PM	65.457	-113.887	0	0	0	2	0	2	2	0	
10/21/2021 3:41:46 PM	65.609	-114.666	1	0	0	0	0	0	1	3	3 Wolves
10/21/2021 2:30:26 PM	65.634	-114.965	2	2	0	0	1	1	5	0	
10/21/2021 2:28:35 PM	65.633	-114.993	4	1	0	2	3	5	10	0	
10/21/2021 2:27:27 PM	65.637	-114.997	43	13	0	15	10	25	81	0	
10/21/2021 2:23:31 PM	65.640	-115.034	1	1	0	1	1	2	4	0	
10/21/2021 2:22:09 PM	65.637	-115.053	2	2	0	1	1	2	6	0	
10/21/2021 2:20:49 PM	65.635	-115.043	5	1	0	1	5	6	12	0	
10/21/2021 2:19:35 PM	65.636	-115.053	11	6	0	6	4	10	27	0	
10/21/2021 2:14:56 PM	65.646	-115.035	1	1	0	0	1	1	3	0	
10/21/2021 2:12:51 PM	65.670	-115.006	1	1	0	1	0	1	3	0	
10/21/2021 2:05:01 PM	65.705	-114.962	23	6	0	8	3	11	40	0	
10/21/2021 1:17:35 PM	65.840	-115.013	0	0	0	0	1	1	1	0	
10/21/2021 1:10:01 PM	65.849	-115.074	37	7	0	23	17	40	84	0	
10/21/2021 12:52:50 PM	65.886	-115.127	14	7	0	19	16	35	56	0	
10/21/2021 12:50:17 PM	65.892	-115.133	0	0	0	0	1	1	1	0	
10/21/2021 12:48:20 PM	65.897	-115.154	2	1	0	6	1	7	10	0	
10/21/2021 12:36:33 PM	66.002	-115.337	5	2	0	0	0	0	7	0	
10/21/2021 12:33:01 PM	66.022	-115.441	11	7	0	8	2	10	28	0	
10/21/2021 12:26:27 PM	66.034	-115.555	21	8	0	13	9	22	51	3	3 Wolves

Obs date time	latitude	longitude	Cows	Calves	Yrlgs	Small Bulls	Prime Bulls	Total Bulls	All Caribou	Incidental Species	Comment
10/21/2021 12:21:27 PM	66.027	-115.494	54	24	0	27	19	46	124	0	
10/21/2021 12:07:35 PM	66.110	-115.031	5	1	0	5	1	6	12	2	2 Wolves chasing; flew away
10/21/2021 12:03:59 PM	66.108	-115.044	25	7	0	24	8	32	64	0	2 Collared cows, 1 with calf
10/21/2021 11:59:51 AM	66.112	-115.044	5	1	0	3	0	3	9	0	
10/21/2021 11:58:22 AM	66.114	-115.040	6	2	0	6	1	7	15	0	
10/21/2021 11:57:00 AM	66.113	-115.047	0	0	0	0	0	0	0	4	4 Wolves
10/21/2021 11:43:17 AM	66.330	-115.326	0	0	0	0	0	0	0	2	Moose cow and calf
10/20/2021 4:54:57 PM	65.394	-113.521	7	3	0	2	0	2	12	0	Collared cow
10/20/2021 4:51:29 PM	65.419	-113.491	8	5	0	1	1	2	15	0	
10/20/2021 4:50:05 PM	65.418	-113.500	36	26	0	30	7	37	99	0	Collared cow with calf
10/20/2021 4:40:45 PM	65.457	-113.628	3	1	0	9	4	13	17	0	
10/20/2021 4:35:27 PM	65.393	-113.749	22	16	0	15	5	20	58	0	
10/20/2021 4:33:20 PM	65.388	-113.766	53	33	0	14	5	19	105	0	
10/20/2021 4:29:16 PM	65.382	-113.812	121	71	0	33	34	67	259	0	
10/20/2021 4:17:01 PM	65.372	-113.941	51	28	0	15	11	26	105	0	
10/20/2021 2:59:51 PM	65.258	-114.334	1	1	0	1	1	2	4	0	
10/20/2021 2:49:58 PM	65.210	-114.735	18	9	0	4	5	9	36	0	
10/20/2021 2:48:02 PM	65.213	-114.740	38	20	0	6	7	13	71	0	
10/20/2021 2:40:35 PM	65.168	-114.967	25	9	0	9	10	19	53	0	
10/20/2021 2:35:50 PM	65.115	-114.969	9	3	0	1	2	3	15	0	
10/20/2021 2:34:13 PM	65.103	-114.993	7	1	0	3	2	5	13	0	
10/20/2021 2:32:30 PM	65.104	-114.998	5	0	0	2	3	5	10	0	
10/20/2021 2:29:40 PM	65.083	-115.020	16	10	0	1	4	5	31	0	
10/20/2021 2:27:14 PM	65.067	-115.060	1	0	0	0	1	1	2	0	
10/20/2021 2:26:24 PM	65.059	-115.060	3	0	0	1	1	2	5	0	
10/20/2021 2:23:36 PM	65.039	-115.057	20	5	0	2	9	11	36	0	
10/20/2021 2:19:56 PM	65.051	-115.130	2	2	0	0	1	1	5	0	
10/20/2021 1:45:40 PM	65.055	-115.191	10	0	0	4	8	12	22	0	Collared cow
10/20/2021 1:37:17 PM	64.923	-115.226	4	3	0	0	0	0	7	0	
10/20/2021 1:36:54 PM	64.927	-115.224	42	19	0	4	5	9	70	0	
10/20/2021 1:33:39 PM	64.926	-115.204	2	1	0	0	0	0	3	0	
10/20/2021 1:31:18 PM	64.952	-115.176	1	0	0	0	1	1	2	0	
10/20/2021 1:28:16 PM	64.974	-115.087	21	9	0	10	2	12	42	0	
10/20/2021 1:26:56 PM	64.976	-115.076	43	16	0	7	5	12	71	0	
10/20/2021 1:22:27 PM	64.959	-115.062	9	1	0	2	1	3	13	0	
10/20/2021 1:19:58 PM	64.938	-115.104	15	4	0	1	3	4	23	0	
10/20/2021 1:16:06 PM	64.904	-115.178	31	11	0	3	3	6	48	0	
10/20/2021 1:09:26 PM	64.845	-115.283	30	13	0	5	11	16	59	0	
10/20/2021 1:07:24 PM	64.846	-115.272	2	2	0	0	0	0	4	0	
10/20/2021 1:06:07 PM	64.848	-115.258	14	5	0	3	4	7	26	0	
10/20/2021 1:04:59 PM	64.844	-115.249	36	20	0	12	8	20	76	0	

Obs date time	latitude	longitude	Cows	Calves	Yrlgs	Small Bulls	Prime Bulls	Total Bulls	All Caribou	Incidental Species	Comment
10/20/2021 1:02:00 PM	64.850	-115.230	8	2	0	2	5	7	17	0	
10/20/2021 12:58:26 PM	64.848	-115.149	23	12	0	6	11	17	52	0	
10/20/2021 12:56:26 PM	64.848	-115.137	22	9	0	12	14	26	57	0	
10/20/2021 12:53:06 PM	64.853	-115.123	6	3	0	1	1	2	11	0	
10/20/2021 12:48:21 PM	64.868	-115.013	33	26	0	13	17	30	89	0	
10/20/2021 12:45:14 PM	64.870	-115.006	4	2	0	1	1	2	8	0	
10/20/2021 12:43:37 PM	64.869	-114.992	29	13	0	21	20	41	83	0	
10/20/2021 12:39:29 PM	64.874	-114.975	6	3	0	3	1	4	13	0	
10/20/2021 12:38:57 PM	64.877	-114.975	1	0	0	1	2	3	4	0	
10/20/2021 12:38:24 PM	64.871	-114.971	20	7	0	9	3	12	39	0	
10/20/2021 12:35:43 PM	64.862	-114.940	11	7	0	11	6	17	35	0	
10/20/2021 12:33:36 PM	64.861	-114.928	5	3	0	7	4	11	19	0	
10/20/2021 12:32:42 PM	64.866	-114.903	29	13	0	15	19	34	76	0	
10/20/2021 12:29:27 PM	64.861	-114.902	0	0	0	0	0	0	0	1	Moose cow
10/20/2021 12:28:03 PM	64.859	-114.875	24	4	0	12	8	20	48	0	Collared cow
10/20/2021 12:25:54 PM	64.863	-114.867	9	2	0	4	3	7	18	0	
10/20/2021 12:16:43 PM	64.910	-114.642	26	9	0	14	12	26	61	0	
10/20/2021 12:13:42 PM	64.911	-114.629	8	4	0	4	1	5	17	0	
10/20/2021 12:11:44 PM	64.922	-114.582	7	3	0	8	4	12	22	0	
10/20/2021 12:09:21 PM	64.938	-114.567	42	20	0	16	8	24	86	0	
10/20/2021 12:04:39 PM	64.940	-114.588	31	7	0	11	13	24	62	0	
10/20/2021 11:57:59 AM	64.970	-114.607	12	7	0	1	1	2	21	0	
10/20/2021 11:52:55 AM	64.966	-114.556	0	0	0	0	1	1	1	0	
10/20/2021 11:52:51 AM	64.965	-114.558	1	1	0	0	0	0	2	0	
10/20/2021 11:52:21 AM	64.962	-114.563	9	5	0	2	6	8	22	0	
10/20/2021 11:48:24 AM	64.950	-114.639	0	0	0	1	2	3	3	0	
10/20/2021 11:36:41 AM	65.078	-114.378	1	1	0	1	1	2	4	0	
10/20/2021 11:29:56 AM	65.177	-114.189	1	1	0	2	1	3	5	0	