



ESTABLISHMENT AND EVALUATION OF A MOBILE ZONE FOR BATHURST CARIBOU RECOVERY AND MANAGEMENT 2015-2021

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EXECUTIVE SUMMARY

The Bathurst barren-ground caribou herd declined significantly from peak numbers in 1986 of about 470,000 to approximately 6,240 in 2021. A significant decrease occurred between 2006 and 2009 when the herd declined from over 100,000 to an estimated 31,980±10,853 adults (95% Confidence Interval). In 2010, after the results of the 2009 population survey were released, management actions through co-management processes led to the closure of commercial, guided outfitter, and resident hunting of the herd in the Northwest Territories (NWT). Indigenous hunting of Bathurst caribou in the NWT was restricted from an estimated 4,000-5,000/year (mostly cows in the winter) to a harvest target of 300/year and 80% bulls in 2010. The harvest restrictions were implemented through two fixed management zones that encompassed the main Bathurst winter range as defined by accumulated collared cow caribou locations. Further decline in the herd led to the closure of the Indigenous harvest of Bathurst caribou in the NWT in early 2015¹. A Total Allowable Harvest (TAH) of zero caribou was implemented through regulations set by the Wek'èezhì Renewable Resources Board (WRRB) and implemented through a mobile conservation zone defined around collared Bathurst caribou locations, beginning in early 2015. In this report, we describe the history of this mobile zone from 2015 to 2021, and the rules associated with the zone. We also assessed the effectiveness of the mobile zone for implementing zero harvests of caribou over this period.

The criteria used to delineate the mobile zone have evolved since its inception in 2015. Criteria have been discussed and adjusted by a technical working group comprised of the Government of the Northwest Territories, the Tłı̄chǫ Government, and the WRRB, a co-management board established through the 2005 Tłı̄chǫ land claim and self-government agreement. The mobile zone was created by mapping a 100% minimum convex polygon around all the GPS (Global Positioning System) Bathurst collared caribou locations (cows and bulls), with a buffer on the perimeter that varied between 10 and 60 km.

The continual shifting movement of caribou on their winter range meant that regular adjustments were needed to keep the harvest protection zone current. In general, we found that collared caribou showed relatively little directional movement between December and early April, at least in the early years of the mobile zone implementation. Consequently, over this main part of the winter, the mobile zone tended to change relatively little. However, collared caribou locations from recent years suggested that winter range movement had increased and at times with some directionality. Criteria were revised in 2018 and 2019 and included scenarios when there was no overlap between adjacent caribou herds on the winter

¹ Although harvest of the Bathurst herd was primarily on the NWT side, allowable harvest of the Bathurst herd was also reduced in Nunavut due the herd's very large decline; in 2020 the allowable harvest in Nunavut was reduced from 30 bulls to 10.

range and when significant overlap did occur. The criteria were meant to accommodate hunting opportunities on adjacent larger caribou herds while ensuring a high degree of protection for Bathurst caribou.

We assessed the effectiveness of the Bathurst mobile zone for implementing the TAH of zero for the Bathurst caribou herd by assessing three criteria: (1) the adequacy of Bathurst collar numbers, (2) the likelihood of collared caribou moving out of the zone within a one-week window, and (3) compliance monitoring for zero harvest within the zone.

Because the mobile zone depended entirely on collared Bathurst caribou, confidence that the herd's distribution was accurately defined depended on having sufficient collared Bathurst caribou numbers, and by including collared bulls as well as cows. In some winters, the number of Bathurst collars were lower than the minimum recommended number of 40 (based on a previous analysis), which meant that the herd's distribution may not have been comprehensively delimited. Until 2015, the maximum number of Bathurst collars was 20, all on cows. Since 2015, deployment of collars on Bathurst caribou increased to a maximum of 50 (target of 30 cows, 20 bulls), and in March 2019 agreement with co-management partners was reached to further increase numbers to a maximum of 70 collars (target of 50 cows, 20 bulls) based on a statistical power analysis. However, actual collar totals seldom reached these targets and were sometimes well below them when uncertainty in herd affiliation was high during winters with significant range overlap. When collared Bathurst caribou were separated from neighbouring herds in winter (e.g. winter 2015-2016), aerial patrols showed that caribou collar locations visually appeared to be a good indicator of the distribution of Bathurst caribou on the winter range, with very few caribou more than 20 km away from collared caribou.

Average daily movement rates of collared caribou from 2017 and 2018 were examined for three neighbouring herds (Bathurst, Bluenose-East, and Beverly). Bathurst caribou showed the smallest daily movement rate for both 2017 and 2018 at approximately 3.5 to 4.5 km/day in the main winter period of December to March. Mobile zone boundaries calculated once a week with a 20 km buffer were sufficient to include most Bathurst collared caribou (95%) within that time.

Most caribou harvested in the North Slave Region in the last decade have been along the Tibbitt to Contwoyto winter road to the three active diamond mines northeast of Yellowknife, and primarily from the Beverly herd, typically east of the mobile zone where Indigenous harvest is not restricted. During the winter road season, Renewable Resource Officers have monitored the winter road and the mobile zone using voluntary check stations along with regular ground-based and aerial patrols. Caribou have been taken illegally within the zone in most winters, but in relatively low numbers (mean = 52/year, range = 19 to 132, n=7 years), suggesting that overall compliance with the mobile zone has been high.

The Bathurst mobile zone has been a flexible management tool that significantly limited the harvest of caribou from this herd by an order of magnitude. The large, fixed zones used to limit harvest of the Bathurst herd prior to 2015 did not always contain that entire herd, and often restricted harvest of caribou from adjacent herds. Conservation has subsequently been focused on where the herd is, and consequently, the area where caribou harvest was closed or limited has been reduced in size

The mobile zone used in the NWT is a product of adaptive decision-making that has gone through several iterations responding to different levels of winter range overlap with adjacent caribou herds. Compliance with dynamic zone boundaries by hunters has been high. In some winters, particularly since 2018, mixing of the Bathurst, Bluenose-East and Beverly herds occurred on their winter range (based on collared caribou). This has resulted in inadvertently including caribou from all three of these herds. Overall, it appears that the mobile zone has been effective at curtailing harvest of the Bathurst caribou in the NWT, but not yet at zero. Recovery of Bathurst caribou remains a challenge, as the herd remains at historically low numbers. This reminds us that the harvest of caribou by people may not be the only factor affecting Bathurst caribou numbers.

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INTRODUCTION

The Bathurst caribou herd has a large historic range (about 350,000 km²) covering parts of the Northwest Territories (NWT), Nunavut (NU) and northern Saskatchewan. The herd's calving grounds, located west of Bathurst Inlet since 1996 and a portion of the summer range, are in NU (Figure 1). Most of the remainder of the Bathurst range is in the NWT, and when at historically high numbers has sometimes reached as far south as Saskatchewan. The herd has two neighbours: to the west is the Bluenose-East herd that calves west of Kugluktuk, and to the east is the Beverly herd that calves in the Queen Maud Gulf lowlands. These herds are typically separated during calving and summer, with winter distribution being more variable.

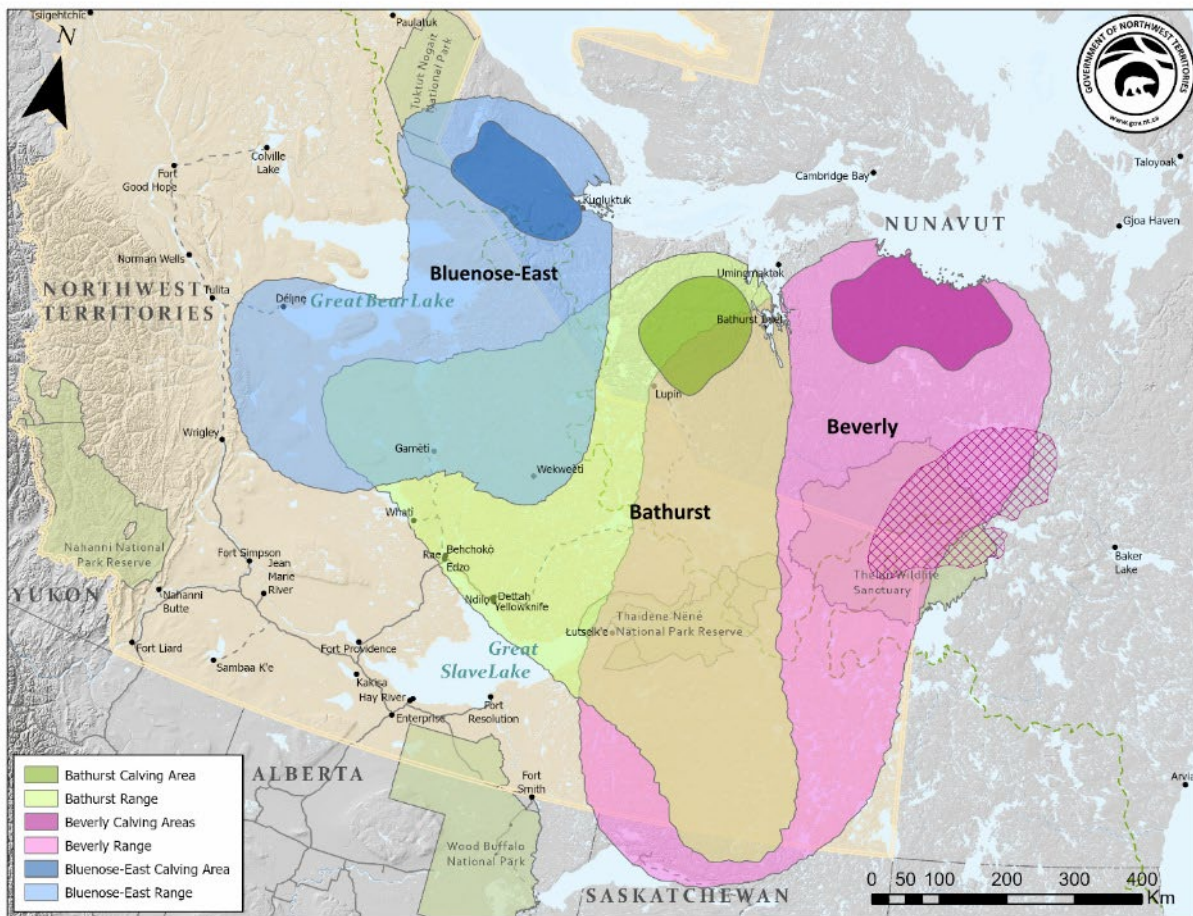


Figure 1. Annual ranges and calving grounds of the Bluenose-East, Bathurst, and Beverly herds, based on accumulated radio collar locations of cows (Nagy et al. 2011). Other herd ranges west and east of these three herds were omitted for simplicity. Map by B. Fournier, GNWT, ECC.

The Bathurst barren-ground caribou herd declined significantly in the 2000s from peak numbers of about 472,000 in 1986. The most rapid decline occurred between 2006 and

2009, when the herd declined from over 100,000 to an estimated $31,980 \pm 10,853$ adults (95% Confidence Interval (CI), Nishi et al. 2014). Photo-based calving ground surveys were first introduced in the early 1980s (Heard 1985) and survey methods since then have remained consistent for the Bathurst herd (e.g. Adamczewski et al. 2016, 2019). A calving-ground photo survey directly estimates breeding and non-breeding females on the calving ground; a total population estimate is then extrapolated by accounting for bulls. Breeding cows are the most important component of the population, and the herd will rise or fall with their abundance (Boulanger et al. 2011). The 2009 estimate of breeding females was $16,650 \pm 4,460$ (Nishi et al. 2014).

The rapid decline of the Bathurst herd 2006-2009 led to several management actions in the NWT. Outfitter tags and resident hunter tags were reduced after the 2006 Bathurst caribou survey, and in 2010, outfitter and resident harvests were closed. Joint management proposals from the Tłı̨chǫ Government (TG) and the Government of the Northwest Territories (GNWT) were submitted to the Wek'èezhì Renewable Resources Board (WRRB) in 2009 and 2010 and led to two public hearings in 2010. These documents (proposals, hearing records, supporting documents, and WRRB decisions and recommendations on the Bathurst herd) can be found on the WRRB public registry (<https://wrrb.ca/public-information/public-registry>). As a result of these hearings, resident harvest and guided outfitter operations in the Bathurst range were kept closed. Indigenous harvest of Bathurst caribou was restricted from an estimated 4,000-5,000 caribou/year, primarily cows) to 300 caribou, of which 80% were to be bulls (WRRB 2010). The 2012 estimate of breeding females on the Bathurst calving ground was $15,935 \pm 2,926$ caribou (Boulanger et al. 2014a), which suggested then that the rapid decline had ended, and that the herd could be stabilizing.

Because Bathurst caribou move into NU for calving and summer foraging (Figure 1), there has historically been harvest of Bathurst caribou there as well, although on a more limited scale than in the NWT. In 2016, the Nunavut Wildlife Management Board (NWMB) held a public hearing on management of Bathurst caribou, which resulted in a limited outfitted hunt of 30 Bathurst bulls. In December 2020, the NWMB held another public hearing to consider a proposal from the Government of Nunavut (GN) to reduce the Bathurst caribou harvest in Nunavut to zero (GN 2019). The Board ultimately decided to limit that harvest to 10 bulls only for subsistence (NWMB 2020).

Following the 2012 calving ground survey, reconnaissance surveys were done on the Bathurst caribou calving ground in 2013 and 2014. Reconnaissance surveys track trends in numbers of cows on the Bathurst calving grounds between photographic surveys (Adamczewski et al. 2020). While the results of the 2013 reconnaissance survey were not considered reliable due to weather conditions, the 2014 survey results raised further concerns of decline from the 2012 estimates (Boulanger et al. 2014b). A similar reconnaissance survey over the Bluenose-East herd's calving ground in June 2014

(Boulanger et al. 2014c) suggested that that herd had also declined further from 2013, when the last calving ground photo survey of that herd was completed (Boulanger et al. 2014d).

The GNWT issued a media release on 29 August 2014 that noted the decline in the two herds was alarming and set the stage for several fall meetings with Indigenous governments, Indigenous organizations and co-management boards to discuss management options before the harvest season began (GNWT Environment and Natural Resources news release, 29 August 2014). Meetings to review the surveys and related information on the two herds were held 9-10 October and 23-24 October 2014 in Yellowknife. Additional meetings of leaders of Indigenous governments, Indigenous organizations and co-management boards were held on 7 and 28 November 2014 in Yellowknife and included the Minister of Environment and Natural Resources (ENR).

As a result of these meetings in the fall and early winter of 2014-2015, ENR submitted a management proposal to the WRRB in January 2015 (ENR and TG 2014) to establish a “Mobile Core Bathurst Caribou Conservation Area” (hereafter referred to as the mobile zone), which the WRRB and TG supported (WRRB 2015, WRRB Reason for Decision Report 2016). The NWT’s *Big Game Hunting Regulations* were amended to support such a mobile zone with a zero harvest of caribou within its boundaries and required authorization cards for harvest of caribou within wildlife management zones R/BC/01, R/BC/02, and R/BC/03 (Appendix A). The intent of the proposal was to protect Bathurst caribou in the NWT from hunter harvest, given the herd’s very low numbers and declining trend. The regulations stated that no person shall harvest barren-ground caribou in an area that is part of the mobile zone.

After the mobile zone was first implemented in the winter of 2015, further large declines in the Bathurst and Bluenose-East herds were detected from calving ground photo surveys in 2015, 2018 and 2021 (Figure 2; Boulanger et al. 2017, 2019, Adamczewski et al. 2019, 2023).

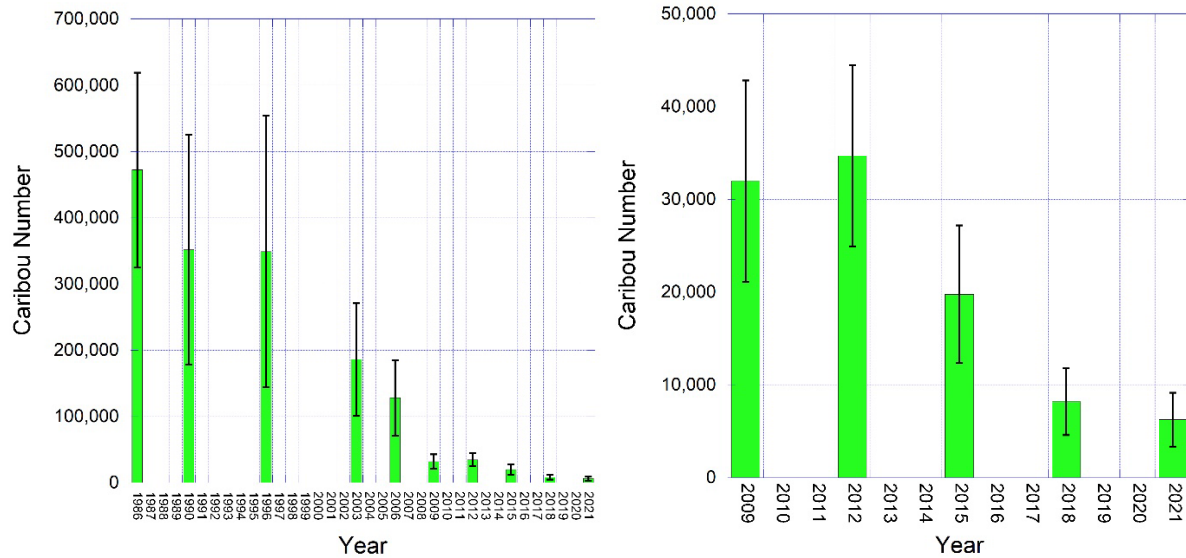


Figure 2. Decline of the Bathurst caribou herd based on breeding female estimates from calving ground surveys from (a) 1986 to 2021 on the left and (b) zoomed in for 2009 to 2021 on the right. Estimates are shown with 95% CI. (Adamczewski et al. 2023).

Most Indigenous harvest of caribou in the North Slave Region occurs during winter, and from about 2017 onwards, has been focused along the Tibbitt to Contwoyto winter road. This seasonal road serves the NWT diamond mines (Ekati, Diavik, and Gahcho Kué), and the corridor can provide relatively easy access to caribou for hunters (Figure 3). At about the same time, there was a westward expansion of the Beverly caribou into the areas around the mines, and the harvest of this herd in the NWT or NU was not limited. Previously, the Beverly caribou herd distribution in winter tended to be further east and north. In most winters, then, it was possible to protect Bathurst caribou with the mobile zone while generally allowing access to Beverly caribou east of the mobile zone and still accessible by the winter road.

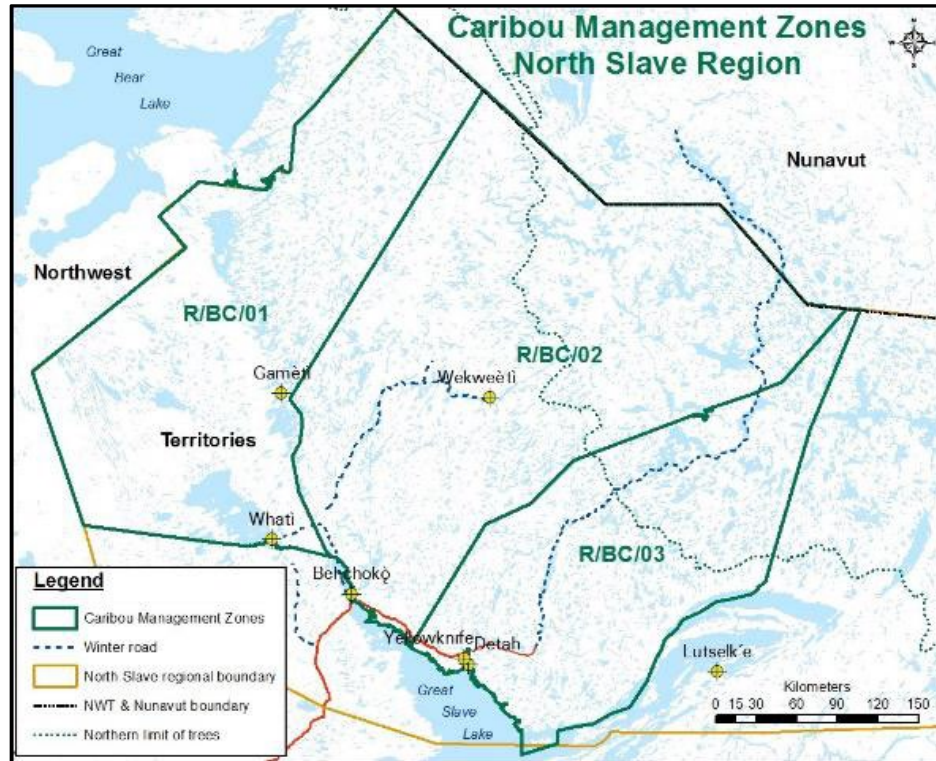


Figure 3. Caribou management zones R/BC/01, R/BC/02 and R/BC/03 in the North Slave administrative region, NWT. Management zones R/BC/02 and R/BC/03 were the zones that from 2010 to 2015 allowed a maximum harvest of 300 caribou with a target of 80% bulls. The zones encompassed the main Bathurst caribou winter range based on accumulated satellite collar locations 1996-2009.

This report details the development of the Bathurst mobile zone 2015-2021 and evaluates how effective this approach has been to protect Bathurst caribou from hunter harvest. The effectiveness of the Bathurst mobile zone was assessed based on three criteria: (1) the adequacy of Bathurst collar numbers to fully define the herd's distribution, (2) the likelihood of collared caribou moving out of the zone within a weekly window, and (3) the compliance monitoring of the zone by Renewable Resource Officers for zero harvest within the zone.

ESTABLISHING THE MOBILE ZONE

Fixed administrative zones were initially used to manage hunter harvest of barren-ground caribou in the North Slave Region (Figure 3). These zones encompassed the main Bathurst caribou winter range based on accumulated satellite collar locations at the time (1996-2009). They were large in area at 57,654 km² (R/BC/01), 78,739 km² (R/BC/02), and 42,834 km² (R/BC/03). Zones R/BC/02 and R/BC/03 were used to restrict caribou harvest from 2010 to 2015 to a maximum of 300 caribou, with a target of 80% bulls. The initial regulations establishing the mobile zone under the NWT *Wildlife Act* (R-006-2015) were enacted in January 2015. Since then, specific mobile zone regulations came into effect on 23 January 2016, with the *Mobile Core Bathurst Caribou Management Zone Regulations* (R-006-2016) under the authority of Sections 88 and 173 of the *Wildlife Act* (Appendix A), replacing the earlier regulation.

Adopting a mobile zone instead of two large, fixed administrative zones offered two advantages: (1) the restricted area in a mobile zone would be much smaller than the two large administrative zones combined, thereby reducing harvest restrictions in areas where they need not be, and (2) the restricted area focused on where the caribou herd was located at any given time. In previous winters, some Bathurst collars were west and east of the large, fixed zones (R/BC/02 and R/BC/03), thus potentially exposing caribou to higher harvest pressure in those areas. Any caribou from neighbouring herds within the two large zones were also protected from harvest temporarily even though there were no Indigenous harvest restrictions during that time period for the Bluenose-East and Beverly herds.

A minimum convex polygon (MCP) was the method used to identify and map the mobile zone boundaries using all functioning collars on Bathurst caribou (cows and bulls (when they became available)). This method assumes that collared caribou provide an adequate representation of all Bathurst caribou. However, this assumption may be less likely at lower sample sizes of collars (Otto et al. 2003, Rettie 2017).

An aerial reconnaissance survey was flown on 30 October 2014 to assess how representative the collared caribou were in delineating overall caribou distribution on the fall/winter range (Figure 4). The mobile zone was not yet established then, but the survey showed that the collared caribou locations appeared representative of the Bathurst caribou winter distribution, at least in the southern portion of the range even with as few as eleven collars, based on a dearth of any caribou observed beyond 10 km of where collared caribou were observed (Figure 4).

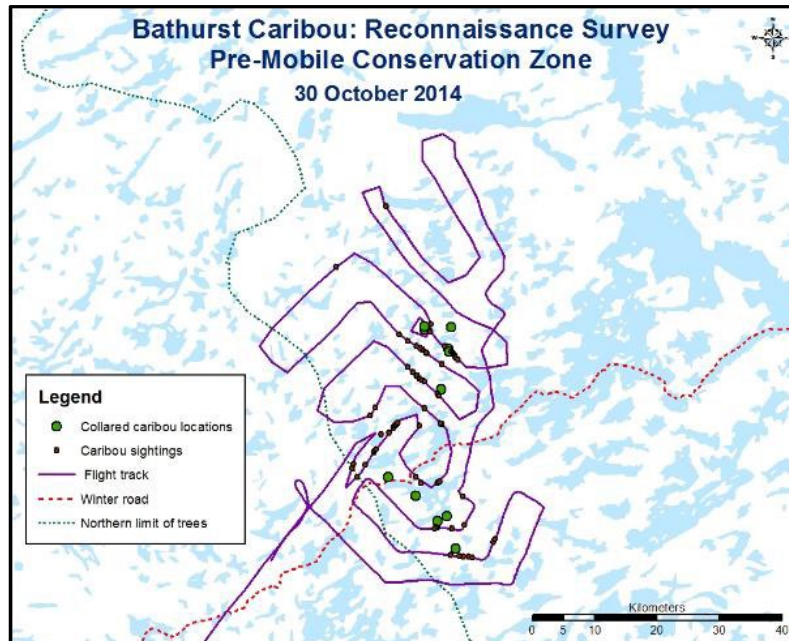


Figure 4. Aerial reconnaissance survey, 30 October 2014, to assess the utility of collared caribou to delineate caribou distribution on the fall/winter range, prior to establishment of a mobile conservation zone. There were 11 collared Bathurst cows at that time.

The mobile zone regulations authorized the generation of a map depicting the no-hunting zone and specified its dissemination to the public, recognizing that the zone could change frequently over the winter. While the regulations allowed for the possibility of subzones and spatial changes, it did not contain specific details on how to create it, leaving that up to wildlife co-management authorities.

Buffers of Varying Sizes

For the initial year of the mobile zone’s implementation (January 2015), a buffer of 20-30 km around the MCP was used every four days to create a new mobile zone. New maps of the mobile zone were printed and sent to hunters, signs of the mobile zone were manually relocated by officers and community monitors, and harvesters had to be current as to where hunting was allowed. Depending on movement rate and distribution of caribou between data acquisition (4-5 days), this frequent relocation of the mobile zone added confusion for people travelling on the land. The TG and ENR joint management proposal for Bathurst caribou in December 2015 proposed revising the zone on a weekly basis (ENR-TG 2015).

Prior to 2015, the number of Bathurst collars had not exceeded 20, all on cows, largely due to community concerns over the use of collars and animal capture and handling. The Tł̨cho Government agreed with the GNWT to increase the maximum target numbers of Bathurst collars to 30 cows and 20 bulls in March 2015 (Adamczewski and Boulanger 2016). Again,

in March 2019, agreement was reached to further increase numbers to a maximum of 70 collars (target of 50 cows, 20 bulls). These increases in collar numbers allowed the potential for bulls to be better protected from harvest by including collared bull caribou in the delineation of the mobile zone boundaries. The increase in collar numbers to 70 also increased perceived confidence in defining the full distribution of the Bathurst herd.

In 2016, a 60 km buffer was introduced as an option to add to the perimeter of the distribution polygon (MCP) of Bathurst caribou collars. A 60 km buffer was implemented to provide more certainty and clarity to hunters about the location of the mobile zone. It was assumed that the use of a larger buffer around the MCP would allow for movement of caribou inside the zone between collar data acquisitions without the need for a new map every few days. This was thought by co-management partners (TG, ENR, and WRRB) to be preferable from a practical management perspective, both for hunters and for officers responsible for compliance.

Overlap and Harvest of Adjacent Herds

In the winter of 2015-2016, the Bathurst herd was largely separated from its neighbours, and the mobile zone had little influence on the potential harvest of the Bluenose-East and Beverly herds (Figure 5). Consequently, a modest buffer around the mobile zone had little effect on reducing harvest opportunities of caribou from adjacent herds.

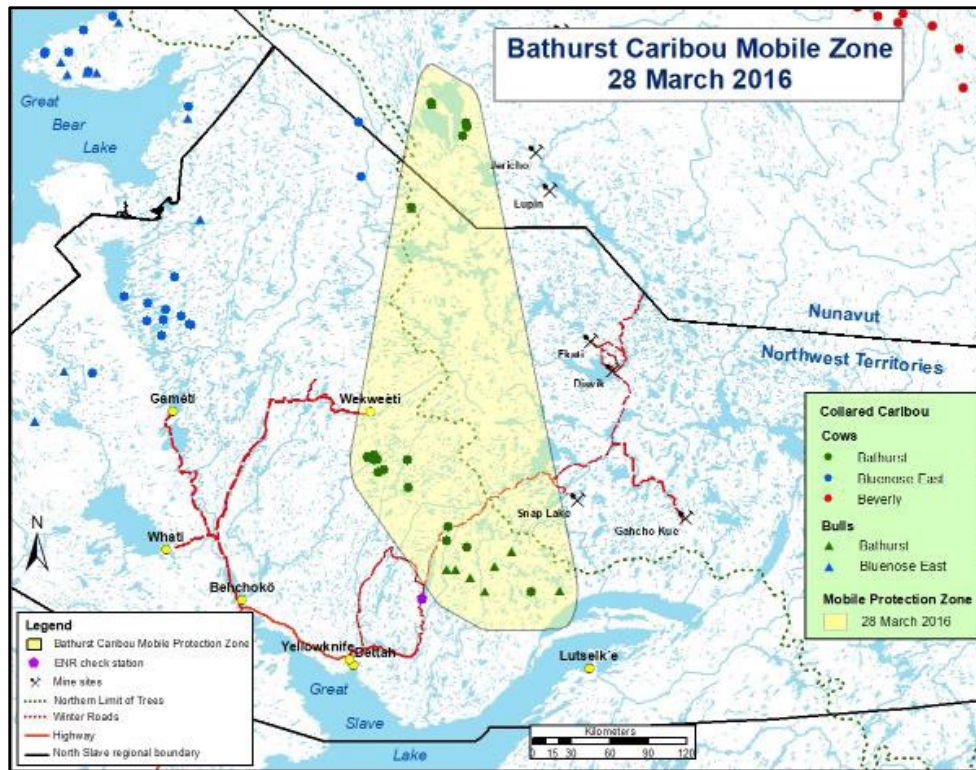


Figure 5. An example winter where caribou herds adjacent to the Bathurst herd did not significantly overlap each other. Coloured points show the distribution of collared caribou in the North Slave Region from the Bathurst, Bluenose-East, and Beverly herds 28 March 2016 and in relation to the Bathurst caribou mobile zone.

In the winter of 2016-2017, the distribution of collared caribou from the Bathurst, Bluenose-East and Beverly herds showed an unusual and unexpectedly high degree of overlap, which meant that the mobile zone for Bathurst caribou with a 60 km, 40 km or 30 km wide buffer also enclosed most of the neighbouring herds (based on collars) and would have severely limited Indigenous hunting opportunities. As a result, the size of the buffer on the mobile zone was reduced to 20 km, then 10 km and was again created at four-day intervals to give hunters reasonable opportunities to hunt the nearby Beverly caribou herd (which had no harvest restrictions in the NWT) and the Bluenose-East herd (which had a Total Allowable Harvest (TAH) of 750 bulls in the Wek'èezhì area at the time). Winter 2018-2019 also had extensive overlap among the adjacent herds (Gurarie et al. 2024), and while multiple buffer sizes were considered (e.g. Figure 6), a 40 km buffer remained throughout that harvest season.

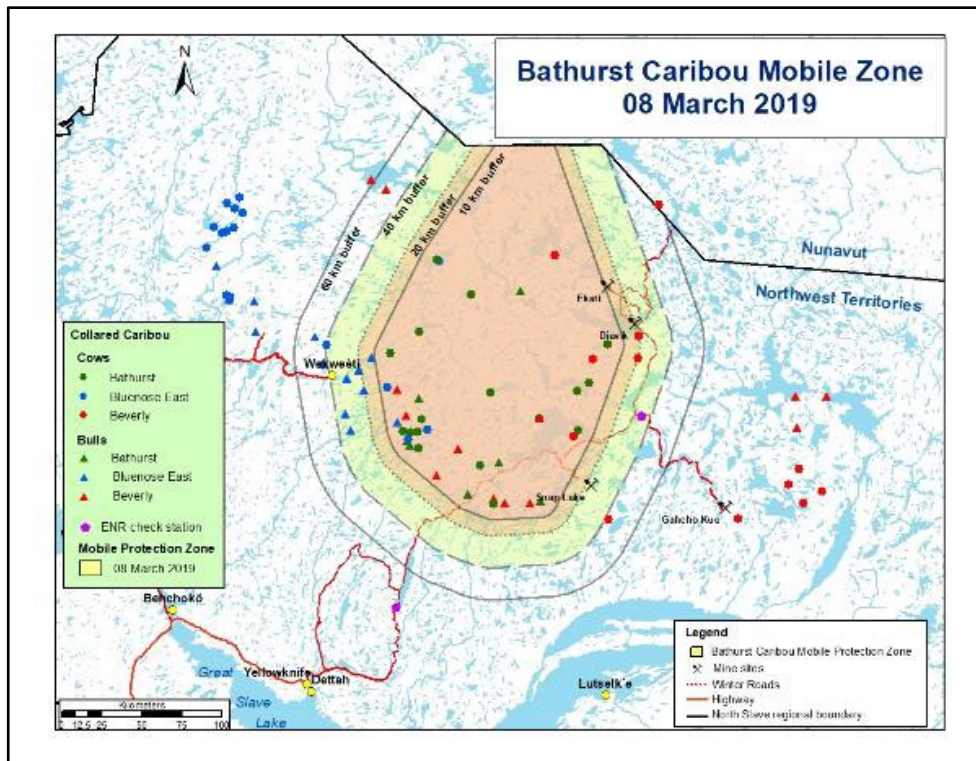


Figure 6. Bathurst caribou mobile zone for 08 March 2019 showing the 10, 20, 40, and 60 km buffer options to mitigate infringement on Indigenous hunting on adjacent caribou herds with some harvest allowed (Bluenose-East herd) or with no harvest restrictions (Beverly herd). Only the 40 km buffer was used for all of 2019.

Single Zone vs. Multiple Zones

From 8-19 January 2017 (before the Tibbitt to Contwoyto winter road opened), a single mobile zone was changed to two subzones, a main one in the west and a smaller one in the east (Figure 7). Although only 35 km apart, the two subzones reflected the distribution of the caribou collars at the time. However, because of subsequent caribou collar movement and buffer overlap, the two subzones became one elongated one for the 02 February 2017 map. This also made the zone easier to manage on the ground with the winter road in use.

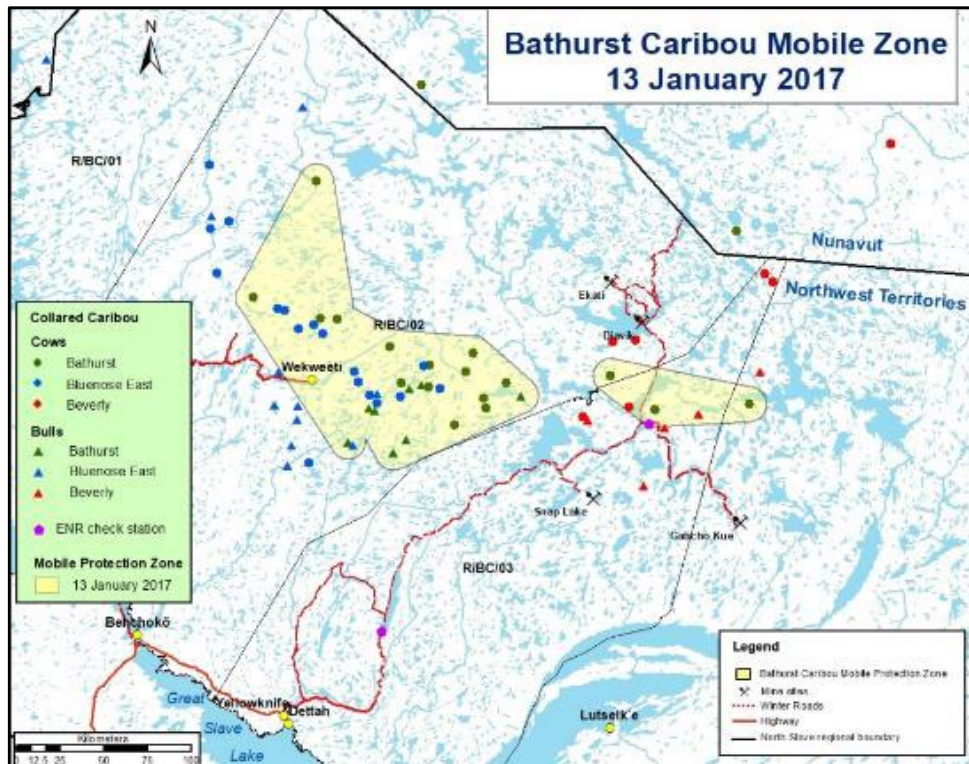


Figure 7. Example of a two-part caribou no-harvest mobile zone for 13 January 2017. The large wildlife management administrative zones are also depicted (alpha-numeric labels).

RE-DEFINING THE MOBILE ZONE

After extensive overlap of caribou herds was observed and subsequent changes to the mobile zone in winter 2016-2017, the Barren-ground Caribou Technical Working Group (BGCTWG) met periodically through the winters of 2017-2018 and 2018-2019 to review the distribution of the herds, based on collars, and the location and buffer size of the mobile zone. This working group was established in 2010 after the WRRB public hearings and their resulting recommendations (see WRRB 2010). Its members include the WRRB, TG, and ENR.

The main purpose of the BGCTWG was to meet regularly to review new information on the Bathurst herd (and later, the Bluenose-East herd as well) and increase communication between its members. The BGCTWG recognized that a balance was needed between conservation (i.e., no harvest) of the Bathurst herd, which would likely result from larger buffers on the mobile zone, and limiting harvest restrictions on neighbouring herds, which might be enabled by smaller buffers or the use of subzones if there was overlap. Plans needed to be adaptive, depending on whether the Bathurst herd was relatively well separated from neighbouring herds or heavily overlapped. These rules updated those previously established in June 2016 as described in the TG and ENR response to the WRRB's Bathurst Caribou Final Report, Part A 2016) and are included in [Appendix B](#). As a result of several discussions within the BGCTWG, the approach for defining the mobile zone was formalized as the set of rules that attempted to ensure conservation of Bathurst caribou while limiting possible infringement on Indigenous harvest of neighbouring barren-ground caribou herds. The November 2018 version of these rules is included as [Appendix B](#).

Initial Mobile Zone Attributes and Modification Schedule

The mobile zone would be defined in the NWT beginning when collared Bathurst caribou moved back into the NWT from calving and summer ranges in NU, potentially as early as mid-summer (1 July), and would continue until the end of the winter harvest season. Review of the mobile zone boundaries from several winters had shown that from approximately the end of November to the end of March, and often a portion of April, there was little directional movement of collared Bathurst caribou, and there were generally low daily movement rates, thus a relatively fixed zone might be possible.

Each year, starting on July 1, all functioning collars on Bathurst caribou (cows and bulls) would be used to define the mobile zone using an MCP, with a default 60 km wide buffer around the MCP. Where collared (Bathurst) caribou showed distinct, well-separated subgroups (e.g. Figures 5, 7), the mobile zone could be shaped as two or more parts of the mobile zone.

Once established, the mobile zone boundaries would not change if all the collared Bathurst caribou remained within the mobile zone. However, if one or more collared Bathurst caribou moved to within five km of the boundary of the zone or moved out of it, the current mobile

zone would be re-defined based on the method described above, and the new zone boundaries would be in effect while all collared Bathurst caribou remained within the new boundaries. The concept of a buffer applied to the mobile zone boundaries was implemented to allow for some movement of caribou within the zone to reduce the need for too frequent revisions (see sections below).

Where collared Bluenose-East or Beverly caribou were within the mobile zone, the WRRB determination of a zero harvest of the Bathurst herd meant that no caribou could be harvested within the mobile zone, regardless of herd affiliation. The possibility of dividing the mobile zone into two or more parts provides some flexibility with respect to identifying areas where collared caribou from neighbouring herds might be found and where some harvest was possible, provided there were no collared Bathurst caribou in the area. However, the working group recognized that a more complex mobile zone with two changing subzones could create increased challenges in communicating and enforcing the zone. In addition, there was the potential for Bathurst caribou, unidentified by collars between the two subzones, being exposed to harvest pressure.

The TG and ENR explored ways of making information about the mobile zone location easily accessible to hunters (ENR and TG 2019a, b). This has included making maps available in formats for GPS (Global Positioning System) devices and Google Earth™, and by using signs on the winter roads used to access caribou during the winter harvest season to show the locations of the mobile zone boundary. Modifying the mobile zone boundaries to use natural features such as rivers or lake edges to make the zone more practical for hunters in identifying the boundaries on the land was also discussed, provided that there would be no significant reduction in protection for the Bathurst herd. However, that possibility has not yet been implemented.

The BGCTWG committed to meeting in December and January of each year to review caribou collar data and mobile zone definition(s), and based on consensus, to recommend any proposed changes to the TG, ENR, and WRRB. The BGCTWG would periodically review information on harvest locations and numbers throughout the winter harvest season to check on herd assignments for harvest and on the possibility of Bathurst caribou being harvested.

Mapping the Zone

Different versions of mobile zone maps were produced each week. One set was for public display and was provided at two scales. One was at a scale of 1:750,000, which showed the Bathurst mobile zone and adjacent zones in the North Slave Region where other caribou harvest restrictions were in place, such as a requirement for authorization cards (see [Appendix A](#)). A French version of this map was also made available due to legal requirements. A second map at a 1:400,000 scale zoomed in to the Bathurst mobile zone, showed lake names, and identified some important locations such as ENR patrol station(s)

and zone boundary intersections with the winter road (see [Appendix A](#)). Each map had the date when it was created (usually the same day as new location data became available), and the date when the next map could be expected (usually seven days later).

Another map version was made for internal government use only. This map was at the larger 1:750,000 scale, but also had the collared caribou locations identified by herd. This map was restricted to biologists, wildlife officers, and senior management and was intended to assist in the management and enforcement of the mobile zone. It was not released to the public to avoid giving unfair aid to hunters in precisely locating caribou for harvest, especially if Bathurst caribou were nearby.

The mobile zone was mapped weekly from January to early May, and the map was disseminated to regional and community offices for posting in conspicuous places for the public to see. Maps were emailed internally to ENR government personnel and externally to GNWT, TG, WRRB, and other Indigenous governments, Indigenous organizations and community governments.

A list of Frequently Asked Questions (FAQ) and their answers were provided with the map each week (see [Appendix A](#)). Maps were also posted on ENR's website and Facebook™ page. A Google Earth™ version (*.kmz) and a Garmin™ GPS version (*.gpx) were also distributed.

Accommodating Harvest from Nearby Herds

Overlap of Bathurst caribou with the neighbouring two herds could sometimes be extensive in the winter, particularly between the Bathurst and Bluenose-East herds.

Two possible scenarios for delineating the mobile zone were considered in the updated 2018 rules for the Bathurst mobile zone ([Appendix B](#)): Scenario A, in which the Bathurst herd largely winters on its own with little overlap with neighbouring herds, and Scenario B, where the herd has extensive overlap with either the Bluenose-East or the Beverly herds. The first scenario was relatively simple, as restrictions on harvesting neighbouring herds were not an issue.

Scenario A. Bathurst Herd is Largely Separate from Neighbouring Herds

In some winters (e.g. 2015-2016; Figure 5), collared caribou from the Bathurst herd had been well separated from the Bluenose-East and Beverly herds. Under these conditions (i.e., Scenario A), hunter access to alternate herds would not be restricted substantially by the mobile zone. Under these conditions, the following rules were applied.

The mobile zone boundary would be defined as an MCP around all functioning collars on Bathurst caribou (cows and bulls) plus a 60 km buffer around the MCP. Collar locations would be updated weekly. The mobile zone would be defined based on all active Bathurst-collared caribou, including any in NU (although the no-harvest zone regulations would only apply in the NWT). In general, separation of the mobile zone into two or more subzones

would be avoided and would be considered only when there was substantial overlap between herds. The mobile zone would be defined in the NWT prior to the fall harvest season and would continue until the end of the winter harvest season. Maps would be updated weekly with new collar locations.

The recommended number of collars for the Bathurst herd to define its winter distribution with confidence was 40 or more, based on analyses by J. Boulanger and others (see Adamczewski and Boulanger 2016 for details and further references). With fewer collars, consideration would be given to a larger buffer on the mobile zone, as there would be a greater chance that a portion of the herd's distribution would not be well defined. An approximately equal number of collars on the two neighbouring herds would be recommended to define their distribution with confidence.

Once established, the mobile zone boundaries would not change while all the collared Bathurst caribou remained within the mobile zone, and no collars were <20 km from the boundary. If one or more collared Bathurst caribou moved to within 20 km of the boundary of the zone or moved out of the mobile zone, the mobile zone would be re-defined based on the same method described above (using a 60 km buffer), and the new zone boundaries would be in effect while all collared Bathurst caribou remained within the new boundaries.

If Bluenose-East or Beverly collared caribou were found in the Bathurst mobile zone, the no-harvest regulations would still apply since caribou from different herds are indistinguishable from each other. Information about the mobile zone would be made available to hunters via maps, in formats suitable for GPS devices, and signs on the winter roads.

Scenario B. Bathurst Herd Shows Overlap with One or Both Neighbouring Herds

The mobile zone boundary would initially be defined as an MCP around all functioning collars on Bathurst caribou (cows and bulls) plus a 60 km buffer around the MCP. The overall approach defined for Scenario A – numbers of collars, weekly maps, no harvest of any caribou within the zone, and length of the season – would also apply in the overlap scenario.

Hunter access to the Beverly caribou or Bluenose-East caribou would be considered sufficient if at least 50% of active collars on either of these two herds in the NWT were outside the mobile zone. If more than 50% of the collared caribou from either the Bluenose-East or Beverly herds were found within the NWT and were within the mobile zone, then reduction of the mobile zone buffer could be considered. Under these conditions, the mobile zone buffer could be reduced in 10 km increments until less than 50% of the collars from the neighbouring herds were within the zone. A 20 km buffer would be maintained at a minimum to ensure adequate protection of the Bathurst herd. The range and median distance travelled by the collared caribou over the preceding seven days could be used to help determine the size of the buffer.

In general, the separation of the mobile zone into two or more subzones would be avoided. However, delineation of two or more subzones could be considered if there were two or more widely separated groups of collared caribou to minimize impact on harvest opportunities in the area in between. The minimum distance between nearest-neighbour collars in proposed subzones would be 80 km. A subzone would need to have a minimum of three collared Bathurst caribou, as this is the minimum number needed to define a polygon.

Although these criteria are called rules, and many of them are supported in regulations, they can be amended as needed (with justification and support). Because the implementation of the mobile zone is a relatively novel approach, some flexibility was recognized as needed in its application. Such was the situation in January to early February 2017 when a 10 km buffer was used (Figure 8).

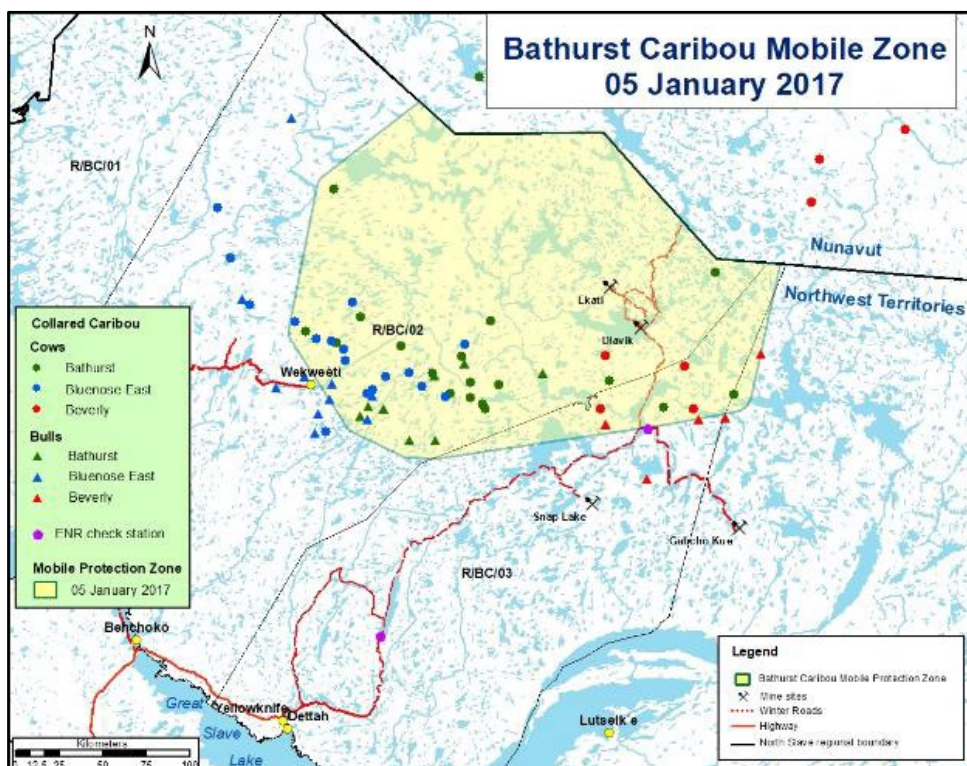


Figure 8. Mobile zone with a 10 km buffer and collared caribou locations on 5 January 2017. Bathurst collared caribou locations are in green, Bluenose-East in blue, and Beverly in red. The mobile zone boundaries were truncated at the NU border.

At that time, a large portion of Bluenose-East and Bathurst collared animals had mixed together within the 40 km buffer area to the west, and a significant number of Beverly and Ahiak animals had also closed in with some Bathurst collared caribou to the east. Under this scenario, very few Bluenose-East caribou bulls could be harvested to the west due to long distances and limited access from the communities, and no harvest of the Beverly and Ahiak caribou to the east would be allowed. With the winter road to the diamond mines now open,

ENR anticipated that hunters would want to access the area where Beverly and Ahiak caribou could be legally and sustainably harvested and shared these concerns with TG and WRRB. It was agreed to adjust the size of the buffer area around the mobile zone to 10 km to allow for some hunting and avoid the risk of infringements to Indigenous hunting rights.

Although the mobile zone has never overlapped with other ecotypes of caribou, like boreal caribou (*Rangifer tarandus tarandus*), for enforcement purposes, managers needed to ensure that the zone could be applied wherever it was needed, and to any type of caribou found within it. Consequently, the regulation was changed by removing the term “barren-ground” so it would apply to all types of caribou (GNWT-ENR letter to WRRB, 6 August 2020).

Summary of Mobile Zone Attributes

Attributes that characterized the Bathurst caribou mobile zone to 2021 are summarized in Table 1. Numbers of collars have increased since 2015 and have included bulls since 2016. In 2017, Bathurst caribou were widely distributed from north of Wekweètì and eastward to Aylmer Lake, resulting in a large MCP for the mobile zone, both as a single zone or when split into two subzones (Table 1). In 2018, most of the Bathurst collared caribou straddled both sides of the NWT/NU border. In most years, the mobile zone consisted of just one polygon. Buffer zones applied to the mobile zone boundary have been variable over the first seven years as managers tried to balance protection of the Bathurst caribou herd by maintaining harvest opportunities for adjacent herds. Some shifting of the Bathurst collared caribou occurred to the southeast in winter, and hence the resultant mobile zone, as indicated by the greater inclusion of the Gahcho Kué winter road (Table 1). Overlap of caribou from the adjacent Bluenose-East and Beverly caribou herds varied in the early years of the mobile zone but became a regular annual feature from 2019 onwards (Table 1).

Table 1. Summary of attributes of the Bathurst caribou mobile zone in the NWT during the ten-week winter road operation (late January to late March/early April), 2015-2021.

Mobile Zone Attributes		Year (winter)						
		2015	2016	2017	2018	2019	2020	2021
# collars used to define the mobile zone (sex ratio)	Max.	15 (15f)	33 (24f:9m)	30	30	29	24 (22f:2m)	48 (37f:11m)
	Min.	12 (12f)	30 (22f:8m)	(19f:11m) 28 (17f:11m)	(19f:11m) 20 (9f:11m)	(18f:11m) 24 (17f:7m)	23 (21f:2m)	47 (36f:11m)
# collars within mobile zone in NWT (sex ratio)	Max.	15 (15f)	25 (17f:8m)	30	14 (5f:9m)	29	24 (22f:2m)	48 (37f:11m)
	Min.	12 (12f)	22 (15f:7m)	(19f:11m) 28 (17f:11m)	9 (1f:8m)	(18f:11m) 24 (17f:7m)	23 (21f:2m)	43 (34f:9m)
# of polygons		1	1	2, 1	1	1	1	1
Buffer zone size(s)	km	18+	30	10, 15	20	40, 20, 40	60, 50	40, 30, 20
Average area of mobile zone (NWT) with buffer	km ²	20,607	33,051	32,464	36,585	44,380	46,525	49,317
	SE*	632	4,924	3,456	828	1,016	592	1,662
Average minimum convex area enclosed for all Bathurst caribou collars	km ²	5,582	30,487	71,415	55,798	21,260	14,171	36,670
	SE	517	842	1,321	1,989	1,148	681	3,884
	% in NWT	100	90.2	71.0	54.4	97.4	100	96.3
% active collars in mobile zone from adjacent caribou herds	BNE [†]	19.6	0	53.3	0	30.5	18.1	35.3
	Bev/Ah ^{††}	4.4	0	16.1	30.2	53.6	14.7	72.8
Average length of winter road within mobile zone (km) in NWT	T2C [‡] (SE)	132 (5.1)	169 (2.8)	151 (23.0)	225 (10.3)	298 (8.9)	349 (3.1)	219.1 (18.5)
	GK ^{‡‡} (SE)	0	0	8 (2.8)	18 (5.9)	59 (12.1)	11 (1.8)	58.3 (2.7)

* SE = Standard Error

‡ T2C = Tibbitt-to-Contwoyto Winter Road

† BNE = Bluenose-East caribou

‡‡ GK = Gahcho Kué winter road

†† Bev/Ah = Beverly and/or Ahiak caribou

EFFECTIVENESS OF THE MOBILE ZONE TO PROTECT BATHURST CARIBOU

The effectiveness of the Bathurst mobile no-harvest zone was assessed by considering the following criteria:

1. The number of collared caribou were sufficient to fully define the herd's distribution. (i.e., if portions of the herd were not identified by collared caribou, they might have been subject to harvest because they were outside the zone).
2. Collared caribou remained in the zone between weekly maps (i.e., if the zone initially contained all the collared caribou, but within the week some collars moved out of the zone, they would potentially be subject to harvest).
3. Compliance of harvesters with the no-harvest zone. That is, did any illegal harvest of caribou occur within the zone (e.g. hunters may not have accepted the zone and harvested substantial numbers of caribou within it, or did any harvest occur in the zone that was not promptly detected).

Adequacy of Collars to Define Bathurst Caribou Distribution

An assessment by Otto et al. (2003) on the number of satellite collars needed to define the spatial distribution of the George River herd in Québec/Labrador at different seasons was used to facilitate directing military jet flights away from the herd. Numbers of collars required varied with season, with the lowest numbers needed during calving because the herd's cow distribution was quite predictable at that time. For winter, Otto et al. (2003) suggested that 49 collars would provide a 75% probability of defining the herd's distribution adequately, and 64 collars would provide a 95% probability. Boulanger (2011) carried out a similar assessment and suggested that at least 40 satellite collars would be needed to adequately assess the distribution of a wintering caribou herd like the Bathurst or one of its neighbours like the Bluenose-East herd. These assessments indicated that Bathurst collar numbers should be at least 40 and preferably more to be confident that the herd's distribution would be well defined.

However, the numbers of collared caribou in the Bathurst herd 2015-2019 have often been below the numbers suggested by the analyses of Otto et al. (2003) and Boulanger (2011) as adequate to define a herd's winter distribution sufficiently. Larger numbers of collars would thus improve confidence that no significant part of the herd is outside the mobile zone and potentially subject to harvest (Adamczewski and Boulanger 2016). Since 2015, deployment of collars on Bathurst caribou increased from a target of 20 to 50 (target of 30 cows, 20 bulls), and in March 2019 agreement was reached to further increase numbers to a maximum of 70 collars (target of 50 cows, 20 bulls). These increases were approved by the WRRB (WRRB 2019 a, b)¹. However, these targets were often not achieved, and in most years, the actual collar numbers were much lower. Winter range overlap of the Bathurst, Bluenose-East and Beverly herds has been extensive since about 2018. In addition, the Bathurst herd was

outnumbered by the Beverly herd by about 15:1. This has made it particularly difficult to isolate Bathurst caribou for collar deployment.

The number of collars on Bathurst caribou between 2015 and 2019 has been below 40 for most of the harvest season (Table 2). New deployments typically occurred in mid to late March (Table 2), with attrition of collars over the years resulting from collared caribou dying or collars expiring (or occasionally malfunctioning) and dropping off. In 2018, new collar deployments were attempted earlier in winter to spread out the effort and increase the likelihood of attaining targets. In 2019, inclement weather precluded some deployment attempts but multiple deployment efforts in subsequent winters were expected to continue after the maximum collar targets for the Bathurst and Bluenose-East herds increased to 70 collars (target of 50 cows and 20 bulls, as of 2019; WRRB 2019 a, b). This new target for the Bathurst herd increased the likelihood that at least 40 collars would be functioning when the mobile zone boundaries were derived. Having enough collars deployed to delineate the mobile zone boundaries would likely be the single most important factor to adequately define the spatial extents of the herd.

Table 2. Number of GPS collars deployed on Bathurst caribou 2015-2019. Existing collars define the spatial extent of the mobile zone during winter with weekly updates. New collar deployments are carried out every year, usually in March, to reach target numbers as caribou die or collars reach the end of their life. New collars are normally assigned to the herd in June for cows and July for bulls.

Year	Existing Collars	New Deployments Dates	New Collars to Deploy	Total Collars
2015	14 (F)	13-17 Mar.	40 (21 F: 19 M)	54 (35 F: 19M)
2016	28 (20 F: 8 M)	20-31 Mar.	20 (9 F: 11 M)	48 (29 F: 19 M)
2017	29 (18 F: 11 M)	10-17 Mar.	9 (5 F: 4 M)	38 (23 F: 15 M)
2018	33 (18 F: 15 M)	16-19 Dec. (2017)	9 (0 F: 9 M)	
		11, 22-25 Feb.	21 (13 F: 8 M) *	
		27-31 Mar.	15 (15 F: 0 M) *	<78 (46 F: 32 M) *
2019	24 (16 F: 14 M)	19-27 Mar., 03 Apr.	47 (33 F: 14 M)	71 (49 F: 22 M)

Information from aerial reconnaissance flights was also used to assess how well collared Bathurst caribou delimited the herd's distribution. These flights were carried out (e.g. winter 2015-2016) when the Bathurst herd had little or no overlap with neighbouring herds. One such flight in October 2014 suggested that collared cows at that time were clearly associated with most sightings of caribou groups. Flights carried out between March 5 and 6, 2015, to assess late-winter calf:cow ratios in the Bathurst herd in the first winter of the mobile zone, suggested that the 14 collared cows were strongly representative of the herd's main distribution (Figure 9). Very few caribou were seen on flight lines near the periphery of the mobile zone, and very few caribou were more than 20 km away from a collared caribou.

While instructive, helicopter flight lines were focused on locations of collared caribou, and a systematic survey of the mobile zone was not carried out.

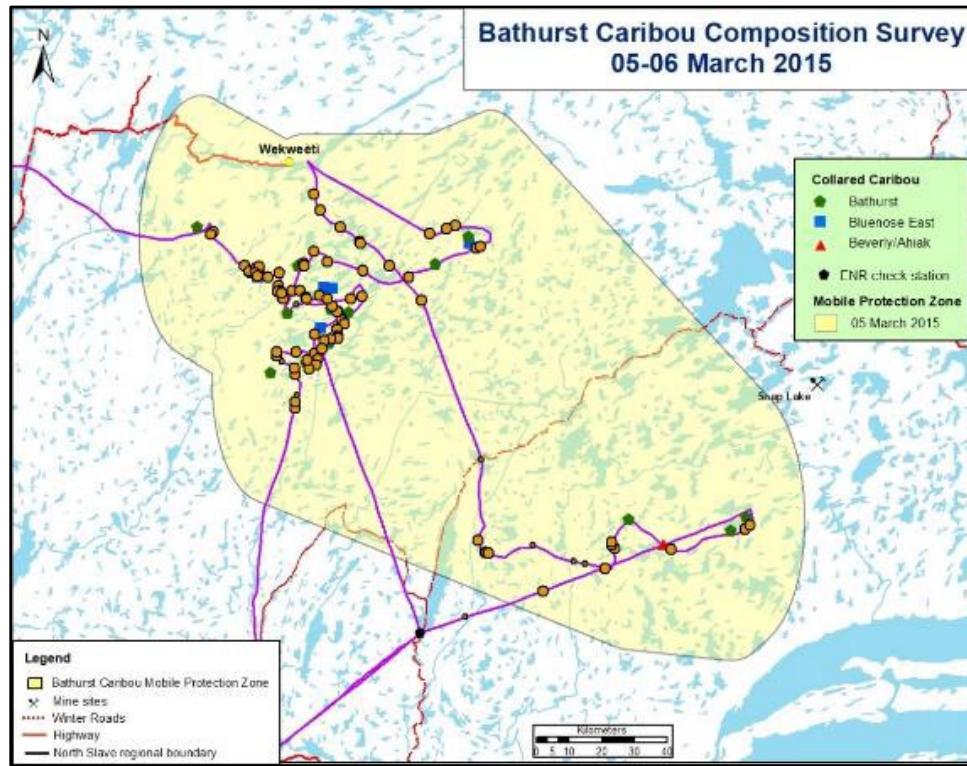


Figure 9. Late winter classification survey 5-6 March 2015 for Bathurst caribou. Locations of caribou groups observed during the survey are plotted. Locations of 14 collared Bathurst caribou (all female) on March 5 are shown. Nearly all the caribou observed were within the boundaries of the Bathurst mobile conservation zone polygon established at the time.

A reconnaissance flight on 18 April 2016 (Figure 10) was used to assess numbers of caribou on the periphery of areas where collared Bathurst caribou were located. At this time, there were 20 newly collared Bathurst caribou (nine cows and 11 bulls) added to the previously collared 11 Bathurst caribou (eight cows, three bulls). While survey coverage was limited, observations of caribou groups were generally within 10-20 km of one or more collared caribou, and all caribou seen were within the southern portion of the mobile zone.

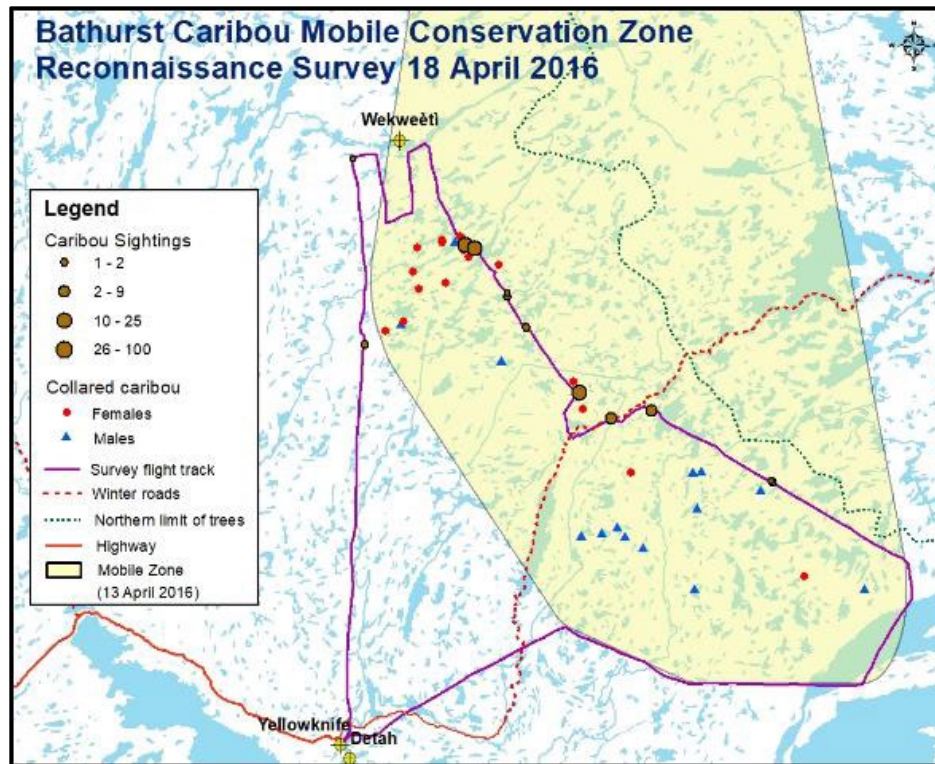


Figure 10. Caribou reconnaissance survey 18 April 2016 to assess mobile zone boundary in relation to winter distribution of collared caribou. There were 17 collared cows and 14 collared bulls in the Bathurst herd at the time.

Taken together, the three aerial flights conducted in the winter of 2015-2016, while limited in coverage, suggested that the number of collared Bathurst caribou generally represented the herd’s distribution well, and that uncollared caribou groups observed were rarely more than 10-20 km from collared caribou.

Movement of Collared Caribou Out of the Mobile Zone

Caribou are highly mobile animals that are capable at some times of year of moving 30-40 km or more in a day, for example, during the spring migration of cows to their calving grounds and during the insect season in July (Nagy et al. 2011). In mid-winter, daily caribou movement rates are usually much less. Maps of the Bathurst mobile zone were updated on a weekly basis through the winter harvest season using the most recent collared caribou locations. We assessed the potential for collared caribou to move out of the mobile zone within five to seven days, and contracted Boulanger (2019) and Caslys Consulting Ltd. (2019) to assist in this assessment. Their reports are included as [Appendices C](#) and [D](#) respectively. A summary of their analyses is given here.

Average daily movement rates were calculated for the three herds (Bathurst, Bluenose-East and Beverly) across five- or seven-day windows according to the year being collected (five days for 2017 and seven days for 2018). Five- and seven-day windows were selected to

evaluate which interval and buffer would best delineate the mobile zone (Caslys Consulting Ltd. 2019, Appendix D). and average daily movement rates calculated for each to generate the five- and seven-day averages (Tables 3 and 4).

Table 3. Maximum average daily movement rate for five-day windows in 2017 of Bathurst, Bluenose-East and Beverly collared caribou (Caslys Consulting Ltd. 2019).

Herd	Movement Rate (km/day)	Time Window
Bathurst	4.55	31 January to 4 February
Bluenose-East	3.19	6 January to 10 January
Beverly	4.48	21 January to 25 January

Table 4. Maximum average daily movement rates for Bathurst, Bluenose-East and Beverly collared caribou for seven-day windows in 2018 (Caslys Consulting Ltd. 2019).

Herd	Movement Rate (km/day)	Time Window
Bathurst	4.43	1 January to 7 January
Bluenose-East	3.63	8 January to 14 January
Beverly	4.84	15 January to 21 January

The movement analysis revealed that the average daily movement rates in winter differed across the three caribou herds. The Bathurst and Beverly movement rates were similar, but the Bluenose-East caribou rates were consistently lower (Figures 11, 12; Caslys Consulting Ltd 2019). It is likely that habitat characteristics of the winter ranges contributed to this difference (e.g. Nagy 2011). The Bluenose-East winter range occupies less tundra ecozone than the Bathurst and Beverly herds, is less variable in elevation, and has significantly fewer large lakes. These physical differences and how they affect snow depth could be important factors limiting daily movement rates in winter. Boulanger (2019) estimated the mean rate of movement per day for Bathurst caribou in 2017 (January-early April) after outliers were removed to be 3.5 km.

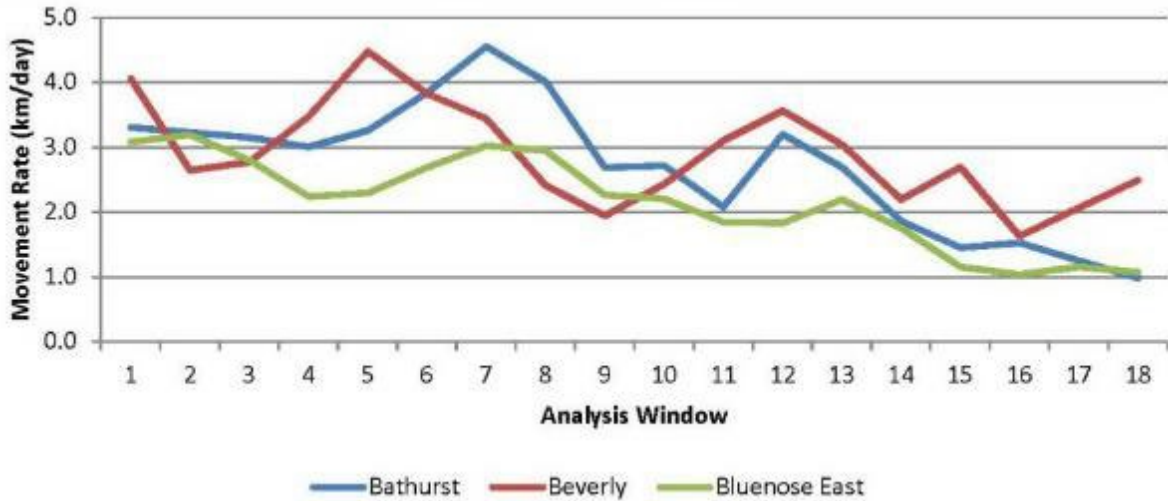


Figure 11. Average movement rates of Bathurst, Bluenose-East and Beverly collared caribou for 2017 within the NWT from 1 January to 1 April, subdivided into five-day consecutive analysis windows (Caslys Consulting Ltd. 2019).

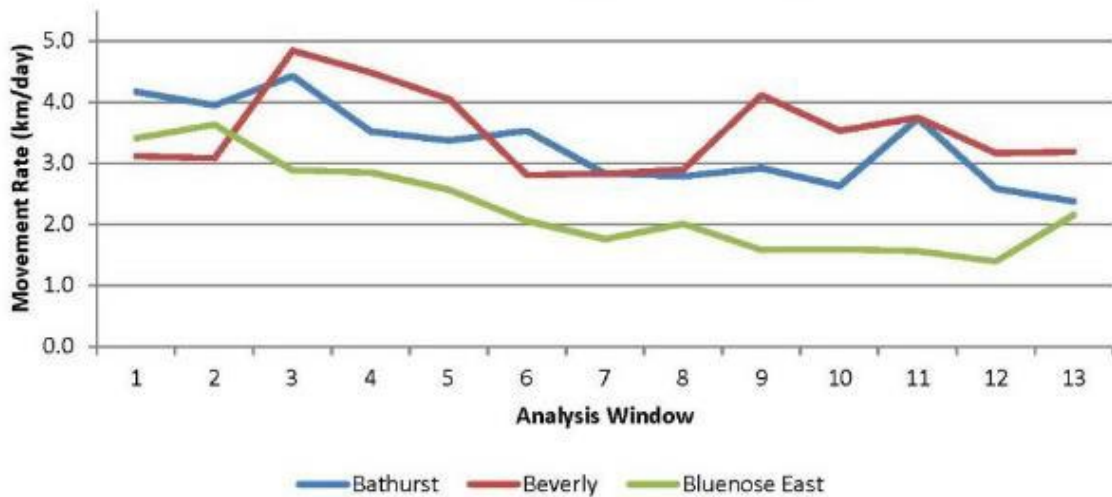


Figure 12. Average daily movement rates for Bathurst, Bluenose-East and Beverly collared caribou for 2018 within the NWT from 1 January to 1 April, subdivided into seven-day consecutive analysis windows (Caslys Consulting Ltd. 2019).

Bathurst Collared Caribou and Herd Coverage Analysis

To determine if the mobile zone formulation provided adequate coverage to protect the herd from harvesting, Boulanger (2019) conducted a preliminary analysis of the collared caribou from the Bathurst herd from 2017 and 2018. The analysis sought to determine which minimum buffer size (10 to 60 km, in 10 km intervals) was needed to minimize the chance of caribou moving out of the mobile zone within the week after it was established.

Collar sample sizes (including bulls and cows) varied from 24 to 49 in 2017 and 2018 (Boulanger 2019, Appendix C). The proportion of locations within the mobile zone as a function of the MCP buffer and year data set is shown in Figure 13 (from Boulanger 2019). This figure suggests that at least 95% of collared caribou locations (as indicated by the whiskers on each box plot) were contained within the mobile zone when the MCP buffer was at least 20 km, except when NWT and NU were considered, in which case it was 30 km. The most applicable mobile zone for 2018 was the NWT-only scenario, so therefore 20 km was adequate for both the 2016-2017 and 2017-2018 winters. The strategy of estimating the MCP with all collared Bathurst caribou locations but truncating it at the NWT border increased coverage of collared caribou within NWT when the Bathurst herd straddled the territorial border with NU.

As noted earlier, these analyses could only use the collar locations and movement rates available; at lower collar numbers (e.g. 24), confidence in the herd’s distribution being fully defined was reduced.

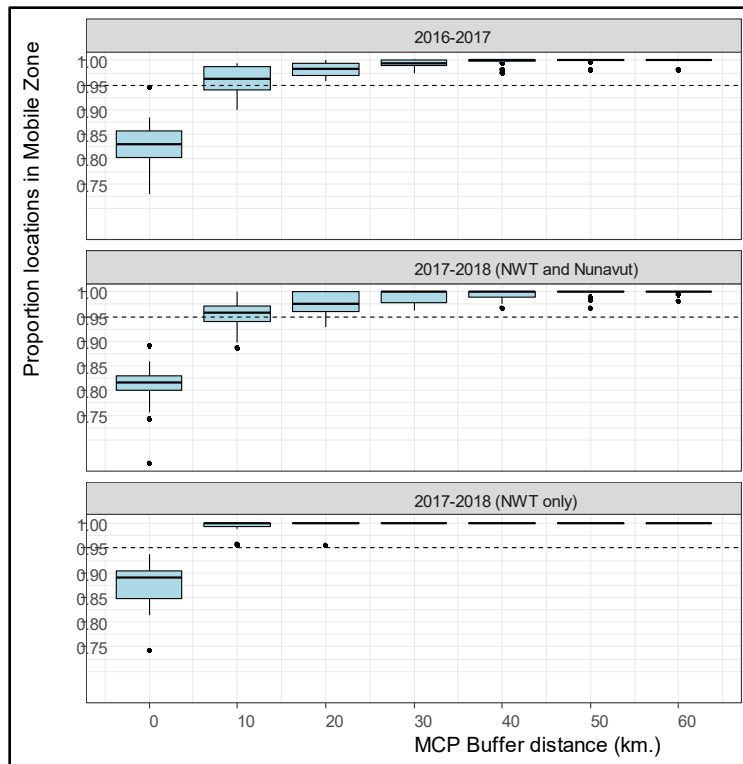


Figure 13. Summary of the proportion of collar locations within management zones as a function of the MCP buffer and the data set used for the analysis. The time interval is one week (seven days), and the dotted lines show that at least 95% of the locations would have still been within the zone at that buffer size. The middle line for each plot is the median value, with the box extending to the 25th and 75th percentiles. The whiskers extend to the range of data up to 1.5 interquartile ranges (the interquartile range is the box width). Points beyond this are outliers and are shown as dots (from Boulanger 2019).

Boulanger (2019) noted that movement rate as an indicator of coverage is potentially problematic since the likelihood of a caribou going outside the zone is dependent on its location relative to zone boundaries. If a caribou is in the center of the zone, it is less likely to move outside, even if movement rates increase. Mobile zone maps were often re-created every four days prior to 2019 based on the duty cycle of the collars, some of which were programmed to send new data every four days. However, Boulanger's (2019) analysis presented herein supported the adaptive approach adopted in winter 2019, where coverage of collared caribou within each zone can be evaluated on a weekly basis. A weekly interval is pragmatic and still allows iterative adjustments dependent on the distribution and movement of collared caribou at the time.

Compliance Monitoring

Once the mobile zone boundaries were established, maps were produced and posted on the ENR website as well as in hard copy in ENR regional offices and North Slave Region communities. Regulations define the distribution list for the maps to ensure harvesters have the information needed to be in compliance. Here, we summarize compliance monitoring by ENR Renewable Resource Officers.

Caribou harvesting in the North Slave Region in the winter has generally depended heavily on winter roads to the Tłı̨ch̨ communities of Gamètì, Whatì, and Wekweètì, and to the diamond mines north of Yellowknife (e.g. Figure 14). Prior to 2010, winter harvest of Bathurst caribou was estimated at 4,000-5,000/year, primarily cows, with much of that harvest likely along winter roads to the Tłı̨ch̨ communities (Adamczewski et al. 2020). At that time, Indigenous harvest was not restricted and was the primary source of harvest with resident and guided outfitter harvest occurring at much lower levels (Adamczewski et al. 2020). Availability of maintained winter roads, albeit for only about ten weeks, enabled a harvest predominantly by pick-up trucks or trucks transporting snowmobiles, rather than snowmobiles only, which increased ease, speed and distance of harvesting. However, closure of the resident and outfitter harvest in 2010 and the use of the two large fixed zones with a limit of 300 Bathurst caribou generally eliminated this type of large-scale harvest from winter roads serving Tłı̨ch̨ communities.

The reliance on winter roads to hunt caribou in the winter in the North Slave Region has continued since 2010. In recent years (2009-2019), the Bathurst herd's reduced numbers have been accompanied by a large reduction in the herd's annual range, with a shift northwards, especially on the winter range (Mennell 2021). Since 2015, the Bathurst herd in particular has wintered in the vicinity of the diamond mines where, previously, the herd had more commonly passed through those areas on northward and southward seasonal migrations. In addition, the Bathurst herd has, in some winters overlapped heavily with the Bluenose-East herd, and from 2017 to 2019 with the Beverly herd, based on collared caribou.

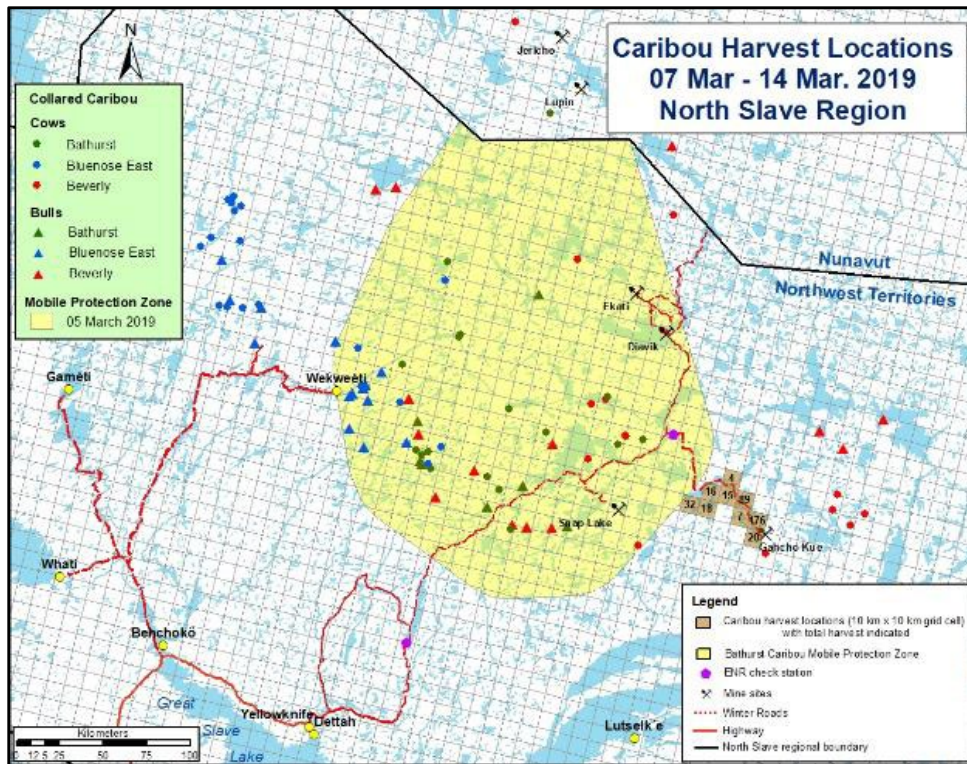


Figure 14. An example of the spatial distribution of caribou harvest locations reported by Renewable Resource Officers on patrol along the Tibbitt to Contwoyto winter road from 7 to 14 March 2019, showing their occurrence outside the mobile zone. Site locations are based on 10 km² grid cells distributed throughout the territory. Collared caribou locations are shown for 5 March 2019, which were used with a 40 km buffer to create the boundaries of the Bathurst caribou mobile zone for that week. Harvest of caribou for that week (brown grid cells with total number of caribou harvested that week) were along the spur winter road to the Gahcho Kué diamond mine and outside the mobile zone.

Much of the caribou harvest in the North Slave Region appears to have shifted to the Beverly herd, often east and southeast of the mobile zone (Table 5, Figures 15, 16). Indigenous harvest of this herd was not restricted in the NWT or in NU owing to its relatively substantial numbers, estimated at about 103,000 in 2018, despite being in decline (Campbell et al. 2019). Harvest of Bluenose-East caribou has been restricted since 2016, with a TAH managed through the use of authorization cards by Indigenous harvesters only. This herd has tended to be in remote areas with little or no access by winter roads and trails, which has further concentrated the regional caribou harvest onto the Beverly herd when it can be accessed via the Tibbitt to Contwoyto winter road.

Table 5. Summary of barren-ground caribou harvested immediately prior to the implementation of the mobile zone (2013-2014) and afterward (\geq January 2015). The harvest year runs from 1 July to 30 June. NU data courtesy of M. Dumond, GN, Kugluktuk (personal communication).

Harvest Year	Management Area	# Bulls	# Cows	# Calves	# Unknown	Total
2013-2014	R/BC/02, R/BC/03	63	78	2	24	167
	Nunavut	67	0	0	0	67
	TOTAL	130	78	2	24	234
2014-2015	North Slave Region					0
	Nunavut				~100	~100
	TOTAL				~100	~100
2015-2016	North Slave Region					0
	Nunavut				~100	~100
	TOTAL				~100	~100
2016-2017	North Slave Region					0
	Nunavut				~300	~300
	TOTAL				~300	~300
2017-2018	North Slave Region				35	35*
	Nunavut					30
	TOTAL				35	65
2018-2019	North Slave Region					49*
	Nunavut					~30
	TOTAL					~79
2019-2020	North Slave Region					39*
	Nunavut					30
	TOTAL					69
2020-2021	North Slave Region					132*
	Nunavut	10				10
	TOTAL					142

* illegal harvest only

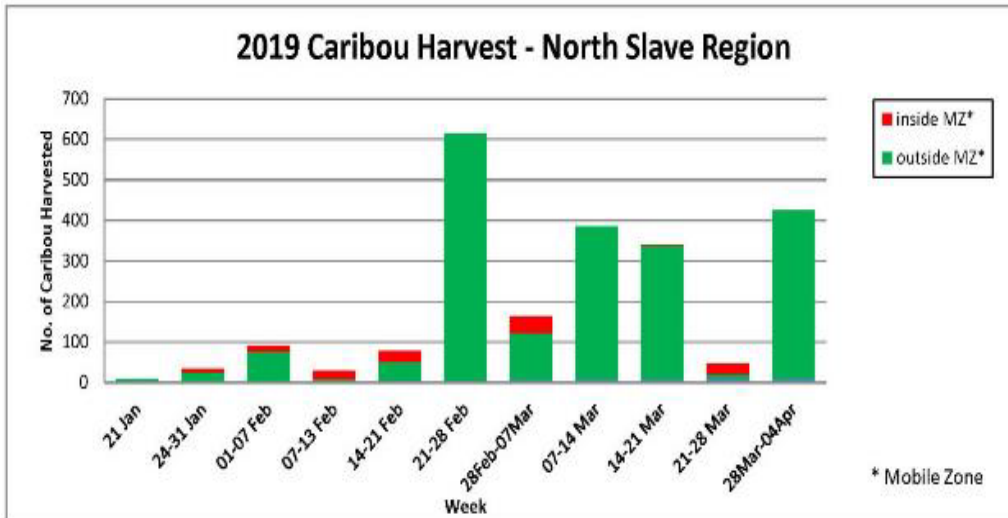


Figure 15. Weekly summary of the 2019 barren-ground caribou harvest in the North Slave Region. Harvest reporting was determined by Renewable Resource Officers or monitors during winter patrols. Spatial location of harvest sites was recorded by unique 10 km² grid cells and whether the site was inside or outside the no-harvest caribou conservation mobile zone that changed weekly (with notification). About 6.3% (n=135) of the caribou harvested with known locations (n=2,014) were inside the mobile zone.

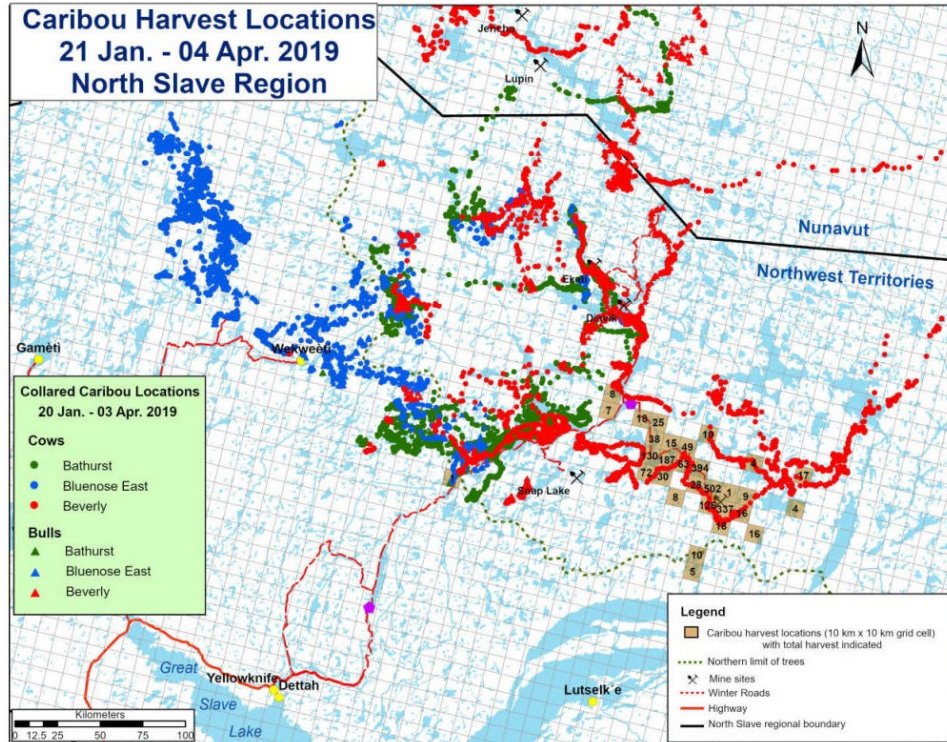


Figure 16. Locations of barren-ground caribou harvested in the North Slave Region, January to April 2019. Also shown are daily locations of collared caribou in the area monitored from 20 January to 3 April 2019. Locations of collared caribou come from the daily movements of 24 individual caribou from the Bathurst (green symbols), 36 individuals from the Bluenose-East herd (blue symbols), and 32 individuals from the Beverly herd (red symbols). The 10 km² grid cell overlay used to spatially record harvest is also shown.

The total harvest of caribou has declined in recent years, in part due to restrictions applied for management. In 2016-2017, the total caribou harvest within the North Slave Region was estimated at 3,000 caribou with 80% bulls and in 2017-2018, about 500 caribou were harvested, virtually all bulls. In 2018-2019, 2,182 caribou were harvested, 1,271 being bulls (58%), with 15 unknown sex (kill sites). Harvest recording used to be facilitated by community monitors. However, since 2015/2016, this has not happened regularly, and Renewable Resource Officers recorded the harvest during their weekly patrols of the winter roads. While not all harvest sites may be documented this way, the vast majority likely are. Wounding losses are largely unknown, thus these numbers should be considered minimum counts. Check stations were established at Gordon Lake and Mackay Lake to support ground and aerial patrols during the winter road operation, and initially on a 24 hr/7 day basis.

Given the harvest closure for the Bathurst herd and the distribution of collared caribou, most of the harvest since 2015 was likely from the Beverly herd, as documented for the 2019 winter harvest (Figures 15, 16, 17). Hunter activity was heavy in 2019 because three caribou herds overlapped on their winter ranges in an area easily accessible by the winter road corridor. In addition, 2019 was the first year of an enhanced wolf harvest incentive program,

which may have brought out more harvesters (Cluff 2019). The areas where most harvests occurred east of the mobile zone had Beverly collars in the area (Figure 17). Based on 2018 population estimates, the Beverly herd outnumbered the Bathurst herd about 12:1; even if there were Bathurst caribou mixed with Beverly caribou, it is likely that the harvest was predominantly Beverly caribou.

We cannot rule out, however, the possibility that some Bathurst caribou were harvested inside or outside the mobile zone in 2019. This is because collared caribou numbers were low, often below the desired threshold sample size of 40, for all three herds. However, the likelihood of the main harvest, as shown in Figure 16, being predominantly Beverly caribou is high, both because that area had primarily Beverly collared caribou and the numerical disparity between the Bathurst (low) and Beverly (high) herd sizes.

Of 135 caribou harvested inside the mobile zone in 2019, and another 124 caribou harvested along the perimeter, all but one of those caribou appear to be from the Beverly herd. This assumption was based on the movements and distribution of the collared caribou (Figure 16) and the newly deployed collared caribou, which ended up belonging to the Beverly herd (Figure 17). Newly collared caribou (e.g. March) are not assigned to a herd affiliation until later in the year. For cows, that time is June when they arrive or approach a calving ground. And, bulls are not formally assigned a herd affiliation until July as this is the time of year when bulls are most clearly associated with members of its own herd.

The presence and accessibility of the Beverly herd in winter to the east of the mobile zone likely enhances compliance with the mobile zone regulations and dilutes the likelihood of Bathurst caribou being harvested within the mobile zone and outside of it.

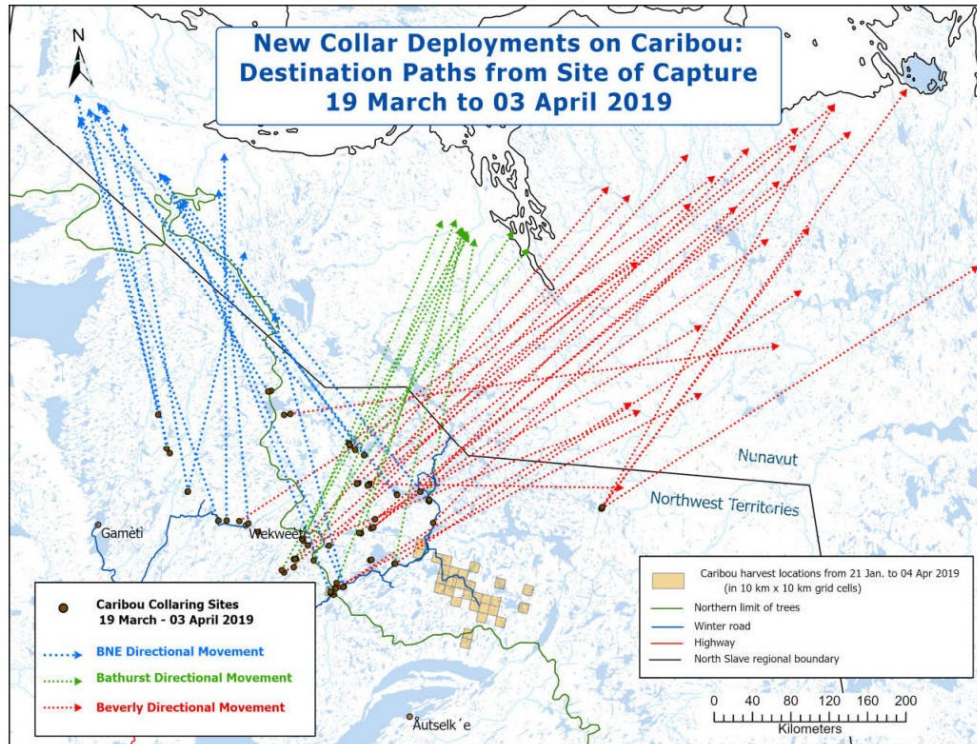


Figure 17. Deployment of new collars on caribou from the Bluenose-East, Bathurst and Beverly herds in late winter, and the locations of those caribou in June/July 2019. Newly collared caribou in late winter are not assigned to a specific herd until June when movements to the calving grounds have been completed (cows) or until July (bulls) when their separation among herds is more obvious. The dotted lines show the direction of the 2019 new collar deployments on caribou made after collaring (March 19 to April 3) to their locations in July, and hence their herd assignment (by colour).

Despite best efforts to achieve compliance, caribou have been harvested illegally within the mobile zone each year since 2015, when the mobile zone was first implemented. Given that most harvesting occurs along the Tibbitt to Contwoyto winter road, Renewable Resource Officers patrolling that road have been able to document much of it. In 2017, 2018, and 2019, 42, 22, and 20 caribou, respectively, were seized by Renewable Resource Officers because these caribou were illegally shot within the mobile zone (Table 6). Enforcement activity in response to illegal harvest can be challenging when there is a lag time between the time of harvest and discovery, subsequent snowfall cover, and scavenging. For example, one caribou was harvested in the 2019 mobile zone, but little remained at the site when officers arrived on the scene. Collecting carcasses and gathering compelling evidence may not be possible or practical, depending on how much time had elapsed since the caribou were shot and butchered, and when the site was discovered.

Table 6. Summary of caribou killed (illegally) within the Bathurst Caribou Mobile Conservation Zone (no hunting). The harvest year runs from 01 July to 30 June.

Year	Cases	Number of caribou killed
2016/2017	2	42
2017/2018	7	22
2018/2019	7	20
2019/2020	7	95
2020/2021	12	132
2021/22	8	32

A further complication for illegal harvest reporting occurs when the mobile zone shifts the following week, where the harvest location was legal the previous week but would be illegal in the current week and the harvest cannot be confidently assigned to a particular day. Consequently, the frequency of patrolling and noting harvest sites with dates is critical to parsing out harvests as legal or not, especially near weekly zone boundaries. The total number of caribou reported killed illegally within the mobile zone over seven years has been 362 (mean = 51.7/year, median = 32/year), but is variable among years 52 (S.E.=16.7).

It remains uncertain whether the presence and accessibility of overlapping caribou herds on the winter range contribute to the likelihood of illegal harvesting by increasing the number of hunters to the area, or whether it facilitates compliance by redirecting the harvest away from the Bathurst herd. Overall, we believe the number of Bathurst caribou harvested with the mobile zone has been low; herd overlap and particularly the presence of much more numerous Beverly caribou as identified by Beverly collars within the zone reduces the probability of the illegally killed caribou within the zone being Bathurst. In some winters, a large proportion of the Bluenose-East collars, and presumably a large proportion of that herd, have also been within the mobile zone. Their presence further reduces the likelihood of illegally harvested caribou within the zone being Bathurst caribou.

DISCUSSION

Effectiveness of the Mobile No-harvest Zone for Bathurst Caribou

The Bathurst mobile zone was first implemented in early 2015 as a replacement for two large limited-harvest zones used between 2010 and 2015. We believe this approach represented an improvement in that it focused on where the Bathurst herd caribou were at any point in time, and in years with limited adjacent herd overlap, resulted in a much smaller area where harvest was restricted. During 2018-2021, extensive herd overlap of the Bathurst, Bluenose-East and Beverly herds has resulted in a mobile zone that created challenges in attempts to ensure harvesting access to the Beverly herd east and north of the mobile zone. The mobile zone has been built around locations of collared Bathurst cows and bulls; thus should have included all parts of the herd. Collared bulls have tended to occupy ranges somewhat more southerly than the cows.

We assessed three potential issues that could reduce the effectiveness of the mobile zone:

- (1) **The adequacy of the number of collared caribou used:** The numbers of Bathurst collars have often been below the 40 recommended by technical analyses. This was the case for all three herds of interest in 2019 (Bathurst n=24, Bluenose-East n=36, Beverly n=32). In early 2015, when the mobile zone was first used, there were just 14 Bathurst cow collars and no bull collars. It is possible that some portions of the herd at low collar numbers were not fully defined and could have been outside the zone, and exposed to harvest there, particularly just east of the mobile zone on winter roads. Collar numbers were expected to increase further in 2019-2020 to 70 based on more intensive planned monitoring of the Bathurst and Bluenose-East herds, although there can be challenges in identifying Bathurst caribou for new collars when the herd is overlapped with the larger Beverly and Bluenose-East herds during winter.

Aerial reconnaissance surveys in 2015-2016 suggested that the collars generally defined the Bathurst herd's distribution well and that there were very few caribou more than 20 km from collared animals. Aerial reconnaissance on March composition surveys over multiple years has often similarly shown that a single collared Bathurst caribou often has low numbers of caribou (50-100-200) in the vicinity. Though the coverage of these surveys can be limited, practical experience suggests that the Bathurst collars are generally representative of the herd's main distribution.

To date, low collar numbers have been perceived to be the main limitation of the mobile zone in protecting Bathurst caribou from harvest, even though reconnaissance surveys may suggest otherwise. Maintaining a minimum of 40-50 Bathurst collars through the winter harvest season would certainly increase confidence that the herd's distribution has been well defined and that the mobile zone encompasses a large proportion of the herd.

(2) Movement of collared caribou out of the zone within a one-week window:

Overall, analyses showed that Bathurst collared caribou had relatively low movement rates in winter, and that a 20 km buffer on the MCP should contain a high percentage of the collared caribou. A one-week window is unlikely to result in significant movement out of the mobile zone, and this issue is unlikely to have resulted in a significant Bathurst caribou harvest.

(3) Compliance monitoring: A high percentage of caribou harvested in the North Slave region since 2015 has occurred along the Tibbit to Contwoyto winter road. Hunters have primarily targeted Beverly caribou east of the mobile zone, where harvest is unrestricted, and the number of caribou in the area has sometimes numbered in the thousands. Renewable Resource Officers have regularly monitored the mobile zone, and the caribou harvest east of it using daily ground-based patrols, periodic aerial patrols and two check stations at key locations along the winter road. The presence of collared caribou from the Beverly herd and this herd's relatively large size suggest that this harvest has likely been predominantly from the Beverly herd, and harvest risk to Bathurst caribou east of the zone is highly diluted.

Some illegal caribou harvest has occurred in most winter harvest seasons (i.e., 2015-2021), but the overall numbers have averaged about 52 caribou/year. Most hunters have complied with the mobile zone, possibly because they have been able to harvest caribou with no restrictions further east. Overlap with neighbouring caribou herds has created some challenges in the implementation of the mobile zone, particularly since 2018 when the Bathurst, Bluenose-East and Beverly herds have overlapped extensively and significant numbers of the Bluenose-East and Beverly herds have been within the zone. However, overlap of the Bathurst herd with the much larger Beverly herd and in some areas with the Bluenose-East herd, has also likely meant that most of the harvest in mixed areas has not been Bathurst caribou. This applies to the illegal harvest within the zone and more so in areas east of the zone, where the main caribou harvest has occurred on mine winter roads.

The BGCTWG has monitored the overlap and has adapted the rules for the zone when needed. The mobile zone will continue to evolve as conditions require.

Harvest Reduction and Monitoring of the Bathurst Herd

Overall, the harvest of Bathurst caribou has been reduced to low numbers in the NWT since 2015 (Table 6). The annual illegal harvest within the mobile zone accounted for about 52 ± 16.7 (SE) caribou/year, but there can be significant departures from that average in any given year (range 10-135, Table 6). Extensive overlap of herds since 2018 has meant that this illegal harvest has likely been mostly Beverly caribou, possibly some Bluenose-East caribou, and a small number of Bathurst caribou. We believe that the overall objective of a very limited Bathurst caribou harvest has been largely achieved.

The mobile zone used in the NWT is a product of adaptive decision-making that has gone through several iterations responding to different levels of winter range overlap with adjacent caribou herds. We believe the concept of the mobile zone represents a reliable tool

for conservation purposes and that it has been adequately tested in the past five winters. If needed, it may be applicable to other caribou herds requiring additional management intervention for their recovery. This approach does require adequate numbers of collared caribou, close ground-based and aerial compliance monitoring, and general acceptance by hunters and the public.

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APPENDIX A

GNWT Wildlife Regulations and Information Handout for Mobile Core Bathurst Caribou Management Zone.

WILDLIFE ACT

MOBILE CORE BATHURST CARIBOU MANAGEMENT ZONE REGULATIONS

The Commissioner, on the recommendation of the Minister, under sections 88 and 173 of the *Wildlife Act* and every enabling power, makes the *Mobile Core Bathurst Caribou Management Zone Regulations*.

1. The Mobile Core Bathurst Caribou Management Zone is established as a wildlife management zone for barren-ground caribou, consisting of one or more areas delimited as follows:

- (a) from the date that these regulations come into force to January 25, 2016, in accordance with the area shaded in yellow in the map in the Schedule;
- (b) from January 26, 2016 and thereafter, in accordance with a map of the area or areas, which shall be
 - (i) available for public inspection and lodged with the Superintendent at Yellowknife and each of the regional offices of the Department of Environment and Natural Resources, and
 - (ii) posted in a conspicuous place in each community in or near which the area or areas are located.

2. (1) No person shall harvest barren-ground caribou in an area that is part of the Mobile Core Bathurst Caribou Management Zone.

(2) For greater certainty, these regulations prevail over the *Big Game Hunting Regulations* in respect of the authorization to harvest barren-ground caribou in those wildlife management zones or areas that overlap with any area that is part of the Mobile Core Bathurst Caribou Management Zone.

3. The *Mobile Core Bathurst Caribou Conservation Area Regulations*, established by regulation numbered R-006-2015, are repealed.

LOI SUR LA FAUNE

RÈGLEMENT SUR LA ZONE DE GESTION DU NOYAU DE POPULATION MOBILE DU CARIBOU DE BATHURST

Le commissaire, sur la recommandation du ministre, en vertu des articles 88 et 173 de la *Loi sur la faune* et de tout pouvoir habilitant, prend le *Règlement sur la zone de gestion du noyau de population mobile du caribou de Bathurst*.

1. La zone de gestion du noyau de population mobile du caribou de Bathurst est désignée à titre de zone de gestion de la faune du caribou des toundras et est composée d'une ou plusieurs des régions décrites comme suit :

- a) à compter de l'entrée en vigueur du présent règlement, soit le 25 janvier 2016, en conformité avec l'aire ombragée en jaune sur la carte à l'annexe;
- b) à compter du 26 janvier 2016 et, par la suite, en conformité avec la carte de la région ou des régions qui est, à la fois :
 - (i) disponible à l'examen public et déposée auprès du surintendant à Yellowknife et de chaque bureau régional du ministère de l'Environnement et des Ressources naturelles,
 - (ii) affichée dans un endroit bien en vue dans chaque collectivité dans, ou près de, laquelle la région ou les régions sont situées.

2. (1) Il est interdit à toute personne de récolter le caribou des toundras dans une région qui fait partie de la zone de gestion du noyau de population mobile du caribou de Bathurst.

(2) Il est entendu que le présent règlement l'emporte sur le *Règlement sur la chasse au gros gibier* qui traite de l'autorisation de récolter le caribou des toundras dans ces zones ou régions de gestion de la faune qui chevauchent toute région qui fait partie de la zone de gestion du noyau de population mobile du caribou de Bathurst.

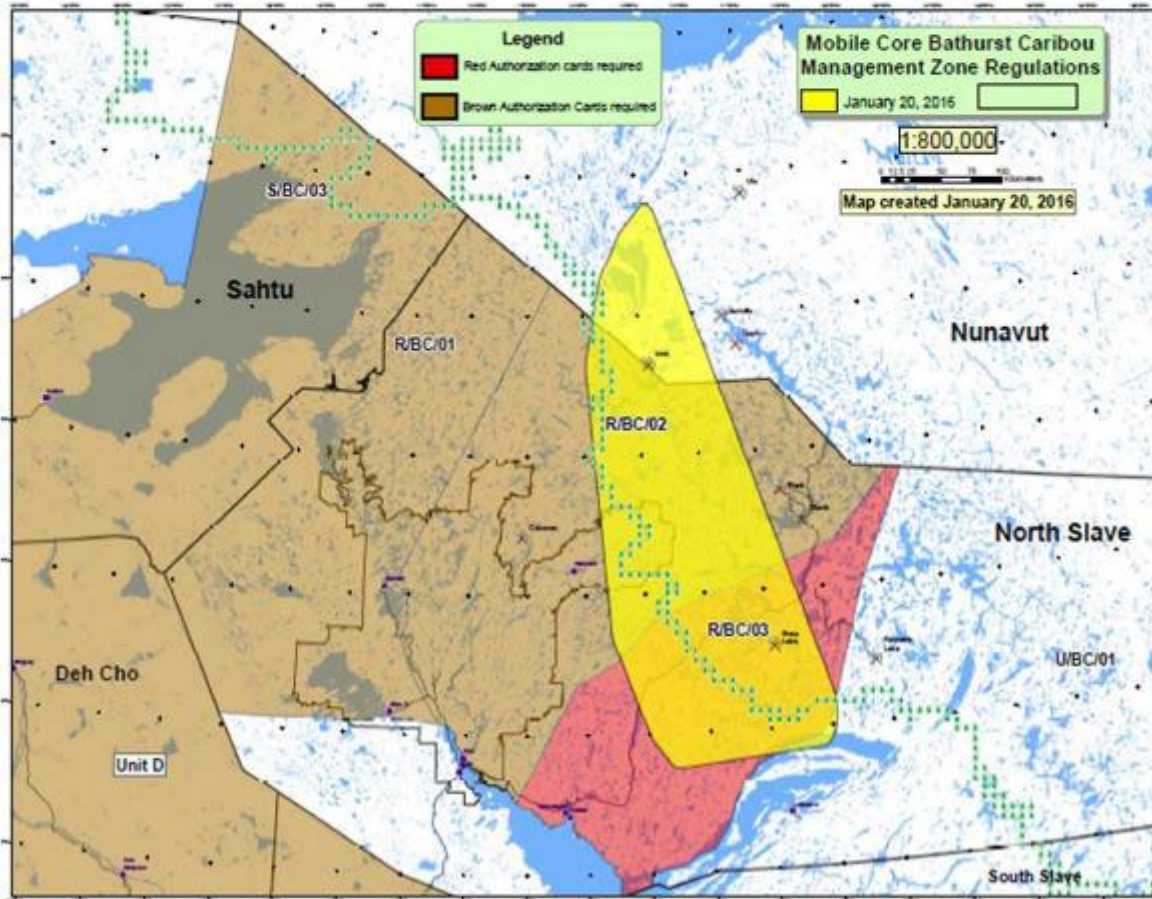
3. Le *Règlement sur la région de conservation du noyau de population mobile du caribou de Bathurst*, pris par le règlement n° R-006-2015, est abrogé.

4. These regulations come into force January 23, 2016.

4. Le présent règlement entre en vigueur le 23 janvier 2016.

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Mobile Core Bathurst Caribou Management Zone

The Mobile Core Bathurst Caribou Management Zone exists as a wildlife management zone for barren-ground caribou under the *Wildlife Act*.

You **must not hunt caribou** inside this yellow zone.

How do I find out the boundaries of the Mobile Zone?

Get the most recent map. The map is updated every Tuesday. You can get a map from:

- Gordon Lake patrol station
- McKay Lake patrol station
- Your local or regional ENR office
- Your local band, community, government or organization office
- ENR North Slave Region Facebook page www.facebook.com/enrnorthslaveregion/
- ENR website www.enr.gov.nt.ca/en/services/mobile-core-bathurst-caribou-management-zone

Download the most recent .gpx file for your GPS device to plot the zone boundary at www.enr.gov.nt.ca/en/services/mobile-core-bathurst-caribou-management-zone

What happens if I'm caught harvesting inside the Mobile Zone?

An officer will investigate the scene.

If the officer determines that the caribou may have been harvested illegally, they will seize the caribou meat.

The officer may ask for a voluntary statement from you for the investigation file.

The officer will write up a violation report, and after an investigation is under way, you will be told the next steps.

If the investigation indicates there has been an illegal harvest in the Mobile Zone, a charge will be laid and you will get a date for a court appearance.

If the officer seizes your meat and ENR is not able to store the meat until the court process is complete:

The officer will write up a disposition order to decide who will receive the meat.

You will receive notice that a disposition hearing is set with a Justice of the Peace.

You can state your case to keep the meat at the hearing. If it is decided you can't keep it, the meat becomes the property of the GNWT.

The GNWT will then give the meat to a charitable organization.

APPENDIX B: RULES FOR THE DEFINITION OF BATHURST MOBILE ZONE

— updated 16 November 2018 —

Rules for Definition of the Mobile Core Bathurst Caribou Conservation Area (MCBCCA) for winter 2017-2018 ENR, TG and WRRB, revised November 16, 2018

Background

The Mobile Core Bathurst Caribou Conservation Area (MCBCCA; hereafter referred to as the mobile zone) was first used in the winter of 2014-2015 to protect Bathurst caribou in the NWT from hunter harvest. The mobile zone was built as a minimum convex polygon (MCP; essentially a line drawn around the outside of all collars) with a buffer of 20-30 km to account for other caribou in the herd associated with the collared animals.

A key assumption of defining the mobile zone is that the collared Bathurst caribou are truly representative of the distribution and movements of most animals in the herd. Based on this assumption being correct, the mobile zone offered two advantages over the two large fixed zones used 2010-2014: (1) the restricted area was much smaller than the two large zones, limiting harvest restriction in the region, and (2) the restricted area focused on where the herd was at any given time. In previous winters, some Bathurst collars were west and east of the large fixed zones, thus potentially exposed to higher harvest pressure in those areas.

Prior to the 2016-2017 harvest season, delineation of the mobile zone included a 60 km buffer (see [Appendix A](#) of this document). The rationale for this modification was to provide more certainty and clearer information to hunters about the location of the mobile zone. The use of a larger mobile zone would allow for movement of caribou inside the zone between collar data acquisitions without creating the need for a new map every four days. Thus, if Bathurst collared caribou moved around within this expanded mobile zone, the boundaries could remain unchanged for extended periods, as compared to a new zone and boundaries that changed weekly.

However, in the winter of 2016-2017, the distribution of collared caribou from the Bathurst, Bluenose-East and Beverly and Ahiak herds showed an exceptional degree of overlap, which meant that the mobile zone for Bathurst caribou with a 60 km, 40 km or 30 km buffer also enclosed most of the neighbouring herds (based on collars) and would have severely limited Aboriginal hunting opportunities. As a result, the size of the buffer on the mobile zone was reduced to 20 km and then 10 km to give hunters reasonable opportunities to hunt the Beverly and Ahiak herds (where there is currently no harvest restriction in the NWT) and the Bluenose-East herd (which has a Total Allowable Harvest in place of 750 bulls in Wek'èezhì). For a part of the winter, the single mobile zone was changed to two subzones, a main one in the west and a smaller one in the east. Overall, monitoring by officers and

community monitors indicated that few Bathurst or Bluenose-East caribou were taken (based on the locations of reported kills relative to distributions of collared caribou) and that harvest was primarily Beverly and Ahiak caribou with a large proportion of bulls.

At a meeting of the Barren-ground Caribou Technical Working Group on September 15, 2017, the unforeseen conditions and changes to the mobile zone in winter 2016-2017 were reviewed, and a revised set of rules was developed. The group recognized that a balance might be needed between conservation (no harvest) of the Bathurst herd, which will likely be promoted by larger buffers, and limiting harvest restrictions on neighbouring herds, which may be enabled by smaller buffers if there is overlap. Plans need to be adaptive, depending on whether the Bathurst herd is relatively well separated from neighbouring herds (Situation A) or well mixed with either one or both of the neighbouring herds (Situation B). These rules are an update on [Appendix A](#) from June 29, 2016, Tłı̨chǫ Government and Environment and Natural Resources response to the Wek'èezhì Renewable Resources Board's (WRRB) Bathurst Caribou Final Report, Part A. The wildlife regulation for the mobile zone is in [Appendix B](#).

Situation A: Bathurst Herd is Largely Separate from Neighbouring Herds

In some winters (e.g. 2015-2016; see Figure 18), the Bathurst collared caribou have been well separated from the Bluenose-East and Beverly and Ahiak caribou. Under these conditions (i.e., Situation A), hunter access to alternate herds is not restricted substantially by the mobile zone. Under these conditions, the following rules will be applied.

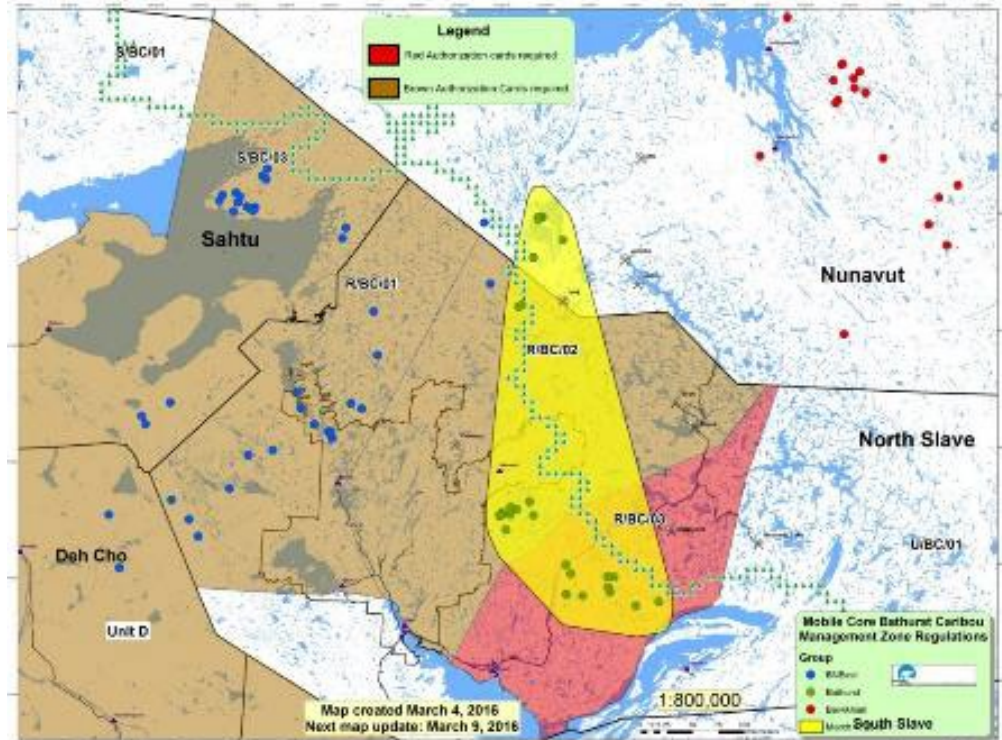


Figure 18. Mobile zone and collared caribou locations in March 2016. Bluenose-East collared locations are blue, Bathurst green and Beverly and Ahiak red. Map B. Croft, GNWT ECC.

The mobile zone boundary will be defined from an MCP around all functioning collars on Bathurst caribou (cows and bulls) plus a 60 km buffer around the MCP.

A recommended number of collars for the Bathurst herd to define its distribution with confidence is 40 or more, based on analyses by J. Boulanger and others (see Adamczewski and Boulanger 2016 for details and further references).

With fewer collars, consideration should be given to a larger buffer on the mobile zone, as there is a greater chance that a portion of the herd’s distribution is not well defined.

An approximately equal number of collars on the two neighbouring herds is also recommended to define their distribution with confidence.

Collar locations will be updated weekly.

The mobile zone will be defined based on all active Bathurst collars, including any in Nunavut (although the no harvest zone will only apply in the Northwest Territories (NWT)).

In general, separation of the mobile zone into two or more subzones will be avoided and will be considered only when there is substantial overlap between herds. An example of substantial overlap from winter 2016-2017 is in Figure 19; similar situations will be considered on a case-by-case basis.

Once established, the mobile zone boundaries will not change as long as all the collared Bathurst caribou remain within the mobile zone and no collars are <20 km from the boundary.

If one or more collared Bathurst caribou move to within 20 km of the boundary of the zone or move out of the mobile zone, the mobile zone will be re-defined based on the same method described above (60 km buffer), and the new zone boundaries will be in effect as long as all collared Bathurst caribou remain within the new boundaries.

With respect to areas where collared Bathurst caribou may overlap with collared Bluenose-East or Beverly and Ahiak caribou, the WRRB determination of a zero (0) Total Allowable Harvest (TAH) on the Bathurst herd means that no caribou will be harvested within the mobile zone, regardless of herd affiliation.

The mobile zone will be defined in the NWT prior to the fall harvest season and will continue until the end of the winter harvest season.

Tłı̨ch̨ Government (TG) and the Department of Environment and Natural Resources (ENR) will explore ways of modifying zone boundaries to use natural features such as rivers or lake edges as a way of making the zone more practical for hunters, provided that there is no significant reduction in protection for the Bathurst herd.

TG and ENR will also explore ways of making information about the mobile zone location more easily accessible to hunters by making it available in formats for GPS devices and Google Earth, and by using signs on the winter road to show the direction of the zone boundary.

Situation B: Bathurst Herd Shows Overlap with Neighbouring Herds

During winter 2016-2017, a 40 km buffer on the Bathurst mobile zone would have nearly eliminated hunter access to Beverly and Ahiak caribou and severely restricted access to Bluenose-East caribou in Wek'èezhìı̨ (see Figure 19). Under these conditions, reduction of the mobile zone buffer may be considered under the following rules.

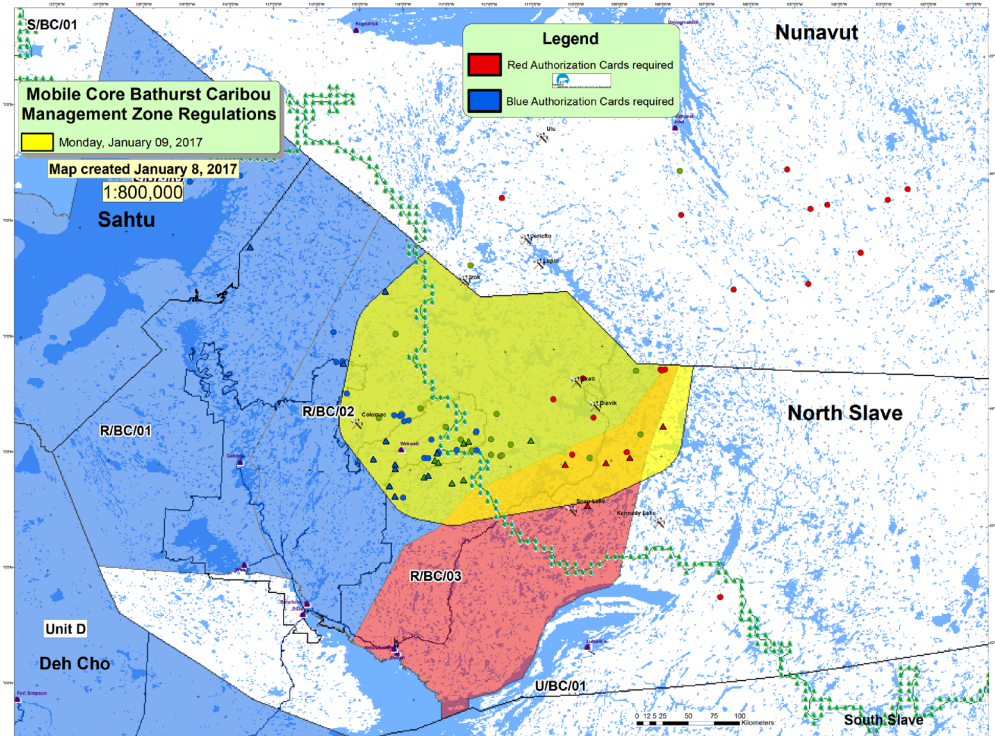


Figure 19. Mobile zone and collared caribou locations January 9, 2017 – 40 km buffer. Bluenose-East collared locations are blue, Bathurst green and Beverly and Ahiaak red. Map B. Croft, GNWT ECC.

The mobile zone boundary will initially be defined from a MCP around all functioning collars on Bathurst caribou (cows and bulls) plus a 60 km buffer around the MCP.

Collar locations will be updated weekly.

A recommended number of collars for the Bathurst herd to define its distribution with confidence is 40 or more, based on analyses by J. Boulanger and others (see Adamczewski and Boulanger 2016 for details and further references).

With fewer collars, consideration should be given to a larger buffer on the mobile zone as there is a greater chance that a portion of the herd’s distribution is not well defined.

An approximately equal number of collars on the two neighbouring herds is also recommended to define their distribution with confidence.

The mobile zone will be defined based on all active Bathurst collars, including any in Nunavut (although the no harvest zone will only apply in NWT).

The minimum buffer under any conditions on the mobile zone will be 20 km².

Hunter access to Beverly and Ahiak caribou or Bluenose-East caribou will be considered sufficient if at least 50% of active collars on either of these two herds in the NWT are outside the mobile zone.

If more than 50% of the collared caribou from either the Bluenose-East or Beverly and Ahiak herds, found within the NWT, are within the mobile zone, then reduction of the mobile zone buffer can be considered.

Under these conditions, the mobile zone buffer may be reduced in 10 km increments until <50% of the collars from the neighbouring herd are within the zone. A minimum of 20 km on the buffer will be maintained at all times.

Use the range and median distance traveled by the collared caribou over the preceding seven days to help determine the size of the buffer.

In general, separation of the mobile zone into two or more subzones will be avoided.

However, delineation of two or more subzones may be considered if there are two or more widely separated groups of collared caribou. The minimum distance between nearest-neighbor collars in proposed subzones will be 80 km³.

A subzone would need to have a minimum of three collared Bathurst caribou; this is the minimum needed to define a polygon.

If one or more collared Bathurst caribou move to within 20 km of the boundary of the zone or move out of the mobile zone, the mobile zone will be re-defined.

With respect to areas where collared Bathurst caribou may overlap with collared Bluenose-East or Beverly and Ahiak caribou, the WRRB determination of a zero (0) TAH on the Bathurst herd means that no caribou will be harvested within the mobile zone, regardless of herd affiliation.

The mobile zone will be defined in the NWT prior to the fall harvest season and will continue until the end of the winter harvest season.

TG and ENR will explore ways of modifying zone boundaries to use natural features such as rivers or lake edges as a way of making the zone more practical for hunters, provided that there is no significant reduction in protection for the Bathurst herd.

² Based on experience of flying the Bathurst mobile zone in winters with little overlap (e.g. 2015-2016), the collars consistently are associated with the main wintering concentrations of the herd, and very few caribou are found more than about 20 km away from collars.

³ With a 20 km buffer, collared caribou 40 km apart would have buffers that touch; the 80 km separation would mean that the subzones with a 20 km buffer would be separated by 40 km.

TG and ENR will also explore ways of making information about the mobile zone location more easily accessible to hunters by making it available in formats for GPS devices and Google Earth, and by using signs on the winter road to show the direction of the zone boundary.

Review of Mobile Zone Definition

To assist in adaptive decision-making about the mobile zone, the Barren-ground Caribou Technical Working Group will plan to meet in December and January to review collar data and mobile zone definition(s), and recommend to TG, ENR, and WRRB any changes to be made. By this time in the winter, collared caribou have usually ended most directional movement until April. The working group will periodically review information on harvest locations and amounts to check on herd assignments for harvest and check on the possibility of Bathurst caribou being harvested.

Literature Cited

Adamczewski, J. and J. Boulanger. 2016. Technical rationale to increase the number of satellite collars on the Bathurst caribou herd. Environment and Natural Resources, Government of Northwest Territories. Manuscript Report No. 254.

APPENDIX B(A): FROM JUNE 29, 2016 TG & ENR RESPONSE TO THE WRRB'S BATHURST CARIBOU FINAL REPORT, PART A

As a result of a number of discussions between the Tłı̨chǫ Government (TG) and the Department of Environment and Natural Resources (ENR), the approach to defining the Mobile Core Bathurst Caribou Management Zone (MCBCMZ) has been modified slightly from the initial two winters to reduce the number of times that the zone is re-defined and make the zone more predictable and practical for hunters. The criteria for defining the zone for the 2016-2017 harvest season are expected to be as follows:

The mobile zone boundary will be defined from a minimum convex polygon (MCP) around all functioning collars on Bathurst caribou (cows and bulls) plus a 60 km buffer around the MCP.

Where collared Bathurst caribou show distinct, well-separated subgroups, the mobile zone can be shaped as two or more parts of the mobile zone.

Once established, the mobile zone boundaries will not change as long as all the collared Bathurst caribou remain within the mobile zone.

If one or more collared Bathurst caribou move to within 5 km of the boundary of the zone or move out of the mobile zone, the mobile zone will be re-defined based on the same method described above, and the new zone boundaries will be in effect as long as all collared Bathurst caribou remain within the new boundaries.

With respect to areas where collared Bathurst caribou may overlap with collared Bluenose-East or Beverly and Ahiak caribou, the Wek'èezhì Renewable Resources Board (WRRB) determination of a zero harvest on the Bathurst herd means that no caribou will be harvested within the mobile zone, regardless of herd affiliation. The possibility of dividing the mobile zone into two or more parts provides some flexibility with respect to identifying areas where collared caribou from neighbouring herds may be found and where some harvest is possible, provided there are not Bathurst collars in the area.

The mobile zone will be defined in the Northwest Territories (NWT) beginning when collared Bathurst caribou move back into the NWT, potentially as early as mid-summer, and will continue until the end of the winter harvest season.

TG and ENR will explore ways of modifying zone boundaries to use natural features such as rivers or lake edges as a way of making the zone more practical for hunters, provided that there is no significant reduction in protection for the Bathurst herd. Review of the mobile zone boundaries from winter 2015-2016 suggests that from about the end of November to the end of March, there was little directional movement of collared Bathurst caribou, and a

relatively fixed zone may be possible. Boundaries on the land that are readily recognized by hunters would be very helpful to both harvesters and enforcement officers.

TG and ENR will also explore ways of making information about the mobile zone location more easily accessible to hunters by making it available in formats for GPS devices and Google Earth, and by using signs on the winter road to show the direction of the zone boundary.

APPENDIX C: EVALUATION OF THE BATHURST CARIBOU HERD MOBILE PROTECTION ZONE FOR THE WINTERS OF 2017 AND 2018

January 2, 2019

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Introduction

This short report summarizes the preliminary analysis of the coverage of Bathurst collared caribou to determine if mobile zones provided adequate coverage of all collared caribou as a function of mobile zone formulation.

Methods and Results

Data Screening

Collar data was initially screened by estimating daily movement rates to determine any outlier movements that were potentially caused by GPS location error. For 2017, this screening revealed that the mean daily movement rate was 7.5 km/day; however, this was influenced by outlier observations as indicated by the quantiles. Namely, the 95th percent quantile was 17.1, and the 97.5th quantile was 70.1 with a maximum rate of 350 km/day. Visual inspection of points suggested that points with movement rates of >78 were due to extreme east-to-west movements that were likely GPS error. For this reason, points that resulted in daily movement rates of >78 km/day were deleted from the analysis. The resulting mean rate of movement per day was 3.5 km (SD=6.5, min=0.01, max=68.24). The same filtering strategy was used for 2018.

Mobile Zone Calculations

Mobile zones were estimated on a weekly basis using the locations from the first day of the week, starting on January 1st up to the end of April (for 2017 and 2018). For the first day the current locations (or the last location available in the previous week) were used for each collared caribou with the minimum convex polygon (MCP) estimator to estimate a 100% home range (all locations included). The 100% MCP estimator basically draws a polygon around the outermost locations. This contrasts with the standard MCP estimator that utilizes 95% of locations (excluding outermost points). This polygon was then buffered by distances from 10 km to 60 km to emulate the mobile zone formulations used to encompass the Bathurst herd. Inclusion of daily locations for the following week was then assessed with the proportion of locations outside the polygons tabulated for each formulation. This process was repeated for each weekly interval.

In 2018, many of the collars were in Nunavut to the north of the Northwest Territories (NWT) Taiga Plains and Taiga Shield Ecosystems. The mobile zone was truncated at this boundary in 2018, and therefore analyses were conducted with this truncation as well as with the full data set. For the NWT only mobile zone calculation in 2018, all the location data was initially used to estimate the MCP and mobile zone buffers. The MCP and mobile zone were then clipped at the NWT/Nunavut ecoregion boundary.

All calculations were done in the *adehabitat* package (Calenge 2015) as well as various GIS routines in the *R* statistical package (R_Development_Core_Team 2009). Results were explored graphically using the *ggplot2* package (Wickham 2009).

Summary of Collar Sample Sizes

Collar sample sizes (including bulls and cows) varied from 24 to 49 in 2017 and 2018 for the main data sets (Table 7). All collared caribou for 2017 and 2018 were used for MCP analyses. For the 2018 analysis with the zone clipped at the NWT boundary, only collared caribou within NWT were used to estimate coverage of collared caribou within the mobile zone.

Table 7. Collar sample sizes and weekly intervals used in mobile zone analysis. Sample sizes include collared bulls and cows.

Interval	Start date	Collared Caribou Sample Size		
		2017	2018	2018 (NWT only)
1	01-Jan	27	24	13
2	08-Jan	27	28	15
3	15-Jan	31	25	14
4	22-Jan	28	27	13
5	29-Jan	29	25	13
6	05-Feb	30	24	13
7	12-Feb	30	27	14
8	19-Feb	28	27	15
9	26-Feb	28	33	21
10	05-Mar	29	30	18
11	12-Mar	31	30	18
12	19-Mar	48	22	14
13	26-Mar	44	23	13
14	02-Apr	44	34	24
15	09-Apr	49	28	17

In 2017, three caribou stayed north near Lupin and Bathurst Inlet (BGCA15235, BGCA15231, and BGCA14712) and were therefore not included in the analysis. One collar in 2018 was far north (BGCA17152) and was therefore not considered in the analysis.

Winter 2017 results

In 2017, inclusion of caribou within an unbuffered MCP polygon ranged from 0.73 to 0.95. A buffer of at least 20 km was needed to ensure that 95% of daily locations were included in the mobile zone for most weeks (Figure 20).

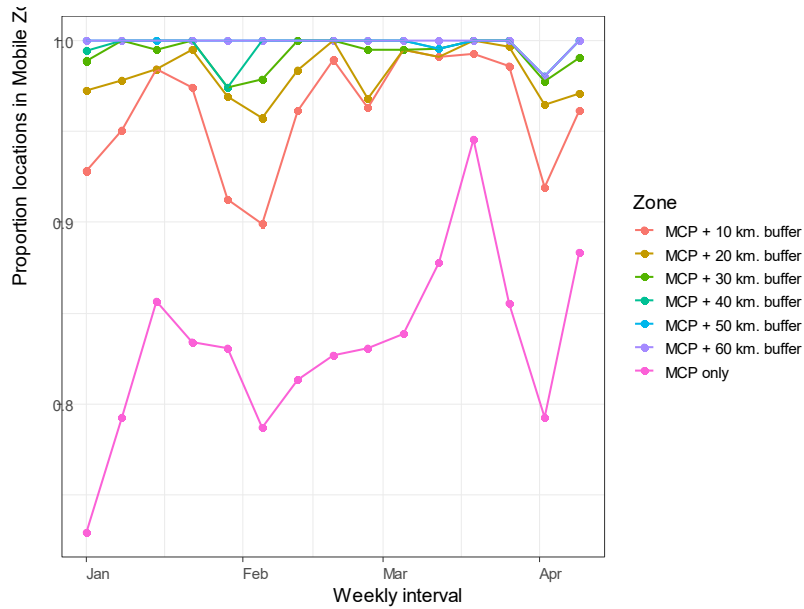


Figure 20. Proportion of weekly locations within various mobile zone formulations for the winter of 2017

This data is plotted in Figure 21 by weekly interval revealing a similar shape to the polygons over most of the winter with an elongation occurring starting in March. The mobile zone straddled the NWT and Nunavut border for most weeks considered.

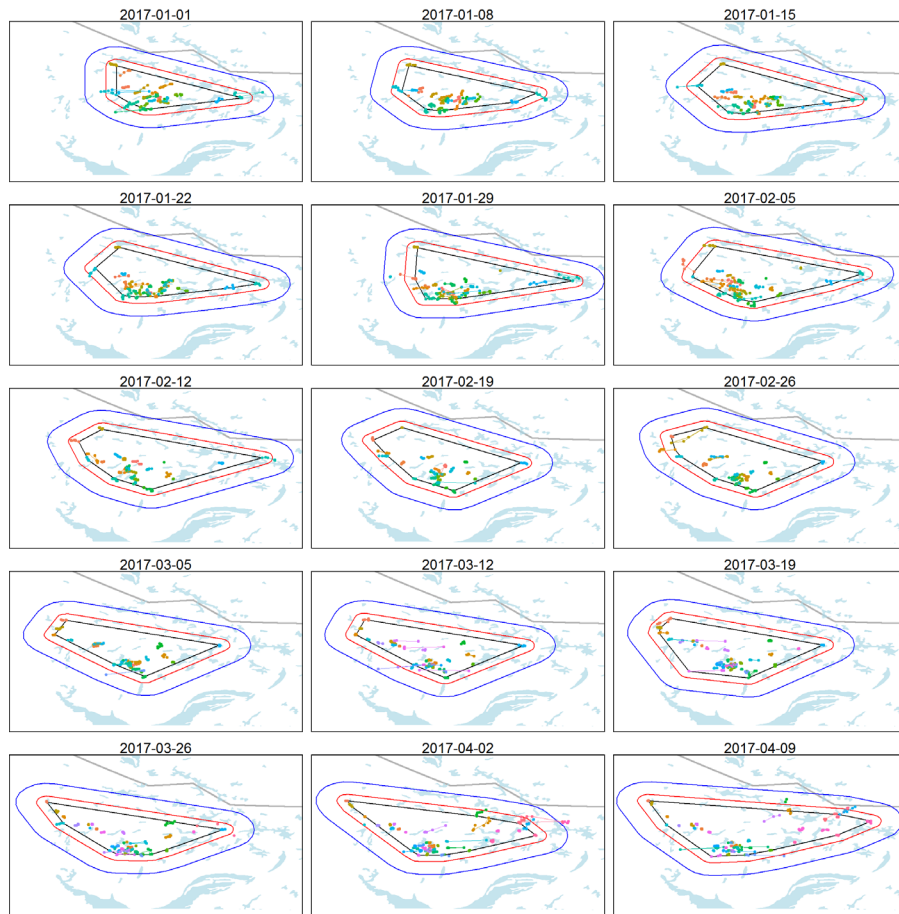


Figure 21. Plots of weekly caribou locations, movement paths, and mobile zones (black-MCP only, red-MCP+20K, blue-MCP+60K) as a function of weekly interval for the winter of 2017. Also shown is the NWT/Nunavut border (in grey) and dominant lakes.

Winter of 2018 - Full Data Set

For the full data set (including Nunavut), inclusion of caribou within an unbuffered MCP polygon ranged from 0.65 to 0.89. As with 2017, a buffer of at least 20 km was needed to ensure that 95% of daily locations were included in the mobile zone for most weeks (Figure 22).

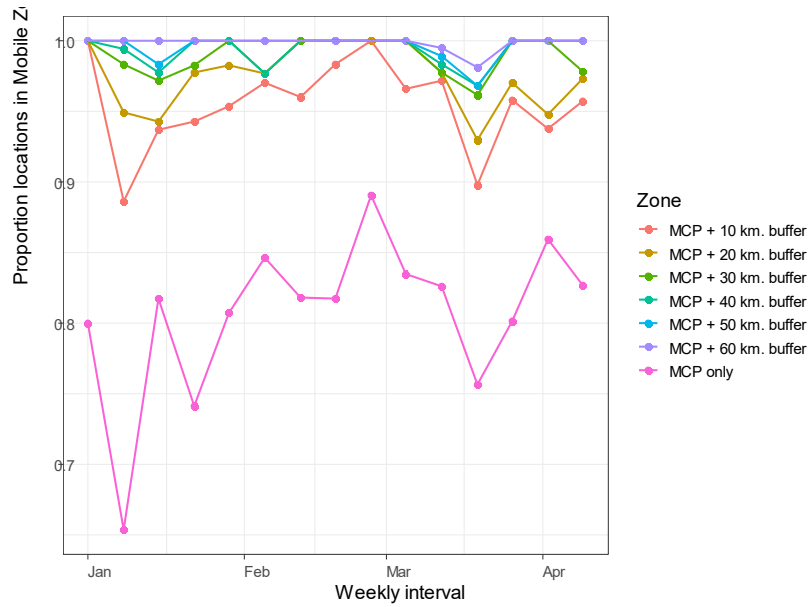


Figure 22. Proportion of weekly locations within various mobile zone formulations for the winter of 2018.

A plot of locations reveals that approximately half of the herd was in Nunavut for the majority of the winter (Figure 23). This made the mobile zone quite large, with a large spread of locations since some of the herd was further south.

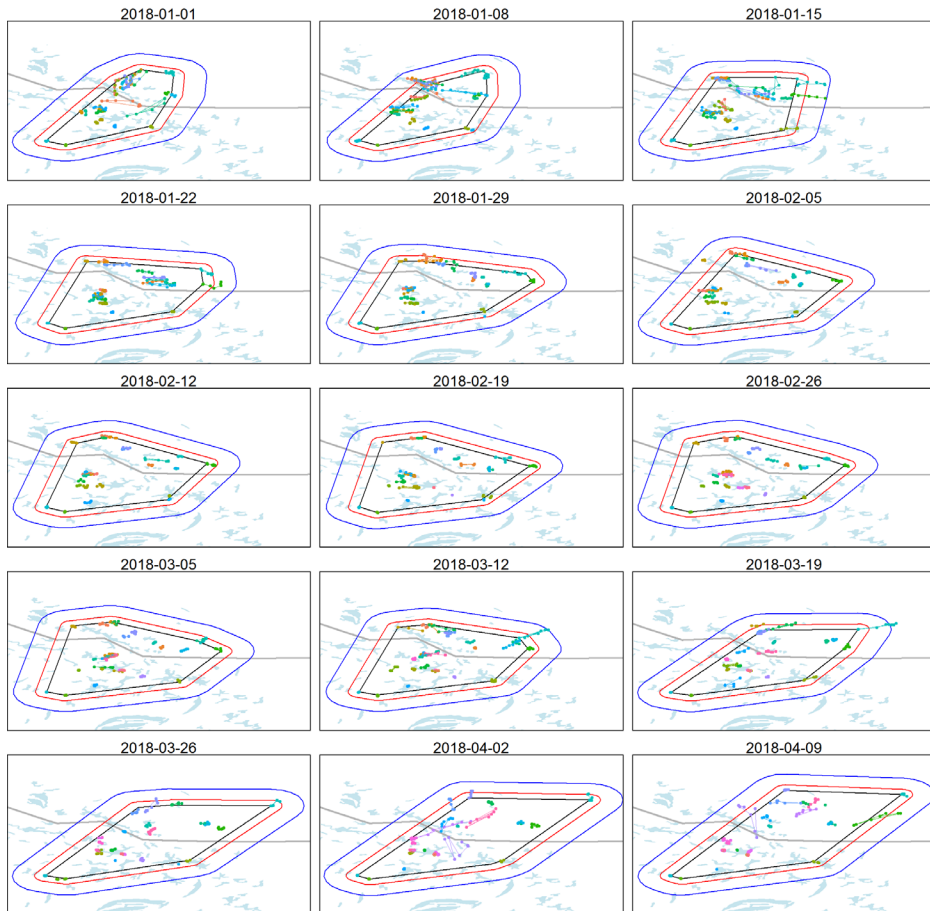


Figure 23. Plots of weekly caribou locations, movement paths, and mobile zones (black-MCP only, red-MCP+20K, blue-MCP+60K) as a function of weekly interval for the winter of 2018. Also shown is the NWT/Nunavut border in grey and dominant lakes.

Winter of 2017-2018 - Mobile Zone Restricted to NWT

The analysis was repeated with mobile zones clipped at the NWT border, with results suggesting that a smaller buffer of 10-20 km was needed to ensure 95% of caribou (that were in NWT) were within the mobile zone (Figure 24).

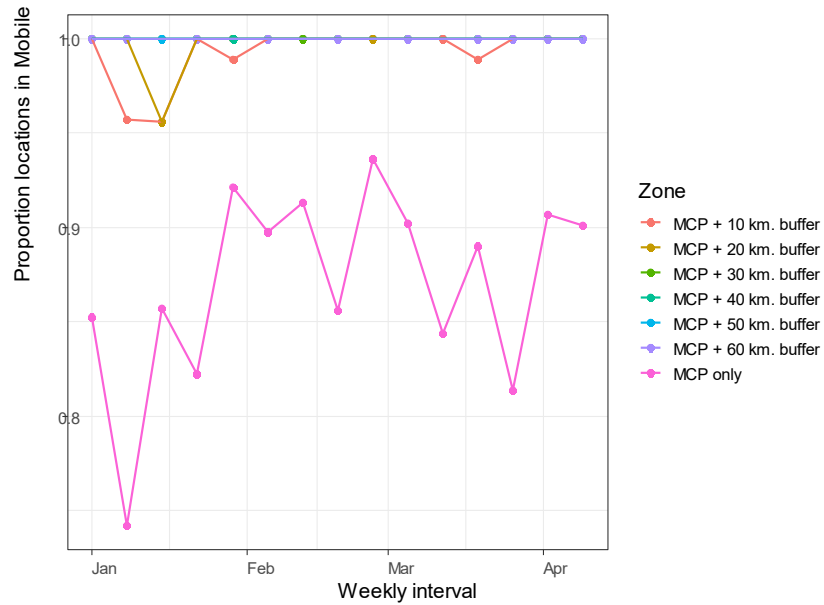


Figure 24. Proportion of weekly locations within various mobile zone formulations for the winter of 2018, with locations in Nunavut excluded.

A plot of locations reveals a smaller mobile zone that is clipped at the NWT/Nunavut border (Figure 25).

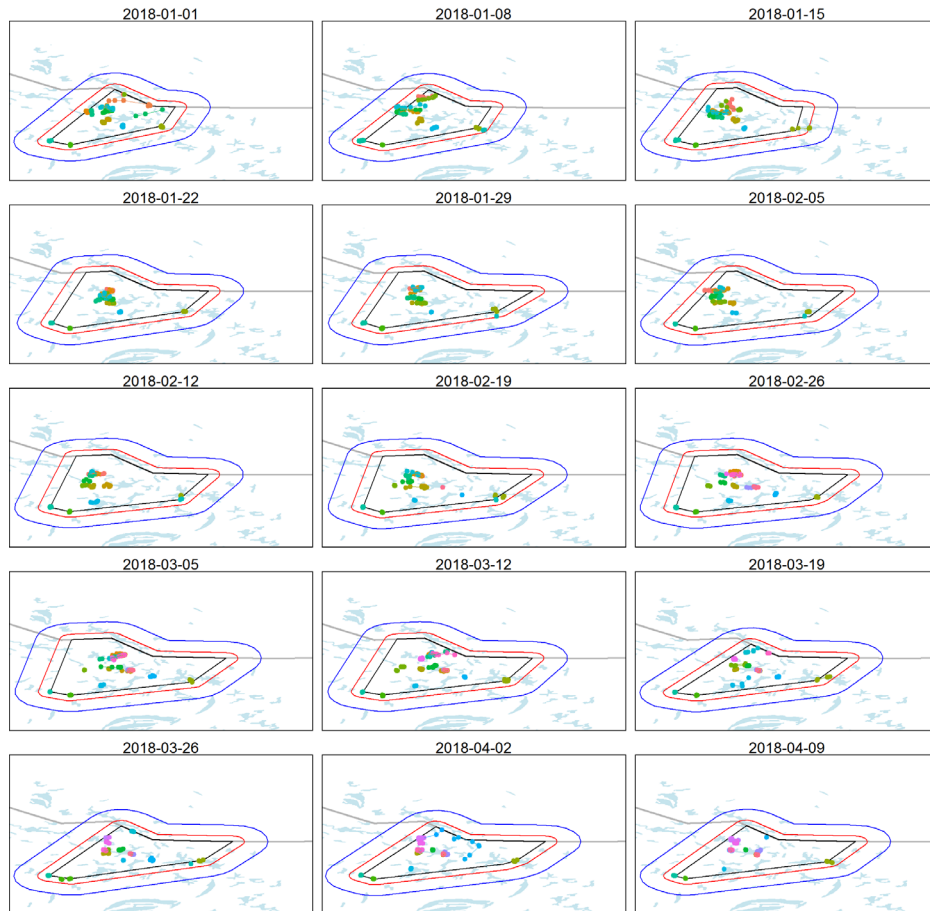


Figure 25. Plots of weekly caribou locations, movement paths, and mobile zones (black-MCP only, red-MCP+20K, blue-MCP+60K) as a function of weekly interval for the winter of 2018 (Nunavut locations excluded with zones clipped at the NWT border). The NWT/Nunavut border is shown as a grey line.

Overall Summary of Results

Figure 26 summarizes the proportion of locations within the mobile zone as a function of the MCP buffer and the yearly data set. This figure suggests that at least 95% of collared caribou locations, as indicated by the whiskers on each box plot, were contained within the mobile zone when the MCP buffer was at least 20 km, except when NWT and Nunavut were considered in which it was 30 km. The most applicable mobile zones for 2018 was the NWT-only scenario so in this case 20 km was adequate for both 2016-2017 and 2017-2018 winters.

The strategy of estimating the MCP with all locations but truncating it at the NWT border increased coverage of collared caribou within NWT. This makes intuitive sense in that it effectively adds extra area to the zone between the NWT border and the collared locations.

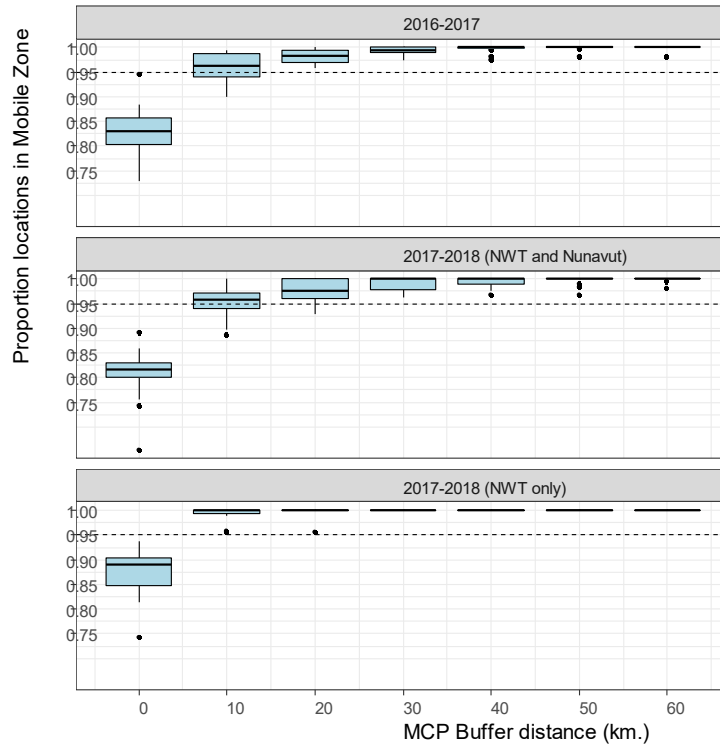


Figure 26. Summary of proportion locations within management zones as a function of the MCP buffer and data set used for the analysis. Table 1 provides sample sizes of collars used in summaries. The middle line for each plot is the median value, with the box extending to the 25th and 75th percentiles. The whiskers extend to the range of data up to 1.5 interquartile ranges (the interquartile range is the box width). Points beyond this are outliers and are shown as dots.

Discussion

The main objective of this exercise was to determine adequate buffers needed to minimize the chance of caribou wandering out of the zone in the week after it is implemented. In 2017 and 2018, a buffer of at least 20 km was needed to ensure 95% of caribou were within the zone using the most applicable mobile zone scenarios that only included NWT (and not Nunavut).

This analysis assumes that collared caribou provide an adequate representation of all Bathurst caribou. This assumption may be less likely at lower sample sizes of collars (Otto et al. 2003, Rettie 2008). Otto et al (2003) suggested that sample sizes of 34 to 64 collared caribou were needed to ensure coverage during the winter season for the George River Herd. In this case, the sample sizes used in this analysis (Table 7), which range from 24 to 49 caribou, are on the lower end of the sample size recommended by Otto et al 2003. In this case, using a larger buffer than suggested just by collared caribou would provide insurance that all caribou within the Bathurst herd are included in the zone.

The zones generated in this analysis were reasonably similar to the mobile zone used by the Department of Environment and Natural Resources (ENR) in 2017 and 2018. The MCP method used to generate zones is relatively simple, and it would be expected that similar results would occur if the same data sets were used to generate the zones. The main differences between zones in this exercise and ENR zones would be due to the actual collar location dates used to generate the zones and potential adjustments to the zones based on overlap of other herds and other factors.

I note that movement rate as an indicator of coverage is potentially problematic since the likelihood of a caribou going outside the zone is dependent on its location relative to zone boundaries. If a caribou is in the center of the zone, then it is less likely to move outside even if movement rates increase. I suggest that an adaptive approach could be used to mobile zone size, where coverage of collared caribou within each zone is evaluated on a weekly basis and iteratively adjusted depending on the distribution and movement of collared caribou.

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APPENDIX D: BARREN-GROUND CARIBOU MOVEMENT ANALYSIS

Submitted to: Bruno Croft, Government of Northwest Territories, Environment and Natural Resources

Submitted by: Caslys Consulting Ltd. Copyright®

Contact: Jason Shaw, jshaw@caslys.ca

January 2019

Introduction

The objective of this project was to calculate the daily average movement rate for Bathurst, Bluenose-East and Beverly barren-ground caribou subpopulations in the Northwest Territories (Figure 27). The daily average movement rate between January and April will be used to inform the delineation of the Mobile Conservation Zone.

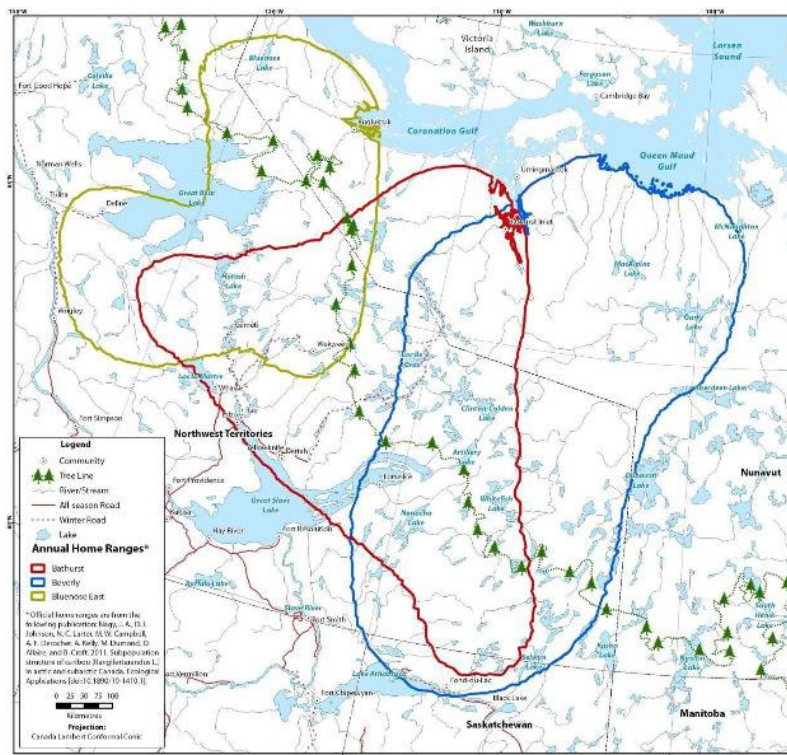


Figure 27. Annual Ranges for the Bathurst, Beverly, and Bluenose-East Subpopulations.

Data

GPS tracking data are collected for the Bluenose-East and Beverly barren-ground caribou subpopulations as part of a long-term population monitoring program.

[Appendix D\(A\)](#) contains a summary of the frequency of locations for each collar in the source data broken down by month.

For this analysis, GPS collar data were restricted to locations falling within the Northwest Territories collected between January 1 and April 1, 2017 and 2018 (Figure 28). As data collection frequencies varied between collars, all data were resampled to daily fixes (i.e., 24 hours) to ensure a standardized measure for daily displacement. Additionally, locations that were either pre-deployment or post-mortality (e.g. locations that ended up in communities) or had a data gap of more than two days were removed. Table 8 summarizes the number of locations and individuals available for the analysis.

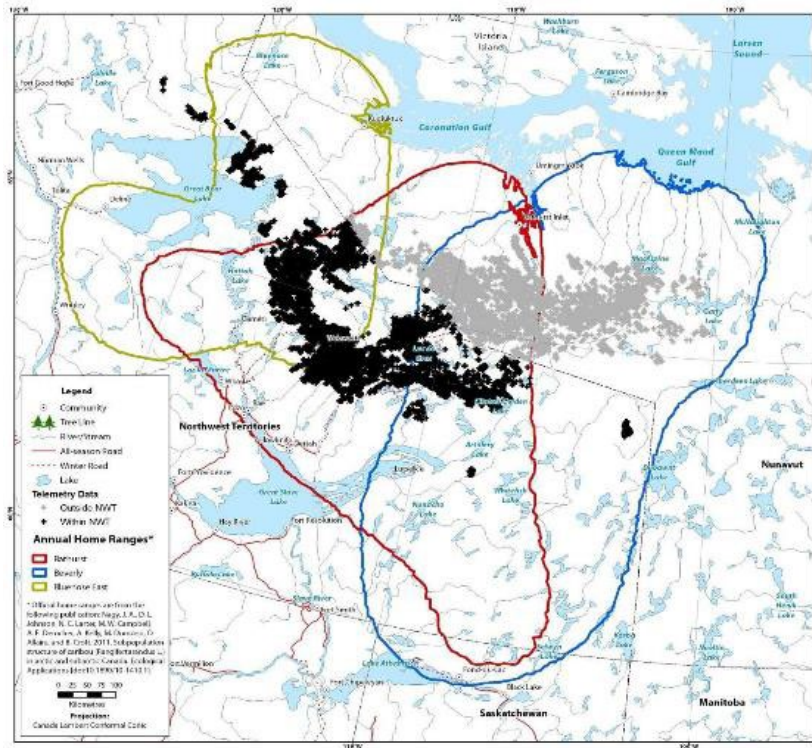


Figure 28. Telemetry locations within the Northwest Territories.

Table 8. Collar and location fix summary by subpopulation and year.

Year	Subpopulation	Number of Individuals	Number of Locations
2017	Bathurst	46	2,810
2017	Beverly	45	2,031
2017	Bluenose-East	57	3,500
2018	Bathurst	40	2,600
2018	Beverly	54	3,763
2018	Bluenose-East	52	3,210

Analysis

Daily average movement rates were calculated for the three subpopulations across five- or seven-day windows according to the year being collected (five days for 2017 and seven days for 2018). Five- and seven-day windows were selected to support the delineation of the Mobile Conservation Zone by the Government of the Northwest Territories Analysis windows (Table 9) were established by subdividing the time period between January 1 and April 1 into five- or seven-day groups based on Julian date. For example, the first five-day analysis window covers January 1-5 and the second January 6-10, while the first seven-day window covers January 1-7 and second January 8-14. Each location was assigned an analysis window ID based on the Julian date it was collected.

Table 9. Analysis windows.

2017 Analysis Window	Date Range	2018 Analysis Window	Date Range
[1,6]	January 1-5	[1,8]	January 1-7
[6,11]	January 6-10	[8,15]	January 8-14
[11,16]	January 11-15	[15,22]	January 15-21
[16,21]	January 16-20	[22,29]	January 22-29
[21,26]	January 21-25	[29,36]	January 30 – February 4
[26,31]	January 26-30	[36,43]	February 5-11
[31,36]	January 31 – February 4	[43,50]	February 12-18
[36,41]	February 5-9	[50,57]	February 19-25
[41,46]	February 10-14	[57,64]	February 26 – March 4
[46,51]	February 15-19	[64,71]	March 5-11
[51,56]	February 20-24	[71,78]	March 12-18
[56,61]	February 25 – March 1	[78,85]	March 19-25
[61,66]	March 2-6	[85,91]	March 26 - April 1
[66,71]	March 7-11		
[71,76]	March 12-16		
[76,81]	March 17-21		
[81,86]	March 22-26		
[86,91]	March 27 – April 1		

The GPS locations were imported into R and movement metrics calculated for each caribou's trajectory using the package *adehabitatLT* (Calenge 2006). For the purposes of this analysis, only the total displacement metric ("dist") was used. As daily GPS locations represent net movement over a 24-hour period, the total displacement corresponds to daily movement rate. To generate the five- and seven-day averages, the average daily movement rate for each subpopulation was calculated within each analysis window.

Results

The results of the analysis show differing average daily movement rates across the three caribou subpopulations. Bathurst and Beverly movement rates appear to be similar, and Bluenose-East appears to be consistently lower. Table 10 summarizes the maximum average daily movement rate for each subpopulation over a five-day window in 2017 and Figure 29 shows the movement rates over the whole analysis period.

Table 10. Maximum average daily movement rate for the five-day window in 2017.

Subpopulation	Movement Rate (km/day)	Time window
Bathurst	4.55	January 31 to February 4
Beverly	4.48	January 21 to January 25
Bluenose-East	3.19	January 6 to January 10

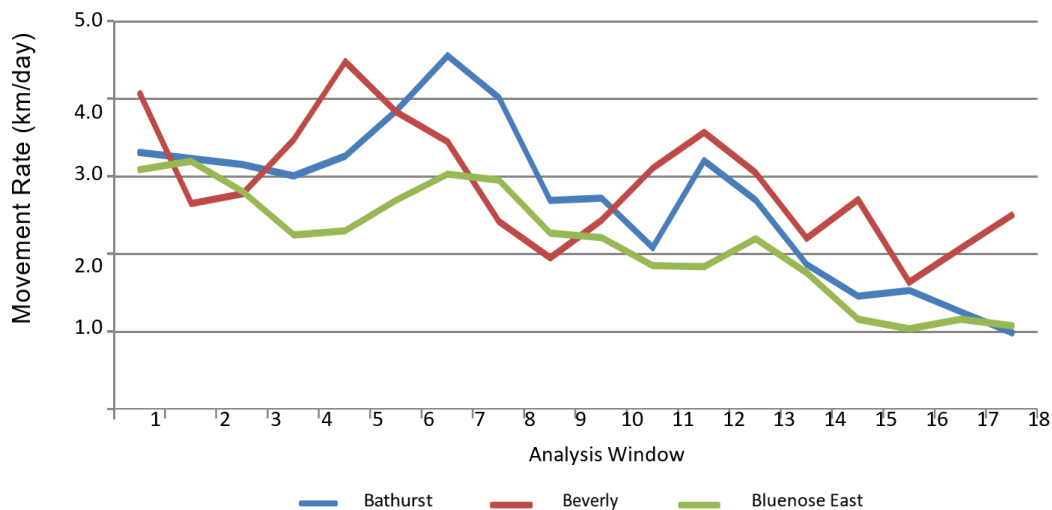


Figure 29. Average movement rates for 2017 within NWT – five-day analysis window.

Table 11 summarizes the maximum average daily movement rate for each subpopulation over a seven-day window in 2018 and Figure 30 shows the movement rates over the whole analysis period.

Table 11. Maximum average daily movement rates for seven-day window in 2018.

Subpopulation	Movement Rate (km/day)	Time Window
Bathurst	4.43	January 1-7
Beverly	4.84	January 15-21
Bluenose-East	3.63	January 8-14

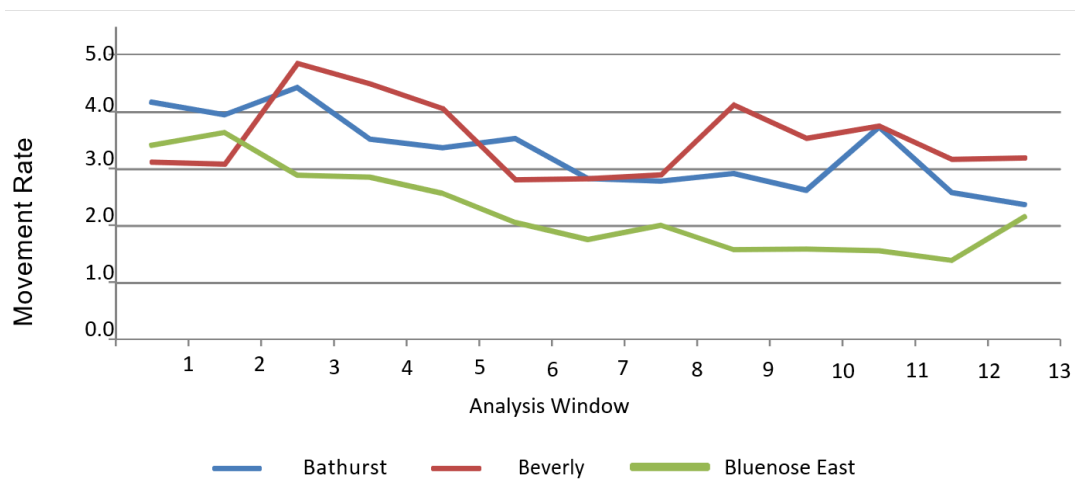


Figure 30. Movement rates over the whole analysis period.

Literature Cited

Calenge, C. 2006. The package adehabitat for the R software: a tool for the analysis of space and habitat use by animals. *Ecological Modeling* 197: 516-519.

APPENDIX D(A): COLLAR SUMMARY

Collar Summary – Number of Locations per Month for Each Collar

Herd	Animal Id	Gender	Jan-17	Feb-17	Mar-17	Apr-17	Jan-18	Feb-18	Mar-18	Apr-18
Bathurst	BGCA14705	Female	31	28	29	1	31	28	14	
Bathurst	BGCA14708	Female	31	27	31	1	31	28	15	
Bathurst	BGCA14709	Female	22	27	31	1	21	28	14	
Bathurst	BGCA14710	Female	27	28	31	1				
Bathurst	BGCA14711	Female	31	28	31	1	31	28	17	
Bathurst	BGCA14712	Female	31	28	31	1	31	27	14	
Bathurst	BGCA14713	Female	31	28	31	1	31	28	14	
Bathurst	BGCA15221	Female	31	28	25	1				
Bathurst	BGCA15222	Female	28	28	31	1				
Bathurst	BGCA15224	Female	31	29	30	1	17	17	17	
Bathurst	BGCA15229	Female	31	16						
Bathurst	BGCA15231	Female	31	28	31	1				
Bathurst	BGCA15235	Female	26	28	31	1				
Bathurst	BGCA15239	Female	31	28	31	1				
Bathurst	BGCA15252	Male	30	28	31	1				
Bathurst	BGCA15253	Male	14	11	16	1				
Bathurst	BGCA15255	Male	25	28	31	1				
Bathurst	BGCA15256	Male	31	28	31	1				
Bathurst	BGCA15259	Male	14	16	31					
Bathurst	BGCA16100	Male	93	518	525	3				
Bathurst	BGCA16102	Male	93	84	93	3	738	672	744	24
Bathurst	BGCA16103	Male	93	84	93	3	534	327	744	24
Bathurst	BGCA16104	Male	93	84	93	3	93	84	93	3
Bathurst	BGCA16106	Male	93	84	93	3	450	204	380	24
Bathurst	BGCA16108	Male	93	84	93	3	93	84	94	3
Bathurst	BGCA16112	Female	93	53						
Bathurst	BGCA16113	Female	93	84	93	3				

Herd	Animal Id	Gender	Jan-17	Feb-17	Mar-17	Apr-17	Jan-18	Feb-18	Mar-18	Apr-18
Bathurst	BGCA16114	Female	111	340	93	3				
Bathurst	BGCA16117	Female	93	84	93	3				
Bathurst	BGCA16119	Female	93	84	564	24	93	84	93	3
Bathurst	BGCA16121	Female	502	219	494	3				
Bathurst	BGCA17100	Male			45	3	493	265	744	24
Bathurst	BGCA17102	Female			45	3	458	91	324	24
Bathurst	BGCA17103	Female			45	3				
Bathurst	BGCA17107	Female			57	3				
Bathurst	BGCA17108	Male			51	3	121	83	117	3
Bathurst	BGCA17114	Female			57	3	316	196	377	
Bathurst	BGCA17115	Male			57	3	358	84	93	3
Bathurst	BGCA17116	Male			57	3	459	84	262	3
Bathurst	BGCA17125	Male			45	3	93	84	93	3
Bathurst	BGCA17126	Female			399	24	318			
Bathurst	BGCA17131	Female			45	3	198	84	152	3
Bathurst	BGCA17132	Male			33	3	2	9	1	
Bathurst	BGCA17141	Female					93	84	93	3
Bathurst	BGCA17147	Male			9					
Bathurst	BGCA17149	Male					79	61	43	
Bathurst	BGCA17152	Female				3	93	84	104	3
Bathurst	BGCA17157	Female				3	93	90	93	3
Bathurst	BGCA17160	Female				3	93	84	93	3
Bathurst	BGCA17183	Male					128	84	119	3
Bathurst	BGCA17184	Male					459	671	180	3
Bathurst	BGCA18106	Male						408	744	24
Bathurst	BGCA18113	Female						15	93	3
Bathurst	BGCA18116	Female								24
Bathurst	BGCA18119	Female							96	24
Bathurst	BGCA18121	Female						72	744	24
Bathurst	BGCA18140	Female								24

Herd	Animal Id	Gender	Jan-17	Feb-17	Mar-17	Apr-17	Jan-18	Feb-8	Mar-18	Apr-18
Bathurst	BGCA18141	Female								24
Bathurst	BGCA18142	Female						72	744	24
Bathurst	BGCA18144	Female							88	24
Bathurst	BGCA18145	Female						72	495	3
Bathurst	BGCA18147	Female							48	24
Bathurst	BGCA18148	Female						120	744	24
Bathurst	BGCA18149	Male						73	744	24
Beverly	BGCA12625	Female	31	28	31	1				
Beverly	BGCA14714	Female	76	73	90	3	81	71	93	3
Beverly	BGCA14717	Female	74	74	93	3	73	65	89	3
Beverly	BGCA14721	Female	64	47	81	3	22	20	83	3
Beverly	BGCA14723	Female	88	80	88	3	75	74	85	3
Beverly	BGCA14725	Female	1							
Beverly	BGCA14728	Female	33	49						
Beverly	BGCA14730	Female	30	33	76	3	42	59	59	3
Beverly	BGCA14731	Female	12	31	56	3	40	40	67	2
Beverly	BGCA14734	Female	92	81	95	3	88	67	90	3
Beverly	BGCA14736	Female	31	11	46	3	29	16	16	
Beverly	BGCA14742	Female	16	36	55	1	28	28	36	3
Beverly	BGCA14745	Female	44	55	74	1	67	59	71	2
Beverly	BGCA14746	Female	38	33	74	3	43	12	43	
Beverly	BGCA14749	Female	22	28	31	1	31	28	18	
Beverly	BGCA15227	Female	31	28	31	1				
Beverly	BGCA15266	Female	19	14	31	1	5	5	8	
Beverly	BGCA15293	Female	93	84	50					
Beverly	BGCA15296	Female		12	29					
Beverly	BGCA15297	Female	93	84	59					
Beverly	BGCA15301	Female	93	84	55					
Beverly	BGCA15302	Male	91	81	93	3	92	89	49	
Beverly	BGCA15303	Male	64	66	87	3				

Herd	Animal Id	Gender	Jan-17	Feb-17	Mar-17	Apr-17	Jan-18	Feb-8	Mar-18	Apr-18
Beverly	BGCA15307	Male	33	34	58	3	27	41	80	3
Beverly	BGCA15310	Female	88	83	93	3	85	84	93	3
Beverly	BGCA15315	Male	94	83	92	3	86	70	73	2
Beverly	BGCA15316	Male	93	83	93	3	81	84	25	
Beverly	BGCA16116	Female	93	84	93	3	498	666	394	3
Beverly	BGCA17101	Male			39	3	92	83	93	3
Beverly	BGCA17105	Female			72	3	143	184	410	3
Beverly	BGCA17133	Male					93	84	93	3
Beverly	BGCA17134	Female			33	3	93	84	93	3
Beverly	BGCA17135	Female			27	3	93	84	93	3
Beverly	BGCA17136	Male			30	3	92	84	93	3
Beverly	BGCA17137	Male			33	3				
Beverly	BGCA17138	Male					91	84	92	3
Beverly	BGCA17139	Female			39	3	93	84	93	3
Beverly	BGCA17142	Female					93	84	93	3
Beverly	BGCA17143	Female			39	3	93	84	93	3
Beverly	BGCA17144	Female					93	84	93	3
Beverly	BGCA17145	Female			30	3	93	84	93	3
Beverly	BGCA17146	Male			27	3	93	84	93	3
Beverly	BGCA17148	Female			33	3	93	84	102	3
Beverly	BGCA17150	Male			33	3	88	84	93	3
Beverly	BGCA17151	Male				3				
Beverly	BGCA17153	Male				3	98	90	93	3
Beverly	BGCA17154	Female			45	3	98	84	93	3
Beverly	BGCA17155	Female			27	3	93	84	104	3
Beverly	BGCA17156	Female				3	98	84	99	3
Beverly	BGCA17158	Male			39	3	93	84	93	3
Beverly	BGCA17159	Male			39	3	93	84	92	3
Beverly	BGCA17179	Male					625	672	744	24
Beverly	BGCA17181	Male					439	132	93	3

Herd	Animal Id	Gender	Jan-17	Feb-17	Mar-17	Apr-17	Jan-18	Feb-8	Mar-18	Apr-18
Beverly	BGCA17182	Male					228	84	93	3
Beverly	BGCA17185	Male					213	84	93	3
Beverly	BGCA18100	Male						18	98	3
Beverly	BGCA18101	Male						18	94	3
Beverly	BGCA18102	Female						72	743	24
Beverly	BGCA18103	Male						18	93	3
Beverly	BGCA18104	Male						120	744	24
Beverly	BGCA18107	Male						51	93	3
Beverly	BGCA18109	Female						73	744	24
Beverly	BGCA18111	Female						15	93	3
Beverly	BGCA18112	Female						15	93	3
Beverly	BGCA18117	Female								24
Beverly	BGCA18118	Female								24
Beverly	BGCA18120	Female								24
Beverly	BGCA18138	Female								24
Beverly	BGCA18139	Female								24
Beverly	BGCA18143	Female						72	505	3
Bluenose-East	BGCA12628	Female	24	28	31	1				
Bluenose-East	BGCA14751	Female	94	75	97	3				
Bluenose-East	BGCA14752	Male	84	84	75	3				
Bluenose-East	BGCA14753	Female	88	16						
Bluenose-East	BGCA14756	Male	23							
Bluenose-East	BGCA14759	Female	16	43	43	3				
Bluenose-East	BGCA14760	Male	31	57	71	3				
Bluenose-East	BGCA14761	Female	58	52	81	2				
Bluenose-East	BGCA14764	Female	82	82	95	3				
Bluenose-East	BGCA15182	Female	165	154	139	6	72	87	56	
Bluenose-East	BGCA15234	Female	28	22	31	1				
Bluenose-East	BGCA15240	Female	32	28	31	1				
Bluenose-East	BGCA15251	Male	32	28	31	1				

Herd	Animal Id	Gender	Jan-17	Feb-17	Mar-17	Apr-17	Jan-18	Feb-18	Mar-18	Apr-18
Bluenose-East	BGCA15262	Female	14	28	31	1				
Bluenose-East	BGCA15264	Female	6	15	19					
Bluenose-East	BGCA15265	Female	31	28	31	1	36	16		
Bluenose-East	BGCA15267	Female	33	28	31	1				
Bluenose-East	BGCA15269	Male	6	12	16					
Bluenose-East	BGCA15272	Female	31	28	32					
Bluenose-East	BGCA15275	Female	31	28	31	1				
Bluenose-East	BGCA15278	Male	30	28	31	1	31	28	31	1
Bluenose-East	BGCA15280	Male	28	28	31	1				
Bluenose-East	BGCA15283	Male	31	28	31	1				
Bluenose-East	BGCA15289	Female	31	28	31	1	28	28	31	1
Bluenose-East	BGCA15290	Male	31	28	31	1	31	28	31	1
Bluenose-East	BGCA16105	Male	93	84	93	3				
Bluenose-East	BGCA16107	Male	93	84	93	3	93	84	93	3
Bluenose-East	BGCA16111	Male	93	84	93	3	93	84	93	3
Bluenose-East	BGCA16118	Female	93	84	93	3				
Bluenose-East	BGCA16120	Female	93	84	93	3	93	84	93	3
Bluenose-East	BGCA16122	Female	31	28	34	1	31	27	31	1
Bluenose-East	BGCA16123	Female	31	28	31	1	31	28	31	1
Bluenose-East	BGCA16125	Female	31	28	33	1	31	28	34	1
Bluenose-East	BGCA16127	Female	37	28	31	1	31	28	31	1
Bluenose-East	BGCA16128	Female	31	34	31	1	31	28	31	1
Bluenose-East	BGCA16129	Male	30	28	31	1				
Bluenose-East	BGCA16130	Female	31	28	31	1	31	28	31	1
Bluenose-East	BGCA16132	Female	31	28	31	1	31	28	42	1
Bluenose-East	BGCA16133	Female	31	28	31	1	24	28	34	1
Bluenose-East	BGCA16134	Female	31	28	31	1	31	28	31	1
Bluenose-East	BGCA17104	Male			62	3	93	84	93	3
Bluenose-East	BGCA17106	Male			51	3	93	84	92	3
Bluenose-East	BGCA17109	Male			54	3	93	84	93	3

Herd	Animal Id	Gender	Jan-17	Feb-17	Mar-17	Apr-17	Jan-18	Feb-8	Mar-18	Apr-18
Bluenose-East	BGCA17110	Male			63	3	93	84	93	3
Bluenose-East	BGCA17111	Female			62	3	85	80	91	3
Bluenose-East	BGCA17113	Male			45	3	90	83	93	3
Bluenose-East	BGCA17117	Male			55	3	93	84	93	3
Bluenose-East	BGCA17118	Male			54	3	92	83	93	3
Bluenose-East	BGCA17119	Female			51	3	92	84	92	3
Bluenose-East	BGCA17120	Female			58	3	92	83	93	3
Bluenose-East	BGCA17122	Male			45	3				
Bluenose-East	BGCA17123	Male			52	3	93	84	92	3
Bluenose-East	BGCA17124	Female			405	24	93	84	93	3
Bluenose-East	BGCA17127	Male			60	3	93	84	93	3
Bluenose-East	BGCA17128	Male			329	23	93	84	93	3
Bluenose-East	BGCA17129	Female			60	3	93	84	93	3
Bluenose-East	BGCA17130	Male			45	3	93	84	93	3
Bluenose-East	BGCA18122	Female							57	3
Bluenose-East	BGCA18123	Male							57	3
Bluenose-East	BGCA18125	Male							57	3
Bluenose-East	BGCA18126	Male							57	3
Bluenose-East	BGCA18127	Male							58	3
Bluenose-East	BGCA18128	Female							57	3
Bluenose-East	BGCA18129	Female							57	3
Bluenose-East	BGCA18131	Female							58	3
Bluenose-East	BGCA18133	Female							59	3
Bluenose-East	BGCA18134	Female							57	3
Bluenose-East	BGCA18135	Female							58	3
Bluenose-East	BGCA18136	Female							57	3
Bluenose-East	BGCA18137	Female							66	3
Bluenose-East	BGCA18152	Female							59	3
Bluenose-East	BGCA18153	Male							60	3
Bluenose-East	BGCA18154	Female							60	3

Herd	Animal Id	Gender	Jan-17	Feb-17	Mar-17	Apr-17	Jan-18	Feb-8	Mar-18	Apr-18
Bluenose-East	BGCA18155	Female							60	3
Bluenose-East	BGCA18166	Female							31	3
Bluenose-East	BGCA18185	Female							40	3

APPENDIX E

Attributes of the Bathurst Caribou Mobile Zone in the Northwest Territories, 2015 to 2021, during the ten-week winter road* operating period (late January to late March/early April).

Table 12. Attributes of the Bathurst Caribou Mobile Zone in 2015 in the Northwest Territories, during winter road* operating period (late January to late March/early April).

2015												
No.	Week (3-5 day periods)	# collars used to define mobile zone (sex ratio)	# Bathurst collars within NWT mobile zone (sex ratio)	# of polygons	Buffer zone size ¹ (km)	Area of mobile zone (km ²)	Area enclosed for all Bathurst collars		Active collars from adjacent caribou herds† within mobile zone (#/total)		Length of winter roads within mobile zone (km)	
							km ²	% in NWT	BNE	Bev/Ah	T2C	GK
1	28 Jan – 31 Jan	12 (12f)	12 (12f)	1	18+	19,515	5,921	100	5/22	1/25	161.2	0
2	01 Feb – 05 Feb	12 (12f)	12 (12f)	1	18+	16,550	3,392	100	5/27	1/22	116.3	0
3	09 Feb – 13 Feb	15 (15f)	15 (15f)	1	18+	20,221	6,537	100	4/24	1/26	127.1	0
4	17 Feb – 23 Feb	12 (12f)	12 (12f)	1	18+	19,768	3,961	100	5/27	1/22	160.5	0
5	25 Feb – 02 Mar	14 (14f)	14 (14f)	1	18+	23,208	8,614	100	5/26	1/22	135.0	0
6	02 Mar – 04 Mar	12 (12f)	12 (12f)	1	18+	20,230	4,134	100	5/25	1/23	122.6	0
7	05 Mar – 08 Mar	14 (14f)	14 (14f)	1	18+	23,072	7,307	100	5/26	1/22	133.5	0
8	17 Mar – 20 Mar	14 (14f)	14 (14f)	1	18+	22,553	6,123	100	5/26	1/21	125.9	0
9	26 Mar – 29 Mar	14 (14f)	14 (14f)	1	18+	19,932	4,652	100	5/25	1/22	117.0	0
10	30 Mar – 04 Apr	14 (14f)	14 (14f)	1	18+	21,022	5,177	100	6/28	1/22	125.7	0

* Tibbitt to Contwoyto winter road (T2C) and Gahcho Kue winter road (GK)

† BNE = Bluenose-East caribou; Bev = Beverly caribou; Ah = Ahiak

¹ MZ not based on an MCP and a fixed buffer

T2C winter road: total length = 438 km (to NWT/Nunavut border)

GK winter road” total length = 108.4 km

Table 13. Attributes of the Bathurst Caribou Mobile Zone in 2016 in the Northwest Territories, during the winter road* operating period (late January to late March/early April).

No.	Week (~5 day interval)	# collars used to define mobile zone (sex ratio)	# Bathurst collars within NWT mobile zone (sex ratio)	# of polygons	Buffer zone size (km)	Area of mobile zone (NWT) (km ²)	Area enclosed for all Bathurst collars		Active collars from adjacent caribou herds† within mobile zone (#/total)		Length of winter roads within mobile zone (km)	
							km ²	% in NWT	BNE	Bev/Ah ¹	T2C	GK
1	24 Jan – 31 Jan	33 (24f:9m)	25 (17f:8m)	1	30	37,319	28,167	89.0	0/46	0/31	164.0	0
2	01 Feb – 05 Feb	33 (24f:9m)	25 (17f:8m)	1	30	34,145	24,559	90.1	0/42	0/35	152.9	0
3	09 Feb – 13 Feb	30 (22f:8m)	22 (15f:7m)	1	30	38,939	29,740	89.4	0/38	0/29	174.5	0
4	17 Feb – 20 Feb	32 (23f:9m)	24 (16f:8m)	1	30	39,210	29,371	90.6	0/24	0/32	174.6	0
5	21 Feb – 25 Feb	31 (22f:9m)	23 (15f:8m)	1	30	42,964	32,942	90.8	0/41	0/31	180.0	0
6	29 Feb – 03 Mar	32 (23f:9m)	24 (16f:8m)	1	30	44,259	33,704	91.6	0/41	0/31	182.7	0
7	04 Mar – 09 Mar	32 (23f:9m)	22 (15f:7m)	1	30	41,553	31,612	91.2	0/41	0/29	168.2	0
8	13 Mar – 16 Mar	31 (23f:8m)	23 (16f:7m)	1	30	41,384	31,790	90.2	0/30	0/36	167.0	0
9	20 Mar – 24 Mar	31 (22f:9m)	23 (15f:8m)	1	30	40,421	31,189	89.3	0/38	0/29	163.0	0
10	28 Mar – 01Apr	31 (22f:9m)	23 (15f:8m)	1	30	41,324	31,793	90.1	0/39	0/29	165.7	0

* Tibbitt to Contwoyto winter road (T2C) and Gahcho Kue winter road (GK)

† BNE = Bluenose-East caribou; Bev = Beverly caribou

¹ no bulls collared from the Beverly/Ahiak caribou herds

T2C winter road: total length = 438 km (to NWT/Nunavut border)

GK winter road” total length = 108.4 km

Table 14. Attributes of the Bathurst Caribou Mobile Zone in 2017 in the Northwest Territories, during winter road* operating period (late January to late March/early April).

No.	Week (Tuesday/ Wednesday to Monday/ Tuesday)	# collars used to define mobile zone**	# Bathurst collars within NWT mobile zone	# of polygons	Buffer zone size (km)	Area of mobile zone (km ²)	Area enclosed for all Bathurst collars		Active collars from adjacent caribou herds† within mobile zone (#/total)		Length of winter roads within mobile zone (km)	
							km ²	% in NWT	BNE	Bev	T2C	GK
1	25 Jan – 30 Jan	28of31 (18f:10m) (sex ratio)	28 (18f:10m) (sex ratio)	2	10	17,303	65,320	67.9	17/38	4/24	28.1	0
2	31 Jan – 06 Feb	30of33 (19f:11m)	30 (19f:11m)	2	10	21,123	68,971	67.2	19/38	4/25	28.7	0
3	07 Feb – 13 Feb	30of33 (19f:11m)	30 (19f:11m)	1	10	22,494	70,739	65.6	14/38	5/25	99.3	17.0
4	14 Feb – 21Feb	30of33 (19f:11m)	30 (19f:11m)	1	10	35,619	79,899	67.6	19/38	6/25	214.1	27.4
5	22 Feb – 27 Feb	28of31 (17f:11m)	28 (17f:11m)	1	15	32,108	68,582	72.0	19/37	3/23	186.3	11.5
6	28 Feb – 06 Mar	28of31 (17f:11m)	28 (17f:11m)	1	15	32,369	67,862	72.7	20/37	3/23	167.5	6.6
7	07 Mar – 14 Mar	28of31 (17f:11m)	28 (17f:11m)	1	15	25,911	72,358	73.4	20/37	3/23	181.5	3.4
8	15 Mar – 20 Mar	28of31 (17f:11m)	28 (17f:11m)	1	15	39,596	73,751	74.6	25/37	3/23	207.8	7.4
9 ^a	21 Mar – 28 Mar	28of31 (17f:11m)	28 (17f:11m)	1	15	55,799	71,441	74.3	24/37	5/22	211.3	0
10	29 Mar – 04 Apr	28of31 (17f:11m)	28 (17f:11m)	1	15	32,314	75,222	74.7	22/37	2/20	188.6	12.4

* Tibbitt to Contwoyto winter road (T2C) and Gahcho Kue winter road (GK)

† BNE = Bluenose-East caribou; Bev = Beverly caribou

^a Mobile zone clipped at NWT/NU border but Bathurst collars in Nunavut still not used for calculating mobile zone

** Bathurst collars in Nunavut were not used to define the mobile zone in 2017.

T2C winter road: total length = 438 km (to NWT/Nunavut border)

GK winter road” total length = 108.4 km

Table 15. Attributes of the Bathurst Caribou Mobile Zone in 2018 in the Northwest Territories, during winter road* operating period (late January to late March/early April).

No.	Week (Thursday to Wednesday)	# collars used to define mobile zone	# Bathurst collars within NWT mobile zone	# of polygons	Buffer zone size	Area of mobile zone	Area enclosed for all Bathurst collars		Active collars from adjacent caribou herds† within mobile zone		Length of winter roads within mobile zone (km)	
		(sex ratio)	(sex ratio)	(km)	(km ²)	km ²	% in NWT	BNE	Bev	T2C	GK	
1	25 Jan – 31 Jan	30 (19f:11m)	13 (5f:8m)	1	20	32,074	43,317	64.1	0/33	11/37	218.9	11.4
2	01 Feb – 07 Feb	29 (18f:11m)	13 (5f:8m)	1	20	32,599	49,020	55.6	0/33	11/37	219.9	10.8
3	08 Feb – 14 Feb	29 (17f:12m)	14 (5f:9m)	1	20	37,159	57,815	54.0	0/33	13/37	232.2	21.4
4	15 Feb – 21 Feb	29 (17f:12m)	14 (5f:9m)	1	20	37,159	58,810	52.9	0/33	12/37	225.2	16.8
5	22 Feb – 28 Feb	28 (16f:12m)	14 (5f:9m)	1	20	38,813	62,350	53.5	0/32	13/37	197.0	26.0
6	01 Mar – 07 Mar	28 (16f:12m)	14 (5f:9m)	1	20	39,983	61,427	53.8	0/32	12/37	272.0	38.2
7	08 Mar – 14 Mar	28 (16f:12m)	14 (5f:9m)	1	20	37,030	61,772	53.6	0/32	11/37	194.7	0
8	15 Mar – 21 Mar	28 (16f:12m)	14 (5f:9m)	1	20	35,887	57,320	54.3	0/32	10/36	200.0	0
9	22 Mar – 28 Mar	20 (9f:11m)	9 (1f:8m)	1	20	35,887	50,467	52.3	0/32	9/34	200.7	0
10	29 Mar – 04 Apr	20 (9f:11m)	9 (1f:8m)	1	20	39,261	55,681	49.6	0/32	8/34	290.7	57.4

* Tibbitt to Contwoyto winter road (T2C) and Gahcho Kue winter road (GK)

† BNE = Bluenose-East caribou; Bev = Beverly caribou

T2C winter road: total length = 438 km (to NWT/Nunavut border)

GK winter road” total length = 108.4 km

Table 16. Attributes of the Bathurst Caribou Mobile Zone in 2019 in the Northwest Territories, during the winter road* operating period (late January to late March/early April).

No.	Week (Tuesday Monday)	to	# collars used to define mobile zone	# Bathurst collars within NWT mobile zone	# of polygons	Buffer zone size	Area of mobile zone	Area enclosed for all Bathurst collars		Active collars from adjacent caribou herds†		Length of winter roads within mobile zone (km)	
								km ²	% in NWT	BNE	Bev		T2C
			(sex ratio)	(sex ratio)		(km)	(km ²)	km ²	% in NWT	BNE	Bev	T2C	GK
1	29 Jan – 04 Feb		29 (18f:11m)	29 (18f:11m)	1	40	39,673	15,108	100	13/43	23/33	284.9	62.5
2	05 Feb – 11 Feb		28 (18f:10m)	28 (18f:10m)	1	40	45,919	17,763	100	16/43	24/33	278.6	108.4
3	12 Feb – 18 Feb		28 (18f:10m)	28 (18f:10m)	1	40	50,839	21,281	100	17/43	24/33	301.1	108.4
4	19 Feb – 25 Feb		28 (18f:10m)	28 (18f:10m)	1	20	40,134	25,302	100	6/43	18/33	270.2	83.6
5	26 Feb – 04 Mar		28 (18f:10m)	28 (18f:10m)	1	20	44,006	28,069	100	6/43	18/32	271.9	95.6
6	05Mar – 11 Mar		25 (18f:7m) ^a	25 (18f:7m)	1	40	44,107	19,711	87.5	15/40	14/31	259.8	44.8
7	12 Mar – 18 Mar		25 (18f:7m)	25 (18f:7m)	1	40	47,087	22,156	99.3	14/40	13/31	313.8	40.6
8	19 Mar – 25 Mar		25 (18f:7m)	25 (18f:7m)	1	40	44,089	20,580	98.5	13/39	12/30	334.1	24.0
9	26 Mar – 01 Apr		24 (17f:7m)	24 (17f:7m)	1	40	43,425	20,283	95.5	12/39	12/29	335.1	16.4
10	02 Apr – 08 Apr		24 (17f:7m)	24 (17f:7m)	1	40	44,520	22,351	93.0	13/39	12/29	325.1	6.0

* Tibbitt to Contwoyto winter road (T2C) and Gahcho Kue winter road (GK)

† BNE = Bluenose-East caribou; Bev = Beverly caribou

^a dead collared Bathurst caribou to far east removed

T2C winter road: total length = 438 km (to NWT/Nunavut border)

GK winter road” total length = 108.4 km

Table 17. Attributes of the Bathurst Caribou Mobile Zone in 2020 in the Northwest Territories, during the winter road* operating period (late January to late March/early April).

No.	Week (Tuesday Monday)	# collars used to define mobile zone (sex ratio)	# Bathurst collars within NWT mobile zone (sex ratio)	# of polygons	Buffer zone size (km)	Area of mobile zone (km ²)	Area enclosed for all Bathurst collars		Active collars from adjacent caribou herds† within mobile zone (#/total)		Length of winter roads within mobile zone (km)	
							km ²	% in NWT	BNE	Bev	T2C	GK
1	28 Jan – 03 Feb	24 (22f:2m)	24 (22f:2m)	1	60	45,173	10,053	100	6/32	5/30	342.4	9.0
2	04 Feb – 10 Feb	24 (22f:2m)	24 (22f:2m)	1	60	48,537	11,963	100	7/32	5/30	348.2	14.2
3	11 Feb – 17 Feb	24 (22f:2m)	24 (22f:2m)	1	50	43,267	12,502	100	6/32	5/30	326.9	0
4	18 Feb – 24 Feb	24 (22f:2m)	24 (22f:2m)	1	50	44,042	13,252	100	6/32	5/30	341.4	3.2
5	25 Feb – 02 Mar	24 (22f:2m)	24 (22f:2m)	1	50	45,688	14,299	100	6/32	4/30	346.7	7.9
6	03 Mar – 09 Mar	24 (22f:2m)	24 (22f:2m)	1	50	47,210	15,537	100	6/32	4/30	354.1	18.4
7	10 Mar – 16 Mar	24 (22f:2m)	24 (22f:2m)	1	50	47,110	15,398	100	5/31	4/30	357.5	10.2
8	17 Mar – 23 Mar	23 (21f:2m)	23 (21f:2m)	1	50	47,884	16,041	100	5/31	4/30	357.3	11.4
9	24 Mar – 30 Mar	23 (21f:2m)	23 (21f:2m)	1	50	48,397	16,446	100	5/31	4/30	357.6	14.3
10	31 Mar – 06 Apr	23 (21f:2m)	23 (21f:2m)	1	50	47,945	16,215	99.9	5/30	4/30	356.9	16.2

* Tibbitt to Contwoyto winter road (T2C) and Gahcho Kue winter road (GK)

† BNE = Bluenose-East caribou; Bev = Beverly caribou

T2C winter road: total length = 438 km (to NWT/Nunavut border)

GK winter road" total length = 108.4 km

Table 18. Attributes of the Bathurst Caribou Mobile Zone in 2021 in the Northwest Territories, during the winter road* operating period (late January to late March/early April).

No.	Week (Tuesday to Monday)	# collars used to define mobile zone (sex ratio)	# Bathurst collars within NWT mobile zone (sex ratio)	# of polygons	Buffer zone size (km)	Area of mobile zone (km ²)	Area enclosed for all Bathurst collars		Active collars from adjacent caribou herds† within mobile zone (#/total)		Length of winter roads within mobile zone (km)	
							km ²	% in NWT	BNE	Bev	T2C	GK
1	26 Jan – 01 Feb	48 (37 F:11 M)	48 (37 F:11 M)	1	40	43,089	15,580	100	18/46	15/18	114.9	67.8
2	02 Feb – 08 Feb	48 (37 F:11 M)	48 (37 F:11 M)	1	40	40,673	13,332	100	18/45	15/18	195.9	67.5
3	09 Feb – 15 Feb	48 (37 F:11 M)	48 (37 F:11 M)	1	30	43,489	22,232	100	18/45	15/18	190.3	43.9
4	16 Feb – 22 Feb	48 (37 F:11 M)	48 (37 F:11 M)	1	30	50,289	27,914	99.9	18/45	15/18	187.5	51.4
5	23 Feb – 01 Mar	48 (37 F:11 M)	47 (37 F:10 M)	1	20	49,963	35,585	99.8	16/45	14/18	170.2	45.0
6	02 Mar – 08 Mar	47 (36 F:11 M)	46 (36 F:10 M)	1	20	50,479	37,306	96.9	15/45	14/18	249.8	61.7
7	09 Mar – 15 Mar	47 (36 F:11 M)	46 (36 F:10 M)	1	20	50,172	38,021	94.4	12/42	12/18	218.0	60.2
8	16 Mar – 22 Mar	47 (36 F:11 M)	44 (35 F:9 M)	1	20	54,416	44,562	91.2	14/42	11/18	287.2	61.8
9	23 Mar – 29 Mar	47 (36 F:11 M)	43 (34 F:9 M)	1	20	55,454	46,100	90.4	13/41	10/18	293.0	61.7
10	30 Mar – 05 Apr	47 (36 F:11 M)	43 (34 F:9 M)	1	20	55,146	46,066	90.1	13/41	10/18	284.5	61.5

* Tibbitt to Contwoyto winter road (T2C) and Gahcho Kue winter road (GK)

† BNE = Bluenose-East caribou; Bev = Beverly caribou

T2C winter road: total length = 438 km (to NWT/Nunavut border)

GK winter road" total length = 108.4 km