KITIKMEOT INUIT ASSOCIATION SUPPLEMENTAL INFORMATION ON CARIBOU

Final Hearing Written Submission for the 2016 Draft Nunavut Land Use Plan

January 13, 2017

Introduction

This is the final hearing written submission of Kitikmeot Inuit Association (KIA) on the Draft Nunavut Land Use Plan 2016 ("DNLUP 2016"). KIA worked in co-operation with Nunavut Tunngavik Inc. (NTI), the Kivalliq Inuit Association, and the Qikiqtani Inuit Association in creating a submission representative of the interests of the 3 Regional Inuit Associations (the "Joint Submission"). KIA fully supports the Joint Submission report provided to the Nunavut Planning Commission, and wishes to offer the following information as a supplement to the Joint Submission.

In this supplement, KIA focussed on an assessment of caribou calving grounds on the mainland of the West Kitikmeot region. Although we focussed on the west Kitikmeot Region, we believe the facts of this analysis applies to the Mainland caribou herds in the rest of the Kitikmeot region. KIA has a serious concern about the DNLUP 2016 regarding the static polygons proposed to protect caribou calving grounds on the mainland of the Kitikmeot region, and specifically the west Kitikmeot region. KIA believes that traditional knowledge, a scientific re-examination of the caribou collar data used by the Government of Nunavut (GN) to generate these polygons, and prior failed attempts to delineate caribou calving grounds with legal boundaries all demonstrate that the polygons provided by the Government of Nunavut (the "GN Polygons") to the NPC for the DNLUP 2016. We believe using the GN Polygons as a proposed method of protecting caribou calving grounds is fraught with problems and inaccuracies. We provide our arguments and evidence in this submission.

KIA believes that the GN Polygons designated as protected areas will have a significantly negative effect on KIA's membership and mandate. KIA's Board-approved mandate is "To Manage Kitikmeot Inuit Lands and Resources, and protect and promote the social, cultural, political, environmental, and economic well-being of Kitikmeot Inuit". The protected area status of the GN Polygons will significantly affect KIA choices for careful multiple use management of Inuit Owned Lands, and prevent benefitting from carefully planned activities on federally owned lands in areas where caribou calving is not present, or present for only a short time in a year. Caribou calving only occurs for a brief period of the year, and banning carefully planned multiple uses so that caribou are not affected in these areas will affect KIA's socio-economic interests.

Caribou are central to the cultural identity of Kitikmeot Inuit. KIA believes in careful management of caribou and their calving grounds. On May 5, 2016 KIA passed a resolution to support the development of mobile protection measures for caribou, wherever they may occur in concentration, even beyond the peak calving period. (Appendix 1). KIA resolved that:

1) KIA supports reasonable mobile protective measures for concentrations of caribou, including calving caribou, wherever they may be, irrespective of the season.

2) KIA will lobby responsible agencies and proponents to bolster their investments in caribou monitoring, information sharing, and enforcement in order to ensure caribou are appropriately protected.
3) KIA supports development of research initiatives geared to identifying adaptive management approaches that allow for the co-existence of caribou and development in the Kitikmeot Region.

A current application of mobile protection is for the Bathurst caribou herd. For at least the last two years, the Government of the Northwest Territories (GNWT) has established a mobile protection zone in the wintering grounds of Bathurst caribou in the Northwest Territories (NWT). This mobile zone is established, monitored, and adjusted using caribou collar data to enforce a no-hunting zone for NWT harvesters.

The evidence provided in this submission regarding how fluid caribou calving grounds are over space and time will make it apparent why KIA believes that mobile protection offers a far more effective means to manage caribou compared to delineated protected areas.

One of the most important uncertainties in the DNLUP 2016 is whether there is any effect on caribou populations as a result of properly planned development. So far there is little evidence and scant scientific literature that a direct relationship exists. Observational evidence suggested that that mineral exploration and development has occurred in the West Kitiktmeot region when large and increasing populations of caribou existed. In recent years there have been caribou population declines, on the mainland of the West Kitikmeot. This decline has occurred during one of the lowest levels of mineral development activity in the Kitikmeot region in decades. West of Kugluktuk there is no development and yet the Bluenose East herd is in decline.

Information Sources

KIA used three information sources used to articulate KIA views in this submission. They are:

1) **Kitikmeot Inuit Traditional Knowledge:** The Naonaoyoatit Traditional Knowledge Project (NTKP). The NTKP is a geo-referenced GIS database containing data about Inuit land use and environmental conditions from the 1800s through to present time. It is the foundation of Inuit Traditional Knowledge for the West Kitikmeot Region and is maintained by the Kitikmeot Inuit Association on behalf of the knowledge holders. Within the West Kitikmeot, knowledge was provided by 267 elders and land-users who resided in the communities of Ekaluktutiak (Cambridge Bay), Kugluktuk, Kingaok (Bathurst Inlet) and Omingmaktok (Bay Chimo) at the time of their interviews. KIA created a report about caribou calving grounds from the NTKP with the assistance of

Vivian Banci. This report presents Inuit Knowledge regarding caribou calving within the western Kitikmeot region.

2) **A re-analysis of essentially the same caribou collar data used to generate the GN Polygons for the Bluenose East and Bathurst caribou calving grounds:** KIA retained the services of Kim Poole of Aurora Wildlife Research, Inc., and Kelsey Russell and Mike Setterington of Environmental Dynamics Inc., to analyze caribou collar data provided by the GNWT for the Bluenose East and Bathurst Caribou Herds. This is the same collar data used by the GN to generate the GN Polygons, except for the inclusion of data for years 2015 and 2016 which were collected since the GN Polygons were released (Appendix 2).

3) **Demonstrating the difficulty in delineating legal fixed borders to protect caribou calving:** This was a KIA analysis of past Fixed Regulatory Boundaries issued or proposed by government in order to protect Caribou calving areas. KIA accessed information from government records to compare where the proposed protected areas were located vs. where the caribou calve now (Appendices 3 and 4).

As a summary, our assessment shows that caribou calving areas exhibit variability over short periods (i.e. 2-10 years) and are highly dynamic over a longer term If land managers used longer timeframes of 50-100 years for management decisions of the land, it becomes obvious that using fixed delineated areas to protect caribou will be fruitless. Caribou do not respect these human-defined boundaries.

Summary of Kitikmeot Inuit Traditional Knowledge

Inuit thoughts on the structure of caribou herds is more fluid than how biologists describe caribou. Instead of discrete herds named after the areas in which they calve, Inuit describe a herd as a group of caribou where the majority show fidelity to certain large regions for long periods. Occasionally herds from separate regions come together. This sharing of areas can be short-term or it can result in amalgamation or restructuring of herds which is more long-term.

Inuit describe caribou and their use of space use more dynamically than do biologists. The areas that caribou use are not fixed and predictable. Caribou select from a range of options depending on a myriad of factors which include weather, vegetation conditions and predation. These options are part of the collective memory of caribou, established by experience gained over centuries. Thus, migration corridors, wintering grounds and calving grounds can shift based on what is happening in the environment.

With the advent of aerial survey technology, Mainland caribou were labelled with distinct ‘herd’ names usually in association with geographic areas where scientists found them calving at a

specific time (i.e. Bathurst (after Bathurst Inlet) , Bluenose East (after Bluenose Lake)). Traditionally, Inuit do not distinguish between Mainland caribou herds but there are known physical differences between certain Mainland caribou. Inuit did differentiate between Mainland, Island, and Peary Caribou which have more distinct physical appearances. Western scientists have recently discovered through genetic analysis, what Inuit knew already, that Mainland caribou herds are not genetically distinct, but are sub-herds of a larger Mainland herd. Inuit have always lived near caribou calving areas, and the largest and most important areas are also the locations of very old Inuit habitation. Outside of the important calving areas, Inuit documented other calving areas as they followed caribou on their migrations. Mainland caribou calving areas occurred across the west Kitikmeot region.

Although at times it has caused hardship, major population declines, or changes in caribou calving grounds is not a surprise to Inuit. They see such changes in calving grounds as adaptive behaviour that allow caribou to select the most optimal habitats which will ensure the survival of their calves. Some calving areas are more consistently high quality than other areas which are used until the vegetation is depleted. This is the reason that Inuit believe caribou switched from calving around Bathurst Inlet from one side to the other in the 1990s. However, as Inuit describe, all of Bathurst Inlet is one large calving area and caribou presence is affected by the year that the area is used. Large calving areas are also identified in the Queen Maud Gulf area, and east, north and west of Contwoyto Lake. There are also certain areas described by Inuit that western scientists are not aware were heavily used for calving at one time. Calving areas for the Bluenose-East herd are in an area from Tahikpak (Bluenose Lake) to Emakyoak (Great Bear Lake), but by the 1990s they calved closer to Kugluktuk.

The use of space by animals that occupy hundreds of thousands of kilometers must be analyzed at all spatial scales. What may seem as a large shift to humans is merely a selection by tuktut of one of their many options.

Re-analysis of the same caribou collar data used to generate the GN Polygons for the Bluenose East and Bathurst caribou calving grounds.

KIA requested professional biologists to conduct analyses of collar data from the Bluenose-East and Bathurst caribou herds to determine the accuracy of the GN Polygons to reflect annual variation in use by calving and post-calving caribou. KIA's scientists identified and removed barren cows from analyses and annually mapped calving and post-calving areas, and compared these with the GN PDNLUP maps.

The analyses identified areas of concentrated annual use within the mapped GN Polygon calving and post-calving areas, with a degree of annual variability year over year. Scientific conclusions were:

- In any given year, varying portions of the GN Polygon were not used by calving or post-calving caribou, resulting in situations where some areas could unnecessarily exclude development activities; the overlap of peak calving areas was about 50-60% from year to year, demonstrating a movement of caribou calving grounds within a short timeframe.
- Since the GN Polygons were submitted to NPC, they appear to be obsolete. For example, the GN Polygons do not accurately reflect current calving areas for the Bathurst herd — which has extended eastward – and especially for the Bluenose-East herd — which has extended to the northwest.
- The peak season of calving results in a much smaller area used for calving than the GN Polygon.
- The GN Polygon extending southeast of Kugluktuk showed very limited used by calving caribou, likely because of inclusion of barren cows in the GN Polygon.
- Caribou are adaptable in their use of areas due to changes in weather and forage availability, as well as changes in herd size. Timing of calving can vary by days over time, affecting dates used to derive area boundaries. Boundaries of mapped seasonal areas can also vary considerably based on analysis methods and data used. Rather than treating seasonal ranges as static entities, the patterns observed suggest areas of concentrated annual use may change over time and thus should be re-examined regularly, and that use of mobile protection measures that account for annual variability in use may be more appropriate for these herds in the Kitikmeot Region.
- The GN Polygons are based on a very conservative methodology:
    1) the GN analyzed data across all available years as one dataset, blurring annual variability and creating the impression of a large and consistently used calving area;
    2) the GN used one month of time as the calving period, when calving typically happens in a much shorter period, which includes more caribou calving range;
    3) The GN employed methodology also used a kernel density of 95% (the most conservative use of statistics to maximize the potential range of calving caribou; according to wildlife experts a more appropriate density is 50% to accurately capture calving caribou; and,
    4) some female caribou were included in the GN study that were likely not pregnant. As a result, the range of caribou calving with the GN Polygon does not show variability between years, it does not show trends of movement, or that many areas of the GN polygon are not used for calving in a particular year.

Demonstrating the difficulty in delineating legal fixed borders to protect caribou calving

Proposed Tuktut Nogait National Park Extension

Tuktut Nogait National Park, meaning "young caribou" in Inuvialuktun, was created by Parks Canada in 1996 in the Inuvialuit Settlement Region to protect the Bluenose west caribou herd and its calving and post-calving habitat. As part of this National Park Development, Parks Canada proposed to extend the park boundary east into Nunavut in order to protect the Bluenose East Calving Ground, which calved in the area of Bluenose Lake. Collar data presented in this report demonstrates that the Bluenose East herd has not used this area for calving in over two decades, and the calving ground has shifted south and east towards Kugluktuk. Thus, an area once delineated on a map to protect the Bluenose East currently would have no significant benefit for the Bluenose East Herd (although it is important to note that there is little activity of any kind in the area of Bluenose Lake. The rigid, static boundaries that form the perimeter of Tuktut Nogait National Park have been rendered ineffective and irrelevant to its intended purpose.

Special Management Areas and Critical Wildlife Areas East of Bathurst Inlet

Prior to the execution of the Nunavut Agreement, the GNWT delineated areas to be designated as critical wildlife areas (Appendix 3) in what is now the Nunavut Settlement Area, and later carried forward into the Nunavut Agreement as special management areas (SMA) (Appendix 4). The equivalent of a modern-day GIS polygon, boundaries were created to identify calving grounds for herds of caribou, with nomenclature associated to their "regular" calving grounds. An area was created on the east side of Bathurst Inlet to protect Bathurst caribou calving grounds (which are now to the west of Bathurst Inlet). While these areas were identified, there was never actually any legislation or statutes presented that would restrict or prohibit certain activities, and thus no enforceable rules or penalties associated with any activity in an area.

These are areas formally recognized by the Government of Nunavut (GN), however no action has been taken to produce any restrictions or prohibitions to protect caribou. These areas are now being superseded by the NLUP, resulting in an apparent abandonment of these obsolete boundaries, which were once conceived to protect caribou calving grounds. The ineffectiveness of these delineations will be echoed in the proposed management of GN Polygons contained in the NLUP.

An example of an ineffective SMA is the apparent decline of the Beverly caribou herd, in and around the region identified as the Beverly Calving Area SMA in the Wildlife Act. Over a span of fourteen years, the caribou herd known as the Beverly herd experienced a significant shift in seasonal movements, and decline in herd size (Adamczewski et. al, 2015). It is believed that the decline in herd size can actually be attributed to the mixing of the Beverly and Ahiak herds,

resulting in a merged seasonal range. The special management area created for the Beverly herd protects an area where the merged Beverly-Ahiak herd no longer frequents.

Summary

The application of Inuit Traditional Knowledge is a powerful tool for land use planners as it provides access to information that is otherwise unavailable. Kitikmeot Inuit Traditional Knowledge demonstrates the dynamic nature of caribou and their calving grounds, and that the GN Polygons are unlikely to be effective in protecting caribou over the long term.

Re-analysis of the data used to generate the GN Polygons shows the variability of use of calving grounds form year to year, limiting land uses in times of the year, or in years, when no calving caribou are present. There is also a trend indicating that the GN Polygons may already be going obsolete, as calving grounds appear to be shifting beyond the current GN Polygon borders, the application of GN polygons leaves no protection for caribou during calving if they are outside the GN Polygon.

Previous attempts have been made to delineate caribou calving grounds with legal boundaries. These attempts, when comparing where the caribou are calving now, are obsolete and a clumsy attempt at managing dynamic caribou herds.

For these reasons, the KIA supports mobile protection measures for caribou, and does not support the GN Polygons in the NLUP 2016. Whether mobile protection measures need to be incorporated into the NLUP 2016, or instead be administered by existing agencies with relevant authority is an important question.

References

Adamczewski, J., Gunn, A., Poole, K. G., Hall, A., Nishi, J., & Boulanger, J. (2015). What Happened to the Beverly Caribou Herd after 1994? *Arctic*, 68(4), 407. doi:10.14430/arctic4523

Appendix 1

KIA support for mobile protection measures for caribou.

Whereas, the Kitikmeot Inuit Association (KIA) met at a duly constituted Board meeting on May 5, 2016, in Kugluktuk, Nunavut, and;

Whereas, caribou are an essential component of Inuit social and cultural identity, and KIA wants to conserve caribou populations for future generations, and;

Whereas, the KIA Board acknowledges that caribou populations have cycles of lower and higher numbers over history and this is possibly caused by several natural (disease, weather, predators, parasites, insects, habitat quality, etc…) and man-made factors (harvesting, harvest efficiency, and development), and;

Whereas, the KIA Board was updated by KIA technical staff on the current status of caribou calving ground protected areas to the Nunavut Planning Commission (NPC), and;

Whereas, the KIA Board acknowledges that caribou calving grounds shift unpredictably on the mainland of the Kitikmeot Region, and;

Whereas, in addition to the NPC processes, there are other existing legal alternatives to NPC designated protected areas that are held by government, NWMB, and KIA that can establish more flexible and responsive protection measures for caribou, if they are needed, and;

Whereas, any protected area designation is inflexible to the natural changes in the caribou calving ground areas, and thus will protect areas, but not necessarily calving caribou, and;

Whereas, KIA rigorously reviews project proposals in the Kitikmeot region to protect caribou, and KIA includes these in its land tenures and recommendations to NIRB.

Now Therefore be it resolved:

i. KIA supports reasonable mobile protective measures for concentrations of caribou, including calving caribou, wherever they may be, irrespective of the season.
ii. KIA will lobby responsible agencies and proponents to bolster their investments in caribou monitoring, information sharing, and enforcement in order to ensure caribou are appropriately protected.
iii. KIA supports development of research initiatives geared to identifying adaptive management approaches that allow for the co-existence of caribou and development in the Kitikmeot Region.

Moved By: David Nivingalok **Seconded By: Andre Otokiak**

Disposition: **Carried** **KIA BD 32/16**

Appendix 2

Variability in calving and post-calving areas of the Bluenose-East and Bathurst caribou herds

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EXECUTIVE SUMMARY

The Government of Nunavut Department of Environment (GN-DoE) provided the Nunavut Planning Commission (NPC) with maps for the 2016 Draft Nunavut Land Use Plan (DNLUP) representing seasonal areas of use by barren-ground caribou. These maps combined collar data from the past three decades and retained barren (non-breeding) cows for determination of calving areas, resulting in large mapped calving and post-calving areas. At the request of the Kitikmeot Inuit Association (KitIA), we conducted analyses of collar data from the Bluenose-East and Bathurst caribou herds to determine the accuracy of the DNLUP boundaries to reflect annual variation in use by calving and post-calving caribou. We identified and removed barren cows from analyses and annually mapped calving and post-calving areas, and compared these with the DNLUP maps.

Our analyses identified areas of concentrated annual use within the mapped DNLUP calving and post-calving areas, with a degree of annual variability year over year. Our conclusions:

- In any given year, varying portions of the DNLUP mapped areas were not used by calving or post-calving caribou, resulting in situations where some areas could unnecessarily exclude development activities;
- More importantly, areas that have experienced increasing recent use (since 2011–2013) by caribou may not be adequately identified, for example, the DNLUP mapping does not accurately reflect current calving areas for the Bathurst herd — which has extended eastward – and especially for the Bluenose-East herd — which has extended to the northwest. Similar differences were evident for the post-calving area for the Bluenose-East herd;
- We also identified areas within the DNLUP calving map southeast of Kugluktuk that showed very limited used by calving caribou, likely as a result of inclusion of barren cows in DNLUP mapping.

Caribou are adaptable in their use of areas due to changes in weather and forage availability, as well as changes in herd size. Timing of calving can vary by days over time, affecting dates used to derive area boundaries. Boundaries of mapped seasonal areas also can vary considerably based on analysis methods and data used. Rather that treating seasonal ranges as static entities, the patterns observed suggest areas of concentrated annual use may change over time and thus should be re-examined regularly, and that use of mobile protection measures that account for annual variability in use may be more appropriate for these herds in the Kitikmeot Region.

AUTHORSHIP

EDI Environmental Dynamics Inc. and Aurora Wildlife Research staff who contributed to this project include:

Kelsey Russell (EDI), B.Sc. ..... Lead Author

Kim Poole (AWR), M.Sc., R.P.Bio..... Lead Author and Senior Review

Matt Power (EDI), A.Sc.T.. ..... GIS analyses and mapping

Mike Setterington (EDI), M.Sc., R.P.Bio. .....Senior Review

ACKNOWLEDGEMENTS

The Project was managed by Jared Ottenhof, Lands Officer, KitIA, and Geoff Clarke, Director of Lands, KitIA. Anne Gunn provided helpful comments on a draft version of this report and also provided the report cover photo (with permission).

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1 INTRODUCTION

At the request of the Kitikmeot Inuit Association (KitIA), EDI Environmental Dynamics Inc. (EDI) and Aurora Wildlife Research (AWR) were retained to provide background technical information and analysis to support KitIA's input into the 2016 Draft Nunavut Land Use Plan (DNLUP; NPC 2016); specifically, a technical analysis of the caribou calving and post-calving area boundaries of the Bluenose-East and Bathurst caribou herds, and their utility for the protection of caribou.

The Government of Nunavut Department of Environment (GN-DoE) provided the Nunavut Planning Commission (NPC) with maps representing seasonal areas of use by barren-ground caribou accumulated over the past three decades. In the 2016 DNLUP, the proposed land use designations identify calving and post-calving areas, key access corridors, and freshwater crossings as Protected Areas, prohibiting exploration or development within these areas (NPC 2016). The calving and post-calving areas (also termed grounds) of both the Bathurst Caribou Herd (BAH) and the Bluenose-East Caribou Herd (BNE) occur within the Kitikmeot Region. With the approval of this draft plan, all development within the areas identified by the GN-DOE that delineate calving and post-calving would be prohibited. Our emphasis in this report is on analysis of the BNE herd, with more limited analysis for the BAH herd due to time constraints.

The KitIA would like to demonstrate to NPC that there is large inter-annual variability in the location of calving and post-calving areas over the longer term, and providing Protected Area designation to defined areas may not adequately protect caribou habitat.

1.1 TERMINOLOGY

Barren-ground caribou calving cows have two characteristics: first, the pregnant cows annually migrate to concentrate within a relatively small area typically used for calving in previous years; and second, most cows have their calves within a few days of each other during a distinctly defined calving period (Russell et al. 2002). When the cows are about to give birth, their daily movements slow down and once the calf is born, it takes a few days for the calf to bond with the cow and build enough strength to easily keep up. The cow's lactation peaks 7–10 days after the birth and by about three weeks after the birth, the calf has begun to independently forage but still needs the cow's milk for growth. Biologists have relied on those biological dates and characteristics of calving behaviour to define the areas used. However, methods to describe both the timing and areas used for calving have changed over time. Consequently, terminology has varied which can lead to confusion.

During a 2001 gathering of experts for a barren-ground caribou calving ground workshop, the consensus definition of a calving ground was:

> *"The area occupied by the parturient [calving] barren-ground caribou from calf birth through the initiation of foraging by calves" (Russell et al. 2002).*

This definition highlights the importance of the areas used by cows and calves up to three weeks after birth when the calves are particularly vulnerable (Russell et al. 2002). The three weeks is generally divided into a 7–10 day calving period including the birth (characterised by low daily movement rate) and then a post-calving period until independent foraging is initiated at about three weeks of age (Russell et al. 2002).

In this report we use terms to describe the calving and post-calving periods and areas. A number of terms and definitions surrounding these periods have been used over the years, but in this report we have minimized the terminology used. Maps of calving and post-calving areas produced for the NPC DNLUP were based on date ranges provided by Nagy (2011) (Caslys Consulting Ltd. 2016). We also provide a tighter definition (peak calving) to more closely define the area used during and immediately after calving as determined by the lowest daily movement rates.

Calving occurs over a 7–10 day period in early June when almost all cows in the calving area give birth. When the cows are about to give birth, they reduce the daily rate of travel and once the calf is born, the cows do not move much until their calf is strong enough to keep up with them. Calving is now often measured from cows with satellite or GPS collars which allow for the measurement of the daily rate of travel. The calving areas mapped by NPC in the DNLUP are based on dates used by Nagy (2011) who used daily movement rates for each herd to describe calving from caribou collared between 1993 and 2008. To align with these date ranges and for the purpose of this report, the annual ***calving area*** is the area used by the calving cows during the dates used to develop the maps for the DNLUP (Caslys Consulting Ltd. 2016).

Peak of calving is the date at which approximately 50% of cows calved in a given year, and was originally based on observations of newborn calves and cows during aerial surveys. More recently, the movement rates of satellite and GPS-collared cows are used to determine the 7-day period of greatly reduced movement by each individual breeding cow that is associated with calving (Gunn et al. 2008). As used here, the ***peak calving area*** is the area used by calving cows during this 7-day period. This is a shorter period than used for mapping calving area in the DNLUP.

Post-calving is the time from when calves are about seven days old to when they are old enough to independently forage at about three weeks of age. The annual post-calving area is the area used by the cows after calving for about two weeks. Russell et al. (2002) described that "*Indicators of foraging may include the number of nursing bouts per day (from 30 down to 4 or 5 times), good calf locomotion, time spent foraging, and calf body size (herd-specific indicators should be established for each managed herd).*" The post-calving areas mapped in the DNLUP (which excludes areas overlapping with the calving areas), are based on Nagy's (2011) analysis of daily movement rates from 1993–2008 collared caribou for all mainland Nunavut caribou herds, as updated with collar locations to 2012 (Caslys Consulting Ltd. 2016). For the purpose of this report and to enable comparison between analysis methods, the annual ***post-calving area*** is the area used by cows during the dates used to develop the post-calving maps for the DNLUP (Caslys Consulting Ltd. 2016).

Concentrated area**:** The area of greatest overlap from multiple years of data is termed the "concentrated" area. We avoided use of the term "core" since this often refers to a GIS-derived polygon that encompasses 50–80% of the collar locations under consideration (Formica et al. 2010; Johnson and Russell 2014), but in

the case of DNLUP polygons, the maps produced use 95% utilization distribution boundaries (Caslys Consulting Ltd. 2016).

Additional terms that we use in this report include:

- ***Fix:*** A satellite or GPS location from a collared caribou;
- ***Polygon:*** A closed shape that delineates a static area on a map, generally generated using a GIS program;
- ***Calving site:*** The suspected or estimated location where the calf is born.

2 METHODS

We used BNE and BAH collar data provided by the Government of Northwest Territories, Environment and Natural Resources (GNWT-ENR; 1996 to July 2016) to explore the variability in calving and post-calving areas over time and space, using different approaches to delineate seasonal ranges. Caribou location data from 1996 to 2005 (BNE) or 2007 (BAH) were derived solely from satellite collars that generally provided a collar location every 1 to 5 days with associated location error generally <150 metres (m), but ranging up to 1,000 m (Gunn et al. 2008). Use of satellite collars continued in a diminished manner to 2016, but beginning in 2006, GPS collars were increasingly deployed with resultant increased accuracy in locations (<20 m in most cases) and fix frequency.

Analysis of the data differed between herds. For the BNE herd we provide an analysis of calving area and post-calving area to match date ranges used by the GN-DOE to develop maps for the DNLUP (NPC 2016), as well as analysis of peak calving area. For the BAH herd we updated analyses of peak calving area conducted up to 2007 from Gunn et al. (2008) and subsequently updated for an unpublished environmental assessment in the Kitikmeot Region (EDI Environmental Dynamics Inc. and Aurora Wildlife Research, unpubl. data).

2.1 IDENTIFYING CALVING COWS

Pregnant cows generally decreased their movements immediately prior to birth, with reduced movements in the days immediately following calving (Gunn and Russell 2008; Figure 1).Calving date was estimated by determining the period of low movement rates in combination with a spatial analysis of movement patterns (e.g., circular movement in a small area versus directional movement). If numerous low movements were observed for an individual within a likely calving period, generally the earliest date of decreased movement was chosen as the calving date (Nagy 2011).

To focus analyses on calving cows only for both calving and post-calving, the movement rates of collared female caribou were examined during the general calving period (mid-May to late June) to determine whether individuals calved. Distance between fix locations was determined for each individual on a daily basis (if there was more than one fix per day, these data were rarefied), and standardized by serial date. In their analysis, Gunn et al. (2008) identified two satellite collar fix locations over a 7-day period that demonstrated reduced movement rates during calving; however, due to the higher fix frequency of the GPS collars used post-2006, up to 21 locations (three fixes per day) were used per calving year. In addition, each collar was examined spatially during the months of May and June using ArcMap. This provided an indication of the proximity of individual collared caribou to known calving areas around the general calving period.

Calving date analyses were based on individual movement rates and patterns. If individuals were found to be quite a distance away from known calving areas, the entire data set for that individual was examined to determine whether it calved in another calving area, if it was likely barren, or if it calved outside the known

calving areas. Caribou removed from the databases had either obviously calved in neighbouring calving areas, had limited collar data available during the calving period, were suspected to be barren, or were located a considerable distance from known calving areas (e.g., outliers; APPENDIX A, Table 5).

Our analysis assumes that the calving location and area used by calving females as determined from the collar data represents the overall distribution of breeding cows in the calving area. The temporal and spatial resolution of satellite collars (with fewer locations and greater location error) will be less than the resolution of GPS collars. Gunn et al. (2008) found reasonable agreement between the locations of caribou during peak calving as determined from satellite collars and areas of moderate to high density caribou as observed during aerial surveys. This is illustrated from the 2015 aerial survey of the BNE calving area (Boulanger et al. 2016; Figure 2).

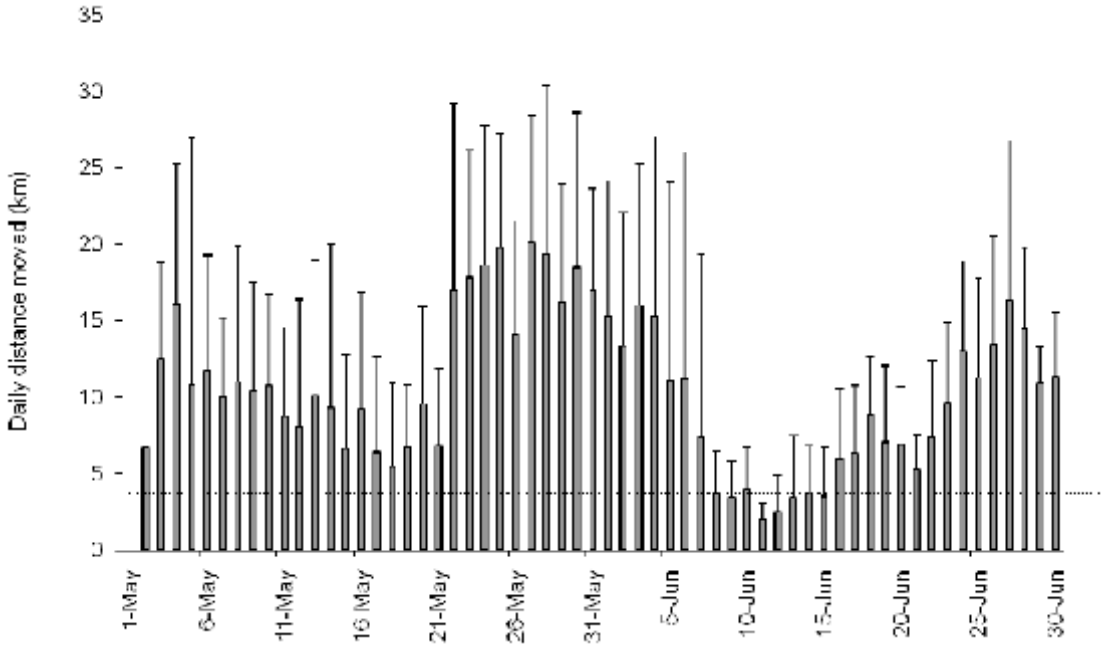


Figure 1. Mean daily movements (+ 1 SD) of barren ground caribou by satellite collared Bathurst caribou during May and June 2009 (Nishi et al. 2014).

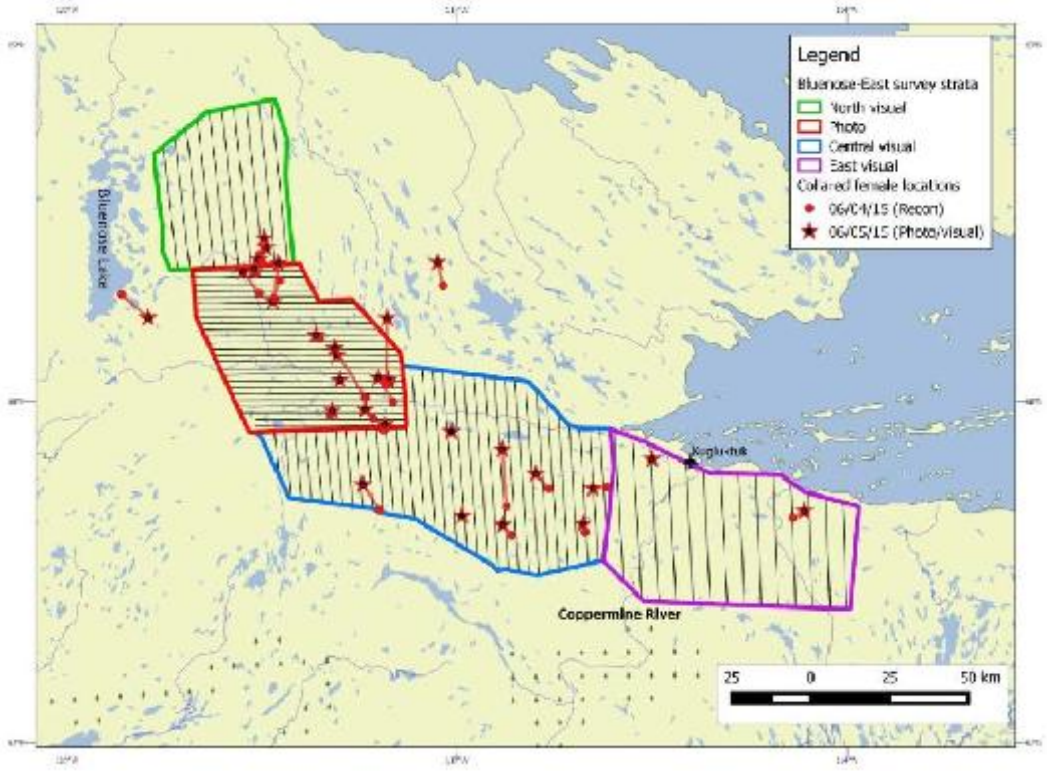


Figure 2. Caribou collar locations compared with the final stratification for the calving ground survey of the Bluenose-East caribou herd, June 2015 (Boulanger et al. 2016).

2.2 SEASONAL RANGES

Following the methods outlined by Caslys Consulting Ltd. (2016), we used the kernel density estimation (KDE) method of utilization distribution (UD) to develop polygons that represent probability of use based on density values (Worton 1989) for each year of collar data. All analyses were conducted using Geospatial Modelling Environment (GME; Version 0.7.4.0); however, the program used in the GN-DoE analyses was not provided in their methods report (Caslys Consulting Ltd. 2016). Other than sample size of collared individuals, the most influential variable affecting polygon shape and size is the input search radius, also known as the bandwidth or smoothing parameter. As the search radius decreases, the prediction accuracy for the range boundary increases. As the search radius increases, the resulting range boundary becomes smoothed, representing a broader density of use. There are a number of ways to derive the search radius, and for the analysis conducted on behalf of the GN the GIS approach used two different methods (the reference search radius and least squares cross-validation), resulting in a range of search radii from 3 to 20 km. Based on both ecological (e.g., Boulanger et al. 2012) and logistical (minimum distance that produced continuous range boundaries) justifications, the authors used an 11 km search radius (Caslys Consulting Ltd. 2016). It is unclear what dataset was used to derive these estimates (i.e., averaged across individual herds or all herds). Although it is generally not accepted to apply a bandwidth value to a dataset based on another dataset, we adopted this value for the sake of method replication. Utilization distribution boundaries were derived for 50, 80, 90, 95, and 100% kernels density estimates. The 95% density class had to surround a

higher density class (e.g., 50%, 80%, or 90%) to be included in the final range delineation. To connect these areas, which were often patchy, each individual polygon was buffered by 11 km, then all the buffered polygons were merged and dissolved (i.e., shared edges removed), and finally a negative 11 km buffer was applied to restore it to the original 95% density class.

Calving and post-calving areas were determined for BNE caribou using the date ranges defined for the DNLUP (Caslys Consulting Ltd. 2016; NPC 2016): calving (28 May–20 June) and post-calving (21 June–3 July). Our analyses of the BNE data attempted to highlight variability when similar methods as used for the DNLUP are applied. The methods applied to this analysis were similar to the GN-DoE approach except our input data extended to 2016. In addition, the calving and post-calving areas developed for NPC included all collared BNE cows (calving as well as non-calving), combined all years of collar data into a single analysis, and did not account for animals that switched herds (J. Shaw, pers. comm.; Caslys Consulting Ltd. 2016). Our analysis separated collar location by year (where possible), identified barren cows, and identified cows which switched herds. For some of the earlier years when satellite collars were used exclusively (1996–2005), sample sizes (number of individuals and locations) were too small to be representative of the herd's annual use of calving and post-calving areas. For these years, locations were grouped into two time periods: 1996–2000 and 2001–2005. Additionally, and in accordance with the methods outlined by Caslys Consulting Ltd. (2016), all collar data for these analyses were rarefied (i.e., sub-sampled) to provide only one location per day, per collar.

Analysis of BAH herd data followed determination of peak calving areas using collar data (satellite collars only) conducted by Gunn et al. (2008) for 1996–2007. Our assessment focused on BAH data from 2008 to 2016, while following similar methods of Gunn et al. (2008) to maintain consistency across years. Peak calving areas were also determined for the BNE herd using collar data from 1996–2016.

Once the calving date was estimated for each animal (based on reduced movement rates and spatial localization), the date of peak of calving was calculated for each herd for each year (when 50% of cows calved that year, calculated as the median date among individuals). The 7-day period of reduced movement likely associated with calving (Gunn et al. 2008) was used to determine the peak calving area. Fix locations suggesting calving, plus six days, were selected and formed the basis of the peak calving polygon delineation. Since the number of fixes per caribou varied across years and between animals, locations were weighted to allow for equal representation of each collared caribou in building the polygon. Locations in each year were weighted according to the following formula (number of fix locations per caribou ranged from 1 to 21):

$$Weighted\ value = \frac{1}{\#\ fix\ locations\ per\ Caribou\ ID}$$

The collar locations were then entered into the GME program to calculate 90% fixed kernel peak calving area polygons. The area of peak calving was then calculated. Peak calving areas among years were merged to create the cumulative peak calving areas from 1996 to 2016.

We also evaluated inter-annual variability by determining the percent overlap of calving, post-calving, and peak calving areas (only peak calving areas for BAH) from one year to the next. This demonstrates the relative amount of area that was used by calving cows in consecutive years. Additionally, we also calculated

the percent of overlap of BNE calving and post-calving areas (not conducted for the BAH) with the polygons used in the DNLUP. For the post-calving areas, the DNLUP calving and post-calving polygons were merged to create a single area because the overlap of post-calving with calving area is unknown. To calculate overlap, the following formula was adapted from Gunn et al. (2008):

$$Percent\ overlap = \frac{(2\ x\ area\ of\ polygon\ overlap\ (km^2))x\ 100}{Area\ of\ year\ 1\ polygon + Area\ of\ year\ 2\ polygon}$$

2.3 CENTRES OF ACTIVITY DURING CALVING

We calculated the approximate annual centroid of BNE and BAH during calving to illustrate spatial changes over time. We determined the centroid (geographic centre of the polygon) of use during calving and peak calving each year for both BNE and BAH caribou (peak calving only for BAH; 1996–2000 and 2001–2005 were grouped for BNE due to low sample size). Calving centroids for the BAH herd from 1996 to 2007 were obtained using data from Gunn et al. (2008).

3 VARIABILITY IN CALVING AND POST-CALVING AREAS

The calving, peak calving, and post-calving areas of both the BNE and BAH herds demonstrated considerable spatial variability from 1996 to 2016, including both the location and size of the ranges (Maps 1–8; Table 1). Similarly, both herds demonstrated temporal variability in the timing of peak of calving over this time period (Table 2).

Table 1. Size (km²) and inter-annual overlap (%) of the Bluenose-East calving, post-calving, and peak calving seasonal ranges, and the Bathurst peak calving area, 1996–2016.

Year	Bluenose-East						Bathurst	
	Calving (km²)	Overlap (%)	Post-calving (km²)	Overlap (%)	Peak calving (km²)	Overlap (%)	Peak calving (km²)	Overlap (%)
1996							614	-
1997	10,050 (1996–2000)	-	15,681 (1996–2000)	-	5,761 (1996–2000)	-	3,035	33
1998							2,005	38
1999							3,974	41
2000							3,900	38
2001	11,250 (2001–2005)	53 (2001–2005)	10,337 (2001–2005)	64 (2001–2005)	4,249 (2001–2005)	34 (2001–2005)	4,760	11
2002							2,345	49
2003							5,793	28
2004							1,611	34
2005							4,962	34
2006	6,497	53	6,631	15	3,056	37	1,316	38
2007	6,026	47	7,441	12	3,283	25	1,884	4
2008	9,349	47	11,214	40	4,568	28	2,703	61
2009	10,736	48	9,540	31	8,050	44	1,772	49
2010	11,692	53	15,549	100	8,442	46	1,899	37
2011	6,950	60	7,390	28	5,027	46	1,528	53
2012	14,822	59	11,466	43	8,333	55	1,981	52
2013	17,836	73	10,166	49	7,592	54	845	47
2014	11,515	65	12,271	100	6,729	49	1,452	58
2015	14,004	54	11,879	64	6,148	52	2,309	48
2016	11,827	68	10,892	66	6,963	56	923	33
Cumulative size km²	33,328	-	38,722	-	22,838	-	12,087	-
Average overlap (%±SE)	-	57 (±2.5%)	-	51 (±8.4%)	-	44 (±3.1%)	-	39 (±3.2%)

Table 2. Median and range of peak of calving dates of the Bluenose-East and Bathurst caribou herds based on changes in movement rates and patterns from collar data (1996–2016).

Year	Bluenose-East		Bathurst	
	Median	Range	Median	Range
1996–2000	5 June	27 May–13 June	-	4–14 June[1]
2001–2005	3 June	1–20 June	-	8–14 June[1]
2006	3 June	28 May–7 June	-	8–14 June[1]
2007	3 June	2–15 June	-	8–14 June[1]
2008	3 June	4–9 June	10 June	3–15 June
2009	4 June	25 May–16 June	8 June	4–13 June
2010	4 June	27 May–11 June	5 June	3–8 June
2011	5 June	25 May–13 June	4 June	1–9 June
2012	4 June	25 May–13 June	4 June	31 May–8 June
2013	7 June	30 May–13 June	6 June	5–13 June
2014	6 June	28 May–14 June	4 June	27 May–9 June
2015	6 June	27 May–10 June	3 June	25 May–10 June
2016	2 June	29 May–10 June	1 June	28 May–6 June

[1]Gunn et al. (2008)

3.1 BLUENOSE-EAST CARIBOU

Prior to the mid-1990s, the Bluenose-East herd was part of a single herd known as the Bluenose herd, with calving spread at varying densities over a widely spaced area (Hawley et al. 1976). Reanalysis of the aerial survey and collar data showed that three distinct calving areas existed within the original Bluenose herd, leading to the recognition of three distinct calving areas: Bluenose-East, Bluenose-West, and Cape Bathurst (Nagy et al. 2005). The highest density of calving within the current range of the BNE herd from the mid-1960s to the early 1990s surrounded Bluenose Lake. Subsequent to the mid-1990s, most of the recognized calving occurred farther to the southeast within the Rae and Richardson rivers valleys west of Kugluktuk (Nagy 2009; this report).

From 1996 to 2012, the estimated peak of calving date ranged from 2–7 June, with a median date of 4 June (Table 2). Up to 2012, the area of greatest annual overlap of the BNE calving area remained largely west of Kugluktuk; however, beginning in 2013, an area farther to the northwest experienced increasing use by collared calving females (Map 1 and Map 3). This is consistent with the 2015 survey report that described higher density strata in this area (Boulanger et al. 2016). From 1996–2016, there was a distinct area of considerable overlap in use, evident during both the broad calving (28 May–20 June) and peak calving periods (Map 2 and Map 4). Although the concentrated area of cumulative peak calving area is smaller (Table 1), it still captures the area immediately west of Kugluktuk as experiencing the most consistent use over the years, which is largely consistent with the central area of the DNLUP calving area polygon (Map 4).

The average inter-annual overlaps of calving and post-calving areas (57±2.5% and 51±8.4%, respectively; Table 1) for the BNE were relatively larger than the overlap of annual peak calving areas, (44±3.1%; Table 1). This suggests that the area used during peak calving is more variable year-to-year than the broader calving and post-calving areas.

Our estimated BNE post-calving area showed variability in areas used, with greater use of more southern areas during 2006–2012 (largely located within the DNLUP designated calving area), and more use of northern areas from 2013–2016 (located primarily within the DNLUP post-calving area; Map 5). On average, our calving areas overlapped with 59±2.9% (range = 50–78%) of the DNLUP calving area in any given year (Figure 3). The cumulative BNE post-calving area was larger than the calving and peak calving areas (Table 1); however, the area of greatest overlap covered much of the same area (Map 6). In our analyses, the area of greatest cumulative use during post-calving was roughly centred between the DNLUP calving and post-calving area polygons (Map 6). On average, our post-calving areas overlapped with 44±3.0% (range = 18–61%) of the DNLUP calving and post-calving area (merged) in any given year (Figure 3).

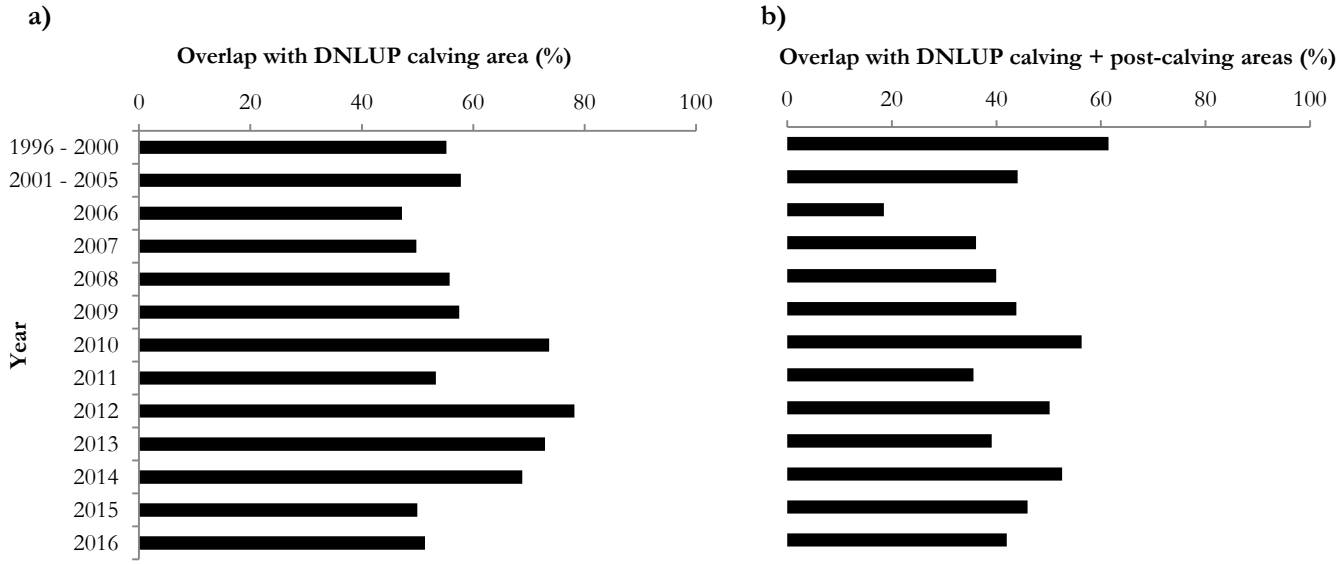
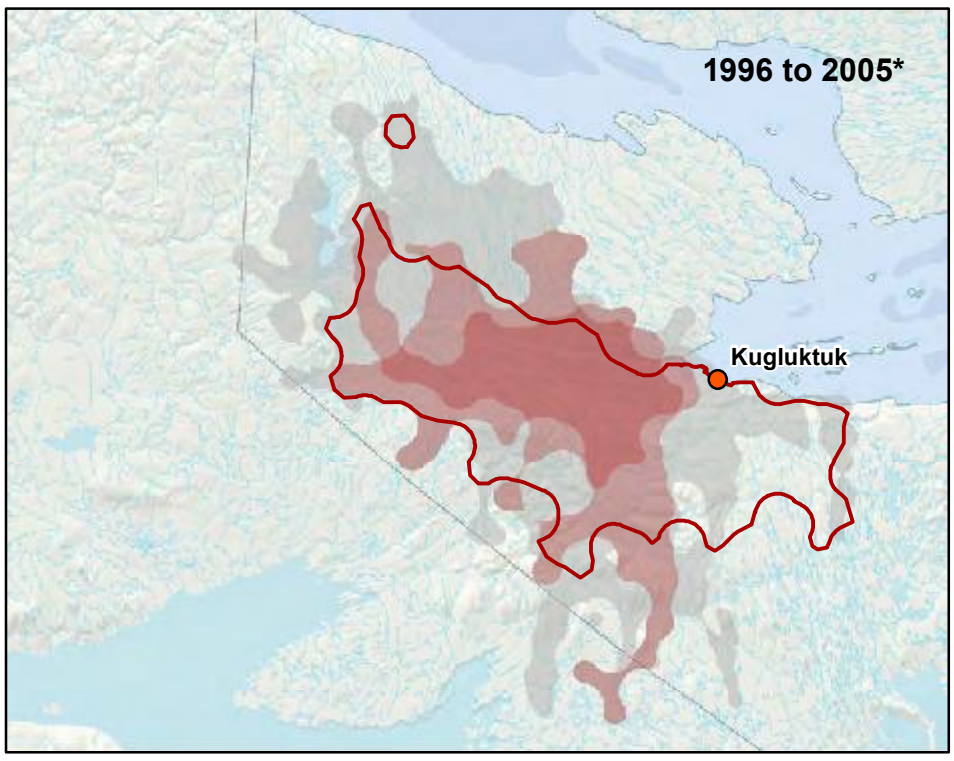
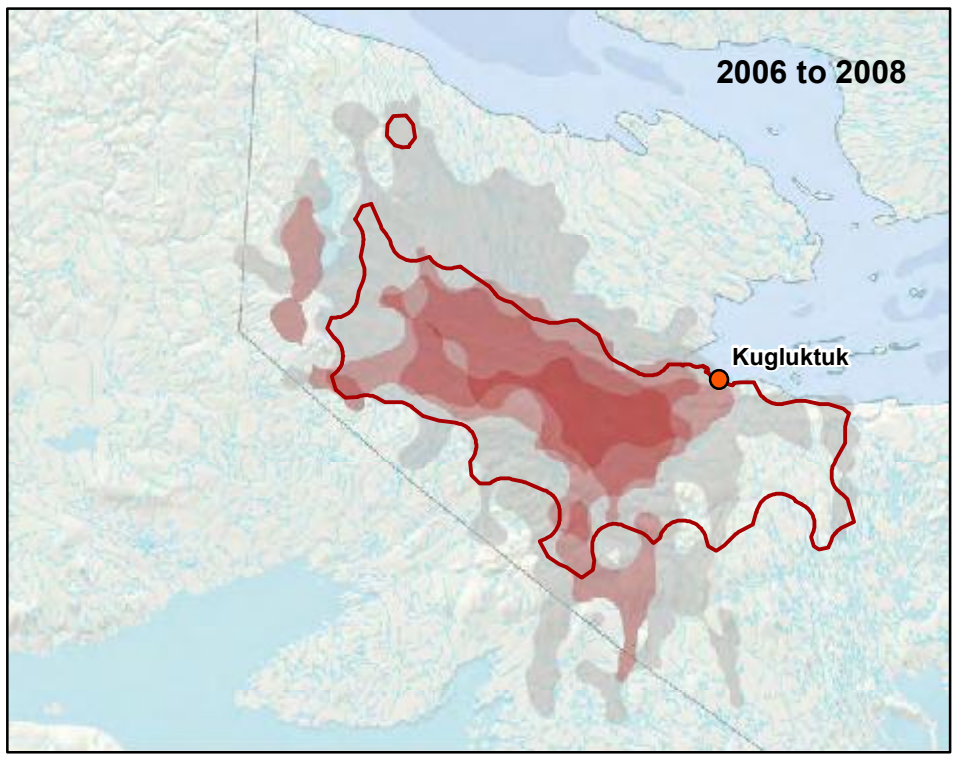
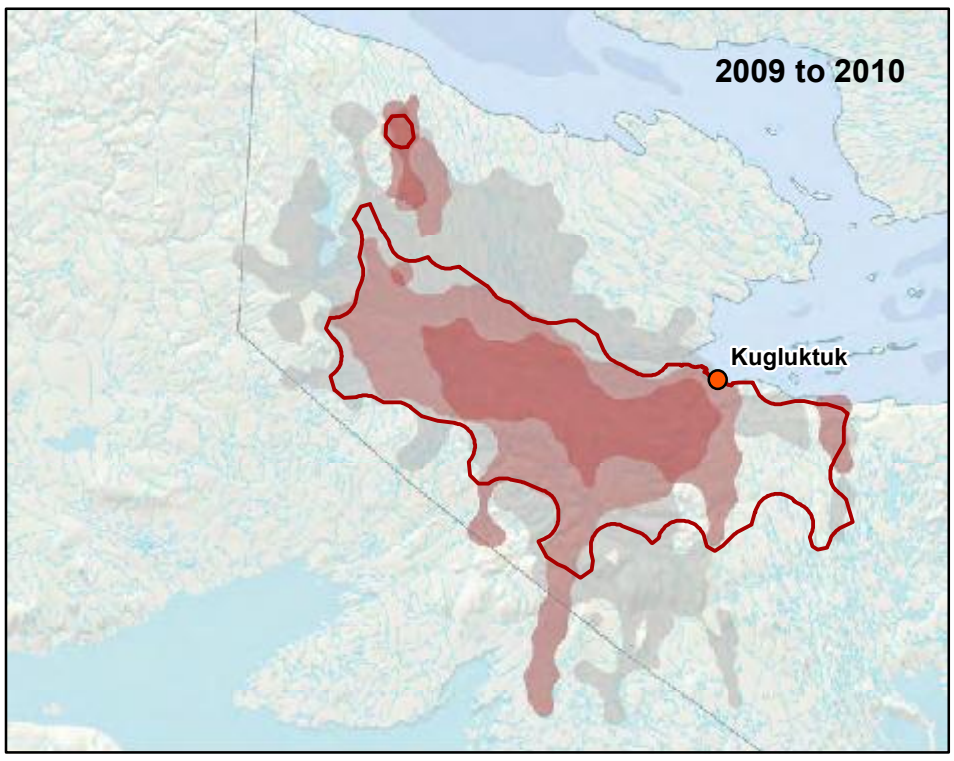
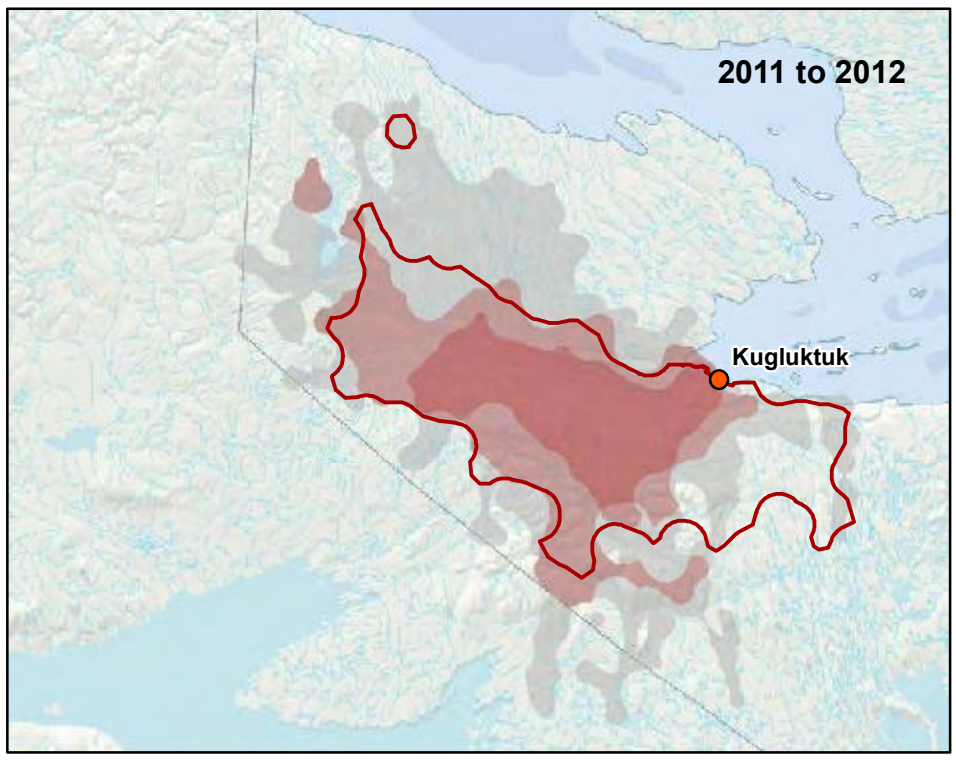


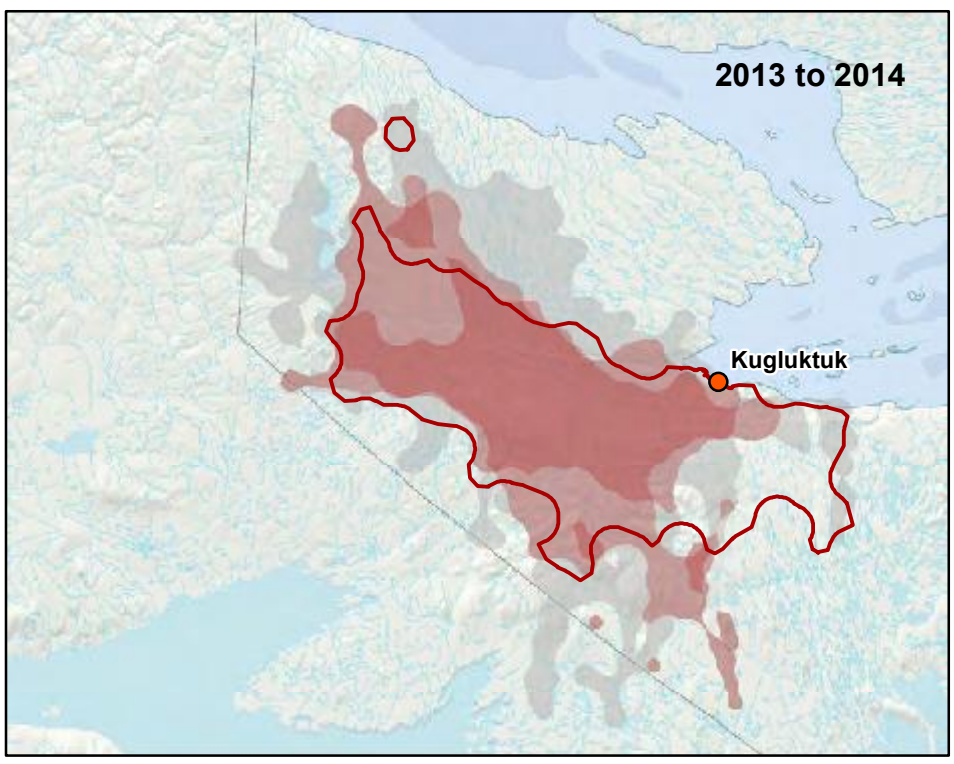
Figure 3. Overlap of Bluenose-East calving (a) and post-calving (b) areas with the DNLUP-designated calving and post-calving areas, 1996–2016.

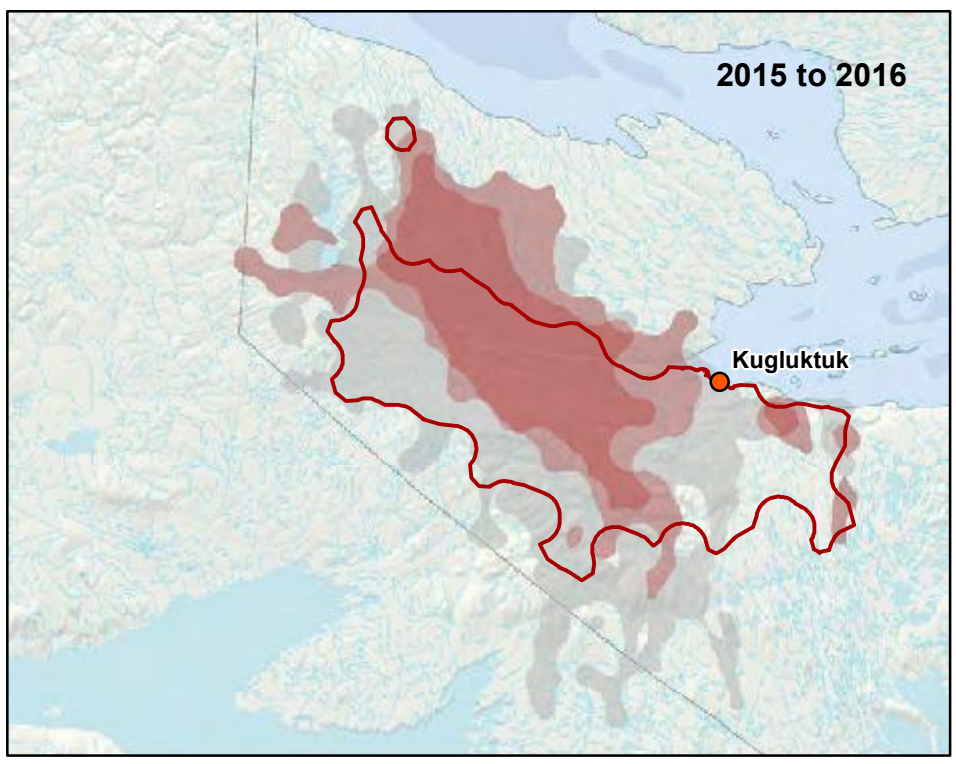












Legend

Calving Areas (1996 – 2016)

(Single Year) no overlap

Overlap

Caribou Calving Area (NPC Designation)

Bluenose-East Caribou Herd Cumulative Calving Area

Estimated calving areas (28 May – 20 June) of the Bluenose-East caribou herd (1996 – 2016)

*Note: Date ranges represent two grouped time periods used in the analysis: 1996 - 2000 and 2001 - 2005.

Project data displayed is site specific. Caribou calving areas developed by EDI from data obtained by Government of the Northwest Territories – Environment & Natural Resources (2016).

1,000,000 Topographic Spatial Data provided by Natural Resources Canada via online source geogratis.cgdi.gc.ca.

Disclaimer: This is not an official land survey and the spatial data presented is subject to change.

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Kilometres

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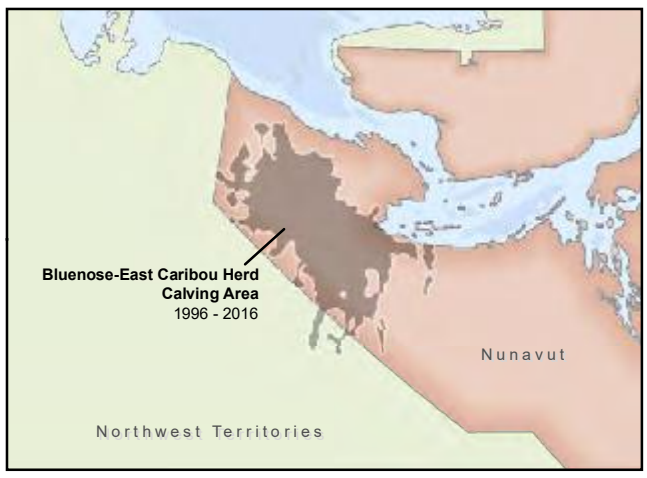

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2015
2016
1996-2000
2006
2010
2013
2014
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2011
2007
2001-2005
2009

Richardson Bay
Kugluktuk
DISMAL LAKES
COPPERMINE RIVER
Napaktulik Lake
Northwest Territories
Nunavut

Legend

- Northern Limit of Timoney Treeline Transition Zone
- Caribou Calving Area (NPC Designation)

Overlap of Calving Areas (1996 - 2016)

High
Low

Centre of Calving Area (1996 - 2016)*

1996 — darker by year — 2016

Cumulative calving areas (28 May – 20 June) of the Bluenose-East caribou herd (1996 – 2016)

Data Sources

*Collar data from 1996 - 2000 (grouped) and 2001 - 2005 (grouped) are considered two separate year classes.

Project data displayed is site specific. Caribou calving areas developed by EDI from data obtained by Government of the Northwest Territories – Environment & Natural Resources (2016).

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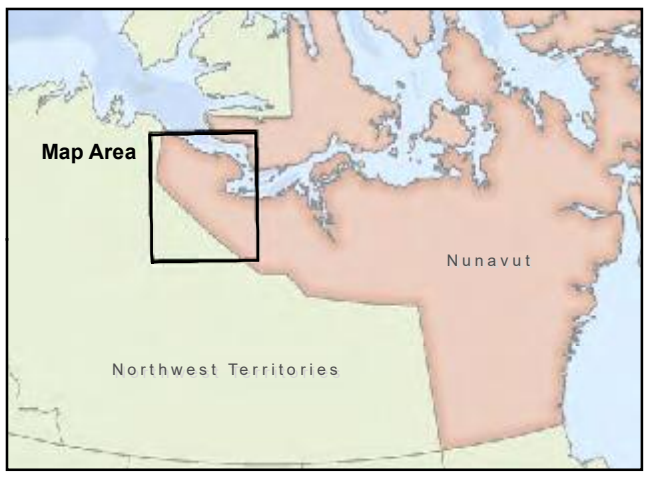

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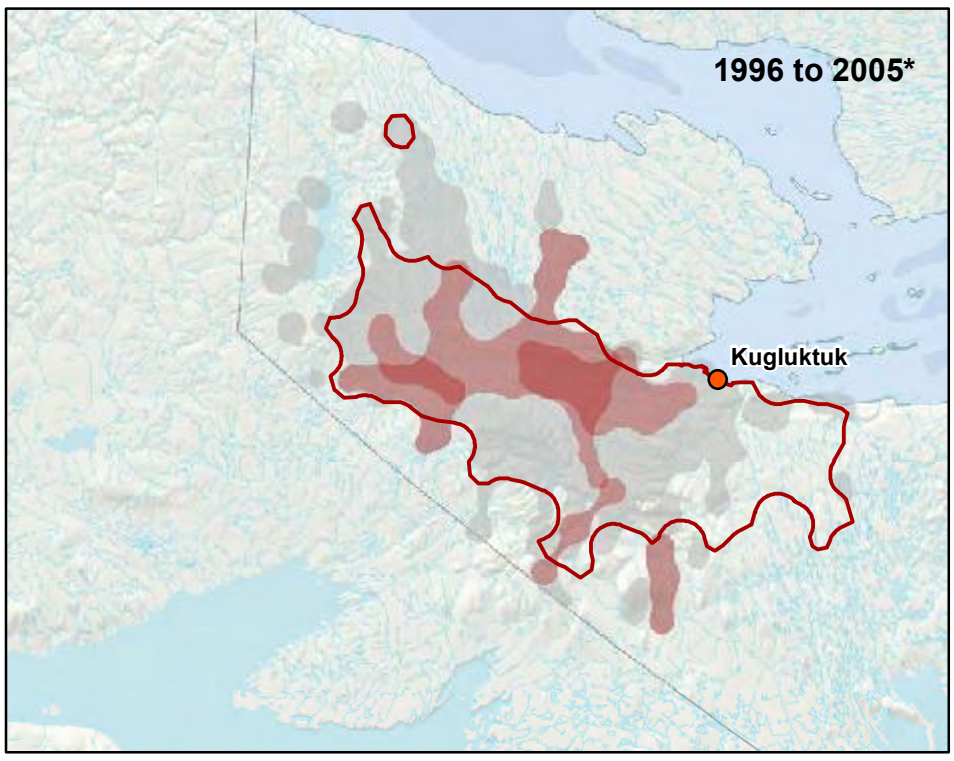

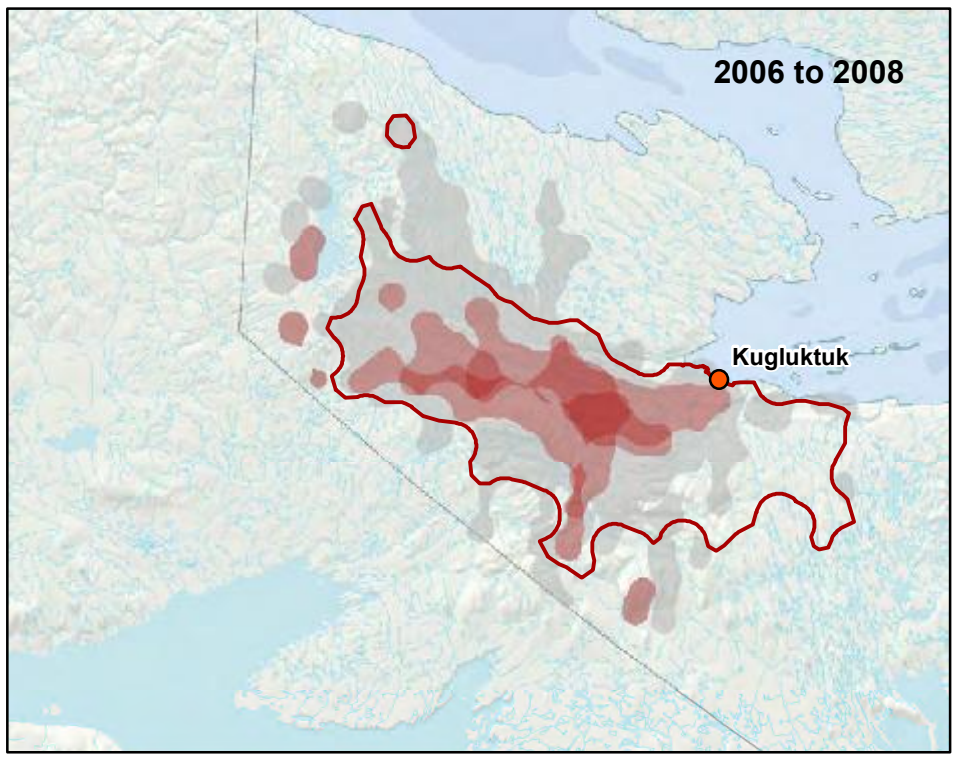

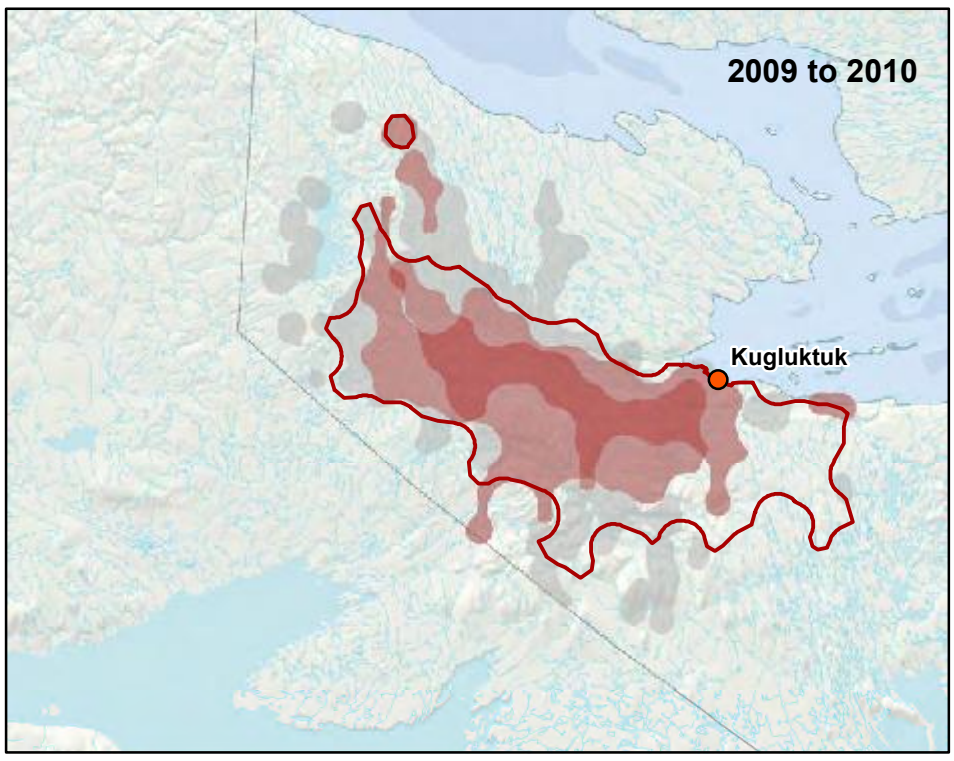

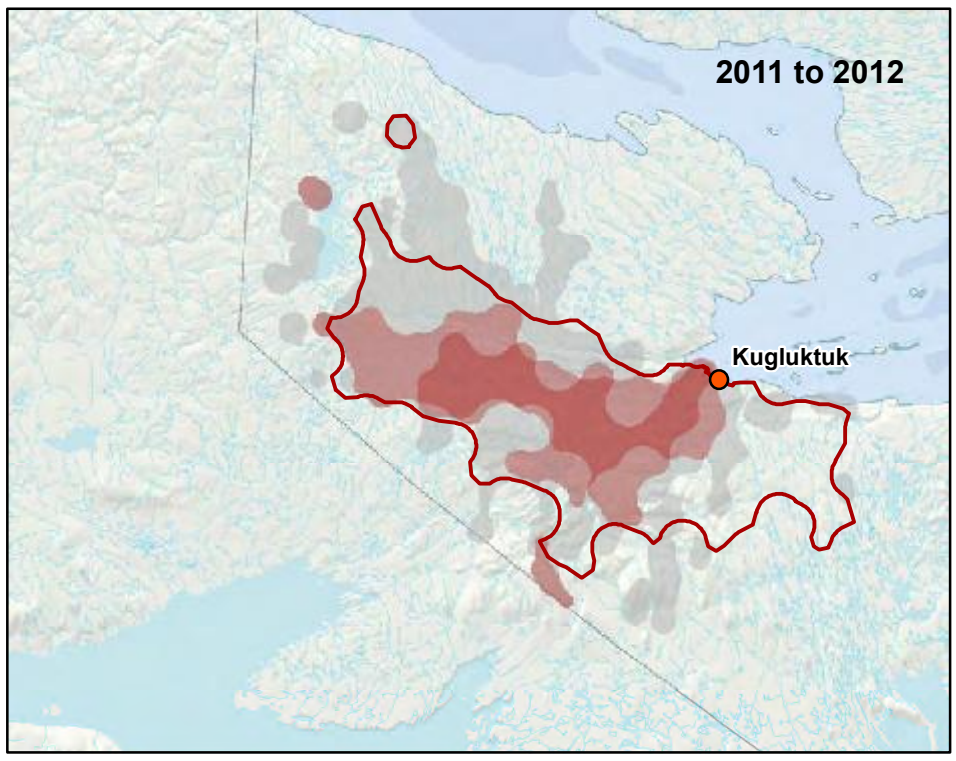

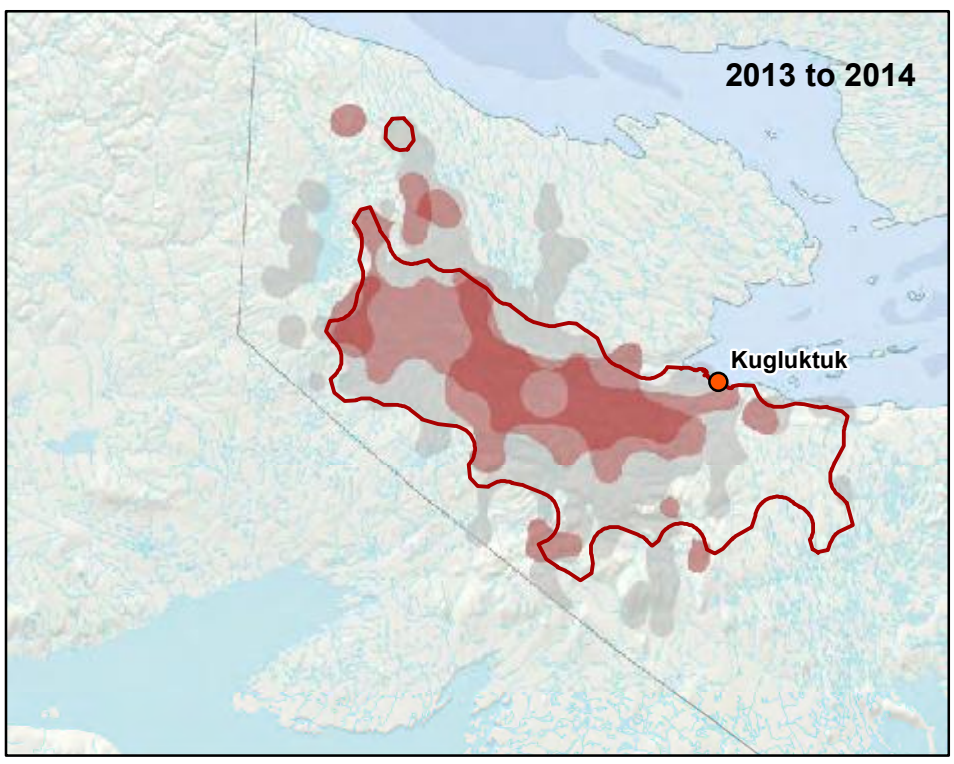

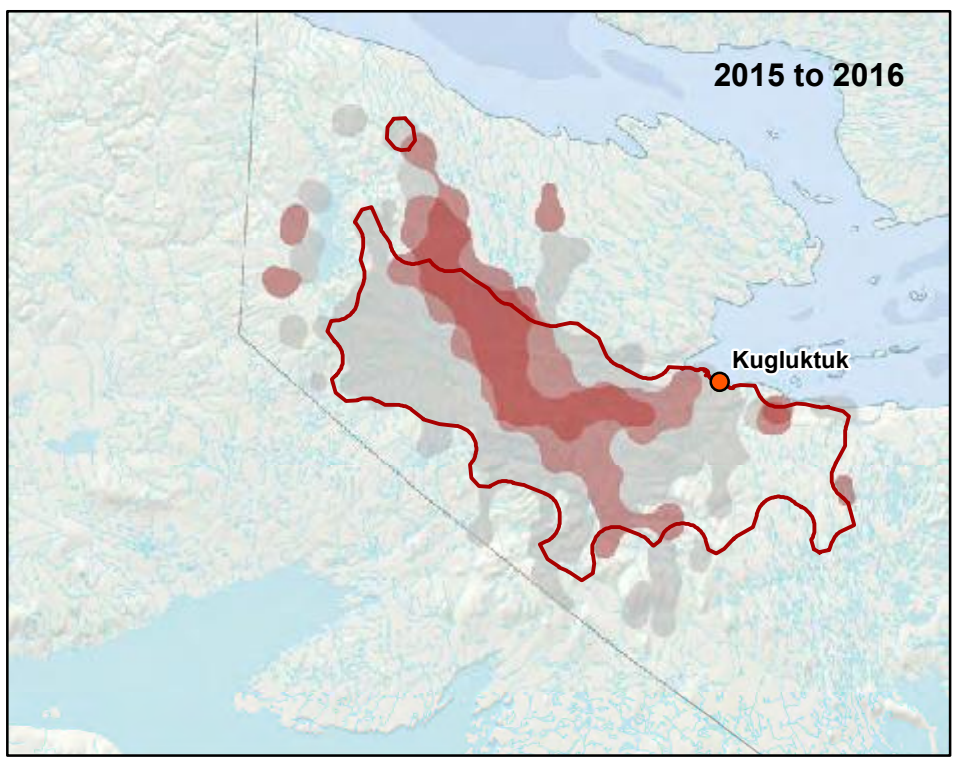

Legend

Peak Calving Area (1996 – 2016)

(Single Year) no overlap

Overlap

Calving Area (NPC Designation)

Bluenose-East Caribou Herd Cumulative Peak Calving Area

Estimated peak calving areas of the Bluenose-East caribou herd (1996 – 2016)

*Note: Date ranges represent two grouped time periods used in the analysis: 1996 - 2000 and 2001 - 2005.

Project data displayed is site specific. Caribou calving areas developed by EDI from data obtained by Government of the Northwest Territories – Environment & Natural Resources (2016).

1,000,000 Topographic Spatial Data provided by Natural Resources Canada via online source geogratis.cgdi.gc.ca.

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Kilometres

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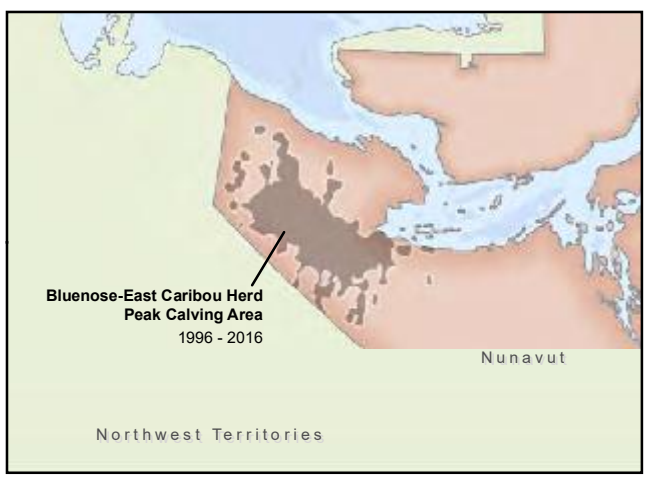

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2015
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1996-2000
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2008
2001-2005

Richardson Bay
Kugluktuk

DISMAL LAKES

COPPERMINE RIVER

Northwest Territories
Nunavut

Legend

- Northern Limit of Timoney Treeline Transition Zone
- Caribou Calving Area (NPC Designation)

Overlap of Peak Calving Areas (1996 - 2016)

High
Low

Centre of Peak Calving Area (1996 - 2016)*

1996 — darker by year — 2016

Cumulative peak calving areas of the Bluenose-East caribou herd (1996 – 2016)

Data Sources

*Collar data from 1996 - 2000 (grouped) and 2001 - 2005 (grouped) are considered two separate year classes.

1:250,000 and 1,000,000 Topographic Spatial Data provided by Natural Resources Canada via online source geogratis.cgdi.gc.ca.

Project data displayed is site specific. Caribou calving areas developed by EDI from data obtained by Government of Northwest Territories – Environment & Natural Resources Branch (2016).

Disclaimer: This is not an official land survey and the spatial data presented is subject to change.

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Kilometres

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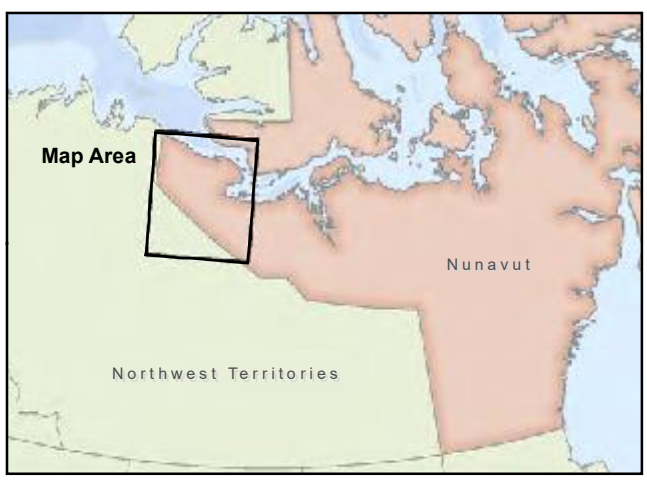

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Aurora Wildlife Research

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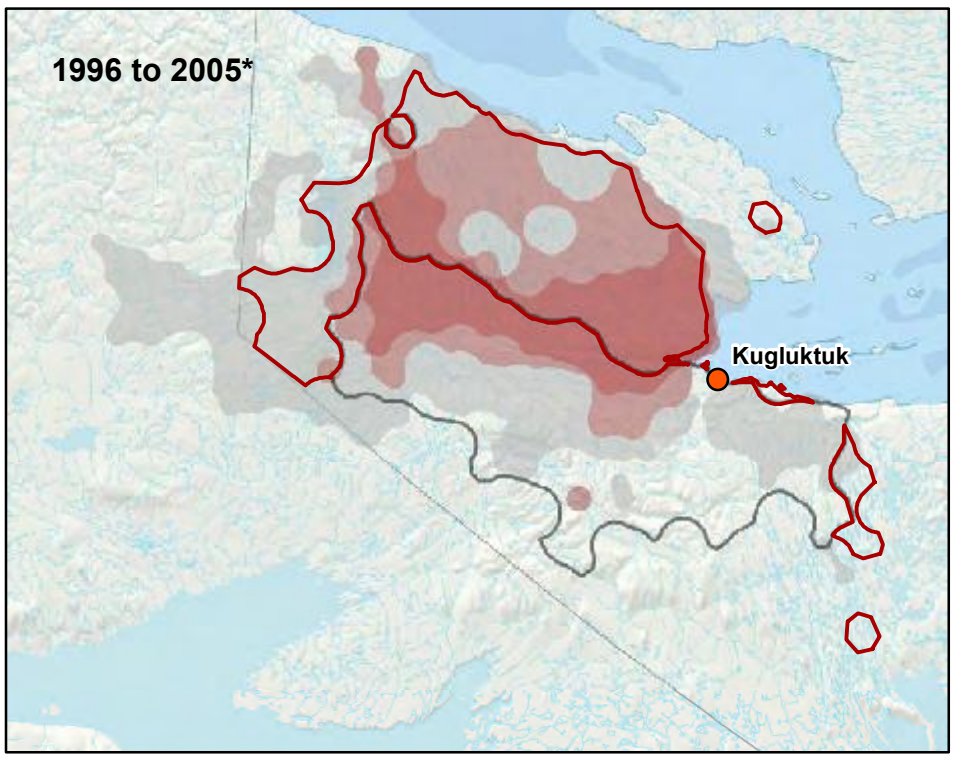

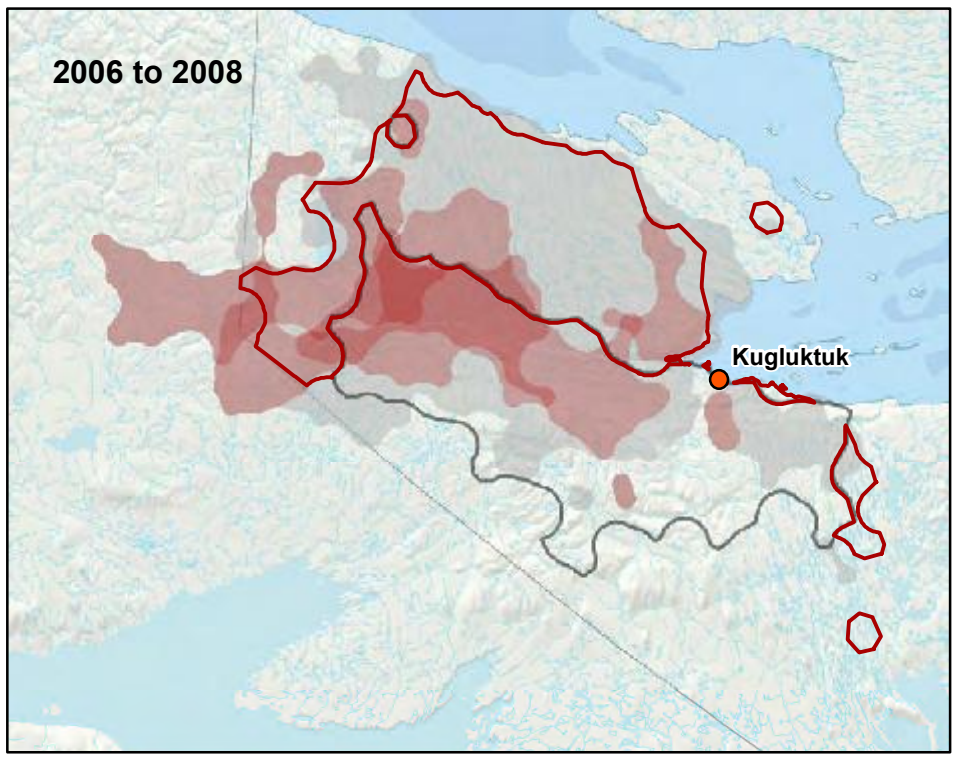

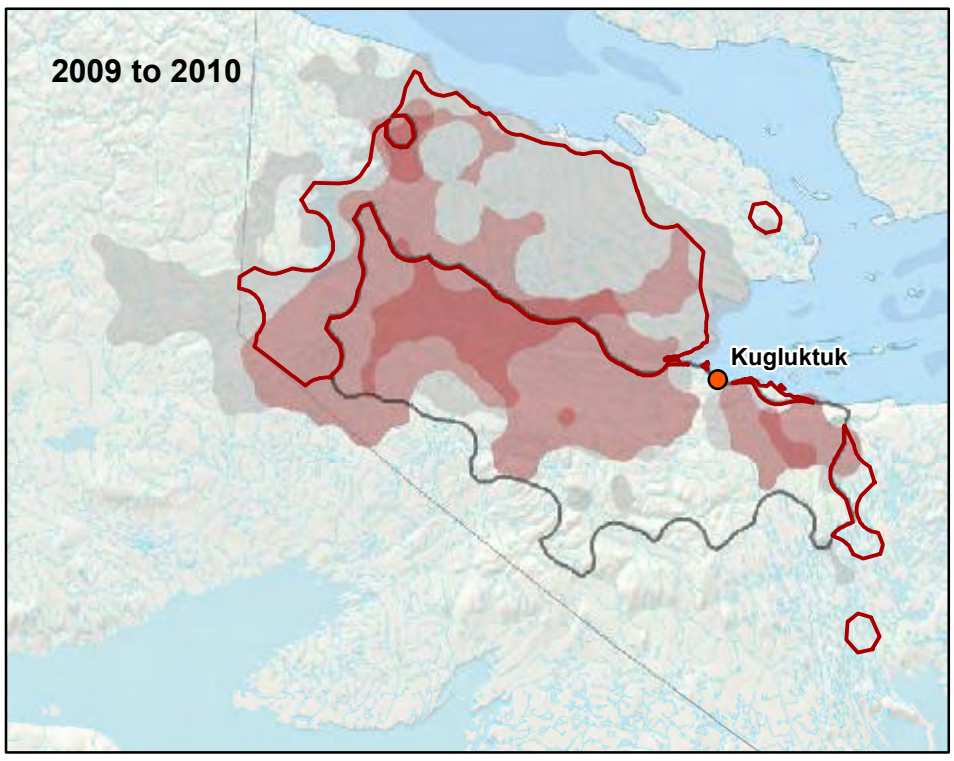

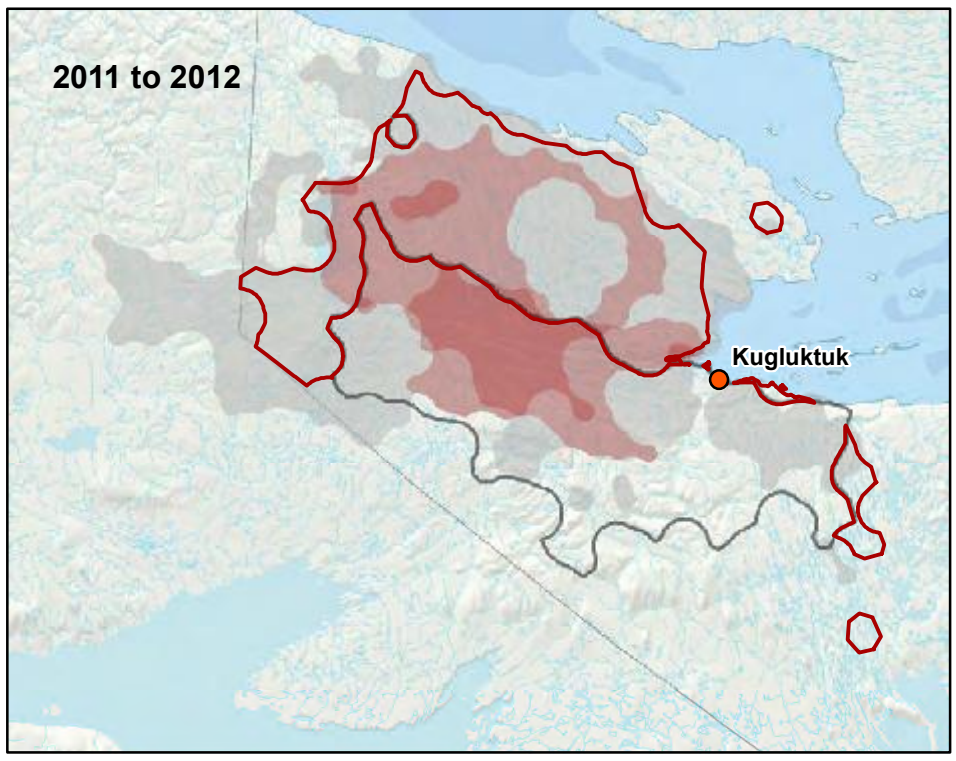

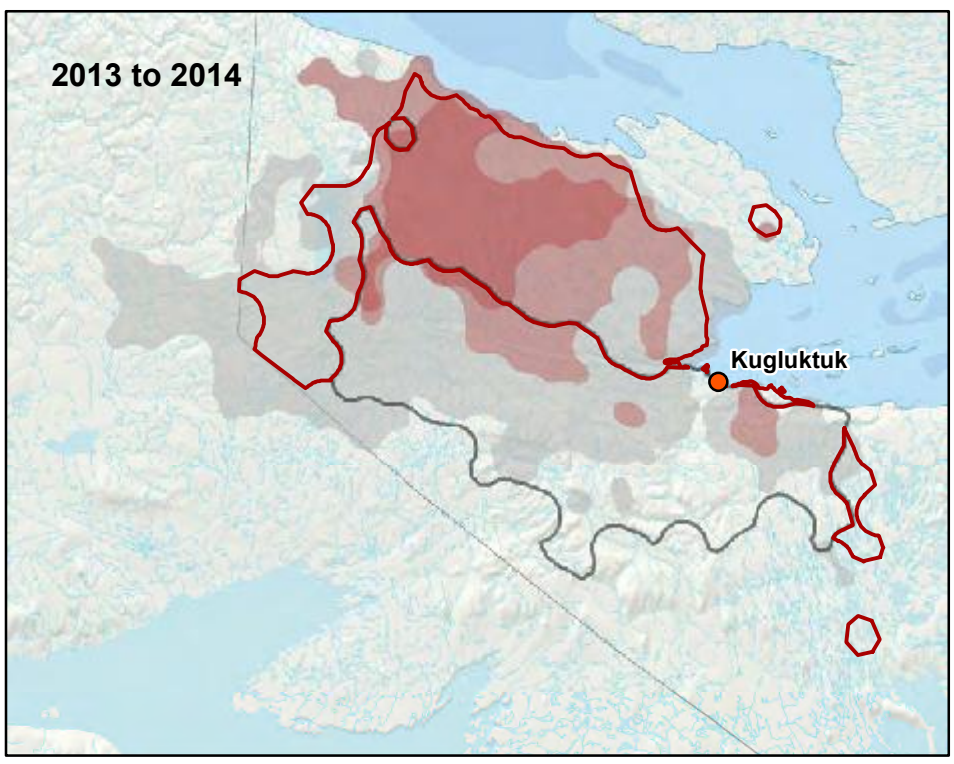

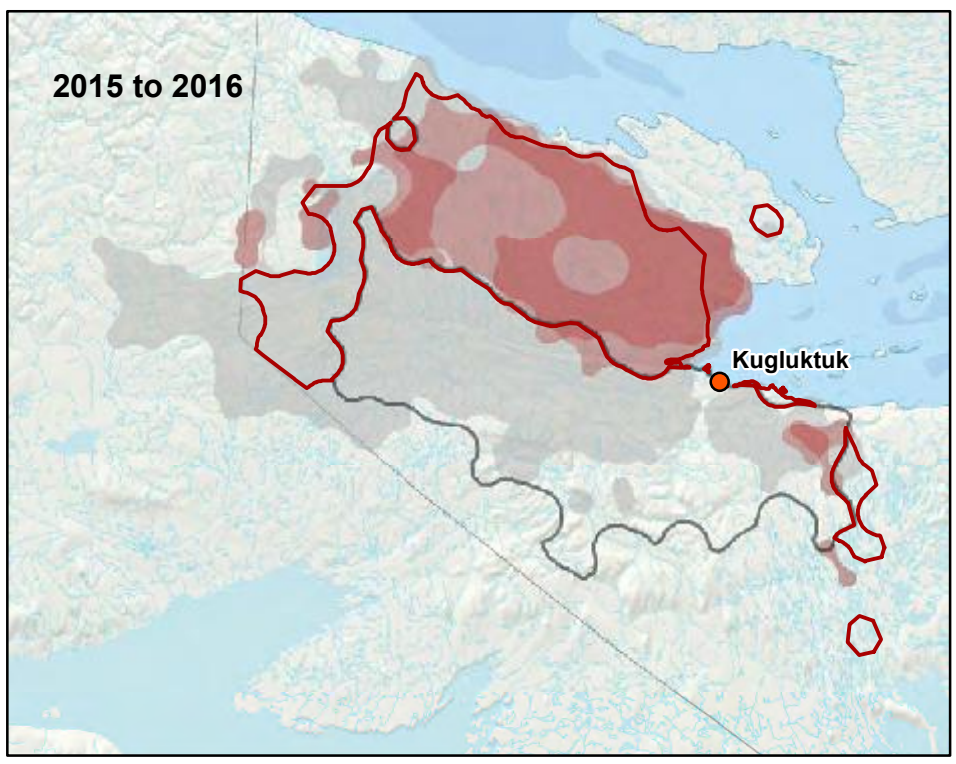

Legend

Post–Calving Areas (1996 – 2016)

(Single Year) no overlap

Overlap

Caribou Calving Area (NPC Designation)

Caribou Post-Calving Area (NPC Designation)

Bluenose East Caribou Herd Cumulative Post-Calving Area

Estimated post-calving areas (21 June – 3 July) of the Bluenose–East caribou herd (1996 – 2016)

*Note: Date ranges represent two grouped time periods used in the analysis: 1996 - 2000 and 2001 - 2005.

Project data displayed is site specific. Caribou calving areas developed by EDI from data obtained by Government of the Northwest Territories – Environment & Natural Resources (2016).

1:250,000 and 1,000,000 Topographic Spatial Data provided by Natural Resources Canada via online source geogratis.cgdi.gc.ca.

Disclaimer: This is not an official land survey and the spatial data presented is subject to change.

0 50 100 150 200

Kilometres

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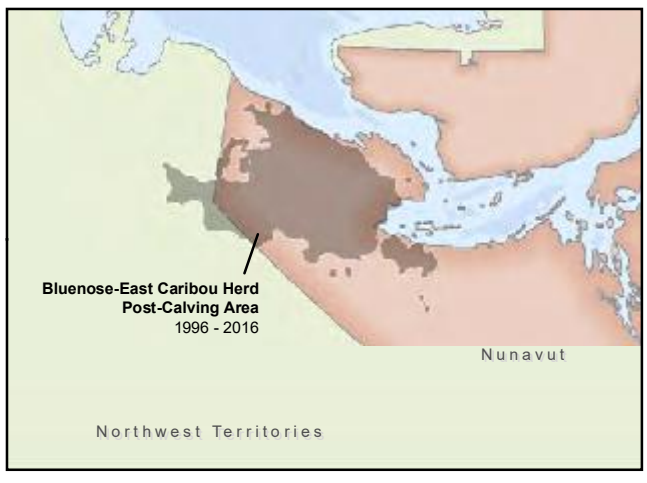
Map Projection: North American Datum 1983 UTM Zone 11N



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MP	KR / KP		

Aurora Wildlife Research

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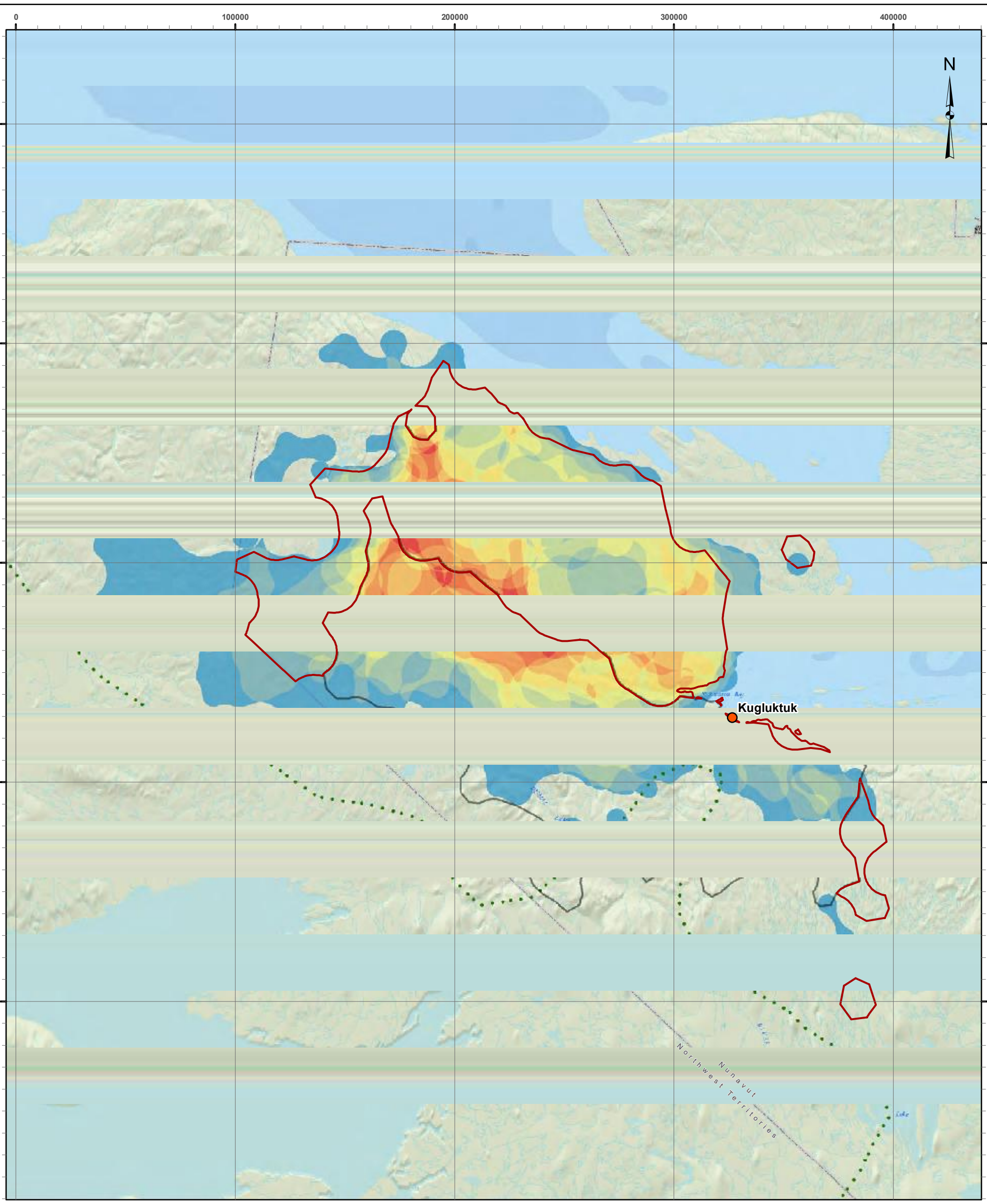
Path: O:\2016\16Y0408_KitIA_DNLUP_Review\GIS\FinalMaps\Map5_BNE_PostCalvingGrounds.mxd



Legend

- Northern Limit of Timoney Treeline Transition Zone
- Caribou Calving Area (NPC Designation)
- Caribou Post-Calving Area (NPC Designation)

Overlap of Post-Calving Areas (1996 - 2016)

High

Low

Cumulative post-calving areas of the Bluenose-East caribou herd (1996 – 2016)

Data Sources

1:250,000 and 1,000,000 Topographic Spatial Data provided by Natural Resources Canada via online source geogratis.cgdi.gc.ca.

Project data displayed is site specific. Caribou calving areas developed by EDI from data obtained by Government of Northwest Territories – Environment & Natural Resources Branch (2016).

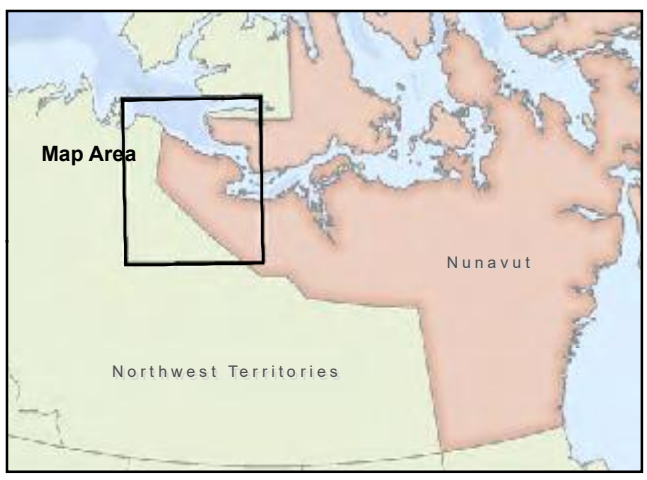
Disclaimer: This is not an official land survey and the spatial data presented is subject to change.

0 25 50 75 100

Kilometres

Reference Scale: 1:1,750,000 (printed on 11" x 17")

Map Projection: North American Datum 1983 UTM Zone 12N



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Drawn:	Checked:		
MP	KR / KP	Map 6	Date: 12/20/2016

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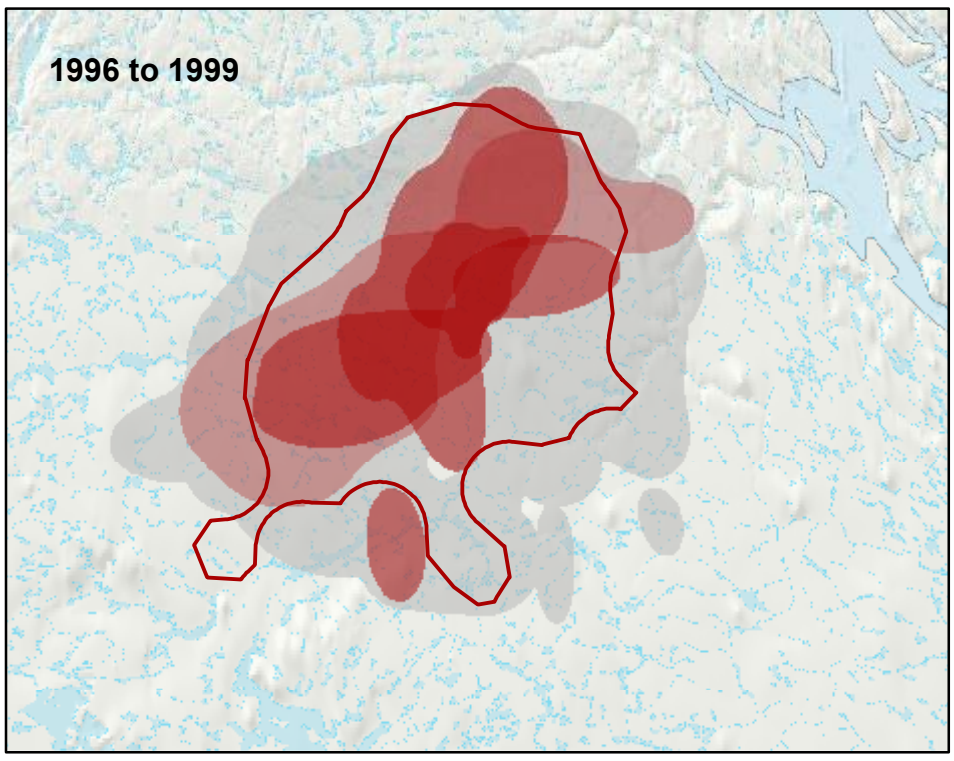
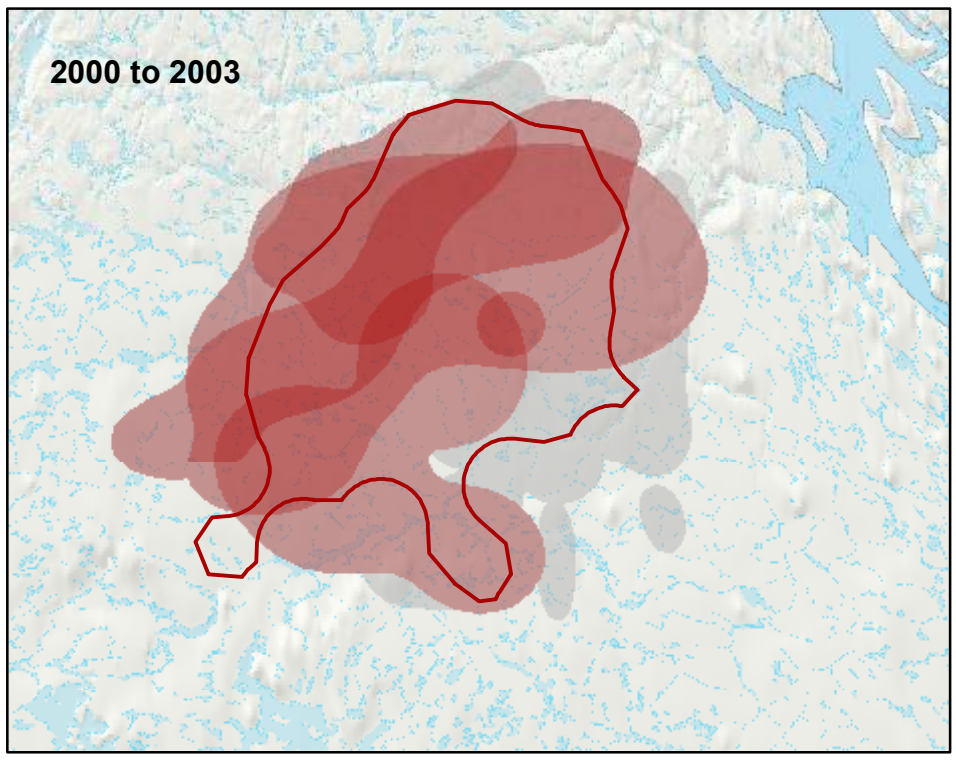
3.2 BATHURST CARIBOU

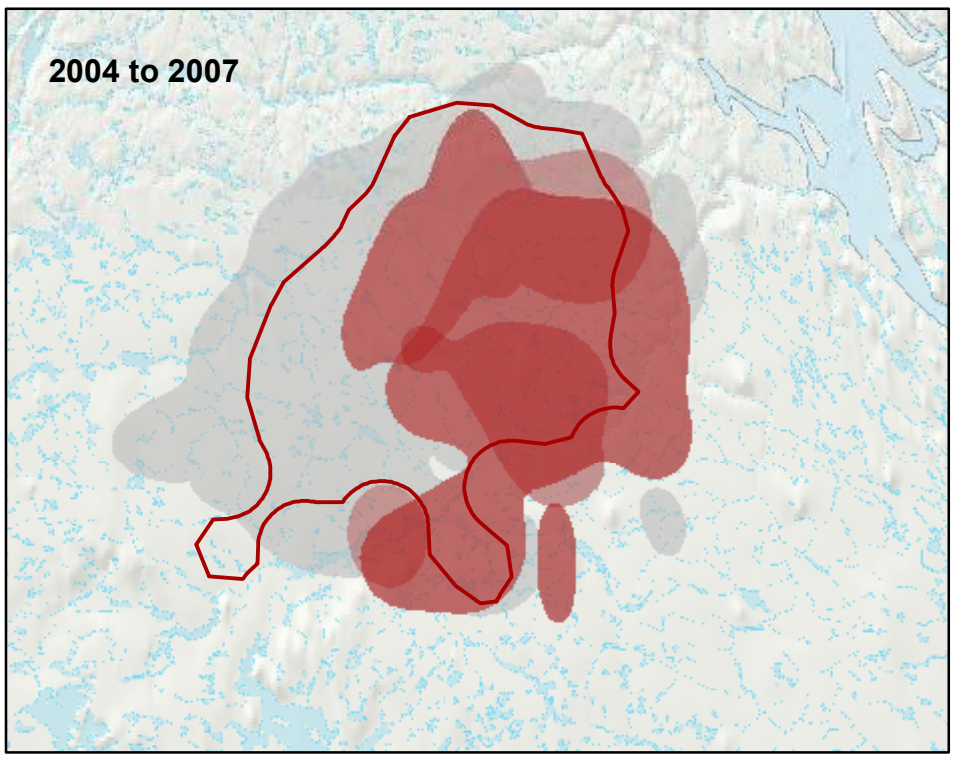
The GNWT began surveys of the Bathurst caribou herd's calving areas in 1965, largely in response to the increase of exploration and development activity in the vicinity of calving areas (Sutherland and Gunn 1996). In 1977 and 1979 caribou were observed calving west of Bathurst Inlet (Fleck and Gunn 1982); however, the majority of the herd calved east of Bathurst Inlet up to the mid-1980s, and between 1986 and 1996 calving area use had shifted to west of the inlet, roughly around the Hood and Burnside rivers (Sutherland and Gunn 1996). This shift in calving areas was also observed by Inuit knowledge holders (Hagialok 1998; Kapolak 1998; Akana 1998 in Thorpe et al. 2001). With the population peak in 1986, this shift was attributed to increased density of calving cows in the calving area (east of Bathurst Inlet), possibly leading to increased forage competition and risk of parasitism, ultimately causing a shift to calving areas in the west that were not as recently highly used (Gunn et al. 2013).

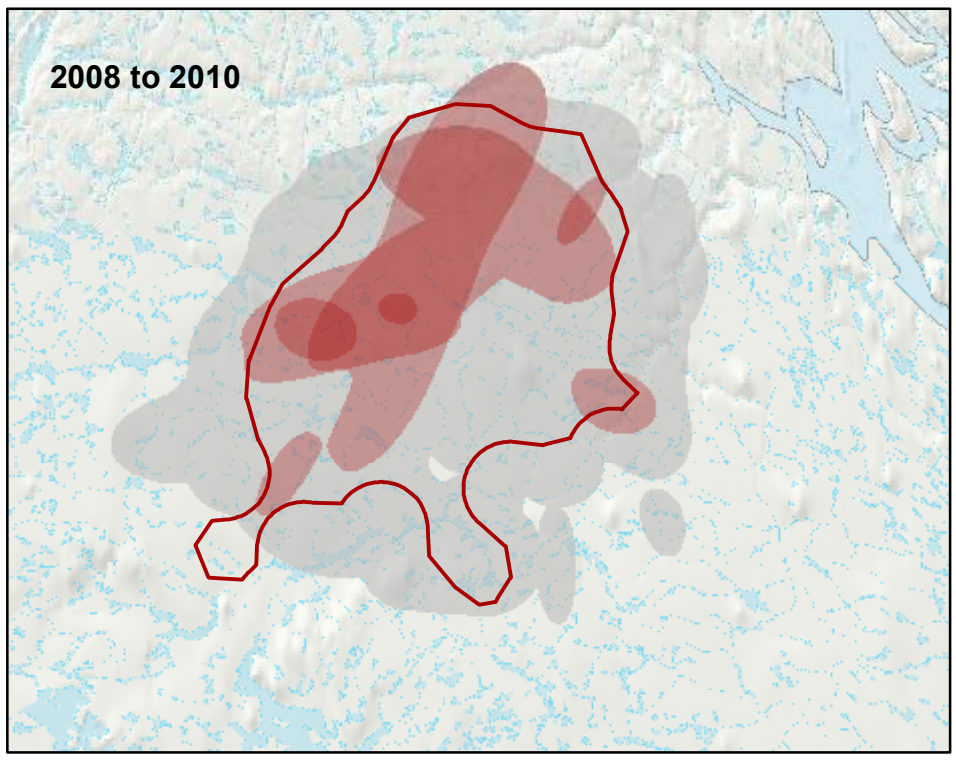
From 1966 to 1996, the Bathurst herd's peak of calving was estimated to occur throughout a five day period between 3 and 15 June (Sutherland and Gunn 1996), with estimates of peak of calving as late as 18 June (Gunn et al. 2008). Since 1996, the Bathurst calving area has remained west of Bathurst Inlet and centred around the Hood River (Gunn et al. 2008), with some year-to-year latitudinal variation between the Burnside and James rivers (Map 7). From 1996 to 2009, peak of calving was estimated to occur between 4 and 12 June (Nagy 2011), with cows arriving in the vicinity of the calving areas between 20 May and 5 June (Gunn and Poole 2010). From 2008–2016, the peak of calving date ranged from 1–10 June (Table 2).

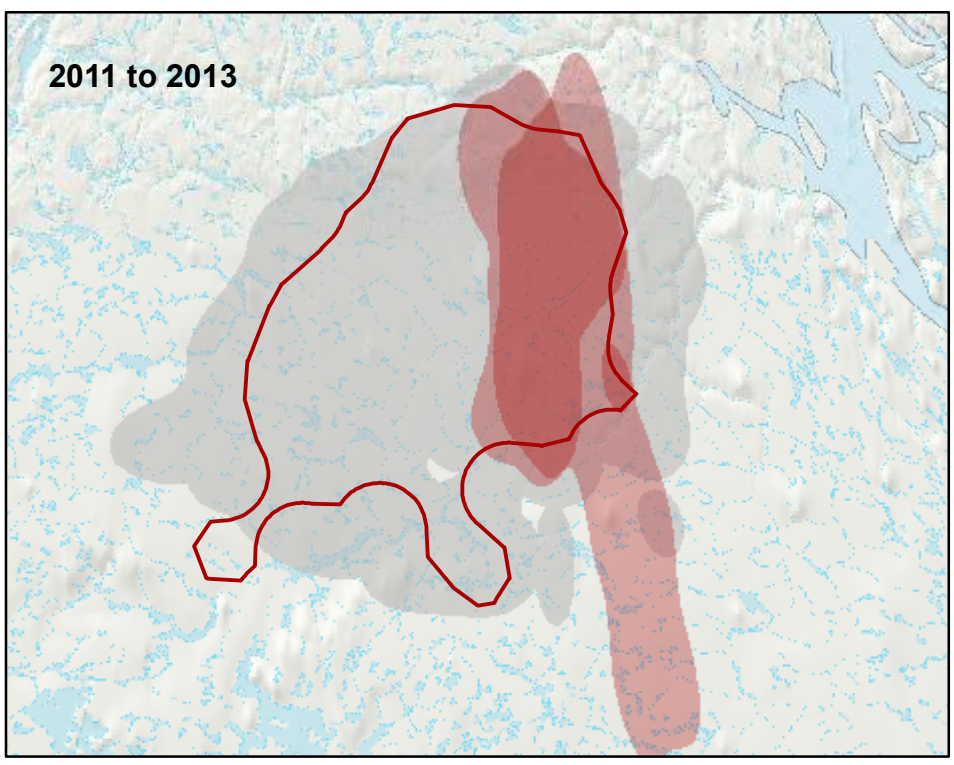
The BAH peak calving area in most years used only a portion of the DNLUP areas for calving, and in some years extended beyond the mapped boundary (Map 7). Annually, there was a notable shift to the eastern edge of the area beginning in 2011. The concentrated peak calving areas show an area of greatest overlap centred in the central and northeast portions of the DNLUP polygon (Map 8). The average overlap of annual peak calving areas for the BAH herd from 1996 to 2007 was 32% (±4.0%) with no consistent directional shift (Gunn et al. 2008), and increased to an average of 49% (±3.1%) from 2008–2016 (Table 1), with an apparent directional shift to the east (Map 7). The average annual overlap was 39% (±3.2%) over all years (1996–2016).

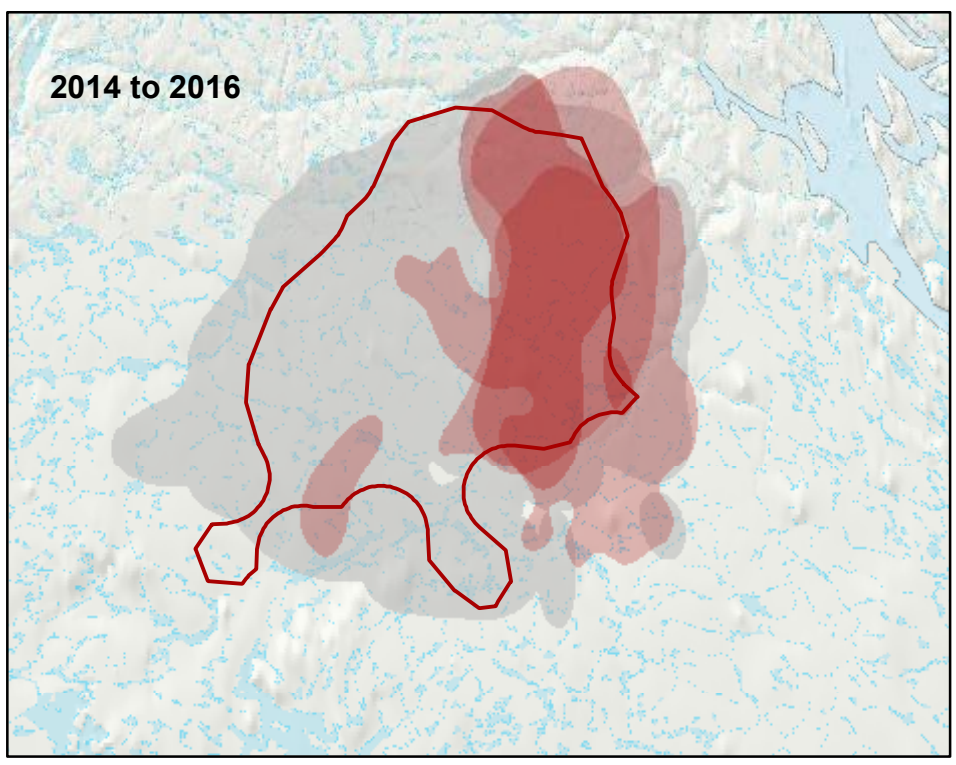












Legend

Peak Calving Areas (1996 – 2016)

(Single Year) no overlap

Overlap

Caribou Calving Area (NPC Designation)

Bathurst Caribou Herd Cumulative Peak Calving Area

Estimated peak calving areas of the Bathurst caribou herd (1996 – 2016)

Data Sources

Project data displayed is site specific. Caribou calving areas developed by EDI from data obtained by Government of the Northwest Territories – Environment & Natural Resources (2016).

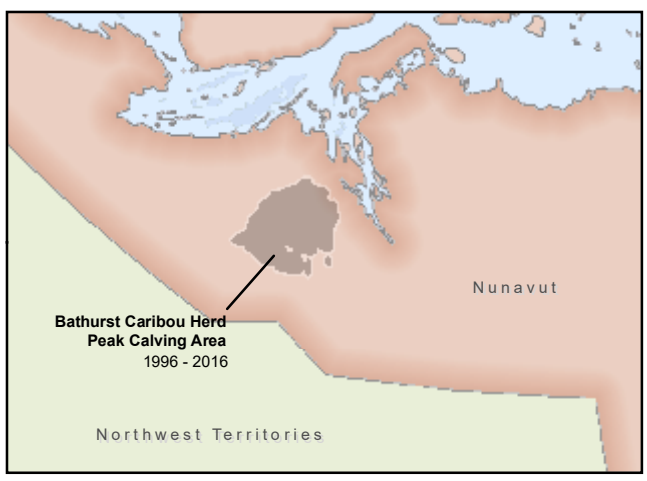
1:250,000 and 1,000,000 Topographic Spatial Data provided by Natural Resources Canada via online source geogratis.cgdi.gc.ca.

Disclaimer: This is not an official land survey and the spatial data presented is subject to change.

0 25 50 75 100

Kilometres

Map Scale = 1:1,800,000 (printed on 11 x 17)
Map Projection: North American Datum 1983 UTM Zone 12N



Drawn:	Checked:		
MP	KR / KP	Map 7	Date: 12/20/2016

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500000
600000
7500000
7400000
7300000

TREE RIVER
RIVER
ARCTIC SOUND
JAMES RIVER
RIVER
HOOD
Lake
Contwoyto Lake
Rockinghorse Lake
Nunavut
Northwest Territories

N

2016
2002
2014
2013
2011
2001
2009
2007
1996
2015
1997
2012
2004
1999
2010
2008
2003
1998
2005
2006
2000

Legend

- Northern Limit of Timoney Treeline Transition Zone
- Caribou Calving Areas (NPC Designation)

Overlap of Peak Calving Areas (1996 - 2016)

High
Low

Centre of Peak Calving Area (1996 - 2016)

1996 — darker by year — 2016

Cumulative peak calving areas of the Bathurst caribou herd (1996 – 2016)

Data Sources

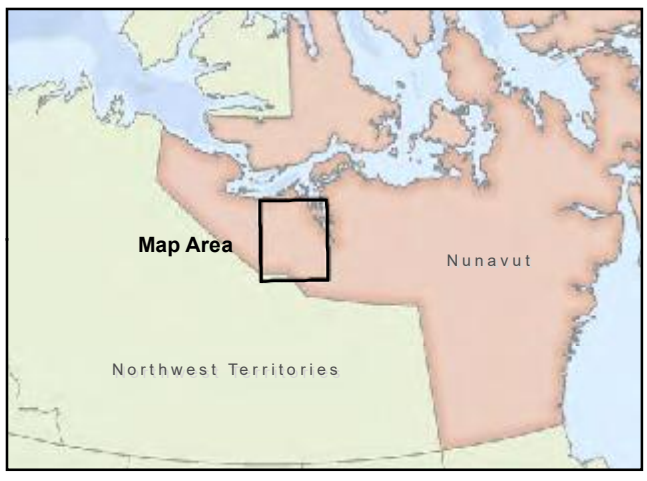
1:250,000 and 1,000,000 Topographic Spatial Data provided by Natural Resources Canada via online source geogratis.cgdi.gc.ca.

Project data displayed is site specific. Caribou calving areas developed by EDI from data obtained by Government of Northwest Territories – Environment & Natural Resources Branch (2016).

Disclaimer: This is not an official land survey and the spatial data presented is subject to change.

0 10 20 30 40 50
Kilometres

Reference Scale: 1:850,000 (printed on 11" x 17")
Map Projection: North American Datum 1983 UTM Zone 12N



Aurora Wildlife Research
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Drawn:	Checked:		
MP	KR / KP	Map 8	Date: 12/20/2016

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4 IMPLICATIONS

Caribou movements and use of areas reflects adaptability to annual and longer term changes in weather and forage availability (Bergerud et al. 2008). Caribou also adapt their use of areas as caribou herd size increases and decreases (Gunn et al. 2012). This adaptability of how and when caribou use areas, such as for calving and post-calving, creates uncertainties for mapping those areas for land use planning.

The timing of calving and subsequent dates for peak lactation and when the calf begins to forage independently determines the areas used as calving and post-calving areas. The timing of calving can vary by a few days each year depending on the cow's body reserves and annual changes in weather. For example, the range of median dates for the BAH herd calving is ten days earlier in 2016 compared to 2008, while the BNE herd dates have varied by only a few days for the same time period (Table 2). This means the timing used to define areas used for calving and post-calving can vary each year by a few days, or can vary by a week or more over the longer term, so dates used to derive area boundaries have to account for the likely spread or trends in calving dates.

As well as the variability in calving dates, how caribou cows annually use the calving areas varies by year. Snow conditions during pre-calving migration may delay the cows and they may calve before they reach the calving area used in previous years (Gunn and Poole 2010). Additionally, cows do not necessarily use the identical area for calving year after year as their fidelity is to the other calving cows and the 'general' area rather than specific sites. The annual variation in the calving areas may show a directional shift which is currently apparent at a small scale for both herds in recent years (Maps 2, 4, 8). Based on our overlap analysis with the DNLUP polygons (Figure 3), the polygons never encompass 100% of the seasonal range use, leaving considerable used areas (up to 53% and 82% during calving and post-calving, respectively) outside the designated boundaries in any given year and further highlighting the rigidity of the DNLUP boundaries. Before collared cows were used to monitor annual distribution of calving areas, monitoring was infrequent and annual directional shifts were not detected, giving the impression of jumps in calving distribution. Caution is warranted in interpreting potential shifts in calving areas as we may have not yet seen all the possible variations in calving distribution especially during severe declines (Gunn et al. 2012).

As well as the variability in the timing and use of peak calving areas, further uncertainty is that there are many ways to analyze and map the seasonal range use of caribou. The same dataset run using different assumptions about which cows to include (e.g., whether to include barren cows), and run through different statistical and GIS packages (i.e., ArcGIS vs. GME and R) can produce differing maps. For example, one key difference between the results of our calving analyses and the DNLUP designated calving area is the area to the east and southeast of Kugluktuk that was included in the DNLUP calving area polygon where we found limited to no use by calving cows (Map 1 and Map 3). Another difference is the scattered isolated polygons far from conventional calving areas, such as the polygons mapped north of Kugluktuk and near Napaktulik Lake (e.g., Map 2). The difference may be that an extremely long calving period (e.g., 23 days for the BNE) was selected for mapping, and that barren cows were included in the calculation of calving areas used in the DNLUP (J. Shaw, pers. comm.; Caslys Consulting Ltd. 2016). We suggest that mapping of calving areas should not include barren cows, which often lag far behind pregnant cows during spring

migration and often occur some distance from the calving areas during calving (Gunn et al. 2008). The area within the DNLUP calving polygon sparsely used by calving caribou to the southeast of Kugluktuk covers approximately 2,500 km^2 (Map 2). Use of calving date ranges based on clear terminology and definitions would facilitate more accurate mapping of these seasonal ranges.

In this report we have presented information for calving and post-calving areas for two mainland barren-ground caribou herds within the Kitikmeot Region. Treating these seasonal ranges as static entities can result in situations where some areas that currently have low or no use as a calving area (e.g., for the BNE, southeast of Kugluktuk) are unnecessarily protected from development activities, but more importantly, other areas that have experienced increasing recent use are not adequately protected (e.g., calving areas northwest of Kugluktuk for the BNE from 2013–2016). Our analyses also showed large areas within the cumulative maps that are unused in many years. This pattern of use would lend itself to use of mobile protection measures as a more responsive way of managing disturbance to calving and post-calving caribou.

Although the concept of concentrated calving or post-calving areas certainly has merit, how this area is delineated and applied in land use planning must be carefully considered. We suggest calving areas be defined by determining areas that are consistently used by a certain density of calving cows (e.g., 5 females/km^2; Taillon et al. 2012) over a discrete period of time (e.g., 5–10 years) and are applied in combination with mobile protection measures that account for annual variability in use (e.g., Poole and Gunn 2015). As a key component of the land use planning process, it should be understood that these areas of concentrated annual use may change over time and thus should be re-examined regularly.

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6 AUTHORS' TECHNICAL QUALIFICATIONS

Kelsey Russell (B.Sc., M.Sc. candidate, EDI Environmental Dynamics Inc., Whitehorse, YT) has taken on roles in a variety of disciplines including environmental impact assessment, wildlife and habitat research and monitoring, modelling, and GIS analyses. She has worked on numerous research projects and reports for various projects in Yukon, British Columbia, and Nunavut and has 5+ years of experience working on wildlife in the north, with a focus on barren-ground and woodland caribou herds. Kelsey has conducted field work and research projects for a number of organizations and throughout her experiences, has become very familiar with national and regional regulatory and research agencies and individuals. She is also currently a Master's of Science candidate at the University of Northern British Columbia studying the effects of wildfire on caribou habitat selection strategies.

Kim Poole (M.Sc., R.P.Bio., C.W.B., Aurora Wildlife Research, Nelson, BC). Kim has 35 years of wildlife research and management experience in northern and western Canada, 15 years of which was spent in Yellowknife with the territorial government. He has considerable experience with caribou in both British Columbia and NWT/Nunavut, having worked on impact assessments, movement and distribution modeling, survey design and implementation, surveys, habitat studies and methods to reduce impacts to wildlife. Kim has conducted numerous reviews of environmental impact assessments for all three Regional Inuit Organizations in Nunavut and a number of other Aboriginal organizations. Kim has strong experience in study design, data analysis, and report writing, as demonstrated in authorship in over 50 refereed journal articles.

Mike Setterington (M.Sc., R.P.Bio., C.W.B., EDI Environmental Dynamics Inc., Whitehorse, YT) is a senior terrestrial biologist who has worked since 1995 on projects related to wildlife and bird ecology, habitat management, impact assessment, and post-environmental assessment monitoring in western and northern Canada. He has managed a number of projects related to environmental assessments and has coordinated the submission of technical reports to environmental and socio-economic impact review boards. Mike has experience both as a government regulator/expert witness and as a project proponent representative. He was also the technical regulator at several mining project hearings and was the Government of Nunavut representative on a number of Federal/Provincial/Territorial working groups including those for wildlife recovery planning, species at risk, and protected areas planning.

Matt Power (A.Sc.T, EDI Environmental Dynamics Inc., Whitehorse, YT) is a Senior Technologist, Project and GIS Manager with EDI. He has worked in the natural resources sector as a technologist for over 16 years and has considerable experience in environmental assessment and monitoring relating to wildlife, fisheries and vegetation. His biological background provides a distinct advantage to his primary role as EDI's Geographic Information Systems (GIS) Manager. Matt supports GIS production, administration and technical assistance to all EDI offices. His experience in GIS includes database development and maintenance, data (spatial/non-spatial) interpretation, manipulation and analysis (including remote sensing) of vector/raster formats and production of map displays, graphics and illustration. He has worked extensively in the ArcGIS platform while integrating analytical extensions such as Spatial Analyst and 3D Analyst.

APPENDIX A. DATA USED IN ANALYSES

Table 3. Number of collared female Bluenose-East caribou (*with number of locations*) used in the delineation of calving (28 May–20 June) and post-calving (21 June–3 July) seasonal ranges, 1996–2016.

Year	Satellite	GPS	Total	Total locations (rarefied)
1996	5	-	5	100
1997	5	-	5	120
1998	5	-	5	100
1999	4	-	4	96
2000	3	-	3	71
2001	0	-	0	0
2002	0	-	0	0
2003	3	-	3	12
2004	3	-	3	13
2005	8	-	8	134
2006	7*(106)*	6*(141)*	13	247
2007	9*(150)*	3*(71)*	12	221
2008	12*(215)*	16*(384)*	28	599
2009	23*(339)*	18*(423)*	41	762
2010	17*(396)*	22*(527)*	39	923
2011	7*(123)*	15*(359)*	22	482
2012	20*(480)*	25*(587)*	45	1067
2013	10*(239)*	16*(382)*	26	621
2014	4*(94)*	20*(427)*	24	521
2015	4*(91)*	28*(635)*	32	726
2016	5*(111)*	31*(705)*	36	816

Table 4. Number of collared female Bathurst caribou (*with number of locations*) used in the delineation of annual and peak calving seasonal ranges, 1996–2016.

Year[1]	Annual calving		Peak calving	
	Satellite	GPS	Satellite	GPS
1996	9	-	9	-
1997	7	-	7	-
1998	2	-	2	-
1999	12	-	12	-
2000	11	-	11	-
2001	10	-	10	-
2002	11	-	11	-
2003	10	-	10	-
2004	5	-	5	-
2005	12	-	12	-
2006	14	-	14	-
2007	19	-	19	-
2008	12 *(203)*	-	12 *(42)*	-
2009	1 *(28)*	9 *(723)*	1 *(7)*	9 *(58)*
2010	2 *(56)*	13 *(732)*	2 *(14)*	13 *(188)*
2011		17 *(1,040)*		17 *(355)*
2012		18 *(1,066)*		18 *(377)*
2013		12 *(515)*		12 *(238)*
2014		17 *(780)*		17 *(344)*
2015		31 *(1,529)*		31 *(707)*
2016		19 *(1,049)*		19 *(493)*

[1]Data from 1996–2007 is derived from Gunn et al. (2008) and does not include number of locations.

Table 5. Caribou removed from calving and post-calving analyses.

Year	Caribou ID	Reason
Bluenose-East caribou		
2000	BE16565	Suspected non-breeder
2004	151	Removed one erroneous location (animal retained for analysis)
	159	Removed one erroneous location (animal retained for analysis)
2008	1015	Calved in BAH calving area
	1114	Data limited; could not determine breeding status
	1708	Calved in BAH calving area
2009	1019	Suspected non-breeder
	7051	Suspected non-breeder
	7053	Calved in BAH calving area
	7099	Suspected non-breeder
	BG209	Suspected non-breeder
	BG214	Suspected non-breeder
2010	210	Removed one erroneous location (animal retained for analysis)
	1023	Calved in BAH calving area
	1606	Suspected non-breeder
	7024	Suspected non-breeder
	7044	Suspected non-breeder /potential collar failure or mortality
	7062	Calved in BAH calving area
	7101	Suspected non-breeder
2011	7101	Suspected non-breeder
2012	1604	Suspected non-breeder
2016	BGCA12514	Calved in BNW calving area
	BGCA12515	Suspected non-breeder
	BGCA12517	Calved in BNW calving area
Bathurst caribou		
1999[1]	127	Outlier
2000[1]	128	Outlier
2001[1]	105	Outlier
	126	Outlier
	124	Outlier
2003[1]	137	Outlier
2004[1]	156	Outlier
2005[1]	171	Suspected non-breeder
	184	Suspected non-breeder
	185	Suspected non-breeder
	191	Suspected non-breeder
	192	Suspected non-breeder

Year	Caribou ID	Reason
2009	BG209	Suspected non-breeder; located near BNE calving area
	BG212	Outlier
2010	BG225	Outlier
	BG233	Suspected non-breeder
	BG248	Suspected non-breeder
	BG249	Suspected non-breeder
2012	BG236	Suspected non-breeder /potential collar failure or mortality
	BGCA12489	Outlier
2013	BGCA12489	Suspected non-breeder
2014	BGCA12489	Suspected non-breeder
2016	BGCA16112	Data limited; could not determine breeding status
	BGCA16113	Data limited; could not determine breeding status
	BGCA16114	Data limited; could not determine breeding status
	BGCA16116	Data limited; could not determine breeding status
	BGCA16117	Data limited; could not determine breeding status
	BGCA16119	Data limited; could not determine breeding status
	BGCA16121	Data limited; could not determine breeding status

[1]Outliers removed from 1996–2007 were determined by Gunn et al. (2008)
Note: All collared male caribou were removed from all databases

Appendix 3

WILDLIFE ACT

CONSOLIDATION OF CRITICAL WILDLIFE AREAS REGULATIONS

R.R.N.W.T. 1990,c.W-3

AS AMENDED BY

R-083-98 (CIF 98/08/01)

LOI SUR LA FAUNE

CODIFICATION ADMINISTRATIVE DU RÈGLEMENT SUR LES AIRES FAUNIQUES CRITIQUES

R.R.T.N.-O. 1990, ch. W-3

MODIFIÉ PAR

R-083-98 (EEV 1998-08-01)

CRITICAL WILDLIFE AREAS REGULATIONS

1. The critical wildlife areas shall be delimited in accordance with the descriptions in the Schedule and shall be known by the names respectively assigned to them.

2. Caribou calving areas are critical wildlife areas during the period of May 25 to June 15 of every year.

RÈGLEMENT SUR LES AIRES FAUNIQUES CRITIQUES

1. Les aires fauniques critiques sont délimitées en conformité avec les descriptions contenues à l'annexe et sont désignées sous leurs noms respectifs.

2. Les aires de mise bas du caribou constituent des aires fauniques critiques entre le 25 mai et le 15 juin de chaque année.

SCHEDULE

CRITICAL WILDLIFE AREA I/CW/01 - BLUENOSE CALVING AREA

(a) All that portion of the Northwest Territories, as shown on the National Topographic Series Maps 97C of Franklin Bay, Edition 2 , 97F of Malloch Hill, Edition 3, 107D of Stanton, Edition 2 and 107E of Cape Dalhousie, Edition 2, produced at a scale of 1:250,000 by the Canada Map Office, Department of Natural Resources, Ottawa, and being more particularly described as follows:

(b) Commencing at a point on the low tide mark of Wood Bay at approximately 69°45′ N and approximately 128°48′18″ W;

(c) thence northeasterly and southeasterly following the low tide mark of Wood Bay, Harrowby Bay, Franklin Bay and Langton Bay to its intersection with approximately 69°19′11″ N and 125°30′ W;

(d) thence south along 125°30 ′ W to its intersection with the east bank of the Horton River at approximately 69°05′24″ N;

(e) thence northwesterly in a straight line to the point of commencement.

CRITICAL WILDLIFE AREA I/CW/02 - BLUENOSE CALVING AREA

(a) All that portion of the Northwest Territories, as shown on the National Topographic Series Maps 97A of Erly Lake , Edition 2 and 97D of Brock River, Edition 2, produced at a scale of 1:250,000 by the Canada Map Office, Department of Natural Resources, Ottawa, and being more particularly described as follows:

(b) Commencing at the point of intersection of 68° N and 123° W;

(c) thence north along 123° W to its intersection with the low tide mark of the mainland in Amundsen

ANNEXE

AIRE FAUNIQUE CRITIQUE I/CW/01 - AIRE DE MISE BAS DE BLUENOSE

a) Toute cette partie des Territoires du Nord-Ouest, telle qu'indiquée sur les cartes du Système national de référence topographique 97C de Franklin Bay, deuxième édition, 97F de Malloch Hill, troisième édition, 107D de Stanton, deuxième édition et 107E de Cape Dalhousie, deuxième édition, établies selon une échelle de 1/250 000 par le Bureau des cartes du Canada du ministère des Ressources naturelles à Ottawa, et plus particulièrement décrite comme suit :

b) Commençant à un point sur la laisse de basse mer de la baie Wood à environ 69° 45′ N et environ 128° 48′ 18″ O;

c) de là, vers le nord-est et le sud-est en suivant la laisse de basse mer de la baie Wood, de la baie Harrowby, de la baie Franklin et de la baie Langton jusqu'à son intersection avec environ le 69° 19′ 11″ N et le 125° 30′ O;

d) de là, vers le sud le long du 125° 30′ O jusqu'à son intersection avec la rive est de la rivière Horton à environ 69° 05′ 24″ N;

e) de là, vers le nord-ouest en ligne droite jusqu'au point de départ.

AIRE FAUNIQUE CRITIQUE I/CW/02 - AIRE DE MISE BAS DE BLUENOSE

a) Toute cette partie des Territoires du Nord-Ouest, telle qu'indiquée sur les cartes du Système national de référence topographique 97A de Erly Lake, deuxième édition et 97D de Brock River, deuxième édition, établies selon une échelle de 1/250 000 par le Bureau des cartes du Canada du ministère des Ressources naturelles à Ottawa, et plus particulièrement décrite comme suit :

b) Commençant au point d'intersection du 68° N et du 123° O;

c) de là, vers le nord le long du 123° O jusqu'à son intersection avec la laisse de basse mer du

Gulf at approximately 69°49′15″ N;

(d) thence easterly and southeasterly following the low tide mark of Amundsen Gulf to its intersection with approximately 69°33′25″ N and 120° 40′51″ W;

(e) thence south along 120°40′51″ W to its intersection with 68° N;

(f) thence west along 68° N to the point of commencement.

CRITICAL WILDLIFE AREA N/CW/01 - QAMANIRJUAK CALVING AREA

(a) All that portion of the Northwest Territories, as shown on the National Topographic Series Maps 55E of Arviat, Edition 3, 55F of Dawson Inlet, Edition 3, 55J of Marble Island, Edition 2, 55K of Tavani, Edition 2, 55L of Kaminak Lake, Edition 2, 55M of MacQuoid Lake, Edition 3, 55N of Gibson Lake, Edition 3, 55-O of Chesterfield Inlet, Edition 2, 56D of Baker Lake, Edition 2, 65H of South Henik Lake, Edition 2, 65-I of Ferguson Lake, Edition 2 and 65P of Thirty Mile Lake, Edition 2, produced at a scale of 1:250,000 by the Canada Map Office, Department of Natural Resources, Ottawa, and being more particularly described as follows:

(b) Commencing at a point on the north shore of Tyrrell Arm of Yathkyed Lake at approximately 62°30′ N and approximately 97°19′ W;

(c) thence northeasterly in a straight line to its intersection with the south shore of Thirty Mile Lake at approximately 63°36′30″ N and approximately 96°55′ W;

(d) thence northeasterly in a straight line to its intersection with the south shore of Baker Lake at approximately 64°01′50″ N and approximately 95°48′ W;

(e) thence easterly following the south shore of Baker Lake, the south shore of Chesterfield Inlet and

continent dans le golfe Amundsen à environ 69° 49′ 15″ N;

d) de là, vers l'est et le sud-est en suivant la laisse de basse mer du golfe Amundsen jusqu'à son intersection avec environ le 69° 33′ 25″ N et le 120° 40′ 51″ O;

e) de là, vers le sud le long du 120° 40′ 51″ O jusqu'à son intersection avec le 68° N;

f) de là, vers l'ouest le long du 68° N jusqu'au point de départ.

AIRE FAUNIQUE CRITIQUE N/CW/01 - AIRE DE MISE BAS DE QAMANIRJUAK

a) Toute cette partie des Territoires du Nord-Ouest, telle qu'indiquée sur les cartes du Système national de référence topographique 55E de Arviat, troisième édition, 55F de Dawson Inlet, troisième édition, 55J de Marble Island, deuxième édition, 55K de Tavani, deuxième édition, 55L de Kaminak Lake, deuxième édition, 55M de MacQuoid Lake, troisième édition, 55N de Gibson Lake, troisième édition, 55-O de Chesterfield Inlet, deuxième édition, 56D de Baker Lake, deuxième édition, 65H de South Henik Lake, deuxième édition, 65-I de Ferguson Lake, deuxième édition et 65P de Thirty Mile Lake, deuxième édition, établies selon une échelle de 1/250 000 par le Bureau des cartes du Canada du ministère des Ressources naturelles à Ottawa, et plus particulièrement décrite comme suit :

b) Commençant à un point sur la rive nord du bras Tyrrell du lac Yathkyed à environ 62° 30′ N et environ 97° 19′ O;

c) de là, vers le nord-est en ligne droite jusqu'à son intersection avec la rive sud du lac Thirty Mile à environ 63° 36′ 30″ N et environ 96° 55′ O;

d) de là, vers le nord-est en ligne droite jusqu'à son intersection avec la rive sud du lac Baker à environ 64° 01′ 50″ N et environ 95° 48′ O;

e) de là, vers l'est en suivant la rive sud du lac Baker, la rive sud du ruisseau Chesterfield et la rive

the southwestern shore of Cross Bay to its intersection with approximately 93°23′ W;

(f) thence southeasterly in a straight line to its intersection with 63° N and 91°30′ W;

(g) thence southwesterly in a straight line to its intersection with the most easterly extremity of Maguse Lake at approximately 61°23′ N and approximately 94°43′ W;

(h) thence northwesterly in a straight line to the point of commencement.

CRITICAL WILDLIFE AREA N/CW/02 - BEVERLY CALVING AREA

(a) All that portion of the Northwest Territories, as shown on the National Topographic Series Maps 66B of Aberdeen Lake, Edition 2 and 66G of Deep Rose Lake, Edition 2, produced at a scale of 1:250,000 by the Canada Map Office, Department of Natural Resources, Ottawa, and being more particularly described as follows:

(b) Commencing at the point of intersection of 64°45′ N and 99°20′ W;

(c) thence north along 99°20′ W to its intersection with 65°30′ N;

(d) thence east along 65°30′ N to its intersection with 98°05′ W;

(e) thence south along 98°05′ W to its intersection with 64°45′ N;

(f) thence west along 64°45′ N to the point of commencement.

CRITICAL WILDLIFE AREA N/CW/03 - BEVERLY CALVING AREA

(a) All that portion of the Northwest Territories, as shown on the National Topographic Series Maps 66B of Aberdeen Lake, Edition 2 and 66C of Beverly Lake, Edition 2, produced at a scale of 1:250,000 by the Canada Map Office, Department of Natural Resources, Ottawa, and being more particularly

sud-ouest de la baie Cross jusqu'à son intersection avec environ le 93° 23′ O;

f) de là, vers le sud-est en ligne droite jusqu'à son intersection avec le 63° N et le 91° 30′ O;

g) de là, vers le sud-ouest en ligne droite jusqu'à son intersection avec l'extrémité la plus à l'est du lac Maguse à environ 61° 23′ N et environ 94° 43′ O;

h) de là, vers le nord-ouest en ligne droite jusqu'au point de départ.

AIRE FAUNIQUE CRITIQUE N/CW/02 - AIRE DE MISE BAS DE BEVERLY

a) Toute cette partie des Territoires du Nord-Ouest, telle qu'indiquée sur les cartes du Système national de référence topographique 66B de Aberdeen Lake, deuxième édition et 66G de Deep Lake, deuxième édition, établies selon une échelle de 1/250 000 par le Bureau des cartes du Canada du ministère des Ressources naturelles à Ottawa, et plus particulièrement décrites comme suit :

b) Commençant au point d'intersection du 64° 45′ N et du 99° 20′ O;

c) de là, vers le nord le long du 99° 20 ′ O jusqu'à son intersection avec le 65° 30′ N;

d) de là, vers l'est le long du 65° 30′ N jusqu'à son intersection avec le 98° 05′ O;

e) de là, vers le sud le long du 98° 05 ′ O jusqu'à son intersection avec le 64° 45′ N;

f) de là, vers l'ouest le long du 64° 45′ N jusqu'au point de départ.

AIRE FAUNIQUE CRITIQUE N/CW/03 - AIRE DE MISE BAS DE BEVERLY

a) Toute cette partie des Territoires du Nord-Ouest, telle qu'indiquée sur les cartes du Système national de référence topographique 66B de Aberdeen Lake, deuxième édition et 66C de Beverly Lake, deuxième édition, établies selon une échelle de 1/250 000 par le Bureau des cartes du Canada du

described as follows:

(b) Commencing at the point of intersection of 64°15′ N and 101°15′ W;

(c) thence north along 101°15 ′ W to its intersection with 64°35′ N;

(d) thence east along 64°35′ N to its intersection with 99°21′ W;

(e) thence south along 99°21′ W to its intersection with 64°15′ N;

(f) thence west along 64°15′ N to the point of commencement.

CRITICAL WILDLIFE AREA N/CW/04 - BATHURST CALVING AREA

(a) All that portion of the Northwest Territories, as shown on the National Topographic Series Maps 76-I of Overby Lake, Edition 4, 76J of Tinney Hills, Edition 2, 76-O of Rideout Island, Edition 3 and 76P of Brichta Lake, Edition 4, produced at a scale of 1:250,000 by the Canada Map Office, Department of Natural Resources, Ottawa, and being more particularly described as follows:

(b) Commencing at the point of intersection of 66°50′ N and 106°15′ W;

(c) thence north along 106°15 ′ W to its intersection with 67°45′ N;

(d) thence east along 67°45′ N to its intersection with 104° W;

(e) thence south along 104° W to its intersection with 66°50′ N;

(f) thence west along 66°50′ N to the point of commencement.

CRITICAL WILDLIFE AREA N/CW/05 - LONGSTAFF CALVING AREA

ministère des Ressources naturelles à Ottawa, et plus particulièrement décrite comme suit :

b) Commençant au point d'intersection du 64° 15′ N et du 101° 15′ O;

c) de là, vers le nord le long du 101° 15 ′ O jusqu'à son intersection avec le 64° 35′ N;

d) de là, vers l'est le long du 64° 35′ N jusqu'à son intersection avec le 99° 21′ O;

e) de là, vers le sud le long du 99° 21 ′ O jusqu'à son intersection avec le 64° 15′ N;

f) de là, vers l'ouest le long du 64° 15 ′ N jusqu'au point de départ.

AIRE FAUNIQUE CRITIQUE N/CW/04 - AIRE DE MISE BAS DE BATHURST

a) Toute cette partie des Territoires du Nord-Ouest, telle qu'indiquée sur les cartes du Système national de référence topographique 76-I de Overby Lake, quatrième édition, 76J de Tinney Hills, deuxième édition, 76-O de Rideout Island, troisième édition et 76P de Brichta Lake, quatrième édition, établies selon une échelle de 1/250 000 par le Bureau des cartes du Canada du ministère des Ressources naturelles à Ottawa, et plus particulièrement décrite comme suit :

b) Commençant au point d'intersection du 66° 50′ N et du 106° 15′ O;

c) de là, vers le nord le long du 106° 15′ O jusqu'à son intersection avec le 67° 45′ N;

d) de là, vers l'est le long du 67° 45′ N jusqu'à son intersection avec le 104° O;

e) de là, vers le sud le long du 104° O jusqu'à son intersection avec le 66° 50′ N;

f) de là, vers l'ouest le long du 66° 50 ′ N jusqu'au point de départ.

AIRE FAUNIQUE CRITIQUE N/CW/05 - AIRE DE MISE BAS DE LONGSTAFF

(a) All that portion of the Northwest Territories, as shown on the National Topographic Series Map 37D of Lake Gillian, Edition 1, produced at a scale of 1:250,000 by the Canada Map Office, Department of Natural Resources, Ottawa, and being more particularly described as follows:

(b) Commencing at the point of intersection of 69° N and 75°30′ W;

(c) thence north along 75°30′ W to its intersection with 69°30′ N;

(d) thence east along 69°30′ N to its intersection with 73° W;

(e) thence south along 73° W to its intersection with 69° N;

(f) thence west along 69° N to the point of commencement.

CRITICAL WILDLIFE AREA N/CW/06 - DEWAR CALVING AREA

(a) All that portion of the Northwest Territories, as shown on the National Topographic Series Maps 27B of Ekalugad Fiord, Edition 2 and 37A of Foley Island, Edition 2, produced at a scale of 1:250,000 by the Canada Map Office, Department of Natural Resources, Ottawa, and being more particularly described as follows:

(b) Commencing at the point of intersection of 68° N and 73° W;

(c) thence north along 73° W to its intersection with 69° N;

(d) thence east along 69° N to its intersection with 70° W;

(e) thence south along 70° W to its intersection with 68° N;

(f) thence west along 68° N to the point of commencement.

a) Toute cette partie des Territoires du Nord-Ouest, telle qu'indiquée sur la carte du Système national de référence topographique 37D de Gillian Lake, première édition, établie selon une échelle de 1/250 000 par le Bureau des cartes du Canada du ministère des Ressources naturelles à Ottawa, et plus particulièrement décrite comme suit :

b) Commençant au point d'intersection du 69° N et du 75° 30′ O;

c) de là, vers le nord le long du 75° 30 ′ O jusqu'à son intersection avec le 69° 30′ N;

d) de là, vers l'est le long du 69° 30′ N jusqu'à son intersection avec le 73° O;

e) de là, vers le sud le long du 73° O jusqu'à son intersection avec le 69° N;

f) de là, vers l'ouest le long du 69° N jusqu'au point de départ.

AIRE FAUNIQUE CRITIQUE N/CW/06 - AIRE DE MISE BAS DE DEWAR

a) Toute cette partie des Territoires du Nord-Ouest, telle qu'indiquée sur les cartes du Système national de référence topographique 27B de Ekalugad Fiord, deuxième édition et 37A de Foley Island, deuxième édition, établies selon une échelle de 1/250 000 par le Bureau des cartes du Canada du ministère des Ressources naturelles à Ottawa, et plus particulièrement décrite comme suit :

b) Commençant au point d'intersection du 68° N et du 73° O;

c) de là, vers le nord le long du 73° O jusqu'à son intersection avec le 69° N;

d) de là, vers l'est le long du 69° N jusqu'à son intersection avec le 70° O;

e) de là, vers le sud le long du 70° O jusqu'à son intersection avec le 68° N;

f) de là, vers l'ouest le long du 68° N jusqu'au point de départ.

CRITICAL WILDLIFE AREA N/CW/07 - BAIRD CALVING AREA

(a) All that portion of the Northwest Territories, as shown on the National Topographic Series Maps 37A of Foley Island, Edition 2 and 37B of Spicer Islands, Edition 2, produced at a scale of 1:250,000 by the Canada Map Office, Department of Natural Resources, Ottawa, and being more particularly described as follows:

(b) Commencing at a point on the low tide mark of Baird Peninsula at approximately 68°40′30″ N and 76°30′ W;

(c) thence westerly and northerly following the low tide mark of Baird Peninsula to its intersection with 69° N and approximately 76°37′56″ W;

(d) thence east along 69° N to its intersection with the low tide mark of Baird Peninsula at approximately 75°31′15″ W;

(e) thence southwesterly following the low tide mark of the east and south shores of Baird Peninsula to the point of commencement.

AIRE FAUNIQUE CRITIQUE N/CW/07 - AIRE DE MISE BAS DE BAIRD

a) Toute cette partie des Territoires du Nord-Ouest, telle qu'indiquée sur les cartes du Système national de référence topographique 37A de Foley Island, deuxième édition et 37B de Spicer Islands, deuxième édition, établies selon une échelle de 1/250 000 par le Bureau des cartes du Canada du ministère des Ressources naturelles à Ottawa, et plus particulièrement décrite comme suit :

b) Commençant à un point sur la laisse de basse mer de la presqu'île Baird à environ 68° 40′ 30″ N et 76° 30′ O;

c) de là, vers l'ouest et le nord en suivant la laisse de basse mer de la presqu'île Baird jusqu'à son intersection avec le 69° N et environ le 76° 37′ 56″ O;

d) de là, vers l'est le long du 69° N jusqu'à son intersection avec la laisse de basse mer de la presqu'île Baird à environ 75° 31′ 15″ O;

e) de là, vers le sud-ouest en suivant la laisse de basse mer des rives est et sud de la presqu'île Baird jusqu'au point de départ.

CRITICAL WILDLIFE AREA N/CW/08 - BLUENOSE CALVING AREA

(a) All that portion of the Northwest Territories, as shown on the National Topographic Series Maps 86M of Bebensee Lake, Edition 2, 86N of Dismal Lakes, Edition 3, 86-O of Coppermine, Edition 3, 87A of Cape Krusenstern, Edition 1, 87B of Bluenose Lake, Edition 2, 87C of Penny Bay, Edition 2, 87D of Read Island, Edition 1, 96P of Bloody River, Edition 2, 97A of Erly Lake, Edition 2 and 97D of Brock River, Edition 2, produced at a scale of 1:250,000 by the Canada Map Office, Department of Natural Resources, Ottawa, and being more particularly described as follows:

(b) Commencing at the point of intersection of 68° N and 120°40′51″ W;

AIRE FAUNIQUE CRITIQUE N/CW/08 - AIRE DE MISE BAS DE BLUENOSE

a) Toute cette partie des Territoires du Nord-Ouest, telle qu'indiquée sur les cartes du Système national de référence topographique 86M de Bebensee Lake, deuxième édition, 86N de Dismal Lakes, troisième édition, 86-O de Coppermine, troisième édition, 87A de Cape Krusenstern, première édition, 87B de Bluenose Lake, deuxième édition, 87C de Penny Bay, deuxième édition, 87D de Read Island, première édition, 96P de Bloody River, deuxième édition, 97A de Erly Lake, deuxième édition et 97D de Brock River, deuxième édition, établies selon une échelle de 1/250 000 par le Bureau des cartes du Canada du ministère des Ressources naturelles à Ottawa, et plus particulièrement décrite comme suit :

b) Commençant au point d'intersection du 68° N et du 120° 40′ 51″ O;

(c) thence north along 120°40′51″ W to its intersection with the low tide mark of the mainland in Amundsen Gulf at approximately 69°33′25″ N;

(d) thence southeasterly following the low tide mark of Amundsen Gulf to its intersection with approximately 68°59′43″ N and 115°45′ W;

(e) thence south along 115°45 ′ W to its intersection with 67°50′ N;

(f) thence west along 67°50′ N to its intersection with 120° W.

(g) thence northwesterly in a straight line to the point of commencement.

CRITICAL WILDLIFE AREA S/CW/01 - BLUENOSE CALVING AREA

(a) All that portion of the Northwest Territories, as shown on the National Topographic Series Maps 96-O of Horton Lake, Edition 3 and 96P of Bloody River, Edition 2, produced at a scale of 1:250,000 by the Canada Map Office, Department of Natural Resources, Ottawa, and being more particularly described as follows:

(b) Commencing at the point of intersection of 67°50′ N and 123° W;

(c) thence north along 123° W to its intersection with 68° N;

(d) thence east along 68° N to its intersection with 120°40′51″ W;

(e) thence southeasterly in a straight line to its intersection with 67°50′ N and 120° W;

(f) thence west along 67°50′ N to the point of commencement.
R-083-98,s.2.

c) de là, vers le nord le long du 120° 40′ 51″ O jusqu'à son intersection avec la laisse de basse mer du continent dans le golfe Amundsen à environ 69° 33′ 25″ N;

d) de là, vers le sud-est en suivant la laisse de basse mer du golfe Amundsen jusqu'à son intersection avec environ le 68° 59′ 43″ N et le 115° 45′ O;

e) de là, vers le sud le long du 115° 45′ O jusqu'à son intersection avec le 67° 50′ N;

f) de là, vers l'ouest le long du 67° ′ N jusqu'à son intersection avec le 120° O;

g) de là, vers le nord-ouest en ligne droite jusqu'au point de départ.

AIRE FAUNIQUE CRITIQUE S/CW/01 - AIRE DE MISE BAS DE BLUENOSE

a) Toute cette partie des Territoires du Nord-Ouest, telle qu'indiquée sur les cartes du Système national de référence topographique 96-O de Horton Lake, troisième édition et 96P de Bloody River, deuxième édition, établies selon une échelle de 1/250 000 par le Bureau des cartes du Canada du ministère des Ressources naturelles à Ottawa, et plus particulièrement décrite comme suit :

b) Commençant au point d'intersection du 67° 50′ N et du 123° O;

c) de là, vers le nord le long du 123° O jusqu'à son intersection avec le 68° N;

d) de là, vers l'est le long du 68° N jusqu'à son intersection avec le 120° 40′ 51″ O;

e) de là, vers le sud-est en ligne droite jusqu'à son intersection avec le 67° 50′ N et le 120° O;

f) de là, vers l'ouest le long du 67° 50 ′ N jusqu'au point de départ.
R-083-98, art. 2.

Appendix 4

Nunavut Regulations
Wildlife Act
Nun. Reg. R-009-2015 — Conservation Areas Regulations
Schedule B

Nun. Reg. R-009-2015, Sched. B, s. 1

S 1.

Currency

1.
The boundaries of the James Bay Special Management Area are all that portion of Nunavut, as shown on the National Topographic Series Maps 32M of Fort-Rupert, Edition 2, 33D of Eastmain, Edition 1(B), 33E of Rivière Au Castor, Edition 5, 33L of Pointe Louis-XIV, Edition 2, 42P of Moosonee, Edition 2, 43A of Fort Albany, Edition 2, 43B of Kapiskau River, Edition 2, 43G of Ekwan River, Edition 2, 43H of Akimiski Island North, Edition 1, 43J of Lakitusaki River, Edition 2 and 43-O of Cape Henrietta Maria, Edition 2, produced at a scale of 1:250,000 by the Canada Map Office, Department of Natural Resources, Ottawa, and being more particularly described as follows:

1(1) Commencing at a point on the low tide mark of the most northerly extremity of Cape Henrietta Maria at approximately 55° 09'35" N and approximately 82°20'45" W;

1(2) thence southeasterly in a straight line to its intersection with the low tide mark of the most westerly extremity of Cape Jones at approximately 54°37'25" N and approximately 79°45'30" W;

1(3) thence southerly, westerly and northerly following the low tide mark of James Bay to the point of commencement;

1(4) excluding therefrom the parcel of land enclosed within the Twin Islands Wildlife Sanctuary.

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Nunavut Regulations
Wildlife Act
Nun. Reg. R-009-2015 — Conservation Areas Regulations
Schedule B

Nun. Reg. R-009-2015, Sched. B, s. 2

S 2.

Currency

2.
The boundaries of the Qamanirjuaq Calving Area are all that portion of Nunavut, as shown on the National Topographic Series Maps 55E of Arviat, Edition 3, 55F of Dawson Inlet, Edition 3, 55J of Marble Island, Edition 2, 55K of Tavani, Edition 2, 55L of Kaminak Lake, Edition 2, 55M of MacQuoid Lake, Edition 3, 55N of Gibson Lake, Edition 3, 55-O of Chesterfield Inlet, Edition 2, 56D of Baker Lake, Edition 2, 65H of South Henik Lake, Edition 2, 65-I of Ferguson Lake, Edition 2 and 65P of Thirty Mile Lake, Edition 2, produced at a scale of 1:250,000 by the Canada Map Office, Department of Natural Resources, Ottawa, and being more particularly described as follows:

2(1) Commencing at a point on the north shore of Tyrrell Arm of Yathkyed Lake at approximately 62°30' N and approximately 97°19' W;

2(2) thence northeasterly in a straight line to its intersection with the south shore of Thirty Mile Lake at approximately 63°36'30" N and approximately 96°55' W;

2(3) thence northeasterly in a straight line to its intersection with the south shore of Baker Lake at approximately 64°01'50" N and approximately 95°48' W;

2(4) thence easterly following the south shore of Baker Lake, the south shore of Chesterfield Inlet and the southwestern shore of Cross Bay to its intersection with approximately 93°23' W;

2(5) thence southeasterly in a straight line to its intersection with 63° N and 91°30' W;

2(6) thence southwesterly in a straight line to its intersection with the most easterly extremity of Maguse Lake at approximately 61°23' N and approximately 94°43' W;

2(7) thence northwesterly in a straight line to the point of commencement.

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Nunavut Regulations
Wildlife Act
Nun. Reg. R-009-2015 — Conservation Areas Regulations
Schedule B

Nun. Reg. R-009-2015, Sched. B, s. 3

s 3.

Currency

3.
The boundaries of the Beverly Calving Area #1 are all that portion of Nunavut, as shown on the National Topographic Series Maps 66B of Aberdeen Lake, Edition 2 and 66G of Deep Rose Lake, Edition 2, produced at a scale of 1:250,000 by the Canada Map Office, Department of Natural Resources, Ottawa, and being more particularly described as follows:

3(1) Commencing at the point of intersection of 64°45' N and 99°20' W;

3(2) thence north along 99°20' W to its intersection with 65°30' N;

3(3) thence east along 65°30' N to its intersection with 98°05' W;

3(4) thence south along 98°05' W to its intersection with 64°45' N;

3(5) thence west along 64°45' N to the point of commencement.

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Nunavut Regulations
Wildlife Act
Nun. Reg. R-009-2015 — Conservation Areas Regulations
Schedule B

Nun. Reg. R-009-2015, Sched. B, s. 4

s 4.

Currency

4.
The boundaries of the Beverly Calving Area #2 are all that portion of Nunavut, as shown on the National Topographic Series Maps 66B of Aberdeen Lake, Edition 2 and 66C of Beverly Lake, Edition 2, produced at a scale of 1:250,000 by the Canada Map Office, Department of Natural Resources, Ottawa, and being more particularly described as follows:

4(1) Commencing at the point of intersection of 64°15' N and 101°15' W;

4(2) thence north along 101°15' W to its intersection with 64°35' N;

4(3) thence east along 64°35' N to its intersection with 99°21' W;

4(4) thence south along 99°21' W to its intersection with 64°15' N;

4(5) thence west along 64°15' N to the point of commencement.

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Nunavut Regulations
Wildlife Act
Nun. Reg. R-009-2015 — Conservation Areas Regulations
Schedule B

Nun. Reg. R-009-2015, Sched. B, s. 5

s 5.

Currency

5.
The boundaries of the Bathurst Calving Area are all that portion of Nunavut, as shown on the National Topographic Series Maps 76-I of Overby Lake, Edition 4, 76J of Tinney Hills, Edition 2, 76-O of Rideout Island, Edition 3 and 76P of Brichta Lake, Edition 4, produced at a scale of 1:250,000 by the Canada Map Office, Department of Natural Resources, Ottawa, and being more particularly described as follows:

5(1) Commencing at the point of intersection of 66°50' N and 106°15' W;

5(2) thence north along 106°15' W to its intersection with 67°45' N;

5(3) thence east along 67°45' N to its intersection with 104° W;

5(4) thence south along 104° W to its intersection with 66°50' N;

5(5) thence west along 66°50' N to the point of commencement.

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Nunavut Regulations
Wildlife Act
Nun. Reg. R-009-2015 — Conservation Areas Regulations
Schedule B

Nun. Reg. R-009-2015, Sched. B, s. 6

s 6.

Currency

6.
The boundaries of the Longstaff Calving Area are all that portion of Nunavut, as shown on the National Topographic Series Map 37D of Lake Gillian, Edition 1, produced at a scale of 1:250,000 by the Canada Map Office, Department of Natural Resources, Ottawa, and being more particularly described as follows:

6(1) Commencing at the point of intersection of 69° N and 75°30' W;

6(2) thence north along 75°30' W to its intersection with 69°30' N;

6(3) thence east along 69°30' N to its intersection with 73° W;

6(4) thence south along 73° W to its intersection with 69° N;

6(5) thence west along 69° N to the point of commencement.

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Nunavut Regulations
Wildlife Act
Nun. Reg. R-009-2015 — Conservation Areas Regulations
Schedule B

Nun. Reg. R-009-2015, Sched. B, s. 7

s 7.

Currency

7.
The boundaries of the Dewar Calving Area are all that portion of Nunavut, as shown on the National Topographic Series Maps 27B of Ekalugad Fiord, Edition 2 and 37A of Foley Island, Edition 2, produced at a scale of 1:250,000 by the Canada Map Office, Department of Natural Resources, Ottawa, and being more particularly described as follows:

7(1) Commencing at the point of intersection of 68° N and 73° W;

7(2) thence north along 73° W to its intersection with 69° N;

7(3) thence east along 69° N to its intersection with 70° W;

7(4) thence south along 70° W to its intersection with 68° N;

7(5) thence west along 68° N to the point of commencement.

Currency
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Nunavut Regulations
Wildlife Act
Nun. Reg. R-009-2015 — Conservation Areas Regulations
Schedule B

Nun. Reg. R-009-2015, Sched. B, s. 8

s 8.

Currency

8.
The boundaries of the Baird Calving Area are all that portion of Nunavut, as shown on the National Topographic Series Maps 37A of Foley Island, Edition 2 and 37B of Spicer Islands, Edition 2, produced at a scale of 1:250,000 by the Canada Map Office, Department of Natural Resources, Ottawa, and being more particularly described as follows:

8(1) Commencing at a point on the low tide mark of Baird Peninsula at approximately 68°40'30" N and 76°30' W;

8(2) thence westerly and northerly following the low tide mark of Baird Peninsula to its intersection with 69° N and approximately 76°37'56" W;

8(3) thence east along 69° N to its intersection with the low tide mark of Baird Peninsula at approximately 75°31'15" W;

8(4) thence southwesterly following the low tide mark of the east and south shores of Baird Peninsula to the point of commencement.

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Nunavut Regulations
Wildlife Act
Nun. Reg. R-009-2015 — Conservation Areas Regulations
Schedule B

Nun. Reg. R-009-2015, Sched. B, s. 9

s 9.

Currency

9.
The boundaries of the Bluenose Calving Area are all that portion of Nunavut, as shown on the National Topographic Series Maps 86M of Bebensee Lake, Edition 2, 86N of Dismal Lakes, Edition 3, 86-O of Coppermine, Edition 3, 87A of Cape Krusenstern, Edition 1, 87B of Bluenose Lake, Edition 2, 87C of Penny Bay, Edition 2, 87D of Read Island, Edition 1, 96P of Bloody River, Edition 2, 97A of Erly Lake, Edition 2 and 97D of Brock River, Edition 2, produced at a scale of 1:250,000 by the Canada Map Office, Department of Natural Resources, Ottawa, and being more particularly described as follows:

9(1) Commencing at the point of intersection of 68° N and 120°40'51" W;

9(2) thence north along 120°40'51" W to its intersection with the low tide mark of the mainland in Amundsen Gulf at approximately 69°33'25" N;

9(3) thence southeasterly along the low tide mark of the Amundsen Gulf to its intersection with approximately 68°59'43" N and 115°45' W;

9(4) thence south along 115°45' W to its intersection with 67°50' N;

9(5) thence west along 67°50' N to its intersection with 120° W;

9(6) thence northwesterly in a straight line to the point of commencement.

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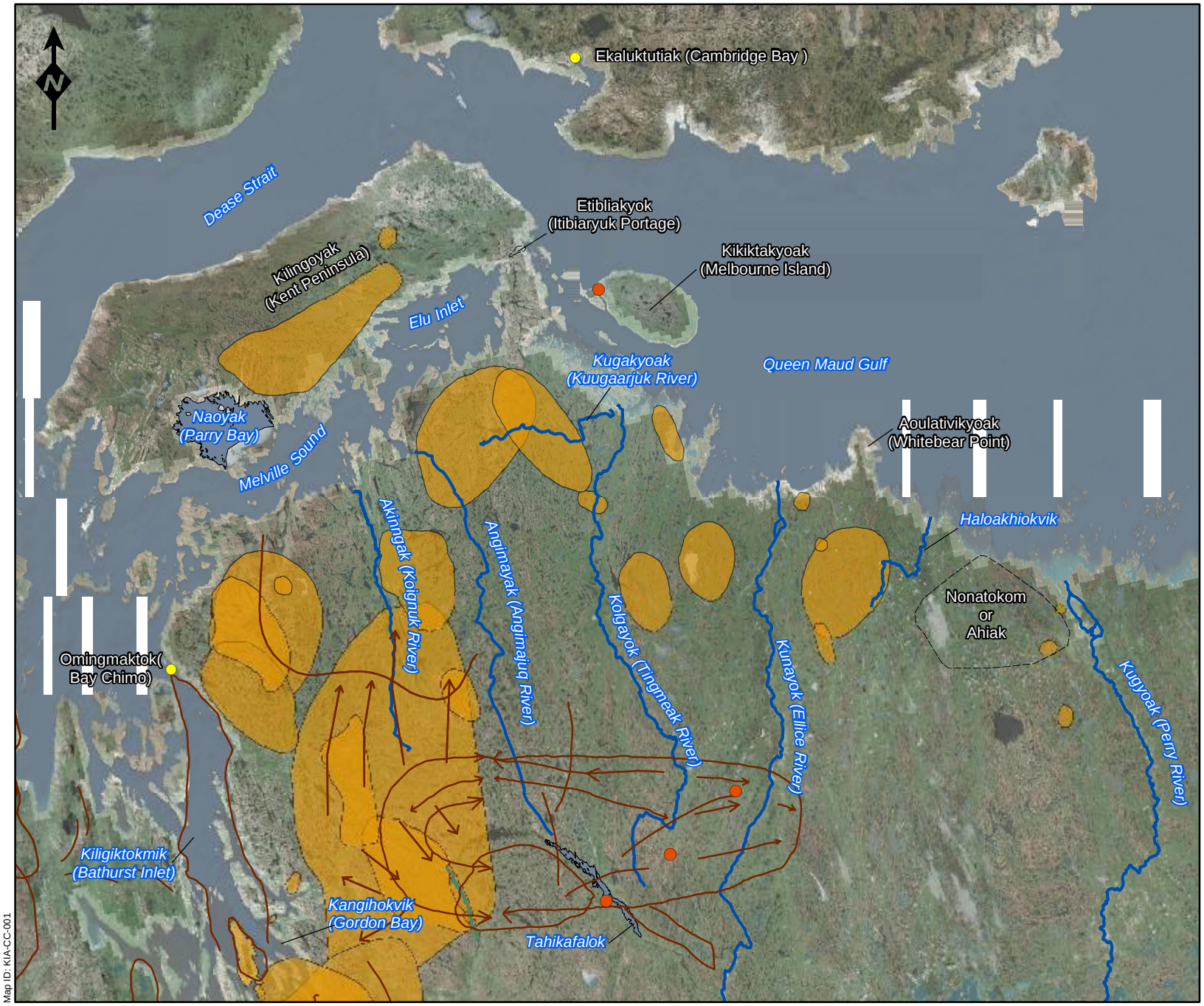
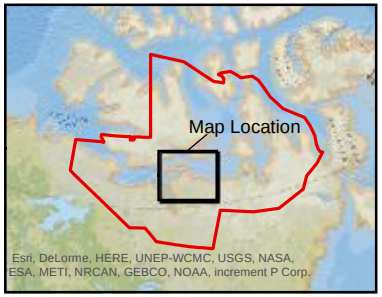
Appendix 5





Kitikmeot Region

Calving Location

Calving Extents

Calving Area

1:1,500,000

0 25 50

Kilometres

Coordinate System: Lambert Conformal Conic

Data Source: Naonaiyaotit Traditional Knowledge Project (NTKP) 2015

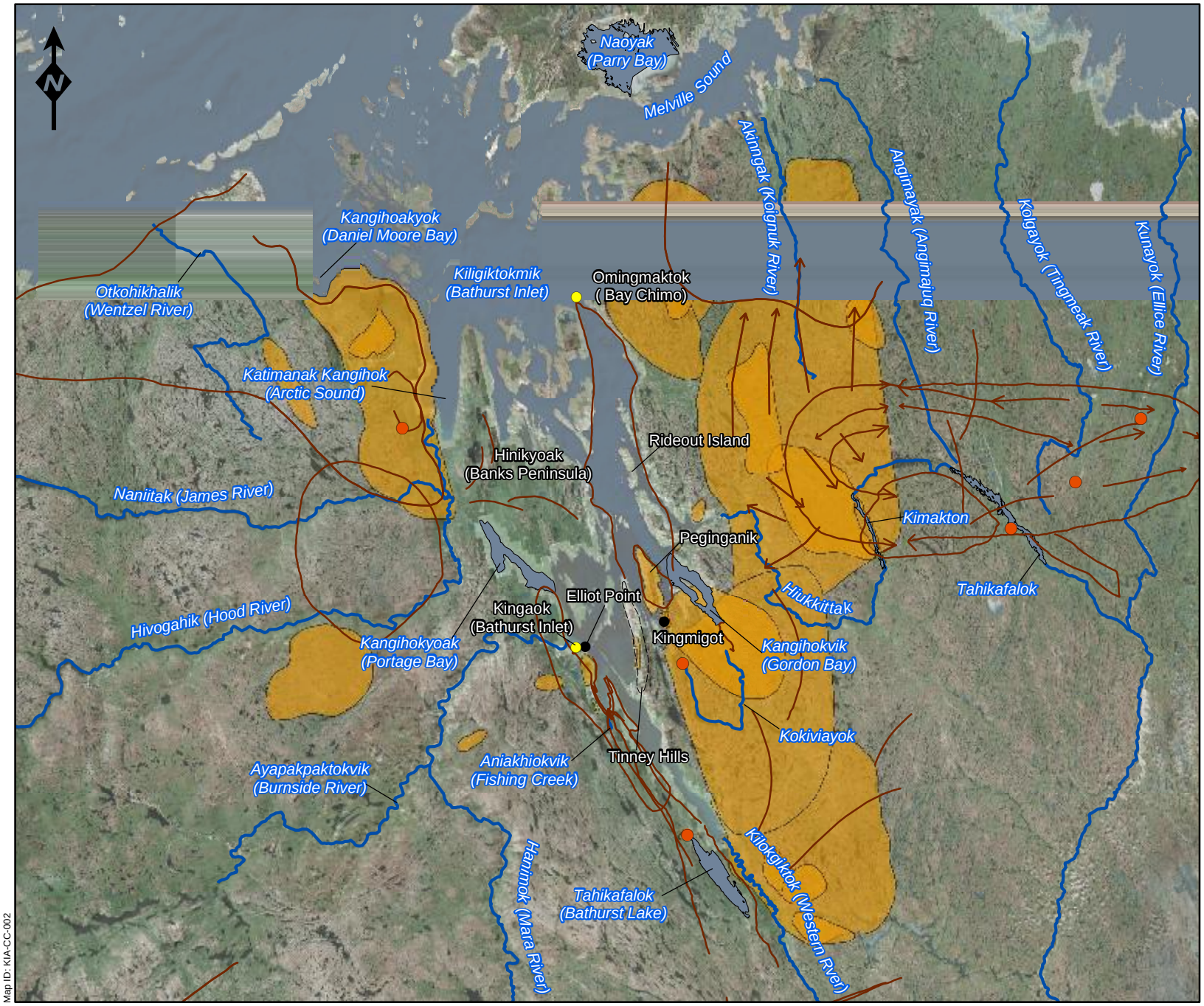
Background Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

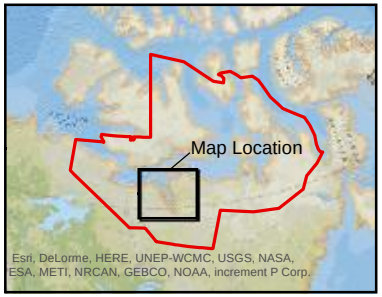
Map ID: KIA-CC-001

December 08 2016

Map produced by Spicker GIS Services (www.spickergis.com)

Figure 1. Calving Areas used by Mainland Caribou up to the 1990s on Kilingoyak (Kent Peninsula) and the Kunayok - Kugyoak (Ellice and Perry Rivers) Coastline





Kitikmeot Region

Calving Location

Calving Extents

Calving Area

1:1,500,000

0 25 50

Kilometres

Coordinate System: Lambert Conformal Conic

Data Source: Naonaiyaotit Traditional Knowledge Project (NTKP) 2015

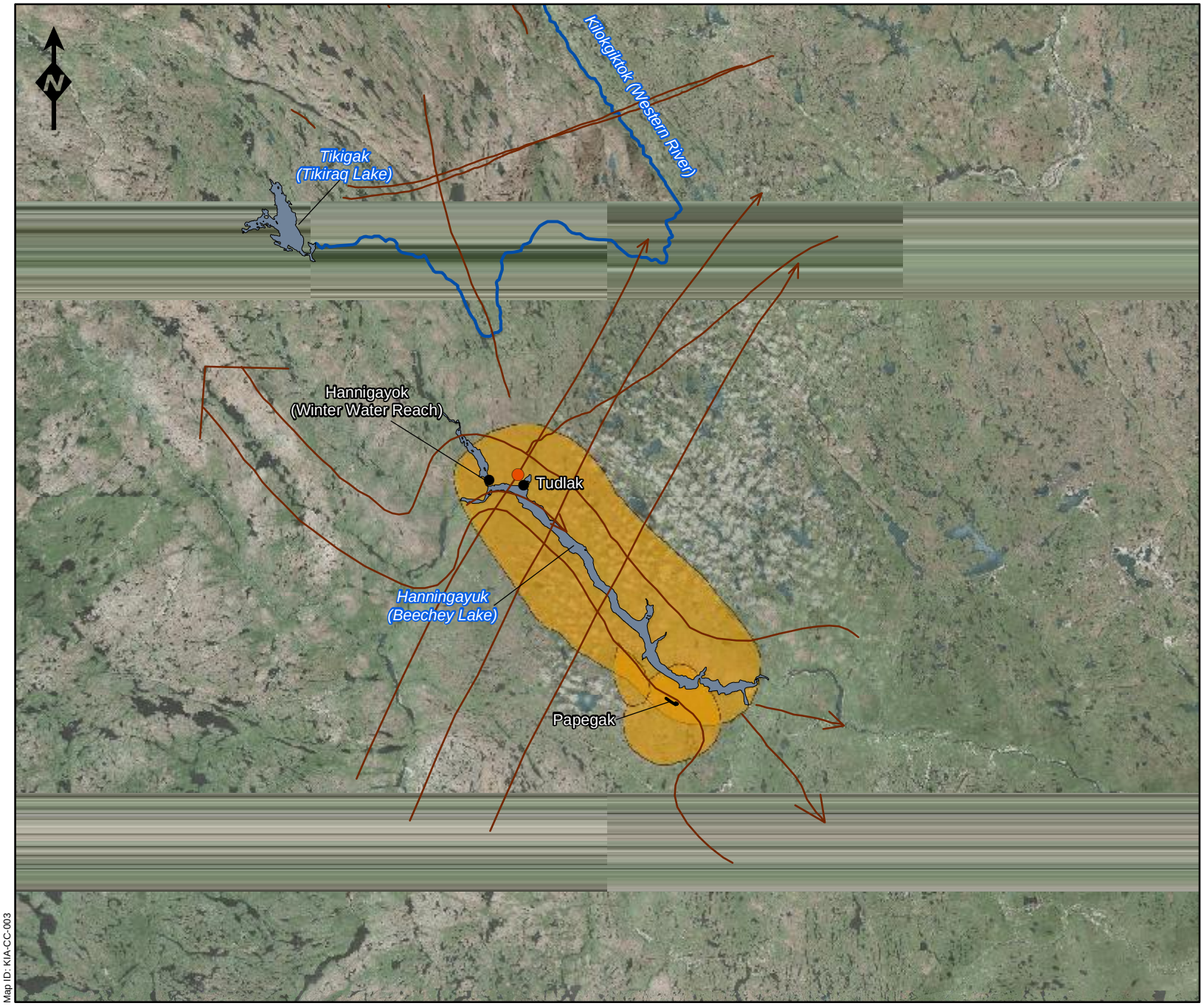
Background Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

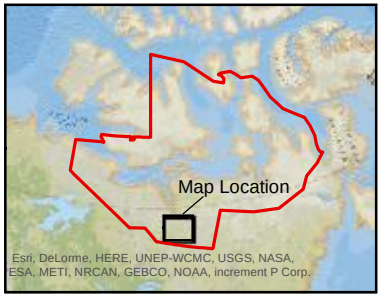
Map ID: KIA-CC-002

December 08 2016

Map produced by Spicker GIS Services (www.spickergis.com)

Figure 2. Calving Areas used by Mainland Caribou up to the 1990s within Kiligiktokmik (Bathurst Inlet)





Kitikmeot Region

Calving Location

Calving Extents

Calving Area

1:750,000

0 12.5 25

Kilometres

Coordinate System: Lambert Conformal Conic

Data Source: Naonaiyaotit Traditional Knowledge Project (NTKP) 2015

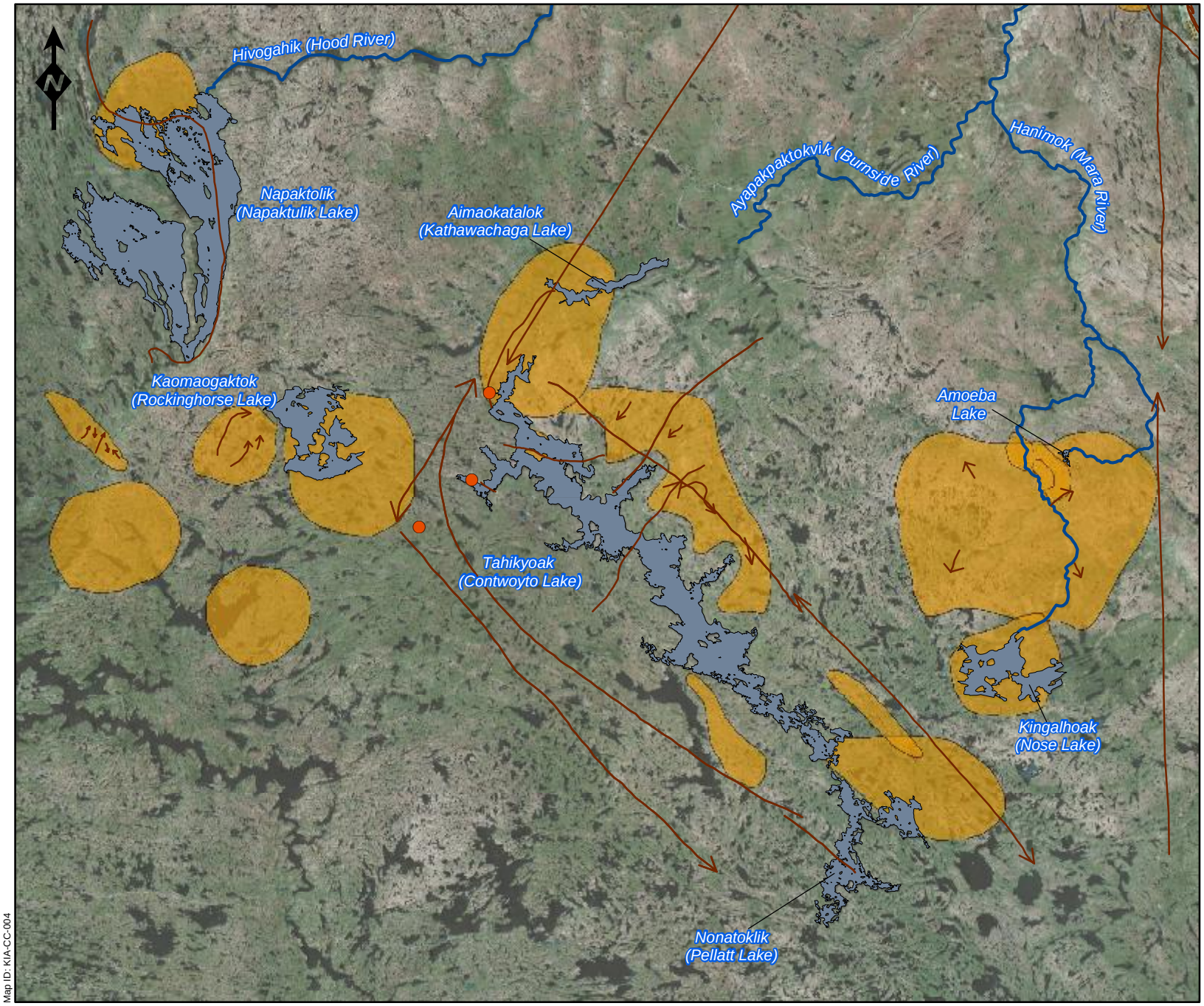
Background Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

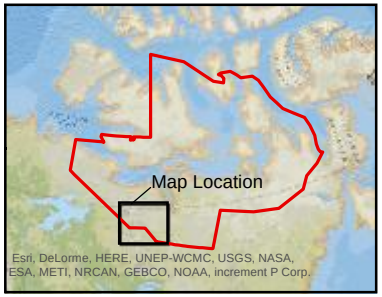
Map ID: KIA-CC-003

December 08 2016

Map produced by Spicker GIS Services (www.spickergis.com)

Figure 3. Calving Areas used by Mainland Caribou up to the 1990s in the Hanningayuk (Beechey Lake) Area





Kitikmeot Region

Calving Location

Calving Extents

Calving Area

1:1,250,000

0 25 50

Kilometres

Coordinate System: Lambert Conformal Conic

Data Source: Naonaiyaotit Traditional Knowledge Project (NTKP) 2015

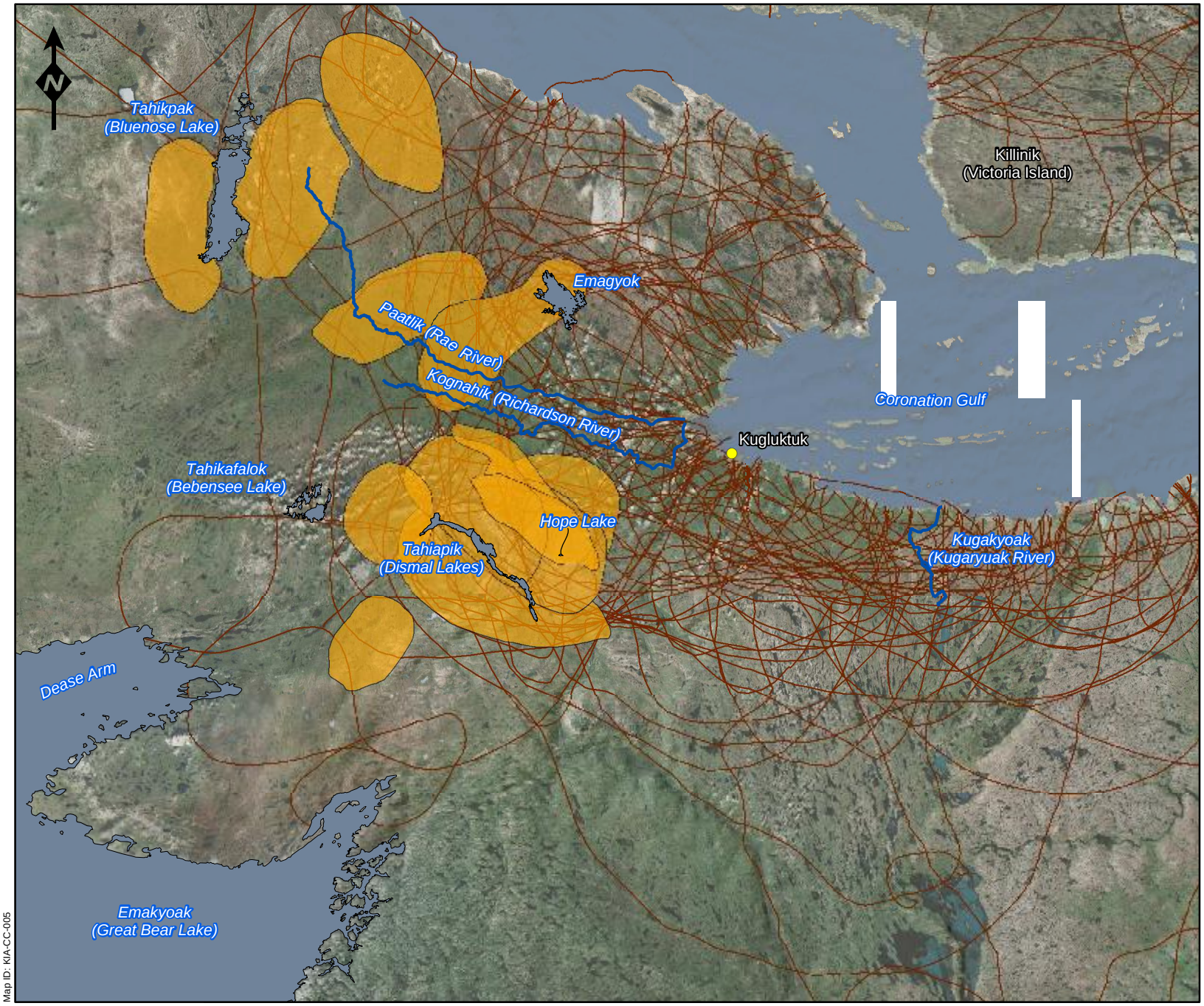
Background Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

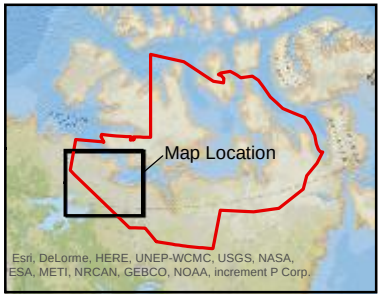
Map ID: KIA-CC-004

December 08 2016

Map produced by Spicker GIS Services (www.spickergis.com)

Figure 4. Inland Calving Areas used by Mainland Caribou up to the 1990s





Kitikmeot Region

Migration Corridors

Calving Area (Inferred from descriptions in ILUOP (1974a and 1974b))

1:2,000,000

0 25 50

Kilometres

Coordinate System: Lambert Conformal Conic

Data Source: Naonaiyaotit Traditional Knowledge Project (NTKP) 2015

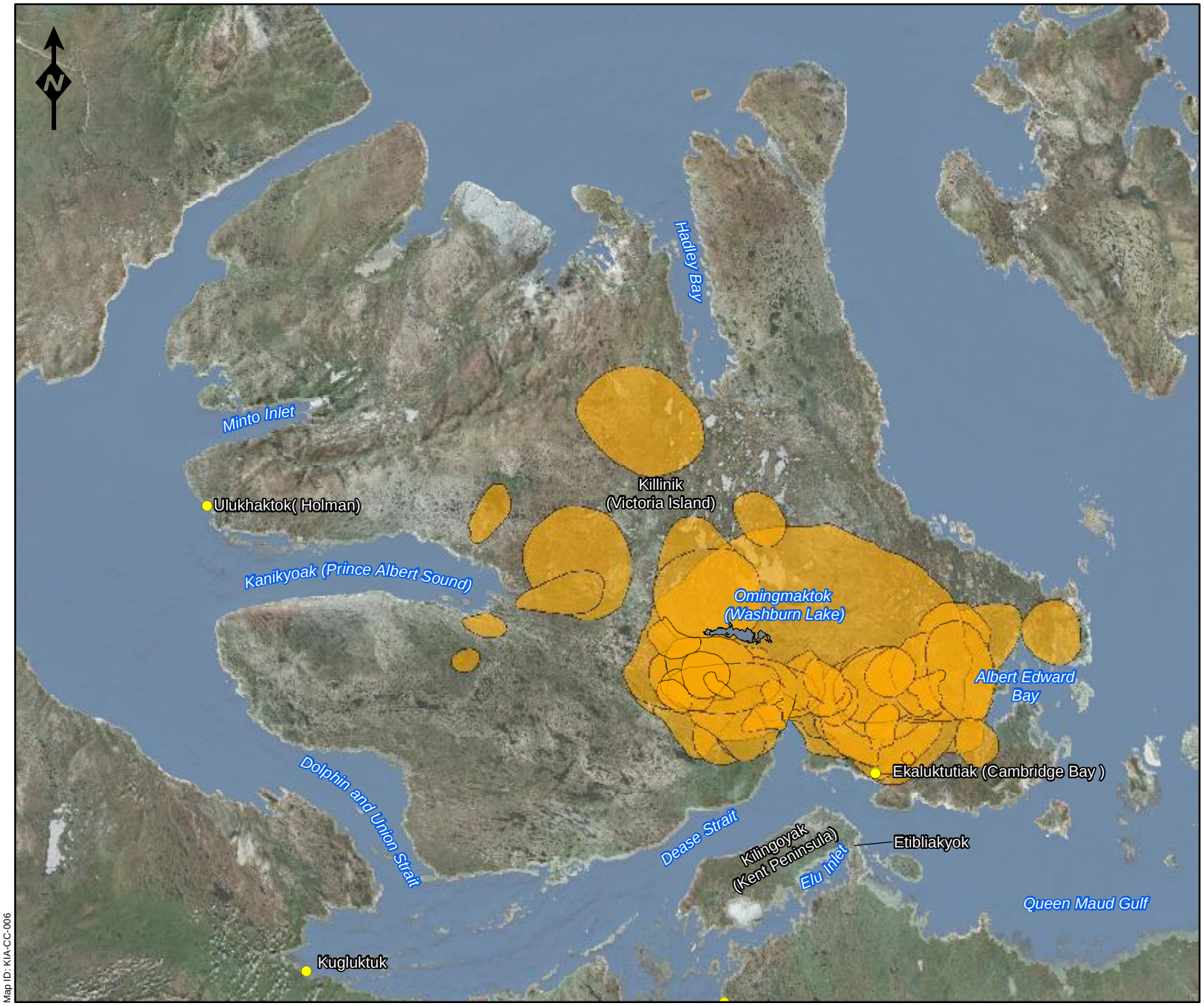
Background Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

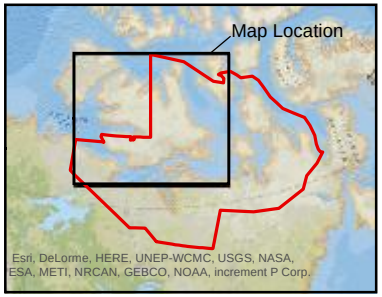
Map ID: KIA-CC-005

December 08 2016

Map produced by Spicker GIS Services (www.spickergis.com)

Figure 5. Calving Areas used by Bluenose-East Caribou from the 1880s to 1960s





Kitikmeot Region

Calving Area (Inferred from descriptions in ILUOP (1974a and 1974b))

1:4,000,000

0 50 100

Kilometres

Coordinate System: Lambert Conformal Conic

Data Source: Naonaiyaotit Traditional Knowledge Project (NTKP) 2015

Background Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Map ID: KIA-CC-006

December 08 2016

Map produced by Spicker GIS Services (www.spickergis.com)

Figure 6. Calving Areas used by Victoria Island Caribou from the 1880s to 1960s