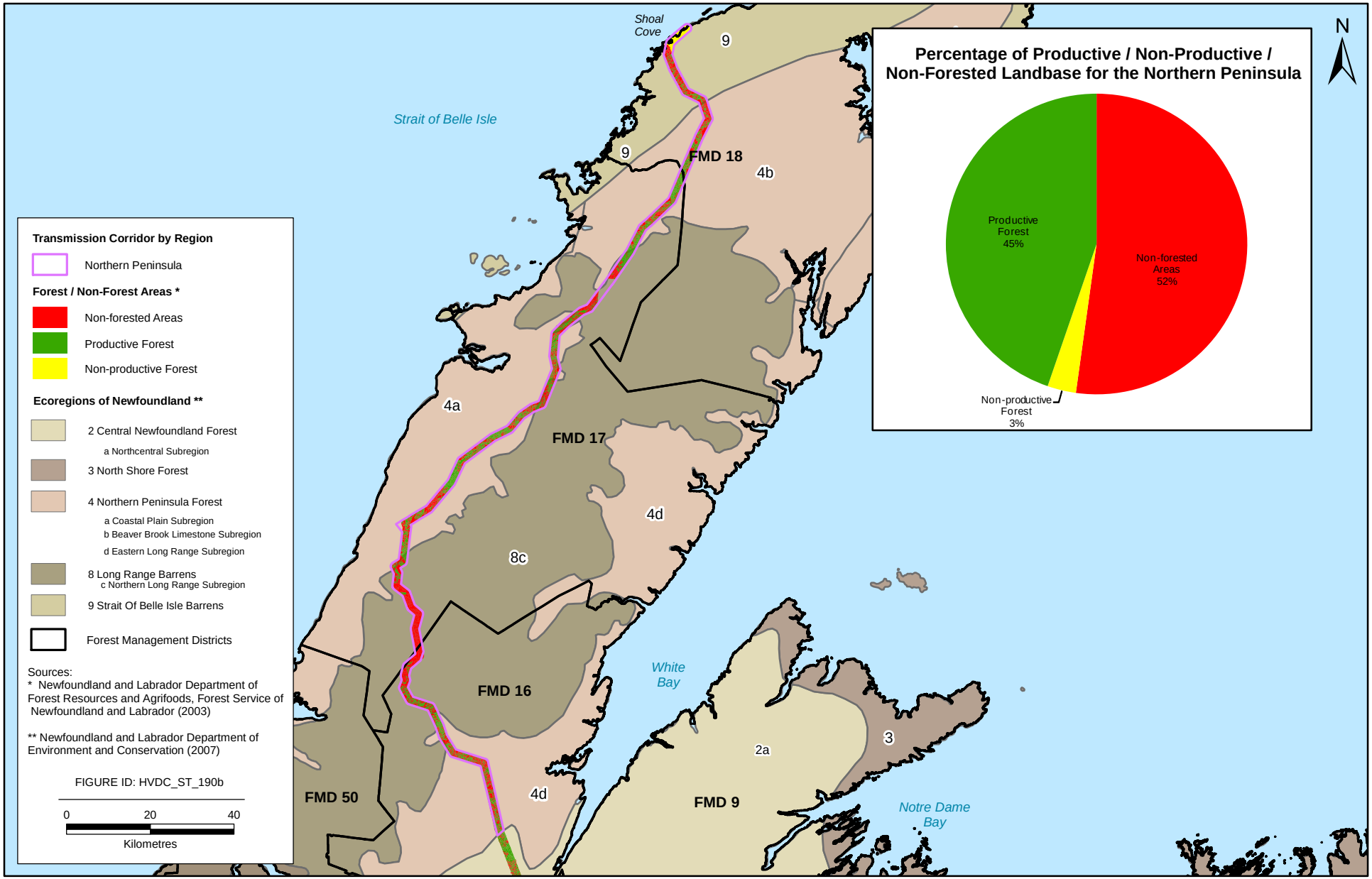


FIGURE 10.3.3-19

Available Forest Landbase Summary within the Transmission Corridor for the Northern Peninsula

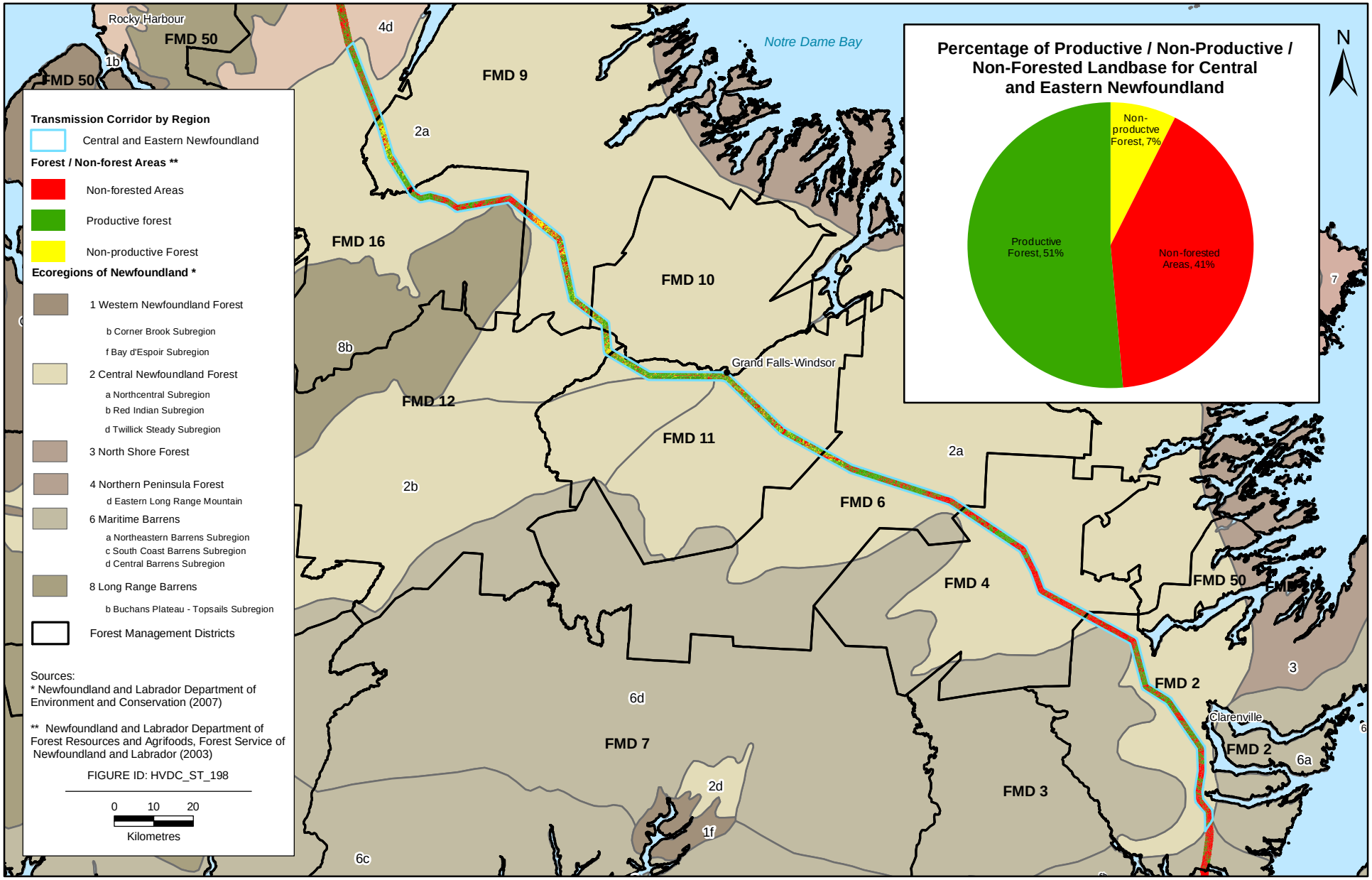


FIGURE 10.3.3-20

Available Forest Landbase Summary within the Transmission Corridor for Central and Eastern Newfoundland

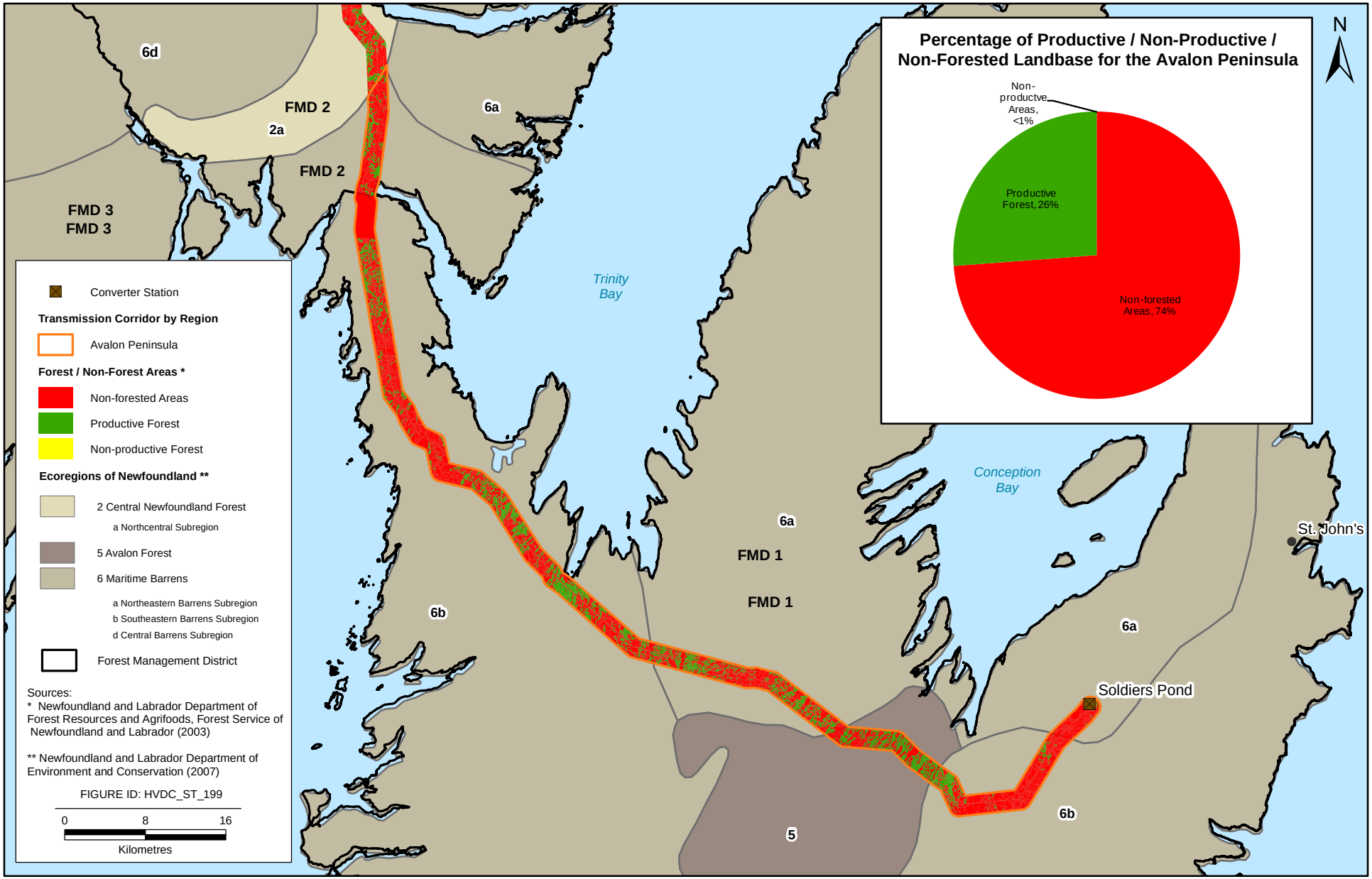


FIGURE 10.3.3-21

Available Forest Landbase Summary within the Transmission Corridor for the Avalon Peninsula

Table 10.3.3-20 Gross Merchantable Volume (Softwood / Hardwood) within the Transmission Corridor by Forest Management District for Newfoundland and Labrador

Forest Management District	Softwood Volume (m^3)	Percent of Softwood (%)	Hardwood Volume (m^3)	Percent of Hardwood (%)	Total Volume of Merchantable Timber[(a)] (m^3)	Percent of Total Volume of Merchantable Timber (%)
Newfoundland						
1	242,968	5	15,501	4	258,470	5
2	501,451	11	47,348	14	548,800	11
4	194,908	4	33,189	10	228,097	5
6	132,698	3	11,931	3	144,629	3
9	271,481	6	21,473	6	292,954	6
10	24,894	1	2,687	1	27,580	1
11	204,219	4	42,190	12	246,409	5
12	26,444	1	2,961	1	29,404	1
16	915,954	19	65,907	19	981,860	19
17	756,791	16	87,162	25	843,953	17
18	251,549	5	18,420	5	269,969	5
Subtotal (Newfoundland)	*3,523,357*	*83*	*348,767*	*100*	*3,872,124*	*85*
Labrador						
19A	706,207	17	0	0	706,207	15
Subtotal (Labrador)	*706,207*	*17*	*0*	*0*	*706,207*	*15*
Total (Newfoundland and Labrador)	**4,229,564**	**100**	**348,767**	**100**	**4,578,331**	**100**

(a) The GMV calculations for Labrador are for softwoods only and were calculated using NLDNR yield-based methodology, as stand and stock table data are not presently available.

Aboriginal Ecological Knowledge

AEK regarding vegetation in parts of the Study Area was obtained through land and resource use interviews with members of the NunatuKavut Community Council (Table 10.3.3-21), and includes information on: the presence of timber in the proposed transmission corridor and the presence of berries in the area near the transmission corridor. The information provided is generally in keeping with the scientific data obtained through the field studies and literature review conducted for the EA (as reported in Section 10.3.3.2).

Table 10.3.3-21 Aboriginal Ecological Knowledge of Vegetation in the Study Area

Group	Source	Quote (Direct and / or Indirect)
NunatuKavut Community Council	NunatuKavut Land and Resource Use Interview, May 2011	*Indirect* In the area of the proposed transmission corridor, there are a lot of big timbers, including fir, and red, black and white spruce
	NunatuKavut Land and Resource Use Interview, May 2011	*Indirect* Bakeapples and squashberries are found in the transmission line area
	NunatuKavut Land and Resource Use Interview, May 2011	*Indirect* Bakeapples are found throughout the Forteau valley but the transmission line shouldn't bother them
	NunatuKavut Land and Resource Use Interview, 2011	*Indirect* There are a lot of partridgeberries in sections of the transmission link area

Local Ecological Knowledge

Local Ecological Knowledge regarding vegetation in parts of the Study Area was obtained through participants of the 2010 Open House in St. John's. This is listed below (Table 10.3.3-22), and includes information on the presence of rare plants. The information provided is generally in keeping with the scientific data obtained through the field studies and literature review conducted for the EA (as reported in Section 10.3.3.2).

Table 10.3.3-22 Local Ecological Knowledge of Vegetation in the Study Area

Community	Source	Indirect Quote
St. John's, NL	Labrador-Island Transmission Link Open House Participant, St. John's, May 10, 2010	There are rare plants at Yankee Point

10.3.4 Caribou

Woodland caribou (*Rangifer caribou*) within NL are classified as one of three ecotypes: (i) sedentary, (ii) migratory or (iii) montane (Bergerud et al. 2008; Boulet et al. 2005; Thomas and Gray 2002, internet site). The montane ecotype is restricted to the Torngat Mountains in Labrador and, given their distance from the Study Area, is not discussed further. Migratory caribou are typically tundra dwelling and are characterized by their extensive seasonal migrations between winter and calving grounds (Bergerud et al. 2008). Currently, the province recognizes the George River Herd (GRH) as the migratory ecotype. This herd has recently wintered in the vicinity of the Study Area in Labrador (such as observed by the Study Team in the winter of 2009 to 2010).

Sedentary caribou are a forest-dwelling ecotype that undergoes a seasonal dispersion (rather than migration) during calving (Bergerud et al. 2008). The Red Wine Mountains Herd (RWMH) and Mealy Mountains Herd (MMH) (including the Joir River subpopulation of the MMH) are sedentary herds that occur near the Study Area in Labrador. Both of these herds are currently listed as threatened under the *NLESA* and the federal *SARA*. Woodland caribou in Newfoundland are also labelled sedentary (NLDEC 2009a, internet site); however, several herds undergo seasonal migrations, which is further complicated by observations of only some individuals within a herd undergoing these migrations (Saunders 2011, pers. comm.).

In Newfoundland, there has been a recent shift in the NLDEC understanding of caribou distribution, leading away from the traditionally used 'herd' structure. The current approach describes caribou occupancy areas

based on differing amounts of range use by collared caribou: Primary Core areas (50% kernel); Secondary Core areas (80% kernel); and Occupancy Areas (100% kernel). A kernel is a statistical output generated by a GIS that predicts the probability of spatial use based on locational data. Primary Core areas are those that receive the highest use while Occupancy Areas include all areas used by caribou regardless of intensity of use.

10.3.4.1 Study Area

Existing baseline conditions for woodland caribou are presented in relation to the proposed transmission corridor from Central Labrador to the Island of Newfoundland's Avalon Peninsula and a surrounding 15 km wide Study Area, as well as considering the location of other Project-related components and activities. As for other components, the nature of the information presented in the following section is primarily based on the specific regions and management units. The following sections provide a regional overview of the presence, abundance and distribution of caribou in the Study Area for the four geographic regions: (i) Central and Southeastern Labrador, (ii) Northern Peninsula, (iii) Central and Eastern Newfoundland, and (iv) Avalon Peninsula (Figure 10.3.4-1).

10.3.4.2 Information Sources and Data Collection

Information on caribou was obtained primarily through meetings with government departments and other organizations, and compiled from library and internet sources. Various agencies and government departments were contacted to obtain data and information on caribou, including the Wildlife Division (Department of Environment and Conservation, Government of Newfoundland and Labrador) and Sustainable Development and Strategic Science (Department of Environment and Conservation, Government of Newfoundland and Labrador). The NLDEC has many ongoing caribou research programs in the province and recent results suggest possible changes in the understanding of distribution and movement patterns, and causes and rates of mortality of woodland caribou. Although much of this research is recent and still undergoing preliminary analysis, extensive discussions were held with the NLDEC biologists (including J. Blake, C. Doucet, I. Schmelzer, C. Dyke, P. Saunders, K. Miller, G. Luther, J. Fenske, J. Weir, M. Trindade and S. Mahoney) to ensure that the Division's latest information and current interpretation of caribou distribution and abundance were accurately reflected in this EIS.

An annotated bibliography describing relevant caribou studies completed in NL during the past approximately 20 years was compiled (Stantec 2012a, 2011d). Sources include published and unpublished reports, peer-reviewed journal articles, government documents, research theses, books, field guides, other articles and personal communications.

Bergerud et al. (2008) provide comprehensive information regarding migratory (predominantly the GRH) and sedentary ecotypes of caribou throughout Labrador and north-eastern Québec. Extensive information on caribou within the lower Churchill River watershed was consulted, including decades of telemetry data (i.e., Very High Frequency and satellite technology) collected by the NLDEC Wildlife Division, DND, the Institute for Environmental Monitoring and Research (IEMR) and the Government of Québec. Results of aerial surveys beginning in the 1960s to present (e.g., Jeffery 2008a, b, c; Jeffery 2007a, b, c, d; Schmelzer et al. 2004; Trimper and Chubbs 2003; Schaefer et al. 1999; Veitch et al. 1993; Brown and Theberge 1990; Veitch 1990; Brown 1986; Pilgrim 1981; Folinsbee 1979, 1974; Bergerud 1963) were also used. Along the transmission corridor in Central and Southeastern Labrador, caribou and / or indications of their presence were documented by Northland Associates (1980a, b, c). Recovery strategies for woodland caribou herds in Labrador prepared by Schmelzer et al. (2004) provide information on the RWMH and MMH, including details on their distribution, herd status and limiting factors. These are important source documents of the research and management effort undertaken to date on these herds and were considered in this EIS.

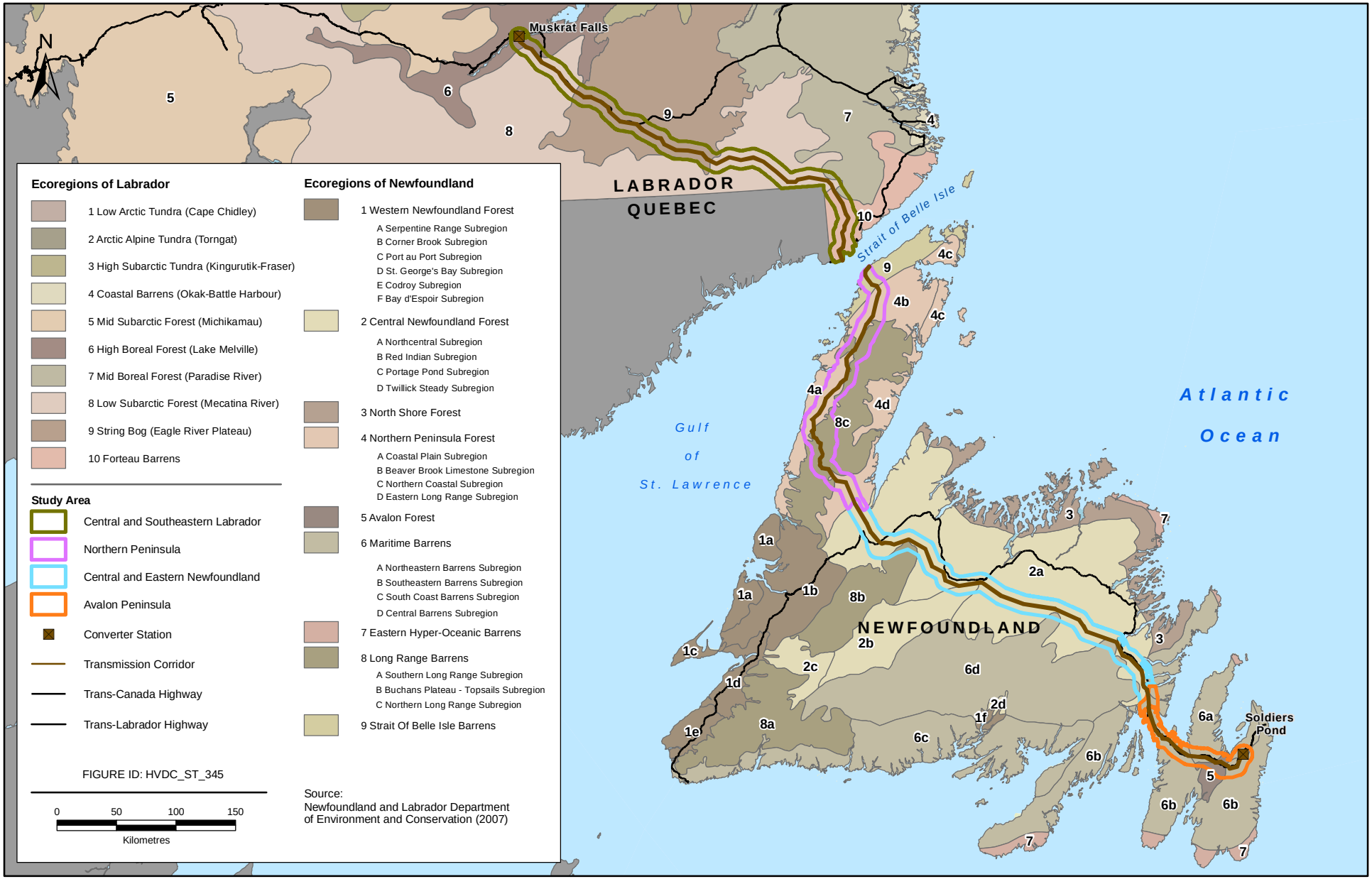


FIGURE 10.3.4-1

Caribou Study Area

In Newfoundland, the observed shifts in caribou range and core areas, and greater separation between animals during calving (Blake 2011a, pers. comm.) have led to a more "ecoregional" approach. As previously stated, the approach currently being used by NLDEC is based on collared caribou locations from 2005 to May 2009 and delineates Primary Core areas (50% kernel), Secondary Core areas (80% kernel) and Occupancy Areas (100% kernel) (Blake 2011a, pers. comm.; NLDEC 2011a). This delineation includes: a mechanism to incorporate not only shifts in calving areas but also movements of some populations to more dispersed calving distributions; the inclusion of important areas that might not receive annual use; home range sizes; and daily, seasonal and yearly movements (NLDEC 2011a). Additional information on the biology, distribution and status of woodland caribou was available through various key sources including Mahoney and Virgil (2003), Mahoney and Schaefer (2002), Mahoney et al. (2001a, b), Mahoney et al. (1998), Snow and Mahoney (1995), Mahoney et al. (1990) and Bergerud (1972, 1971), as well as communications with personnel from the NLDEC in Corner Brook and St. John's. Information was also gathered through the Caribou Data Synthesis and work arising from the Caribou Strategy in Newfoundland.

A *Caribou and Their Predators Component Study* (Stantec 2012a, 2011d) was completed in support of this Project based on research completed by Stantec, and other available research completed throughout NL in recent years. Where relevant, information from elsewhere in Canada regarding woodland caribou has been used to supplement the understanding of existing conditions.

In terms of spatial overlap with the Study Area, winter habitat use was considered for migratory caribou while year-round habitat use was considered for sedentary woodland caribou, with particular focus on calving / post-calving and winter periods.

An ELC was completed of the Study Area from Muskrat Falls in Central Labrador to Soldiers Pond on Newfoundland's Avalon Peninsula (Stantec 2011b, 2010a). The purpose of the ELC was to identify, categorize and evaluate vegetation types and associated habitats on a regional scale. See section 10.3.3.2 for further information. The ELC habitat classifications formed the basis for the habitat mapping exercise for caribou herds and aggregations found within or overlapping the Study Area.

Habitat quality was assessed for caribou based on the literature review and available data and was classified as primary, secondary or tertiary habitat (primary habitat being the most suitable for caribou, tertiary being the least) based on criteria such as the presence of structural and compositional elements, and forage. A series of detailed habitat quality maps were subsequently generated based on the Habitat Types identified by Stantec (2011b, 2010a). Maps produced for each region based on the coverage of the ELC, were colour-coded to reflect habitat quality and to indicate the percentage of primary, secondary and tertiary habitat available within the Study Area.

This evaluation and mapping of potential caribou habitat suitability is intended to provide an overview of the potential for portions of the Study Area to support caribou herds. It is not intended to indicate definitively whether caribou are currently found in a specific location as movement of caribou herds varies seasonally. Rather, it provides a description of the potential use of an area at a regional scale across the Study Area. In this regard, this caribou habitat potential mapping was considered together with the other knowledge presented in the *Caribou and Their Predators Component Study* (Stantec 2012a, 2011d).

AEK has been collected from consultation initiatives with Aboriginal groups in the Study Area (a summary of all Aboriginal consultation initiatives conducted for the Project can be found in Chapter 7 of the EIS). Sources of AEK include, but are not limited to, land use surveys and interviews, reviews of existing published and unpublished literature and through the provision of information to Nalcor by an Aboriginal group or organization.

LEK was collected from consultation initiatives with various communities (a summary of all consultation with public stakeholders can be found in Chapter 8 of the EIS) including Open Houses and correspondence. A general literature review and media search was also conducted.

10.3.4.3 Description of Caribou

Table 10.3.4-1 summarizes the caribou herds in Labrador and their potential overlap with the Study Area, identified from literature and through consultation with the NLDEC. Of the ecotypes of woodland caribou present near the Study Area in Labrador, the GRH (migratory) has a vast range covering much of the Ungava Peninsula but can winter in the vicinity of the Study Area. The RWMH and the MMH ranges overlap the Study Area (Table 10.3.4-1). The range of the MMH includes a recently delineated subpopulation of caribou in the Joir River area. Unless specifically noted, discussion of the MMH for the remainder of this section ncludes the Joir River subpopulation.

Table 10.3.4-1 Labrador Caribou Herd Ranges within the Central and Southeastern Region

Caribou Herd	Central and Southeastern Labrador Region	Elsewhere In Labrador
George River	Y	Y - range extends throughout central and northern Labrador
Lac Joseph	N	Y - south-western Labrador
Leaf River	N	Y - primarily associated with Québec
Mealy Mountains	Y	N
Red Wine Mountains	Y	Y - central Labrador
Torngat Mountains	N	Y - northern Labrador

Source: Bergerud et al. 2008.

Note: Y = Yes, caribou herd occurrence.
N = No, no caribou herd occurrence.
Occurrence in a geographic region is based on herd home ranges in Labrador. However, caribou may occur outside of these core / identified areas in any given year. Similarly, the indicated presence of caribou in any geographic region does not imply overlap with the Study Area.

Ongoing research programs by the NLDEC Wildlife Division indicate that caribou distribution may not be best described using a 'herd' structure as previously done, but as "occurring throughout the province in various densities" (Dyke 2011, pers. comm.). Caribou distribution in Newfoundland has most recently been described through the use of occupancy areas, which include information on intensity of use (Blake 2011a, pers. comm.; NLDEC 2011a). Caribou are often managed according to recognized aggregations or herds in which individuals share common genetic characteristics and interbreed. Where physically isolated by barriers or distances, these herds may also be considered separate populations. In some situations, adjacent herds may belong to a larger metapopulation (Courtois et al. 2003). Note that for the purposes of discussion regarding caribou, the term 'herd' is retained where traditionally used and 'aggregation' or 'group' is used otherwise.

Caribou management areas in Labrador and on the Island of Newfoundland are illustrated in Figure 10.3.4-2 and Figure 10.3.4-3, respectively. The NLDEC uses both "Zones" and "Areas" to describe caribou hunting areas in the province; for the remainder of this section, the term "Caribou Management Areas" is used. These management areas, as established by the NLDEC, do not necessarily reflect the current understanding of caribou distribution in Labrador and on the Island and do not necessarily represent caribou overlap with the Study Area (Table 10.3.4-1).

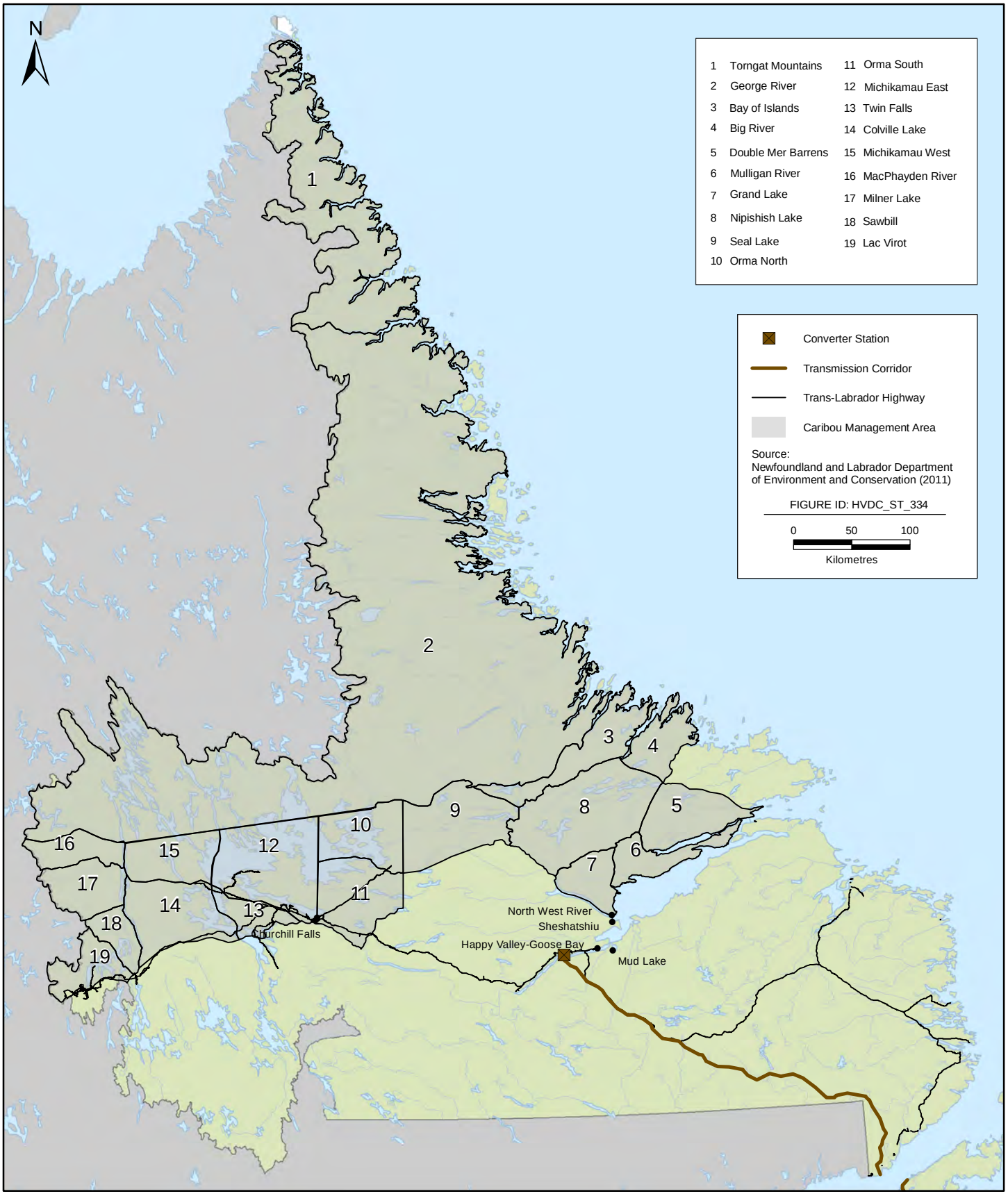


FIGURE 10.3.4-2

Caribou Management Areas in Labrador

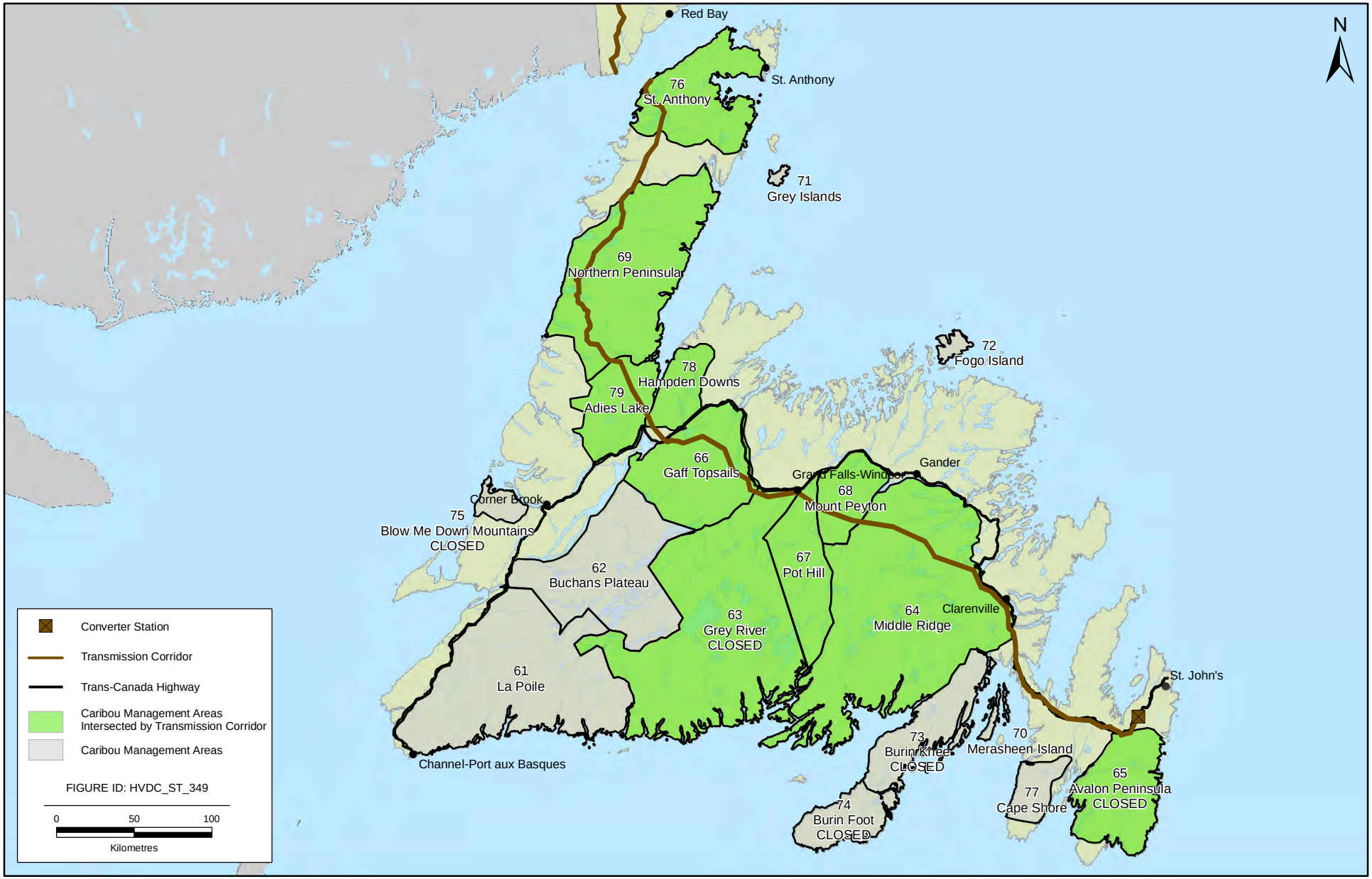


FIGURE 10.3.4-3

Caribou Management Areas in Newfoundland

Relevant Caribou Herds in Labrador

Labrador contains all three ecotypes of caribou, including both migratory and sedentary woodland caribou. Only the herds that are in proximity to the Study Area in Central and Southeastern Labrador are discussed (e.g., Lac Joseph, Torngat Mountains and Leaf River herds are not discussed in this section). Estimated population size of each herd in proximity to the Study Area in Central and Southeastern Labrador is provided in Table 10.3.4-2. Distributions of each herd in relation to the Study Area are shown in Figure 10.3.4-4. The ranges of these herds were determined using telemetry location data available as of the end of 2010 and a GIS (Blake 2011a, pers. comm.). Range distribution was provided for the GRH, RWMH and MMH (including Joir River) as minimum convex polygons (MCPs) based on telemetry locations collected from collared caribou that were available at the end of 2010 (Blake 2011a, pers. comm.). MCPs represent range based on the inclusion of all areas between the furthest caribou collar locations. MCPs do not indicate intensity of range use, either annually or seasonally (Blake 2011a, pers. comm.). Furthermore, MCPs do not reflect that caribou can occur beyond the boundaries of their ranges and move between herds or populations (Blake 2011a, pers. comm.). Telemetry data may suggest that there is little separation between the Lac Joseph, Red Wine Mountains and Mealy Mountains herds as there is some overlap of ranges during the rut, winter and spring (Couturier et al. 2009).

Table 10.3.4-2 Population Estimates of Caribou Herds in Labrador Relevant to the Study Area

Herd	Estimate (year)	Status (# years[(a)])
Red Wine Mountains[(b)]	97 (72-189) (2001)	Decreasing (-87%, 20 years)
Mealy Mountains[(c, d)]	2,106 ± 1,341 (2005)	Stable (3 years)
George River	50,000 (2011)	Decreasing (-81%, 10 years)

(a) Number of years since previous population estimate.

(b) While a complete census of the RWMH has not been conducted since 2001, the herd was estimated to be 87 in 2003 (Schmelzer 2011, pers. comm.; Schmelzer et al. 2004). Since this time, minimum counts based on groups associated with collared females have been conducted during November (i.e., prior to the seasonal incursion of the migratory GRH) have estimated 80 caribou in 2007 and 75 caribou in 2009 (Schmelzer 2011, pers. comm.).

(c) The estimate for the MMH in 2005 was lower than the 2002 estimate of 2,585; however, it did not represent a statistically significant decline (Schmelzer 2011, pers. comm.).

(d) Population estimate does not include the Joir River subpopulation (minimum count in February 2009: 110 caribou). (Blake 2011b, pers. comm.).

George River Herd

The migratory GRH is the largest herd in the province and one of the largest in Canada, and was most recently estimated at 50,000 caribou in 2011 (NLDEC 2011b, internet site) (Table 10.3.4-2). The herd was estimated at 428,000 to 451,000 caribou in June 1993 (Bergerud et al. 2008), while other surveys in the same year estimated between 540,000 and 750,000 caribou (Couturier et al. 1996; Russell et al. 1996). The range of the GRH covers approximately 900,000 km^2 (Schmelzer and Otto 2003) extending from the area immediately south of Happy Valley-Goose Bay and Hamilton Inlet northwards and westwards throughout the Ungava Peninsula (Figure 10.3.4-4). Although GRH caribou are continually moving, Bergerud et al. (2008) identified a basic annual cycle of accelerated and decelerated movements that includes calving and post-calving (June and July), breeding (generally October) and an extended winter "pause" (late December to mid-February).

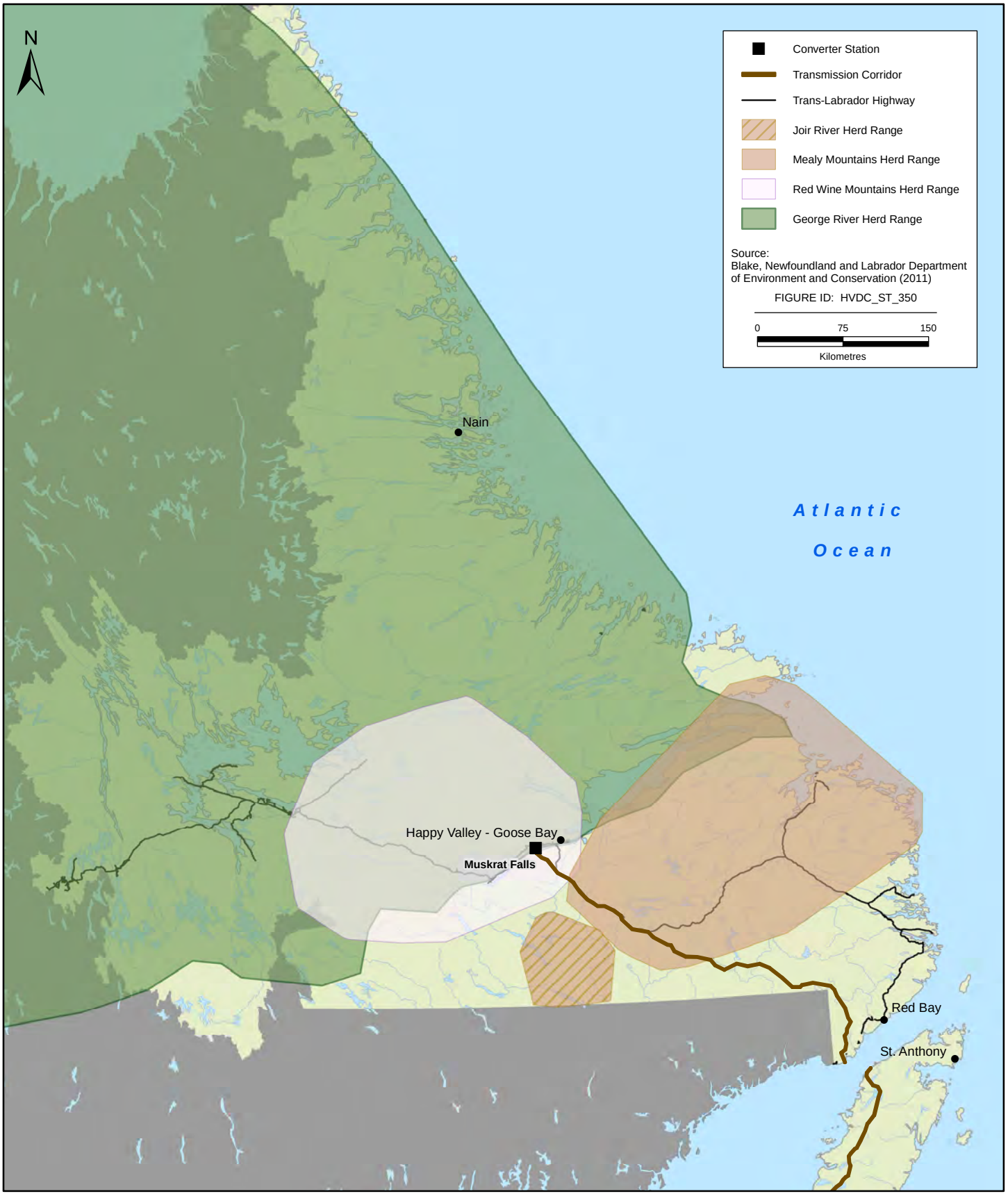


FIGURE 10.3.4-4

Caribou Herds in Central and Southeastern Labrador

Calving and rutting areas for the GRH occur in the northern portion of the range with animals migrating southwards to wintering grounds (Bergerud et al. 2008), which may in some years include locations within the Study Area. Winter locations are widely spaced both above and below the tree line (Bergerud et al. 2008). Migratory caribou winter ranges are unpredictable and may shift over time (Schaefer et al. 2000) in response to limited forage availability (Schmelzer and Otto 2003). In taiga regions, open black spruce - lichen forests are frequently used as well as areas with little snow cover (Bergerud et al. 2008). This is thought to increase access to forage while limiting the risk of predation (Bergerud et al. 2008). The occurrence of the GRH in the Study Area, if any, is likely to be limited to winter and their presence in any given year will be influenced by the amount of snow cover and risk of predation. Their use of the Study Area is inconsistent, and at most comprises a small proportion of caribou in the herd.

Figure 10.3.4-2 shows Caribou Management Areas in Labrador. The range of the GRH overlaps five hunting zones, but none overlap with the Study Area boundaries. Hunting of the GRH is legal within the seasons defined in the *Newfoundland and Labrador Hunting and Trapping Guide* (NLDEC 2009b).

Red Wine Mountain and Mealy Mountains Herds

In Labrador, sedentary woodland caribou are listed as threatened by the *NLESA* which prohibits disturbing, killing, capture, possession or trading of these caribou. Woodland caribou are also listed under Schedule 1 of *SARA* which prohibits hunting and provides protection in the absence of provincial legislation. In 2004, the Labrador Woodland Caribou Recovery Team developed a recovery strategy for the sedentary herds to outline specific actions required for their protection (i.e., prevent extinction) and to aid their recovery (Schmelzer et al. 2004). The RWMH and MMH have been closed to licensed hunting since 1972 and 1976, respectively (with the exception of a single licensed hunt in 1989 permitted for the MMH) (Schmelzer et al. 2004).

Population estimates for the sedentary herds that overlap the Study Area in Labrador are significantly lower than for the GRH: 97 in the RWMH (2001) and 2,106 in the MMH (not including the Joir River subpopulation) (2005) (Table 10.3.4-2) (Schmelzer 2011, pers. comm.; Schmelzer et al. 2004). A minimum count of the Joir River subpopulation in February 2009 identified 110 caribou (Blake 2011b, pers. comm.). Sedentary caribou historically occurred from Hudson Bay to the Labrador Sea, but are now mostly found in more interior locations (Figure 10.3.4-4). This may be due to increased hunting pressure resulting from increased snowmobile availability since the 1960s (Bergerud et al. 2008), but is also likely influenced by caribou avoidance of heavy snowfall by moving into Labrador from Québec wintering grounds (Jacques Whitford 1997a).

The RWMH range, which covers an area of approximately 46,000 km^2 in central Labrador (Schmelzer et al. 2004), overlaps with the north-west terminus of the Study Area. The RWMH range overlaps with the distribution of the Lac Joseph Herd and the western boundary of the MMH range and lies north of the boundary of the Joir River subpopulation (Figure 10.3.4-4). The MMH, the most easterly herd, covers an area of approximately 49,000 km^2 while the Joir River subpopulation has a range of approximately 5,200 km^2. Both the RWMH and the MMH overlap with the Study Area (Schmelzer et al. 2004) (Figure 10.3.4-4). Home ranges of all sedentary caribou herds in Labrador can overlap with the GRH during winter resulting in intermingling of animals (Schmelzer et al. 2004). Approximate density of sedentary caribou in Labrador is three caribou/100 km^2 (NLDEC 2009a, internet site). Recent population estimates for the MMH indicate it is stable (Schmelzer et al. 2004). The RWMH, however, is decreasing (an approximate 87% decrease since 1989) despite the fact that the recruitment rates were consistent with a stable or increasing population, indicating that mortality, and not recruitment, may be limiting the herd (Schmelzer et al. 2004).

Although the different ecotypes of caribou in Labrador and Québec seem only to mix at certain times of year, a "weak but significant global genetic differentiation" was found to occur between herds (Boulet et al. 2007, 2005). Although the sedentary herds were not genetically distinct from each other, the amount of differentiation between sedentary herds increased with the distance between them (e.g., the MMH was most different from the Lac Joseph Herd). However, gene flow also occurs between the sedentary and the migratory herds (e.g., RWMH and GRH). The MMH was considered the most genetically distinguishable of the herds

evaluated. Other research also found genetic differentiation between sedentary woodland herds was greater with increased distance and suggested that these smaller groups may act as a metapopulation (Courtois et al. 2003).

Relevant Caribou Herds in Newfoundland

Woodland caribou in Newfoundland are part of the Boreal Population, and belong to the sedentary ecotype (NLDEC 2009a, internet site), although some herds have traditionally exhibited behaviours similar to migratory caribou herds (Dyke 2011, pers. comm.). Caribou are distributed over much of the Island in differing densities, although certain areas receive higher use than others. On the Island, caribou are distributed over the Northern Peninsula, and Central and Eastern Newfoundland, as well as parts of the Avalon Peninsula. The approximate density of caribou in Newfoundland is 30 caribou/100 km^2, considerably higher than in Labrador (three caribou/100 km^2) (NLDEC 2009a, internet site).

In late 2010, the provincial government released information pertaining to woodland caribou distribution on the Island. Caribou distribution in Newfoundland was mapped using telemetry locations collected from collared caribou between 2005 and May 2009 and using a GIS (Figure 10.3.4-5) (Blake 2011b, pers. comm.). Kernel analysis was used to determine areas receiving different amounts of use (i.e., Primary Core areas, Secondary Core areas, and Occupancy areas) (Blake 2011a, pers. comm.). This approach to determining caribou distribution did not distinguish individual herds or groups but included data from all collared caribou. Three levels of use were determined: Primary Core area, Secondary Core area and Occupancy areas based on 50, 80 and 100% kernels, respectively (Blake 2011b, pers. comm.).

Caribou were considered abundant in Newfoundland during the early 1900s, but declined rapidly between 1915 and 1930 (NLDEC 2009c, internet site), possibly as a result of the introduction of a parasite associated with reindeer (Ball et al. 2001). Following this decline, caribou herds remained in relatively low numbers until about the late 1990s (NLDEC 2009c, internet site). By 1995 the population was 116,604 (Trindade et al. 2010a) and by 2002, the range had again expanded (Mahoney and Schaefer 2002a) with densities at an estimated 150 caribou/100 km^2 (Thomas and Gray 2002). Since that time, numbers have declined to 34,000 caribou (Lewis et al. 2011) representing a density of approximately 30 caribou/100 km^2 (NLDEC 2009c, internet site). The decline in population has led to hunting closures in some areas (e.g., Grey River (NLDEC 2008) and Avalon Peninsula (NLDTCR 2002)) (Figure 10.3.4-3).

Although results from recent surveys indicate that the declines may have slowed in certain parts of the Island (e.g., Middle Ridge (Mahoney and Soulliere 2011; NLDEC 2010c, internet site) and the south coast (NLDEC 2011b, internet site; Mahoney and Soulliere 2011)), it also indicates that one of the largest issues facing caribou populations in Newfoundland is poor calf survival (Trindade et al. 2010b), and hence poor recruitment rates. Between 1979 and 1997 calf survivorship was approximately 66% but decreased to less than 10% between 2003 and 2007 in some populations (Mahoney and Weir 2009). However, calf survival rates have generally increased since 2007 (Mahoney and Soulliere 2011). The overall calf survival rate between 2003 and 2009 was approximately 18% and the 2010 rate was over 51% (Trindade et al. 2010b). The primary cause of calf mortality is predation, with 94% of calf deaths attributed to predation (Trindade et al. 2010a). Although calf mortality rates have increased, adult survival is high and is comparable to earlier estimates (1979 to 1997: 86%; 2004 to 2007: 84%) (Soulliere et al. 2010; Mahoney et al. 2008). However, the overall age of the population is increasing (Mahoney 2008). Given the current demographic rates and limiting factors, the caribou population in Newfoundland is predicted to continue to decline (Mahoney 2008). Population models indicate that improved calf survivorship is necessary to increase population size (Trindade et al. 2010a) even with the cessation of hunting (Mahoney and Soulliere 2011; Weir et al. 2010).

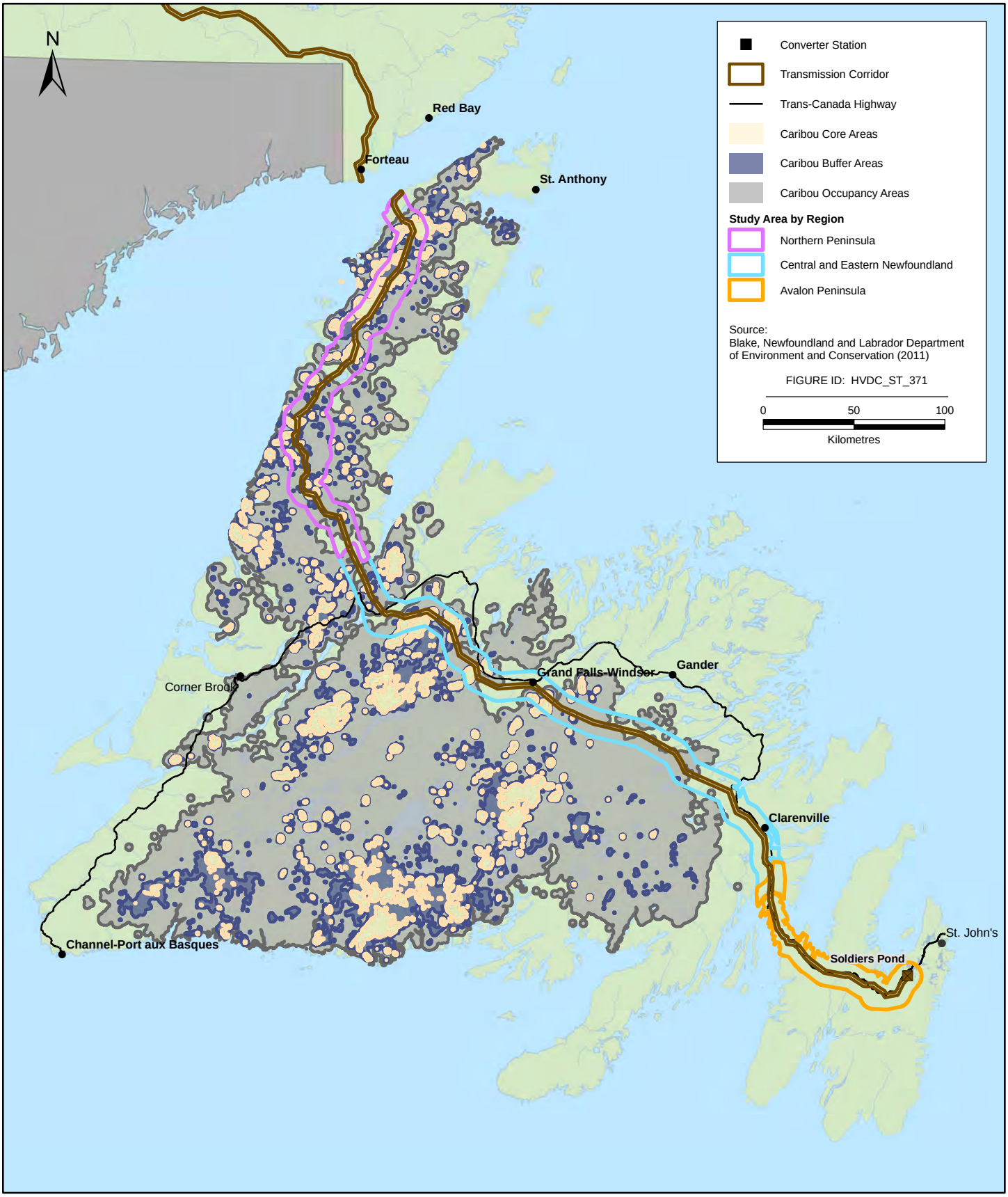


FIGURE 10.3.4-5

Caribou Distribution in Newfoundland based on Locations from Telemetry Collars, 2005-2009

The overlap between caribou distribution and the Study Area and transmission corridor is presented in Figure 10.3.4-6 and Figure 10.3.4-7 for the Northern Peninsula and the Central and Eastern Newfoundland regions, respectively. Note that in the Avalon Peninsula Region, there is no caribou distribution overlapping with the Study Area or transmission corridor (Figure 10.3.4-8). Although the lack of occupancy areas in the Avalon Peninsula is due to the lack of collars currently deployed in this area (Blake 2011b, pers. comm.; NLDEC 2010a, internet site) rather than absence of caribou, the number of caribou in the region has declined greatly, which has led to the closure of that management area to hunting since 2004 (NLDEC 2011c, internet site). As the most recent delineation of core areas does not include caribou on the Avalon Peninsula, the Wildlife Division has advised that the Morgan and Doucet (2007) core areas should be used in this region (Blake 2011b, pers. comm.). The core areas delineated using this method do not overlap with the Study Area; therefore, the Avalon Peninsula Region will not be discussed in detail in this section. For more information on the previously used core areas, see Appendix A of the *Caribou and Their Predators* report (i.e., Stantec 2012a, 2011d).

Concurrent with recent declines in abundance, wildlife officials have documented changes in caribou behaviour in terms of distribution, migration, calving and wintering locations and occupied habitats (particularly since 2004) (Dyke 2011, pers. comm.; Saunders 2011, pers. comm.) and decreases in body size (decreases in jawbone size in adults, antler size in males, and calf weights) (Mahoney et al. 2011; Mahoney et al. 2010; Trindade et al. 2010b). While the exact cause of such changes remains unconfirmed, several factors that may be affecting caribou populations in Newfoundland include: increased predation; density-dependant mechanisms and / or changes in distribution; snow and / or other weather conditions; development; and forest harvesting. Recent work is indicating that reductions in caribou body size may be due to forage-abundance relationships rather than caribou abundance or climate patterns (Mahoney et al. 2011). Research is also indicating that density-dependent competition for forage may be affecting changes in the timing of migration, as some populations spend less time on the summer grounds following periods of high population levels (Mahoney and Schaefer 2002b), and caribou diet, as the composition of the diet following high populations contain decreased amounts of lichen, possibly a result of reduced lichen availability due to overgrazing during peak population periods (Trindade and Mahoney 2011). Currently, however, there is no indication of malnutrition and body condition similar to that in 1997 to 1998 (Soulliere et al. 2010).

Historically, a herd approach was used to manage caribou on the Island. However, shifts in caribou range and core areas, and greater separation at calving (Saunders 2011, pers. comm.), have led to a more ecoregional approach and understanding that describes caribou as "occurring throughout the province in various densities" (Dyke 2011, pers. comm.). Recent genetic analysis has identified several distinct haplotypes and has grouped them into four different clades. Results indicated that, with the exception of the herds on the Avalon Peninsula, there is a lack of genetic differentiation among herds and regions indicating a large amount of genetic exchange, or mixing, among most herds in Newfoundland, especially in the central region (Wilkerson 2010). There is a haplotype present in the St. Anthony herd that is also present in several central herds, but absent from the Northern Peninsula herd, which is located in between the St. Anthony and central herds (Wilkerson 2010). Additionally, the haplotypes present in the Avalon and Cape Shore herds are distinct from the rest of the Island herds (Wilkerson 2010). Prior to the caribou distribution data released in Blake (2011a, pers. comm.), a different definition of caribou core areas was used by the NLDEC (Morgan and Doucet 2007). Determined using a GIS and all available caribou locational data (satellite telemetry data and other sources), these core area were based on 70% of calving / post-calving locations and 50% of wintering locations (Morgan and Doucet 2007; NLDEC Wildlife Division unpublished data). Areas of use were also delineated for three caribou aggregations on the Island (Corner Brook Lakes, Gregory Lake, and Hodge's Hill) based on 95% of all locations irrespective of season (NLDEC Wildlife Division unpublished data). However, this approach has been abandoned in lieu of a "protocol that was more representative of what caribou populations were currently doing at the landscape scale" (NLDEC 2011a).

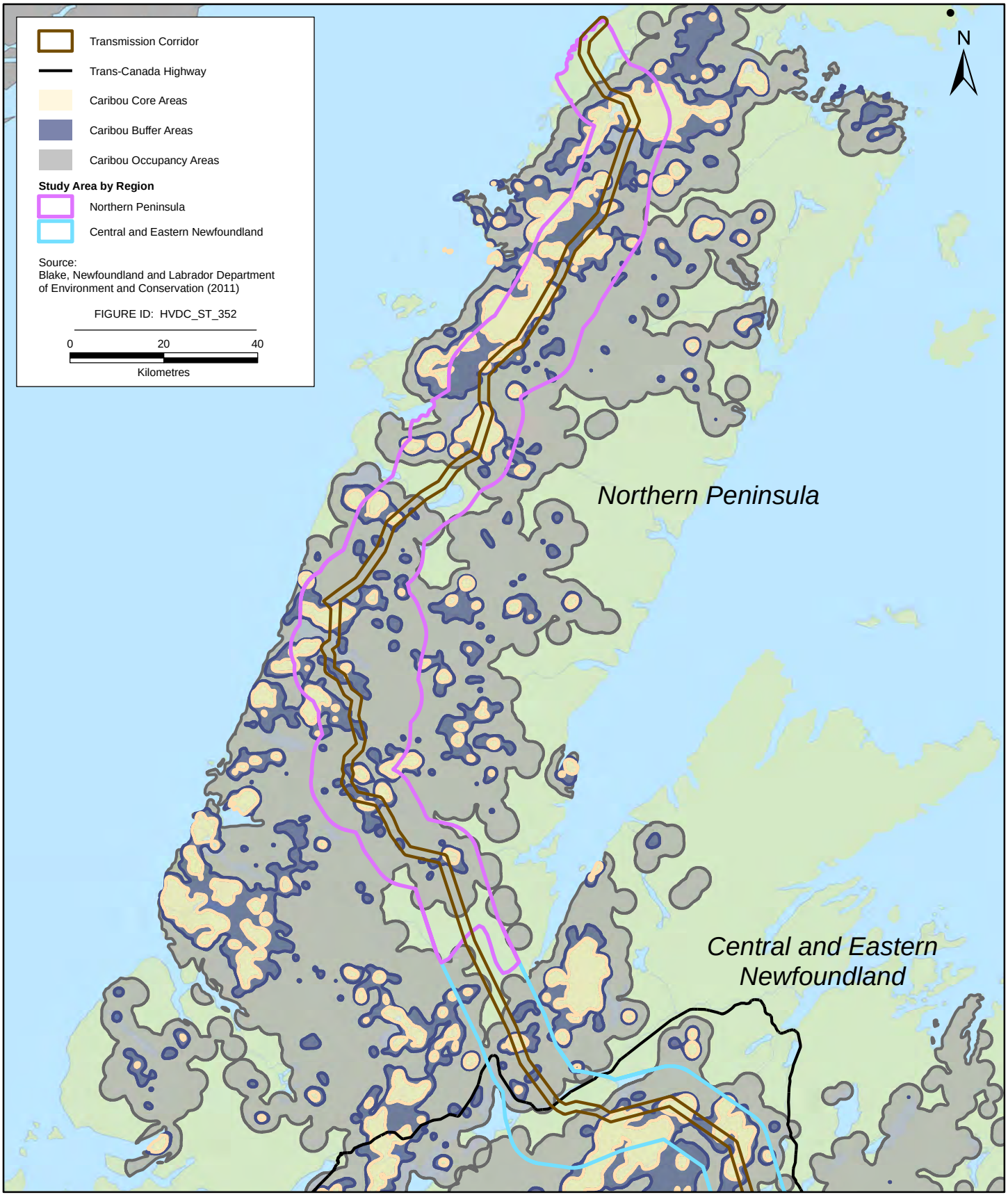


FIGURE 10.3.4-6

Caribou Distribution in the Northern Peninsula Region

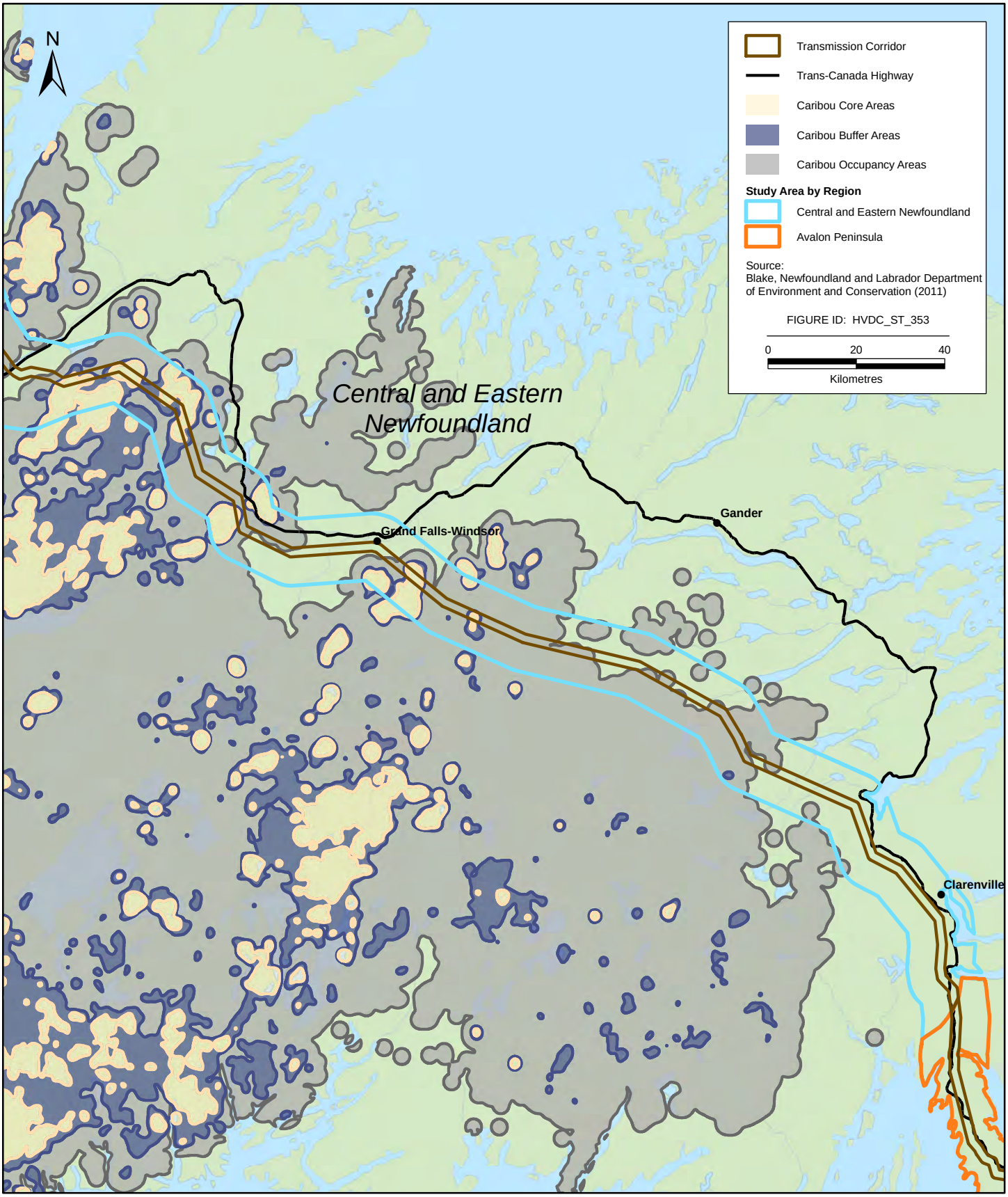
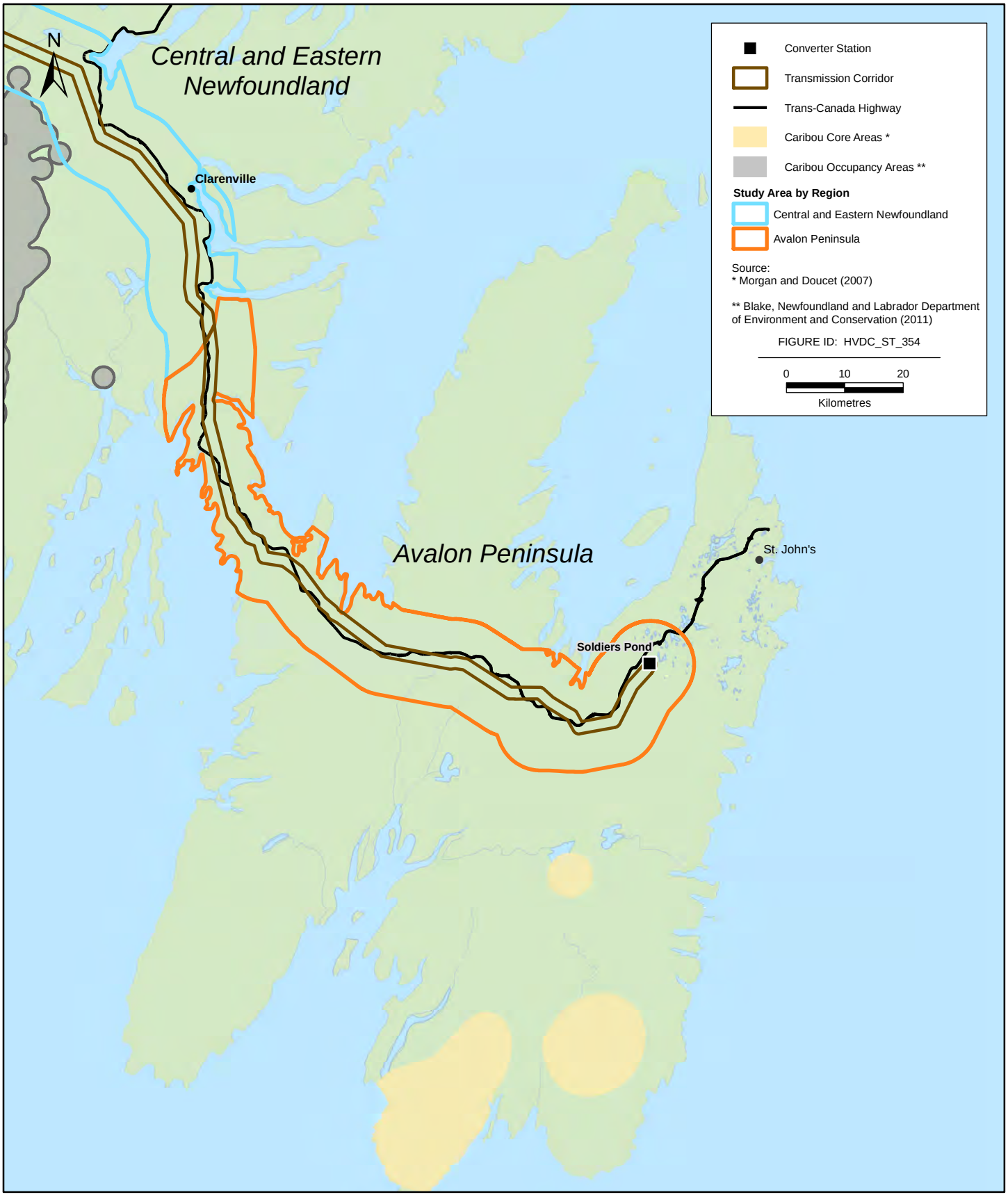


FIGURE 10.3.4-7

Caribou Distribution in the Central and Eastern Newfoundland Region



nalcor energy

FIGURE 10.3.4-8

Caribou Distribution in the Avalon Peninsula Region

Caribou Habitat Association in Labrador

The two caribou ecotypes present in Labrador (migratory and sedentary) have somewhat different seasonal habitat associations. In Labrador, both sedentary and migratory caribou herds winter south of the treeline in areas with low snow cover and access to lichens, especially terrestrial 'reindeer' lichen (*Cladonia* spp.) (Bergerud et al. 2008). During spring (calving / post-calving), however, the two ecotypes have evolved different strategies to avoid predators. Sedentary female caribou typically disperse during spring for calving, whereas migratory female caribou move north of the treeline and remain as a group in areas with generally <75% snow cover (so their brown calves remain cryptic) (Bergerud et al. 2008).

Habitats north of the treeline in Labrador can be broadly characterized by lichens, mosses and graminoids while habitats south of the treeline can be characterized by forest tundra and open lichen woodlands dominated by black spruce, white spruce (*Picea glauca*), eastern larch (*Larix laricina*), alders (*Alnus* spp.), dwarf birch (*Betula glandulosa*) and willows (*Salix* spp.) (Hearn et al. 1990). Given the location of the Study Area within Labrador, the GRH is only likely to occur near the Study Area during the winter period. The sedentary caribou herds (RWMH and MMH), however, may use portions of the Study Area during the winter and calving / post-calving periods.

Winter Habitat (Migratory and Sedentary Caribou)

In winter, both sedentary and migratory herds select areas with low snow cover and access to areas rich in terrestrial 'reindeer' lichens (Bergerud et al. 2008). The GRH moves south and west in search of fall and winter lichen "pastures" and areas offering relief from deep snow (Minaskuat Inc. 2009a; Bergerud et al. 2008). Coniferous forests are a source of arboreal lichens, important during winter in areas with deep snow (Fortin et al. 2008). Terrestrial lichens (Fortin et al. 2008; Courtois et al. 2004) and evergreen shrubs (Bergerud et al. 2008) can also be important winter forage and caribou have dug craters up to 142 cm deep to access forage (Brown and Theberge 1990). Sedentary caribou may also select closed conifer stands without terrestrial lichens and open conifer stands that may have terrestrial lichens (Courtois et al. 2004).

As shallow snow can reduce the risk of predation by allowing increased mobility (Bergerud et al. 2008), frozen lakes and other ice-covered areas (e.g., wetlands, rivers) can provide increased visibility and mobility to avoid and evade predators and can be used to access new sources of food (Fortin et al. 2008). Ice-covered areas are also selected, possibly as they have reduced snow accumulation (Fortin et al. 2008).

Areas that support alternative prey (e.g., mixed forests with moose (*Alces alces*) tend to be avoided as they may increase the risk of predation by wolves (*Canis lupus*) (Fortin et al. 2008; Seip 1992). Fortin et al. (2008) also state that woodland caribou avoided early successional forests, including recently burned and harvested forests.

The ELC habitat types within caribou winter range in Central and Southeastern Labrador and their potential use are summarized in Table 10.3.4-3. The most predominant Ecoregions in the Study Area within Central and Southeastern Labrador are the String Bog and Low Subarctic Forest. Winter primary habitat occupies between 35% and 69% of the Ecoregions, totalling 2,573 km^2 (Table 10.3.4-4). Secondary quality winter habitat is particularly common in this region, and comprises between 24% and 61% of the Ecoregions (2,890 km^2) due to the downgrading of wetland habitat to secondary quality during winter, while tertiary winter habitat occupies 5% or less of the Ecoregions (85 km^2) (Table 10.3.4-4).

Table 10.3.4-3 Ecological Land Classification Habitat Type and Potential Caribou Use of the Study Area in Central and Southeastern Labrador

Habitat Type[(a)]	Calving / Post-Calving	Winter	Comments
Black Spruce Lichen Forest	Primary	Primary	Continuous cover of lichens provides a source of food; predator abundance low (Fortin et al. 2008; Courtois et al. 2004)
Burn	Tertiary	Tertiary	No evidence of caribou documented during 2008 surveys (Stantec 2012a, 2011d)
Conifer Forest	Primary	Primary	As confirmed by Chubbs et al. (1993) and Courtois et al. (2004); one site contained evidence of caribou (tracks, scat) during surveys in 2008 (Stantec 2012a, 2011d)
Conifer Scrub	Primary	Primary	Associated lichens provide forage (Courtois et al. 2004)
Exposed Earth	Tertiary	Tertiary	Non-vegetated
Hardwood Forest	Tertiary	Tertiary	No evidence of caribou documented during 2008 surveys (Stantec 2012a, 2011d)
Lichen Heathland	Secondary	Secondary	Three sites contained evidence of caribou (scat, tracks, trails) during 2008 surveys (Stantec 2012a, 2011d)
Mixedwood Forest	Tertiary	Tertiary	No evidence of caribou documented during 2008 surveys (Stantec 2012a, 2011d)
Open Conifer Forest	Secondary	Secondary	Primarily moss ground cover; one site contained evidence of caribou (trails) during 2008 surveys (Stantec 2012a, 2011d)
Wetland	Primary	Secondary	Reduced predation risk; in winter, provides refuge from deep snow and thus increases mobility. Three sites contained evidence of caribou (scat) during 2008 surveys in (Stantec 2012a ,2011d)

(a) Habitat Types are described in Table 2-3 of *Caribou and Their Predators Component Study* (Stantec 2012a, 2011d).

Table 10.3.4-4 Winter and Calving / Post-Calving Habitat Ratings of the Ecoregions in the Study Area in Central and Southeastern Labrador

Ecoregion	Area of Ecoregion within Study Area (km^2)	Primary		Secondary		Tertiary		Non-Habitat Areas[(a)]	
		%	Area (km^2)	%	Area (km^2)	%	Area (km^2)	%	Area (km^2)
Winter									
High Boreal Forest	321	69	221	24	77	5	16	2	6
Mid Boreal Forest	118	56	66	41	48	1	1	2	2
String Bog	2,011	35	704	61	1,227	1	20	3	60
Low Subarctic Forest	2,385	49	1,169	46	1,097	2	48	3	72
Forteau Barrens	919	45	414	48	441	–[(b)]	–	7	64
Total[(c)]	**5,754**	**45**	**2,574**	**50**	**2,890**	**1**	**85**	**4**	**205**
Calving / Post-Calving									
High Boreal Forest	321	71	228	22	71	5	16	2	6
Mid Boreal Forest	118	89	105	9	11	-	-	2	2
String Bog	2,011	61	1,227	35	704	1	20	3	60
Low Subarctic Forest	2,385	69	1,646	26	620	2	48	3	72
Forteau Barrens	919	62	570	31	285	–	–	7	64
Total[(c)]	**5,754**	**66**	**3,775**	**29**	**1,690**	**1**	**84**	**4**	**205**

(a) Represents areas classified as Exposed Earth / Anthropogenic / Cutblock; Open Water; Shallow Water with Vegetation; Snow / Ice; Burn; and Cloud / Shadow.

(b) No Tertiary Habitat identified within the Ecoregion.

(c) All values were rounded to the nearest whole number, therefore, totals may contain rounding errors.

Calving / Post-Calving Habitat (Sedentary Caribou)

Sedentary caribou tend to disperse during calving / post-calving and seek birth sites with low predation risk (Bergerud et al. 2008). In summer, woodland caribou preferentially select open lichen woodlands (mature spruce forests) and peatlands (Hins et al. 2009), which offer refuge from predators and abundant lichen (Dunford 2003). Generally, sedentary caribou in Labrador select forage in treed, peatland complexes dominated by larch and black spruce, and tend to avoid early successional forests and recently disturbed areas (Rettie and Messier 2000; Stuart-Smith et al. 1997).

Coniferous forests are also selected during summer (Chubbs et al. 1993), whether closed or open, or with or without lichens (Courtois et al. 2008). Mature closed forests, 50 years of age or older, may also be preferentially selected within individual females' home ranges and open black spruce lichen woodlands are frequented (Hins et al. 2009). Minaskuat Inc. (2009a) similarly found that caribou in Labrador selected open black spruce scrub habitats. As in winter, areas that support alternative prey (e.g., hardwood forests and moose) would be avoided during summer, as they may increase the risk of predation by wolves (Minaskuat Inc. 2009a).

The ELC habitat types within caribou calving / post-calving range in Central and Southeastern Labrador and their potential use are summarized in Table 10.3.4-3. The predominant habitat quality rating in the calving / post calving season in the Study Area was primary habitat, totalling 3,775 km^2 (approximately 65% of the predominant Ecoregions in the Study Area, and up to 89% of the minor Ecoregions (Table 10.3.4-4). Secondary habitat comprises approximately 30% of the predominant Ecoregions (1,690 km^2), while tertiary habitat represents <1% (84 km^2) (Table 10.3.4-4).

Caribou Habitat Association in Newfoundland

Newfoundland occurs within the Boreal Shield Ecozone (NRCan 2007, internet site), and most of the Island is forested, primarily with coniferous species, mixed with bogs, fens, marshes and other wetlands. Lichens and shrubs are common on areas of exposed bedrock. Although woodland caribou in Newfoundland are considered sedentary (NLDEC 2009a, internet site), they undergo seasonal dispersions (Bergerud et al. 2008) as well as exhibiting migratory behaviour, at least historically, between calving and wintering areas (Dyke 2011, pers. comm.). While forage and habitat preferences are similar on the Island and in Labrador, several studies have focused particularly on caribou in Newfoundland. Information from these studies is presented in terms of winter and calving / post-calving habitats.

Winter Habitat

Newfoundland caribou primarily select reindeer lichens (both terrestrial (*Cladina* spp.) (Mayor et al. 2009) and and arboreal (Bergerud 1972)) and evergreen shrubs during winter (Bergerud 1972). Access to arboreal lichens, abundant on trees adjacent to forest edges, is particularly important when snow is deepest (Fortin et al. 2008; Bergerud 1972). Coniferous forest landscapes in particular have been identified as a source of arboreal lichens (Fortin et al. 2008; O'Brien et al. 2006; Schaefer 1996; Schaefer and Pruitt 1991), although Bergerud (1972) found that Newfoundland caribou would not venture into spruce forests when snow was deep unless the crust was substantial enough to bear their weight. Additionally, caribou in Newfoundland select for shallow snow conditions (Mayor et al. 2007). Generally, snow in Newfoundland was both deep and soft during January and February, but was frequently crusted later in March (between 1957 and 1966) (Bergerud 1972). Terrestrial lichens are also used during winter (Mayor et al. 2009; Fortin et al. 2008; Mayor et al. 2007; Courtois et al. 2004). However, Courtois et al. (2008) found that the presence of terrestrial lichens was less important as caribou selected closed conifer stands without terrestrial lichens and open conifer stands with or without terrestrial lichens. As in Labrador, shallow snow offers a reduced predation risk by allowing increased mobility, and thus ice-covered habitats (e.g., wetlands, lakes, rivers) would provide visibility and mobility advantages (Bergerud et al. 2008; Fortin et al. 2008; Mysterud and Ostbye 1999).

Adult caribou in western Newfoundland were found to select rock and heath barrens, and virgin and mature forest stands considerably more than other habitats during winter (Mahoney and Virgil 2003). Bogs, early climax stands, and ponds and lakes were intermediate in their selection value, while recently harvested stands and disturbed sites were used much less in winter than other habitats (Mahoney and Virgil 2003). Of the intermediate habitats, early climax forests stands were more valuable during winter (Mahoney and Virgil 2003).

Areas that support alternative prey tend to be avoided as they may increase the risk of predation (Fortin et al. 2008; Seip 1992). In Newfoundland, black bear (*Ursus americanus*) has been considered the principal large predator and moose the alternative prey species (Mahoney and Virgil 2003). Black bears preferentially forage in regenerating stands and prey on the calves of ungulates (Mahoney and Virgil 2003). Fortin et al. (2008) confirmed that woodland caribou avoided early successional forests, including recently burned and harvested forests.

The ELC habitat types within caribou winter range in Newfoundland and their potential use are summarized in Table 10.3.4-5. Direct field observations during the preparation of the ELC were used to inform these habitat types and document existing use by caribou. The predominant habitat quality rating in the winter season in the Northern Peninsula and Central and Eastern Newfoundland Study Areas was secondary (between 36% and 81% of the Ecoregions (2,027 km^2 and 1,868 km^2, respectively) (Table 10.3.4-6). Primary habitat comprised 4% to 29%, while tertiary habitat comprised between 3% and 49% (Table 10.3.4-6). Primary habitat was the second most common habitat in the Northern Peninsula Study Area (1,072 km^2), while in the Central and Eastern Newfoundland Study Area the second most common habitat was tertiary (2,264 km^2). In the Avalon Peninsula Study Region however, tertiary habitat was the most common (approximately 33%, 573 km^2) with primary habitat occurring the least frequently (approximately 13%, 229 km^2) (Table 10.3.4-6).

Table 10.3.4-5 Ecological Land Classification Habitat Type and Potential Caribou Use of the Study Area in Newfoundland

Habitat Type[(a)]	Calving / Post-Calving	Winter	Comments
Alpine Vegetated	Primary	Secondary	Quality rating based on Mahoney and Virgil (2003); lichen / moss / berry ground cover had seven sites containing caribou, trails, scat and / or evidence of cratering during surveys in 2008 in the Study Area (Stantec 2012a, 2011d)
Burn	Tertiary	Tertiary	Quality rating based on Mahoney and Virgil (2003); caribou and / or evidence of their presence were not identified during surveys in 2008 in this habitat type (Stantec 2012a, 2011d)
Conifer Forest	Primary	Primary	Quality rating based on Fortin et al. (2008) and Schaefer and Pruitt (1991); 16 sites noted with evidence (scat, trails, hair) of caribou during 2008 surveys (Stantec 2012a, 2011d)
Conifer Scrub	Primary	Primary	Quality rating based on Fortin et al. (2008) and Schaefer and Pruitt (1991); scattered lichens provide some forage; little protection from predators. Eight sites noted with evidence (trails, scat) of caribou during 2008 surveys (Stantec 2012a, 2011d)
Cutover	Tertiary	Tertiary	Quality rating based on Mahoney and Virgil (2003). Six sites noted with evidence (scat, trails, forage) of caribou during 2008 surveys (Stantec 2012a, 2011d)
Kalmia Lichen / Heathland	Primary	Primary	Quality rating based on Mahoney and Virgil (2003). Two sites noted with evidence (scat, browse) of caribou during 2008 surveys (Stantec 2012a, 2011d)
Mixedwood Forest	Tertiary	Tertiary	Five sites noted with caribou or evidence of their presence (scat, trails) during 2008 surveys (Stantec 2012a, 2011d)
Open Conifer Forest	Secondary	Secondary	Quality rating based on Fortin et al. (2008) and Schaefer and Pruitt (1991); primarily moss ground cover. One site contained evidence of caribou (scat, trails) during 2008 surveys (Stantec 2012a, 2011d)
Rocky Barrens	Primary	Primary	Four sites noted with caribou or evidence of their presence (scat, tracks) during 2008 surveys (Stantec 2012a, 2011d)
Wetland	Primary	Secondary	22 sites noted with caribou or evidence of their presence (i.e., tracks, trails, scat, and bones) during 2008 surveys (Stantec 2012a, 2011d)
Scrub / Heathland / Wetland	Primary	Secondary	Quality rating based on Stantec (2012a, 2011d)

(a) Habitat Types are described in Table 2-3 of *Caribou and Their Predators Component Study* (Stantec 2012a, 2011d).

Table 10.3.4-6 Winter and Calving / Post-Calving Seasons Habitat Ratings of the Ecoregions in the Study Area in Newfoundland

Ecoregion by Geographic Region	Amount of Ecoregion within Study Area (km^2)	Primary		Secondary		Tertiary		Non-Habitat Areas[(a)]	
		%	Area (km^2)	%	Area (km^2)	%	Area (km^2)	%	Area (km^2)
Winter Habitat									
Northern Peninsula									
Strait of Belle Isle Barrens	260	16	42	62	161	3	8	19	49
Northern Peninsula Forest	2,033	29	590	38	773	19	386	14	285
Long Range Barrens	1,763	25	441	62	1,093	7	123	6	106
Total[(b)]	**4,056**	**26**	**1,072**	**50**	**2,027**	**13**	**518**	**11**	**440**
Central and Eastern Newfoundland									
Long Range Barrens	114	4	5	81	92	11	13	4	5
Maritime Barrens	273	20	55	57	156	17	46	6	16
Central Newfoundland Forest	4,501	9	405	36	1,620	49	2,205	6	270
Total[(b)]	**4,888**	**9**	**464**	**38**	**1,868**	**46**	**2,264**	**6**	**291**
Avalon Peninsula									
Maritime Barrens	1,520	14	212	47	714	30	456	9	137
Avalon Forest	233	7	16	29	68	50	117	13	30
Total[(b)]	**1,753**	**13**	**229**	**45**	**782**	**33**	**573**	**10**	**167**
Calving / Post-Calving Habitat									
Northern Peninsula									
Strait of Belle Isle Barrens	260	43	112	35	91	3	8	19	49
Northern Peninsula Forest	2,033	51	1,037	17	346	19	386	13	264
Long Range Barrens	1,763	69	1,216	18	317	7	123	6	106
Total[(b)]	**4,056**	**58**	**2,365**	**19**	**754**	**13**	**518**	**10**	**419**
Central and Eastern Newfoundland									
Long Range Barrens	114	82	93	3	3	11	13	4	5
Maritime Barrens	273	64	175	14	38	16	44	6	16
Central Newfoundland Forest	4,501	32	1,440	13	585	49	2,205	6	270
Total[(b)]	**4,888**	**35**	**1,708**	**13**	**627**	**46**	**2,262**	**6**	**291**
Avalon Peninsula									
Maritime Barrens	1,520	61	935	-	-	30	456	9	137
Avalon Forest	233	36	85	-	-	50	117	13	30
Total[(b)]	**1,753**	**58**	**1,020**	-	-	**33**	**573**	**10**	**167**

(a) Represents areas classified as Exposed Earth / Anthropogenic / Cutblock; Open Water; Shallow Water with Vegetation; Snow / Ice; Burn; and Cloud / Shadow.

5 (b) Values were rounded to the nearest whole number, therefore, rounding errors may occur.

Calving / Post Calving Habitat

During spring, caribou in Newfoundland feed preferentially on broad-leaved evergreen and deciduous shrubs and sedges, and on deciduous shrubs, reindeer lichens and fungi in summer (Bergerud 1972). Woodland caribou exhibit a preference for mature coniferous forests during summer (Chubbs et al. 1993) with or without the presence of terrestrial lichens (Courtois et al. 2008). Bergerud (1971) noted that few caribou were observed in Newfoundland during summer as they were generally under trees during the day to escape harassment by flies.

As with woodland caribou elsewhere, female caribou seek birth sites with low predation risk (Bergerud et al. 2008; Bergerud and Page 1987). Adult caribou in western Newfoundland selected rock and heath barrens, and virgin and mature forest stands significantly more than other habitats during the calving / post-calving period (Mahoney and Virgil 2003). Hardwood and softwood scrub were also preferred (Mahoney and Virgil 2003). Recent research suggests that caribou in certain areas of Newfoundland (e.g., Middle Ridge, La Poile and the Northern Peninsula) are selecting areas of low-lying vegetation (Morgan et al. 2010) and barrens and wetlands (McCarthy et al. 2011) for calving while selecting against mixed-forest (McCarthy et al. 2011). Bogs, early climax stands and ponds and lakes were intermediate in their selection value, while recently harvested stands and disturbed sites were used significantly less than other habitats during this period (Mahoney and Virgil 2003). Of the intermediate habitats, bog habitat was more important during summer and fall (Mahoney and Virgil 2003). Open water is also important as it can be used for escape from predators (Bergerud et al. 2008; Bergerud et al. 1990; Bergerud 1985).

As in winter, areas that support alternative prey (e.g., moose) would be avoided during summer, as they may increase the risk of predation by black bear (Mahoney and Virgil 2003).

The ELC habitat types within caribou calving / post-calving ranges on the Island and their potential use are described in Table 10.3.4-5. During the calving / post calving season, primary habitat was the most prevalent habitat quality rating in both the Northern Peninsula and Avalon Peninsula Study Areas (Northern Peninsula – 43% to 69%, 2,365 km^2; Avalon Peninsula – 36% to 61%, 1,020 km^2) (Table 10.3.4-6). However, the most prevalent habitat rating in Central and Eastern Newfoundland was tertiary (between 11% and 49%, 2,262 km^2) (Table 10.3.4-6). In the Northern Peninsula Study Area there were similar amounts of secondary (17% to 35%, 754 km^2) and tertiary (3% to 19%, 518 km^2) habitat (Table 10.3.4-6). Primary habitat was the second most prevalent habitat rating in the Central and Eastern Newfoundland region of the Study Area (32% to 82%, 1,708 km^2) while secondary was the least common (3% to 14%, 627 km^2) (Table 10.3.4-6). The Avalon Peninsula had no secondary habitat and approximately 10% (167 km^2) tertiary habitat.

Limiting Factors

Woodland caribou herds are susceptible to, and recover slowly from, declines because of their low rate of reproduction. The main factors leading to caribou declines are predation, habitat loss and fragmentation (both natural and anthropogenic) and hunting. In NL, several limiting factors have been identified for caribou including the availability of quality forage that is influenced by environmental circumstances such as fire and snow conditions. For example, forage may be limited in times of heavy snowfall or hard-packed snow conditions (Mahoney and Virgil 2003) while fire reduces lichen availability (Fortin et al. 2008; Schaefer and Pruitt 1991).

Predation

Predation may be a limiting factor for caribou in Labrador and Newfoundland. Within Labrador, Messier et al. (1988) did not consider predation a limiting factor for the GRH, but acknowledged it could become so if the herd declined. Natural predators for caribou in the province include black bear, wolf (Labrador only), coyote (*Canis latrans*), red fox (*Vulpes vulpes*), lynx (*Lynx canadensis*) and large raptors, to which calves are particularly vulnerable (Mahoney and Virgil 2003; Snow and Mahoney 1995; Mahoney et al. 1990). Herds with low predation experience <50% calf mortality within their first six months (Bergerud 1985). In a study of

collared GRH caribou between 1984 and 1992, the causes of mortality were: wolf (50%), unknown circumstances (20%), hunting (11%), unknown predation (7%), summer starvation (6%), black bear (4%), and accident / disease (2%) (Bergerud et al. 2008).

For the sedentary herds, the wolf-caribou interactions are somewhat different than for the GRH. Wolf predation is the primary source of mortality for female caribou in Labrador (NLDEC 2011d). In the RWMH, wolf predation accounted for two-thirds of all deaths during two periods, 1981 to 1988 and 1993 to 1997 (Schaefer et al. 1999). Between 1998 and 2009, wolf predation accounted for 56% of mortality in RWMH adult females at rates similar to those during the 1980s (Schmelzer 2011). It is speculated that wolf predation on the RWMH may be associated with the presence of moose and GRH caribou in the RWMH range (Bergerud et al. 2008; Schmelzer et al. 2004; Schaefer et al. 2001, 1999; Chubbs and Schaefer 1997). As the density of forest-dwelling caribou are frequently too low to sustain wolf populations, wolves rely on moose populations to persist. Hence, wolf abundance will increase as moose density increases, which results in a marked increase in predation of caribou (Seip 1991). The decline of the RWMH in the 1990s coincided with both an increase in moose densities in Labrador and frequent incursions of the GRH, which may have led to an increase in wolf density and subsequent predation on the RWMH (Nalcor Energy 2009). Black bears have been documented to prey on GRH caribou (Bergerud et al. 2008) and accounted for 7 of 30 RWMH caribou mortalities (23%) documented by Schaefer et al. (1999). Black bear predation accounted for 28% of adult female mortalities in the RWMH between 1998 and 2009 (Schmelzer 2011), also similar to rates in the 1980s. Both black bears and wolves are also present throughout the MMH range. Older forests tend to be richer in lichens than younger forests, and are less favoured by moose, which are considered an alternate prey species of wolves. Wolves can require the food equivalent of 11 to 14 caribou each per year (Bergerud 1985). To this end, some wolf packs follow migrating caribou herds from summer to winter range and back.

In Newfoundland, the predator-prey dynamics are somewhat different due to the presence of coyotes and absence of wolves. Predation is the primary cause of caribou calf mortality in Newfoundland with 94% of calf deaths attributed to predation, although the predation rates and trends differ between regions and years (Trindade et al. 2010a).

The presence of the eastern coyote, believed to be a mix of coyote, wolf and wild dog, was first confirmed in Newfoundland in 1987, and by the mid-1990s, was confirmed throughout much of Newfoundland (Blake 2006, internet site). They are larger than their western counterparts and consequently hunt larger prey (Blake 2006, internet site). Their presence may be unique in terms of the extirpation of wolves and therefore interactions between coyote and potential prey are likely different than other regions within their range. Coyote stomach content analysis indicates that over 80% of the diet consists of moose, caribou and snowshoe hare (*Lepus americanus*), with moose carrion dominating in fall and winter (Blake 2011a, pers. comm.). Although there is some suggestion that coyote prey more heavily on large animals like caribou when snowshoe hare populations are low (Blake 2006, internet site), they may now be switching to snowshoe hare as they are becoming more abundant (Blake 2011a, pers. comm.). Current adult caribou mortality is believed to be similar to historical rates; however, the increase in mortality several years ago was likely related to the introduction and spread of coyote throughout the province (Saunders 2011, pers. comm.).

Recent research in Newfoundland has indicated that coyote accounted for 15% of deaths of radio-collared caribou calves (NLDEC 2009a, internet site); however, data have suggested that calf mortality and resultant poor recruitment is driven by a complex web of predators that includes not only coyote but also black bear (Mumma et al. 2011; Mahoney and Weir 2009; Blake 2006, internet site) that, along with lynx, could be considered a major predators (Mahoney and Virgil 2003; Snow and Mahoney 1995; Mahoney et al. 1990). Black bears contributed to 33% of the mortality of caribou calves collared in the Middle Ridge and Gaff Topsails herds between 2003 and 2005 (Blake 2006, internet site) and accounted for 20 to 55% of the mortality in juvenile caribou on the Island (Jennings et al. 2011). The GNL is continuing to research predator-prey dynamics. However, there can be challenges in collecting these data due to the large home ranges of both black bear (adult males: 400 to 1,760 km^2; adult females: 38 to 693 km^2) and coyote (territorial adults: 19 to 260 km^2), which are larger than reported in other jurisdictions (Mahoney and Soulliere 2011; NLDEC 2010d;) and expanding range of caribou calving areas (NLDEC 2009a, internet site).

Habitat Loss (Natural and Anthropogenic)

Range and forage conditions may be important limiting factors for caribou. A primary factor regulating the GRH is summer range condition (Crête and Huot 1993; Messier et al. 1988). The decline of the GRH in the 1980s and 1990s has been attributed to poor foraging conditions on the summer range, which led to complete exhaustion of fat reserves of lactating females and a decrease in calf production and survival (Crête and Huot 1993). Summer foraging habitat for the GRH is considered spatially limited as, in contrast to winter habitat, alternative summer range is not available for colonization following an increase in herd size (Messier et al. 1988).

Thus, increasing caribou numbers can lead to summer range deterioration, a decline in female body condition and decreased fecundity and calf survival (Crête and Huot 1993). Although its total range is expansive, deterioration of summer range and the subsequent decline of the GRH suggest that availability of summer habitat is a limiting factor; therefore, loss of this habitat could have an adverse effect on the herd. Similarly, because of the increased importance of winter habitat for caribou from the GRH (Schmelzer and Otto 2003), loss of extensive areas of winter range could have adverse effects. The Recovery Strategy for sedentary woodland caribou in Labrador does not include habitat degradation through overgrazing as a threat to the sedentary herds (RWMH and MMH) at this time (Schmelzer et al. 2004).

Disturbances such as forest-harvesting are another human-related factor that can decrease the amount of available habitat (Snow and Mahoney 1995) and is considered permanent. Caribou in the boreal forest require large tracts of relatively undisturbed, older forest habitat to disperse so that they are harder for predators and hunters to locate, and to avoid the linear corridors used by predators and hunters to access prey more easily. Alteration of habitat may also lead to increased moose numbers (inter-specific competition) and black bear abundance, thereby causing increased predation pressure (Fortin et al. 2008; Mahoney and Virgil 2003). The decline of woodland caribou across Canada may be a result of the reduction in the availability of lichen-rich mature coniferous forests and an increase in access for predators and hunters (Dyer et al. 2001; James and Stuart-Smith 2000; Smith et al. 2000). Recent research found that one of the factors correlated with caribou calving / post-calving range sizes in Newfoundland was the amount of total disturbance present within the calving / post-calving range (McCarthy et al. 2011). Specifically, for every additional square kilometre of total disturbance (defined as natural and anthropogenic disturbances including fires, mining and quarries, agricultural land and power lines), individual female's calving / post-calving ranges increased by approximately 5.4 km^2 (McCarthy et al. 2011). At high levels of avoidance, caribou may abandon entire fragmented areas resulting in small calving / post-calving areas (Joly et al. 2006). The current amount of disturbance in Newfoundland and the resulting fragmentation do not appear to be compressing caribou ranges (McCarthy et al. 2011). Additionally, calf recruitment rates were found to decrease with increasing amounts of disturbance (McCarthy et al. 2011).

Hunting

Human-related limiting factors for caribou include legal and illegal hunting pressure**.** In Labrador, hunting is only permitted on the GRH. Licenses and hunting quotas were established in Labrador in 1959 (Bergerud 1967), but no bag limit was set until 1963 (eight caribou per family with no limit for Aboriginal hunters) (Bergerud 1967). In Québec, sport hunting of the GRH was first permitted in 1964 with no bag limit (Couturier et al. 1990). Messier et al. (1988) suggested that intensive hunting of the GRH in the mid-1980s (5-7% harvest rate in 1984 to 1986), combined with low calf recruitment, depressed the growth rate of the herd. The recent decline in the GRH population has led to changes to the hunting regulations and a reduction to only 1 license per non-Aboriginal hunter.

The RWMH and MMH have been closed to licensed hunting since 1972 and 1976, respectively (with the exception of a single licensed hunt in 1989 permitted for the MMH); however, hunting of the RWMH by Aboriginal people continued legally until 2002 (Schmelzer et al. 2004). The RWMH has been particularly vulnerable in recent years. Not only has its range overlapped that of the legally hunted GRH (seasonally accessible via roads in central Labrador), but the Study Team has observed illegal and public protest hunts of

caribou in areas designated closed to hunting (where the GRH may also be present), particularly in recent years. Without genetic analysis, the exact numbers of caribou harvested from either the MMH or RWMH cannot be ascertained.

In Newfoundland, the caribou population has decreased dramatically (66% since the late 1990s) (Soulliere et al. 2010), and as such, caribou quotas have been reduced. For the 2010 to 2011 season, the quota was set at 740 caribou (NLDEC 2010e, internet site) and as an indication of harvest rates, hunter success rates from the last two caribou hunting seasons (2007-2008 and 2008-2009) were 62.1% and 64.7% (NLDEC 2010e, internet site; NLDEC 2009b). Previously, however, hunter success was 80 to 85% in the 1980s (Mahoney et al. 2008). The overall mean harvest rate including both sexes between 1980 and 2003 was 5.6% (Trindade et al. 2010c). Investigations of the age structure of the population over time, which have identified a male minority in the population, with primarily younger males since 1993, indicate that harvest rates may have affected the population (Trindade et al. 2010c).

Parasites

Parasites are also believed to be an important factor limiting caribou and have been widely studied. Ball et al. (2001) reported that the brain worm (*Elaphostrongylus rangiferi)* was prevalent in the Avalon and St. Anthony caribou herds but infection has since spread to the rest of the Island (Soulliere et al. 2010). This parasite can cause a debilitating neurologic disease seen primarily in young animals in late winter. It is known to occur widely in woodland and barren-ground caribou across Europe (Lankester 2001); however, Newfoundland is the only place in North America where *E. rangiferi* has been found. The GRH is the only herd in North America infected with the liver parasite (*Fascioloides magna)* (Pollock et al. 2009) and was found in 78% of specimens in 2009 (Pollock et al. 2009), an incidence higher than noted in the 1980s. Tapeworm larva (*Taenia hydatigena*) are also found in caribou in the province; it was prevalent in 50% of the GRH sampled in 2009 (Pollock et al. 2009).

Other Sources of Mortality

Certain caribou behaviour can have an inherent risk of death. For instance, mortality due to fighting during the rut (amongst males) or during calving (largest cause of death for females) have been reported by Bergerud (1971). Drowning during spring Has also been reported by Bergerud et al. (2008) as a common cause of calf mortality.

Of the Caribou Management Areas on the Island crossed by the Study Area, the Grey River and Avalon Peninsula zones are closed to hunting. In Newfoundland, one Corner Brook Lakes caribou calf death (of 15 analyzed by Mahoney and Virgil (2003) was the result of illegal hunting. Roads contribute as a limiting factor for caribou to varying degrees, through vehicle collisions or by facilitating travel by both predators and hunters (Fortin et al. 2008; James and Stuart-Smith 2000; Bergerud 1974).

Aboriginal Ecological Knowledge

AEK regarding caribou in parts of the Study Area was obtained through interviews completed with Labrador Innu and land and resource use interviews with members of the NunatuKavut Community Council. This information is listed below (Table 10.3.4-7), and includes information regarding where caribou can be found, behaviour, health, adaptation to human presence, and diet. The information provided is generally in keeping with the scientific data obtained through the field studies and literature review conducted for the EA (as reported in Section 10.3.4.2).

Table 10.3.4-7 Aboriginal Ecological Knowledge of Caribou in the Study Area

Group	Source	Quote (Direct and / or Indirect)
Labrador Innu	Labrador Innu Traditional Knowledge Committee (ITKC) Member, January 26, 2007 (p. 45)[(a)]	*Direct/Indirect* *Ushakatik*^{u} – 'where there is always caribou'. ITKC members said that the best places for *ushakatik*^{u} are where there are moss and lichen, and some *ushakatik*^{u} have reputations for being fairly predictable places to find caribou. "When caribou find a lot of moss on the hills, that's where they like to eat. So anytime they go, they remember the hills where they ate previously. When Innu remember finding caribou in a particular spot, they return there again to look for the caribou" (P1.26.1.07).
	Labrador Innu Traditional Knowledge Committee Member, February 12, 2007 (p. 55)[(a)]	*Direct* "Other animals were very intelligent/wild in the past. The other older hunters say this as well. For example, the caribou would go a long way when they sensed danger. But they are not as intelligent/wild as they used to be. The caribou sit on the road, and don't care about the noise. In the past, when they heard noise, they would take off" (P3.12.2.07).
	Labrador Innu Traditional Knowledge Committee Member, November 20, 2006 (p. 46)[(a)]	*Indirect* Although ITKC members or their relatives had killed caribou very close to Mishta-shipu in the past, and one member had tracked Penipuapishk^{u} (Red Wine Mountains) caribou as far as Uinukupau (Winokapau Lake), no *ushakatik*^{u} were identified on the floor of the valley. Excluding the higher elevation regions north and south of the river, kill sights for caribou were identified close to the southern shore of Mishta-shipu about 3.5 km downstream of Ushkan-shipiss, on the south side of Mishta-shipu across from the mouth of Etuat-shipis, and in a marsh between Manatueu-shipu (Traverspine River) and Atshakash-shipiss, just upstream of the junction between the two rivers (P7.20.11.06).
	Labrador Innu Traditional Knowledge Committee Member, November 30, 2006 (p. 56)[(a)]	*Indirect* The caribou are not always in herds. They would gather together for the rut in September. After rut they would separate into small groups or individual males (P4.30.11.06).
	Labrador Innu Traditional Knowledge Committee Member, January 26, 2007 (p. 62)[(a)]	*Indirect* *Atik*^{u} (caribou) eat *uapitsheushkamik*^{u} (caribou lichen). It grows on top of hills, and sometimes on marshes, for example, small islands in the marshes. *Massekushkamik*^{u} (sphagnum moss, generic) is a type of moss in the marshes, but caribou doesn't eat it (P6.26.1.07).
	Labrador Innu Traditional Knowledge Committee Member, November 28, 2006 (p. 62)[(a)]	*Indirect* *Atik*^{u} (caribou) eat *ushkuai-pishum* (tree fungi, probably *Fomes spp*.) after they scrape their antlers off (velvet). Eating the "mushrooms" hardens their antlers in readiness for rut. It also eats the mushrooms on the ground; the soft ones (P3.28.11.06).
	Labrador Innu Traditional Knowledge Committee Member, February 7, 2007 (p. 62)[(a)]	*Indirect* *Atik*^{u} (caribou) and *mush* (moose) eat mâtâpək, a type of water plant that grows in marshes (P4.7.2.07).

Table 10.3.4-7 Aboriginal Ecological Knowledge of Caribou in the Study Area (continued)

Group	Source	Quote (Direct and / or Indirect)
	Labrador Innu Traditional Knowledge Committee Member, November 16, 2006 (p. 76)[(a)]	*Direct* "*Atik*[u] (caribou) hardly have any bone marrow in the spring. The reason their marrow is like that is from walking a long distance. The old people used to say all caribou are like that after walking long distances" (P4.16.11.06).
NunatuKavut Community Council	NunatuKavut Land and Resource Use Interview, 2011	*Indirect* Mark's Hill is an important area for caribou for the interior part of Eastern Labrador. It is fairly close to the transmission line.

(a) Source: *Innu Environmental Knowledge of the Mishta-shipu (Churchill River) Area of Labrador in Relation to the Proposed Lower Churchill Project* (Armitage 2007). Refer to Appendix 10-1.

Local Ecological Knowledge

LEK regarding caribou in parts of the Study Area was obtained through conversation with participants of Open Houses in Hawke's Bay and Grand Falls-Windsor. This is listed below (Table 10.3.4-8), and includes information on the size of caribou herds, where caribou can be found, behaviour, health and disease. The information provided is generally in keeping with the scientific data obtained through the field studies and literature review conducted for the EA (as reported in Section 10.3.4.2).

Table 10.3.4-8 Local Ecological Knowledge of Caribou in the Study Area

Community	Source	Indirect Quote
Grand Falls-Windsor, NL	Labrador-Island Transmission Link Open House participant, Grand Falls-Windsor, April 27, 2010	Caribou herds are a lot smaller than in the past and much easier to "spook."
Hawke's Bay, NL	Labrador-Island Transmission Link Open House participant, Hawke's Bay, April 29, 2010	The caribou spend the summer on the interior high ground and winter on the coast, but recently it has been observed that there is a reversal.
	Labrador-Island Transmission Link Open House participant, Hawke's Bay, April 29, 2010	Seen more caribou this year than in many years, specifically near the drill sites [referring to Parsons Pond].
	Labrador-Island Transmission Link Open House participant, Hawke's Bay, April 29, 2010	Brain worm in caribou was a contributing factor to their decline in past years [few years].
	Labrador-Island Transmission Link Open House participant, Hawke's Bay, April 29, 2010	The caribou are healthier now than they have been in the past.
	Labrador-Island Transmission Link Open House participant, Hawke's Bay, April 29, 2010	When the St. John Highlands freeze due to cold and rain the caribou and partridge move down off the hills.

10.3.5 Moose and Black Bear

Moose and black bear are large mammals with widespread distribution throughout NL. These species are important ecologically, as well as from a cultural, recreational and economic (i.e., outfitting) perspective. An overview of the baseline conditions for these two species is presented in this section.

10.3.5.1 Study Area

Existing baseline conditions for moose and black bear are presented in relation to the proposed transmission corridor from Central Labrador to the Island of Newfoundland's Avalon Peninsula and a surrounding 15 km wide Study Area, as well as considering the location of other Project-related components and activities (Figure 10.3.5-1). Consistent with other environmental components, the nature of the information presented in the following section is based on the specific regions and management units for which data are available. Overviews of the presence, abundance, and distribution of moose and black bear are provided for Labrador and Newfoundland, with regional differences highlighted as they occur.

10.3.5.2 Information Sources and Data Collection

The existing (baseline) environment information presented in this section is based on that included in the *Moose and Black Bear Study* (Stantec 2010d) and associated *Supplementary Report* (Stantec 2011e) that was prepared for the Project and its EA and included as part of the *Caribou and Other Large Mammals Component Study* that was submitted under the EA process in June 2011.

An ELC was completed of the Study Area from Muskrat Falls in Central Labrador to Soldiers Pond on Newfoundland's Avalon Peninsula (Stantec 2011b, 2010a). The purpose of the ELC was to identify, categorize and evaluate vegetation types and associated habitats on a regional scale. Habitat Types within the Study Area were surveyed during a 60 person-day field program in the summer of 2008. Vegetation, site photographs, site conditions and wildlife suitability data were collected for 404 sites within the Study Area. High-resolution satellite images and aerial photographs of the Study Area were incorporated into a computer-based GIS and used to define and delineate 15 Vegetation / Habitat Types and several non-Habitat Types within the Study Area. The ELC habitat classifications formed the basis for the season habitat mapping exercise for moose and black bear within the Study Area.

Habitat quality was assessed for moose and black bear based on literature reviews and available data and was classified as primary, secondary or tertiary habitat (primary habitat being the most suitable, tertiary being the least) based on criteria such as the presence of structural and compositional elements, and forage. A series of detailed habitat quality maps were subsequently generated based on the Habitat Types identified by Stantec (2011b, 2010a). Maps produced for each region based on the coverage of the ELC were colour-coded to reflect habitat quality and to indicate the percentage of primary, secondary and tertiary habitat available within the Study Area.

This evaluation and mapping of potential seasonal habitat suitability for moose and black bear provides an overview of the potential for portions of the Study Area to support these species.

AEK has been collected from consultation initiatives with Aboriginal groups in the Study Area (a summary of all Aboriginal consultation initiatives conducted for the Project can be found in Chapter 7 of the EIS). Sources of AEK include, but are not limited to, land use surveys and interviews, reviews of existing published and unpublished literature and through the provision of information to Nalcor by an the Aboriginal group or organization.

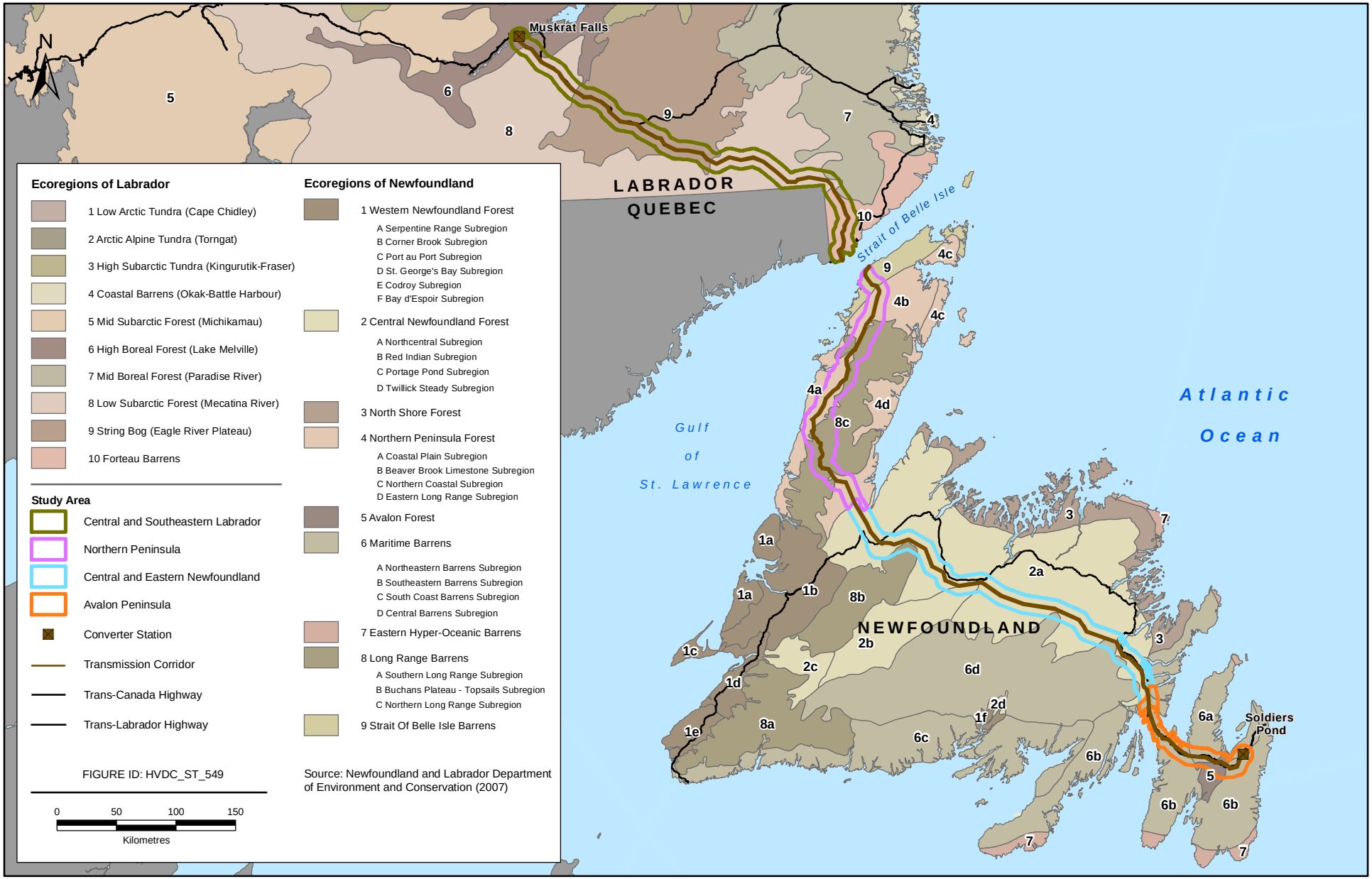


FIGURE 10.3.5-1

Moose and Black Bear Study Area

10.3.5.3 Description of Moose and Black Bear

Moose

Life History, Distribution and Densities

Moose are a large ungulate and member of the deer family and are found in boreal forests throughout northern North America (Snyder 1991). They are a generalist species, adapting to the relative abundance of available habitat and forage (Osko et al. 2004; Jackson et al. 1991). Largely influenced by the availability of feeding opportunities, as well as the need for shelter in winter, the habitat preferences of moose shift seasonally (Bowyer et al. 2003). Open wetlands and other riparian zones are generally an important component of summer habitat (Peek 1997) and moose typically stay away from mature forest for most of the year (Cederlund and Okarma 1988), with the exception of open areas (canopy gaps) with young vegetation (Stelfox et al. 1995).

Moose were introduced to the Island of Newfoundland in the late 1800s and to Labrador in the 1950s (Chubbs and Schaefer 1997; Mercer and Kitchen 1968). The distribution and abundance of this large ungulate has since expanded in both regions of the province. The population has grown and sustained an annual harvest throughout the various Moose Management Areas (MMAs) in NL Figures 10.3.5-2 and Figure 10.3-5.3 show MMAs for Labrador and the Island of Newfoundland, respectively. The Study Area in Labrador overlaps three MMAs: 53A, 58 and 59 (Figure 10.3.5-2) and on the Island, the Project intersects 21 MMAs (Figure 10.3.5-3).

In Labrador, this species was the result of the introduction of 12 animals on the south coast in the 1950s and also the result of herds moving east from Québec (Chubbs and Schaeffer 1997). By 1961, moose had reached the lower Churchill River watershed near the Minipi River (Mercer and Kitchen 1968), with licensed hunting beginning in 1977 once population numbers had reached levels able to sustain the hunt (Chubbs and Schaeffer 1997).

Although moose populations are increasing in the province overall, densities in Labrador remain relatively low compared to other areas near the northern extent of this species range (Minaskuat Inc. 2009a; Chubbs and Schaeffer 1997; Boer 1992; Fryxell et al. 1988; Brassard et al. 1974), possibly associated with an overall low abundance of willow and alder browse (Jacques Whitford 1997b). An overall population size of 5,000 individuals was estimated in Labrador in 1990 (Karns 1997).

Density estimates of moose in Central Labrador are generally low, ranging from 0.016 to 0.03 moose/km^2, although this number is based on studies in relatively low quality habitats (Jung et al. 2009). Estimates of moose density in 2008 near Double Mer were also similarly low, indicating a density of 0.6 moose/km^2. Densities along coastal Labrador are even lower than in central Labrador, with Found (1998) reporting densities of 0.00035 moose/km^2 in MMA 57 and 0.0091 moose/km^2 in MMA 58, the latter of which overlaps with the proposed transmission corridor (Figure 10.3.5-2), along the then-proposed Trans-Labrador Highway (Phase 2) TLH2 from Cartwright to Red Bay. The highest densities of 1.7 moose/km^2 were reported in south-central Labrador (Trimper et al. 1996). More recently in 2008, moose density and population size were estimated in MMA 55 during aerial surveys conducted jointly by the province's Wildlife Division and the Nunatsiavut Government (Barney, no date (n.d.)). Results from this survey indicate densities of 0.06 moose/km^2 and a population size of 314 ± 80 animals, representing a four-fold increase in animals since 1980.

In Newfoundland, moose were the result of two introductions of male / female pairs in 1878 at Gander Bay in north-eastern Newfoundland and in 1904 near Howley in western Newfoundland (Conor Pacific Environmental Technologies Inc. and Westworth Associates Environmental Ltd. 2000; Northcott 1974). By 1935, moose occupied much of the Island (GNL n.d. a), largely due to low rates of competition from other ungulate species and low predation (Conor Pacific Environmental Technologies Inc. and Westworth Associates Environmental Ltd. 2000). The first regulated hunting season was in 1930 (GNL n.d. b), and currently over 25,000 moose licenses are issued annually (GNL 2009).