HOPE BAY PROJECT
DRAFT ENVIRONMENTAL IMPACT STATEMENT

Table of Contents

List of Figures

List of Tables

List of Appendices

Glossary and Abbreviations

Terminology used in this document is defined where it is first used. The following list will assist readers who may choose to review only portions of the document.

CESCC	Canadian Endangered Species Conservation Council
CWS	Canadian Wildlife Service
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DNA	Deoxyribonucleic acid
DEM	Digital Elevation Model
ECCC	Environment and Climate Change Canada
EIS	Environmental Impact Statement
ELC	Ecological Land Classification
EM	Ecosystem Mapping
GIS	Geographic Information System
GN DOE	Government of Nunavut Department of the Environment
GPS	Global Positioning System
KIA	Kitikmeot Inuit Association
HSR	Habitat Suitability Rating: final rating assigned to an ecosystem unit with all assumptions and adjustments taken into account
Life Requisite	Specific activities of an animal that are critical for sustaining and perpetuating the species and that depend on particular habitat attributes or conditions. Life requisites include feeding, cover, breeding, migration, hibernation, etc.
LSA	Local Study Area
MBCA	Migratory Birds Convention Act
NIRB	Nunavut Impact Review Board
NU	Nunavut
NWT	Northwest Territories
PRISM	Program for Regional and International Shorebird Monitoring
RISC	BC Resources Information Standards Committee
RSA	Regional Study Area

SARA	Species at Risk Act
SOP	Standard Operating Procedure
Species Account	A summary of geographic distribution, life requisites, seasonal use of habitats, limiting factors, and habitat attributes for an animal species within a geographic range
Species Diversity	A measure of biodiversity that takes into account the number of species present, as well as the relative abundance of each species. Species diversity indices are mathematical estimators of diversity based on sample data (i.e., Fisher's-alpha and Simpson's Diversity Index).
Species Richness	The simplest measure of biodiversity. It is a count of the number of different species in a given area or sample
Suitability	Ability of the habitat in its current condition to provide life requisites of an animal
the Program	The Wildlife Mitigation and Monitoring Plan Compliance Monitoring Program (WMMP Compliance Monitoring Program). Refers to the current WMMP, the monitoring that occurs, and the associated report for any given year.
The Project	The Hope Bay Project
VECs	Valued Ecosystem Components
WHR	Wildlife Habitat Rating: preliminary rating assigned to an ecosystem unit
WKSS	West Kitikmeot / Slave Study
WKRLUP	West Kitikmeot Region Land Use Plan
WMMP	Wildlife Mitigation and Monitoring Plan. The WMMP is the official document that outlines the program to be conducted to mitigate and monitor wildlife for the Doris Gold Mine Project.
Zone of Influence (ZOI)	The area over which an effect of a Project may occur and may be measured compared to natural populations prior to and at a greater distance from the Project. This area is typically given a circle around a Project and is measured by its radius.

9. Terrestrial Wildlife and Wildlife Habitat

This section provides an overview of terrestrial wildlife populations and available wildlife habitat in the areas surrounding the Phase 2 Project. The assessment evaluates the potential effects of the Phase 2 Project on wildlife VECs, and then evaluates the potential effects of the Hope Bay Project (Permitted Project plus Phase 2) and cumulative effects on wildlife VECs.

The Hope Bay Project is located in the Hope Bay greenstone belt, a north-south belt of gold deposits extending south from Roberts Bay in Melville Sound. The Hope Bay Project is made up of the Permitted Project and Phase 2, which is the object of this draft Environmental Impact Statement (EIS).

The Permitted Project includes:

1. the Doris Project – currently completing construction and entering operations and includes the Roberts Bay laydown, the Doris site located approximately 4 km south of Roberts Bay and including an accommodation area, underground mine and Tailings Impoundment Area (TIA);
2. the Hope Bay Regional Exploration Project - drilling to explore for resources;
3. the Boston Advanced Exploration Project – a bulk sample at the Boston site, approximately 60 km south of Roberts Bay; and
4. the Madrid Advanced Exploration Project – a bulk sample at the Madrid site, approximately 10 km south of the Doris site (application currently in review).

Phase 2 will include:

1. continued use of the Doris site, with accommodation, milling and TIA located there;
2. expansion of the Roberts Bay laydown with a cargo dock and additional fuel storage;
3. expansion of the TIA;
4. continued operation of the Madrid site;
5. construction and operation of a 53 km all-weather road from Madrid, south to Boston; and
6. construction and operation of the Boston underground mining site.

Section 9.4.1 includes an overview of Phase 2 and the Hope Bay Project. A comprehensive description of Phase 2 activities is included in Section 3, the Project Description.

9.1 INCORPORATION OF TRADITIONAL KNOWLEDGE

9.1.1 Incorporation of Traditional Knowledge for Existing Environment and Baseline Information

Traditional Knowledge (TK) and cultural significance of wildlife was considered throughout the design and implementation of the wildlife and wildlife habitat baseline program. The wildlife and wildlife habitat baseline programs focused on species of cultural importance to Inuit as well as the characterization of habitat that supports those species.

Results from the *Naonaiyaotit Traditional Knowledge Project* (NTKP) report (Banci and Spicker 2016) were integrated into the Existing Environment and Baseline Information sections of the draft Environmental Impact Statement (EIS) and discussed in relation to scientific knowledge presented in peer reviewed journals and studies as well as baseline studies conducted for Phase 2. Ecosystems of traditional and cultural importance due to their value as wildlife habitat, including eskers, sedge wetlands, marine shores and riparian ecosystems were incorporated into habitat suitability models and mapped as high quality habitat.

Habitat for wildlife species identified from TK, particularly caribou, were included in the setting and used in the effects assessment (Section 9.8), including wintering habitat for Dolphin and Union (Island) caribou and summering areas for Beverly/Ahiak caribou. Movement corridors described in TK were also included in the baseline and effects assessment, including overland movement areas, such as the Kent Peninsula and the Kent Peninsula isthmus, sea-ice crossing areas in Dolphin and Union Straight, Elu Inlet, and Melville sound and fresh water crossing locations on the Nunavut mainland.

Descriptions of good quality habitat from TK for caribou, muskox, grizzly bear, wolf, and wolverine were included in the Habitat Suitability Models for each species to evaluate habitat loss. Specific locations of higher quality habitat or areas where these species were harvested were also included in the setting and in the effects assessment.

During baseline data collection, TK was further incorporated through the involvement of Inuit personnel in field programs, with input sought from elders and experienced land users on program optimization. This TK input assisted in identifying areas best suited to detections of caribou, carnivores and den sites, and influenced the placement of remote monitoring cameras and Deoxyribonucleic acid (DNA) tripods, as well as how survey effort was focused. TK was also used as baseline information to support the human and environmental risk assessments (Volume 6, Section 5; Human Health and Environmental Risk Assessment) which in turn support the wildlife effects determination (Volume 6, Section 5).

9.1.2 Incorporation of Traditional Knowledge for Terrestrial Wildlife Selection

Results from the NTKP report (Banci and Spicker 2016) were reviewed for scope and refine the potential Wildlife and Wildlife Habitat Valued Ecosystem Component (VEC) list (see Volume 2, Section 4).

The NTKP report provides maps of distribution of valued animal species, environmental components, and traditional land use activities. The wildlife species and habitat features identified in the NTKP report were considered as potential VECs for the wildlife and wildlife habitat assessments. Caribou is the most harvested terrestrial mammal in the Kitikmeot region and many families rely on them as a main or supplemental food source food source (Rescan 2013a). Other terrestrial wildlife species that are highly regarded by Inuit include grizzly bears, muskox, furbearers, raptors, and migratory birds (Banci and Spicker 2016).

Traditional knowledge was combined with data from public consultation, baseline surveys, and published species distributions to determine which valued components would potentially interact with Phase 2, and therefore be evaluated as a candidate VEC. As a result of this process, and in consideration of the Phase 2 Project Specific Guidelines for the Phase 2 Project, caribou, muskox, grizzly bear, furbearers (wolverine), raptors, waterbirds, and upland birds were selected as VECs for the EIS (Volume 2, Section 4; Effects Assessment Methodology).

9.1.3 Incorporation of Traditional Knowledge for Spatial and Temporal Boundaries

The NTKP report was used to guide the boundaries of the Local Study Area (LSA) and Regional Study Area (RSA) used for the EIS. Baseline wildlife field studies and habitat suitability modeling were completed in the delineated Local and Regional study areas to encompass potential Hope Bay Project effects on wildlife resulting from construction, operation and closure of the Hope Bay Project.

Current Inuit use of the land for hunting and travel (identified in Banci and Spicker 2012b, 2016), overlaps the LSA and RSA (Volume 6, Section 4; Land Use), and was also considered in the delineation of the study area boundaries. The wildlife RSA encompasses an area large enough to characterize potential effects to species which may come into contact with the Hope Bay Project or Project-related activities.

9.1.4 Incorporation of Traditional Knowledge for Project Effects Assessment

Traditional Knowledge was used to identify potential effects of the Phase 2 Project on wildlife VECs by examining where and when Phase 2 Project components may interact with wildlife VECs or wildlife VEC habitat identified by TK. These included habitats used for winter and summer forage and important habitat areas such as eskers, fresh water crossings, streams, wetlands, ocean ice crossings and other features.

In addition to TK gathered by the KIA (Banci and Spicker 2016), TMAC held a workshop with elders and harvesters in September, 2016, in Cambridge Bay to discuss habitat use, potential effects of Phase 2 on caribou and to propose mitigation and management to minimize these effects. The elders and harvesters identified 18 potential effects, which were rated by their likelihood to occur (unlikely, possible and expected) and their likely impact on caribou (low, medium, high). These potential effects were then evaluated in the effects assessment (Section 9.8.1, Table 9.8-1).

TK collected by the KIA (Banci and Spicker 2016) and land user information gathered through the caribou workshop were then used to evaluate potential effects on caribou, particularly for habitat loss, disturbance to caribou, disruption of movement, direct mortality and the potential effects of chemicals and pollution in the environment (assessed as potential changes to environmental media quality) (Section 9.8).

TK and land user information were also incorporated into the assessment of effects for other wildlife VECs, primarily to evaluate habitat loss, disruption of movement and response of wildlife species to disturbances for muskox, grizzly bear, wolverine and birds.

Traditional movement patterns, particularly of caribou, along with satellite collar information and land user information were also used to define the study area and potential cumulative effects for caribou, including habitat loss and disturbance over the seasonal and annual ranges for this VEC.

9.1.5 Incorporation of Traditional Knowledge for Mitigation and Adaptive Management

Traditional Knowledge collected by the KIA (Banci and Spicker 2016) was used to identify mitigation and adaptive management for wildlife VECs by examining where and when Phase 2 Project components may interact with wildlife VECs or wildlife VEC habitat identified by TK.

In addition to TK gathered by the KIA (Banci and Spicker 2016), TMAC held a workshop with elders and harvesters in September, 2016, in Cambridge Bay to discuss habitat use, potential effects of Phase 2 Project on caribou and to propose mitigation and management to minimize these effects. The elders

and harvesters identified proposed mitigation and adaptive management measures for Phase 2 and Hope Bay Project. A complete list of the potential effects identified by elders and harvesters, their proposed mitigation and TMACs commitments to mitigation and adaptive management are listed in Section 9.8.2, Table 9.8-2.

The majority of these proposed mitigation and adaptive management measures focused on reducing noise and dust so that caribou would not be disturbed by Phase 2, including measures to reduce noise disturbance from helicopters, fixed wing aircraft, blasting, processing, rock hauling, and vehicles on roads. Disturbance from dust was addressed through dust control on roads. TMAC committed to mitigation and adaptive management measures to address each of these proposed mitigations (Table 9.8-2).

The second major area of proposed mitigation was reducing potential disruption of movement for caribou by aircraft, Phase 2 sites, and the Phase 2 roads. The proposed mitigations included crossing ramps on roads at identified movement corridors for caribou, speed limits, giving wildlife the right of way on roads, avoiding caribou (and other wildlife) during migration, monitoring for caribou during migration and adaptively managing Phase 2 activities to reduce disturbance during migration. TMAC committed to mitigation and adaptive management measures to address each of these proposed mitigations (Table 9.8-2).

Elders and harvesters also proposed potential effects, mitigation and management for grizzly bears and wolverine, and these measures are discussed in Sections 910 and 9.14. Mitigation measures for these species included having appropriate plans in place to deal with grizzly bears and wolverines that may be attracted to the Phase 2 site.

9.2 EXISTING ENVIRONMENT AND BASELINE INFORMATION

9.2.1 Regional Overview and Past Activities

The Phase 2 Project is located approximately 153 km southwest of Cambridge Bay, Nunavut, on the southern shore of Melville Sound in the West Kitikmeot region of Nunavut. The Phase 2 Project is located within the Hope Bay greenstone belt, a predominantly north-south oriented band of mineralized geology approximately 80 km long and 20 km wide. The northern portion of the Hope Bay Belt (the Belt) boarders the ocean and is characterized by cliffs and rocky dykes interspersed with lakes, rivers, wetlands, and uplands. Further inland cliffs and rocky outcrops become less common and the topography is characterized by rolling tundra.

The Belt's vegetation is characterized by shrub tundra vegetation such as dwarf birch (*Betula nana*), willow (*Salix* spp.), Labrador tea (*Ledum decumbens*), avens (*Dryas* spp.), and blueberries (*Vaccinium* spp.). The region provides habitat to a number of wildlife species, including migratory caribou and wolves, and resident muskox, grizzly bear, wolverine, foxes, and a variety of other smaller mammal species. The distribution of moose distribution has also been expanding northward in recent years. Migratory bird species including upland birds, waterbirds, and raptors also use the region during migration and breeding seasons. Resident birds such as ptarmigan, ravens, and gyrfalcon, and other species identified by Inuit TK such as rough-legged hawk, snowy owl, and snow bunting, may also overwinter in the region (Banci and Spicker 2016).

9.2.2 Proximity to Designated Environmental Areas

There are currently no existing or proposed parks or conservation areas on or adjacent to the Hope Bay Project site. The nearest conservation area is the Queen Maud Gulf Migratory Bird Sanctuary (QMGMBS)

approximately 50 km east of the Project. A part of the QMGMBS is also designated as an Important Bird Area (IBA) (IBA 2012a), and is identified as a key terrestrial habitat site for migratory birds by the Canadian Wildlife Service (CWS) (Latour et al. 2008). The QMGMBS supports over one million breeding waterbirds every year (IBA 2012a), and is used by caribou during the calving, post-calving and summer seasons.

The Thelon Wildlife Sanctuary is located roughly 300 km to the south of the Project, and was created in the 1920s to protect caribou and muskox populations (Taylor 2006). It is an important area for caribou during late summer and fall, as well as other Arctic wildlife. The 2016 Draft Nunavut Land Use Plan designated wildlife conservation areas including key migratory bird habitat sites and caribou habitat. The Bathurst/Elu Inlet key migratory bird habitat site covers marine areas within Melville Sound, Elu Inlet, and upper Bathurst Inlet; interactions between the Permitted Project and Phase 2 Project activities and this key migratory bird habitat site is discussed further in the Volume 5, Section 11: Marine Wildlife. A caribou freshwater crossing area occurs to the northeast of the Hope Bay Project between the mainland and habitat on the Kent Peninsula as well as a caribou ice crossing area at the eastern end of Elu Inlet to the northeast of the Hope Bay Project.

9.2.3 Regulatory Framework

Wildlife and wildlife habitat are protected by both federal and territorial legislation, including the Nunavut *Wildlife Act* (2003), *Nunavut Land Claims Agreement Act* (1993a), Canada *Wildlife Act* (1994a), the *Migratory Birds Convention Act* (1994b), and the *Species at Risk Act* (SARA; 2002).

The following sections describe these acts and their subsidiary regulations, and guidelines and how they apply to the protection of wildlife and wildlife habitat.

9.2.3.1 Nunavut *Wildlife Act*

The Nunavut *Wildlife Act* (2003) identifies and defines wildlife management in Nunavut, including legislated responsibilities for the conservation, protection and recovery of species at risk, managing nuisance wildlife, and possession of wildlife. The Act provides interpretation of approved and restricted hunting and related activities, including the possession of wildlife, and the enforcement that will follow should the Act or corresponding regulations be contravened. The Act protects against significant disturbance to wildlife (Section 73(1)) and the unlawful harvesting of bird eggs (includes all species) and destruction of bird nests (Sections 72(1) and 72(2)). The residences of certain wildlife (bear, fox, beaver, muskrat, weasel, wolf or wolverine) are also protected (Section 73(1)(b)).

9.2.3.2 Nunavut Agreement

The *Nunavut Land Claims Agreement Act* (1993a) is legislation that enables the *Nunavut Land Claims Agreement* (NLCA; 1993b). The Nunavut Wildlife Management Board (NWMB), established under the NLCA, is the responsible authority for the management of wildlife and wildlife habitat in conjunction with government bodies. Section 5.2.34 of the NLCA outlines additional responsibilities for the NWMB, including the approval of conservation areas, wildlife management zones, wildlife management strategies, species at risk recovery plans, the designation of species of conservation concern, and dissemination of wildlife management information to appropriate government bodies.

9.2.3.3 Canada Wildlife Act

The Canada *Wildlife Act* (1994a) identifies and defines actions for wildlife research and conservation, and allows for the creation, management, and protection of wildlife areas. The purpose of wildlife areas is to preserve habitats that are critical to migratory birds and other wildlife species, focusing on species that are at risk. The Wildlife Area Regulations under the Canada *Wildlife Act* (1994a) outline

the activities that are prohibited within designated National Wildlife Areas, such as hunting or fishing, unless these activities are deemed permissible by the Minister and posted in said National Wildlife Areas (Section 3(2)) or persons have been granted a permit to conduct prohibited activities provided those activities will not interfere with the conservation of wildlife (Section 4).

9.2.3.4 Migratory Birds Convention Act

The *Migratory Birds Convention Act* (1994b) prohibits the taking or killing of migratory birds, their nests, and eggs (Section 5(a)), and the deposition of harmful substances in areas frequented by migratory birds (Sections 5.1(1) and 5.1(2)). The species protected include waterfowl, cranes, rails and coots, shorebirds including gulls and terns, pigeons and doves, insectivorous songbirds (excluding blackbirds), seabirds, loons, grebes, herons, egrets, and bitterns.

9.2.3.5 Species at Risk Act

The federal *Species at Risk Act* (SARA; 2002) is designed to prevent Canadian indigenous species, subspecies, and distinct populations from becoming extirpated or extinct. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses and identifies species at risk. COSEWIC is mandated under SARA to classify species according to their level of conservation concern: *extinct*, *extirpated*, *endangered*, *threatened*, *special concern*, *not at risk* or *data deficient*. Currently, only those species that have been designated by COSEWIC and are subsequently listed in Schedule 1[1] of the Species at Risk Public Registry may qualify for legal protection and recovery under *SARA*. The *Species at Risk Act* prohibits the killing, harming, harassing, capturing or taking of an individual of a species that is listed in Schedule 1 as *extirpated*, *endangered* or *threatened* (*SARA,* Section 32(1)). *SARA* (Section 33) protects the residences of species listed as *extirpated*, *endangered* or *threatened* from being damaged and destroyed. Section 79 of the Act contains regulation in relation to assessment of environmental effects on listed wildlife or its critical habitat. Section 79(1) states that "…every person who is required by or under an Act of Parliament to ensure that an assessment of the environmental effects of a project is conducted, and every authority who makes a determination under paragraph 67(a) or (b) of the *Canadian Environmental Assessment Act*, 2012 in relation to a project, must, without delay, notify the competent minister or ministers in writing of the project if it is likely to affect a listed wildlife species or its critical habitat." Section 79(2) states "…the person must identify the adverse effects of the project on the listed wildlife species and its critical habitat and, if the project is carried out, must ensure that measures are taken to avoid or lessen those effects and to monitor them. The measures must be taken in a way that is consistent with any applicable recovery strategy and action plans."

9.2.4 Data Sources

Baseline data on terrestrial wildlife has been collected in the Hope Bay Greenstone Belt since the 1990s. For the draft EIS, baseline data collected since 2006 were used because these data represent the most relevant pre-development data for the Hope Bay Project. The exceptions are the ungulate aerial surveys in the RSA. These were conducted between 1996 and 2011, after which aerial surveys were discontinued due to low numbers of animals observed.

[1]Schedule 2 lists the species that were assessed by COSEWIC prior to the proclamation of SARA in 2003. Since then all of the species on Schedule 2 have been reassessed using the new assessment criteria adopted in October 1999. The species that did not meet the new risk criteria have remained on Schedule 2. Schedule 3 lists species of Special Concern that have yet to be assessed. After assessment reporting and following consultations, the Minister makes a recommendation to Governor in Council; Governor in Council then decides on whether or not they should be added to Schedule 1, the List of Wildlife Species at Risk. The protection and/or conservation measures afforded by SARA apply only to species once they are on Schedule 1.

Baseline data to support the EIS were obtained from the following reports:

- *Inuit Traditional Knowledge for TMAC Resources Inc. Proposed Hope Bay Project, Naonaiyaotit Traditional Knowledge Project* (NTKP) (Banci and Spicker 2016);
- *Doris North Project: 2015 Wildlife Mitigation and Monitoring Plan Compliance Monitoring Report* (ERM 2016a);
- *Doris North Project: 2014 Wildlife Mitigation and Monitoring Plan Compliance Monitoring Report (ERM 2015b);*
- *Doris North Project: 2013 Wildlife Compliance Monitoring Report (ERM Rescan 2014a);*
- *Doris North Project: Wildlife Mitigation and Monitoring Program Report, 2012 (Rescan 2013e);*
- *Doris North Gold Mine Project: 2012 Final Grizzly Bear DNA Report (Rescan 2012a)*;
- *Doris North Project: Wildlife Mitigation and Monitoring Program, 2011 (Rescan 2011f);*
- *Hope Bay Belt Project: Marine Wildlife Baseline Report, 2011 (Rescan 2011g)*
- *Hope Bay Belt Project: 2010 Wildlife Habitat Suitability Baseline Report* (Rescan 2011h);
- *Doris North Gold Mine Project: 2011 Interim Grizzly Bear DNA Report (Rescan 2011a);*
- *Doris North Gold Mine Project: Wildlife Mitigation and Monitoring Program, 2010 (Rescan 2011c);*
- *Doris North Gold Mine Project: Wildlife Mitigation and Monitoring Program, 2009 (Rescan 2010);*
- *Doris North Project: Wildlife Mitigation and Monitoring Program – 2008 Final Report (Golder 2009);*
- *Doris North Project: Wildlife Mitigation and Monitoring Program – 2007 Final Report (Golder 2008a);*
- *Doris North Project: Wildlife Mitigation and Monitoring Program – 2006 Final Report (Golder 2007)*;
- *BHP Diamonds Inc*. Hope Bay Belt Project. 1998 Environmental Data Report (Rescan 1999);
- *BHP World Minerals*. Hope Bay Belt Project. Environmental Baseline Studies Report 1996 (Rescan 1997);
- Doris Project Final Impact Statement. 2005, Supporting Document D2. Terrestrial Wildlife of Hope Bay, Nunavut: An integration and overview of data collected from 1994 – 2002. Prepared by Hubert and Associates, November 2002 (Miramar 2005).
- Doris North Project Final Impact Statement. 2005, Supporting Document D3. Data Report Wildlife Studies: June – July 2003. Prepared by Hubert and Associates, September 2003 (Miramar 2005).
- Doris North Project Final Impact Statement. 2005, Supporting Document D4. Wildlife Baseline Data Synthesis. Prepared by Golder Associates Ltd., October 2005 (Miramar 2005).

In addition to the reports listed above, unpublished data collected in 2014 on waterbirds and furbearers near the Boston property were incorporated into the draft EIS. Publically available data from other nearby studies (e.g., Back River Project; Sabina 2015a) were also compared to data from the Hope Bay baseline and monitoring programs to provide a regional context.

9.2.5 Methods

Baseline studies were conducted to document wildlife activity and distribution within the LSA and RSA, and to inventory the available habitat for wildlife VECs considered in the assessment. This included a detailed literature review, the examination of existing wildlife inventories, identification of species of conservation concern, field surveys, habitat suitability modeling, and DNA programs. Study objectives for each wildlife group are summarized in Table 9.2-1.

Table 9.2-1. Baseline Study Objectives for Wildlife for the Phase 2 Project

Wildlife Group	Species	Baseline Objectives
Mammal Species		
Ungulates	Caribou	• Determine the abundance and distribution within the RSA. • Quantify seasonal habitat in the RSA by developing habitat suitability models for 1) calving, 2) post-calving and summer, 3) fall, and 4) winter.
	Muskox	• Collect information on seasonal distribution within the RSA. • Quantify seasonal habitat in the RSA by developing habitat suitability models for 1) late winter and early spring, 2) summer and 3) fall (rutting).
Bears	Grizzly Bear	• Determine the relative abundance and distribution in the RSA. • Estimate the local population in the RSA using DNA mark-recapture techniques. • Quantify seasonal habitat in the RSA by developing habitat suitability models for 1) spring, 2) summer, and 3) fall and by conducting den surveys
Furbearers	Furbearers (general)	• Document the presence of furbearer species in the RSA, with a particular emphasis on determining presence of wolverine and grey wolves in the area.
	Wolverine	• Estimate the local population in a sub-set of the RSA using DNA mark-recapture techniques. • Quantify suitable denning habitat in the RSA by developing habitat suitability models and conducting den surveys.
	Grey Wolf	• Quantify suitable denning habitat in the RSA by developing habitat suitability models and conducting den surveys.
Avian Species		
Raptors	General	• Document the presence of raptor species in the LSA and RSA, particularly those listed as Sensitive in Nunavut. • Determine occupancy and productivity of cliff-nesting raptor species in the LSA and RSA through location and inspection of nests. • Determine peregrine falcon abundance and distribution in the LSA and RSA. • Quantify suitable cliff-nesting and ground-nesting habitat in the RSA by developing habitat suitability models.
Waterbirds	General	• Document seasonal presence of species and spatial distribution of waterbirds throughout the LSA and RSA. • Identify important habitats and map their locations (e.g., breeding sites and migratory staging lakes) in the LSA and RSA. • Document species of conservation concern in the LSA and RSA during breeding and staging periods.
Upland Birds	General	• Determine the abundance and species richness of upland birds in the RSA. • Document breeding evidence and presence of species of conservation concern in the RSA.

9.2.6 Characterization of Baseline Conditions for Caribou

This section outlines the existing baseline conditions for caribou. Section 9.2.6.1 describes population trends and conservation, distribution and migration patterns, habitat use, and caribou crossings. Section 9.2.6.2 presents baseline data collected on caribou for the Hope Bay Project.

9.2.6.1 Introduction

Caribou (*Rangifer tarandus groenlandicus*) and caribou harvest are central to Inuit culture, identity, recreation, and kinship. Caribou are of economic and cultural importance to the Inuit and other residents of Nunavut, and the most important wildlife species for the western Kitikmeot region (Banci and Spicker 2016). The life cycle of the caribou was a major influence on where Inuit travelled and lived as they relied on caribou for food and clothing (Banci and Spicker 2016). Most northern communities, including Cambridge Bay, Bathurst Inlet, Kugluktuk, and Omingmaktok, harvest caribou, including the Bathurst, Beverly, Ahiak, Dolphin and Union (Island), and Bluenose East caribou (GNWT ENR 2012). Further information on the Inuit's reliance and relationship with caribou can be found in the socio-economics section of the EIS (Volume 6, Section 3).

In addition to their importance to Inuit, barren-ground caribou are a biological keystone species in the Arctic. Caribou are a main prey item for grizzly bears and wolves. Other carnivores such as wolverine, foxes, and golden eagles scavenge on the caribou remains left from grizzly bear and wolf predation. Inuit TK of the Kitikmeot region includes observations of close associations of the abundance of these carnivore species to caribou abundance at a local scale (Banci and Spicker 2016).

Two caribou herds have the potential to interact with the Hope Bay Project. The range of the Dolphin and Union caribou herd overlaps the RSA during winter and the range of the Beverly herd (includes Beverly herd and Ahiak herd) caribou herd overlaps the RSA during summer (Figure 9.2-1).

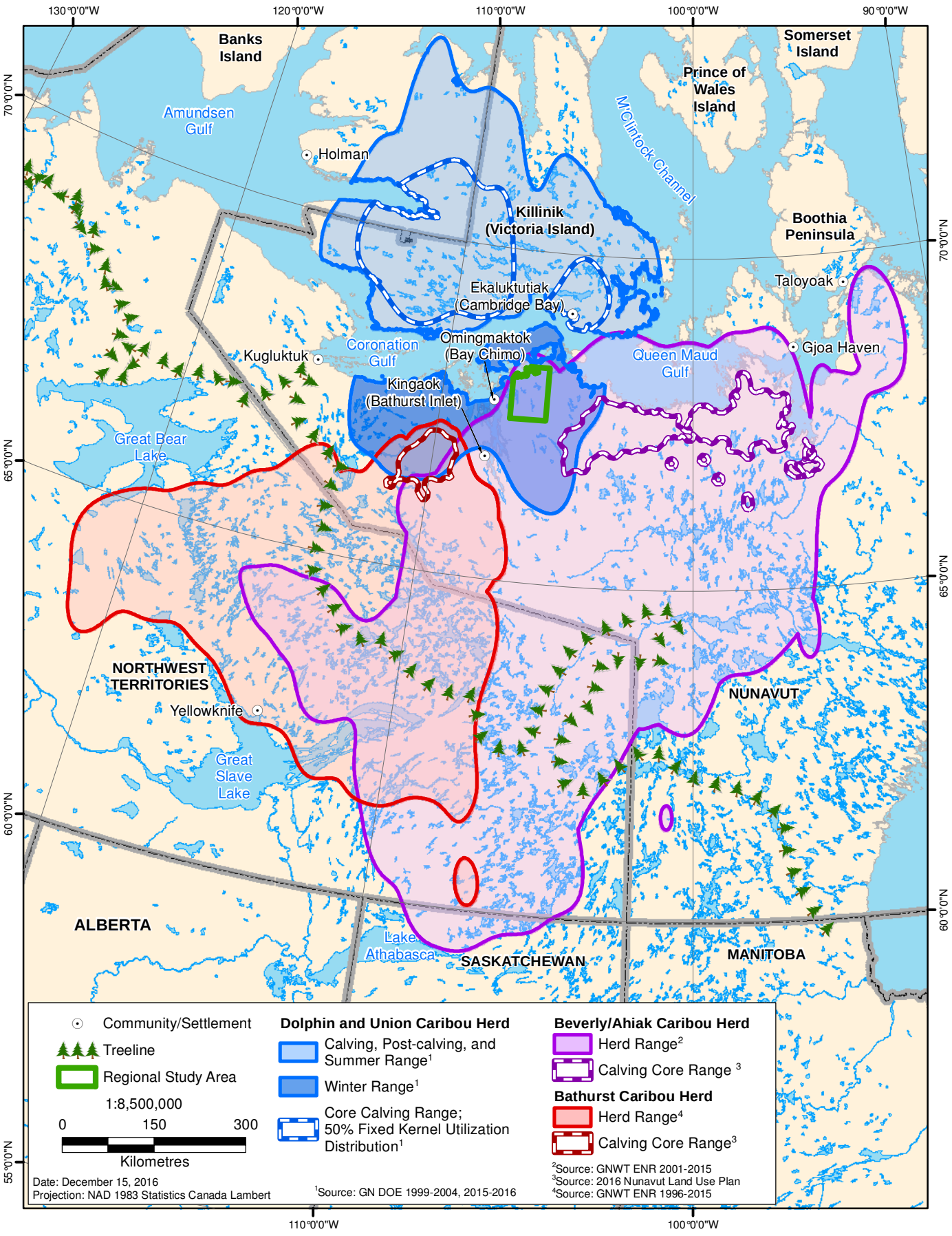
The Dolphin and Union caribou herd is named after the Dolphin and Union Strait on which they travel during their annual spring and fall migrations between the mainland and Victoria Island. Dolphin and Union caribou are genetically distinct from Peary caribou and barren-ground caribou (COSEWIC 2004). Inuit TK distinguishes Dolphin and Union caribou from mainland caribou by their light color, and are locally referred to as "island caribou"(Banci and Spicker 2016). The Dolphin and Union caribou herd is federally listed as Special Concern on Schedule 1 of *SARA* (COSEWIC 2004).

At present, the Beverly/Ahiak herd calves within the Queen Maud Gulf area; the Beverly sub-population to the west and the Ahiak sub-population to the east. Collared females have been observed switching use of calving grounds between the two (Nagy et al. 2011; Campbell et al. 2012; Nagy, Campbell, and Kelly 2012). Currently there is some disagreement over whether these herds should be referred to separately or together. The Governments of Nunavut and Northwest Territories survey the two herds separately and refers to them as two sub-populations in their population survey reports. This document refers to these herds either separately or together as the Beverly/Ahiak herd where relevant. The barren-ground population of caribou, to which the Beverly/Ahiak herd in addition to the Bathurst herd (described below) was announced as being classified as Threatened by COSEWIC in a press release in December 2016 but the assessment report had not been released at the date of production of the EIS (Government of Canada 2016).

The calving grounds of the Ahiak caribou (previously known at the Queen Maud Gulf herd) extend over about 31,000 km^2 along the coast of the Queen Maud Gulf. These are the largest calving grounds of any mainland barren-ground caribou herd in Nunavut and the Northwest Territories (Johnson D., Nagy J., and Williams J. 2008).

Figure 9.2-1

Annual Ranges of the Bathurst, Beverly/Ahiak, and Dolphin and Union Caribou Herds



The Beverly caribou traditionally calved to the south of the Ahiak caribou near Garry Lake. Recently, it was postulated that low cow survival and low calf productivity have led to the Beverly caribou to join the Ahiak caribou on their calving grounds 250 km to the north in the western Queen Maud Gulf calving area (Adamczewski et al. 2015). This may have started as early as the mid-1990s and integration seems to have been complete by 2011.

Two other notable caribou herds are not expected to interact with the Hope Bay Project. The Bathurst caribou herd does not overlap the Hope Bay Project site and occurs to the west of the RSA, on the west side of Bathurst Inlet (Figure 9.2-1). The Peary caribou herd (*R.t. pearyi*) may spatially overlap the Northwest Passage shipping route outside of the marine wildlife RSA, but their on-ice movements are not expected to interact with shipping because the Hope Bay Project will be shipping during the open water season.

For the purposes of the assessment, population trends, distribution, and habitat associations are described for the Beverly/Ahiak caribou herd and Dolphin and Union caribou herd because these two herds have the potential to interact with the Hope Bay Project.

Population Trends and Conservation

Beverly/Ahiak Caribou

The Ahiak caribou were formerly known as the Queen Maud Gulf (QMG) herd and is also referred to as the QMG sub-population in some recent publications, e.g., (Nagy et al. 2011; Nagy, Campbell, and Kelly 2012). Aerial surveys have been conducted several times in the QMG, however, until recently the methods and area surveys have not been consistent.

Pre-calving surveys were conducted during the late spring migration in 1983 and 1995. Pre-calving surveys produced population estimates of 33,000 (± 5,100) animals in May 1983 (Heard, Williams, and Jingfors 1986) and 31,556 (± 4,879) caribou in May 1995 (Buckland et al. 2000). Both of these surveys were in the late portion of the spring migration and covered similar areas as the more recent survey in 2011.

Early aerial surveys were conducted over different sized areas, depending on the year, in 1986, 1996, and 2006:

- The aerial survey of the QMG in 1986 surveyed the eastern third of the QMG, east of the Simpson River, and produced a population estimate of 11,265 (± 1,615) caribou (Gunn, Fournier, and Nishi 2000).
- In 1996, collar data indicated that a much larger area of the QMG was being used for calving than through in the 1980s and a high-level reconnaissance survey was conducted roughly within the Queen Maud Gulf Bird Sanctuary (QMGBS) from approximately 80 km west of the Elise River to Chantrey Bay. This survey estimated a population of 83,134 (± 5,298) within this larger area (Gunn, Fournier, and Nishi 2000).
- In 2006, a survey of the QMG area estimated 123,226 (± 14,500) caribou although the methods and data have not been published so comparisons of area surveyed cannot be made (Gunn, Russell, and Eamer 2011).

The surveys conducted in 1996 and 2006 included both the eastern and western QMG areas. These surveys likely counted both Ahiak caribou (in the east) and Beverly caribou (in the west). During the 1990s and 2000s, the Beverly caribou moved their calving grounds into the QMG to join the Ahiak (Nagy

et al. 2011). As a consequence, these surveys likely should not be used to determine population trends for the Ahiak population.

In 2011, the first systematic survey was conducted of the entire Queen Maud Gulf area, including the Boothia Peninsula and the calving grounds of both Beverly and Ahiak sub-populations. This survey produced a population estimate for the Ahiak sub-populations of 71,340 adults (± 3,882) of which 27,729 (± 1,579) were breeding females (Campbell et al. 2012).

The areas surveyed for the Ahiak caribou were similar during the 1983 and 1995 pre-calving surveys and the 2011 survey. As part of the analysis for the 2011 survey, the densities of caribou in these matching survey blocks were compared. The density roughly doubled from 0.27/km^2 in 1983 and 0.32/km^2 in 1995 to 0.73/km^2 in 2011 (Campbell et al. 2014). This suggests that the Ahiak sub-population is increasing in size although it is not understood whether this is from the growth of the herd, or immigration of Beverly caribou.

The Beverly caribou have historically calved between Garry Lake to the north and Beverly Lake to the south. Aerial surveys conducted on this calving ground between 1967 and 1994 reported that the Beverly caribou were generally increasing. The sub-population size was estimated at fairly stable numbers between 1967 and 1982, with similar herd sizes values in 1967 (159,000), 1971 (164,000), 1974 (124,000) and 1982 (164,338 ± 72,332).

However, between 1984 and 1994, the Beverly sub-population estimates fluctuated by approximately 50-100,000 caribou between years; 1984 (263,691 ± 80,652), 1987 (93,546 ± 19,423), 1988 (189,561 ± 70,961), 1993 (86, 728 ± 17,943), and 1994 (276,000 ± 106,600) (Campbell et al. 2012). A survey conducted in 2002 indicated low numbers of caribou on the traditional calving grounds, which created concern that the Beverly sub-population was declining (Campbell et al. 2012).

An analysis of collaring data provided an indication of the cause of the decline of observed caribou on the traditional Beverly calving area. This analysis indicated that the Beverly caribou had moved their calving area from the traditional area between Garry and Beverly Lakes to the QMG area, immediately to the west of the Ahiak herd (Nagy et al. 2011). An aerial survey was conducted in 2011 in both the Beverly and Garry Lakes calving area and the QMG area. This survey estimated the size of the Beverly sub-population as 124,189 (± 13,996) caribou, of which 52,825 (± 2,638) were breeding females (Campbell et al. 2012).

Hence, the apparent decline in the Beverly caribou on the traditional (Beverly and Garry Lakes) calving areas after 1994 was likely caused by the departure of cows for the QMG calving area. Likewise, the apparent increase in the Ahiak caribou reported from the 1996 and 2006 surveys of the QMG area may have been caused by the immigration of the Beverly caribou (Gunn, Russell, and Eamer 2011; Nagy et al. 2011). Once the Beverly and Ahiak caribou were shown to both calve in the QMG area, thereafter they have been referred to as “sub-populations” in GN survey reports.

As a whole, it is likely that the Beverly sub-population of caribou has declined in abundance and there is some evidence that the Ahiak sub-population has increased in size (Campbell et al. 2012). It is not well understood whether movement from the Beverly sub-population to the Ahiak sub-population can explain these population changes.

Several factors are thought to affect the populations of barren-ground caribou. These include, harvest, predation, insect harassment, disease, road and industrial development, and climate change (Solberg et al. 2001; Tews, Ferguson, and Fahrig. 2007; Joly et al. 2011b; Banci and Spicker 2015, 2016).

Beverly/Ahiak caribou are harvested by people from the communities of Gjoa Haven, Omingmaktok, Cambridge Bay, and Lutsel K'e, and in winter by people from northern Saskatchewan where some of the herd overwinters (Gunn, Russell, and Eamer 2011). In NWT, harvesting is managed following the 2011–2015 Caribou Management Strategy. Aboriginal harvesters with a General Hunting License (GHL) are not restricted from harvest of the Beverly/Ahiak herd. In 2010, local resident (non-aboriginal), outfitted and commercial harvest of Beverly caribou was suspended. Starting in January 2014, the area U/BC/01 to the east of Great Slave Lake is open for resident hunting, which includes some of the wintering grounds of the Beverly herd. In this area resident hunters must have a tag and are allowed one male caribou between 15 August and 30 April. In Nunavut, non-aboriginal resident hunters are limited to 5 caribou per year, while non-residents (person who is not a resident of Nunavut but who is a Canadian citizen) and non-resident aliens (person who is neither a resident of Nunavut nor a non-resident) are limited to 2 caribou per year. In Saskatchewan, resident hunters are limited to one caribou of either gender (Saskatchewan 2016)

Harvest estimates for the Beverly sub-population were last recorded systematically in 2005–2006 (BQCMB 2006) (Table 9.2-2). These estimates indicate that approximately 75% of Beverly harvest was occurring in Saskatchewan, however the government of Saskatchewan report that the Beverly caribou no longer winter in Saskatchewan (Saskatchewan 2016). With the decline in the Bathurst herd, there are some indications that there is increasing harvesting pressure on the Beverly herd on their winter range to the east of Great Slave Lake.

Table 9.2-2. Harvest Rates of Beverly Caribou 2005-2006

Province/Territory	Community	Traditional Use	Resident Hunter	Commercial
Nunavut	Baker Lake	400	n/a	50
NWT	Fort Resolution	0		
NWT	Fort Smith	100	75	20
NWT	Lutsel K'e	100		150
Saskatchewan	Black Lake	1,600		
Saskatchewan	Camsell Portage	0		
Saskatchewan	Fond du Lac	1,000		
Saskatchewan	Stoney Rapids	200	2	
Saskatchewan	Uranium City	0		
Alberta	Fort Chipewyan	75		
Totals		**3,475**	**77**	**220**

Source: (BQCMB 2006)

There is very little information on harvest rates of Ahiak caribou. Given that their wintering range is generally to the north of the tree-line and communities in NWT and Saskatchewan and west of communities in Nunavut this herd may not experience significant harvest pressure.

In addition to harvest, the barrenland caribou populations are also thought to be affected by parasites, weather, forest fires and development pressures. Harassment by black flies and especially bot (oestrid) flies can cause significant disturbances to tundra caribou in July and August (Witter et al. 2012a). Insects are abundant on warm days when wind speeds are low (Boulanger, Poole, et al. 2004) especially for the two weeks spanning late June to early July (Thorpe et al. 2001). Caribou compensate for harassment by engaging in avoidance behaviours (on average 5% of the day) such as head tossing and erratic running when insects are active, from about 0800 to 2100 hours (Witter et al. 2012a).

The Beverly caribou spend the winter within the boreal forest, in mature forest stands where their main forage item, mat-forming lichens, are most abundant (Chen et al. 2009; Province of British Columbia 2014). An increase in the number of forest fires within the winter range of Beverly caribou, is resulting in decreased availability of lichen, which require many years to grow back after fire (Chen, Russell, et al. 2013). The frequency of forest fires in the caribou winter range below treeline is largely determined by decadal changes in climate such as the Arctic Oscillation (Overland and Wang 2005).

Recent evidence suggests that over-winter survival of the Bathurst caribou herd, and possibly other herds such as the Beverly/Ahiak may be related to forage conditions on the summer range (McDonald and Wilcockson 2003). Chen, Foy, et al. (2013) demonstrated that productivity on the summer range explains a significant portion of the variation in caribou birth rate (86%), net productivity (56%), and calf survival rate (52%), but not cow survival rate.

The BQCMB also identified industrial development, including low level aircraft overflights and the increase in all-season resource roads in northern Saskatchewan and Manitoba as increasing the access to formerly inaccessible areas, thereby increasing the level of disturbance and harvest for the Beverly and Qamanirjuaq herds (BQCMB 2014).

Dolphin and Union (Island) Caribou

In the early 1900s, the Dolphin and Union (Island) caribou herd was estimated at 100,000 animals (COSEWIC 2004). Overhunting and possibly also rain-on-snow events caused a population decline between 1900 and 1920 to the point where caribou were not observed migrating between Victoria Island and the mainland after about 1930; and instead, remained on Victoria Island year-round (Gunn 2005). Beginning in the 1970s, the herd size increased, and in the late 1980s the herd resumed its migration to the mainland (Gunn et al. 1997). In 1993, approximately 7,200 Dolphin and Union caribou were counted on the mainland prior to migrating over the ice in spring (Gunn et al. 1997). In 1997, the Dolphin and Union caribou herd was estimated at 28,000 ± 3,350 animals (Nishi and Gunn 2004), about one-third of its historic size. The most recent population estimate was conducted in 2007 and estimated 27,787 ± 7,537 caribou suggesting that the population size is stable, though still only a third of its historic size (M. Dumond, GN , unpublished data, cited from Poole et al. 2010; COSEWIC 2004). Inuit TK parallels these findings; Dolphin and Union caribou were rarely observed after the 1920s and into the 1950s, but observations had become regular by the 1990s (Banci and Spicker 2016).

Threats to the Dolphin and Union caribou herd have been identified as climate change, and winter shipping activity along the herd's migration route (COSEWIC 2004). During migration, the caribou require ice thick enough to support their weight as they cross the Coronation Gulf, Dease Strait, and the Queen Maud Gulf (COSEWIC 2004). Climate change has shortened the time interval caribou have on the mainland between the fall and spring migrations, since this movement is dependent on ice formation. Since 1982, freeze-up between Victoria Island and the mainland has occurred 8-10 days later which may have affected the timing of fall migration (Poole et al. 2010). There is concern that this trend will continue with a declining period for Dolphin and Union caribou on the mainland during winter. Concern has also been raised about increased winter shipping activity which may break up the ice in Dease Strait or the Queen Maud Gulf, causing the Dolphin and Union caribou migration to be blocked or animals may fall through the recently broken ice (COSEWIC 2004; Poole et al. 2010; Festa-Bianchet et al. 2011). Dolphin and Union caribou have been observed by hunters to die after breaking through newly-forming ice, and caribou have been observed with ice on their fur in December, possibly from falling through sea ice during southward migration (reviewed in Poole et al. 2010).

In addition to affecting migration of Dolphin and Union caribou, climate change may result in an increase in the number of rain-on-snow events, which are thought cause mortality due to starvation

during winters with severe ice conditions (COSEWIC 2004). In some high-arctic herds, such as the Peary caribou herd, scientists have observed hundreds of caribou carcasses after winters associated with severe weather and have attributed these die offs to icing events (Gunn and Dragon 2002). A study in the Norwegian Arctic has documented low calf production following all but one winter with high ice cover (Stien et al. 2012), and a strong correlation between icing and population size (Hansen et al. 2011).

Caribou harvest in Nunavut was systematically measured during a five year period between June 1996 and May 2001 (Priest and Usher 2004). Harvesters reported that they harvested both mainland (likely Bluenose east and Beverly/Ahiak) and island (Dolphin and Union) caribou, however the numbers were reported together (Priest and Usher 2004) and summarized in Table 9.2-3.

Table 9.2-3. Harvest of Caribou in Cambridge Bay, Bathurst Inlet, Kugluktuk, Omingmaktok 1996-2001

Caribou Harvest	96/97	97/98	98/99	99/00	00/01	Mean
Cambridge Bay	1,653	359	654	715	672	811
Kingaut (Bathurst Inlet)	117	83	98	75	94	93
Omingmaktok (Bay Chimo)	314	247	155	111	52	176
Kugluktuk	1,561	1,462	1,913	1,584	1,355	1,575
Number of Harvesters	**96/97**	**97/98**	**98/99**	**99/00**	**00/01**	**Total**
Cambridge Bay	39	40	53	50	54	92
Kingaut (Bathurst Inlet)	18	17	17	18	17	21
Omingmaktok (Bay Chimo)	19	16	10	8	8	23
Kugluktuk*	106	88	104	105	100	146

** harvest predominantly Bathurst caribou*

In each of these four communities, harvest was concentrated from the fall to the winter, from August to January. In Cambridge Bay, almost half of the harvest was concentrated in October, which corresponds to the rutting period when Dolphin and Union caribou are near the community, congregating on the south shore of Victoria Island waiting to cross the sea ice to the mainland. In Kingaut, harvest was spread throughout the year, and due to the herd distributions, it is likely that winter harvests from this community were Dolphin and Union, while those harvested in summer were Beverly/Ahiak or Bathurst. In Omingmaktok, harvest was also spread throughout the year, with a peak in November through February, likely of Dolphin and Union caribou. In Kugluktuk, harvest was spread throughout the year, and due to the herd distributions, it is likely that harvests from this community were Bluenose East and possibly Bathurst caribou. If all harvested caribou by these four communities were Dolphin and Union, the average rate of harvest would represent 9.5% of the Dolphin and Union herd counted in 1997.

Bathurst Caribou

In the 1980s, the Bathurst caribou herd was one of the largest migratory herds in Arctic Canada, estimated at approximately 450,000 animals in 1986 (Heard and Williams 1991; Boulanger et al. 2011). Similar to other North American caribou herds, the Bathurst caribou herd has declined in size (Vors and Boyce 2009; Boulanger et al. 2011), to approximately 31,900 individuals in 2009, likely due, in part, to relatively high winter harvests of females (4,000 to 5,000 per year), which coincided with declines between 1986 and 2006 (Adamczewski et al. 2009). Between 2006 and 2012, assessments of caribou body condition, pregnancy rates, and cow-calf ratios suggested improvements in breeding productivity, and the population appeared to be stabilizing or increasing slightly (Adamczewsk et al. 2015). However, recent

reconnaissance surveys conducted on the calving grounds in 2014 suggest that the herd may be in further decline (GNWT ENR 2014). The current Bathurst caribou population is low compared to its historic size, which can make the herd vulnerable to disturbance, weather and other factors (BCMPC 2004; GNWT ENR, pers. comm.).

Most northern communities, including Kingaut (Bathurst Inlet), Kugluktuk, and Omingmaktok, have likely historically harvested Bathurst caribou during spring migration and post-calving (GNWT ENR 2012). Data from Inuit hunters between 1996 and 2001 indicate that the average number of caribou harvested annually by Inuit hunters (averaged by community) were: 93 in Bathurst Inlet, 1,575 in Kugluktuk, and 176 in Omingmaktok (Priest and Usher 2004). However, these data also include harvest of caribou from the Dolphin and Union caribou herd and the Bluenose East caribou herd. Limits on the number of caribou that can be harvested for both traditional and commercial use have recently been implemented (GNWT ENR 2016a). The annual harvest for the herd in Nunavut was set at 240 males and 60 females for the 2012-2013 winter hunting season (Adamczewski et al. 2009; Wekʼèezhìi Renewable Resources Board 2012). All Bathurst caribou harvest has since been suspended in Nunavut (Nunavut 2016). Since 2014, the Northwest Territories has placed a total harvest ban on Bathurst caribou during the winter hunting season, aside from a 15 individual limit for Aboriginal ceremonial use. These harvest restrictions remain in effect (Nunavut 2016).

Distribution and Migration Patterns

Most of the barren-ground caribou migrate annually between the calving grounds on the tundra and overwintering grounds in the south. During winter, some herds migrate south below or near the treeline, such as the Beverly and Bathurst caribou herds, while other herds overwinter on the tundra including the Dolphin and Union caribou herd.

Herd specific seasonal distribution patterns are discussed for the Beverly/Ahiak and Dolphin Union herds in Section 9.2.6.5. These patterns are interpreted in relation to the Hope Bay Project area. A discussion on the movement of the calving grounds for the Bathurst caribou herd is also included, although this herd does not overlap the Hope Bay Project area.

Habitat Use

Caribou habitat is one of six main issues identified in the 2011/2012, 2014, and 2016 Draft Nunavut Land Use Plans for protecting and sustaining the environment (NPC 2012, 2014b, 2016). Habitat selection on the tundra by caribou is mainly dictated by predator and insect avoidance, and the distribution and availability of suitable forage (Calef 1981; Heard, Williams, and Melton 1996; Russell J.H. 1998; Wilson R.R. et al. 2012). Caribou also select travel routes during migration that provide easier movement, such as frozen lakes in winter, and sometimes eskers (Thorpe et al. 2001; Banci and Spicker 2016). Inuit TK has also identified important habitat for caribou including nadlok (shallow lake crossings and narrows of rivers during the ice-free season), wetlands, eskers, and other high land features used for insect and heat relief (Banci and Spicker 2016).

The following sections outline habitat selection of caribou during each of the six life history/life cycle stages: calving, post-calving, summer, fall migration, winter, and spring migration. Detailed habitat mapping for caribou is included in Section 9.2.6.2 in the sections on habitat suitability modeling.

Calving

Caribou calving grounds on the tundra are areas that facilitate predator avoidance, and offer forage availability after snowmelt for lactating females (Griffith et al. 2001; Wilson R.R. et al. 2012). However, a potential trade-off exists between safety and forage availability; calving females may

choose calving grounds that are relatively safe from predators but are not necessarily places where snow melts earlier nor where vegetation biomass is greatest (Wilson R.R. et al. 2012). Though forage availability may be lower, some have suggested that calving grounds are located in areas where forage quality is high (reviewed in Griffith et al. 2001; Wilson R.R. et al. 2012). Inuit TK identified wetlands as important areas for calving, as wetlands provided flat areas with a source of water, and provided a source of high quality food for their calves (Banci and Spicker 2016).

Post-calving and Summer

Access to high quality forage is likely the key driver of habitat selection in the post-calving period (Witter et al. 2012a). Females need to acquire adequate nutrient reserves for lactation. Calves feed exclusively on their mother's milk until about three weeks of age when calves begin foraging on their own. Calf body condition at birth and in the first few weeks of life, and thus calf survival, are highly dependent on female nutritional status (reviewed in Couturier et al. 2009).

Summer

During summer, caribou are thought to select habitat based on forage quality and insect harassment (Skarin et al. 2008). Females must acquire adequate forage to store enough nutrient resources to survive and to maintain pregnancy throughout the winter (Helle and Tarvainen 1984; Colman et al. 2003). Thus, access to high quality forage is not only important to calf survival within the year, but also to the survival of females and yearlings in the subsequent winter, and to the ability of females to birth healthy calves in the subsequent spring (White R. G. 1983; Couturier et al. 2009). Foraging throughout summer predominately occurs in sedge meadows, where caribou can graze up to 50% of the net primary productivity (Jefferies 1992).

During periods when insect harassment is high, caribou may trade off foraging quality for habitat that provides relief from insects. Caribou are often seen swimming in lakes to escape the heat and insects (Thorpe et al. 2001) and along the ocean or lake shorelines where the breezes provide relief from heat and insects (Banci and Spicker 2016). Caribou will stand in the shade of cliffs, eskers or hills to get relief from the heat (Banci and Spicker 2016). Caribou also attempt to avoid insects by moving for some part of the daytime to windier, cooler places, such as on top of eskers and hills and to higher elevation tundra where insects are less dense (Russell, Martell, and Nixon 1993; Skarin et al. 2008; Wilson R.R. et al. 2012; Witter et al. 2012a; Banci and Spicker 2015, 2016). At night when there are few insects, caribou move to lower elevation sites where the forage quality is usually higher (Skarin et al. 2008). Caribou also make large-scale seasonal movements to areas with fewer insects (Wilson R.R. et al. 2012). Depending on topography and the location of large lakes, such movements may occur through relatively narrow travel corridors (Wilson R.R. et al. 2012).

Fall Migration

During the fall, caribou require habitats that provide abundant forage and facilitate travel. Caribou breed in the fall during the rut but implantation of the fertilized egg is delayed and can be aborted if animal condition is poor during the winter. Hence, high quality forage is important in the fall. Green forage becomes less available as the fall progresses and caribou choose lichen veneer for foraging (Johnson C. et al. 2005). Sedge wetland and riparian tall shrub habitats may also be used depending on the availability of green forage. However, a habitat modeling study by Johnson et al. (2005) indicated that caribou may avoid areas dominated by sedge, peat bog, and heath tundra during the fall. Eskers, ridges, and other high points are selected for easy travel (Thorpe et al. 2001).

Winter

High quality winter habitat for tundra-wintering caribou includes low snow depth and abundant lichen (reviewed in Ferguson M. A. D., Gauthier L., and Messier F. 2001; Joly, Chapin, and Klein 2010). Inuit

TK includes observations of wintering caribou in areas where snow is relatively shallow, such as in rocky or elevated wind-swept areas where caribou could more easily crater for lichen (Banci and Spicker 2016). Insufficient forage availability in winter can have a large impact on population dynamics of tundra-wintering caribou. Poor female body condition during winter can affect calf weights and survival, and thus population recruitment (Couturier et al. 2009). Due to the energetic demands of their growing foetuses, female caribou may choose riskier habitats that provide good forage relative to bulls (Joly 2008).

Spring Migration

Snow and ice remain on the tundra during spring migration and thus Beverly caribou use large frozen lakes and rivers as travel corridors, while the Dolphin and Union caribou travel across the frozen ocean. Caribou also use other areas that facilitate travel on the tundra, such as eskers and open snow-free upland, and follow the contours of steeper terrain before crossing over (LeResche and Linderman 1975; Thorpe et al. 2001). When travelling over tundra, caribou must also seek places where snow cover is shallow so they can more easily dig for graminoids and lichen (Russell, Martell, and Nixon 1993; Ferguson M. A. D., Gauthier L., and Messier F. 2001).

Caribou Crossings and Migration Routes

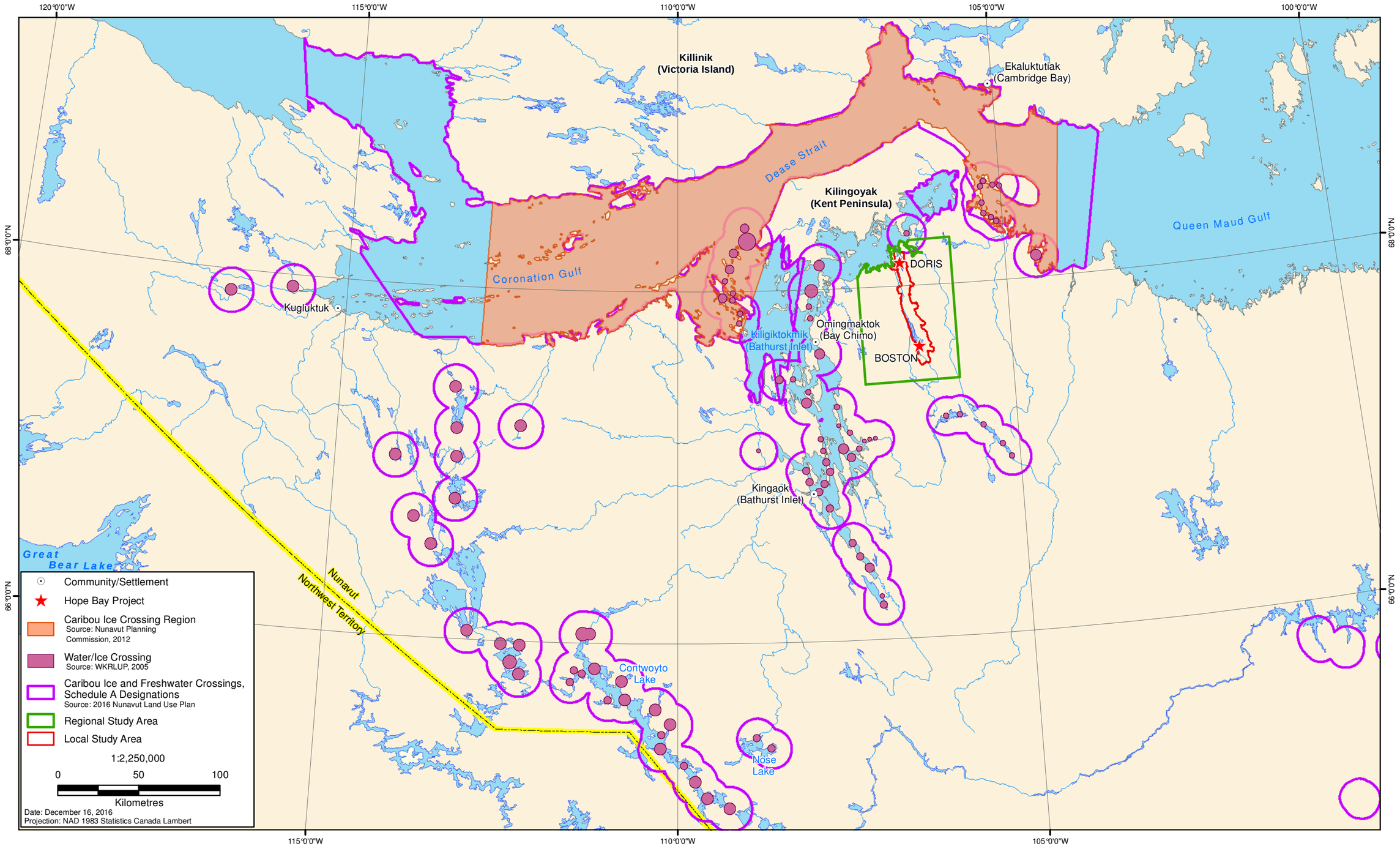
Migration routes across the sea ice have been identified as key aspects of caribou habitat. The 2016 Draft Nunavut Land Use Plan indicates that herds are vulnerable to changing sea ice conditions and disturbance by ice breaking, and management direction within the plan states “Regulatory Authorities, where appropriate, need to mitigate impacts of project proposals with ship traffic on spring and fall caribou sea ice crossing.” Water crossings are also considered within the 2005 Draft West Kitikmeot Regional Land Use Plan (NPC 2005).

The Dease Strait, between Victoria Island and the mainland, and the Queen Maud Gulf are important crossing areas for the Dolphin and Union caribou herd during their annual spring and fall migrations (COSEWIC 2004; Poole et al. 2010). Dolphin and Union caribou travel across the sea ice twice as fast during the (fall) south migration to the mainland (23 days) than the (spring) north migration (on average 48 days) (Poole et al. 2010). Caribou cannot cross south to the mainland until ice has formed, and cannot cross north to Victoria Island once the sea ice has melted.

Inuit TK identified several important crossing areas for Dolphin and Union caribou. During the spring and fall migration periods, the most important migration crossing route was at the west end of the Queen Maud Gulf at the Kent Peninsula isthmus (Banci and Spicker 2016). Migration routes for Dolphin and Union caribou were also identified over the sea ice on Dease Strait. Crossing areas were also identified in the southern portion of Bathurst Inlet for the Beverly caribou herd (Banci and Spicker 2016).

Nadloks, or shallow areas of lakes and narrows of rivers, on the mainland were also identified by TK as important crossing areas for mainland caribou during the open water season in summer and fall (Banci and Spicker 2016). Terrestrial and marine caribou crossing locations identified by the Inuit as well as in the 2016 Nunavut Land Use Plan are presented in Figure 9.2-2.

Figure 9.2-2
Designated Caribou Crossings



9.2.6.2 Baseline Data for Caribou

The objectives of baseline studies were to determine the movements the Beverly/Ahiak caribou herd and the Dolphin and Union caribou herd during each season, to what degree these movements overlapped with the Hope Bay Project area, and how caribou use habitat within the wildlife RSA over a number of ecologically significant scales.

Baseline data is available from government agencies and was also directly collected in the field. Four baseline characterization studies were conducted:

1. analysis of satellite collar data (2001 to 2014/2015 for Beverly/Ahiak caribou, and 1999 to 2004 for Dolphin and Union caribou) to determine movement patterns and seasonal ranges;
2. aerial surveys conducted from 1996 to 2011 in the RSA and in 2010 on sea ice transects located in Bathurst Inlet and Melville Sound during key life history/life cycle stages for caribou;
3. remote motion-triggered cameras (2012 to 2015) for monitoring habitat use of key habitat features including detailed timing information for when caribou use these features; and
4. habitat suitability modeling to determine the importance, location, and abundance of caribou habitat.

Analysis of Satellite Collar Data

General Methods

Caribou use of the land can broadly be classified into two groups: 1) migrations (spring and fall) when large herds of caribou relocate to specific locations, and 2) resident periods (calving, post-calving, summer, and winter) when the daily movement rate of caribou is lower than migrations and the herd occupies a distinct range for that season. In order to map habitat use by caribou during each season, two methods were used. Satellite collar data provides data on the movement of caribou during the migratory period. During migrations, satellite collars provided a series of point data on the locations of individual caribou traversing the landscape. Collectively, these data summarize the herd's migration routes highlighting key corridors and river crossings.

During the resident periods, habitat use was analyzed using fixed kernel utilization distributions (UDs) that indicate areas of high usage. Core use areas were estimated using the 50% fixed kernel UD, which represents an area with a 50% probability that an animal (or group of animals) is inside that area. Seasonal ranges or areas of active use were estimated using the 95% fixed kernel UD which represents a 95% probability that caribou will be inside the area.

Data was analyzed by season/life history stage. These stages vary between herds and are defined by movement rates for migrations vs. winter and summer ranges (Johnson C. et al. 2005). The peak of calving (the day when 50% of the caribou have calved) and the weaning of calves are used to define the calving period and post-calving period, respectively. Calving is synchronized to occur within a short, typically a 10–15 day, period, and calves are generally weaned three to five weeks after they are born (Russell, Kofinas, and Griffith 2002).

Beverly/Ahiak Caribou

A collaring program for the Beverly herd was initiated in 2001 by the governments of Northwest Territories and Nunavut. Each year, satellite collars are fitted on female caribou during the winter. The data generated from this program allows researchers to investigate seasonal trends in habitat use as well as track the real time movement patterns of caribou. Prior to 2008, all collars deployed on Beverly

caribou were satellite collars which typically provided one (fixed) location every one to five days (depending on programming and season). Each location had an associated error between 150 m and 1,000 m depending upon the location class (Johnson C.J. and Gillingham M.P. 2005). Beginning in 2008, GPS collars with satellite uplink were deployed providing three to six locations daily with much greater location accuracy (generally < 15 to 25 m).

The yearly distribution and movements of Beverly caribou are classified into six distinct periods (Table 9.2-4). The timing of spring migration and calving for Beverly females can vary up to a week between years (Gunn, Fournier, and Nishi 2000; Johnson D., Nagy J., and Williams J. 2008).

Table 9.2-4. Timing of Life History Stages of Beverly Caribou

Cycle Stage	Start Date	End Date
Calving[1]	June 5	June 20[2]
Post-calving[3]	June 21	July 25
Summer[4]	July 26	August 31
Fall Migration[5]	September 1	October 31
Winter[6]	November 1	April 14
Spring Migration[7]	April 15	June 4

[1] Gunn, Fournier, and Nishi (2000).
[2] Gunn, Fournier, and Nishi (2000); Gunn and D'Hont (2002); Johnson et al. (2008); Campbell et al. (2012)
[3] Five weeks post-calving, which extends into post-calving and early summer periods (early summer period is defined in Gunn et al. (2008)); Russell, Kofinas, and Griffith (2002).
[4] Gunn et al. (2008).
[5] Johnson et al. (2005); includes rut period defined in Gunn et al. (2008).
[6] Includes late fall and winter periods defined in Gunn et al. (2008).
[7] Gunn, Fournier, and Nishi (2000).

Calving (June 5 to June 20)

During calving, Beverly/Ahiak caribou primarily occur in the Queen Maud Gulf Migratory Bird Sanctuary (Gunn, Fournier, and Nishi 2000; Gunn A. and D'Hont A. 2002; A. D'Hont, GNWT ENR, unpublished data) east of the RSA. Inuit TK indicated the main calving areas occurring in the Queen Maud Gulf area in several concentrated areas including near the Ellice River, Tingmeak River, Whitebear Point, Kuugaarjuk River, and Haloakhiokvik (Banci and Spicker 2016). Beverly/Ahiak caribou are segregated by age and gender on the calving grounds, with bulls occurring mostly on the eastern edge, females with cows in the middle, and non-parturient females and yearlings on the western edge (Campbell et al. 2012).

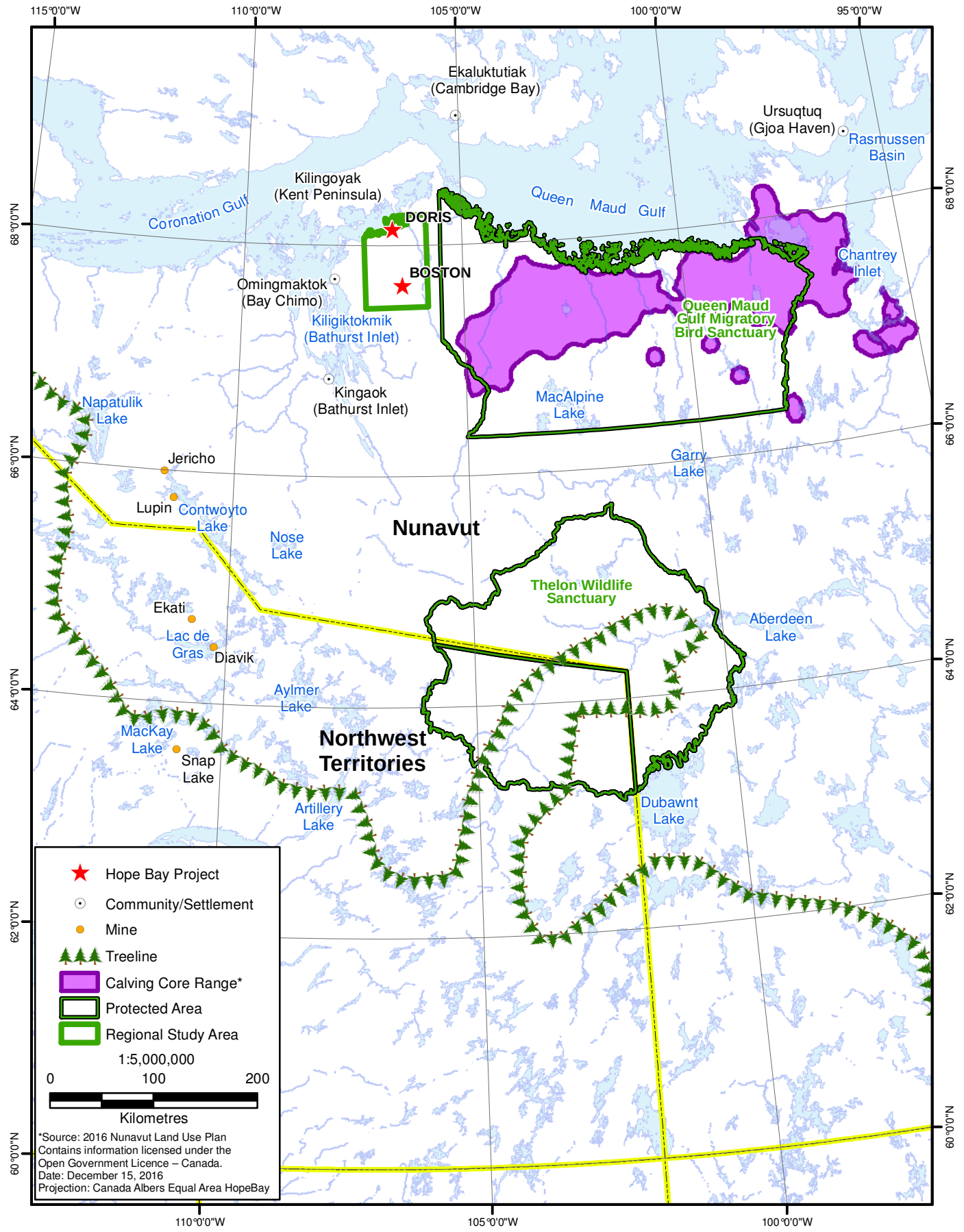
The Beverly/Ahiak caribou occur in adjacent calving ranges, with the Beverly sub-population typically west of the Perry River and the Ahiak sub-population to the east. Most caribou returned to their individual calving grounds in each year, however a total of three instances (of an average of 17 collared individuals per year) occurred where Beverly or Ahiak caribou switched calving grounds for a single year.

For the most part, Beverly/Ahiak female caribou are not expected to occur in the RSA during calving, as their calving grounds are located to the east of the RSA in the Queen Maud Gulf Migratory Bird Sanctuary (Figure 9.2-3).

Currently, satellite collar data and an aerial survey conducted in 2011 of both the historic (Beverly and Garry Lakes) calving area and the Queen Maud Gulf area indicated that the majority of Beverly caribou are using the Queen Maud Gulf area, while a small proportion are using the Beverly and Garry Lakes area for calving. Hence, maps of Beverly calving show two distinct calving areas, a large one in the Queen Maud Gulf and a small one north of Garry Lake

Figure 9.2-3

Range of Satellite-collared Beverly/Ahiak Caribou Herd during Calving



Post-calving (June 21 to July 25)

Following calving, Beverly/Ahiak caribou typically remain on the calving grounds for the post calving period (Gunn, Fournier, and Nishi 2000). Caribou may stay on the calving grounds because the Queen Maud Gulf area hosts productive wetland vegetation, and/or because there are large watercourses in the area that caribou are reluctant to cross until water levels have receded (Campbell et al. 2012). During post-calving, cows and calves may aggregate into large groups ranging from hundreds to thousands of individuals (Gunn A. and D'Hont A. 2002). Inuit TK indicates that sometime during the post-calving and summer season, Beverly/Ahiak caribou travel south from their calving grounds or north towards the coast (Banci and Spicker 2016). Collared, female Beverly caribou are generally not anticipated to occur in the RSA during post-calving (Figure 9.2-4). At this time, their range primarily overlaps their calving grounds on the Queen Maud Migratory Bird Sanctuary.

Summer (July 26 to August 31)

During the summer and into the fall, Beverly/Ahiak caribou generally continue to move south from the Queen Maud Gulf Migratory Bird Sanctuary towards the Thelon Game Sanctuary, located on the Northwest Territories/Nunavut border east of Great Slave Lake (Figure 9.2-5) (Gunn, Fournier, and Nishi 2000; Banci and Spicker 2016). However, while Inuit TK generally agrees with the trend in the southern movement of Beverly/Ahiak caribou during the summer months, the occurrence of caribou during the summer months was considered to be unpredictable and variable, and does not reflect Inuit TK information that during summer season, Beverly/Ahiak caribou travel south from their calving grounds or north towards the coast (Banci and Spicker 2016). From mid-July onward, most bulls and juveniles have joined females on summer ranges (Heard, Williams, and Melton 1996). Movement rates of collared females increase steadily from mid- to the end of June from about 5 to 12 km/day (Nishi et al. 2010). A small proportion of the combined Beverly/Ahiak caribou herd summer and fall ranges (UD 95%) overlaps the RSA, particularly around the southern half of the RSA, before shifting southward to the treeline for the winter. Along with bulls and juveniles, the combined Beverly/Ahiak cows and calves are expected to occur in the RSA during summer. The summer range (95% UD) of Beverly caribou overlapped with the RSA, during all years between 2001 and 2014, with the exception of 2002 and 2012. However, the core summer range (50% UD) of Beverly caribou only overlapped with the RSA during the summers of 2003 and 2005, and minimally overlapped the RSA in 2001 and 2004 in the southeast portion of the RSA.

Fall Migration (September 1 to October 31)

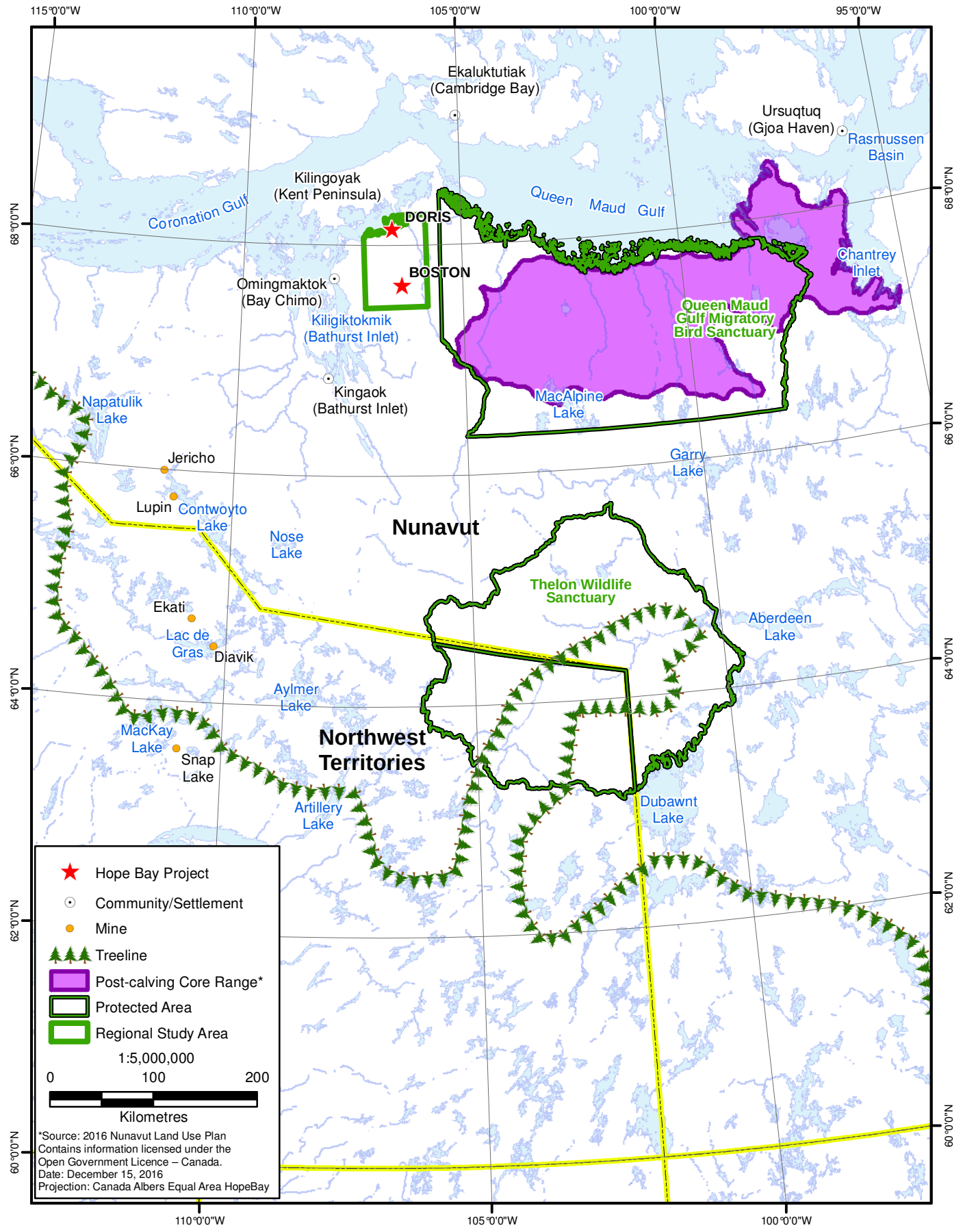
During the fall, Beverly caribou generally continue to move south from the summer range towards the Thelon Game Sanctuary where the fall rut occurs while the fall distribution of Ahiak caribou remains north of treeline (Figure 9.2-5) (Gunn, Fournier, and Nishi 2000; Banci and Spicker 2016). Fewer Beverly/Ahiak caribou are found in the RSA relative to the density in summer. The combined Beverly/Ahiak fall range (95% UD) overlapped with the RSA in all years from 2001 to 2014 with the exception of 2004, 2007, 2011, and 2012. The core fall range (50% UD) of the Beverly caribou overlapped with the RSA during the fall of 2003 and 2005.

Winter (November 1 to April 14)

Beverly caribou winter over a broad area extending from the east side of Bathurst Inlet (above tree line) south to the area east of Great Slave Lake and as far south as the Saskatchewan border in the boreal forest (Figure 9.2-6) (Gunn, Fournier, and Nishi 2000). The winter distribution of Ahiak caribou overlaps the Beverly winter range, but is generally above treeline, and so they are classified as tundra-wintering caribou (Gunn, Fournier, and Nishi 2000).

Figure 9.2-4

Range of Satellite-collared Beverly/Ahiak Caribou Herd during Post-calving



Inuit TK indicates that, during the winter, mainland caribou overwinter in the northern portion of Bathurst Inlet on both the east and west sides of the inlet (Banci and Spicker 2016). Observations of mainland caribou intermixed with Dolphin and Union caribou in winter on either side of Bathurst Inlet may have been Beverly or Ahiak caribou (Banci and Spicker 2016). During winter, caribou are relatively sedentary, usually moving less than 2 km per day (Joly 2008).

Based on the 95% kernel distribution of collared female caribou, very few Beverly or Ahiak caribou occur in the southern end of the RSA during the winter period. The winter range (95% UD) of the combined Beverly/Ahiak caribou overlapped with the RSA during the earlier years of study in the winters of 2001-2002, 2002-2003, and 2003-2004, and most recently during the winter of 2014-2015. The core winter range (50% UD) only overlapped with the RSA during the winter of 2014/2015.

Spring Migration (April 15 to June 4)

Both evidence from the satellite collars and Inuit TK indicate that Beverly/Ahiak caribou migrate northwards relatively quickly from their wintering grounds to their calving grounds along the Queen Maud Gulf to the east of the RSA (Banci and Spicker 2016). Female barren-ground caribou were estimated to move about 14 to 20 km/day during the last three weeks of May (versus < 4 km/day during calving; Gunn and Poole 2009; Nishi et al. 2010). Pregnant females initiate migration to calving grounds, while non-parturient females follow at a slower speed (Gunn A. and D'Hont A. 2002). With the exception of 2009, female Beverly caribou do not cross through the RSA on their way to the calving grounds (Figure 9.2-6). Inuit TK indicates that all of Bathurst Inlet, including the areas on the east including the RSA, was used by migratory caribou due to the proximity to the calving grounds (Banci and Spicker 2016). Bulls and juvenile Beverly caribou follow the females north (Bear Scare Ltd. 2005; Young et al. 2010). By mid-June bulls comprise up to 10% of caribou on the calving grounds (Heard, Williams, and Melton 1996; Gunn, Dragon, and Boulanger 2002; Gunn A. and D'Hont A. 2002). In years with delayed snow melt or deep snow that makes travel difficult, some females may calve before reaching calving grounds, while other females birth low weight calves with reduced chances of survival (Griffith et al. 2001).

Summary

Overall, collar data suggests that Beverly/Ahiak caribou are most commonly present in the RSA in the summer from mid-July to the end of August. The wildlife RSA overlaps the northwestern range extent of the Beverly/Ahiak herd range. However, in most years the seasonal core use habitat based on 50% kernel distributions fell outside of the RSA during all seasons indicating the relative low use of the RSA by Beverly/Ahiak caribou herd caribou. The calving and post-calving range of the Beverly/Ahiak populations lie outside of the RSA. During winter Ahiak, and possibly Beverly caribou may interact with the RSA. Inuit TK generally agreed with caribou distribution and movement patterns determined within baseline studies and within the literature (Banci and Spicker 2016).

Dolphin and Union Caribou

Inuit TK describes that Dolphin and Union caribou winter on the mainland and calve and summer on Victoria Island (Banci and Spicker 2016). Spring migration occurs in May across the sea ice to Victoria Island. These caribou return to the mainland during the fall migration, generally starting following sea ice formation in late October.

The yearly distribution and movements of Dolphin and Union caribou can be classified into six distinct periods: winter, spring migration, calving, post-calving, summer, and fall migration (Table 9.2-5). The following sections discuss the demography and distribution of the Dolphin and Union caribou herd with emphasis on migration timing and routes across sea ice.

Figure 9.2-5
Range of Satellite-collared Beverly/Ahiak Caribou Herd during Summer (26 July to 31 August) and Fall (1 September to 31 October), 2001 to 2014

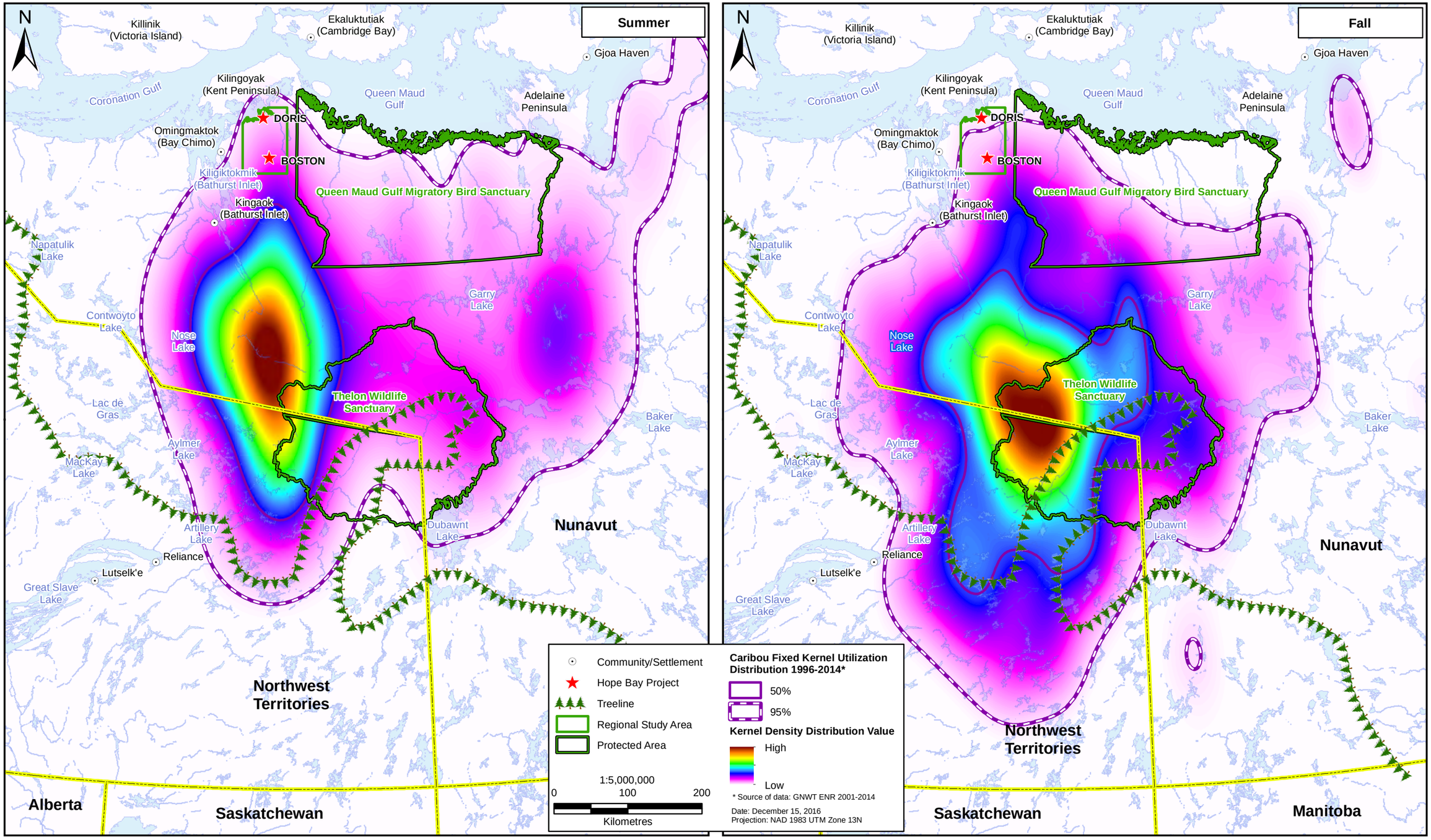
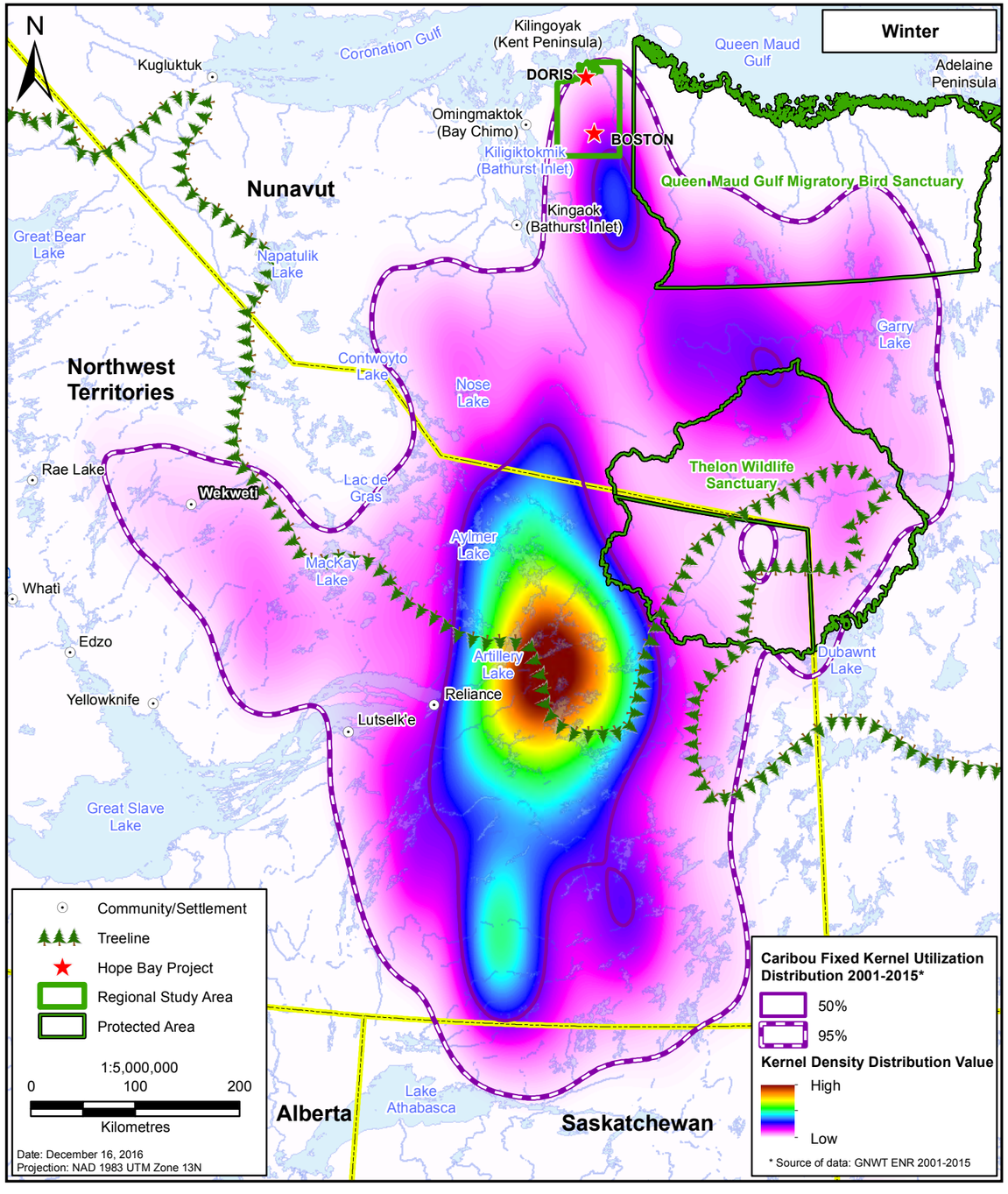


Figure 9.2-6
Range of Satellite-collared Beverly/Ahiak Caribou Herd during Winter (1 November to 14 April) and Spring Migration (15 April to 4 June), 2001 to 2015



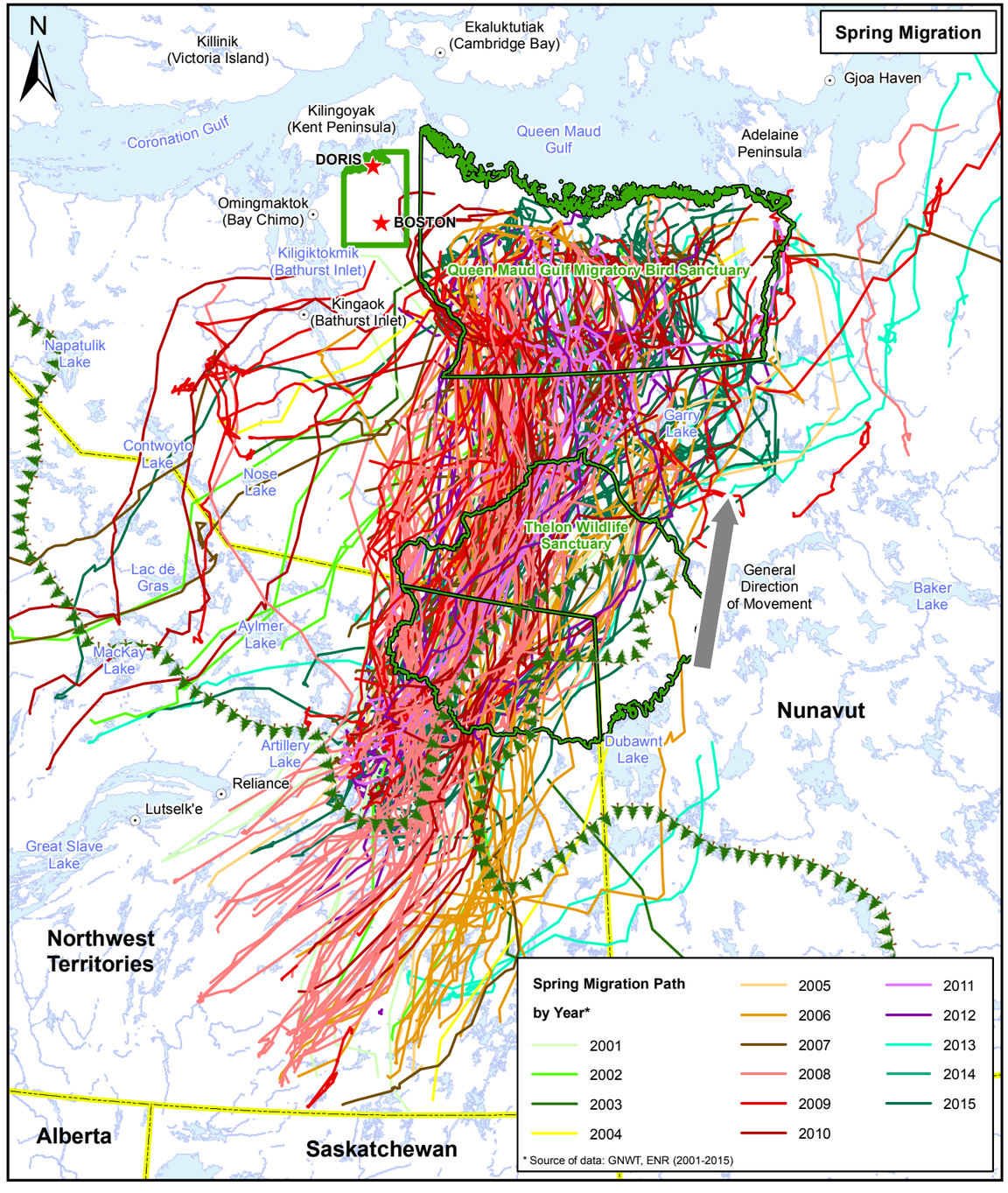


Table 9.2-5. Timing of Life History Stages of Dolphin and Union Caribou

Cycle Stage	Start Date	End Date
Calving	June[1]	June[1]
Post-Calving and Summer	July 1[2]	October 19
Fall Migration	October 20[4]	December 8
Winter	December 8[3]	April 16
Spring Migration	April 17[4]	June 29

[1] General calving period (Nishi 2000); specific dates not given due to limited data.
[2] Post-calving and summer defined as the period after calving and before fall migration.
[3] Winter defined as the period when satellite-collared caribou were located on the Nunavut mainland, between fall and spring migrations.
[4] Spring and fall migration dates defined as the periods when satellite-collared Dolphin and Union caribou crossed the Coronation Gulf, Dease Strait, and the Queen Maud Gulf from 1999 to 2004.

Collaring programs for the Dolphin and Union caribou herd began in the 1980s (Gunn, Fournier, and Nishi 2000). The program started with VHF radio transmitter collars, with 8 to 22 animals collared at any one time. These collars were progressively replaced with satellite collars and then GPS collars in the 2000s, which ended in 2006. A new collaring program was initiated by GN DOE in 2015, with 25 collars installed in 2015 and 19 collar installed in 2016.

Calving, Post-Calving and Summer

Dolphin and Union caribou calve on Victoria Island, and remain there for the post-calving and summer seasons and the rutting period (COSEWIC 2004; Poole et al. 2010; Banci and Spicker 2016). Thus, there is no overlap with the Hope Bay Project RSA during these periods (Figure 9.2-7).

Fall Migration

During the fall, the Dolphin and Union caribou herd migrates to the southern coast of Victoria Island for the rut, before migrating across the sea ice between late October and early November to overwinter on the mainland (median date of 1 November) (Figure 9.2-8) (Poole et al. 2010; Banci and Spicker 2016). Some caribou cross the sea ice as late as December 8 (Poole et al. 2010). During the latter part of fall migration, satellite collared Dolphin and Union caribou have been observed within the RSA (Figure 9.2-8). Inuit TK indicates that caribou will often cross Dease Strait where islands or points of land provide navigation cues, with a notable crossing location at the west end of the Queen Maud Gulf at the Kent Peninsula isthmus (Banci and Spicker 2016).

Winter

Dolphin and Union caribou winter on the north coast of the Nunavut mainland within 150 km of the ocean (Figure 9.2-9), including east and west of Bathurst Inlet, the Kent Peninsula, and along the western edge of the Queen Maud Gulf (COSEWIC 2004; Poole et al. 2010). Inuit TK, satellite collars, aerial surveys, remote cameras and incidental observations indicate that Dolphin and Union caribou occur in the RSA during the winter, generally at low densities and in small groups (Figure 9.2-9).

Within the RSA the majority of collar location points occurred on the eastern side of the RSA, east of the proposed Phase 2 Project infrastructure. Inuit TK indicates that during the winter period, the occurrence of island caribou was less predictable in any specific location and their spatial distribution was variable on a year to year basis (Banci and Spicker 2016). During the winter, the majority of island caribou were found near the Perry and Ellice River and in the Queen Maud Bird Sanctuary (Banci and Spicker 2016). Wintering areas were also located near Omingmaktok and south of the Boston property area, according to Inuit TK (Banci and Spicker 2016), however collar data does not reflect this

information. Inuit TK includes observations of some Dolphin and Union caribou overwintering on Victoria Island prior to the 1950s, but not since then (Banci and Spicker 2016).

Spring Migration

The Dolphin and Union caribou herd migrates from their wintering grounds on the northern coast of the mainland across the sea ice between April and June back to Victoria Island (Figure 9.2-10). During the spring migration, collared Dolphin and Union caribou are found in the RSA, with the majority of animals crossing the sea ice northward from mid-May to late June (Figure 9.2-10; Poole et al. 2010). The median date of crossing in the spring is 24 May; (Poole et al. 2010). The Kent Peninsula and islands in the Coronation and Queen Maud Gulf are used as staging sites during crossing, especially during the north migration (Gunn et al. 1997; Poole et al. 2010). According to Inuit TK, the same migration routes were used during both the spring and fall migration periods (Banci and Spicker 2016). Aerial surveys observed concentrations of caribou tracks on the sea ice at the islands in Hope Bay (west of the Hope Bay Project) and the archipelago in eastern Melville Sound (east of the Hope Bay Project) but few tracks in Roberts Bay where the marine laydown area is located.

Summary

Dolphin and Union caribou do not interact with the Hope Bay Project area during calving, post-calving, summer, fall or rut periods. Dolphin and Union caribou occur in the RSA during winter and during the spring and fall migration periods when caribou are moving between the mainland and Victoria Island. During these periods, Dolphin and Union caribou are generally dispersed in small groups.

Bathurst Caribou

Seasonal movements of the Bathurst caribou herd have been tracked from 1996 to 2016 using satellite collars (between 8 and 35 caribou per year), primarily on cows with several males collared in 2015 (GNWT ENR 2015, unpublished data). Currently the seasonal ranges of the Bathurst caribou herd do not overlap with the Hope Bay Project and occur west of Bathurst Inlet and the RSA. Hence, this section will describe the spatial distribution and movements of this herd to provide broad regional context for historic changes in caribou distribution.

Inuit TK indicates that the calving range of the Bathurst caribou has historically occurred both east and west of Bathurst Inlet (Figure 9.2-11), after which the herd is named (Banci and Spicker 2016). Currently, the calving grounds of the Bathurst caribou occur west of Bathurst Inlet and are concentrated between the James and Burnside Rivers (Figure 9.2-11; Gunn, Poole, and Wierzchowski 2008; Nishi et al. 2010). Inuit TK and scientific studies indicate that the Bathurst herd has calved both east and west of Bathurst Inlet, with a gradual shift to their current location, west of Bathurst Inlet (Russell, Kofinas, and Griffith 2002). Urquhart (1981) compiled the historical evidence for the location of the Bathurst caribou from the 1930s to the 1970s, reporting that there was evidence of calving both east, west, and south of Bathurst Inlet. Kelsall (1953) reported calving both east and west of Bathurst Inlet, however the majority of calving was thought to be on the eastern side of the Inlet (Kelsall 1955).

The first formal aerial surveys for the calving grounds were conducted in 1965 and 1966 on the eastern side of Bathurst Inlet. These surveys reported that the Bathurst caribou were calving on the western boundary of what is today the QMGMBS overlapping with the area currently used by the Beverly sub-population for calving (Williams 1966). Subsequent aerial surveys were conducted on the east side of Bathurst Inlet throughout the late-1960s and into the late 1970s, although there were reports of additional calving west of Bathurst Inlet (Sutherland and Gunn 1996). During all years, these calving grounds were located outside of the Hope Bay Project RSA.

Figure 9.2-7
Range and Locations of Satellite-collared Dolphin and Union Caribou Herd during Calving, Post-Calving, and Summer (30 June to 19 October), 1999 to 2004 and 2015 to 2016

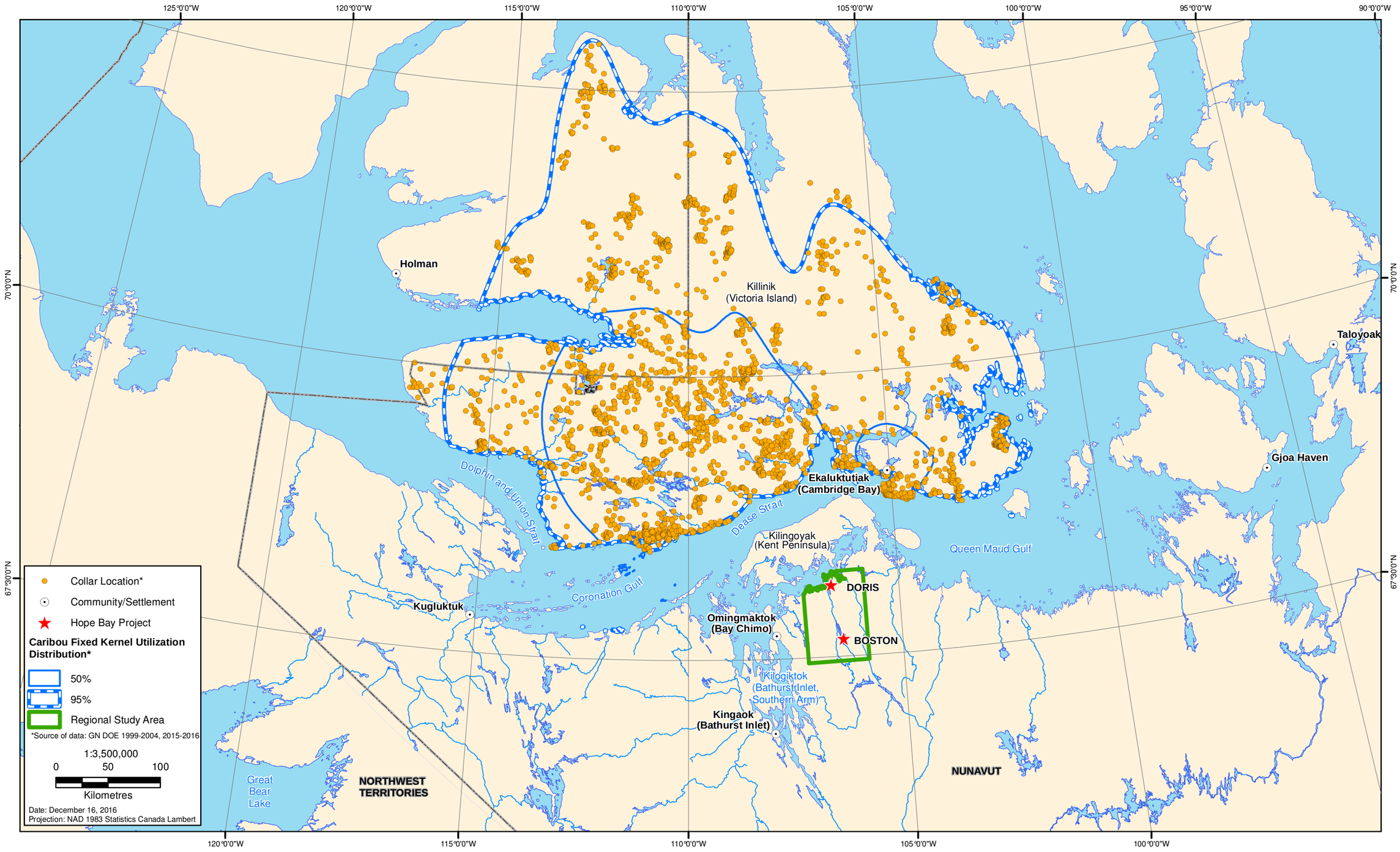


Figure 9.2-8
Locations of Satellite-collared Dolphin and Union Caribou Herd during the Southward Fall Migration (20 October to 8 December), 1999 to 2004 and 2015 to 2016