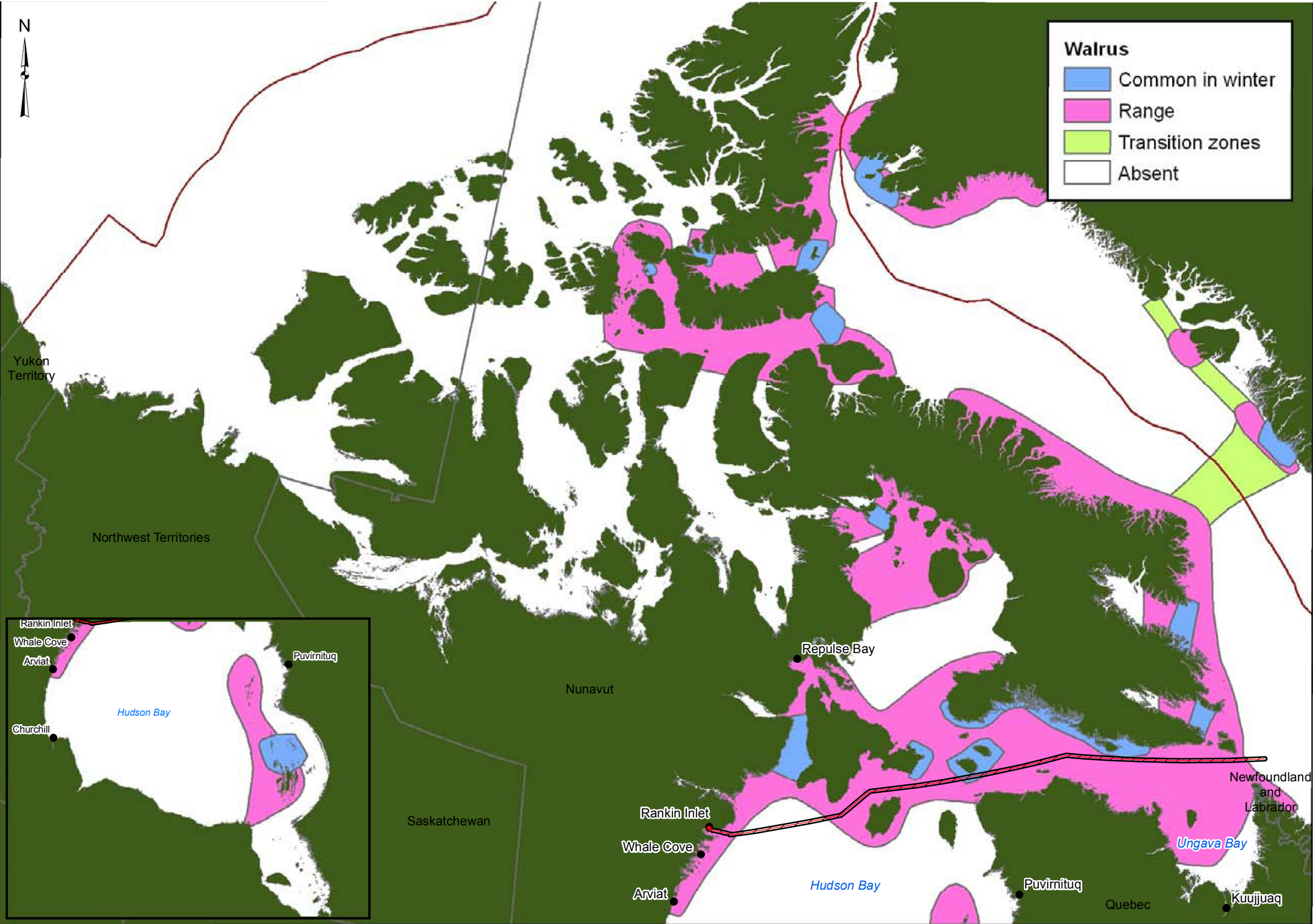


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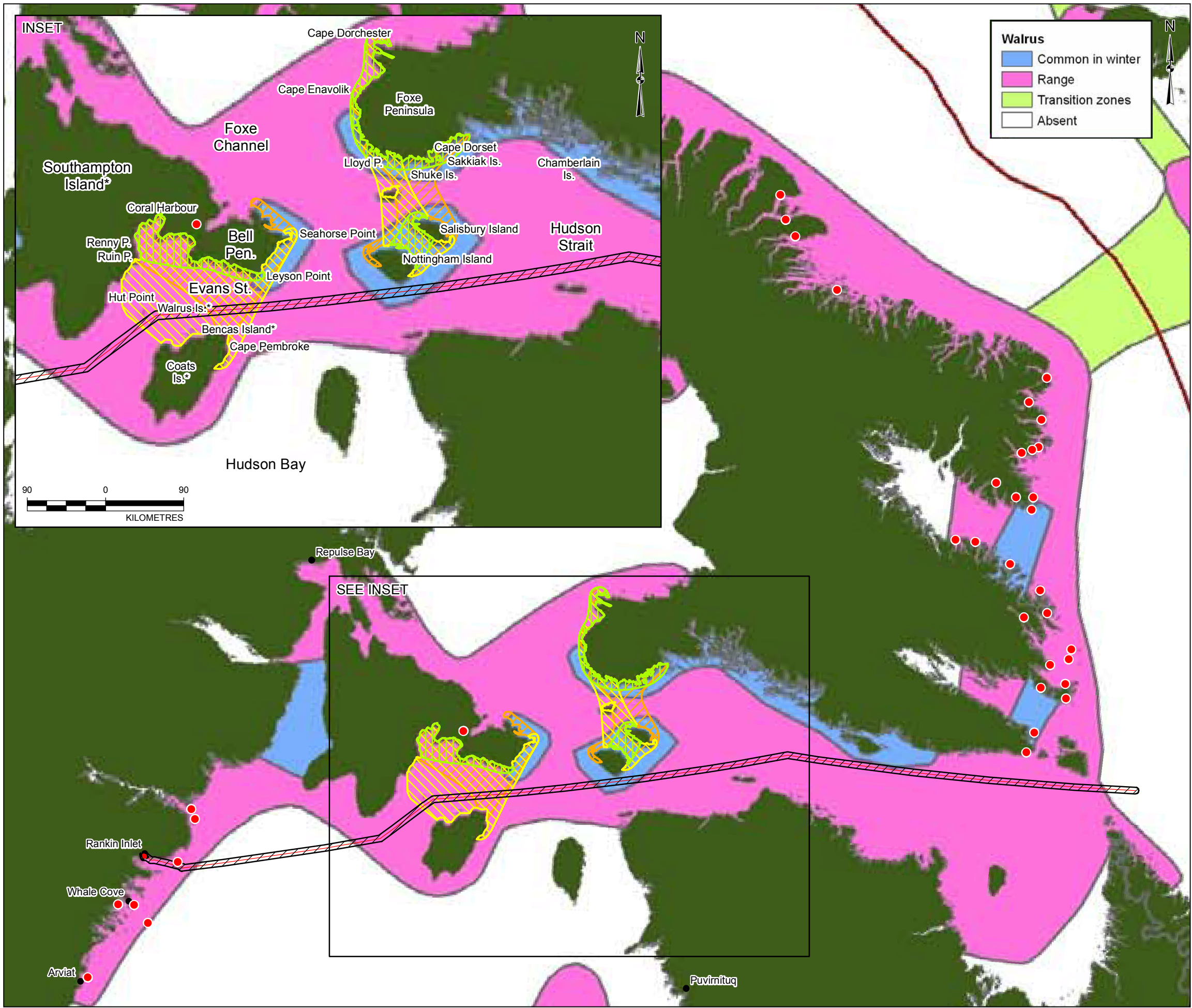
- LEGEND**
- LOCAL STUDY AREA (LSA)
 - MARINE REGIONAL STUDY AREA (MARINE RSA)

REFERENCE
PROVINCIAL DATA OBTAINED FROM E.S.R.I.
BASE IMAGE OBTAINED FROM STEPHENSON AND HARTWIG, 2010
DATUM: NAD 83 PROJECTION: CANADA ALBERS EQUAL AREA CONIC



PROJECT		AGNICO EAGLE MINES LIMITED MELIADINE GOLD PROJECT NUNAVUT			
TITLE		DISTRIBUTION OF ATLANTIC WALRUS (<i>Odobenus rosmarus rosmarus</i>) IN THE MARINE RSA AND ADJACENT ARCTIC WATERS			
		PROJECT NO.		FILE No.	
		DESIGN	AK	19 Jul. 2012	SCALE AS SHOWN
		GIS	DSC	23 Jul. 2012	REV. 0
		CHECK	PR	18 Jan. 2013	FIGURE B-15
		REVIEW	DW	18 Jan. 2013	

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LEGEND

- KNOWN WALRUS HAUL OUT
- WALRUS DISTRIBUTION (SPRING)
- WALRUS DISTRIBUTION (SUMMER)
- WALRUS DISTRIBUTION (FALL)
- LOCAL STUDY AREA (LSA)
- MARINE REGIONAL STUDY AREA (MARINE RSA)

* HAUL OUTS AND MAIN CONCENTRATION AREAS

REFERENCE

PROVINCIAL DATA OBTAINED FROM E.S.R.I.
KNOWN WALRUS HAUL OUT LOCATIONS FROM STEWART ET AL. 2014; LOW 1906;
DEGERBØL AND FREUCHEN 1935; LOUGHREY 1959; REEVES 1978; BORN ET AL. 1995;
DFO 2000; FLEMING AND NEWTON 2003.
SPRING/SUMMER/FALL WALRUS DISTRIBUTION FROM ORR AND REBIZANT, 1987.
*HAUL OUTS AND MAIN CONCENTRATION AREAS FROM DFO, 2002.
BASE IMAGE OBTAINED FROM STEPHENSON AND HARTWIG, 2010.
DATUM: NAD 83 PROJECTION: CANADA ALBERS EQUAL AREA CONIC

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KILOMETRES

PROJECT		AGNICO EAGLE MINES LIMITED MELIADINE GOLD PROJECT NUNAVUT	
TITLE		DISTRIBUTION OF HAUL OUTS AND IMPORTANT HABITAT ATLANTIC WALRUS IN THE MARINE RSA AND ADJACENT ARCTIC WATERS	
	PROJECT NO.		1535029
	DESIGN	EL	12 Jan. 2016
	GIS	CDB	12 Jan. 2016
	CHECK	KZ	15 Jan. 2016
	REVIEW	PR	15 Jan. 2016
		FILE No.	SCALE AS SHOWN
			REV. 0

FIGURE B-16



Beluga whale (*Delphinapterus leucas*)

Beluga whales are circumpolar in distribution, typically occurring in warm shallow estuaries during summer and migrating south during autumn to over-winter in the pack-ice, at established polynyas, or along prominent ice leads where open water conditions prevail (Doidge and Finley 1993; NAMMCO 2005). Beluga whales in the Canadian Arctic are sub-divided into 7 populations based on summer distribution and genetic differences (COSEWIC 2004a). The highest concentrations of belugas in the Canadian Arctic occur in the Hudson Bay region (Stephenson and Hartwig 2010), where animals during summer are observed in concentrated groups along both eastern and western coasts, as well as in James Bay and in nearby Ungava Bay (Gosselin et al. 2013). Each spring and fall, Hudson Strait is considered an important migration route for over 60,000 beluga whales from the Eastern and Western Hudson Bay populations (Gosselin et al., 2013; Richard 2005, 2010). Estuaries serve as important feeding and calving grounds for beluga whales, with their first arrival in these areas timed with the initial ice breakup in late June and their abundance increasing into the summer. Molecular genetic studies indicate at least two populations in Hudson Bay: a western Hudson Bay (WHB) stock and an eastern Hudson Bay (EHB) stock (Brennin et al. 1997; Brown Gladden et al. 1997; De March and Postma 2003). The WHB stock numbers about 57 000 individuals (Richard 2005). Genetic studies (Turgeon et al. 2012) and satellite telemetry (Bailleul et al. 2012) have shown that the two stocks overwinter together, where interbreeding likely occurs. Beluga whales in James Bay appear to constitute a distinct breeding population (Postma et al. 2012).

Most beluga whales present during summer in the Hudson Bay region belong to the WHB stock and occur in shallow coastal waters along western Hudson Bay (Martin et al. 2001), concentrating in the Churchill, Nelson, and Seal River estuaries (Stephenson and Hartwig 2010). The most recent population estimate for the WHB population was estimated at approximately 57,300 animals (95% C.I.: 37,700 to 87,100) (Richard 2005), making this stock of beluga the most abundant cetacean species in the region. Individuals from the EHB stock occur during summer along the shores of eastern Hudson Bay, including the Nastapoka River and the Little Whale River estuaries in northeastern Nunavik (Quebec's Arctic region) (Stephenson and Hartwig 2010). The EHB stock, currently listed as endangered by COSEWIC, was depleted by intensive commercial hunting between the 1860s and the early 1900s and has decreased from an estimated pristine population size of 12,500 to about 3,000 individuals in 2009 (Hammill et al. 2009). Aerial line transect surveys conducted in 2011 provided revised abundance estimates of the EHB stock at 3,351 animals (CV 48.9%; 95% CI: 1552 to 7855), which included correction factors for submerged animals and an additional 354 individuals counted during dedicated surveys in Little Whale River estuary (Gosselin et al. 2013). An uncorrected density estimate of 0.02 individuals / km² (CV 47.1%) was reported for EHB beluga whales in the eastern Hudson Bay survey area (Gosselin et al. 2013). The 2011 EHB abundance estimate is higher than that of 2008 (2,646 individuals; Gosselin et al. 2009), lower than that of 2004 (4,274 individuals; Gosselin 2005), and in line with model predictions of the stock abundance for 2011 (Doniol-Valcroze et al. 2011).

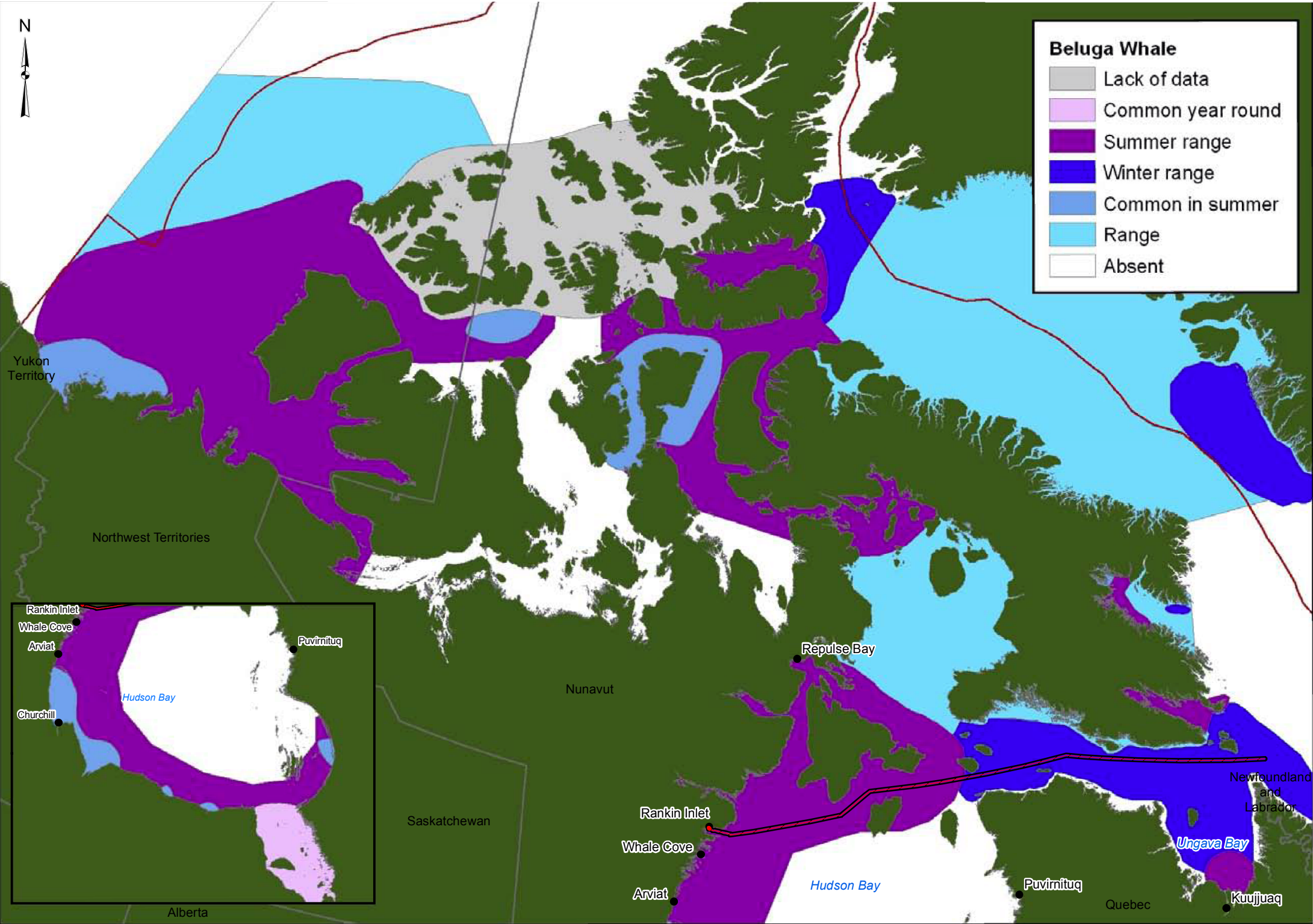
Belugas have been observed in many areas of Hudson Strait during the summer months (July and August), and even throughout the fall from September to November (Lewis et al. 2009). Migration is believed to begin northward along the coast of Hudson Bay during late August / early September (COSEWIC 2004a). In early August, satellite tagging studies and aerial surveys indicate a behavioural shift with beluga starting to migrate from southwestern Hudson Bay estuaries (e.g., Seal, Churchill and Nelson rivers; Sergeant 1973; Smith 2007). Most beluga have left Hudson Bay by early September, with some following the west coast of Hudson Bay northward into Rankin inlet, while others mover eastward along the southern coast of Hudson Bay then northward along the Nunavik coastline or crossing Hudson Bay via offshore waters (Smith 2007). In late



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September, beluga whales tagged in eastern Hudson Bay begin migrating northward along the coast and move through Hudson strait in the months of October and November (Lewis et al., 2009). Although some beluga whales have been reported to overwinter in polynyas in northwest Hudson Bay and in James Bay, in general, beluga whales over-winter in highly productive areas in Hudson Strait, Davis Strait, and Baffin Bay (Gosselin et al. 2009; Hammill and Lesage 2009; Hammill et al. 2009; DFO 2010a; Stephenson and Hartwig 2010). Smith (2000) suggests that it appears that the Western Hudson Bay, Eastern Hudson Bay, Ungava Bay and possibly James Bay stocks join together to winter in Hudson Strait. Figure B-17 provides an overview of beluga whale distribution in the RSA based on historical sightings, current scientific knowledge, and IQ. The presence of beluga whales along the shipping corridor is thought to be low, given their general distribution pattern and preference for shallow nearshore waters.

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- LEGEND**
- LOCAL STUDY AREA (LSA)
 - MARINE REGIONAL STUDY AREA (MARINE RSA)

REFERENCE

PROVINCIAL DATA OBTAINED FROM E.S.R.I.
BASE IMAGE OBTAINED FROM STEPHENSON AND HARTWIG, 2010
DATUM: NAD 83 PROJECTION: CANADA ALBERS EQUAL AREA CONIC



PROJECT		AGNICO EAGLE MINES LIMITED MELIADINE GOLD PROJECT NUNAVUT			
TITLE		DISTRIBUTION OF BELUGA WHALES (<i>Delphinapterus leucas</i>) IN THE MARINE RSA AND ADJACENT ARCTIC WATERS			
		PROJECT NO.		FILE No.	
		DESIGN	AK	19 Jul. 2012	SCALE AS SHOWN
		GIS	DSC	24 Jul. 2012	REV. 0
		CHECK	PR	18 Jan. 2013	FIGURE B-17
		REVIEW	DRW	18 Jan. 2013	



Beluga whales are harvested year-round by most coastal Inuit communities (20 out of 28) (Table B-4) (Priest and Usher 2004). During summer, they are mostly hunted along the western coast of Hudson Bay up to 35 km offshore (Canadian Circumpolar Institute 1992) from Arviat to Cape Fullerton. They are hunted primarily for their tusks and their meat. The meat is eaten or fed to dogs with (Born *et al.* 1995).

Over the 5-year period from 1996 to 2001, the total annual mean number of beluga whales taken through hunting was approximately 1,339 for all of Nunavut, whereas annual rates of belugas harvested from the community of Rankin Inlet ranged from 22 in 1998 to 1999 to 116 in 1999 to 2000 (Priest and Usher 2004). Subsistence harvest of beluga whales by Nunavik Inuit communities is directed towards a mixture of the WHB and EHB stocks, with the reported 2010 harvest consisting of 45 beluga whales taken near Sanikiluaq (Belcher Islands), 16 in the eastern Hudson Bay area, 15 in Ungava Bay, 146 in Hudson Strait in the spring and 58 in the fall (Doniol-Valcroze *et al.* 2011).

Narwhal (*Monodon monoceros*)

Two of 3 recognized populations of narwhals occur in the Canadian Arctic (Baffin Bay and Hudson Bay), with the third stock residing in East Greenland (COSEWIC 2004b). The populations are distinguished by means of their summer distribution, although the degree of genetic interchange between the 3 stocks is poorly known. The summer range of northern Hudson Bay narwhals includes the waters surrounding Southampton Island, with the larger aggregations in Repulse Bay, Frozen Strait, Western Foxe Channel, and Lyon Inlet (Figure B-18). Most narwhals are assumed to winter in eastern Hudson Strait and range over an area of roughly 250 000 km² (COSEWIC 2004b), while some occur in open leads and polynyas in northern Hudson Bay and western Hudson Strait. The core summering areas potentially overlap with the proposed open-water shipping route between Rankin Inlet and eastern Hudson Strait (Figure B-18).

Little information is known on narwhal habitat requirements. Throughout the year, they appear to be closely associated with the Arctic pack-ice, following the distribution of the ice and moving towards coastal areas when these are ice free. In summer, they appear to prefer coastal areas and ice-free shallow bays. During freeze-up, the coastal areas are abandoned, and the narwhals move offshore (Heide-Jørgensen 2002). During their fall migrations, and later while wintering in the pack ice, narwhals tend to prefer deep fjords and the continental slope, where depths range from -1000 to -1500 m and upwelling zones may increase biological productivity. The quality of sea-ice habitat, particularly the presence of leads in fast-ice and the density of broken pack-ice, appears to highly influence habitat selection (COSEWIC 2004b). Given that narwhals are an ice-associated species, it is likely that potential effects of climate change will result in changes to their habitats, prey availability, and increased natural mortality and may lead to changes in abundance, distribution and stock structure (Laidre and Heide Jørgensen 2005, Laidre *et al.* 2008). Narwhals generally travel in small groups in summer (<10 individuals), but gather in concentrations of many hundreds of animals during migrations in the spring and fall.

In Nunavut, local residents and scientists have observed killer whales feeding and hunting on marine mammals including narwhals (Steltner *et al.* 1984; Campbell *et al.* 1988; Stewart *et al.* 1995; Laidre *et al.* 2002; Higdon and Ferguson, 2009). Killer whales may be an important predator of narwhals, as indicated by their evasive behavioural responses when killer whales are nearby (Campbell *et al.* 1988; Laidre *et al.* 2002). This evasive behaviour may lead to more narwhals being available to hunters as narwhals tend to seek protection near shorelines, in bays or in inlets when killer whales are present. DFO is working with Nunavut HTOs to gather information on killer whale abundance and distribution in Nunavut, to evaluate their impact on their prey (Ferguson *et al.* 2012, 2011, Higdon *et al.* 2011).

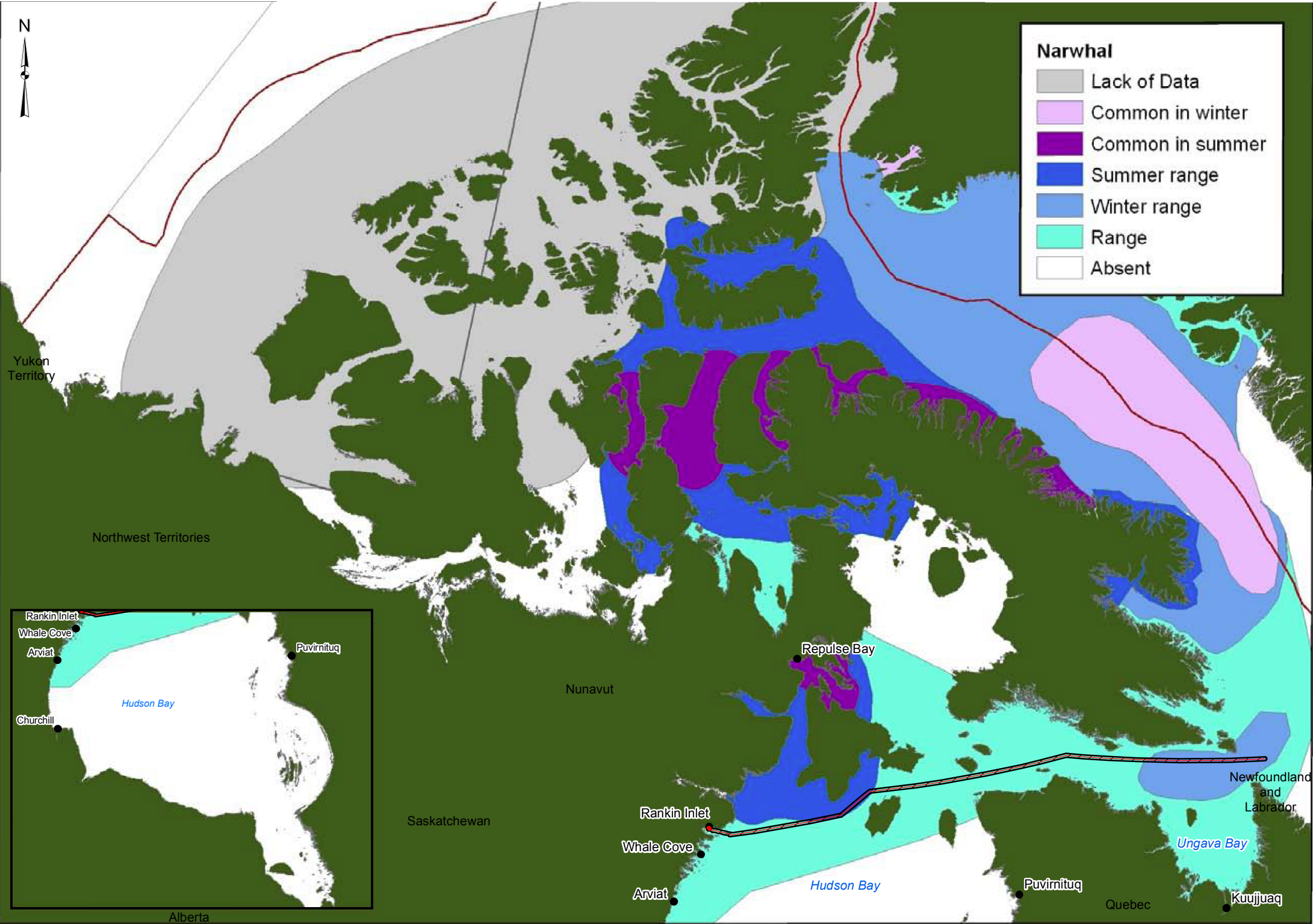


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Mating in narwhals occurs between March and May, and calving occurs in July and August. Since the lactation period exceeds 12 months, the interval between successive conceptions is usually 3 years, but about 20% of females conceive at the first breeding season following birth of their calves (Heide-Jorgensen 2002). The basic life history features of the narwhal are similar to those of other medium-sized toothed whales (Hay 1985), with long life spans and sexual maturity estimated to be 6 to 7 years for females and 9 years for males (Garde et al. 2007). Narwhals feed heavily during migrations, but very little during the open water season (Hay and Mansfield 1989). Fish, squid, and shrimp make up the narwhal diet, particularly Arctic cod and polar cod (Heide-Jorgensen 2002). Their main predators are killer whales, polar bears, and humans, and possibly occasionally Greenland sharks and walrus (Hay and Mansfield 1989). Narwhal are harvested by coastal Inuit communities in Nunavut throughout the year under a quota system. The blubber is highly prized by the Inuit for food and is consumed locally or traded to other Inuit communities. The meat is also consumed as food. Narwhal tusks are a valuable economic commodity. Coral Harbour, Chesterfield Inlet, Rankin Inlet, Cape Dorset, Whale Cove, Kimmirut, Arviat, Baker Lake, and Hall Beach.

In 2008, DFO conducted a survey of the summer aggregation area for the Northern Hudson Bay narwhal population. Given apparent defects in the 2008 survey and uncertainty in the results, including the estimation of sustainable catches, a new survey was recommended (DFO 2012a,b). In August 2011, DFO conducted additional aerial surveys of the Northern Hudson Bay summer aggregation area. The 2011 surveys of the summering aggregations of Northern Hudson Bay narwhals produced a population estimate of 12,485 (95% CI: 7,515 to 20,743) (DFO 2012a). On the basis of this survey, an annual Total Allowable Landed Catch (TALC) of 157 narwhals for the Northern Hudson Bay population was allocated (DFO 2012a). In northern Hudson Bay, the harvest quota is to be shared among hunters in Repulse Bay, Coral Harbour, Chesterfield Inlet, Rankin Inlet, Cape Dorset, Whale Cove, Kimmirut, Arviat, Baker Lake, and Hall Beach (DFO 2012b). COSEWIC (2004b) currently recognizes narwhal in the Canadian Eastern Arctic as a species of "Special Concern".

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- LEGEND**
- LOCAL STUDY AREA (LSA)
 - MARINE REGIONAL STUDY AREA (MARINE RSA)

REFERENCE

PROVINCIAL DATA OBTAINED FROM E.S.R.I.
BASE IMAGE OBTAINED FROM STEPHENSON AND HARTWIG, 2010
DATUM: NAD 83 PROJECTION: CANADA ALBERS EQUAL AREA CONIC



PROJECT		AGNICO EAGLE MINES LIMITED MELIADINE GOLD PROJECT NUNAVUT			
TITLE		DISTRIBUTION OF NARWHAL (<i>Monodon monoceros</i>) IN THE MARINE RSA AND ADJACENT ARCTIC WATERS			
		PROJECT NO.		FILE No.	
		DESIGN	AK	19 Jul. 2012	SCALE AS SHOWN
		GIS	DSC	24 Jul. 2012	REV. 0
		CHECK	PR	18 Jan. 2013	FIGURE B-18
		REVIEW	DW	18 Jan. 2013	

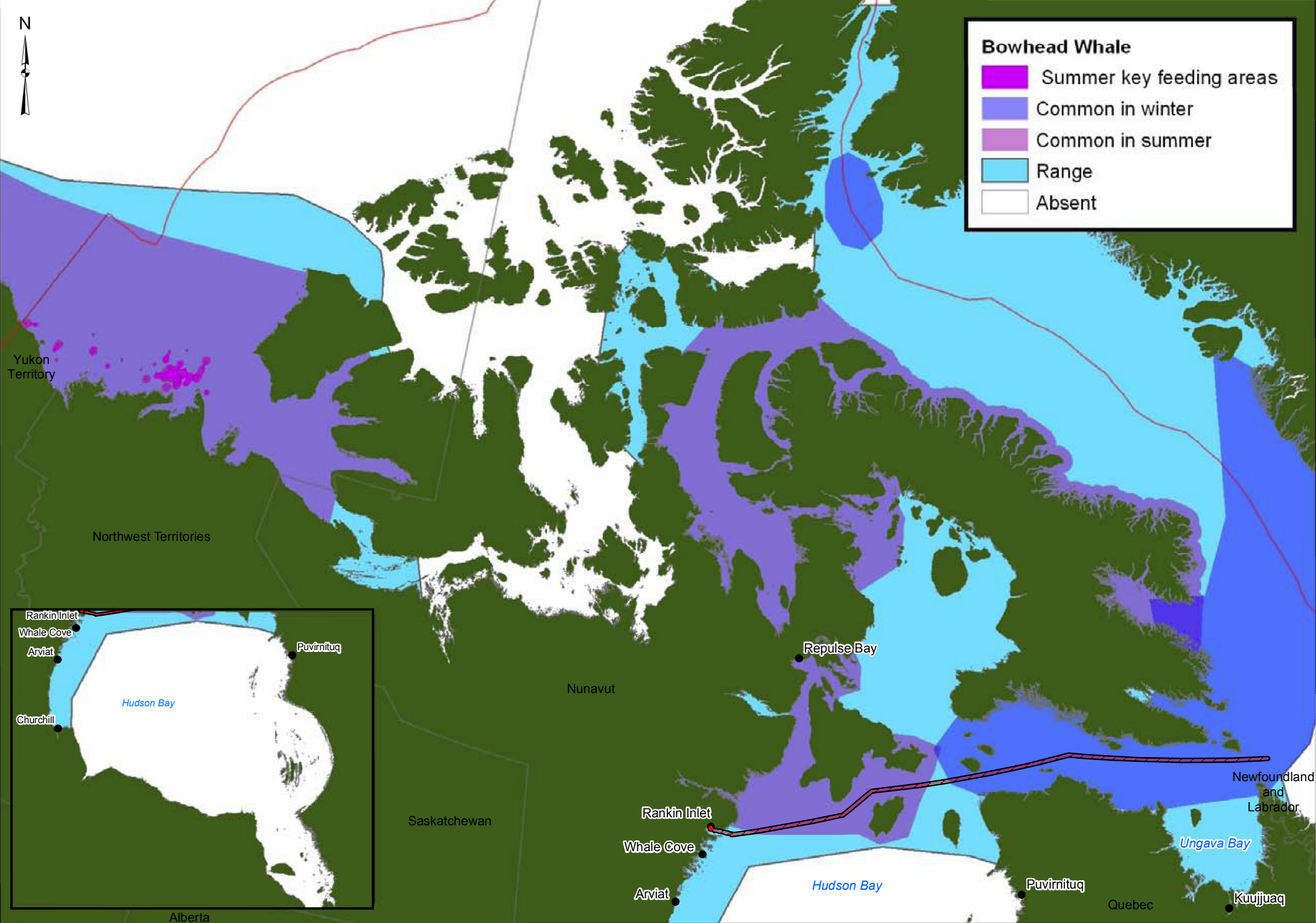


Bowhead whales (*Balaena mysticetus*)

The bowhead whale is the only baleen whale that occurs in circumpolar Arctic waters year-round. This species is especially well adapted to life in seasonally ice-covered seas by having no dorsal fin, a thick blubber layer, a low surface area to volume body ratio, and an enlarged head that they use to break through thick sea-ice (Montague 1993). Males tend to be smaller than females and reach sexual maturity at 12 to 13 m body length (Koski et al. 1993). Females reach sexual maturity at 12 to 14 m (Koski et al. 1993), which corresponds to >25 years in age (Rosa et al. 2004). There is evidence that the lifespan of bowhead whales can exceed 150 years (DFO 1999). Mating is believed to occur in February or March, with calves born from April to early June. Calves remain with their mothers for nearly a year (Koski et al. 1993).

Bowhead whales that occur in Hudson Bay/Hudson Strait belong to the Eastern Canadian Arctic-West Greenland (EC-WG) population, 1 of 4 populations present in Arctic waters. This population has a home range of approximately one million square kilometres, with summering grounds occurring in western Baffin Bay, the Canadian High Arctic, northern Foxe Basin, and northwestern Hudson Bay (COSEWIC 2009). Thus, impacts to the EC-WG bowhead whale population due to the Project have the potential for transboundary effects. Studies indicate that EC-WG bowhead whales travel large distances (Dueck et al. 2006; Ferguson et al. 2010a), may be spread over thousands of kilometres, and may segregate by size, sex, or reproductive status (Finley 2001). In the Hudson Bay region there are important areas of aggregation including the spring nursery area in northern Foxe Basin, northwest Hudson Bay for summering locations and Hudson Strait for wintering habitat in (Higdon and Ferguson 2010). Historic bowhead concentration areas, including possible nursery areas, include Roes Welcome Sound and around Rankin inlet (Reeves and Cosens 2003). The fall migration occurs over 2 to 3 months starting in late August/September. Wintering grounds are located in areas of unconsolidated pack-ice, such as northern Hudson Bay, Hudson Strait, central Davis Strait, southern Baffin Bay, and off West Greenland. These areas provide shelter and protection from their main predator killer whales. During spring, whales from southeastern Baffin Island travel to summering areas in Prince Regent Inlet and Gulf of Boothia by either a southern route via Hudson Strait and Fury and Hecla Strait, or a northern route via Lancaster Sound. In April and May, some bowheads move west transiting through Hudson Strait to their summer aggregation areas in northwest Hudson Bay (Reeves and Mitchell 1990) and also to northern Foxe Basin (NWMB 2000). Bowhead cow-calf pairs have been observed using the flow edge as a nursery area in northern Foxe Basin (Cosens and Blouw 2003). Figure B-19 provides an overview of bowhead whale distribution in the RSA based on historical sightings, current scientific knowledge, and IQ. Seasonal migration and general distribution patterns of EC-WG bowhead whales are thought to be largely dictated by ice conditions (Ferguson et al. 2010a), water depth and temperature (Thomson et al. 1986; Finley 2001; Harwood et al. 2010), predators (NWMB 2000; Finley 2001; Laidre et al. 2008; Ferguson et al. 2010b), and abundance and distribution of their main prey species including euphausiids, copepods, and epibenthic organisms (mysids and gammariid amphipods) (Thomson et al. 1986; LGL 1987; Finley 2001; Harwood and Smith 2002; COSEWIC 2009).

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- LEGEND**
- LOCAL STUDY AREA (LSA)
 - MARINE REGIONAL STUDY AREA (MARINE RSA)

REFERENCE

PROVINCIAL DATA OBTAINED FROM E.S.R.I.
BASE IMAGE OBTAINED FROM STEPHENSON AND HARTWIG, 2010
DATUM: NAD 83 PROJECTION: CANADA ALBERS EQUAL AREA CONIC

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

TITLE

**DISTRIBUTION OF EASTERN CANADIAN ARCTIC / WEST
GREENLAND BOWHEAD WHALES (*Balaena mysticetus*)
IN THE MARINE RSA AND ADJACENT ARCTIC WATERS**

Golder Associates

PROJECT NO.		1535029		FILE No.	
DESIGN	AK	19 Jul. 2012		SCALE AS SHOWN	REV. 0
GIS	DSC	24 Jul. 2012			
CHECK	PR	18 Jan. 2013			
REVIEW	DW	18 Jan. 2013			

FIGURE B-19

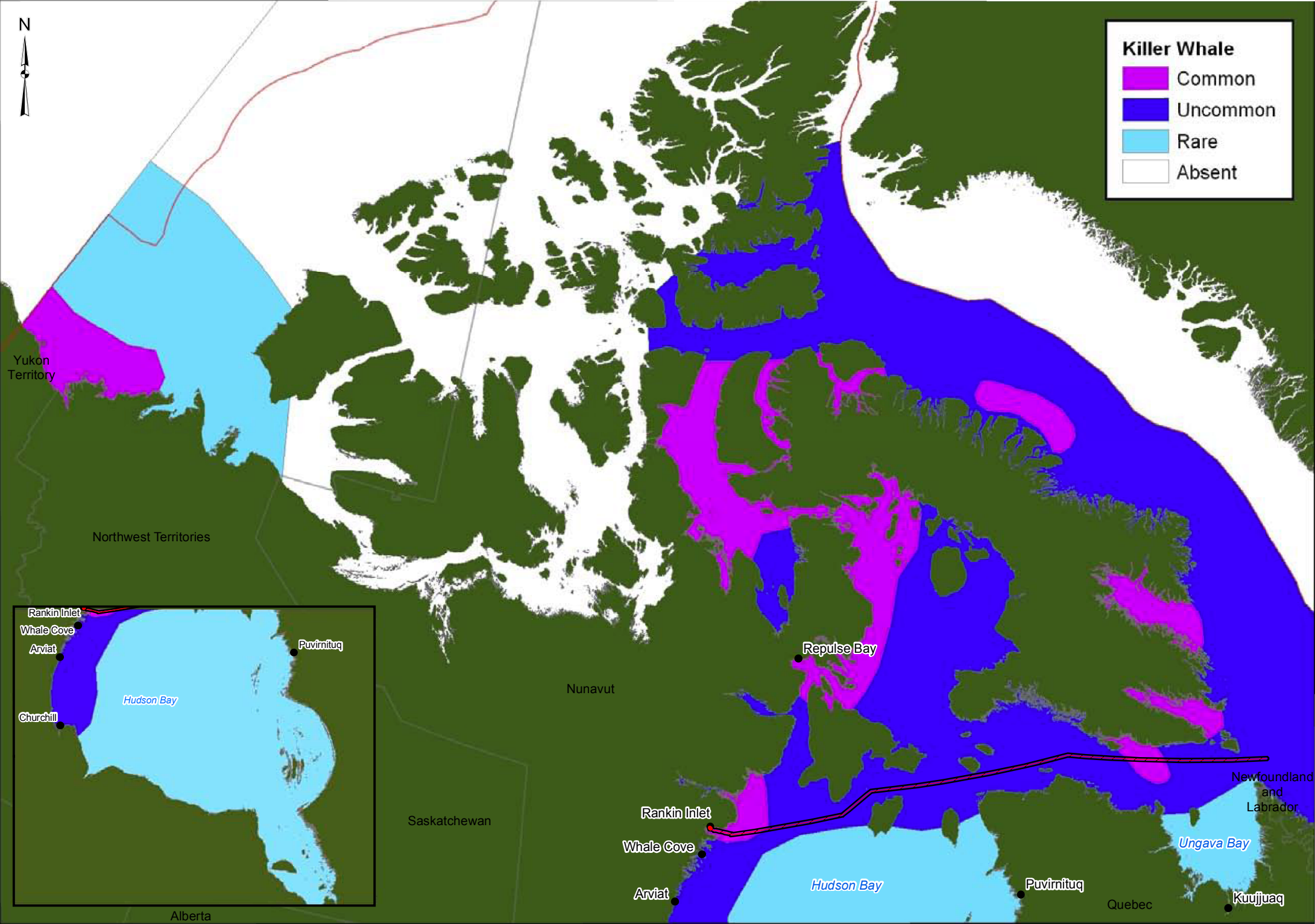


The population of EC-WG bowhead whales is currently estimated at 6,344 animals (95% CI 3119 to 12 906; COSEWIC 2009). EC-WG bowhead whales are currently designated as 'special concern' (COSEWIC 2009) and are being considered for listing under the federal SARA. EC-WG bowhead whales currently support a limited subsistence harvest by Inuit in Nunavut, which is co-managed by the Nunavut Wildlife Management Board (NWMB) and DFO. The population crosses international boundaries and in 2007, the International Whaling Commission granted Greenland a quota of two animals per year from this population pending annual review of the hunt sustainability.

Killer whale (*Orcinus orca*)

Killer whales are widely distributed throughout the Canadian Arctic, where they likely prey on a large variety of marine mammal species, including those harvested by coastal Inuit communities. They are known to migrate into Hudson Bay, Foxe Basin, and the central High Arctic each summer when open-water conditions allow (Dunbar and Moore 1980; Higdon 2007; COSEWIC 2008a), likely seeking out prey, such as seals (Leatherwood et al. 1976) and juvenile bowhead whales (Finley 2001). Declining summer sea ice may be allowing killer whales to expand their range in the Arctic, as they have been observed with increasing frequency in the Hudson Bay region (Higdon 2007). There is little available information on abundance or density of killer whales in Nunavut, and it is unknown if increases in sightings are representative of a growing population (Higdon 2007). The Inuit Traditional Ecological Knowledge of Killer Whales (Westdal 2009) summarised information on killer whales provided by workshop participants from Rankin Inlet, Arviat, Repulse Bay, Igloolik, and Hall Beach. Participants from Rankin Inlet indicated that killer whales have been around for a long time. In the past, there were not many killer whales seen near Rankin Inlet. About half the participants said that sightings have increased in recent years, and two participants mentioned that killer whales have been sighted by people in the community every summer since 2000 (Volume 9, Section 9.3.1.3.3.3). Figure B-20 provides an overview of killer whale distribution in the RSA based on historical sightings, current scientific knowledge (satellite telemetry studies and prey distribution), and IQ. Killer whales are not actively hunted by coastal Inuit communities in the Canadian Arctic.

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- LEGEND**
- LOCAL STUDY AREA (LSA)
 - MARINE REGIONAL STUDY AREA (MARINE RSA)

REFERENCE
PROVINCIAL DATA OBTAINED FROM E.S.R.I.
BASE IMAGE OBTAINED FROM STEPHENSON AND HARTWIG, 2010
DATUM: NAD 83 PROJECTION: CANADA ALBERS EQUAL AREA CONIC



PROJECT		AGNICO EAGLE MINES LIMITED MELIADINE GOLD PROJECT NUNAVUT			
TITLE		DISTRIBUTION OF KILLER WHALE (<i>Orcinus orca</i>) IN THE MARINE RSA AND ADJACENT ARCTIC WATERS			
		PROJECT NO.		FILE No.	
		DESIGN	AK	19 Jul. 2012	SCALE AS SHOWN
		GIS	DSC	24 Jul. 2012	REV. 0
		CHECK	PR	18 Jan. 2013	FIGURE B-20
		REVIEW	DW	18 Jan. 2013	



Polar bear (*Ursus maritimus*)

Polar bears in the Canadian Arctic are segregated into 13 sub-populations, with those occurring in the RSA belonging to the Western Hudson Bay (WHB), Foxe Basin (FB), and Davis Strait (DS) sub-populations (Thieman et al. 2008). Delineation of the geographic separation of these three sub-populations is shown on Figure B-21. Polar bears generally occur at low densities throughout their range and are most abundant in shallow water areas near shore or where currents or upwellings increase biological productivity near ice edges associated with open water, polynyas, or lead systems (Schliebe et al. 2008). The productivity of polar bear habitat is closely linked to the physical attributes of sea ice and the density and distribution of ice-dependent seals, especially ringed and harp seals (COSEWIC 2008b; Peacock et al. 2013). From early winter until spring, polar bears are dispersed predominantly over sea-ice along the coast where they may range >200 km offshore. The annual ice melt generally forces polar bears in Hudson Bay and James Bay ashore from mid-July through late August, when they are at their maximum yearly weight from feeding on fat, newly-weaned seals. IQ on aspects of climate change from residents of Baker Lake and Arviat suggests that ice is melting earlier in recent years (as early as June) and may be forcing bears to retreat ashore sooner than in previous years (GN 2005). Polar bears tend to show long-term site fidelity with respect to preferred terrestrial summering grounds and spend several months of the open-water season in coastal areas, with some individuals also found inland (COSEWIC 2008b). During the summer, the WHB sub-population tends to congregate on coastal capes and headlands between Cape Churchill and Arviat (Figure B-22; Stapleton et al. 2014; Stirling et al. 1999). Arviat residents have reported that polar bears are becoming more common in areas in which they have not been observed previously, particularly during the summer months (GN 2005). The FB polar bear sub-population concentrates along the coastline during late summer and is observed in highest densities on Southampton Island, on several islands near Lyon Inlet, and on coastal islands throughout the Foxe Basin area (Figure B-23; Garshelis et al. 2012). In the Project area, the DS sub-population congregates along coastal areas of Frobisher Bay, on Akpatok Island, and along the northern tip of Ungava Bay (Labrador / Quebec border) at the entrance to Hudson Strait (Figure B-23; Peacock et al. 2013). During the open-water season, polar bears also have been observed offshore swimming in ice-free waters of Hudson Bay as reported during aerial surveys and other field investigations being conducted in the region (S. Atkinson 2013, pers. comm.). The majority of these sightings occurred less than 5 km from shore and in waters adjacent to larger islands (S. Atkinson 2013, pers. comm.; M. Dyck 2014, pers. comm.). No open-water surveys targeting polar bears have been conducted during the summer, and, therefore, no at-sea density estimates are available for this species during this period. However, the number of polar bears occurring offshore during the open-water summer season is thought to be minimal (S. Atkinson 2013, pers. comm.; M. Dyck 2014, pers. comm.).

During fall, there is a gradual northward movement of the WHB subpopulation along the south coast of Hudson Bay, as bears gather to await the formation of new sea ice in November (Amstrup et al. 2007). Some polar bears tagged in the Churchill region moved northward along the Kivalliq Coast as far as Chesterfield Inlet (Stirling et al. 1999). Polar bears may overlap with the RSA and LSA in Melvin Bay during the winter time. During winter and spring, polar bears belonging to the Davis Strait sub-population use the sea ice along Davis Strait, Labrador Sea, and west to Ungava Bay and eastern Hudson Strait (Peacock et al. 2013). During winter, the FB sub-population generally is restricted within the mouth of Hudson Strait (COSEWIC 2008b). Figure B-23 provides an overview of polar bear distribution in the RSA based on historical sightings, current scientific knowledge, and IQ.



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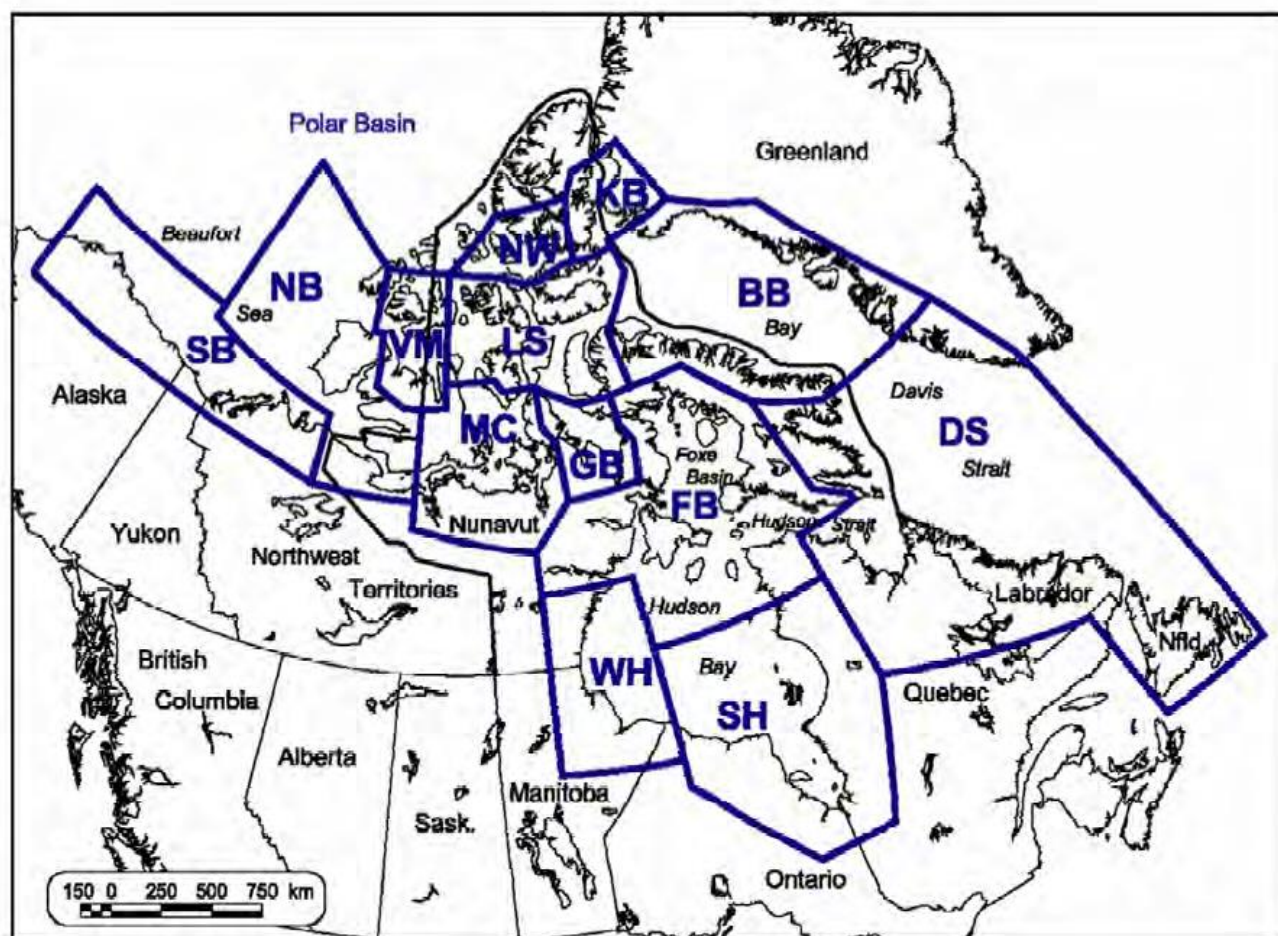


Figure B-21: Canadian Sub-populations of Polar Bears. Abbreviations of Delineated Sub-populations include Viscount Melville Sound (VM), Norwegian Bay (NW), Kane Basin (KB), Lancaster Sound (LS), Baffin Bay (BB), Davis Strait (DS), Southern Hudson Bay (SH), Western Hudson Bay (WH), Fove Basin (FB), Gulf of Boothia (GB), M'Clintock Channel (MC), Southern Beaufort Sea (SB), and Northern Beaufort Sea (NB) (adapted from COSEWIC 2008b)



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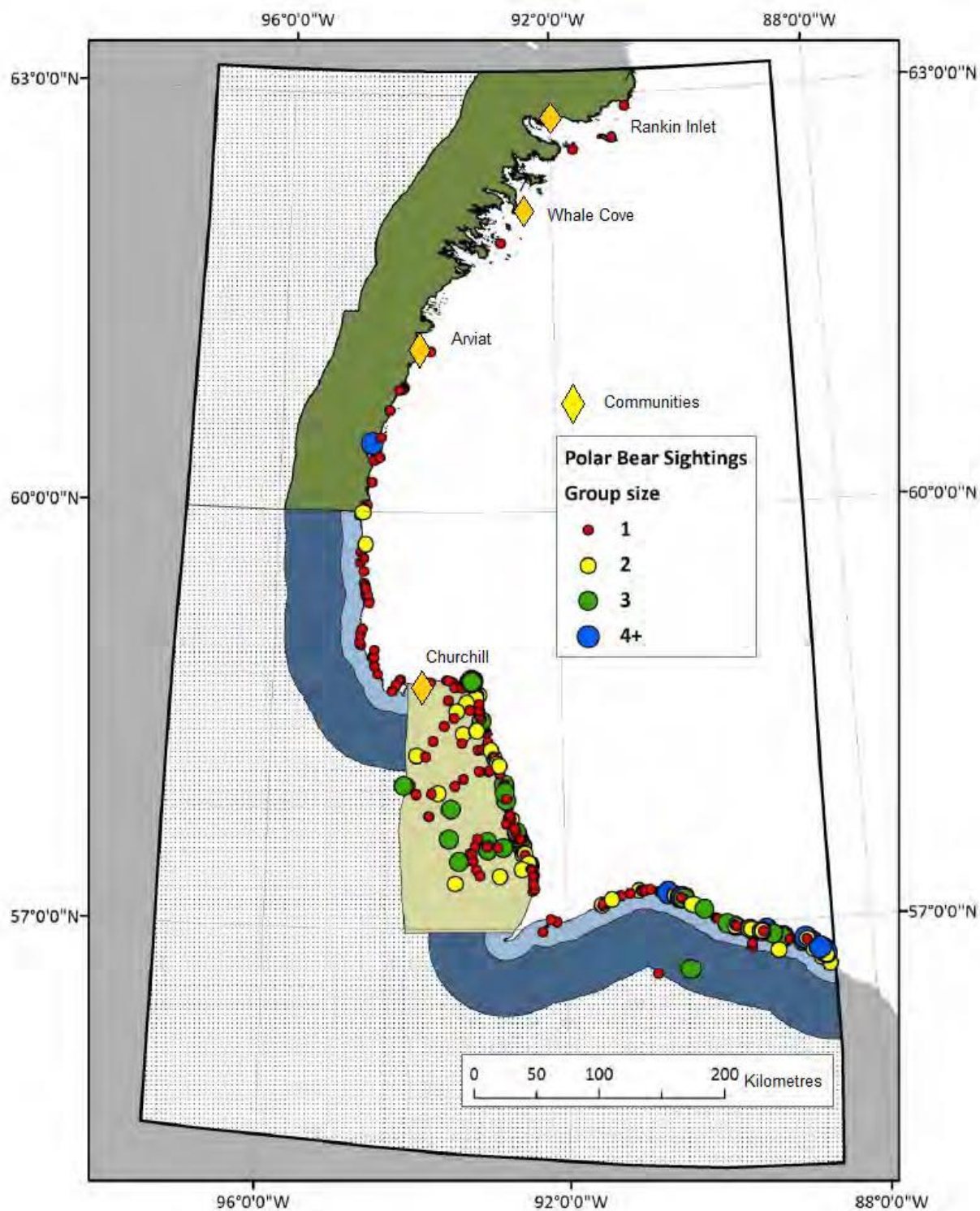
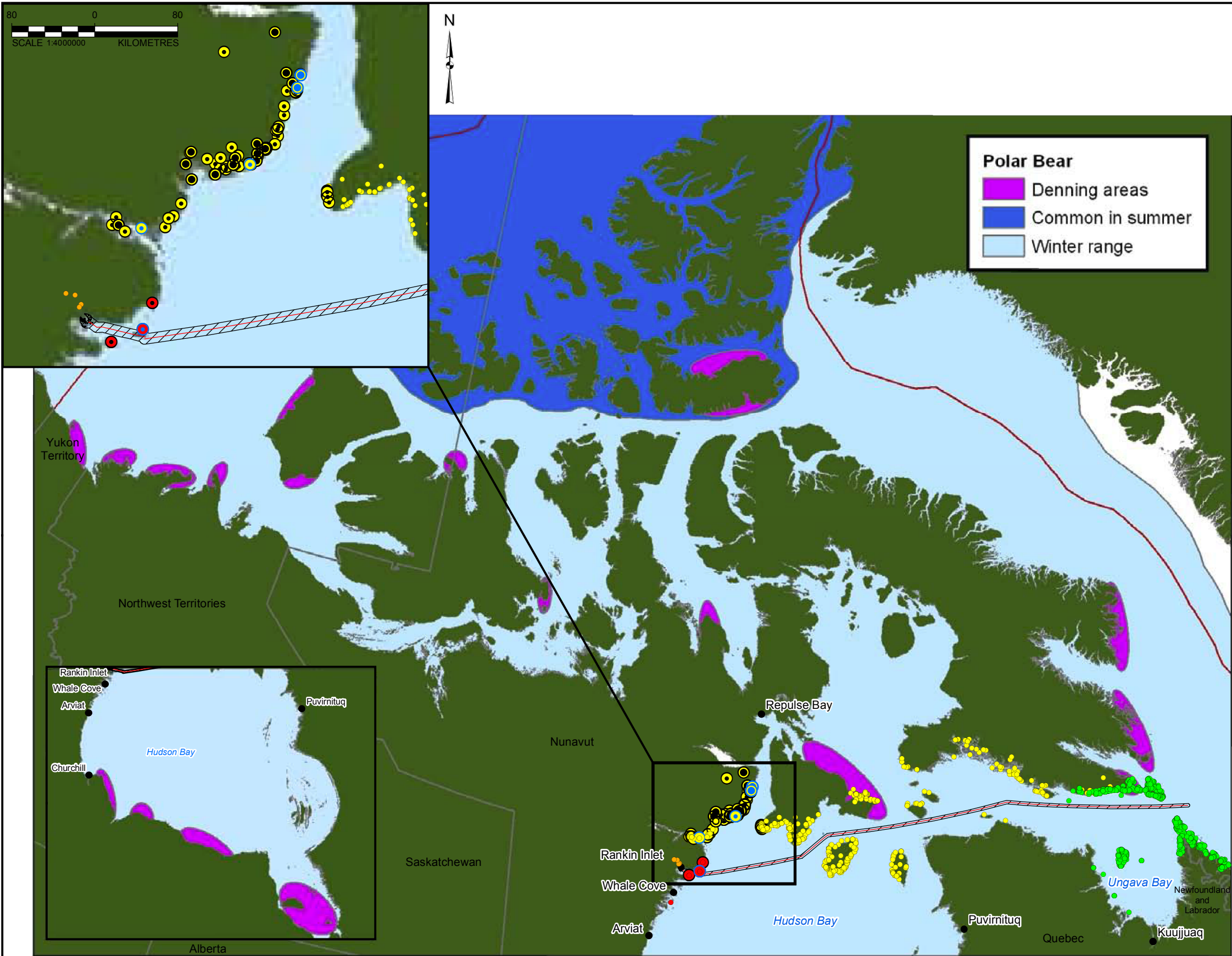


Figure B-22: Polar Bear of the Sightings Recorded During Aerial Surveys in the Western Hudson Bay in August of 2011 (extracted from Stapleton et al. 2014)

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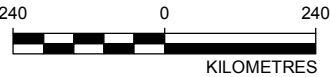
LEGEND

POLAR BEAR SIGHTINGS

- 2009/2010 AERIAL SURVEY SIGHTINGS DURING LATE SUMMER (GN UNPUBLISHED DATA)
- 2005-2007 MARK CAPTURE-RECAPTURE SURVEY (GN UNPUBLISHED DATA)
- WEST HUDSON BAY - AUGUST 2011 AERIAL SURVEY (GN UNPUBLISHED DATA)
- SUMMER POLAR BEAR SIGHTINGS COLLECTED DURING FIELD WORK
- 1 SPOTTING
- >1 SPOTTING
- SPOTTED IN WATER
- SHIPPING ROUTE (APPROXIMATE)

REFERENCE

PROVINCIAL DATA OBTAINED FROM E.S.R.I.
BASE IMAGE OBTAINED FROM STEPHENSON AND HARTWIG, 2010
GOVERNMENT OF NUNAVUT (GN) UNPUBLISHED DATA PROVIDED BY M.DYCK AND S.STAPLETON
DATUM: NAD 83 PROJECTION: CANADA ALBERS EQUAL AREA CONIC



PROJECT		AGNICO EAGLE MINES LIMITED MELIADINE GOLD PROJECT NUNAVUT			
TITLE		DISTRIBUTION OF POLAR BEAR (<i>Ursus maritimus</i>) IN THE MARINE RSA AND ADJACENT ARCTIC WATERS (ADAPTED FROM STEPHENSON AND HARTWIG 2010, GN UNPUBLISHED DATA)			
		PROJECT NO.		FILE No.	
		DESIGN	AK	19 Jul. 2012	SCALE AS SHOWN
		GIS	DSC	24 Jul. 2012	REV. 0
		CHECK	KZ	16 Feb. 2014	FIGURE B-23
		REVIEW	DRW	16 Feb. 2014	



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When the majority of individuals move back onto the ice in November during freeze-up, pregnant females remain on land near the coast to dig maternity dens in deep snowdrifts and frozen ground. Breeding occurs in March to May, implantation is delayed until fall, and birth is generally thought to occur from late November to mid-January. Although some cubs are born in earth dens, most births occur in snow dens that may be occupied for 5 to 6 months during the maternal event (Schliebe et al. 2008). Only pregnant female polar bears den for this extended period of time, during which time they rely on fat stores for energy and sustenance. The average litter size is less than 2. Cubs are dependent upon mothers until after the start of their third year of life. Age of first reproduction is normally 5 to 6 years for females. These factors contribute to the low reproductive potential for the species (Schliebe et al. 2008).

The WHB subpopulation was shown to have declined by 22% between 1987 and 2004, from approximately 1294 individuals in 1,987 to 935 individuals in 2004 (Regehr et al. 2007). However, recent aerial surveys conducted during summer of 2011 estimate abundance of the WHB sub-population at just over 1000 animals (Stapleton et al. 2014). The highest concentrations of bears occurred along the coasts and surrounding islands, particularly in the area south of Arviat. This study is supported by IQ shared by Inuit Elders indicating that the number of polar bears and dens along the western coast of Hudson Bay are increasing (COSEWIC 2008b). Results from a compilation of interviews conducted with local Inuit by the Nunavut Tunngavik Incorporated (NTI) indicate that polar bear numbers in the Rankin Inlet region have been increasing since the 1980s (GN 2005).

The DS sub-population was recently estimated by Peacock et al. (2013) by compiling 35 years of mark-recapture studies. This sub-population was estimated to number 2,158 individuals (± 180 SE) in 2007 - an increase from the last population assessment conducted in 1970. The population is thought to be influenced by low recruitment rates, average adult survival rates, high population density when compared to other sub-populations in the area, as well as high prey density but variable ice conditions. Peacock et al. (2013) suggest that the DS subpopulation appears to be stable and likely may be experiencing the effects of density dependence.

Mark-recapture surveys conducted from 1989 to 1994 estimated the FB sub-population at 2,197 individuals ($+256$ SE) (Taylor et al. 2006). In 2004, the estimated abundance of this sub-population had increased to 2,300 animals. Information from traditional knowledge studies suggested the population was increasing and the opinion of various scientists agreed that an increase may have occurred due to low historical harvests rates (COSEWIC 2008b). Recent aerial surveys conducted during the late summer of 2009 and 2010 generally agreed with these previous population assessments, and estimate polar bear abundance for the FB subpopulation at approximately 2580 individuals (95% CI about 2,100 to 3,200),; Garshelis et al. 2012). The FB sub-population, characterized by average litter sizes, robust annual growth rates, and good body conditions (Garshelis et al. 2012), appears to be near stable taking into account current harvest levels.

Polar bears are harvested by coastal Inuit communities in Nunavut throughout the year under a quota system. The polar bear quota increased from 8 to 21 bears from the 2010-2011 to the 2011-2012 annual quota for the Western Hudson Bay sub-population, which includes the area around the communities of Arviat, Baker Lake, Whale Cove, Rankin Inlet, and Chesterfield Inlet (GN 2011). The 2013-2014 recommended quota is 24 bears (GN 2013). The number of polar bears hunted in Rankin Inlet from 1996 to 2001 ranged from 1 to 13 bears (Priest and Usher 2004). The annual 2013-2014 hunting quota for the FB subpopulation is 106 bears and includes 7 communities in Nunavut and 4 in Quebec (GN 2013; COSEWIC 2008b). The annual quota for the DS



subpopulation was 61 bear for 2012-2013; the recommended 2013-2014 quota is 48 bears (GN 2013). COSEWIC (2008b) currently recognizes polar bears in the Canadian Arctic as a species of “Special Concern”.

Hearing Abilities of Marine Mammals

Marine mammals are acoustically diverse, with wide variations in ear anatomy, frequency range, and amplitude sensitivity (Ketten 1991). An animal's sensitivity to sound varies with frequency. Response to underwater sound likely depends strongly on the presence of and level of sounds in the frequency bands or range of frequencies to which the animal is most sensitive (Richardson et al. 1995a). The general trend is that larger species, such as bowhead whales, tend to have better hearing sensitivities at lower frequency ranges than smaller species, such as beluga whales and narwhal. Hearing abilities are generally only well understood in certain captive species where audiograms (plots of hearing threshold at different sound frequencies) have been developed based on behavioural response studies (reactions to sound) and electrophysiological experiments (measuring auditory evoked potentials) (Erbe 2002).

Toothed Whales (Beluga, Narwhal, Killer Whale)

The hearing abilities of beluga whales and narwhals at high frequencies are exceptionally well developed. This likely is related to their use of high frequency sounds for echolocation. Audible frequencies for toothed whales range from 80 Hz to 150 kHz, but they are most sensitive to sounds in the frequency range of 8 to 90 kHz (Richardson et al. 1995a).

Beluga whales are considered ‘mid-frequency cetaceans’ (Southall et al. 2007), meaning their most sensitive hearing range occurs in the mid-frequency range. Using sound for foraging, navigation, and social purposes, they are a highly vocal species with call types consisting of echolocation clicks, pulsed tones, whistles, and noisy vocals. Echolocation clicks are produced in the 40 to 60 kHz and 100 to 120 kHz range, with source levels reported at 206 to 225 dB re 1 μ Pa at 1 m (Au 1993). Non-echolocation calls (e.g., whistles) are centered on frequencies below 6 kHz, but may sometimes attain frequencies up to 14 kHz (Schevill and Lawrence 1949; Sjare and Smith 1986), with dominant frequencies ranging between 400 Hz and 8.3 kHz. Belugas can detect frequencies as low as 40 to 75 Hz; however, their sensitivity at this range is poor (Awbrey et al. 1988). Beluga whales have been documented to communicate with one another at distances of over 300 to 500 m (Bel'kovich and Shchekotov 1992).

No behavioural or electrophysiological audiograms are available for narwhals. Their vocalizations include echolocation clicks, pulsed tonal calls, and whistles. Narwhal echolocation sounds have been recorded at 40 kHz, with source levels reported at 218 dB re 1 μ Pa at 1 m (Mohl et al. 1990). Pulsed tones are produced in the 500 Hz to 5 kHz range, and whistles have been reported in the 300 Hz to 18 kHz range, with dominant frequencies occurring at 300 Hz to 10 kHz (Ford and Fisher 1978).

Baleen Whales (Bowhead Whales)

On a comparative basis, the baleen whale auditory system does not appear as specialized as that of toothed whales (Ketten 1997). Audiograms are not available for baleen whales due to the lack of these animals in captive settings, which is required (based on current technology) to conduct behavioural and electrophysiological hearing studies. Hearing thresholds and frequency sensitivities in baleen whales are thus inferred from anatomical ear structure, vocalizations, and behavioural studies in the wild (Richardson et al. 1995a). In general,



most baleen whale species have been shown to react to frequencies below 1 kHz (Richardson et al. 1995a). They have an estimated auditory bandwidth of 7 Hz to 22 kHz (Southall et al. 2007).

Hearing in bowhead whales can be inferred indirectly by the frequency at which they vocalize and the levels of sound at which behavioural reactions occur. Bowhead whales have been shown to react to sound with dominant frequencies between 50 and 500 Hz (Richardson et al. 1995a). Avoidance behaviour has been reported when bowhead whales were exposed to low broadband sounds of 90 dB re 1 μ Pa (Richardson et al. 1995a). The majority of the sounds produced by bowhead whales are low frequency-modulated calls, with reported frequency ranges of approximately 25 to 900 Hz (Ljungblad et al. 1982; Clark and Johnson 1984; Cummings and Holliday 1984). Bowhead vocalizations include pulsive and tonal sounds, the latter either descending, ascending, constant, or inflecting in frequency (Clark and Johnson 1984). The duration of bowhead vocalizations range from short 0.5 second signals to long and melodic 4 to 5 second tones (Clark and Johnson 1984). Most single-note tones carry little sound energy above 400 Hz (Wursig and Clark 1993). Source levels from tonal moans and pulsive sounds range from 128 to 185 dB re 1 μ Pa at 1 m, with some vocalizations recorded by hydrophones up to 20 km away from calling whales (Clark et al. 1986).

Singing behaviour is considered to be an advanced form of vocalization in baleen whales (Clark 1991). Songs are composed of units, phrases, and themes; units sung in a sequence form phrases, a repetition of a phrase is a theme, and several themes combined create a song that can last several minutes (Payne and McVay 1971). Songs have been documented to change within and between seasons (Clark and Johnson 1984; Würsig and Clark 1993; Tervo et al. 2007).

Pinnipeds (Seals and Walrus)

Underwater hearing sensitivity in seals and walrus falls in between that of baleen and toothed whales, with an estimated auditory bandwidth between 75 Hz and 75 kHz. Phocinid seals, such as the ringed seal and bearded seal, have underwater hearing thresholds between 60 and 85 dB re 1 μ Pa at 1 m, with flat audiograms between 1 kHz and 30 to 50 kHz (Mohl 1968; Terhune and Ronald 1972, 1975; Terhune 1981). Some phocinids have been documented to be able to detect very high frequency sounds up to 180 kHz, although, their sensitivity to sounds above 60 kHz is poor and frequencies cannot be discriminated (Mohl 1968).

Ringed seal vocalizations include barks, clicks, and yelps, all of which occur in the 400 Hz to 16 kHz frequency range, with dominant frequencies concentrated above 5 kHz (Stirling 1973; Cummings et al. 1984). Source levels are between 95 and 130 dB re 1 μ Pa at 1 m, considerably lower in energy than other marine mammal vocalizations, and likely the reason why ringed seal vocalizations generally are detectable only within 1 km of the source (Cummings et al. 1984).

Bearded seals vocalize in the form of 'songs', which are presumed to be associated with territoriality and courtship (Ray et al. 1969; Budelsky 1993). Songs have been recorded at between 20 Hz and 6 kHz, with dominant frequencies occurring at 1 to 2 kHz, and source levels of 178 dB re 1 μ Pa at 1 m (Ray et al 1969; Stirling et al 1983; Cummings et al. 1984). Unlike ringed seals, bearded seal vocalizations can be detected as far as 25 km from the source (Cleator et al. 1989).

Few studies have measured the audiogram of the walrus. In general, walrus have sensitive hearing to low frequency sounds (Kastelein et al. 2002). A study of an 18-year-old captive walrus reported an optimal hearing range between 1 kHz and 12 kHz, with maximum sensitivity (67 dB re 1 μ Pa at 1 m) occurring at 12 kHz



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(Kastelein et al. 2002). Hearing sensitivity fell gradually below 1 kHz and dropped off sharply above 12 kHz (Kastelein et al. 2002). Walrus vocalizations include bell tones (male-specific), clicks, taps, knocks, rasps, and grunts. The dominant frequencies of most vocalizations occur between 400 and 1200 Hz (Ray and Watkins 1975). Clicks and taps are produced in the 100 Hz to 10 kHz range, with dominant frequencies concentrated below 2 kHz. Rasps are produced in the 200 to 600 Hz range, with dominant frequencies occurring between 400 and 600 Hz. The dominant frequencies of grunts occur below 1 kHz (Scheville et al. 1966; Ray and Watkins 1975; Stirling et al. 1983). Vocalizations in walrus are typically associated with herd organization and coordination behaviour (Richardson et al. 1995a).

Polar Bear

Little is known on underwater hearing abilities in polar bears. In-air hearing has been studied on captive subjects (using auditory evoked potentials to produce audiograms) demonstrating that polar bears can likely hear in-air at a slightly wider range of frequencies than humans (up to 25 kHz) and have absolute hearing thresholds below 27 to 30 dB re 20 µPa at 1 m (Nachtigall et al. 2007).

1.3.2.4 Species at Risk

COSEWIC and SARA-listed species potentially occurring within the RSA include 4 marine bird species and 6 marine mammal species, as outlined in Table B-5.

Table B-5: Species at Risk Potentially Occurring in the Shipping Corridor in Hudson Bay / Hudson Strait

Common Name	Species	SARA Status ^(a)	COSEWIC Status ^(b)
Marine Mammals			
Narwhal	<i>Monodon monoceros</i>	No status	SC
Beluga whale	<i>Delphinapterus leucas</i>	No status	EN – EHB stock SC – WHB stock
Bowhead whale	<i>Balaena mysticetus</i>	No status	SC
Polar bear	<i>Ursus maritimus</i>	SC – Schedule 1	SC
Walrus	<i>Odobenus rosmarus</i>	No status	SC
Killer Whale	<i>Orcinus orca</i>	No status	SC
Marine Birds			
Peregrine falcon	<i>Falco peregrinus tundrius</i>	SC-Schedule 1	SC
Ross's gull	<i>Rhodostethia rosea</i>	TH – Schedule 1	TH
Ivory gull	<i>Pagophila eburnea</i>	EN – Schedule 1	EN
Red knot	<i>Calidris canutus</i>	EN - <i>rufa</i> ssp. – Schedule 1 SC - <i>islandica</i> ssp. – Schedule 1	EN - <i>rufa</i> ssp. SC - <i>islandica</i> ssp.

^(a) SARA (Species at Risk Act). The Act is a key federal government commitment to prevent wildlife species from becoming extinct and secure the necessary actions for their recovery. It provides for the legal protection of wildlife species and the conservation of their biological diversity (extracted from SARA 2012).

^(b) COSEWIC (Committee on the Status of Endangered Wildlife in Canada) is a committee of experts that assesses and designates which wildlife species are in some danger of disappearing from Canada. It is up to Government to legally protect wildlife species designated by COSEWIC. The potential impacts of legal listing are for Government to analyse, and the Species at Risk Act (SARA) applies only to wildlife species on the SARA legal list (extracted from COSEWIC 2012).

EN=Endangered, SC=Special Concern, TH=Threatened



Mitigation measures will be implemented to avoid or minimize any adverse effects from the Project on species at risk (SAR) in the marine environment regardless of the 'significance' of effects determined as part of the assessment. If marine-based SAR are encountered during the Project, including evidence of a SAR (e.g., dens, nests or eggs of a SAR), the primary mitigation measure implemented will be avoidance. A monitoring program will be undertaken to confirm that mitigation measures are successful. The results of monitoring will be provided to the relevant agency with management responsibility for the applicable SAR involved. Mitigation and monitoring strategies will be consistent with applicable status reports, recovery strategies, action plans and management plans that may become available during the Project.

Detailed mitigation measures proposed for the Project effects are discussed in detail in the sections below. In some instances, mitigation measures for one species are also relevant for other species. Follow-up and monitoring is discussed for all species in Section 8.3.11 of the FEIS.

1.3.2.5 Sensitive/Protected Areas

Measures have been taken by federal, provincial, and territorial governments, non-governmental organizations, as well as international organizations to identify, evaluate and protect areas of biological importance in Nunavut's marine and coastal environment. This section provides an overview of these protected areas in Hudson Bay / Hudson Strait in relation to the proposed shipping corridor (RSA).

Marble Island

Marble Island, located approximately 45 km southeast (offshore) of Rankin Inlet (Figure B-24) in proximity to the existing shipping corridor, was identified during the traditional knowledge study as an important congregation area for whales, seals, and birds (FEIS Volume 9, Section 9.3). This area has a long history of diverse use by Inuit who first came to the island as seasonal hunters, taking advantage of its wide variety of wildlife (Davis 1996). Marble Island is formally listed on the Canadian Register of Historic Places (Parks Canada 2012). Stewart et al. (1991) recommended the Rankin Inlet–Marble Island marine area to Parks Canada for consideration as a national marine park to conserve and protect the following key ecological and cultural features of this area:

- a dense, breeding population of threatened peregrine falcons near Rankin Inlet;
- a large breeding colony of common eider on Marble Island;
- anadromous stocks of Arctic char, which are locally harvested by Inuit communities;
- unique oceanographic conditions influenced by the influx of Chesterfield Inlet waters;
- maritime historical sites at Marble Island from the Knight Expedition and the whaling period including 2 shipwrecks; and
- evidence of historical coastal Inuit cultures (Stewart and Lockhart 2005).

Both the exceptional peregrine population and the maritime historical sites at Marble Island are facing increasing human disturbance and would benefit from the protection afforded by National Parks designation as they are



located near the growing community of Rankin Inlet and are a stop for tourists visiting by cruise ship. The area's rocky Canadian Shield shoreline provides a greater variety of marine habitats than the Churchill-Nelson area. Diana and Meliadine rivers provide small-scale estuarine habitats. This area would afford some protection to historical bowhead whale habitats, although more suitable bowhead whale habitat is present to the north in Roes Welcome Sound. All Project vessels along the shipping route will maintain a minimum distance of 2 km from Marble Island in order to avoid disrupting sensitive marine species located on or around the Island.

Ecologically and Biologically Significant Areas

DFO has identified a number of Arctic Ecologically and Biologically Significant Areas (EBSAs) in Hudson Bay and Hudson Strait using criteria from the Convention on Biological Diversity (Cobb 2011). These areas have been previously identified as important in ecosystem overviews, stock status reports, and traditional knowledge studies. Those EBSAs in the Hudson Bay Complex biogeographic region that overlap with the proposed shipping corridor are described below and illustrated in Figure B-24:

Southampton Island (including Coats Island) (EBSA 1.5)

- Largest island in Hudson Bay and situated near the confluence of Hudson Bay and Foxe Basin waters resulting in dynamic oceanographic mixing, and high marine productivity.
- Summer and winter use by the Northern Hudson Bay-Davis Strait population of Atlantic Walrus (Special Concern under COSEWIC).
- The waters surrounding Southampton Island are important spring and fall migration routes for beluga whales (Endangered under COSEWIC) and EC-WG bowhead whales (Special Concern under COSEWIC).
- Important nesting areas occur on Coats Island for seabirds (thick-billed murre, common eider, and black guillemot), which feed on aggregations of marine fish (e.g., capelin and Arctic cod) (Mallory and Fontaine 2004). The largest single colony of common eider in Nunavut occurs in East Bay.
- Southampton, Coats, and Mansel islands also are considered important denning and summer refuge habitat for the Foxe Basin polar bear population. Polar bears also frequent the land-fast ice adjacent to the islands in winter.
- Data confidence for this area is high due to intensive marine bird studies, tagging and survey data for marine mammals, and published IQ. The Southampton Island area scores high for several EBSA criteria.

Western Hudson Bay (Whale Cove to Arviat) (EBSA 1.6)

- Important area for beluga, killer whale, seabirds and Arctic char.
- Dense kelp beds occur along the coastline and provide important habitat for fish in the area.
- Area supports a wealth of LEK and TEK from the communities of Whale Cove, Rankin Inlet, and Arviat on the importance of marine mammals and fish (DFO 2011a).
- Important Arctic char stocks exist in this area and use the marine environment for feeding.



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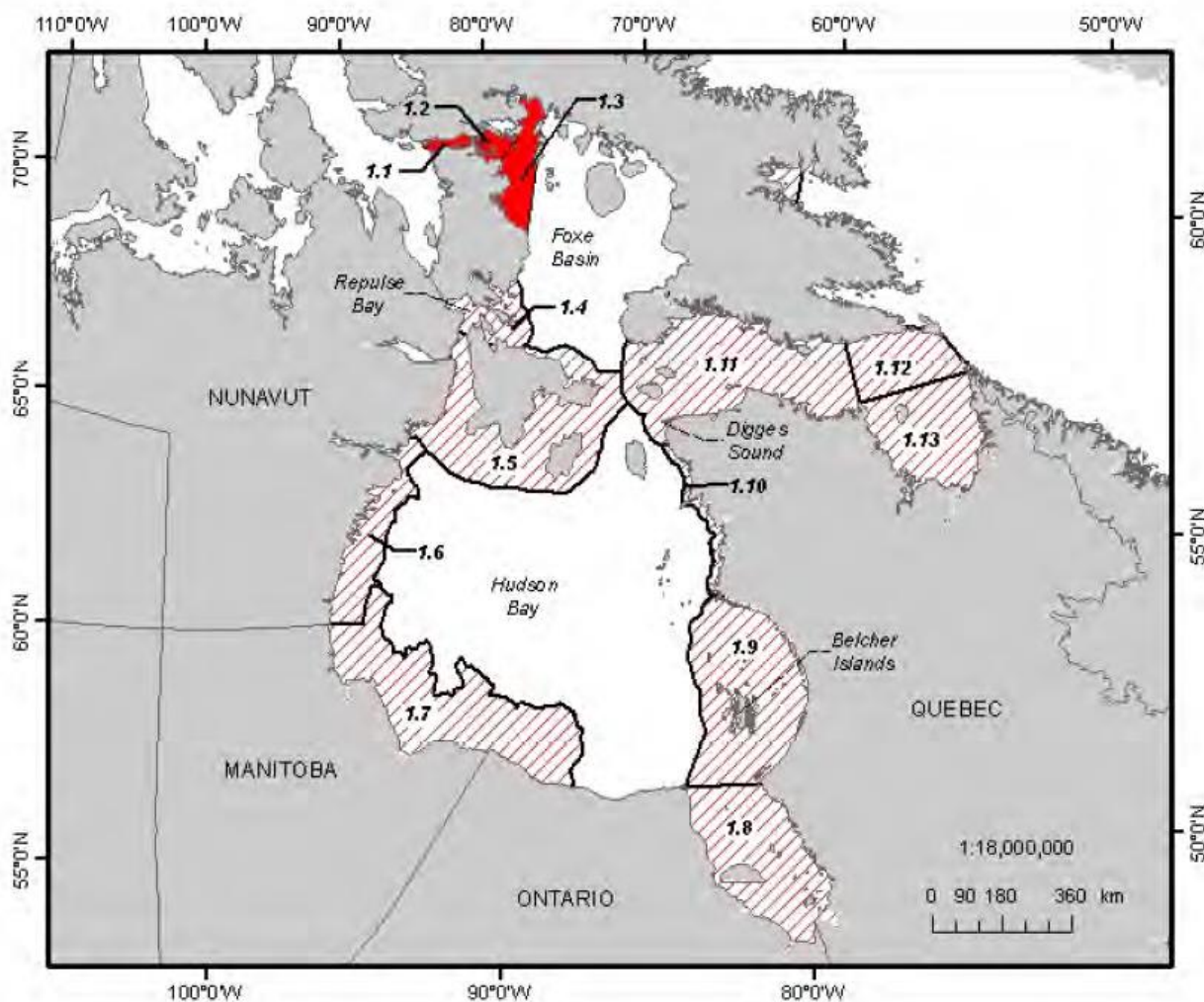


Figure B-24: Preliminary EBSA Identification Results for Foxe Basin (in solid red; 1.1 to 1.3) and for Hudson Bay / Hudson Strait (in red hatched lines; 1.4 to 1.12) as Determined Through a Series of Workshops Conducted in 2009 (DFO 2010b) (extracted from Cobb 2011)

Western Hudson Bay/Churchill/Nelson/Seal Estuaries (EBSA 1.7)

- The Nelson and Churchill estuaries provide an important habitat for a number of marine mammals and fish including the world's largest summer aggregation of beluga whales (Endangered under COSEWIC). Up to 3000 beluga whales congregate annually in the Nelson River estuary, with smaller numbers in the Churchill River estuary, to rear young and feed in these waters. Although the reason for these aggregations is not known, 2 commonly reported hypotheses are 1) thermal advantage from warm freshwater to initiate moulting; and 2) an evolutionary adaptation to take refuge from predation by killer whales in the shallow estuaries. Aggregations of approximately 70 000 beluga whales in this area are important for population fitness consequences.



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- The Churchill region represents a key denning, feeding, and point of mobilization for Western Hudson Bay polar bear, which head north along the newly formed sea-ice to hunt ringed seal during fall/winter.
- A high degree of certainty exists for biophysical data available for this area due to Manitoba Hydro EIA Projects on the Nelson and Churchill rivers, as well as ongoing studies investigating the effects of climate change on marine mammals.
- The Seal River estuary was identified in 1999 as an Important Bird Area and is globally important for migrating black scoter.
- The Seal River is a Canadian Heritage River and remains a pristine, high-grade, remote wilderness river. It is the largest remaining undammed river in northern Manitoba. Harbour seals travel considerable distances up the Seal River estuary, representing an important adaptation to the freshwater environment by a marine mammal.
- The Province of Manitoba has designated a number of legally protected and managed lands, and identified Areas of Special Interest (candidate protected areas) along the Manitoba coastline for various ecological and biological reasons.
- Five internationally recognized Important Bird Areas have been identified along this part of Hudson Bay.
- Wapusk National Park and the provincially designated Churchill Wildlife Management Area, which extends to the Manitoba border and protects one of the world's largest known polar bear maternity denning areas. This national park also protects important caribou habitat. Similarly, the Kaskatamagan Wildlife Management Area (provincial designation) was established to protect the fragile coastal and tundra ecosystems and to protect important habitat for a number of bird species. The Churchill Special Conservation Area, designated to conserve and protect the Ross's gull, is also an integral part of the primary polar bear migration corridor in Manitoba.
- Hubbard Point, located north of the Seal River estuary, is an aggregation area for older male polar bears during the ice-free season. Beluga whales also congregate in waters off Hubbard Point, which is part of the North Hubbard Area of Special Interest.

West and Central Hudson Strait (EBSA 1.10):

- Serves as a key channel for Arctic waters via Foxe Basin, the outflow of Hudson Bay water, and also periodic intrusions of Atlantic water into northeastern Hudson Bay.
- Major seasonal migration route for all marine mammals that spend the summer in Hudson Bay and Foxe Basin and winter in either Hudson Strait or Davis Strait, including beluga whale, narwhal, and bowhead whale. The use of Hudson Strait by migrating marine mammals has been well documented through tagging studies and IQ.
- Walrus spend winters in west and central Hudson Strait on ice flows and on islands, such as Nottingham and Salisbury, where strong currents maintain open water. Walrus also overwinter on the northern shore of Hudson Strait near Kimmirut.
- Productivity is higher in West and Central Hudson Strait than Foxe Basin or Hudson Bay.



Support a number of important seabird nesting and feeding areas that occur on the northern and southern shores. Twenty percent of the North American population of thick-biller murres and a small colony of Atlantic Puffins are found near the Digges Sound and 10% of the Canadian population of common eiders breed and feed near Markham Bay (Mallory and Fontaine 2004).

- Physical oceanography in this EBSA has been well studied as part of long-term studies on Arctic flow-through.

Eastern Hudson Strait (EBSA 1.11):

- Heavily influenced by oceanographic conditions from Davis Strait resulting in high productivity.
- Important area for shrimp - Canadian Shrimp Fishing Area 3 occurs near Northern Ungava Bay eastward to Resolution Island.
- Supports western extent of Greenland halibut habitat.
- Provides significant overwintering refuge for Hudson Bay beluga whales and approximately 5000 to 8000 bowhead whales during winter.
- Support important occurrences of cold water corals in the deeper waters of the strait (Kenchington et al. 2011).

Ungava Bay (EBSA 1.12):

- Support Ungava Bay beluga whale stock, which has been reduced to as few as approximately 50 animals and may be extirpated (presently listed as Endangered under COSEWIC).
- Support important occurrences of corals in the deeper waters of the bay (Kenchington et al. 2011).
- Support 2 large colonies of thick-billed murre on Akpatok Island (Mallory and Fontaine 2004). Collectively, these colonies constitute the largest number of breeding thick-billed murre in Canada (>20% of the Canadian population). Black guillemots also nest along the Akpatok Island coast.
- A large portion of the breeding population of common eiders aggregate on the islands off the western shore of Ungava Bay. Key nesting sites occur at the Eider, Plover, Payne, and Gyrfalcon islands and the islands of northeastern Ungava Bay.
- Approximately 80 to 100 polar bear (~5% of the Davis Strait population) den and rear cubs along the southern shore of Akpatok Island during summer.

National Parks

To date, Parks Canada has established 2 National Parks in the Hudson Bay marine ecosystem: Wapusk and Ukkusiksalik (Stewart and Lockhart 2005). Wapusk National Park, established on 24 April 1996, is situated east of Churchill and protects an area of 11 475 km² that extends southward from Cape Churchill. Resources within the boundaries of the park are of national and international importance, including one of the world's largest known polar bear denning areas, and vital habitat for hundreds of thousands of waterfowl and shorebirds that nest along the coast of Hudson Bay or gather and feed there during the annual spring and fall migrations



(Stewart and Lockhart 2005). Park management is overseen by a board with representatives from the federal and provincial governments, the municipality of Churchill, and the First Nations of Fox Lake and York Factory. Ukkusiksalik National Park, established on 23 August 2003, extends westward from Roes Welcome Sound to include Wager Bay and the Brown and Piksimanik rivers, encompassing an area of 23 500 km² (Stewart and Lockhart 2005). Inuit residents from the Kivalliq communities, including Chesterfield Inlet, use this area for subsistence hunting and fishing.

Parks Canada also has identified several marine regions in arctic Canada within which it plans to recognize as Natural Areas of Canadian Significance. Two of the Natural Areas of Canadian Significance overlap with the proposed RSA, including Hudson Bay and Hudson Strait (Stewart and Lockhart 2005). The National Marine Parks Policy guides this process. Each area is intended to represent the natural, historical, and cultural diversity within a region. While National Marine Parks have yet to be established in northern Canada, Parks Canada has sought advice on which areas might make the best and most representative marine parks in the Hudson Bay and Hudson Strait marine regions. In Hudson Bay, Stewart et al. (1991) recommended 2 areas to Parks Canada for consideration as national marine parks – the Churchill-Nelson area and the Rankin Inlet-Marble Island area.

The Churchill-Nelson area was recommended for consideration as a National Marine Park prior to the establishment of Wapusk National Park, with the primary goal to protect the summer resident population of beluga whales in the Nelson, Churchill, and Seal rivers estuaries (known as the largest concentration of beluga whales in the world) (Stewart and Lockhart 2005). Other important physical, biological, and human use characteristics of this area include 1) extensive low-lying marshy coastal plains with wide tidal mud flats; 2) large estuarine habitats of the Churchill and Nelson rivers; 3) exceptional autumn concentrations of polar bears on the islands and headlands near Cape Churchill; 4) breeding shorebirds and waterfowl including the common eider; and 5) pre-historical coastal cultures, historical ports of entry instrumental in the exploration and development of central Canada, and the region's only deep water port for international shipping (Stewart and Lockhart 2005).

As noted earlier, the Rankin Inlet-Marble Island area was recommended as a National Marine Park to conserve and protect several key ecological and cultural features in this area (Stewart et al. 1991). The area of Hudson Strait immediately northeast of the Hudson Bay marine region was recommended as the most representative candidate for consideration as a future national marine park in the Hudson Strait marine region (DFO 2005b).

Migratory Bird Sanctuaries

Environment Canada's Canadian Wildlife Service (EC-CWS) has established 11 migratory bird sanctuaries in Nunavut to control and manage areas of key importance for the protection of migratory bird species and their habitat (Stewart and Lockhart 2005). Three of these sanctuaries occur within, or in the vicinity of, the proposed RSA: the McConnell River Migratory Bird Sanctuary south of Arviat, and the Harry Gibbons and East Bay Migratory Bird Sanctuaries on the southeast coast of Southampton Island. Both areas include terrestrial, wetland, and marine habitats, with the latter typically consisting of nearshore foraging areas for migratory birds. The Migratory Birds Convention Act prohibits activities in Migratory Bird Sanctuaries. Canadian Wildlife Service manages the activities that can be carried out within these areas. Prohibitive measures are placed on what activities can occur in these areas, as outlined in the Bird Sanctuary Regulations. Although important fish habitat could be protected through migratory bird sanctuaries, it is not an effective measure unless there is valuable bird habitat associated with the area that coincides with important or critical fish habitat.



The McConnell River Migratory Bird Sanctuary, established in 1960 to protect a small colony of lesser snow geese, encompasses 32 800 hectares (ha) along the west coast of Hudson Bay south of Arviat. This sanctuary is owned by the Coastal Inuit of Nunavut and subject to co-management agreements under the Nunavut Land Claims Agreement (Stewart and Lockhart 2005). Subsistence hunting and fishing activities presently occur within the sanctuary, mostly by community members of Arviat. In 1982, under the terms of the Ramsar Convention, the sanctuary was designated as a “Wetland of International Importance especially as Waterfowl Habitat” (Ramsar Site 248) because it provided major nesting habitat for multiple migratory bird species including Canada geese, lesser snow geese, and Ross’s goose. Up to 200 000 birds colonize this sanctuary on an annual basis, with habitat degradation presently occurring due to a local increase in the snow goose population (Stewart and Lockhart 2005).

The Harry Gibbons Migratory Bird Sanctuary is located on Southampton Island in northern Hudson Bay, encompassing extensive tidal flat and wetland habitat areas along the Boas River delta and associated estuarine environment in the Bay of God’s Mercy. This area supports large nesting colonies of lesser snow goose (population >500 000 birds in 1997), Atlantic brant, Canada goose, and tundra swan (Stewart and Lockhart 2005). Smaller breeding colonies of migratory birds are located outside the sanctuary at Ell Bay and Bear Cove (Stewart and Lockhart 2005).

The East Bay Migratory Bird Sanctuary is located on Southampton Island near the community of Coral Harbour. Established in 1959, this area encompasses 113 800 ha including marine, intertidal, and subtidal components. Notable bird species include Arctic tern, Atlantic brant, lesser snow goose, Canada goose, common and king eider, black guillemot, jaeger, herring and Sabine’s gull, red knot, red phalarope, red-throated loon, ruddy turnstone, and several species of plover and sandpiper.

Important Bird Areas

Important Bird Areas (IBAs) are sites recognized as being globally important habitat for the conservation of bird populations, as designated by Bird Studies Canada, Nature Canada, and Birdlife International (Birdlife International 2012), an international bird protection organization. Collectively, these organizations support the international conservation of discrete sites that provide habitat for threatened birds, large groups of birds, and birds restricted by range or by habitat. Three Important Bird Areas occur within, or in the vicinity of the RSA; including Harry Gibbons and East Bay Migratory Bird Sanctuaries (sites #NU022 and #NU023 respectively) on Southampton Island, and McConnell River Migratory Bird Sanctuary south of Arviat.

International Biological Programme

In 1975, the International Biological Programme recognized a number of areas of biological, geological, and historical importance in northern Canada that were in urgent need of special protection (Nettleship and Smith 1975). Several of these areas, which have since been offered protection, and which occur within or in the vicinity of the RSA, include McConnell River (McConnell River Migratory Bird Sanctuary), and Boas River (Harry Gibbons Migratory Bird Sanctuary). Other areas near the RSA that have been identified as International Biological Programme sites but are not yet protected include Coats Island and Digges Islands. Coats Island is located northeast of Southampton Island. Digges Islands (West and East) are located in Digges Sound, at the northwest tip of the Ungava Peninsula in Western Hudson Strait. Both areas support key terrestrial habitats for migratory birds and seasonal habitats for several marine mammal species (Nettleship and Smith 1975).



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Key Marine Habitat for Migratory Birds

EC-CWS has established 'key marine habitat' sites for migratory birds located near the proposed shipping route. Some of these sites overlap with existing protected/sensitive areas such as migratory bird sanctuaries designated by EC-CWS, IBAs, and/or International Biological Program sites. These areas were primarily established to protect terrestrial or coastal resources for marine birds. 'Key marine habitat' sites designated by EC-CWS aim specifically to identify important marine habitat areas for marine avifauna. Not all of these sites are protected under legislation; however, as local knowledge increases regarding habitat use and the overall importance of these sites to marine birds, legal protection status may follow. Generally, these areas are used by marine birds from late April through September. Additional details on the key marine habitat sites for migratory birds located near the proposed shipping route are summarized in Table B-6 and Figure B- 8 (adapted from Mallory and Fontaine 2004).

Table B-6: Environment Canada Key Marine Habitat Sites for Migratory Birds Located Near the Proposed Shipping Route

Site Name	Sensitivities	Biological Significance	Status	Size (km ²)		Distance from shipping lane (km)
				Marine	Land	
Coats Island near Cape Pembroke	Sensitive to disturbance of important nesting sites along coast, important foraging grounds and staging / breeding areas in the marine environment, and key migratory corridors. Concerns around increases in vessels in the area coming close to Coats and Walrus islands.	Important nesting areas occur on Coats Island for seabirds (thick-billed murre, common eider, and black guillemot), which feed on aggregations of marine fish (e.g., capelin and Arctic cod). Glaucous gull and peregrine falcon can be found along the cliffs at the colonies. Home to a large Iceland gull (<i>Larus glaucoides</i>) colony and the largest single colony of common eider in Nunavut occurs in East Bay.	International Biological Programme site (Region 9, Site No. 6-3) and an IBA (NU005).	1918	0	Overlaps
Digges Sound	Sensitive to disturbance of important nesting sites along coast, important foraging grounds and staging / breeding areas in the marine environment, and key migratory corridors. Concerns around increases in vessels in the area. Colonies are considered to be some of the most disturbed by human activities in the Canadian Arctic.	20% of North American population of thick-billed murre and a small colony of Atlantic puffin (<i>Fratercula arctica</i>) and razorbill (<i>Alca torda</i>) occur near Digges Sound. 10% of the Canadian population of common eider breed and feed near Markham Bay. Other species that also breed here are black guillemot, glaucous gull, Iceland gull, herring gull, and Arctic tern.	International Biological Programme site (Region 9, Site No. 6-7) and an IBA in Canada (NU001).	2207	102	~3



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Table B-6: Environment Canada Key Marine Habitat Sites for Migratory Birds Located Near the Proposed Shipping Route

Site Name	Sensitivities	Biological Significance	Status	Size (km ²)		Distance from shipping lane (km)
				Marine	Land	
Frobisher Bay	<p>Sensitive to disturbance of important nesting sites along coast, important foraging grounds and staging / breeding areas in the marine environment, and key migratory corridors. Concerns around increases in vessels in the area and potential hydrocarbon exploration.</p> <p>The complex nature of currents in the region suggests that a potential oil spill in southern Davis Strait could not reach this marine area.</p>	<p>Colony of 3% of Canadian thick-billed murre population. Glaucous gull, black-legged kittiwake, and possibly Northern fulmar breed here. Nearby Loks Land is thought to support Nunavut's largest known colony of razorbill (not been visited since 1953). Dovekies congregate off the Hall Peninsula in August. An important nesting, feeding, and migration stop-over for common eider, Iceland gull, ivory gull, and harlequin duck (<i>Histrionicus histrionicus</i>). Canada goods and long-tiled ducks may also be found here.</p>	<p>Hantzsch Island is an International Biological Programme site (Region 9, Site No. 7-10) and a Canadian IBA (NU025).</p>	12442	1336	Overlaps
Button Islands	<p>Sensitive to disturbance of important nesting sites along coast, important foraging grounds and staging / breeding areas in the marine environment, and key migratory corridors. Concerns around increases in vessels in the area and potential hydrocarbon exploration.</p> <p>The complex nature of currents in the region suggests that oil spills in southern Davis Strait could enter this marine area.</p> <p>Oil spills associated with shipping could endanger a large number of marine birds and pollute their feeding areas.</p>	<p>Black-legged kittiwake and northern fulmar forage near the Button Islands. Ivory gulls and common eider have been observed. Thick-billed murre breed here.</p>	<p>International Biological Programme site (Region 9, Site No. 6-8).</p>	3909	81	Overlaps



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Table B-6: Environment Canada Key Marine Habitat Sites for Migratory Birds Located Near the Proposed Shipping Route

Site Name	Sensitivities	Biological Significance	Status	Size (km ²)		Distance from shipping lane (km)
				Marine	Land	
Akpatok Island	<p>Sensitive to disturbance of important nesting sites along coast, important foraging grounds and staging / breeding areas in the marine environment, and key migratory corridors - particularly for murre.</p> <p>Shoreline around Akpatok Island is considered to be "high hazardous risk of oil spills".</p> <p>Concerns around increases in vessels in the area and potential hydrocarbon exploration.</p> <p>The complex nature of currents in the region suggests that oil spills in southern Davis Strait could reach this marine area.</p> <p>Oil spills associated with shipping could endanger a large number of marine birds and pollute their feeding areas.</p>	<p>Large breeding colony of thick-billed murre. Black guillemots also nest along the Akpatok Island coast. Black guillemot nest along the island's coast.</p> <p>Peregrine falcon and glaucous gull also breed here.</p>	<p>Biological Programme site (Region 9, Site No. 6-6) and an IBA in Canada (NU007).</p>	4943	859	82
Ungava Bay Archipelagoes	<p>Sensitive to disturbance of important nesting sites along coast, important foraging grounds and staging / breeding areas in the marine environment, and key migratory corridors.</p>	<p>Support a large portion of breeding common eider. Eider occur in this area from April through October</p>	<p>The Plover and Payne, Gyrfalcon, and north eastern Ungava Bay islands are Canadian IBA (NU027, NU028, NU029).</p>	5624	5	93
Sleeper Islands	<p>Degradation of staging and foraging areas, particularly for eiders.</p> <p>Potential hydrocarbon exploration.</p> <p>Prevailing west and north west winds render the east coast of the Bay most susceptible to oil damage.</p>	<p>Common eiders nest here in the summer months. Over 30 species of birds have been observed in the Sleeper Islands.</p>	<p>IBA site (NU033).</p>	1880	90	536



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Table B-6: Environment Canada Key Marine Habitat Sites for Migratory Birds Located Near the Proposed Shipping Route

Site Name	Sensitivities	Biological Significance	Status	Size (km ²)		Distance from shipping lane (km)
				Marine	Land	
Belcher Islands	Degradation of staging and foraging areas, particularly for eiders. Excessive harvest of down from breeding colonies. Potential hydrocarbon exploration. Prevailing west and north west winds render the east coast of the Bay most susceptible to oil damage.	Common eider nest here in the summer. In the winter, polynyas and the floe edge support substantial numbers of common eider and long-tailed duck.	The North Belcher and South Flaherty islands are Canadian IBA (NU031, NU100).	5 to 15 recurrent, small polynyas		680
Northern Ontario Coastline	Degradation of staging and foraging areas, particularly for ducks. Potential hydrocarbon exploration.	Black scoter moult along this marine area feeding on blue mussels and other molluscs. Common eiders are year-round residents. Canada geese and lesser snow geese make use of coastal areas.	Waters in James Bay are part of the James Bay Preserve.	7860	41	607
Markham Bay	Disturbance and sensitivity to potential pollution of foraging, staging and migrating areas.	Support a large portion of breeding common eider. Support substantial numbers of Kumlien's gull (<i>Larus glaucooides kumlieni</i>) colonies and black guillemot. Eiders occur in this area from April through October.	No special designation.	4015	423	58
East Bay	Disturbance and sensitivity to potential pollution of foraging, staging and migrating areas.	Supports Arctic Canada's largest single colony of common eider. Supports colony of black guillemot and a large population of lesser snow goose. Substantial numbers of Atlantic brant and Sabine's gull also breed here. Supports some of the highest known breeding densities of shorebirds in the eastern Arctic. Red phalarope are the most common shorebirds.	Migratory Bird Sanctuary and a Canadian IBA (NU023).	274	1	84



Areas of High Biological Importance

Fisheries and Oceans Canada sponsored an Arctic Marine Workshop to bring together expert knowledge on marine fauna and habitat use in the Canadian Arctic (Stephenson and Hartwig 2010). The objective of the workshop was to identify overlapping areas of habitat use by different Arctic species, and, therefore, areas of High Biological Importance (HBI) to wildlife. In total, 19 HBI were identified; 3 of these occur within, or in the vicinity of, the proposed RSA including Southampton Island, Chesterfield Inlet, and Hudson Strait. The Southampton Island HBI extends from Cape Bylot to Ell Bay and includes the north and west coasts of Coats Island. This area provides important habitat for several species of seal, walrus (including an overwintering area), and numerous marine bird species. It also provides key denning habitat for polar bears and important foraging grounds for bowhead whales. The Chesterfield Inlet HBI consists of the Hudson Bay coast from Whale Cove to Arviat. This area provides key habitat for beluga whales, killer whales, several species of seal, Arctic char, and several seabird species along the coast. The Hudson Strait HBI, which includes Akpatok, Salisbury, and Nottingham Islands, has been identified as being amongst the most productive areas in the Arctic (Stephenson and Hartwig 2010), supporting several large seabird colonies along the coast, key shrimp habitat, and important overwintering areas for several marine mammals including narwhal, beluga whale, and walrus. This area is known to be more productive than Hudson Bay due to an increased level of surface mixing and a large tidal exchange. The ice edge, which extends the length of the Strait during winter, is also considered dynamic habitat for numerous Arctic marine species.

Bowhead Whale Critical Habitat Areas

Wheeler et al. (2012) investigated critical summer and fall habitat for bowhead whales in the eastern Canadian Arctic by performing a monthly ecological niche factor analysis for 3 bowhead whale spatial datasets in contrast to concurrent eco-geographical variable datasets (including sea surface temperature, chlorophyll, ice cover, water depth, slope, and distance to shore) to determine overall bowhead whale habitat suitability in this region. The study produced 11 habitat suitability models, and resulted in the development of a composite map of predicted high suitability habitat for the months of June to October. In total, 21 discrete areas were identified (with low confidence) within the Eastern Canadian Arctic as 'critical habitat' during the open-water season (Figure B-25). Of these, 9 (Areas 13, 14, 15, 16, 17, 18, 19, 20, and 21) were located within, or in the vicinity of, the proposed RSA or shipping corridor between Rankin Inlet and eastern Hudson Strait. Coastal Inuit knowledge (referred to as Inuit Qaujimajatuqangit or IQ – see Figure B-26) supported the identification of critical habitat in northwest Ungava Bay (Big Island; Area 15). Aerial surveys (Cosens and Innes 2000) and telemetry studies (Dueck et al. 2006) supported the identification of critical habitat near Southampton and Coats islands (Area 20). There was no corroborating IQ or scientific evidence to support other identified critical habitat in northern Hudson Bay, Hudson Strait, and Labrador (Areas 13 to 15, 18, and 19). This may be due to bowhead whales no longer frequenting these areas, or population surveys and IQ studies were not conducted in these areas.



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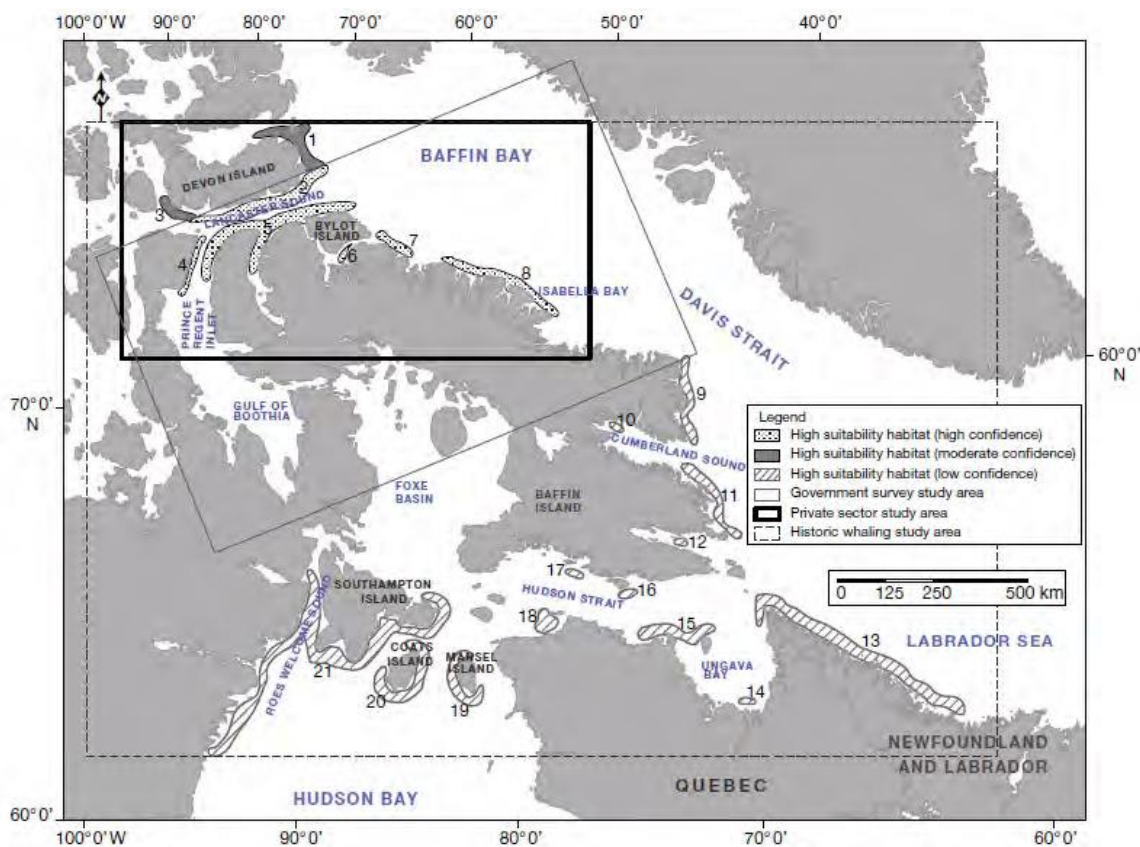


Figure B-25: Discrete Areas of Highly Suitable Bowhead Whale Habitat Identified for 3 or More Months from June to October in the Eastern Canadian Arctic (by analytical confidence) Produced by Ecological Niche Factor of 3 Bowhead Location Datasets and Associated Eco-Geographical Variables (extracted from Wheeler et al. 2012)



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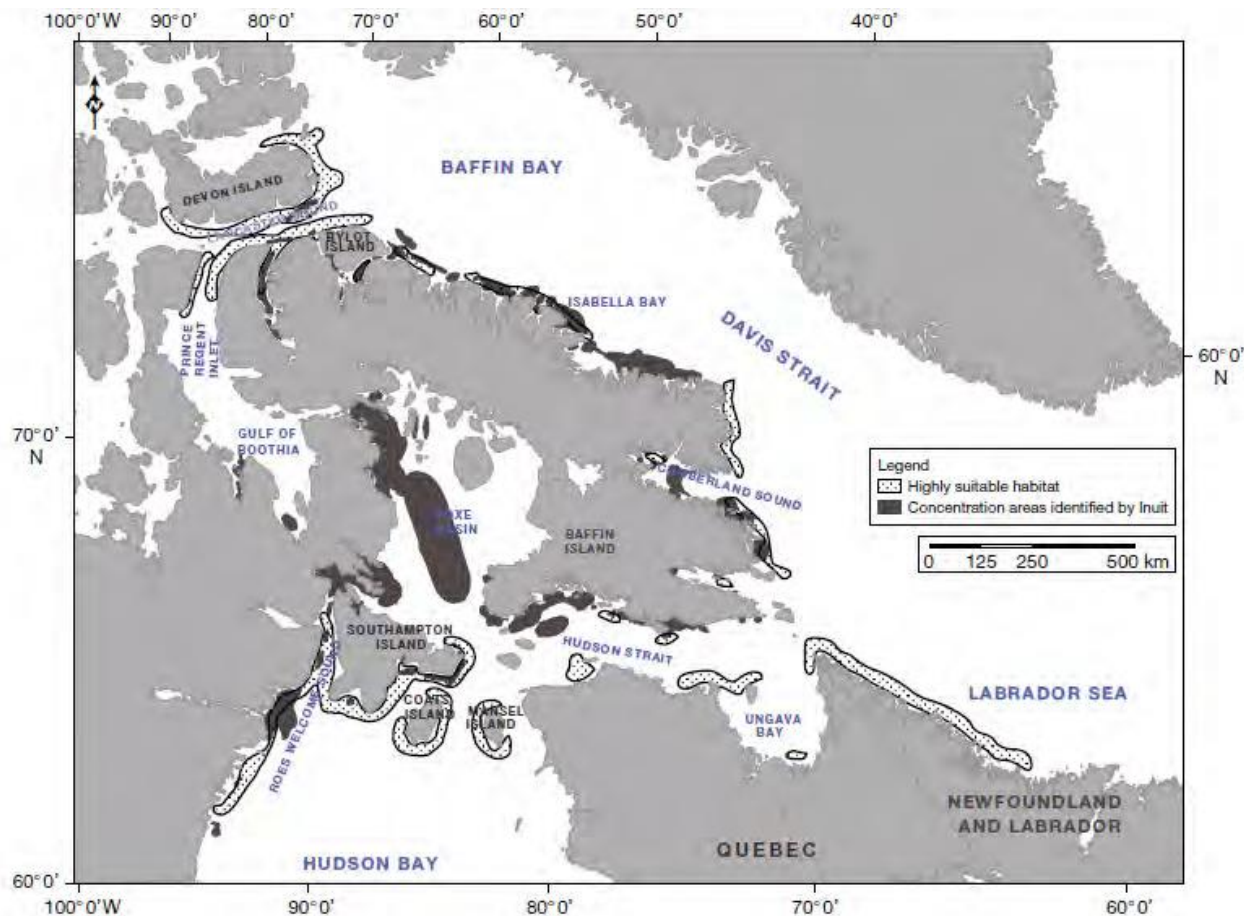


Figure B-26: Comparison of Highly Suitable Bowhead Whale Habitat Predicted by Ecological Niche Factor Analyses with Bowhead Concentration Areas Identified by Inuit in Nunavut, Canada, in Late Spring, Summer, and Early Fall (adapted from NWMB 2000 and Wheeler et al. 20)

1.4 Traditional Knowledge

Sources of IQ for marine wildlife included the following:

- IQ studies conducted by Nanuk Enterprises in 1997 and 1998 in Rankin Inlet and Chesterfield Inlet. The results of these studies are summarized in FEIS Volume 9, Section 9.3;
- IQ studies conducted by Nanuk Enterprises in 2010-2011 in Rankin Inlet, Chesterfield Inlet, and Whale Cove. The full report is included as FEIS Volume 9, Appendix 9.3-A and summarized in FEIS Volume 9, Section 9.3;
- Interview conducted on 15 July 2011 by Nunami Stantec in Rankin Inlet with representatives from the Kangiqliniq Hunters and Trappers Organization. The full report is included as Appendix 8.2-A of the FEIS;
- IQ studies conducted by Nanuk Enterprises / Outcrop Ltd. during 2012, consisting of interviews with local hunters, fishers, tour operators, and experienced seamen representing the communities of Rankin Inlet,



Chesterfield Inlet, and Whale Cove. The 2012 interviews focused on marine resources along the proposed shipping route through Hudson Bay and the marine approaches to Rankin Inlet. The full report is included as FEIS Volume 9, Appendix 9.3-C and summarized in FEIS Volume 9, Section 9.3; and

- A literature review of the Nunavut Atlas (Canadian Circumpolar Institute 1992) and the Inuit Land and Occupancy Project (Freeman and Murty 1976) conducted by Golder in 2012 summarizing historical Traditional Resource Use (TRU) in the Rankin Inlet region and surrounding communities as described in FEIS Volume 9, Section 9.3.

Collectively, these studies identify the following main points of interest with respect to traditional resource use and traditional knowledge in the Project area:

- Itivia is commonly used by local community members for small boat operations including boat mooring and launching. The location of the proposed landing barge corresponds with the only navigable area at Itivia during a low tide;
- Arctic char represent an important food species for the local community and are mainly harvested during August in the Rankin Inlet region. Some residents also participate in the commercial Arctic char fishery, which occurs approximately 40 to 50 km (25 to 30 miles) outside Rankin Inlet, although it occurred closer historically. Other fish species locally harvested in the Project area (in marine waters) include sculpin, cod, capelin, whitefish, and trout;
- Hunting and fishing in Melvin Bay is thought to be less productive today than in the past (1960s and 1970s), a factor potentially linked to recent increases in local vessel traffic in the bay;
- Marine mammal species harvested in the Rankin Inlet region include the following:
- Beluga whales - hunted during the open-water season (primarily in August and September) – mainly near Marble Island. Most individuals summer near Churchill and migrate north along the west coast of Hudson Bay beginning in late August. Some individuals overwinter in polynya areas (when ice conditions allow) in northwestern Hudson Bay, Roes Welcome Sound, and Hudson Strait;
- Walruses – uncommon in Rankin Inlet in recent years, this species is hunted year-round in areas north of Marble Island. During summer and winter, large numbers of walruses haul-out on Bencus, Coats, Walrus, and Southampton islands;
- Polar bears – hunted primarily during winter on the sea-ice. Hunting is based on a quota system, which was lowered for the WHB sub-population during the 2010-2011 harvest to 8 individuals due to concerns for the population size, and then raised to 21 individuals for the 2011-2012 quota following increased reports by community members of problem bears near the communities (GN 2011). Some individuals have been observed on Marble Island and swimming offshore during the summer months between the surrounding islands. There is some concern by community members that increased shipping in the area may result in adverse impacts on polar bears, including behavioural disturbance (active avoidance or displacement effects) and/or physical injury / mortality from potential ship strikes;



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- Four species of seal (ringed, bearded, harp, and harbour) – hunted throughout the year (on sea-ice and in open-water), with ringed seals being the most commonly hunted species. Recent increases in the number of harp seals near Rankin Inlet may represent influx of animals from adjacent Chesterfield Inlet that have been displaced by increased shipping / icebreaking activities in this area;
- Hunters have expressed concern over the proximity of the shipping route to Marble Island and potential effects of shipping on marine mammal distribution / migration, and hunting activities in this area. However, the implementation of a 2 km buffer (exclusion zone) around Marble Island for all Project vessels is deemed sufficient to mitigate these concerns;
- Narwhals and bowhead whales are not an important subsistence species for the Rankin Inlet community and are uncommon in the Rankin Inlet area. Narwhals summer north of Rankin Inlet in Daly Bay, Roes Welcome Sound, and Foxe Basin and winter in pack-ice regions of eastern Hudson Strait and Davis Strait. Bowhead whales are occasionally observed near Repulse Bay, Frozen Strait, Southampton Island, and Chesterfield Inlet;
- Hudson Strait is considered an important migratory corridor for marine mammals (beluga whales, narwhals, bowhead whales, and harp seals) transiting between Davis Strait / Labrador Sea and Hudson Bay / Foxe Basin. The critical migratory periods are early summer (June) and fall (late August to October). Proposed shipping activities for the Project coincide with the fall migratory period;
- Killer whales appear to be increasing locally in number particularly near Marble Island, although this species is not traditionally harvested. Concerns have been raised regarding the potential effects of the increasing killer whale population on other marine mammals due to predation, particularly with respect to bowhead whales;
- Several marine bird species are known to forage and/or nest in the Project area, including eider ducks (common eiders), black guillemots, Arctic terns, and several species of gull. Most nesting periods fall outside the shipping season (open-water). Egg harvesting occurs in spring for goose, eider duck, tern, guillemot, and gull. Shorebirds and raptors are not harvested by Inuit. The number of marine birds in Melvin Bay in recent years is thought to have decreased;
- Locally harvested shellfish species include blue mussels and clams. Historically, shellfish harvesting occurred along the north shore of Melvin Bay. Today, the harvest mainly occurs outside the harbour due to related health advisories from the Department of Health and Social Services. Scallops collected from the stomachs of hunted walruses are highly regarded by elders;
- Seaweeds (marine vegetation) are not locally harvested in the Project area in Melvin Bay;
- With respect to climate change, several major changes have been observed over the past 20 years in Rankin Inlet and include later freeze-ups, shorter sea-ice periods, decreases in land-fast ice, greater uncertainty in weather conditions, higher frequency of severe storm events, decreases in marine mammals observed in July, and changes in the timing of moulting of ringed seals (occurring as early as April); and
- Rankin Inlet community members recognize 2 shipping routes for access to Rankin Inlet (see Maps 1 and 2 in FEIS Volume 9, Appendix 9.3-C). In the deep-water sections of the shipping corridor, the exact shipping routes are not marked and likely vary by several kilometres. Recent increases in local shipping activity have been linked to several large Projects in the region including Meliadine, Meadowbank, Kiggavik, Baffinland, and Roche Bay.



2.0 CLOSURE

We trust that this report meets your immediate requirements. If you have any questions regarding the content of this report, please do not hesitate to contact this office.

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APPENDIX E • RISK ANALYSIS OF MARINE TRANSPORTATION ROUTES

The approach used for the risk assessment draws on that of Areva for the Kiggavik Project²¹.

A hazard is a condition with the potential to cause personal injury or death, property damage, environmental harm, or loss of service. Hazard severity along shipping and tug-barge routes can range from catastrophic resulting in fatalities and/or loss of the ship to minor where the incident does not significantly reduce ship safety and where mitigation measures are well within the crew's capabilities. A complete range of hazard severity is presented below in Table C-1.

Table C-1 Hazard Severity for Ship and Tug with Barge Routes

Hazard Severity and Rating Value	Definition
Catastrophic (Value 4)	Results in multiple fatalities and/or loss of the ship, tug or barge.
Hazardous (Value 3)	Reduces the capability of the ship or its operator's ability to cope with adverse conditions to the extent that there would be: <ul style="list-style-type: none"> • Large reduction in safety margin or functional capability; • Crew physical distress/excessive workload such that operators cannot be relied upon to perform required tasks accurately or completely; • Serious injuries to a small number of the crew; and • Possible fatality of one or more of the crew.
Major (Value 2)	Reduces the capability of the ship or its operators to cope with adverse operating conditions to the extent that there would be: <ul style="list-style-type: none"> • Significant reduction in safety margin or functional capability; • Significant increase in operator workload; • Conditions impairing operator efficiency or creating significant discomfort; • Physical distress to crew, including injuries; and • Major environmental damage, and/or major property damage.
Minor (Value 1)	Does not significantly reduce ship safety. Actions required by operators are well within their capabilities. Include: <ul style="list-style-type: none"> • Slight reduction in safety margin or functional capabilities; • Slight increase in workload such as routine ship navigation plan changes; • Some physical discomfort to the crew; and • Minor occupational illness and/or minor environmental damage, and/or minor property damage.

Likelihood ranges from probable where the incident is anticipated to occur one or more times in shipping and barge movements over the life of the Project, to extremely improbable where it is not anticipated to occur during the entire life-of-mine for the Project to any of the ships, tugs and barges contracted to AEM. Table C-2 provides a complete range of likelihoods.

²¹ Areva. 2011. Kiggavik Project, Environmental Impact Statement, Marine Transportation, Tier 3 Technical Appendix 2J.

Table C-2 Likelihood of Mishap along Ship and Tug-Barge Routes

Likelihood and Rating Value	Definition
Probable (Value 4)	Qualitative: Anticipated to occur one or more times in ship or tug-barge operations over the life of the Project. Quantitative: Probability of occurrence per operational hour is greater than 1×10^{-5} .
Remote (Value 3)	Qualitative: Unlikely to occur to each ship or tug-barge during its contract with the mine. May occur several times in the life of all ships and tankers for the life of the Project. Quantitative: Probability of occurrence per operational hour is less than 1×10^{-5} but greater than 1×10^{-7} .
Extremely Remote (Value 2)	Qualitative: Not anticipated to occur to each ship or tug-barge while it is contracted by AEM during the life of the Project. May occur a few times in the life-of-mine to the ships and tankers contracted to AEM. Quantitative: Probability of occurrence per operational hour is less than 1×10^{-7} but greater than 1×10^{-9} .
Extremely Improbable (Value 1)	Qualitative: So unlikely that it is not anticipated to occur during the entire life-of-mine for the Project to any of the ships and tankers contracted to AEM. Quantitative: Probability of occurrence per operational hour is less than 1×10^{-9} .

The hazard severity value is multiplied by the likelihood value to determine the risk level. Table C-3 outlines the risk levels outcomes, which range from negligible to catastrophic.

Table C-3 Risk Levels

Severity and Value		Likelihood			
		Extremely Improbable	Extremely Remote	Remote	Probable
		1	2	3	4
Minor	1	1	2	3	4
Major	2	2	4	6	8
Hazardous	3	3	6	9	12
Catastrophic	4	4	8	12	16

Risk Levels 1-2 represent a negligible to low level of hazard to shipping. It does not significantly reduce the safety of the ship or tug-barge. Actions required by the ship's or tug's crew are well within their capabilities to avoid harm to the vessel, the crew and the environment.

Risk Levels 3-4 represent low to major risk. There is a significant reduction in the safety margin or functional capability of the ship or tug-barge. A great effort on the part of the crew will be required to avoid damage to the ship, major environmental effects and/or injuries to the crew.

Risk Levels 6-9 represent major to hazardous risk. The ship's or tug-barge's crew will have difficulty in coping with the adverse conditions to the extent the ship or tug barge will have a large reduction in its safety margin or functional capability, which could lead to serious injury to the crew and possible environmental harm.

Risk Levels 12-16 represent hazardous to catastrophic risk and is to be avoided. There could be fatalities, loss of the vessel, and/or major environmental harm.

Table C-4 Preliminary Risk Analysis of Tug-Barge and Ship Marine Routes

Preliminary Risk Analysis of Tug-Barge and Ship Marine Routes							
Hazard	Before Controls			Mitigation Measures	After Mitigation		
	Severity	Likelihood	Risk Level		Severity	Likelihood	Residual Risk
Tug-barge or ship runs aground	3	3	9	<ul style="list-style-type: none"> Use electronic navigation aids; Remain in shipping lanes; Buoys within the near-shore islands; Monitor adherence to standard operating procedures; and One way traffic only in the access passage to Melvin Bay and Itivia harbour. 	3	2	6
Loss of or damage to sea cans in heavy seas	2	3	6	<ul style="list-style-type: none"> Lock sea cans to the deck; Use appropriate stacking height for voyage; and Slow tug tow speed in heavy seas. 	2	2	4
Tug-barge or ship has mechanical failure	2	3	6	<ul style="list-style-type: none"> Regular preventative maintenance schedule; Maintain an inventory of critical parts on board; and Have redundant critical systems. 	2	2	4
Barge tow line breaks	2	3	6	<ul style="list-style-type: none"> Have redundant tow line for safety purposes; and Slow tow speed in heavy seas. 	2	2	4
Collision or grounding of tugs between mooring location of large ships and Itivia harbour	3	4	12	<ul style="list-style-type: none"> One way traffic only in the access passage to Melvin Bay and Itivia harbour; Install Automatic Identification System on all tugs; and Tugs proceed at a slower speed during low visibility periods. 	3	2	6
Tug-barge or ship collides with a small boat from Rankin Inlet	2	3	9	<ul style="list-style-type: none"> Education of public on use of shipping lanes; Make public aware of incoming ships and tug-barge traffic in Melvin Bay; Tugs-barge and ships proceed at a slow speed in periods of low visibility; and Tug-barge and ships use horn in periods of heavy fog. 	2	2	4
Tug-barge or ship sinks upon hitting ice	4	3	12	<ul style="list-style-type: none"> Shipping is scheduled for open water; Sail around ice; and Slow vessel speed to avoid damage. 	3	2	6