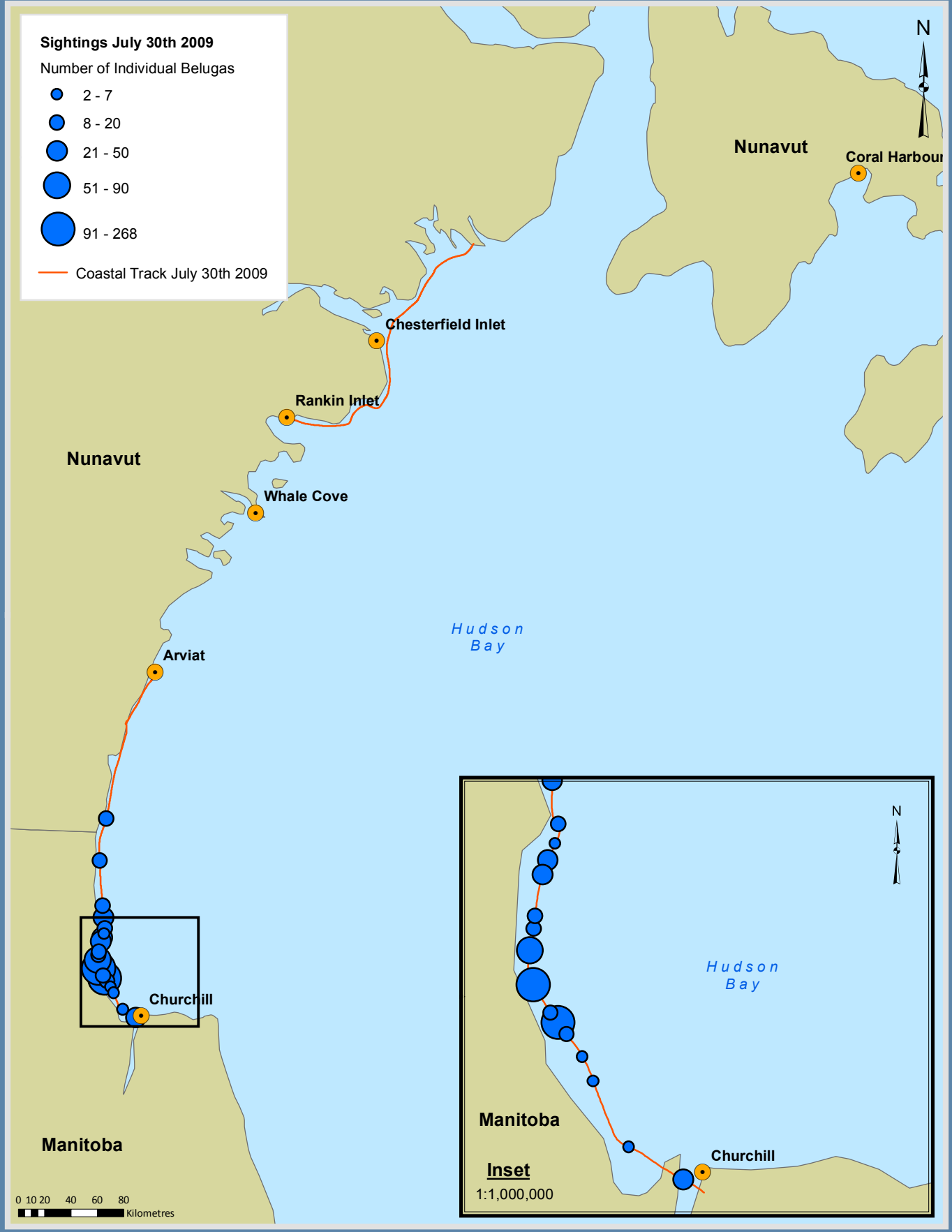


Projection: NAD 1983 UTM Zone 15N
Creator: SS
Date: 12/04/2009 Scale: 1:4,000,000
File: 1038926.04-005
Data Sources: *Natural Resources Canada, Geobase®, Nation Topographic Database, Areva Resources Canada Inc.*

**FIGURE 8.3-5**
COASTAL SURVEY EFFORT AND BELUGA SIGHTINGS FOR JULY 30, 2009
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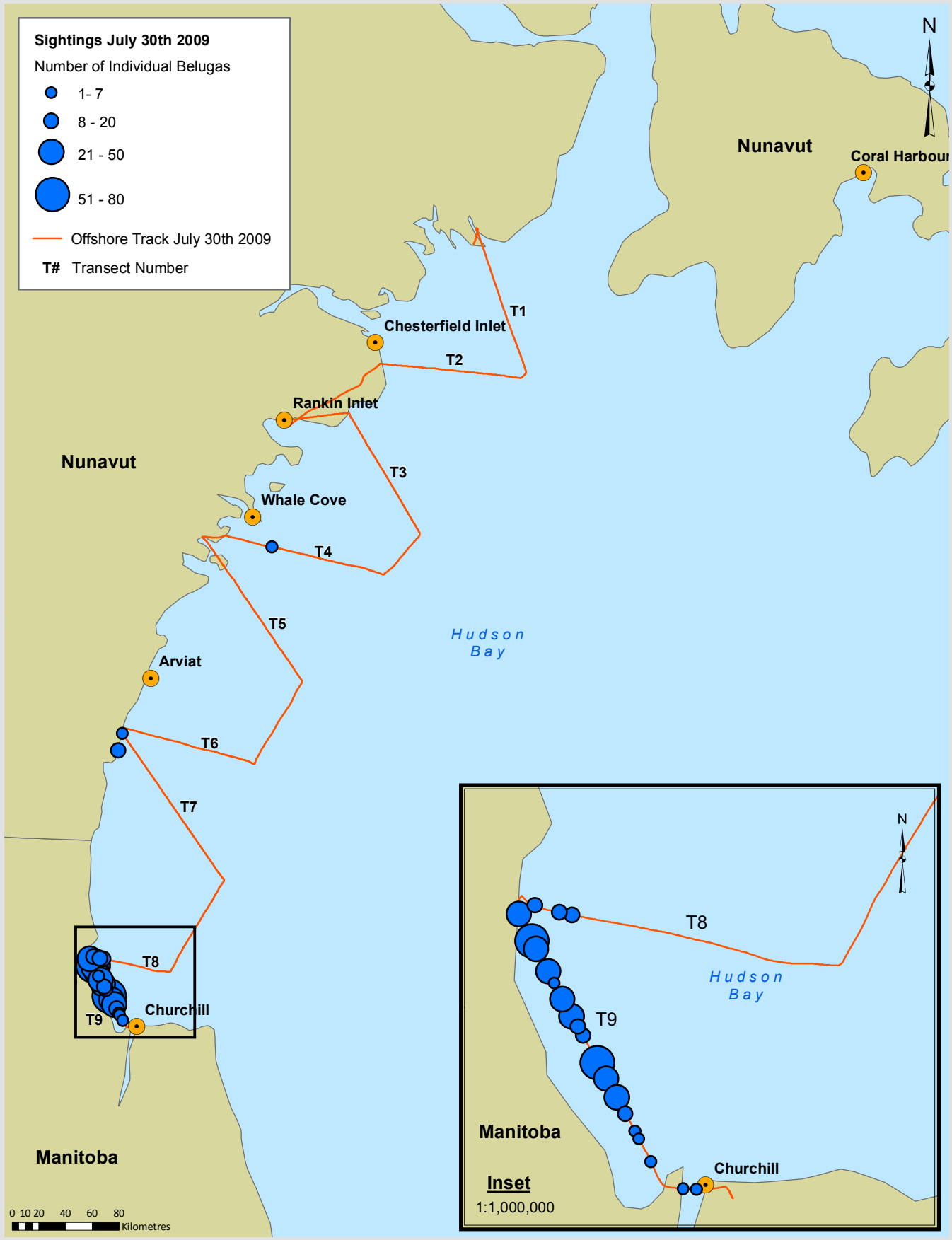


Projection: NAD 1983 UTM Zone 15N
Creator: SS
Date: 12/04/2009 Scale: 1:4,000,000
File: 1038926.04-006
Data Sources: *Natural Resources Canada, Geobase®, Nation Topographic Database, Areva Resources Canada Inc.*

**FIGURE 8.3-6**
OFFSHORE SURVEY EFFORT AND BELUGA SIGHTINGS FOR JULY 30, 2009
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**Photo 8.3-2 Three Adult and one Sub-adult Belugas Sighted in the Churchill River Estuary on July 30, 2009**


Projection: NAD 1983 UTM Zone 15N
Creator: SS
Date: 12/04/2009 Scale: 1:4,000,000
File: 1038926-007
Data Sources: *Natural Resources Canada, Geobase®, Nation Topographic Database, Areva Resources Canada Inc.*

**FIGURE 8.3-7**
COASTAL SURVEY EFFORT AND
OTHER MARINE MAMMAL SIGHTINGS
FOR JULY 30, 2009
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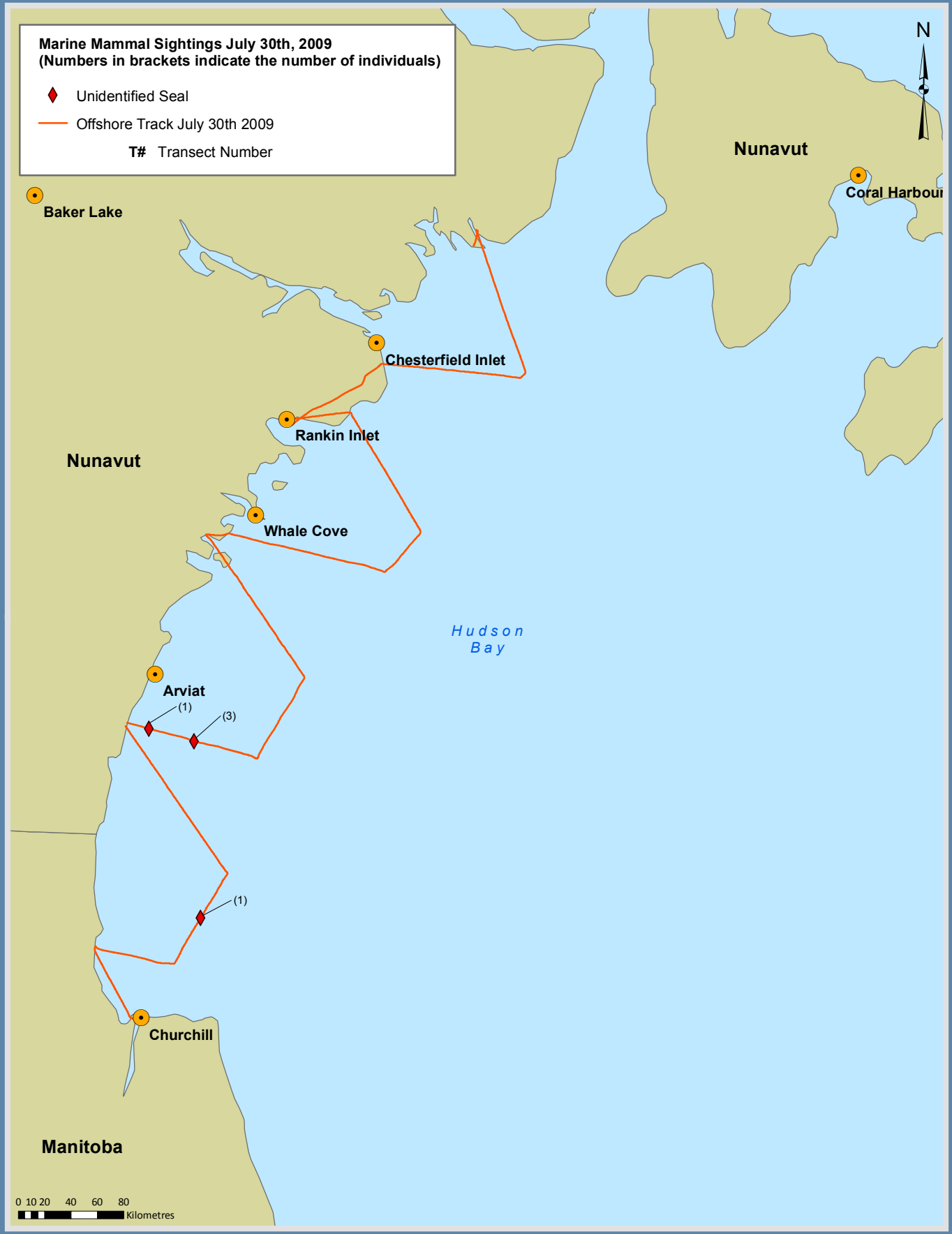


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Creator: SS
Date: 12/04/2009 Scale: 1:4,000,000
File: 1038926.04-008
Data Sources: *Natural Resources Canada, Geobase®, Nation Topographic Database, Areva Resources Canada Inc.*

**FIGURE 8.3-8**
OFFSHORE SURVEY EFFORT AND
OTHER MARINE MAMMAL SIGHTINGS
FOR JULY 30, 2009
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**August 31, 2009**

A total of 1,897 km were flown over 8.1 hours on August 31, 2009. The ability to detect marine mammals was characterized as good overall, with clear weather and calm sea states throughout much of the day. Relatively long periods of reduced sightability, resulting from sun glare (approximately three hours along Transects 7 to 8 and the coast south of Arviat) and fog (less than 0.5 hours along the coast near Rankin Inlet), were also recorded. No sea ice was encountered. Due to low ceilings and fog north of Rankin Inlet, the southern Transects (5 to 9) were flown first and after a refuelling stop in Churchill, the coast was flown to Waypoint 8, and Transects 3 and 4 were completed. Due to time restrictions, Transects 1 and 2 were not surveyed.

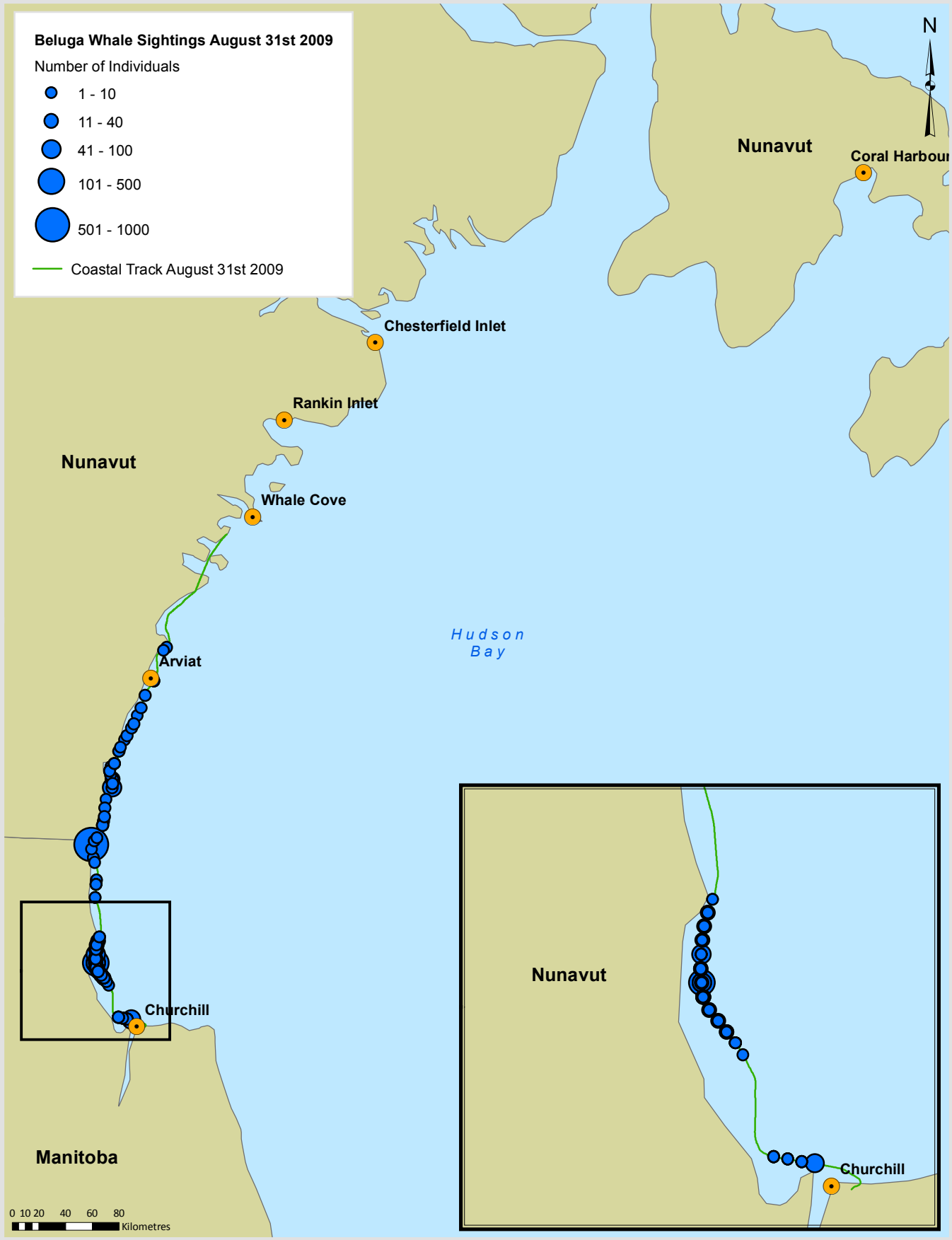
A total of 3,867 whales were observed over 273 sightings. Sightings included documentation of a "superpod", comprised of approximately 1,000 whales (Photo 8.3-3). Similar to the summer surveys conducted in July, the vast majority of whales were observed congregating in the relative vicinity of the Churchill River estuary. At least thirty two cow/calf sightings were documented. Observed activities included moulting, travelling and resting, while behaviours included milling, swimming and diving. Many whales appeared skittish and dove beneath the surface in response to the noise generated by the plane.

A total of 1,381 whales were observed on the coastal survey across 192 sightings (Figure 8.3-9), while 2,486 whales were observed on the offshore transects amongst 81 sightings (Figure 8.3-10). Similar to the surveys conducted in July, all of these sightings were documented along Transects 8 and 9, spanning the Churchill River Estuary. No whales were observed offshore, nor were any viewed in Transects 1 through 7.

Seventeen seals were observed over 14 sightings (Figures 8.3-11 and 8.3-12), including four harp seals, four ringed seals and nine unidentified seals. The most common behaviour documented was surfacing.

Two polar bears were counted on the coastal survey, each as a separate sighting (Figures 8.3-11). In both instances, the bears were swimming in relatively shallow water close to shore.

**Photo 8.3-3 Superpod of Belugas Sighted Along Coast North of Churchill on August 31, 2009**

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Creator: SS
Date: 12/04/2009 Scale: 1:4,000,000
File: 1038926.04-009
Data Sources: *Natural Resources Canada, Geobase®, Nation Topographic Database, Areva Resources Canada Inc.*

**FIGURE 8.3-9**
COASTAL SURVEY EFFORT AND BELUGA SIGHTINGS FOR AUGUST 31, 2009
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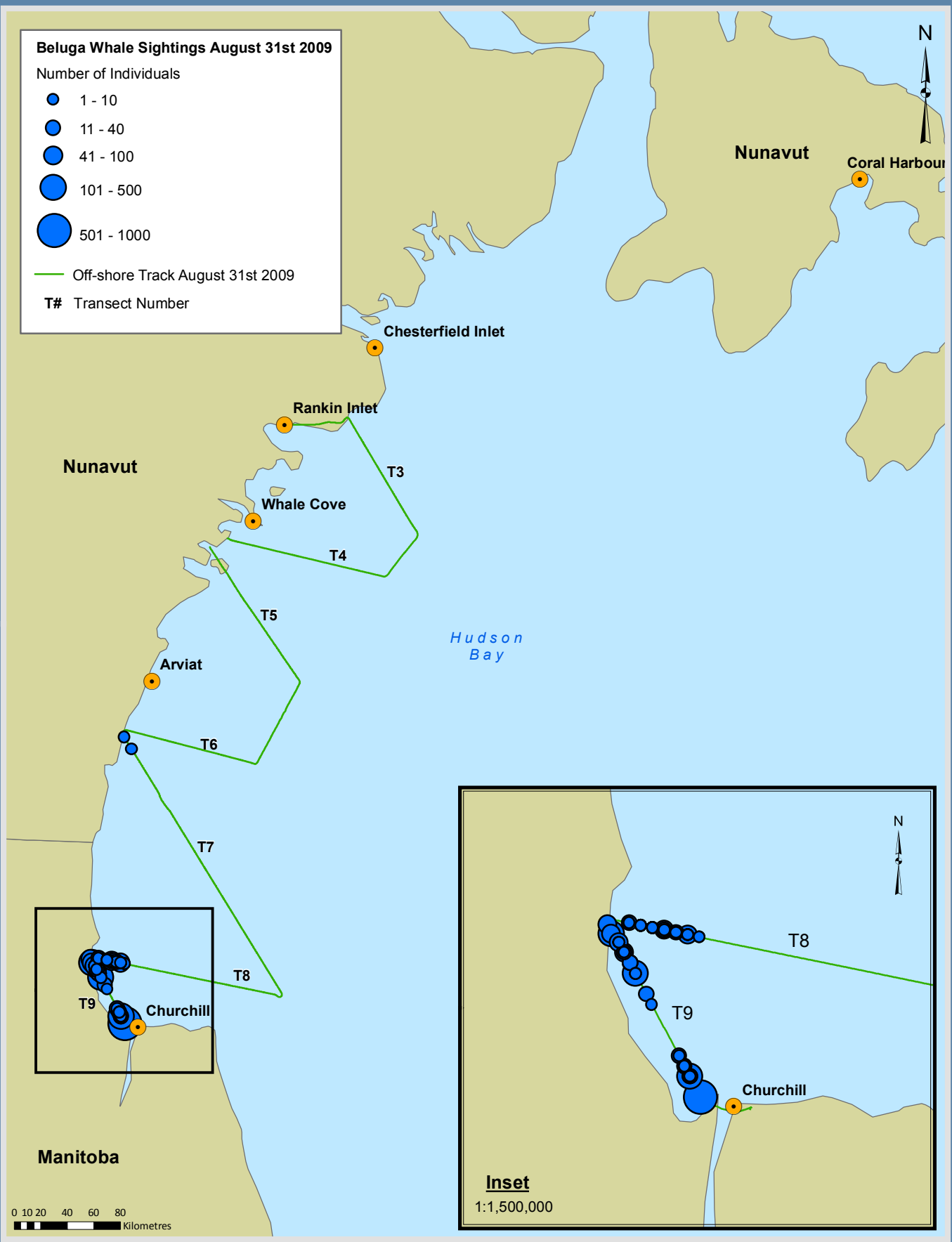


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Creator: SS
Date: 12/04/2009 Scale: 1:4,000,000
File: 1038926.04-010
Data Sources: *Natural Resources Canada, Geobase®, Nation Topographic Database, Areva Resources Canada Inc.*

**FIGURE 8.3-10**
OFFSHORE SURVEY EFFORT AND BELUGA SIGHTINGS FOR AUGUST 31, 2009
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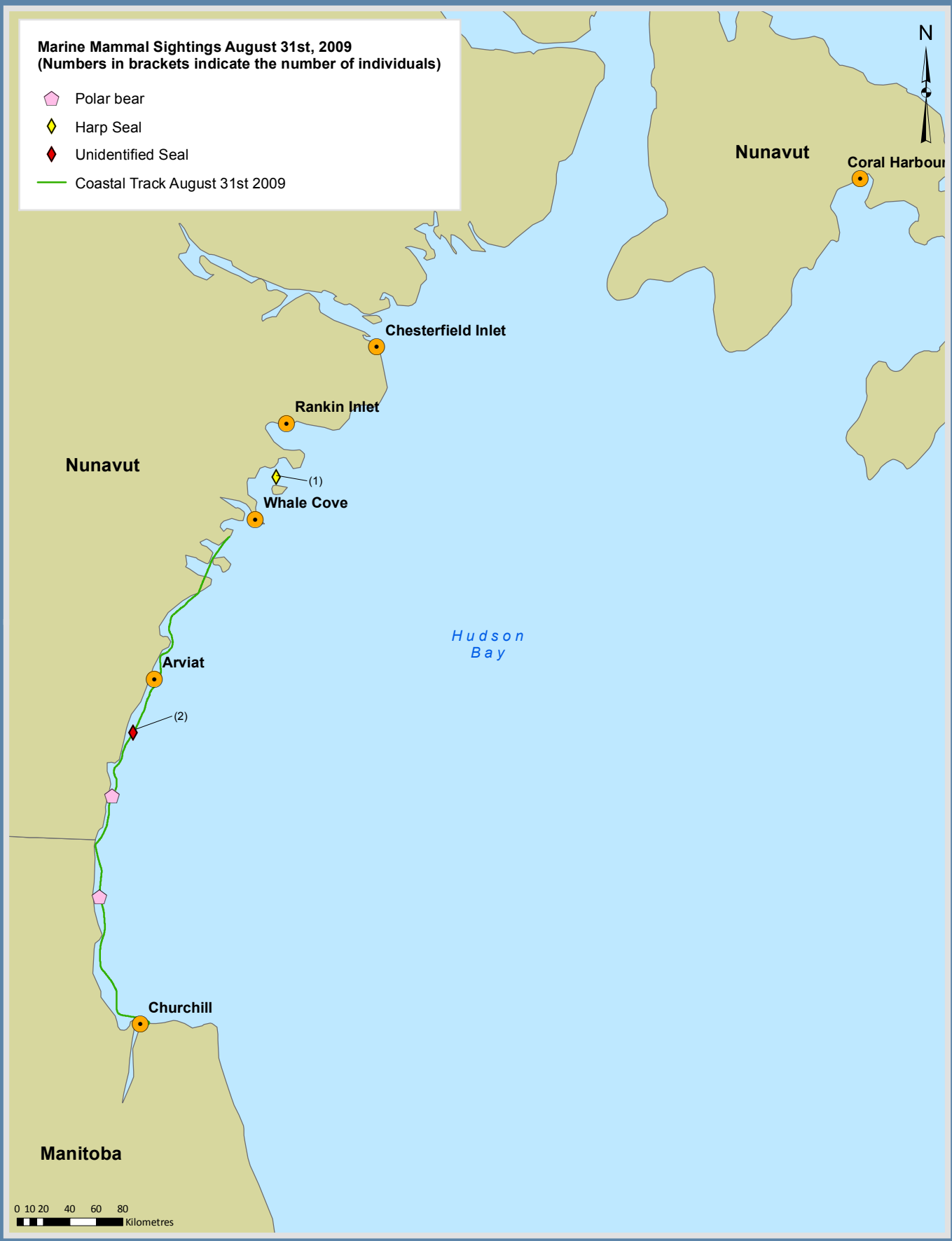


Projection: NAD 1983 UTM Zone 15N
Creator: SS
Date: 12/04/2009 Scale: 1:4,000,000
File: 1038926.04-011
Data Sources: *Natural Resources Canada, Geobase®, Nation Topographic Database, Areva Resources Canada Inc.*

**FIGURE 8.3-11**
COASTAL SURVEY EFFORT AND
OTHER MARINE MAMMAL SIGHTINGS
FOR AUGUST 31, 2009
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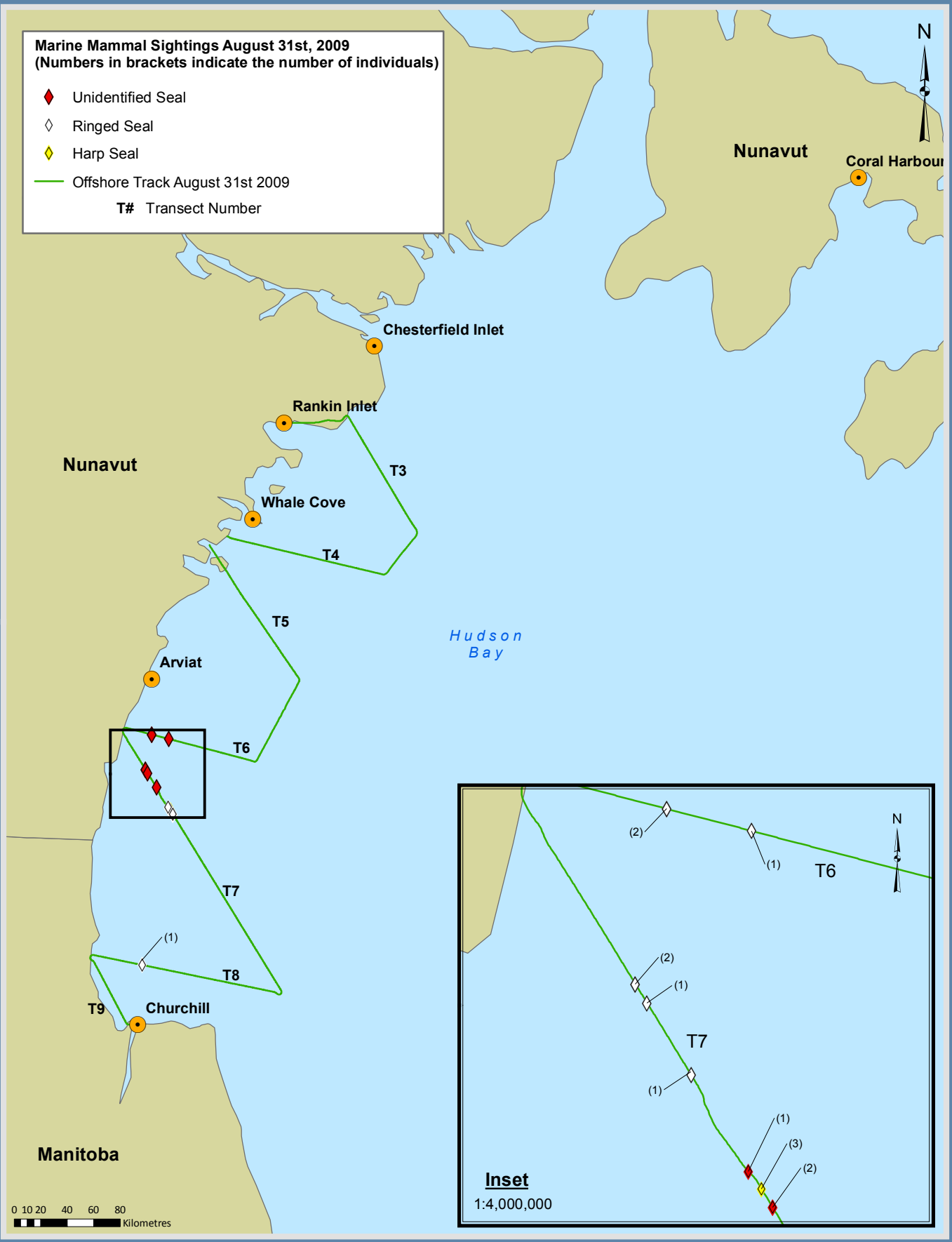


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Creator: SS
Date: 12/04/2009 Scale: 1:4,000,000
File: 1038926.04-012
Data Sources: *Natural Resources Canada, Geobase®, Nation Topographic Database, Areva Resources Canada Inc.*

**FIGURE 8.3-12**
OFFSHORE SURVEY EFFORT AND
OTHER MARINE MAMMAL SIGHTINGS
FOR AUGUST 31, 2009
**KIGGAVIK PROJECT - EIS**

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**September 3, 2009**

A total of 1,223 km were flown over seven hours of flight time on September 3, 2009. Overall, the ability to detect marine mammals was ranked as moderately impaired during the survey. Due to low ceilings and fog north of Rankin Inlet, the coast down to Churchill was surveyed first. After a refuelling stop, the northern portion of the coast (between Rankin Inlet and Chesterfield Inlet) was surveyed. Offshore Transects 1 and 2 were then completed, since they had not been surveyed the previous day. Transect 9 was also surveys but other planned offshore transects could not be completed. Though sea states were calm throughout much of the day, relatively long periods of reduced sightability, resulting from sun glare (approximately three hours along the coast from Rankin to Churchill), were recorded. Fog hindered sightability along the coast north of Rankin Inlet and along Transects 1 to 2, for approximately two hours. No sea ice was encountered. It is difficult to evaluate exactly how these factors influenced the ability of the observers to detect marine mammals on that day. However, as indicated below, sighting numbers were high (second highest of all survey days) which suggests that observers we able to adequately detect marine mammals in most areas, or at least where they were abundant. Sightings in areas where sightability was poorer were likely underestimated relative to days and areas where sightability was high. A detailed analysis of sighting rates as a function of environmental conditions was beyond the scope of this study.

A total of 1,131 belugas were counted over 228 separate sightings. While there was still a high density of whales in the Churchill River Estuary, the numbers appeared fewer than three days previous. This may be linked to a two-day windstorm, which caused substantial turbidity in the estuary, greatly reducing sightability owing to murky, muddy water (Photo 8.3-4). There were at least 39 cow/calf pair sightings made. A greater proportion of whales were observed outside of the delta, many travelling north of Chesterfield Inlet. Approximately 70 whales, representing 9% of the sightings on this day, were observed along the coast north of Rankin Inlet, suggesting the northward migration was underway.

A total of 731 whales were observed on the coastal survey across 167 sightings (Figure 8.3-13). A total of 400 belugas were observed across 61 sightings along the offshore track, though the vast majority of these sightings were along the coastal portion of the transects. One sighting of three whales was also observed greater than 5 km offshore on Transect 2 (Figure 8.3-14).

There was one sighting of two seals swimming on the coastal survey between Arviat and Churchill (Figure 8.3-15).

Three polar bears were observed over two sightings, one on the coastal route between Arviat and Churchill and two north of Chesterfield Inlet on Transect 1 (Figures 8.3-15 and 8.3-16). In both instances, the bears were on a coastal headland and appeared to be startled by the plane.

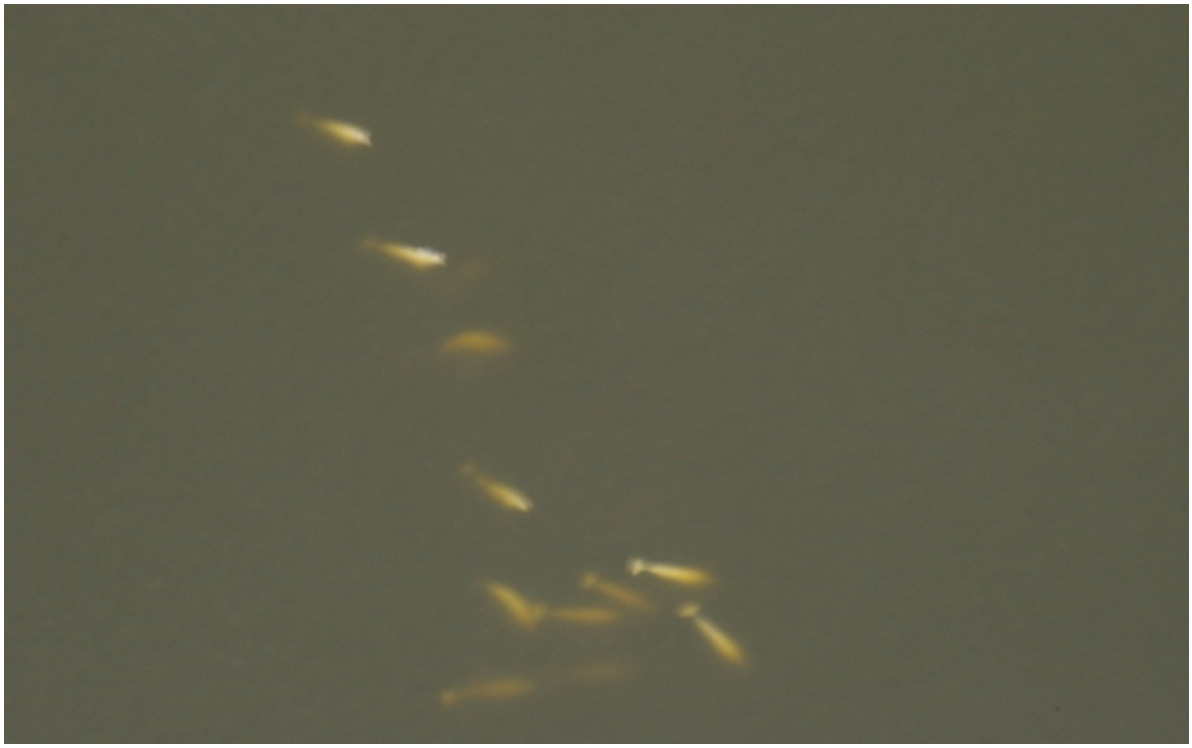
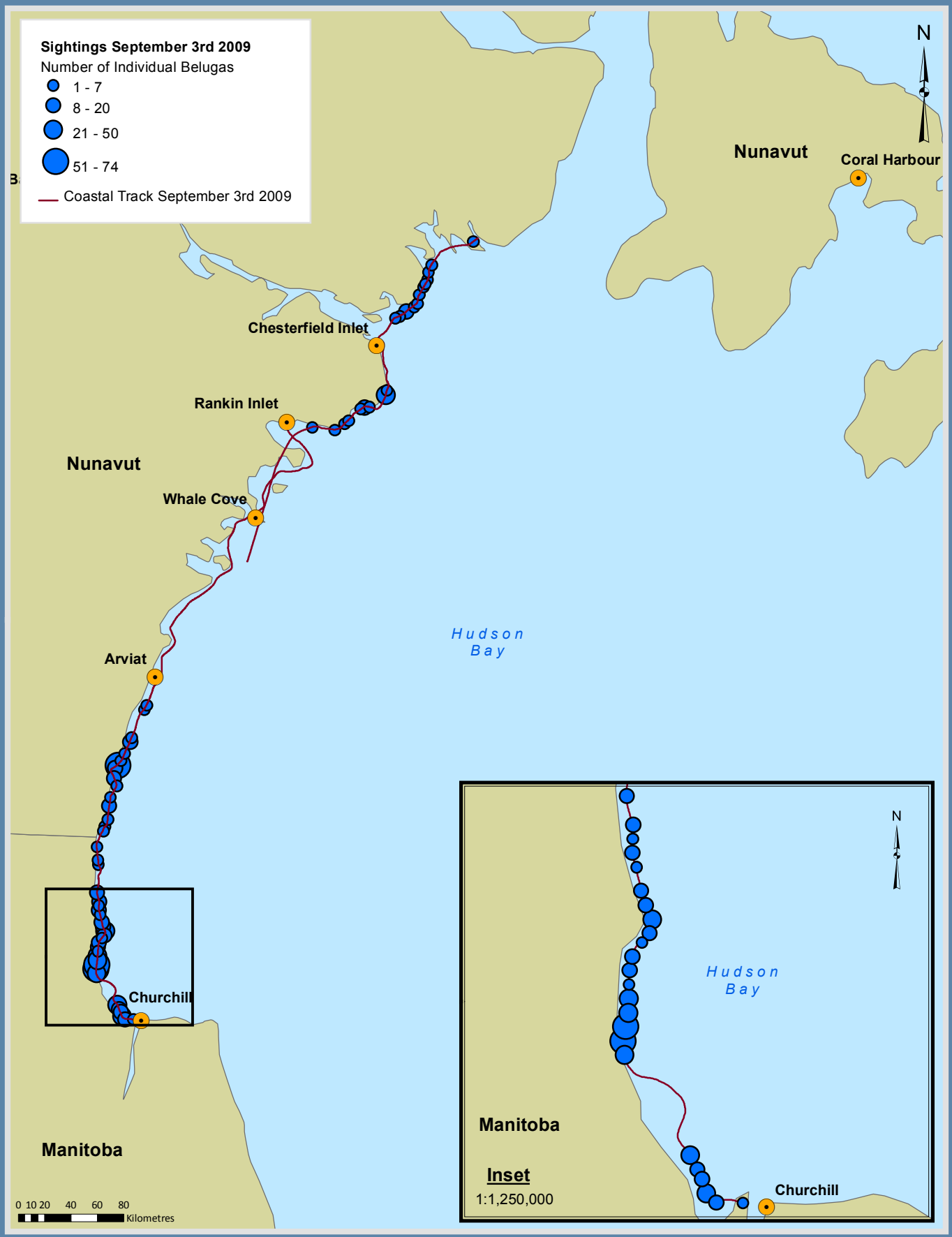


**Photo 8.3-4 Group of Belugas Observed in the Murky Waters of the Churchill River Estuary after a two-day Windstorm on September 3, 2009**




Projection: NAD 1983 UTM Zone 15N
Creator: SS
Date: 12/04/2009 Scale: 1:4,000,000
File: 1038926.04-013
Data Sources: *Natural Resources Canada, Geobase®, Nation Topographic Database, Areva Resources Canada Inc.*

**FIGURE 8.3-13**
COASTAL SURVEY EFFORT AND BELUGA SIGHTINGS FOR SEPTEMBER 3, 2009
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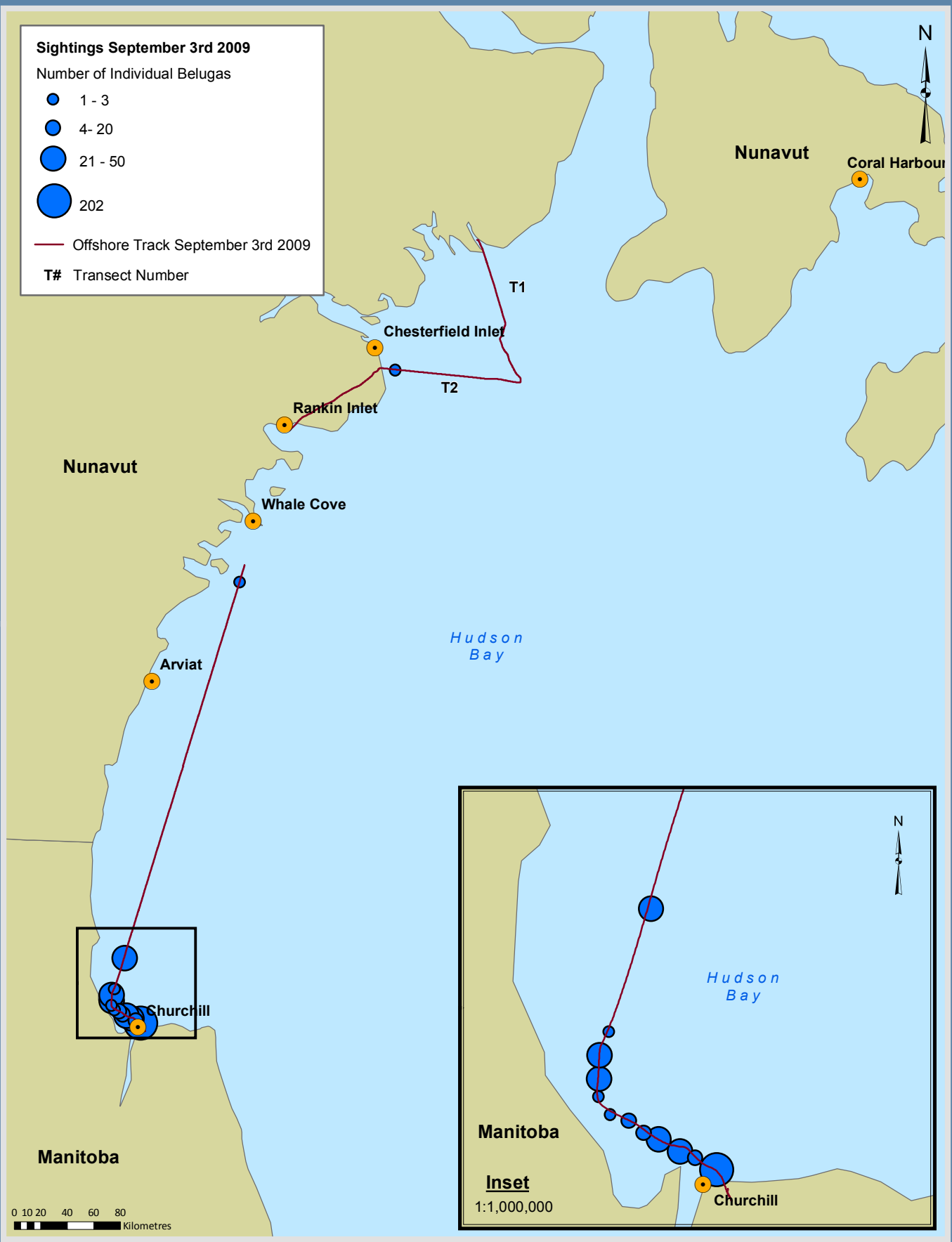


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Creator: SS
Date: 12/04/2009 Scale: 1:4,000,000
File: 1038926.04-014
Data Sources: *Natural Resources Canada, Geobase®, Nation Topographic Database, Areva Resources Canada Inc.*

**FIGURE 8.3-14**
OFFSHORE SURVEY EFFORT AND BELUGA SIGHTINGS FOR SEPTEMBER 3, 2009
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Projection: NAD 1983 UTM Zone 15N
Creator: SS
Date: 12/04/2009 Scale: 1:4,000,000
File: 1038926.04-015
Data Sources: *Natural Resources Canada, Geobase®, Nation Topographic Database, Areva Resources Canada Inc.*

**FIGURE 8.3-15**
COASTAL SURVEY EFFORT AND
OTHER MARINE MAMMAL SIGHTINGS
FOR SEPTEMBER 3, 2009
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Projection: NAD 1983 UTM Zone 15N
Creator: SS
Date: 12/04/2009 Scale: 1:4,000,000
File: 1038926.04-016
Data Sources: *Natural Resources Canada, Geobase®, Nation Topographic Database, Areva Resources Canada Inc.*

**FIGURE 8.3-16**
OFFSHORE SURVEY EFFORT AND
OTHER MARINE MAMMAL SIGHTINGS
FOR SEPTEMBER 3, 2009
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### 8.3.3 Summary of Marine Mammal Sightings

Marine mammals, including beluga, pinnipeds (i.e., seals and walruses) and polar bears were sighted on every survey day.

Over four days of surveying, a total of 7,127 beluga whales were observed over 763 separate sightings; 50 seals across 28 sightings; 20 walrus from one sighting; and 22 polar bears across seven sightings (Table 8.3-3).

**Table 8.3-3 Summary of Sightings and Number of Marine Mammals Observed per Day, July 29 – 31 and August 31 – September 3, 2009**

| Day | Beluga (# of sightings) | Beluga (# of animals) | Pinniped (# of sightings) | Pinniped (# of animals) | Polar Bear (# of sightings) | Polar Bear (# of animals) |
|---|---|---|---|---|---|---|
| July 29, 2009 | 123 | 952[1] | 7[5] | 31 | 2 | 16 |
| July 30, 2009 | 139 | 1177[2] | 7 | 20 | 1 | 1 |
| July 31, 2009 | N/A | N/A | N/A | N/A | N/A | N/A |
| August 31, 2009 | 273 | 3867[3] | 14 | 17 | 2 | 2 |
| September 1, 2009 | N/A | N/A | N/A | N/A | N/A | N/A |
| September 2, 2009 | N/A | N/A | N/A | N/A | N/A | N/A |
| September 3, 2009 | 228 | 1131[4] | 1 | 2 | 2 | 3 |
| **TOTAL** | **763** | **7,127** | **29** | **70** | **7** | **22** |

NOTES:

[1] Includes 18 cow/calf pairs

[2] Includes at least 20 cow/calf pairs

[3] Includes at least 32 cow/calf pairs

[4] Includes at least 39 cow/calf pairs

[5] Includes 1 sighting of 20 walrus

In total, 7,127 belugas were detected during 763 separate sighting events over 7,035 km of track-line surveyed. Overall, proportion and the encounter rates of beluga whale sightings were much greater on the coastal surveys (66% of sightings or 17 sightings per 100 km and 115 individuals per 100 km) than on offshore surveys (34% of sightings or six sightings per 100 km and 91 individuals per 100 km) (Table 8.3-4). However, the whales were almost exclusively coastally associated; only one sighting of three whales was made at greater than 5 km offshore, along Transect 4 on the July 30, 2009 survey (Figure 8.3-6). While these metrics give an idea of encounter rates throughout the study area, they fail to capture the clumped distribution of whales, which is centred on the Churchill estuary.

A total of 102 whales (1.3%) were observed north of Rankin Inlet over the course of the surveys, 70% of which were sighted during the September 3, 2009 survey alone.

**Table 8.3-4 Beluga Whale Encounter Rates per 100 km by Survey Region, July 29 – 30 and August 31 – September 3, 2009**

| Survey Region | Number of Sightings | Number of Belugas | Survey Distance km | Sightings per 100 km | Belugas per 100 km |
|---|---|---|---|---|---|
| Coastal | 501 | 3381 | 2922 | 17 | 115 |
| Offshore | 262 | 3746 | 4113 | 6 | 91 |
| **TOTAL** | **763** | **7,127** | **7,035** | **11** | **101** |

In total, 22 polar bears were documented across seven separate sighting events over 7,035 km of track-line surveyed (Table 8.3-5). The majority of polar bears were observed on coastal headlands (95%), indicating a strong coastal association. Seventy-one percent of these sightings (86% of individuals) occurred during the coastal survey and 29% (or 14% of individuals) along the offshore transects; however, like belugas, two of the three bears documented on the offshore transects were actually observed along the coastal portion. Encounter rates were higher on the coastal surveys (0.17 sightings or 0.65 polar bears per 100 km) than the offshore surveys (0.05 sightings or 0.07 polar bears per 100 km). A lone bear was spotted offshore swimming in the residual brash ice northeast of Churchill during the July 29 survey.

**Table 8.3-5 Polar Bear Encounter Rates per 100 km by Survey Region, July 29 – 30 and August 31 – September 3, 2009**

| Survey Region | Number of Sightings | Number of Polar Bears | Survey Distance km | Sightings per 100 km | Polar Bears per 100 km |
|---|---|---|---|---|---|
| Coastal | 5 | 19 | 2922 | 0.17 | 0.65 |
| Offshore | 2 | 3 | 4113 | 0.05 | 0.07 |
| **TOTAL** | **7** | **22** | **7,035** | **0.10** | **0.31** |

In total, 70 pinnipeds were observed during 29 separate sighting events over 7,035 km of track-line surveyed. Pinnipeds were observed both coastally and offshore, with 41% of the sightings (42% of individuals) documented on the coastal survey and 59% (57% of individuals) on the offshore transects. Again, many of the sightings on the offshore transects were actually made in the coastal region. Walrus (one herd of 20 individuals) were observed exclusively offshore and associated with residual ice floes northeast of Churchill. This resulted in a similar overall pinniped encounter rate in coastal and offshore areas (0.41 sightings and about 1 pinniped per 100 km) (Table 8.3-6). However, when the walrus sighting was excluded from all pinnipeds, the encounter rate was higher in coastal (0.41 sightings and 1 seal per 100 km) than offshore areas (0.38 sightings and 0.48 individuals per 100 km).

**Table 8.3-6 Pinniped Encounter Rates per 100 km by Survey Region, July 29 – 30 and August 31 – September 3, 2009**

| Survey Region | Number of Sightings | Number of Pinnipeds | Survey Distance km | Pinniped Sightings per 100 km | Pinnipeds per 100 km | Seal Sightings per 100 km | Seals per 100 km |
|---|---|---|---|---|---|---|---|
| Coastal | 12 | 30 | 2922 | 0.41 | 1.00 | 0.41 | 1.00 |
| Offshore | 17 | 40 | 4113 | 0.41 | 0.97 | 0.38 | 0.48 |
| **TOTAL** | **29** | **70** | **7,035** | **0.41** | **1.00** | **0.40** | **0.71** |

## 8.4 Vessel Reconnaissance Tour 2009

### 8.4.1 Description of Tour

As recommended by the residents of Chesterfield Inlet, a vessel tour was conducted to capture IQ on important hunting and fishing grounds in the area (Photo 8.4-1). The duration of the tour was 10 hours, from 08:00 until 18:00. The route was essentially a large loop, first travelling the north coast of the Inlet and returning along the south (Figure 8.4-1). Along the way, fishing cabins and popular hunting spots were pointed out by Leo and Don Mimialik. A series of informal questions were asked to both Leo and Don, relating to the timing and location of hunting of various marine mammals, such as beluga, seal, polar bear and walrus. Additionally, all marine mammal sightings were recorded using a Garmin GPS (Figure 8.4-1).

**Photo 8.4-1 Leo and Don Mimialik on the Vessel Reconnaissance Tour August 29, 2009**

### 8.4.2 Information Collected

Belugas are mostly hunted in the Baker forelands, in late August/early September. Leo Mimialik mentioned reports of beluga entering Chesterfield Inlet in early-mid August 2009 (Figure 8.4-1); several boats attempted to harvest belugas, but were unsuccessful.

Beluga used to swim into the harbour at Chesterfield Inlet, but this happens more seldom now, likely because of increased boat traffic. Often, they will pass through the harbour at night.

Ringed seals are the most common seal species in the Inlet. They are hunted everywhere, but especially near the islands in the Inlet, such as Ellis Island and Big Island. Seals are often present at Daley Bay. They are hunted for both consumption and for their skins.

Harp seals are abundant in the Inlet until about October. They are hunted mostly for fur, to be used in mitts and mukluks. They are not popular to eat, as the flavour of the meat is extremely strong.

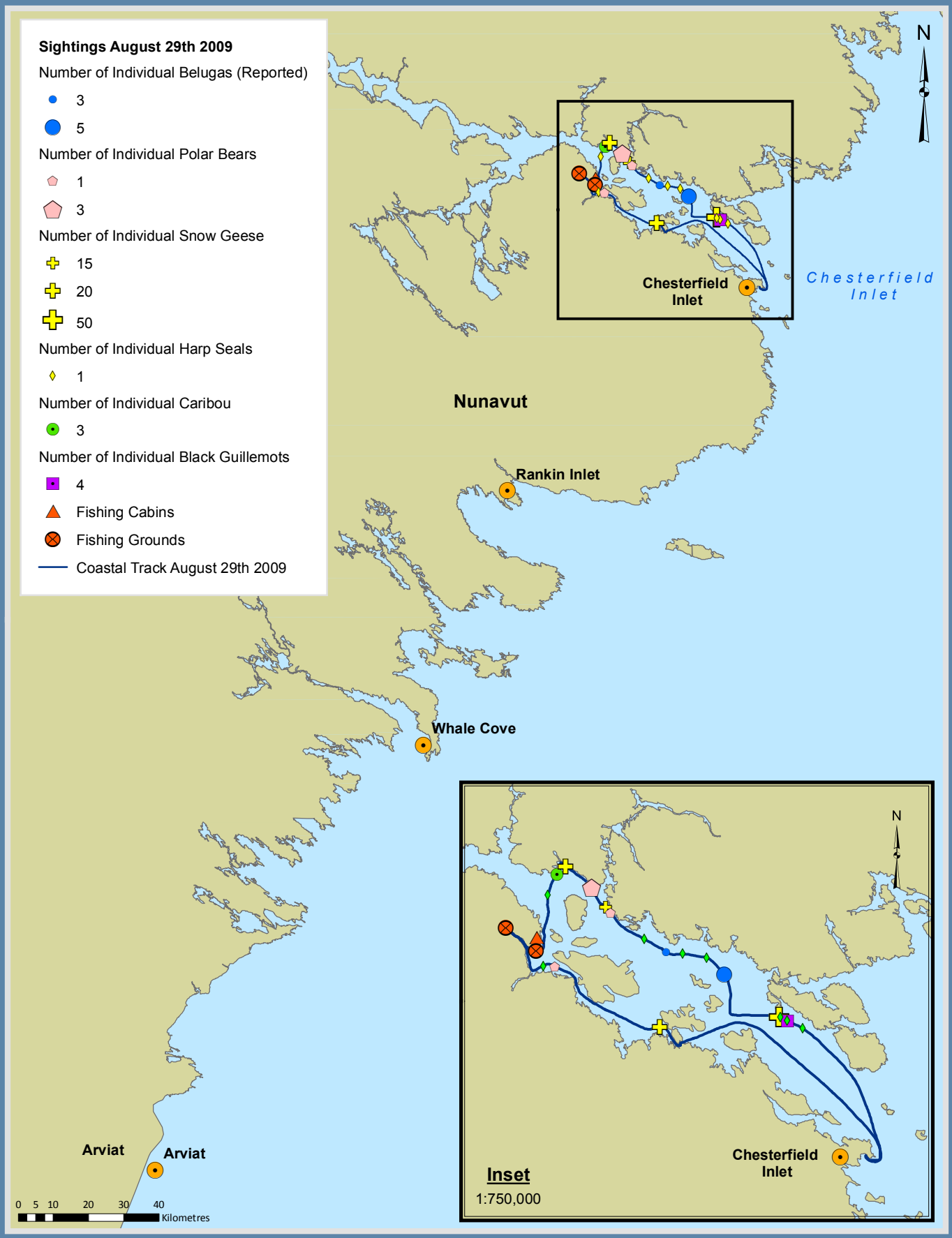
Polar bears are now more common in the Chesterfield Inlet region than in the past, particularly in coastal areas; encounters with bears have increased over the last few years, especially around the garbage dump and hunting cabins.

A few people hunt polar bears for pelts and meat, typically in the spring. The bears have dens around Wager Bay in the winter.

Walrus hunting is not as popular as it used to be. Walrus are typically hunted in the spring, after ice breakup. They are hunted north of Chesterfield Inlet, around Daley Bay and Depot Island.

Family fishing cabins dot the landscape of Chesterfield Inlet, predominantly on the south side of the Inlet. Fishing for river-run char occurs in Steep Bank Bay, mostly using gill nets.

Bird nesting grounds are found on the islands in the mouth of the Inlet, such as Promise Island. Canada geese and snow geese are typically hunted in the spring when they are fat.

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Creator: SS
Date: 12/03/2009 Scale: 1:1,500,000
File: 1038926.04-017
Data Sources: *Natural Resources Canada, Geobase®, Nation Topographic Database, Areva Resources Canada Inc.*

**FIGURE 8.4-1**
VESSEL RECONNAISSANCE TOUR OF CHESTERFIELD INLET
AUGUST 29, 2009
**KIGGAVIK PROJECT - EIS**

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## 8.5 Discussion

Integration of available scientific literature, IQ and results from Nunami Stantec aerial surveys indicates that marine mammals present in the waters and/or ice habitats along the proposed Project vessel routes include beluga whales, seals, walruses and polar bears.

Lack of bowhead whale and/or narwhal sightings during both the 2008 and 2009 surveys suggests that these species are rare in the study area. Literature and IQ confirm that preferred habitat for both species appears to lie north of the study area, around Repulse Bay and Foxe Basin (COSEWIC 2004b; AREVA 2009; COSEWIC 2009). Killer whales live at all latitudes and sporadically migrate into Hudson Bay in the summer (Stewart and Lockhart 2005b); while several sightings of pods of killer whales have been reported by Inuit communities over the past few years, they were not observed during either the 2008 or 2009 aerial surveys.

Walruses and ringed seals are year-round residents of Hudson Bay, while harp seals are seasonal visitors to the region. In congruence with both the literature and IQ, results from the aerial surveys suggest that ringed and harp seals are the most common pinnipeds in the study area (Stewart and Lockhart 2005b; AREVA 2009). Survey results indicate that walruses, while not common, are present in southwestern Hudson Bay; information found in literature and IQ lend support to these observations and affirm walruses are more abundant in areas north of Chesterfield Inlet (Born *et al.* 1995; AREVA 2009).

Observations taken during the Nunami Stantec field surveys complement information presented in both the literature and IQ. All sources indicate polar bears frequent coastal areas along Western Hudson Bay in the summer, and are most common in the area between Arviat and Churchill (COSEWIC 2008; AREVA 2009).

Results from the aerial surveys indicate that, belugas are the most common and abundant cetacean species in Hudson Bay. Other researchers corroborate these findings, believing that aggregations of belugas summering in the estuaries of the Nelson, Churchill and Seal rivers in July and August to be some of the largest known in the world (Richard 2005b). Consequently, beluga whales will be the predominant focus of the discussion below.

### 8.5.1 Beluga Whale

Beluga whales are an important cultural and ecological species in Nunavut (Fisheries and Oceans Canada (DFO 2000). Members of the Aqigiq Hunters and Trappers Organisation (HTO) and the Chesterfield Inlet Council relate that beluga whales are the most abundant and culturally important marine mammal species in the Chesterfield Inlet area. Belugas are generally hunted along the coast in the summer and are harvested up to 35 km offshore (Riewe 1992).

The range of the Western Hudson Bay beluga population overlaps with the proposed vessel route. However, it is possible that Churchill area belugas from Western Hudson Bay represent a distinct population centered on the Churchill River; genetic findings to date seem to support these further divisions (de March and Postma 2003). This hypothesis is also supported by IQ collected by AREVA, which recognizes two herds of belugas in Western Hudson Bay, one that migrates north from Churchill and another that migrates south from Foxe Basin (AREVA 2009).

#### *8.5.1.1 Encounter Rates*

Results from the field surveys indicate that beluga whales are the most commonly sighted marine mammal in Western Hudson Bay. The relative abundance of beluga whales calculated in 2008 was lower than that found by other researchers (Gosselin 2005) and is approximately 60 times lower than that calculated in 2009. The 2008 surveys were flown in mid-September, and it is possible that the majority of the whales had already migrated northward past the Chesterfield Inlet region by that time. More belugas appeared to have been sighted in coastal regions surveyed south of Chesterfield Inlet on the first day of the aerial survey (September 10, 2008) than on subsequent days which may indicate the tail end of migration. The coastal aerial surveys conducted in early September 2009 seemed to also indicate signs of northward beluga migration past Chesterfield Inlet at that time. Anecdotal information collected on the Vessel Tour also confirmed that belugas travelled past the Chesterfield Inlet in late August 2009. Aerial surveys in 2009 covered a much larger study area and were timed to capture peak beluga presence in the Churchill River estuary.

Richard (2005b) estimated 57,300 (95% C.L.: 37,700-87,100) belugas in Western Hudson Bay. Sightings data from the 2009 aerial survey were generally consistent with the literature and confirmed the presence of thousands of whales densely aggregated in southwestern Hudson Bay, predominantly in the area between Arviat and Churchill; however, the aerial survey program was not designed to derive a population estimate, and therefore, any conclusions related to population size are not possible.

#### *8.5.1.2 Distribution*

The summer distribution of the Western Hudson Bay beluga population centers in the coastal waters of Manitoba, with the largest aggregations occurring in the estuaries of the Seal, Churchill and Nelson Rivers (Richard 2005b). St. Aubin *et al.* (1990) have shown that the occupation of warm, less saline waters of estuaries is related to the annual moult and is connected with significant hormonal changes that are associated with new skin growth. Additionally, the use of estuarine habitats by females may be related to calving (Harwood and Smith 2002).

Both the literature and IQ suggest that aggregation of belugas near the coast may also be attributed to the presence of killer whales (Richard 2005b). There are many Inuit reports of belugas and narwhals hugging the shoreline when killer whales are present in an area. During interviews

conducted in Chesterfield Inlet, one Elder said the Foxe Basin herd behaves as if something is chasing it, such as killer whales, while another Elder believes that beluga will go up Chesterfield Inlet if there are killer whales (AREVA 2009). It has recently been shown that it does not take a large number of killer whales to cause a noticeable reduction in a marine mammal population (Williams *et al.* 2004). Therefore, belugas may have adapted to seek shelter in shallow waters at times when there is no pack ice in which to hide from killer whales (Richard 2005b). While no killer whales were observed during either the 2008 or 2009 survey, the coastal nature of the 2008 beluga sightings may be linked to the presence of killer whales, as a pod of orcas was reported by Chesterfield Inlet residents a week prior to the surveys.

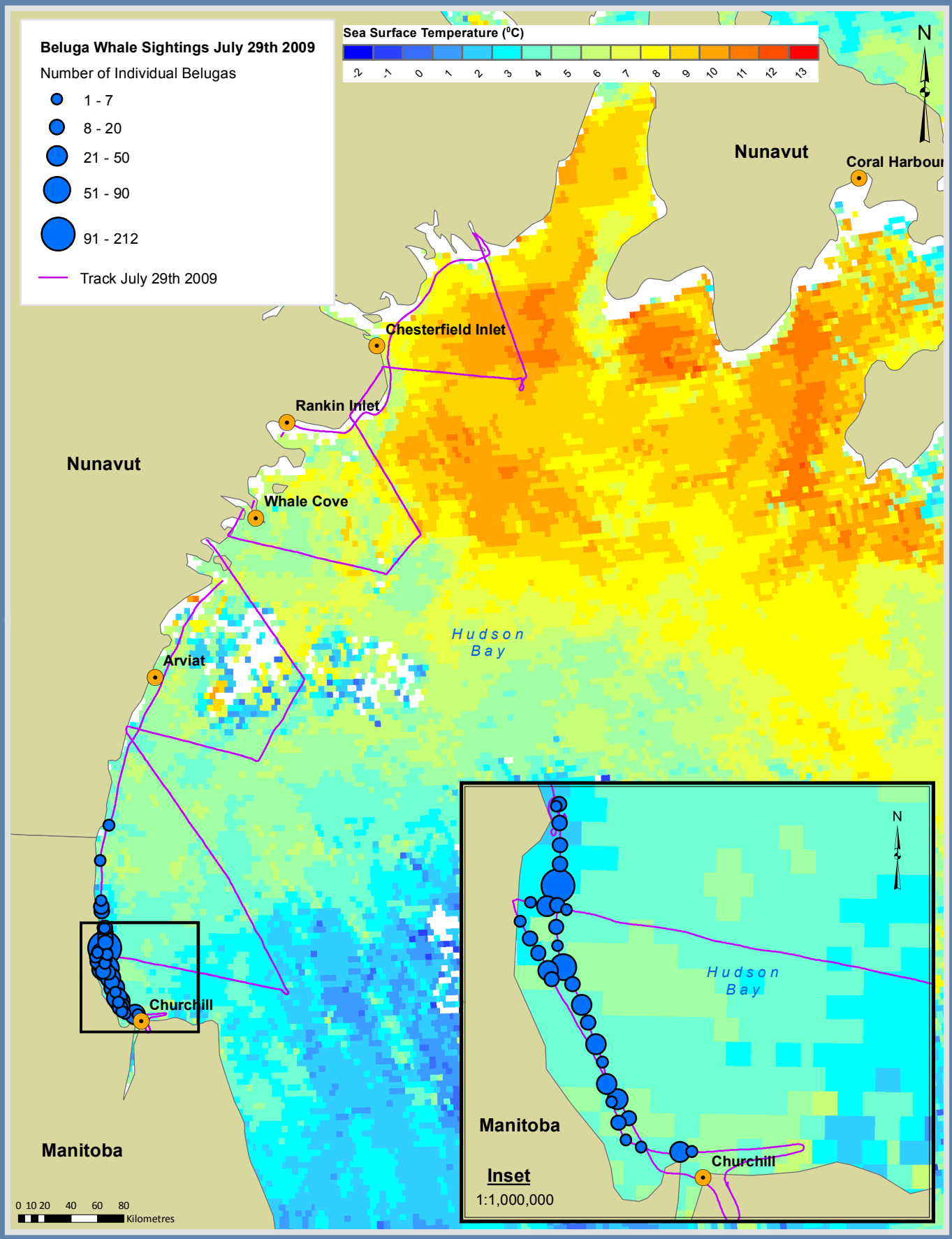
Scientific literature, IQ and field surveys conducted by Nunami Stantec all substantiate that belugas are clustered in the Churchill River estuary from mid-June (immediately following spring ice breakup) until the end of August or early September; their numbers are greatest from late July through mid-August (COSEWIC 2004a). Most whales leave the estuary and move northward along the Kivalliq coast in late August or early September (Sergeant 1973). This is supported by Inuit traditional knowledge and the fact that southern Kivalliq communities hunt belugas earlier in the season (July – August) than do those to the north (August-September) (Gamble 1988).

It is postulated that environmental variables play an important role in triggering the beluga whale migration. Satellite imagery of sea surface temperatures and chlorophyll *a* concentrations was obtained in an attempt to establish a correlation between changes in these variables and the start of the beluga migration (Figures 8.5-1 to 8.5-6). The white grid cells in these figures represent areas where data are deficient, since cloud cover had blocked the satellites from obtaining a proper reading. Figures 8.5-2, 8.5-5 and 8.5-6 indicate that the shallow waters of the Churchill River estuary are extremely productive relative to deeper, offshore waters. This is supported by the literature, where limited data suggest that productivity in Hudson Bay appears to be greatest in coastal waters, particularly in embayments and estuaries, where there is periodic entrainment or upwelling of deeper, nutrient-rich water (Stewart and Lockhart 2005b). During the summer, primary productivity appears to be greater inshore than offshore. Evaluation of Figures 8.5-2, 8.5-5 and 8.5-6 suggests that areas of clumped beluga distribution coincide with regions of high primary productivity.

Additionally, sea surface temperature (SST) may also play a role in migration timing. Sergeant (1973) suggested most whales begin to travel north along the west coast of Hudson Bay in late August or early September, when the weather begins to get stormy. Results from the 2009 field season appear to loosely support this claim. Surveys were grounded on September 1 and 2 due to high winds and stormy weather; and when they recommenced on September 3, as predicted in the literature, more whales were observed travelling northward along the coast than on previous survey days. Figures 8.5-3 and 8.5-4 depict a slight drop in SST between August 31 and September 3, 2009. It is possible that the storm event, and corresponding change in temperature, served as an environmental cue, prompting the belugas to begin their northward migration.

Results from the 2008 field season are also generally consistent with available literature. Surveys were conducted around Chesterfield Inlet in mid-September (i.e., Sept. 10 to 15), and the low number of whales observed (62) suggests that the bulk of the migration had already passed and that whales were en route to their over-wintering habitat. Information provided by the Aqigiq Hunters and Trappers Organization in early September revealed that belugas migrated through the Chesterfield Inlet region as early as late August 2008.

The locations of the sightings during both the 2008 and 2009 aerial survey programs suggest that coastal regions provide more regular beluga whale summering habitat than offshore regions. However, contrary to results from the 2009 surveys, radio-tagging studies conducted in 2003 showed that some beluga moved north of Churchill later in the season, in mid-September or early October, and travelled offshore from the Kivalliq Coast or across central Hudson Bay. They passed south of Southampton Island in mid- to late October, and all three of the animals whose tags were still transmitting in November continued east, reaching Hudson Strait and northern Ungava Bay by late November (Richard 2005b). Results from the 2008 field season seem to support these data. During the surveys conducted in mid-September, a total of 25 belugas were observed offshore over ten separate sighting events (33% of sightings and 40% of individuals). In contrast, during the 2009 aerial surveys, conducted in late July and late August respectively, there was only one offshore sighting of 3 whales on July 30. It is plausible that the surveys, which ended on September 3, were flown too early to capture this later offshore migration. The uncertainty surrounding offshore beluga distribution and abundance in Western Hudson Bay remains a considerable data gap. Additional aerial survey effort farther offshore and later in the season (i.e. October) were not possible due to plane availability and cost limitations. Such surveys may help resolve some of these issues.




Projection: NAD 1983 UTM Zone 15N
Creator: SS
Date: 12/04/2009 Scale: 1:4,000,000
File: 1038926.04-025
Data Sources: *Natural Resources Canada, Geobase®, Nation Topographic Database, Areva Resources Canada Inc.*

**FIGURE 8.5-1**
WEEKLY MEAN SURFACE TEMPERATURE
AND BELUGA WHALE SIGHTINGS
FOR JULY 29, 2009
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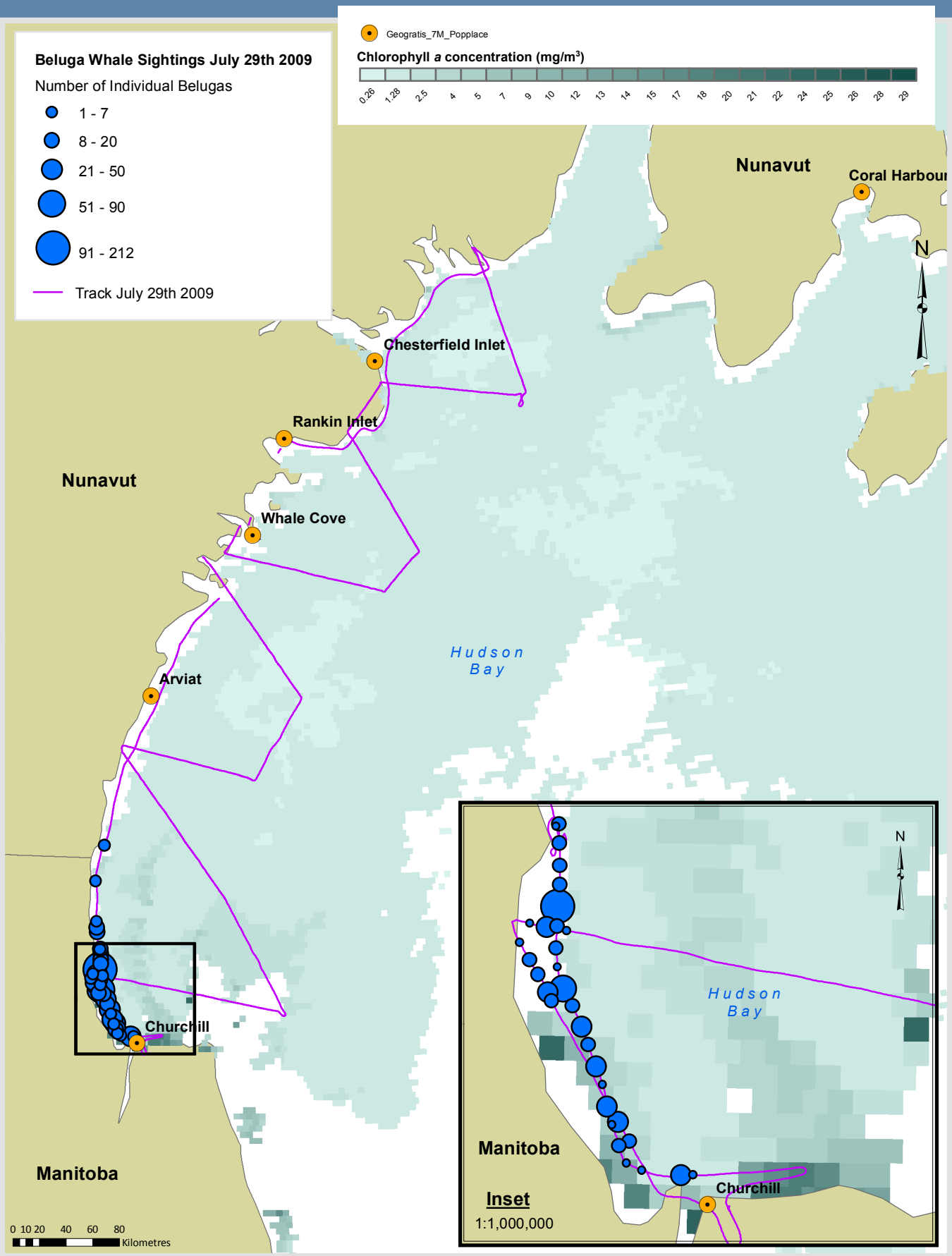


Projection: NAD 1983 UTM Zone 15N
Creator: SS
Date: 12/04/2009 Scale: 1:4,000,000
File: 1038926.04-024
Data Sources: *Natural Resources Canada, Geobase®, Nation Topographic Database, Areva Resources Canada Inc.*

**FIGURE 8.5-2**
DAILY CHLOROPHYLL *a* CONCENTRATIONS
AND BELUGA WHALE SIGHTINGS
FOR JULY 29, 2009
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