Legend

- Kiggavik and Sissons Leases
- Regional Study Area
- Water

Short-eared Owl Habitat Suitability - Growing Season

- High
- Moderate
- Low
- No Rating

Short-eared Owl Observations*

- Short-eared Owl Observations (2008)
- Short-eared Owl Observations (2009)
- Short-eared Owl Observations (2010)

*Numbers indicate observed number of individuals.

Area of Detail

Nunavut

N

0 2.5 5 10 15 20 Kilometres

Projection: NAD 1983 UTM Zone 14N
Creator: CASLYS CONSULTING LTD.
Date: 05/08/2014 Scale: 1:500,000
File: 5.6-7_Short-eared_Owl_Habitat_Suitability_Growing.mxd
Data Sources: Natural Resources Canada, GeoBase®, National Topographic Database, AREVA Resources Canada Inc., and Gebauer & Associates.

FIGURE 5.6-7
SHORT-EARED OWL HABITAT SUITABILTY - GROWING SEASON

KIGGAVIK PROJECT - EIS

Gebauer & Associates ENVIRONMENTAL CONSULTANTS
CASLYS CONSULTING
AREVA

AREVA Resources Canada Inc - P.O. Box 9204 - 817 - 45th Street West - Saskatoon, SK - S7K 3X5

5.7 Ungulates

5.7.1 Caribou

5.7.1.1 Status of Barren-ground Caribou Herds

Overview

The barren-ground caribou is listed as secure in Nunavut (CESCC 2011, internet site) and, with the exception of two subspecies, is not listed federally under the SARA or by COSEWIC. The two listed subspecies, the Dolphin and Union population (ssp. *groenlandicus*; COSEWIC Special Concern) and the Peary caribou (ssp. *pearyi*; COSEWIC 'Endangered' and *SARA* Schedule 1 Endangered'), do not occur in the Project area (COSEWIC 2014, internet site; *SARA* 2014, internet site).

Barren-ground caribou populations are generally designated as 'herds' based on where an aggregation of animals is known or suspected to calve. According to Vors and Boyce (2009), of the 43 caribou herds that have been monitored across the circumpolar north, at least 34 are currently declining, perhaps in association with increasing temperatures and precipitation and anthropogenic landscape change. Data from the Circumpolar Rangifer Monitoring and Assessment Network (CARMA) indicate that approximately half of the 22 herds assessed are decreasing or declining, whereas the other half are stable or increasing (CARMA 2011, internet site). Recent estimates suggest that five of the eight barren-ground caribou herds in the NWT have declined during the past ten years (WGGS of NWT Species 2006). For example, from 1996 to 2003, the Bathurst herd declined by approximately 53% (BHPB 2004) while between 2003 and 2009, it declined at an even higher rate (Boulanger 2011; Adamczewski et al. 2009). The estimated population of the Bathurst herd in 1986 was approximately 500,000 animals compared to less than 50,000 in 2009 (Adamczewski et al. 2009). Similar or greater rates of decline have been suggested for the less understood Beverly herd (CARMA 2010, internet site; Gunn et al. 2011).

A decline in caribou population has also been observed in IQ and engagement data. There are many people who will say that caribou numbers are decreasing (EN-CI KIA Feb 2010). There were more caribou in 1968 than there are today (IQ-RBJ 2011). Caribou haven't been round for a while, and I'm wondering why (EN-BL OH Oct 2012). Not many caribou have come through Baker Lake this year (IQ-BLHT 2011). Recent population declines in several caribou herds may be part of a downward trend in a caribou population cycle that can last from 20 to 60 years. Elders have said that caribou move from time to time and that number estimates by the government are faulty because they do not take into account that animals do not always consistently occupy one area, and that populations generally return (McDonald et al. 1997). A hunter shares how he was told to cache many caribou as it was predicted caribou would be scarce – it happened and he was thankful for IQ and guidance (EN-BL EL Sept 2013). Another Elder remembers how he moved into Chesterfield in 1949 due to starvation on the land and there were no caribou in Chesterfield Inlet at that time (IQ-CI06 2009).

These population cycles were reported in other IQ studies and suggested in the scientific literature (Ferguson et al. 1998; Gunn 2008; Vors and Boyce 2009). Available population data from 1970 onwards indicates that most northern caribou herds have increased from lows around 1975 to a peak around 1995, followed by a decline (Gunn et al. 2011), but few studies have been able to document cycles across multiple caribou herds in the north.

Evidence indicates that recent declines are much more rapid than has been observed in the past (Vors and Boyce 2009). Factors that may be contributing to the decline include, climate change (i.e., increasing global temperatures, severe weather, ice storms, earlier spring flush), increases in mosquitoes and flies leading to harassment and reduced foraging, and development and industrial encroachment (Bergerud et al. 1984; Gunn 1984a; Moore 1987; Vistnes et al. 2004; Cameron et al. 2005; Vistnes and Nellemann 2007; Vors and Boyce 2009; Struzik 2010, internet site). Caribou population decline as a result of human development is reiterated in IQ and engagement data from the region. *Migration routes of caribou were normal but the establishment of communities has resulted in changes* (EN-BL EL Sept 2013). *With the development of Rankin Inlet, caribou were observed to change their migration routes and not travel to their traditional areas as often* (EN-BL NIRB Apr 2010). *When there is activity in an area, the animals do not go extinct, they just move* (EN-CH KIA Feb 2010). *There has been less movement of the Qamanirjuaq herd the last couple of years; animals are not going north, maybe due to blasting or aerial surveys* (EN-RI KWB Oct 2009). Hudson Bay hunters note that *there used to be caribou on the land there and sea mammals, but now hardly any. Animals used to be visible, but not now. I know we see a few caribou but not like before* (EN-RI KWB June 2012). In other IQ studies, hunters have commented that before firearms, caribou were abundant along the coast [of Repulse Bay], but since firearms they have moved inland (Freeman 1976).

The five caribou herds identified in Nunavut's mainland region are the Beverly, Ahiak, Wager Bay, Lorillard, and Qamanirjuaq herds. All of these herds are known to occur within the RSA, although at different frequencies and seasons depending on their herd ranges. The approximate annual distribution and calving grounds for these herds in Nunavut, based on recent analysis of satellite-tracking data over many years, are presented in Figure 5.7-1 (from Nagy et al. 2011). The analysis of the telemetry data used to delineate ranges assigned each collared animal to a herd based on the calving area it returns to on a yearly basis. Nagy et al. (2011) now consider the Ahiak, Wager Bay, and Lorillard herds as part of a tundra-wintering barren-ground caribou herd. Other available information from the BQCMB shows slightly different range boundaries for the Beverly herd (Figure 5.7-2), reflecting the inherent difficulty in accurately delineating herd ranges and why these herds continue to be studied and reassessed. Migratory tundra caribou are known to shift their distribution among years, often as a result of changes in herd abundance (Gunn et al. 2011). Each herd is discussed in more detail in the following sections.

Recent findings suggest that although delineation of caribou herds may be appropriate for short-term management, the status of adjacent herds should be included in long-term management strategies because animals do not necessarily stay with the herd they are born into (Hinkes et al. 2005; Boulet

et al. 2007). Adjacent herds could provide a source of animals, thereby buffering effects to a herd, or conversely, could act as a sink, thereby increasing effects. This interchange of animals between herds is noted in IQ and engagement data. *During the winter, after freeze-up, the herds mix and some Elders believe that some of the caribou from the Manitoba herd have crossed Chesterfield Inlet and have become part of the Lorillard herd* (IQ-CI08 2009; IQ-CI03 2009).

Beverly Caribou

The historic Beverly herd range extends over 1,000 km from boreal forests in northern Saskatchewan and Manitoba (i.e., Clearwater River and Reindeer Lake areas), across the subarctic taiga of the NWT, to the tundra of west-central Nunavut (i.e., Pelly and Garry lakes area; BQCMB 1999a, internet site). Because the herd overlaps with the Bathurst caribou herd to the west, and the Ahiak and Qamanirjuaq herds to the east, the western and eastern limits are much less defined, extending a minimum of 600 km from Great Slave and Great Bear lakes in the NWT to east of Dubawnt Lake, Nunavut (Wakelyn 1999a, internet site). Caribou from the Beverly herd are hunted primarily by the Dene of northern Saskatchewan, western NWT, and northern Manitoba. Hunters from Baker Lake are likely the only Nunavut-based hunters to harvest from the Beverly herd (NPC 2000).

The annual distribution and life history of the Beverly (and Qamanirjuaq) herd is well known and locations of the 'traditional calving grounds' (i.e., the same general areas used repeatedly) and post-calving areas have been documented since 1957 (Figure 5.7-2; BQCMB 1999a, internet site). The Beverly herd calving grounds were delineated from 23 years of data by CWS, the Department of Resources, Wildlife and Economic Development, and during monitoring for the Caribou Protection Measures (Gunn and Sutherland 1997a). These long-term data sets have identified variation in use of the range; specific areas used in a given year are known as 'annual calving areas' and the location varies from year to year (BQCMB 2007, internet site). This change over time concurs with IQ and engagement data. *Caribou never stay in one ground because when they are delivering calves, they need clean grounds in order to keep themselves clean. They do not go to the same spot or ground for delivering calves every year* (EN-BL CLC Nov 2008).

The Beverly herd has recently been documented as significantly declining since surveys were last conducted in 1994 (Boulanger and Gunn 2007; BQCMB 2009a, internet site; CARMA 2011, internet site). In the 1980s and 1990s, populations were estimated to be approximately 250,000 animals, corresponding to over 110,000 breeding females (CARMA 2011, internet site; Campbell et al. 2012); however, in 2008, only 93 breeding cows were spotted during surveys of the traditional Beverly calving ground (CARMA 2011, internet site), and surveys in 2009 and 2010 found less than half those counted in 2008 (BQCMB 2009a internet site; BQCMB unpublished data 2010). A comparable survey in 1994 counted 5,737 breeding cows on the calving ground. The reasons for the population decline are difficult to ascertain. Possible causes range from climate change, natural population

cycles to industrial activity, and hunting. Some residents have observed *Beverly caribou move north because of too much activity [from research] near Schultz Lake* (EN-BL CLARC Apr 2013).

Another argument, now widely accepted by government biologists, suggests that Beverly caribou previously calving in the traditional calving grounds have migrated further north to the Queen Maud Gulf to calve (Campbell 2010, pers. comm.; Nagy et al. 2011). Collaring data (1996 to 2013; cows only) from the GNWT and GN show a similar distribution to the historically documented range, but also indicate more movement to the north, and use of northern calving grounds adjacent to the Ahiak herd along Queen Maud Gulf (Figure 5.7-3A). Aerial surveys of this calving area in 2011 estimated over 52,000 breeding females for the Beverly herd; studies were not completed at the southern 'traditional calving grounds' because numbers observed during reconnaissance flights were too low to survey (Campbell et al. 2012).These surveys suggested that the Beverly population was still on a decline compared to pre-1994 populations. Given the limited understanding of the Queen Maud Gulf calving area in the past, Beverly animals may have been included in what was previously described as the Queen Maud Gulf or Ahiak herd. The observed population decline in the Beverly herd may have been less drastic, a result of a gradual switch in calving grounds. This argument suggests the possibility of two distinct calving areas for Beverly animals in the past; however, an alternative explanation may be that the observed population decreases were evidence of a severe decline that forced a shift to different calving areas for the Beverly, and the move to the Queen Maud Gulf calving area (Gunn et al. 2011). Although not fully understand or agreed upon, it is clear that the connection between the two herds make it difficult to fully explain population fluctuations. Further studies and discussions are underway by the GN, GNWT, and BQCMB to better understand the population dynamics of these herds.

Ahiak Caribou

The Ahiak herd (formerly Queen Maud Gulf herd) range extends from the Queen Maud Gulf and Chantry Inlet to south of the Thelon Game Sanctuary, and as far west as Great Slave Lake (Figure 5.7-1). In the southern part of their winter range, below the tree line, the Ahiak herd may overlap with wintering Beverly caribou (NWT ENR 2005, internet site). The Ahiak herd was not always recognized as a major discrete herd, and information on population trends and the close relationship to other herds such as the Beverly is incomplete (Gunn et al. 2011). Reference was first made to the Ahiak herd (i.e., "…a discrete population in the previously unsurveyed area south of the Queen Maud Gulf") in 1983 (Heard et al. 1986); however, the status of the Ahiak herd was unknown since the mid-1990s when the herd was estimated at ~200,000 caribou (NWT ENR 2006, internet site; CARMA 2011, internet site).

Limited data have suggested that the Ahiak herd population increased for a number of years until the mid-2000s, followed by a decline and then a more recent rebound in numbers (Gunn et al. 2011). However, as already discussed, some Beverly caribou migrate further north to the Queen Maud Gulf to calve during this period and population numbers for the Ahiak may or may not reflect this shift. A recent argument suggests that this is evidence that the Beverly and Ahiak herds may be more closely linked than previously thought (Nagy et al. 2011; Campbell 2010, pers. comm.). Recent collaring data (i.e., 2006 to 2013; cows only) from the GNWT and GN is provided in Figure 5.7-2B).

The Ahiak herd is generally harvested by communities in the Kitikmeot and Kivalliq region, and western NWT.

The territorial governments conducted studies in 2011 to assess the population dynamics of the Ahiak and Beverly herds, and ongoing satellite-collaring programs are contributing valuable information on herd distribution and seasonal movement patterns.

Wager Bay Caribou

Little published information is available for the Wager Bay caribou herd which, along with the Lorillard herd, was previously identified as northeast mainland caribou (Heard et al. 1986; Campbell 2005), but is now considered to be a tundra-wintering herd. Further information based on satellite collar data and calving ground delineation flights were used to define this population (Gunn and Fournier 2000; Campbell 2005). Satellite collar location data provide information on seasonal use of habitat by the Wager Bay herd, showing that the winter range extends from northwest of Aberdeen Lake to Wager Bay, and primarily north of the Thelon River system and Chesterfield Inlet (Figure 5.7-2C). Calving areas near Repulse Bay were identified from IQ – *caribou will calve anywhere; however, more caribou tend to calf in an area north of the town* (IQ-RBJ 2011). Collar data also identified calving areas for the Wager Bay herd in the area around Repulse Bay, and immediately north of Wager Bay (Figure 5.7-2C).

Lorillard Caribou

Little published information is available for the Lorillard caribou herd, which, along with the Wager Bay herd, was previously identified as northeast mainland caribou (Heard et al. 1986; Campbell 2005), but is now considered to be a tundra-wintering herd. Further information based on satellite collar data and calving ground delineation flights were used to define this population (Gunn and Fournier 2000; Campbell 2005). Satellite collar location data provide information on seasonal use of habitat by the Lorillard herd, showing that the winter range extends from west of Aberdeen Lake to Hudson Bay with most animals wintering north of the Thelon River System (Campbell 2005; Figure 5.7-2D). Some individuals have also wintered in the northeast corner of the NWT and north of Chesterfield Inlet (Figure 5.7-2D). Riewe (1992) also noted that caribou herds sometimes wintered along parts of Chesterfield Inlet and that they were hunted regularly. IQ and engagement data help further delineate Lorillard herd movements. *Caribou tend to congregate on both sides of Chesterfield Inlet during July, and during August and September, tens of thousands of caribou have been observed on the north side of the inlet* (IQ-CI01 2009; IQ-BLE 2011). *Although the Lorillard herd has a calving area between Wager Bay and Chesterfield Inlet, and there are other calving areas near Josephine Lake and Kaminuriak Lake, caribou can calve anywhere* (IQ-CI01 2009; IQ-CI03 2009; IQ-CI06 2009).

Qamanirjuaq Caribou

The Qamanirjuaq herd generally ranges from the southern Kivalliq (i.e., south of the Thelon River, Baker Lake, and Chesterfield Inlet) to northern Manitoba and northeastern Saskatchewan (BQCMB 1999a, internet site; see Figure 5.7-1). IQ, supported by some collaring data, has indicated that animals will sometimes cross Chesterfield Inlet. It is noted that *the Qamanirjuaq herd migrates north, around Baker Lake, and then to the coast, north of Chesterfield Inlet* (IQ-CI03 2009), and that *during the winter, after freeze-up, the [Qamanirjuaq and Lorillard] herds mix* (IQ-CI08 2009; IQ-CI03 2009). Observed differences between these animals are also noted: *the caribou on the north side of Chesterfield Inlet are larger than those on the south side of the inlet because they have less area in which to roam* (IQ-CI08 2009). The east-west range of the Qamanirjuaq herd extends approximately 500 km, from the shores of Hudson Bay across the southern Kivillaq region to Aberdeen Lake, while the north-south range extends approximately 1,000 km from the Thelon River and Baker Lake, Nunavut to south of Brochet, Manitoba (Wakelyn 1999b, internet site; Figure 5.7-1). Most of the caribou harvested in the Kivalliq region are those from the Qamanirjuaq herd (NPC 2000). Animals from the herd are also harvested regularly from communities in northern Manitoba and northern Saskatchewan during the winter. Recent collaring data (i.e., 2008 to 2013) from the GN indicate a similar distribution to the historically documented range (Figure 5.7-2E). IQ notes that *caribou are present near Arviat year-round* (IQ-ARVJ 2011), an observation supported by available collar data.

The Qamanirjuaq herd may have declined by one-third since the population was last assessed in the mid-1990s (BQCMB 2009b, internet site; Campbell 2010, pers. comm.). GNWT surveys in the 1970s documented fewer than 50,000 animals but then increasing in the 1980s to approximately 250,000 animals and peaking in 1994 at 496,000 animals (CARMA 2011, internet site). Since then, the population has declined to an estimated 350,000 animals in 2008 which was not considered statistically significant (CARMA 2011, internet site; Gunn et al. 2011). The decline appears to have continued since then, but recent population data are not currently available (Campbell 2010, pers. comm.).

5.7.1.2 Traditional Use and Harvest

Background

Barren-ground caribou are a critical component of Inuit culture and subsistence lifestyle. Hunters described the people as *dependent on caribou, fish, seals, ptarmigan, and beluga for food* (IQ-RIHT 2009). Baker Lake Inuit are particularly reliant on caribou because other traditional foods such as seals, walrus, and whales are not available or are relatively scarce (IDS 1978; InterGroup 2008). One Elder explained that *caribou and ptarmigan were their main food source, as they did not have fishing rods to catch fish in the summer* (IQ-BL08 2008), pointing to their dependence on terrestrial harvests. Hunters emphasized that *most people in Baker Lake still depend on caribou for food* (IQ-BLH 2009; IQ-BLHT 2011).

Traditionally, Inuit moved with the caribou and established hunting camps along known migration routes, but today, Inuit no longer follow a nomadic lifestyle. Nevertheless, healthy caribou populations and access by hunters remain vital to Inuit social, cultural, and economic well-being (NPC 2000). Elders say they *hunt as much now as they did when they were younger* (IQ-RBJ 2011), and people have noted that *caribou are a main source of food (eat mainly native foods) and they do not eat a lot of food from the stores* (EN-BL NIRB Apr 2010). *Consuming country food is not considered 'ritual food' but the daily way of life* (IQ-CIHT 2009). People say *we have not changed our diet. We feed off the land. We live seasonally as long as I can remember up till now* (EN-BL NPC June 2007).

Based on recent collaring distribution data, most of the caribou harvested around the RSA are likely from the Ahiak, Lorillard, and Qamanirjuaq herds. For the larger Kivalliq region, animals from Wager Bay, and some from the Beverly herd, are also hunted. Hunters from Baker Lake are the only Nunavut-based hunters to harvest from the Beverly herd, but this herd is hunted primarily by the Dene of northern Saskatchewan, western NWT, and northern Manitoba (NPC 2000). The BQCMB estimates that Baker Lake harvests 40% Qamanirjuaq, 20% Beverly and 40% Wager Bay caribou (BQCMB 2008).

5.7.1.2.1 Hunting Areas

Caribou hunting areas have been identified throughout the RSA from IQ and engagement data, hunter data, and previous land use studies (e.g., IDS 1978; NLUIS 1980). Hunting, camping, and caching areas identified from IQ are included in Figure 5.1-12; however, it is recognized that hunting can occur in any place at any time. IQ data note that *areas used for hunting, trapping, and other resources are dependent on the movements of the caribou. A comparison between areas used by residents of Baker Lake in the past, and areas currently used is difficult as variation in caribou migration routes have occurred over the years* (IQ-BL01 2009; IQ-BL02 2008).

More recent hunter data indicate that relatively few caribou have been harvested in the lands in closer proximity to the Mine LSA, based on harvest location statistics collected as part of the Nunavut Wildlife Harvest (NWMB 2005) and the ongoing AREVA/AEM HHS (discussed in Section 5.1.5; see Figures 5.1-12 and 5.1-13). A number of camping areas were identified around Judge Sissons Lake, and *in the summer people hunt there [Kiggavik] and there are cabins in this area* (IQ-BLHT 2011). An Elder pointed out *areas near the south road* [previously considered option] *that are traditionally and currently used for camping and caribou hunting* (EN-BL NIRB Apr 2010). From land use information collected between 1960 and 1978, the Judge Sissons Lake area was noted as sometimes being used as a travel route westwards to Aberdeen Lake, and that the area was irregularly used for fox trapping, caribou hunting, and fishing (NLUIS 1980). The area around Aberdeen and Schultz lakes was noted as a caribou hunting area (see Figure 5.1-12). IQ and engagement data also mention hunting areas further afield around Beverly Lake, all of which indicate likely travel routes through the RSA (Riewe 1992; EN-BL CLC Apr 2007; IQ-BLHT 2011).

Substantial numbers of caribou were documented wintering in some years in the Princess Mary Lake area (south of the RSA), and during those years caribou were hunted from fall through to spring (NLUIS 1980). *Pitz Lake and Princess Mary Lake are both well used. Both have winter and summer camping areas, migratory areas, fish spawning, gravesites, caribou crossings, and spiritual significant areas* (EN-BL HTO Feb 2013; Figure 5.1-12). *In December, we hunt south of Baker when the Qamanirjuaq herd moves through* (IQ-BLHT 2011). Harvest data confirm that caribou continue to be hunted in these southerly areas as well (Section 5.1.5 and Figure 5.1-12).

Caribou harvest densities continue to be highest in the immediate vicinity and east and north of Baker Lake (20 km radius; cumulative counts), and up to the Thelon River, west of which harvest rates drop off sharply (see details in Section 5.1.5.6). Similarly, very little hunting or trapping activity was reported in the northwestern half of the RSA from 1960 through 1978 (NLUIS 1980).

Harvest Rates

Caribou harvest rates can be estimated based on a number of historical and current datasets, and IQ and engagement data. Despite their lack of comparability due to differences in methods and data sources, these information sources can provide some indication of harvest rates and trends for local caribou populations around Baker Lake (see Section 5.1-4 for pertinent details on all of these studies).

- Annual caribou harvest recorded from 1969 to 1977 ranged between 494 and 2,378 animals (IDS 1978). Total annual harvest for Baker Lake households in 1976/'77 was estimated to equal 4,100 caribou (extrapolated from sample data above and total population numbers).
- Annual caribou harvest recorded from 1996 to 2001 ranged between 2,057 and 2.846 animals, from hunting data for approximately 226 hunters (NWMB 2005); however, the study concluded that these numbers likely underestimated total annual harvest rates for Baker Lake.
- The recent AREVA diet survey concluded that approximately 5,020 caribou were harvested annually by the residents of Baker Lake in 2009/'10.
- Total annual harvest for Baker Lake households was estimated from the AEM/AREVA HHS to be approximately 5,000 animals from 2007 to 2013 (extrapolated from HHS participant data and total population numbers).
- Weekly harvest rates of *two or three caribou* are reported in the IQ, although *sometimes we share with other families* (IQ-BLHT 2011). This estimate, if assumed to be an average for all hunting families, indicates a much higher annual harvest for Baker Lake than provided from other surveys. The estimate may be more applicable to busy hunting months and represent multiple hunters in a group.

From the 1970s to present day, total caribou harvest in Baker Lake may have increased, which would parallel the increasing human population of Baker Lake. This increase is reiterated in IQ and engagement data. *There are more caribou being taken and the town is growing, and there are many community feasts. There are feasts with caribou all the time* (EN-BL OH Oct 2012). Baker Lake's population increased by 14.7% between 2001 and 2006 (Statistics Canada 2006, internet site), and from 44% between 2006 and 2011 (Statistics Canada 2011, internet site); Continued positive growth is likely due to the operational Meadowbank Gold Mine and increased employment opportunities, although factors such as the existing age pyramid, birth rates, and relocation for employment opportunities both into and out of Baker Lake can alter observed trends (Tier 3, Technical Appendix 9A Socio-economic Baseline). Alternatively, increased harvest rates may also reflect an increased availability of animals. For example the Qamanirjuaq herd experienced population lows in the 1970s followed by an increase, and the Meadowbank road likely provides improved access to caribou for Baker Lake hunters.

5.7.1.3 Population Data

Overview

Based on local knowledge, regional survey programs, satellite collar information, and site-specific field surveys (details in sections below), caribou are found in the area around Kiggavik throughout the year. IQ and engagement data confirm baseline observations: *the area around Baker Lake is an important caribou habitat* (EN-BL NIRB Apr 2010), and *where there is exploration, there is a lot of caribou* (EN-RI HTO Nov 2012); and *there are often caribou around Meadowbank* (IQ-BLE 2011). Historical and recent data on caribou sightings are summarized in Table 5.7-1.

Table 5.7-1 Summary of Current and Historic Survey Data on Caribou Populations in the Kiggavik Regional Study Area

Year	Observation Method	Total Number Observed	Number of Sightings	Number of Animals Per Sighting	% of Sightings with Calves	% of Calves (where observed)	Density Estimate
2010	All-Season Road	620	40	1 to 93	23% (yearlings)	21%	ND
	HOL (Mine LSA)	437	39	1 to 50	5.1% (yearlings)	28%	ND
	South AWAR Nest Survey	7	2	1 to 6	0	0	ND
	Winter Road	1[(a)]	1	1	ND	ND	ND
	Camp Log/Monitor	1,981	105	1 to 400	ND	ND	ND
		AREVA and Cameco camp monitors also recorded 15 sightings of large groups					

Table 5.7-1 Summary of Current and Historic Survey Data on Caribou Populations in the Kiggavik Regional Study Area

Year	Observation Method	Total Number Observed	Number of Sightings	Number of Animals Per Sighting	% of Sightings with Calves	% of Calves (where observed)	Density Estimate
		numbering over 1,000 to up to 10,000 animals in the Mine LSA and RSA					

Table 5.7-1 Summary of Current and Historic Survey Data on Caribou Populations in the Kiggavik Regional Study Area

Year	Observation Method	Total Number Observed	Number of Sightings	Number of Animals Per Sighting	% of Sightings with Calves	% of Calves (where observed)	Density Estimate
2009	RSA Aerial (collaring)	1,170	29	1 to 750	17%	25%	ND
	South AWAR Ground	14	10	1 to 3	0	0	ND
	Thelon River Transects	>56	1	>56	ND	ND	ND
	All-Season Road Quarry	1	1	1	0	0	ND
	Sissons Transects (LSA)	27	2	1 to 26	50%	35%	ND
	Sissons Transects (RSA)	Large herd of 3,000 to 5,000 animals observed					
	Incidentals	Large herd of 405 animals observed near Thom Lake Large herd of 2,000 to 3,000 animals observed in Sissons Lease area					
	HOL (Mine LSA)	1,963	588	1 to 200	5%	ND	ND
	Camp Log/Monitor	679	36	1 to 200	ND	ND	ND
2008	RSA Aerial	1,604	155	1 to 200	3%	26%	ND
	LSA Aerial	53	8	1 to 18	13%	ND	ND
	South AWAR Aerial	76	20	1 to 21	ND	ND	ND
	South AWAR Ground	2	2	1	0	0	ND
	HOL (Mine LSA)	264	59	1 to 20	12%	30%	ND
2007	RSA Aerial	37	24	1 to 8	4%	ND	ND
	Weekly LSA Aerial	66	19	1 to 9	5%	ND	ND
	Incidentals	ND	115	1 to 275	13%	ND	ND
	Camp Log/Monitor[(b)]	ND	81	1 to 19	16%	ND	ND
1980[(c)]	Ground Observations	254	ND	ND	ND	ND	ND
1979[(d)]	Ground Observations	94	ND	ND	ND	ND	ND
1978[(d)]	Ground Observations	152	ND	ND	ND	ND	ND

(a) Sign (tracks, pellets, browse, etc.) observed during August 2010 survey, although only one animal observed
(b) AREVA (2008)
(c) URG (1981) only included 'total caribou days' for Lone Gull and Schultz Lake, approximately equivalent to RSA
(d) Speller et al. (1979) only included 'total caribou days' for Lone Gull and Schultz Lake, approximately equivalent to

Table 5.7-1 Summary of Current and Historic Survey Data on Caribou Populations in the Kiggavik Regional Study Area

Year	Observation Method	Total Number Observed	Number of Sightings	Number of Animals Per Sighting	% of Sightings with Calves	% of Calves (where observed)	Density Estimate
RSA)							
ND = No data, or data too limited to calculate							

Aerial Surveys

Mine Local Study Area: Aerial surveys were flown in the LSA in 2007 and 2008 (Figure 5.1-1F). In 2007, 19 groups totaling 66 caribou were documented during five weekly systematic surveys conducted from June to September. Of these sightings, 5% were nursing groups (total number of calves not recorded)**.** In 2008, eight groups totaling 53 caribou were recorded during the three monthly surveys conducted from May to September. Of these sightings, 13% contained calves (total number of calves not recorded).

Mine Regional Study Area: Twenty-four groups totaling 37 caribou were recorded in the 2007 RSA during the one-day survey conducted on August 26, 2007 (Figure 5.1-1G). Group size ranged up to eight animals, and 23 of the 24 sightings were non-nursing groups. The majority of the caribou observed were found in heath tundra habitat (46%), but tussock hummock (21%) and sedge wetland (17%) habitats were also frequently used. Most of the caribou observations were north of Kiggavik camp, but there were no discernible areas of concentration.

Five aerial surveys of the RSA were flown in 2008. Fewer caribou were recorded in the RSA in May, late July, and September, and those caribou were generally found in small groups (<10), and in one group of 40 on July 22. Most of the caribou observations during the summer aerial surveys were located in the northern portion of the RSA near Schultz Lake (Figure 5.1-1G). In October, caribou group sizes ranged up to 200 (Figure 5.7-4) with sightings generally recorded in the northern and western portions of the RSA; however, the largest group of 200 caribou was observed in the southeast portion of the RSA (Figure 5.1-1G).

An aerial survey of the previously considered South AWAR option was completed in 2008 and incidental caribou observations were recorded (total of 76 individuals; Figure 5.1-6). In 2009, aerial observations of wildlife were recorded during helicopter ferrying flights, and a reconnaissance flight flown prior to a November satellite-collaring program during which over 1,000 caribou were recorded (Table 5.7-1, Figure 5.1-2).

Height-of-Land Ground Surveys

HOL surveys provide information on seasonal occurrence of caribou in the Mine LSA (Table 5.1-2). Based on available data, caribou were present at higher numbers in the Mine LSA in late summer, particularly early July/late August in 2008 (Figure 5.7-5A) and August in 2009 (Figure 5.7-5B). HOL data collected in 2010 are not as comparable to previous years because field surveys occurred earlier in the season, although the April/May 2010 HOL data for caribou demonstrate the movement of caribou through the LSA during spring migration (see Table 5.1-2 and Figure 5.7-5C). The greatest number of caribou observed at HOL stations over one field season was in 2009 (total of 1,993 individuals). There was no obvious trend in group composition because the majority of observations could not be classified to age or sex from the distance of observation (average distance from observation point = 1.1 km).

Other Ground-based Surveys

Caribou presence was recorded during most ground-based surveys including:

- incidental observations throughout the RSA in 2007 (Figure 5.1-3);
- incidental observations and a winter survey along the All-Season Road (Figures 5.1-4 and 5.1-5, respectively);
- reconnaissance survey along the Winter Road (Figure 5.1-7);
- incidental observations and reconnaissance survey data along the previously considered South AWAR option from 2008 to 2010 (Figure 5.1-6); and
- incidental observations at the Thelon Crossing and Baker Lake dock areas (Figures 5.1-8 and 5.1-9, respectively).

Other sources of ground-based survey data include reconnaissance surveys, exploration wildlife monitors, camp log book, and incidental observations made during non-systematic aerial surveys (Table 5.7-1). The largest number of caribou observed in the RSA to date was a herd of an estimated 10,000 individuals that was recorded by Cameco wildlife biologists on July 25, 2010 approximately 14 km northwest of camp (Figure 5.7-6). Other large herds were observed during the same late July/early August time period in 2009 (Figure 5.7-7). These observations included a group of 405 caribou, consisting of predominately (93%) bulls, that was spotted on July 15, 2009 north of Thom Lake. A group of 2,000 caribou consisting of predominately cows (52%) and calves (33%) was observed south of the Sissons Lease and northwest of Buzzard Lake on July 29, 2009. Another group of 3,000 caribou, comprised of 65% bulls, 30% cows, and 5% calves, was observed southeast of Buzzard Lake in August.

Caribou Satellite Collaring Study

Collaring studies were initiated by AEM and the GN in May 2008. In November 2009, AREVA joined AEM and the GN in this continued effort. These collaring studies have contributed key information on caribou movements in a region where information on caribou has been largely unavailable. Animals collared in May 2008 in the Meadowbank RSA have primarily remained north of the Thelon River (and the RSA) in all seasons. In 2009, 2011, and 2013, animals were collared primarily north and west of the LSA (Figure 4.3-6), which is reflected in the significant caribou movements depicted in this area (see Figure 5.7-8), and within or in close proximity to the Meadowbank RSA.

Data on the movement of collared caribou inform field observations. In July 2009, two collared caribou cows from the Qamanirjuaq herd intersected and moved along the southern perimeter of the RSA from July 19 to 29 (GNDoE, unpublished data; Figure 5.7-7). This record of movement suggests that the large numbers of cow/calf groups observed in this time period during field studies (see Section 5.7.1.3.3 above) may have been from the Qamanirjuaq herd. Similarly in July/August 2010, collared animals were again recorded moving into the RSA boundary, along with observed herds estimated to number up to 10,000 animals (Figure 5.7-6). The collaring data and field observations support the assumption that some Qamanirjuaq animals were moving through the region during the post-calving period. More detailed discussions of the caribou collar study data, and observed distribution and movements of herds in the region and the RSA are included in Section 5.7.1.4.

5.7.1.4 Distribution and Movement

Caribou Herd Seasons

Barren-ground caribou herds exhibit an annual nomadic life cycle over ranges that cover thousands of square kilometers. They are found in different areas of their annual range at different times of the year based on an annual life cycle with seven generally recognized ‘seasons’. Those seasons are based on distinct movements and include spring migration, calving, post-calving aggregation, summer dispersal, rut and fall migration, early winter, and late winter (Table 5.7-2, from BQCMB 1999a, internet site).

Table 5.7-2 Mainland Barren-ground Caribou ‘Seasons

Activity	Estimated dates	Notes
Spring migration(a)	March 16 to May 25	Males migrate to traditional calving grounds about 1 month (April to June) after females and yearlings. Route depends on winter distribution
Calving(a)	May 26 to June 25	Most calves born June 5 to 15. Condition of cows affects timing. The same region is used annually, but specific place varies.

Table 5.7-2 Mainland Barren-ground Caribou 'Seasons

Activity	Estimated dates	Notes
Post-calving aggregation(a)	June 26 to July 31	By early July most cows and calves have left calving grounds. Animals gather in large groups to reduce insect harassment.
Summer dispersal(a)	August 1 to September 15	By end of July, caribou begin moving south. Groups break up when insect harassment decreases and scatter to avoid harassment from warble and nose botflies. Begin to regroup in late August and September.
Rut and fall migration	September 16 to October 31	Southward movement influenced by snowfall and ice formation. Rut occurs in late October. Following the rut, adult males separate from other caribou and aggregate into separate groups.

Table 5.7-2 Mainland Barren-ground Caribou 'Seasons

Activity	Estimated dates	Notes
Early winter	November 1 to December 31	Animals generally move away from areas with deep snow.
Late winter	January 1 to March 15	Tundra-wintering caribou seek range where snow is relatively shallow, such as ridge tops.
'Adapted from BQCMB 1999a, internet site (Table 1) (a) DIAND Caribou Protection Measures protect animals on designated calving grounds from May 15 to July 15, and protect designated water crossings from May 15 to September 1.		

Seasonal Occurrence in the Regional Study Area

Caribou movement and habitat use within the vicinity of the RSA varies among years. Collared animals from the Qamanirjuaq herd were found at both the closest and furthest average distance from the RSA during the herd's annual life cycle. Qamanirjuaq caribou are on average closest to the RSA (153 km) during the post-calving season, and at their furthest (582 km) during the winter season (Table 5.7-3A). Collared animals from the Lorillard herd are found closer to the RSA throughout most of the year, except during calving and post-calving. Collared Ahiak caribou were closest to the RSA during the fall (Table 5.7-3A).

Collared Ahiak caribou were recorded more frequently in the RSA, except during the spring when more collared Lorillard caribou were present, and in the post-calving season when some collared Qamanirjuaq animals were present in the RSA (Table 5.7-3B). Qamanirjuaq caribou were recorded within the boundaries of the RSA during all seasons, although very little during spring migration and calving seasons. Only one collared Beverly caribou from 2002 has been observed using the RSA (not indicated on Table 5.7-3B because not included in dataset for analysis). The movements of each herd for each season are presented in Figures 5.7-9A to 5.7-9F. Summary descriptions of collared caribou movements are provided below. For the purposes of this discussion, collar locations are considered generally representative of herd movements.

Table 5.7-3A Average Distance from the RSA of Collared Female Barren-ground Caribou during Various Portions of the Caribou Life Cycle

Caribou Seasons	Average Distance, Minimum, and Maximum (kilometer) from RSA				
	Beverly[a]	Ahiak[b]	Wager Bay[c]	Lorillard[d]	Qamanirjuaq[e]
Spring Migration (March 16 to May 25)	411 (17–797)	225 (0–765)	309 (26–695)	183 (0–486)	417 (38–764)
Calving (May 26 to June 25)	341 (91–620)	342 (85–548)	488 (223–718)	283 (94–460)	188 (0–644)
Post-calving (June 26 to July 31)	287 (1–570)	369 (1–645)	557 (167–752)	254 (12–433)	153 (0–676)
Late Summer (August 1 to September 15)	359 (0–583)	245 (0–644)	552 (139–747)	160 (0–386)	309 (0–693)
Fall and Rut (September 16 to October 31)	340 (0–716)	187 (0–603)	409 (56–734)	176 (0–437)	387 (0–800)
Early and Late Winter (November 1 to March 15)	482 (11–853)	221 (0–671)	208 (0–658)	161 (0–412)	571 (0–836)

Source: GNWT ENTR and GNDoE (unpublished data)

Seasonal dates are from original source, and differ slightly from seasonal dates in other tables and figures

(a) n = 69, data from 1996 to 1998, and 2001 to 2012 (GNWT ENR and GNDoE);

(b) n = 31, data from 2002 to 2013 (GNWT ENR and GNDoE)

(c) n = 16, data from 1999 to 2006, and 2009 to 2012 (GNDoE)

(d) n = 28, data from 1998 to 2006, and 2011 to 2013 (GNDoE)

(e) n = 92, data from 1993 to 2013 (GNDoE)

Table 5.7-3B Use of RSA by Collared Individuals During Various Portions of the Caribou Life Cycle

Caribou Seasons	% of Locations in the RSA Based on Total Number of Collared Individuals				
	Beverly (a)	Ahiak(b)	Wager Bay (c)	Lorillard(d)	Qamanirjuaq(e)
Spring Migration (March 16 to May 25)	0%	12.0%	0%	13.20%	0.2%
Calving (May 26 to June 25)	0%	0%	0%	0%	3.0%
Post-calving (June 26 to July 31)	0%	0.1%	0%	0%	6.2%

Table 5.7-3B Use of RSA by Collared Individuals During Various Portions of the Caribou Life Cycle

Caribou Seasons	% of Locations in the RSA Based on Total Number of Collared Individuals				
Late Summer (August 1 to September 15)	0%	12.5%	0%	4.2%	5.2%
Fall and Rut (September 16 to October 31)	0%	10.1%	0%	7.9%	7.1%
Early and Late Winter (November 1 to March 15)	0%	8.0%	4.0%	7.5%	9.3%

Source: GNWT ENR and GNDoE (unpublished data)

(a) n = 65, data from 1996 to 1998, and 2001 to 2012 (GNWT ENR and GNDoE); note that the single Beverly collared animal found in the RSA in 2002 was not included in the dataset used for this analysis

(b) n = 31, data from 2002 to 2013 (GNWT ENR and GNDoE)

(c) n = 16, data from 1999 to 2006, and 2009 to 2012 (GNDoE)

(d) n = 28, data from 1998 to 2006, and 2011 to 2013 (GNDoE)

(e) n = 93, data from 1993 to 2013 (GNDoE)

Spring Migration (March 16 to May 25): For the Beverly, Ahiak, and Qamanirjuaq herds, pregnant cows and yearlings are the first to start the northern migration to the traditional calving grounds on the tundra, followed by non-pregnant cows and young bulls (BQCMB 2009c, internet site). Mature bulls are the last to leave the winter range, up to one month after the pregnant cows (BQCMB 1999a, internet site). Most collared caribou in the RSA during this season are from the Ahiak and Lorillard herds (Figure 5.7-9A). Ahiak collared animals moved from north and west of the RSA and Aberdeen Lake area, in a northeast direction towards Chantrey Inlet, and were occasionally found in the western half of the RSA. Lorillard collared animals moved in a general eastward direction from north of the Thelon River to an area between Chesterfield Inlet and Wager Bay. At least one collared Lorillard animal was south of Chesterfield Inlet during this period. Qamanirjuaq caribou were documented in sparse numbers throughout the RSA during this pre-calving season, and animals generally moved in a southeast direction toward their traditional calving grounds southeast of the Kazan River.

Calving (May 26 to June 25): Most cows arrive on their calving grounds in the last week of May or early June, and most calves are born from June 5 to 15 (BQCMB 1999a, internet site). *In May, caribou on both the north and south sides of the inlet start to move toward their calving grounds* (IQ-CI08 2009). The 'traditional calving grounds' and post-calving areas of the Beverly and Qamanirjuaq herds have been documented for many years, and variation in calving areas has been noted. Some Beverly collared animals appear to have calved in the traditional Beverly calving grounds northwest of Aberdeen Lake (compare Figure 5.7-9B to Figure 5.7-2), while others have reached calving grounds further north along the Queen Maud Gulf, where there is some overlap with Ahiak animals. Qamanirjuaq collared animals appear to be calving in a well-defined area that closely matches

delineated traditional calving areas, between and west of Rankin Inlet and Whale Cove. Ahiak collared animals appear to be calving around Chantrey Inlet and between Chantrey Inlet and Pelly Bay (Kugaaruk) north to Taloyoak. Calving grounds of the Lorillard and Wager Bay herds have also been documented based on several years of satellite collaring data (Figure 5.7-1). Wager Bay collared animals appear to have much variability in calving location, ranging from north of Wager Bay and in the vicinity of Repulse Bay, and on to Chantrey Inlet. Most Lorillard collared animals are on their calving grounds between Chesterfield Inlet and Wager Bay. No collared animals were found in the RSA during the calving season, except for one individual from the Qamanirjuaq herd recorded in June 2005 (Figure 5.7-9B).

Post-Calving (June 26 to July 31): By early July, most cows and calves have left the calving areas and begin to aggregate in larger groups that include adult males, to reduce harassment from mosquitoes and predation by wolves (BQCMB 1999a, internet site). *When July comes and there are a lot of bugs, the caribou usually come close to town, but right now we have seen only a few caribou because there are no mosquitoes* (EN-BL CLC June 2011).The RSA is located near the edge of traditional post-calving areas for the Beverly herd (to the north) and the Qamanirjuaq herd (to the south) (Figure 5.7-2); however, the transitory nature of these herds makes exact boundaries difficult to define. Hunters have noted that *in the last three years have mainly been seeing male caribou in that area (tough meat); do not see as much females, young caribou or calves any more* (EN-BL NIRB Apr 2010). Beverly collared animals were generally far west of the RSA with only one collared animal coming near to the northwest end of the RSA just north of Thelon River/Aberdeen Lake before moving westward (Figure 5.7-9C). Qamanirjuaq collared animals spread out in different directions from their calving grounds but none have occurred north of the Thelon River. Qamanirjuaq collared animals were the only ones recorded in the RSA during the post-calving season from 1999 to 2013 data. All collared Ahiak animals remained north of the Aberdeen Lake area, and Wager Bay collared animals are still near their calving grounds, although a few animals have headed further north towards the Boothia Peninsula. No collared Wager Bay or Lorillard caribou were found within the RSA during the post-calving season.

Summer Dispersal (August 1 to September 15): By the end of July, Beverly and Qamanirjuaq caribou begin moving toward the tree line, and in August, scatter to avoid harassment from warble and nose botflies. *As Inuit's knowledge, the caribou start heading (south) in September* (EN-BL EL Oct 2012). In some years, movement of some herds has been back towards the calving grounds (BQCMB 1999a, internet site). For example, in 2009 and 2010, a component of the Qamanirjuaq herd first moved northward and westward before heading southward. Beverly collared animals were mostly west of the RSA, with the closest just north of Aberdeen Lake, and many had moved into the NWT (Figure 5.7-9D). Collared Qamanirjuaq animals were located mostly to the south during the summer dispersal season, with some reaching Manitoba, but a few were still in the RSA south of the Thelon River. Caribou numbers increased in the RSA at the end of the post-calving period and into the summer dispersal period. *Caribou normally come around the end of August, but this year they are just starting to come* (EN-BL OH Oct 2012). *In September, it is not too far and in Baker Lake, there are lots of caribou* (EN-AR KWB Oct 2013). Some Ahiak collared animals crossed the

Aberdeen Lake system into the western part of the RSA, but most remained further north. Some Lorillard collared animals moved as far west as Schultz Lake, but most were situated on the north side of Chesterfield Inlet between the communities of Baker Lake and Chesterfield Inlet. Some collared animals were found within the RSA, to the east of the Thelon River. Wager Bay collared animals remained further north, and none were in the RSA.

Rut and Fall Migration (September 16 to October 31): Movement towards the tree line and/or southern wintering grounds on the barren-grounds occurs between October and December. Mating (the rut) occurs in late October, and usually near the tree line for migratory herds such as the Beverly and Qamanirjuaq. Following the rut, adult males separate from the other caribou and aggregate into separate groups (BQCMB 1999a, internet site). By late fall, most Beverly collared animals have moved into the NWT, but one Beverly collared animal was recorded in the RSA in the fall of 2002. Most Qamanirjuaq collared animals are widely spaced during this season and are moving in a south-southwest direction (Figure 5.7-9E). At least one collared animal was found in the southern part of the RSA during this period. No Wager Bay collared animals were in the RSA; they are widely spaced, with some considerably to the west with the Ahiak herd. Ahiak collared animals were also widely spaced and interspersed, many moving with Beverly animals into the NWT. Some Ahiak collared animals were found in the RSA south of the Thelon River. A few Lorillard collared animals were found in the RSA, but most were located between the hamlets of Baker Lake and Chesterfield Inlet, with some collared animals in Ahiak and Wager Bay herd ranges.

Early and Late Winter (November 1 to March 15): By November, most of the migratory Beverly and Qamanirjuaq caribou are south of the tree line. Animals may continue to move until snow depth reaches > 50 cm around February or March (BQCMB 1999a, internet site). Several Beverly collared animals remained on the barren-grounds where they mixed with some of the Ahiak, Lorillard, and Wager Bay animals (Figure 5.7-9F). Some mixing of Qamanirjuaq, Beverly, and Ahiak collared animals also occurred in southeastern NWT. At least one collared Qamanirjuaq animal was found within the RSA south of Baker Lake. A few collared Wager Bay animals were present within the northern portion of the RSA, but most are widely spaced from northwest of Repulse Bay to west of the RSA. Hunters in Repulse Bay confirm that *caribou are harder to find during winter [further north]; believe that they are either at Baker or north at Igluliq* (IQ-RBJ 2011). Caribou present in the RSA during the winter largely comprise animals from the Lorillard and Ahiak herds, although a portion of the Ahiak collared animals are in the NWT with Beverly collared animals. Another large portion of the Ahiak collared animals are north of Aberdeen Lake with the Lorillard and Wager Bay herds. Collared Ahiak animals were found in the RSA, mostly around the Aberdeen Lake system. Although some Lorillard collared animals were found in the RSA, others are as far away as northeastern NWT where they mix with Beverly, Ahiak, and Qamanirjuaq herds.

Important Caribou Areas in the Regional Study Area

Long-term protection of calving grounds and post-calving areas, and seasonal protection during migration and rut are key conservation concerns for management of the Beverly and Qamanirjuaq herds (BQCMB 2004, internet site), and are a priority for all barren-ground caribou.

Calving Areas: The RSA is at the periphery of historically documented post-calving areas for the Beverly and Qamanirjuaq caribou. No government-designated or other formally identified calving areas are present within the RSA, and the RSA is not within caribou protection areas identified within Territorial Land Use Regulations. Department of Indian Affairs and Northern Development (DIAND) Caribou Protection Measures protect animals on designated calving grounds from May 15 to July 15. The closest calving areas to the RSA are the traditional calving grounds for the Beverly herd to the north, and for the Qamanirjuaq herd to the southeast (Figures 5.7-1 and 5.7-2).

Contrary to the information sources described above, some IQ and engagement data suggest that calving has occurred in the RSA (see Figure 5.7-10). *Qamanirjuaq herd is calving close to site* (EN-AR HTO Nov 2010). *Last May a helicopter landed on the other side of Thelon River's mouth during caribou calving* (EN-BL CLC July 2010). *Caribou migration routes are very important in the region; area used as calving grounds and also as migration routes, especially during the fall* (EN-BL NIRB Apr 2010). A small calving area was identified near Pitz Lake from IQ (Figures 5.7-10 and 5.7-11). Other IQ contradicts such observations — *even though it's not a calving ground, it is grizzly bear country* (EN-BL HTO Mar 2009). Caribou collar data collected to date very closely matches designated calving areas. No collared caribou were observed in the RSA during the calving season, except on one occasion, and it seems unlikely that the RSA is used for calving today. All available information sources, including IQ and engagement data, have clearly shown the potential for changes in caribou migration and seasonal patterns over time, and caribou can occur in the area at any season.

Post-calving Areas: Cows and calves are sensitive to disturbance and vulnerable to predation during a critical three-week period following calving. Based on regional surveys completed from 1948 through 1990, the area in and around the RSA has historically been used by the Beverly herd during post-calving movements (e.g., Darby 1978; IDS 1978; BQCMB 1999a, internet site; see Figures 5.7-2 and 5.7-11), although exact boundaries are not known (BQCMB 1999b, internet site). Most observations of Beverly caribou in the Kiggavik area during the post-calving period were prior to 1960 (citations in Beak 1989). The area north and west of Aberdeen Lake is generally recognized as being of greater use (Riewe 1992). These historical information sources also identified post-calving areas for the Qamanirjuaq herd to the south of Baker Lake (Figure 5.7-2). More recent analysis of collar data has expanded the delineation of post-calving areas for this herd into the southeast corner of the RSA (Figure 5.7-11).

Collaring data and ground observations from baseline studies confirm the use of the RSA as a post-calving area, although not by Beverly collared animals (Figure 5.7-9C and 5.7-11). Only Qamanirjuaq collared animals were recorded in the RSA during the post-calving season between 1999 and 2013, based on available collaring data. Herds of up to 10,000 individuals were encountered in the RSA during the late July/early August 2010 period (see Figure 5.7-6). As well, in late July and early August 2010, several hundred caribou with some calves were observed crossing the Thelon River from north to south. Collar data suggest these would have been Qamanirjuaq animals in the post-calving period, although Lorillard and Ahiak collared animals were present in the RSA in the summer period (see Figures 5.7-9C and 5.7-9D)**.**

Water Crossings: Water crossings play an important role in many periods of the annual cycle for caribou. For the Beverly herd, water crossings are frequent, as there are waterbodies throughout their range, especially the winter range (BQCMB 2007, internet site). During migration, caribou follow natural geographic features, which cause them to concentrate at traditional water crossings (Williams and Gunn 1982). At times, caribou will gather in large numbers for hours before they attempt a water crossing. Once a few animals have successfully made it across, the remainder of the herd is more likely to follow (BQCMB 2007, internet site). If disturbed during this gathering time, the herd may disperse and move away from the crossing area. Hunters in the Baker Lake area are aware of this and will allow the caribou to make the water crossing before beginning their hunt (BQCMB 2007, internet site). IQ and engagement data concur: *It is important that the caribou leaders are not disturbed during migrations; this is information we learned from our Elders* (EN-BL EL Oct 2012). *When there is a herd, the leader of the herd is followed quite closely by the rest of the herd, and nobody tries to disturb the herd to not disrupt the migratory route* (EN-BL HTO Mar 2009).

All water crossings are included in the migration maps (Figures 5.7-12A to 5.7-12D). Some documented crossings that fall within the RSA are protected under the Territorial Land Use Regulations. Protected crossings are those where some land-use related activities within 5 km of designated water crossings are prohibited by the DIAND Caribou Protection Measures from May 15 to September 1. Furthermore, establishment of camps and blasting within 10 km of a designated water crossing are prohibited between May 15 and September 1 on the ranges of the Beverly and Qamanirjuaq caribou herds on mainland Nunavut. Water crossings were identified on a map that was maintained by the DIAND up to 1992 (DIAND 1992), and are currently within a spatial database maintained by the GN DoE. Crossings 13 to 18 are at the northern and northwestern boundaries of the RSA at Schultz Lake and Aberdeen Lakes. Crossing 106 is just outside of the RSA at the southeastern tip. Crossings 17 and 18 at Aberdeen Lake, which are 40 km west of the Kiggavik Project, were used heavily in the early 1900s, but neither crossing was documented to have been used extensively from 1960 to 1989 (Beak 1989). During this same time period, Williams and Gunn (1982) stated that Crossing 17 is of high importance to the Beverly herd.

Additional water crossings (unprotected by DIAND but identified in GN DoE database) occur at dispersed points along the Thelon River, Aniguq Lake (~25 km west of Baker Lake, south of Thom Lake), and at the mouth of Quinnguq Bay (south of the mouth of Thelon River at Baker Lake). Elders

confirmed previously documented information with IQ, noting that *Qikiqqtarjualik Lake (Judge Sissons Lake) and Anigguq Lake were main caribou crossing areas within the Kiggavik RSA, and that the narrows situated at the west end of Aberdeen Lake (Qikiqqtalik) is also a caribou crossing area (*IQ-BL01 2008; IQ-BL02 2008; IQ-BL04 2008; Figure 5.7-10). The proposed All-Season Road *spans the Thelon River in an area of a caribou crossing* (EN-BL OH Nov 2010). In 2010, surveys by Cameco at an identified water crossing (Crossing 16) observed several hundred caribou, some with calves, crossing from north to south in late July and early August (Figure 5.7-6). The animals were likely from the Qamanirjuaq herd, given collar movements from that time period (Figure 5.7-9C), presumably having crossed the Thelon from south to north before moving back to the south side of the Thelon River.

Migration Patterns

Understanding movement patterns of migratory and tundra-wintering caribou in and around the RSA is challenging given variability in movements between seasons, herds and individuals. Information from various sources, including IQ and engagement studies, baseline ground and aerial surveys, and telemetry data at local and regional scales in Nunavut and the NWT, has provided some evidence on how caribou move in and around the RSA annually. Unlike other caribou use areas to the north and west of the RSA, the area around Baker Lake is a mixing or overlap area for migratory and tundra-wintering caribou, and is used during most caribou seasons, although some more than others. The RSA predominantly provides a transit corridor between calving grounds and wintering grounds for the Ahiak and Qamanirjuaq herds, and a wintering area for tundra-wintering herds such as the Lorillard and Wager Bay herds. As a result, caribou occur in the region year-round, which is supported by IQ and engagement data. *When you look at the area, caribou do wander all over the place* (EN-BL HTO Mar 2009). *Caribou migration routes are very important in the region; area used as calving grounds and also as migration routes, especially during the fall* (EN-BL NIRB Apr 2010). One Elder noted *large herds of caribou (thousands) migrate near and through the proposed routes* (EN-BL NIRB Apr 2010). *When caribou are looking for food they migrate and travel far* (EN-BL CLC Oct 2012).

To identify areas of greatest caribou densities during spring and fall migration, available telemetry data were analyzed across the full extent of the migratory and tundra-wintering herd ranges (Figures 5.7-12A and 5.7-12C; note: a migration analysis by government for the Beverly herd is still in progress and is not included in these figures). Spring and fall migration are major directional movements for caribou in the region. For spring migration (April to June), areas of high use by collared caribou are more contained (i.e., less spread out), and these corridors are quite clearly delineated on the way to and in proximity of calving grounds outside the RSA) (Figure 5.7-12A). Telemetry data indicate that most collared caribou are moving in a northerly direction in the spring, but generally outside the RSA.

IQ-derived spring migration arrows do not all concur with the patterns observed in the collar data, as some indicate spring movement into the RSA from north-to-south and south-to-north (Figure 5.7-12B). In most cases, historical IQ identified spring movement in a mostly northerly direction out of the RSA (IDS 1978), which is supported by recent collaring data. Some IQ collected in the 1970s also has unexpected discrepancies; one arrow shows spring movement towards the RSA by southern (presumably Qamanirjuaq) animals (Figure 5.7-12B). As discussed in previous sections, other IQ has indicated calving in the area, and one collared caribou was recorded in the RSA during calving season. Taken together, spring movement through the RSA is known to occur, but to a much lesser extent than outside (e.g., west) of the RSA.

For fall migration (September to November), as animals are migrating to wintering grounds, areas of high use by collared caribou are more widely distributed (i.e., more spread out; Figure 5.7-12C). Fall migration corridors are also located closer to the Kiggavik area than spring corridors, as herds generally move in a southerly direction from calving grounds. Similar to the spring migration corridors, the areas of greatest use in the fall were north of Aberdeen Lake (i.e., Beverly), east of the Thelon River (i.e., Ahiak), and south of Baker Lake (i.e., Qamanirjuaq).

Few fall migration arrows were identified from IQ. The two IQ-derived fall migration arrows located south of the RSA at Qamanaajuk Lake are supported by the somewhat limited caribou collar data available (Figure 5.7-12D). Most historical IQ identified fall movement in a southerly and westerly direction out of the RSA (IDS 1978). This historical IQ collected in the 1970s also showed fall movement to the north of Baker Lake and east of the Thelon River, which was also observed in more recent telemetry data.

Many of the IQ-derived migration arrows were not differentiated by season; rather they reflected an important corridor of movement. The absence of a perfect correlation between the regional migration corridor density analyses, the individual collared caribou walk lines, and the IQ-derived migration arrows provide further evidence of seasonal and year-round variation in movement patterns of caribou in the RSA as they move to calving grounds to the north and south. *When you look at the area, caribou do wander all over the place* (EN-BL HTO Mar 2009).

The differences between information sources, and the challenges in making firm statements about caribou migration in the RSA, reflect the inherent potential for change in caribou movement patterns. IQ and engagement data note the changes that have occurred in migration. *The Elders say caribou have always changed their migration routes. They will eat lichen along one route and will not use it again until lichen is back* (EN-BL OH Oct 2012). Some believe that *caribou naturally change their migration patterns every few years and an Elder explained that while herds used to start migrating towards the southeast and cross the Annigguq Lake and the mouth of Kazan River, they now start to migrate from the southeast towards the northwest. Another Elder simply stated that the herds don't take the same routes anymore* (IQ-BL01 2009; IQ-BL05 2008; IQ-BL02 2008; IQ-BLHT 2011; IQ-RBJ 2011). *When he was young, caribou did not migrate but when he was older they did migrate. He*

was told by his Elders they do this cycle between migrating and not migrating and they should expect this to happen again. When they are not migrating the caribou stay near Baker. Caribou migrations are different every year. Caribou movements depend on food availability and they keep moving as resources consumed in an area (IQ-RBJ 2011).

In some cases, changes in migration patterns have been discussed as a result of human activity. It is very hard to predict where the caribou are today. When I was young (Hudson Bay area), the caribou migrated through here and crossed river. But since the mine was in Rankin and human population grew, the migration route changed. Some caribou go through Rankin but not as many as there used to be; perhaps it is becoming this way in Baker (IQ-BLHT 2011). Meadowbank changed caribou migration to Repulse Bay (EN-RB OH May 2009). When the nickel mine was built in Rankin Inlet in the 1950s, the caribou stopped going to Chesterfield Inlet, but in 1970, the herd 'suddenly' reappeared (IQ-CI03 2009). The caribou no longer go to Rankin Inlet because there are too many people, adding that there are too many people with snowmobiles on the south side of Chesterfield Inlet and this has made it difficult to determine the natural movement of caribou anymore (IQ-CI04 2009). Changes in migration patterns due to human activity have also been identified in other IQ studies (Kendrick and Lyver 2005).

Habitat Suitability

Caribou use of habitat is dynamic with suitable habitat not always used even if available, which makes delineating habitats in a specific area difficult. The reasons for suitable habitat remaining unused could be cyclical habitat use by a herd, abundance of other higher quality habitat, or random patterns of suitable quality habitat. Lack of use of suitable habitat during one year does not necessarily mean the habitat will remain unused in subsequent years.

Given the uncertainty and unpredictability of habitat use by caribou, literature was reviewed to determine habitat and food preferred by caribou[5]. This information was used to rate the suitability of different ELC habitat units available to barren-ground caribou in the RSA, and to identify and quantify the habitat that might be important to caribou during important seasons of their annual life cycle.

[5] A Habitat Suitability Index approach was used because collar data were not made available for the purposes of developing Resource Selection Functions.

Seasonal Habitat Selection

Although the annual life cycle of barren-ground caribou has been described according to six seasons (see Table 5.7-3), for the purposes of this baseline**,** habitat use during spring and summer (i.e., growing season) and fall and winter (i.e., winter season) was described since most of habitat selection modeling approximately follows these seasons. By categorizing caribou habitat selection into summer (growing season) and winter (winter season), the focus is on caribou that are spending significant time within the RSA. Habitats are seasonally important for caribou (i.e., important winter habitat is not necessarily important growing season habitat). Caribou are most sensitive to disturbances that alter their use of habitat during the late-winter, calving, and post-calving periods. A detailed discussion of habitat selection during primary seasons is provided below.

Winter (Winter Season): Late-winter is the time of the year when populations of caribou are most limited by habitat and may be subject to density-dependent forage availability (Tyler et al. 2008). The two factors that most affect habitat selection by caribou during winter are snow condition and lichen availability. Snow depth and hardness are the limiting climatic conditions during winter (Adamczewski et al. 1988; Turney and Hear 1991) making food acquisition more energetically costly because caribou spend an increasing amount of their energy cratering for food (Tucker et al. 1990). Also, movement becomes more costly with increasing snow depth (Turney and Hear 1991).

Lichen is the most important source of winter food for caribou because it is relatively high in energy and highly digestible compared to other sources of food (Storeheier et al. 2002). Lichen can comprise a large portion (greater than half) of a caribou's winter food intake (Thompson and McCourt 1981; Boertje 1984; Storeheier et al. 2002;). Other vegetation reported in caribou diet during the late-winter includes graminoids, woody plants (shrubs), and some moss. Moss is thought to be a by-catch of grazing for other vegetation because moss is not easily digestible by Arctic ruminants and the presence of moss in feces may be an indication of decreasing quality of winter range or difficult winter conditions (Ihl and Barboza 2007). The most heavily used winter vegetation communities in order of preference are lichen steppes, lichen heath tundra, dwarf shrub-lichen tundra, and dwarf shrub-sedge tundra (Thompson et al. 1978). *In January they try to be in rough areas when it is too cold* (EN-BL EL Oct 2012). Late-winter is even more critical for cows because they are using more energy during the late stages of gestation (Adamczewski et al. 1993).

Spring (Growing Season): During the spring, energy requirements of female caribou increase because of late-gestation and the start of lactation (Adamczewski et al. 1993). Female barren-ground caribou are more sensitive to disturbances during this period compared to other times of the year (Reimers and Colman 2006). Caribou form large groups as a way of avoiding predation through dilution of risk and like many other Arctic animals, have adapted to giving birth at a time of year that coincides with the peak of available resources (Post and Forchhammer 2008).

In spring, barren-ground caribou migrate north from winter range in April and May. Compared to the yearly range of a herd, cows calve in relatively small discrete areas. Calving grounds are traditionally used and are probably the most predictable habitats used by caribou. Calving is a critical time of the year for caribou because calving cows are highly sensitive to disturbance while their calves are vulnerable and cows require high quality food for production of milk. Caribou exhibit highly synchronous calving. The timing of calving has evolved to coincide with the start of the growing season because newer growth provides the higher quality nourishment that calving and post-calving caribou need to recover from the winter and feed their new calves (Post and Forchhammer 2008; Sharma et al. 2009).

Caribou select for habitats that have an earlier start of the growing season (Sharma et al. 2009). Habitats that contain open shrub, grasslands with sparse shrubs, and lichen veneer are preferred habitats (Johnson et al. 2005; Sharma et al. 2009). Generally, caribou avoid riparian shrub areas and treed habitat (Johnson et al. 2005; Sharma et al. 2009).

Summer (Growing Season): Food is abundant during the summer season, so caribou can feed on abundant high quality vegetation and restore fat reserves required to survive the coming winter (Ouellet et al. 1997). Females in particular need to gain enough weight during the summer to be able to reproduce. In summer through to late fall caribou feed on shrubs, grasses, lichens and mushrooms (Boertje 1984), and they gain weight relatively quickly. Vegetation quality is highest in the early summer and decreases as vegetation matures (Hebblewhite et al. 2008), so caribou summer movement may be determined by the phenology of the region. Part of the migratory behaviour of caribou is thought to be a strategy of acquiring this new, high-quality summer vegetation (Post and Forchhammer 2008). Other factors thought to influence caribou distribution in the summer are thermoregulation, predator avoidance, and insect avoidance. Caribou can avoid insect harassment and over-heating by moving to habitats that tend to be windier, cooler, and/or higher elevation.

Insect harassment was reported to change activity budgets of caribou by increasing the amount of time standing and decreasing the amount of time feeding (Toupin et al. 1996). Insect harassment can alter caribou habitat selection towards areas where insect abundance is limited, such as snow patches (Toupin et al. 1996). Insect avoidance by caribou may affect caribou body condition through changes in activity budgets/patterns; however, severe insect harassment that can alter caribou behavior and distribution likely occurs during a limited number of days during the summer (Toupin et al. 1996). Caribou are most distressed by oestrid flies (Morschel and Klein 1997). Other environmental factors have been reported to cause greater changes to caribou activity, such as temperature (Morschel and Klein 1997) and human disturbances, which may interfere or alter movement patterns and reduce foraging time (Bergerud et al. 1984; Cameron et al. 2005).

Fall (Winter Season): September to December is the period of the year when barren-ground caribou start their migration south and shift to a predominantly lichen-based diet (Boertje 1984). Caribou select habitats with lichen and open evergreen shrublands and avoid sedge, peat bog, rock, heath tundra, waterbodies, closed evergreen forests, and areas with open evergreen forests and no lichen understory (Johnson et al. 2005; Sharma et al. 2009).

Caribou Habitat Suitability

Caribou need extensive space to undertake traditional movements, presumably, as a strategy to minimize predation, exploit seasonal habitats, and avoid deep snow (Adamczewski et al. 1988; Tucker et al. 1990). Continuous unfragmented habitat is important for caribou populations because caribou may avoid habitats that contain human infrastructure and/or disturbances (Nellemann and Cameron 1996, 1998; Johnson et al. 2005; Mayor et al. 2009;), although there is still some uncertainty about how effects are measured and interpreted (Reimers et al. 2007). The use of traditional calving grounds may increase calf survival of barren-ground caribou (Cameron et al. 1992); therefore, reducing anthropogenic disturbances on calving grounds may be important for maintaining recruitment rates that sustain population growth.

The RSA was divided into ELC units that are recognizably different in vegetation content and geographic features (see Section 4.5.1). As discussed above, caribou generally feed on lichen during winters, and fresh shrubs (leaves and stems) and graminoids during the growing season (Adamczewski et al. 1988); therefore, habitat that contains these features will be of higher value to caribou in the appropriate season. Snow depth and hardness influences the availability of food in winter, so areas where snow depth is limited are important (Adamczewski et al. 1988; Tucker et al. 1990); however, snow depth and hardness is not represented in the ELC, so they are not included in the habitat values.

The relative importance of each ELC unit for caribou in the growing and winter seasons was rated as High, Moderate, or Low based on the ELC unit's maximum importance during the season in question (Table 5.7-4). For example, Lichen Tundra is particularly important in late winter, but the value of this habitat unit was rated as High for the entire winter season, and Graminoid Tundra is important early in the growing season when vegetation quality is greatest, but is rated as High for the entire growing season.

Based on the relative habitat quality ratings applied to the ELC units, habitat suitability was quantified for the RSA and all LSAs for the growing and winter season (Table 5.7-5). During the growing season, there is a roughly equal amount of High, Moderate, and Low quality habitat distributed throughout the RSA (over 30% of each; Table 5.7-5). Most of the High quality habitat in the growing season is situated in southern portions of the RSA (Figure 5.7-13). This habitat distribution corresponds with the distribution of post-calving aggregations of caribou observed during baseline studies (Figures 5.7-6 and 5.7-7), and also with collared caribou movements in the post-calving

season (Figure 5.7-9C) and summer season (Figure 5.7-9D). Slightly less High quality habitat is available for caribou during the winter season, and the amount of Low quality habitat remains fairly constant year-round at about 30% in the RSA (Table 5.7-5; Figure 5.7-14). The location of High quality habitat corresponds with the distribution of collared caribou in areas northwest of the RSA, and to the east of the Thelon River (Figure 5.7-9E).

Proportionally more High suitability habitat is found in the Mine LSA than in the RSA (Table 5.7-5). The Mine LSA has proportionally more High and Moderate suitability habitat in the growing season relative to the RSA. The Mine LSA is at the northern edge of the High suitability habitat predominant in the southern half of the RSA during the growing season, which is perhaps one reason why large herds of caribou were observed in the Mine LSA in 2010. As well, during the winter season, the Mine LSA is at the southern edge of the predominantly High suitability habitat found in the northwest portion of the RSA. This distribution of High suitability habitat in winter may be one reason why large numbers of caribou were seen in this region in November 2009 when 21 collars were deployed.

Table 5.7-4 Summary of Relative Value of Ecological Land Classification Units to Caribou during the Growing and Winter Periods in the Regional Study Area

ELC Unit	Growing	Winter	Reasoning
Water	Nil	L	Water is not important caribou habitat. Shorelines may provide some insect relief, but other habitats associated with elevation provide better relief.
Sand	M	L	Caribou select for Sand and Gravel to avoid insect harassment in the growing season (BQCMB 1999a, internet site). The value of Sand and Gravel in winter is low because the habitat contains limited food and there are no insects in winter.
Gravel	M	L	Caribou select for Sand and Gravel to avoid insect harassment in the growing season (BQCMB 1999a, internet site). The value of Sand and Gravel in winter is low because the habitat contains limited food and there are no insects in winter.
Rock Association	L	L	Rock Association provides little usable habitat for caribou as there is little available food.
Wet Graminoid	H	M	Wet Graminoid was categorized as high in the growing season because of high quality new growth that is high in energy content, easily digestible, and abundant. Caribou select graminoids in spring and summer; however, caribou avoid areas containing sedges and peat bogs in fall. Nevertheless, the overall rating for the growing season is high.
Graminoid Tundra	H	M	Graminoid Tundra was categorized as high in summer because of high quality new growth that is high in energy content, easily digestible, and abundant. In winter, the quality of vegetation decreases, therefore, so does habitat value.
Graminoid/ Shrub Tundra	H	M	Graminoid/Shrub Tundra has a similar value to the Graminoid Tundra and Wet Graminoid ELC units because it contains high quality seasonal vegetation, as well as more open shrubs (compared to straight shrub

Table 5.7-4 Summary of Relative Value of Ecological Land Classification Units to Caribou during the Growing and Winter Periods in the Regional Study Area

ELC Unit	Growing	Winter	Reasoning
			habitat). It may be of higher value than Graminoid Tundra because of the diversity of food types that are selected by caribou – shrub, lichen and graminoid.
Shrub Tundra	M	L	Shrubs (willows) form a large part of caribou diet in the growing season and there is evidence that caribou select riparian areas during post-calving season, but caribou do not select this habitat type in winter.
Shrub/ Heath Tundra	H	M	Shrub/Heath Tundra is considered important during the growing season because it contains willows as well as other sources of food. The value is lower in winter because caribou focus more on areas where lichen is present.
Heath Tundra	M	H	This habitat type has all the vegetation used by caribou in the growing season. Due to the presence of lichen the value is higher in the winter.
Heath Upland	M	H	This habitat type has all the vegetation used by caribou in the growing season. Due to the presence of lichen the value is higher in the winter. Ridge tops my also provide areas of reduced snow depth.
Heath Upland/ Rock Complex	L	M	Relatively low value in the growing season because of the rock content, but is higher in winter because of lichen content.
Lichen Tundra	M	H	Lichen is the most important food source for caribou in winter. In the growing season, when caribou select for other food, lichen is still part of their diet and they still spend time in these areas, but not to the same extent.
Growing season is approximately June 1 to September 30 (four months). Winter season is defined as approximately October 1 to May 31 (eight months). H = High; M = Moderate; L = Low			

Table 5.7-5 Comparative Percentages of Caribou Habitat Suitability in Local and Regional Study Areas

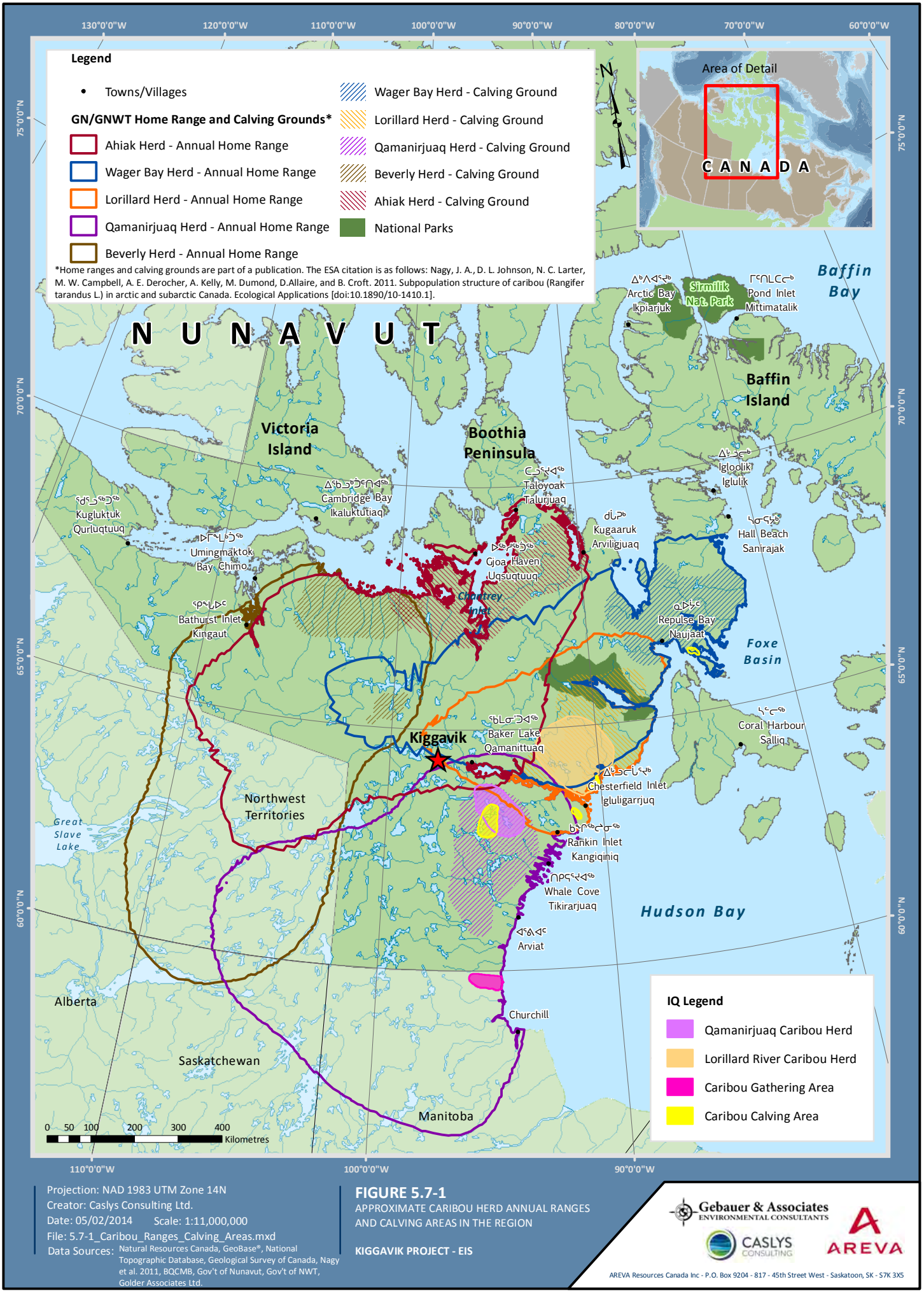
Habitat Suitability – Growing Season(a)	Mine LSA		All-Season Road LSA		Winter Road LSA		RSA	
	ha	%	ha	%	ha	%	ha	%
High	17,401	38.7%	18,415	35.4%	21,492	38.3%	333,172	33.9%
Moderate	20,819	46.3%	22,162	42.6%	12,299	21.9%	339,273	34.5%
Low	6,789	15.1%	11,292	21.7%	22,096	39.4%	307,829	31.3%
No Rating	0	0.0%	162	0.3%	203	0.4%	2,585	0.3%
Habitat Suitability – Winter Season	**Mine LSA**		**All-Season Road LSA**		**Winter Road LSA**		**RSA**	
	ha	**%**	**ha**	**%**	**ha**	**%**	**ha**	**%**
High	18,032	40.1%	20,290	39.0%	9,767	17.4%	288,804	29.4%
Moderate	18,071	40.1%	21,573	41.5%	22,590	40.3%	379,711	38.6%
Low	8,907	19.8%	10,006	19.2%	23,531	42.0%	311,759	31.7%
No Rating	0	0.0%	162	0.3%	203	0.4%	2,585	0.3%
Totals	**45,009**	**100.0%**	**52,031**	**100.0%**	**56,090**	**100.0%**	**982,859**	**100.0%**

Growing season is approximately June 1 to September 30 (four months).

(a) Indicator species is peregrine falcon

(b) High suitability habitat includes all areas within 2 km of known active and inactive raptor nest sites

ha = hectare



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Data Sources: Natural Resources Canada, GeoBase®, National Topographic Database, Geological Survey of Canada, Nagy et al. 2011, BQCMB, Gov't of Nunavut, Gov't of NWT, Golder Associates Ltd.

FIGURE 5.7-1
APPROXIMATE CARIBOU HERD ANNUAL RANGES AND CALVING AREAS IN THE REGION

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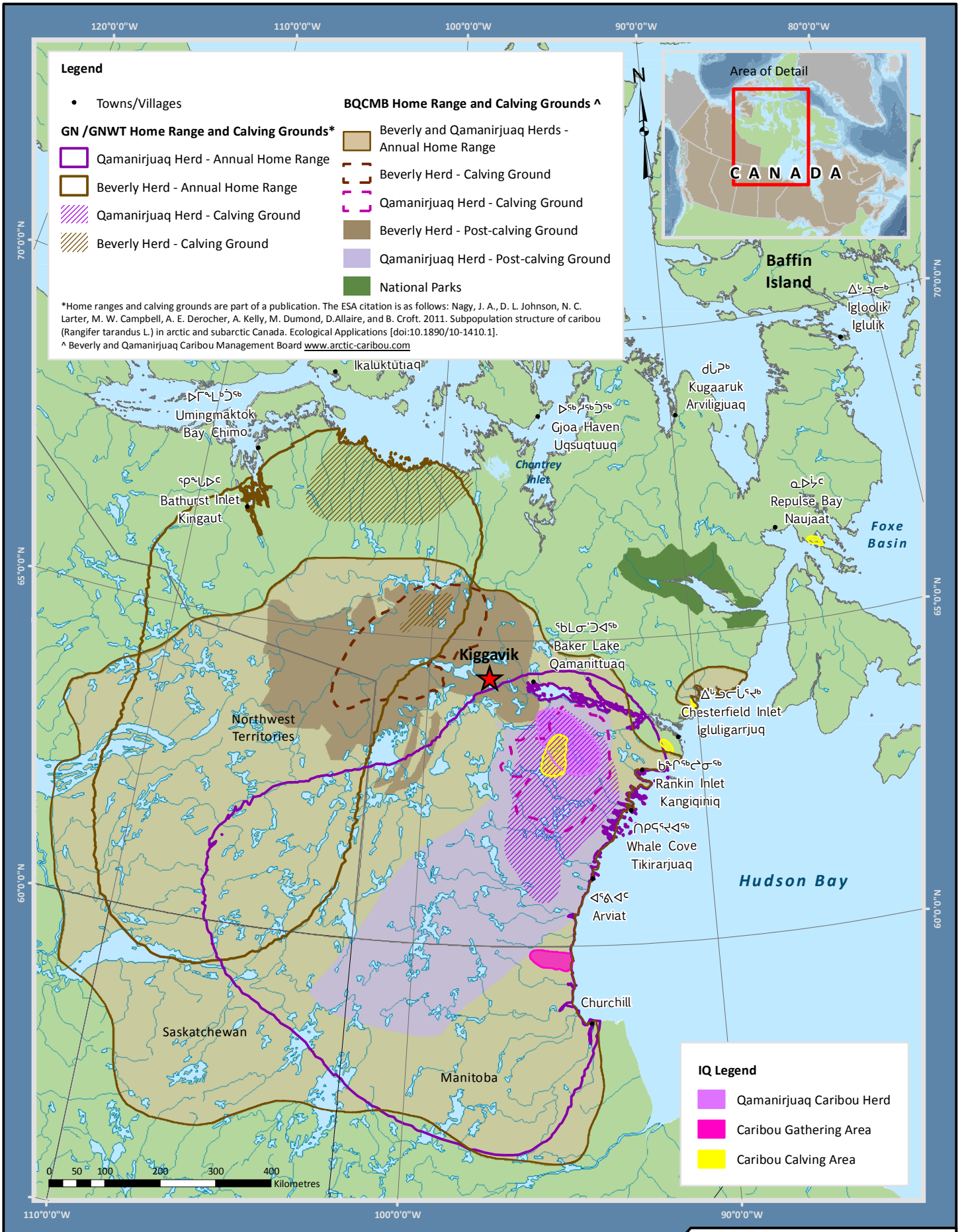

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Data Sources: Natural Resources Canada, GeoBase®, National Topographic Database, Geological Survey of Canada, Nagy et al. 2011, BQCMB, Gov't of Nunavut, Gov't of NWT, Golder Associates Ltd.

FIGURE 5.7-2
BEVERLY AND QAMANIRJUAQ CARIBOU HERD ANNUAL RANGES, CALVING AND POST-CALVING AREAS

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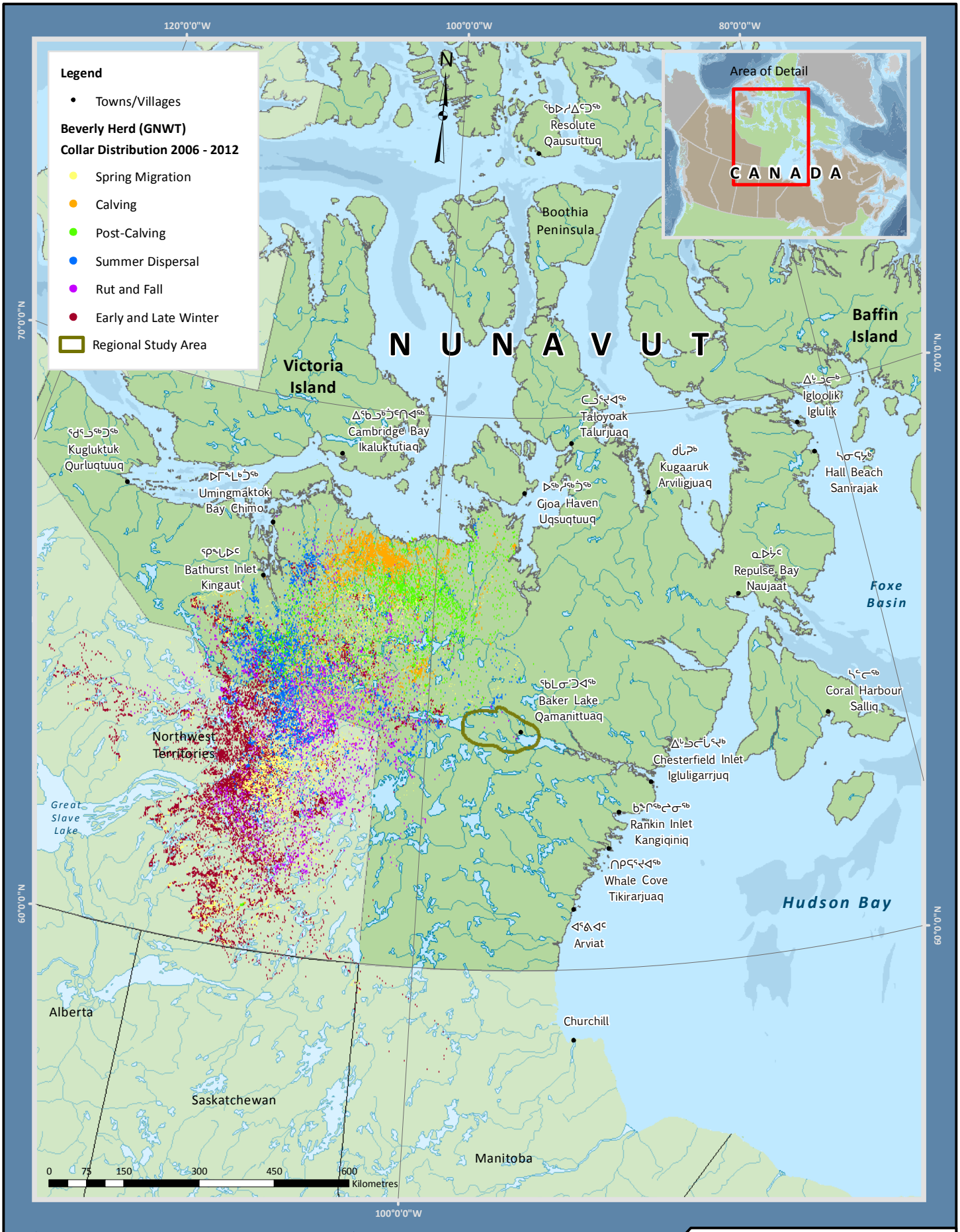

Projection: NAD 1983 UTM Zone 14N
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Date: 04/08/2014 Scale: 1:10,000,000
File: 5.7-3A_Beverly_Herd_Presence_RSA.mxd
Data Sources: Natural Resources Canada, GeoBase®, National Topographic Database, Geological Survey of Canada, BQCMB, and Gov't of NWT.

FIGURE 5.7-3 A
BEVERLY HERD PRESENCE IN THE REGION

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GN Caribou data collected and analysed by:
Mitch Campbell - Government of Nunavut, Department of Environment, Wildlife Division
Background:
Telemetry data collected between 2008 and 2013.

Projection: NAD 1983 UTM Zone 14N
Creator: Caslys Consulting Ltd.
Date: 04/18/2014 Scale: 1:10,000,000
File: 5.7-3B_Ahiak_Herd_Presence_RSA.mxd
Data Sources: Natural Resources Canada, GeoBase®, National Topographic Database, Geological Survey of Canada, BQCMB, Gov't of Nunavut, and Gov't of NWT.

FIGURE 5.7-3 B
AHIAK HERD PRESENCE IN THE REGION

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Projection: NAD 1983 UTM Zone 14N
Creator: Caslys Consulting Ltd.
Date: 04/18/2014 Scale: 1:10,000,000
File: 5.7-3C_WagerBay_Herd_Presence_RSA.mxd
Data Sources: Natural Resources Canada, GeoBase®, National Topographic Database, Geological Survey of Canada, Gov't of Nunavut, and BQCMB.

FIGURE 5.7-3 C
WAGER BAY HERD PRESENCE IN THE REGION

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Projection: NAD 1983 UTM Zone 14N
Creator: Caslys Consulting Ltd.
Date:04/18/2014 Scale: 1:10,000,000
File: 5.7-3D_Lorillard_Herd_Presence_RSA.mxd
Data Sources: Natural Resources Canada, GeoBase®, National Topographic Database, Geological Survey of Canada, BQCMB, and Gov't of Nunavut.

FIGURE 5.7-3 D
LORILLARD HERD PRESENCE IN THE REGION

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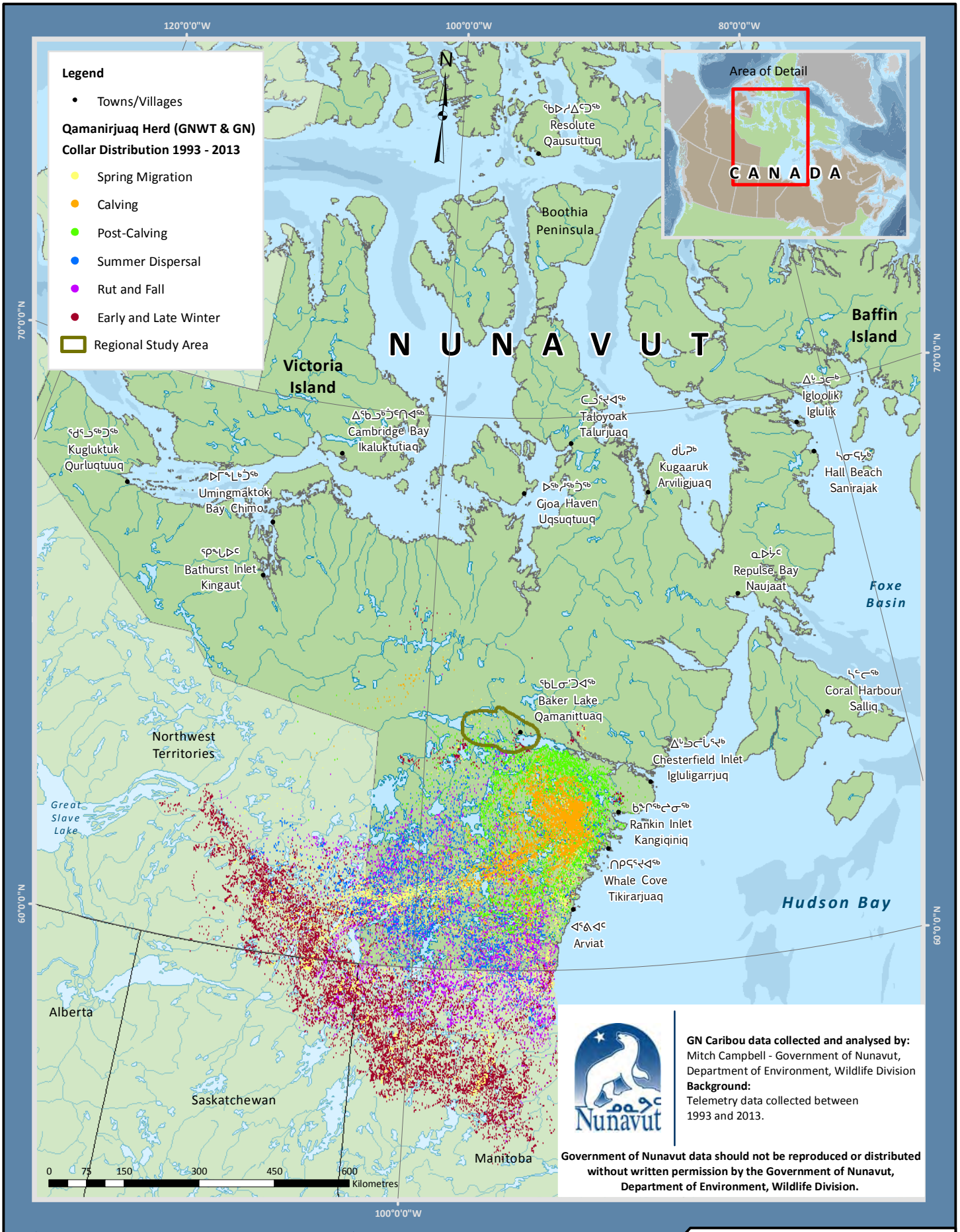

GN Caribou data collected and analysed by:
Mitch Campbell - Government of Nunavut, Department of Environment, Wildlife Division
Background:
Telemetry data collected between 1993 and 2013.

Projection: NAD 1983 UTM Zone 14N
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Data Sources: Natural Resources Canada, GeoBase®, National Topographic Database, Geological Survey of Canada, BQCMB, Gov't of Nunavut, and Gov't of NWT.

FIGURE 5.7-3 E
QAMANIRJUAQ HERD PRESENCE IN THE REGION

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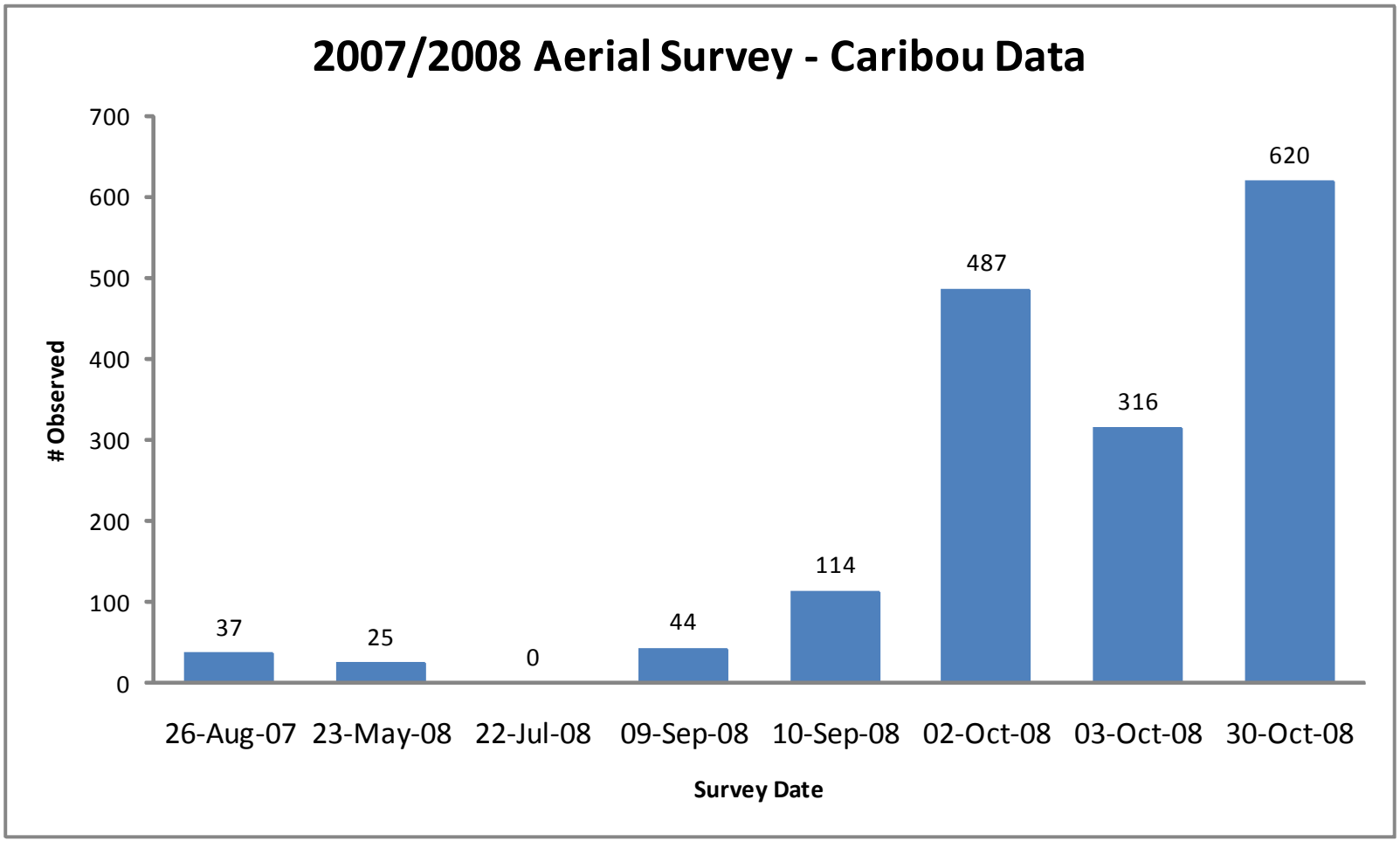

Figure 5.7-4 Number of Caribou Observed During 2007 and 2008 Aerial Surveys of the Regional Study Area

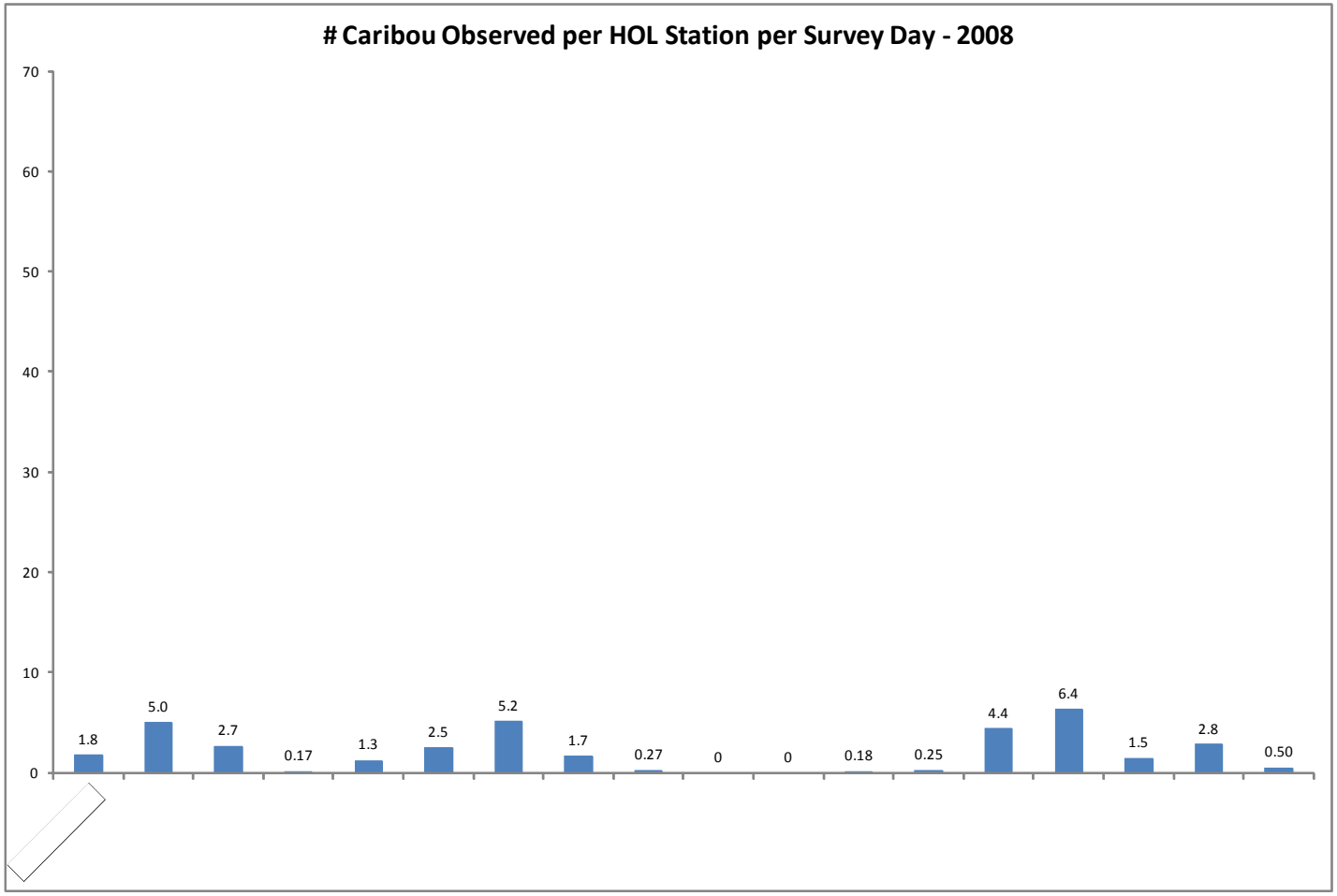

Figure 5.7-5A Number of Caribou Observations by Height-of-Land Survey Data (2008)

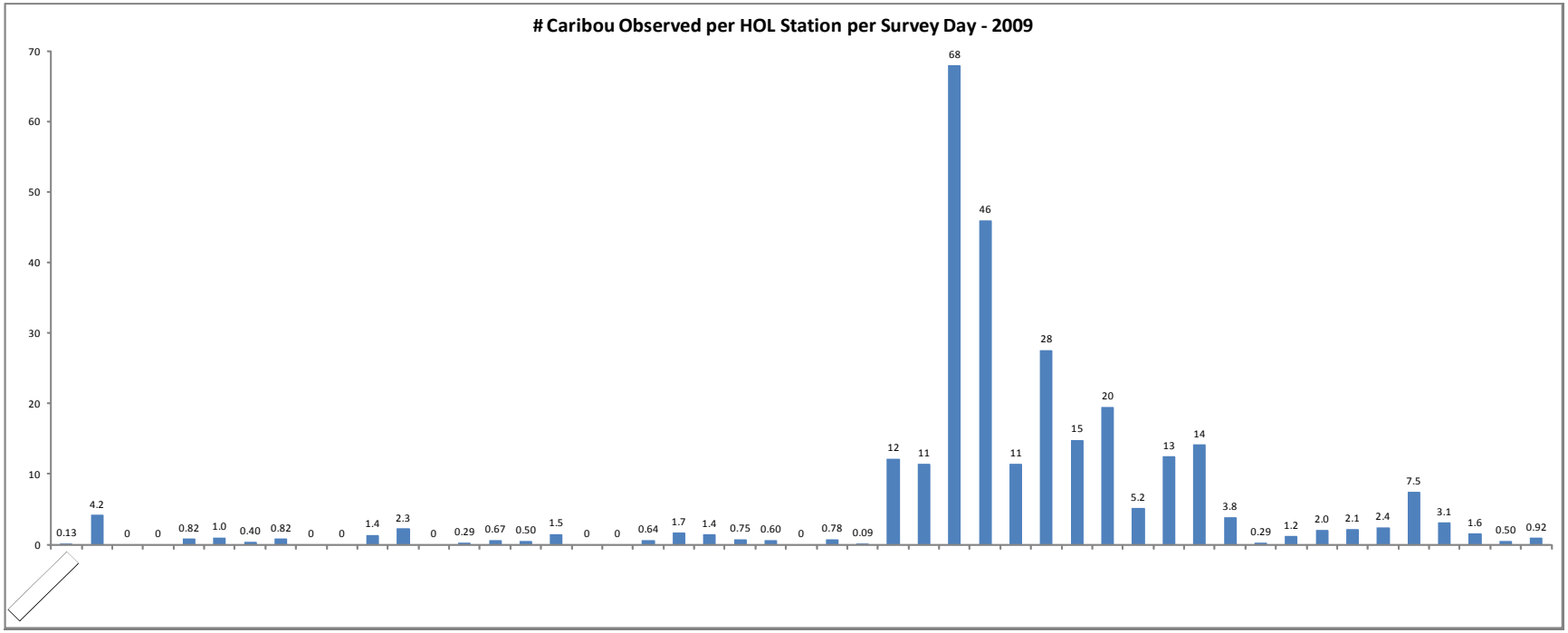

Figure 5.7-5B Number of Caribou Observations by Height-of-Land Survey Data (2009)

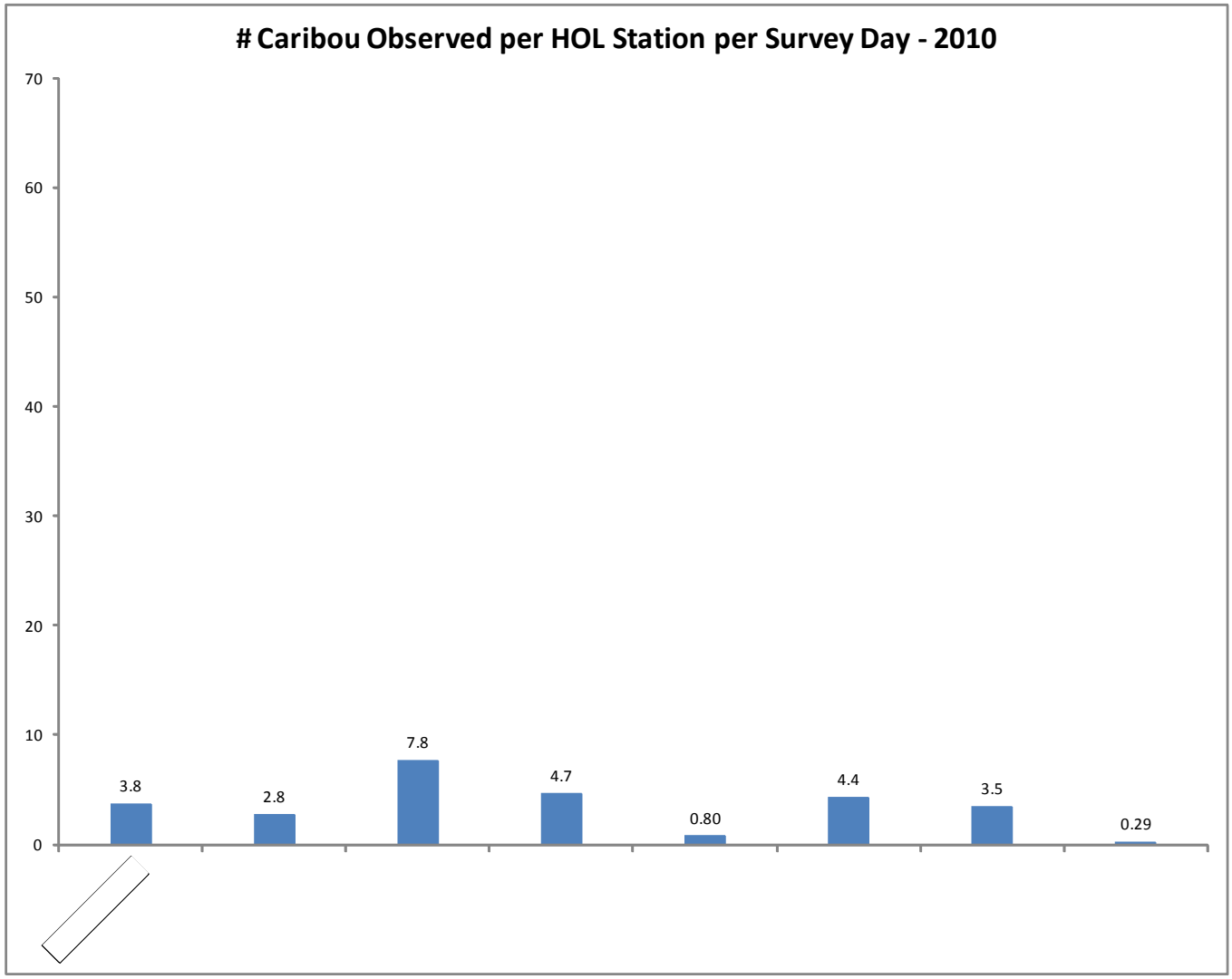

Figure 5.7-5C Number of Caribou Observations by Height-of-Land Survey Data (2010)