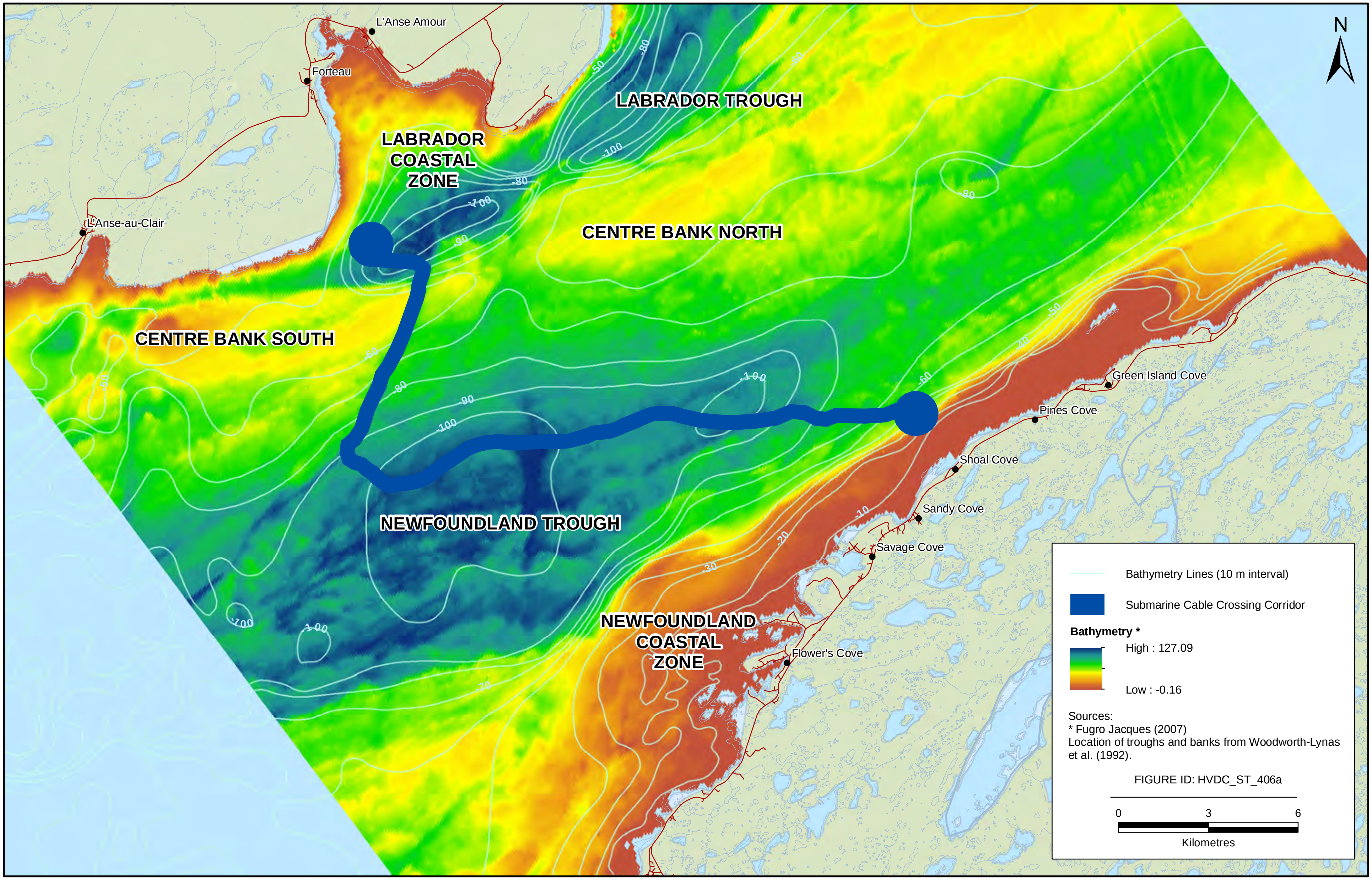

nalcor energy

FIGURE 10.5.2-2

Bathymetry in the Strait of Belle Isle

Table 10.5.2-3 Local Ecological Knowledge of Geology and Bathymetry in the Study Area

Community	Source	Indirect Quote
Flower's Cove, NL	Labrador-Island Transmission Link EA, Strait of Belle Isle Marine Crossing Meeting participant, Flower's Cove, NL, January 12, 2011	Water is shallower on the Newfoundland side of the Straits than the Labrador side
West St. Modeste, NL	Labrador-Island Transmission Link EA, Strait of Belle Isle Marine Crossing Meeting participant, West St. Modeste, NL, January 13, 2011	Centre Bank is the deepest point out from Forteau Point

10.5.2.3 Descriptions of Seabed Hazards

Strait of Belle Isle

There have been two earthquakes in the Strait of Belle Isle since 1985, both occurring in November 1999 (Earthquakes Canada 2010a, internet site) (Figure 10.5.2-3). Earthquakes in the Strait of Belle Isle are measured using the Nuttli Magnitude scale, developed and applied to seismic events in eastern North America (Earthquakes Canada 2010b, internet site). The two earthquakes in the Strait of Belle Isle had magnitudes between 2.6 and 2.7. Earthquakes with a magnitude between 2.5 and 3 produce a low rumbling noise which can be heard by people at rest. Earthquakes of these magnitudes would have no effects on the local environment (Earthquakes Canada 2008, internet site).

There is currently one active ocean disposal site in the Strait of Belle Isle, associated with the disposal of fish offal (Public Works and Government Services Canada Environmental Services 2005). This site is located at L'Anse au Loup, at the end of the main wharf near the local fish processing plant, and has a depth of approximately 6 m (Figure 10.5.2-3). This disposal site is approximately 12 km from the submarine cable crossing corridor. Permit for use of the site has been issued annually to the Labrador Fishermen's Union Shrimp Company since 1990. The allowable dumping quantity for the site is 1,000 tonnes/year (Public Works and Government Services Canada Environmental Services 2005).

There is potential for unexploded ordinance within the Strait of Belle Isle (Figure 10.5.2-3). The *HMS Raleigh*, equipped with 190 mm, 152 mm, and 127 mm guns, ran aground off Point Amour, Labrador, in August 1922 in shallow water (<30 m), carrying approximately 900 naval rounds (Fugro Jacques GeoSurveys Inc. 2008). It is believed that the wreck and ordinance were spread over an area of approximate 200 m x 50 m (10 ha). The DND has completed a three-year remediation effort focused on conducting underwater detonation of the remaining ordinance due to the risk associated with munitions washing ashore. This area is approximately 5 km north-east of the submarine cable crossing corridor.

There are no pipelines, cables or other infrastructure on or in the seabed within the Strait of Belle Isle (Canadian Hydrographic Services (CHS) 2002). There are 17 shipwrecks in the Study Area, but none within the submarine cable crossing corridor (Barron, n.d. internet site) (Figure 10.5.2-3). The depths of these wrecks vary between 10 and 70 m (Fugro Jacques GeoSurveys Inc. 2010).

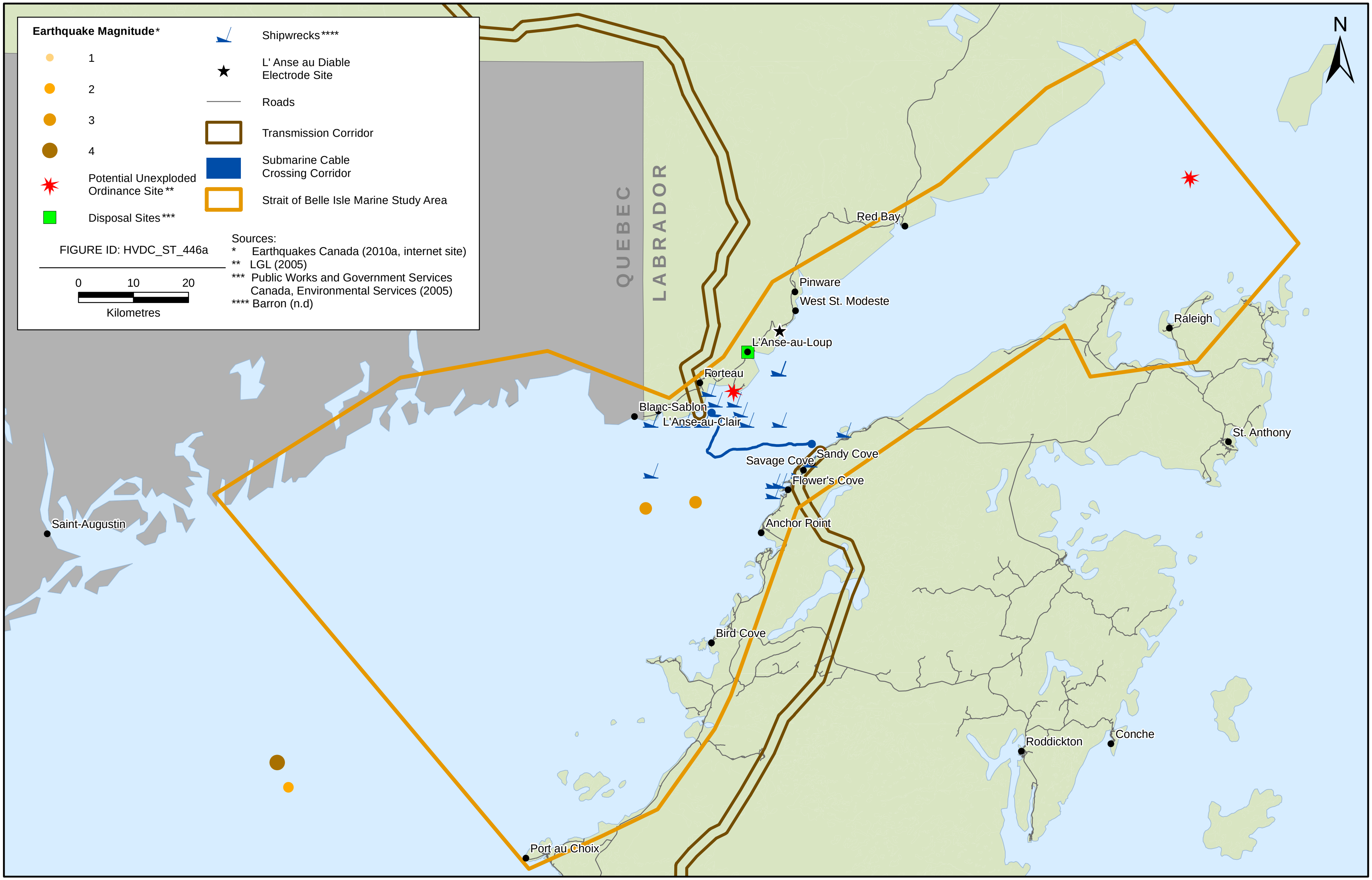

FIGURE 10.5.2-3

Potential Seabed Hazards in the Strait of Belle Isle

Conception Bay

There has been one earthquake in Conception Bay since 1985, and none within the Study Area (Figure 10.5.2-4). The only earthquake in the Bay measured 2.4 on the Nuttli Magnitude scale and occurred in March 1996 (Earthquakes Canada 2010a, internet site). Earthquakes with magnitude <2.5 are only detectable by seismographs and are not felt by people (Earthquakes Canada 2008, internet site). In addition, there was one land-based earthquake recorded in 2009 near the town of Whitbourne, approximately 35 km from Dowden's Point. This earthquake measured 3.3 on the Nuttli Magnitude scale. Earthquakes between 3.0 and 4.0 can produce an audible rumbling noise. Earthquakes of these magnitudes do not have effects on buildings or the surrounding environment (Earthquakes Canada 2008, internet site).

There is currently one active ocean disposal site in Conception Bay. The site, located off Bell Island, is associated with disposal of fish offal. The site is reached by boat and has a depth of 95 m and an allowable dumping quantity of 200 tonnes/year. This site has not been active since 2000 (Public Works and Government Services Canada Environmental Services 2005). This disposal site is approximately 20 km north-east of the Dowden's Point Study Area.

There are abandoned submarine telegraph (trans-Atlantic) cables entering the western side of Conception Bay, which terminate in Bay Roberts and Harbour Grace (Figure 10.5.2-4) (CHS 2001). These cables are approximately 15 km from the Dowden's Point Study Area. There are also submarine cables (power, telecommunications) linking Bell Island to the mainland, approximately 20 km from the Dowden's Point Study Area. There are no pipelines within or near the Study Area.

There have been more than 350 shipwrecks recorded in Conception Bay, none of which are within the Study Area (Figure 10.5.2-4) (Barron n.d., internet site). The location for most of these wrecks was recorded with a low level of accuracy, and only those with full longitude and latitude coordinates are provided on Figure 10.5.2-4. The depth of the wrecks shown in Figure 10.5.2-4 vary between 20 m and 100 m.

There is a Pilot Boarding Station in the Study Area, near the mouth of Holyrood Bay (Atlantic Pilotage Authority 2010, internet site; CHS 2001.) (Figure 10.5.2-4).

10.5.3 Currents and Tides

10.5.3.1 Information Sources and Data Collection

The main information source on currents in the Strait of Belle Isle was the Project-specific report *Marine Fish and Fish Habitat in the Strait of Belle Isle: Information Review and Compilation* (Sikumiut 2010a). Currents in the Strait of Belle Isle have been studied and measured since the late 1800s by Dawson (1913, 1907) who's early work has since been verified and expanded upon by the Bedford Institute of Oceanography (Toulany et al. 1987; Garrett and Petrie 1981; Farquaharson and Bailey 1966), and SNC-Lavalin (Hatch Mott MacDonald 2005, internet site). The findings of these studies were also used to describe the currents in the Strait of Belle Isle Study Area.

Information sources on currents within Conception Bay were collected by de Young and Sanderson (1995) between 1988 and 1991 to characterize the circulation and hydrography of the Bay.

The main information sources for tides within the Strait of Belle Isle were mainly gathered from the CHS database (Sikumiut 2010a). Data were obtained for tide stations at Blanc-Sablon and Baie de Brador, within the Strait of Belle Isle Study Area, and Harrington Harbour, approximately 145 km south-west of the Study Area. The Blanc-Sablon and Baie de Brador stations are located on the Labrador side of the Strait of Belle Isle, with Harrington Harbour located on the Québec north shore. There were no CHS tidal stations located on the Newfoundland side of the Study Area (Sikumiut 2010a).

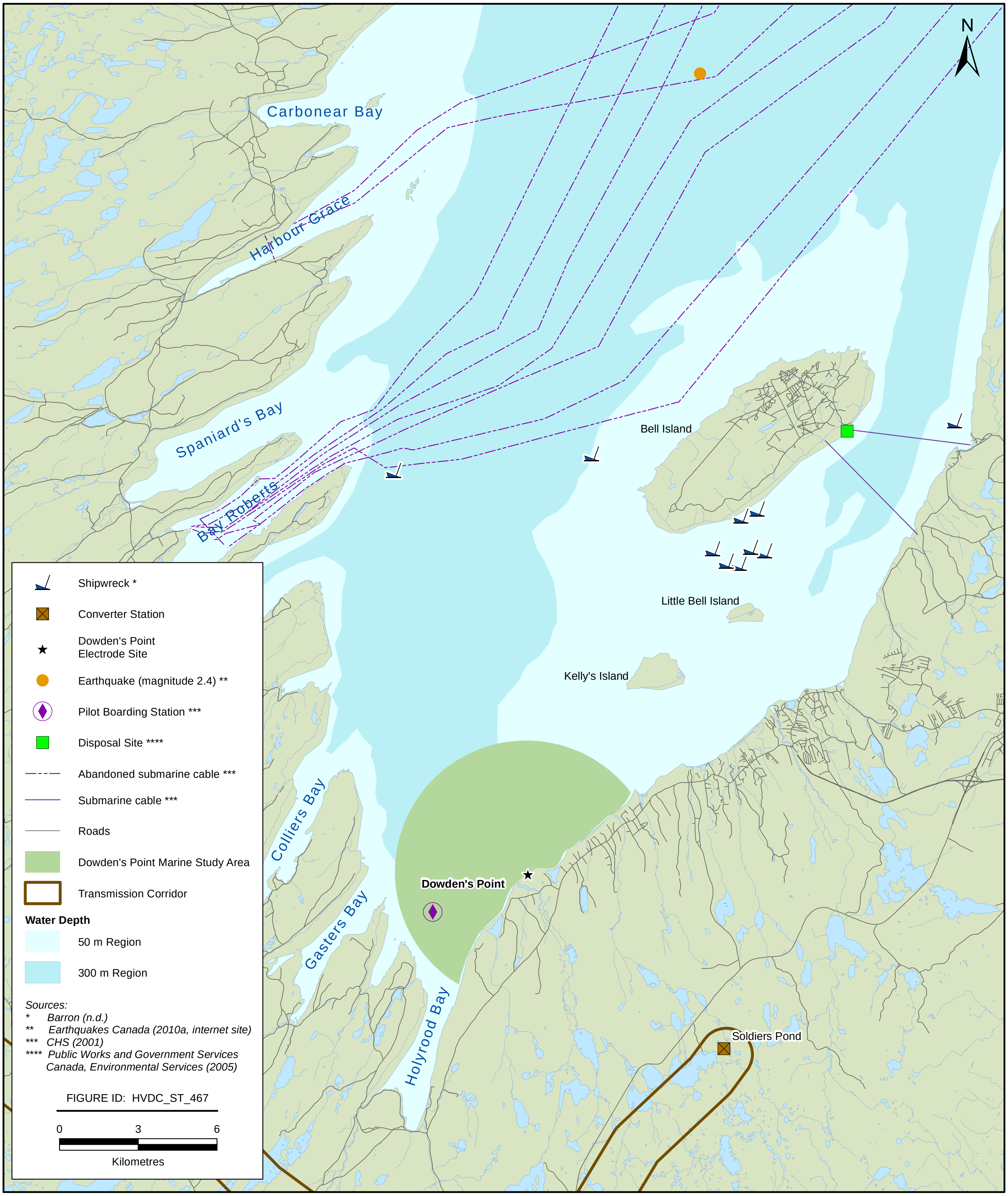

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FIGURE 10.5.2-4

Potential Seabed Hazards in Conception Bay

Additionally, for the Project, AMEC (2011b) modelled and described the existing oceanographic environment in *Strait of Belle Isle: Oceanographic Environment and Sediment Modelling*. For this study, Nalcor installed four synchronized tidal gauges to monitor the water level at four locations in the Strait of Belle Isle over a period of about two months. The purpose of the monitoring program was to provide robust boundary conditions for the hydrodynamic numerical model. The four stations were selected at strategic locations within the Strait to be as close as possible to the model boundaries. Tidal gauges were installed in the Strait of Belle Isle Study Area at Pinware and Blanc-Sablon on the Labrador side of the Strait of Belle Isle, and Eddies Cove and St. Barbe on the Newfoundland side of the Strait of Belle Isle.

Tidal data for Conception Bay were collected from a tide gauge at Holyrood (Sikumiut 2011a).

Information related to currents and tides was also obtained from researching existing sources such as the CHS.

No Project-specific field work was conducted to characterize existing current conditions within the Strait of Belle Isle or Conception Bay, and no Project-specific field work was conducted for the tidal conditions in Conception Bay but was collected for the Strait of Belle Isle Study Area.

LEK was collected from consultation initiatives with various communities (a summary of all consultation with public stakeholders can be found in Chapter 8 of the EIS) including open houses and correspondence. A general literature review and media search was also conducted. Since there is extensive existing knowledge on currents and tides, and the Project is not likely to affect these, no Project specific field work was conducted.

10.5.3.2 Description of Currents and Tides

Strait of Belle Isle

Currents refer to the steady flow of surface ocean water in a prevailing direction and can be influenced by tides, winds, buoyancy (density differences), waves and remote forcing (factors that act at a distance).

Generally, currents in the Strait of Belle Isle follow the orientation of the Strait (Figure 10.5.3-1). A dominant feature in the oceanography of the Gulf of St. Lawrence, influencing the Strait, is the freshwater outflow from the St. Lawrence River into the estuary, which continues along the north coast of the Gaspé Peninsula. This 'Gaspé Current' is sustained by subsurface upwelling of ocean water and circulates in a counter clockwise flow with most water exiting the Gulf through the Cabot Strait. The tidal pulse from the Atlantic Ocean enters the Gulf of St. Lawrence from two directions, through the Cabot Strait and Strait of Belle Isle, and tidal energies flow in a counter-clockwise fashion increasing in height from a low of 0.6 m (Magdalen Islands) to 5.0 m (Québec City) (Farquaharson 1970). A branch of the Labrador Current flows south-west along the Labrador coast into the Gulf of St. Lawrence, while water flows north-east from the Gulf of St. Lawrence through the Strait of Belle Isle along the coast of Newfoundland (Figure 10.5.3-1) (Canadian Ice Service 2001, internet site). Detailed discussion of currents, speeds and influences, and tides in the Strait of Belle Isle is available in Sikumiut (2010a).

Currents in the Strait of Belle Isle are influenced by the tide which is perpendicular to the flows described above, as well as by meteorological conditions. Tides in the Strait of Belle Isle are considered mixed, semi-diurnal with two highs and lows during every lunar day (24 to 25 hours) (DFO 2010a, internet site). Due to its configuration, having openings on both the Atlantic Ocean and Gulf of St. Lawrence, there are differences in the time of high-water found throughout the Strait of Belle Isle. Tidal changes in water level are approximately 1.3 m for mean tides, and up to approximately 3 m for large tides, as recorded at the Harrington Harbour monitoring station, located at the south-west edge of the Strait of Belle Isle on the Québec coast. Water levels in the Strait of Belle Isle vary by approximately 2.2 m during large tides, and tidal streams can attain a velocity of up to 1.3 m/s (2.5 knots) when accompanied by strong dominant winds (DFO 2010a, internet site).

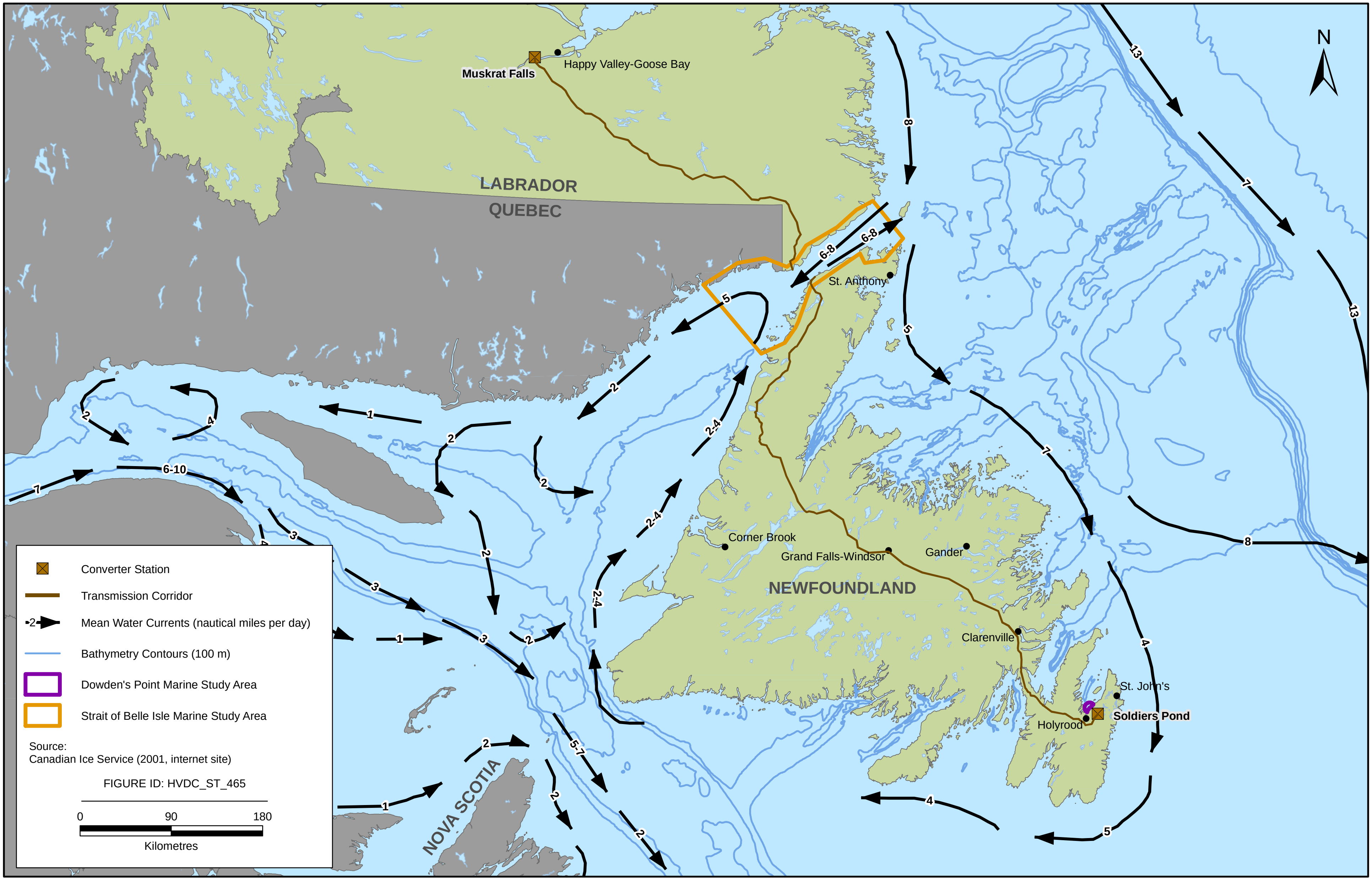


FIGURE 10.5.3-1

Water Currents in the Strait of Belle Isle and Gulf of St. Lawrence

The findings of AMEC (2011b) on tides in the Strait of Belle Isle, have the following key observations which generally supports the DFO (2010a, internet site) as reported above. The key observations on currents and tides from the study were as follows:

- The tidal wave propagates from north-east to south-west and induces strong along-Strait currents of 1 m/s and greater.
- As a result, flood flows from north-east to south-west and ebb flows from south-west to north-east.
- The tide is asymmetric, particularly during neap periods, inducing asymmetric currents.
- Cotidal lines are not perpendicular to the Strait but rather are curved.
- During neap tides, ebb and flood currents are of similar amplitude, the change of direction occurs about an hour after high or low water level, and strong currents occur during those periods. The tidal wave is therefore not standing and conserves many of the characteristics of a progressive wave.
- During neap tides, maximum current speed occur about 1 hour (hr) before low or high tides.
- During neap tides, lower high and low water levels occur consistently during an outflow to the north-east (ebb flow).
- The flow is generally stronger within the main channel of the Strait and weaker in the shallow areas, but present strong local acceleration within the Point Amour area. The cyclonic and anticyclonic gyre occurring regularly within Forteau Bay is also an interesting feature of the circulation.
- During spring tides, the slack period (time of no current) occurs approximately between high tide and low tide and is maximum at high and low, very much like a progressive wave. The flood flow is also stronger than the ebb and reaches almost 1.5 metres per second (m/s).

For a detailed description of flow through the Strait of Belle Isle, see Sections 10.5.2 to 10.5.4. In summary, water flow through the Strait of Belle Isle can be highly variable throughout the year (Toulany et al. 1987; Garrett and Petrie 1981). There are periods of a dominant water flow in either direction through the Strait (Toulany et al. 1987; Garrett and Petrie 1981), along with periods of separated inflow (toward the Gulf of St. Lawrence) along the northern, Labrador shore and outflow (towards the Northwest Atlantic) along the southern, Newfoundland shore (Bailey 1958; Huntsman et al. 1954). It is important to note that due to these flows, the water quality in the Strait of Belle Isle, including the Project's submarine cable corridor, is influenced by water properties originating in the Labrador Current along the Labrador Shelf, and in the Gulf of St. Lawrence. Also of note are the shared water quality attributes between the Strait of Belle Isle and adjacent regions in the Northwest Atlantic, as waters in these areas also originate (in part) from the Labrador Shelf.

Residual current fluctuations in the Strait of Belle Isle are correlated with large-scale differences between opposite ends of the Strait, rather than local winds (Dawson 1907). There are two factors that are likely to be responsible for these differences: geostrophic and barotropic balance.

Geostrophic balance entails that water flow (particularly for surface currents) is depth-dependent and driven by sea level differences between the opposite ends of the Strait of Belle Isle, produced by meteorological forcing (Garrett and Petrie 1981). For example, outflow from the Gulf of St. Lawrence towards the Labrador Shelf may be driven in part by large-scale, wind-induced set-up (i.e., a rise in the mean water level above the still-water elevation of the sea (Komar 1998) in the gulf and set-down in the shelf (Garrett and Toulany 1981).

Barotropic balance involves a depth-independent, density-dependent pressure gradient that drives currents along the Strait of Belle Isle (Toulany et al. 1987). Barotropic balance arises from the temporal and spatial variations in density within the water column of the Strait of Belle Isle, where greater stratification has been observed during the summer months versus the fall (Toulany et al. 1987). During the summer of 1980, a nearly linear increase in density was seen from the surface to approximately 50 m depth, below which density remained constant. In contrast, in the fall, there was greatly reduced stratification, and density increased approximately linearly from the surface all the way to the bottom of the Strait (Toulany et al. 1987).

In the Strait of Belle Isle, current velocities are greatest on the surface, decreasing with depth, and are typically greatest near the Labrador coast (Garrett and Toulany 1981; Farquaharson and Bailey 1966). Maximum flows of 2.6 m/s have been recorded at the surface near the Labrador coast, and a maximum of 2.4 m/s recorded at near-surface metres mid-Strait. Maximum bottom flows of 1.6 m/s were also observed near the Labrador coast and mid-Strait.

Conception Bay

The direction of current flow in Conception Bay is controlled by local topography, particularly basin shape at most locations, and are strongly variable (de Young and Sanderson 1995). The bottom (near seabed) current, demonstrate / exhibits a counter clockwise flow and the currents at Dowden's Point would be parallel to the shore flowing in a north-east direction (Catto et al. 1999), while the surface current exhibits a clockwise flow.

There are strong tidal currents in Conception Bay, particularly along the north-east shore. Dowden's Point is semi-exposed and the shoreline is largely open and exposed with no embayments. Tidal changes in water level at Holyrood are approximately 0.9 m for mean tides, up to approximately 1.3 m for large tides (CHS 2001). Tidal data from the DFO tide gauge in Holyrood indicate a mean tidal amplitude of 0.94 m and high tide amplitude of 1.34 m with a mean water level of 0.58 m (DFO 2010a, internet site).

Surface currents in Conception Bay are weaker than those in the Strait of Belle Isle, averaging between 0 and 0.02 m/s (de Young and Sanderson 1995), but have been measured at speeds up to 0.43 m/s (Seaconsult 1990). Bottom currents in Conception Bay are also weak, averaging between 0.01 and 0.02 m/s (de Young and Sanderson 1995). Despite this trend, there are some locations within Conception Bay where currents are stronger than average, including the eastern side and near the mouth, where the outflowing current is between 0.1 and 0.2 m/s (de Young and Sanderson 1995). Current speed in Conception Bay also varies with water depth, with currents at 124 m depth being recorded at 0.07 m/s (Seaconsult 1990). The highest monthly surface current speeds were recorded in June, while the highest monthly bottom current speeds were recorded in November (Seaconsult 1990).

Local Ecological Knowledge

LEK regarding currents and tides of the Marine Environment in parts of the Study Area was obtained through conversation with participants of open houses in Hawke's Bay and L'Anse au Loup, Labrador-Island Transmission Link Proposed Conception Bay South Shoreline Electrode meeting participants, and Labrador-Island Transmission Link EA, Strait of Belle Isle Marine Crossing meeting participants in Flower's Cove. This is listed below, and includes information on tidal strength in the straits, where the tide is strongest, top and bottom layers of tides that travel in different directions, and coastal erosion due to tidal flow. The information provided is generally consistent with the scientific data obtained through the field studies and literature review conducted for the EA (as reported in Section 10.5.3.1).

Table 10.5.3-1 Local Ecological Knowledge of Currents and Tides in the Study Area

Community	Source	Indirect Quote
Hawke's Bay, NL	Labrador-Island Transmission Link open house participant, Hawke's Bay, April 29, 2010	The tide is 4 to 5 knots in the straits.
	Labrador-Island Transmission Link open house participant, Hawke's Bay, April 29, 2010	The tide is worst in the narrows (Project area).
L'Anse au Loup, NL	Labrador-Island Transmission Link open house participant, L'Anse au Loup, May 1, 2010	The tide current in the Straits is always 3 knots, can be up to 4-5 knots.
	Labrador-Island Transmission Link open house participant, L'Anse au Loup, May 1, 2010	There used to be an hour between high tide and low tide, but now there is no time at all. The water just starts swirling.
	Labrador-Island Transmission Link Strait of Belle Isle Field Programs Meeting participant, L'Anse au Loup, June 13, 2011	Fishermen have noted a strong current in the areas of the Strait, up to 13 knots. A boat travelling at 15 knots can be slowed to 2 knots when sailing in an area of strong current.
	Labrador-Island Transmission Link Strait of Belle Isle Field Programs Meeting participant, L'Anse au Loup, June 13, 2011	Fishermen don't fish in the middle of the Strait in the fall, the tide is too strong and they risk losing their fishing gear.
	Labrador-Island Transmission Link Strait of Belle Isle Field Programs Meeting participant, L'Anse au Loup, June 13, 2011	The tide is so strong that 20 and 40 lb crab pots set in 20 fathoms of water were found 5 miles away.
	Labrador-Island Transmission Link Strait of Belle Isle Field Programs Meeting participant, L'Anse au Loup, June 13, 2011	There are two layers of tide in the Strait. The top layer and the bottom later travel in different directions.
Conception Bay South, NL	Labrador-Island Transmission Link Proposed Conception Bay South Shoreline Electrode Meeting participant, Conception Bay South, February 22, 2011	There is significant amount of coastal erosion and tidal flow in the proposed electrode site area.
Flower's Cove, NL	Labrador-Island Transmission Link EA, Strait of Belle Isle Marine Crossing Meeting participant, Flower's Cove, NL, January 12, 2011	The Strait of Belle Isle is more powerful than a river.
	Labrador-Island Transmission Link EA, Strait of Belle Isle Marine Crossing Meeting participant, Flower's Cove, NL, January 12, 2011	I have seen situations where the tide is so high you can't find buoys.

10.5.4 Winds and Waves

Wind and waves within the Strait of Belle Isle Study Area and Dowden's Point Study Area are described in this section, including the relevant information sources used.

10.5.4.1 Information Sources and Data Collection

Primary information sources including available datasets and literature produced by research agencies such as Meteorological Services Canada and the National Oceanic and Atmospheric Administration were reviewed and presented in *Marine Fish and Fish Habitat in the Strait of Belle Isle: Information Review and Compilation* (Sikumiut 2010a). The baseline description of winds and waves in the Strait of Belle Isle is based on data from MSC50, a wind and wave hindcast of hourly data of the North Atlantic Ocean provided by Meteorological Services Canada (Swail et al. 2006). Data for the hindcast were obtained from a variety of datasets including the National Oceanic and Atmospheric Administration Marine Environmental Buoy Database, the Marine Environmental Data Service Marine CD-ROM (Canadian data) and the International Comprehensive Ocean Atmosphere Data Set (Sikumiut 2010a). MSC50 includes hourly wind and wave data from 1954 through 2009, inclusive, and includes consideration of iced-over periods (Swail et al. 2006).

The baseline description of winds and waves in Conception Bay uses data from the AES40 dataset for the east coast of Newfoundland. AES40 is a wind and wave hindcast of hourly data of the North Atlantic Ocean and includes hourly data from 1958 through 1997 (EC, Atlantic Climate Centre 2003).

Data for MSC50 node 18071, located in the Strait of Belle Isle (51.4° N, 56.8° W), were used in the description of wind and wave activity in the Strait and were used in the development of wind and wave roses (Sikumiut 2010a, b).

Data for AES40 East Coast, which covers the eastern coast of Newfoundland, were used in the description of wind and wave activity in Conception Bay (EC, Atlantic Climate Centre 2003).

These data were collected from existing sources through literature searches and reviews; no field work was undertaken for this component.

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

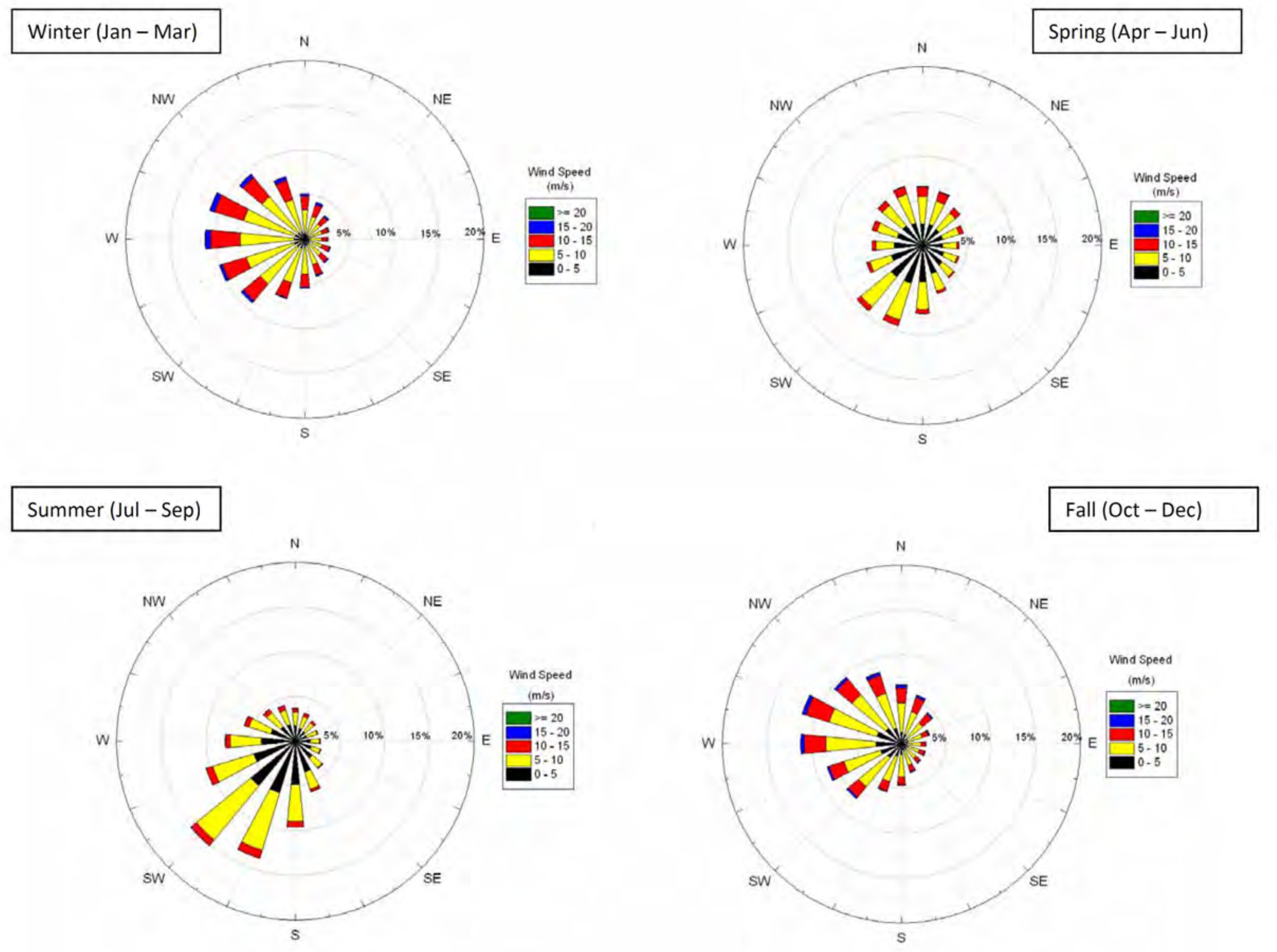
10.5.4.2 Description of Winds and Waves

Strait of Belle Isle

Wind direction is generally aligned with the Strait of Belle Isle. Predominant wind direction is from the west or north-west during winter months (January to March), while north-east and south-west winds are typical during the spring (April to June) (Figure 10.5.4-1). These wind directions are highly dependent on the two major storm tracks in the region, one which takes low-pressure systems through Labrador, and the second that produces low-pressure systems with north-east winds that pass through Newfoundland. The majority of winds originate from the south-west during July to September and veer to westerlies in late October and November (Sikumiut 2010a) (Figure 10.5.4-1).

Wind speeds are, on average, comparable from May through August averaging 5 to 10 m/s, increasing markedly in September and October. Maximum wind speeds in the Strait of Belle Isle (at MSC50 node 18071) can reach more than 25 m/s and occur <1% of the time, typically from November through January (Sikumiut 2010a).

Wave direction differs on the Labrador and Newfoundland sides of the Strait of Belle Isle and is influenced by wind direction. On the Labrador shore, the predominant wave direction is from the south-west, with a typical wave height of 0 to 0.5 m (54% of the time) and an extreme wave height of 7.0 m. On the Newfoundland shore, the predominant wave directions are west and south-west, with typical wave heights of 0 to 0.5 m (57% of the time) and an extreme wave height of 5.5 m (AMEC 2010b).



Source: Swail et al. (2006) as cited in Sikumiut (2010)

FIGURE ID: HVDC_ST_233

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FIGURE 10.5.4-1

Seasonal Wind Roses for MSC50 Node 18071 in the Strait of Belle Isle

Wave height and direction also vary by season. The largest waves in the Strait of Belle Isle occur from October to January and are typically from the west and south-west, similar to the predominant wind direction. A study by SNC-Lavalin in 1981 (Hatch Mott MacDonald 2005, internet site) measured sea states in the Strait of Belle Isle and determined that wave heights were lowest in August and highest in November. The average wave height observed during that study was 1.03 m, with a maximum recorded wave height of 7.7 m. Based on these data, seasonal wave roses were developed, using units of significant wave height (H_{sig} in metres) (Figure 10.5.4-2).

During the winter months, wave height is reduced by the amount of sea ice in the Strait of Belle Isle, the Labrador Sea, and the Gulf of St. Lawrence. If no ice cover is assumed, the maximum wave height with a return period of 100 years would be approximately 10 m, occurring in January (Hatch Mott MacDonald 2005, internet site). This means that, assuming no ice cover, a wave height of 10 m is expected to be exceeded once in 100 years.

Conception Bay

On the east coast of Newfoundland, including Conception Bay, prevailing winds are typically from the west during the fall and winter months (October through March) and south-west during the spring and summer (April through September). Wind speeds are, on average, comparable between May and August (between 5.7 and 6.2 m/s), increasing through the fall months to an average high of 10.3 m/s in January. Extreme wind speeds, reaching more than 25 m/s occur <1% of the time, typically in January and February (EC, Atlantic Climate Centre 2003).

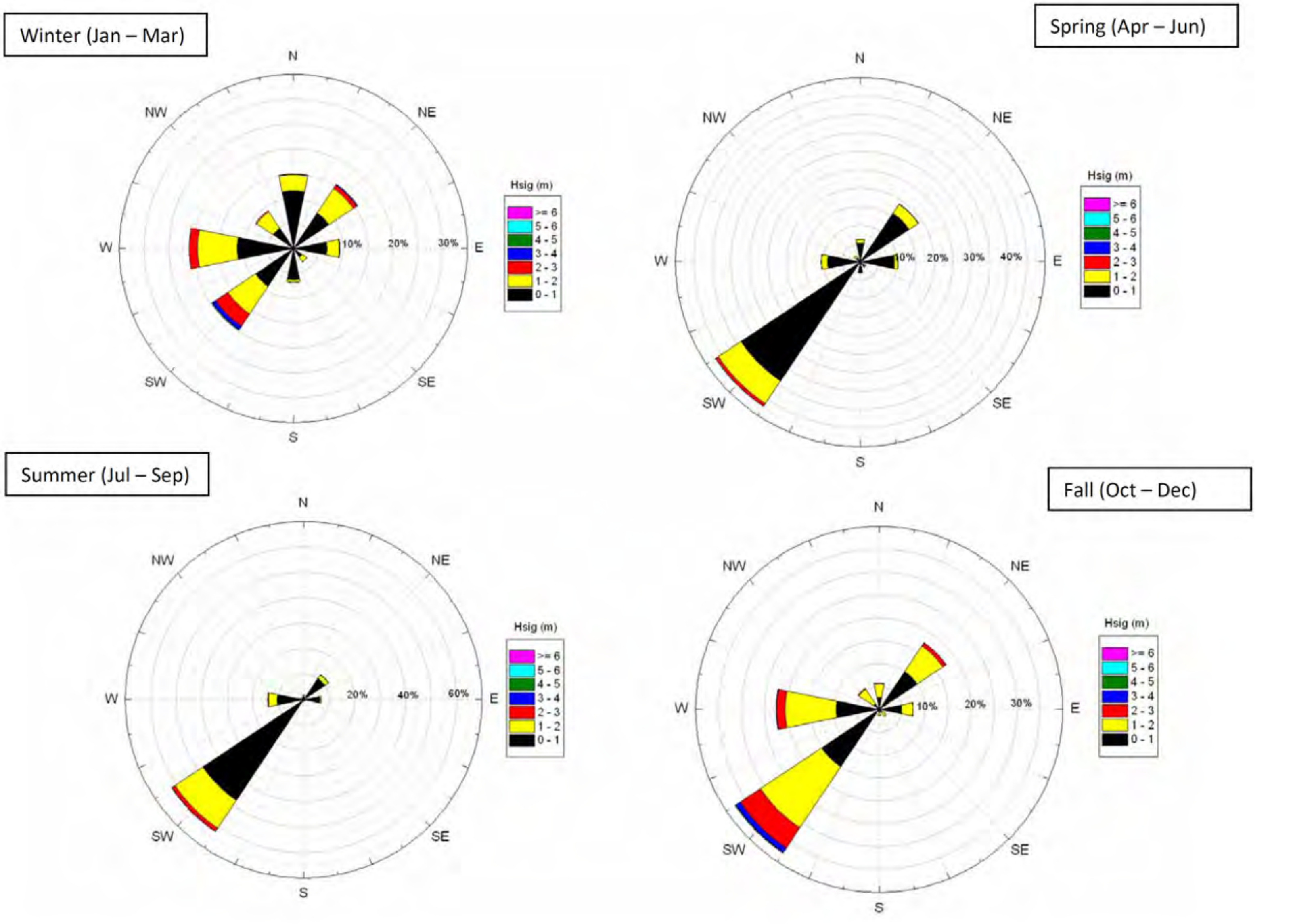
Waves on the east coast of Newfoundland, including in Conception Bay, typically follow the wind direction, flowing mainly south-west in the spring and summer months (March through October), and west in the winter (November through February). Wave height varies throughout the year, with the lowest waves typically occurring in July, with an average height of 1.6 m. The highest waves typically occur in December, with an average height of 3.4 m (EC, Atlantic Climate Centre 2003).

Local Ecological Knowledge

LEK regarding winds and waves of the Marine Environment in parts of the Study Area was obtained through personal communication, as well as conversation with participants of Labrador-Island Transmission Link Proposed Conception Bay South Shoreline Electrode Meeting and Labrador-Island Transmission Link CBS T'Railway Meeting. This is listed below, and includes information on wave action in Conception Bay South and the destruction caused by waves. The information provided is generally in keeping with the scientific data obtained through the field studies and literature review conducted for the EA (as reported in Section 10.5.4.1).

Table 10.5.4-1 Local Ecological Knowledge of Currents and Tides in the Study Area

Community	Source	Indirect Quote
Conception Bay South, NL	Labrador-Island Transmission Link Proposed Conception Bay South Shoreline Electrode Meeting participant, Conception Bay South, February 22, 2011	A 120 tonne bridge was washed away near Indian Pond.
	Labrador-Island Transmission Link CBS T'Railway Meeting participant, Conception Bay South, NL, March 7, 2011	The area of the proposed electrode site gets the worst wave action in all of Conception Bay. It is highly suggested the inland option would be Nalcor's safest bet.



Source: Swail et al. (2006) as cited in Sikumiut (2010)

FIGURE ID: HVDC_ST_234

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FIGURE 10.5.4-2

Seasonal Wave Roses for MSC50 Node 18071 in the Strait of Belle Isle

10.5.5 Sea Ice and Icebergs

10.5.5.1 Information Sources and Data Collection

Sikumiut (2010a) reviewed data on sea ice distribution, concentration and frequency, which were obtained from the Canadian Ice Service Sea Ice Climatic Atlas for eastern Canada for (Canadian Ice Service 2001, internet site). The Canadian Ice Service maintains a database of historical ice coverage in Canada and uses these data to produce 30-year climatic ice atlases for regions of the country. These atlases provide mapping products, by date, for frequency of ice coverage, predominant ice type and median ice concentration (Canadian Ice Service 2001, internet site).

Data and baseline conditions for iceberg distribution and behaviour were obtained from reports completed in support of the proposed fixed link transportation project including C-CORE (2004) and Hatch Mott MacDonald (2005, internet site). Iceberg surveys in the Strait of Belle Isle for data have focused on seabed scouring. C-CORE (2004) used data on drift speed, iceberg keel depth, frequency, water depth and seabed slope to determine iceberg scour risk and required cover depths.

Information on seabed scouring in the Strait of Belle Isle was also obtained from Fugro Jacques GeoSurveys Inc. (2010), a field program completed in support of the Project. This report, *Marine Habitats in the Strait of Belle Isle: Interpretation of 2007 Geophysical (Sonar) Survey Information for the Submarine Cable Crossing Corridors* involved the collection of detailed information on bathymetry and substrate characteristics within the proposed submarine cable crossing corridors, including through side-scan sonar, multi-beam and sub-bottom profile surveys in 2007. This study presents a detailed analysis and interpretation of these geophysical survey data to identify and classify the seafloor marine habitats (substrate types and water depths) within the two initially proposed corridors.

Following the change in the Project concept for the proposed Strait of Belle Isle marine cable crossing which identified Shoal Cove as a possible landing site, and the concept of one single corridor across the Strait of Belle Isle, an additional supplementary study was completed. As the single corridor is essentially an amalgamation of the two previously proposed and studied marine corridors, utilizing portions of each and a new short segment in to Shoal Cove, supplementary reports for Fugro Jacques GeoSurveys (2010) were completed. Fugro-Jacques GeoSurveys (2011), *Marine Habitats in the Strait of Belle Isle: Interpretation of 2007 Geophysical (Sonar) Survey Information Supplementary Report*, presents an "extraction" of the relevant data from the information from the 2007 marine geophysical surveys and associated interpretation and analyses that fall within the proposed single corridor and provides a summary overview of the information.

Information regarding sea ice and icebergs in Conception Bay was obtained from a review of literature and data from the Canadian Ice Service (2001, internet site). Seabed scouring information for Conception Bay was obtained from Kelly et al. (2009).

No Project-specific field work was conducted to characterize sea ice or icebergs in Conception Bay, as they will not be affected by the Project.

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

10.5.5.2 Description of Sea Ice and Icebergs

Strait of Belle Isle

Sea ice in the Strait of Belle Isle is a combination of land-fast ice formation and pack ice, which drifts in from the Labrador Sea. It typically begins formation in December and has melted or broken-up by late May or early June. Land-fast ice in the Strait of Belle Isle is typically <0.6 m thick (Hatch Mott MacDonald 2005). The thickness and strength of pack ice changes over time as individual ice floes collide and freeze together. The thickness of a single ice floe is typically less than 1 m; however, these collisions can result in ice formations several metres thick, but with less strength than a solid sheet of ice (Hatch Mott MacDonald 2005, internet site).

In a typical year, local land-fast ice forms first in the Strait of Belle Isle in mid- to late-December. In January, pack ice from the Labrador Sea begins to drift into the Strait, with coverage reaching 70 to 90% by the end of January. On average, greater than 90% coverage is reached by mid-February and can last up to six weeks. Ice coverage during winter months is near 100%. The majority of ice in the Strait of Belle Isle during the winter is considered first-year ice. On average, the spring ice break-up starts in March on the Labrador side of the Strait of Belle Isle (Canadian Ice Service 2001, internet site).

Pack ice moves in and out of the Strait of Belle Isle with the currents and wind, and is strongly influenced by the tides that flow perpendicular to the dominant water currents and wind. As a result, movement of ice in the Strait of Belle Isle is quite variable (National Geospatial-Intelligence Agency 2010). Only a small percentage of this ice moves into the Gulf of St. Lawrence (Hatch Mott MacDonald 2005, internet site).

Approximately 60 to 90 icebergs drift into the Strait of Belle Isle each year, constituting approximately 10 to 15% of all icebergs to pass the latitude of the Strait of Belle Isle, drifting from the Labrador Sea. Most icebergs drift into the Strait of Belle Isle in May and June, entering on the Labrador side, carried by the prevailing currents, and exiting through the same channel on the Newfoundland side. There have been occasions when icebergs passed through the Strait of Belle Isle into the Gulf, but this is an infrequent occurrence (C-CORE 2004).

C-CORE (2004) suggest that the shoal located north-east of the submarine corridor and Centre Bank North (Figure 10.5.2-4) prevents large, deep icebergs from entering the Strait of Belle Isle. However, evidence of scouring has been identified in the Study Area, frequently associated with Coarse-Large substrates (see Table 10.6-1 in Fugro Jacques Geosurveys 2010) at depths of 90 to 110 m (Fugro Jacques Geosurveys 2010). A detailed discussion of icebergs in the Strait of Belle Isle is provided in Sikumiut (2010a).

Conception Bay

Conception Bay is known to contain ice, mainly composed of pack ice, during winter and spring months. The majority of ice in the Bay is new ice, with some gray ice near the mouth of the Bay (Canadian Ice Service 2001, internet site). Ice also forms in the Bay itself, largely from ice foot development from along the north-west coast of the Bay. Ice scour has resulted from icebergs and pack ice entering the Bay (Kelly et al. 2009).

Local Ecological Knowledge

LEK regarding sea ice and icebergs of the Marine Environment in parts of the Study Area was obtained through conversation with participants of the open house in Hawke's Bay, personal communication, as well as conversation with Labrador-Island Transmission Link Strait of Belle Isle Field Programs Meeting. This is listed below (Table 10.5.5-1), and includes information on: icebergs in the straits, the protection sea ice gives the coast from icebergs, and the lack of icebergs in the strait in the past few years. The information provided is generally consistent with the scientific data obtained through the field studies and literature review conducted for the EA (as reported in Section 10.5.5.1).

Table 10.5.5-1 Local Ecological Knowledge of Sea Ice and Icebergs in the Study Area

Community	Source	Indirect Quote
Hawke's Bay, NL	Labrador-Island Transmission Link open house participant, Hawke's Bay, April 29, 2010	Icebergs will be a problem in the straits
	Labrador-Island Transmission Link open house participant, Hawke's Bay, April 29, 2010	Most icebergs get stuck 1 to 2 miles offshore and not in the middle of the strait
	Strait of Belle Isle fisher (Newfoundland), Personal communication, Winter 2011	When a thick layer of pan ice forms along the sides of the Strait in winter, this often protects the shallower coastal areas from icebergs
L'Anse au Loup, NL	Labrador-Island Transmission Link Strait of Belle Isle Field Programs Meeting participant, L'Anse au Loup, June 13, 2011	Icebergs get grounded in locations all over the Strait. We haven't seen as many icebergs in the last few years. We think the lack of icebergs is due to a change in current

10.5.6 Marine Ambient Noise

10.5.6.1 Information Sources and Data Collection

During 2010, acoustic data were recorded at three locations within the Strait of Belle Isle: near Newfoundland, near the middle of the Strait (Middle), and near Labrador. Two deployments (June to August and October to December) recorded ambient noise from each of the three locations (Jasco 2011a).

Data were collected using the AURAL M2 16 bit single channel autonomous underwater digitalized sound recorder system. For this Project-specific study, they were outfitted with HTI-96 hydrophones, configured for 22 dB of gain and the recorder was set for a sampling frequency of 32,768 hertz (Hz). Recorders were deployed using a 'float-on-a-rope' method (Jasco 2011a). Locations of recorders are provided in Table 10.5.6-1 and Table 10.5.6-2.

Table 10.5.6-1 Recorder Locations in the Strait of Belle Isle, June – August 2010

Recorder Location	Latitude	Longitude
Newfoundland	51'19.739	56'45.729
Middle	51'21.003	56'52.95
Labrador	51'27.89	56'53.30

Source: Jasco (2011a).

Table 10.5.6-2 Recorder Locations in the Strait of Belle Isle, September – December 2010

Recorder Location	Latitude	Longitude
Newfoundland	51'19.47	56'45.92
Middle	51'21.02	56'53.04
Labrador	51'27.51	56'53.29

Source: Jasco (2011a).

Manual analysis was used to identify biological sounds that occurred during the recording period. Manual analysis was performed at consistent set intervals. For each 30 minute file, 5% (90 seconds) of the data were analyzed manually. The manual analysis was performed using a custom software tool to maintain consistency of approach by all analysts. The tool, called 'SpectrogramPlotter' allowed Jasco's manual analysts to generate annotations in a structured format (Jasco 2011a).

Automated acoustic analysis software was used to compute ambient sound levels, detect marine mammal calls, and detect anthropogenic and shipping events within the acoustic data (Jasco 2011a).

10.5.6.2 Description of Marine Ambient Noise

From the first deployment period, there were 2,890 sound events in total, that were annotated manually, of which 1,910 were identified as marine mammal calls. The bulk of these calls were made by humpback whales (*Megaptera novaeangliae*) (Table 10.5.6-3). Most sounds were annotated at the Middle station, followed closely by the Labrador station. There was considerably less biological acoustic activity at the Newfoundland station (Jasco 2011a). A summary of marine mammal calls for the June to August deployment period is provided in Table 10.5.6-3.

Table 10.5.6-3 Station Counts of Marine Mammal Calls Identified by Manual Analysis by Species for the June to August Deployments

Species	Labrador	Middle	Newfoundland	Total
Blue whale (*Balaenoptera musculus*)	0	0	9	9
Fin whale (*Balaenoptera physalus*)	2	9	0	11
Sei whale (*Balaenoptera borealis*)	0	1	0	1
Humpback whale (*Megaptera novaeangliae*)	521	427	56	1,004
Killer whale (*Orcinus orca*)	46	297	23	366
Dolphin (various species) (*Lagenorhynchus* sp.)	221	232	66	519
Unknown	365	448	167	980
Total	**1,155**	**1,414**	**321**	**2,890**

Source: Jasco (2011a).

The ambient noise analysis for the Strait of Belle Isle demonstrates that sound levels are well within the limits of prevailing noise for oceans. More specifically, ambient noise levels in the 10 to 100 Hz band ranged from 80 to 130 dB re 1 µPa, with highest ambient levels recorded at the acoustic station in the middle of the Strait of Belle Isle. Lowest ambient noise levels were typically recorded at the acoustic station located near the Labrador coast. Below 100 Hz real and pseudo-noise from tidal flow dominates the measured noise. Tidal noise is amplitude modulated by the lunar cycle, with a minimum level at the neap tides. Above 100 Hz, vessel traffic was the most pronounced noise source during the summer months. During the fall, increased storm activity increased the overall noise levels by 5 dB (Jasco 2011a).

10.5.7 Marine Water Quality

This overview describes the existing marine water quality in the Strait of Belle Isle and Conception Bay areas, with respect to temperature, salinity, nutrients, metals and petroleum hydrocarbons focussed on the Project's proposed submarine cable crossing corridor and shoreline electrode sites. Additional information on currents and water masses, which influence water quality, is described in Sections 10.5.2 to 10.5.4.

Overall, the existing water quality in these areas is nearly pristine, with the exception of a small number of coastal sites. Temperature, salinity, nutrient and pH levels are within historical and acceptable limits, oxygenation and water clarity are high, and metal and petroleum hydrocarbon concentrations are low.

The marine water quality discussion is focused on the Strait of Belle Isle (including the proposed 500 m wide submarine cable crossing corridor and shoreline electrode site at L'Anse au Diable), and Conception Bay (including the proposed shoreline electrode site at Dowden's Point (Figure 10.5.7-1).

10.5.7.1 Information Sources and Data Collection

Relevant data were integrated from studies in the Strait of Belle Isle and at the shoreline electrode sites, as well as relevant research from the adjacent Gulf of St. Lawrence, Labrador Shelf, Grand Banks and Northwest Atlantic regions. This summary was compiled through primary and gray literature reviews, and encompasses the findings of four Project-specific studies: *Marine Fish and Fish Habitat in the Strait of Belle Isle: Information Review and Compilation* (Sikumiut 2010a); *Marine Water and Sediment and Nearshore Habitat Survey – Potential Electrode Sites* (Sikumiut 2011a); *2011 Marine Habitat and Water Sediment and Benthic Survey: Strait of Belle Isle Cable Corridor Segment – Shoal Cove Option* (Sikumiut 2011b); and *Marine Water and Sediment Survey – Strait of Belle Isle Submarine Cable Crossing Corridors* (Sikumiut 2011c).

- *Marine Fish and Fish Habitat in the Strait of Belle Isle: Information Review and Compilation* (Sikumiut 2010a): This study involved the identification, compilation, review and presentation of existing and available information on marine fish and fish habitat in the Strait of Belle Isle. This includes information on the physical environment / marine habitats (climate, wind, bathymetry, water temperature and salinity, currents, tides, wave, icebergs and sea ice, and surficial geology) and the biological environment (plankton, benthic invertebrates, algae and fish species presence, abundance and distribution).
- *Marine Water, Sediment, Benthos and Nearshore Habitat Surveys: Potential Electrode Sites* (Sikumiut 2011a): A 2010 marine sampling survey to collect information on water and sediment quality, and benthic invertebrates. It also included a bathymetric survey and video survey to identify substrate, macroflora and macrofauna distribution and backshore characteristics at two proposed shore electrode sites at L'Anse au Diable and Dowden's Point.
- *2011 Marine Habitat and Water Sediments and Benthic Survey: Strait of Belle Isle Cable Corridor Segment – Shoal Cove Option* (Sikumiut 2011b): A 2011 marine-vessel based survey of the marine habitat for the corridor segment to Shoal Cove. Marine water, sediment and benthic samples were also collected from within this same corridor segment and the results of these surveys are provided.
- *Marine Water and Sediment Survey - Strait of Belle Isle Submarine Cable Crossing Corridors* (Sikumiut 2011c): A 2010 vessel-based marine sampling survey was conducted to collect information on existing water and sediment quality and benthic invertebrates along the initially proposed submarine cable corridors.

Sources of information included the libraries of research organizations (e.g., Memorial University of Newfoundland, and DFO), and the internet. All relevant data and reports located were reviewed for this summary.

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FIGURE 10.5.7-1

Locations of the Submarine Cable Crossing Corridor (Strait of Belle Isle) and Shoreline Electrode Sites (L'Anse au Diable and Dowden's Point)

Strait of Belle Isle (Submarine Cable Corridor)

There has been relatively little water quality data published for the Strait of Belle Isle. However, the cold, saline water from the Labrador Shelf is known to be a primary source for water entering the Strait of Belle Isle, as well as warmer water from the Gulf of St. Lawrence (Han et al. 1999; Banks 1966; Petrie et al. 1988; Bailey 1958). Waters from the Labrador Shelf also flow onto the Grand Banks and adjacent Northwest Atlantic regions (Colbourne and Mertz 1998). As such, data for these areas are of relevance for describing water quality in the Strait of Belle Isle, since it is likely that they will have numerous water properties in common. Some of the more recent information from available literature and relevant Project-specific reports (Sikumiut 2011b, c) are briefly summarized below.

Temperature and Salinity

Mean sea surface temperature and salinity data for the Strait of Belle Isle and surrounding area from the hydrographic database maintained by DFO (DFO 2007a, internet site), and from remote operational sensing by the National Oceanic and Atmospheric Administration (DFO 2009b, internet site) were reviewed in Sikumiut (2010a). Seasonal variations in sea surface temperature were examined using 2009 mid-season 15-day composite images from the National Oceanic and Atmospheric Administration remote operational sensing database. Temperature and salinity data at depths up to 100 m for the Strait of Belle Isle, from 51 to 52°N and 57.1 to 56.2°W, were also reviewed using the Biohydrographic database (Bedford Institute of Oceanography 2010, internet site in Sikumiut 2010a).

Water samples were collected in June of 1978 on two cruises to four stations in the Northwest Atlantic between the surface and up to 3,172 m depth using Go-Flo samplers or a rosette system with sample bottles and an attached conductivity-temperature-depth (CTD) profiler, to determine temperature and salinity in these areas (Campbell and Yeats 1981). Data from one of these cruises were analyzed by Yeats and Bewers (1985), while data from both cruises were examined by Yeats and Campbell (1983).

A long-standing winter (March 1996 to 2004) temperature and salinity survey has been conducted in the Strait of Belle Isle and Esquiman Channel, and near Anticosti Island (Gulf of St. Lawrence), using a CTD profiler and Niskin bottles (Galbraith 2006). Similarly, ten cross-shelf transects along the Labrador Shelf, consisting of a total of 52 hydrographic stations were established and profiled, using bottles on a rosette attached to a CTD profiler (Drinkwater and Harding 2001). High-resolution temperature, salinity and density fields were used to analyze a three dimensional diagnostic model for hydrography and circulation in the Gulf of St. Lawrence, including the Strait of Belle Isle as the most northeasterly region of the model (Han et al. 1999).

Sea water was sampled at 20 locations in the vicinity of the submarine cable corridor in the Strait of Belle Isle for the Project-specific studies (Sikumiut 2011b, c) (Figure 10.5.7-2). At each station, the water column was profiled using a CTD profiler (Seabird SBE 19 Plus (Sea-Bird Electronics 2002)) and YSI meter (Model 600QS), and water samples were collected at subsurface, mid (within a thermocline or halocline where present, or mid water depth if no such clines existed), and bottom water column levels using Niskin bottles (see Table 10.5.7-1 for depths; see Sikumiut (2011c) for detailed methods). Water quality analyses were carried out by Maxxam Analytics.

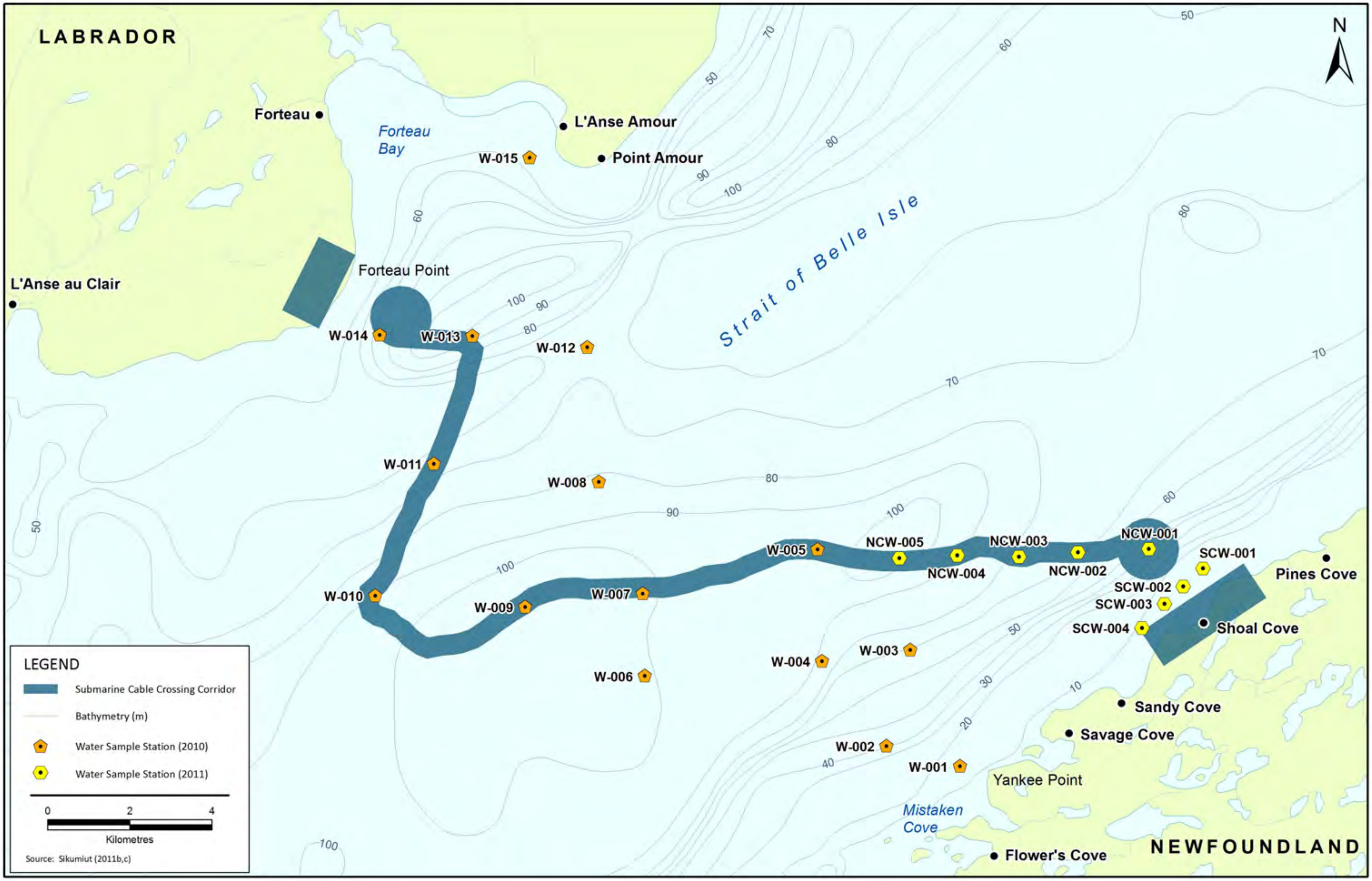

FIGURE 10.5.7-2

Water Sampling Stations in the Strait of Belle Isle, 2010 and 2011

Table 10.5.7-1 Water Sampling Depths in the Strait of Belle Isle, September 2010 and June 2011

Station ID	Water Depth (m)	Sample Depth (m)		
		Near Surface	Mid	Near Bottom
W-001	13.9	2	–[a]	10
W-002	40	2	20	40
W-003	76	2	40	70
W-004	91	2	50	75
W-005	108	2	50	100
W-006	121	2	45	100
W-007	115	2	45	85
W-008	88	2	40	80
W-009	109	2	35	85
W-010	103	2	30	85
W-011	70	2	30	65
W-012	65	2	25	60
W-013	115	1	50	100
W-014	86	2	40	70
W-015	55	1	25	50
NCW-001[b]	71	10	40	55
NCW-002[b]	79	5	35	70
NCW-003[b]	88	5	25	75
NCW-004[b]	101	5	25	75
NCW-005[b]	95	8	40	85

Source: Sikumiut (2011b, c).

[a] Only near surface and near bottom samples were collected (i.e., no mid-depth sample) at station W-001 due to a shallow total water depth.

[b] NCW-001, NCW-002, NCW-003, NCW-004 and NCW-005 refer to Station ID as presented in Sikumiut 2011c.

Nutrients

Nitrate values have been analyzed from water samples collected along the Labrador Shelf (Drinkwater and Harding 2001), while nitrate concentrations in samples from the Northwest Atlantic, collected by Campbell and Yeats (1981) have been examined by Yeats and Campbell (1983). Dissolved oxygen (DO) concentrations recorded near the surface and bottom of the water column in the Grand Banks by Colbourne (1993) have been reviewed in Petro-Canada (1996).

Sea water samples from the Strait of Belle Isle (Sikumiut 2011b, c) were also analyzed for nutrient concentrations (i.e., nitrate, nitrite, nitrogen (in the form of ammonia nitrogen), phosphorous and orthophosphate), along with several other conventional parameters, by Maxxam Analytics.

Metals

Trace metal concentrations recorded from sea water from the Northwest Atlantic (Mobil Oil Canada Ltd. 1985), Gulf of St. Lawrence (Mobil Oil Canada Ltd. 1985), and Grand Banks (MacKnight et al. 1981) have been reviewed in Petro-Canada (1996). Metal concentrations recorded from sea water samples from numerous studies in the Northwest Atlantic (including Gill and Fitzgerald 1988; Boyle et al. 1986; Flegal 1986; Dalziel and Yeats 1985; Gill and Fitzgerald 1985; Bruland and Franks 1983; Schaule and Patterson 1983) have also been reviewed and summarized in Fowler (1990). Metal concentrations in sea water samples collected from four stations in the Northwest Atlantic (see above) have been analyzed by Yeats and Bewers (1985), Yeats and Campbell (1983) and Campbell and Yeats (1981). Metal concentrations measured in sea water samples from Baffin Bay, and similar data collected in the Gulf of St. Lawrence by Yeats et al. (1978) have been reviewed in Campbell and Loring (1980).

Sea water samples from the Strait of Belle Isle (Sikumiut 2011b, c) were analyzed for metal concentrations, including chromium, cadmium, mercury, arsenic, boron, selenium and strontium by Maxxam Analytics.

Petroleum Hydrocarbons

Hydrocarbon levels obtained from sea water samples from the Grand Banks (Levy 1986) and Labrador Shelf (Levy 1983) have been reviewed in Petro-Canada (1996).

Sea water samples from the Strait of Belle Isle (Sikumiut 2011b, c) were analyzed for petroleum hydrocarbon concentrations (including C6 to C32 hydrocarbons, benzene, ethylbenzene, xylene and toluene) by Maxxam Analytics.

L'Anse au Diable (Shoreline Electrode Site)

Data from the literature relevant to the Strait of Belle Isle is considered applicable to the L'Anse au Diable shoreline electrode site, which is situated along the north-west shoreline of the Strait (Figure 10.5.7-1). The Project's site-specific survey at the electrode site (Sikumiut 2011a) is briefly described below.

Temperature and Salinity

The four sea water sample station locations for the shoreline electrode site in L'Anse au Diable are shown in Figure 10.5.7-3 (Sikumiut 2011a). Sea water samples were collected near surface using a Niskin bottle, and the water column at each station was profiled using a CTD profiler (Seabird SBE 19 Plus) and YSI meter (Model 600QS) (see Table 10.5.7-2 for water depths; see Sikumiut 2011a for detailed methods). Analyses of these samples were carried out by Maxxam Analytics.

Table 10.5.7-2 Water Sampling Depths in the L'Anse au Diable Shoreline Electrode Site, September 2010

Station ID	Habitat	Sample Depth (m)
W-016	Subtidal	6.5
W-017	Subtidal	5.0
W-018	Subtidal	8.0
W-019	Subtidal	5.0

Source: Sikumiut (2011a).

Nutrients

Sea water samples from the L'Anse au Diable shoreline electrode site (Sikumiut 2011a) were analyzed for nutrient concentrations (i.e., nitrate, nitrite, nitrogen (in the form of ammonia nitrogen), phosphorous and orthophosphate), and other conventional parameters, by Maxxam Analytics.

Metals

Sea water samples from the L'Anse au Diable shoreline electrode site (Sikumiut 2011a) were analyzed for metal concentrations (including chromium, cadmium, mercury, arsenic, boron, selenium and strontium) by Maxxam Analytics.

Petroleum Hydrocarbons

Sea water samples at the L'Anse au Diable shoreline electrode site (Sikumiut 2011a) were also analyzed for petroleum hydrocarbon concentrations (including C6 to C32 hydrocarbons, benzene, ethylbenzene, xylene and toluene) by Maxxam Analytics.

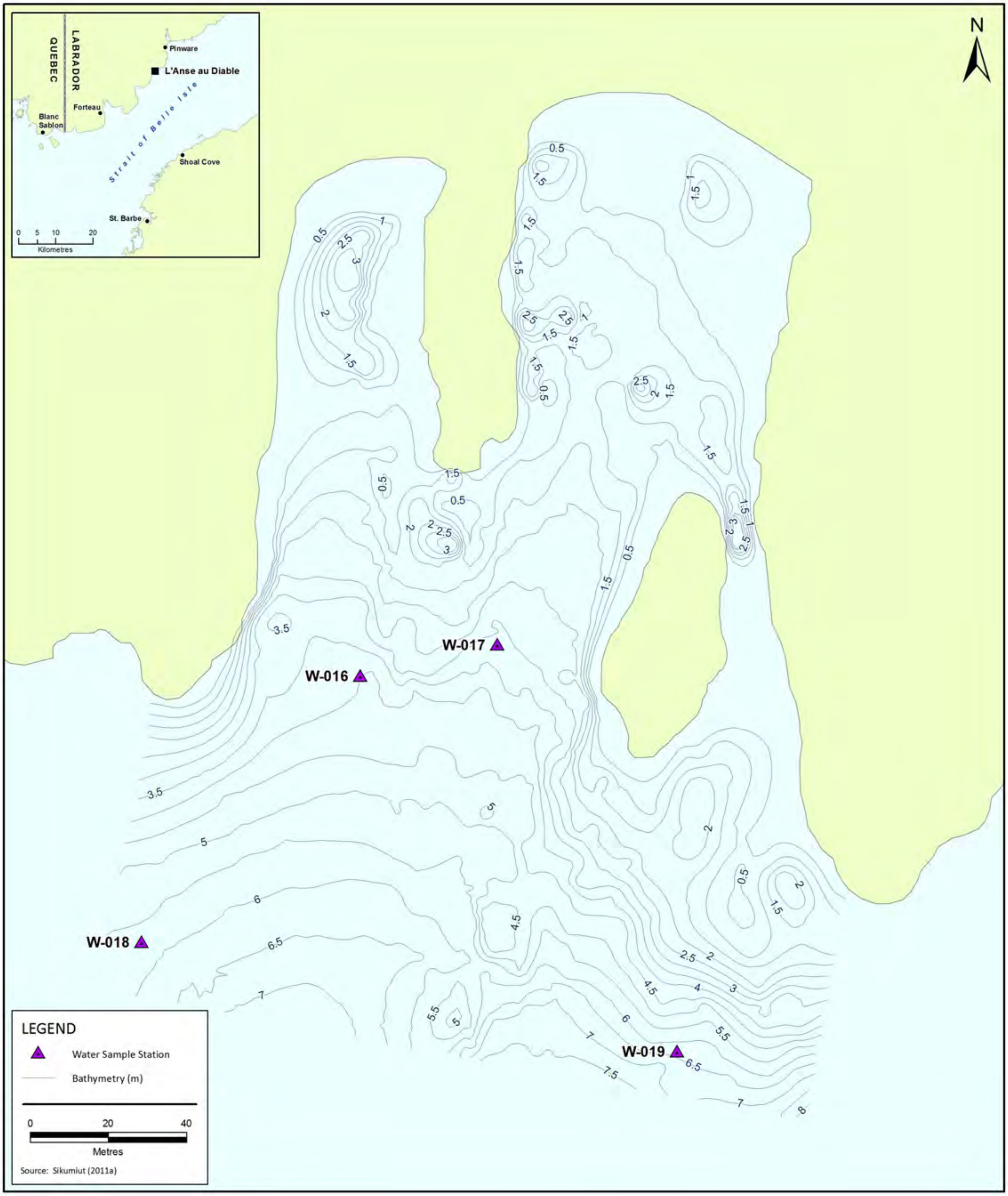

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FIGURE 10.5.7-3

Water Sampling Stations at the Proposed Shoreline Electrode Site at L'Anse au Diable, Strait of Belle Isle, 2010

Dowden's Point (Shoreline Electrode Site)

The majority of the available literature concerning sea water quality for Conception Bay comes from sample stations within approximately 7 km of the Dowden's Point shoreline electrode site, which is situated in the south-eastern portion of Conception Bay (Figure 10.5.7-1). This and other literature pertaining to water quality sampling in Conception Bay, along with the Project's site-specific survey (Sikumiut 2011a) are described below, with locations shown in Figure 10.5.7-4, Figure 10.5.7-5 and Figure 10.5.7-6.

Temperature and Salinity

Temperature and salinity data from the water column in the southern shore of Conception Bay have been analyzed using a CTD profiler (Parrish et al. 2009; Choe and Diebel 2008; Richoux et al. 2004). Temperature and salinity data collected using two CTD profilers throughout Conception Bay by de Young and Sanderson (1995) have been reviewed by Parrish (1998). Temperature and salinity have been determined at two stations (southern shore and central) in Conception Bay using a CTD profiler (Ostrom et al. 1997), while surface temperature along six transects in the north-western region of Conception Bay has been measured using a towed thermistor, with water column temperature recorded at the beginning and end of each transect using a salinometer (Horne 1994).

The four sea water sample station locations for the Dowden's Point shoreline electrode site from the Project-specific study (Sikumiut 2011a) are shown in Figure 10.5.7-4. Water samples were collected near the surface using a Niskin bottle, and the water column at each station was profiled using a CTD profiler (Seabird SBE 19 Plus) and YSI meter (Model 600QS) (see Table 10.5.7-3 for water depths; see Sikumiut 2011a for detailed methods). Analyses of these samples were carried out by Maxxam Analytics.

Table 10.5.7-3 Water Sampling Depths in the Dowden's Point Shoreline Electrode Site, October 2010

Station ID	Habitat	Sample Depth (m)
W-020	Subtidal	4.0
W-021	Subtidal	4.4
W-022	Subtidal	3.3
W-023	Subtidal	4.0

Source: Sikumiut (2011a).

Nutrients

In addition to profiling the sea water column in the southern shore and central regions of Conception Bay, Ostrom et al. (1997) collected water samples at both sampling stations and analyzed them for nitrate concentration.

Sea water samples collected in the Dowden's Point shoreline electrode site for the component study (Sikumiut 2011a) were analyzed for nutrient concentrations (i.e., nitrate, nitrite, nitrogen (in the form of ammonia nitrogen), phosphorous and orthophosphate), and other conventional parameters by Maxxam Analytics.

Metals

Sea water samples collected in the Dowden's Point shoreline electrode site for the component study (Sikumiut 2011a) were analyzed for metal concentrations (including chromium, cadmium, mercury, arsenic, boron, selenium and strontium) by Maxxam Analytics.

Petroleum Hydrocarbons

Sea water samples collected in the Dowden's Point shoreline electrode site for the Project-specific study (Sikumiut 2011a) were analyzed for petroleum hydrocarbon concentrations (including C6 to C32 hydrocarbons, benzene, ethylbenzene, xylene and toluene) by Maxxam Analytics.

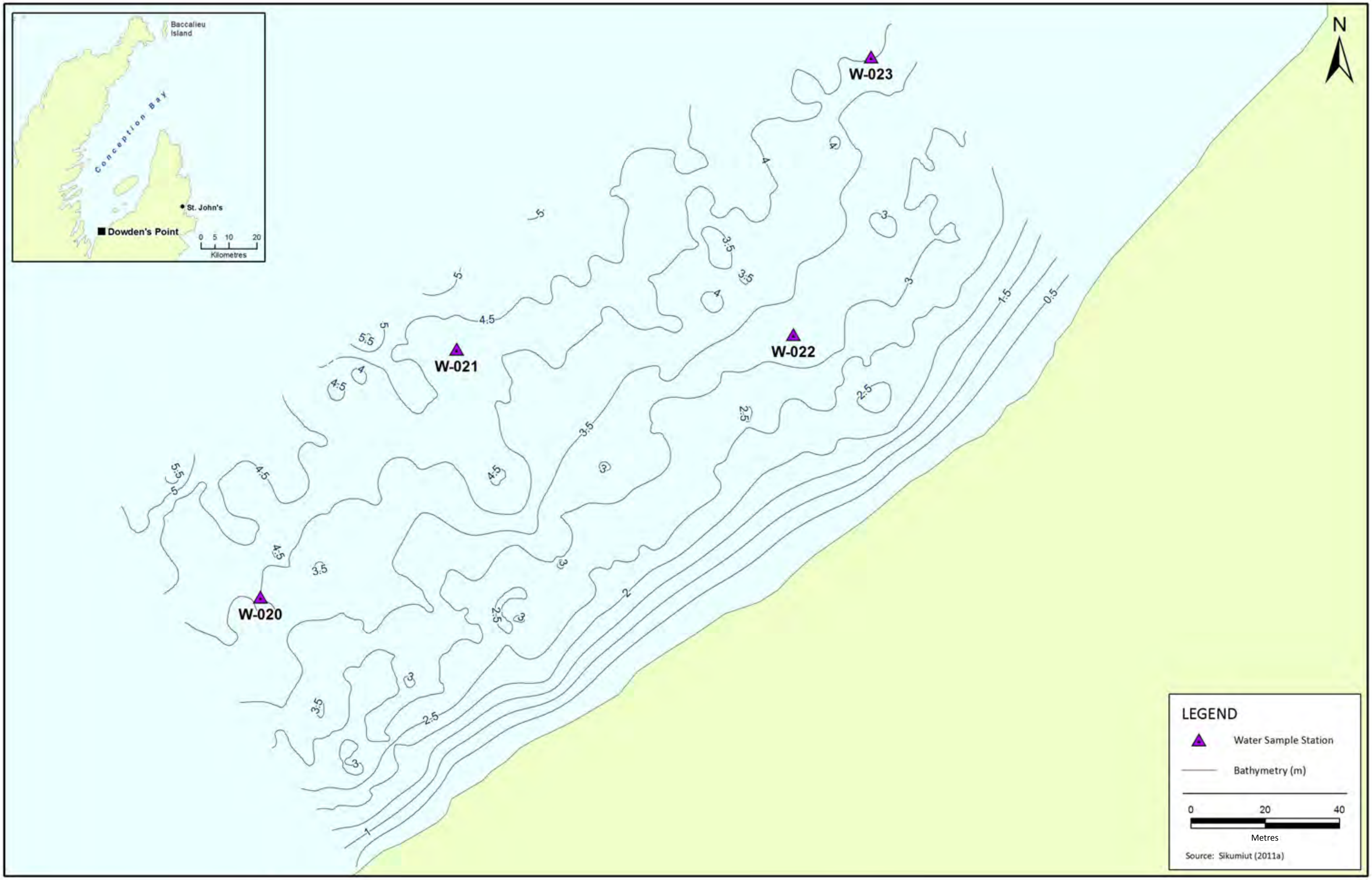

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FIGURE 10.5.7-4

Water Sampling Stations at the Proposed Shoreline Electrode Site at Dowden's Point, Conception Bay, Newfoundland, 2010

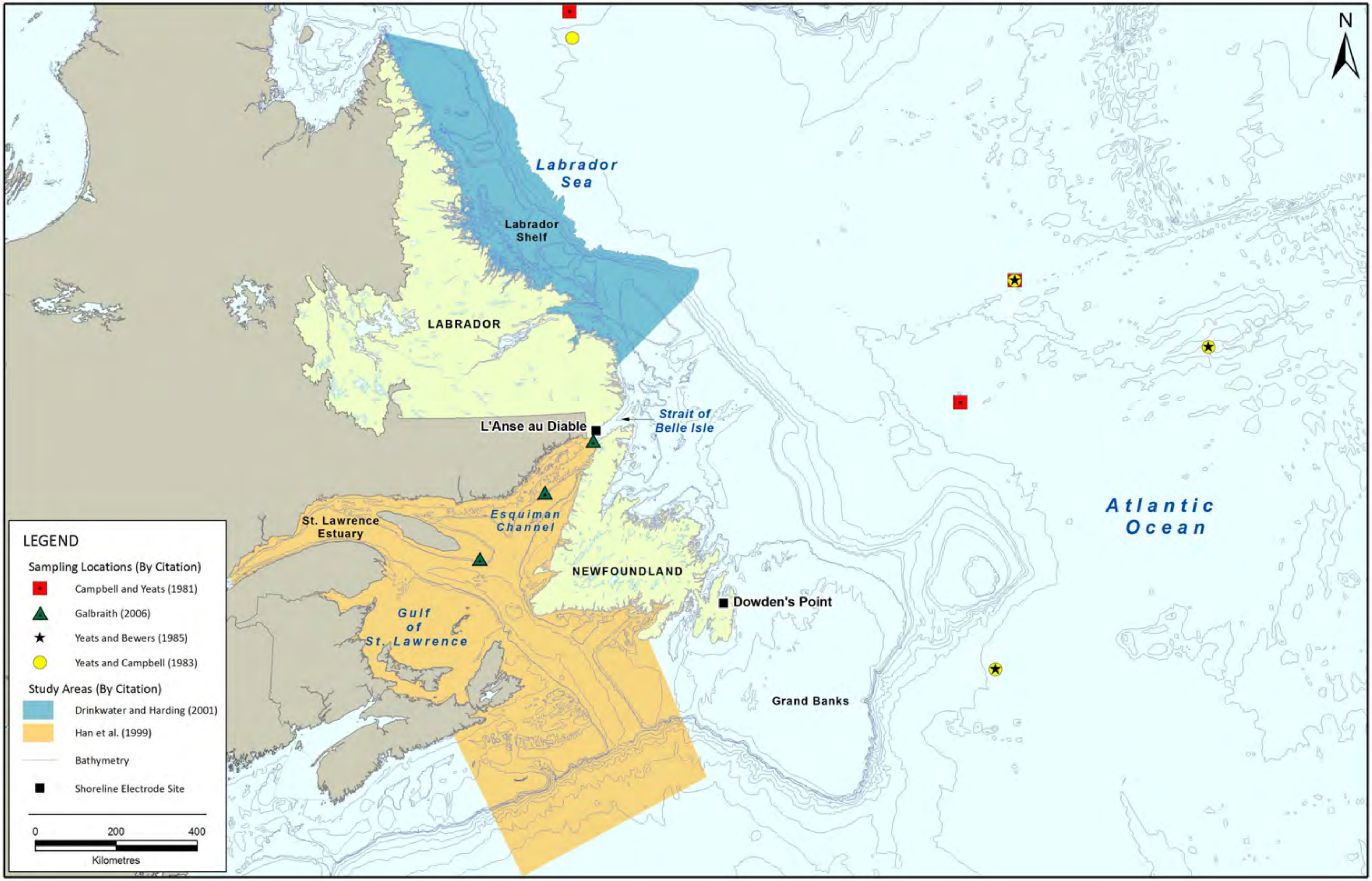

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FIGURE 10.5.7-5

Water Sampling Locations in the Strait of Belle Isle, Gulf of St. Lawrence, Labrador Shelf, Grand Banks and Northwest Atlantic

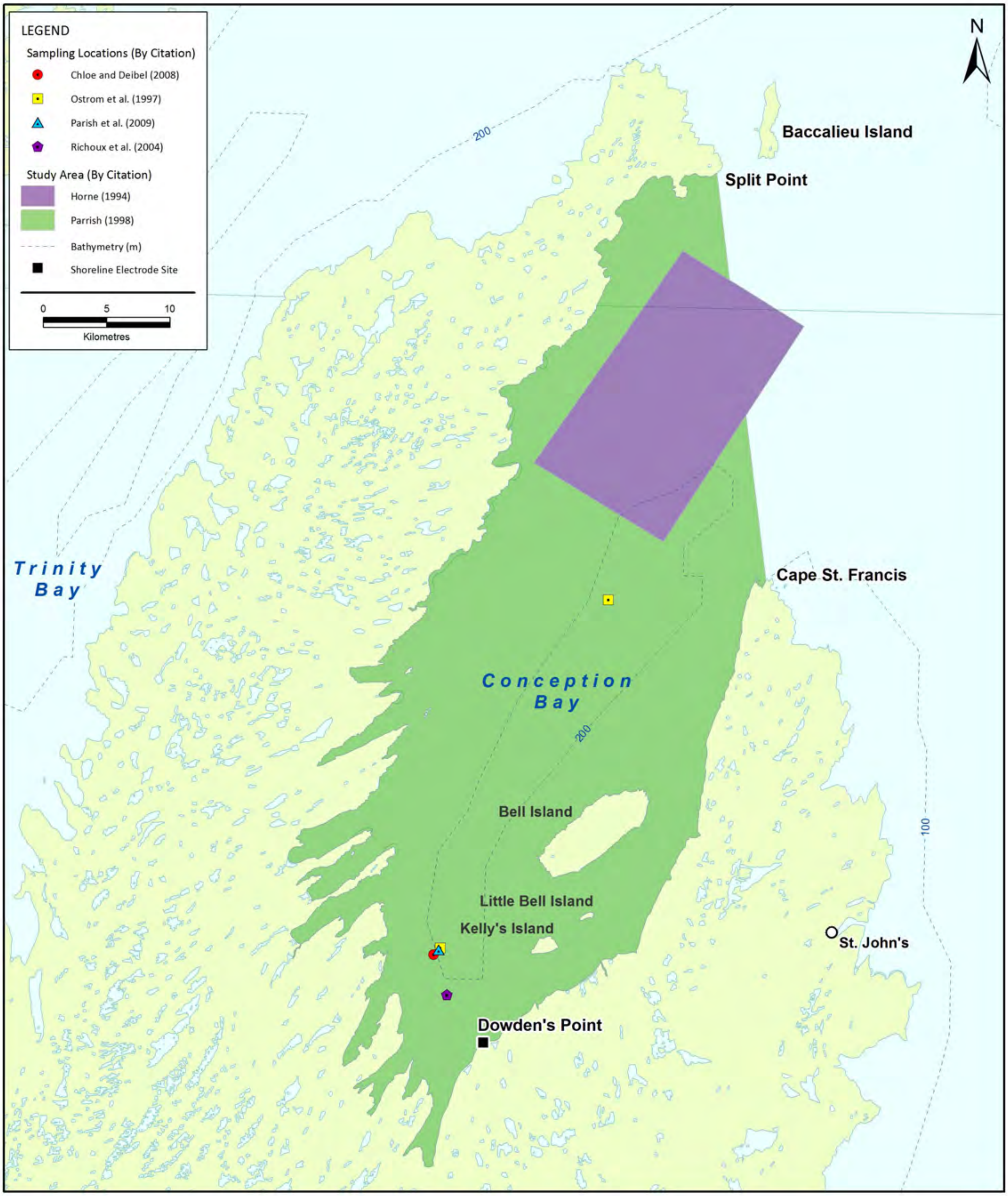

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FIGURE 10.5.7-6

Water Sampling Locations in Conception Bay, Newfoundland

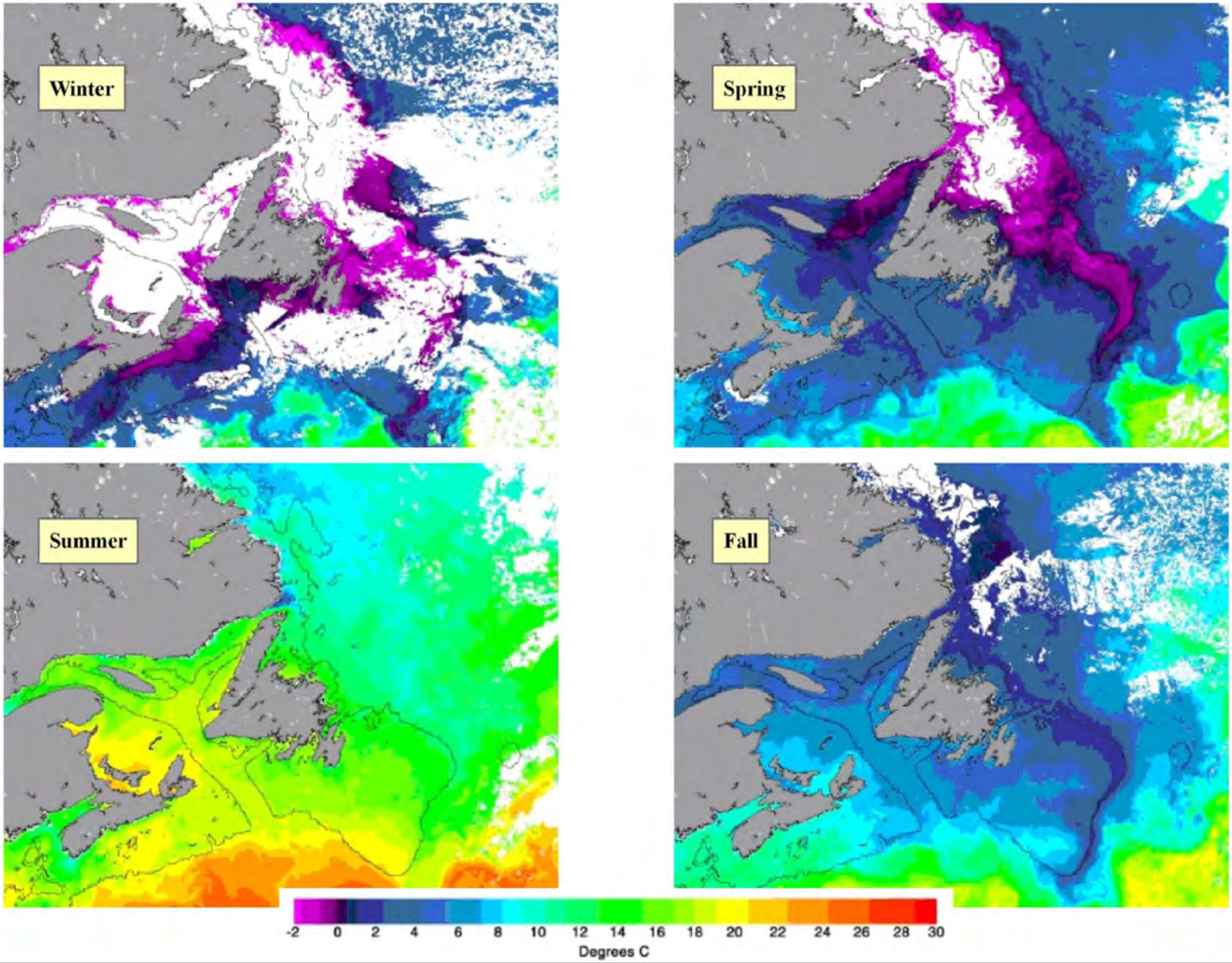
10.5.7.2 Description of Marine Water Quality

Strait of Belle Isle (Submarine Cable Corridor)

Temperature and Salinity

Sea surface temperatures in the Strait of Belle Isle have been found to range from -3 to -1°C in the winter, to 6 to 14°C in the summer (Figure 10.5.7-7; Table 10.5.7-4) (Sikumiut 2010a; Galbraith 2006; Han et al. 1999). On average, the southern shore of the Strait (along the coast of Newfoundland) has a sea surface temperature several degrees warmer than the main body of the Strait in the spring and summer, while the northern shore (along the coast of Labrador) has a mean surface temperature several degrees lower in the summer (Sikumiut 2010a; Figure 10.5.7-7). This reflects the typical inflow and outflow patterns (from the Labrador Shelf and Gulf of St. Lawrence, respectively) in the Strait of Belle Isle, as noted by Bailey (1958) and Huntsman et al. (1954).

Sea surface salinity levels in the Strait of Belle Isle range from 30 to 33 practical salinity units (PSU) throughout the year (Sikumiut 2010a; Galbraith 2006; Han et al. 1999), with the highest levels occurring in the winter months (Sikumiut 2010a).



Source: Sikumiut (2010a)

FIGURE 10.5.7-7

Seasonal Sea Surface Temperature in the Strait of Belle Isle and Adjacent Regions

Table 10.5.7-4 Salinity, Temperature, Nitrate, Hydrocarbon and Dissolved Oxygen Levels in Sea Water from the Northwest Atlantic

Location	Salinity (‰)	Temperature (°C)	Nitrate (mg/L)	Dissolved Oxygen (mg/L)[(a)]	Hydrocarbons (Surface) (mg/L)	Hydrocarbons (Water Column) (mg/L)	Reference
Strait of Belle Isle (15 Days in mid Winter, Fall, Spring and Summer 2009)	– Surface: 30 to 33 (PSU)	– Surface: -1 (winter) to 14 (summer)	—	—	—	—	Sikumiut (2010a)
Strait of Belle Isle (Winter 1996 to 2004)	– 30 to 33 (PSU)	– -1.8 to -1.7	—	—	—	—	Galbraith (2006)
Strait of Belle Isle (Winter 1950 to 1955)	– Surface: 32 (PSU) – Bottom: 32 (PSU)	– Surface: -3 – Bottom: -3	—	—	—	—	Han et al. (1999)
Strait of Belle Isle (Summer 1950 to 1955)	– Surface: 30 (PSU) – Bottom: 32 (PSU)	– Surface: 6 – Bottom: -3	—	—	—	—	
Labrador Shelf (September 1985)	29 to 34 (PSU)	5 to 9	≤0.06			—	Drinkwater and Harding (2001)
Labrador Sea (60°51.0′N, 56°14.6′W; June 1978; bottom depth 2,875 m)	33.96 to 34.88	—	—	—	—	—	Campbell and Yeats (1981)
Baffin Bay (72°14.1′N, 65°56.9′W; June 1978; bottom depth 2,323 m)	28.36 to 34.55	-1.70 to 2.91	—	—	—	—	
Northwest Atlantic Ocean (50°47.9′N, 44°01.7′W; bottom depth 4,090 m)	34.88 to 35.31	2.53 to 11.72	—	—	—	—	
Northwest Atlantic Ocean (53°00.0′N, 40°59.7′W; bottom depth 3,575 m)	34.78 to 34.97	2.88 to 8.06	—	—	—	—	

Table 10.5.7-4 Salinity, Temperature, Nitrate, Hydrocarbon and Dissolved Oxygen Levels in Sea Water from the Northwest Atlantic (continued)

Location	Salinity (‰)	Temperature (°C)	Nitrate (mg/L)	Dissolved Oxygen (mg/L)[a]	Hydrocarbons (Surface) (mg/L)	Hydrocarbons (Water Column) (mg/L)	Reference
Northwest Atlantic Ocean (53°00′N, 40°59.7′W; June 1978; bottom depth 3,575 m)	34.78 to 34.97	2.9 to 8.1	—	—	—	—	Yeats and Bewers (1985)
Northwest Atlantic Ocean (50°15′N, 35°30′W; June 1978; bottom depth 4,206 m)	34.90 to 35.21	—	—	—	—	—	
Northwest Atlantic Ocean (45°00′N, 45°00′W; June 1978; bottom depth 4,360 m)	34.90 to 35.82	—	—	—	—	—	
Northwest Atlantic Ocean (53°00′N, 41°00′W; June 1978; bottom depth 3,575 m)	34.78 to 34.97	2.9 to 8.1	0.471 to 1.12	—	—	—	Yeats and Campbell (1983)
Northwest Atlantic Ocean (50°15′N, 35°30′W; June 1978; bottom depth 4,206 m)	34.90 to 35.21	—	0.35 to 1.23	—	—	—	
Northwest Atlantic Ocean (45°00′N, 45°00′W; June 1978; bottom depth 4,360 m)	34.90 to 35.82	—	0.050 to 1.34	—	—	—	
Grand Banks	—	—	—	– Surface: 11.43[b]; 13.58[c] – Near bottom: 10.00[b]; 10.72[c]	0.0289	0.00017	Petro-Canada (1996)
Labrador Shelf[d]	—	—	—	—	0.00813	0.00051	

Note: Sample depths and dates provided where available.
Samples were collected from near surface to near bottom depths, and ranges provided were the minimum and maximum values obtained throughout the water column for Yeats and Bewers (1985),Yeats and Campbell (1983) and Campbell and Yeats (1981).
— = no data available.

(a) Dissolved oxygen reported in literature as mL/L; values converted to mg/L using methodology available from Sea-Bird Electronics (2011, internet site).

(b) Levy (1983).

(c) Colbourne (1993).

(d) Levy (1986).

Similar water column temperature and salinity values to those in the Strait of Belle Isle have been found for the Labrador Shelf region. However, in this area, at least in early fall (1985) and summer (1978), sea water temperatures were not found to exceed 9°C, and salinity values had a slightly broader range of approximately 29 to 35 parts per thousand (‰) (Table 10.5.7-4). It should be noted that the numeric difference between PSU and ‰ is small (Sea-Bird Electronics 2010, internet site), and that for the purposes of this summary can be assumed to be equivalent in value (e.g., National Oceanic and Atmospheric Administration 2006) (Drinkwater and Harding 2001; Campbell and Yeats 1981). Furthermore, comparable temperature and salinity values were obtained in various locations in the Northwest Atlantic during a summer sampling period in 1978, with water column temperatures found to range from approximately 2 to 12°C, and salinity values ranging between approximately 34.8‰ and 35.8‰ (Table 10.5.7-4) (Yeats and Bewers 1985; Yeats and Campbell 1983; Campbell and Yeats 1981).

Additionally, in the summer the Strait is a two-layer system, with the surface layer consisting of the upper 50 to 60 m of the water column. There is a notable difference in mean temperature between the upper and lower layers, with the lower layer measuring up to 10°C colder than the upper layer. Conversely, there is relatively little difference in salinity between the two layers. This distinct layering disappears in the fall and winter, and is replaced by a single, homogeneous layer that begins to form in October. This homogeneous system persists until April, after which point stratification begins anew (Sikumiut 2010a).

Early fall 2010 and June 2011 sampling in and along the submarine cable crossing corridor in the Strait of Belle Isle yielded sea surface temperatures that fell within historical ranges found during the summer for the Strait (Sikumiut 2010a; Han et al. 1999), with a range of 3.99°C to 10.91°C and mean value of 7.57°C (Table 10.5.7-5) (Sikumiut 2011b, c). This is similar to temperature data from the literature for the Labrador Shelf in early fall 1985 (Drinkwater and Harding 2001), and for the Northwest Atlantic in early summer 1978 (Yeats and Bewers 1985; Yeats and Campbell 1983; Campbell and Yeats 1981). Mid and near bottom water temperatures in and along the submarine cable crossing corridor in the Strait of Belle Isle from Sikumiut (2011b, c) ranged from 2.24°C to 2.97°C and 1.51°C to 1.87°C, and had mean values of 2.62°C and 1.68°C, respectively (Table 10.5.7-5). These were greater than the bottom temperature of -3°C recorded in this area of the Strait in both winter and summer, 1950 to 1955 (Han et al. 1999).

Salinity values obtained throughout the water column in and along the submarine cable crossing corridor in the Strait of Belle Isle in early fall 2010 and June 2011 also fell within historical ranges from all four seasons of the year in 2009 (Sikumiut 2010a), winter 1996 to 2004 (Galbraith 2006), and both winter and summer 1950 to 1955 (Han et al. 1999), with mean values of 30.90 PSU (near surface), 31.21 PSU (mid depth) and 31.43 PSU (near bottom) (Table 10.5.7-5; Sikumiut 2011c). These values also correspond to ranges found along the Labrador Shelf in fall 1985 (Drinkwater and Harding 2001) and summer 1978 (Campbell and Yeats 1981), and in Baffin Bay in summer 1978 (Campbell and Yeats 1981). These salinity values were lower than those ranges found farther offshore in the Northwest Atlantic in summer 1978 (Yeats and Bewers 1985; Yeats and Campbell 1983; Campbell and Yeats 1981).

A general trend observed in the CTD profiles collected by Sikumiut (2011c) was that where thermoclines were present, they tended to occur deeper in the water column at stations closer to the southern shore of the Strait of Belle Isle, while they tended to be shallower at stations closer to the northern shore. This may be a factor resulting from the periods of separated flow observed by Bailey (1958) and Huntsman et al. (1954), of outflowing waters from the Gulf of St. Lawrence into the Strait along the southern, Newfoundland shore, and inflowing waters from the Labrador Shelf into the Strait of Belle Isle along the northern, Labrador shore.

Additionally, as noted, not all sample stations in the Strait of Belle Isle had thermoclines present (Sikumiut 2011b, c). The waters in the Strait of Belle Isle at the time of the sampling (late September 2010 and June 2011) were likely in a transitional state between the two distinct layers which have been observed in the Strait in the summer, and the single homogeneous layer which persists throughout the fall and winter (Sikumiut 2010a).

Table 10.5.7-5 Conventional Parameters (mean ± standard deviation) from Sea Water Samples in and Along the Proposed Submarine Cable Crossing Corridor and Shoreline Electrode Sites

Parameter (units)	Reportable Detection Limit	In and Along the Submarine Cable Crossing Corridor			L'Anse au Diable (Near Surface)	Dowden's Point (Near Surface)	CCME Guideline
		Near Surface	Mid	Near Bottom			
Temperature (°C)	-5 to +35 (resolution: 0.0001)	7.57 ± 2.23[(a)]	2.62 ± 0.26[(a, b)]	1.68 ± 0.20[(a, b)]	7.49 ± 0.70	8.39 ± 0.10	—
Conductivity (µS/cm)	0 to $9x10^6$ (resolution: 0.00005 S/cm)	42,500 ± 2,695[(a)]	42,895 ± 2,664[(a)]	43,050 ± 2,544[(a)]	41,750 ± 500	44,000 ± 0	—
Salinity (PSU)[(c)]	—	30.90 ± 0.36 [(a)]	31.21 ± 0.45[(a)]	31.43 ± 0.48[(a)]	30.74 ± 0.21 ($^0/_{00}$)	29.18 ± 0.39 ($^0/_{00}$)	—
pH	—	7.83 ± 0.06	7.82 ± 0.06	7.80 ± 0.07	7.81 ± 0.03	7.80 ± 0.01	7.0 to 8.7
Total Alkalinity (Total as $CaCO_3$) (mg/L)	5	2,632 ± 6,193	2,766 ± 6,333	2,635 ± 6,191	94 ± 1	94 ± 1	—
Hardness ($CaCO_3$) (mg/L)	1	5,520 ± 520	5,526 ± 446	5,620 ± 494	5,250 ± 238	5,075 ± 171	—
Turbidity (NTU)	0.1	0.3 ± 0.1[(d)]	0.2 ± 0.1[(e)]	0.2 ± 0.1[(f)]	0.3 ± 0.28	ND	—
Total Suspended Solids (TSS) (mg/L)	1	1.5 ± .5[(g)]	1.4 ± 0.5[(h)]	1.5 ± 0.8[(i)]	1.5 ± 1	2 ± 0	—
Calculated TDS (mg/L)	1	31,589 ± 598	31,644 ± 528	32,050 ± 807	30,150 ± 252	31,100 ± 356	—
Colour (TCU)	5	31,000 ± 0[(j)]	31,000 ± 0[(j)]	ND	ND	ND	—
Total Organic Carbon (mg/L)	5	ND	ND	ND	ND	ND	—

Table 10.5.7-5 Conventional Parameters (mean ± standard deviation) from Sea Water Samples in and Along the Proposed Submarine Cable Crossing Corridor and Shoreline Electrode Sites (continued)

Parameter (units)	Reportable Detection Limit	In and Along the Submarine Cable Crossing Corridor			L'Anse au Diable (Near Surface)	Dowden's Point (Near Surface)	CCME Guideline
		Near Surface	Mid	Near Bottom			
Reactive Silica (SiO_2) (mg/L)	0.5	ND	ND	ND	ND	ND	—
Dissolved Oxygen (DO) (% sat)	—	107.6 ± 5.2	100.4 ± 0.9[b]	101.1 ± 1.6[b]	107.4 ± 1.0	108.1 ± 3.1	—
DO (mg/L)	—	10.55 ± 0.64	10.96 ± 0.09[b]	11.27 ± 0.15[b]	10.58 ± 0.06	10.70 ± 0.80	—
Oxygen Reduction Potential (ORP) (mV)	—	114.3 ± 37.8	163.8 ± 37.1[b]	191.7 ± 42.2[b]	84.0 ± 4.0	238.9 ± 5.3	—

Source: Sikumiut (2011a, b. c); CCME (2010, internet site).

Note: ‰ = Parts Per Thousand; ND = Not Detected; % sat = % saturation; µS/cm - microSiemens per centimetre; $CaCO_3$ = calcium carbonate
— = not applicable.

(a) No data for station W-008 due to equipment malfunction.
(b) Values from NCW-001, NCW-002, NCW-003, NCW-004 and NCW-005 in Sikumiut (2011c) only.
(c) Temperature for mid and near bottom depths, and all salinity values estimated from CTD profiles in Figure 3.1, Figure 3.2 and Figure 3.3 in Sikumiut (2011c).
(d) ND at W-002, W-006, W-009, W-010, and W-014 and NCW 3.
(e) ND at W-009, W-010, and W-013 and NCW 1 and 2.
(f) ND at W-005, W-009, and W-010 and NCW 2, 4 and 5.
(g) ND at W-002, W-003, W-004, W-010, and W-014.
(h) ND at W-003.
(i) ND at W-002, W-005, W-008, and W-011.
(j) Value from W-006 only; ND at all other stations.

Nutrients, Oxygen, pH and Turbidity

Inorganic nutrients, such as nitrate, occur naturally in aquatic systems and are essential for primary production in the Northwest Atlantic (Petro-Canada 1996). Their concentrations in the water column vary with season, and are affected by factors such as water column stability, currents and phytoplankton concentration (Petro-Canada 1996). In the absence of recent nutrient information for the Strait of Belle Isle in the published literature, and given the flow of Labrador Shelf waters into the Strait, it may be inferred that nutrient conditions in the Labrador Shelf are likely indicative of nutrient levels within the Strait. Water samples examined by Drinkwater and Harding (2001) at stations along the Labrador Shelf, particularly those from the Hamilton Bank situated immediately north-east of the Strait, indicated low nitrate levels of <0.06 milligrams per litre (mg/L) in September 1985 (Table 10.5.7-4), with near zero concentrations at the surface. These levels correspond with the lower limit of nitrate concentrations found in the Northwest Atlantic in summer 1978, where values ranged from 0.05 to approximately 4.7 mg/L (Table 10.5.7-4; Yeats and Campbell 1983).

Sea water samples collected in the Strait of Belle Isle in September 2010 and June 2011 (Sikumiut 2011b, c) showed nitrate concentrations that were similar to the results of Drinkwater and Harding (2001) from the Labrador Shelf, with no nitrate detected at the surface, and concentrations ranging from 0.05 to 0.06 mg/L (mean of 0.05 mg/L) at mid depth and from 0.06 to 0.08 mg/L (mean of 0.07 mg/L) near the bottom of the water column (Table 10.5.7-6). As expected for open oceanic waters, these values were all well below the CCME Canadian Water Quality Guidelines for the PAL value of 16 mg/L (CCME 2010, internet site). Nitrite was not detected in the water samples (Table 10.5.7-6) (Sikumiut 2011b, c), and nitrogen in the form of ammonia nitrogen was solely found during the June 2011 sampling program. Concentrations ranging from 0.05 to 0.10 mg/L (mean of 0.06 mg/L) were found at the surface, 0.19 to 0.39 (mean of 0.26 mg/L) mid depth, and 0.05 to 0.43 (mean of 0.16 mg/L) near the bottom. Where detected, low concentrations of both total phosphorous and orthophosphate (a salt of phosphoric acid) were found in the water samples collected in the Strait, with the highest concentration of total phosphorous found in the near surface samples (up to 11,000 µg/L; mean of 3,787 µg/L), and the lowest at mid depth (up to 8,900 µg/L; mean of 1,922 µg/L) (Table 10.5.7-6) (Sikumiut 2011b, c).

Dissolved oxygen, from photosynthesis by marine algae and phytoplankton or gaseous exchange with the atmosphere, is an essential component of sea water, and its concentration is positively correlated with the ability of the aquatic system to sustain life (Petro-Canada 1996). The concentration of DO is considered to be high at levels in excess of approximately 7 mg/L (Pinet 2003). As such, the influx of Labrador Shelf waters into the Strait of Belle Isle leads to highly oxygenated water within the Strait (Galbraith 2006), and a potentially high ability to support aquatic life. Similarly, DO concentrations recorded from the nearby Grand Banks region, which is also fed (in part) by waters from the Labrador Shelf, have also been high, ranging from 11.43 mg/L (Levy 1983) to 13.58 mg/L (Colbourne 1993) at the surface, and 10.00 mg/L (Levy 1983) to 10.72 mg/L (Colbourne 1993) near the bottom of the water column (Table 10.5.7-4).

Sea water samples collected in the Strait in fall 2010 indicated high oxygenation, with DO concentrations ranging from 9.64 to 11.51 mg/L (mean of 10.47 mg/L) near the surface, 10.87 to 11.09 mg/L mid-depth (mean of 10.96 mg/L), and 11.09 to 11.51 mg/L (mean of 11.27 mg/L) near the bottom of the water column (Table 10.5.7-5) (Sikumiut 2011b, c). These water samples were mostly supersaturated, with DO saturation levels ranging from 99.8 to 114.9% (mean of 107.6%) near the surface, 99.5 to 101.4% mid-depth (mean of 100.4%), and 99.7 to 103.9% near the bottom (mean of 101.1%) (Table 10.5.7-5) (Sikumiut 2011b, c). Oxygen reduction potential (ORP) can serve as an indicator of water quality in terms of cleanliness and the ability to break down contaminants, with higher ORP levels signifying a greater ability to destroy contaminants such as microbes or carbon-based organics (Ozone Solutions 2010, internet site). The ORP levels in the Strait approximated the range that is considered optimal for fish health (150 to 250 millivolts (mV); Ozone Solutions 2010, internet site), with a mean value of 114.3 mV at the surface, 163.8 mV mid-depth, and 191.7 mV near the bottom (Table 10.5.7-5) (Sikumiut 2011b, c).

The sea water samples collected in the Strait of Belle Isle yielded pH values that were slightly alkaline and well within the CCME (2010) guideline range of 7.0 to 8.7 at all depths (Table 10.5.7-5) (Sikumiut 2011b, c).

Table 10.5.7-6 Nutrients (mean ± standard deviation) from Sea Water Samples Collected in the Vicinity of the Proposed Submarine Cable Crossing Corridor

Parameter (units)	Reportable Detection Limit	In and Along the Submarine Cable Corridor			L'Anse au Diable	Dowden's Point	CCME Guideline
		Near Surface	Mid	Near Bottom			
Nitrate + Nitrite (mg/L)	0.05	ND	0.05 ± 0.01[a]	0.07 ± 0.01[b]	ND	ND	—
Nitrite (mg/L)	0.01	ND	ND	ND	ND	ND	—
Nitrate (mg/L)	0.05	ND	0.05 ± 0.01[a]	0.07 ± 0.01[b]	ND	ND	16[c]
Nitrogen (Ammonia Nitrogen) (mg/L)	0.05	0.06 ± 0.02[d]	0.26 ± 0.11[e]	0.16 ± 0.16[d]	ND	ND	—
Total Phosphorous (µg/L)	100; 10,00[f]	3,787 ± 6,247	1,922 ± 3,901	2,605 ± 4,930	ND	ND	—
Orthophosphate (mg/L)	0.01	0.01 ± 0.00[g]	0.01 ± 0.00[h]	0.01 ± 0.01[i]	0.01 ± 0.00[j]	0.01 ± 0.00	—

Note: Data from Sikumiut (2011a, b, c); CCME (2010, internet site).
ND = Not Detected.
— = no guideline value.
(a) Mean from W-006, W-010, and W-011.
(b) Mean from W-006, W-007, W-009, and W-011.
(c) CCME Guideline (CCME 2010, internet site) is for direct effects only and does not consider indirect effects from eutrophication.
(d) Mean from NCW-001to NCW-005.
(e) Mean from NCW-001, NCW-002 and NCW-005.
(f) Reportable Detection Limit dependent upon characteristics of individual phosphorous samples.
(g) ND at W-001, W-002, W-003, W-004, W-005, W-009, W-010, and NCW-005.
(h) ND at W-001, W-002, W-003, and W-005.
(i) ND at W-001, W-002, W-003, and W-004.
(j) ND at W-017.

Turbidity, a measure of the lack of clarity or transparency of water, and total suspended solids (TSS), a measure of all inorganic and organic particles and microorganisms suspended in the water column, vary naturally with location and season and can be detrimental to marine organisms at high levels (Caux et al. 1997). The water samples collected in the Strait of Belle Isle exhibited low values for turbidity ($<$0.40 NTU; Caux et al. 1997) and TSS ($\leq$4 mg/L) at the time of sampling for all three sample depths (Table 10.5.7-5; Sikumiut 2011b, c), indicating high water clarity. This is comparable to the results from MacKnight et al. (1981) in the Grand Banks region, where suspended PM was found to be within normal open ocean concentrations.

Overall, water samples in and along the Project submarine cable crossing corridor in the Strait of Belle Isle were highly oxygenated and had near pristine pH and clarity, but were relatively poor in nutrients, congruent with available historical data in nearby regions.

Metals

In the absence of recent information for the Strait of Belle Isle in the published literature, it was inferred that metal concentrations found in regions adjacent to the Strait (including the Gulf of St. Lawrence, Labrador Shelf and Northwest Atlantic) are likely indicative of metal concentrations within the Strait. Overall, metal concentrations have been found to be relatively low in these regions (Table 10.5.7-7; Table 10.5.7-8; Petro-Canada 1996; Fowler 1990; Yeats and Bewers 1985; Yeats and Campbell 1983; Campbell and Yeats 1981; Campbell and Loring 1980). Where chromium was detected in those regions, all concentrations were found to be well below the CCME (2010) guideline of either 1.5 µg/L or 56 µg/L (for hexavalent and trivalent chromium, respectively) (Table 10.5.7-7). However, cadmium concentrations were found to exceed the CCME (2010) guideline of 0.12 µg/L in samples obtained from the Grand Banks in spring (0.20 µg/L) and summer (0.26 µg/L) by MacKnight et al. (1981) (Table 10.5.7-7). No other concentrations of cadmium detected in the Gulf of St. Lawrence, Labrador Shelf or Northwest Atlantic exceeded the CCME (2010) guideline (Table 10.5.7-7). Where detected, all mercury and arsenic concentrations from the Grand Banks and Northwest Atlantic were well below the CCME (2010) guideline concentrations of 0.016 and 12.5 µg/L (for inorganic mercury and arsenic, respectively) (Table 10.5.7-8).

Water samples collected within and along the Project's submarine cable crossing corridor in the Strait of Belle Isle in September 2010 and June 2011 resulted in major ion concentrations which, based on otherwise near pristine water quality conditions, are presumed to have been within acceptable limits (Table 10.5.7-9) (Sikumiut 2011b, c). The majority of metals tested for were not detected in these water samples at all depths (Table 10.5.7-10) (Sikumiut 2011b, c). Akin to the regions surrounding the Strait, these water samples did not detect chromium in excess of the CCME (2010) guidelines values, although it should be noted that the reportable detection limit (100 µg/L) was greater than the CCME (2010) guidelines' values (Table 10.5.7-10) (Sikumiut 2011b, c). Similarly, cadmium was not detected at any sample depth in the Strait, although again, the reportable detection limit (30 µg/L) was greater than the CCME (2010) guidelines' value (Table 10.5.7-10) (Sikumiut 2011b, c).

Contrary to the concentrations found in the Grand Banks and Northwest Atlantic, mercury was detected at a level which exceeded the CCME (2010) guideline of 0.016 µg/L at two of the 20 near surface sample stations in the Strait, with values of 0.019 µg/L and 0.017 mg/L (Table 10.5.7-10; Sikumiut 2011c). However, the mercury concentrations detected at two of the 20 mid depth sample stations did not exceed the CCME (2010) guideline (Table 10.5.7-10; Sikumiut 2011c). Mercury was not detected at any depths at any of the remaining stations. Arsenic was not detected at any sample depth within the Strait of Belle Isle, although the detection limit (100 µg/L) was greater than the CCME guideline value (Table 10.5.7-10; Sikumiut 2011c). Where detected, boron, selenium and strontium were present in relatively low concentrations, although not necessarily at all stations or sample depths (Table 10.5.7-10) (Sikumiut 2011b, c).

Overall, the major ions in the Strait of Belle Isle were within normal background ranges, and the metals that were present in and around the submarine cable crossing corridor were relatively low in concentration, with few isolated areas where the CCME (2010) guidelines were slightly exceeded. This corresponds to the conclusion of Eaton et al. (1986) that metal concentrations in seawaters in the North Atlantic and its coastal areas vary little except in some coastal regions with localized contamination.

Petroleum Hydrocarbons

There is only a small amount of historical published data regarding hydrocarbon concentrations in the Strait of Belle Isle. Relatively low concentrations have been recorded in the surface waters of adjacent regions, ranging from 0.00813 mg/L in the Labrador Shelf (Levy 1986) up to 0.0289 mg/L in the Grand Banks (Levy 1983). Much lower concentrations have been recorded in the water column in these two areas, ranging from 0.00051 mg/L on the Labrador Shelf (Levy 1986) down to 0.00017 mg/L on the Grand Banks (Levy 1983) (Table 10.5.7-4).

Table 10.5.7-7 Chromium, Manganese, Iron, Nickel, Copper, Cadmium and Zinc Levels in Sea Water from the Gulf of St. Lawrence and Northwest Atlantic

Location	Chromium (µg/L)	Manganese (µg/L)	Iron (µg/L)	Nickel (µg/L)	Copper (µg/L)	Cadmium (µg/L)	Zinc (µg/L)	Reference
Central St. Lawrence Estuary	—	—	5.5	0.52	0.84	0.093	2.11	Petro-Canada (1996)
Grand Banks[(a)]	– March: 0.31 – Nov.: 0.37	—	– March: 3.50 – Nov.: 1.40	– March: 1.36 – Nov.: 0.91	– March: 1.85 – Nov.: 1.97	– March: 0.20 (**) – Nov.: 0.26 (**)	– March: 3.79 – Nov.: 2.01	
Pelagic Northwest Atlantic Ocean	0.23	—	0.45	0.23	0.11	0.04	0.35	
Labrador Sea (60°15.7′N, 56°14.6′W; June 1978; bottom depth 1,000 m)	—	—	—	0.235 to 0.311	0.197 to 0.699	0.0270 to 0.0506	—	Yeats and Campbell (1983)
Northwest Atlantic Ocean (53°00′N, 41°00′W; June 1978; bottom depth 3,575 m)	—	—	—	0.158 to 0.335	0.114 to 0.235	0.0236 to 0.0450	0.0458 to 0.569	
Northwest Atlantic Ocean (50°15′N, 35°30′W; June 1978; bottom depth 4,206 m)	—	—	—	0.176 to 0.276	0.108 to 0.210	0.0247 to 0.119	0.203 to 0.562	
Northwest Atlantic Ocean (45°00′N, 45°00′W; June 1978; bottom depth 4,360 m)	—	—	—	0.141 to 0.282	0.089 to 0.210	0.00337 to 0.0674	0.0785 to 0.438	

Table 10.5.7-7 Chromium, Manganese, Iron, Nickel, Copper, Cadmium and Zinc Levels in Sea Water from the Gulf of St. Lawrence and Northwest Atlantic (continued)

Location	Chromium (µg/L)	Manganese (µg/L)	Iron (µg/L)	Nickel (µg/L)	Copper (µg/L)	Cadmium (µg/L)	Zinc (µg/L)	Reference
Baffin Bay (72°14.1′N, 65°56.9′W; June 1978; bottom depth 2,323 m)	0.172 to 0.255	—	—	—	—	—	—	Campbell and Yeats (1981)
Labrador Sea (60°51.0′N, 56°14.6′W; June 1978; bottom depth 2,875 m)	0.213 to 0.260	—	—	—	—	—	—	
Northwest Atlantic Ocean (50°47.9′N, 44°01.7′W; June 1978; bottom depth 4,090 m)	0.177 to 0.239	—	—	—	—	—	—	
Northwest Atlantic Ocean (53°00.0′N, 40°59.7′W; June 1978; bottom depth 3,575 m)	0.182 to 0.270	—	—	—	—	—	—	
Gulf of St. Lawrence[(b)]	—	– Total: 0.98 – Dissolved: 0.80	– Total: 3.40 – Dissolved: 1.60	Total: 0.39	Total: 0.61	Total: 0.07	—	Campbell and Loring (1980)
Baffin Bay	Total: 0.18 to 0.25	Total: 0.10 to 0.30	Total: 0.8 to 3.0	Total: 0.17 to 0.30	Total: 0.18 to 0.30	Total: 0.02 to 0.06	—	
Northwest Atlantic Ocean	—	—	—	—	—	0.0002[(c)]	—	Fowler (1990)

Table 10.5.7-7 Chromium, Manganese, Iron, Nickel, Copper, Cadmium and Zinc Levels in Sea Water from the Gulf of St. Lawrence and Northwest Atlantic (continued)

Location	Chromium (µg/L)	Manganese (µg/L)	Iron (µg/L)	Nickel (µg/L)	Copper (µg/L)	Cadmium (µg/L)	Zinc (µg/L)	Reference
Northwest Atlantic Ocean (53°00′ N, 40°59.7′W; June 1978; bottom depth 3,575 m)	—	– Dissolved: 0.027 to 0.069 – T.D.: 0.037 to 0.089	—	—	—	—	—	Yeats and Bewers (1985)
Northwest Atlantic Ocean (50°15′N, 35°30′W; June 1978; bottom depth 4,206 m)	—	– Dissolved: 0.036 to 0.086 – T.D.: 0.053 to 0.134	—	—	—	—	—	
Northwest Atlantic Ocean (45°00′N, 45°00′W; June 1978; bottom depth 4,360 m)	—	– Dissolved: 0.019 to 0.088 – T.D.: 0.030 to 0.179	—	—	—	—	—	

Note: TD = Total Dissolvable.

— = no data available.

Sample depths and dates provided where available.

Samples were collected from near surface to near bottom depths, and ranges provided were the minimum and maximum values obtained throughout the water column for Yeats and Bewers (1985), Yeats and Campbell (1983) and Campbell and Yeats (1981).

** = Mean value of the measured parameter is not acceptable under the CCME Guidelines (CCME 2010, internet site).

(a) MacKnight et al. (1981).

(b) Yeats et al. (1978).

(c) Bruland and Franks (1983).

Table 10.5.7-8 Mercury, Lead, Arsenic, Molybdenum and Vanadium Levels in Sea Water from the Northwest Atlantic

Location	Mercury (µg/L)	Lead (µg/L)	Arsenic (µg/L)	Molybdenum (µg/L)	Vanadium (µg/L)	Reference
Grand Banks[a]	March: 0.004 November: 0.002	March: 0.39 November: 0.41	March: 1.89 November: 1.89	March: 0.086 November: 0.460	March: 0.16 November: 0.13	Petro-Canada (1996)
Pelagic Northwest Atlantic Ocean	0.001	0.003	1.5	10.0	—	
Northwest Atlantic Ocean	0.0007 ± 0.0002[b]; 0.0005[c]; 0.0008[d]	0.03[e]; 0.026 ± 0.004[f]; 0.0081[g]	—	—	—	Fowler (1990)

Note: — = no data available.
[a] MacKnight et al. (1981).
[b] Gill and Fitzgerald (1985).
[c] Dalziel and Yeats (1985).
[d] Gill and Fitzgerald (1988).
[e] Schaule and Patterson (1983).
[f] Boyle et al. (1986).
[g] Flegal (1986).

Table 10.5.7-9 Major Ions (mean ± standard deviation) from Sea Water Samples Collected in the Vicinity of the Proposed Submarine Cable Crossing Corridor

Parameter (units)	Reportable Detection Limit	In and Along the Submarine Cable Crossing Corridor			L'Anse au Diable	Dowden's Point	CCME Guideline
		Near Surface	Mid	Near Bottom			
Total Calcium (µg/L)	10,000	387,200 ± 24,914	383,790 ± 23,794	392,800 ± 23,522	362,250 ± 11,500	405,500 ± 4,796	—
Total Magnesium (µg/L)	10,000	1,103,500 ± 110,748	1,107,737 ± 95,746	1,112,150 ± 108,556	1,060,750 ± 53,313	991,750 ± 43,714	—
Total Sodium (µg/L)	10,000	10,051,500 ± 263,784	9,974,211 ± 292,106	10,241,000 ± 351,402	9,455,000 ± 205,670	9,827,500 ± 203,531	—
Total Potassium (µg/L)	10,000	362,950 ± 17,105	363,053 ± 14,136	371,800 ± 19,846	336,000 ± 6,782	353,250 ± 2,500	—
Dissolved Chloride (mg/L)	300	17,200 ± 410	17,421 ± 507	17,400 ± 503	16,750 ± 500	17,250± 500	—
Dissolved Sulphate (SO_4) (mg/L)	50	2,390 ± 55	2,405 ± 62	2,395 ± 76	2,325 ± 50	2,350 ± 58	—

Note: Data from Sikumiut (2011a, b, c); CCME (2010, internet site).
— = no CCME Guidelines (CCME 2010, internet site) value.

Table 10.5.7-10 Metals (mean ± standard deviation) from Sea Water Samples Collected in the Vicinity of the Proposed Submarine Cable Crossing Corridor

Parameter (units)	Reportable Detection Limit	In and Along the Submarine Cable Corridor			L'Anse au Diable	Dowden's Point	CCME Guideline
		Near Surface	Mid	Near Bottom			
Total Mercury (µg/L)	0.013	0.016 ± 0.002[(a)(**)]	0.014 ± 0.000[(b)]	ND	ND	0.022 ± 0.000[(c)(**)]	0.016[(d)]
Total Aluminum (µg/L)	500	ND	10,700 ± 0.00	ND	ND	ND	—
Total Antimony (µg/L)	100	ND	ND	ND	ND	ND	—
Total Arsenic (µg/L)	100[(e)]	ND	ND	ND	ND	ND	12.5
Total Barium (µg/L)	100	ND	ND	ND	ND	ND	—
Total Beryllium (µg/L)	100	ND	ND	ND	ND	ND	—
Total Bismuth (µg/L)	200	ND	ND	ND	ND	ND	—
Total Boron (µg/L)	500	3,839 ± 467[(f)]	3,879 ± 423[(f)]	4,049 ± 556[(g)]	3,637 ± 169[(h)]	3,395 ± 160	—
Total Cadmium (µg/L)	30[(e)]	ND	ND	ND	ND	ND	0.12
Total Calcium (µg/L)	10,000	380,333 ± 22,806	379,571 ± 26,442	386,200 ± 20,922	362,250 ± 11,500	405,500 ± 4,796	—
Total Chromium (µg/L)	100[(e)]	ND	ND	ND	ND	ND	1.5; 56[(i)]
Total Cobalt (µg/L)	40	ND	ND	ND	ND	ND	—
Total Copper (µg/L)	200	781 ± 0.00[(f)]	ND	ND	ND	ND	—
Total Iron (µg/L)	5,000	ND	ND	ND	ND	ND	—
Total Lead (µg/L)	50	97 ± 42[(j)]	ND	ND	ND	ND	—
Total Magnesium (µg/L)	10,000	1,056,667 ± 65,310	1,061,929 ± 62,300	1,069,533 ± 38,569	1,060,750 ± 53,313	991,750 ± 43,714	—
Total Manganese (µg/L)	200	ND	ND	ND	ND	ND	—
Total Molybdenum (µg/L)	200	ND	ND	ND	ND	ND	—
Total Nickel (µg/L)	200	ND	ND	ND	ND	ND	—
Total Selenium (µg/L)	100	ND	116 ± 0[(k)]	ND	ND	ND	—
Total Silver (µg/L)	10	ND	ND	ND	ND	ND	—
Total Strontium (µg/L)	200	6,895 ± 494	6,897 ± 420	6,992 ± 564	6.390 ± 182	6,293 ± 128	—
Total Thallium (µg/L)	10	ND	ND	ND	ND	ND	—
Total Tin (µg/L)	200	ND	ND	ND	ND	ND	—
Total Titanium (µg/L)	200	ND	ND	ND	ND	ND	—
Total Uranium (µg/L)	10	ND	ND	ND	ND	ND	—
Total Vanadium (µg/L)	200	ND	ND	ND	ND	ND	—

Table 10.5.7-10 Metals (mean ± standard deviation) from Sea Water Samples Collected in the Vicinity of Proposed Submarine Cable Corridor (continued)

Parameter (units)	Reportable Detection Limit	In and Along the Submarine Cable Corridor			L'Anse au Diable	Dowden's Point	CCME Guideline
		Near Surface	Mid	Near Bottom			
Total Zinc (µg/L)	500	517 ± 0.00[l]	ND	ND	ND	ND	—

Note: Data from Sikumiut (2011a, b, c); CCME (2010).
ND = Not Detected.
— = no CCME Guidelines (CCME 2010, internet site) value.
(**) = Mean value of the measured parameter is not acceptable under the CCME Guidelines (CCME 2010, internet site).
[a] Mean from W-003, NCW 2, 3 and 4.
[b] Mean from W-005.
[c] ND at W-020 and W-021.
[d] CCME Guideline (CCME 2010, internet site) is for inorganic mercury only, whereas the concentration reported is for total mercury.
[e] Reportable Detection Limit is greater than the CCME Guideline value; metal may be present in values that exceed the CCME Guideline (CCME 2010, internet site), but is not detectable by these methods.
[f] ND for NCW-001, NCW-002, NCW-003, NCW-004 and NCW-005.
[g] ND for NCW-001, NCW-002, NCW-004 and NCW-005.
[h] ND at W-016.
[i] CCME Guideline (CCME 2010, internet site) values are for hexavalent and trivalent chromium, whereas the concentration reported is for total chromium.
[j] Mean from W-014 and W-015.
[k] Mean from W-012.
[l] Mean from NCW-002.

Hydrocarbons (C6 to C32) were not detected in water samples from the Strait of Belle Isle in September 2010 or June 2011 (Table 10.5.7-11) (Sikumiut 2011b, c), although the reportable detection limit in this case was not as low as the values obtained for either the surface or water column concentrations in the Labrador Shelf (Levy 1986) and Grand Banks (Levy 1983). Similarly, neither benzene, ethylbenzene nor xylene were detected in water samples collected in and along the submarine cable crossing corridor in the Strait (Table 10.5.7-10) (Sikumiut 2011c). However, toluene was detected at all three sample depths in the Strait, but at levels well below the CCME (2010) guideline of 0.215 mg/L (Table 10.5.7-10) (Sikumiut 2011c). This supports the conclusion that background extractable petroleum residues in waters off the east coast of Canada tend to be well below the concentrations of petroleum-related substances which are known to be toxic or to induce negative, sub-lethal effects to marine life (Kiceniuk and Khan 1983).

Overall, waters in and around the Strait of Belle Isle were nearly pristine at the time of sampling (Sikumiut 2011b, c), with only toluene present in trace amounts where detected.

L'Anse au Diable Shoreline Electrode Site

Historical data from the literature concerning the Strait of Belle Isle is applicable to the proposed L'Anse au Diable shoreline electrode site, along the north-western shoreline of the Strait (Figure 10.5.7-1). As such, details from the literature for temperature, salinity, nutrients, metals and petroleum hydrocarbons for the Strait of Belle Isle are applicable. Results from water sampling in the proposed L'Anse au Diable shoreline electrode site are discussed below.

Table 10.5.7-11 Petroleum Hydrocarbons (mean ± standard deviation) from Sea Water Samples Collected in the Vicinity of the Proposed Submarine Cable Crossing Corridor

Parameter (units)	Reportable Detection Limit	In and Along the Submarine Cable Corridor			L'Anse au Diable	Dowden's Point	CCME Guideline
		Near Surface	Mid	Near Bottom			
Benzene (mg/L)	0.001	ND	ND	ND	ND	ND	0.11
Toluene (mg/L)	0.001	0.001 ± 0.000[a]	0.001 ± 0.000[b]	0.001 ± 0.001[c]	0.001 ± 0.000	0.001 ± 0.000[d]	0.215
Ethylbenzene (mg/L)	0.001	ND	ND	ND	ND	ND	0.025
Xylene (Total) (mg/L)	0.002	ND	ND	ND	ND	ND	—
C6-C10 (less BTEX) (mg/L)	0.010	ND	ND	ND	ND	ND	—
>C10-C16 Hydrocarbons (mg/L)	0.050	ND	ND	ND	ND	ND	—
>C16-C21 Hydrocarbons (mg/L)	0.050	ND	ND	ND	ND	ND	—
>C21-<C32 Hydrocarbons (mg/L)	0.100	ND	ND	ND	ND	ND	—
Modified TPH (Tier1) (mg/L)	0.100	ND	ND	ND	ND	ND	—
Reached Baseline at C32 (mg/L)	N/A	Yes	Yes	Yes	Yes	Yes	—

Note: Data from Sikumiut (2011a, b, c); CCME (2010, internet site).
ND = Not Detected; TPH = total petroleum hydrocarbons
— = no CCME Guidelines (CCME 2010, internet site) value.
(a) ND at W-002, W-011, and W-015.
(b) ND at W-004, W-011, and W-015.
(c) ND at W-003, W-009, W-010, W-014, and W-015.
(d) Mean from W-020.

Temperature and Salinity

Early fall 2010 water sampling in the proposed L'Anse au Diable shoreline electrode site recorded sea surface temperatures ranging from 6.80°C to 8.47°C, with a mean value of 7.49°C (Table 10.5.7-5) (Sikumiut 2011a). These temperatures were similar to historical ranges from early summer and fall for areas in and adjacent to the Strait of Belle Isle (e.g., Sikumiut 2010a; Drinkwater and Harding 2001; Han et al. 1999; Yeats and Bewers 1985; Yeats and Campbell 1983; Campbell and Yeats 1981).

Salinity levels found throughout the water column in the L'Anse au Diable shoreline electrode site in September 2010 were within historical ranges found throughout all seasons of the year in and around the Strait of Belle Isle (e.g., Sikumiut 2010a; Galbraith 2006; Drinkwater and Harding 2001; Han et al. 1999; Campbell and Yeats 1981), ranging from 30.50 to 31.00‰ with a mean near surface value of 30.74‰ (Table 10.5.7-5) (Sikumiut 2011a). However, salinity levels were lower than those found in the Northwest Atlantic in summer 1978 (Yeats and Bewers 1985; Yeats and Campbell 1983; Campbell and Yeats 1981) which is likely a function of distance to shore and the associated freshwater sources. Overall, similar to the proposed submarine cable crossing corridor, salinity levels in the L'Anse au Diable shoreline electrode site in the fall of 2010 were considered normal, and were comparable to historical values for the Strait and adjacent areas.

None of the CTD profiles collected in the L'Anse au Diable electrode site demonstrated the presence of thermoclines or haloclines (Sikumiut 2011a). This may be due to the fact that the water column at this site was relatively shallow, and underwent continuous mixing from wind, wave and tidal forces.

Nutrients, Oxygen, pH, Turbidity

Sea water sampling in L'Anse au Diable in September 2010 did not detect the presence of nitrate, nitrite, nitrogen (in the form of ammonia nitrogen), or phosphorous in the near surface water samples (Table 10.5.7-6) (Sikumiut 2011a). This is similar to the results for sample stations in and along the submarine cable crossing corridor in September 2010 (Table 10.5.7-6) (Sikumiut 2011c). Similar to samples collected in and along the Strait of Belle Isle submarine cable crossing corridor (Sikumiut 2011c), orthophosphate was detected in low concentrations in three of the four near surface water samples at L'Anse au Diable, with a value of 0.01 mg/L (Table 10.5.7-6) (Sikumiut 2011a).

Surface waters at the L'Anse au Diable shoreline electrode site in fall 2010 were highly oxygenated, with DO concentrations ranging from 10.49 to 10.63 mg/L (mean of 10.58 mg/L) (Table 10.5.7-5) (Sikumiut 2011a). The L'Anse au Diable near surface waters were also supersaturated, with DO saturation levels from 106.3 to 108.7% (mean of 107.4%) (Table 10.5.7-5) (Sikumiut 2011a). While not quite as high as waters in and along the submarine cable crossing corridor, the ORP levels from near surface samples in L'Anse au Diable still approximated the optimal range for fish health (Ozone Solutions 2010, internet site) with a mean value of 84.0 mV (Table 10.5.7-5) (Sikumiut 2011a), indicating excellent water quality.

The sea water sampling in the proposed L'Anse au Diable shoreline electrode site resulted in pH values that were slightly alkaline and similar to those found in and along the proposed submarine cable corridor (Table 10.5.7-5) (Sikumiut 2011a, b, c). The mean pH value near the surface was 7.81 in L'Anse au Diable, well within the CCME (2010) guideline range of 7.0 to 8.7 (Table 10.5.7-5) (Sikumiut 2011a).

Near surface turbidity and TSS levels were slightly lower in the L'Anse au Diable shoreline electrode site than in the submarine cable corridor in September 2010 and June 2011, with mean values of 0.28 NTU and 1.50 mg/L, respectively (Table 10.5.7-5) (Sikumiut 2011a, b, c). This indicates high water clarity, and is similar to data from the Grand Banks where suspended PM was within normal oceanic levels (MacKnight et al. 1981).

Overall, similar to the submarine cable crossing corridor in the Strait of Belle Isle, water samples in the L'Anse au Diable shoreline electrode site were highly oxygenated and had near pristine pH and clarity, but were relatively poor in nutrients, similar to available historical data for the Strait and nearby regions.

Metals

Sea water samples from the proposed L'Anse au Diable shoreline electrode site collected in September 2010 and June 2011 had major ion concentrations which were similar to those obtained in and along the proposed submarine cable crossing corridor (Table 10.5.7-9) (Sikumiut 2011a, b, c). Similar to samples from the Strait, the majority of metals tested for were not detected in the L'Anse au Diable water samples (Table 10.5.7-10) (Sikumiut 2011a). In these samples, neither chromium, cadmium, mercury nor arsenic were detected, although the reportable detection limits for chromium, cadmium and arsenic were greater than their respective CCME (2010) guideline values (Table 10.5.7-10) (Sikumiut 2011a). In contrast to samples from the Strait, selenium was not detected at either of the four sample stations in L'Anse au Diable, while boron and strontium were present in relatively low concentrations that were similar to those found in and along the submarine cable crossing corridor (Table 10.5.7-10; Sikumiut 2011a).

Overall, in September 2010 and June 2011 the major ions in the L'Anse au Diable shoreline electrode site were within normal background ranges, and the metals that were present were relatively low in concentration. Of those metals with designated CCME (2010) guideline values (i.e., chromium, cadmium, mercury and arsenic), none were detected at the reportable detection limit.

Petroleum Hydrocarbons

Similar to results from sampling in the Strait of Belle Isle, in September 2010 and June 2011 hydrocarbons (C6 to C32) were not detected in sea water samples from L'Anse au Diable (Table 10.5.7-11) (Sikumiut 2011a, b, c). Additionally, neither benzene, ethylbenzene nor xylene were detected (Table 10.5.7-11) (Sikumiut 2011a).

However, toluene was detected in the same concentration as samples from the Strait (0.001 mg/L), well below the CCME (2010) guideline value of 0.215 mg/L (Table 10.5.7-11) (Sikumiut 2011a). This supports the conclusion that waters off the east coast of Canada tend to have background petroleum residues well below concentrations of petroleum-related substances known to be toxic or induce negative, sublethal effects to marine life (Kiceniuk and Khan 1983).

Overall, waters in the proposed L'Anse au Diable shoreline electrode site were nearly pristine at the time of sampling, with only toluene present in trace amounts.

Dowden's Point Shoreline Electrode Site

For a detailed description of flow in Conception Bay, see Sections 10.5.2 to 10.6.4. In short, tidal currents in Conception Bay tend to be weak, variable and cyclonic, with a persistent outflowing current near the eastern shoreline of the outer bay (de Young and Sanderson 1995).

Temperature and Salinity

Sea surface temperatures in Conception Bay range from -0.5 to 19°C throughout the year, and near bottom temperatures from -1.5 to 1°C (Figure 10.5.7-7; Table 10.5.7-12; Sikumiut 2010a; Parrish et al. 2009; Choe and Deibel 2008; Richoux et al. 2004; de Young and Sanderson 1995 in Parrish 1998; Ostrom et al. 1997; Horne 1994). On average, the southern shore of Conception Bay, including the area around Dowden's Point, has a sea surface temperature several degrees warmer than the main body of the bay in the summer (Figure 10.5.7-7) (Sikumiut 2010a). This may be a result of a generally shallower water depth in the southern portion of the bay (de Young and Sanderson 1995). However, on average, this distinction in surface temperature is not apparent during the remaining seasons of the year (Figure 10.5.7-7; Sikumiut 2010a).

Near surface water sampling in October 2010 at the Dowden's Point shoreline electrode site yielded temperatures that mostly fell within historical surficial values recorded throughout the year in Conception Bay (e.g., Sikumiut 2010a; Parrish et al. 2009; Choe and Deibel 2008; Richoux et al. 2004; de Young and Sanderson 1995; Ostrom et al. 1997; Horne 1994), ranging from 8.32°C to 8.54°C (mean value of 8.39°C) (Table 10.5.7-5; Sikumiut 2011a). However, temperatures from Dowden's Point were outside the range (1°C to 6°C) found by Ostrom et al. (1997) in surface waters from the central portion of Conception Bay between late spring and early summer 1990. Overall, sea surface water temperatures in the Dowden's Point shoreline electrode site were considered normal and within historical surficial values for the region.

Throughout the year, salinity levels in Conception Bay have been found to range from 24.1 to 33.2 PSU within the water column and at the sea surface (Table 10.5.7-12; Parrish et al. 2009; Choe and Deibel 2008; Richoux et al. 2004; de Young and Sanderson 1995; Ostrom et al. 1997), and from 32.1 to 34 PSU near the bottom of the water column (Table 10.5.7-12; Richoux et al. 2004; Ostrom et al. 1997). Contrary to the Strait of Belle Isle, salinity levels in Conception Bay were not found to increase during any particular season of the year (Table 10.5.7-12).

Table 10.5.7-12 Temperature, Salinity and Nitrate of Sea Water from Conception Bay, Newfoundland

Location	Temperature (°C)	Salinity (PSU)	Nitrate (mg/L)	Reference
Conception Bay (15 Days in mid winter, fall, spring and summer 2009)	– Surface: -1.5 (winter) to 19 (summer)	—	—	Sikumiut (2010a)
Conception Bay (Southern Shore; March 1996 to August 1998)	– Water Column: -1.5 to 15.9 – Below 150 m: <0	>31.8	—	Parrish et al. (2009)
Conception Bay (Southern Shore; 47°32.2′N, 53°07.9′W; Monthly sampling from 3 July 2002 to 12 June 2003, except during winter)	– Near surface: -1.5 to 16.6 – Below 150 m: <0	31.1 to 33.2	—	Choe and Deibel (2008)
Conception Bay (Southern Shore; 47°30.5′N, 53°07.5′W to 47°32.5′N, 53°07.0′W; December 1998 to November 2000)	– Surface: -0.5 to 16.0 – Near Bottom (240 m): -1.0 to 0.0	– Surface: 24.1 to 33.0 – Near Bottom (240 m): 32.1 to 34.0	—	Richoux et al. (2004)
Conception Bay (Several sample periods per year from 1988 to 1991)[(a)]	-1.6 to 17	31 to 32.5	—	Parrish (1998)
Conception Bay (Southern Shore; 23 March to 30 August 1990)	– Surface: ~-1 to 12 – Near Bottom (~200 m): ~-1.5 to -1	– Surface: ~31.5 to 32.5 – Near Bottom (~200 m): ~33.0 to 33.5	– Surface: ~0 to 0.062 – Near Bottom (~200 m): ~0.341 to 0.713	Ostrom et al. (1997)
Conception Bay (Central; 1 May to 24 June 1990)	– Surface: ~1 to 6 – Near Bottom (~200 m): ~-1.5 to -1	– Surface: ~32.1 to 32.5 – Near Bottom (~200 m): ~32.9 to 33.2	– Surface: ~0 to 0.0062 – Near Bottom (~200 m): ~0.372 to 0.682	
Conception Bay (North-western Shore; 26 June to 15 July 1990)	– Surface: 7 to 11 – Near bottom: 0 to 1	—	—	Horne (1994)

Note: PSU = practical salinity units.
Sample depths and dates provided where available.
~ = approximately.
— = no data available.
(a) de Young and Sanderson (1995).

Near surface salinity levels found in the Dowden's Point in October 2010 were within historical ranges recorded throughout all seasons of the year in the surface and water column in Conception Bay (e.g., Parrish et al. 2009; Choe and Deibel 2008; Richoux et al. 2004; de Young and Sanderson 1995; Ostrom et al. 1997), ranging from 28.7 to 29.5‰ (mean of 29.18‰) near the surface (Table 10.5.7-5) (Sikumiut 2011a). However, the highest salinity levels found throughout the water column at Dowden's Point (up to 32‰) were slightly lower than those found near the bottom in nearby locations in Conception Bay (e.g., Richoux et al. 2004; Ostrom et al. 1997). This difference was likely due to differences in water depth. Overall, while slightly lower than in and along the proposed submarine cable crossing corridor and the L'Anse au Diable shoreline electrode site, salinity levels in the Dowden's Point shoreline electrode site in the fall of 2010 were considered normal, and were similar to reported historical values for near surface and water column values in Conception Bay.

While slight temperature and salinity gradients were observed near the surface in the CTD profiles collected by Sikumiut (2011a), similar to CTD profiles collected in L'Anse au Diable, there were no clearly defined thermoclines or haloclines present at Dowden's Point. This may be due to the influence of freshwater in the surface waters, along with the shallow water column depth and continual mixing from wind, wave and tidal forces at this site.

Nutrients

Water samples examined by Ostrom et al. (1997) in the southern and central portions of Conception Bay in spring and summer 1990 indicated low nitrate concentrations, with 0 to 0.062 mg/L detected at the surface, and 0.341 to 0.713 mg/L detected near the bottom of the water column (Table 10.5.7-12).

Near surface sampling at Dowden's Point in October 2010 did not detect the presence of nitrate, nitrite, nitrogen (in the form of ammonia nitrogen), or phosphorous in near surface water samples (Table 10.5.7-6) (Sikumiut 2011a). This is expected given the high variability in nutrient values caused by physical conditions and biological activity at this location. These results are comparable with those of Sikumiut (2011a) at the L'Anse au Diable shoreline electrode site in September 2010, and with the results of Drinkwater and Harding (2001) for the Labrador Shelf in September 1985. Similar to the proposed submarine cable crossing corridor and L'Anse au Diable shoreline electrode site, orthophosphate was detected in low concentrations in Dowden's Point, at 0.01 mg/L (Table 10.5.7-6) (Sikumiut 2011a, b, c).

Near surface waters in the Dowden's Point shoreline electrode site in fall 2010 were highly oxygenated, with DO concentrations ranging from 10.01 to 11.84 mg/L (mean of 10.70 mg/L) (Table 10.5.7-5) (Sikumiut 2011a). The water column at Dowden's Point was also supersaturated, with DO saturation levels from 104.1 to 111.1% (mean of 108.1%) (Table 10.5.7-5) (Sikumiut 2011a). The ORP levels from near surface samples at Dowden's Point fell within the optimal range for fish health (Ozone Solutions 2010, internet site), with a mean value of 238.9 mV (Table 10.5.7-5) (Sikumiut 2011a), indicating the waters in this location are generally of high quality. Overall, mean DO concentration and saturation, and ORP levels were slightly greater in the Dowden's Point shoreline electrode site than either the submarine cable crossing corridor or the L'Anse au Diable shoreline electrode site.

The sea water sampling in Dowden's Point in fall 2010 resulted in pH values that were slightly alkaline and similar to those found in the Strait of Belle Isle and at L'Anse au Diable (Table 10.5.7-5) (Sikumiut 2011a, b, c). The mean pH value near the surface was 7.80 in Dowden's Point, well within the CCME (2010) guideline range of 7.0 to 8.7 (Table 10.5.7-5) (Sikumiut 2011a).

Turbidity was not detected in near surface water samples from the Dowden's Point shoreline electrode site in October 2010 (Table 10.5.7-5) (Sikumiut 2011a). However, TSS levels were found to be somewhat greater than those from surficial sampling in the Strait of Belle Isle and L'Anse au Diable sites (Sikumiut 2011a, b, c), with a mean value of 2.00 mg/L (Table 10.5.7-5) (Sikumiut 2011a). These results appear contradictory, as turbidity, or lack of water clarity, is positively correlated with TSS levels. Essentially, turbidity is an indicator of the light scattering properties of water and is directly dependent on the amount, size and composition of suspended solids (National Land and Water Resources Audit Advisory Council 2008, internet site). Therefore, greater TSS levels should directly result in greater turbidity levels. As such it is likely that there was an instrument error. Nevertheless, based on the TSS levels, water clarity was high in Dowden's Point at the time of sampling.

Overall, similar to the submarine cable crossing corridor and the L'Anse au Diable shoreline electrode site, water samples in the Dowden's Point shoreline electrode site were highly oxygenated and had near pristine pH and clarity, but were relatively poor in nutrients at the time of sampling, similar to available historical data for Conception Bay and nearby regions.

Metals

Sea water samples from the Dowden's Point shoreline electrode site in October 2010 resulted in major ion concentrations which were similar to those found at both the submarine cable crossing corridor and the L'Anse au Diable shoreline electrode site in September 2010 and June 2011 (Table 10.5.7-9) (Sikumiut 2011a, b, c). The majority of metals tested for were not detected in Dowden's Point (Table 10.5.7-10) (Sikumiut 2011a). Neither chromium, cadmium nor arsenic were detected in water samples from Dowden's Point, although the reportable detection limits for these metals were greater than their respective CCME (2010) guideline values (Table 10.5.7-10) (Sikumiut 2011a). Mercury was detected at two of four stations in Dowden's Point at a mean value of 0.022 µg/L, which exceeds the CCME (2010) guideline of 0.016 µg/L (Table 10.5.7-10) (Sikumiut 2011a). The source of the mercury at this location is not known. Selenium was not detected in Dowden's Point, while boron and strontium were present in relatively low concentrations (Table 10.5.7-10) (Sikumiut 2011a, b, c).

Overall, in October 2010 the major ions in the Dowden's Point shoreline electrode site were presumed to be within normal background ranges, and the metals that were found were present in relatively low concentrations. Of those metals with designated CCME (2010) guideline values (i.e., chromium, cadmium, mercury and arsenic), only mercury was detected at two of four stations, and its concentration only slightly exceeded the CCME guideline value.

Petroleum Hydrocarbons

Comparable to the Strait of Belle Isle and L'Anse au Diable (Sikumiut 2011a, b, c), hydrocarbons (C6 to C32) were not detected in samples from Dowden's Point in October 2010 (Table 10.5.7-11) (Sikumiut 2011a). Neither benzene, ethylbenzene nor xylene were detected in these samples (Table 10.5.7-11) (Sikumiut 2011a). Toluene was detected in trace amounts at one of four stations in Dowden's Point, at a concentration of 0.001 mg/L which is well below the CCME (2010) guideline value of 0.215 mg/L (Table 10.5.7-11) (Sikumiut 2011a). As above, this is comparable with the conclusion of Kiceniuk and Khan (1983) that eastern Canadian waters tend to have background petroleum residues well below concentrations of petroleum-related substances known to be toxic or induce negative, sublethal effects to marine life.

Overall, waters in the Dowden's Point shoreline electrode site were nearly pristine at the time of sampling, with only toluene detectable at a single station.

10.5.8 Marine Fish and Fish Habitat

Marine fish habitat is defined as the place where marine fish live, and includes all living and non-living factors or conditions of the surrounding environment such as the physical and chemical characteristics of the sea water column and bottom substrate, and biological components including plankton, macroalgae, and benthic fauna, defined as invertebrates living either in or on the bottom substrate.

Marine "fish" are defined here to include fishery-targeted invertebrates and fishes (e.g., *Chlamys islandica* (Icelandic scallops), *Gadus morhua* (Atlantic cod)), non-fishery-targeted fishes (e.g., *Myoxocephalus* sp. (sculpins), *Microgadus tomcod* (tomcod)), and invertebrate and fish Species of Special Conservation Concern (e.g., *Anarhichas* spp. (wolffishes)).

As suggested by Kelly et al. (2009), a system for classifying and quantifying coastal marine fish habitat which may be impacted as a result of various industrial developments (i.e., potential to cause a Harmful Alteration, Disruption or Destruction (HADD)), representative species were chosen based on the following: (i) they directly or indirectly support an existing (or potential) Aboriginal, commercial, or recreational fishery; (ii) they are listed as a species at risk under the *SARA* / *NLESA*; or; (iii) they are being assessed by COSEWIC. The representative species approach was used to provide a focus for the description of the existing environment.

10.5.8.1 Study Area

Figure 10.5.7-1 in Section 10.5.7 shows the Project components (i.e., submarine cable crossing corridor; L'Anse au Diable shoreline electrode site; Dowden's Point shoreline electrode site) in relation to the Strait of Belle Isle and Conception Bay. The Strait of Belle Isle Area is identical to the study area used in *Marine Fish and Fish Habitat in the Strait of Belle Isle: Information Review and Compilation* (Sikumiut 2010a). It extends from the north-eastern Gulf of St. Lawrence (about 75 km south-west of the submarine cable crossing corridor) to the eastern end of the Strait of Belle Isle (about 75 km north-east of L'Anse au Diable) (Figure 10.5.8-1). The Dowden's Point Area includes the Marine Environment occurring within a 5 km radius of Dowden's Point (Figure 10.5.8-2). The Strait of Belle Isle Area and Dowden's Point Area together constitute the Study Area for marine fish and fish habitat.

10.5.8.2 Information Sources and Data Collection

- *Marine Water and Sediment Survey - Strait of Belle Isle Submarine Cable Crossing Corridors* (Sikumiut 2011c): A 2010 vessel-based marine sampling survey was conducted to collect information on existing water and sediment quality and benthic invertebrates along the initially proposed submarine cable corridors.
- *Strait of Belle Isle Corridor Segment: Marine Water, Sediment, Benthos and Habitat Survey Supplementary Report* (Sikumiut 2011b): A 2011 marine vessel-based survey of the marine habitat for the corridor segment to Shoal Cove. Marine water, sediment and benthic samples were also collected from within this same corridor segment and the results of these surveys are provided.
- *Marine Water, Sediment, Benthos and Nearshore Habitat Surveys: Potential Electrode Sites* (Sikumiut 2011a): A 2010 marine sampling survey to collect information on water and sediment quality, and benthic invertebrates. It also included a bathymetric survey and video survey to identify substrate, macroflora and macrofauna distribution and backshore characteristics at two proposed shoreline electrode sites at L'Anse au Diable and Dowden's Point.
- *Marine Flora, Fauna and Habitat Survey – Strait of Belle Isle Submarine Cable Crossing Corridors, 2008 and 2009* (AMEC 2010b): A marine survey field program was conducted in 2008 and 2009 to gather detailed information on marine habitats, flora and fauna along the initially proposed submarine cable crossing corridors in the Strait of Belle Isle. A 2008 vessel-based survey was carried out using a drop-video camera system, and resulted in seafloor video coverage over approximately 52 km (85%) of the two identified initial corridors. A 2009 dive survey in the shallow inshore area on the Newfoundland side covered an additional 2.8 km. The video collected was subsequently reviewed and analysed in detail to identify, classify and map the type, occurrence / abundance and distributions of marine habitat (substrate), macroflora and macrofauna within the initial submarine cable crossing corridors. A shoreline and intertidal survey was also conducted at four potential cable landing sites on the Labrador and Newfoundland sides of the Strait. AMEC (2011a), Marine Flora, Fauna and Habitat Survey: Strait of Belle Isle Supplementary Report, presents an "extraction" of the relevant data from the 2008-09 marine surveys that fall within proposed single corridor and provides a summary overview of the information.
- *Marine Habitats in the Strait of Belle Isle: Interpretation of 2007 Geophysical (Sonar) Survey Information for the Submarine Cable Crossing Corridors* (Fugro Jacques GeoSurveys Inc. 2010): Nalcor has collected detailed information on bathymetry and substrate characteristics within the proposed submarine cable crossing corridors, including through side-scan sonar, multi-beam and sub-bottom profile surveys in 2007. This study presents a detailed analysis and interpretation of these geophysical survey data to identify and classify the seafloor marine habitats (substrate types and water depths) within the two initial corridors, also using the 2008 and 2009 marine video survey information (AMEC 2010b) to guide and inform the analysis. This study supplements the marine flora, fauna and habitat study (AMEC 2010b) by providing complete marine habitat analysis coverage for the two initial submarine cable corridors. Fugro Jacques GeoSurveys Inc. (2011), Marine Habitats in the Strait of Belle Isle: Interpretation of 2007 Geophysical (Sonar) Survey Information Supplementary Report, presents an "extraction" of the relevant data from the information from the 2007 marine geophysical surveys and associated interpretation and analyses that fall within the proposed single corridor and provides a summary overview of the information.

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FIGURE 10.5.8-1

Strait of Belle Isle Area

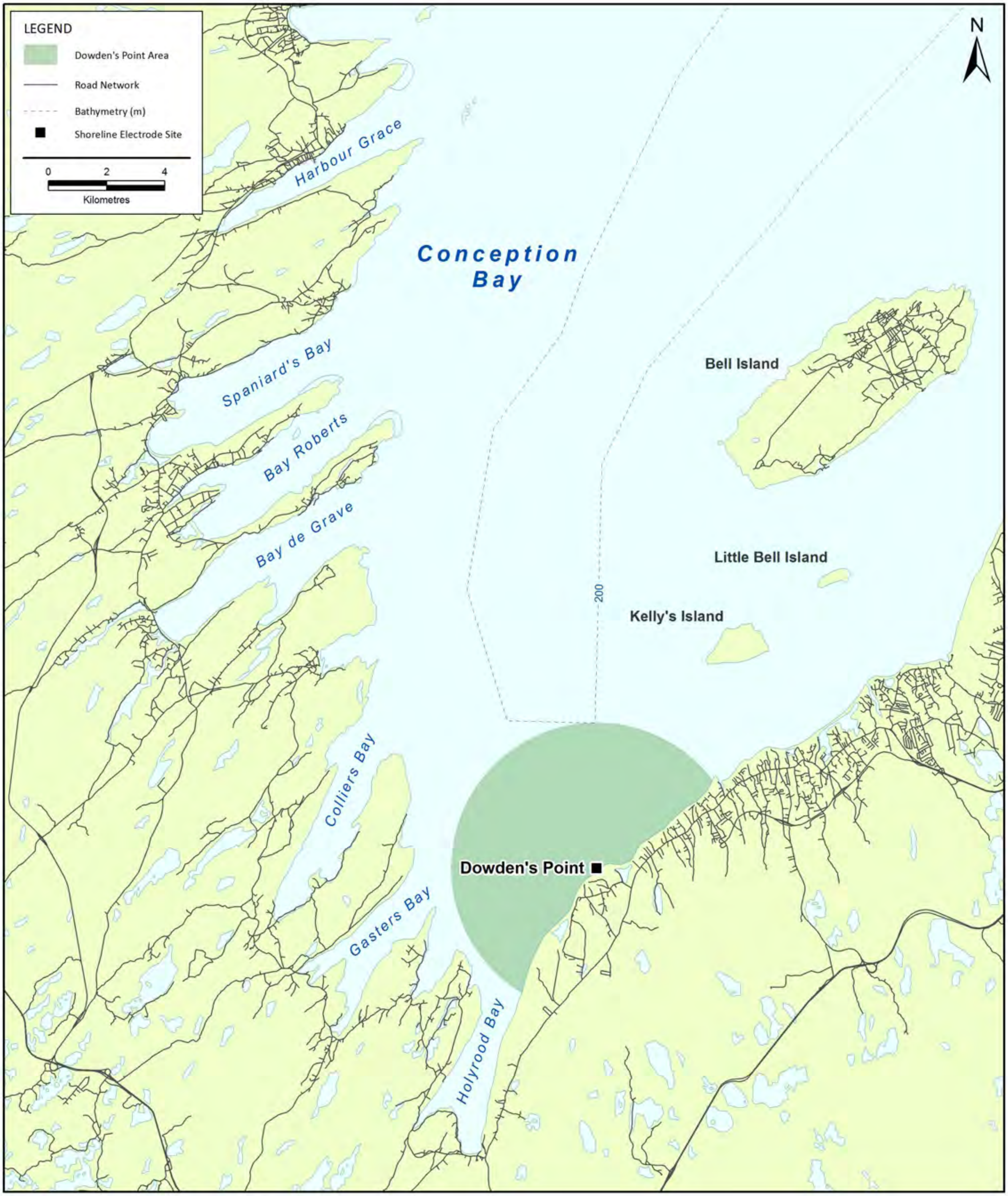

FIGURE 10.5.8-2

Dowden's Point Area, Conception Bay, Newfoundland

- *Marine Fish and Fish Habitat in the Strait of Belle Isle: Information Review and Compilation* (Sikumiut 2010a): This study involved the identification, compilation, review and presentation of existing and available information on marine fish and fish habitat in the Strait of Belle Isle. This includes information on the physical environment / marine habitats (climate, wind, bathymetry, water temperature and salinity, currents, tides, wave, icebergs and sea ice, and surficial geology) and the biological environment (plankton, benthic invertebrates, algae and fish species presence, abundance and distribution). The report supplements Nalcor's marine surveys in the Strait of Belle Isle.
- *Marine Fisheries in the Strait of Belle Isle* (Canning & Pitt Associates Inc. (Canning & Pitt) 2010): A study of marine fishing activity in the area of the Project's submarine cable crossing of the Strait of Belle Isle, based on the compilation and analysis of existing and available datasets, the literature and interviews. The report describes relevant fisheries activities (1989 to 2008) for the wider Strait of Belle Isle area (Northwest Atlantic Fisheries Organization Unit Area 4Ra) and the focuses on current local fisheries near the submarine cable crossing of the Strait of Belle Isle. In addition to existing fisheries statistical data from DFO, the report also includes the results of consultations with fisheries from communities on both sides of the Strait, as well as discussions with relevant governmental and industry representatives.

Marine Fish and Fish Habitat in the Strait of Belle Isle: Information Review and Compilation by Sikumiut (2010a) is cited extensively in this section. The numerous information sources used in Sikumiut (2010a) are provided in Section 2.2.1 of that report. The major sources of information used in Sikumiut (2010a) include the Gulf of St. Lawrence Integrated Management Initiative, the Community-based Coastal Resource Inventory (CCRI), and the DFO research vessel survey and sentinel fisheries databases. All three of these information sources are the responsibility of DFO. Details on Gulf of St. Lawrence Integrated Management Initiative, CCRI and the DFO research survey and sentinel fisheries databases are provided in Section 3.1 of Sikumiut (2010a).

Literature sources for SSCC included *SARA* recovery strategies and management plans, COSEWIC assessment and status reports, primary literature and DFO documents. Websites included those for the *SARA* (*SARA* 2011, internet site), the *NLESA* (GNL 2011, internet site), and the COSEWIC (COSEWIC 2011, internet site).

Other information sources used in this existing environment section include the primary scientific literature, gray literature (e.g., consultant's reports, government documents), other government databases, and relevant web sites.

Sea Water and Bottom Substrate

Strait of Belle Isle Area

Methodologies for the collection of physical and chemical sea water data in the Strait of Belle Isle Area are described in Section 10.5.7 of this EIS, including details of the September 2010 and June 2011 sea water sampling (Sikumiut 2011b, c).

Recent geo-referenced bottom substrate surveys have been conducted in the Strait of Belle Isle Area using side-scan sonar, sub-bottom profiler and regional multibeam echosounder in 2007 (Fugro Jacques GeoSurveys Inc. 2010), drop video camera in 2008 (AMEC 2010b), and diver-mediated video camera in 2009 (AMEC 2010b). Sediment sampling using a Van Veen grab sampler was conducted in the Strait of Belle Isle Area in October 2010 and June 2011 (Sikumiut 2011b, c).

The 2007 geophysical surveys (Fugro Jacques GeoSurveys Inc. 2010) examined an estimated area of 28 km^2 in the Strait of Belle Isle Area (Figure 10.5.8-3). Potential submarine cable crossing corridors were initially identified using a multibeam echosounder, after which detailed geophysical surveys of two 500 m wide corridors were conducted using a side-scan sonar, sub-bottom profiler and regional multibeam echosounder to further investigate and characterize the bathymetric and bottom surficial geological conditions. The side scan sonar imagery was reviewed, interpreted and analyzed using the results of the 2008 drop video camera habitat survey (AMEC 2010b) to guide and inform the interpretation (i.e., groundtruthing). Data collected during the Fugro Jacques GeoSurveys Inc. (2010) and AMEC (2010b) surveys were used to identify and categorize the substrate into five substrate and six water depth classes, resulting in detailed substrate mapping at a 1:10,000 scale. Details of the geophysical surveys and associated analyses are available in Fugro Jacques GeoSurveys Inc. (2010). In 2011, the data were re-analyzed to provide substrate class distribution summary statistics for only those surveyed areas within the proposed submarine cable crossing corridor (Fugro Jacques GeoSurveys Inc. 2011).

The October 2008 drop video camera survey collected information from approximately 52 km of bottom substrate in the Strait of Belle Isle Area, 14 km of which are located within the proposed submarine cable crossing corridor (Figure 10.5.8-4). The drop video camera system was operated from a longliner and suspended about 1.5 m above the substrate, resulting in an approximate 5 m wide field of view. Georeferencing of the video recording was done using the GPS aboard the longliner.

In September 2009, a diver-mediated video camera habitat survey was conducted for 2.8 km of nearshore bottom substrate at Mistaken Cove and Yankee Point on the Newfoundland side of the Strait of Belle Isle (Figure 10.5.8-4). The approximate width of the field of view for the diver-mediated survey was 2 m. None of the diver-mediated video camera survey was conducted within the proposed submarine cable crossing corridor. The video recorded during the 2008 and 2009 surveys was viewed and analyzed for bottom substrate characterization data using a method employed during standard DFO marine fish habitat characterization (Kelly et al. 2009). More methodology details related to the 2008 drop video camera and 2009 diver-mediated video camera habitat surveys are available in AMEC (2010b).

In June 2011, a 2011 marine vessel-based survey of the marine habitat for the corridor segment to Shoal Cove was conducted (Figure 10.5.8-4) (Sikumiut 2011b). A total of 13 km of linear coverage was obtained using drop camera habitat survey methods similar to AMEC (2010b). Habitat characterization similarly followed the methods presented in Kelly et al. (2009). With this additional coverage collected in 2011, the total linear coverage within the corridor is approximately 27 km which is >75% of the corridor length within the Strait of Belle Isle.

In October 2010 and June 2011, surficial sediment sampling using a stainless steel 30 cm x 30 cm Van Veen grab sampler was attempted at 21 deepwater stations in the Strait of Belle Isle Area, 18 of which occur within the proposed submarine cable crossing corridor (Sikumiut 2011b, c) (Figure 10.5.8-5). Selection of the sediment sampling stations in 2010, was based on data collected during previous bottom substrate surveys in 2007, 2008 and 2009 (AMEC 2010b; Fugro Jacques GeoSurveys Inc. 2010). 2011 sampling also used Sikumiut (2011b) drop camera habitat survey to inform site selection. Surficial sediment samples were successfully collected at 7 of the 14 stations, all of which occur either within or near the proposed submarine cable crossing corridor. The sediment samples were analysed for particle size, trace elements (major ions and metals), petroleum hydrocarbons, total organic carbon and moisture by a certified laboratory (Sikumiut 2011b, c).

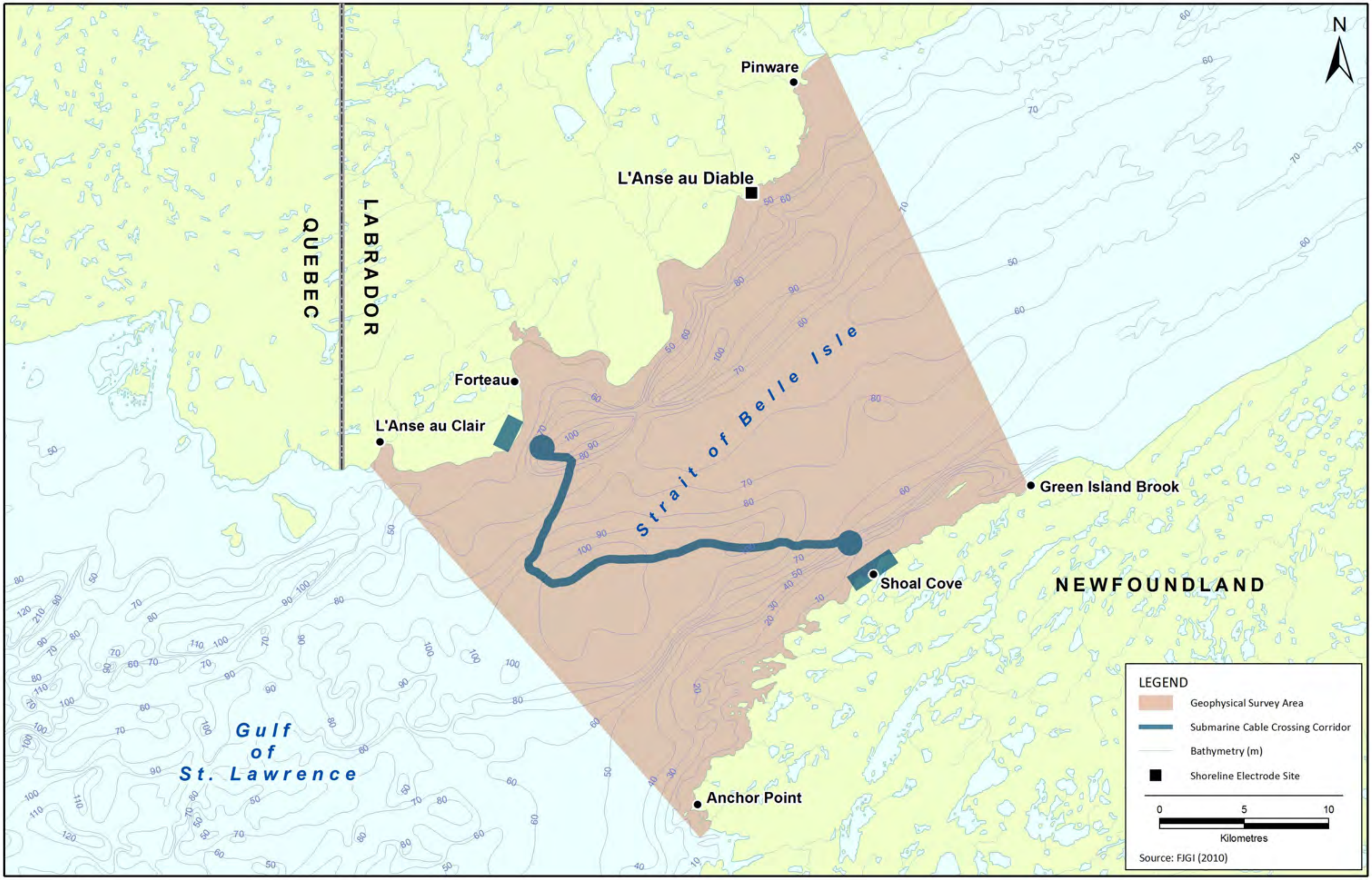

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FIGURE 10.5.8-3

Approximate Geophysical Survey Program Area, Strait of Belle Isle, 2007

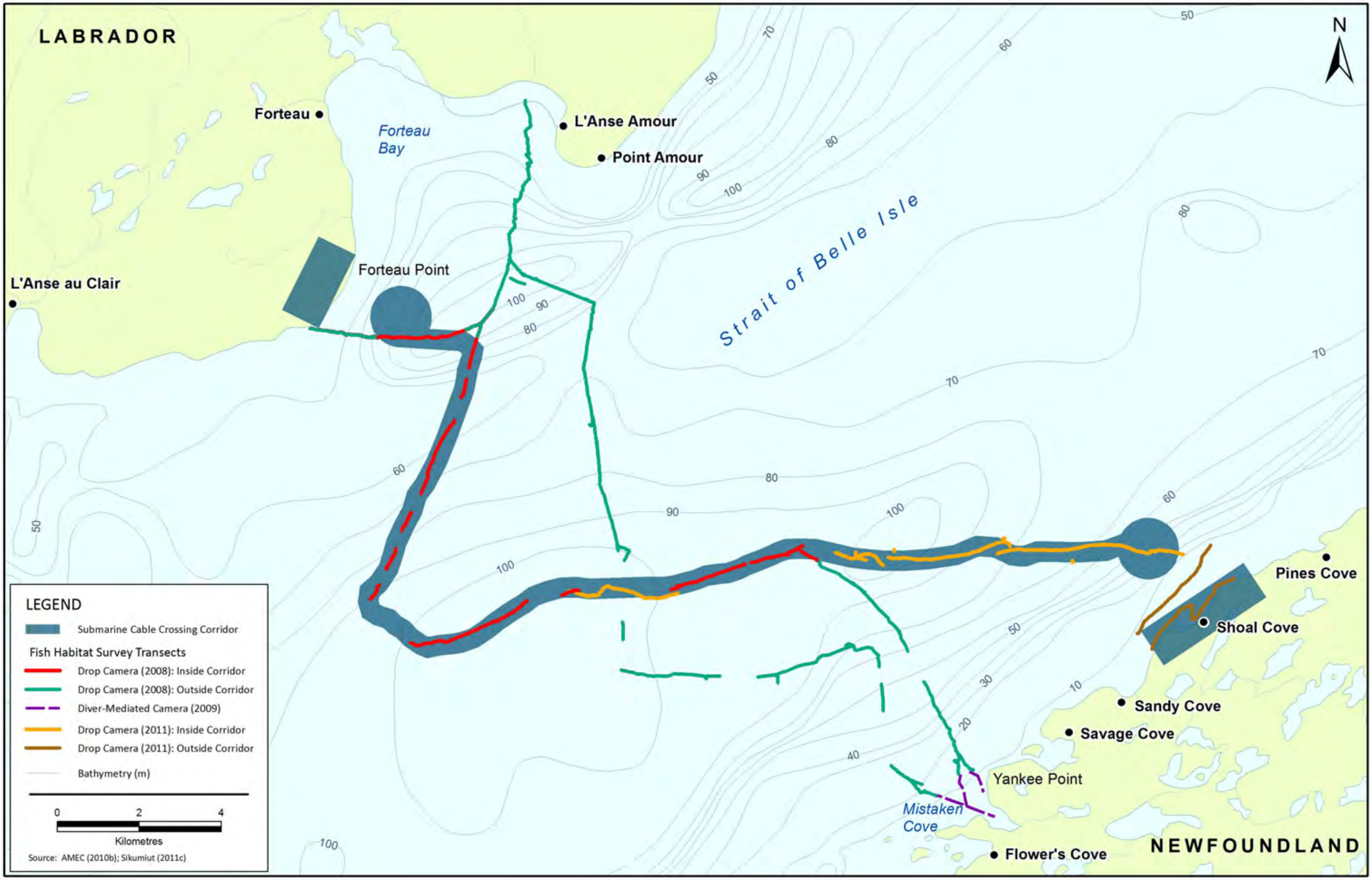

FIGURE 10.5.8-4

Drop and Diver-Mediated Video Camera Fish Habitat Survey Transects in the Strait of Belle Isle, 2008, 2009 and 2011

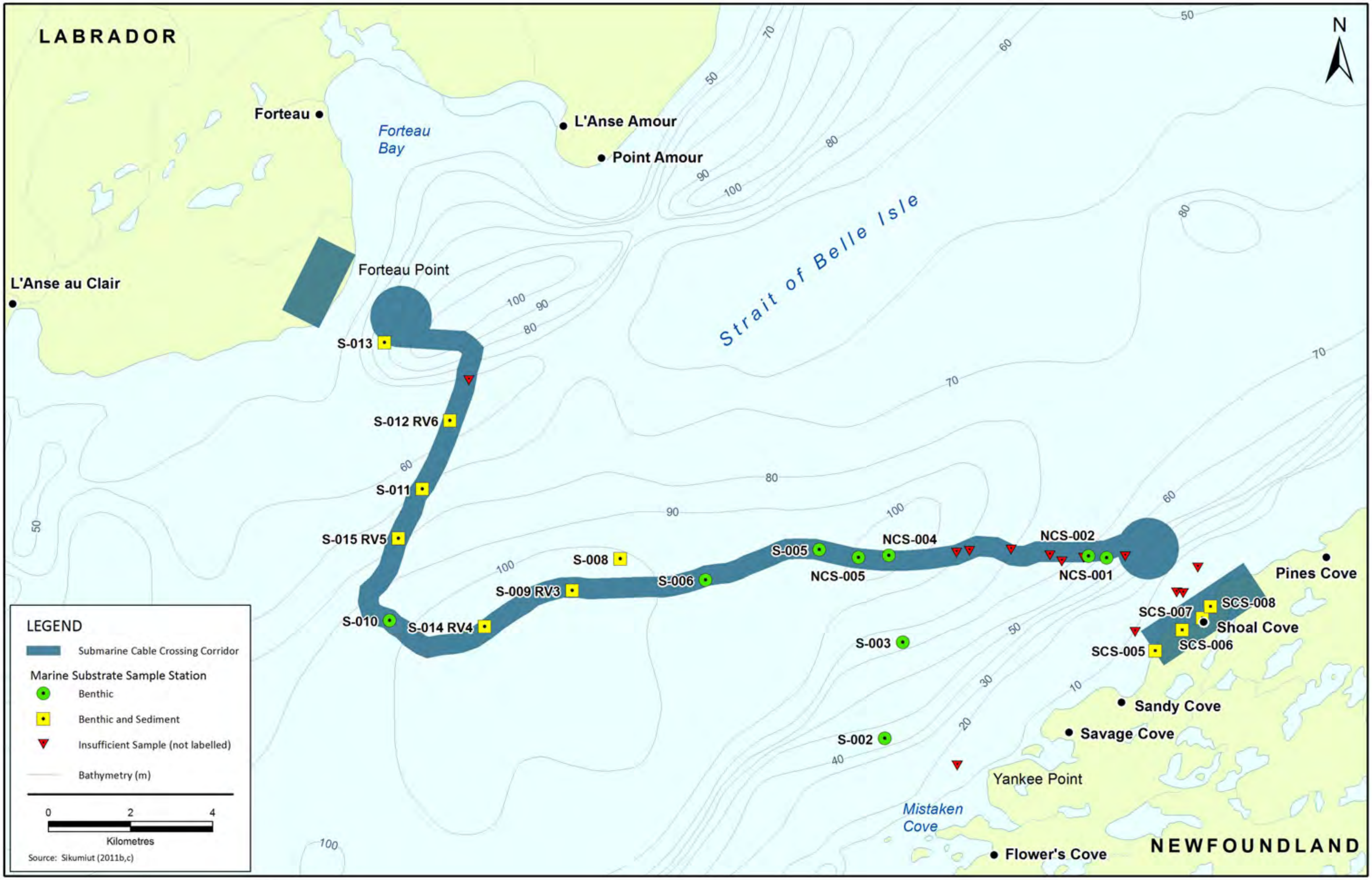

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FIGURE 10.5.8-5

Benthic and Sediment Sampling Stations in the Strait of Belle Isle, 2010 and 2011

Other data presented in Sikumiut (2010a) that pertains to physical and chemical aspects of the bottom substrate in the Strait of Belle Isle Area were obtained from the review of primary and gray literature, and various databases (e.g., DFO RoxAnn System (echosounder) data (Jacques Whitford 2000b), EC's Atlantic Sensitivity Mapping Program (aerial reconnaissance) (EC 1999, 1998), and the CCRI database (Labrador Straits Development Association (LSDA) 2002; Nordic Economic Development Corporation (NEDC) 2001; Red Ochre Regional Board (RORB) 2001). The DFO RoxAnn System is an acoustic survey tool used in the systematic mapping of marine benthic habitat and biological communities. The qualitative Traditional Ecological Knowledge (TEK) data of the CCRI database were collected through interviews with people having direct knowledge of the area, primarily fishers. More details on these databases are provided in Section 3.1.2 of Sikumiut (2010a).

Methodologies for the collection of physical and chemical sea water data in the vicinities of the proposed shoreline electrode sites at L'Anse au Diable and Dowden's Point are described in Section 10.5.7 of this EIS, including details of the October 2010 sea water sampling (Sikumiut 2011a). The physical and chemical surficial sediment data most relevant to the proposed shoreline electrode sites were also collected in October 2010 (Sikumiut 2011a).

L'Anse au Diable

The marine habitat survey conducted at L'Anse au Diable included a shoreline survey (i.e., backshore and intertidal zone), surficial sediment sampling, and a drop video camera survey. The sediment sampling was conducted with a Van Veen grab sampler at eight shallow water stations with water depths ranging from <0.5 m to 6 m (Sikumiut 2011a) (Figure 10.5.8-6). The surficial sediment samples collected were analyzed for particle size, available elements, available metals, petroleum hydrocarbons, total organic carbon and moisture by a certified laboratory (Maxxam Analytics) (Sikumiut 2011a). The shoreline survey and analysis of the drop video camera survey information were completed using methodology employed by DFO for marine fish habitat characterization (Kelly et al. 2009). The proposed electrode site at L'Anse au Diable occurs within the Strait of Belle Isle Area, hence physical and chemical bottom substrate data collection methodology already described for the Strait of Belle Isle Area also applies to L'Anse au Diable (Sikumiut 2011c).

Other data pertaining to the bottom substrate sediments at the proposed shoreline electrode site at L'Anse au Diable were obtained from the CCRI database (LSDA 2002), and through review of primary and gray literature.

Dowden's Point Area

A shoreline survey and drop video camera habitat survey were conducted at the proposed Dowden's Point shoreline electrode site. The approximate dimensions of the drop video camera survey area at Dowden's Point were 250 m x 150 m (Figure 10.5.8-7). The Dowden's Point shoreline survey and analysis of the drop video camera habitat survey information were conducted using methodology employed by DFO for marine fish habitat characterization (Kelly et al. 2009). Sediment sampling at Dowden's Point was unsuccessful due to the coarse nature of the bottom substrate (Sikumiut 2011a). More details of the 2010 surveys at the proposed shoreline electrode sites are available in Sikumiut (2011a).

Other data pertaining to the bottom substrate sediments in the Dowden's Point Area were collected from the CCRI database (Capitol Coast Development Alliance (CCDA) 2001), and through review of primary and gray literature.

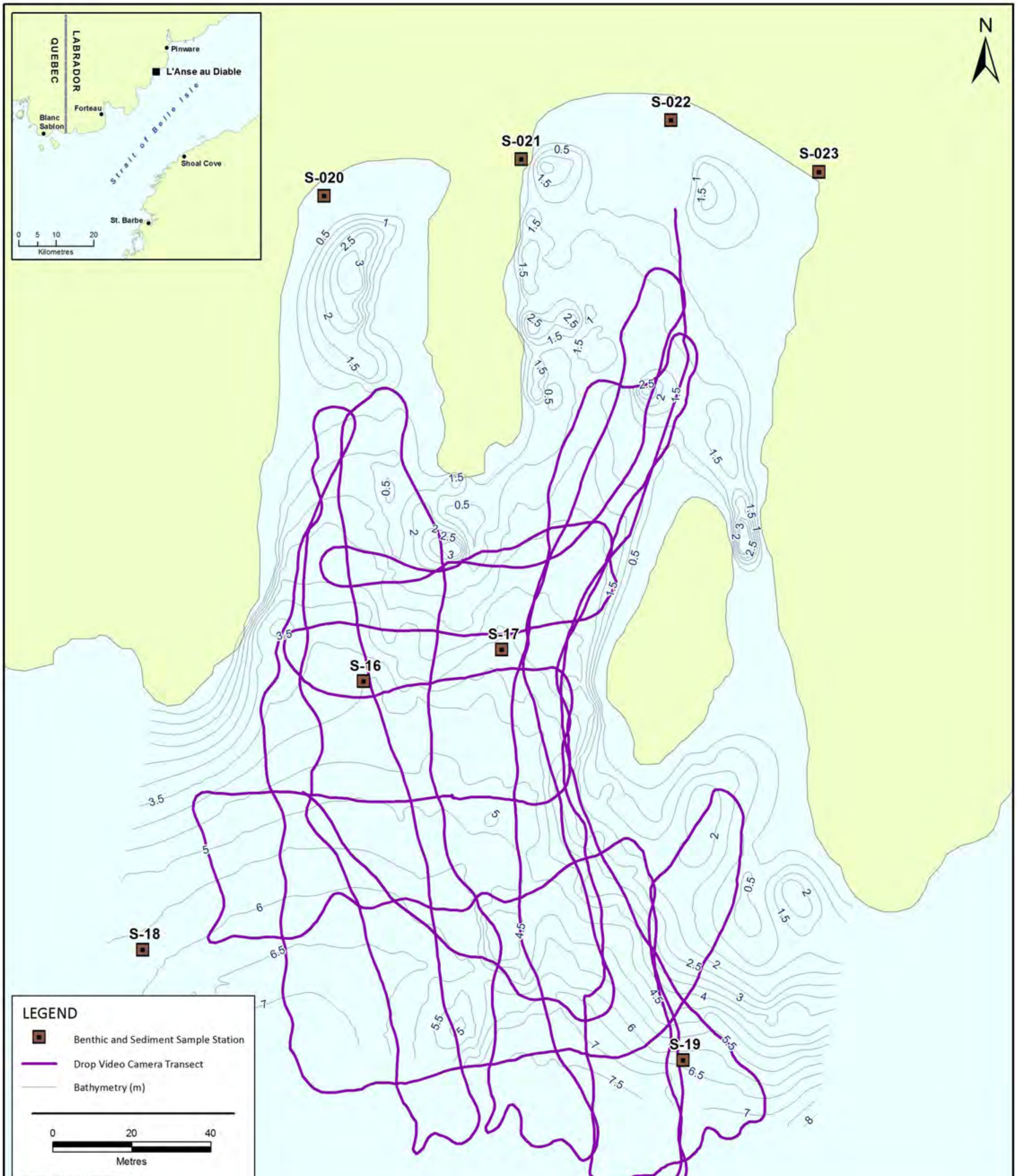

FIGURE 10.5.8-6

Benthic and Sediment Sampling Stations, and Drop Video Camera Fish Habitat Survey Transects at the Proposed Shoreline Electrode Site at L'Anse au Diable, Strait of Belle Isle, 2010

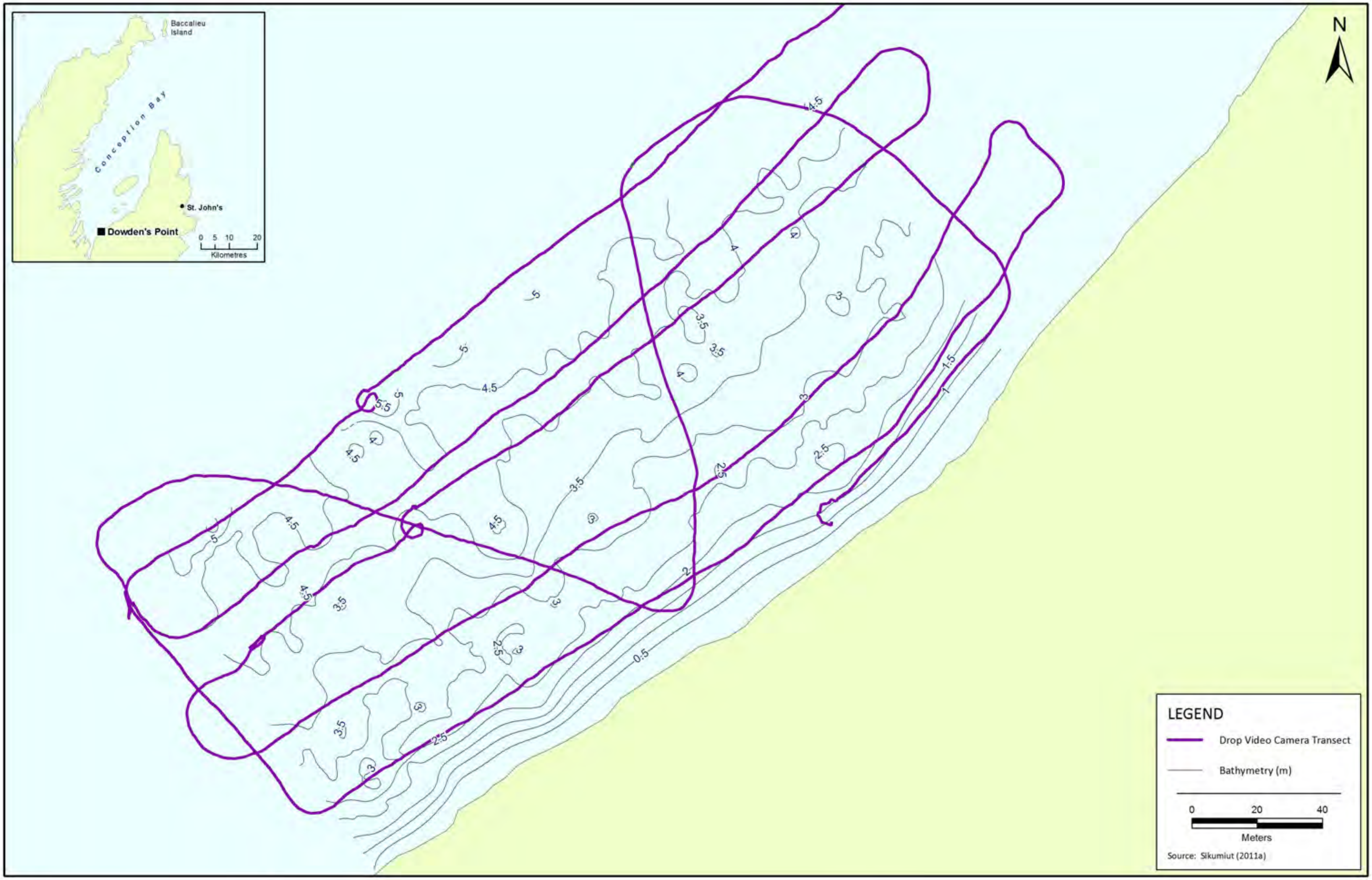

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FIGURE 10.5.8-7

Drop Video Camera Fish Habitat Survey Transects at the Proposed Shoreline Electrode Site at Dowden's Point, Conception Bay, Newfoundland, 2010

Plankton

Strait of Belle Isle Area

The description of plankton in the Strait of Belle Isle Area is based primarily on information provided in Sikumiut (2010a). Data used in Sikumiut (2010a) were collected from the primary literature, government documents and the DFO remote sensing operational database (DFO 2011, internet site).

L'Anse au Diable

The description of plankton in the vicinity of the proposed L'Anse au Diable shoreline electrode site is based primarily on information provided in Sikumiut (2010a). Data used in Sikumiut (2010a) were collected from the primary literature, government documents and the DFO remote sensing operational database (DFO 2011, internet site).

Dowden's Point Area

Data relating to plankton in the Dowden's Point Area were collected from the primary literature, government documents and the DFO remote sensing operational database (DFO 2011, internet site).

Macroalgae

Strait of Belle Isle Area

Information on macroalgae in the Strait of Belle Isle Area is based primarily on information provided in Sikumiut (2010a). Data used in Sikumiut (2010a) were primarily from the 2008 and 2009 video camera habitat surveys in the Strait of Belle Isle (AMEC 2010b). The video information collected during both surveys was viewed and analyzed for macroalgal occurrence data using methodology employed by DFO for marine fish habitat characterization (Kelly et al. 2009). Sikumiut (2011b) also reports the macroalgal occurrence data observed during the drop-camera survey and analyzed using Kelly et al. (2009). Other macroalgal data relevant to the Strait of Belle Isle Area were collected through the review of primary and gray literature, and from the CCRI database (LSDA 2002; NEDC 2001; RORB 2001).

L'Anse au Diable

Description of macroalgae occurring at the proposed L'Anse au Diable shoreline electrode site is based primarily on the October 2010 survey at the site. Macroalgal data were collected by shoreline surveying, by surficial sediment sampling with a Van Veen grab sampler, and by drop video camera habitat surveying (Sikumiut 2011a). The shoreline survey and video analysis were completed using methodology employed by DFO for marine fish habitat characterization (Kelly et al. 2009). Other macroalgal data relevant to the proposed L'Anse au Diable shoreline electrode site were collected through review of primary and other publicly available literature, and from the CCRI database (LSDA 2002).

Dowden's Point Area

Information on macroalgae occurring at the proposed Dowden's Point shoreline electrode site is based primarily on the October 2010 surveys at the site. Macroalgal data were collected by shoreline surveying and by drop video camera habitat surveying (Sikumiut 2011a). Surficial sediment sampling at Dowden's Point was unsuccessful due to the coarse nature of the bottom substrate (Sikumiut 2011a). The shoreline survey and video analysis were completed using methodology employed by DFO for marine fish habitat characterization (Kelly et al. 2009). Other macroalgal data relevant to the Dowden's Point Area were collected through review of primary and gray literature, and from the CCRI database (CCDA 2001).

Benthic Fauna

Strait of Belle Isle Area

The most relevant benthic fauna data for the Strait of Belle Isle Area were collected using field survey methods that include video recording of substrate (AMEC 2010b), bottom sampling with a grab sampler (Sikumiut 2011b, c), and trawling during DFO research surveys (Sikumiut 2010a). Infaunal information was collected during both drop and diver-mediated video camera habitat surveys in the Strait of Belle Isle Area in 2008 and 2009 (AMEC 2010b). The video information was analyzed for infaunal occurrence data using methodology employed by DFO for marine fish habitat characterization (Kelly et al. 2009).

The Van Veen grab sampling for benthic fauna in the Strait of Belle Isle Area was successful at 16 of the 21 stations where sampling was attempted in October 2010 and June 2011 (Figure 10.5.8-5). The collected fauna were sorted and identified to the lowest practical taxonomic level, followed by the calculation of benthic community indicators (indices) (Sikumiut 2011b, c). Specifics of the DFO research survey methodology are included in Section 3.1.3 of Sikumiut (2010a).

Other benthic fauna data for the Strait of Belle Isle Area were obtained from the CCRI database (LSDA 2002; NEDC 2001; RORB 2001), from review of primary and gray literature, and through personal communications.

L'Anse au Diable

Benthic fauna data at the proposed L'Anse au Diable shoreline electrode site were collected in October 2010 (Sikumiut 2011a). Benthic samples were collected at eight stations in water depths ranging from <0.5 m to 6.0 m (Figure 10.5.8-6) (Sikumiut 2011a). In addition, a drop video camera habitat survey was conducted at the site (Figure 10.5.8-6), and the video was subsequently analyzed for benthic fauna using methodology employed by DFO for marine fish habitat characterization (Kelly et al. 2009).

Other data pertaining to benthic fauna occurring in the vicinity of the proposed L'Anse au Diable electrode site were obtained from the CCRI database (LSDA 2002).

Dowden's Point Area

Benthic fauna data related to the proposed Dowden's Point shoreline electrode site were collected in October 2010 using a drop video camera habitat survey (Figure 10.5.8-7) (Sikumiut 2011a). The video was subsequently analyzed for benthic fauna using methodology employed by DFO for marine fish habitat characterization (Kelly et al. 2009).

Other data pertaining to benthic fauna occurring in the Dowden's Point Area were obtained from the CCRI database (CCDA 2001) and consultants' reports.

Marine Fish

Fishery-Targeted Invertebrates

Strait of Belle Isle Area

The information required to identify the fishery-targeted invertebrate species in the Strait of Belle Isle Area was obtained from Canning & Pitt (2010). Canning & Pitt (2010) used available commercial fishery landings data from the DFO as well as information gathered during consultations with representatives of commercial fishers in the Strait of Belle Isle Area. Details on these methods are available in Section 1.3 of Canning & Pitt (2010).

Information related to the identified fishery-targeted invertebrate species that occur in the Strait of Belle Isle Area was obtained primarily from Sikumiut (2010a). Sikumiut (2010a) used various data sources, including DFO research vessel surveys, DFO sentinel fisheries, and the CCRI database. Specifics of the methodologies used during DFO research surveys and sentinel fisheries are described in Section 3.1.3 of Sikumiut (2010a). The qualitative CCRI TEK data were obtained from the portions of the CCRI database relating to the Strait of Belle Isle Area (LSDA 2002; NEDC 2001; RORB 2001).

Occurrence data relating to fishery-targeted invertebrates in the Strait of Belle Isle Area were also obtained from AMEC (2010b) and Sikumiut (2011c). The recordings of the October 2008 drop video camera survey, September 2009 diver-mediated video camera survey and the June 2011 drop camera survey were viewed and analyzed to collect data on benthic invertebrates using methodology employed for standard DFO marine fish habitat characterization (Kelly et al. 2009). Details of the surveys are available in AMEC (2010b) and Sikumiut (2011c).

Other data pertaining to fishery-targeted invertebrates in the Strait of Belle Isle Area were obtained through literature review, personal communications, and from the CCRI database (LSDA 2002; NEDC 2001; RORB 2001).

L'Anse au Diable

The information required to identify the fishery-targeted invertebrate species that occur in the vicinity of the proposed L'Anse au Diable shoreline electrode site was obtained from Canning & Pitt (2010). Canning & Pitt (2010) used available commercial fishery landings data from DFO as well as information gathered during consultations with representatives of commercial fishers in the Strait of Belle Isle. More details of these methods are available in Section 1.3 of Canning & Pitt (2010).

Information related to the identified fishery-targeted invertebrate species that occur in the vicinity of the proposed L'Anse au Diable shoreline electrode site was obtained primarily from Sikumiut (2011a). These data were collected by drop video camera habitat surveying and Van Veen grab sampling (see Figure 10.5.8-6). The collected video information was analyzed for invertebrate occurrence data using methodology employed by DFO for marine fish habitat characterization (Kelly et al. 2009). Other data related to occurrence of fishery-targeted invertebrates at this site were obtained from the CCRI database (LSDA 2002).

Dowden's Point Area

Information required to identify the fishery-targeted invertebrate species that occur in Dowden's Point Area, including the proposed Dowden's Point shoreline electrode site were obtained from Section 15.6 Marine Fisheries of this EIS. Canning & Pitt used available commercial fishery landings data from the DFO as well as information gathered during consultations with representatives of commercial fishers in Conception Bay. More details of these methods are available in Section 15.6 of this EIS.

Occurrence information related to the identified fishery-targeted invertebrate species at the proposed Dowden's Point shoreline electrode site was obtained primarily from Sikumiut (2011a). These data were collected by drop video camera habitat surveying (Figure 10.5.8-7). The collected video information was analyzed for invertebrate occurrence data using methodology employed by DFO for marine fish habitat characterization (Kelly et al. 2009). Data were also obtained from the CCRI database (CCDA 2001).

Fishery-Targeted Fishes

Strait of Belle Isle Area

The information required to identify the fishery-targeted fishes in the Strait of Belle Isle Area was obtained from Canning & Pitt (2010). Canning & Pitt (2010) used available commercial fishery landings data from the DFO as well as information gathered during consultations with representatives of commercial fishers in the Strait of Belle Isle Area. More details of these methods are available in Section 1.3 of Canning & Pitt (2010).

Information related to the identified fishery-targeted fish species that occur in the Strait of Belle Isle Area was obtained primarily from Sikumiut (2010a). Sikumiut (2010a) used various data sources, including DFO research vessel surveys, DFO sentinel fisheries, and the CCRI database. Specifics of the methodologies used during DFO research surveys and sentinel fisheries are described in Section 3.1.3 of Sikumiut (2010a). The qualitative CCRI TEK data were obtained from the portions of the CCRI database relating to the Strait of Belle Isle Area (LSDA 2002; NEDC 2001; RORB 2001).

Occurrence data relating to fishery-targeted fishes in the Strait of Belle Isle Area were also obtained from AMEC (2010b) and Sikumiut (2011c). The recordings of the October 2008 drop video camera survey September 2009 diver-mediated video camera survey and June 2011 drop camera survey were viewed and analyzed to collect data on fishes using methodology employed for standard DFO marine fish habitat characterization (Kelly et al. 2009). Details of the surveys are available in AMEC (2010b) and Sikumiut (2011c).

Other data pertaining to fishery-targeted fishes in the Strait of Belle Isle Area were obtained through literature review, personal communications, and from the CCRI database (LSDA 2002; NEDC 2001; RORB 2001).

L'Anse au Diable

The information required to identify the fishery-targeted fishes that occur in the vicinity of the proposed L'Anse au Diable shoreline electrode site was obtained from Canning & Pitt (2010). Canning & Pitt (2010) used available commercial fishery landings data from DFO as well as information gathered during consultations with representatives of commercial fishers in the Strait of Belle Isle. More details of these methods are available in Section 1.3 of Canning & Pitt (2010).

Information related to the identified fishery-targeted fish species that occur in the vicinity of the proposed L'Anse au Diable shoreline electrode site was primarily obtained from Sikumiut (2011a). These data were collected by drop video camera habitat surveying and Van Veen grab sampling (Figure 10.5.8-6). The collected video information was analyzed for fish occurrence data using methodology employed by DFO for marine fish habitat characterization (Kelly et al. 2009). Other data related to occurrence of fishery-targeted fishes at this site were obtained from the CCRI database (LSDA 2002).

Dowden's Point Area

Information required to identify the fishery-targeted fishes that occur in the Dowden's Point Area were obtained from Section 15.6 Marine Fisheries of this EIS. Canning & Pitt (2010) used available commercial fishery landings data from DFO as well as information gathered during consultations with representatives of commercial fishers in Conception Bay. More details of these methods are available in Section 15.6 of this EIS.

Occurrence information related to the identified fishery-targeted fishes at the proposed Dowden's Point shoreline electrode site was obtained primarily from Sikumiut (2011a). These data were collected by drop video camera habitat surveying (Figure 10.5.8-7). The collected video information was analyzed for fish occurrence data using methodology employed by DFO for marine fish habitat characterization (Kelly et al. 2009). Data were also obtained from the CCRI database (CCDA 2001).

Non-Fishery-Targeted Fishes

Strait of Belle Isle Area

Information related to the non-fishery-targeted fishes that occur in the Strait of Belle Isle Area was obtained primarily from Sikumiut (2010a). Sikumiut (2010a) used various data sources, including DFO research vessel surveys, and the CCRI. Specifics of the methodologies used during DFO research surveys and sentinel fisheries are described in Section 3.1.3 of Sikumiut (2010a). The qualitative CCRI TEK were obtained specifically from the parts of the CCRI database relating to the Strait of Belle Isle Area (LSDA 2002; NEDC 2001; RORB 2001).

Other occurrence data relating to non-fishery-targeted fishes in the Strait of Belle Isle Area were obtained from AMEC (2010b) and Sikumiut (2011c). Data were collected using drop and diver-mediated video camera survey techniques in 2008, 2009 and 2011. The video collected during both surveys was viewed and analyzed for biota occurrence using methodology employed for standard DFO characterization of fish habitat (Kelly et al. 2009). Other data pertaining to non-fishery-targeted fishes in the Strait of Belle Isle Area were obtained through literature review and personal communications.

L'Anse au Diable

Information related to non-fishery-targeted fishes that occur in the vicinity of the proposed L'Anse au Diable shoreline electrode site was obtained primarily from Sikumiut (2011a). These data were collected by drop video camera habitat surveying (Figure 10.5.8-6). The collected video information was analyzed for fish occurrence data using methodology employed by DFO for marine fish habitat characterization (Kelly et al. 2009). Other data related to occurrence of non-fishery-targeted fishes at this site were obtained from the CCRI database (LSDA 2002).

Dowden's Point Area

Occurrence information related to non-fishery-targeted fishes at the proposed Dowden's Point shoreline electrode site was obtained primarily from Sikumiut (2011a). These data were collected by drop video camera habitat surveying (see Figure 10.5.8-7). The collected video information was analyzed for fish occurrence data using methodology employed by DFO for marine fish habitat characterization (Kelly et al. 2009). Other data related to non-fishery-targeted fishes in the Dowden's Point Area were obtained from the CCRI database (CCDA 2001).

Species of Special Conservation Concern

Data relevant to marine fish SSCC that potentially occur in the Study Area were obtained primarily through literature review and from government websites, augmented by data collected during the field programs, as appropriate.

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

LEK was collected from consultation initiatives with various communities (a summary of all consultation with public stakeholders can be found in Chapter 8 of the EIS) including open houses, correspondence, a general literature and media search, etc.

10.5.8.3 Description of Marine Fish and Fish Habitat

Sea Water and Bottom Substrate

Strait of Belle Isle Area

Detailed physical and chemical characteristics of sea water in the Strait of Belle Isle Area are described in Section 10.5.7 on Marine Water Quality, including the results of the September 2010 and June 2011 sea water sampling in the Strait of Belle Isle (Sikumiut 2011b, c). Overall, the existing water quality in the Strait of Belle Isle Area is nearly pristine, with the exception of a small number of isolated coastal sites. Temperature, salinity, nutrient and pH levels are within historical and acceptable limits, oxygenation and water clarity are high, and metal and petroleum hydrocarbon concentrations are low.

During the past 35 years, there has been considerable investigation of the surficial sediment occurring in the Strait of Belle Isle Area, especially in areas considered for fixed link and transmission cable projects (Sikumiut 2010a). The most recent investigations of the bottom substrate in the Strait of Belle Isle Area have been conducted during the past four years (Sikumiut 2011b, c; AMEC 2010b; Fugro Jacques GeoSurveys Inc. 2010).

In its interpretation of 2007 geophysical survey information collected in the Strait of Belle Isle, Fugro Jacques GeoSurveys Inc. categorized surveyed areas by substrate class and water depth class (Fugro Jacques GeoSurveys Inc. 2010). Recently, Fugro Jacques GeoSurveys Inc. re-analyzed only those data relevant to the proposed submarine cable crossing corridor (Fugro Jacques GeoSurveys Inc. 2011). The substrate and water depth classes that pertain to the proposed submarine cable crossing corridor are described in Table 10.5.8-1. The distributions of substrate class and water depth within the proposed submarine cable crossing corridor are indicated in Figure 10.5.8-8. Note that the corridor has been arbitrarily divided into five segments to allow detailed descriptions of the analysis results (Figure 10.5.8-8).

Table 10.5.8-1 Substrate and Water Depth Classes Used in the Interpretation of 2007 Geophysical Survey Data Relevant to the Proposed Submarine Cable Crossing Corridor

Substrate Class	Description
Bedrock	Continuous rock
Coarse-Large	Rubble and boulder (140 to >1000 mm)
Coarse-Small	Gravel and cobble (2 to <140 mm)
Shell	Calcareous remains of invertebrate shells
Coarse-Small / Shell	About 50% coarse-small, 50% shells
Water Depth Class	**Description**
Deep subtidal 1	>30 to 60 m
Deep subtidal 2	>60 to 90 m
Deep subtidal 3	>90 to 120 m

Source: Fugro Jacques GeoSurveys Inc. (2010).

Approximately 61% (10.533 km^2) of the length of the proposed submarine cable crossing corridor has been surveyed by side-scan sonar, sub-bottom profiler, and regional multibeam echosounder. Drop video camera habitat surveying has been conducted along approximately 77% (i.e., 27 km) of the corridor

The bottom substrate class distribution within the proposed submarine cable crossing corridor is presented in Table 10.5.8-2 (Fugro Jacques GeoSurveys Inc. 2011). As indicated, the area of the proposed submarine cable crossing corridor is approximately 17.1 km^2. Of this area, approximately 10.5 km^2 (61%) has been surveyed for bottom substrate class distribution data. Segment 5 bottom substrate was examined through analysis of the video survey data (Sikumiut 2011b).

Table 10.5.8-2 Bottom Substrate Type for Surveyed Areas within the Proposed Submarine Cable Crossing Corridor

Substrate Class	Area (km^2)	Area (%)	No. of Polygons in each Substrate Class
Bedrock	0.870	8.26	155
Coarse-Large	1.644	15.61	378
Coarse-Small	6.369	60.47	26
Coarse-Small/Shells	0.752	7.14	2
Shells	0.898	8.53	109
Fine	0.00	0.00	0
Total	10.533	100	670

Source: Fugro Jacques GeoSurveys Inc. (2011).

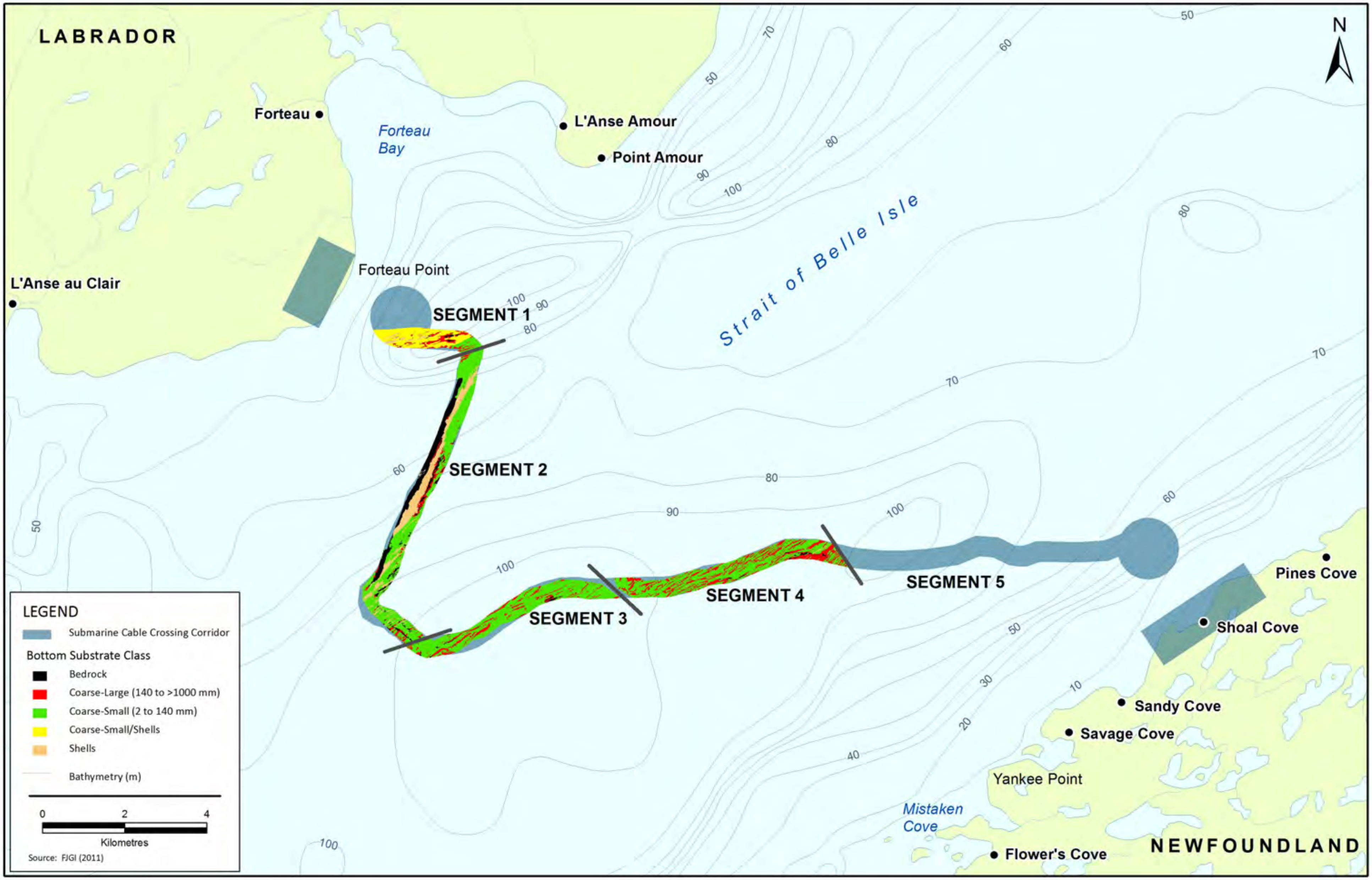


FIGURE 10.5.8-8

Distribution of Bottom Substrate Class within Segments of the Submarine Cable Crossing Corridor

Overall, Coarse-Small (gravel and cobble) is the dominant substrate class for the surveyed portion (6.369 km^2) of the proposed submarine cable crossing corridor (60.47% of total surveyed area). Areas for the other substrate classes within the surveyed portion include 15.6% Coarse-Large (rubble and boulder), 8.53% Shell, 8.3% Bedrock, and 7.14% Coarse-Small with Shell. No Fines (detritus / silt / sand) were identified in the surveyed area (Table 10.5.8-2).

Gravel and cobble is the dominant bottom substrate type of surveyed area within Segment 2, Segment 3 and Segment 4, while gravel, cobble and shell is dominant within Segment 1. The percentage Shell substrate was highest within Segment 2 (Table 10.5.8-2).

Fugro Jacques GeoSurvey Inc. (2011) also included the description of substrate class distribution relative to water depth class (Table 10.5.8-3).

Bedrock is essentially the only bottom substrate class occurring in the portions of the surveyed area where water depths range between 30 and 60 m. Shell substrate accounts for the limited non-bedrock area (<1%). For the portion of the surveyed area where water depths range between 60 and 120 m, gravel and cobble are the dominant substrate types, followed by bedrock, shell, rubble / boulder, and gravel / cobble / shell (Table 10.5.8-3).

Table 10.5.8-3 Bottom Substrate Type by Water Depth Range of Surveyed Areas within the Proposed Submarine Cable Crossing Corridor

Water Depth Range (m)	Water Depth Range Area (km^2)	Substrate Class Area (km^2) and Percentage of Section					
		Bedrock	Coarse-Large	Coarse-Small	Coarse-Small / Shells	Shells	Fine
30-60	0.169	0.168 99.51%	0.000 0.00%	0.000 0.00%	0.000 0.00%	0.001 0.49%	0.000 0.00%
60-90	2.081	0.531 25.51%	0.117 5.64%	0.970 46.61%	0.100 4.79%	0.363 17.45%	0.000 0.00%
90-120	8.283	0.171 2.06%	1.527 18.44%	5.399 65.18%	0.652 7.87%	0.534 6.45%	0.000 0.00%
Total	**10.533**	**0.870** **8.26%**	**1.644** **15.61%**	**6.369** **60.47%**	**0.752** **7.14%**	**0.898** **8.53%**	**0.000** **0.00%**

Source: Fugro Jacques GeoSurveys Inc. (2011).

AMEC (2010b) classified bottom substrate surveyed in 2008 and 2009 using the same substrate classes and water depths presented in Table 10.5.8-1. In 2011, AMEC (2011a) re-analyzed the relevant survey areas within the currently proposed submarine corridors. The results indicated that of the approximately 15 km of survey area, 46.7% was Coarse-Small, 27.9% was Coarse-Large, and 25.3% Shells (AMEC 2011a).

Physical and chemical surficial sediment data were also collected during the September / October 2010 survey in the Strait of Belle Isle (Sikumiut 2011b). Sediments were collected at seven stations with locations based on substrate class information collected during the 2007 (Fugro Jacques GeoSurveys Inc. 2010) and 2008 (AMEC 2010b) surveys (see Figure 10.5.8-5). The sediment samples were characterized primarily by gravel and secondarily by sand. Other reported constituents included clay, silt and shells. Only those chemical parameters found at detectable levels in the survey sediment samples are reported in Table 10.5.8-4.

Table 10.5.8-4 Concentration Ranges (mg/kg) of Detectable Chemical Parameters in Surficial Sediments Collected from the Strait of Belle Isle, September / October 2010

Chemical Parameter	Concentration Range (mg/kg)
Elements	
Available calcium	180,000-400,000 [7]
Available magnesium	3,800-8,800 [7]
Available phosphorous	150-570 [7]
Available potassium	320-760 [7]
Available sodium	4,300-11,000 [7]
Available sulphur	2,800-6,300 [7]
Metals	
Available aluminum	550-1,400 [7]
Available barium	68 [1][(a)]
Available iron	2,300-5,200 [7]
Available lead	5-8 [3][(b)]
Available manganese	160-400 [7]
Available strontium	1,400-2,400 [7]
Available vanadium	26-30 [2][(c)]
Hydrocarbons	
>C_{10}-C_{16}	25 [1][(a)]
>C_{16}-C_{21}	14-200 [2][(c)]
>C_{21}-<C_{32}	220 [1][(a)]

Source: Sikumiut (2011b).
Note: The number in square brackets indicates the number of stations where detectable levels were found.
(a) Station S-014 (Segment 3).
(b) Stations S-009 (Segment 3), S-013 (Segment 1) and S-014.
(c) Stations S-009 and S-014.

The surficial sediment organic carbon levels ranged from 2.0 to 20.0 g/kg at the seven Strait of Belle Isle stations sampled in October 2010, Station S-009 (Segment 3) having the highest and Station S-015 (Segment 2) the lowest (Figure 10.5.8-8). As indicated in Table 10.5.8-4, sediments collected at Stations S-009 and S-014 (Segment 3) had the highest frequency of detectable levels of chemical parameters not detected in sediments collected elsewhere (i.e., barium, vanadium and hydrocarbons). Both stations are located in the deepest water at the middle of the Strait of Belle Isle (Figure 10.5.8-8). Neither CCME Interim Sediment Quality Guidelines (CCME 2011, internet site) nor Probable Effects Levels was exceeded by any of the detectable chemical concentrations in the sediment samples.

The substrate data presented by Fugro Jacques GeoSurveys Inc. (2010) reflect data collected in 1979 (SNC-Lavalin 1980) and re-analyzed DFO RoxAnn data (Jacques Whitford 2000b).

As indicated in Sikumiut (2010a), the Atlantic Sensitivity Mapping Program database (EC 1999, 1998) shows that the Shoal Cove area (eastern portion of the proposed submarine cable crossing corridor) is classified as a bedrock shoreline with a platform lower intertidal zone form, boulder beach shore type, mixed coarse – no sand backshore material, and beach backshore form (Sikumiut 2010a). Sikumiut (2011c) were unsuccessful in retrieving a suitable sediment sample despite the numerous attempts. This too supports the Sikumiut (2011c) drop camera habitat survey.

Detailed physical and chemical characteristics of sea water at the proposed shoreline electrode sites at L'Anse au Diable and Dowden's Point are described in Section 10.5.7 on Marine Water Quality, including the results of the September / October 2010 sea water sampling at both sites (Sikumiut 2011b). Overall, the existing water quality at both proposed shoreline electrode sites is nearly pristine. Temperature, salinity, nutrient and pH levels are within historical and acceptable limits, oxygenation and water clarity are high, and metal and petroleum hydrocarbon concentrations are low.

L'Anse au Diable

Two types of backshore were identified during the 2010 survey at L'Anse au Diable; Rock Platform (76%) and Sand / Flat Beach (24%). Similarly, the make-up of the bottom substrate of the intertidal zone at L'Anse au Diable was determined to be bedrock (57%) and sand (43%), the former extending from the Rock Platform backshore and the latter extending from the Sand / Flat Beach backshore (Sikumiut 2011a). Details related to the shoreline survey conducted at L'Anse au Diable are included in Section 3.1.4.3 of Sikumiut (2011a).

Analysis of the drop video camera imagery indicated that bedrock / boulder and sand are the dominant bottom substrate classes at the proposed L'Anse au Diable shoreline electrode site (combined percentage view time of 77%). Various combinations of substrate classes accounted for the remaining 23% of the video viewing time. Bedrock and boulder dominated much of the northern (inshore) and south-eastern portions of the survey area while sand dominated the bottom substrate in the south-western portion and innermost intertidal areas of the L'Anse au Diable site. Substrate class distribution modelling results are presented in Figure 3.12 in Sikumiut (2011a). Details related to the shallow subtidal zone substrate distribution at L'Anse au Diable, as determined by the September / October 2010 survey, are included in Section 3.1.4.4 of Sikumiut (2011a).

The surficial sediments collected at all eight stations (four intertidal and four subtidal) at the proposed L'Anse au Diable electrode site (Figure 10.5.8-6) consisted primarily of sand (at least 94%), followed by gravel, silt and clay. The chemical parameters found at detectable levels in the surficial sediment samples are reported in Table 10.5.8-5. The surficial sediment organic carbon levels at L'Anse au Diable ranged from 0.3 to 0.5 g/kg at the eight stations sampled in September / October 2010.

Table 10.5.8-5 Concentration Ranges (mg/kg) of Detectable Chemical Parameters in Surficial Sediments Collected at the L'Anse au Diable Shoreline Electrode Site, 2010

Chemical Parameter	Concentration Units	Concentration Range	
		Intertidal Stations	Subtidal Stations
Elements			
Available calcium	mg/kg	150-900 [4]	560-2000 [4]
Available magnesium	mg/kg	160-210 [4]	340-480 [4]
Available potassium	mg/kg	—	140-230 [4]
Available sodium	mg/kg	500-910 [4]	1,800-3,000 [4]
Metals			
Available aluminum	mg/kg	170-260 [4]	180-240 [4]
Available iron	mg/kg	620-740 [4]	830-1,200 [4]
Available manganese	mg/kg	2-3 [4]	3-4 [4]
Available strontium	mg/kg	—	6 [1](a)
Available thallium	mg/kg	0.1 [1](b)	
Available vanadium	mg/kg	—	2-4 [4]
Other			
Organic carbon	g/kg	0.3-0.4 [2](c)	0.4-0.5 [4]
Moisture	%	8-19 [4]	17-19 [4]

Source: Sikumiut (2011a).
Note: The number in square brackets indicates the number of stations where detectable levels were found.
(a) Station S-17.
(b) Station S-20.
(c) Stations S-20 and S-21.

Dowden's Point Area

Only one type of backshore was identified during the 2010 shoreline survey at Dowden's Point; Steep Gravel and Sand Beach. The bottom substrate of the intertidal zone at Dowden's Point was characterized by boulder and rubble (Sikumiut 2011a). Additional information related to the shoreline survey conducted at Dowden's Point is included in Section 3.2.2.3 of Sikumiut (2011a).

Analysis of the drop video camera imagery collected at Dowden's Point indicated that boulder / cobble is the dominant bottom substrate type at the proposed shoreline electrode site (81.1% of viewing time). Other bottom substrate types observed include boulder / cobble / sand (12.6% of viewing time), boulder (4.6% of viewing time), and sand with boulder / cobble (1.6% of viewing time). While boulder / cobble dominate the survey area, the boulder dominated areas occur nearest shore where depths are <2.5 m, and the boulder / cobble / sand dominated areas in the deeper parts of the survey area (>3 m). Substrate class distribution modelling results are presented in Figure 3.19 in Sikumiut (2011a). Details related to bottom substrate class distribution at the Dowden's Point shoreline electrode site, as determined by the September / October 2010 survey, are included in Section 3.2.2.4 of Sikumiut (2011a).

Plankton

Plankton refers to free-floating organisms that drift in the water column and includes bacteria, fungi, phytoplankton (primarily unicellular algae), zooplankton (marine invertebrates), eggs and larvae of macroinvertebrates, and ichthyoplankton (eggs and larvae of fishes). Zooplankton serve as the link between primary production and organisms higher in the marine food web, thereby transferring organic carbon from phytoplankton to fish and other higher-order marine organisms. This marine ecosystem component is important because areas of enhanced plankton production are typically congregation areas for fishes, seabirds, marine mammals, and possibly sea turtles.

Strait of Belle Isle Area

Plankton production is enhanced in areas of upwelling where nutrient-rich bottom water is brought to the surface due to a combination of bottom topography, wind and currents. During the determination of Ecologically and Biologically Significant Areas (EBSAs) in the Estuary and Gulf of St. Lawrence Large Oceans Management Area, the Strait of Belle Isle region, which overlaps extensively with the Strait of Belle Isle Area, was identified as an important area in terms of primary production (DFO 2009c, 2007b). Labrador Shelf waters entering the Gulf of St. Lawrence through the Strait of Belle Isle, tidal mixing, and upwelling processes all contribute to the occurrence of highly productive areas within the Strait of Belle Isle Area (Savenkoff et al. 2007).

Phytoplankton in the vicinity of the Strait of Belle Isle Area is limited by light regimes and presence of sea ice (Harrison and Li 2008). This part of the Study Area is subject to high meteorological forcings, including tidal mixing and upwelling, which not only supplies nutrients to the upper water column but also limits the amount of light available for phytoplankton growth (Sikumiut 2010a).

The north-eastern Gulf of St. Lawrence is typically characterized by a lower phytoplankton biomass between April and October than is observed in the rest of the Gulf of St. Lawrence, leading to the suggestion that the phytoplankton bloom in this area might typically occur in late March / early April immediately following ice melt (de Lafontaine et al. 1991).

Chlorophyll 'a' concentration, a measure of primary production, can be derived from ocean colour. The amount and distribution of phytoplankton in the ocean can be interpreted through the detection of pigments in particular parts of the visible light spectrum using optical instruments on satellites. Four images from the DFO remote operational sensing database representing 2009 chlorophyll 'a' concentrations in the Strait of Belle Isle Area during a two-week period in each of February (winter), May (spring), August (summer) and November (fall) were presented in Sikumiut (2010a). The images indicate that the highest chlorophyll 'a' concentrations in the Strait of Belle Isle Area in 2009 occurred during spring and summer, followed by fall and, lastly, winter.

As for zooplankton, there is evidence that waters from the Labrador Shelf carry larvae through the Strait of Belle Isle and into the Gulf of St. Lawrence (Mullins 2010, pers. comm.). An example of this larval transport system pertains to snow crab (*Chionoecetes opilio*) larvae (Lambert 2010, pers. comm.). A primary retention area for krill, a key zooplankton species in the Gulf of St. Lawrence food web, has been identified in the north-eastern Gulf of St. Lawrence (Sourisseau et al. 2004).

L'Anse au Diable

At L'Anse au Diable, the trends indicated for the Strait of Belle Isle Area also apply (i.e., highest chlorophyll 'a' concentrations in 2009 occurred during spring and summer, followed by fall and winter (see Figure 3.15 in Sikumiut 2010a).

The preceding discussion on zooplankton in the Strait of Belle Isle Area is also relevant to the proposed L'Anse au Diable shoreline electrode site.

Dowden's Point Area

With respect to the Dowden's Point Area, the highest chlorophyll 'a' concentrations in Conception Bay in 2009 occurred during the fall, followed by summer, spring and winter (see Figure 3.15 in Sikumiut 2010a).

In their work on zooplankton, Richoux et al. (2003) also reported observations of the timing of the phytoplankton bloom at their study site in Conception Bay. The study site was located north-west of Dowden's Point, just inside the perimeter of the Dowden's Point Area where water depth exceeds 240 m. Between December 1998 and November 2000, the spring phytoplankton bloom began in early April to mid-May, followed by a fall bloom in late August to September. The spring blooms were characterized by higher chlorophyll 'a' concentrations than the fall blooms.

Richoux et al. (2003) studied the seasonal population dynamics of the hyperbenthic (living just above the bottom substrate) mysid *Mysis mixta* collected at the same deepwater site within the Dowden's Point Area described above for phytoplankton. Choe and Deibel (2000) reported that some of the most commonly occurring hyperbenthic macroinvertebrates in Conception Bay include the chaetognath *Parasagitta elegans*, the amphipod *Acanthostepheia malmgreni*, and the mysid *M. mixta*.

Choe and Deibel (2009) reported the collection of the planktonic tunicate *Oikopleura vanhoeffeni* at a location in Conception Bay that occurs within the Dowden's Point Area. The bottom-to-surface collections using a ring net were made in an approximate water depth of 250 m. Choe and Deibel (2000) reported that some of the most commonly occurring hyperbenthic macroinvertebrates in Conception Bay include *Parasagitta elegans* and *Acanthostepheia malmgreni*.

Macroalgae

Strait of Belle Isle Area

Summaries of the macroalgal data collected by AMEC (2010b) in the Strait of Belle Isle Area in 2008 and 2009 and re-analyzed in AMEC (2011a) for the currently proposed Strait of Belle Isle cable crossing corridor only, are presented in this section.

The only macroalgae observations reported during the 2008 drop video camera survey within the proposed submarine cable crossing corridor were Corallinales (both coralline and crustose algae) which belongs to the Division Rhodophyta (AMEC 2011a; AMEC 2010b). The Corallinales were observed in Segment 1, Segment 2 and Segment 3 but only coralline algae was observed in Segment 4.

Other species of macroalgae observed in the 2008 survey included *Agarum cribrosum*, *Ptilota* sp., *Desmerestia* sp., *Laminaria* sp., *Alaria* sp., *Ascophyllum nodosa* and *Fucus* sp. (AMEC 2010b). Species of macroflora observed during the 2009 survey included all the same species as the 2008 survey and also included brown filamentous algae, green filamentous algae, *Palmaria palmate*, *Ascophyllum nodosa*, *Ulva* sp., and *Chorada* sp. (AMEC 2010b).

As indicated in Sikumiut (2010a), the CCRI database also contains macroalgal data for the Strait of Belle Isle Area. Locations with occurrence of Irish moss (*Chondrus crispus*) and kelp were identified in the nearshore on the Newfoundland end of the proposed submarine cable crossing corridor (NEDC 2001), and occurrences of eelgrass (*Zostera* sp.) and rockweed were noted along sections of the Newfoundland shore west of the proposed corridor (RORB 2001).

Macroalgae data were collected during habitat surveys conducted at both proposed shoreline electrode sites in October 2010 using drop video camera, and, in the case of L'Anse au Diable, a Van Veen grab sampler.

L'Anse au Diable

An abundance and diversity of macroalgae were observed during the October 2010 habitat surveys at L'Anse au Diable (Table 10.5.8-8) (Sikumiut 2011a). Kelp was observed in the drop camera video field of view more than 30% of the time, followed by coralline algae (27%), other red algae (20%), green algae (13%), and other brown algae (9%).

Table 10.5.8-8 Macroalgae Observed during the Drop Video Camera Habitat Survey at L'Anse au Diable, 2010

General Category	Scientific and Common Names	Division
Kelp	*Alaria esculenta* (edible kelp) *Agarum cribosum* (sea colander) *Laminaria digitata* (horsetail kelp) *L. saccharina*	Phaeophyta (brown algae)
Coralline algae	Corallinales (Order)	Rhodophyta (red algae)
Red algae	*Ptilota* sp., *Ptilota serrata* (red fern) *Palmaria palmata* (dulse) Unidentified filamentous	Rhodophyta (red algae)
Green algae	*Ulva* sp. (sea lettuce) Unidentified green algae	Chlorophyta
Brown algae	*Desmerestia* sp. (sour weed) Unidentified filamentous	Phaeophyta
Rockweed	*Fucus* sp.	Phaeophyta

Source: Sikumiut (2011a).

The distributions of the macroalgae were associated with the distributions of bottom substrate classes at L'Anse au Diable. Most of the bedrock and boulder, and much of the cobble had coralline algae attached. Sea colander was most strongly associated with vertical surfaces of bedrock and crevices in the bedrock. Most of the other algal species / groups were also associated with bedrock, boulder and cobble (Sikumiut 2011a). Details regarding macroalgal distributions at the proposed L'Anse au Diable shoreline electrode site are included in Section 3.1.4.5 of Sikumiut (2011a). Van Veen grab sampling at L'Anse au Diable also collected macroalgae at some of the intertidal stations. However, the type of macroalgae was not indicated (Sikumiut 2011a).

The CCRI database (LSDA 2002) indicates the occurrence of kelp in the vicinity of L'Anse au Diable.

Dowden's Point Area

The abundance and diversity of macroalgae observed during the October 2010 habitat surveys at Dowden's Point were much lower than observed at L'Anse au Diable (Table 10.5.8-9). Coralline algae accounted for more than 99% of macroalgae observed within the Dowden's Point habitat survey area (Sikumiut 2011a). Small amounts of filamentous brown and red algae were also observed.

Table 10.5.8-9 Macroalgae Observed during the Drop Video Camera Habitat Survey at Dowden's Point, 2010

General Category	Scientific and Common Names	Division
Coralline algae	Corallinales (Order)	Rhodophyta (red algae)
Brown algae	Unidentified filamentous	Phaeophyta
Red algae	Unidentified filamentous	Rhodophyta (red algae)

Source: Sikumiut (2011a).

Most of the boulder and cobble had coralline algae attached. Details regarding macroalgal distributions at the proposed Dowden's Point shoreline electrode site are included in Section 3.2.2.5 of Sikumiut (2011a).

The CCRI database (CCDA 2001) indicates the occurrence of kelp and Irish moss in the Dowden's Point Area. Nearshore diver-mediated bottom habitat surveys conducted in the Dowden's Point Area in 1992 and 1993 identified the occurrence of coralline algae, various filamentous brown algae, and kelp (Christian 1993).

Benthic Fauna

Strait of Belle Isle Area

Benthic faunal data collected during drop and diver-mediated video camera habitat surveys in the Strait of Belle Isle Area in 2008 and 2009 were re-analyzed in AMEC (2011a) for the currently proposed Strait of Belle Isle cable crossing corridor only.

A total of 26 macrofaunal taxa were identified within the corridor. Taxa are listed in order of their percent occurrence in Table 10.5.8-10. Percent occurrence is defined as the total length of all reaches where the taxon was present.

The benthic faunal occurrences within the proposed submarine cable crossing corridor were extracted from the 2008 survey data (AMEC 2010b) and are presented in Table 10.5.8-11 in terms of absence / presence and ranking of abundance by corridor segment. The benthic faunal species / groups in Table 10.5.8-11 are listed in decreasing order of reported abundance.

Segment 1 has relatively high abundance rankings for sea cucumbers (*Cucumaria frondosa*) and sea stars only, while Segment 4 has the greatest number of high rankings. The rankings are reflections of the physical bottom habitat diversities found in the respective corridor segments.

Benthic samples collected in the Strait of Belle Isle Area in October 2010 and June 2011 also provided data relating to benthic fauna in the vicinity of the proposed submarine cable crossing corridor (Sikumiut 2011b, c). Table 10.5.8-12 provides an occurrence and community index (abundance, biomass and taxon richness) summary related to the benthic invertebrates found in these surficial sediment samples collected at 12 stations, nine of which are located within the proposed corridor.

A total of 14,303 benthic organisms were found in the samples collected from the 12 stations in October 2010 (AMEC 2010a) and 3,554 from the 4 stations in June 2011. Polychaetes were the most abundant benthos (84.3%, *Spirorbis* spp. accounting for 60.0%), followed by amphipods (11.7%), echinoderms (7.5%), bivalves (4.3%), gastropods (2.5%), sponges (2.0%) and isopods (1.8%) (Table 10.5.8-12). Benthic samples collected at Station S-009 (Segment 3) and Station S-010 (Segment 2) Figure 10.5.8-5) exhibited the most consistently high rankings for abundance, biomass and taxon richness, while benthic samples collected at Station S-005 (Segment 4) and Station S-014 (Segment 3) (see Figure 10.5.8-5) exhibited the most consistently low rankings for the same indices. Details related to taxonomic identification of the collected benthos are included in Table 3.15 and Table 3.16 in Sikumiut (2011b, c). Calculated values of other community indices for each station are presented in Table 3.17 in Sikumiut (2011b, c).

Table 10.5.8-10 Benthic Fauna Observed during the Drop Video Camera Habitat Survey in the Strait of Belle Isle, 2008 within the Currently Proposed Corridor

Percent Occurrence	Common Name	Taxon	Category
90.9	Pale urchin	*Strongylocentrotus pallidus*	Echinoderm
89.7	Hydroid	—	Cnidarian
84.6	Starfish	*Crossaster* sp.	Echinoderm
82.4	Starfish	*Asterias* sp.	Echinoderm
79.1	Sea anemone	—	Cnidarian
78.3	Toad crab	*Hyas* sp.	Crab
75.6	Soft coral	*Gersemia* sp.	Colonial
71.7	Stalked sea squirt	*Boltenia* sp.	Tunicate
67.9	Bryozoan	—	Colonial
62.9	Deep sea scallop	*Placopecten magellanicus*	Shellfish
57.5	Barnacle	*Balanus* sp.	Mollusc
54.2	Sponge	Porifera	Colonial
41.6	Basket star	*Gorgonocephalus* sp.	Echinoderm
40.7	Icelandic scallop	*Chlamys islandica*	Shellfish
32.5	Brittle star	Ophiuroidea	Echinoderm
28.8	Starfish	*Solaster* sp.	Echinoderm
27.7	Sea squirt	Ascidiacea	Tunicate
19.7	Snow crab	*Chionoecetes opilio*	Crab
19.1	Sea cucumber	*Cucumaria frondosa*	Echinoderm
13.5	Alligatorfish	*Aspidophoroides monopterygius*	Fish
4.7	Sculpin	*Myoxocephalus* sp.	Fish
3.7	Sand dollar	*Echinarachnius parma*	Echinoderm
2.1	Atlantic cod	*Gadus morhua*	Fish
1.8	Cushion Star	*Asterina* sp.	Echinoderm
1.3	Unidentified Fish	—	Fish
0.4	Gastropod	—	Mollusc

Note: Rank is based on descending percent occurrence, the percentage of the total transect length of all the reaches where the taxon was present.

Table 10.5.8-11 Corridor Segment Abundance Ranking for Benthic Fauna Observed During 2008 Drop Video Camera Habitat Survey

Benthic Faunal Species / Group	Corridor Segment			
	1	2	3	4
Hydroids	4	3	1	2
Sea anemones	3	1	4	2
Stalked sea squirt (*Boltenia* sp.)	4	3	1	2
Basket star (*Gorgonocephalus* sp.)	None	3	2	1
Bryozoans	4	2	3	1
Soft coral (*Gersemia* sp.)	4	1	3	2
Sponges (Porifera)	4	1	3	2
Brittle stars (Ophiuroidea)	None	3	2	1
Sea stars (*Asterias* sp.)	2	1	4	3
Barnacles (*Balanus* sp.)	3	2	1	4
Icelandic scallop (*Chlamys islandica*)	4	3	2	1
Deep sea scallop (*Placopecten magellanicus*)	4	3	2	1
Pale urchin (*Strongylocentrorus pallidus*)	4	2	3	1
Toad crab (*Hyas* sp.)	4	3	2	1
Snow crab (*Chionoecetes opilio*)	3	4	1	2
Sea cucumber (*Cucumaria frondosa*)	1	4	2	3
Sand dollar (*Echinarachnius parma*)	None	2	None	1

(a) Rankings of abundance, based on Appendix F *in* AMEC (2010b). "1" represents the highest abundance ranking, and "4" represents the lowest abundance ranking.

Table 10.5.8-12 Benthic Fauna Collected in the Strait of Belle Isle, October 2010 and June 2011

Sampling Station[a]	Corridor Segment	Dominant Benthic Invertebrates in Sample	Abundance Rank[b]	Biomass Rank[b]	Taxon Richness Rank[b]
S-002	Approximately 4 km south of corridor	Polychaetes (e.g., *Spirorbis* spp.), echinoderms (e.g., sea stars, sea urchins)	10	7	12
S-003	Approximately 2 km south of corridor	Polychaetes (e.g., *Spirorbis* spp.), echinoderms (e.g., sea stars, sea urchins, brittle stars), amphipods	14	6	13
S-005	4	Polychaetes (e.g., *Spirorbis* spp.), echinoderms (e.g., sea stars, sea urchins), amphipods	15	14	13
S-006	4	Polychaetes (e.g., *Spirorbis* spp.), echinoderms (e.g., sea stars, sea urchins), amphipods	7	11	4
S-008	< 0.5 km north of corridor	Polychaetes (e.g., *Spirorbis* spp.), echinoderms (e.g., sea stars), amphipods	9	15	8

Table 10.5.8-12 Benthic Fauna Collected in the Strait of Belle Isle, October 2010 and June 2011 (continued)

Sampling Station[(a)]	Corridor Segment	Dominant Benthic Invertebrates in Sample	Abundance Rank[(b)]	Biomass Rank[(b)]	Taxon Richness Rank[(b)]
S-009	3	Polychaetes (e.g., *Spirorbis* spp.), bryozoans, echinoderms, barnacles, crustaceans	2	4	2
S-010	2	Polychaetes (e.g., *Spirorbis* spp., *Sabellidae* sp., *Syllidae* sp.), bivalves (e.g., *Hiatella arctica*), *Saccoglossus* sp. (Hemichordata), sponges, echinoderms (e.g., sea stars), amphipods	3	1	1
S-011	2	Polychaetes (e.g., *Spirorbis* spp.), echinoderms (e.g., sea stars), amphipods	11	12	7
S-012	2	Polychaetes (e.g., *Spirorbis* spp.), echinoderms (e.g., sea stars, sea urchins), amphipods	8	8	5
S-013	1	Polychaetes (e.g., *Spirorbis* spp.), echinoderms (e.g., sea stars), amphipods	1	13	9
S-014	3	Polychaetes (e.g., *Spirorbis* spp.), echinoderms (e.g., sea stars), amphipods, barnacles, sponges	12	9	10
S-015	2	Polychaetes (e.g., *Spirorbis* spp.), bryozoans, echinoderms, crustaceans	4	16	6
NCW-001	5	Biological community included foraminifers and hydrozoans, as well as brittle stars, polychaetes, bivalves, brachiopods, sea spiders and a sea urchin.	6	10	10
NCW-002	5	Encrusting and branching bryozoans, foraminiferans and hydrozoans. Brittle stars and *Spirorbis* spp. were abundant, as well as sea urchins, bivalves and polychaetes.	13	2	11
NCW-004	5	Encrusting bryozoans, foraminiferans, *Spirorbis* worms, amphipods, brittle stars and sea urchins.	16	5	14
NCW-005	5	Bryozoans and foraminifers and some small pieces of hard corals. Various polychaetes, amphipods, isopods, brittle stars, sponges, ascidians (sea squirts) and pycnogonids (sea spiders), as well as sea urchins, soft corals, molluscs and barnacles were present.	5	3	3

Source: Sikumiut (2011b, c).
Note See Figure 10.5.8-5 for sample locations.

As reported in Sikumiut (2010a), benthic invertebrate fauna were also collected in the Strait of Belle Isle Area during DFO Research Vessel surveys and sentinel fisheries conducted between 1999 and 2009. The species collected include hermit crab (*Pagarus arcuatus*), toad crab (*Hyas sp.*), rock crab (*Cancer irroratus*), soft corals (Alcyoniidae), sea anemones, sponges, tunicates, various echinoderms, and various non-commercial shrimps.

The various non-commercial shrimp species caught during DFO research vessel surveys and sentinel fisheries conducted between 1999 and 2009 include many that are unique from a distributional perspective to the Strait of Belle Isle Area (Chabot et al. 2007). The Strait of Belle Isle Area occurs within an EBSA named 'Strait of Belle Isle' (see "Special Areas" later in this section). It was identified for the Estuary and Gulf of St. Lawrence in 2006 during a DFO workshop as a step towards specifying objectives for integrated oceans management and for the Gulf of St. Lawrence Integrated Management Initiative (DFO 2009c, 2007b). The Strait of Belle Isle EBSA includes the Strait of Belle Isle and the Mecatina Trough located west of the Strait of Belle Isle. One of the primary characterizations of the Strait of Belle Isle EBSA relates to the occurrence of the aforementioned shrimp species of distributional importance:

- Greenland lebbeid (*Lebbeus groenlandicus*);
- Circumpolar eualid (*Eualus gaimardii gaimardii*);
- Circumpolar eualid (*Eualus gaimardii belcherii*);
- Arctic eualid (*Eualus fabricii*);
- Greenland shrimp (*Eualus macilentus*);
- Sculptured shrimp (*Sclerocrangon boreas*);
- Parrot shrimp (*Spirontocaris spinus*);
- Polar lebbeid (*Lebbeus polaris*);
- Pink shrimp (*Pandalus montagui*);
- Sevenline shrimp (*Sabinea septemcarinata*);
- Arctic argid (*Argis dentata*); and
- Zebra lebbeid *(Lebbeus microceros).*

In addition to the shrimp species listed above, there are also ascidians, seastars and basket stars in the Strait of Belle Isle EBSA that have limited distributions elsewhere (DFO 2009c, 2007b).

Ardisson and Bourget (1992) described spatial distribution patterns of benthic littoral fauna in the Estuary and the Gulf of St. Lawrence. While not in the Strait of Belle Isle proper, three stations of the Lower North Shore were located in the western part of the Strait of Belle Isle Area. A recurrent association of 12 species found to characterize the entire Estuary-Gulf area included hydroids (e.g., *Obelia longissima*), blue mussels (*Mytilus edulis*), other bivalves (e.g., *Hiatella arctica*), and barnacles (e.g., *Balanus crenatus*, *Semibalanus balanoides*). Motile and sessile species found at the three stations that are located within the Strait of Belle Isle Area are indicated in Ardisson and Bourget (1992).

Both sponges and corals occur within the Strait of Belle Isle Area, although apparently in low densities (DFO 2010b; Kenchington et al. 2010). Distributions of sponge and coral catches during recent DFO research vessel surveys occur on either side of the proposed submarine cable crossing corridor but do not overlap the corridor.

L'Anse au Diable

Data related to benthic fauna at the proposed L'Anse au Diable shoreline electrode site were collected using two methods in October 2010: Van Veen grab sampling and drop video camera surveying. Benthic invertebrates collected during Van Veen grab sampling are indicated in Table 10.5.8-13 in terms of occurrence and rankings for abundance, biomass and taxon richness.

Table 10.5.8-13 Benthic Invertebrates Collected at L'Anse au Diable, September and October 2010

Sampling Station	Dominant Benthic Invertebrates in Sample	AbundanceRank[(a)]	Biomass Rank[(a)]	Taxon Richness Rank[(a)]
Subtidal Stations				
S-016	Encrusting bryozoans, foraminifers, polychaetes (e.g., *Spirorbis* spp.), echinoderms and crustaceans	3	4	1
S-017	Polychaetes, crustaceans, sea urchin spines	5	1	3
S-018	Polychaetes and amphipods	6	3	2
S-019	Polychaetes	4	2	1
Intertidal Stations				
S-020	Polychaetes and amphipods	7	7	4
S-021	Sea urchin spines, foraminifers and polychaetes	2	5	4
S-022	Polychaetes and amphipods	8	6	5
S-023	Polychaetes	1	8	5

Source: Modification of Table 3.10 *in* Sikumiut (2011a).
Note: See Figure 10.5.8-6 for sample locations.

Overall, the benthic invertebrate communities at the deeper subtidal stations had higher biomass and taxon richness than those sampled in the intertidal zone. Difference in abundance between intertidal and subtidal was not as apparent. Polychaetes, amphipods and echinoderms dominated the benthic fauna collected by grab sampling. Details regarding benthic invertebrate data collected at L'Anse au Diable by grab sampling are included in Section 3.1.3 in Sikumiut (2011a).

Dowden's Point Area

Sponges and corals occur within Conception Bay, although apparently in very low densities (DFO 2010b; Kenchington et al. 2010). Reported distributions of sponge and coral catches during recent DFO research vessel surveys occur primarily in the northern part of Conception Bay, outside of the Dowden's Point Area.

The CCRI database (LSDA 2002) indicates the presence of whelk, toad crab and sea urchins in the Dowden's Point Area.

Marine Fish

Fishery-targeted Invertebrates

Strait of Belle Isle Area

Invertebrate species harvested within the Strait of Belle Isle Area during the 2004-2008 period have been identified in Canning & Pitt (2010). These species, listed in decreasing order of average catch value, are as follows:

- American lobster (*Homarus americanus*);
- Northern shrimp (*Pandalus borealis*);

- Iceland scallop;
- Snow crab;
- Sea cucumber; and
- Whelk (*Buccinum undatum*).

Of these six invertebrate species, only Iceland scallop and whelk have been harvested in the vicinity of the proposed submarine cable crossing corridor during the 2004-2008 period (Canning & Pitt 2010). Canning & Pitt (2010) indicates that toad crab and rock crab may also be harvested in the vicinity of the proposed corridor.

Fishery-targeted invertebrate species, as identified by Canning & Pitt (2010), observed during the drop video camera habitat survey in 2008 (AMEC 2010b) include Iceland scallop, snow crab, toad crab and sea cucumber. All four species were observed in Segments 1 through 4 and Segment 5, with toad crab being the most abundant of the four. No occurrences of fishery-targeted invertebrates were reported during either the nearshore diver-mediated video camera habitat survey in 2009 (AMEC 2010b), or the benthic sampling in the Strait of Belle Isle Area in October 2010 and June 2011 (Sikumiut 2011b, c).

Fishery-targeted invertebrates caught in the Strait of Belle Isle Area during DFO research vessel surveys and sentinel fisheries between 1999 and 2009 include snow crab, Iceland scallop, northern shrimp and sea cucumber (Sikumiut 2010a). The CCRI database (LSDA 2002; NEDC 2001; RORB 2001) indicates the presence of American lobster, northern shrimp, Iceland scallop, snow crab, whelk and toad crab in the Strait of Belle Isle Area (see Figure 3.28 in Sikumiut 2010a). Of these fishery-targeted invertebrates identified by the CCRI database, Iceland scallop, whelk and toad crab distributions overlap with the footprint of the proposed submarine cable crossing corridor (see Figure 3.28 in Sikumiut 2010a).

L'Anse au Diable

As with the Strait of Belle Isle Area, the fishery-targeted invertebrates that have been harvested in the vicinity of the proposed shoreline electrode site at L'Anse au Diable include Iceland scallop, whelk, and toad crab. In addition, rock crab has also been harvested in the same vicinity. The 2010 drop camera survey at L'Anse au Diable reported the observation of one snow crab (Sikumiut 2011a). These same species have been identified by the CCRI database (LSDA 2002; NEDC 2001; RORB 2001) as occurring in the vicinity of L'Anse au Diable (see Figure 3.28 in Sikumiut 2010a).

Dowden's Point Area

Lobster is harvested commercially on suitable grounds located closer to shore within the Dowden's Point Area, principally between Dowden's Point and Lance Cove to the north-east (see Section 10.5.8.3 Marine Fish; Species Profile). No fishery-targeted invertebrates were observed during the October 2010 drop video camera survey at Dowden's Point (Sikumiut 2011a).

The CCRI database (CCDA 2002) identifies the occurrences of American lobster, northern shrimp and snow crab within the Dowden's Point Area. Although not identified as fishery-targeted invertebrate fauna (see Section 10.5.8.3 Marine Fish; Species Profile), squid also occur sporadically within the Dowden's Point Area (CCDA 2002).

Species Profiles

The eight invertebrate species identified as fishery-targeted species in the Strait of Belle Isle Area and the Dowden's Point Area are profiled below.

Iceland Scallop

Iceland scallop are distributed in waters of the sub-Arctic (Naidu et al. 2001), and are typically found in water depths ranging from 55 to 180 m off NL (DFO 2009d). The currents of the Strait of Belle Isle make the area favourable for these filter feeders. Iceland scallop are generally associated with hard bottom substrates including sand, gravel, shell fragments and stones (Naidu et al. 2001). Based on the depth preferences off NL, Iceland scallops prefer high salinity (>18 ppt) and are not usually exposed to wave energy (Christian et al. 2010).

Broadcast spawning by Iceland scallops in northern Gulf of St. Lawrence waters typically begins around July or August (Arsenault and Himmelman 1998), which likely reflects the timing of Iceland scallop spawning in the Strait of Belle Isle Area. The larvae hatch hours after egg fertilization and remain planktonic for about 10 weeks before settling to the bottom substrate (Crawford 1992; Vahl 1982).

In the Strait of Belle Isle Area, there are three distinct scallop beds (see Figure 3.29 *in* Sikumiut 2010a) that, for DFO assessment purposes, are considered to be one stock (DFO 2009d). Corridor Segments 2, 3 and 4 overlap a portion of the westernmost bed. Historically, the Iceland scallop has been an important fishery species in the Strait of Belle Isle since 1969, with catches peaking in 1972, 1985 and 1994.

As a result of catch declines in the late 1990s, a scallop refugium was established in 2000, to increase recruitment and promote survival of newly settled scallops in the absence of fishing. This refugium was an 8 km wide corridor across the Strait of Belle Isle, encompassing a total area of 365.3 km^2 (see Figure 3.29 *in* Sikumiut 2010a) (DFO 2009d). Results of this study demonstrated no clear trend in biomass since 1995 (DFO 2009d). It was also determined that there was no difference in density between inside and outside the established refugium, with natural mortality being higher inside the refugium. A higher density of predatory starfish was reported inside the refugium. Prior to the establishment of the refugium, shell height was larger in that area and this has remained unchanged between the 2000 and 2007 surveys, suggesting that the establishment of the refugium has had no effect on shell height (DFO 2009d). Given the lack of positive effects of the refugium, the area was re-opened to fishing in 2009 (Stansbury 2010, pers. comm.). There is overlap of the proposed submarine cable crossing corridor with the former refugium area. Iceland scallop was observed during within the proposed submarine cable crossing corridor during the 2008 drop video camera habitat survey in the Strait of Belle Isle Area (AMEC 2010b).

Whelk

The whelk is a gastropod mollusc characterized by a thick, spirally coiled shell and a large muscular foot. Its geographic range in the western Atlantic extends from Labrador to New Jersey (Christian et al. 2010). This cold water species inhabits a wide range of bottom substrate types but appears to prefer muddy or sandy bottoms at water depths ranging from the intertidal zone to >200 m. Barrie (1979) found whelk inhabiting a 4 to 90 m depth range in Nain, Labrador. This gastropod species can occur in areas with low to high wave energy, and low to strong currents (DFO 2007a, internet site; Kenchington and Glass 1998). The CCRI database (LSDA 2002) identifies whelk occurrence at the Labrador end of the proposed submarine cable crossing corridor (see Figure 3.28 in Sikumiut 2010a).

Whelk typically migrate shoreward in late spring / summer to spawn. On the north shore of the Gulf of St. Lawrence, whelk typically mate during May to July (Christian et al. 2010). Again, this timing is likely similar to that in the Strait of Belle Isle Area. Internal fertilization results in the laying of clusters of egg cases 2 to 3 weeks after mating, often on irregular surfaces and kelp beds. Juveniles hatch after 5 to 8 months of embryonic development (late fall / winter) (Christian et al. 2010). Adults lead a sedentary life, spending most of their time immobile and half buried in sediments. Evidence suggests that this behaviour, together with the absence of a larval phase, limits mixing with adjoining populations and the possibility to rapidly recolonize overexploited sites (DFO 2009e).

Whelk feed on live prey and also scavenge dead animals, predominantly invertebrates (e.g., sea urchins, polychaetes, bivalve molluscs and crustaceans) (Christian et al. 2010). The primary predators of whelk include American lobster, Atlantic cod, crabs and sea stars (Christian et al. 2010).

Toad Crab

Toad crab are found on both sides of the North Atlantic in depths ranging from the shallow subtidal to <700 m (Williams 1984). This crab is represented by two species, *Hyas araneus* and *H. coarctatus*, the former typically occurring in slightly shallower water than the latter (Miller and O'Keefe 1981). This crab is known to occur along the Labrador coast and in the Strait of Belle Isle (Department of Fisheries and Aquaculture (DFA) 2002a). Toad crab is typically found on various substrate types with *H. araneus* preferring soft bottom substrates and *H. coarctatus* preferring harder substrates (Squires 1990). The CCRI database (LSDA 2002) identifies toad crab occurrence at the Labrador end of the proposed submarine cable crossing corridor (see Figure 3.28 in Sikumiut 2010a).

The provincial DFA undertook catch and release exploratory surveys off the coast of Labrador in 2001 and 2002, which included the Strait of Belle Isle Area (DFA 2002b). The results of these surveys provided evidence of an abundance of commercial size toad crabs in the Strait of Belle Isle Area, and for potential economic benefits. In the Strait of Belle Isle Area, toad crabs were typically fished in areas with water depths ranging between 12 and 84 m. A follow-up survey by the DFA (2002a) intended to establish a size profile of toad crabs was undertaken in the area between L'Anse au Loup and L'Anse au Diable during August 29, 2002 and September 17, 2002. The results of this survey indicated that approximately 99% of the toad crabs captured were *H. araneus* and were taken in water depths ranging from 13 to 70 m. Approximately 84% of the captured toad crab were males of commercial size. Most of the females captured (>98%) during this survey were bearing eggs. However, due to a lack of comparable data, it is difficult to precisely determine spawning time in this area (DFA 2002a).

Hyas araneus typically mate during May to July and the females carry the fertilized eggs for about 10 months until larval hatch in March or April (Christian et al. 2010). The larvae are planktonic for one to several months, depending on water temperature, during which time they moult and eventually settle to the bottom substrate (Christian et al. 2010). Catch locations for toad crab in the Strait of Belle Isle Area by DFO scientific surveys and sentinel fisheries between 1999 and 2009 are indicated in Figure 3.31 in Sikumiut (2010a). Catch locations in the vicinity of the proposed submarine cable crossing corridor are concentrated at the Labrador end.

Rock Crab

Rock crab are found in the north-west Atlantic from southern Labrador to Miami, Florida at depths ranging from the low water mark to 575 m (Williams 1984). In the northern part of its range, rock crab is generally found in 5 to 20 m of water, while to the south it occurs primarily in deeper waters (DFO 1996). This crab species is most common in shallow water (<20 m), especially in bays on open sand or sand / mud bottoms (DFO 2000).

Rock crab typically mate in April and May, followed by egg extrusion and fertilization in late fall (Christian et al. 2010). Egg-bearing female rock crabs show a marked preference for soft bottoms in which they can bury themselves and form aggregations (DFO 2010c). After hatching in late spring or summer, the larvae are planktonic for up to three months, during which time they metamorphose to the settlement stage. After settlement to bottom substrate of variable type, the juveniles moult through various stages and reach sexual maturity in 3 to 6 years (DFO 2007c).

Rock crab are major predators in northern subtidal communities, preying on various fauna including juvenile scallops, mussels, gastropods, various echinoderms and polychaetes. Groundfish and lobsters are the primary predators of rock crab (Christian et al. 2010).

American Lobster

The American lobster is a benthic decapod crustacean with a distribution range from Cape Hatteras, North Carolina to the Strait of Belle Isle (Christian et al. 2010). Although adult lobsters are generally found in water depths <50 m, they have been observed as deep as 700 m (DFO 2003a; Ennis 1984). Lobsters prefer to live in cracks and shelters, and therefore are often found on rocky bottoms with substantial algal cover. Algae not only provides protective cover but it also attracts several organisms on which lobsters prey. Adult lobsters are occasionally found on other types of bottom substrate such as mud, sand or gravel, but these are not preferred habitat (Christian et al. 2010).

Adult lobsters appear to reside in relatively shallow coastal waters in the summer because of higher water temperatures, and then often migrate to deeper areas in the winter, perhaps to avoid the increased turbulence associated with winter weather (St. Lawrence Global Observatory 2010, internet site). Young lobsters <40 mm in length typically remain in the shallow subtidal waters at depths of <10 m, in areas with gravel and cobble bottom substrate. They may also be found on bottoms covered with mussel shells and algae.

Mating typically occurs between July and September, followed by egg extrusion approximately one year later. Larval hatch occurs once water temperatures have increased sufficiently, and will persist for about a four month period (i.e., late May to September) (DFO 2009f). Larvae remain planktonic for several weeks before metamorphosing to the stage which settles to the bottom (Christian et al. 2010).

The adult lobster is thought to have few natural predators and commercial harvesting accounts for most adult mortality. Diet typically consists of rock crab*,* polychaetes, molluscs*,* echinoderms, and various finfish. Much of the resource information on lobster in is typically comprised of fishery-related data (Collins et al. 2009).

Data for Lobster Fishing Areas 14C (includes the Strait of Belle Isle Area) and 7 (includes the Dowden's Point Area) are insufficient to assess stock size in those areas (DFO 2009f). This information is not considered necessary to describe the existing environment conditions for lobster.

Northern Shrimp

Northern shrimp, also known as pink shrimp, are most abundant north of 46 degrees north (°N). In the north-west Atlantic, they occur from West Greenland (75°N) south to Georges Bank (42°N) (Parsons and Fréchette 1989; Squires 1990). Water temperatures in areas of the north-west Atlantic, where the northern shrimp are most abundant range from 1 to 6°C, sometimes restricting them to deep areas (i.e., >180 m) (Koeller et al. 1996). Northern shrimp appear to prefer areas with soft, mud, silt substrates but occasionally they will be found on sand and gravel / rock substrates (DFO 1989; Williams 1984). These water temperature and substrate conditions occur throughout the Newfoundland-Labrador offshore area within a depth range of approximately 150 to 600 m, providing a vast area of suitable habitat (Orr et al. 2002; DFO 2006a).

The northern shrimp is usually a protandric hermaphrodite, meaning that it first functions sexually as a male (one to several years), undergoes a brief transitional period known as sex inversion and spends the remainder of its life as a sexually mature female (secondary female) (DFO 2008a; DFO 1993). There are some variations in its life history depending primarily on environmental temperatures.

Northern shrimp spawn once a year, generally around late June or early July. In eastern Canadian waters, shrimp eggs are extruded during late summer and fall and remain attached to the underside of the female's abdomen until hatching the following spring / summer (Christian et al. 2010). Northern shrimp females tend to be almost 100% ovigerous in autumn and spawn at least annually (Squires 1965). Ovigerous females may display seasonal horizontal migration to shallower warmer water areas in order to maximize the rate of embryonic development. The time between egg extrusion and hatching is temperature dependent, the shortest periods occurring in areas with higher temperatures (DFO 1993). Larval hatching typically occurs sometime during the spring.

Upon hatching, larvae rise to near the surface where they start feeding on small plankton. After remaining planktonic for a few months, the larvae begin to move downwards in the water column and metamorphose to adult form (DFO 1993).

Northern shrimp exhibit diel vertical migration, spending time near the bottom during the day and moving upwards in the water column at night. During the day, the shrimp feed on bottom items including worms, small crustaceans, detritus and marine plants. At night, the diet shifts to pelagic food items such as copepods and euphausiids. The migration consists mainly of males and smaller females (DFO 2008b).

The northern shrimp prefers soft mud or silt substrates with a high organic content that provides a food source (DFO 2007d). Northern shrimp are known to be prey of Greenland halibut (*Reinhardtius hippoglossoides*) (Vollen et al. 2004), Atlantic halibut (*Hippoglossus hippoglossus*), other flatfish, cod, redfish (*Sebastes spp.*) and harp seals (*Pagophilus groenlandicus*) (Lawson and Hobson 2000; Squires 1990).

Snow Crab

Snow crab are distributed within Canadian waters between the southern tip of Nova Scotia and mid Labrador coast (Dawe et al. 2010; DFO 2009g). This includes the Gulf of St. Lawrence and the Strait of Belle Isle Area. Snow crab generally prefer deep, cold waters. Large, commercial size, male crab are typically found on mud or sand substrates, whereas intermediate sized crab are more often associated with harder substrates (Dawe et al. 2010; DFO 2005). Early benthic stages of snow crab are typically associated with soft mud substrates (Dionne et al. 2003).

In spring, mating pairs can be found in shallow waters. Larvae hatch in late spring / early summer and remain planktonic until settlement to the sea bottom It is possible that larvae from the Labrador coast waters are transported to the northern Gulf of St. Lawrence by the currents in the Strait of Belle Isle (Lambert 2010, pers. comm. *in* Sikumiut 2010a).

Prey items include fish, clams, polychaete worms, brittle stars, shrimp and other crustaceans, while predators of snow crabs include groundfish, seals and other snow crab (DFO 2003b).

While there is some concentration of fishing effort in the eastern part of the Strait of Belle Isle Area, historically, the Strait of Belle Isle has not been an area of high fishing effort for snow crab (Dawe et al. 2010; Lambert, 2010, pers. comm. *in* Sikumiut 2010a). Snow crab catch locations in the Strait of Belle Isle Area from 1999 to 2009 from DFO scientific surveys and sentinel fisheries are presented in Figure 3.30 in Sikumiut (2010a). None of these catch locations overlap the proposed submarine cable crossing corridor or the proposed shoreline electrode site at L'Anse au Diable.

Sea Cucumber

The orange-footed sea cucumber is one of the most abundant and widely distributed echinoderm species along the east coast of Canada. It occurs from the Arctic to Cape Cod, from the lower intertidal zone and cold tide pools to deeper than 300 m in the subtidal zone (Gosner 1979). The sea cucumber is abundant at depths of <30 m on hard, rocky bottoms where it can constitute up to 70% of the epifaunal biomass. Densities are highest where water currents ensure a steady food supply for this suspension feeding species. Coady (1973) found abundant quantities of this sea cucumber throughout the waters off Newfoundland and at locations off Labrador, typically at depths <30 m.

Coady (1973) found that the timing of sea cucumber spawning in NL appeared to be closely associated with the spring phytoplankton bloom. Fertilized eggs and embryos of this echinoderm are buoyant. Falk-Petersen (1982) determined that *C. frondosa* had larvae that underwent pelagic development. According to Hamel and Mercier (1996), embryonic development was fastest at 12°C, pH of 8 and a salinity of 26 ppt under laboratory conditions. Furthermore, the free-swimming larvae hatched approximately 9 days after fertilization and remained pelagic for 6 to 7 weeks (Hamel and Mercier 1996). Mussel beds may enhance survival of newly settled sea cucumbers by providing a refuge from predation (Christian et al. 2010). After 4 to 5 months, young sea cucumbers move to sheltered, illuminated areas of rocky substrate (Hamel and Mercier 1996). Miles (1995) reported that higher abundances of juvenile sea cucumbers were found in coralline algae compared to kelp holdfasts, mussel beds and vertical rock faces along the coast of New Hampshire. Once they grow to about 35 mm length, the sea cucumbers migrate from protected to exposed areas.

Adults normally occur in small dense beds on rock or gravel substrates. Legault and Himmelman (1993) found that sea cucumbers in the northern Gulf of St. Lawrence were most common on bedrock to cobble substrates at depths ranging from 4 to 15 m. Himmelman (1991) reported the occurrence of *C. frondosa* in three of the types of subtidal regions in the northern Gulf of St. Lawrence, moderately exposed, medium sloped bottoms at 4 to 8 m, exposed, gently sloped bedrock platforms at 10 to 15 m, and gently sloped sediment bottoms in areas of strong tidal currents at 10 to 15 m.

Sea cucumbers are filter feeding planktivores, using the ten tentacles surrounding the mouth (DFO 1997). They are passive suspension feeders in that they depend entirely on ambient water movements to drive water through their filtering tentacles (LaBarbera 1984). Hamel and Mercier (1998) found that *C. frondosa* in the St. Lawrence estuary fed mainly during spring and summer on phytoplankton, small crustaceans and a variety of eggs and larvae. They observed that feeding rates were highest during ebb and rising tides, but concluded that food availability rather than physical parameters such as temperature or current best explains the cyclic feeding behaviour of sea cucumbers at seasonal and tidal scales.

To determine if a viable sea cucumber fishery could be sustained within the Strait of Belle Isle, stock assessments were conducted by DFO in 2005. A bottom tow was conducted in October 2005 within the Strait of Belle Isle to examine size index and other variables to compare with sea cucumber from the St. Pierre Bank. Results of this study demonstrated that *C. frondosa* from the Strait of Belle Isle were smaller in linear dimension with a thicker body wall on average than the St. Pierre Bank sea cucumber stock (Grant 2006). Information regarding sea cucumber within the Strait of Belle Isle Area is limited, as the DFO project for sea cucumber resource assessment is not yet complete (Power 2010, pers. comm. *in* Sikumiut 2010a). The DFA have also undertaken surveys in the Strait of Belle Isle region to determine the viability of a possible sea cucumber fishery in the area (Melindy 2010, pers. comm. *in* Sikumiut 2010a), however, results of these surveys were not available. These data were not considered to be necessary to describe the existing environment for sea cucumbers.

Fishery-targeted Fishes

Strait of Belle Isle Area

Canning & Pitt (2010) identified the fish species harvested within the Strait of Belle Isle Area during the 2004 to 2008 period. These species, listed in decreasing order of average value, are as follows:

- Atlantic cod;
- capelin (*Mallotus villosus*);
- lumpfish (*Cyclopterus lumpus*);
- Atlantic mackerel (*Scomber scombrus*);
- Greenland halibut;
- Atlantic herring (*Clupea harengus*);
- Atlantic halibut;
- American eel;
- winter flounder (*Pseudopleuronectes americanus*); and
- American plaice (*Hippoglossoides platessoides*).

Of these ten fish species, six (i.e., Atlantic cod, capelin, lumpfish, Atlantic mackerel, Atlantic herring, and Atlantic halibut) have been harvested in the vicinity of the proposed submarine cable crossing corridor during the 2004-2008 period (Canning & Pitt 2010). Although not harvested in the Marine Environment, the American eel is harvested in freshwater systems that empty into the Strait of Belle Isle Area near the proposed corridor. Given that this fish is catadromous (reproduces in the freshwater and feeds in the Marine Environment), there is likelihood that it migrates through the proposed corridor.

Brook trout, Arctic char (*Salvelinus alpinus*) and Atlantic salmon (*Salmo salar*) also likely occur in the Strait of Belle Isle Area, including the vicinity of the proposed submarine cable crossing corridor, during migrations between the Freshwater and Marine environments (Sikumiut 2010a). While not commercially harvested within the Strait of Belle Isle Area, these species are likely targeted during recreational fisheries.

Several demersal and groundfish species caught in DFO research vessel surveys and sentinel fisheries in the Strait of Belle Isle Area during the 1999-2009 period were identified in Sikumiut (2010a). Based on criteria including overall distribution, role in the ecosystem, recreational, commercial and / or economic importance, and potential for a future fishery, several species were discussed in detail, including the following:

- lumpfish;
- Greenland halibut;
- witch flounder (*Glyptocephalus cynoglossus*);
- capelin;
- Atlantic herring;
- Atlantic mackerel; and
- various salmonids (e.g., anadromous brook trout, anadromous Arctic char, Atlantic salmon).

Identifiable fishery-targeted fishes observed during the video camera habitat surveys in the Strait of Belle Isle Area included Atlantic cod in 2008, and winter flounder in 2009. Cod occurred in 5 to <25% of the 2008 drop video camera survey transect reaches, while winter flounder was seen only once during the 2009 diver-mediated video camera survey. Drop camera surveys from 2011 identified Atlantic cod was the only fishery-targeted fish species observed along the proposed cable crossing corridor, specifically at 90 to 100 m depths in both Section 1 and Section 4 (AMEC 2010b).

The occurrence of numerous fishery-targeted groundfish and pelagic species within the Strait of Belle Isle Area are indicated in the CCRI database (LSDA 2002; NEDC 2001; RORB 2001). They are as follows:

- Atlantic cod;
- Atlantic halibut;
- Greenland halibut;
- redfish;
- winter flounder;
- capelin;
- Atlantic herring;
- Atlantic mackerel;
- Atlantic salmon;
- brook trout; and

- Arctic char.

Figure 3.18 and Figure 3.22 in Sikumiut (2010a) present TEK information related to where some of these fishes spawn within the Strait of Belle Isle Area. The fishery-targeted fishes that spawn in the vicinity of the proposed submarine cable crossing corridor include lumpfish, flounder, Atlantic herring and capelin (see Figure 3.18 and Figure 3.22 in Sikumiut 2010) (LSDA 2002; NEDC 2001; RORB 2001).

The CCRI database contains information on Strait of Belle Isle Area spawning locations for Atlantic cod, lumpfish, winter flounder other flounders and sand lance (*Ammodytes spp.*). Winter flounder, lumpfish, capelin and Atlantic herring are the only species identified as spawning in the vicinity of the submarine cable crossing corridor; winter flounder and capelin at the Forteau nearshore area, and lumpfish, capelin and Atlantic herring at the Shoal Cove nearshore area (Sikumiut 2010a).

In their descriptions of the Strait of Belle Isle EBSA, DFO (2009c; 2007b) indicated that this area, which includes the proposed submarine cable crossing corridor, is the main location of spawning by the fall herring component of the northern Gulf of St. Lawrence, and is characterized by high concentrations of capelin, spiny dogfish (*Squalus acanthias*), and sand lance.

L'Anse au Diable

As indicated for the Strait of Belle Isle Area, Canning & Pitt (2010) identified the fish species harvested within the Strait of Belle Isle Area within which the proposed L'Anse au Diable shoreline electrode site is located. Of the identified species, Atlantic cod, capelin, lumpfish, Atlantic mackerel, and Atlantic herring have been harvested in the vicinity of the proposed L'Anse au Diable shoreline electrode site during the 2004-2008 period (Canning & Pitt 2010). Although not harvested in the Marine Environment, the American eel is harvested in freshwater systems that empty into the Strait of Belle Isle near L'Anse au Diable. Given that this fish is catadromous, it is likely that it migrates through the vicinity of L'Anse au Diable. Brook trout, Arctic char and Atlantic salmon also likely occur in the vicinity of the proposed L'Anse au Diable electrode site during migrations between the Freshwater and Marine environments (Sikumiut 2010a). While not commercially harvested in this area, they could be targeted during recreational fisheries.

Figure 3.18 (Section 3.3.1) and Figure 3.22 (Section 3.3.2) in Sikumiut (2010a) present information related to where some of these fishes spawn within the Strait of Belle Isle Area. The fishery-targeted fishes that spawn in the vicinity of the L'Anse au Diable shoreline electrode site include lumpfish, Atlantic cod, capelin and Atlantic herring (see Figure 3.18 and Figure 3.22 in Sikumiut 2010a) (LSDA 2002; NEDC 2001; RORB 2001). While Atlantic salmon do not spawn in the Marine Environment at L'Anse au Diable, they do spawn in rivers that flow into the Strait of Belle Isle Area in the vicinity of L'Anse au Diable.

No fishery-targeted fishes were observed at the proposed L'Anse au Diable shoreline electrode site during the drop video camera habitat survey conducted in October 2010 (Sikumiut 2011a).

Dowden's Point Area

Section 15.6 of this EIS (Marine Fisheries) indicate that fish species commercially harvested within the Dowden's Point Area include capelin, Atlantic herring, Atlantic mackerel and lumpfish. Lumpfish are caught on suitable grounds located close to shore within the Dowden's Point Area, principally between Dowden's Point and Lance Cove to the north-east. The occurrences of capelin, Atlantic herring and Atlantic mackerel within the Dowden's Point Area were also reflected in the CCRI database (CCDA 2001). Atlantic cod was also identified as an occurring species within the Dowden's Point Area (CCDA 2001).

One unidentified gadoid fish was observed at the proposed Dowden's Point shoreline electrode site during the drop video camera habitat survey conducted in October 2010 (Sikumiut 2011a).

Species Profiles

Atlantic Cod

Atlantic cod found within the Strait of Belle Isle Area are generally from the northern Gulf of St. Lawrence population (i.e., Laurentian North population) (Northwest Atlantic Fisheries Organization Areas 3Pn 4RS). These cod are known to migrate extensively on an annual basis (DFO 2009h). During winter, these cod are found off south-western and southern Newfoundland in depths >366 m (DFO 2009h). On the basis of migration patterns, Yvelin et al. (2005) suggested that this stock consisted of three components in the Gulf of St. Lawrence. While all three components had the same over-wintering location off southern Newfoundland, tagging studies have shown a portion of the population remained in that area throughout the year. The other two components of the population migrated north to one of two regions: off the coast of western Newfoundland or in the northern Gulf of St. Lawrence, including the Strait of Belle Isle (Yvelin et al. 2005). Northern Gulf of St. Lawrence cod typically migrate to the west coast of Newfoundland, Northwest Atlantic Fisheries Organization Division 4R (see Figure 3.17 in Sikumiut 2010a), between April and May (DFO 2009h).

Spawning of Atlantic cod occurs in a variety of depths (Smedbol and Wroblewski 1997; Hutchings et al. 1993) and they are known to spawn in inshore, nearshore and offshore waters (Morgan and Trippel 1996; Hutchings et al. 1993). Studies in 2001 on spawning females within the Gulf of St. Lawrence indicated that spawning occurs more predominantly in April in the northern Gulf of St. Lawrence (Méthot et al. 2005). Results from these studies demonstrated that during 2001 a higher percentage of spawning Atlantic cod females occurred in 4R than other parts of the Gulf of St. Lawrence, and that only spent females were captured in 4R in April (Méthot et al. 2005). Results from tagging studies show that the Atlantic cod found in the Strait of Belle Isle Area mix with Burgeo Bank cod (3Ps) every winter, occasionally mix with 2J3KL (NL population) cod in the Strait of Belle Isle, and mix with 4TVn (Laurentian South population) stock in the north-west portion of the Gulf of St. Lawrence (DFO 2009h). Results from the sentinel tagging surveys (Bérubé and Fréchet 2001) show that most catches in the Strait of Belle Isle occur between July to October. These are found further south in 4R and 3Pn between September and December.

Although cod from the Strait of Belle Isle Area are mainly from the 4RS and 3Pn stock, Atlantic cod from other stocks have been present in the area. Only a few cod were tagged and released with acoustic transmitters off Bonavista and only a few of these were detected in the Strait of Belle Isle Area (Brattey 2010, pers. comm. *in* Sikumiut 2010a) suggesting that the Bonavista cod stock does not undertake extensive migrations to the Strait of Belle Isle Area. As juveniles, cod associate with complex habitats, such as boulders / large rock, cobble, macroalgae and eelgrass in inshore environments. This is specifically for protection from predators, such as larger conspecifics and other piscivorous fish and sea birds (Laurel et al. 2003). Distribution of Atlantic cod changes with age where juvenile nursery areas are primarily located at inshore shallow areas along the coast of southern Labrador and eastern Newfoundland. Young of the year are found mainly inshore, with year one cod starting to appear offshore. By age three and four they have distribution to offshore areas overlapping with older fish.

Capture locations of Atlantic cod in the Strait of Belle Isle Area from 1999 to 2009 by DFO scientific surveys and sentinel fisheries are presented in Figure 3.39 in Sikumiut (2010a). It is apparent that Atlantic cod are widely distributed throughout the Strait of Belle Isle Area, including within or close to the proposed submarine cable crossing corridor and the L’Anse au Diable shoreline electrode site. Atlantic cod spawning locations within the Strait of Belle Isle Area are identified in the CCRI database (see Figure 3.18 in Sikumiut 2010a) (LSDA 2002; NEDC 2001; RORB 2001). Spawning locations were identified near Red Bay on the Labrador side and in Pistolet Bay and in an area mid-way between Flower’s Cove and Cooks Harbour on the Newfoundland side. All of these locations are at least 30 km from the proposed submarine cable crossing corridor and L’Anse au Diable shoreline electrode site.

Capelin

Capelin are a small, pelagic fish species found in the north-west Atlantic including off the coast of NL, Grand Banks, Gulf of St. Lawrence within the Scotian Shelf and the Bay of Fundy (DFO 2008c). Most spawning occurs in coastal areas, although a small component of the population remains in offshore areas and spawns in areas such as the Southeast Shoal. Coastal spawning occurs in both inter-tidal waters and on beaches of sand or fine gravel substrate. This typically occurs in water temperatures between 6°C and 10°C, predominantly at night (DFO 2008c). Eggs attach to the substrate, and incubation timing varies by temperature, and can last approximately 15 days at 10°C (DFO 2008c). Upon hatching, larvae are near the surface, and remain planktonic feeders until winter. The majority of growth occurs during the first year, and the first spawn can occur by age two. Nearly all males die after reproduction (DFO 2008c).

Capelin are a significant link in food chains as they provide the transfer of energy between primary and secondary producers to higher trophic levels (DFO 2008c). Within the northern Gulf of St. Lawrence, including the Strait of Belle Isle Area, capelin are a main forage species prey (DFO 2008c; 2007b). It has been demonstrated that the main cause of mortality for capelin in this area has been predation by various species. Savenkoff et al.(2004) indicated that during the mid-1980s, capelin were preyed on by Atlantic cod and redfish. After the decline of these groundfish in the early 1990s, capelin were important prey items for cetaceans, harp seals, and Greenland halibut in the mid-1990s and early 2000s. By the mid-2000s, capelin were also the main prey items for redfish and other capelin. In DFO (2007b) it was suggested that aggregations of capelin in the Strait of Belle Isle Area may contribute to abundance of marine mammals in the area, further underlining the importance of capelin in the Strait of Belle Isle Area.

There has been an upward trend for landings of capelin in the Gulf of St. Lawrence (DFO 2008c). Concentrated catches in the Strait of Belle Isle Area have been reported by the research vessel CCGS Teleost in 2005, 2006 and 2007, and by the CCGS Alfred Needler (Gregoire et al. 2008). There is a commercial purse seine fishery in Northwest Atlantic Fisheries Organization Divisions 4R and 4S in June and July, and in recent years the most significant landings of capelin have been within 4Ra (Strait of Belle Isle) (Gregoire et al. 2008). Capture locations of capelin in the Strait of Belle Isle Area from 1999 to 2009 by DFO scientific surveys and sentinel fisheries are presented in Figure 3.23 in Sikumiut 2010a. Few of the capelin catch locations overlap the proposed corridor.

Spawning locations for capelin were identified in the CCRI database and are presented in Figure 3.22 in Sikumiut 2010a. Note that capelin spawn throughout the sections of Quebec and Newfoundland and Labrador coasts in the Strait of Belle Isle Area which in not entirely reflected in Figure 3.22. According to the CCRI (NEDC 2001; RORB 2001), capelin spawn in the vicinity of Shoal Cove at the Newfoundland end of the proposed submarine cable crossing corridor. These are likely locations where capelin have been observed “rolling” on the beaches in the area.

Lumpfish

Lumpfish primarily inhabit rocky or stony bottoms and are considered groundfish. However, several studies indicate that lumpfish remain in the offshore pelagic areas most of their mature lives (DFO 2006b). In the north-west Atlantic, lumpfish range from Greenland to Chesapeake Bay (DFO 2006b).

According to the DFO (2006b) little scientific information exists on the lumpfish in the Gulf of St. Lawrence. However, tagging studies were conducted in 2004 and 2005 in the northern Gulf of St. Lawrence (Fréchet et al. 2006) to determine migration patterns. Results from this study suggested that lumpfish migration is limited, with most individuals moving within an area of <40 km. It was noted, however, that there are still uncertainties about migration of lumpfish since the targeted fishery is seasonal and short (Fréchet et al. 2006).

Mature lumpfish migrate from offshore to coastal areas prior to spawning, which typically occurs in May and June each year. Males arrive at the coastal areas earlier than females in an attempt to mark their territory. Spawning is assumed to be temperature dependent, beginning at approximately 4°C. Females lay two to three egg masses at 8 to 14 day intervals and return offshore, leaving males to guard their egg masses (DFO 2006b).

During early life stages, lumpfish are found attached to floating algae and rocks, lobster traps and other solid objects (DFO 2006b).

The diet of lumpfish includes many invertebrates including euphausiid shrimps, pelagic amphipods, copepods, as well as other shellfish, jellyfish and anemones. Predators of lumpfish in the northern Gulf of St. Lawrence include gray seals (*Halichoerus grypus*) and Greenland sharks (*Somniosus microcephalus*) (DFO 2006b).

There is a directed fishery for lumpfish in the northern Gulf of St. Lawrence, including the Strait of Belle Isle Area. This fishery targets females for roe during the spring (Fréchet et al. 2006). Capture locations of lumpfish in the Strait of Belle Isle Area from 1999 to 2009 by DFO scientific surveys and sentinel fisheries are presented in Figure 3.19 *in* Sikumiut 2010a. Lumpfish spawning locations have also been identified in the CCRI database (LSDA 2002; NEDC 2001; RORB 2001) (see Figure 3.18 *in* Sikumiut 2010a), located mostly on the Newfoundland side of the Strait of Belle Isle, although some small spawning grounds were located on the Labrador side.

Atlantic Herring

Atlantic herring are schooling pelagic fish found in the north-west Atlantic from Labrador to Cape Hatteras (McQuinn et al. 1999). Herring form schools for feeding purposes, spawn near the coast, and overwinter in deeper waters. Herring return to the same feeding and spawning areas every year (DFO 2006c). After spawning, eggs attach to the substrate, and form a thick carpet of eggs a few centimetres thick on the sea floor (DFO 2006c).

Like capelin, Atlantic herring are an important food chain link, providing food for various trophic levels. On the west coast of Newfoundland (Northwest Atlantic Fisheries Organization Division 4R), there are two spawning stocks present: one which spawns in the spring, and one that spawns in the fall (Savenkoff et al. 2006). The spring spawning stock spawns near the west coast of Newfoundland, and in and around St. Georges Bay (McQuinn et al. 1999) during the months of April and May (Savenkoff et al. 2006). The fall spawning stock spawns north of Point Riche from mid-July to mid-September (McQuinn et al. 1999). The Strait of Belle Isle has been identified as the main area for spawning of the fall herring component of the northern Gulf of St. Lawrence (DFO 2009c). Outside of the spawning season, the two stocks can be found to coincide with one another in St. Georges Bay (spring), Strait of Belle Isle (summer) and in Bonne Bay during the fall (McQuinn et al. 1999).

Like capelin, the major source of mortality for the northern Gulf of St. Lawrence herring is predation. Redfish (*Sebastes* spp.) and large cod were the main predators in the mid-1980s. Cetaceans and harp seals replaced these species as the main predators in the mid-1990s and 2000s, and harp seals in the 2000s (DFO 2006c). Prey items included zooplankton (<5 mm) in the mid-1980s, consisting mostly of copepods, and in the 1990s and 2000s small and large zooplankton (euphausids and amphipods) were the two main prey items in the northern Gulf of St. Lawrence (DFO 2006c).

Capture locations of Atlantic herring in the Strait of Belle Isle Area from 1999 to 2009 by DFO scientific surveys and sentinel fisheries are presented in Figure 3.24 in Sikumiut 2010a. Spawning locations for Atlantic herring were identified within the CCRI database, and are presented in Figure 3.22 in Sikumiut 2010a. Note that Atlantic herring spawn throughout the sections of Quebec and Newfoundland and Labrador coasts in the Strait of Belle Isle Area which in not entirely reflected in Figure 3.22. According to the CCRI (NEDC 2001; RORB 2001), herring spawn in the vicinity of Shoal Cove at the Newfoundland end of the proposed submarine cable crossing corridor. Spawning locations were identified primarily on the Newfoundland side of the Strait of Belle Isle, near the coast.

Atlantic Mackerel

Like capelin and Atlantic herring, Atlantic mackerel are an important food chain link, providing food for various trophic levels, as well as being the target of a commercial fishery. Atlantic mackerel are a pelagic fish species that occurs on both sides of the north Atlantic and in the north-west Atlantic is distributed from North Carolina to Newfoundland (DFO 2008d). Mackerel are often found inshore in spring and summer, but occur in deeper waters at the edge of the continental shelf in late fall and winter. In the Gulf of St. Lawrence, spawning occurs in the southern region. Data collected during the mid-1980s, 1990s and early 2000s examined ecosystem function of the Gulf of St. Lawrence with a focus on mackerel perspective (Gregoire et al. 2006).

Gregoire et al. (2006) demonstrated that small (<5 mm) and large (larger than 5 mm) zooplankton were the major prey item of mackerel in the mid-1980s. Data collected in the mid-1990s and early 2000s demonstrated that while zooplankton were still the main dietary component of mackerel in the northern Gulf of St. Lawrence, Northern shrimp and capelin made up larger components of the diet. During the mid-1980s, mackerel were preyed upon by cetaceans and large demersal fish (primarily cod), but by the mid 1990s and early 2000s, the main predators of mackerel were predominantly cetaceans (Gregoire et al. 2006).

There is a directed fishery for mackerel in both Newfoundland and Québec regions of the Gulf of St. Lawrence. Capture locations of Atlantic mackerel in the Strait of Belle Isle Area from 1999 to 2009 by DFO scientific surveys and sentinel fisheries are presented in Figure 3.25 *in* Sikumiut 2010a. Spawning locations for Atlantic mackerel were identified within the CCRI database, and presented in Figure 3.22 in Sikumiut 2010a. Spawning locations were identified primarily on the Newfoundland side of the Strait of Belle Isle, west of the proposed submarine cable crossing corridor.

Atlantic Halibut

Although Atlantic halibut is the largest of the flatfish and a prized species on the market, knowledge of its biology and stock status is limited. In the northern Gulf of St. Lawrence, halibut are most abundant at depths of 200 m or more. Based on information collected during scientific trawl surveys, Gulf of St. Lawrence Atlantic halibut appear able to spawn in January and May at least. Smaller halibut feed primarily on invertebrates but larger ones are primarily fish eaters (DFO 2009i).

Atlantic Salmon

Similar to anadromous Arctic char, Atlantic salmon descend to the sea in the spring after several years of early life in the freshwater environment. Known as smolts, these juvenile salmon spend up to 108 hours in the estuary, generally lasting only one or two tidal cycles in the area (Tyler et al. 1978). Unlike anadromous char or brook trout, salmon will spend one or more winters at sea before returning to their natal river. Atlantic salmon that mature after one year in the ocean are known as grilse as compared to two sea winter salmon that mature after two years in the ocean and often travel to the waters off Greenland during the maturation period.

Hedger et al. (2009) provided evidence through a telemetry study that Atlantic salmon spawning in rivers in the south-western part of the Gulf of St. Lawrence migrate to offshore areas through the Strait of Belle Isle. Of the 144 detections of salmon kelts in the Strait of Belle Isle, 78% indicated swimming depths ≤1 m, and that swimming depth during diving ranged from 4 m to 15 m.

There are 14 rivers that flow into the Strait of Belle Isle Area that are listed as ‘Salmon Rivers’ in Schedule I of the *Newfoundland and Labrador Fishery Regulations.* Scheduled salmon rivers are designated by DFO (see Section 10.4.5, Freshwater Fish and Fish Habitat). Two of these rivers, Forteau River and L’Anse au Loup Brook, have mouths located within 30 km of the Labrador end of the proposed submarine cable crossing corridor (Figure 3.26 *in* Sikumiut 2010a). The mouths of two scheduled salmon rivers, L’Anse au Loup Brook and Pinware River, are located within 15 to 20 km of L’Anse au Diable (Figure 3.26 *in* Sikumiut 2010a). There are 18 scheduled salmon rivers that empty into Conception Bay (Reddin et al. 2009). The scheduled salmon that empties into Conception Bay nearest to Dowden’s Point is Seal Cove Brook, located within 1 to 2 km of Dowden’s Point (Reddin et al. 2009).

Non-Fishery-targeted Fishes

Strait of Belle Isle Area

Identifiable non-fishery-targeted fishes observed during the video camera habitat surveys included alligatorfish (*Aspidophoroides monopterygius*) and sculpin (*Myoxocephalus* sp.) in 2008, and cunner (*Tautogolabrus adspersus*) and ocean pout (*Zoarces americanus*) in 2009. Alligatorfish occurred in 5 to <25% of the 2008 survey transect reaches, while cunner and ocean pout were observed only once during the 2009 survey. During the part of the 2008 drop video camera habitat survey conducted within the proposed submarine cable crossing corridor, alligatorfish were observed in all four Segments while sculpin were observed in Segment 2 and Segment 4 only (AMEC 2010b).

In the description of the Strait of Belle Isle EBSA, DFO (2009c; 2007b) indicated that the Strait of Belle Isle Area is characterized by high concentrations of spiny dogfish and sand lance. However, no specific information on location of these two species within the Strait of Belle Isle Area was indicated.

The CCRI database (LSDA 2002; NEDC 2001; RORB 2001) indicates the occurrence of sharks (unspecified species) and swordfish (*Xiphias gladius*) within the Strait of Belle Isle Area. The database also indicates spawning locations for sand lance within the Strait of Belle Isle Area but not in the vicinity of the proposed submarine cable crossing corridor.

L'Anse au Diable

Results of the drop video camera habitat survey at the proposed L'Anse au Diable shoreline electrode site included sculpin (unspecified species) as the only non-fishery-targeted fish observed during the September / October survey (Sikumiut 2011a).

Dowden's Point Area

No non-fishery-targeted fishes were observed during the October 2010 drop video camera habitat survey conducted at the proposed Dowden's Point shoreline electrode site. The CCRI database (CCDA 2001) indicates that flounder and sharks occur within the Dowden's Point Area.

Species of Special Conservation Concern

For the purposes of this section of the EIS, SSCC include those marine invertebrate and fish species / populations designated as Endangered, Threatened or Special Concern under Schedule 1 of *SARA*; Endangered, Threatened or Vulnerable under the *NLESA*; or Endangered, Threatened or Special Concern by COSEWIC. Only species listed as either Endangered or Threatened on Schedule 1 of the *SARA* have legal status and listed as Endangered, Threatened or Vulnerable by the *NLESA* are provided special protection. Based on these criteria, 18 fish species with likelihood of occurrence in the Study Area are SSCC (Table 10.5.8-14). Species profiles are provided below for the five species identified in Schedule 1 of *SARA* or the *NLESA*.

Table 10.5.8-14 Marine Fish Species of Special Conservation Concern that may Potentially Occur within the Study Area

Common Name	Scientific Name	Species Designation		
		SARA Schedule 1	*NLESA*	COSEWIC
White shark	*Carcharodon carcharias*	Endangered	—	Endangered
Northern wolffish	*Anarhichas denticulatus*	Threatened	—	Threatened
Spotted wolffish	*Anarhichas minor*	Threatened	—	Threatened
Atlantic wolffish	*Anarhichas lupus*	Special Concern	—	Special Concern
American eel	*Anguilla rostrata*	—	Vulnerable	Special Concern
Atlantic cod (Laurentian North population)	*Gadus morhua*	—	—	Endangered
Porbeagle shark	*Lamna nasus*	—	—	Endangered
Roundnose grenadier	*Coryphaenoides rupestris*	—	—	Endangered
Deepwater redfish (Various populations)	*Sebastes mentella*	—	—	Endangered Threatened
Atlantic salmon (Southern Newfoundland population)	*Salmo salar*	—	—	Endangered Threatened Special Concern
Cusk	*Brosme brosme*	—	—	Threatened
American plaice (Maritime population)	*Hippoglossoides platessoides*	—	—	Threatened
Acadian redfish (Atlantic population)	*Sebastes fasciatus*	—	—	Threatened
Blue shark (Atlantic population)	*Prionace glauca*	—	—	Special Concern
Basking shark (Atlantic population)	*Cetorhinus maximus*	—	—	Special Concern
Roughhead grenadier	*Macrourus berglax*	—	—	Special Concern
Spiny dogfish (Atlantic population)	*Squalus acanthis*	—	—	Special Concern
Shortfin mako	*Isucus oxyrinchus*	—	—	Threatened

Source: *SARA* (2011, internet site); GNL (2011, internet site); COSEWIC (2011, internet site).

Species Profiles

White Shark (Atlantic Population)

The white shark (*Carcharodon carcharias*), the quintessential shark species due to its large size and predatory nature, is widely distributed in sub-polar to tropical seas of both hemispheres but is most frequently observed and captured in inshore temperate waters over the continental shelves of the western North Atlantic, Mediterranean Sea, southern Africa, southern Australia, New Zealand and the eastern North Pacific (COSEWIC 2006a). Although rare in waters of Atlantic Canada (only 32 records since 1874), the white shark has been recorded in numerous locations, including the Strait of Belle Isle (COSEWIC 2006a). Its known bathymetric range is from just below surface to a depth of 1,280 m (Bigelow and Schroeder 1948 in COSEWIC 2006a). Reproductive details of the white shark are poorly understood (COSEWIC 2006a). One possible pupping area on the east coast of North America is the Mid-Atlantic Bight, far south of the Strait of Belle Isle (Casey et al. 1985 in COSEWIC 2006a). It is an apex predator with a wide prey base which includes teleost fishes, elasmobranchs, marine mammals, cephalopods, other mollusks, decapods crustaceans, marine birds and reptiles. Biological information on this shark from Canadian waters is limited (COSEWIC 2006a). There are no systematic surveys for white sharks in Canadian waters. Most records of this shark in Canadian waters are from incidental catch reports, opportunistic stranding reports, and published historical observations (COSEWIC 2006a).

Northern Wolffish

The northern wolfish (*Anarchichas denticulatus*) is a deepwater fish of cold northern seas that has been caught at depths ranging from 38 to 1,504 m, with observed densest concentrations between 500 and 1000 m at water temperatures of 2 to 5°C. During 1980 to 1984, this species was most concentrated on the north-east NL shelf and banks, the south-west and south-east slopes of the Grand Banks, and along the Laurentian Channel. Between 1995 and 2003, the area occupied and the density was considerably reduced (Kulka et al. 2008).

Northern wolffish are uncommon in the Gulf of St. Lawrence. These wolffish are known to inhabit a wide range of bottom substrate types, including mud, sand, pebbles, small rock and hard bottom, with highest concentrations observed over sand and shell hash in the fall, and coarse sand in the spring. Unlike other wolffish species, both juvenile and adult stages of this species have been found a considerable distance above the bottom, as indicated by diet (Kulka et al. 2008).

Prey of northern wolffish are primarily bathypelagic (>200 m depth) biota such as ctenophores and medusa, but also include mesopelagic biota (<200 m depth) and benthic invertebrates. Pelagic fish represent the largest percentage of stomach contents on the basis of volume. Tagging studies have suggested limited migratory behaviour by these wolffish (Kulka et al. 2008).

Northern wolffish typically spawn late in the year on rocky bottom. Cohesive masses of fertilized eggs are laid in crevices but are unattached to the substrate. Pelagic larvae hatch after an undetermined egg incubation time, and typically feed on crustaceans, fish larvae and fish eggs (Kulka et al. 2008).

DFO research vessel surveys and sentinel fisheries caught northern wolffish in the Strait of Belle Isle Area in 2006, 2007 and 2008 (Figure 3.37 *in* Sikumiut 2010a). Most were caught about 25 km west of the proposed submarine cable crossing corridor but some wolffish catches were made in the vicinity of L'Anse au Loup between Forteau Point and L'Anse au Diable.

Wolffishes (unspecified species) were identified in the CCRI database (CCDA 2001) as occurring within the Dowden's Point Area; however, there are no records of Northern wolffish occurrence in Conception Bay (Stantec 2012c).

Spotted Wolffish

The life history of the spotted wolffish (*Anarchichas minor*) is similar to that of the northern wolffish except that it seldom inhabits the deepest areas used by the northern wolffish. Although spotted wolffish have been caught at depths ranging from 56 to 1,046 m, the observed densest concentrations occur between 200 and 750 m at water temperatures of 1.5 to 5°C. Concentrations of this species, its distribution and its habitat preference are the same as discussed for the northern wolffish (Kulka et al. 2008).

Prey of spotted wolffish are primarily benthic (>75%), typically including echinoderms, crustaceans, and molluscs associated with both sandy and hard bottom substrates. Fish also constitutes part of the spotted wolffish diet (<25%). Tagging studies indicate the spotted wolffish migrations are local and limited (Kulka et al. 2008).

Spotted wolffish exhibit internal fertilization which typically occurs on stony bottom around July and August in NL waters. Cohesive masses of eggs are deposited in crevices, remaining unattached to the substrate. After an undetermined incubation time, pelagic larvae hatch and start to feed on crustaceans, fish larvae and fish eggs within a few days of hatching (Kulka et al. 2008).

DFO research vessel surveys and sentinel fisheries caught spotted wolffish in the Strait of Belle Isle Area in 2003, 2004, 2008 and 2009 (Figure 3.37 *in* Sikumiut 2010a). As was the case with the northern wolffish, most of the spotted wolffish were caught >25 km west of the proposed submarine cable crossing corridor. The lone exception was a capture just east of Shoal Cove in 2004.

Wolffishes (unspecified species) were identified in the CCRI database (CCDA 2001) as occurring within the Dowden's Point Area.

Atlantic Wolffish

Atlantic wolffish (*Anarhichas lupus*) are primarily demersal and inhabit shallower areas than the northern and spotted wolffishes. This species has been observed from near shore to a depth of 918 m at water temperatures ranging from -1 to 10°C, but are most common at water depths of 150 to 350 m with water temperatures ranging from 1.5 to 4°C. During 1980-1984, this species was most concentrated in the same areas as the northern wolffish, with additional concentrations on the southern Grand Banks and the Gulf of St. Lawrence. More recently, the area occupied and density within the area was considerably reduced in the northern part of its confirmed range, but has remained relatively constant in the Gulf of St. Lawrence (Kulka et al. 2008). Unlike the northern and spotted wolffishes, Atlantic wolffish are often observed by divers close to shore, and they form dense concentrations offshore.

During its feeding period, this wolffish species appears to prefer complex reliefs of rocks without algal growth and sand. Shelters in these rock reliefs are typically situated on 15 to 30° slopes with good water circulation. There is an indication that Atlantic wolffish form colonial settlements during the feeding period (Kulka et al. 2008). Prey of Atlantic wolffish are primarily benthic (>85%), typically including echinoderms (e.g., sea urchins), crustaceans (e.g., crabs) and molluscs (e.g., scallops) associated with both sandy and hard bottom substrates. Fish also constitutes part of the spotted wolffish diet (<15%) (e.g., redfish).

Migration by Atlantic wolffish is also limited, with seasonal inshore movement in the spring when mature fish are found in areas with water depths <15 m. These wolffish seem to prefer stony bottom substrate for spawning in September and October in NL waters. After internal fertilization, cohesive masses of eggs are deposited in crevices on the bottom, remaining unattached to the substrate. The egg mass is guarded and maintained by the male Atlantic wolffish for the 7 to 9 month incubation time, after which pelagic larvae hatch and commence to feed on crustaceans, fish larvae and fish eggs within a few days of hatching (Kulka et al. 2008).

DFO research vessel surveys and sentinel fisheries caught Atlantic wolffish in the Strait of Belle Isle Area every year between 2000 and 2009. As was the case with the other two wolffish species, most of the Atlantic wolffish were caught west of the proposed submarine cable crossing corridor. However, there were catches within the corridor and at L'Anse au Loup between Forteau Point and L'Anse au Diable (Sikumiut 2010a).

Wolffish (unspecified species) were identified in the CCRI database (CCDA 2001) as occurring within the Dowden's Point Area.

American Eel

The American eel is a facultatively catadromous species that spawns in the Sargasso Sea, in the middle of the North Atlantic, and whose juvenile and adult stages have historically occurred in all accessible freshwater, estuarine and coastal areas associated with the Atlantic Ocean (DFO 2010d). After spawning, the larval leptocephali are transported via the Gulf Stream along the Atlantic coast of North America. Following detrainment from the Gulf Stream to the continental shelf, the leptocephali metamorphose to glass eels that subsequently become pigmented elvers as they enter coastal waters in the spring.

Spawning migration from the freshwater environment to the marine environment typically occurs in late summer / fall. Recent studies have shown that some eels spend all of their life cycle in coastal waters and do not have a freshwater phase (DFO 2010d). It is conceivable that both elvers and mature eels would at some time pass through the Study Area, both in the Strait of Belle Isle Area and the Dowden's Point Area.

Information related to other SSCC that have likelihood of occurrence within the existing environment area and have COSEWIC designations only, is included in Section 3.3.4 of (Sikumiut 2010a).

Special Areas

Almost all of the Strait of Belle Isle Area occurs within the Strait of Belle Isle EBSA of the Estuary and Gulf of St. Lawrence Large Oceans Management Area identified by DFO. Conservation objectives for this LOMA were developed in 2007 by DFO to guide managers and other ecosystem users throughout the Integrated Management process of human activities that will be carried out there, by establishing safe limits within which social, cultural and economic objectives can be established (DFO 2009c). The conservation objective for each EBSA within the Estuary and Gulf of St. Lawrence Large Oceans Management Area is as follows:

- Ensure that the features of the EBSA related to its uniqueness, which make the area appropriate for aggregation and / or that ensure the reproduction and survival of the dependant species in that area (fitness consequences), are not altered by human activities.
- The relative importance of each EBSA in the Estuary and Gulf of St. Lawrence Large Oceans Management Area was assigned during a workshop in 2007, and was based on three criteria: (1) the EBSA itself; (2) the species and stocks of concern; and (3) the structural and functional properties of the ecosystem. The key characteristics of the Strait of Belle Isle EBSA, which was rated as a first priority EBSA, include the following (DFO 2009c):
  - Particularly complex topography.
  - Very important for Greenland lebbeid shrimp and represents the only area in the Gulf where circumpolar eualid (subsp. *gaimardii*) shrimp have been observed. It is also a very significant area for a few shrimp species that are somewhat limited in their distribution elsewhere (Greenland lebbeid, circumpolar eualid (subsp. *belchen*)) and for a few invertebrate species (ascidians, starfish, basket stars, sculptured shrimp, Arctic eualid, Greenland shrimp, parrot shrimp, polar lebbeid, pink shrimp, sevenline shrimp, Arctic argid, and zebra lebbeid) that are limited or somewhat limited in their distribution elsewhere.
  - Main area for spawning of the fall herring component of the northern Gulf. It is also an area with high concentrations of capelin (and marine mammals) and other pelagic species (spiny dogfish and sand lance).
  - Extremely significant and diverse area for large cetaceans and several other piscivorous (fish eating) marine mammal species.

Aboriginal Ecological Knowledge

AEK regarding marine fish and fish habitat in parts of the Study Area was obtained through land and resource use interviews. This is listed below (Table 10.5.8-15) and includes information on the scallop fishery, and herring breeding areas. The information provided is generally consistent with the scientific data obtained through the field studies and literature review conducted for the EA (as reported in Section 10.5.8.2).

Table 10.5.8-15 Aboriginal Ecological Knowledge of Marine Fish and Fish Habitat in the Study Area

Group	Source	Quote (Direct and/or Indirect)
NunatuKavut Community Council	NunatuKavut Land and Resource Use Interview, May 2011	*Indirect* There is no commercial harvest of mussels in the Strait.
	NunatuKavut Land and Resource Use Interview, May 2011	*Indirect* There are mussel farms across the Québec border, and scallop and cod are harvested in the Straits.

Local Ecological Knowledge

LEK regarding marine fish and fish habitat in parts of the Study Area was obtained through Labrador-Island Transmission Link Strait of Belle Isle Marine Crossing Meeting participants in Flower's Cove and West St. Modeste. This is listed below (Table 10.5.8-16) and includes information on the scallop fishery in the Strait, and the Strait of Belle Isle as an ecologically sensitive area and important breeding ground for herring. The information provided is generally consistent with the scientific data obtained through the field studies and literature review conducted for the EA (as reported in Section 10.5.8.2).

Table 10.5.8-16 Local Ecological Knowledge of Marine Fish and Fish Habitat in the Study Area

Community	Source	Indirect Quote
Flower's Cove, NL	Labrador-Island Transmission Link EA, Strait of Belle Isle Marine Crossing Meeting participant, Flower's Cove, NL, January 12, 2011	The scallop fishery is very important in the Strait.
West St. Modeste, NL	Labrador-Island Transmission Link EA, Strait of Belle Isle Marine Crossing Meeting participant, West St. Modeste, NL, January 13, 2011	The Strait of Belle Isle is a breeding ground for herring; it is an ecologically sensitive area.

10.5.9 Marine Mammals and Sea Turtles

The Strait of Belle Isle and Conception Bay are known to support a diverse group of marine mammals including members of the Orders Cetacea and Carnivora, with more than 20 species potentially using these areas at various times of the year. This section describes these species, including their life history, and known occurrence and use of the Study Areas. Several of these species also have SSCC statuses, and where relevant, these designations are included with each species description.

Sea turtles are also known to occur in the Strait of Belle Isle and Conception Bay areas. This section discusses the species of sea turtles, including their life history, and use of the Study Area. Sea turtle species also have SSCC statuses, and are discussed with each species description.

10.5.9.1 Study Area

The Study Area for marine mammals and sea turtles reflects their use of larger areas, and includes the Strait of Belle Isle and Conception Bay. The Strait of Belle Isle Area is defined as the area extending from Port au Choix on the west coast of Newfoundland to the tip of the Northern Peninsula and from Baie Jacques Cartier, Québec to Chateau Bay, Labrador (Sikumuit 2010b). The Strait of Belle Isle Area includes the proposed submarine cable crossing corridor and the L'Anse au Diable shoreline electrode sites.

The Study Area for the Dowden's Point shoreline electrode site includes the entirety of Conception Bay.

10.5.9.2 Information Sources and Data Collection

The primary sources of information relating to marine mammals used in this review include the following and sources listed therein:

- *Marine Mammals, Sea Turtles and Sea Turtles in the Strait of Belle Isle: Supplementary Information Review and Compilation* (Sikumiut 2010b): This report includes the identification, compilation, review, and presentation of existing and available information on marine mammals, sea turtles and seabirds in the Strait of Belle Isle area, as a supplementary update to the marine mammal and seabird studies described below.

- *Marine Mammals and Seabirds in the Strait of the Belle Isle* (Jacques Whitford 2000a). This survey included aerial and boat-based marine mammal and seabird surveys conducted in the Strait of Belle Isle in the summer and fall of 1998, along with a detailed and comprehensive review of known sightings and other information from the available literature and other datasets. The study objective was to describe the occurrence, spatial and temporal distribution, and relative abundance of marine mammals and seabirds in the Strait and surrounding area during the ice-free season. Aerial surveys flown in 1998 covered an area of approximately 5,400 km^2 in a transect pattern with a spacing of 7.4 km (4 nautical miles). This transect spacing was selected to maximize the potential for sightings and reduce the risk of missing animals or duplicating observations. Twenty-five transects were flown, covering an estimated length of 1,200 km (648 nautical miles). The aerial survey could be flown in a single day and the survey area was flown twice over two consecutive days when weather permitted. To compliment the aerial surveys, boat-based surveys were also conducted in 1998. These surveys were conducted at three-week intervals to coincide as closely as possible with the aerial surveys. Data collected through both survey methods were analyzed using line-transect methods.
- *Strait of Belle Isle: Ambient Noise and Marine Mammal Survey* (Jasco 2011a): During 2010, acoustic data were recorded at three locations within the Strait of Belle Isle: near Newfoundland, near the middle of the Strait of Belle Isle, and near Labrador. Two deployments (June – August and September – December) recorded ambient noise from each location. Analysis of the data collected included visual examination of spectrograms, combined with auditory review of a sample of the acquired digital audio. Automated analysis of the data was also performed to quantify ambient sound levels, detect shipping noise, and identify biological sounds, including the calls of marine mammals. Manual analysis was also used to identify biological sounds that occurred during the recording period. Where possible, vocalizations were identified to species and quantified.
- Scientific literature.
- Gray literature (e.g., consultant's reports, government documents).
- Government databases (DFO datasets).
- Relevant web sites.

Additional data collected in the Strait of Belle Isle available from other sources (Hammill and Stenson 2010; Stenson et al. 2010; Lawson and Gosselin 2009; Lawson et al. 2007; Lesage et al. 2007) was reviewed and incorporated into the marine mammal existing environment description as appropriate. In particular, Lesage et al. (2007) provides information on marine mammals in the Gulf of St. Lawrence, including the Strait of Belle Isle. In 2007, DFO conducted large-scale aerial surveys of marine megafauna in the Northwest Atlantic including much of the Canadian seaboard (Lawson and Gosselin 2009).

The above information review and compilation report is cited extensively in this section. Other information sources include the primary scientific literature, gray literature (e.g., consultant's reports, government documents), government databases, and relevant web sites.

Data collection for sea turtles was limited to a literature review. No sea turtle-specific field work was conducted in either the Strait of Belle Isle Area or Conception Bay. Surveys for marine mammals and sea birds conducted in the Strait of Belle Isle in 1998 (Jacques Whitford 2000a) reported no sea turtle observations.

10.5.9.3 Description of Marine Mammals

Marine mammals are members of the Orders Cetacea and Carnivora. The Cetacea include members of the mysticete or baleen whales (e.g., blue whales, *Balaenoptera musculus*) and the odontocetes or toothed whales (e.g., harbour porpoises, *Phocoena phocoena*). The Carnivora include the seals and walruses. This section discusses the existing environment for marine mammals that occur in the Strait of Belle Isle and Conception Bay.

The Strait of Belle Isle and Conception Bay support a diverse assemblage of marine mammals, with the species composition and abundance varying by season and location. Twenty-two species of marine mammals may occur in the Strait of Belle Isle and Conception Bay, including 17 species of cetaceans (whales, dolphins and porpoises) and five species of seals, and possibly walruses.

At least 15 species of marine mammals are known to use the Strait of Belle Isle regularly: gray seal, harbour seal (*Phoca vitulina*), hooded seal (*Cystophora cristata*), harp seal, minke whale (*Balaenoptera acutorostrata*), blue whale, fin whale (*Balaenoptera physalus*), sei whale (*Balaenoptera borealis*), humpback whale, killer whale (*Orcinus orca*), harbour porpoise, Atlantic white-sided dolphin (*Lagenorhynchus acutus*), white-beaked dolphin (*Lagenorhynchus albirostris*), short-beaked common dolphin (*Delphinus delphis*), and long-finned pilot whale (*Globicephala melas*). Other species (sperm whale (*Physeter macrocephalus*), narwhal (*Monodon monoceros*), beluga whale (*Delphinapterus leucas*), bowhead whale (*Balaena mysticetus*), North Atlantic right whale (*Eubalaena glacialis*), bearded seal (*Erignathus barbatus*), and Atlantic walrus (*Odobenus rosmarus rosmarus*)) are considered extralimital in the Strait of Belle Isle or extremely rare.

Most marine mammals are present in the Strait of Belle Isle between May and December, while harp seals, hooded seals, and fin whales also occur between December and May. The Strait of Belle Isle is considered a migratory corridor during spring and fall, a winter breeding and pupping area for ice-associated seals, and a feeding area for cetaceans.

Although systematic data on marine mammal use of Conception Bay is less readily available, this area also supports a rich assemblage of marine mammals, primarily during the open-water season. Species which have been commonly reported in Conception Bay include humpback whale, minke whale, fin whale, long-finned pilot whale, harbour porpoise, white-beaked dolphin and killer whale with rarer sightings of blue whale, sei whale, sperm whale, Atlantic white-sided dolphin, and narwhal.

Most marine mammals are considered seasonal inhabitants of the Strait of Belle Isle Area and Conception Bay, with peak abundance in the Strait of Belle Isle Area occurring between May and August (Jacques Whitford 2000a). Migration by baleen whales into the waters around NL can begin as early as March, with most species beginning their southbound migration in October and November. Small toothed whales may occur in the Strait of Belle Isle Area year round, although numbers are greater in summer and fall. A number of the seal species found in the Strait of Belle Isle are associated strongly with ice and may be present in greater numbers during the winter months as well as during the spring and fall migrations.

Data compiled from several surveys (in 1995, 1996, and 2002) identified most observed marine mammal species using the Strait of Belle Isle regularly between May and December, with a few (harp seals, hooded seals and fin whales) using the Strait of Belle Isle between December and May (Lesage et al. 2007). Data such as those compiled by Lesage et al. (2007) indicate that the Strait of Belle Isle supports a diverse array of marine mammals due, at least in part, to persistent zooplankton aggregations that form the foundation of the food web (Sourisseau et al. 2006). Areas of cetacean activity in the Strait of Belle Isle have been identified between L'Anse au Clair and L'Anse au Loup and in the vicinity of Red Bay (Jacques Whitford 2000a). No such cetacean activity areas have been identified in Conception Bay.

The species of marine mammals may occur in the Strait of Belle Isle Area and Conception Bay are listed in Table 10.5.9-1; some of these species are only represented by historical records and may not occur in modern times (Sjare 2010, pers. comm. *in* Sikumiut 2010b; Jacques Whitford 2000a; Lewis and Doutt 1942). This section reviews the marine mammal species that are likely to occur in the Strait of Belle Isle Area and Conception Bay, including data on seasonality of occurrence. As previously mentioned, several marine mammal species, particularly those of the Order Cetacea are listed as SSCC. Table 10.5.9-1 also indicates the designation by COSEWIC and *SARA*.

Table 10.5.9-1 Marine Mammal Species Known or may Potentially Occur in the Strait of Belle Isle Area and Conception Bay

Common Name and Current COSEWIC / *SARA* Designation	Scientific Name	Season of Occurrence
Order Cetacea (Suborder Mysticeti – Baleen Whales)		
Blue whale (Endangered / Schedule 1, Endangered)	*Balaenoptera musculus*	Spring, summer, fall; possible some overwintering in Canadian waters (not in the Strait of Belle Isle Area or Conception Bay)
Fin whale (Special Concern / Schedule 1, Special Concern)	*Balaenoptera physalus*	Spring, summer, fall; possible some overwintering in Canadian waters (not in the Strait of Belle Isle Area or Conception Bay)
Humpback whale (Not at Risk / Schedule 3, Special Concern)	*Megaptera novaeangliae*	Spring, summer, fall
Minke whale (Not at Risk / Not listed)	*Balaenoptera acuterostrata*	Spring, summer, fall
Bowhead whale (Special Concern / No status)	*Balaena mysticetus*	Not likely to occur; historical presence only
North Atlantic right whale (Endangered / Schedule 1, Endangered)	*Eubalaena glacialis*	Not likely to occur; historical presence only
Sei whale (Data Deficient / Not listed)	*Balaenoptera borealis*	Summer
Order Cetacea (Suborder Odontoceti – Toothed Whales, Dolphins, Porpoises)		
Long-finned pilot whale (Not at Risk / Not listed)	*Globicephala melas*	Perhaps nearshore in summer; offshore in winter and spring
Beluga whale (Threatened / Schedule 1, Threatened) (St. Lawrence River population)	*Delphinapterus leucas*	Not likely to occur; extralimital
Narwhal (Special Concern / No status)	*Monodon monoceros*	Not likely to occur; extralimital
Killer whale (Special Concern / No status)	*Orcinus orca*	Summer; possibly year-round
Sperm whale (Not at Risk / Not listed)	*Physeter macrocephalus*	Summer
Harbour porpoise (Special Concern / Schedule 2, Threatened)	*Phocoena phocoena*	Spring, summer
Atlantic white-sided dolphin (Not at Risk / Not listed)	*Lagenorhynchus acutus*	Spring, summer, fall; possible some overwintering in Canadian waters (not in the Strait of Belle Isle Area or Conception Bay)
Short-beaked common dolphin (Not at Risk / Not listed)	*Delphinus delphis*	Summer, fall
White-beaked dolphin (Not at Risk / Not listed)	*Lagenorhynchus albirostris*	Spring, summer, fall; possible some overwintering in Canadian waters (not in the Strait of Belle Isle Area or Conception Bay)
Sowerby's Beaked Whale (Special Concern / Schedule 1, Special Concern)	*Mesoplodon bidens*	Not likely to occur; extralimital
Order Carnivora (Family Phocidae – Seals; Family Odobenidae – Walrus)		
Gray seal (Not at Risk / Not listed)	*Halichoerus grypus*	Spring, summer, fall
Harbour seal (Not at Risk / Not listed)	*Phoca vitulina*	Spring, summer, fall

Table 10.5.9-1 Marine Mammal Species Known or may Potentially Occur in the Strait of Belle Isle Area and Conception Bay (continued)

Common Name and Current COSEWIC / *SARA* Designation	Scientific Name	Season of Occurrence
Harp seal (Not evaluated / Not listed)	*Pagophilus groenlandicus*	Winter, spring
Hooded seal (Not at Risk / Not listed)	*Cystophora cristata*	Winter, spring
Bearded seal (Data Deficient / Not listed)	*Erignathus barbatus*	Not likely to occur; extralimital
Atlantic walrus (Special Concern / No status)	*Odobenus rosmarus rosmarus*	Not likely to occur; extralimital

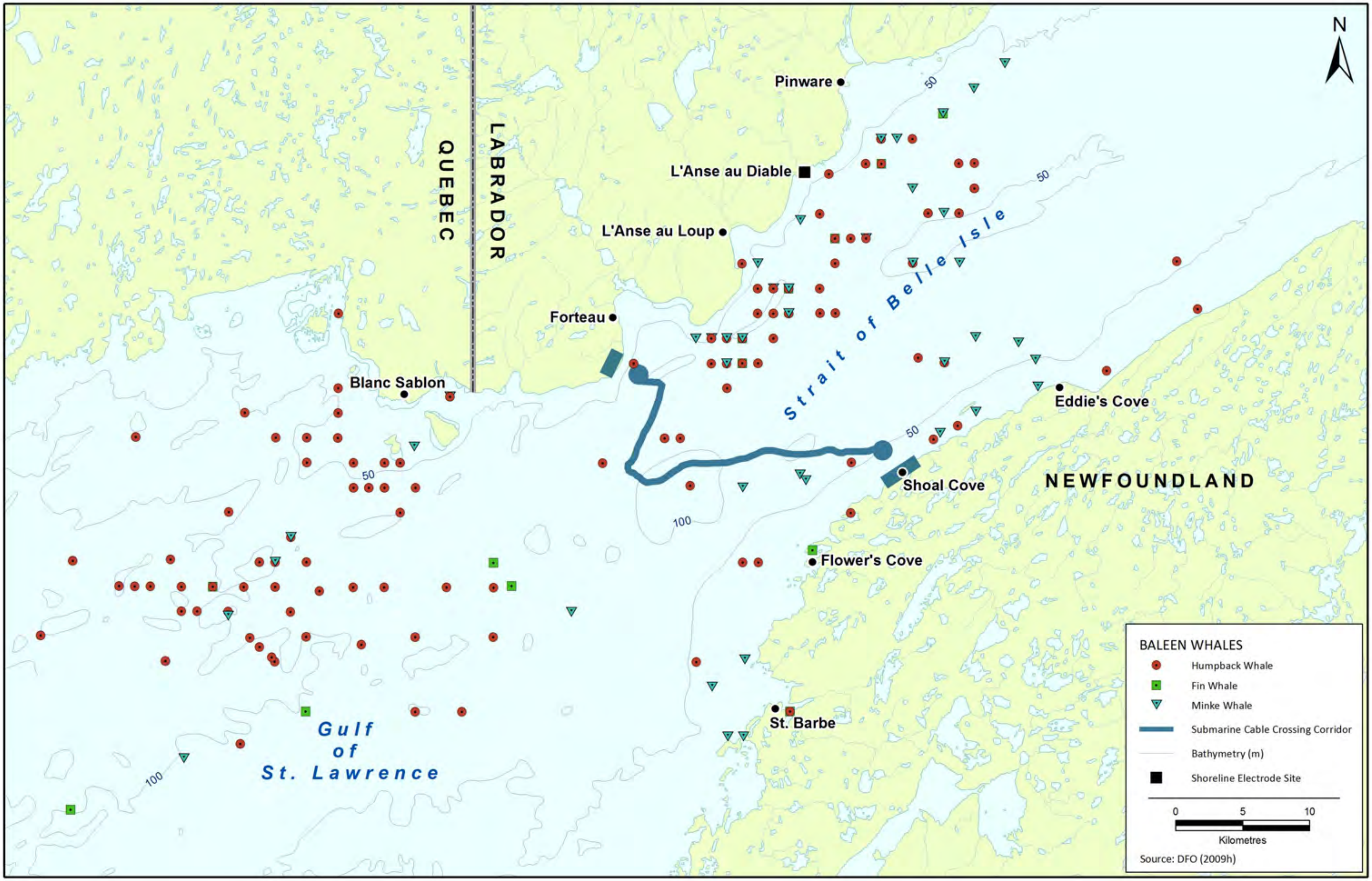
Notes: See text for references. COSEWIC = Committee on the Status of Endangered Wildlife in Canada. *SARA* = *Species at Risk Act*.

Due to the wide-ranging nature of marine mammals (cetaceans and pinnipeds), population and distribution information available for each species frequently covers north-western Atlantic data sources. Species are generally so wide-ranging that it is not possible to isolate particular bays, straits or regional seas and present population and distribution data in all but the most general terms, although some species do show site fidelity in their use of habitat.

Figure 10.5.9-1, Figure 10.5.9-2, Figure 10.5.9-3 and Figure 10.5.9-4 provide sighting data from the DFO Cetacean Database for the period 1864-2008 (DFO 2009j) for baleen whales, large toothed whales, delphinids and unidentified whales, respectively, for the Strait of Belle Isle Area, while Figure 10.5.9-5, Figure 10.5.9-6, Figure 10.5.9-7 and Figure 10.5.9-8 provide sighting data for these same groups for Conception Bay.

The data for the Strait of Belle Isle Area represent approximately 3,000 individual records, all but five occurring post-1945. The data for Conception Bay represent approximately 2,900 records, all but 10 occurring post-1960 (DFO 2009j). As noted by DFO in St. John's (Lawson 2009, pers. comm.), these data can be used to indicate what species have occurred in a given region, but cannot provide fine-scale descriptions or predictions of abundance or distribution. A number of caveats should be noted when considering these DFO cetacean sighting data, and include:

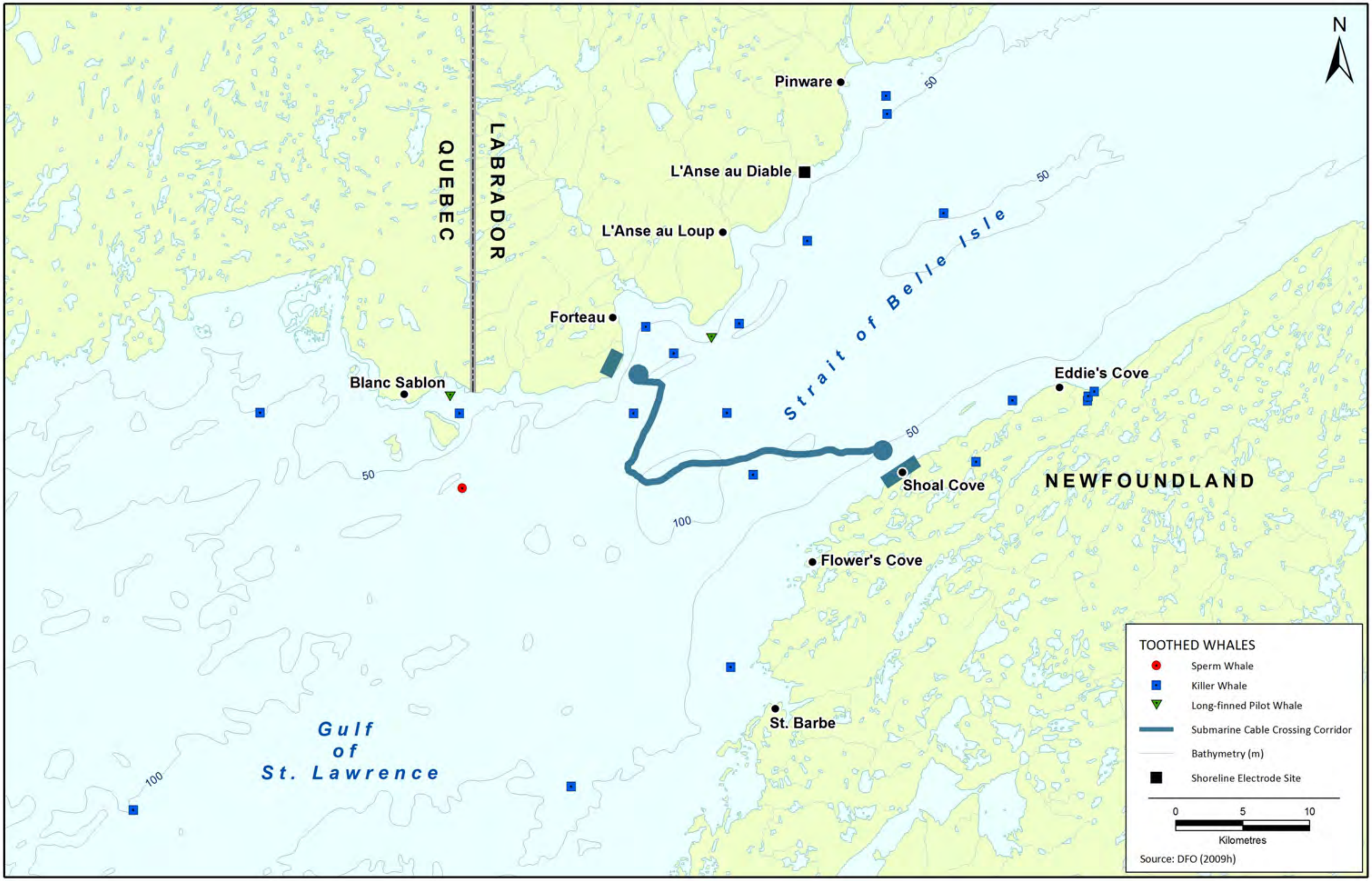
- The sighting data have not yet been completely error-checked.
- The quality of some of the sighting data is unknown.
- Most data have been gathered from platforms of opportunity that were vessel-based. The inherent problems with negative or positive reactions by cetaceans to the approach of such vessels have not yet been factored into the data.
- Sighting effort has not been quantified (i.e., the numbers cannot be used to estimate true species density or abundance for an area).
- Both older and some more recent survey data have yet to be entered into this database. These other data will represent only a very small portion of the total data.
- Numbers sighted have not been verified (especially in light of the significant differences in detectability among species).
- For completeness, these data represent an amalgamation of sightings from a variety of years and seasons. Effort (and number of sightings) is not necessarily consistent among months, years, and areas. There are large gaps between years. Thus seasonal, depth, and distribution information should be interpreted with caution.
- Many sightings could not be identified to species, but are listed to the smallest taxonomic group possible.



nalcor energy

FIGURE 10.5.9-1

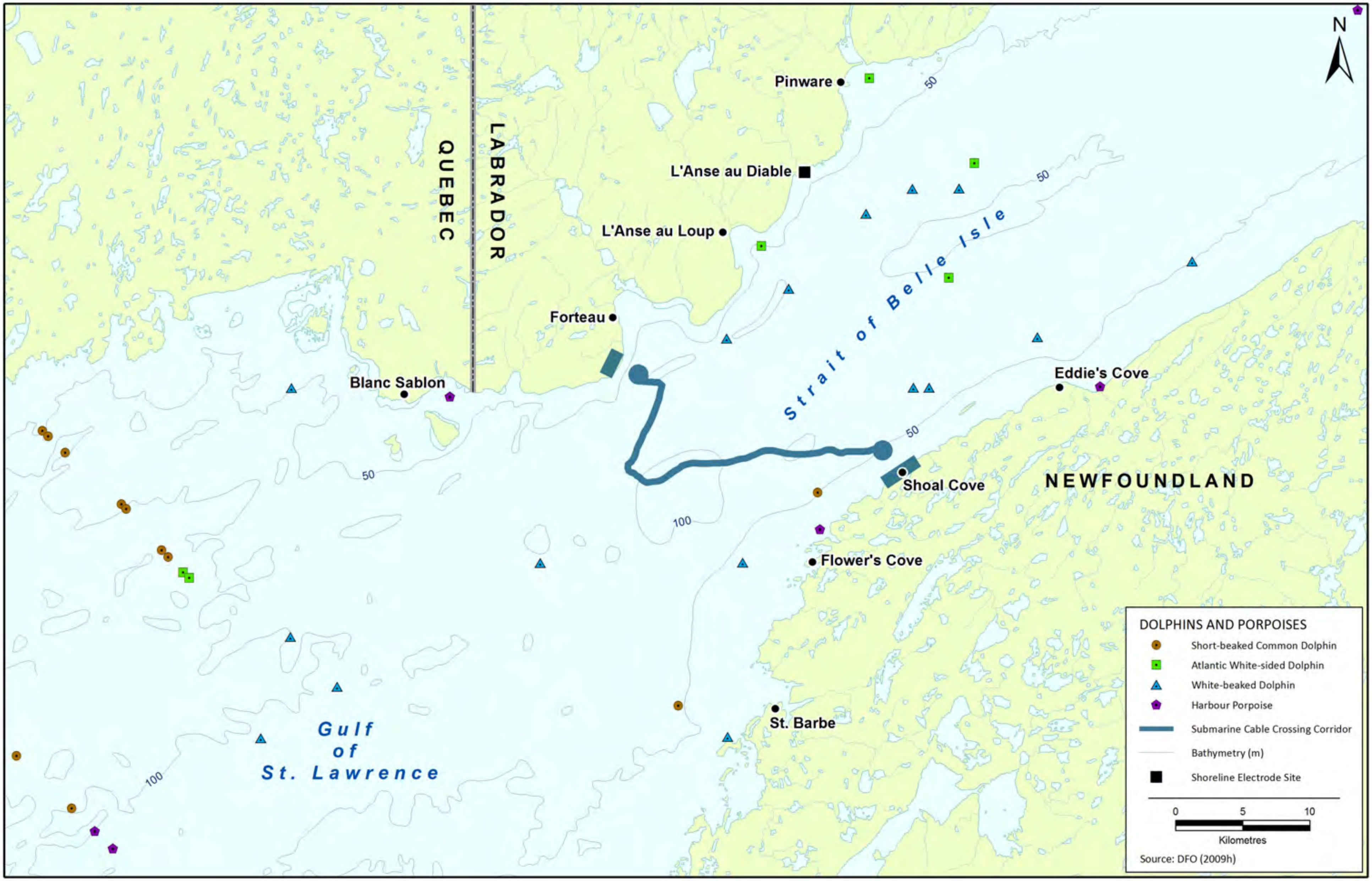
Historical Observations of Baleen Whales in the Strait of Belle Isle Area



nalcor energy

FIGURE 10.5.9-2

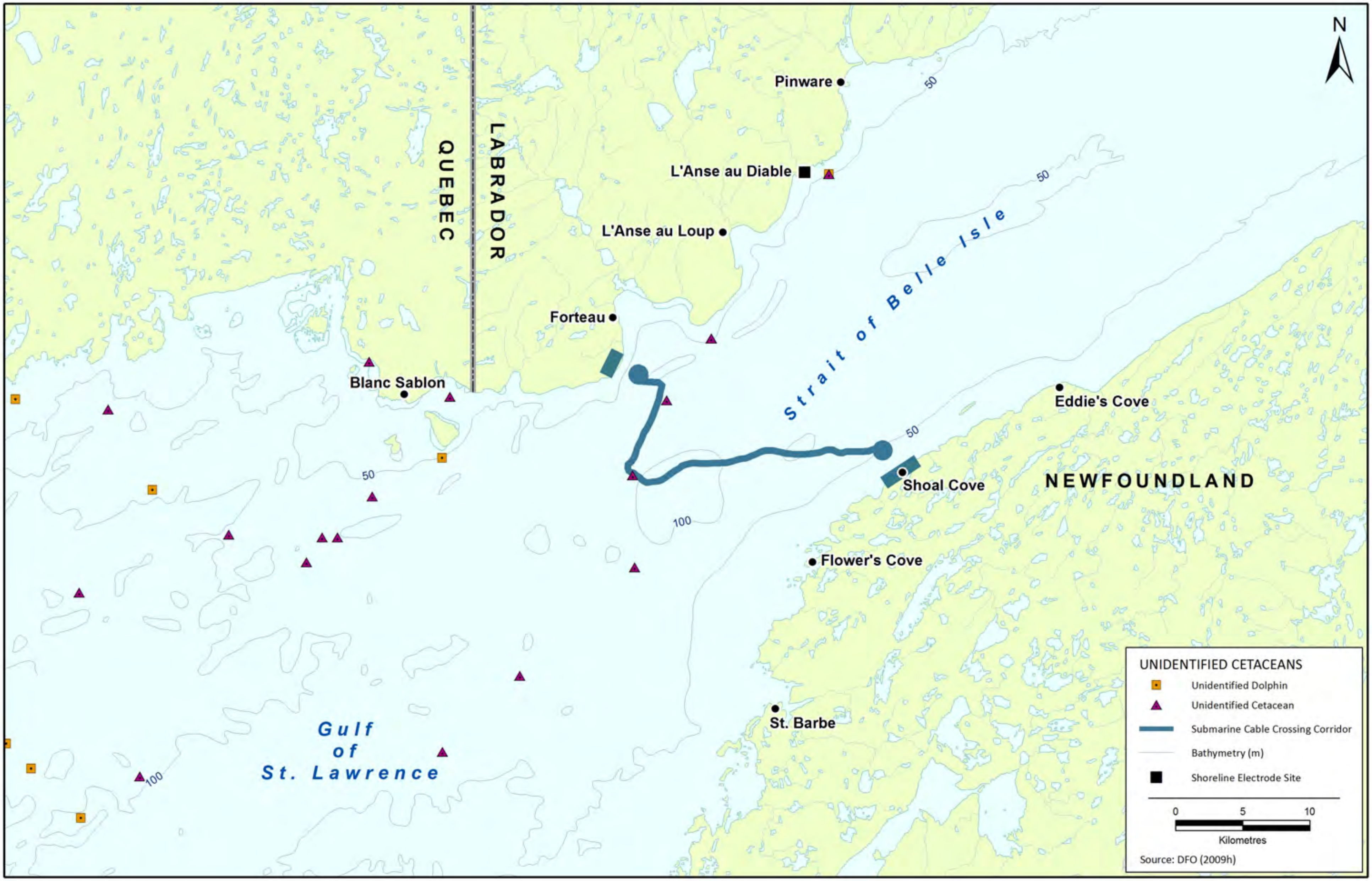
Historical Observations of Toothed Whales in the Strait of Belle Isle Area



nalcor energy

FIGURE 10.5.9-3

Historical Observations of Dolphins and Porpoises in the Strait of Belle Isle Area



nalcor energy

FIGURE 10.5.9-4

Historical Observations of Unidentified Cetaceans in the Strait of Belle Isle Area

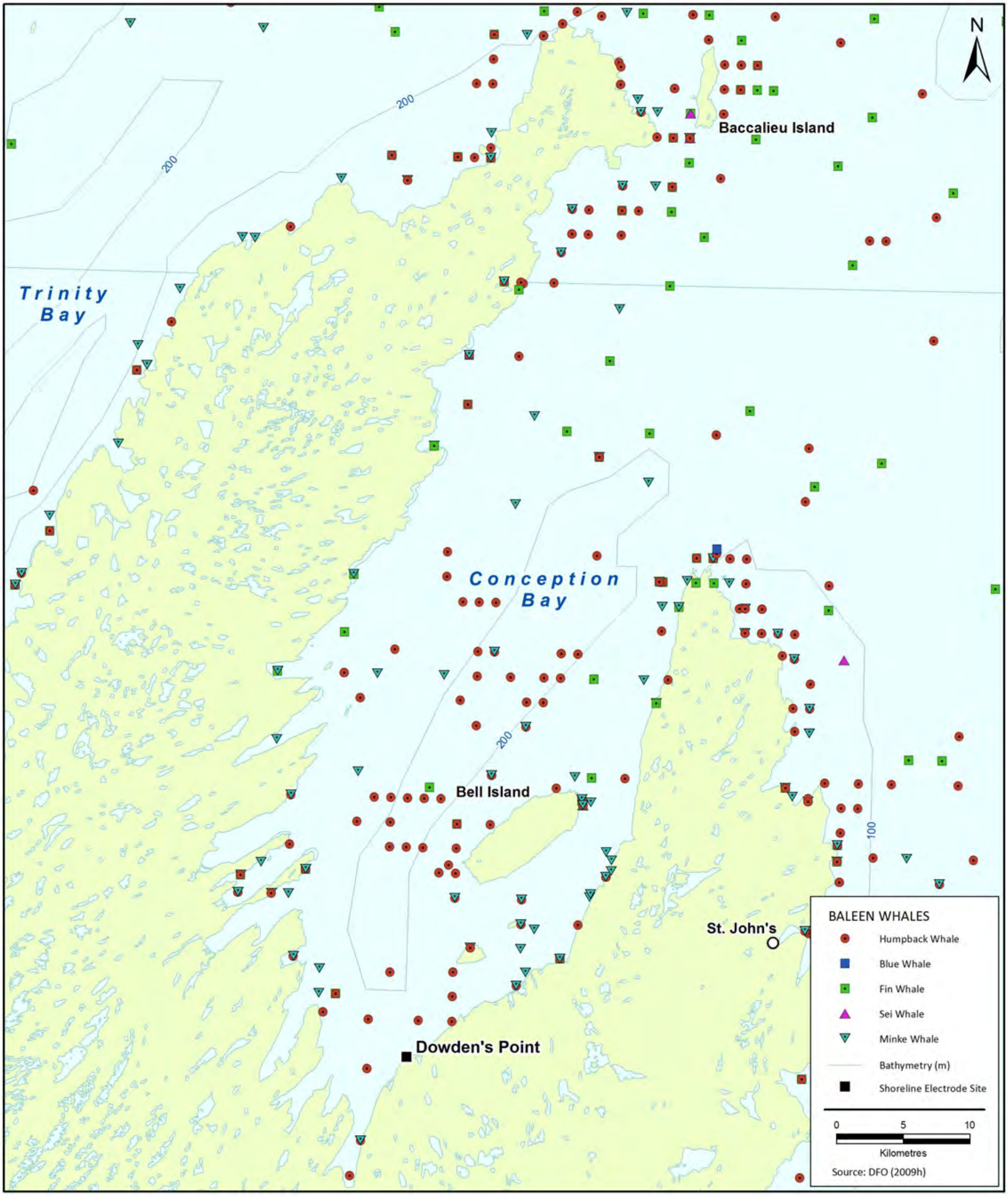


FIGURE 10.5.9-5

Historical Observations of Baleen Whales in Conception Bay, Newfoundland

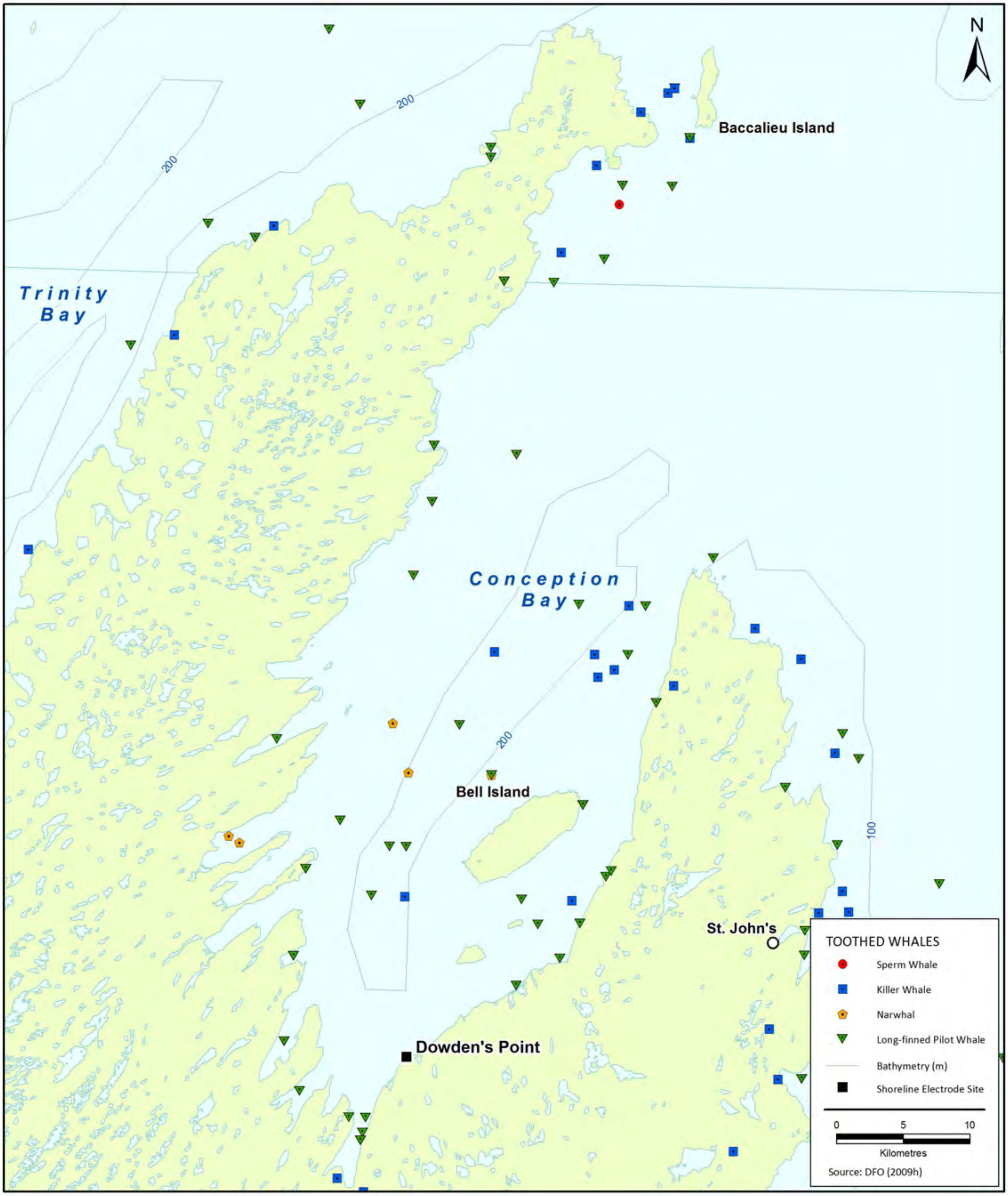


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FIGURE 10.5.9-6

Historical Observations of Toothed Whales in Conception Bay, Newfoundland

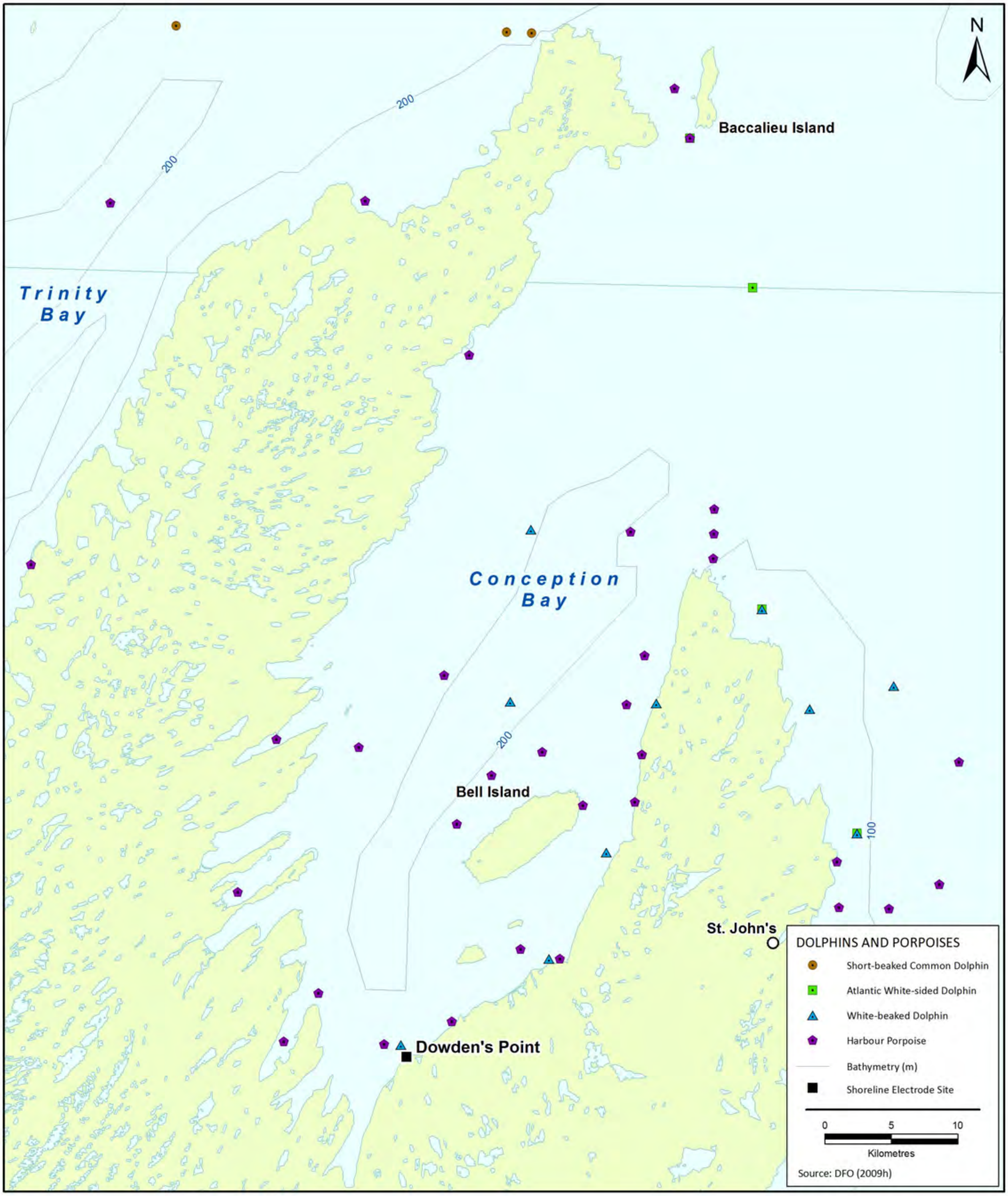

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FIGURE 10.5.9-7

Historical Observations of Dolphins and Porpoises in Conception Bay, Newfoundland

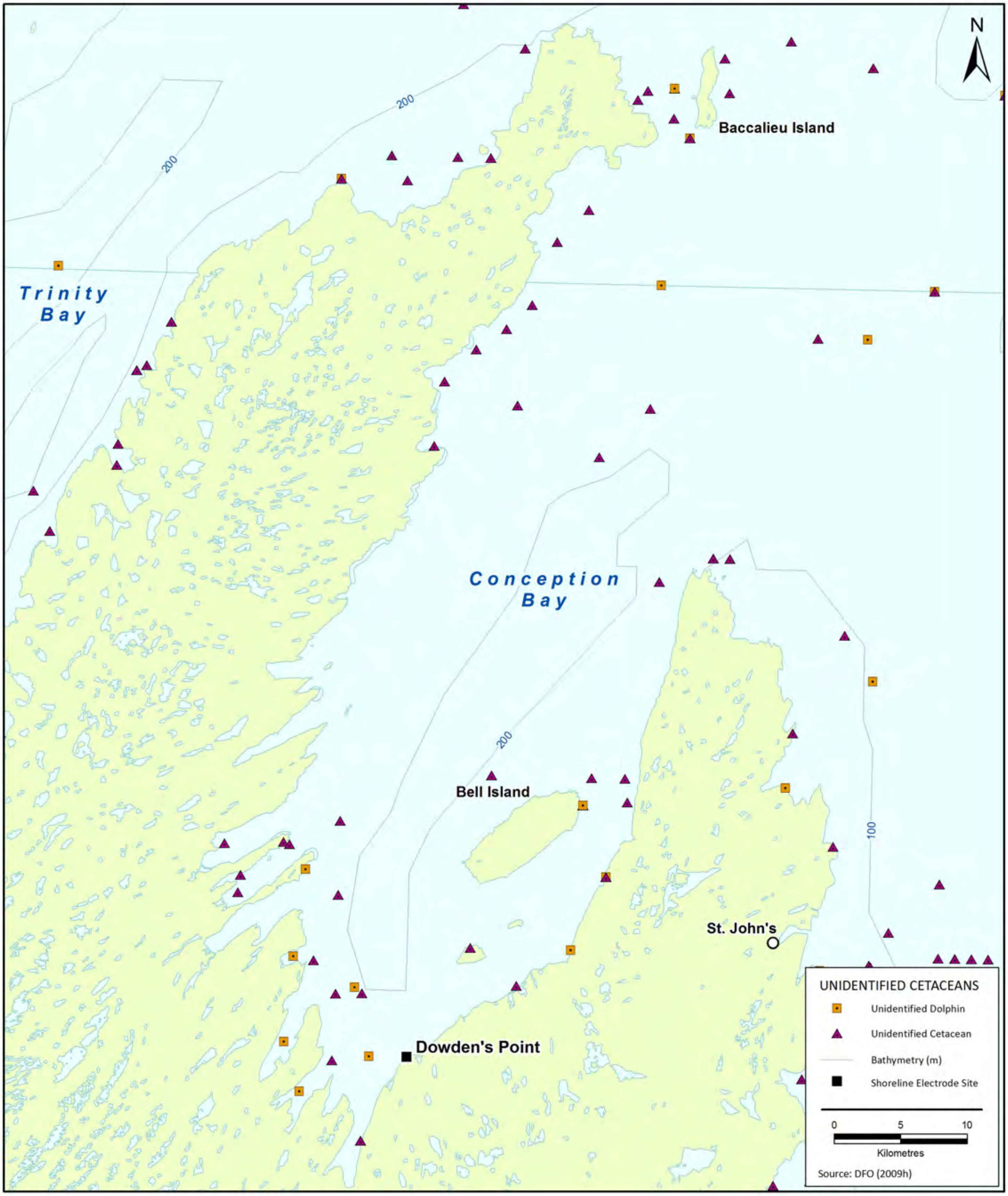


FIGURE 10.5.9-8

Historical Observations of Unidentified Cetaceans in Conception Bay, Newfoundland

Mysticetes

Most baleen whales that occur in the northern hemisphere feed in higher latitudes in the summer months, moving south for the winter to mate and calve (Davis and Browne 1996, internet site). Stranding data from Sable Island, Nova Scotia indicates that some species that migrate south in winter could occur in low numbers in Atlantic Canada outside of the summer months, although similar data for the Strait of Belle Isle Area are not available (Lucas and Hooker 2000).

Baleen whales are frequently sighted in the Strait of Belle Isle Area. A number of the species expected to be present have been assessed by COSEWIC and are listed under the *SARA* (Table 10.5.9-1). Historically, bowhead whales occurred in the Strait of Belle Isle, but there are no modern reports documenting their presence and reports of North Atlantic right whales caught in the Strait of Belle Isle are questionable (Rastogi et al. 2004).

North Atlantic right whales and bowhead whales are not expected to be present in either the Strait of Belle Isle or Conception Bay, and therefore, they are not considered further in this review. Sei whales have been reported historically in the Strait of Belle Isle Area, but encounters are considered rare. Sei whales have been observed on numerous occasions in Conception Bay.

Mysticete sightings in the Strait of Belle Isle Area are presented in Figure 10.5.9-1 and unidentified species in Figure 10.5.9 4.

Mysticete sightings in Conception Bay are presented in Figure 10.5.9-5 and unidentified species in Figure 10.5.9-8.

Blue Whale

The blue whale is a wide-ranging species found in all the world's oceans except the Arctic Ocean. It is listed by both the International Union for Conservation of Nature (IUCN) and COSEWIC as Endangered (IUCN 2010, internet site; COSEWIC 2002) and was added to the *SARA* list as an endangered species (Schedule 1) in January 2005 (Beauchamp et al. 2009). The most recent recovery strategy for the Northwest Atlantic population of blue whales was issued in 2009 (Beauchamp et al. 2009).

In the Northwest Atlantic, blue whales are found from the Scotian Shelf to the Davis Strait (National Marine Fisheries Service 1998). The winter distribution is not well known, but they do occur in the southern North Atlantic (Reeves et al. 2004). Some overwintering in the Gulf of St. Lawrence may occur (Jacques Whitford 2000a) and during March and April, they frequent the south-west coast of Newfoundland and the Gulf of St. Lawrence to feed on krill (Jacques Whitford 2000a). During the summer months, blue whales feed exclusively on euphausiids, feeding at depth and on the surface. Blue whales are observed in coastal waters as well as in the open ocean. They are frequently seen in estuaries and shallow coastal zones where the mixing of waters results in the high productivity of krill (SARA 2011, internet site).

Blue whales can be found in Atlantic Canada in spring, summer and fall, usually distributed along the north shore of the Gulf of St. Lawrence, from the St. Lawrence River estuary to the Strait of Belle Isle (COSEWIC 2002). Approximately 400 blue whales have been photo-identified during surveys in the Gulf of St. Lawrence to the west of the Strait of Belle Isle (Ramp et al. 2006). Each year, 20 to 105 blue whales are identified in the Gulf of St. Lawrence (Beauchamp et al. 2009). The current size of the Northwest Atlantic population is unknown, but is unlikely to exceed 250 sexually mature animals (Beauchamp et al. 2009).

Although the north shore of the Gulf of St. Lawrence, from the estuary to the Strait of Belle Isle, is recognized as an area of relatively frequent blue whale sightings during spring, summer and fall (Mansfield 1985), blue whale sightings have been infrequently reported in the literature or during the 1998 surveys (Jacques Whitford 2000a) when three blue whales were observed near Blanc-Sablon. Jasco (2011b) identified sound recordings that they determined to be blue whales from the Newfoundland acoustic stations deployed in the Strait of Belle Isle during four days in July. No blue whale vocalizations were identified during the October to December deployment (Jasco 2011b).

While some blue whales could occur in the Strait of Belle Isle Area, their numbers are likely to be low and their presence sporadic. No blue whales have been recorded within Conception Bay (based on DFO data), although one sighting is documented just off Grates Cove (Figure 10.5.9-5).

Fin Whale

The IUCN lists the fin whale as Near Threatened (IUCN 2010, internet site) and it is considered of Special Concern in Canada (COSEWIC 2005, internet site) and is on Schedule 1 (Special Concern) under the *SARA* (SARA 2011, internet site); the most recent assessment and status report on fin whales in Canadian waters was prepared in 2005 (COSEWIC 2005, internet site).

The fin whale occurs worldwide. In the Northwest Atlantic, the species ranges from Davis Strait and Baffin Bay south to the Canary Islands and Antilles (Perry et al. 1999; Rice 1998). Their primary summer range is from Cape Hatteras, North Carolina, northward. Detailed population information is not available for the stock of fin whales that occurs in the waters off NL but estimates are 1,013 (95% Confidence Interval: 459-2,654) off Newfoundland in 2003 (International Whaling Commission 2007) and 2,814 (Coefficient of Variation: 0.21) for the waters off the east coast of North America from the Gulf of St. Lawrence southward (Anonymous 2005, internet site).

Fin whales regularly occur in the Gulf of St. Lawrence (Lesage et al. 2007), but their overall abundance in the area is low, estimated at the low 100s (Kingsley and Reeves 1998; Mitchell 1974). Surveys have reported fin whales in the northern and north-eastern Gulf of St. Lawrence (Lesage et al. 2007) and six whales were seen during surveys in summer 2007 (Lawson and Gosselin 2009). Lesage et al. (2007) reported an uncorrected estimate of 347 individuals for the Gulf of St. Lawrence. Fin whales are known to occur in the St. Lawrence Estuary during the ice-free period until at least January and in the northern Gulf during the ice-covered period (Lesage et al. 2007); some whales may winter off Nova Scotia. There are reports of fin whales being trapped in ice in the historical literature (Sergeant et al. 1970). During the summer, fin whales favour areas with dense prey concentrations, including shallow areas with high topographic relief and are often associated with oceanic fronts (COSEWIC 2005, internet site).

Sightings in the Strait of Belle Isle Area during the 1998 surveys were infrequent (Jacques Whitford 2000a) but fin whales have been observed throughout the Strait of Belle Isle (Figure 10.5.9-1). In 2010, Jasco (2011b) documented fin whale calls from the Labrador and Middle stations. Detections occurred from July 1 to August 16. During the second deployment, calls were detected from September 30 to November 8, and again on November 27. Fin whales have also been observed within Conception Bay (Figure 10.5.9-5).

Sei Whale

The Atlantic population of the sei whale is considered by COSEWIC as Data Deficient (COSEWIC 2004a) and this population is not listed under the *SARA* (SARA 2011, internet site). The IUCN lists the species as Endangered (IUCN 2010, internet site).

The sei whale has a cosmopolitan distribution, and prefers temperate oceanic waters (Gambell 1985). Sei whales are known for their high mobility and unpredictable appearances (Reeves et al. 1998). Incursions into nearshore waters of the Gulf of Maine, associated with high copepod densities, are well documented (Schilling et al. 1992; Payne et al. 1990). The species undertakes seasonal migrations from subpolar higher latitudes in the summer to lower latitudes in winter (Perrin et al. 2002).

No reliable population estimates are available for sei whales. An estimate from the 1970s for the Nova Scotia stock suggested a minimum population of 870 individuals (Mitchell and Chapman 1977). The marine mammal surveys conducted in 1998 identified two probable sei whales in August, but could not confirm their identification (Jacques Whitford 2000a). This is because fin and sei whales are often hard to distinguish in the field.

Limited historical sightings of sei whales in the Strait of Belle Isle Area have been documented (Sikumiut 2010a) and sightings are considered rare. A single sei whale call was detected during the acoustic programme in the Strait of Belle Isle Area in the summer 2010 on July 4 at the Middle station (Jasco 2011b). It was not detected during the second deployment period of September to December (Jasco 2011b). There have been a few sightings of sei whales in Conception Bay (Figure 10.5.9-5) but given the difficulties of identifying this species in the field, those sightings should be interpreted with caution. Sei whales may be present in both the Strait of Belle Isle Area and Conception Bay but they likely occur in low numbers.

Minke Whale

The species is designated Not at Risk in Canada (COSEWIC 2006b) and has no status under the *SARA* (SARA 2011, internet site); minke whales are considered Least Concern by the IUCN (IUCN 2010, internet site).

The minke whale is a common species, widespread in the world's oceans and occurs in coastal and offshore waters. While migration routes are poorly known, some portion of the population may overwinter in their summer range in the Northwest Atlantic, while others winter near Bermuda, the Bahamas and the Antilles and along the United States east coast south of 40°N.

Of the four stocks of minke whales recognized by the International Whaling Commission, the Canadian East Coast stock is the one found in the Strait of Belle Isle Area and Conception Bay. The entire North Atlantic population is estimated at 182,000. Surveys in Canadian waters provide the following population estimates: 1,000 in the Gulf of St. Lawrence, 3,000 in the Scotian Shelf and at least 5,000 in waters off NL (COSEWIC 2006b). In Newfoundland waters, a northward migration along the east coast results in peak numbers being observed in June and July and then again in October and November during the southward migration (Sergeant 1963). The minke whale is considered a highly coastal species and seldom ranges more than 160 km from land; it frequently enters bays and inlets (Nowak 1999). Minke whales prey on a variety of species, including krill (euphausiid spp.), herring and capelin, depending on availability (Mitchell 1974).

Jacques Whitford (2000a) reports that minke whales were common in the Strait of Belle Isle Area from May to August, with greatest abundance in July and August, coinciding with the arrival of capelin in the area. Jacques Whitford (2000a) estimated 200 minke whales in the Strait of Belle Isle Area during their boat and aerial surveys, with more minke whales observed on the Labrador side of the Strait of Belle Isle and an apparent concentration of animals between L'Anse Amour and Blanc-Sablon. Minke whale sightings in the Strait of Belle Isle Area are presented in Figure 10.5.9-1 while sightings from Conception Bay are provided in Figure 10.5.9-5. Minke whales are considered one of the most frequently observed cetacean species in both areas (along with humpback whales).

Humpback Whale

The Western North Atlantic population of humpback whales is classified as Not at Risk in Canada (COSEWIC 2003) and as Special Concern on Schedule 3 under the *SARA* (SARA 2011, internet site); humpback whales are listed as Least Concern by the IUCN (IUCN 2010, internet site). The species occurs in all of the world's major ocean basins (Clapham and Mead 1999) and all but the Arabian Sea subpopulation migrate between calving and mating grounds in tropical waters to feeding grounds in high latitudes.

The Western North Atlantic population of humpback whales spend the summers from the Gulf of Maine north to the Barents Sea, Greenland Sea and Davis Strait and this is the population found in Atlantic Canada waters. In winter, most of the animals migrate south to wintering grounds in the West Indies (IUCN 2010, internet site).

Feeding aggregations of humpback whales occur in the Gulf of St. Lawrence and eastern Newfoundland / southern Labrador where whales feed on capelin, herring, sand lance (Ammodytidae) and mackerel (Scombridae). Genetic and photo identification data indicate that these feeding aggregations represent relatively discrete subpopulations that are determined matrilineally (IUCN 2010, internet site) although common breeding grounds permit gene flow between groups.

Humpback whale sightings in the Strait of Belle Isle Area are quite common (Jacques Whitford 2000a; Figure 10.5.9-1) and they are regularly observed in the Gulf of St. Lawrence (Lawson and Gosselin 2009; Lesage et al. 2007) and frequently observed in Conception Bay (Figure 10.5.9-5). Humpback whale aggregations occur in the northern gulf and the Strait of Belle Isle / Mecatina Plateau (Lesage et al. 2007) from May to August (Jacques Whitford 2000a). The lower north shore of Québec and the Strait of Belle Isle are known as areas of relatively high humpback whale densities during the summer (Kingsley and Reeves 1998). Surveys conducted in the Strait of Belle Isle Area in 1998 estimated 60 humpback whales (Jacques Whitford 2000a), with the narrow section of the Strait of Belle Isle an area of particularly high density. Jacques Whitford (2000a) reported that humpback whales were most frequently observed near Belle Isle and from L'Anse au Loup to L'Anse au Clair. Lawson and Gosselin (2009) reported that humpback whales were sighted in the Strait of Belle Isle more often than any other species. Humpback whale calls were the most numerous marine mammal call identified during the summer 2010 acoustic program (Jasco 2011b) in the Strait of Belle Isle Area, with 1004 calls documented, in the June to August deployment period alone, and were present almost continuously. During the second deployment period (September to December) this species was also detected regularly (Jasco 2011b).

Humpbacks migrate south for the winter, although some animals are present through to January (Lesage et al. 2007). An estimated 2,500 individuals are thought to occur in the waters off Atlantic Canada (COSEWIC 2003; Whitehead 1987) and they have a high likelihood of occurring in both the Strait of Belle Isle Area and Conception Bay, with abundance peaking in August (Jacques Whitford 2000a).

Odontocetes

Nine species of odontocetes have been sighted in the Strait of Belle Isle Area or Conception Bay (Table 10.5.9-1). However, the narwhal records are the result of a single extralimital individual seen in 1988 in Conception Bay and one in 2003 that spent the spring and summer in the bay (see Figure 10.5.9-6; DFO 2009j). These sightings are considered to be so unusual that they are not discussed further.

A single sperm whale was observed in the Strait of Belle Isle Area in 1981 (DFO 2009j) and rare sightings have also been made near Conception Bay (Figure 10.5.9-6). Any sperm whales that are seen in the Strait of Belle Isle Area and Conception Bay are expected to be lone male animals, as females do not usually range north of 40 degrees latitude (Whitehead 2003; Griffin 1999). Due to the scarcity of sperm whale sightings, the species is not discussed further.

Large odontocete sightings for the Strait of Belle Isle (including killer whales) are presented in Figure 10.5.9-2 and delphinids and harbour porpoise sightings are shown in Figure 10.5.9-3. The locations of unidentified cetacean sightings are presented in Figure 10.5.9-4. Sightings for Conception Bay are shown in Figure 10.5.9-6, Figure 10.5.9-7, and Figure 10.5.9-8.

Long-finned Pilot Whale

The Atlantic long-finned pilot whale is a widespread species currently assessed as Not at Risk in Canada and it is not listed under the *SARA* (SARA 2011, internet site); it is listed as Data Deficient by the IUCN (IUCN 2010, internet site).

This species is found in temperate and subpolar regions (Olson and Reilly 2002) and is found in coastal and oceanic waters. In summer, pilot whales appear to follow their prey, squid and mackerel, into continental waters (Reeves et al. 2003). In the Northwest Atlantic, they are found over continental slopes in winter and spring, and over the shelf in summer and fall. Pilot whales are social and are often found in large pods of 20 to 100 individuals, although some groups are much larger (Perrin et al. 2002).

Pilot whales were historically common in the waters around Newfoundland during summer and were thought to remain through to late fall (Sergeant and Fisher 1957). Aerial surveys conducted offshore of eastern Newfoundland and south-eastern Labrador estimated the pilot whale population at 13,200 (Hay 1982) and more recent estimates are of a few thousand individuals in the Gulf of St. Lawrence (Waring et al. 2007; Abend and Smith 1999; Kingsley and Reeves 1998). Pilot whales are known to summer in coastal waters off southern Labrador and in the Gulf of St. Lawrence, moving offshore in winter (Sergeant and Fisher 1957).

In summer 1998 surveys in the Strait of Belle Isle Area, five pilot whales (Figure 10.5.9-2) were recorded (Jacques Whitford 2000a). It is uncertain how abundant pilot whales are in Conception Bay in recent years but they have historically occurred there (Figure 10.5.9-6).

Harbour Porpoise

The harbour porpoise found in Atlantic Canada belongs to the Northwest Atlantic population and is recognized as subspecies *P. p. phocoena*. The species is designated as Special Concern in Canada (COSEWIC 2006c, internet site), is listed under the *SARA* (Schedule 2) as Threatened (SARA 2011, internet site) and it is designated as Vulnerable by the IUCN (IUCN 2010, internet site).

Harbour porpoises are widely distributed over the continental shelves of the temperate northern hemisphere. Porpoises in Atlantic Canada range from the Bay of Fundy north to Cape Aston and south to North Carolina. Three discrete subpopulations are recognized in Atlantic Canada: (i) Newfoundland / Labrador; (ii) Gulf of St. Lawrence; and (iii) Bay of Fundy-Gulf of Maine. There are no reliable population estimates available for these populations, but total abundance is estimated at >50,000 individuals (COSEWIC 2006c, internet site).

Harbour porpoises are well adapted to cold waters and are rarely found in water warmer than 16°C. They favour waters <200 m deep (IUCN 2010, internet site). They occur in the coastal waters of Labrador and eastern and south-eastern Newfoundland during spring and summer but little is known about their wintering habitat. There is no evidence that they occur in the Gulf of St. Lawrence in winter (Lesage et al. 2007). They prey primarily on small fish and squid, including capelin, herring, hake (*Merluccius bilinearis*), and sand lance.

Harbour porpoise are often sighted in the Strait of Belle Isle (Lesage et al. 2007; Jacques Whitford 2000a) and Jacques Whitford (2000a) provided an estimated number of 5,580 based on extrapolating sighting data collected during sea state 1 across the Strait of Belle Isle, although this number may be high. Sighting data for the Strait of Belle Isle Area and Conception Bay are provided in Figure 10.5.9-3 and Figure 10.5.9-7, respectively.

Atlantic White-sided Dolphin

The Atlantic white-sided dolphin has been considered Not at Risk in Canada since 1991 and it is not listed under the *SARA* (SARA 2011, internet site). It is considered Least Concern by the IUCN (IUCN 2010, internet site).

The species is considered abundant throughout its range, with an estimated 51,640 dolphins off the eastern North American shoreline (Waring et al. 2006). There are no reliable estimates for the Gulf of St. Lawrence. Kingsley and Reeves (1998) provided highly variable estimates based on surveys conducted in August 1995 (when 12,000 animals were estimated) and then in July 1996 (when surveys recorded 500 animals).

Atlantic white-sided dolphins are found in cold temperate to subpolar waters in the North Atlantic (Cipriano 2002; Reeves et al. 1999) and range from the waters of the continental shelf and slope to deep ocean. Although often found in the deeper waters of the Gulf of St. Lawrence they also occur in the shallower waters of the Strait of Belle Isle and the St. Lawrence River (IUCN 2010, internet site). Calving occurs over a prolonged period during the summer, with peaks in June and July. Atlantic white-sided dolphins are often seen with other cetacean species, including large baleen whales; they feed on herring, mackerel, cod, smelt, hake, and sand lance.

While surveys suggest that the numbers of white-sided dolphins may vary widely from year to year, they can be considered regular visitors to the Strait of Belle Isle (Figure 10.5.9-3). Jacques Whitford (2000a) observed white-sided dolphins in the Strait of Belle Isle Area in August, September and October, with peak abundance in August. The acoustic survey in the Strait of Belle Isle Area undertaken in 2010 (Jasco 2011b) documented numerous marine mammal calls attributed to *Lagenorhynchus* species. Dolphin whistles were detected at all three stations with spatial variability over the recording period (i.e., the Newfoundland station had the most detections in early July, and the Labrador station had the most in August). Sightings have not been reported from Conception Bay, although white-sided dolphins have been observed beyond the mouth of the bay (Figure 10.5.9-7).

White-beaked Dolphin

White-beaked dolphins are considered Not at Risk in Canada (since 1998) and are not listed under the *SARA* (SARA 2011, internet site). The species is designated as Least Concern by the IUCN (2010, internet site).

White-beaked dolphins are found in cold temperate to subpolar waters in the North Atlantic. The species favours the continental shelf and offshore waters, although it is usually found in waters <100 m deep (Kingsley and Reeves 1998). They calve in summer and early autumn (May to September) and feed on a variety of pelagic schooling fish (Reeves et al. 1999).

Although considered abundant, there are few population estimates available (IUCN 2010, internet site) and numbers could exceed a hundred thousand animals (Reeves et al. 1999) with a few thousand in the waters off eastern Canada. Aerial surveys have documented the presence of white-beaked dolphins in the north-eastern portion of the Gulf of St. Lawrence and the Strait of Belle Isle (Lesage et al. 2007; Figure 10.5.9-3) in the summers of 1995, 1996 and 2002. The 1995-1996 surveys resulted in a population estimate of 2,500 for the Gulf of St. Lawrence.

Peak observations of these dolphins in the Strait of Belle Isle Area have been made in August and September (Jacques Whitford 2000a) when the animals are presumed to be beginning their southward migration. Jacques Whitford (2000a) reported 940 white-beaked dolphins observed during their summer 1998 boat surveys. The seasonal movements of this species are not well understood and ice entrapments and sightings along the Newfoundland coast indicate that at least some animals overwinter in Newfoundland waters (Lesage et al. 2007; Hai et al. 1996).

The acoustic survey undertaken in 2010 (Jasco 2011b) documented 519 marine mammal calls in the Strait of Belle Isle Area attributed to *Lagenorhynchus* species. Dolphin whistles were detected at all three stations with spatial variability over the recording period (i.e., the Newfoundland station had the most detections in early July, and the Labrador station had the most in August). Several sightings of this species have occurred inside Conception Bay (Figure 10.5.9-7), mainly along the east coast of the bay.

Short-beaked Common Dolphin

The short-beaked common dolphin is considered Not at Risk in Canada (since 1991) and it is not listed under the *SARA* (SARA 2011, internet site); the species is designated as Data Deficient by the IUCN (IUCN 2010, internet site).

Short-beaked common dolphins are an oceanic species that are widely distributed across tropical and cool temperate waters (Perrin 2002). It can be found nearshore and far offshore. Common dolphins appear to favour areas with steep sea floor relief and upwelling-modified waters (Evans 1994). They feed on schooling fish and squid (Perrin 2002).

The species is considered to be abundant, with 121,000 estimated in the western North Atlantic (Waring et al. 2006). Published data indicates that short-beaked common dolphins were found in Canadian waters during summer and fall but were absent from the St. Lawrence Estuary and Gulf of St. Lawrence (Waring et al. 2007). However, surveys in 2002 and a stranding in 2005 demonstrate that the species is found in the Gulf (Lesage et al. 2007) and the Strait of Belle Isle. Lesage et al. (2007) reported a total of 243 individuals observed in the Gulf of St. Lawrence.

Data presented in Figure 10.5.9-3 shows several sightings of short-beaked dolphins in the Strait of Belle Isle Area, but none within Conception Bay (Figure 10.5.9-7), although they have been recorded east and north of the bay

Killer Whale

The killer whale is listed as Data Deficient by the IUCN (IUCN 2010, internet site) while the Northwest Atlantic / Eastern Arctic population is assessed as Special Concern in Canada (COSEWIC 2008); killer whales have no status under the *SARA* (SARA 2011, internet site).

Killer whales are widespread. They can be found in most marine regions of the world, although they are more common in nearshore areas and in higher latitudes (Forney and Wade 2006; Dahlheim and Heyning 1999). Killer whales feed on a wide range of species, including baleen whales, seabirds, turtles, fish and cephalopods (Ford 2002; Dahlheim and Heyning 1999; Ford and Ellis 1999), although prey selection is often determined by location and group preference.

Killer whales occur throughout the waters of eastern Canada including the Gulf of St. Lawrence and the Strait of Belle Isle (Figure 10.5.9-2; Lesage et al. 2007; Jacques Whitford 2000a). Pods of killer whales range over wide areas but they do not show seasonal north - south migrations as do many other species of cetaceans (Mitchell and Reeves 1988; Reeves and Mitchell 1988) and they can tolerate significant ice cover.

There are no reliable estimates of killer whale populations in the Northwest Atlantic, but a minimum of 64 individuals in the waters off NL have been added to a photo-identification catalogue (Lawson et al. 2007). Observations of killer whales during aerial and boat-based surveys in the Gulf of St. Lawrence have been sporadic, but it is not clear if this is due to their low density, absence, or if it is related to the study design (Lesage et al. 2007). Most killer whales recorded in the Strait of Belle Isle were observed between June and September (Figure 10.5.9-2).

Jacques Whitford (2000a) report that killer whales occur in the Strait of Belle Isle infrequently but on a recurring basis. Acoustic surveys conducted in summer 2010 in the Strait of Belle Isle Area documented numerous marine mammal calls attributed to killer whales (Jasco 2011b). Killer whale calls were detected at all three stations, but more consistently at the Middle station from late June to early July (Jasco 2011b). During the second deployment period from September to December, no killer whales were detected (Jasco 2011b). Killer whales have been observed in Conception Bay (Figure 10.5.9-6), again on an infrequent but recurring basis.

Beluga Whale

Although almost exclusively a cold water, Arctic species, the southern distribution limit for beluga whales occurs in the St. Lawrence Estuary (O'Corry-Crowe 2002). The St. Lawrence Estuary population is considered Threatened in Canada (COSEWIC 2004b, internet site) and is listed as Threatened (Schedule 1) under the *SARA* (SARA 2011, internet site). The estimated population is 900-1,300 individuals (COSEWIC 2004b, internet site). This population is concentrated in the St. Lawrence Estuary, with the primary summer concentration centred around the Saguenay River mouth approximately 1,000 km from the Strait of Belle Isle Area. The population is largely sedentary and the animals do not make long-distance migrations.

There have been five sightings of beluga whales offshore near St. Lunaire, Newfoundland and L'Anse au Loup, Labrador between 1985 and 1993 (Jacques Whitford 2000a), although not all have been verified. It is assumed that these animals were vagrants from the St. Lawrence Estuary population (Jacques Whitford 2000a). A beluga sighting was also reported in 2007 (Lawson and Gosselin 2009); however, sightings in the Strait of Belle Isle are rare. A few lone juvenile beluga whales have been sighted off the north-west coast of Newfoundland but these sightings are considered unusual (Lesage et al. 2007). The majority of beluga remain in the St. Lawrence Estuary during the summer, with many remaining throughout the year. The area from Pointe-des-Monts to Sept-Iles is considered to be an important wintering area for this population (Lesage et al. 2007).

Recent observations indicate that larger groups of this species move around the Northern Peninsula and could be encountered in the Strait of Belle Isle or use it as a migratory pathway (Stantec 2012c).

Based on the above information, there is a low likelihood that beluga whales will occur within the Strait of Belle Isle Area or Conception Bay.

Pinnipeds

Six species of pinnipeds have been reported in or in close proximity to the Strait of Belle Isle Area: harp seal, gray seal, harbour seal, hooded seal, bearded seal, and Atlantic walrus. The latter two species are considered extralimital with sightings expected to be extremely unlikely (and in the case of walrus, historical) (Sjare 2010, pers. comm. *in* Sikumiut 2010b; Lewis and Doutt 1942) and they are not discussed further.

Sightings of harp seal, gray seal and harbour seal are possible in Conception Bay (largely based on broad distribution data due to the lack of published surveys for Conception Bay (Perrin et al. 2002; Nowak 1999; Riedman 1990)).

Harp Seal

The harp seal is the most abundant seal in the Gulf of St. Lawrence, with an estimated population of nearly 2 million (Lesage et al. 2007). The total Northwest Atlantic population is estimated at 6.85 million seals in 2009 (Hammill and Stenson 2010), with close to 8 million worldwide (IUCN 2010, internet site). Due to its large population size, the species is not listed in Canada (SARA 2011, internet site) and not listed under the *SARA*; this species is considered Least Concern by the IUCN (IUCN 2010, internet site).

Harp seals are widespread in the North Atlantic and Arctic Ocean, ranging from northern Hudson Bay and Baffin Island to the western North Atlantic and the Gulf of St. Lawrence; vagrants have been reported as far south as Virginia (Rice 1998; Scheffer 1958). Harp seals aggregate in large herds to give birth from late February to April (Lavigne and Kovacs 1988) and pups on born on the ice and are nursed for 12 days before weaning (Lydersen and Kovacs 1996; Kovacs et al. 1991; Kovacs 1987; Kovacs and Lavigne 1985). Females mate as lactation is drawing to a close. Moulting takes place from early April to early May (Lavigne and Kovacs 1988). Harps seals are migratory, and after breeding their movements follow the ice north; annually a seal may travel more than 5,000 km (Lavigne and Kovacs 1988). Harp seals feed heavily in winter and summer (on a wide range of fish and invertebrate prey), and less so in spring and fall.

Harp seals occur in the Gulf of St. Lawrence between January and May and in the Strait of Belle Isle Area between December and May (Lesage et al. 2007; Stenson et al. 2003; Jacques Whitford 2000a). Harp seal herds were observed in association with pack ice in the Strait of Belle Isle Area in 1981 and 1982 (Jacques Whitford 2000a). In 1998, densities of harp seals increased in the Strait of Belle Isle after November, as animals migrated through the Strait in winter to breeding grounds near the Magdalen Islands; densities increased in spring (June) as they migrated to the Labrador and Greenland coasts (Jacques Whitford 2000a).

Resource status assessments have been conducted for harp seals, including in the Strait of Belle Isle and have provided pup production estimates (Stenson et al. 2010, 2005, 2003, 2002). Harp seals have been observed using the pack ice in the Strait of Belle Isle Area for whelping (Sjare 2010, pers. comm. *in* Sikumiut 2010b). After whelping, animals move with the ice south into the Gulf of St. Lawrence or migrate through the Strait of Belle Isle to the north-east (Lesage et al. 2007). By-catch of harp seals in the lumpfish fishery in the Gulf of St. Lawrence between April and July indicates that at least some seals occur in the Gulf of St. Lawrence during the ice-free season (Sjare et al. 2005).

There is a high likelihood that harps seals will occur within the Strait of Belle Isle Area during both the ice-covered and ice-free seasons and could include breeding and non-breeding animals, adults and juveniles. Based on the known distribution of harp seals (Perrin et al. 2002; Nowak 1999; Riedman 1990), some animals could occur in Conception Bay during the ice-covered season but whelping areas are not found near the bay.

Gray Seal

Gray seals are found in continental shelf waters including the Gulf of St. Lawrence and are considered Not At Risk in Canada since 1999 (SARA 2011, internet site) and are not listed under the *SARA;* this species is designated as Least Concern by the IUCN (IUCN 2010, internet site).

Gray seals are the second most abundant seal species in the Gulf of St. Lawrence (behind the harp seal), with an estimated 52,000 individuals entering the Gulf to breed in 2004 (Bowen et al. 2007; Trzchinski et al. 2006; Hammill and Gosselin 2005). This represents one-fifth of the Northwest Atlantic population, based on pup counts in whelping areas. The all-age population in Canadian waters (including two main stocks in the Gulf of St. Lawrence and at Sable Island) is approximately 250,000 (DFO 2006d); the Sable Island population is growing while that in the Gulf of St. Lawrence is reportedly in decline (Bowen et al. 2007; Hammill et al. 2007).

The seals occur in the waters off Newfoundland, including the Strait of Belle Isle Area for moulting, feeding and breeding (Waring et al. 2007; Hammill and Gosselin 2005; Beck et al. 2003; Lavigueur and Hammill 1993; Lavigueur et al. 1993; Stobo et al. 1990; Mansfield and Beck 1977) and are strongly associated with exposed reefs, rocky ledges and sand banks that are used as haul-out habitat. While diet varies by location, favoured prey includes sand eels, Atlantic cod, herring and capelin. Gray seals give birth and mate in January (pupping can occur on land or ice) and moult during May and June (Stobo et al. 1990). Haul-out sites have been noted in the Strait of Belle Isle Area, and Jacques Whitford (2000a) observed gray seals in low numbers during September-November surveys.

Gray seals can be expected in the Strait of Belle Isle Area during the ice-free period between May and December (Lesage et al. 2007) and thus, individuals are likely to be moulting and feeding rather than pupping. Gray seals can also be expected in low numbers in Conception Bay during the ice-free period (Perrin et al. 2002; Nowak 1999; Riedman 1990).

Harbour Seal

The harbour seal is considered Not at Risk in Canada and it is not listed under the *SARA* (SARA 2011, internet site; COSEWIC 2007c, internet site). This species is considered to be Least Concern by the IUCN (IUCN 2010, internet site) due to its stable or increasing population. Harbour seals are a coastal species that show far less migratory movements than other pinnipeds. The species is widespread along the coasts of the North Atlantic and North Pacific and its worldwide population is estimated at 350,000 to 500,000 animals (IUCN 2010, internet site). The harbour seal found in Atlantic Canada is the Western Atlantic harbour seal, *P. v. concolor*.

Harbour seals favour coastal waters and are also common in bays, rivers, estuaries and intertidal areas. They are usually considered non-migratory and show a high degree of site fidelity to areas they use (Burns 2002). They are generalist foragers, taking fish, cephalopods and crustaceans.

The harbour seal is less numerous than other pinniped species in the Strait of Belle Isle Area and Conception Bay, with the Atlantic Canada population estimated at 10,000-15,000 individuals, with 4,000-5,000 of those found in the Gulf of St. Lawrence (Lesage et al. 2007). Harbour seals give birth and mate from May through July and moult later in the summer (Boulva and McLaren 1979).

Although data are lacking, Jacques Whitford (2000a) reported that few harbour seals were observed during aerial surveys in September 1981 in the Strait of Belle Isle Area, while others have reported that harbour seals do use the Strait of Belle Isle during the ice-free period (Lesage et al. 2007; Robillard et al. 2005). Based on observations, few harbour seals are expected in the Strait of Belle Isle Area and this species may also be present in small numbers in Conception Bay (Perrin et al. 2002; Nowak 1999; Riedman 1990).

Hooded Seal

Hooded seals in the Atlantic Ocean form a single population. Although considered Not at Risk in Canada since 1986 and with no status under the *SARA* (SARA 2011, internet site), the species is listed by the IUCN as

Vulnerable (IUCN 2010, internet site) primarily because the Northeast Atlantic stock has declined by 85-90% over the last 40-60 years (IUCN 2010, internet site).

Hooded seals are found at high latitudes within the North Atlantic and seasonally they extend their range north into the Arctic Ocean, as well as south into the North Sea in the Northeast Atlantic. They breed on pack ice and are associated with the ice much of the year, although they spend significant periods of time in offshore waters, without hauling out (Folkow and Blix 1999; Lavigne and Kovacs 1988). There are four major pupping areas, none of which are near the Strait of Belle Isle Area or Conception Bay: near the Magdalen Islands in the Gulf of St Lawrence, north of Newfoundland in an area known as the "Front," the Davis Strait (Sergeant 1974), and in the West Ice in the Greenland Sea near the Island of Jan Mayen.

Aerial surveys conducted at all three whelping areas in the Northwest Atlantic in 2005 resulted in an estimate of 116,900 pups. The entire population, modelled based on the pup counts, produced an estimate of 592,000 individuals (Waring et al. 2005), which suggests a moderate increase between the mid-1980s and 2005 (Hammill and Stenson 2006, 2007).

Hooded seals pup on pack ice in mid-March. Pupping does not occur in the Strait of Belle Isle Area, but the Strait of Belle Isle is on their migratory route between feeding and breeding grounds (Jacques Whitford 2000a). Pups are weaned in just four days (Bowen et al. 1985). Once the pups are on their own, females leave the whelping patch and move to the northern slope of the Laurentian channel where they stay until May when they begin their migration to Greenland (Bajzak et al. 2009). Males leave the breeding area earlier than females (Lesage et al. 2007) as soon as mating is complete. Adults moult in July followed by dispersal into the North Atlantic. Aggregations of hooded seals are only seen during breeding and moulting, at other times the species is largely solitary.

Jacques Whitford (2000a) documented a single hooded seal in the Strait of Belle Isle Area in April 1982. Hooded seals are known to migrate through the Strait during winter and spring (Bajzak et al. 2009) and to use pack ice there (Sjare 2010, pers. comm. *in* Sikumiut 2010b). Bajzak et al. (2009) reported that 23 tagged hooded seals migrated toward Greenland using the Cabot Strait and the Strait of Belle Isle. Hooded seals spend their summers in the Arctic (Lesage et al. 2007) so are most likely to occur in the Strait of Belle Isle Area during the ice-covered season. Small numbers of vagrant hooded seals may occur within Conception Bay.

10.5.9.4 Description of Sea Turtles

Sea turtles are marine reptiles belonging to the superfamily Chelonioidae. There are currently seven recognized species of sea turtle found in the world's oceans. Of these seven species, three are historically known to occur in eastern Canada: the loggerhead turtle (*Caretta caretta*), leatherback turtle (*Dermochelys coriacea*) and Kemp's ridley turtle (*Lepidochelys kempii*). The first two species are known to occur in the Strait of Belle Isle Area and in the waters of eastern Newfoundland, including Conception Bay. Kemp's ridley turtles have been recorded in eastern Canada (primarily Nova Scotia), but little is known about their distribution (Márquez-M. 1994; Pritchard 1989). Kemp's ridley turtles are not expected in the Strait of Belle Isle Area nor Conception Bay and is not discussed further.

Sea turtles are wide-ranging marine animals that are found in national and international waters. In Canada, the leatherback and loggerhead turtles are both classified as Endangered by COSEWIC (COSEWIC 2010b, internet site; COSEWIC 2001; DFO 2010e). The leatherback turtle is listed as a Schedule 1 (Endangered) species under the *SARA* (Atlantic Leatherback Turtle Recovery Team 2006) whereas the loggerhead turtle currently has no status under the *SARA*. The IUCN (IUCN 2010, internet site) classifies the loggerhead turtle as Endangered (assessed in 1996 as facing a high risk of extinction in the wild in the near future), and the leatherback turtle as Critically Endangered (assessed in 2000 as facing an extremely high risk of extinction in the wild in the immediate future).

Loggerhead Turtle

The loggerhead turtle is a widely distributed species occurring in coastal tropical, subtropical waters and extending into temperate waters around the world. Its distribution is largely constrained by water temperature and it does not generally occur where the water temperature is below 15°C (O'Boyle 2001), which limits its northern range. Loggerhead turtles are suspected to take long migrations using warm water currents such as the Gulf Stream that bring them far from their nesting grounds in tropical and subtropical waters. Loggerheads may be seen in the open seas during these migrations; they have not been reported in the Strait of Belle Isle.

The major nesting areas for loggerhead turtles include coastal beaches in the south-eastern United States of America, Yucatán Peninsula of Mexico, Columbia, Cuba, South Africa, eastern Australia and Japan (United States Fish and Wildlife Service 2003, internet site). Loggerhead turtles arrive in nesting areas after spending the first 2–6 years of their lives at sea. While at sea, the majority remain in offshore, deep, pelagic waters to feed. When mature, loggerhead turtles return to the beaches where they were hatched to nest; breeding occurs along migration routes between the feeding and nesting grounds (Miller et al. 2000, internet site). Their nesting season is typically from May to August (United States Fish and Wildlife Service 2003, internet site). During, or shortly after the breeding season, females disperse to distant feeding grounds via migration routes that are not well defined.

Adult loggerhead turtles feed on a variety of benthic fauna such as conchs, crabs, shrimp, sea urchins, sponges and fish. During the migration through the open sea, they eat jellyfish, pteropods, floating mollusks, floating egg clusters, flying fish and squid (Parker et al. 2005).

The United States' nesting population is estimated at 68,000 to 90,000 nests per year (Conant et al. 2009); only two nesting beaches have >10,000 females nesting each year (South Florida and Masirah Island, Oman). No nesting beaches occur in Canada (DFO 2010e; Conant et al. 2009).

In the North Atlantic, post-hatchling loggerhead turtles are known to migrate from their rookery beaches in the south-eastern United States to oceanic development habitats in the waters of the eastern North Atlantic (DFO 2010e; Frick et al. 2003), including those near the Azores. Young turtles spend at least six years in these oceanic development habitats before leaving for neritic habitats in the Northwest Atlantic (Bjorndal et al. 2000). Loggerhead turtles have been observed in the waters of Atlantic Canada during the summer (O'Boyle 2001) where the primary use of habitat is foraging; although data are limited, most loggerhead turtles in Atlantic Canadian waters are thought to be oceanic / neritic juveniles (DFO 2010e).

All turtle sightings mapped by DFO (2009b, internet site) within the Strait of Belle Isle Area and Conception Bay are provided in Figure 10.5.9-9 and Figure 10.5.9-10, respectively. There have been no observations of loggerhead turtles reported in the Strait of Belle Isle Area or Conception Bay. Sightings of loggerhead turtles in these areas are assumed to be rare.

Leatherback Turtle

Leatherback turtles are the most widely distributed sea turtles in the world and they range great distances from their tropical and subtropical breeding grounds. The most northerly recorded latitude of a leatherback turtle is 70°N (Atlantic Leatherback Turtle Recovery Team 2006; COSEWIC 2001).

Leatherback turtles appear to migrate along bathymetric contours ranging from depths of 200 to 3,500 m. Leatherback turtles are highly pelagic and approach coastal waters only during the reproductive season (COSEWIC 2001). Leatherbacks that occur in Atlantic Canadian waters represent nesting populations in a minimum of 10 countries in South and Central America, and the Caribbean (James et al. 2007). The global population is estimated at 34,500 nesting females (range of 26,200-42,900; Spotila et al. 1996); no nesting beaches occur in Canada (COSEWIC 2001).

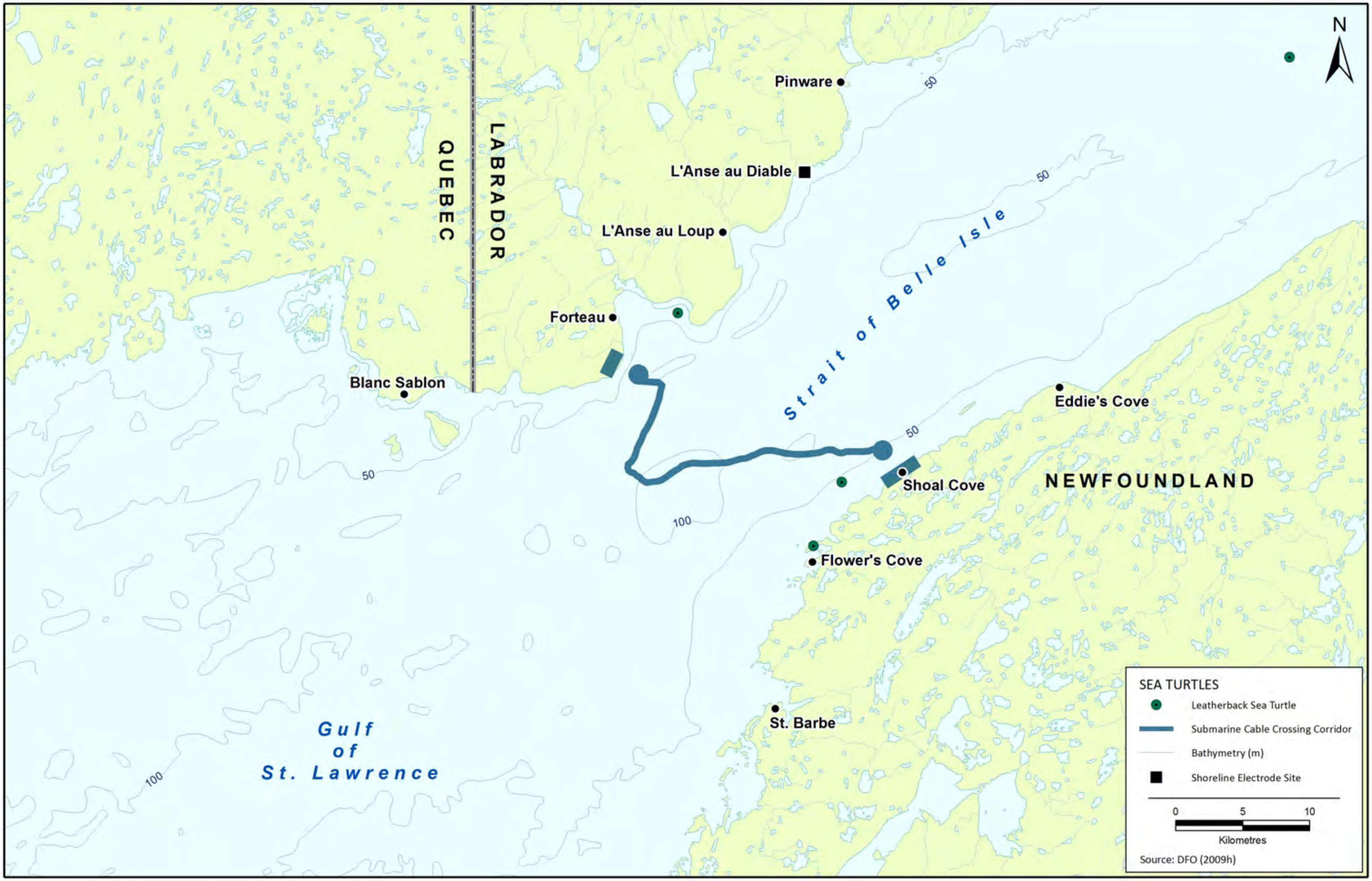
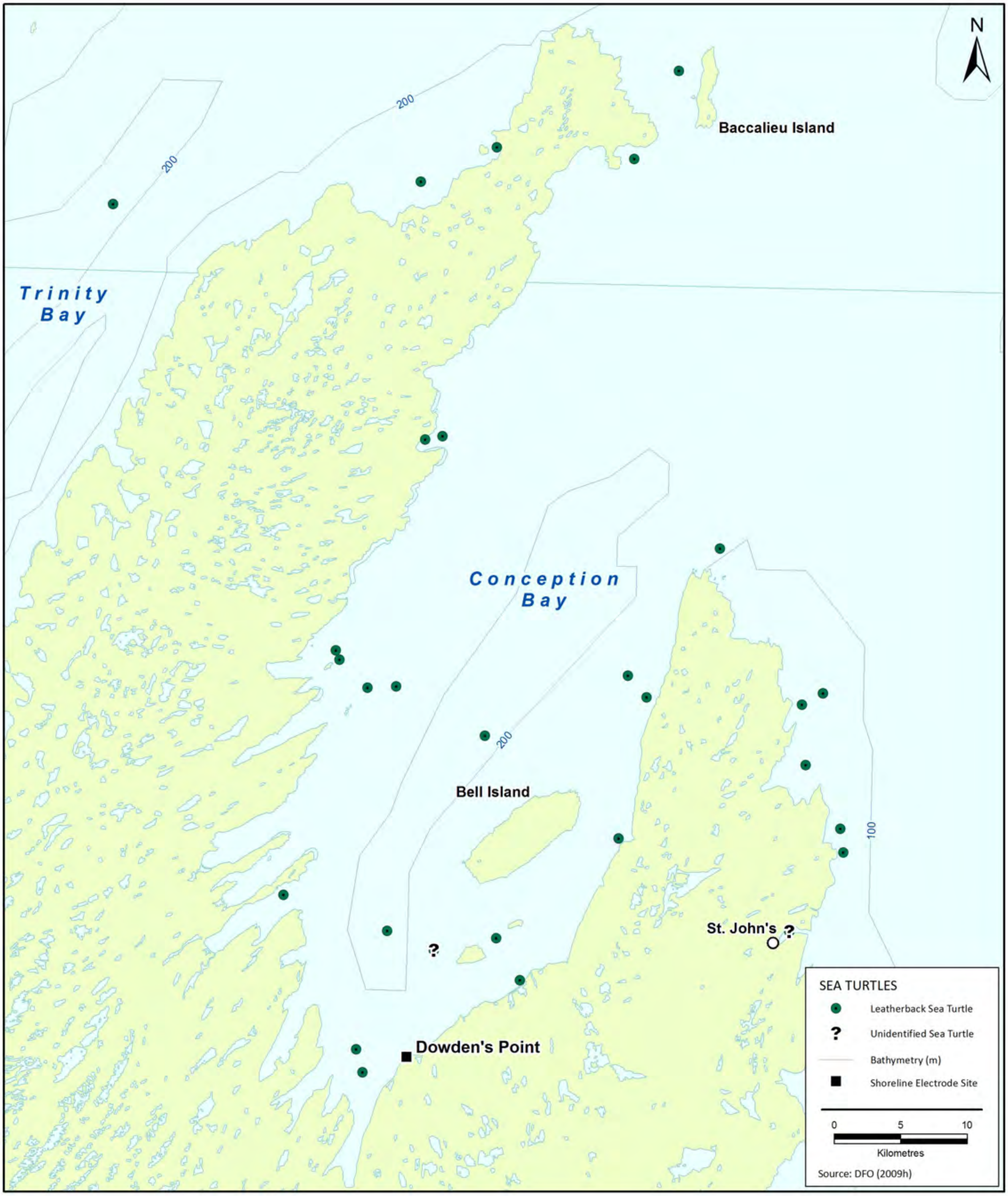


FIGURE 10.5.9-9

Historical Observations of Sea Turtles in the Strait of Belle Isle Area



nalcor energy

FIGURE 10.5.9-10

Historical Observations of Sea Turtles in Conception Bay, Newfoundland

Formerly considered extralimital in the North Atlantic, it is now determined that this species regularly enters the waters off eastern Canada (COSEWIC 2001), including the Labrador Sea, Gulf of St. Lawrence, and surrounding straits, inlets and bays. Foraging appears to be the main use of northern waters during summer and fall (Atlantic Leatherback Turtle Recovery Team 2006). Leatherback turtles feed mainly on jellyfish, tunicates and other epipelagic soft-bodied invertebrates. Most sightings in Canadian waters occur from May to November (O'Boyle 2001), with the peak sighting period occurring in August and September (Goff and Lien 1988). Most leatherbacks that occur in Atlantic Canadian waters are large sub-adults and adults, with a female-biased sex ratio among mature turtles (James et al. 2007).

Leatherbacks have been recorded in the Strait of Belle Isle Area (Figure 10.5.9-9) in low numbers, and throughout Conception Bay (Figure 10.5.9-10) where they may be feeding. Leatherbacks feed in coastal areas and along oceanic frontal systems where jellyfish productivity is high (COSEWIC 2001). While sightings of leatherback turtles are possible in the Strait of Belle Isle Area and Conception Bay, numbers are low in both areas and the potential for sightings is considered low.

10.5.10 Seabirds

Seabirds are defined here as those species that use marine waters, including the intertidal zone, for foraging, resting or migrating. These seabirds come from a variety of bird taxa and include geese and ducks (eiders, scoters, goldeneyes, mergansers and other species of ducks; Anatidae), loons (Gaviidae), fulmars and shearwaters (Procellariidae), storm-petrels (Hydrobatidae), Northern Gannet (Sulidae), cormorants (Phalacrocoraciidae), plovers (Charadriidae), sandpipers and phalaropes (Scolopacidae), skuas and jaegers (Stercorariidae), gulls and terns (Laridae), and murres, razorbills, guillemots, puffins and Dovekie (collectively called auks or alcids; Alcidae) (for a list of individual species see Table 10.5.10-1).

Seabird species are often grouped into three categories based on the habitat (water depth) they prefer. Shearwaters and fulmars, storm-petrels, Northern Gannet, skuas and jaegers, most auk species, phalaropes, and some species of gulls and terns predominately use waters >50 m in depth. Some of these species show this preference even while on foraging trips during the nesting season. Because of this habitat preference these species are collectively referred to as "pelagic seabirds" (Table 10.5.10-1). Geese, ducks, loons, cormorants, most gull species, most tern species and Black Guillemot (*Cepphus grylle*) spend most of their time using waters 50 m deep or shallower. These species are referred to as "coastal waterbirds", although they may migrate over deeper waters. Many species of plovers and sandpipers forage in the intertidal zone and are referred to as "shorebirds", although they may migrate (non-stop) over waters of any depth and distance from land.

The Study Team has identified, acquired, compiled, reviewed and presented available and existing information and data on seabirds in the Strait of Belle Isle and Conception Bay. Dr. W. A. Montevecchi, Memorial University of Newfoundland, a regional expert in seabird ecology, did much of this work. The study initially involved conducting a thorough inventory of available information related to the Strait of Belle Isle and Conception Bay. The approach used to review and synthesize relevant information is presented, as are the key sources of information and data, and the agencies, organizations and persons contacted to acquire the information / data. This section also outlines the considerations used to determine relevancy of information to the EIS. Any issues and challenges associated with this review are also discussed.

Table 10.5.10-1 Seabird Species Using the Strait of Belle Isle Area and Conception Bay: Seasonal and Breeding Status

Common Name	Scientific Name	Strait of Belle Isle Area		Conception Bay	
		Seasonal Status	Breeding Status	Seasonal Status	Breeding Status
Pelagic seabirds					
Fulmars and shearwaters	**Procellariidae**				
Northern Fulmar	*Fulmarus glacialis*	Summer visitor, spring and autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Autumn transient[j]	Non-breeding[d]
Great Shearwater	*Puffinus gravis*	Summer visitor, spring and autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Autumn transient[j]	Non-breeding
Sooty Shearwater	*Puffinus griseus*	Summer visitor, spring and autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Autumn transient[j]	Non-breeding
Storm-Petrels	**Hydrobatidae**				
Leach's Storm-Petrel	*Oceanodroma leucorhoa*	Summer visitor, spring and autumn transient[b,c,d,e,f,g,h,i]	Breeding[d]	Summer visitor, spring and autumn transient[j]	Breeding[d]
Gannets	**Sulidae**				
Northern Gannet	*Morus bassanus*	Summer visitor, spring and autumn transient[b,c,d,e,f,g,h,i]	Non-breeding[d]	Summer visitor, spring and autumn transient[j]	Breeding[d]
Phalaropes	**Scolopacidae**				
Red-necked Phalarope	*Phalaropus lobatus*	Spring and autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Spring and autumn transient[j]	Non-breeding
Red Phalarope	*Phalaropus fulicarius*	Spring and autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Spring and autumn transient[j]	Non-breeding
Skuas and jaegers	**Stercorariidae**				
Great Skua	*Stercorarius skua*	Autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Autumn transient[j]	Non-breeding
Pomarine Jaeger	*Stercorarius pomarinus*	Autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Spring and autumn transient[j]	Non-breeding
Parasitic Jaeger	*Stercorarius parasiticus*	Autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Spring and autumn transient[j]	Non-breeding
Long-tailed Jaeger	*Stercorarius longicaudus*	Autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Spring and autumn transient[j]	Non-breeding
Gulls	**Laridae**				
Black-legged Kittiwake	*Rissa tridactyla*	Summer visitor, spring and autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Summer visitor, spring and autumn transient[j]	Breeding[d,j]
Ivory Gull[a]	*Phagophila eburnea*	Winter visitor[j]	Non-breeding[j]	Vagrant[j]	Non-breeding[j]

Table 10.5.10-1 Seabird Species Using the Strait of Belle Isle Area and Conception Bay: Seasonal and Breeding Status (continued)

Common Name	Scientific Name	Strait of Belle Isle Area		Conception Bay	
		Seasonal Status	Breeding Status	Seasonal Status	Breeding Status
Auks	**Alcidae**				
Dovekie	*Alle alle*	Spring and autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Spring and autumn transient, winter visitor[j]	Non-breeding
Common Murre	*Uria aalge*	Summer visitor, spring and autumn transient[b,c,d,e,f,g,h,i]	Breeding[d]	Summer visitor, spring and autumn transient[j]	Breeding[d]
Thick-billed Murre	*Uria lomvia*	Spring and autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Summer visitor, spring and autumn transient[j]	Breeding[d]
Razorbill	*Alca torda*	Summer visitor, spring and autumn transient[b,c,d,e,f,g,h,i]	Breeding[d]	Summer visitor, spring and autumn transient[j]	Breeding[d]
Atlantic Puffin	*Fratercula arctica*	Summer visitor, spring and autumn transient[b,c,d,e,f,g,h,i]	Breeding[d]	Summer visitor, spring and autumn transient[j]	Breeding[d]
Coastal waterbirds					
Geese and ducks	**Anatidae**				
Canada Goose	*Branta canadensis*	Summer visitor, spring and autumn transient[b,c,d,e,f,g,h,i]	Breeding[i]	Spring and autumn transient[j]	Non-breeding
American Black Duck	*Anas rubripes*	Summer visitor, spring and autumn transient[b,c,d,e,f,g,h,i]	Breeding[i]	Spring and autumn transient, winter visitor[j]	Breeding[j]
King Eider	*Somateria spectabilis*	Spring and autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Spring and autumn transient[j]	Non-breeding
Common Eider	*Somateria mollissima*	Summer visitor, spring and autumn transient[b,c,d,e,f,g,h,i]	Breeding[d]	Spring and autumn transient, winter visitor[j]	Non-breeding
Harlequin Duck[a]	*Histrionicus histrionicus*	Summer visitor, spring and autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Spring and autumn transient, winter visitor[j]	Non-breeding
Surf Scoter	*Melanitta perspicillata*	Spring and autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Spring and autumn transient[j]	Non-breeding
White-winged Scoter	*Melanitta fusca*	Spring and autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Spring and autumn transient, winter visitor[j]	Non-breeding
Black Scoter	*Melanitta americana*	Spring and autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Spring and autumn transient[j]	Non-breeding
Long-tailed Duck	*Clangula hyemalis*	Spring and autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Spring and autumn transient, winter visitor[j]	Non-breeding

Table 10.5.10-1 Seabird Species Using the Strait of Belle Isle Area and Conception Bay: Seasonal and Breeding Status (continued)

Common Name	Scientific Name	Strait of Belle Isle Area		Conception Bay	
		Seasonal Status	Breeding Status	Seasonal Status	Breeding Status
Common Goldeneye	*Bucephala clangula*	Spring and autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Spring and autumn transient, winter visitor[j]	Non-breeding
Barrow's Goldeneye[a]	*Bucephala islandica*	Spring and autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Spring and autumn transient, winter visitor[j]	Non-breeding
Red-Breasted Merganser	*Mergus serrator*	Spring and autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Spring and autumn transient, winter visitor[j]	Non-breeding
Common Merganser	*Mergus merganser*	Spring and autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Spring and autumn transient, winter visitor[j]	Non-breeding
Loons	**Gaviidae**				
Red-throated Loon	*Gavia stellata*	Summer visitor, spring and autumn transient[b,c,d,e,f,g,h,i]	Breeding	Spring and autumn transient, winter visitor[j]	Non-breeding
Common Loon	*Gavia immer*	Spring and autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Spring and autumn transient, winter visitor[j]	Non-breeding
Cormorants	**Phalacrocoraciidae**				
Double-crested Cormorant	*Phalacrocorax auritus*	Summer visitor, spring and autumn transient[b,c,d,e,f,g,h,i]	Non-breeding[d]	Summer visitor, spring and autumn transient[j]	Breeding[d,j]
Great Cormorant	*Phalacrocorax carbo*	Summer visitor, spring and autumn transient[b,c,d,e,f,g,h,i]	Non-breeding[d]	Resident[j]	Non-breeding
Gulls and Terns	**Laridae**				
Black-headed Gull	*Chroicocephalus ridibundus*	Absent		Spring and autumn transient, winter visitor[j]	Non-breeding
Ring-billed Gull	*Larus delawarensis*	Summer visitor, spring and autumn transient[b,c,d,e,f,g,h,i]	Breeding[i]	Summer visitor, spring and autumn transient[j]	Breeding[j]
Herring Gull	*Larus argentatus*	Spring and autumn transient, summer visitor[b,c,d,e,f,g,h,i]	Breeding[d]	Resident[j]	Breeding[j]
Iceland Gull	*Larus glaucoides*	Spring and autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Spring and autumn transient, winter visitor[j]	Non-breeding

Table 10.5.10-1 Seabird Species Using the Strait of Belle Isle Area and Conception Bay: Seasonal and Breeding Status (continued)

Common Name	Scientific Name	Strait of Belle Isle Area		Conception Bay	
		Seasonal Status	Breeding Status	Seasonal Status	Breeding Status
Great black-backed Gull	*Larus marinus*	Summer visitor, spring and autumn transient[b,c,d,e,f,g,h,i]	Breeding[d]	Resident[j]	Breeding[j]
Glaucous Gull	*Larus hyperboreus*	Autumn and spring transient[b,c,d,e,f,g,h,i]	Non-breeding	Spring and autumn transient, winter visitor[j]	Non-breeding
Common Tern	*Sterna hirundo*	Summer visitor, spring and autumn transient[b,c,d,e,f,g,h,i]	Breeding[d]	Summer visitor, spring and autumn transient[j]	Breeding[d,i]
Arctic Tern	*Sterna paradisaea*	Summer visitor, spring and autumn transient[b,c,d,e,f,g,h,i]	Breeding[d]	Summer visitor, spring and autumn transient[j]	Breeding[j]
Auks	**Alcidae**				
Black Guillemot	*Cepphus grylle*	Summer visitor, spring and autumn transient[b,c,d,e,f,g,h,i]	Breeding[d]	Summer visitor, spring and autumn transient[d,j]	Breeding[d]
Shorebirds					
Plovers	**Charadriidae**				
Black-bellied Plover	*Pluvialis squatarola*	Autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Autumn transient[j]	Non-breeding
American Golden-plover	*Pluvialis dominica*	Autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Autumn transient[j]	Non-breeding
Semipalmated Plover	*Charadrius semipalmatus*	Summer visitor, spring and autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Spring and autumn transient[j]	Non-breeding
Piping Plover[a]	*Charadrius melodus melodus*	Vagrant[b,c,d,e,f,g,h,i]	Non-breeding	Vagrant[j]	Non-breeding
Sandpipers	**Scolopacidae**				
Spotted Sandpiper	*Actitis macularius*	Summer visitor, spring and autumn transient[b,c,d,e,f,g,h,i]	Breeding[i]	Summer visitor, spring and autumn transient[j]	Breeding[j]
Greater Yellowlegs	*Tringa melanoleuca*	Spring and autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Spring and autumn transient[j]	Non-breeding
Lesser Yellowlegs	*Tringa flavipes*	Autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Autumn transient[j]	Non-breeding
Eskimo Curlew[a]	*Numenius borealis*	Transient, probably extinct[b,c,d,e,f,g,h,i]	Non-breeding	Transient, probably extinct[j]	Non-breeding
Whimbrel	*Numenius phaeopus*	Autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Autumn transient[j]	Non-breeding
Ruddy Turnstone	*Arenaria interpres*	Autumn transient[b,c,d,e,f,g,h,i]	Non-breeding	Autumn transient[j]	Non-breeding

Table 10.5.10-1 Seabird Species Using the Strait of Belle Isle Area and Conception Bay: Seasonal and Breeding Status (continued)

Common Name	Scientific Name	Strait of Belle Isle Area		Conception Bay	
		Seasonal Status	Breeding Status	Seasonal Status	Breeding Status
Red Knot[(a)]	*Calidris canutus rufa*	Autumn transient[(b,c,d,e,f,g,h,i)]	Non-breeding	Autumn transient[(j)]	Non-breeding
Sanderling	*Calidris alba*	Autumn transient[(b,c,d,e,f,g,h,i)]	Non-breeding	Autumn transient[(j)]	Non-breeding
Semipalmated Sandpiper	*Calidris pusilla*	Autumn transient[(b,c,d,e,f,g,h,i)]	Non-breeding	Autumn transient[(j)]	Non-breeding
Least Sandpiper	*Calidris minutilla*	Summer visitor, spring and autumn transient[(b,c,d,e,f,g,h,i)]	Breeding[(j)]	Summer visitor, spring and autumn transient[(j)]	Breeding[(j)]
White-rumped Sandpiper	*Calidris fuscicollis*	Autumn transient[(b,c,d,e,f,g,h,i)]	Non-breeding	Autumn transient[(j)]	Non-breeding
Purple Sandpiper	*Calidris maritima*	Spring and autumn transient[(k)]	Non-breeding	Winter visitor[(j)]	Non-breeding
Dunlin	*Calidris alpina*	Autumn transient[(b,c,d,e,f,g,h,i)]	Non-breeding	Autumn transient[(j)]	Non-breeding
Short-billed Dowitcher	*Limnodromus griseus*	Autumn transient[(b,c,d,e,f,g,h,i)]	Non-breeding	Autumn transient[(j)]	Non-breeding

Note: Breeding: Summer visitor constructing nest, laying eggs and fledging young; Non-breeding: present for an extended period of time as post-breeding or sexually immature individuals; Resident: present year-round; Transient: present in passage between summering and wintering ranges; Vagrant: occurring outside of its usual geographic range; Visitor: present for an extended period of time.

(a) Species of special conservation concern.
(b) Rees (1963).
(c) LGL (1983).
(d) Lock et al. (1994).
(e) LeGrow (1999).
(f) Jacques Whitford and Kingsley (2000).
(g) Goulet and Robertson (2007).
(h) CWS (2010a).
(i) Sikumiut (2010b).
(j) Mactavish (2010, pers. comm.).
(k) Paquet (2012, pers. comm.); Thomas (2012, pers. comm.); Wells (2012, pers. comm.).

10.5.10.1 Study Areas

Seabirds are highly mobile and often fly dozens of kilometres to forage for food to bring back to their nestlings. Consequently, the existing environment for seabirds considered here includes waters and coastlines several kilometres from the submarine cable crossing corridor and shoreline electrode sites. The Study Area for seabirds includes the Strait of Belle Isle and Conception Bay. The Strait of Belle Isle Area is primarily from Saint Augustin, Québec, and Twin Islands, Newfoundland, to Battle Harbour, Labrador, and Cape Bauld, Newfoundland (Figure 10.5.10-1). However, some nesting colonies of pelagic seabirds outside of this area are discussed. Description of the existing environment for seabirds in Conception Bay includes the bay itself and Baccalieu Island Ecological Reserve, Grates Point and Cape St. Francis just outside Conception Bay (Figure 10.5.10-2).

10.5.10.2 Information Sources and Data Collection

The existing environment description for seabirds draws extensively from:

- *Marine Mammals and Seabirds in the Strait of Belle Isle*, a report on dedicated marine mammal and seabird surveys for NLH in the Strait of Belle Isle in 1998, with an information review and an updated summary and introduction by Nalcor in November 2009 (Jacques Whitford and Kingsley 2000); and
- *Marine Mammals, Sea Turtles and Seabirds in the Strait of Belle Isle: Supplementary Information Review and Compilation* (Sikumiut 2010b).

The above reports and additional data were compiled through literature reviews, existing data formats (i.e., population survey databases) and Project-specific field data collection listed below. Some of the existing data were acquired through communication with a variety of CWS staff to determine the availability of, and acquire access to, additional relevant information and data. The following responsible personnel within CWS were contacted:

- Regina Wells, Wildlife Technician responsible for the Atlantic Canada Shorebird Surveys database (data collected by volunteers), CWS, Goose Bay, NL;
- Carina Gjerdrum, Seabird Issues Biologist, responsible for the Programme Intégré de Recherches sur les Oiseaux Pélagiques database and the Eastern Canadian Seabirds At Sea (ECSAS) database, CWS, Dartmouth, NS, formerly administered by David Fifield, CWS, Mt. Pearl, NL; and
- Peter Thomas, Senior Species at Risk Biologist – NL, responsible for colonial waterbird survey data for NL, CWS, Mt. Pearl, NL.

Important data sources were:

- Published literature, including various report series of EC, CWS.
- Programme intégré de recherches sur les oiseaux pélagiques database of ship-board abundance surveys of seabirds-at-sea conducted from the 1960s to 1980s; before 1984 birds were counted up to distances from the survey vessel limited only by visibility, but after 1984 only those within 300 m of the vessel were counted; however, there are insufficient data from Conception Bay (CWS 2010a; Gjerdrum 2010, pers. comm.).
- ECSAS database of ship-board density surveys of seabirds-at-sea beginning in the early 2000s; however, there are no data from Conception Bay (Fifield 2011, pers. comm.). Birds were counted on one side of the survey vessel up to 300 m from the vessel which allows the calculation of density (the number of birds per square kilometre). Flying birds were counted only during “snapshot” counts completed after every 300 m of the ship’s progress (CWS 2010b).

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FIGURE 10.5.10-1

Important Bird Areas and Seabird Concentration Areas in the Vicinity of the Strait of Belle Isle Area

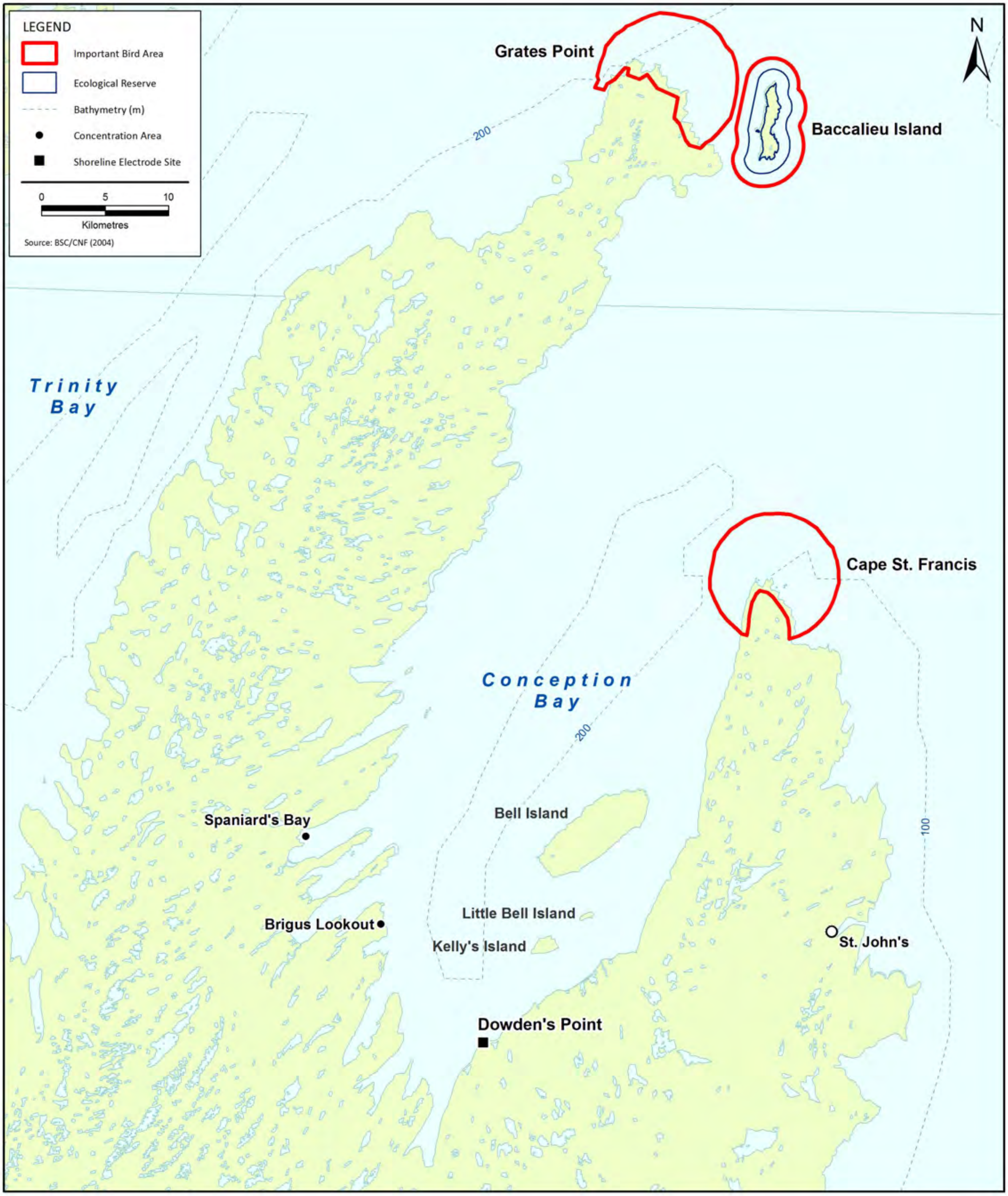

FIGURE 10.5.10-2

Important Bird Areas and Seabird Concentration Areas in Conception Bay, Newfoundland

- Offshore Labrador Biological Studies (OLABS) – baseline biological studies in support of hydrocarbon exploration and production activities in the Labrador Sea and along the Labrador coast. Twice monthly aerial surveys of seabirds and marine mammals were conducted from April 1981 to April 1982 including the Strait of Belle Isle Area (LGL 1983). The OLABS survey route in the Strait of Belle Isle Area crossed the proposed submarine cable crossing corridor, consisting of:
  - a zig-zag transect that crossed the Strait of Belle Isle six times from St. Barbe, Newfoundland, to Cape Norman, Newfoundland, and Chateau Bay, Labrador, and Belle Isle;
  - an offshore transect down the centre of the Straight of Belle Isle, running from an imaginary line between Blanc-Sablon, Québec, and St. Barbe, to Belle Isle; the lengths of offshore transects totalled 312.5 km;
  - two nearshore (< 6 km from a coastline) transects, one running from Blanc-Sablon to Chateau Bay, Labrador, and the other running from St. Barbe to St. Anthony, Newfoundland;
  - Birds were counted up to a distance of 200 m from each side of a high-winged aircraft at an altitude of 45 m travelling at a ground speed of 185 to 210 km/h; the resulting density data (LGL 1983) are supplemented by:
    - observations from shore watches at the eastern entrance to the Strait of Belle Isle; these were conducted on the Newfoundland shore of the Strait of Belle Isle Area at Cape Norman (50 ten-minute counts on five days from June 22 to July 16, 1981), L'Anse aux Meadows (33 ten-minute counts on June 16-19, 1981) and Cape Bauld (358 ten-minute counts on 30 days from June 24 to September 8, 1981); and
    - ship-board counts at the western entrance conducted from the ferry travelling between St. Barbe and Blanc-Sablon (85 ten-minute counts during 13 crossings on seven days from June 17 to August 22, 1981).
- The Seabirds of Québec, CWS (CWS 2004a, b, internet sites).
- Atlantic Canada Shorebird Survey database (data collected by volunteers), CWS (2010c).
- Colonial waterbird census data published in Lock et al. (1994) and unpublished colonial waterbird census data from CWS database, Mt. Pearl, NL (CWS 2011, 2010d).
- CWS Red Knot occurrences database. St. John's, Newfoundland.
- Important Bird Areas (IBA) Program database, (Bird Studies Canada 2004a, b, c, d, e, f, g, h, i, internet sites). IBAs are places of international significance for the conservation of birds (IBA Canada 2004, internet site). They are identified using criteria that are internationally agreed upon, standardized, quantitative, and scientifically defensible. Some of the sites described here received IBA designation due to the presence of globally or continentally significant congregations of seabirds, i.e., they hold 1% of a biogeographical population of a species or, where the population threshold is unknown or there are several species present, they hold 20,000 individuals (globally significant) or 15,000 individuals (continentally significant). The IBA designation does not give a site legal protection, but some IBAs overlap with legally protected sites.
- Canada Newfoundland Labrador Offshore Petroleum Board's (C-NLOPB) Strategic Environmental Assessment of the Labrador Shelf Offshore Area (LGL 2005).

Nalcor's predecessor, Newfoundland and Labrador Hydro contracted four dedicated ship-board surveys of seabirds and marine mammals in the Strait of Belle Isle from late August to late October 1998 (Jacques Whitford and Kingsley 2000). During each of these four survey periods, five strip transects at 7.4 km intervals were surveyed across the Strait from Lourdes-de-Blanc-Sablon to Pigeon Cove in the west to L'Anse au Loup to Green Island Cove in the east. Two of the survey lines cross the proposed submarine cable crossing corridor, one survey line was a few kilometres north-east of the corridor, and two of the lines were about five and 12 km, respectively, south-west of the corridor. Each transect was surveyed twice per survey period, except on 7 October when each transect was surveyed only once. All birds within a strip transect of 100 m in width were counted. Raw data are presented in Jacques Whitford and Kingsley (2000). Because length and width of the strip transects are reported in that document, densities of seabird species (number of birds per square kilometre) were calculated and are presented here.

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

10.5.10.3 Description of Seabirds

Each season, different populations of seabirds use the waters around the two proposed shoreline electrode sites and the proposed submarine cable crossing corridor. During the nesting season (May to September), nesting colonies of pelagic seabirds strongly influence the composition and distribution of the bird community in the Strait of Belle Isle Area, whereas colonies of coastal waterbirds are most important in Conception Bay. During spring and autumn migration (March to April and October to November, respectively, for most species), species of pelagic seabirds, coastal waterbirds and shorebirds that nest in Arctic and Subarctic regions dominate the Strait of Belle Isle Area bird community. In Conception Bay coastal waterbirds and shorebirds that nest in Arctic and Subarctic regions are most numerous during the migrations. During winter (December to February), the avifauna of the Strait of Belle Isle Area is comprised mostly of coastal waterbirds and pelagic seabirds that nest in the Arctic, whereas in Conception Bay the avifauna is dominated by coastal waterbirds that nest in Subarctic and Arctic regions.

Nesting Populations and Breeding Biology

Strait of Belle Isle Area

A diversity of seabird species occurs during the nesting season in the Strait of Belle Isle Area, both as breeders and non-breeders (see Table 10.5.10-1) (Sikumiut 2010b). This seabird community is dominated by non-breeding pelagic seabirds, a large nesting colony of pelagic seabirds, as well as coastal waterbirds nesting in small colonies and as individual pairs. Currents within the Strait of Belle Isle also influence the distribution of the different groups of the bird community. The flow of the cold Labrador Current along the north side of the Strait favours pelagic seabird species, whereas warmer water from the Gulf of St. Lawrence along the south side of the Strait of Belle Isle favours coastal waterbird species (LeGrow 1999). No SSCC nest in the Strait of Belle Isle Area (Sikumiut 2010b).

Pelagic Seabirds

Atlantic Puffin (*Fratercula arctica*), Razorbill (*Alca torda*), Common Murre (*Uria aalge*), Black Guillemot, Leach's Storm-Petrel (*Oceanodroma leucorhoa*), gulls and terns nest in the Strait of Belle Isle Area. The only large colony of pelagic seabirds is located 13 km west of the proposed submarine cable crossing corridor at Baie de Brador IBA, Québec, where 18,920 pairs of Atlantic Puffin and Razorbill nest, along with smaller numbers of gulls and Black Guillemot (Table 10.5.10-2) (CWS 2004a, internet site). Boundaries of IBAs are illustrated in Figure 10.5.10-1. Baie de Brador IBA is comprised of two areas (Figure 10.5.10-1).

At the east end of the Strait of Belle Isle, Leach's Storm-Petrel nests 100 km north-east of the proposed shoreline electrode site on St. Peter Island in St. Peter Bay and Common Murre nests 95 km north-east of the L'Anse au Diable shoreline electrode site, on Belle Isle (Figure 10.5.10-1, Table 10.5.10-2) (Bird Studies Canada 2004g, internet site; Lock et al. 1994). Although these nesting colonies are relatively far from the proposed submarine cable crossing corridor and the L'Anse au Diable shoreline electrode site, birds nesting at those colonies may forage in the corridor or near the electrode site during May to September. Off the east coast of the Northern Peninsula Black-legged Kittiwake (*Rissa tridactyla*), a pelagic gull, nests in the Northern Groais Island IBA (Russell and Fifield 2001) (Figure 10.5.10-1). However, birds nesting there are unlikely to cross the peninsula on foraging trips. Nesting seabirds also concentrate in the Pinware River estuary in summer to forage for spawning capelin and other small fish (Sikumiut 2010b).

Table 10.5.10-2 Estimated Numbers of Pairs of Colonial Seabirds Nesting in the Vicinity of the Strait of Belle Isle Area

Species	Number of Pairs												
	Gros Mécatina	Saint Augustin	Baie de Brador	St. Peter Bay	Belle Isle	L'Anse aux Meadows	Eastern Pond	Hare Bay	James Island	Whale Islands	Twin Islands	Northern Groais Island[a]	Bell Island[b]
Pelagic Seabirds													
Leach`s Storm-Petrel	–	–	–	P[c]	–	–	–	–	–	–	–	–	–
Black-legged Kittiwake	–	–	–	–	–	–	–	–	–	–	–	2,400[c]	–
Common Murre	–	–	–	–	P[c]	–	–	–	–	–	–	–	–
Razorbill	366[d]	2[d]	2,160[e]	–	–	–	–	–	–	–	–	–	–
Atlantic Puffin	–	–	18,920[f]	–	–	–	–	–	–	–	–	–	–
Coastal Waterbirds													
Common Eider	–	6[g]	–	–	–	90[c]	65[c]	93+[c]	–	–	P[h]	–	30+[c]
Herring Gull	–	3107[i]	1-42[i]	–	–	–	–	–	–	–	–	–	–
Great Black-backed Gull	–	159[g]	1-105[i]	–	–	–	–	–	–	–	–	–	–
Common Tern	–	–	–	–	–	–	–	10[c]	162[c]	–	–	–	–
Arctic Tern	–	–	–	–	–	–	20[c]	50+[c]	38[c]	300[c]	–	–	–
Tern sp.	–	–	–	–	–	–	–	180+[c]	–	–	–	–	–
Black Guillemot	8[c]	5[c]	2[i]	–	–	–	–	–	–	–	–	–	–
Total	374	3,279	21,229	P	P	90	85	333+	200	300	P	2,400	30+

Note: – = Zero pairs.
P = present at colony.
(a) Including The Sisters Rocks.
(b) Including Shepherd Island and Île aux Canes Migratory Bird Sanctuaries.
(c) Lock et al. (1994).
(d) Chapdelaine et al. (2001).
(e) CWS (2004b, internet site).
(f) CWS (2004a, internet site).
(g) Bird Studies Canada (2004f, internet site).
(h) CWS and Newfoundland and Labrador Culture Recreation and Youth Wildlife Division (1987).
(i) Bird Studies Canada (2004a, internet site).

The density of Northern Fulmar (*Fulmarus glacialis*) during OLABS surveys in 1982 in offshore areas of the Strait of Belle Isle Area in the nesting season ranged from 4.7 birds/km^2 in July to 0.04 birds/km^2 in September (average 2.0 birds/km^2) (LGL 1983). This species was absent during most nearshore surveys during the nesting season. Densities of pelagic seabirds and coastal waterfowl during 1981 OLABS surveys may have been influenced by larger than average capelin spawning runs in the Strait of Belle Isle that summer (Mactavish 2010, pers. comm.). During surveys in the Strait of Belle Isle conducted for Nalcor on 29-30 August 1998, fulmar density was low but during the 15-18 September surveys it was 0.5 birds/km^2 (Table 10.5.10-3) (Jacques Whitford and Kingsley 2000). During ECSAS surveys in the 2000s the average density of fulmars from May to August was 0.41 birds/km^2 (Table 10.5.10-4) (Sikumiut 2010b).

Table 10.5.10-3 Densities of the Six Most Numerous Seabird Species Observed During Ship-Board Surveys of the Proposed Submarine Cable Crossing Corridor and Vicinity in Late Summer and Early Autumn 1998

August 29-30, 1998		September 15-18, 1998		October 7, 1998		October 27-29, 1998	
Species	**Birds/km^2**	**Species**	**Birds/km^2**	**Species**	**Birds/km^2**	**Species**	**Birds/km^2**
Sooty Shearwater	4.3	Black-legged Kittiwake	5.7	Black-legged Kittiwake	0.8	Dovekie	0.9
Atlantic Puffin	3.4	Atlantic Puffin	0.7	Dovekie	0.8	Atlantic Puffin	0.5
Herring Gull	1.6	Herring Gull	0.5	Murres[(a)]	0.2	Common Eider	0.4
Black-legged Kittiwake	1.4	Northern Fulmar	0.5	Herring Gull	0.1	Razorbill / Murres[(b)]	0.4
Great Black-backed Gull	0.6	Northern Gannet	0.2	Sooty Shearwater	0.1	Razorbill	0.2
Murres[(a)]	0.5	Great black-backed Gull	0.1	Northern Fulmar	0.1	Herring Gull	0.1

Source: Jacques Whitford and Kingsley (2000).
(a) Combined Common Murre, Thick-billed Murre and Murres not identifiable to species.
(b) Large Auks not identifiable to species (Razorbill, Common Murre or Thick-billed Murre).

Table 10.5.10-4 Average Densities of Seabirds in the Strait of Belle Isle Area from Surveys in May through August from Eastern Canadian Seabirds at Sea Database

Seabird species or group	Density (Birds/km^2)
All seabirds	9.61
Northern Fulmar	0.41
Shearwaters	0.87
Northern Gannet	1.37
Large gulls	1.45
Black-legged Kittiwake	2.34
Dovekie	0.25
Murres	0.65
Other alcids (auks)	0.59

Source: CWS (2010b).

During OLABS surveys Great Shearwater (*Puffinus gravis*) arrived in the Strait of Belle Isle in June, and density ranged from 0.2 birds/km^2 in September to 36.0 birds/km^2 in July (average 13.1 birds/km^2) (LGL 1983). Density varied from 0 to 0.07 birds/km^2 in nearshore areas. Sooty Shearwater (*Puffinus griseus*) density in offshore areas during OLABS surveys varied from 0.02 birds/km^2 in September to 5.4 birds/km^2 in July (average 1.2 birds/km^2), whereas in nearshore areas it ranged from 0 to 0.02 birds/km^2 in August. Jacques Whitford and Kingsley (2000) reported Sooty Shearwater was recorded in a density of 4.3 birds/km^2 on 29-30 August 1998 but was scarce during the 15-18 September surveys (Table 10.5.10-3). Manx Shearwater (*Puffinus puffinus*) was recorded in low densities during summer surveys (Jacques Whitford and Kingsley 2000). During ECSAS surveys combined shearwater species had a density of 0.87 birds/km^2 (Table 10.5.10-4) (Sikumiut 2010b).

Leach's Storm-Petrel was recorded in low densities during the 1998 surveys (Jacques Whitford and Kingsley 2000).

Northern Gannet was present in relatively low densities during OLABS surveys, ranging from 0.01 birds/km^2 in May to 0.1 birds/km^2 in September (LGL 1983). Gannet density was 0.2 birds/km^2, low during 29-30 August surveys in 1998 but much lower during other surveys (Table 10.5.10-3) (Jacques Whitford and Kingsley 2000). Gannet density during ECSAS surveys averaged 1.37 birds/km^2 (Table 10.5.10-4) (Sikumiut 2010b).

Phalarope density during OLABS surveys in offshore areas ranged from 0.04 birds/km^2 in September to 0.4 birds/km^2 in June, but this species was absent from nearshore areas except in August (LGL 1983). Red Phalarope (*Phalaropus fulicarius*) was recorded in low density during the August and September 1998 surveys (Jacques Whitford and Kingsley 2000).

Black-legged Kittiwake was recorded in nearshore areas in densities ranging from 0.2 birds/km^2 in May to 12.6 birds/km^2 in September during OLABS surveys (LGL 1983). In offshore areas, kittiwake OLABS densities ranged from 0 birds/km^2 in August to 0.1 birds/km^2 in June. Jacques Whitford and Kingsley (2000) reported kittiwake densities ranging from 1.4 birds/km^2 on 29-30 August to 5.7 birds/km^2 on 15-18 September (Table 10.5.10-3). During ECSAS surveys kittiwake density was 2.34 birds/km^2 (Table 10.5.10-4) (Sikumiut 2010b).

Pomarine (*Stercorarius pomarinus*), parasitic (*Stercorarius parasiticus*) and unidentified jaegers were observed in low densities during the August and September surveys conducted by Jacques Whitford and Kingsley (2000).

Auks could not be identified to species during OLABS surveys but unidentified auks were seen during OLABS surveys in offshore areas in densities varying from 0.1 birds/km^2 in September to 5.9 birds/km^2 in May (LGL 1983). In nearshore areas, densities ranged from 0 birds/km^2 in August to 0.1 birds/km^2 in June. Jacques Whitford and Kingsley (2000) reported Atlantic Puffin density ranging from 3.4 birds/km^2 on 29-30 August to 0.7 on 15-18 September (Table 10.5.10-3). During these surveys combined Common Murre, Thick-billed Murre (*Uria lomvia*) and unidentified Murre density was 0.5 birds/km^2 on 29-30 August but low on 15-18 September. Razorbill densities were low during these surveys. During ECSAS surveys, density of combined murres was 0.65 birds/km^2, Dovekie was 0.25 birds/km^2 and other auk species was 0.59 birds/km^2 (Table 10.5.10-4) (CWS 2010b).

Pelagic seabird species nesting in the Strait of Belle Isle Area, with the exception of Black-legged Kittiwake and Arctic Tern, have high adult survival but low reproductive rates because of small clutch sizes (one egg in most species) (Gaston 2004). For this reason, perturbations to nesting colonies can have effects on populations of pelagic seabirds. Egg laying takes place from mid-May to mid-June (Table 10.5.10-5). Most young fledge by July to August; however, Leach's Storm-Petrel fledging does not peak until mid-September and continues as late as mid-November (Table 10.5.10-5).

Table 10.5.10-5 Timing of Seabird Nesting in the Strait of Belle Isle Area and Conception Bay

Species	Egg Laying	Incubation	Hatching	Nesting	Fledging
Common Eider	Early May to mid-June[a]	26 days[a]	Mid-June to mid July[a]	35 - 40 days[a]	Mid-August to late September[a]
Leach's Storm-Petrel	Mid-May to mid-August[b,c,d]; peak: first half of June	41 - 42 days[b,c,d]	Peak: last half of July[b,c,d]	63 - 70 days	Until mid-November; peak: late September
Herring Gull, Great Black-backed Gull	Mid- to late May[e,f,g]	26 - 29 days[e,f,g]	Mid- to late June	45 days[f] 50 - 55 days [e,g]	Late July to early August
Common Tern, Arctic Tern	First half of June[h]	22 days[h]	Mid-July	21 - 26 days[h]	late July to early August[h]
Common Murre	Mid-May[i,j]	32 days[i,j]	–	23 days[i,j]	Mid- to late July
Razorbill	Early June[j]	34 - 39 days[j]	Early to mid-July[j]	24 days[j]	Late July to early August[j]
Black Guillemot	Mid May to early June[k]	28 - 33 days[k]	Mid-June to mid July[k]	34 - 39 days[k]	Early to late August[k]
Atlantic Puffin	Mid- to late May[k]	42 days[k]	Early July[k]	40 - 45 days[k]	Mid- to late August[k]

Source: Mobil Oil Canada Ltd. (1985) with updates.
(a) Goudie et al. (2000).
(b) Grimmer (1980).
(c) Huntington (1963).
(d) Wilbur (1969).
(e) Haycock and Threlfall (1975).
(f) Pierotti (1982).
(g) Butler and Trivelpiece (1981).
(h) Hawksley (1950).
(i) Tuck (1961).
(j) Birkhead and Nettleship (1982).
(k) Cairns (1981).

Coastal Waterbirds

Common Eider (*Somateria mollissima*) is the most numerous of the coastal waterbird species in all seasons along NL coasts, and nests in colonies (Lock et al. 1994). Common Eider nests in small numbers at Shoal Cove (CWS 2010d). This species nests in undetermined numbers at Twin Islands (Figure 10.5.10-1, Table 10.5.10-2) (CWS and Newfoundland and Labrador Culture Recreation and Youth Wildlife Division 1987) located 56 km to the south-west of the proposed submarine cable crossing corridor. Six pairs nest at Saint Augustin Migratory Bird Sanctuary and IBA (Bird Studies Canada 2004f, internet site) located 105 km southwest of the submarine cable crossing corridor. At the tip of the Northern Peninsula Common Eider nests near L'Anse aux Meadows in Canard's Cove and in Eastern Pond (Lock et al. 1994). It also nests off the opposite side of the Northern Peninsula in and near Hare Bay Ecological Reserve (93+ pairs), and in Bell Island South Coast IBA (30+ pairs) (Lock et al. 1994). The preferred foraging areas of these nesting birds are not known, but they are unlikely to cross the Northern Peninsula during foraging sorties. Densities of Common Eider, White-winged Scoter, Surf Scoter, and unidentified scoter were low during the August and September 1998 Nalcor surveys (Jacques Whitford and Kingsley 2000).

Small to moderate numbers of Razorbill, Black Guillemot and gulls nest 16 km west of the proposed submarine cable crossing corridor on the Québec shore at Saint-Augustin Migratory Bird Sanctuary and IBA, and 150 km to the west of the corridor at Gros Mécatina Island (Figure 10.5.10-1, Table 10.5.10-2) (Bird Studies Canada 2004f, internet site; Chapdelaine et al. 2001). Common Tern (*Sterna hirundo*) and Arctic Tern (*Sterna paradisaea*) nest in colonies at James Island and the Whale Islands located 50 km south-west of the submarine cable crossing corridor (Figure 10.5.10-1, Table 10.5.10-2) (CWS 2010d). Common Tern and Arctic Tern nest at Eastern Pond and on the east coast of the Northern Peninsula in or near Hare Bay Ecological Reserve, but the latter are unlikely to forage in or near the submarine cable crossing corridor or the L'Anse au Diable shoreline electrode site (Figure 10.5.10-1, Table 10.5.10-2). In addition, several small, unsurveyed colonies of gulls and terns as well as individual pairs of nesting of Black Guillemot are found on cliffs and shorelines along both sides of the Strait of Belle Isle Area (CWS 2010d).

Herring Gull (*Larus argentatus*) was recorded during OLABS surveys in nearshore areas in densities of 3.6 birds/km^2 in September to 9.5 birds/km^2 in June (average 6.3 birds/km^2), and densities in offshore areas ranged from 0.2 to 1.6 birds/km^2 (LGL 1983). Great Black-backed Gull (*Larus marinus*) densities during OLABS surveys in nearshore areas ranged from 0.2 birds/km^2 in August to 2.9 birds/km^2 in July. In offshore areas densities varied from 0.04 birds/km^2 in September to 0.4 birds/km^2 in July. Jacques Whitford and Kingsley (2000) reported Herring Gull density ranging from 1.6 birds/km^2 on 29-30 August to 0.5 birds/km^2 on 15-18 September (Table 10.5.10-3). Great Black-backed Gull densities on those survey dates varied from 0.6 to 0.1 birds/km^2, respectively. During ECSAS surveys densities of combined large gulls (Great Black-backed and Herring Gulls) averaged 1.45 birds birds/km^2 during the nesting season (Table 10.5.10-4) (Sikumiut 2010b).

Common, Arctic and unidentified Terns and Black Guillemot were recorded in low densities during the August and September 1998 surveys (Jacques Whitford and Kingsley 2000).

Shorebirds

Shorebird species that use the marine shorelines of the Strait of Belle Isle Area while nesting consist of Spotted Sandpiper and Greater Yellowlegs (Mactavish 2010, pers. comm.). Autumn migration of shorebird species that nest along the Labrador Sea and in the Canadian Arctic begins in July and continues until late October. Several species, in addition to the two above, use shoreline habitat within the Strait of Belle Isle Area during their autumn migration. These are discussed below under Seasonal Migratory Movements.

Conception Bay

Pelagic Seabirds

The seabird community of Conception Bay during the nesting season is comprised mostly of coastal waterbirds nesting in small colonies and as individual pairs. However, a large colony of pelagic seabirds is located just outside the bay. Colonies of eight pelagic seabirds species are located in the Baccalieu Island Ecological Reserve located 75 km north by north-east of the proposed Dowden's Point shoreline electrode site (Table 10.5.10-6, Figure 10.5.10-2) (Lock et al. 1994). The Leach's Storm-Petrel colony supports an estimated 3.3 million pairs, which is the largest colony of this species in the world. There are also 30,000 Atlantic Puffin, 12,795 Black-legged Kittiwake, 4,000 Common Murre and 1,712 Northern Gannet pairs at Baccalieu Island (Table 10.5.10-6) (Lock et al. 1994).

Much smaller colonies of kittiwakes are scattered along the west shore of Conception Bay, the nearest being Brigus Lookout located 13 km north-west of the Dowden's Point electrode site (Figure 10.5.10-2) (CWS 2011b). There are insufficient data to describe seabird abundance in the marine waters of Conception Bay (Fifield 2011, pers. comm.). However, nesting Leach's Storm-Petrels likely do not forage in Conception Bay in substantial numbers because this species is known to feed primarily off the continental shelf in NL waters (Steele and Montevecchi 1994). Pelagic seabirds are not known to concentrate at or near the Dowden's Point electrode site during capelin spawning (Mactavish 2010, pers. comm.).

Table 10.5.10-6 Estimated Numbers of Nesting Pairs of Colonial Seabirds Nesting in the Vicinity of Conception Bay

Species	Number of Pairs			
	Baccalieu Island	Bell Island	Little Bell Island	Kelly's Island
Northern Fulmar	12[a]	–	–	–
Leach`s Storm-Petrel	3,336,000[b]	–	–	–
Northern Gannet	1,712[c]	–	–	–
Black-legged Kittiwake	12,975[b]	–	–	–
Ring-billed Gull	–	–	–	P[d]
Herring Gull	Present[a]	6-50[e]	251-500[e]	–
Great Black-backed Gull	Present[a]	6-50[e]	6-50[e]	–
Tern sp.	–	–	–	6-50[e]
Common Murre	4,000[b]	–	–	–
Thick-billed Murre	181[b]	–	–	–
Razorbill	100[b]	–	–	–
Black Guillemot	100[b]	P[f]	125[f]	100[f]
Atlantic Puffin	30,000[b]	–	–	–
Total	3,385,080	12-100	382-675	106-150

Note: P = Present.
– = Zero pairs.
[a] Stenhouse and Montevecchi (1999).
[b] Cairns et al. (1989).
[c] Chardine (2000).
[d] Mactavish (2010, pers. comm.).
[f] CWS (2011b).
[e] Lock et al. (1994).

Coastal Waterbirds

Nesting coastal waterbirds are widespread around Conception Bay. There is a colony of 50 pairs of unidentified tern on Kelly's Island, located 8 km north-east of the Dowden's Point shoreline electrode site (Table 10.5.10-6, Figure 10.5.10-2) (Lock et al. 1994). These terns appear to be mostly Common Tern, a species that nests at several other sites around Conception Bay (Mactavish 2010, pers. comm.). Arctic Terns are seen in Conception Bay in the nesting season only at Spaniard's Bay located 25 km north-west of Dowden's Point (Mactavish 2010, pers. comm.).

Black Guillemots nest at Kelly's Island (100 pairs), Little Bell Island (125 pairs) 12 km north-east of Dowden's Point and Bell Island (unknown number) 14 km north-east of Dowden's Point (Table 10.5.10-6) (Lock et al. 1994). However, nesting habitat for this species is scarce in the upper reaches of Conception Bay (Mactavish 2010, pers. comm.). Nesting Great Black-backed and Herring Gulls are ubiquitous around Conception Bay (Mactavish 2010, pers. comm.), and nest on Baccalieu Island but have not been censused there (Lock et al. 1994). Double-crested Cormorant (*Phalacrocorax auritus*) nests on the Harbour Grace Islands just north of Spaniard's Bay (CWS 2011b). These species of coastal waterbirds forage widely in the bay during nesting season but are not known to concentrate at or near the Dowden's Point shoreline electrode site, even during the capelin spawning season (Mactavish 2010, pers. comm.).

Shorebirds

Spotted Sandpiper (*Actitis macularius*) is the only shorebird to regularly use the marine waters within Conception Bay during the nesting season (Mactavish 2010, pers. comm.). However, this species is not colonial, so its density during nesting season is low.

Pre-Moulting and Moulting Concentrations

During summer, some pelagic seabird and coastal waterbird (specifically sea duck) species gather in some NL marine waters to spend the flightless period during the moult of their flight feathers.

Strait of Belle Isle Area

As in other areas of the Northwest Atlantic, the offshore areas of the Strait of Belle Isle Area hosts tens of thousands of moulting Northern Fulmars, Great Shearwaters and Sooty Shearwaters in late June and July, feeding mostly on offal from fishing vessels (LGL 1983). The pre-moulting and moulting fulmars are likely comprised mostly of non-breeding sub-adults, whereas the two shearwater species arrive in the area after completion of their nesting on islands in the South Atlantic (Lock et al. 1994).

Following completion of breeding, male sea ducks gather in sheltered bays for the summer for their moult. Common Eider and the Harlequin Duck (listed as Species of Concern in *SARA* Schedule 1 and Vulnerable under the *NLESA*) gather in continentally significant numbers (up to 50,077 and 50 individuals, respectively) in June around islands and inlets of St. Peter Bay IBA (Bird Studies Canada 2004g, internet site; Russell and Fifield 2001). Reports of 20 or more individuals of Harlequin Duck seen at the south end of the Bell Island South Coast IBA during summer suggest that this species may moult there (Figure 10.6.8-1) (Russell and Fifield 2001).

Conception Bay

Although small numbers of fulmars or shearwaters may enter outer Conception Bay, the marine habitat within Conception Bay is not known to support pre-moulting or moulting concentrations of seabirds within 40 km of the proposed Dowden's Point shoreline electrode site (Mactavish 2010, pers. comm.). There are no large concentrations of moulting coastal waterbirds in Conception Bay during summer. There are insufficient data to describe seabird density in the marine waters of Conception Bay (Fifield 2011, pers. comm.).

Seasonal Migratory Movements

Strait of Belle Isle Area

Large numbers of migrant pelagic seabirds, coastal waterbirds and shorebirds use the Strait of Belle Isle Area in passage between their breeding areas in coastal Labrador, the Canadian Arctic archipelago and Greenland, and their wintering areas in the Gulf of St. Lawrence and the Atlantic waters off Newfoundland, Nova Scotia, New Brunswick and the U.S., and, in the case of many shorebirds, South America (Russell and Fifield 2001; Lock et al. 1994; Tuck 1967). Observations from the Point Amour IBA, where the Strait of Belle Isle narrows to only 17 km wide, thus funnelling migrants and providing the opportunity to sample the migrant seabirds passing through the proposed submarine cable crossing corridor (Figure 10.5.10-1).

Pelagic Seabirds

Pelagic species detected in the Strait of Belle Isle Area during migration surveys include Northern Fulmar, shearwaters, Northern Gannet, Black-legged Kittiwake, phalaropes, auks and jaegers. At this site 4,000 large alcids were observed in northward migration from late April to late May (Russell and Fifield 2001; LeGrow 1999). Of those alcids that could be identified to species, most were Razorbills and the remainder were the two species of murre. This number is considered globally significant for Razorbill (Bird Studies Canada 2004e, internet site). Many of these Razorbills likely originated from the large colony in Gannet Islands Provincial

Ecological Reserve, Labrador, located 220 km north-west of the Strait of Belle Isle Area, which is the largest Razorbill colony in the world (Sikumiut 2010b). The Gannet Islands also host a large Atlantic Puffin colony.

Northern Fulmar density calculated from OLABS surveys during March and April was 0 birds/km^2 in offshore areas and averaged 0.1 birds/km^2 in nearshore areas (LGL 1983). During October and November density in offshore areas averaged 0.1 birds/km^2. In nearshore areas density averaged <0.02 birds/km^2. Densities during surveys by Jacques Whitford and Kingsley (2000) were 0.1 birds/km^2 on 7 October and negligible density on 27-29 October (Table 10.5.10-3).

Great Shearwater was absent from OLABS surveys during spring (LGL 1983). Density during autumn OLABS surveys averaged 2.1 birds/km^2 in offshore areas, but this species was absent from nearshore areas. During October 1998 surveys Great Shearwater occurred in negligible density (Table 10.5.10-3) (Jacques Whitford and Kingsley 2000). Sooty Shearwater was also absent during spring OLABS surveys (LGL 1983). During autumn, density of this species averaged 0.9 birds/km^2 in offshore areas but zero in nearshore areas. Jacques Whitford and Kingsley (2000) reported a density for this species of 0.1 birds/km^2 on 7 October but it was not recorded on 27-29 October (Table 10.5.10-3) (Jacques Whitford and Kingsley 2000). Almost 6,000 Sooty Shearwaters were counted passing Cape Bauld near L'Anse aux Meadows during land-based sea watches on 18-19 August 1981, indicating that southward migration of this species begins in August in this area (LGL 1983). Two flocks totalling more than 700 individuals were observed in early October.

Northern Gannet was not recorded during spring or autumn OLABS surveys (LGL 1983). It was recorded in low density during October surveys conducted by Nalcor (Jacques Whitford and Kingsley 2000).

Red Phalarope was not recorded during the spring or autumn OLABS surveys; however, the small-bodied phalarope species are difficult to detect during aerial surveys (LGL 1983). Red Phalarope was recorded in low density during the fall 2008 ship-board surveys reported by Jacques Whitford and Kingsley (2000).

Black-legged Kittiwake was not recorded during spring OLABS surveys (LGL 1983). During autumn surveys average density in nearshore areas was 1.0 birds/km^2, and in offshore areas was 0.4 birds/km^2. During 1998 surveys, it was recorded in a density of 0.8 birds/km^2 on 7 October but in much lower density on 27-29 October (Table 10.5.10-3) (Jacques Whitford and Kingsley 2000).

No jaegers were recorded during the OLABS surveys in spring or autumn (LGL 1983). However, jaegers (not identified to species) were recorded in low density during the 7 October 1998 survey (Jacques Whitford and Kingsley 2000).

Unidentified auks were recorded during OLABS spring surveys in nearshore areas in an average density of 0.2 birds/km^2 (LGL 1983). In offshore areas auk density averaged 0.7 birds/km^2 in spring and 0.1 birds/km^2 in autumn. During 1998 surveys, density of combined murres was 0.2 birds/km^2 on 7 October (Table 10.5.10-3) (Jacques Whitford and Kingsley 2000). Jacques Whitford and Kingsley (2000) also reported for auks that could not be separated into murres or Razorbill a density of 0.4 birds/km^2 on 27-29 October. Those that could be identified as Razorbill were recorded in a density of 0.2 birds/km^2 on 27-29 October. Atlantic Puffin was recorded in low density on 7 October but 0.5 birds/km^2 on 27-29 October. Dovekie occurred in a density of 0.8 birds/km^2 on 7 October and 0.9 birds/km^2 on 27-29 October.

Coastal Waterbirds

Coastal waterbird species using the Strait of Belle Isle Area during spring and autumn migration include eiders, scoters, other ducks, loons, terns, locally-nesting gulls, Arctic gulls and Black Guillemot. Red-throated and Common Loons were recorded in low densities during fall 1998 surveys (Jacques Whitford and Kingsley 2000). Common Eider is observed in globally significant numbers (over 62,000) from Point Amour IBA from late April to late May during spring migration (Bird Studies Canada 2004e, internet site; Russell and Fifield 2001). Fewer than 400 scoters and only seven Harlequin Duck were noted during the same time period. However, the majority of Scoters may have passed through after the surveys. Common Eider was not recorded during OLABS surveys (LGL 1983). Jacques Whitford and Kingsley (2000) reported that it occurred in a low density on

7 October but in a density of 0.4 birds/km^2 on 27-29 October (Table 10.5.10-3). White-winged Scoter and Long-tailed Duck were also recorded in low densities during the same surveys (Jacques Whitford and Kingsley 2000). Fall migration of murres and Common Eider through the Strait of Belle Isle is more protracted than in spring and can continue into December. However, fall migration in the Strait of Belle Isle has received little study.

Herring Gull was recorded during OLABS surveys in spring in an average density of 0.1 birds/km^2 in nearshore areas and 0.02 birds/km^2 offshore (LGL 1983). During autumn the average density was 0.4 birds/km^2 in nearshore areas and 0.2 birds/km^2 offshore. Jacques Whitford and Kingsley (2000) reported that this species occurred in a density of 0.1 birds/km^2 (Table 10.5.10-3). Great Black-backed Gull was recorded during OLABS surveys in the spring in an average density of 0.3 birds/km^2 in nearshore areas and 0.04 birds/km^2 offshore. During fall OLABS surveys density was 0.2 birds/km^2 in nearshore areas and 0.04 birds/km^2 offshore. Density of this species during 1998 surveys was low (Jacques Whitford and Kingsley 2000). Iceland Gull (*Larus glaucoides*) density during spring OLABS surveys in nearshore areas averaged 0.2 birds/km^2 and in offshore areas averaged 0.3 birds/km^2 (LGL 1983). During fall surveys density averaged 0.02 birds/km^2 in both nearshore and offshore areas. Density was low during fall surveys conducted in 1998 (Jacques Whitford and Kingsley 2000). Glaucous Gull (*Larus hyperboreus*) density during OLABS spring surveys averaged 0.01 birds/km^2 nearshore and averaged 0.003 birds/km^2 offshore (LGL 1983).

Globally significant numbers (over 5,000) of migrating Black Guillemot have been observed from Point Amour during spring migration (Bird Studies Canada 2004e, internet site; Russell and Fifield 2001). Low densities of this species were recorded during October surveys conducted for Nalcor (Jacques Whitford and Kingsley 2000). Large alcids (Thick-billed and Murre, Razorbill) migrate past Point Amour in globally significant numbers (over 40.000) during spring.

During the same surveys in 1998, few terns were recorded (Jacques Whitford and Kingsley 2000).

The only reported area in the Strait of Belle Isle Area where pelagic seabirds or coastal waterbirds concentrate during spring or autumn migration is Cape Bauld. Although most of the bird concentrations seen from Point Amour are migrants in passage, tidal rips during summer and autumn occasionally attract seabirds in concentrations visible from Point Amour (Russell and Fifield 2001).

Shorebirds

Shorebirds stop at tidal flats along headlands, beaches and lagoons to feed and rest during migration through the Strait of Belle Isle (Sikumiut 2010b). The largest numbers of passage migrants are typically observed during autumn migration from July to November, peaking from August to October. Few shorebirds are observed at these sites during spring, because most migrate through the Great Plains of North America during northward migration.

Shorebird stopover sites surveyed by CWS's Atlantic Canada Shorebird Surveys in the Strait of Belle Isle Area include Shoal Cove East, Pines Cove, Eddies Cove East, Anchor Point, Bear Cove, Lower Cove, Shoal Cove West, Deadman's Cove, Sandy Cove and L'Anse aux Meadows (all in Newfoundland), and L'Anse au Loup, Battle Harbour, L'Anse au Clair, Pinware Harbour, L'Anse au Amour and English Point (Forteau Bay) (all in Labrador) (Figure 10.5.10-3) (CWS 2010c; Sikumiut 2010b; Goulet and Robertson 2007). Migrant shorebirds also stop at Hare Bay (CWS and Newfoundland and Labrador Culture Recreation and Youth Wildlife Division 1987).

The ten most numerous species of shorebirds at stopover sites observed in the Strait of Belle Isle Area are, in order of abundance, White-rumped Sandpiper (*Calidris fuscicollis*), Greater Yellowlegs (*Tringa melanoleuca*), Semipalmated Sandpiper (*Calidris pusilla*), Ruddy Turnstone (*Arenaria interpres*), Semipalmated Plover (*Charadrius semipalmatus*), Dunlin (*Calidris alpina*), Sanderling (*Calidris alba*), Least Sandpiper (*Calidris minutilla*), Black-bellied Plover (*Pluvialis squatarola*) and Lesser Yellowlegs (*Tringa flavipes*) (CWS 2010c). Other shorebird species potentially observed in the Strait of Belle Isle Area are listed in Table 10.5.10-1. Peak numbers of shorebirds observed at Shoal Cove West include 305 White-rumped Sandpiper, 27 Greater Yellowlegs, 31 Ruddy Turnstone, 17 Black-bellied Plover, 15 Semipalmated Sandpiper, 14 Semipalmated Plover, and 1 Red Knot; smaller numbers of Spotted Sandpiper, Lesser Yellowlegs, Least Sandpiper, Sanderling, Whimbrel (*Numenius phaeopus*), Hudsonian Godwit (*Limosa haemastica*), Short-billed Dowitcher (*Limnodromus griseus*) and Wilson's Snipe (*Gallinago delicata*) have also been observed (CWS 2010c).

FIGURE 10.5.10-3

Select Atlantic Canada Shorebird Survey Sites in the Vicinity of the Strait of Belle Isle Area

Peak counts at other sites in the Strait of Belle Isle Area include 75 Sanderling and 2 Red Knot at Anchor Point (19 km south-west of the proposed submarine cable crossing corridor); 38 Semipalmated Plover, 58 Semipalmated Sandpiper and 47 White-rumped Sandpiper at Bear Cove (11 km south-west of the corridor); and, 80 Sanderling, 53 Semipalmated Sandpiper, 18 Red Knot and 37 Dunlin at Lower Cove (44 km north-east of the corridor) (Figure 10.5.10-3) (CWS 2010a). At Eddies Cove East (14 km north-east of the corridor) (Figure 10.5.10-3) 203 Greater Yellowlegs, 85 Ruddy Turnstones, 192 Semipalmated Sandpiper, 200 Least Sandpiper and 474 White-rumped Sandpiper have been observed (Goulet and Robertson 2007). English Point in Forteau Bay also provides stopover habitat for shorebirds (e.g., 102 Semipalmated Sandpiper observed 7 km north-east of the submarine cable crossing corridor and 14 km south-west of the L'Anse au Diable shoreline electrode site) (CWS 2010c).

Whimbrel and American Golden-Plover (*Pluvialis dominica*) stage at coastal barrens (heathlands) located in close proximity to the Labrador and Newfoundland coasts, including coastlines adjacent to the Strait of Belle Isle, during autumn migration. There they feed on the berries of ericaceous shrubs (Mactavish 2010, pers. comm.; Sikumiut 2010b; Peters and Burleigh 1951).

Conception Bay

There are few reported concentrations of migrating seabirds in Conception Bay, and the data are summarized in the following subsections.

Pelagic Seabirds

Strong north-east winds in autumn occasionally force Leach's Storm-Petrel, jaegers and auks to the head of the bay, after which many of the birds move north-east along the shoreline past the Dowden's Point shoreline electrode site (Mactavish 2010, pers. comm.). At the Cape St. Francis IBA, 43 km north-east of the shoreline electrode site, up to 650 Common Eiders have been observed during spring migration (Bird Studies Canada 2004h, internet site).

Shorebirds

There are no known concentrations of migrating shorebirds at or near the Dowden's Pont shoreline electrode site, but migrating shorebirds stop at a variety of sites around Conception Bay. The location with some of the largest numbers of shorebirds during autumn migration, Spaniard's Bay, is also the only Atlantic Canada Shorebird Survey site on Conception Bay (surveys from 1984 to 2007) (Figure 10.5.10-2) (Goulet and Robertson 2007). Spaniard's Bay is approximately 23 km north-west of the Dowden's Point shoreline electrode site, and a total of 22 species of shorebird have been recorded there during migration. Maximum counts of shorebirds at this location include 75 Semipalmated Plovers, 40 Black-bellied Plovers, 80 White-rumped Sandpipers, 139 Greater Yellowlegs, 17 Lesser Yellowlegs, 33 Semipalmated Sandpipers, 17 Sanderlings, six Red Knot and 50 Ruddy Turnstones (Goulet and Robertson 2007).

Wintering Populations

Strait of Belle Isle Area

From February through March, seabirds in the Strait of Belle Isle Area are reduced in number and restricted in distribution by ice to small areas of open water (LGL 1983). These birds consist mostly of Common Eider and Thick-billed Murre. In some winters, stretches of open water are present throughout the winter along the Labrador coast of the Strait of Belle Isle. In mid-March 1982, a concentration of 600 unidentified auks was observed along the Newfoundland coast approximately 20 km north-east of the proposed submarine cable crossing corridor.

Pelagic Seabirds

Densities of pelagic seabird species in the marine waters of the Strait of Belle Isle are low during winter (LGL 1983). During OLABS surveys, Northern Fulmar density during the winter in offshore areas averaged 0.01 birds/km^2 but this species was not recorded in nearshore areas. Shearwaters, Northern Gannet and phalaropes were absent during these surveys. Black-legged Kittiwake density averaged 0.4 birds/km^2 in nearshore areas and 0.3 birds/km^2 offshore. Unidentified auks averaged 0.06 birds/km^2 in nearshore areas and 0.2 birds/km^2 offshore during the winter.

Coastal Waterbirds

Large concentrations of Common Eider have been observed in the Strait of Belle Isle Area beginning in mid-December, and several thousand have been noted in coastal waters of sheltered bays near L'Anse aux Meadows, 61 km north-east of the submarine cable crossing corridor and a similar distance from the L'Anse au Diable shoreline electrode site, during winter (Lock et al. 1994; LGL 1983). Common Eider also winters in coastal waters of the Northern Groais Island and Bell Island South Coast IBAs (82 km and 96 km, respectively, from the submarine cable crossing corridor) (Bird Studies Canada 2004b, d, internet sites) and in globally significant numbers (10,000 individuals) in the Fischot Islands IBA (68 km from the corridor) (Bird Studies Canada 2004c, internet site). Approximately 200 American Black Ducks winter in Hare Bay (44 km from the corridor), which is this species' northernmost wintering site in the world (CWS and Newfoundland and Labrador Culture Recreation and Youth Wildlife Division 1987), but these birds are unlikely to travel overland to the submarine cable crossing corridor or L'Anse au Diable shoreline electrode site.

During winter OLABS surveys, coastal waterbird species present in the Strait of Belle Isle were limited to gulls (LGL 1983). Herring Gull was recorded in an average density of 0.01 birds/km^2 in nearshore areas and 0.003 birds/km^2 in offshore areas. Great Black-backed Gull density averaged 0.1 birds/km^2 in nearshore areas and 0.02 birds/km^2 offshore. Iceland Gull density varied widely, from 0 to 4.1 birds/km^2 (average 1.4 birds/km^2) in nearshore areas, but 0 to 0.02 birds/km^2 (average 0.007 birds/km^2) in offshore areas. Glaucous Gull density averaged 0.1 birds/km^2 in nearshore areas and 0.007 birds/km^2 offshore.

Conception Bay

Pelagic seabirds do not winter in Conception Bay, but several species of coastal waterbirds do, including various duck species, Common Loon and Great Cormorant (Table 10.5.10-1).

Coastal Waterbirds

Although smaller groups may winter within Conception Bay on occasion, there are no known concentrations of wintering Eiders near Dowden's Point. As many as 5,000 Common Eiders winter at the Cape St. Francis IBA (Figure 10.5.10-2) (Bird Studies Canada 2004h, internet site), located approximately 43 km north-east of the proposed Dowden's Point shoreline electrode site. Common Eiders (mostly the northern subspecies, *borealis*) winter in globally significant numbers (12,000 individuals) at the Grates Point IBA, 73 km north-west of the shoreline electrode site (Bird Studies Canada 2004i, internet site). Up to 0.04 ducks/km winter along the shores of Bell and Kelly's Islands and along the coast to the east of these islands (Lock et al. 1994). The closest of these islands, Kelly's Island, is 8 km north-east of the electrode site. One to two Barrow's Goldeneyes, have been observed wintering at Spaniard's Bay, 22 km north-west of Dowden's Point, for over ten years (Mactavish 2010, pers. comm.; Schmelzer 2006). However, none have been sighted near the electrode site.

Individual Harlequin Ducks, are occasionally sighted around Conception Bay in winter, but not near Dowden's Point. Great Black-backed, Herring, Glaucous, Iceland and Black-headed Gulls are distributed around the coastline of the bay in mixed flocks of up to a few hundred individuals during the winter. Most of these birds forage primarily at raw sewage outlets and garbage dumps and roost on islands around Conception Bay (Mactavish 2010, pers. comm.).

Shorebirds

Shorebirds rarely winter in Conception Bay, but up to 35 Purple Sandpipers regularly winter just outside the bay at Cape St. Francis (Bird Studies Canada 2004h, internet site).

Prey and Foraging Habits

Seabirds in the Strait of Belle Isle Area and Conception Bay employ a variety of foraging strategies and feed on a variety of prey species (Table 10.5.10-7). Among the pelagic seabird species, many of the shearwaters, storm-petrels, phalaropes and Black-legged Kittiwake, skuas and jaegers forage offshore, capturing their food by seizing it from the surface, either while flying or resting on the surface (Ronconi et al. 2010; Tracy et al. 2002; Rubega et al. 2000; Wiley and Lee 2000, 1999, 1998; Hatch and Nettleship 1998; Huntington et al. 1996; Baird 1994). Northern Gannet searches for prey from the air, then plunge-dives to varying depths to capture the prey item (Mowbray 2002). Most members of the auk family (Alcidae) forage offshore, diving from a resting position on the surface and pursuing their prey underwater (Lavers et al. 2009; Ainley et al. 2002; Lowther et al. 2002; Montevecchi and Stenhouse 2002; Gaston and Hipfner 2000). Surface-diving species spend most of their time on or under the ocean's surface. Diving depth and time also varies by species.

Among the coastal waterbird species, most gull species forage inshore, seizing prey items from the surface, either while flying or resting on the surface (Table 10.5.10-7) (Snell 2002; Gilchrist 2001; Good 1998; Pierotti and Good 1994). Arctic Tern forages inshore during the nesting season and offshore during migration and winter, whereas Common Tern forages only inshore. Terns plunge-dive to shallow depths to capture prey items (Hatch 2002). Loons, cormorants and Black Guillemots forage inshore, and dive from a resting position on the surface and pursue their prey underwater (Evers et al. 2010, internet site; Barr et al. 2000, internet site; Hatch et al. 2000, internet site; Hatch and Weseloh 1999, internet site; Cairns 1981). Marine ducks forage inshore, diving from the surface in shallow water to pick prey items from the surface of the benthos (Robertson and Savard 2002, internet site; Eadie et al. 2000, internet site; Goudie et al. 2000; Longcore et al. 2000, internet site; Suydam 2000, internet site; Mallory and Metz 1999, internet site; Robertson and Goudie 1999; Titman 1999; Savard et al. 1998; Brown and Fredrickson 1997; Bordage and Savard 1995; Eadie et al. 1995, internet site).

Prey size preference depends on seabird body size. Larger species of seabirds (i.e., fulmars, shearwaters, gannets, kittiwakes, skuas, jaegers, murres, razorbill, puffins, guillemots, gulls, loons, cormorants) feed primarily on capelin, sand lance, short-finned squid, crabs, offal or molluscs (Table 10.5.10-7). Smaller species such as phalaropes and Dovekie (*Alle alle*) feed primarily on euphausiids (krill), copepods, amphipods, and other zooplankton.

Most species of shorebirds feed in intertidal areas, walking on exposed flats or wading in shallow water, pecking or probing the substrate (Table 10.5.10-7) (Hicklin and Gratto-Trevor 2010, internet site; Nebel and Cooper 2008, internet site; Elliot-Smith and Haig 2004, internet site; MacWhirter et al. 2002; Harrington 2001; Jehl et al. 2001, internet site; Nettleship 2000; Nol and Blanken 1999; Tibbitts and Moskoff 1999; Elphick and Tibbitts 1998; Oring et al. 1997; Warnock and Gill 1996, internet site; Paulson 1995; Parmelee 1992, internet site). American Golden-Plover, Whimbrel and Eskimo Curlew (*Numenius borealis*) (the latter, historically) forage for berries in heathlands during autumn migration, in addition to feeding in intertidal areas (Johnson and Connors 2010, internet site; Skeel and Mallory 2000; Gill et al. 1998). Eskimo Curlew may be extinct (Table 10.5.10-1). At high tide most shorebird species remain on the shorelines where they feed, resting just above the high tide mark.

Species of Special Conservation Concern

Seabird species having special conservation concern status under the federal (*SARA*) and / or provincial (*NLESA*) legislation that use the Strait of Belle Isle Area and Conception Bay are Ivory Gull, Harlequin Duck (eastern population), Barrow's Goldeneye (eastern population) and Red Knot (*rufa* subspecies) (Table 10.5.10-8). Species that may occur include Piping Plover (*melodus* subspecies) and Eskimo Curlew (Table 10.5.10-8). Most of these seabird species are considered uncommon or rare in the Strait of Belle Isle Area and Conception Bay. National recovery strategies have been developed for both the Piping Plover and the Eskimo Curlew and they are posted on the *SARA* Registry. A discussion of these six species follows Table 10.5.10-8, including their likely occurrence in the Strait of Belle Isle Area and Conception Bay.

Table 10.5.10-7 Foraging Strategies and Prey Items of Seabird Species Using the Strait of Belle Isle Area and Conception Bay

Species, Family and Habitat Group	Foraging Strategy	Prey
Pelagic Seabirds[a]		
Fulmars and Shearwaters		
Northern Fulmar[b]	Surface seizing	Fish, cephalopods, crustaceans, offal
Great Shearwater[c]	Surface seizing	Fish, squid, krill, offal
Sooty Shearwater[c]	Surface seizing	Krill, fish, squid, offal
Storm-Petrels		
Leach's Storm-Petrel[d]	Surface seizing	Fish, cephalopods, crustaceans, offal
Gannets		
Northern Gannet[e]	Deep pursuit plunging	Mackerel, capelin, herring, squid
Phalaropes		
Red and Red-necked Phalaropes[f]	Surface seizing	Copepods, other invertebrates
Gulls		
Black-legged Kittiwake[g]	Surface seizing	Fish, crustaceans, cephalopods, offal
Ivory Gull[h,i]	Surface seizing and surface diving	Fish, invertebrates, carrion
Skuas and Jaegers		
Great Skua And Pomarine, Parasitic and Long-tailed Jaegers[j]	Kleptoparasitism, surface seizing	Fish, offal, mammals, invertebrates, birds, carrion
Auks		
Dovekie[k]	Pursuit surface diving	Copepods, amphipods, molluscs, small fish
Common Murre[l]	Pursuit surface diving	Fish, cephalopods, crustaceans
Thick-billed Murre[m]	Pursuit surface diving	Fish, invertebrates
Razorbill[n]	Pursuit surface diving	Fish, invertebrates
Atlantic Puffin[o]	Pursuit surface diving	Fish, crustaceans, cephalopods
Coastal Waterbirds		
Geese and Ducks		
Canada Goose[p]	Grazing	Grasses, sedges, berries, seeds
American Black Duck[q]	Dabbling	Seeds, roots, tubers, stems, leaves, invertebrates
Common and King Eiders[r]	Surface diving with bottom seizing	Molluscs, crustaceans, echinoderms
Harlequin Duck[s,i]	Diving with seizing	Crabs, amphipods, gastropods
Black, Surf and White-winged Scoters[t]	Surface diving with bottom seizing	Molluscs, crustaceans
Long-tailed Duck[u]		Crustaceans, bivalves

Table 10.5.10-7 Foraging Strategies and Prey Items of Seabird Species Using the Strait of Belle Isle Area and Conception Bay (continued)

Species, Family and Habitat Group	Foraging Strategy	Prey
Common[v] and Barrow's Goldeneye[v,i]	Diving with seizing	Invertebrates
Red-breasted and Common Mergansers[w]	Pursuit surface diving	Fish, crustaceans
Loons		
Common and Red-throated Loons[x]	Pursuit surface diving	Fish, crustaceans
Cormorants		
Great and Double-crested Cormorants[y]	Pursuit surface diving	Mackerel, capelin, herring, squid
Gulls and Terns		
Herring Gull[z]	Surface seizing	Fish, crustaceans, cephalopods, offal
Iceland Gull[aa]	Surface seizing	Fish, invertebrates, small mammals, offal, carrion
Great Black-backed Gull[bb]	Surface seizing	Fish, invertebrates, offal, tetrapods
Glaucous Gull[cc]	Surface seizing	Fish, invertebrates, mammals, offal, carrion
Arctic and Common Tern[dd]	Surface seizing and pursuit plunging	Fish, invertebrates
Auks		
Black Guillemot[ee]	Pursuit surface diving	Fish, invertebrates
Shorebirds		
Plovers		
American Golden-Plover[ff]	Running with pecking	Worms, crustaceans, other invertebrates, berries
Black-bellied, Semipalmated and Piping Plovers[gg]	Running with pecking	Worms, crustaceans, other invertebrates
Sandpipers		
Spotted Sandpiper [hh]	Walking with pecking	Invertebrates, small fish
Greater and Lesser Yellowlegs[ii]	Wading with probing, sweeping pecking	Invertebrates, small fish
Eskimo Curlew[jj,i], Whimbrel [jj]	Walking with pecking, probing	Invertebrates, berries
Ruddy Turnstone[kk]	Walking with overturning, digging pecking, probing	Invertebrates, berries, seeds, carrion, bird eggs
Red Knot[ll,i]	Walking or wading with pecking, probing	Invertebrates
Sanderling[mm]	Running with pecking, probing	Invertebrates
Least, Semipalmated, and White-rumped Sandpipers and Dunlin[nn]	Walking with pecking, probing	Invertebrates

Table 10.5.10-7 Foraging Strategies and Prey Items of Seabird Species Using the Strait of Belle Isle Area and Conception Bay (continued)

Species, Family and Habitat Group	Foraging Strategy	Prey
Short-billed Dowitcher[oo]	Wading with probing benthos	Invertebrates

(a) Nesting pelagic species may feed in nearshore areas on spawning capelin.
(b) Hatch and Nettleship (1998).
(c) Ronconi et al. (2010); Brown et al. (1981).
(d) Huntington et al. (1996).
(e) Mowbray (2002).
(f) Tracy et al. (2002); Rubega et al. (2000).
(g) Baird (1994).
(h) Mallory et al. (2008, internet site).
(i) Species of Special Conservation Concern; see Table 10.5.10-8.
(j) Wiley and Lee (2000, 1999, 1998).
(k) Montevecchi and Stenhouse (2002).
(l) Ainley et al. (2002).
(m) Gaston and Hipfner (2000).
(n) Lavers et al. (2009).
(o) Lowther et al. (2002).
(p) Mowbray et al. (2002, internet site).
(q) Longcore et al. (2000, internet site).
(r) Goudie et al. (2000); Suydam (2000, internet site).
(s) Robertson and Goudie (1999).
(t) Savard et al. (1998); Brown and Fredrickson (1997); Bordage and Savard (1995).
(u) Robertson and Savard (2002, internet site).
(v) Eadie et al. (2000, 1995, internet sites).
(w) Mallory and Metz (1999, internet site); Titman (1999).
(x) Evers et al. (2010, internet site); Barr et al. (2000, internet site).
(y) Hatch et al. (2000, internet site); Hatch and Weseloh (1999, internet site).
(z) Pierotti and Good (1994).
(aa) Snell (2002).
(bb) Good (1998).
(cc) Gilchrist (2001).
(dd) Hatch (2002); Nisbet (2002).
(ee) Cairns (1981).
(ff) Johnson and Connors (2010, internet site).
(gg) Elliot-Smith and Haig (2004, internet site); Nol and Blanken (1999); Paulson (1995).
(hh) Oring et al. (1997).
(ii) Tibbitts and Moskoff (1999); Elphick and Tibbitts (1998).
(jj) Gill et al. (1998); Skeel and Mallory (1996).
(kk) Nettleship (2000).
(ll) Harrington (2001).
(mm) MacWhirter et al. (2002).
(nn) Hicklin and Gratto-Trevor (2010, internet site); Nebel and Cooper (2008, internet site); Warnock and Gill (1996, internet site); Parmelee (1992, internet site).
(oo) Jehl et al. (2001, internet site).

Table 10.5.10-8 Seabird Species of Special Conservation Concern Potentially Occurring in the Strait of Belle Isle Area and Conception Bay

Common Name	*NLESA* Status	*SARA* Designation	COSEWIC Designation
Harlequin Duck, eastern population	Vulnerable	Special concern – Schedule 1	Special concern
Barrow's Goldeneye, eastern population	Vulnerable	Special concern – Schedule 1	Special concern
Piping Plover, *melodus* subspecies	Endangered (May 2000)[a]	Endangered – Schedule 1	Endangered
Eskimo Curlew	Endangered (May 2000)[a]	Endangered – Schedule 1	Endangered
Red Knot, *rufa* subspecies	Endangered (April 2007)[a]	No Status, No Schedule[b]	Endangered
Ivory Gull	Endangered (October 2006)[a]	Endangered – Schedule 1	Endangered

Source: COSEWIC (2010c, internet site).
[a] Date when designation was assigned.
[b] Undergoing consultation process for addition to Schedule 1.

Harlequin Duck

Harlequin Duck, eastern population, is listed on Schedule 1 of *SARA* as 'Special Concern' and on *NLESA* as 'Vulnerable' (Table 10.5.10-8). The COSEWIC designation was previously 'Endangered'; however, it was last assessed by the COSEWIC in May 2001 and placed in a lower risk category (COSEWIC 2010c, internet site). The population of this sea duck is substantially larger than previously thought, though still low. Harlequin Ducks are known to use the Torrent River on the Northern Peninsula as a breeding site (Thomas 2008) and to migrate through the Strait of Belle Isle (Russell and Fifield 2001).

This species' occurrence in the Strait of Belle Isle Area has not been studied as extensively as other species discussed in this section. About 50 Harlequin Ducks have been observed in the summer in the St. Peter Bay IBA in what was probably a pre-moulting concentration (Russell and Fifield 2001). However, during the 1996 monitoring at the Point Amour IBA, only seven Harlequin Ducks were observed, although most Harlequin Ducks may have passed through after the surveys (Russell and Fifield 2001). The proportion of the total population that uses the Strait of Belle Isle as a migratory corridor is not known. However, Gilliland et al. (2008b) show that 20% of the eastern North American wintering population of Harlequin Duck population overwinters on the Northern Peninsula near the Strait of Belle Isle Area.

This species is rarely seen (primarily during autumn, winter or spring) in Conception Bay (Mactavish 2010, pers. comm.).

Barrow's Goldeneye

Barrow's Goldeneye, eastern population, is listed on Schedule 1 of *SARA* as 'Special Concern' and the *NLESA* as 'Vulnerable' (Table 10.5.10-8). It was last assessed by COSEWIC in November 2000 (COSEWIC 2010c, internet site). Reasons for designation include the small numbers of individuals in this eastern population. This species is known to migrate through the Strait of Belle Isle Area to winter primarily in the shallower waters of the St. Lawrence estuary, with small numbers observed throughout Atlantic Canada and Maine (Schmelzer 2006; Robert et al. 2000). They begin arriving on wintering grounds in early October (Robert et al. 2002). If breeding occurs on the Island of Newfoundland it is probably sporadic or infrequent (fresh water bodies only) (Schmelzer 2006).

This population moults on the coast of Labrador and may breed in interior Labrador (LGL 2007; Robert et al. 2002). These birds are likely the source of migrants in the Strait of Belle Isle Area. During waterfowl surveys conducted from Point Amour in the spring of 1996 only one sighting of Barrow's Goldeneye was recorded (CWS 1996).

The only recent reports of this species in Conception Bay consist of one to two males and a Barrow's Goldeneye X Common Goldeneye hybrid male that have wintered for over ten years in Spaniard's Bay, 22 km northwest of the proposed shoreline electrode site (Mactavish 2010, pers. comm.; Schmelzer 2006).

Piping Plover

Piping Plover, *melodus* subspecies, a shorebird, is listed on Schedule 1 of *SARA* as 'Endangered' and on the *NLESA* as 'Endangered' (May 2001) (Table 10.5.10-8). This species was last assessed by COSEWIC in May 2001 (COSEWIC 2010c, internet site). Reasons for its designation include a small number of individuals that are breeding in Canada, and a decreasing quality, loss and destruction of nesting habitat. Predation, habitat degradation by ATV use and other disturbances are interfering with reproductive success. Strong conservation initiatives have failed to result in any substantial increase in numbers of breeding pairs (COSEWIC 2010c, internet site).

Piping Plover nest on some of the sandy beaches on Newfoundland's west and south coasts, the closest to the proposed submarine cable crossing corridor being 175 km to the south-west at Shallow Bay in Gros Morne National Park (Sikumiut 2010b). The closest nesting location to the proposed Dowden's Point shoreline electrode site is 250 km to the south-west at St. Pierre and Miquelon (CWS 2004c, internet site). Piping Plover may occur within the proposed corridor during pre- or post-breeding movements.

Eskimo Curlew

The Eskimo Curlew is a species of shorebird that is listed on Schedule 1 of *SARA* and *NLESA* as 'Endangered' (Table 10.5.10-8). The last assessment by COSEWIC was in November 2009 (COSEWIC 2010c, internet site). This species has 100% of its known breeding range in Arctic Canada. The population collapsed in the late 1800s, primarily due to uncontrolled market hunting and dramatic losses in the amount and quality of spring stopover habitat (native grasslands). The population has never recovered and there have been no confirmed breeding records for over 100 years, or any confirmed records of birds (photographs or specimens) since 1963. Recent sight records suggest the possibility that a small population (fewer than 50 mature individuals) may still persist in remote Arctic landscapes (COSEWIC 2009b).

Factors affecting recovery include low population size, no known chance of rescue from outside populations, and the historic and ongoing conversion of native grasslands on its spring staging areas in Canada and the U.S. and on its wintering grounds in Argentina (COSEWIC 2010c, internet site). Although the species is known to have staged along the Labrador coast, the occurrence of this species in the Strait of Belle Isle or Conception Bay is unlikely because of its extreme rarity or possible extinction.

Red Knot

Red Knot, *rufa* subspecies, is a medium-sized sandpiper listed under the *NLESA* as 'Endangered' (April 2007) (Table 10.5.10-8). This subspecies is designated 'Endangered' by COSEWIC and is in the consultation process for addition to Schedule 1 of *SARA* (Table 10.5.10-8) (COSEWIC 2010c, internet site). The Red Knot received these designations because of a 70% decline in population in the 15 years preceding COSEWIC assessment and threats to a critical food supply on Delaware Bay during its northward migration (COSEWIC 2007d, internet site). The NL government has prepared a recovery strategy, which can be accessed through the Wildlife Division of the Department of Environment and Conservation (Garland and Thomas 2009).

This subspecies nests on the islands of the southern Arctic archipelago of Canada and the adjacent mainland (COSEWIC 2007d, internet site). It winters primarily in Patagonia and Tierra del Fuego in South America. During autumn migration the majority of birds stage on the north shore of the St. Lawrence estuary. Most adults stop in this area in late July to early August, whereas most juveniles stage in mid-August to mid-September. The closest important migration staging site to the proposed submarine cable crossing corridor is 460 km to the south-west at the Mingan Archipelago, Québec. In NL this subspecies uses tidal shorelines, sand-flats and salt-marshes during migration (Garland and Thomas 2009).

This subspecies has been seen on all coasts of Newfoundland during autumn, but the majority of sightings have been from the west coast from St. Paul's Inlet (120 km from the submarine cable crossing corridor) and southward, and from Bellevue Beach, Trinity Bay (Garland and Thomas 2009). During Atlantic Canada Shorebird Surveys, this subspecies has been sighted at Shoal Cove West (one bird), two birds at Anchor Point (19 km south-west of the submarine cable crossing corridor) and 18 birds at Lower Cove (44 km south-west of the corridor) (Figure 10.5.10-3) (CWS 2010c). Red Knot has also been observed at Blanc-Sablon, Lourdes-de-Blanc-Sablon, Île aux Perroquets (up to 120 individuals, Baie de Brador IBA) and Brador, Quebec. Most Labrador sightings are from the south coast (Todd 1963).

In Conception Bay, six *rufa* Red Knots have been sighted at Spaniard's Bay, 23 km north-west of the proposed Dowden's Point shoreline electrode site (Figure 10.5.10-2) (Goulet and Robertson 2007).

Ivory Gull

Ivory Gull is listed on both Schedule 1 of *SARA* and the *NLESA* as 'Endangered' (Table 10.5.10-8). It was last assessed by COSEWIC in April 2006 (COSEWIC 2010c, internet site). Aboriginal traditional knowledge and recent intensive breeding colony surveys indicate that the Canadian breeding population of this seabird has declined by 80% over the last 20 years. Threats include contaminants in the food chain, continued hunting in Greenland, possible disturbance by mineral exploration at some breeding locations and degradation of ice-related foraging habitats as a result of climate change (COSEWIC 2010c, internet site).

This species winters among the pack ice of the Davis Strait, Labrador Sea, and Gulf of St. Lawrence, including the Strait of Belle Isle (Stenhouse 2004). It has been occasionally observed along the coast of the Northern Peninsula (Warkentin and Newton 2009; Stenhouse 2004). In general, sightings of Ivory Gull in the rest of Newfoundland are rare and irregular (Stantec 2010f).

Local Ecological Knowledge

LEK regarding marine birds in parts of the Study Area was obtained through Labrador-Island Transmission Link Strait of Belle Isle Marine Crossing Meeting participant in West St. Modeste. This is listed below (Table 10.5.10-9), and includes information on L'Anse au Diable as a duck hunting area. The information provided is generally in keeping with the scientific data obtained through the field studies and literature review conducted for the EA (as reported in Section 10.5.10.2).

Table 10.5.10-9 Local Ecological Knowledge of Sea Ice and Icebergs in the Study Area

Community	Source	Indirect Quote
West St. Modeste, NL	Labrador-Island Transmission Link EA, Strait of Belle Isle Marine Crossing Meeting participant, West St. Modeste, NL, January 13, 2011	The proposed electrode site in L'Anse au Diable is a duck hunting area

10.5.11 Summary Overview - Species of Special Conservation Concern

Species of special conservation concern for the Terrestrial, aquatic (Freshwater) and Marine environments were identified during the component studies (Nalcor 2011) and discussed in this chapter. Tables 10.5.11-1 and 10.5.11-2 list the protected (i.e., on SARA Schedule 1 or NLESA) SSCC, as well as those listed by COSEWIC (2011, internet site) or assessed by the provincial SSAC (NLDEC 2011e, internet site) with the potential to occur within or near the transmission corridor for the terrestrial and freshwater aquatic environments, respectively, and their regulatory status. Table 10.5.11-3 provides a list of protected (i.e., on SARA Schedule 1 or NLESA) SSCC, as well as those listed by COSEWIC (2011, internet site) or assessed by the SSAC (NLDEC 2011e, internet site) with the potential to occur in the Strait of Belle Isle or Conception Bay (i.e., the Marine Environment), and their regulatory status. These tables also provide a rationale for further inclusion or exclusion of the particular species in the Project effects assessment, and where in the EIS the species is addressed. The rationale relates to the likelihood of species presence in the study area based on the presence of suitable habitat, previously recorded observations, and observations during field programs for the Project.

Table 10.5.11-1 Consideration of Species of Special Conservation Concern in the Environmental Impact Statement – Terrestrial Environment

Species of Special Conservation Concern[a]		Species Regulatory Status				Rationale for Species Inclusion or Exclusion in EIS	Species Addressed in EIS
Common Name	Scientific Name	*Species At Risk Act* Registry[b] (*SARA* 2011)	Provincial Listing[c] (GNL 2011)	National Status[d] (COSEWIC 2011)	Provincial Species Status Advisory Committee[e] (NLDEC 2011)		
Vegetation							
Long's Braya	*Braya longii*	Schedule 1, Endangered	Endangered	Endangered	—	– Known or likely present in the Northern Peninsula	Yes – Sections: 10.3.3 12.2.5.6 Listed Plant Species KI 12.2.6.5 12.6.2-1 Table 12.2.3-2 Table 12.2.5-1 Table 12.2.5-10 Table 12.2.7-1 Table 12.2.9-3 Table 12.6.2-1 Figures 10.3.3-12 to 10.3.3-15
Fernald's Braya	*Braya fernaldii*	Schedule 1, Threatened	Threatened	Threatened	—	– Known or likely present in the Northern Peninsula	Yes – Sections: 10.3.3 12.2.5.6 Listed Plant Species KI 12.2.6.5 12.6.2-1 Table 12.2.3-2 Table 12.2.5-1 Table 12.2.5-10 Table 12.2.7-1 Table 12.2.9-3 Table 12.6.2-1 Figures 10.3.3-12 to 10.3.3-15

Table 10.5.11-1 Consideration of Species of Special Conservation Concern in the Environmental Impact Statement – Terrestrial Environment (continued)

Species of Special Conservation Concern[a]		Species Regulatory Status				Rationale for Species Inclusion or Exclusion in EIS	Species Addressed in EIS
Common Name	**Scientific Name**	***Species At Risk Act* Registry[b] (*SARA* 2011)**	**Provincial Listing[c] (GNL 2011)**	**National Status[d] (COSEWIC 2011)**	**Provincial Species Status Advisory Committee[e] (NLDEC 2011)**		
Fernald's Milk-vetch	*Astragalus robbinsii* var. *fernaldii*	Schedule 1, Special Concern	Vulnerable	Special Concern	—	– Known to occur only from the Strait of Belle Isle region (both sides)	Yes – Sections: 10.3.3 12.2.3 12.2.5.6 Listed Plant Species KI 12.2.6.5 Table 12.2.3-2 Table 12.2.5-10 Table 12.2.7-1 Table 12.2.9-3 Table 12.6.2-1
Boreal Felt Lichen (boreal population)	*Erioderma pedicellatum*	Schedule 1, Special Concern	Vulnerable	Special Concern	—	– Known or likely present in the Avalon Peninsula and Bay d'Espoir	Yes – Sections: 10.3.3 12.2.5.6 Listed Plant Species KI 12.2.8 Figures 10.3.3-14 to 10.3.3-17 Table 10.3.3-15 Table 12.2.3-2 Table 12.2.5-1 Table 12.2.5-10 Table 12.2.7-1 Table 12.2.9-3 Figures 10.3.3-12 to 10.3.3-15
Barrens Willow	*Salix jejuna*	Schedule 1, Endangered	Endangered	Endangered	—	– Not known or likely to occur along or near the transmission corridor	No

Table 10.5.11-1 Consideration of Species of Special Conservation Concern in the Environmental Impact Statement – Terrestrial Environment (continued)

Species of Special Conservation Concern[a]		Species Regulatory Status				Rationale for Species Inclusion or Exclusion in EIS	Species Addressed in EIS
Common Name	**Scientific Name**	***Species At Risk Act* Registry[b] (*SARA* 2011)**	**Provincial Listing[c] (GNL 2011)**	**National Status[d] (COSEWIC 2011)**	**Provincial Species Status Advisory Committee[e] (NLDEC 2011)**		
Crowded Wormseed Mustard	*Erysimum inconspicuum* var. *coarctatum*	—	Endangered	—	—	– Not known or likely to occur along or near the transmission corridor	No
Low Northern Rockcress	*Neotorularia humilis (=Braya humilis)*	—	Endangered	—		– Not known or likely to occur along or near the transmission corridor	No
Porsild's Bryum	*Mielichhoferia macrocarpa (=Bryum porsildii)*	Schedule 1, Threatened	Threatened	Threatened	—	– Not known or likely to occur along or near the transmission corridor	No
Mountain Fern	*Thelypteris quelpaertensis*	—	Vulnerable	—	—	– Not known or likely to occur along or near the transmission corridor	No
Caribou							
Woodland caribou (Boreal population)	*Rangifer tarandus caribou*	Schedule 1, Threatened	Threatened	Threatened	—	– Known to occur in Central and Southeastern Labrador	Yes – Sections: 10.3.4 12.3 Caribou VEC In all sections in 12.3 12.6.4 12.6.5 12.6.6 In all tables in Section 12.3 Table 12.6.1-1 Table 12.6.1-2 Table 12.6.2-1

Table 10.5.11-1 Consideration of Species of Special Conservation Concern in the Environmental Impact Statement – Terrestrial Environment (continued)

Species of Special Conservation Concern[(a)]		Species Regulatory Status				Rationale for Species Inclusion or Exclusion in EIS	Species Addressed in EIS
Common Name	**Scientific Name**	***Species At Risk Act* Registry[(b)] (*SARA* 2011)**	**Provincial Listing[(c)] (GNL 2011)**	**National Status[(d)] (COSEWIC 2011)**	**Provincial Species Status Advisory Committee[(e)] (NLDEC 2011)**		
Furbearers							
Newfoundland Marten (American Marten Newfoundland population)	*Martes americana atrata*	Schedule 1, Threatened	Threatened	Threatened	At Risk	– Newfoundland	Yes – Sections: 10.3.6 12.4.3.2 Marten KI Throughout 12.4 and12.6 Figure 10.3.6-3 Figure 10.3.6-4 Figure 10.3.6-5 Table 10.3.6-1 Table 10.3.6-2 Table 10.3.6-3 Table 10.3.6-4 Table 10.3.6-11 Table 10.3.6-12 Table 12.1-1 Table 12.4.3-2 Table 12.4.3-3 Table 12.4.3-5 Table 12.4.5-1 Table 12.4.5-2 Table 12.4.5-3 Table 12.4.6-1 Table 12.4.7-1 Table 12.4.8-1 Table 12.4.9-1 Table 12.6.1-1 Table 12.6.2-1 Table 12.6.4-1

Table 10.5.11-1 Consideration of Species of Special Conservation Concern in the Environmental Impact Statement – Terrestrial Environment (continued)

Species of Special Conservation Concern[a]		Species Regulatory Status				Rationale for Species Inclusion or Exclusion in EIS	Species Addressed in EIS
Common Name	**Scientific Name**	***Species At Risk Act* Registry[b] (*SARA* 2011)**	**Provincial Listing[c] (GNL 2011)**	**National Status[d] (COSEWIC 2011)**	**Provincial Species Status Advisory Committee[e] (NLDEC 2011)**		
Wolverine (Eastern population)	*Gulo gulo*	Schedule 1, Endangered	Endangered	Endangered	At Risk	– Not found in Newfoundland, and no conclusive evidence that the species is present in Labrador	No Table 10.3.6-1
Avifauna							
Harlequin Duck	*Histrionicus histrionicus*	Schedule 1, Special Concern	Vulnerable	Special Concern	Sensitive	– Known or likely present in Central and Southeastern Labrador and Northern Peninsula regions	Yes – Sections: 10.3.7 10.5.10.3 12.5 Avifauna KI 12.5.5.3 12.6.6 Table 10.3.7-2 Table 10.3.7-6 Table 10.3.7-7 Table 10.5.10-1 Table 10.5.10-7 Table 10.5.10-8 Table 12.5.3-2 Table 12.5.8-1 Table 12.6.1-1 Table 12.6.2-1

Table 10.5.11-1 Consideration of Species of Special Conservation Concern in the Environmental Impact Statement – Terrestrial Environment (continued)

Species of Special Conservation Concern[a]		Species Regulatory Status				Rationale for Species Inclusion or Exclusion in EIS	Species Addressed in EIS
Common Name	**Scientific Name**	***Species At Risk Act* Registry[b] (*SARA* 2011)**	**Provincial Listing[c] (GNL 2011)**	**National Status[d] (COSEWIC 2011)**	**Provincial Species Status Advisory Committee[e] (NLDEC 2011)**		
Rusty Blackbird	*Euphagus carolinus*	Schedule 1, Special Concern	Vulnerable	Special Concern	—	– Known or likely present in Southeastern Labrador	Yes – Sections: 10.3.7 12.5 Avifauna KI 12.5.5.4 Table 10.3.7-1 Table 12.5.3-2 Table 12.5.5-3 Table 12.5.8-1 Table 12.6.2-1
Red Crossbill *percna* subspecies	*Loxia curvirostra percna*	Schedule 1, Endangered	Endangered	Endangered	At Risk	– Known or likely present in Northern Peninsula, Central and Eastern Newfoundland and Avalon Peninsula regions	Yes – Sections: 10.3.7 12.5 Avifauna KI 12.5.5.4 12.5.6.4 Table 10.3.7-1 Table 12.5.3-2 Table 12.6.2-1

Table 10.5.11-1 Consideration of Species of Special Conservation Concern in the Environmental Impact Statement – Terrestrial Environment (continued)

Species of Special Conservation Concern[a]		Species Regulatory Status				Rationale for Species Inclusion or Exclusion in EIS	Species Addressed in EIS
Common Name	**Scientific Name**	***Species At Risk Act* Registry[b] (*SARA* 2011)**	**Provincial Listing[c] (GNL 2011)**	**National Status[d] (COSEWIC 2011)**	**Provincial Species Status Advisory Committee[e] (NLDEC 2011)**		
Grey-cheeked Thrush	*Catharus minimus*	No status	Vulnerable	Not assessed	—	– Known or likely present in Southeastern Labrador, Northern Peninsula, Central and Eastern Newfoundland and Avalon Peninsula regions	Yes – Sections: 10.3.7 12.5 Avifauna KI 12.5.5.4 12.5.6.4 Table 10.3.7-1 Table 12.5.3-2 Table 12.5.5-1 Table 12.5.5-4 Table 12.5.6-1 Table 12.5.8-1 Table 12.6.2-1
Barn swallow	*Hirundo rustica*	No status	No status	Threatened	—	– Occurs in southwestern Newfoundland, outside of the Study Area	Yes – Sections: Table 10.3.7-1
Bobolink	*Dolichonyx oryzivorus*	No status	No status	Threatened	—	– Occurs in southwestern Newfoundland, outside of the Study Area	Yes – Sections: Table 10.3.7-1
Olive-sided Flycatcher	*Contopus cooperi*	Schedule 1, Threatened	Threatened	Threatened	—	– Known or likely present in Southeastern Labrador, Northern Peninsula, Central and Eastern Newfoundland and Avalon Peninsula regions	Yes – Sections: 10.3.7 12.5 Avifauna KI 12.5.5.4 Table 10.3.7-1 Table 12.5.3-2 Table 12.5.5-1 Table 12.6.2-1

Table 10.5.11-1 Consideration of Species of Special Conservation Concern in the Environmental Impact Statement – Terrestrial Environment (continued)

Species of Special Conservation Concern[a]		Species Regulatory Status				Rationale for Species Inclusion or Exclusion in EIS	Species Addressed in EIS
Common Name	**Scientific Name**	***Species At Risk Act* Registry[b] (*SARA* 2011)**	**Provincial Listing[c] (GNL 2011)**	**National Status[d] (COSEWIC 2011)**	**Provincial Species Status Advisory Committee[e] (NLDEC 2011)**		
Short-eared Owl	*Asio flammeus*	Schedule 3, Special Concern	Vulnerable	Special Concern	—	– Known or likely present in Southeastern Labrador, Northern Peninsula and Avalon Peninsula regions	Yes – Sections: 10.3.7 12.5 Avifauna KI 12.5.5.5 Table 10.3.7-1 Table 10.3.7-5 Table 12.5.3-2 Table 12.5.5-1 Table 12.6.2-1
Common Nighthawk	*Chordeiles minor*	Schedule 1, Threatened	Threatened	Threatened	—	– Known or likely present in Southeastern Labrador region	Yes – Sections: 10.3.7 12.5 12.5.5.7 Table 10.3.7-1 Table 12.5.3-2 Table 12.5.5-8 Table 12.5.7-1 Table 12.5.8-1 Table 12.6.2-1

Table 10.5.11-1 Consideration of Species of Special Conservation Concern in the Environmental Impact Statement – Terrestrial Environment (continued)

Species of Special Conservation Concern[a]		Species Regulatory Status				Rationale for Species Inclusion or Exclusion in EIS	Species Addressed in EIS
Common Name	**Scientific Name**	***Species At Risk Act* Registry[b] (*SARA* 2011)**	**Provincial Listing[c] (GNL 2011)**	**National Status[d] (COSEWIC 2011)**	**Provincial Species Status Advisory Committee[e] (NLDEC 2011)**		
Red Knot *rufa* subspecies	*Calidris canutus rufa*	No schedule, No status	Endangered	Endangered	—	– Not known to breed in NL, but stop over during fall migration along the coast of the Avalon Peninsula – Have minimal to no potential interaction with Project components	Yes – Sections: 10.3.7 10.5.10.3 12.5 Table 10.3.7-1 Table 10.5.10-1 Table 10.5.10-7 Table 10.5.10-8 Table 12.5.3-2 Table 12.5.7-1

(a) Includes protected Species of Special Conservation Concern with potential to occur along or near the transmission corridor.
(b) SARA (2011, internet site).
(c) GNL (2011, internet site).
(d) COSEWIC (2011, internet site).
(e) NLDEC (2011e, internet site).

Table 10.5.11-2 Consideration of Species of Special Conservation Concern in the Environmental Impact Statement – Freshwater Environment

Species of Special Conservation Concern[(a)]		Species Regulatory Status				Rationale for Species Inclusion or Exclusion in EIS	Species Addressed in EIS
Common Name	Scientific Name	*Species At Risk Act* Registry[(b)] (*SARA* 2011)	Provincial Listing[(c)] (GNL 2011)	National Status[(d)] (COSEWIC 2011)	Provincial Species Status Advisory Committee[(e)] (NLDEC 2011)		
Fish							
American eel	*Anguilla rostrata*	No status	Vulnerable	Special Concern	Secure	– Suitable habitat – Previously reported in all regions of the Project except the Avalon Peninsula – Not captured during 2008 surveys	Yes – Sections: 10.4.5.2 10.4.6 13.3 T.13.3.9; Also addressed in Section 14.2 under the Marine Environment Fish KI
Banded killifish (Newfoundland population)	*Fundulus diaphanus*	Schedule 1 Special Concern	Vulnerable	Special Concern	Sensitive	– Not known to occur along the transmission corridor in Newfoundland – Not recorded in Labrador – Not captured during 2008 surveys	Yes – Sections: 10.4.6

(a) Includes protected Species of Special Conservation Concern with potential to occur along or near the transmission corridor.
(b) SARA (2011, internet site).
(c) GNL (2011, internet site).
(d) COSEWIC (2011, internet site).
(e) NLDEC (2011e, internet site).

Table 10.5.11-3 Consideration of Species of Special Conservation Concern in the Environmental Impact Statement – Marine Environment

Species of Special Conservation Concern[a]		Species Regulatory Status				Rationale for Species Inclusion or Exclusion in EIS	Species Addressed in EIS
Common Name	**Scientific Name**	***Species At Risk Act* Registry[b] (*SARA* 2011)**	**Provincial Listing[c] (GNL 2011)**	**National Status[d] (COSEWIC 2011)**	**Provincial Species Status Advisory Committee[e] (NLDEC 2011)**		
Fish[e]							
White Shark Atlantic population	*Carcharodon carcharias*	Schedule 1, Endangered	—	Endangered	—	– Known or likely present in the Strait of Belle Isle	Yes – Sections: 10.5.8 T.10.5.8-14 14.5.2 Table 14.5.2-1
Atlantic Wolffish	*Anarhichas lupus*	Schedule 1, Special Concern	—	Special Concern	—	– Known or likely present in the Strait of Belle Isle and Conception Bay	Yes – Sections: 10.5.8 T.10.5.8-14 14.5.2 Table 14.5.2-1
Northern Wolffish	*Anarhichas denticulatus*	Schedule 1, Threatened	—	Threatened	—	– Known or likely present in the Strait of Belle Isle and Conception Bay	Yes – Sections: 10.5.8 T.10.5.8-14 14.5.2 Table 14.5.2-1
Spotted Wolffish	*Anarhichas minor*	Schedule 1, Threatened	—	Threatened	—	– Known or likely present in the Strait of Belle Isle and Conception Bay	Yes – Sections: 10.5.8 T.10.5.8-14 14.5.2 Table 14.5.2-1
American eel[f]	*Anguilla rostrata*	No status	—	Special Concern	Secure	– Known or likely to pass through the Strait of Belle Isle Area and the Dowden's Point Area	Yes – Sections: 10.5.8 T.10.5.8-14 14.2 Also assessed in Section 13.3, Freshwater Fish and Fish Habitat

Table 10.5.11-3 Consideration of Species of Special Conservation Concern in the Environmental Impact Statement – Marine Environment (continued)

Species of Special Conservation Concern[(a)]		Species Regulatory Status				Rationale for Species Inclusion or Exclusion in EIS	Species Addressed in EIS
Common Name	Scientific Name	*Species At Risk Act* Registry[(b)] (*SARA* 2011)	Provincial Listing[(c)] (GNL 2011)	National Status[(d)] (COSEWIC 2011)	Provincial Species Status Advisory Committee[(e)] (NLDEC 2011)		
Marine Mammals and Sea Turtles							
Blue Whale (Northwest Atlantic Ocean population)	*Balaenoptera musculus*	Schedule 1, Endangered	—	Endangered	—	– Known or likely present in the Strait of Belle Isle and Conception Bay	Yes – Sections: 10.5.9 T.10.5.9-1 Table 10.5.6-3 14.3 Table 14.5.2-1
Fin Whale (Atlantic Ocean population)	*Balaenoptera physalus*	Schedule 1, Special Concern	—	Special Concern	—	– Known or likely present in the Strait of Belle Isle and Conception Bay	Yes – Sections: 10.5.9 T.10.5.9-1 Table 10.5.6-3 14.3 Table 14.5.2-1
Leatherback Sea Turtle	*Dermochelys coriacea*	Schedule 1, Endangered	—	Endangered	—	– Known or likely present in the Strait of Belle Isle and Conception Bay	Yes – Sections: 10.5.9 Table 10.5.11-3 14.3.6 14.3.5.6 Table 14.3.3-1 Table 14.5.2-1

Table 10.5.11-3 Consideration of Species of Special Conservation Concern in the Environmental Impact Statement – Marine Environment (continued)

Species of Special Conservation Concern[a]		Species Regulatory Status				Rationale for Species Inclusion or Exclusion in EIS	Species Addressed in EIS
Common Name	**Scientific Name**	***Species At Risk Act* Registry[b] (*SARA* 2011)**	**Provincial Listing[c] (GNL 2011)**	**National Status[d] (COSEWIC 2011)**	**Provincial Species Status Advisory Committee[e] (NLDEC 2011)**		
Seabirds							
Harlequin Duck (eastern population)	*Histrionicus histrionicus*	Schedule 1, Special Concern	Vulnerable	Special Concern	Sensitive	– Known or likely present in Central and Southeastern Labrador and Northern Peninsula regions – Small numbers of Harlequin Duck (COSEWIC 2010c, internet site) use the Strait of Belle Isle and Conception Bay in passage between breeding and wintering areas	See entry for Table 10.5.11-1.
Barrow's Goldeneye (eastern population)	*Bucephala islandica*	Schedule 1, Special Concern	—	Vulnerable	—	– Small numbers use the Strait of Belle Isle and Conception Bay in passage between breeding and wintering areas	Yes – Sections: 10.3.7 10.5.10 12.5 14.4 Table 10.3.7-1 Table 10.5.10-1 Table 10.5.10-7 Table 10.5.10-8 Table 14.5.2-1
Ivory Gull	*Pagophila eburnea*	Schedule 1, Endangered	—	Endangered	—	– Small numbers occasionally use the Strait of Belle Isle and Conception Bay in winter	Yes – Sections: 10.3.7 10.5.10 Table 10.3.7-1 Table 10.5.10-1 Table 10.5.10-7 Table 10.5.10-8 Table 14.5.2-1

Table 10.5.11-3 Consideration of Species of Special Conservation Concern in the Environmental Impact Statement – Marine Environment (continued)

Species of Special Conservation Concern[a]		Species Regulatory Status				Rationale for Species Inclusion or Exclusion in EIS	Species Addressed in EIS
Common Name	Scientific Name	*Species At Risk Act* Registry[b] (*SARA* 2011)	Provincial Listing[c] (GNL 2011)	National Status[d] (COSEWIC 2011)	Provincial Species Status Advisory Committee[e] (NLDEC 2011)		
Red Knot, *rufa* subspecies	*Calidris canutus rufa*	No schedule, No status	Endangered	Endangered	—	– Small numbers use the Strait of Belle Isle and Conception Bay in passage between breeding and winter areas	See entry for Table 10.5.11-1.
Piping Plover, *melodus* subspecies	*Charadrius melodus*	Schedule 1, Endangered	—	Endangered	At Risk	– Vagrant and non-breeding in the Strait of Belle Isle and Conception Bay	Yes – Sections: 10.5.10 Table 10.3.7-1 Table 10.5.10-1 Table 10.5.10-7 Table 10.5.10-8
Eskimo Curlew	*Numenius borealis*	Schedule 1, Endangered	—	Endangered	At Risk	– Unlikely present in the Strait of Belle Isle or Conception Bay because of its rarity or possible extinction	Yes – Sections: 10.5.10 Table 10.3.7-1 Table 10.5.10-1 Table 10.5.10-7 Table 10.5.10-8

(a) Includes protected Species of Special Conservation Concern with potential to occur in the Strait of Belle Isle and Conception Bay study areas.
(b) *SARA* (2011, internet site).
(c) GNL (2011, internet site).
(d) COSEWIC (2011, internet site).
(e) NLDEC (2011e, internet site).
(f) American eel (*Anguilla rostrata*), designated as Vulnerable under the NLESA, is also addressed in Section 13.3, Fish and Fish Habitat.

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APPENDIX 10-1

INNU ENVIRONMENTAL KNOWLEDGE OF THE MISHTA-SHIPU (CHURCHILL RIVER) AREA OF LABRADOR IN RELATION TO THE PROPOSED LOWER CHURCHILL PROJECT

Innu Kaishitshissenitak Mishta-shipu

Innu Environmental Knowledge of the Mishta-shipu (Churchill River) Area of Labrador in Relation to the Proposed Lower Churchill Project

Report of the work of the Innu Traditional Knowledge Committee

June 20, 2007

Peter Armitage
Wolverine & Associates Inc.
PO Box 1441, Stn.C
St. John's, NL, A1C 5N8

Report to Innu Nation

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1. Introduction

In August 2007, An Innu Traditional Knowledge Committee (ITKC) was constituted by the Innu Nation under the terms of a process agreement with Newfoundland and Labrador Hydro (NLH) (see Terms of Reference, Appendix 1). The purpose of the ITKC was to document Innu Traditional Ecological Knowledge (TEK) in relation to the proposed Lower Churchill Hydro Generation Project (Project), as well as Innu propositions related to the potential impacts of the Project. TEK and impact propositions may be considered by Newfoundland and Labrador Hydro (NLH) and the Innu Nation in the environmental assessment of the Project.

In preparation for the ITKC work, an extensive review of relevant literature concerning TEK was undertaken with the view to identifying useful methodological approaches and comparative data. A methods statement was prepared for review by the NLH and Innu Nation task force, which guided the conduct of ITKC meetings and supplementary interviews with ITKC members.

Throughout the ITKC work, we recorded a great deal of information that dealt in general terms with the biota of the Innu territory in Labrador. In fact, from my perspective, the work amounted to an introductory course in Innu natural history. I learned that *mashk*^{u} (black bear) can hear ants in rotting trees, *akushamesheu* (osprey) is a suicidal bird at times, male *atik*^{u} (caribou) eat *ushkuai-pishum* (tree fungi) in order to harden their antlers for the rut, and *utshashumek*^{u} (Atlantic salmon) are found in great numbers wherever there are concentrations of *utshashumeku-esh* (eastern pearl mussel). Such information has been included in this report even though it may not always pertain directly to the Mishta-shipu area, in the expectation that it may be of use to environmental impact assessment researchers and planners.

This report starts with an overview of definitions of some key concepts and methods. Considerable attention is paid thereafter to a discussion of how Innu members of the ITKC know what they know. The discussion includes a brief summary of their direct land use experience in the Mishta-shipu area that is the most important component of their TEK. It also includes an inventory of several additional types of input into their knowledge formation such as information sharing among community members, interaction with western-trained biologists, and the mass media. This discussion sets the stage for the presentation of Innu environmental knowledge about the study area and more generally about the land and biota in Innu territory. The last section of the report deals with Innu discourses about the potential environmental impacts of the hydro project. A linguistic analysis of a sample of discourses is undertaken in order to explore some of the nuances in Innu thinking about such impacts and notions of cause-effect, inference, analogy and other cultural-cognitive processes.

2. Definitions

While the social science, environmental and biological literatures use a variety of terms to label "traditional knowledge" (e.g. Indigenous Knowledge, Local Ecological Knowledge, Traditional Ecological Knowledge), the best label of convenience is "Traditional Ecological Knowledge" (TEK) because of its frequency of use. The term is often used with the caveat that the notion of "tradition" is not intended to imply a static, nonadaptive body of knowledge (Usher, 2000:186). Nor is it intended to constitute a pure category in contrast to other forms of knowledge particularly those that are "non-traditional." In practice, it can be difficult to determine if a particular knowledge is derived from direct or shared observations of the environment or from some other source such as interaction with western-trained biologists or nature programmes on the television. This matter will be discussed at greater length below.

Most students of TEK would agree that there is no single, accepted, legal or official definition of this body of knowledge (see Furgal, Fletcher, and Dickson, 2006:14-15; MVEIRB, 2005:6; and Usher, 2000:185-186). According to Berkes (2000), TEK is, "a cumulative body of knowledge, practice and belief evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment." Usher (2000) provides one of the most refined discussions of TEK focused entirely on its role in environmental assessment (EA). In his view, TEK "refers specifically to all types of knowledge about the environment derived from the experience and traditions of a particular group of people" (ibid.:185). He advances a useful typology of TEK that shapes the methods outlined below. In summary, Usher distinguishes four TEK categories (ibid:186):

1. *knowledge about the environment*. "This includes statements of fact about such matters as weather, ice, coastal waters, currents, animal behaviour, traveling conditions…which are typically based on (a) empirical observations by individuals of specific events or phenomena; (b) generalized observations based on numerous experiences over a long time; or (c) generalized observations based on personal experience reinforced by accounts of others both living…and dead" (ibid.:186). This category of TEK "ranges from specific observations to explanatory inferences, constituting explanations of what people observe and the relations and connections among them, or more broadly, an understanding of why things are as they are." Knowledge concerning plant types and distributions and animal habitats, anatomy, behaviour, sounds, senses, and locomotion, alimentation,[1] and reproduction (e.g. Clément, 1995), as well as indicators of ecosystem health (Parlee, et al. 2005) fall under this category.

2. *knowledge about the use of the environment*. This includes "factual knowledge about past and current use of the environment (e.g. patterns of land

[1] The provision of nourishment or other necessities of life.

use and occupancy, or harvest levels), or other statements about social or historical matters that bear on the traditional use of the environment and hence the rights and interests of the local aboriginal population in the regional environment" (ibid.186).

3. *values about the environment*. These are "culturally based value statements about how things should be, and what is fitting and proper to do, including moral or ethical statements about how to behave with respect to animals and the environment, and about human health and well-being in a holistic sense" (ibid.186).

4. *the foundation of the knowledge system*. This category of TEK deals with the "culturally based cosmology - foundation of the knowledge system – by which information derived from observations, experience, and instruction is organized to provide explanations and guidance."

Usher notes that repeated observations of the environment over time are key to good quality TEK. "The circumstances that foster TEK are neither uniformly distributed nor permanent among aboriginal communities. In places where, for whatever reason, few if any members of the community have recent or current experience of a particular area or phenomenon, there may not be much TEK that will be useful to environmental assessment" (ibid.,187).

While TEK is a label of convenience to describe the focus of this study, the term "environment" must also be considered such a label, because there is no lexical item for this term in the Innu language. When translating "environment" into Innu-aimun, it is often divided into representative constituents such as *assi* (land, vegetation), *aueshish* (animals), *namesh* (fish), etc., and translators must reiterate each of these terms every time the idea of "environment" is expressed. We have a similar problem with "plants/flora" which is usually glossed as either (1) *assit nete kanitautshiki* or (2) *assit nete kanitautshisht*, meaning "that which grows in the earth." In the former case, "that" refers to flora that have an inanimate gender in Innu grammar, while in the latter case it refers to animate species. In both cases, they include botanical taxa such as *mishtik^{u}* (tree), *shakau* (shrub, bush), *atishi* (small shrub, small bush) *mashkushu* (herbaceous plant, grass, fern, etc.), and *uapikun* (flower).[2]

[2] See Clément (1990, 1998) for in-depth discussions of Innu botanical taxa. Clément (1998:38) recorded *kanitautshiki tshekuana assit* in Utshimassit (Davis Inlet). It derives from the inanimate intransitive verb *nitautshin* – something (inanimate vegetal) grows. *kanitautshiki tshekuana assit* is the inanimate form of the expression. Clément says that *kanitautshisht* is the nominalized verb used for animate flora, in which case it would have to be based on an animate intransitive verb *nitautshishu* – 's/he (animate vegetal) grows'. This verb is not found in Drapeau (1991), however, the dictionary contains *nitautshu* with the same meaning and gender. The nominalized form of this would be *kanitautshit* (Marguerite MacKenzie, personal communication).

3. Methods

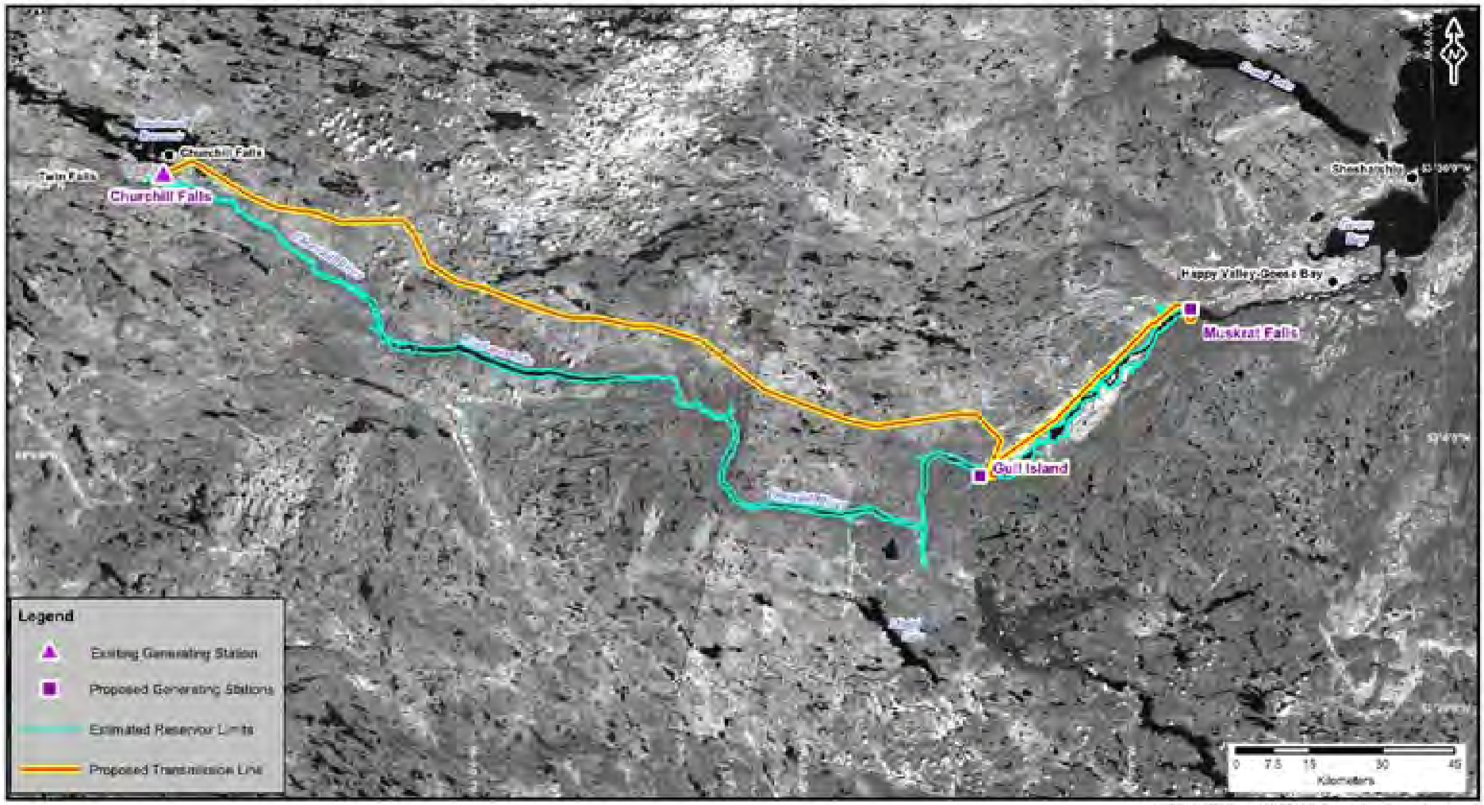
This is a general overview of the methods used to guide the work of the ITKC. More detailed explanations are provided at various places in the report where relevant.

The ITKC was constituted in November 2006 with ten Innu residents of Sheshatshiu. However, two people participated no further than the initial meetings of the committee due to ill health. Committee members included Atuan Penashue, Ishpashtien Penunsi, Katinen Pastitshi, Mani-Matinen Nuna, Mishen Jack, Nishet Penashue, Pien Penashue, and Shimun Michel, all older people who were raised on the land. Their ages ranged from 58 to 82 with an average age of 73 years old, and all of them have direct experience of living, traveling, hunting, fishing, trapping, and gathering in the Mishta-shipu area. Only one of these people has a functional command of English. Co-facilitation and interpretation was provided by Jean-Pierre (Napess) Ashini, who contributed his own experience and knowledge to the process from time to time.

From mid-November to mid-February, a total of eleven focus group sessions were held with the ITKC members - four with the men, four with the women, and three with the entire group. In addition, fourteen separate interviews were held with six of the ITKC members to obtain detailed information about the biota of the Mishta-shipu area as well as more general biophysical information of relevance to the study. All sessions were digitally recorded, and careful notes were kept by me in a field diary at all times. Thirty-six excerpts of narratives from the group sessions and individual interviews were sent to Anne Rich for close transcription and translation in order to facilitate a more comprehensive understanding of Innu discourse particularly in relation to propositions concerning the potential impacts of the hydro project.

The geographic extent for the study focused on the Mishta-shipu valley from Patshishetshuanau (Churchill Falls) to the mouth of the river, covering the area that would be affected by the Muskrat Falls and Gull Island dam structures as well as transmission lines within or near the valley (Map 1). Various incidental references to animals and plants in other parts of the territory were noted as was general information concerning animal behaviour, reproduction, predator-prey relationships, alimentation, etc. Topics for discussion in the focus group meetings

Map 1. ITKC study area showing the limits of the proposed reservoir and transmission line corridor (source Newfoundland and Labrador Hydro)



were chosen by me, however, there was some deviation from this plan on occasion in order to deal with specific questions raised by ITKC members. A semi-directive interview technique was used in the individual interviews (see Huntington, 1998).

Formal eliciting procedures, inspired by the methods of semantic ethnography, were adopted for certain aspects of this inquiry, but only to a small extent given the time limitations of this study (see Black, 1967; Tyler, 1969). Such procedures entail a systematic, controlled question-response method in which questions are formulated in the informant's language in order to elicit his/her semantic categories, and to avoid ethnocentric imposition of outsider (etic) ones. The researcher needs to understand exactly what question an informant is responding to, which is why the question has to be formulated properly in the first place. Learning how to ask the right question in the informant's language is the starting point in this method, and it is here that bilingual co-researchers can be of immense help (Black and Metzger, 1969). In the case of the ITKC work, for example, Napess Ashini advised me on how best to ask questions related to taxonomic classification and species identification. A stable question-response unit employed in attempting to identify *aiapish* was: T1 *tshinuemeu-a* T2?, where T1 is a term for one bird species and T2 a term for a second.

Question: *Aiapish tshinuemeu-a shesheshu* (Is unidentified bird related to greater yellowlegs)? Response: *Ehe* (yes).

Question: *Aiapish tshinuemeu-a kumushkuashit* (Is unidentified bird related to Wilson's/common snipe)? Response: *Ehe* (yes).

Question: *Aiapish tshinuemeu-a nutapashkueshu* (Is unidentified bird related to whimbrel)? Response: *Ehe* (yes).

Question: *Aiapish tshinuemeu-a teshtueshtshish* (Is unidentified bird related to spotted sandpiper)? Response: *Ehe* (yes).

Question: *Aiapish tshinuemeu-a kakatshu* (Is unidentified bird related to northern raven)? Response: *Muat* (no).

Question: *Aiapish tshinuemeu-a mitshishu* (Is unidentified bird related to bald eagle)? Response: *Muat* (no).

It was tempting at this point to jump to the conclusion that *aiapish* is a type of shore bird given the results of contrasting the unidentified species with other birds named thus far. However, this conclusion was found premature once the question was asked for *pipitsheu* (American robin). This species, which is not a shore bird, was also associated with *aiapish*. The question, then, was what criteria are applied in the relational thinking of the informant to contrast one bird with another? If habitat (e.g. feeding or nesting along a shoreline) is not a criterion, then what characteristics of these species apply in making contrasts? It turns out that the informant was classifying these birds on the basis of seasonality.[3] The common raven and the bald eagle are *pipun-pineshish* (winter bird) whereas *aiapish*, the shorebirds, and the American robin are all *nipin-pineshish*, and that is why they are related to one another, on the basis of their common seasonal occupation of the landscape. In this case, the question was of limited use in identifying the species; we learned that it is a migratory bird but nothing more.

I cite this example in order to illustrate some of the complexity underlying TEK research, where even something as superficially simple as the identification of bird species often requires a detailed method of inquiry. However, such methods are necessary if we strive for a good understanding of the emic ("folk") models at play.[4]

A schedule of the ITKC meetings and what was discussed during them is presented in Table 1 below. The ITKC meetings started with a review of Innu place names in the Mishta-shipu valley, that derive from a large database of such names presently being validated by the author and ethnolinguist, José Mailhot. Given the fact that the majority of the ITKC members are cartographically illiterate, and one member is blind, a reliable database of place names is a prerequisite for georeferencing environmental knowledge and land use in the study area. These names serve as anchor points for organizing memories about the land (Armitage, 2005).

Having established the toponymic infrastructure for subsequent discussion, the ITKC was asked to describe in general terms the state of the environment today compared to years gone by. One purpose of this discussion was to obtain some understanding of what might constitute ecosystem health indicators for the members. As noted by Berkes (1999), ecological indicators are one way that Aboriginal people conceive and talk about environmental change. Parlee, et al. (2005:165-166) note that "the percentage of body fat of birds, caribou, and other animals at harvest is one ecological health indicator which appears to be common among many indigenous groups, including the Cree of northern Quebec…the Gwich'in of Alaska…and the Maori of southern New Zealand." Similar ecological health indicators have been noted with respect to Innu discourses about the impacts of military aviation on wildlife (Armitage, 1994).

[3] Innu divide the year into four seasons using terms that are all transitive inanimate verbs – *pipun* ('it is winter'), *shikuan* ('it is the time of melting snow'), *nipin* ('it is summer'), and *takuatshin* ('it is fall') (Drapeau, 1991, my translations).

[4] The term "emic" refers to the native, local or unconscious models or theories or natural and social phenomena, whereas the term "etic" refers to outsider, conscious, or scientific models and theories of these phenomena. More detailed explanations of these terms can be found at http://faculty.ircc.edu/faculty/jlett/Article%20on%20Emics%20and%20Etics.htm

Table1. Schedule of ITKC activities.

Meeting week	Dates of meetings	Subject/purpose
1	16-17 Nov. 06	introduce purpose of ITKC, review place names, describe state of the environment
2	20,22 Nov. 06	document TEK
3	28,29 Nov. 06	document TEK, discuss data from biological survey
4	5,7 Dec. 06	present project description, discuss potential project impacts
5	24 Jan. 07	present project description, discuss potential project impacts
6	7 Feb. 07	meeting with Task Force, discuss project description & potential project impacts, address questions of ITKC members
7	26 Apr. 07	report back to ITKC members

During the second and third group sessions, documenting Innu knowledge about the environment (animals, plants, habitat, etc.) in the study area was the priority. The Innu Nation's GIS specialist assisted with data recording during one meeting, where participants were asked to identify animal and plant locations on digitally projected basemaps, with the GIS specialist entering data directly into a GIS data base. However, this approach was abandoned during subsequent meetings because all but one of the participants could not read maps. Usher's category 2 TEK, "factual knowledge about past and current use of the environment" was also obtained from ITKC participants during these sessions in order to provide a good understanding of the empirical, observational basis upon which their knowledge is grounded. Information concerning Sheshatshiu Innu animal and plant taxonomies was documented to a very limited extent, and only with the goal of organizing species lists according to emic categories.

Working with the ITKC members in focus group sessions and as individuals facilitated the recording of general knowledge of the species found in the valley and their habits and habitats based on longer-term experience, and shared knowledge from other community members who have land use in the Mishta-shipu area. Their values about the land, animals, and plants were recorded, as well as information about their "religious ideology" and "epistemology" that informs inferences about environmental change (Usher's Category 3 and 4 TEK).[5] As we shall see below, Innu values were expressed through various moral or ethical statements about human relations with animals and the land in general.[6]

The religious ideology of traditionally-minded Innu is discussed at length toward the end of this report, but in the meantime remember that older Innu hold a special relationship between humans and animals, where animals are considered to be "persons," and where there is not the division between culture and nature

[5] Innu epistemology refers to Innu ways of knowing about reality.
[6] Innu Elders often object to biologists using tranquilizer darts to immobilize caribou and black bears, and to "hook and release" sports fishing techniques. Such objections derive from the Innu moral system which is based on respect for animal masters (see more on this topic below).

that informs so much of the thinking of people of European ancestry.[7] With respect to Innu epistemology, the culturally-based reasoning (inductive analogy, generalization, association, speculation, extrapolation, etc.) of the ITKC members was explored in order to understand the manner in which propositions are advanced concerning the predicted impacts of the Project on the environment.

Data derived from biological survey of the Mishta-shipu area were tabled for the consideration of ITKC members during the third sessions in order to supplement their knowledge of the environment in the project area, especially given the fact that they have not traveled there in recent years. These data consisted of (1) the locations of furbearer species obtained during an April 2006 furbearer winter use survey conducted by Sikumiut Environmental Management Ltd.[8] (2) an inventory of terrestrial species for the hydro project study area obtained from Minaskuat Limited Partnership, and (3) fish species distribution mapping from AMEC Americas, Earth and Environmental. The list of avian species in the inventory of terrestrial species was reviewed at length with two ITKC members to determine if Innu know of these species in the study area, and if lexical items for the species exist in Innu-aimun.

The hydro project description (see Map 1) was presented to the ITKC at the beginning of the fourth and fifth sessions focusing on the following components:

- two dam complexes, one at Manitu-utshu (Muskrat Falls), the other at Tshiashku-nipi (Gull Lake);
- the reservoirs behind these dams, with special attention to the new shoreline to be created by the reservoir, the geographic extent of the flooding, the habitats to be inundated, and winter draw-down;
- the two transmission lines, one from Manitu-utshu to Tshiashku-nipi, the other from Tshiashku-nipi to Patshishetshuanau (Churchill Falls).

Photographs and maps of the dams, transmission lines, other infrastructure, and reservoirs (obtained from NLH) were used to help inform the ITKC members about project features.

ITKC members had a good understanding of how hydro dams produce flooding and create reservoirs behind them, given the fact that they are already familiar with the Upper Churchill Project, and have visited various locations around the perimeter of the Smallwood Reservoir. Nonetheless, it was important for them to understand clearly the differences in flood regimes between the Smallwood Reservoir and Mishta-shipu valley. Whereas relatively minor increases in water levels inundated great expanses of territory in the case of the Upper Churchill

[7] See Armitage (1992) and Speck (1977[1935]) for the Innu, and Feit (1988), Scott (1996), and Tanner (1979) for the closely related, neighbouring Cree. See Ingold (2000) for a more general discussion of differences in thinking between Aboriginal and European peoples regarding the nature-culture "divide."
[8] The survey did not obtain data on the locations of beaver lodges.

project, the geographic extent of the flooding is expected to be much less with the Lower Churchill Hydro Generation Project given the steep sides of the river valley.

Once the project description had been presented, members of the two ITKC groups were asked to consider the possible impacts of the Project upon the land, biota and other ecosystem components within the study area. Nachel Nuna, who is a fully literate Innu-aimun-English translator, assisted with this process during one session by recording the propositions concerning potential project impacts on flip-chart paper in Innu-aimun. Detailed notes concerning the project impact discourses were kept by me throughout the meetings, and extracts of some of these discourses were subject to close transcription and translation as noted previously. Marguerite MacKenzie, a Memorial University linguist who specializes in Algonquian languages, was consulted thereafter with respect to a linguistic analysis of the transcribed material.

Throughout this process, close attention was paid to the ways in which the ITKC members talk about the impacts (discourse) of the Project. Definitive cause-effect versus speculative statements, inferences, predictions and the like were noted. More will be said about this in the section dealing with Project impact discourses below.

In February 2007, the NLH and Innu Nation Task Force met with the ITKC to review the project description, answer questions about the Project, and hear directly from the members about their concerns. The discussion provided additional information concerning Innu thinking about the Project impacts which has been incorporated in this report.

A final meeting with the committee was held in April 2007 to report the results of the study, clarify certain questions concerning Innu vocabulary, and to discuss ethical considerations related to anonymous data sourcing in this report. ITKC members gave their permission to list their names as participants in the study, but asked that specific information concerning observations and impact propositions not be attributed to them directly. As a result, all attribution throughout this report has been coded so as to maintain the anonymity of individual sources of information.

4. Limitations

To varying degrees, Innu knowledge of animal habitats, anatomy, behaviour, sounds, senses, locomotion, alimentation, and reproduction has been recorded from Innu Elders resident in Mingan (Clément, 1995) and the former Davis Inlet (Clément 1998). Innu botanical knowledge was documented by Clément (1990) for a sample of Mingan Elders. Like his work on Innu zoology, Clément's ethnobotanical study was a major study entailing many months of fieldwork among the Innu and subsequent analysis. Documenting or validating this same knowledge with Sheshatshiu Innu Elders could not be undertaken in any systematic way given time constraints. Therefore, it is assumed that general knowledge related to animal, plant and fish species possessed by Sheshatshiu Innu is more or less similar to the knowledge of their neighbours to the north and south.

Time constraints, as noted in various places throughout this report, posed the major limitation on the amount of environmental knowledge that could be elicited from the ITKC members. In addition, the close transcription and translation of Innu narratives is a time-consuming and expensive proposition, and both time and budgets conspired to limit the volume of Innu discourse that could be examined in detail. Finally, as will be clear from the summary land use biographies below, extensive land use by ITKC members in most of the Mishta-shipu area concluded in the early 1970s, which means that their empirical, observational experience there has not been updated in any significant way for thirty or more years. Under the circumstances, we cannot expect ITKC members to be able to contribute detailed observationally-based information to the current study for the years that they were absent from that part of the territory.

It is important to note that I have not been concerned with determining the veracity of Innu knowledge claims about the environment in relation to some external standard, for example, a western scientific one. The goal is to make sense of Innu knowledge about the “natural environment,” with a particular emphasis on the Mishta-shipu (Churchill River) area. The focus, therefore, has been an “emic” versus “etic” one, concentrating on Innu (insider) understandings, constructs, or conscious models of the natural environment. Furthermore, I have no interest in attempting to demonstrate that Innu knowledge about the land, animals and plants is comparable to western science (cf. Clément, 1995), as such a comparison is beyond the mandate of the ITKC, and would require significant input from people with botanical, zoological, and ecological expertise. I shall return to this point in the conclusion of the report.

A number of academic critics have observed that TEK research is a distillation of knowledge that is embedded within complex social relations and knowledge structures, and that the representation of TEK in reports such as this one decontextualize and therefore distort the knowledge (Ellis, 2005; Nadasdy, 1999; Stevenson, 1996). “A whole array of stories, values, social relations and practices, all of which contribute substance and meaning to aboriginal people’s relationship to the environment, must be ‘distilled out’ of TEK before it can be incorporated into the institutional framework of scientific resource management” (Nadasdy, 1999:7). This criticism has some validity in my view, and it should be kept in mind when reading this report. However, any act of ethnographic representation is an unavoidable exercise in distillation, and we do not stop sifting through the overwhelmingly rich detail of human experience simply because it is impossible to represent this richness in its entirety. Nonetheless, we must recognize that a report of this nature cannot do full justice to lifetimes of experience on the land, and all the nuances of Innu thinking and discourse about the natural world.

5. Epistemology: how Innu know what they know

As noted previously, TEK does not constitute a pure category in contrast to "non-traditional" forms of knowledge. According to Usher, "[c]ontemporary TEK explanations can hardly be unaffected by aboriginal people's knowledge (scientific or otherwise) of the wider world" (2000:185).[9] In practice, it can be difficult to determine if a particular knowledge is derived from direct or shared observations of the environment or from some other source such as interaction with western-trained biologists or nature programmes on the television. In the case of the ITKC members, most of their knowledge concerning Mishta-shipu and other parts of their territory is derived from life experience on the land, while their inferences and deductions about the impacts of the proposed Lower Churchill Project derive at least in part from their observations of the impacts of the Upper Churchill Project. All of the ITKC members either participated in the commercial whitefish fishery at Lobstick Lake or visited the location post-flooding and were therefore in a position to witness some of the environmental effects of Smallwood Reservoir creation. In fact, no one in Sheshatshiu has to travel very far to observe these effects. With the damming of Meshikamau-shipu (Naskaupi River) at its headwaters, Upatauatshetshuan (North West River) now routinely freezes over whereas it never used to do so in the days before damming. Furthermore, one can sometimes taste salt water just above The Rapids at the end of Kakatshu-utshishtun (Grand Lake) at high tide. [10]

Despite the importance of direct experience, the evidence is clear that Innu Elder knowledge is derived from a variety of additional sources. Oral tradition, which refers to the intergenerational transmission of knowledge, is one such source. For example, one ITKC member said "I went as far as Minai-nipiu-paushtik^{u} but I heard stories from my grandparents about their hunting north and south of Uinukapau (Winokapau Lake)" (P1.28.11.06). Another member said she learned a great deal about Mishta-shipu from her husband's father who was a recognized expert in the region given his lengthy history of land use there. "They had different names for brooks and portages that came from Shimiu Pastitshi. Shimiu learned these from people who came before him" (P2.29.11.06). Knowledge of medicinal plants and their uses was transmitted among women from older to younger generations. "*Assiuashik^{u}* is the name of the medicine. It has real medicine in it which is good to treat child fevers and stomach flu. I learned this from the old women, and I have kept this knowledge all along. They are like

[9] Usher cites the example of "field science programs [that] have been employing aboriginal Northerners since at least the 1960s, including some who are elders today. They are aware of what scientists actually do and find out, and even if they do not agree, they have considered scientific knowledge critically against their own" (ibid.:185). See also Stevenson (1996:280-282).
[10] I have had a number of conversations with Settler/Metis and Inuit people in North West River in which they shared the same observations of the impacts of the Churchill River project.

doctors; all the Innu women were like that" (P2.7.12.06). Knowledge acquired from older Innu may have been reinforced by direct experience, as indicated by another ITKC member who said, "I believe what they told us, because I have seen this. Our teachers were our parents, grandparents. That's how we learned, from the stories they told us. That's what I teach my children" (P3.8.2.07).

Of course, everyday information exchange among community members is another important part of the process of accumulating environmental knowledge. For example, information concerning the location of migrating caribou is often circulated among the Innu in this manner, from reports by hunters or travelers on the Trans-Labrador highway who encounter caribou, or from neighbouring non-Innu, as well as government websites that publish maps showing the locations of satellite collared caribou. As a result, older Innu who are no longer mobile can keep track of caribou movements with information from family and other community members, and can thereby offer advice to hunters about where to direct their hunting efforts.

Information exchange among communities, sometimes quite distant from one another, provides building materials for knowledge construction as well, as the following examples indicate.

> Stories I heard from outside. Like an old guy from Winnipeg talking about the area where the land has been flooded by the government. Everything has been destroyed. The old guy was a hunter; he used to trap and eat beaver. And all the animals that were on their land are gone. He hasn't seen any animals that they eat. I'm concerned that the same thing is going to happen when they flood Mishta-shipu (P1.26.4.07).[11]

The same person learned about *ueuepitshu* (walrus) second hand when he was shown a photo of one by Mark Mucko at his cabin at the mouth of Akaneshau-shipu (English River). Mucko had killed the animal somewhere on the north coast of Labrador (P1.26.1.07).

New technologies such as bush radio may be used to facilitate this information exchange. For example, P1 and other men had been out hunting from their camp at Kauipushkakamat when they came across some caribou tracks. After following these tracks for a considerable distance, they gave up the chase and returned to their camp where Shimiu Pastitshi told them that had they continued in the direction they were going, following the caribou tracks, they would have encountered an *ushakatik^u^* (place where there are always caribou). At this point P1 called the camp at Mitshishu-utshishtun on the bush radio to talk with

[11] Of course, the repetition of such propositions locally may constitute "opinion leadership" and may play an important role in generating a consensus around a given issue. One of the methodological problems with focus groups is that opinion leadership in the group is difficult if not impossible to control. Consensus may emerge where it never previously existed, and group members may formulate opinions in this context that they did not previously hold.

Mushuau-Napess. He told Mushuau-Napess what Shimiu Pastitshi had said, that there was an *ushakatik*[u] near his camp, whereupon Mushuau-napess went there and killed some caribou. "It happens all the time. Innu will tell other Innu, who are unfamiliar with an area, where *ushakatik*[u] is, so that they can look for caribou there" (P1.8.12.06).

Nowadays, a variety of other communications media in addition to bush radio are at the service of people in Sheshatshiu, and these often contribute to the process of environmental knowledge formation. Print and electronic news media, television entertainment, community radio and province-wide open-line shows have all have an influence upon what members of the ITKC think about the Mishta-shipu and the impacts of dams. For example, in the fall of 2006, P2 saw a television news report about jammed ice on Mishta-shipu and flooding at Mud Lake. One of her children or grandchildren translated the report for her. Her comment? "Sometimes there's jammed ice by a shoal near the outlet of Mud Lake. This blocks the river and causes the water to rise. But this only ever happened in the spring, never in the fall. I don't understand why the water was so high. The water reached a house on a high bank. The people of Mud Lake were scared and concerned about the flooding" (P2, 7.12.06). This same individual had much to say about large otter or seal-like creatures called *uenitshikumishiteu* that reside at Manitu-utshu, and in attempting to describe what they look like, she said they look a bit like the subterranean creature in the horror movie "Tremors" (1990) that she had once seen on television.[12]

Another ITKC member said that although he does not know how *utshashumek*[u] (Atlantic salmon) eggs turn into the mature fish, he had noted that wherever there are lots of *utshashumek*[u] (Atlantic salmon), there are also lots of *utshashumeku-esh* (eastern pearl mussel). Salmon may grow from these shellfish he thought, and some of his evidence for this inference came from a television programme he had seen, where White people were shown eating shellfish. The contents of the shells they were eating from may have been young salmon (P4.6.2.07).

A bilingual member of the ITKC had watched the news reports of the catastrophic tsunami that hit Indonesia in December 2004. He remembered that people had reported that the birds went silent just before the tidal wave hit, which was evidence of animal sentience of some kind. "Animals know about impending catastrophe as was the case when the tsunami hit Indonesia last year" (P6.5.12.06). He reasoned that the animals in the flood zone along Mishta-shipu would know of the impending flooding once the dams had been completed, and may well vacate the area in advance.

[12] I projected a trailer for this movie to the ITKC members and P2 confirmed that this was the movie of the creature that reminded her of *uenitshikumishiteu*. P2 said that the way that the movie monster moves through the ground is not quite the same as *uenitshikumishiteu*. http://www.imdb.com/title/tt0100814/trailers-screenplay-E12106-10-2

It is important to remember that the current environmental assessment of the Lower Churchill Hydro Generation Project is not the first time that Labrador Innu have participated in the assessment of the project. A version of the Project underwent a federal environmental review in the late 1970s involving public hearings in Happy Valley-Goose Bay. Three of the current ITKC members participated in these hearings and one of them made two interventions before the Environmental Assessment Panel (FEARO, 1980).[13] This process was a source of propositions about the impacts of hydro-electric development that complimented pre-existing ones formed by Innu in relation to the Upper Churchill Project. "Back in 1979 during the first environmental assessment of the [Lower Churchill] Project, the old people were still alive and they were totally opposed to it at the time" (P6.5.12.06).

In the late 1990s another attempt was made to move the Project forward, and a public consultation process was held in the Labrador Innu communities which resulted in the publication of two reports (Innu Nation, 2000; 2001). Numerous meetings were held with Elders and other community members where the potential impacts of hydro development were discussed. The corpus of propositions that emerged from this and other processes comprise a foundation of sorts for present-day deliberations on the same topic.

Another ingredient in the knowledge cocktail surrounding hydroelectric development on Mishta-shipu is Innu participation in various environmental monitoring and research initiatives. Although we have limited evidence of direct input from these initiatives into Innu knowledge concerning Mishta-shipu, it is reasonable to infer that they have helped to shape Innu perceptions of hydro dam impacts. For example, two of the ITKC members worked in the commercial whitefish fishery at Lobstick Lake in the late 1970s and early 1980s and observed biologists sampling fish for "contaminants," presumably methylmercury. Methylmercury as a public health concern for the Innu probably owes its origins to this monitoring effort at the Smallwood Reservoir. Since then, in 2000, Sheshatshiu Innu participated in "Harvest and Country Foods Contaminant Study" in conjunction with the Atlantic Veterinary College in P.E.I. (Pollock, 2004).[14] Another study concerning human body burden of methylmercury from fish consumption by researchers from the Université du Québec à Montréal (UQAM) commenced in 2002.[15] As remembered by one ITKC participant, "a

[13] See the transcripts of the Panel hearings in Happy Valley-Goose Bay, September 12, 1980, Vol. X.
[14] "The general purpose of this study was to assess, in collaboration with Innu hunters and their families, the health of important wildlife species harvested by Innu hunters in Labrador in relation to tissue concentrations of environmental contaminants measured in the animals" (Pollock, 2004, abstract).
[15] This is a reference to a study in 2002 directed by Sylvie de Grosbois, Institute of Environmental Sciences and Collaborative Mercury Research Network, Université du Québec à Montréal. Five members of the ITKC provided hair samples. They had not been told of the results of the study as of the time of the ITKC meetings (ITKC.5.12.06) (see Canuel, et al. 2006). Two ITKC members

woman came on the radio and asked for people to give hair samples. People were paid $100 each for hair samples. They were checking mercury levels" (P6.5.12.06). Five members of the ITKC gave hair samples to the UQAM researchers.

In addition to participating in these studies as passive research subjects, several of the ITKC members have also participated directly in various research projects and biological surveys as research assistants. Two ITKC members were consultants to the archaeological team conducting historic resource assessment of the Project in the late 1990s. Some ITKC members participated in aerial transect surveys to count caribou and migratory waterfowl. Another survey, presumably conducted by the provincial wildlife division, involved killing a large number of caribou. "We once worked with some biologists testing caribou. We killed about 500 George River caribou so they could be tested, and we gave meat to hospitals and Innu people in Sheshatshiu. The biologists threw away the foetuses. They were not counted. I told the biologist that he didn't know anything about caribou" (P3.5.12.06).

One bilingual member of the ITKC has extensive experience with western biologists, having worked for many years as a conservation officer and fisheries guardian. In the spring of 2006, he participated in the furbearer survey along Mishta-shipu conducted by Sikumiut Environmental Management for NLH. He reported that they saw caribou tracks west and south of Kaku-shipu (Fig River) as well as lots of signs of beaver, partridge and porcupine (P7.24.1.07). The ITKC co-facilitator has worked as a guide at hunting and fishing camps, in mineral exploration, and as a co-researcher in a forest harvesting and wildlife study in the Grand Lake road area.

Yet another source of data for members of the ITKC is the authoritative corpus of narratives from the oral tradition known as *atanukan* (*atanukana* – plural).[16] On several occasions during the meetings of the ITKC or interviews with individual members, *atanukan* were referenced as explanations for the physical and behavioural attributes of animals. One Elder explained, for example, that "the caribou has a big artery attached to its heart. If you cut it open, in the artery, you will see what Missinak^{u} [master of aquatic species] did to the caribou. When the

participated in the Lobstick commercial whitefish fishery and knew that fish had been sampled back then.

[16] Savard (2004:22) explains *atanukan* thus: "One finds this term in numerous Algonquian languages….It is a classic genre that we recognize in the ancient works upon which our cultures were erected (the Gilgamesh epic, the Old Testament of the Bible, etc.). The purpose of these stories is to juxtapose two orders of reality: on the one hand, the collection of rules permitting the reproduction of the society in which the audiences for these stories reside; and on the other, nothing less than the totality of the cosmos (day and night, seasonal cycles, life and death, variation in animal and plant species including our own, etc.)….All civilizations (Mesopotamian, Hebrew, Greek, Chinese, Japanese, Arab, Hindu, Inuit, Toungouz, etc.) have created such works (my translation). For more discussion of this term, see Drapeau (1984-85) and Vincent (1982:11-16) for the Innu, and Ellis (1995), Morantz (2002) and Preston (2002:254-257) for the James Bay Cree.

caribou was drinking water, Missinak^{u} had an otter go in the caribou, and you can see otter tracks inside the caribou" (P3.28.11.06). Another ITKC participant asserted that Innu history really does come from *atanukan*, even though some people say that the stories are just parables. "For example, Kuekuatsheu [wolverine, the trickster] was always making mistakes. Every time he visited his brothers, he abused his welcome. When visiting beaver, he sacrificed an *auestiss* [juvenile beaver]. He cooked it. He had been told to throw the bones in the water. He broke the *auetiss*' claw nail, and ever since then, beavers have a crack in their nails. Kuekuatsheu did that to *auestiss*. *Mashk^{u}* (black bear) used to see a long ways, but he's nearsighted because of Kuekuatsheu. It's the same with the caribou which didn't have scent before. However, Kuekuatsheu made the caribou smelly. This is Kuekuatsheu's legacy" (P6.6.2.07).

Any reference to *atanukan* leads us directly to the realm of Innu religious ideology. In talking about Innu religion, it is important to note that traditionally-minded Innu make no distinction between religious and non-religious ideas and practices; they are not compartmentalized realms of experience and rationality. We will return to this matter at greater length later in the report. In the meantime, we need only consider the point that for the ITKC members, animal masters are able to convey important information about their whereabouts and willingness to be hunted or fished through a number of communications media including dreams, the shaking tent ceremony, drumming, scapulimancy, oracles and other signs (Armitage, 1990; Speck, 1977[1935], Tanner, 1979).

As a divinatory technique, the shaking tent was perhaps the most powerful in terms of its ability to establish relations with animal masters and other beings. The last shaking tent ceremony was held at Ushkan-shipiss, a tributary of Mishta-shipu, in November 1969 by a shaman (*kamanitushit*) named Uatshitshish, the father of the one of the ITKC participants who was present for the ceremony. Not long before, he had conducted a shaking tent ceremony at a camp on the portage by Manitu-utshu. According to his daughter, "[t]he reason my father performed the shaking tent is because the hunters asked if there were any animals nearby to hunt. He told them about nearby black bears and they killed four of them. There were hardly any caribou in the area at that time" (P2.29.11.06). Another ITKC member pointed explicitly to the information-gathering role of the shaman: "The *kamanitushit* has power. He's like a scientist, a person who knows things, by using the shaking tent, to know where animals are. He had power to see animals…. you could hear animals in the shaking tent, because it is like a radio, and the *kamanitushit* would bring them in" (P1.5.2.07).

Dreams can also be a source of information concerning animals, according to traditionally-minded Innu. One ITKC member said, "In the past, Innu spent so much time in the country; the dreams came from the animals and the land" (P1.5.2.07). Another member spoke of the predictive power of dreams. "We believe in dreams. For example, I was once at Kameshtashtan [Mistastin Lake] with Massen and Aputet. There were no caribou there for a month, however, one morning before we left camp, Massen had a dream about naked women. We spent the day chasing caribou on an island. I guess the caribou didn't want to be killed, so we gave up the hunt. When we got to the other side of the lake, we saw many caribou, mostly does, and there we killed four. We returned to our camp and skinned them, and there before us were four does without hides. They were naked. That's what the dream foretold, I guess" (P6.6.2.07).

ITKC member land use experience in the Mishta-shipu area

As noted above, most of what the ITKC members know about the environment is based upon direct experience living in the Mishta-shipu area. However, with the exception of some trips to the valley at various points over the last decade in relation to historical resource and environmental assessment, it would appear that none of the ITKC members have spent much time in the Mishta-shipu valley since the early 1970s. The following is a brief summary of the land use biographies of each of the ITKC participants in relation to Mishta-shipu.

An important aspect of Innu land tenure worth remembering here is that Mishta-shipu appears to have been both an important travel corridor as well as the dividing line between two regional subgroups of Innu who traded at the Hudson's Bay Company store in Sheshatshiu/North West River. According to Mailhot (1997:142-144),

> two local bands – northern and southern – traditionally occupied the Lake Melville region. These were sets of interrelated families beyond which one went to find a spouse, failing which one ran the risk of marrying a blood relative. In nomadic days these were the only territorial groups of the Sheshatshit band....The Lake Melville territory, as a matter of fact, consisted of two main divisions corresponding to the two groups. One lay north of the Churchill River and Lake Melville, the other to the south....Each zone had several routes reaching into the hinterland and also several fishing places situated at river mouths, where the families of either group would meet periodically.....It should be noted that the Churchill River allowed access to both zones.

Innu who lived south of Mishta-shipu had strong kinship connections with Innu who settled in villages on the Quebec North Shore. Among the Innu, this population is called *Mashkuannuat* after the important Catholic mission called Musquaro located between Natashquan and La Romaine. Innu who lived north of the river had close relations with members of the Moisie band, whom the Innu refer to as *Uashaunnuat*. In the days before settlement, members of this band traded out of Sept-Iles and Sheshatshiu/North West River (ibid., 138).

<u>P2 (unilingual)</u>

Born in 1930 in the Atatshi-uinipek^{u} (Lake Melville) area, P2 spent much of her youth in the Akamiuapishk^{u} (Mealy Mountains) region, living at various lakes including Enakapeshakamau, Mishtashini, Nekanakau and Iatuekupau. She also spent time at Ukaumau-nipi by way of Mishta-shipu (Mailhot, 1988:48). Following her marriage to P3 in 1944, she traveled up Mishta-shipu on a number of occasions with her extended family to inland areas such as Ukaumau-nipi and Kamassekuakamat. In c. 1947, their travels took them as far upstream Mishta-shipu as the outlet of Uinukapau (Winokapau Lake) where there was an *amatshuatakan* (ascending portage) to the highlands south of the river. From the portage, they traveled lake by lake until they got to Kamassekuakamat, paddling until freeze-up, whereupon they traveled by foot and snowshoe. Kamassekuakamat is where Mishta-napeu (Matiu André) had a small outpost from which he sold staples to Innu in the area (P2.29.11.06). Her eldest daughter was a baby at the time, which dates this land use to about 1947. Manatueu-shipiss, Manitu-utshu, Mekenitsheu-shipiss, and Mud Lake were also focal points for camping and harvesting activities in the 1940s, 50s, and 60s.

Her family used to camp on the portage by Manitu-utshu when traveling up and down Mishta-shipu, and her father, Uatshitshish conducted a shaking tent ceremony here on one occasion. In the fall of 1969 she and her family camped at Ushkan-shipiss, between Manitu-utshu and Tshiashku-nipi. This is where Uatshitshish conducted his final shaking tent ceremony, probably the last one to be conducted anywhere in Innu territory in Labrador and northern Quebec. Following settlement in Sheshatshiu, P2 and her family continued to spend time in *nutshimit*, in the Akamiuapishk^{u} region, at Mishta-mishkumi, and at Mud Lake.

The last time she lived along the shores of Mishta-shipu was sometime around 1971 when the family camped that fall on a long sandy bank called Kaishipanikaut,[17] just downstream of Tshiashku-nipi (Gull Lake). Here, they fished pike, whitefish, lake trout, burbot and suckers. The men trapped beaver, and hunted geese and other migratory waterfowl in the area. Their hunting activities extended as far upstream as Tshiashku-nipi and as far downstream as Kamitinishkau-shipiss. P2 and her husband stopped going to *nutshimit* about ten years ago when the effects of old age confined them to the village.

<u>P3 (unilingual)</u>

Born in 1926 at Iku-shipiss on the southern shores of Atatshi-uinipek^{u} (Lake Melville), P3 spent most of his youth in the Mishta-shipu and Tshenuamiu-shipu (Kenamu River) valleys, along the shores of Atatshi-uinipek^{u}, and in the Akamiuapishk^{u} (Mealy Mountains) highlands. He also saw the Penipuapishk^{u} (Red Wine Mountains) area during his youth (Mailhot, 1988:48). Following his marriage to P2 in 1944, he traveled up Mishta-shipu on a number of occasions with P2, her parents and other family members to inland areas such as

[17] This toponym was recorded during a 1980 mapping project in a slightly different location from that identified by the ITKC participants (LAMAP database, Innu Nation).

Ukaumau-nipi and Kamassekuakamat. His land use biography is identical to that of P2 following his marriage (P3.1.12.06).

P7 (bilingual)

Born in 1949, P7 is the son of P2 and P3, and therefore, his land use biography is similar to that of his parents for much of his youth. He remembers hunting caribou with his father in a marsh area near Manatueu-shipiss (Traverspine River) in the fall of 1960-61 at which time they killed 15 of the animals. That same fall, the family established a base camp at the narrows on the south side of Mishta-shipu just below Etuat-shipiss from which they pursued a number of hunting and fishing activities.[18] In the fall of 1969, shortly after his marriage, he, his wife and first child lived in the Ushkan-shipiss area with other family members, at the time when his grandfather, Uatshitshish, conducted his last shaking tent ceremony. He killed caribou at the mouth of Tepiteu-shipu that fall. In the 1970s, he harvested and camped on Mishta-shipu as far upstream as Tshiashku-nipi (Gull Lake), by way of canoe on the river as well as by accessing the area from camps established at nearby locations on the Trans-Labrador highway such as Etuat-shipiss.[19] P7 also acquired knowledge of the Mishta-shipu area in the context of his work over the years as a conservation officer, fisheries guardian, and by working on biological surveys including the furbearer survey conducted by Sikumiut Environmental Management for NLH in the spring of 2006. In the post-settlement period, he lived and harvested at Akamiuapishk^{u} (Mealy Mountains) at various lakes in the headwaters of Nutapineuaniu-shipu (Eagle River), as well as at Mud Lake.

P4 (unilingual)

P4 was born near Nipississ (Nipishish Lake) in 1929 (Mailhot, 1988:12-13). In the pre-settlement period he frequented the area between Sheshatshiu and Meshikamau (Michikamau Lake) with his parents, and saw Meshikamau before the flooding, traveling there via Meshikamau-shipu (Naskaupi River). He also traveled in the Akamiuapishk^{u} (Mealy Mountains) region, almost as far as Nutapineuaniu-shipu (Eagle River). He traveled up Mishta-shipu four times prior to his marriage in 1949, and spent a year in the area south of Uinukapau (Winokapau Lake). His family had traveled up Mishta-shipu as far as the portage by Kamakatinat utshu, which starts just above Tshiashku-paushtik^{u} and comes out at the mouth of Minai-nipiu-paushtik^{u}. From there they traveled to the Nipissu (Dominion Lake) area, then south of Umishtatai-nipi, going east as far as some burned hills to the southwest of Uinukapau. They trapped furbearing animals along the way and killed some caribou near Umishtatai-nipi. Arriving in the burned hills area, they killed many more caribou and spent the winter. They appear to have made at least one trip to Matiu André’s store at

[18] Dated by reference to the birth date of Charlie Andrew (Aug. 1951).
[19] Andrew, Gregoire, and Sakauye, 1979 fieldnotes and map biographies.

Kamassekuakamat while living in this region.[20] His sister died at Minai-nipu-shipu (Minipi River) in this period, and her body was taken back to Sheshatshiu for burial (P4.24.1.07). He also hunted on the highland above Uinukapau in the days before he got married, and he once traversed Uinukapau on the ice. However, he never paddled there in the summer or fall.

After settlement in Sheshatshiu commenced, he worked on the construction of the Twin Falls hydro facility (c. 1960) (P4.30.11.06). A short while later, he worked at Churchill Falls for three summers where he was involved in drilling rocks for core samples. When the Sheshatshiu Innu band council started an outpost programme in the 1970s, he lived at various locations in the country including Kamashkushkatinau-nipi, Kauashikanepinanut, Kukamessat-kataht, Mitshishu-utshishtun, Pepaukamau, and Shatshit.

P8 (unilingual)

Born in 1943, P8 lived in the Kamassekuakamat area in c. 1947 with her parents, P2, P3, and other families. Her father was ill at the time and died upon this arrival at Happy Valley-Goose Bay that year. She was subsequently adopted by her "grandparents," Shushepish and Ishkuessish, who taught her much about Innu history in the Mishta-shipu valley. She learned more about the region from her parents-in-law after her marriage in the early 1960s. Her father-in-law was highly respected for his knowledge of Mishta-shipu and the lands to the south of the river, due to his extensive land use there. Her memories of living on Mishta-shipu extend as far upstream as Tshiashku-nipi (Gull Lake) (P8.1.12.06). She and her family lived at Ushkan-shipiss in November 1969 when Uatshitshish conducted his final shaking tent ceremony. P8 lived at a few different locations in the country in the 1970s, 80s, and 90s which were accessed by charter aircraft under the band council's outpost programme. These include Kamashkushkatinau-nipi, Katshinukamaut-nipi, and Minai-nipi (Minipi Lake).[21]

P9 (unilingual)

P9 was born in 1932, and traveled as far up Mishta-shipu as the outlet of Uinukapau (Winokapau Lake) with her father and mother (P9.1.12.06). Following

[20] P4 provided a similar summary of his travels in this area in 1979: "I have been to many places and another one is right here somewhere (indicated on map), south of Winokapau Lake. It is barren-like there and that's where we had caribou. We had winter camp there.….Little Mecatina River is called Natuakamiu-shipu in Innu. We have traveled along here when we went out from the country to North West River. Then we made a detour (through the use of portages and paddling along rivers and lakes), finally reaching Gull Lake and down the Hamilton River (indicated on the map). That was about twenty years or thirty years ago; when Goose Bay was built up then" (Andrew and Sakauye interview, 5 Feb. 1979).

[21] The Sheshatshiu Innu band council outpost records label this lake "Little Mud Lake," suggesting a proximity to Mud Lake. However, I am unable to locate a Katshinukamat-nipi anywhere near Mud Lake. We have a lake by the name of Katshinukamat-nipi on NTS map 13G/05, about 35 km to the east of Mud Lake, but we cannot be sure if this is the same lake where P8 and family resided.

the ascending portage referred to by P2 above, they traveled overland to Kamassekuakamat passing Kakupi on the way. The men killed a lot of caribou about two days walk from Kamassekuakamat, so they moved camp to the location of the kill. When they finished preparing the caribou meat, they traveled north to Uinukapau where her father's uncle, Tuminik, had a camp, on a small lake in the highlands to the north of the lake. Tuminik was trapping in this area. After that, they traveled on the high ground back towards Sheshatshiu, descending to Mishta-shipu at the west end of Tshiashku-nipi (Gull Lake), at which point they were running out of food. The construction of the Goose Bay airfield had just started at this point, which dates this land use to about 1941.

P1 (unilingual)

Born in 1930, P1 remembers spending a lot of time with his grandfather in the Mishta-shipu valley downstream of Manitu-utshu in the period before 1941. They fished *tshinusheu* (pike), *matamek*^{u} (brook trout), *kukamess* (lake trout), *makatsheu/mikuashai* (suckers), *atikamek*^{u} (whitefish), and *utshashumek*^{u} (Atlantic salmon), trapped *amishk*^{u} (beaver), *utshashak*^{u} (muskrat), and *pishu* (lynx), and hunted migratory waterfowl and small game such as *kak*^{u} (porcupine) and uapush (snowshoe hare) at various places along this stretch of the river, especially up Mekenitsheu-shipiss (McKenzie River) and Manatueu-shipiss (Traverspine River). He was married in c. 1951, and shortly thereafter traveled as far upstream as Minai-nipiu-shipu (Minipi River) (P1.8.12.06). At this point his group traveled over land to Minai-nipi (Minipi Lake) where they hunted and trapped all around the lake.

They hunted and trapped upstream as far as Tshiashku-nipi (Gull Lake) and downstream as far as Manitu-utshu when their base camp was at the mouth of Tepiteu-shipu. They also hunted and trapped away from the river on both the north and south sides. They had established a camp here in September and returned to Happy Valley in March.

There were hardly any White people at Happy Valley in the early 1950s, and P1's group often camped where Maxwell's bar is now located. They also camped at the mouth of Manatueu-shipiss. A lot of other Innu were living up the river at the same time, but he does not know where their base camps were located. They include Tshetshishepateu, Shimun Gregoire, Tshishenniu-Ishpashtien and their families. They encountered each other along the way and dispersed to different locations.

Shimiu Pastitshi spent lots of time up Mishta-shipu and he was the "real expert" about the valley and surrounding territory. He hunted and trapped in the area between Mishta-shipu and Natuakamiu-shipu (Little Mecatina River) as well as Akamiuapishk^u (Mealy Mountains) region, including Iatuekupau. His land use north of Mishta-shipu did not extend trap as far as Kaishikashkau (Disappointment Lake).

P5 (unilingual)

Born in 1924, P5 did not visit the Mishta-shipu valley as a young man. However, he traveled up Mishta-shipu as far as Tshiashku-nipi (Gull Lake) and the mouth of Minai-nipiu-shipu (Minipi River) after he started to trade out of Sheshatshiu in the late 1930s.[22] He also lived in the headwaters region of Meshikamau-shipu (Naskaupi River) as far as Meshikamau (Michikamau Lake) in this period. His first wife passed away in the vicinity of Tshiashku-nipi in c. 1943 while his second wife died near the mouth of Mishta-shipu in c. 1945, probably at Mud Lake (Mailhot, 1988:10). At one point in the 1940s, members of his group killed 12 caribou at an *ushakatik^u* ('where there are always caribou') on the high ground up Mekenitsheu-shipiss (McKenzie River). The men would leave their families for up to 20 days to hunt and trap at more distant locations (P5.8.12.06). He also resided in the Tepiteu-shipu area (P5.1.12.06, 8.12.06), and he saw Uatshitshish conduct a shaking tent ceremony at Manitu-utshu.[23]

He took up wage employment in about 1963 and therefore did not participate in the band council's outpost programme which commenced the following decade. He visited Patshishetshuanau (Churchill Falls) by way of the Trans-Labrador Highway, and in 1999 he saw many areas along Mishta-shipu by helicopter as a consultant to archaeologists conducting historic resource assessment for the proposed Churchill River Project.

P6 (co-facilitator/interpreter, bilingual)

Born in 1960, P6 has extensive land use experience throughout much of the Labrador Innu territory despite his relatively young age, having lived at more than 20 different locations over the years. These include Maikan-nipi and Kaishikashkau (Disappointment Lake), Kauashikanepinanut, Kauassenekausht, and Utshimauapeu-nipi in the Penipuapishk^u (Red Wine Mountains) area, Iatuekupau in the Akamiuapishk^u (Mealy Mountains) area, Ashtunekamik^u (Snegamook Lake), Ashuapamatikuan (Shipiskan Lake) and Shapeiau (Shapio Lake) in the border region between Sheshatshiu and Natuashish, and Kameshtashtan (Mistastin Lake) in the far north. He lived at Lobstick Lake in the fall of 1973 with his grandfather Shimun Pone and Shamani Andrew's family, not long after the creation of the Smallwood Reservoir. His experience in the Mishta-

[22] P5 told A. Andrew and B. Sakauye (interview 12 February 1979) that the Innu "have many travel routes to different destinations; like, for us, when we go out to the Hamilton River to Minipi Lake, we would use many portages because of many long turns and rapids….Traverspine River (Manatueu-shipiss) was a route we took and came down from the country when we came out. I have not seen all the Hamilton River, but I have seen the Churchill Falls from another route….I have also seen Gull Lake (Tshiashku-nipi) and the Minipi River (Minai-nipiu-shipu)" (I have corrected the toponym spellings).
[23] P5 interview with Y. Labreche, 11 October 1999.

shipu valley is limited to some time at Tshiashku-nipi (Gull Lake) and a camp at "Penitenemi-shipiss" ("Mile 95") on the Trans-Labrador Highway, from which he hunted caribou as far south as Uinukupau (Winokapau Lake).

In his youth, P6 kept his ears open and mind alert whenever his parents and grandparents were talking about animal behaviour, habitat, hunting practices, and Innu history, and he is therefore a good example of the power of oral tradition to transmit large volumes of knowledge between generations. Starting in the 1980s, he occasionally took employment as a guide at sports fishing and hunting camps, and on mineral exploration teams. He also worked on a forest harvesting and wildlife study related to forest management in Forest Management District 19 in Central Labrador.

6. Knowledge content: what Innu know about Mishta-shipu

Having discussed how members of the ITKC know what they know about the environment in the Mishta-shipu area, we shall consider now the content of that knowledge. This discussion of Innu environmental knowledge is by necessity incomplete, as noted at the beginning of the report. Time placed limits on our ability to explore many aspects of Innu knowledge in any depth, and furthermore, the "white room" setting of the focus group and individual interviews removed the ITKC members from contexts probably more conducive to remembering details about the land and its biota, for example, physical presence on the land in the context of travel, hunting, trapping, fishing, and gathering activities. This report is therefore a distillation of Innu environmental knowledge.

For the purpose of this discussion, I have parsed Innu environmental knowledge according to a number of western scientific categories such as geography, taxonomy, animal behaviour and reproduction, predator-prey relationships, species distribution, habitat, and anatomy. These are etic not emic categories, as no traditionally-minded Innu person would organize the presentation of knowledge in this manner and, in fact, there appear to be no Innu terms for these categories. For example, Innu certainly possess a taxonomy for the classification of animal and plant species, and I present elements of this taxonomy in this report, but there is no word in Innu-aimun for "taxonomy" *per se*.[24]

I wish to start the presentation of Innu knowledge content concerning Mishta-shipu with a listing of faunal and floral species that the ITKC members say are found in this region. I have organized these species to some extent according to Innu taxonomic concepts, however, I have not considered systematically the taxonomies employed by Sheshatshiu Innu, because taxonomic investigation

[24] Taxonomy deals with the way that organisms are classified, based on similarities and relationships among them. The system used by western science is based on the 18th century work of Carolus Linnaeus (the Linnaean system of classification), and takes into consideration not only shared, derived characteristics (i.e. homologies), but also their "phylogenic" similarities referring to evolutionary similarities among species.

requires the use of extremely time-consuming, formal eliciting procedures as explained by Black (1967) in her ethnoscientific investigation of Ojibwa ontology and world view.[25] My flirtation with this method certainly supports this conclusion. Attempting to flesh out Innu taxonomy is a time-consuming pursuit not the least because of differences of opinion among Innu experts, due in part to the fact that they may employ different criteria when assigning a species to one taxon versus another. Determining these criteria is time-consuming in its own right. For example, one cannot conclude that all flying animals are *pineshish* when one knows that Innu classify *upau-apukushish* (bat) with the quadrupeds, because "it is related to *apukushish* (mouse)" (P1.25.1.07). One must determine what other criteria other than wings and capacity for flight is at work here. Similarly, one ITKC member placed *akushamesh* (osprey) in the same category as *mitshishu* (bald eagle), even though there is no named taxon for this class of birds, "because it has claws" (P1.25.1.07).[26]

In any event, time limitations precluded the use of formal eliciting procedures in the present study except superficially, as a "spot-checking" tactic, or to facilitate in-depth investigation of a very limited set of issues.[27] Moreover, careful identification and classification of some species, in particular plants, requires the collection of specimens or fieldtrips due to the notorious difficulties involved in using photographs for identification purposes (Diamond, 1991). Field collection of plant and animal species was an impossibility given both time limitations and the season when ITKC meetings and interviews were held (fall-winter). Given these limitations, it is tempting to extrapolate from other parts of the Innu territory to Sheshatshiu, however, there is enough evidence of regional differences in taxonomic beliefs and lexical items for individual species to warrant caution.[28] At best, we can say that the taxonomic descriptions provided by Bouchard and Mailhot (1973) and Clément (1990, 1995, 1998) are reasonable approximations of the concepts held by members of the ITKC, notwithstanding any errors, omissions, and regional differences.

In order to make sense of my organization of the Mishta-shipu species inventory, let us review briefly some of the basics concerning Innu taxonomic concepts as described by the aforementioned authors (Bouchard and Mailhot, 1973; Clément, 1991, 1995). According to Clément (1990:26-27), at the most abstract level, traditionally-minded Innu divide the universe into three domains – *assi* (vegetation), *aueshish* (fauna), and *innu* (human being),[29] the first two being the

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[25] See also Tyler (1969).

[26] See Black (1967) for a discussion of variation and stability in informant responses to taxonomic eliciting procedures.

[27] Black (1967:18, 45) spent 500 hours interviewing six informants over a ten month period using formal eliciting procedures.

[28] Furthermore, there appear to be some errors in Clément's data which give additional cause for caution in making any extrapolations (José Mailhot, personal communication).

[29] The place of various non-human beings such as *memekueshu* (cave creatures), *Mishtapeu* (attending "spirit"), and *Missinak*^{u} (master of aquatic animals) in this universe is not addressed by Bouchard and Mailhot or Clément. Some of these entities may belong to the *aueshish* class,

principal focus of this report. As far as fauna are concerned, Bouchard's and Mailhot's (1973) data from Ekuanitshu (Mingan) and Matamekush (Schefferville) indicate that the Innu have at least four parallel systems for classifying these species: (1) taxonomic; (2) hierarchical on the basis of whether the fauna have maleficent power; (3) a three-way division that associates fauna with particular seasons, namely *pipun-aueshish* (winter animal), *nipin-aueshish* (summer animal), and those that fall in neither of these categories; and (4) realms – *tipenitamun* - controlled by animal masters.[30]

Innu taxonomic classification is my main concern in this report because of my practical interest in providing an inventory of fauna and flora, organized as much as possible according to Innu not western scientific thinking. Nonetheless, elements of some of these other systems of classification appear in various places throughout this report. For example, one ITKC member provided a seasonal classification of *pineshish* (non-waterfowl bird) – *pipun-pineshish* and *nipin-pineshish*, that is winter and summer birds respectively. He also touched on a parallel classification for waterfowl depending on whether they remain on the coast (*uinipeku-shiship*, coast waterfowl) or migrate inland (*nutshimiut-shiship* – country waterfowl).[31] In another example, *uenitshikumishiteu* was placed in the *manitush* (maleficent) category even though it is thought to resemble an otter or seal, and is controlled by *Missinak^u*, the master of aquatic animals.[32]

As far as *aueshish* (four-legged animal) is concerned, Innu distinguish between *Innu-aueshish* (Innu "wild" animal), and domestic ones (Bouchard and Mailhot, 1973; Clément, 1995:462). There appears to be no lexical item for "domestic animal" *per se* in Ekuanitshu (Mingan), but the concept is expressed as *kakanuenimakanit aueshish* ('animal that one takes care of'). The Innu in Matamekush (Schefferville), on the other hand, use the term *kakusseshiu-aueshish* ('White person animal').[33] According to Bouchard and Mailhot (1973), the taxon *Innu-aueshish* is divided into six suprageneric taxa including:

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while others may belong to yet another class for which there is apparently no label in the Innu language. *Mishtapeu*, for example, who resides in a place called *Tshishtashkamik^u* (the "other dimension" according to the co-facilitator) is neither human nor *aueshish*, so which class does s/he belong to? I did not explore this matter in the course of the ITKC work. One ITKC member proposed a more fundamental classification of living and non-living entities in the universe; those made by *Tshishe-manitu* (God) versus those crafted by humans. Presumably, *assi*, *aueshish* and *innu* all fall in the God-made category (P1.5.2.07).

[30] They caution the reader that their data are not definitive, and that it is premature to extrapolate them to other Innu groups (ibid.:39). Clément (1995:461-462) briefly discusses parallel classification systems, and points to other possible systems in addition to those identified by Bouchard and Mailhot, however, his exclusive focus in this publication is Innu faunal taxonomy.

[31] An example of a *uinipeku-shipiship* species is *missip* (common eider). This person saw one once when his daughter brought one back from Unaman-shipu (La Romaine) on the Quebec North Shore (P1. 25.1.07).

[32] Clément lists *uenitshikumishiteu* as a member of the *aueshish* class, and a type of *nitshik^u* (otter) (1995:447).

[33]The term in Pessamiu (Betsiamites) is the same, from the verb *kakusseshiu* – "s/he is French Canadian" (Drapeau, 1991). *kakusseshiu-aueshish* include *uishuau-atik^u* (domestic cow), *pakakuan* (chicken), *kukush* (pig), *mantaish* (sheep), and *kapanakushkueu* (horse).

1. *aueshish* (four-legged animals, including black bear, caribou, beaver, wolf, etc.
2. *missip* (waterfowl, including ducks, geese, loons, etc.[34]
3. *pineshish* (“birds”, including eagles, gulls, owls, etc.)
4. *namesh* (fish, including cod, trout, tadpoles, crabs, etc.)
5. *shatshimeu* (insects, including midges, dragon flies, domestic flies, mosquitos, etc.)
6. *manitush* (creatures with maleficent power, including toads, spiders, snakes, etc.).

However, Clément (1995:443-444) proposes a different classification, with *aueshish* distinguished from *manitush* as branches of an unnamed domain, on the basis of whether an animal is edible (*aueshish*) or inedible or harmful in some way (*manitush*). At this level, Sheshatshiu ITKC members appear to share the same binary classification *aueshish* and *manitush* on the basis of whether a species is edible or inedible (P4, P6.6.2.07). Beyond that, Clément’s informants divide *aueshish* into two classes – *aueshish* (animals having *uaiash* – meat) and *namesh* (animals having *namesh* – flesh).[35] “Meat” animals are further divided into five orders in Clément’s study – *aueshish* (four-legged animals), *missip* (waterfowl), *pineu* (*Tetraonidae*), *pineshish* (small birds), and raptors (no Innu lexeme).

As far as the domain *assi* (vegetation) is concerned, Clément (1990:27) argues for two primary subdivisions, based upon his work with Ekuanitshu (Mingan) Innu. The first I have already spoken of, namely, *assit nete kanitautshiki* or *assit nete kanitautshisht*, “that which grows in the ground” (animate and inanimate variants). These are generally plants with roots including *mishtik^u* (tree), *shakau* (shrub, bush), *atishi* (small shrub, bush), and *mashkushu* (herbaceous plant, grass, fern, etc.).[36] The second subdivision is *assi*, vegetation that covers the earth, rootless “plants,” as in the case of moss, certain lichens, rotten wood, and even *ashissu* (mud).[37] A number of generic taxa could not be placed in either of these two categories including rock tripe, puff-ball, old man’s beard, and mushrooms.

Of course, some of the taxa in the Innu taxonomic system appear similar to Linnaean ones, for example, the taxon *aueshish* (four-legged animals) comprises

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[34] The equivalent term in Sheshatshiu is *shiship*.
[35] Drapeau’s (1991) dictionary defines *namesh* simply as fish, with no mention of fish “flesh.”
[36] See Clément (1990, 1998) for in-depth discussions of Innu botanical taxa. Clément (1998:38) recorded *kanitautshiki tshekuana assit* in Utshimassit (Davis Inlet). It derives from the inanimate intransitive verb *nitautshin* – something (inanimate vegetal) grows. *kanitautshiki tshekuana assit* is the inanimate form of the expression. Clément says that *kanitautshisht* is the nominalized verb used for animate flora, in which case it would have to be based on an animate intransitive verb *nitautshishu* – s/he (animate vegetal) grows. This verb is not found in Drapeau (1991), however, the dictionary contains *nitautshu* with the same meaning and gender. The nominalized form of this would be *kanitautshit*.
[37] As noted elsewhere in this report, ITKC members asserted that suckers eat *ashissu* (“mud”). This lexeme is an animate noun.

nothing but mammals. The significant differences in the two taxonomic systems are immediately apparent, however, when we see that the Innu include *mishtamek*ᵘ (whales) in the category *namesh* along with *matamek*ᵘ (brook trout), *utshashumek*ᵘ (Atlantic salmon), *makatsheu/mikuashai* (suckers), and other fish species. In the Linnaean system, all birds are considered *Aves* whereas Innu divide them among separate orders, namely, *missip* (*shiship*) (waterfowl), *pineu* (grouse), *pineshish* (small birds), and an unnamed raptor category.

In the species inventories presented below (Tables 2-6), the identification of faunal and floral species that the ITKC members say are found in Mishta-shipu region must be considered tentative in many cases given the fact that there were no field trips or field collection of specimens. I relied on the Innu co-facilitator for direct translation of Innu lexemes for many animal species, in particular the four-legged animals and large bird and fish species.[38] Existing lexicons, including Clément (1990, 1995) and Drapeau (1991), were also consulted to help with the task of species identification.[39] We attempted to identify bird species, and find the equivalent English and scientific terminology for them using photos available on the Cornell Lab of Ornithology website "All About Birds" (http://www.birds.cornell.edu/AllAboutBirds/) For a small number of species, we listened to bird calls and watched video clips of the birds obtained from the same internet database. We also used photos of a number of fish species in order to determine if lexical items exist for them in the Innu language. With both birds and fish, we reviewed with ITKC members inventories of species encountered and/or expected to occur within the Mishta-shipu study area provided by consulting biologists working on Project baseline data collection.[40] ITKC members were not familiar with many of these species, in particular smaller fishes such as

[38] No competent interpreter has trouble thinking of the English names for *kakatshu* (raven) or *uapishtan* (marten) for example. There are many cases, however, where finding the correct English term for a species named in Innu-aimun can be problematic.
[39] Some minor adjustments were made to the scientific botanical names found in Clément on the basis of Ryan (1978).
[40] P. Trimper e-mail to P. Armitage, 27 Nov. 2006; furbearer data provided by Sikumiut Environmental Management via L. LeDrew e-mail to P. Armitage 19 Dec. 2006; fish data provided by AMEC Americas, Earth & Environment via L. LeDrew e-mail to P. Armitage 27 Nov. 2006.

Table 2. *aueshish* – four-legged animals

Innu name	English name	Scientific name	Notes
amishk^u	beaver	*Castor canadensis*	
anukutshash	red squirrel	*Tamiasciurus hudsonicus*	
apikushish, katshinuashkuanuieshit	meadow jumping mouse woodland jumping mouse	*Zapus hudsonius* *Napaeozapus insignis*	
atik^u	caribou	*Rangifer tarandus*	
atshikash	mink	*Mustela vison*	
atshik^u	seal (generic)		
innatshik^u	hooded seal?	*Cystophora cristata*	validate identity
kak^u	porcupine	*Erethizon dorsatum*	
maikan	timber wolf	*Canis lupus*	
mashk^u	black bear	*Ursus americanus*	
matsheshu	red fox	*Vulpes vulpes*	
mishtapush	arctic hare	*Lepus arcticus*	
mush	moose	*Alces alces*	
nitshik^u	river otter	*Lutra canadensis*	
pishu	Canada lynx	*Lynx Canadensis*	
pipun-atshik^u	harp seal?	*Pagophilus groenlandicus*	validate identity
pitshuatshik^u	ringed seal?	*Phoca hispida*	validate identity
shikush	least weasel	*Mustela rixosa*	
uapishtan	marten	*Martes americana*	
uapush	snowshoe hare	*Lepus americanus*	
utshashk^u	muskrat	*Ondatra zibethicus*	
uinashk^u	woodchuck	*Marmota monax*	
upau-anukutshash	northern flying squirrel	*Glaucomys sabrinus*	
upau-apikushish	probably the little brown bat	*Myotis lucifugus*	
nipiu-apikushish	water shrew?	*Sorex palustris*	
nashpatinisseshu	star-nosed mole	*Condylura cristata*	
tshinishtui-apikushish	pygmy shrew	*Microsorex hoyi*	this name could refer to other shrews as well

Table 3. *namesh* – fish species

Innu name	English name	Scientific name	Notes
atikamek^u	lake whitefish round whitefish?	*Coregonus clupeaformis* *Prosopium cylindraceum*	"whitefish come in different sizes" – *atikamek*^{u} refers to more than one species?
atshakashamekush	cisco	*Coregonus artedii*	
kauapishisht	Atlantic rainbow smelt	*Osmerus mordax*	
kaushkanusht	three-spined stickleback?	*Gasterosteus aculeatus*	Settlers call it "kəshî". Drapeau records *kaushkanusht* as Atlantic herring *Clupea harengus.*

			validate identity
kukamess	lake trout	*Salvelinus namaycush*	
makatsheu	type of sucker		has white belly
matamek[u]	brook trout	*Salvelinus fontinalis*	
mikuashai	longnose sucker	*Catostomus catostomus*	has red belly
minai	burbot	*Lota lota*	
tshinusheu	northern pike	*Esox lucius*	
utshashumek[u]	Atlantic salmon	*Salmo salar*	
utshashumeku-esh	eastern pearl mussel	*Margaritifera margaritifera*	classification as namesh uncertain, not found in Mishta-shipu. Salmon believed to come from this shellfish

Table 4. "bird" species

Innu name	English name	Scientific name	Notes
shiship	**waterfowl**		
aiakuss	greater scaup	*Aythya marila*	
ashu-muak[u]	red-throated loon	*Gavia stellata*	called *kashakut* among Mashkuannuat
auiu	long-tailed duck, oldsquaw duck	*Clangula hyemalis*	
inniship	American black duck	*Anas rubripes*	
kaiashinikanikutesht	lesser scaup	*Aythya affinis*	
mishikushk[u], kapishkunatshstipest	common goldeneye	*Bucephala clangula*	
mishtishuk[u]	common merganser	*Mergus merganser*	
mitshikutan	surf scoter	*Melanitta perspicillata*	
muak[u]	common loon	*Gavia immer*	
nishk	Canada goose	*Branta canadensis*	
nutshipaushtikueshish	Harlequin duck	*Histrionicus histrionicus*	
shashteship	black scoter	*Melanitta nigra*	called *kueshkeshepatam* in Uashat
tshiashk[u]	gull (generic)		
tshinash	arctic tern	*Sterna paradisaea*	
uapinniship	common or northern pintail	*Anas acuta*	
uapinnishipiss	green-winged teal	*Anas crecca*	
umamuk[u]	white-winged scoter	*Melanitta fusca or Melanitta deglandi*	
ushuk[u]	red-breasted merganser	*Mergus serrator*	
pineu	**partridge (generic)**	***Tetraonidae***	
innapineu	?	?	same colouring as *uapineu* but it is

			larger when plucked (P1. 25.1.07). Clément (1995:531) identifies this as willow ptarmigan. Drapeau (1991) defines it as winter ptarmigan. validate identity
innineu	spruce partridge, spruce grouse	*Dendragapus canadensis*	
kashkanatshish	rock ptarmigan	*Lagopus mutus*	same as *amishkuapineu* which is a Lower North Shore Quebec Innu term (P1.25.1.07).
pashpassu	ruffed grouse	*Bonasa umbellus*	
uapineu	willow ptarmigan, white partridge	*Lagopus lagopus*	
pineshish	**small birds (generic)**		
aiapish	?	?	possibly least sandpiper (*Calidris minutilla*) determine identity
kakatshu	northern raven American crow	*Corvus corax* *Corvus brachychynchos*	*pipun-pineshish* *pipun or nipin?*
kamushkuashit	Wilson's snipe?	*Gallinago delicate?*	*nipin-pineshish* validate identity
kanakuneu	northern three-toed woodpecker	*Picoides tridactylus*	*nipin-pineshish*
kauituassakuanishkueishit	white-throated sparrow white-crowned sparrow	*Zonotrichia albicollis* *Z. leucophrys*	*nipin-pineshish*
mishue	pine grosbeak	*Pinicola enucleator*	*pipun-pineshish*
mukamishu	American bittern	*Botaurus lentiginosus*	*nipin-pineshish*
nutapashkueshu	whimbrel	*Numenius phaeopus*	*nipin-pineshish*
pashpashteu	black-backed three-toed woodpecker	*Picoides arcticus*	*pipun-pineshish*
patshakaishkashish	boreal chickadee	*Parus hudsonicus*	*pipun-pineshish*
pipitsheu	American robin	*Turdus migratorius*	*nipin-pineshish*
shakau-pineshish	common redpoll? yellow warbler?	*Carduelis flammea* *Dendroica petechia*	*pipun-pineshish* validate identity
shakuaikanish	tree swallow	*Tachycineta bicolor*	*nipin-pineshish*
shesheshu	greater yellowlegs	*Tringa melanoleuca*	*nipin-pineshish*
teshtueshtshish	spotted sandpiper	*Actitis macularia*	*nipin-pineshish*
tipaikan-pineshish	golden-crowned kinglet?	*Regulus satrapa*	*nipin-pineshish*
tshatshakanu	?	?	possibly rusty blackbird (*Euphagus carolinus*) or common

			grackle (*Quiscalus quiscula*) determine identity
uapinekushish?	snow bunting	*Plectrophenax nivalis*	*pipun-pineshish*
uishkatshan	gray jay	*Perisoreus canadensis*	*pipun-pineshish*
utshissimanishu	belted kingfisher	*megaceryle alcyon*	*nipin-pineshish*
	other birds		no supra-generic taxon identified for these species
akushamesheu	osprey	*Pandion haliaetus*	
kashakatasht	barred owl	*Strix varia*	
kukukueu?	short-eared owl?	*Asio flammeus*	determine identity
mitshishu	bald eagle	*Haliaeetus leucocephalus*	
nutshineueshu	gyrfalcon	*Falco rusticolus*	
papanatshish	boreal owl	*Aegolius funereus*	
pipitshish	merlin	*Falco columbarius*	
uapikunu	snowy owl	*Nyctea scandiaca*	
uhu	great horned owl	*Bubo virginianus*	

Table 5. *manitush* – inedible, maleficent species

Innu name	**English name**	**Scientific name**	**Notes**
aməshkūtshîsh	whirligig beetle (generic)	*Gyrinidae*	
amu	bumblebee (generic)	*Apidae*	
anik[u]	American toad	*Bufo americanus*	
anishku-enik[u]	ant (generic)		uâpuîânuîutuâu (sleeping bag) = name of white larvae carried by ants. Relationship to *Aianishku-enik*[u] unknown
enik[u]	spider or ant (generic)		
epik[u]	water insect (generic)		
kauîūtət	?	?	type of spider with a big body determine identity
kuakuapishish	butterfly (generic)		
missak[u]	horse fly, stout		
pîtshêpən	grasshopper (generic)		Drapeau (1991) records *kuashkuashkutipeshish* for grasshopper, Clément records *pitshemin*
puîtūtikuân	?	?	larvae found in throat of caribou determine identity
shatshimeu	mosquito, black fly (generic)		
sheuekatshu	dragonfly (generic)		
teteu	northern leopard frog	*Rana pipiens*	
tshishtaueshu	?	?	a stinging insect with a

			long, barbed tail. Resembles a smoky horntail or pigeon horntail determine identity
umatshashkuk[u]	mink frog	*Rana septentrionalis*	
uenitshikumishiteu	?	?	large, orange/yellow otter-like creature, resides at Manitu-utshu
uteshkan-manitush	giant waterbug	*Lethocerus americanus*	
utshîtnâkuesh	blue-spotted salamander?	*Ambystoma laterale*	reported for neighbouring rivers such as Kenamu, Goose, Beaver, and Red Wine Rivers. It may be present on Mishta-shipu. Drapeau (1991) records *ushitshilauesh*

Table 6. *assit nete kanitautshiki/kanitautshisht* – that which grows in the earth[41]

Innu name	**English name**	**Scientific name**	**Notes**
***minishtik*[u]**	**tree**		
assiuashik[u]	Canada yew	*Taxus canadensis* Marsh	looks like fir boughs, therefore it is *mishtik*[u]
innasht	balsam fir	*Abies balsamea* (L.) Mill.	
minaik[u]	white spruce	*Picea glauca* (Moench) Voss	
mitush	trembling aspen	*Populus tremuloides* Michx.	
sheshekatik[u]	black spruce	*Picea mariana* (Mill.) B.S.P.	
uatshinakan	tamarack	*Larix laricina* (Du Roi) K. Koch	
ushkuai	white birch mountain white birch	*Betula papyrifera* Marsh. *Betula cordifolia* Regal	
shakau	**shrub, bush**		
atikupemak[u]	tundra dwarf birch	*Betula glandulosa* Michx.	
atushpi	speckled alder	*Alnus rugosa* (Du Roi) Spreng.	
mikuapemak[u]	red-osier dogwood	*Cornus*	

[41] In the case of berry plants, lexical items comprise two parts – the name of the berry, and a root *akashi* meaning "fruit/berry plant," e.g. *uishatshimin* (redberry) + *akashi* (berry plant).

		stolonifera Michx.	
mashkuminakashi	American mountain-ash, dogberry Showy mountain-ash	*Sorbus americana* Marsh. *Sorbus decora* (Sarg.) Schneid.	
shakau	mountain alder	*Alnus crispa* (Ait.) Pursh	
uapineu-mitshim	willow (generic)	*Salix* spp.	
uîkuâpêmuk	?	?	unidentified type of alder with berries determine identity
atishi	**small bush/ shrub**		small shrubs that are hard to walk across
assiminakashi	black crowberry	*Empetrum nigrum* L.	found among lichen
atuminakashi	chuckley-pear, serviceberry	*Amelanchier bartramiana*	
ikuta	Labrador tea	*Ledum groenlandicum* Oeder	
inniminanakashi	low sweet blueberry	*Vaccinium angustifolium* Ait.	
innitshiminakashi	skunk currant?	*Ribes glandulosum* Grauer	validate identity
massekuminakashi	small cranberry, marshberry	*Vacciniun oxycoccus* L.	
mushuminakashi	squashberry	*Viburnum edule* (Michx.,) Raf.	
nitshikuminakashi	velvet – leaf blueberry	*Vaccinium myrtilloides* Michx.	
pineuminakashi	capillaire, creeping snowberry	*Gaultheria hispidula* (L.) Bigel	Uatshitshish used the leaves in the shaking tent, tied together around the top hoop of the tent (P4.6.2.07).
shikuteuminanakashi	bakeapple	*Rubus chamaemorus* L.	
uishatshiminakashi	lingonberry, redberry, partridgeberry, mountain cranberry	*Vaccinium vitis-idaea* L.	
unclassified in this study			
ashtatshipek[u]	type of algae?	*Thallophyta*	identified as a kind of "seaweed." Drapeau (1991) defines it as "thallophyte (green vegetation) on stagnant water"
atapukuat	blue bead lily	*Clintonia borealis*	caribou eat them in summer. They look like a

			banana peel
kâkâuâtshî *kakauashit?*	type of alpine lichen?	*Cetraria nivalis?*	a plant that grows in marshes, thorny, has roots. Clément has *kakauashit uapitsheuashkamuk*^{u} – *Cetraria nivalis*
kapiputepanit	puffball mushroom (generic)	*Lycoperdon* spp.	recorded kâpîputest with ITKC members. *kapiputepalit* from Drapeau (1991)
kâuîshâkəpekəshâtshî	?	?	a plant that grows on the ground. Thin as thread.
mashkushu	grass (generic)		
massekushkamik^{u}	sphagnum moss (generic)	*Sphagnum* spp.	moss used for baby diapers
mâtâpək	?	*?*	a kind of water plant that grows in marshes
mətshəkəssi mətshəkəssia (pl).	?	?	looks like blueberry leaves, but no berries, grows close to ground. Porcupines eat it after the snow falls
nissimin	?	?	blue colour, looks like blueberries, grows in the barren areas of Akamiuapishk^{u}, Penipuapishk^{u}. Not clear if this plant grows in the Mishta-shipu area.
pinashteshamuk^{u}	plume moss "Knight's Plume"	*Ptilium crista-castrensis*	yellow moss in marshes and among tall trees, used around the edge of the tent in the fall
pishim	mushroom (generic)		
shashapin	seaweed (generic)		brown/black seaweed, looks like noodles
uapitsheushkamik^{u}	caribou lichen, reindeer moss	*Cladonia alpestris*	
uipitakashk^{u}	cow parsnip	*Heracleum lanatum*	see close to salt water, in grassy areas, not many in the country
uishakatshak^{u}	fern (generic)	*Dryopteris* spp.	also called tshishiteu-nipisha (pl)
uishatshipukua	sheep laurel, lambkill	*Kalmia angustifolia* L.	
ushkuai-pishim	type of tree fungi	*Fomes* spp.	male caribou eat this fungus to harden their antlers for rut
ussiteshu/ *ushteshu*	waterlily	*Calla palustris L.*	*ussiteshu* is the spelling from Drapeau (1991)

the longnose dace (*Rhinichthys cataractae*) and a large number of passerines. They provided only generic terms for them such as *pineshish* (small bird) or *namesh* (fish).

Finally, it should be noted that this inventory does not contain the names of all species known to ITKC members. A number of species were identified in the course of our discussions such as *apishtiss* (brant - *Branta bernicla*), *missip* (common eider – *Somateria spectabilis*), *ueuepitshu* (walrus – *Odobenus rosmarus*) and *upimishui* (American eel - *Anguilla rostrata*), but are excluded from this inventory due to their absence from the Mishta-shipu region.

Readers are invited to consult Clément (1990, 1995) for information concerning the etymology of Innu lexical items for animal and plant species.

7. Landscapes: geography and habitat

> In *nutshimit* there's lots of things Innu can do, but I know less about *uinepek*^{u}. Atatshi-uinipek^{u} (Lake Melville) is part of the ocean. The west end is more like *nutshimit*, but *tshishue-uinipek*^{u} ('the real ocean') is out at Uinuat (Rigolet). Along the coast is called *uinipek*^{u}, but salty, ocean water is also called *shiuapui*. The *naneu* ('shoreline, edge of water') is the dividing line between *uinipek*^{u} and *nutshimit*….*taukam* refers to deep water on a lake or at sea. The inland barren areas, the inland lakes, mountains, marshes, forests, everything named with Innu place names is part of *nutshimit* (P3.8.2.07).

A detailed description of Innu geographical concepts is beyond the scope of this report, nonetheless a brief overview will assist our understanding of Innu knowledge of the environment of the Mishta-shipu area. Readers are encouraged to consult Mailhot (1975) and Denny and Mailhot (1976) for more information on this topic. According to Mailhot (1975:314), "physical geography, in the conceptual universe of the Montagnais [Innu], constitutes a broad semantic system that is directly related to botany and various branches of physics." Geographical entities are designated by two parallel terminological complexes: (1) a "nominal paradigm covering twenty or more generic terms such as *shipu* (river), *meshkanau* (route, path), *shipek*^{u} (ocean), and *pakatakan* (portage) that effects a relatively simple delineation of geographic features" (ibid.:317, my translation); and (2) a richer paradigm consisting of a large number of verbs based on the structure – root + medial + final. A simple example of a geographic verb paradigm is *mishikamau* ('it is a big lake'), parsed as *mish* (big) + *kam* (liquid) + *a* (referring to the "qualities of spatially extended inanimate subjects") (Denny and Mailhot, 1976:42).

The entire length of Mishta-shipu is situated within the geographic entity known as *nutshimit* ('the interior, hunting territory'). Its *shatshu* ('mouth, estuary') is at *uinipek*^{u} ('the sea, salt water, ocean'), a grammatical building block for the Innu place name for Lake Melville which is Atatshi-uinipek^{u}, meaning ‘cut-off sea’. The headwaters of Mishta-shipu are on the interior plateau (*takutauat* - ‘on the plateau’). *Nutshimit* encompasses numerous geographic entities that fit both the nominal and verb paradigms mentioned above. These include *utshu* (mountains), *shipu* (‘river’), *nipi* (‘lake’), *minashkuat* (‘in the forest’), *minishtik*^{u} (island), *mushuau* (‘it is a place without trees, it is barren ground’), *massek*^{u} (‘marsh, wetland’), *massekupi* (‘peat bog pond’), etc. *Nutshimit* is a part of *assi* which in certain contexts means ‘land’ or ‘territory’ in the geopolitical senses of these terms. However, *assi* also constitutes a taxonomic category comprising rock, sand, mud, lichen, moss, and other such vegetation (Clément, 1998:29). Another geographic entity, little known to younger Innu, is *Tshishtashkamik*^{u}, the land of *Mishtapeu* and other non-human beings who populate the traditional narratives known as *atanukan* (mentioned previously), and who were encountered routinely in the shaking tent ceremony.

7.1 Place names

The Innu imagination organizes physical space with the aid of these geographic concepts and the generic terms that label them. Place names organize this space in a parallel way, placing a social-cultural map upon the geographic, geological, and biological world encountered by the Innu. Such names often encode descriptive environmental and geographic information that remind people of locations rich in wildlife resources. Other place names reference historical and religious events. Although they are archived in rapidly shrinking oral traditions, they continue to provide portals to vast quantities of memory about particular places on the landscape.[42] Travel across the landscape, way-finding, and the communication of travel routes are greatly facilitated by place names because they are linked to shared narratives about, and cognitive maps of, landmarks and other geographic entities along the routes (see Jett, 1997:491). Some place names record significant life events such as births, deaths and burial locations, where people camped, or places where canoe-making, salmon spearing, trapping, porcupine singeing and other forms of “economic behaviour” transpired.

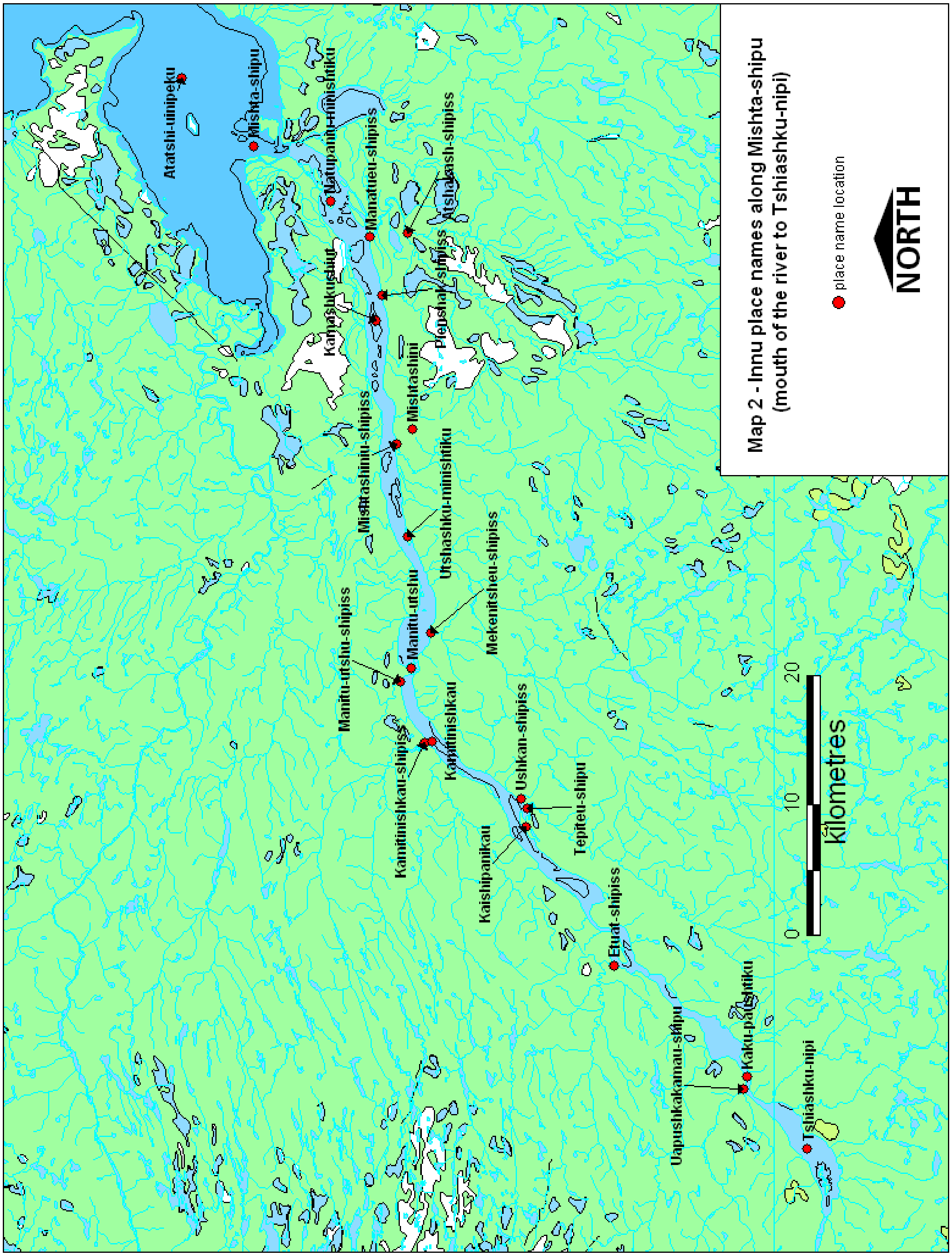
Table 6 presents Innu place names along Mishta-shipu in consecutive order starting at Atatshi-uinipek^{u} (Lake Melville) in the east and moving upstream until we reach Patshishetshuanau (Churchill Falls) (see Maps 2 and 3).[43] Two place names were collected during the ITKC work: (1) Manitu-utshu-shipiss, a tributary of Mishta-shipu located just upstream of Muskrat Falls; and (2) Kaishipanikau, a sandy terrace located just upstream of Tepiteu-shipu, between Tshiashku-nipi (Gull Lake) and Manitu-utshu. Another name, Mushumin-assi, just above Tshiashku-nipi was replaced with the preferred name, Assiuashiku-minishtik^{u} (‘Canadian yew island’).

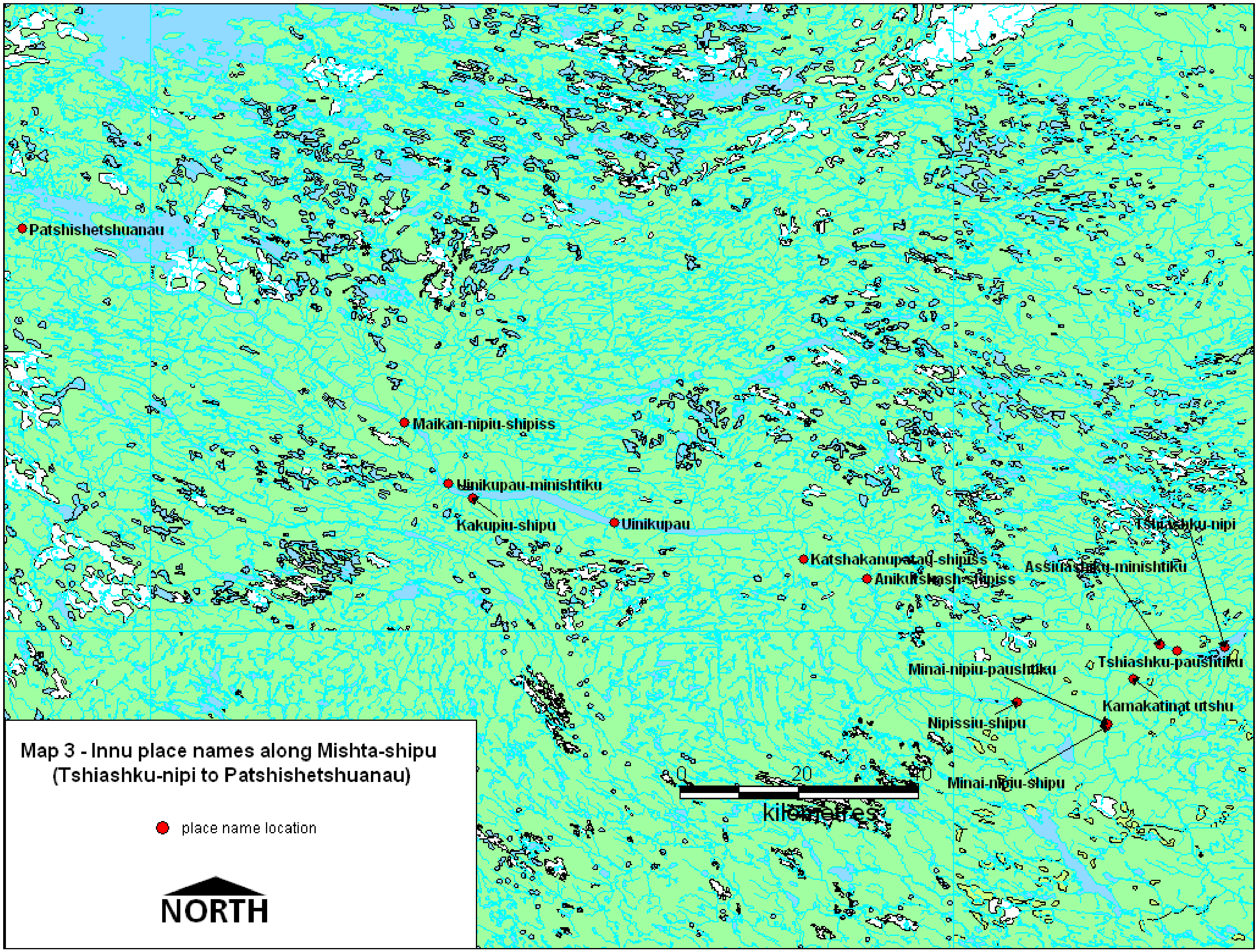
[42] I mean “landscape” in a broader sense including terrestrial and marine topographies.
[43] The translations and correct spellings of these place names were provided by José Mailhot in the context of work on the Labrador Toponomy Project (LABTOP) database.

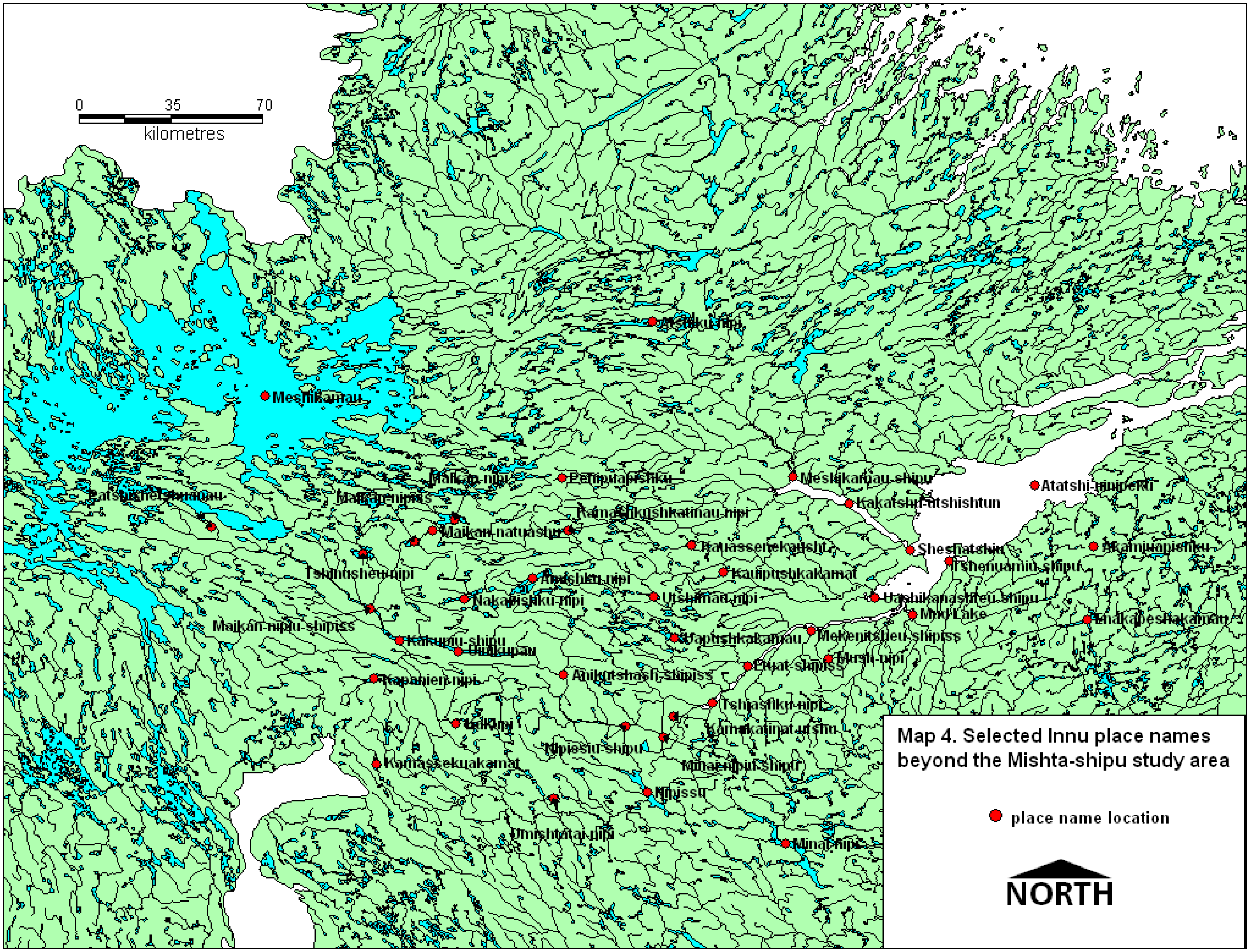
Some of these names encode descriptive geographical information as in Kamashkushiut (‘grassy place’) and Kamitinishkau (‘muddy place, small’), while others reference biota in the area as in Utshashku-minishtik^{u} (‘muskrat island’), or refer to historical figures and non-human beings. For example, the name Uapushkakamau-shipu (‘burnt area lake river’) encodes information about the land surrounding the lake at its headwaters called Uapushkakamau, in this case a past forest fire, the traces of which may no longer be obvious to the eye. Etuat-shipiss takes its name from the late Edward Rich (aka Manitesh), the progenitor of the Rich family in Sheshatshiu and Natuashish who was employed at the Hudson’s Bay Company (HBC) post in Sheshatshiu between 1869 and 1876.[44] Pienshak-shipiss is named after the late Peter Jack, the father of one of the ITKC members. The late Tenesh Pastitshi, the mother-in-law of another of the ITKC members, is responsible for naming Katshakanupatau-shipiss, which means ‘where an animal ran with its tail standing upright river (small)’. Tenesh saw a fox running across this river with its tail in the air. Manitu-utshu is the name given to the hill on the north side of Muskrat Falls, which the Innu believe to be the dwelling place of the giant, otter or seal-like beings known as *uenitshikumishiteu*, mentioned previously.

Uinukupau (Winokapau Lake) appears relatively early in the historic record for Labrador as “Lake Waminikapou” in Holme’s 1888 account of his travels on Mishta-shipu (Holme, 1888). Henry Bryant (1893:38) recorded the name “Pat-ses-che-wan” in his 1893 account of his journey to the “Grand Falls” (Churchill Falls) of Labrador. Pat-ses-che-wan is a corruption of Patshishetshuanau meaning ‘where the current makes clouds of vapour’. Minai-nipiu-shipu, which flows from Minai-nipi (Minipi Lake), also appears early in the fledging Labrador cartography as “Minipi River” (Eaton, 1896).

[44] Biographical information provided by José Mailhot for the Labrador Toponymy Project (LABTOP) database.


Map 2 - Innu place names along Mishta-shipu
(mouth of the river to Tshiashku-nipi)
place name location
NORTH
0
10
20
kilometres
Atatshi-uinipeku
Mishta-shipu
Manatueu-shipiss
Mishtashini
Mishtashiniu-shipiss
Utshashku-minishtiku
Mekenitsheu-shipiss
Manitu-utshu
Manitu-utshu-shipiss
Kamitinishkau
Kamitinishkau-shipiss
Ushkan-shipiss
Tepiteu-shipu
Kaishipanikau
Etuat-shipiss
Uapushkakamau-shipu
Tshiashku-nipi


Patshishetshuanau
Maikan-nipiu-shipiss
Uinikupau-minishtiku
Kakupiu-shipu
Uinikupau
Katshakanupatau-shipiss
Anikutshash-shipiss
Tshiashku-nipi
Assiuashku-minishtiku
Tshiashku-paushtiku
Minai-nipiu-paushtiku
Kamakatinat utshu
Nipissiu-shipu
Minai-nipiu-shipu
0
20
40
kilometres
Map 3 - Innu place names along Mishta-shipu
(Tshiashku-nipi to Patshishetshuanau)
place name location
NORTH



Map 4. Selected Innu place names beyond the Mishta-shipu study area

Table 7. Innu place names along Mishta-shipu (Churchill River)[45]

Innu Name	Official Name	Translation	Feature
Atatshi-uinipek[u]	Lake Melville	Cut-off Sea	inlet
Mishta-shipu	Churchill River	Great River	river
Natupaniu-minishtik[u]	Man O'War Island	War Island	island
Manatueu-shipiss	Traverspine River	Swearing River (small)	river
Atshakash-shipiss		Mink River (small)	shipiss
Pienshak-shipiss		Pienshak River (small)	river
Kamashkushiut		Grassy Place	island
Mishtashini		Big Rock	mountain
Mishtashiniu-shipiss	Caroline Brook	Big Rock River (small)	river
Utshashku-minishtik[u]	Muskrat Island	Muskrat Island	island
Mekenitsheu-shipiss	McKenzie River	McKenzie River (small)	river
Manitu-utshu		Evil Creature Mountain	mountain
Manitu-utshu-shipiss		Evil Creature Mountain River (small)	river
Kamitinishkau-shipiss*		Muddy Place River (small)	river
Kamitinishkau*		Muddy Place (small)	point
Ushkan-shipiss		Bone River (small)	river
Tepiteu-shipu	Upper Brook	unknown	river
Kaishipanikau		pending validation	terrace
Etuat-shipiss		Edward River (small)	river
Kaku-paushtik[u]		Porcupine Rapids	rapids
Uapushkakamau-shipu	Pinus River	Burnt Area Lake River	river
Tshiashku-nipi	Gull Lake	Gull Lake	lake
Tshiashku-paushtik[u]		Gull Rapids	rapids
Assiuashiku-minishtik[u]		Canadian Yew Island	island
Kamakatinat utshu		Big Mountain	mountain
Minai-nipiu-paushtik[u]		Burbot Lake Rapids	rapids
Minai-nipiu-shipu	Minipi River	Burbot Lake River	river
Nipissiu-shipu		Little Lake River	river
Anikutshash-shipiss	Cache River	Squirrel River (small)	river
Katshakanupatau-shipiss	Shoal River	Where An Animal Ran With Its Tail Standing Upright River (small)	river
Uinukupau	Winokapau Lake	Willow Patches Near the Shore?	lake
Kakupiu-shipu	Fig River	Porcupine Dwelling River	river
Uinukupau-minishtik[u]		Willow Patches Near the Shore Island	island
Maikan-nipiu-shipiss	Metchin River	Wolf Lake River (small)	river
Patshishetshuanau	Churchill Falls	Where the Current Makes Clouds of Vapour	falls

7.2 General descriptive information for the Mishta-shipu area

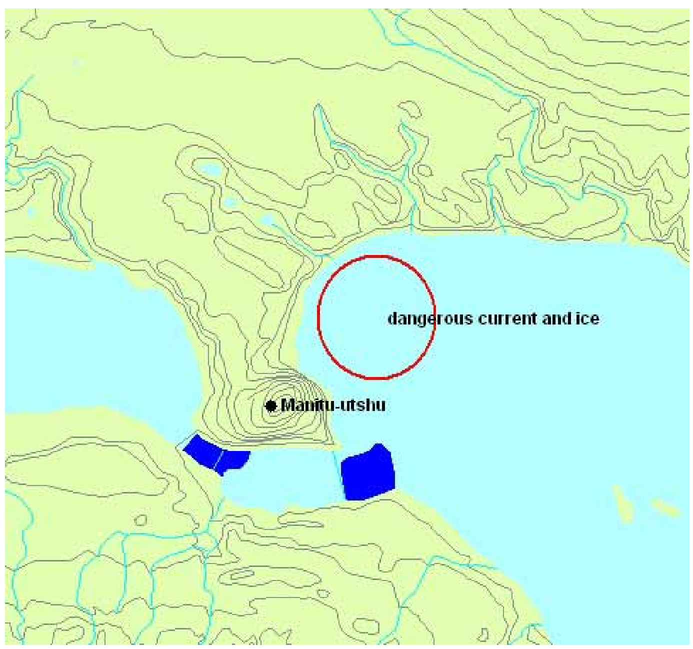
Little in the way of descriptive physical information was elicited from the ITKC members, who focused more on landscape features associated with animal, fish, and plant concentrations. However, a few points of interest were mentioned. For example, Uinukapau (Winokapau Lake) is a difficult place to live in the fall

[45] The spellings of place names marked with an asterisk* are tentative pending validation.

because the prevailing high winds jumble the ice, producing large, protruding chunks, which are hard to travel across (P4.30.11.07).

One person noted an ice jamming problem on Mishta-shipu near Mud Lake. On occasion, ice jams on a shoal near the outlet of the channel flowing from Mud Lake which blocks Mishta-shipu and causes the water to rise in the area, including at Mud Lake. Such ice jamming normally occurs in the spring, so the blockage that occurred in the fall of 2006, as reported in television news reports, was considered to be quite unusual (P2.7.12.06).

It was noted that the cove on the north side of Mishta-shipu below the rapids, and from where the portage commenced when traveling upstream, can be a very dangerous place in the spring (Map 5). The ice is packed on the south side of the rapids at Muskrat Falls, and as a result the current can be very strong in the cove near the portage. Innu avoided this area in the spring because one could easily be capsized by the current or crushed in ice. The late Etuat Rich[46] once saw some military men capsize in this area, with all hands lost except one.



Map 5. Location of an area of dangerous current and ice conditions in the spring near Manitu-utshu/Muskrat Falls

A short distance upstream, a sandy hill located by the mouth of Kamitinishkau-shipiss slipped into Mishta-shipu several decades ago, almost blocking the river. The parents of one of the ITKC members, while not being a direct witness to the event, had traveled through the area shortly after it had occurred (P3.7.2.07). The failure of the sandy structure was mentioned in the context of concern about

[46] A descendant of the the aforementioned Etuat Rich who gave his name to Etuat-shipiss.

the potential effects of flooding on sand banks and other formations along the river.

7.3 Habitat

Just as there are no terms in the Innu language for "environment," "plants" or "flora," so too are there no terms for "habitat," "ecosystem," "ecology," "ecological landscape unit" and a wide range of other terms from western biological science. The Innu language contains lexemes that reference landscape features in relation to concentrations of animal and plant species, but these terms do not translate neatly into western scientific terms such as habitat. The term *ashkui* is a case in point. It refers to a 'clearwater area', an area of open water surrounded by ice in the spring or fall.[47] Some *ashkui* may be open all year round due to the strong current there (e.g. off Netauakau [Sandy Point] near Sheshatshiu), while others only form at river junctions (*takuatuepan*), lake outlets (*kupitan*), or river and brook estuaries (*shatshu*) during fall freeze-up and spring break-up. *Ashkui* can be dangerous places due to the hazards they pose to travel across ice, and so for reasons of safety, people with experience in country living are knowledgeable about the locations of *ashkui* and how they change shape according to fluctuations in temperature, wind velocity, and precipitation. Moreover, Innu associate *ashkui* with *amishk^u* (beaver), *utshashk^u* (muskrat), *nitshik^u* (otter), *namesh* (fish), *mitshishu* (bald eagle), and *shiship* (migratory waterfowl), and as a result they established their spring camps near *ashkui* in order to take advantage of the species abundance there.

Members of the ITKC noted that the mouths of rivers and brooks along the length of Mishta-shipu are, generally speaking, productive places for various animal and fish species, not just when *ashkui* form, but at other times of the year as well. Frequent mention was made of large numbers of ducks and geese at the mouths of brooks in the spring. Lots of *utshashk^u* (muskrat) were known to frequent marshes near the mouths of these brooks (P1.19.11.06).

While *ashkui* labels an emphemeral geographic feature that exists only in relation to ice-laden water bodies, it contains no obvious reference to species abundance, because not all *ashkui* are equal in terms of the numbers of animals that may congregate there each fall or spring. The Innu use a number of other terms to refer to species abundance, all based on the initial *ushak-,*[48] and several of these terms were used to identify locations along Mishta-shipu where various species were plentiful. It is important to note that these terms only refer

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[47] See http://www.innu.ca/ashkui.html for a linguistic analysis of the term. The characteristics of *ashkui*, according to Sheshatshiu Innu, have been described at length in a Gorsebrook Research Institute study by Fletcher, Breeze and Sable (2000). According to Innu interviewed for the study, *ashkui* first open on Mishta-shipu in March (Fletcher and Breeze, 2000:6).

[48] The k- palatalizes to tshi when it is followed by the front vowels i and e, but stays k when followed by the back vowels a and u (Marguerite Mackenzie e-mail to P. Armitage 11 May 2007).

to abundance; they imply nothing about the habitat or ecological relationships at each place.

ITKC members were asked to describe the characteristics of each *ushak-* (place of species abundance) with the view to identifying particular habitat features associated with each place. The descriptions that resulted are of a general nature and provide no definitive guide to habitat types that could be linked to a given lexeme. At best, we can say that the terms operate as conceptual filters that restrict the places where hunting, trapping, fishing and gathering efforts should be focused. For example, if one knows that *ushakashk*^{u} ('where there is always black bear') is generally a burned area with lots of berries, one will not bother to hunt bear in dense black spruce forests or other places that have few berry plants.

The following is the list of terms for places of abundance mentioned by ITKC members. It is not exhaustive, however, as it does not cover a number of such places listed in Drapeau's dictionary (1991) such as *ushakak*^{u} (porcupine), *ushakapishu* (lynx), *ushakapush* (hare), *ushakatsheshu* (fox), *ushakatshik*^{u} (otter), and *ushakitshashk*^{u} (muskrat).

Ushakamesh – 'where there is always fish'. In general, these are located at the mouths of brooks and at points, but they may also be found in deep water, just off-shore. ITKC members said that they used to fish *kukamess* (lake trout), a*tikamek*^{u} (whitefish), *tshinusheu* (pike), *makatsheu/mikuashai* (suckers), *minai* (burbot), and *matamek*^{u} (brook trout) at the mouths of the brooks along Mishta-shipu (ITKC, 22.11.06). Wherever there is lake trout, there is also burbot (P9, 22.11.06). They noted that there are hardly any ponds in the Mishta-shipu valley, and so they would travel up the brooks away from the river to ponds at higher elevations where fish were known to be plentiful (P2, 17.11.06). They would identify new *ushakamesh* through experimentation – "Sometimes when you don't find fish, you keep checking in different places, leaving the hooks out over night to see what you get" (P6.26.1.07).

Ushakatik^{u} – 'where there is always caribou'. ITKC members said that the best places for *ushakatik*^{u} are where there are moss and lichen, and some *ushakatik*^{u} have reputations for being fairly predictable places to find caribou. "When caribou find a lot of moss on the hills, that's where they like to eat. So anywhere they go, they remember the hills where they ate previously. When Innu remember finding caribou in a particular spot, they return there again to look for the caribou" (P1.26.1.07). Although ITKC members or their relatives had killed caribou very close to Mishta-shipu in the past, and one member had tracked Penipuapishk^{u} (Red Wine Mountains) caribou as far as Uinukupau (Winokapau Lake), no *ushakatik*^{u} were identified on the floor of the valley. Excluding the higher elevation regions north and south of the river, kills sites for caribou were identified close to the southern shore of Mishta-shipu about 3.5 km downstream of Ushkan-shipiss, on the south side of Mishta-shipu across from the mouth of

Etuat-shipis, and in a marsh between Manatueu-shipu (Traverspine River) and Atshakash-shipiss, just upstream of the junction between the two rivers (P7.20.11.06).

Ushakamishk^u – 'where there is always beaver'. These are places where there are lots of alder and willow bushes as well as birch and spruce trees that beaver like to eat. The beaver's favourite food is willow, alder and *ushkatamui*, the rhizome of *ushteshu* (waterlily). "*Ushkatamui* is like cabbage for the beaver" (P1.26.1.07). Sometimes beavers move to new areas because the water is "no good" at their ponds. "After they create the reservoir, the trees die, like burned wood. There's lots of food there for the beavers. When searching for beaver, you look for signs up a river, such as cuttings. In the spring, they peel the bark off black spruce and other trees" (P4.7.2.07).[49] "If beavers make one lodge, they keep reproducing, and they keep using the same lodge, where they feel secure. It's like us. If someone builds a cabin, different people will use it. You trap the beavers out of a lodge, and new beavers will return to occupy it" (P1.26.1.07).

ITKC members said that in the old days, *amishk*^{u} (beaver) were found during the spring at the mouths of every brook along Mishta-shipu (P1.28.11.06). There are shoals along some of the rivers such as Manatueu-shipu (Traverspine River), and these are too shallow for beaver lodges, so they would have to travel up the brooks a little, looking for ponds with beavers in them (P1.19.11.06). Nonetheless, some particularly good beaver hunting and trapping areas were identified in the Mishta-shipu valley including a small channel behind an island on the north side of Mishta-shipu across from the mouth of Ushkan-shipiss (P7.20.11.06), along the lower reaches of Manitu-utshu-shipiss, as well as about three kilometres up Kamitinishkau-shipiss and Tepiteu-shipu. A narrow channel of water, disconnected from Mishta-shipu, just upstream of Kaishipanikau, was also considered a hotspot. Four or five lodges had been found in this location (P7.20.11.06). There are river channels near the mouth of Manatueu-shipiss (Traverspine River) that were good for beaver, and three lodges were located there at one time (P7.28.11.06).

Ushakashk^u – 'where there is always black bear'. These are places where berries are plentiful in late summer and the fall, for example, in burnt woods. "The reason they like it here is because there are lots of red berries and blue berries in these burned areas. Their *uatashk*^{u} (dens) are usually far from their berry feeding areas" (P1.26.1.07).

One good place for *mashk*^{u} (black bear) was on the north side of Mishta-shipu just upstream of the junction with Kamitinishkau-shipiss. The banks of Mishta-shipu consist of red mud in this location. Black bears made dens in the hills just above these banks (P1.20.11.06).

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[49] The word used here for "signs" was *nametau* which is a verb meaning 'he leaves traces, marks of his presence' (Drapeau, 1991, my translation).

Ushatshissu – 'where there is always geese'. These include muddy flats near the mouths of brooks, as well as grassy areas, marshes with small ponds, and also barren hill areas with berries (P1, P6.26.1.07). One of the most important areas for *nishk* (Canada goose) was the mouth of Tepiteu-shipu and nearby Kaishipanikaut area located between Tshiasku-nipi (Gull Lake) and Muskrat Falls) (see below).

Ushatshineu – 'where there is always partridge'. These are densely wooded points and along rivers where there is a good mixture of young and old fir trees. *Pineu* (partridges) will stay in these areas for long periods of time (P6.26.1.07). "The *innineu* (spruce grouse) are in the tall fir trees in sheltered areas along the sides of the rivers. On the points where there are lots of fir trees, that's where you find lots of *innineu*" (P1.8.12.06).

While no lexical items were collected to identify concentrations of plant species, ITKC members did have general comments to make about their distribution within the territory. Some stands of large *minaik*^{u} (white spruce) were identified by the committee and noted for providing nesting locations for *akushamesheu* (osprey). "Osprey are everywhere even on hydro poles. When we traveled up Mishta-shipu, we saw nests on white spruce trees along Mishta-shipu" (P3.24.11.06). Other tree species mentioned include *innasht* (balsam fir), *sheshekatshik*^{u} (black spruce), *uatshinakan* (tamarack) and *ushkuai* (birch). Most importantly for the ITKC is the presence of "strong medicine" plants in the river valleys (P2.29.11.06). Willows and dogberry are found in brooks or near salt water, and they are the few medicinal plants that grow outside the valleys, but they are not very strong (P9.29.11.06). ITKC members made special mention of a "rare" plant named *assiuashik*^{u} (Canadian yew) which they had seen on a small island just upstream of Tshiashku-nipi (Gull Lake). This and other medicinal plants are discussed below in the section dealing with "*Nutshimiu-natukun* ('country medicine')."

7.4 General species distribution

Members of the ITKC spoke in more general terms about a number of locations where they had hunted, trapped, fished, and gathered in the Mishta-shipu valley. Perhaps the most important of these locations was the area between Ushkan-shipiss and Kaishipanikaut, centred at the mouth of Tepiteu-shipu. The following is an enumeration of locations along Mishta-shipu where various animals and plants were harvested or observed.

Mouth of Mishta-shipu to Manitu-utshu

- *Innatshik*^{u} (hooded seal?), *pipun-atshik*^{u} (harp seal?) and *pitshuatshik*^{u} (ringed seal?) travel as far as Manitu-utshu. The only seal that goes far inland is *innatshik*^{u}, for example, as far as Atshiku-nipi (Seal Lake) (P4.20.11.06).[50]
- *Kauapishisht* (Atlantic rainbow smelt) are found at the mouth of Mishta-shipu and into Mud Lake, but no further up the river (ITKC.20.11.06).
- "*Atikamek*^{u} (whitefish), *makatsheu/mikuashai* (suckers), *tshinusheu* (pike), and *minai* (burbot) are found on the brooks between Manatueu-shipu and Manitu-utshu" (P2.22.11.06; ITKC.20.11.06).
- "*Utshashumek*^{u} (Atlantic salmon) go as far as Manitu-utshu. Innu caught salmon in nets below the falls. There were lots of seals in the vicinity of the small island just below the falls" (P1.20.11.06).
- "There were a lot of *nishk* (Canada geese) at Utshashku-minishtik^{u} in the fall" (P1.28.11.06).
- "*Uenitshikumishiteu* looks like the 'sea lion' on the match boxes. I saw them on the ice just below the falls at Manitu-utshu in the spring time. My father and grandfather saw it as well [on different occasions]. It can travel underground and make the ground move look like a wave. It is a very dangerous, powerful animal" (P2.7.12.06).

Manitu-utshu to Minai-nipiu-shipu

- In the stretch of river between Manitu-utshu and Tshiashku-nipi (Gull Lake), there are lots of *pashpassu* (ruffed grouse) where there are birch trees (ITKC.20.11.06).
- There are no *utshashumek*^{u} (Atlantic salmon), but there are *tshinusheu* (pike), *atikamek*^{u} (whitefish), *kukamess* (lake trout), *makatsheu/mikuashai* (suckers), and *minai* (burbot) in this part of the river (ITKC.20.11.06).
- There are lots of *amishk*^{u} (beaver) up this stretch as well. They build dams on the brooks (ITKC.20.11.06).
- *Atik*^{u} (caribou) stay in this area in the winter (ITKC.20.11.06).
- Above Manitu-utshu, there are *kukamess* (lake trout), *matamek*^{u} (brook trout), *atikamek*^{u} (whitefish), *tshinusheu* (pike), *minai* (burbot), and *makatsheu/mikuashai* (suckers) (P2.22.11.06).
- "A brook near Manitu-utshu is called Manitu-utshu-shipiss. It had *ushakamishk*^{u} ('where there is always beaver')" (P3.5.12.06).

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[50] More research is required in order to clarify the identities of the seal species mentioned (in Innu-aimun) by ITKC members. Clément (1995) collected *innatshuk*^{u} for habour seal (*Phoca vitulina*), and *pupun-atshuk*^{u} for harp seal on the Quebec North Shore (*Phoca groenlandica*), and *innatshik*^{u} for grey seal (*Halichoerus grypus)* and *pitshu-atshik*^{u} for ringed seal (Phoca hispida) in Utshimassit (Davis Inlet) (1998).

Manatueu-shipiss

- “We found *amishk*^{u} (beaver), *nitshik*^{u} (otter), *atshikash* (mink), *matsheshu* (fox), *mashk*^{u} (black bear), and *pishu* (lynx) up Mantueu-shipiss. There were *uapush* (snowshoe hare) everywhere, and *kak*^{u} (porcupine) on both sides of the river. In the spring, there were *nishk* (geese), *inniship* (American black duck), *muak*^{u} (common loon), *ashu-muak*^{u} (red-throated loon), *mitshikutan* (surf scoter), *shashteship* (black scoter), *auiu* (long-tailed duck), and *mishtishuk*^{u} (common merganser) up the river. We put our nets along the river and caught *tshinusheu* (pike), *matamek*^{u} (brook trout), *kukamess* (lake trout), *makatsheu/mikuashai* (suckers), and *atikamek*^{u} (white fish). *Utshashumek*^{u} (Atlantic salmon) goes up Manatueu-shipiss, as do seals, as far as the rapids. We found lots of berries, including *mushuminakashi* (squashberry), *shikuteuminakashi* (bake apple), *innitshiminakashi* (skunk currant?) in the marshes near the mouth of the river” (P1.19.11.06).
- “There are lots of *utshashumek*^{u} (Atlantic salmon) and brook trout on Manatueu-shipiss (P4.20.11.06). I caught salmon at Manatueu-shipiss in the summer by canoe” (P4.6.02.07).
- “We used to spear fish up Manatueu-shipiss. There are steep rapids upstream where the *utshashumek*^{u} (Altantic salmon) cannot travel further. That’s where we speared the salmon” (P2.22.11.06).
- “We caught a lot of *matamek*^{u} (brook trout) up Manatueu-shipiss at freeze-up, and some of these trout were quite large. There is lots of *innasht* (balsam fir) along the river which is not very deep. Lots of *pineu* (partridge), *uapishtan* (marten), *amishk*^{u} (beaver), and *kak*^{u} (porcupine) – all kinds of animals. It is a good place for beaver and marten. There’s a big marsh near Manatueu-shipiss – that’s where we got *atik*^{u} (caribou). We killed caribou there in the fall or the spring when we came from Akamiuapishk^{u} (Mealy Mountains). Caribou calves are born in marshes” (P2.22.11.06).

Mekenitsheu-shipiss (McKenzie River)

- “We went up Mekenitsheu-shipiss where there were berries were along the shores of the river, on both sides” (P1.20.11.06).
- “We only traveled as far up the river as the big rapids. There was lots of water in this river in former days, and there were *utshashumek*^{u} (Atlantic salmon) in the river as far upstream as the rapids. Here the salmon would get stuck. There used to be a lot of *pitshuatshik*^{u} (ringed seal?) up the river as well” (P3.23.11.06).

Tepiteu-shipu

- Tepiteu-shipu is a good place for *nishk* (Canada geese) in the spring and fall. There were lots of geese and ducks on the ice here by the *ashkui* (area of open water). The ice breaks up early at the mouth of the river (P1, P3.28.11.06).
- There is lots of *uapineu-mitshim* (willow) at Tepiteu-shipu (P1.5.12.06).

- There is lots of *uapineu* (willow ptarmigan) right across from the mouth of Tepiteu-shipu, and this spot is *ushatshineu*, a place where there are always partridge. There were lots of willow ptarmigan there in December. At this time of the year, the *innineu* (spruce grouse) are in the tall fir trees along the sides of the river (P1.8.12.06).
- There are all kinds of *ushakamishk^u* (where there is always beaver) in the Tepiteu-shipu area (P3.5.12.06).
- There are lots of *upau-apikushish* (little brown bat) in the Mishta-shipu area. They are found in areas with lots of white spruce (P2.29.11.06). There are lots of bats at Tepiteu-shipu (P9.29.11.06).
- One of the ITKC members once killed a *uapikunu* (snowy owl) at Tepiteu-shipu (P1.25.1.07).
- There is a good feeding area for *nishk* (Canada geese) at Tepiteu-shipu (P7.5.12.06).
- There are lots of the following fish at the mouth of the river – *kukamess* (lake trout), *matamek^u* (brook trout), *tshinusheu* (pike), *atikamek^u* (whitefish), and *makatsheu/mikuashai* (suckers), all fish caught in a net which was placed off the beach where we set up our tent recently on the visit to Ushkan-shipiss.[51] "Back then, we got too many fish in the net so we didn't put it out long. There were no *minai* (burbot) in the net, but my father saw burbot in this area in the past. One also finds *atshakashamekush* (cisco) in this area. They can be eaten – fried. You find this species (cisco) anywhere in the country. You also find a fish called *kaushkanush* (probably the three-spined stickleback)" (P7.23.11.06).

Kaishipanikaut

- There are lots of *mush* (moose) in the Kaishipanikaut area (P7.24.11.06).
- In the fall, *nishk* (Canada goose), *ushuk^u* (red-breasted mergansers), (*inniship*) American black ducks, *mishikushk^u* (common goldeneye), and *uapinniship* (green-winged teal) were killed in the Kaishipanikaut area. *Aiakuss* (greater scaup) and *kaiashinikanikutesht* (lesser scaup) are also found here. The ducks are the most plentiful here in the spring; not that many in the fall (P3.24.11.06).
- Kaishipanikaut is a good place for *nishk* (Canada goose) in the spring and fall (P1, P3. 28.11.06).

Etuat-shipiss

- There are *tshinusheu* (pike), *minai* (burbot), *atikamek^u* (whitefish), *kukamess* (lake trout), and *makatsheu/mikuaishai* (suckers) at the mouth of Etuat-shipiss. In the spring, when the water is high, you can see the fish in the shallow areas (P3.24.11.06).

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[51] This was the fieldtrip facilitated by NLH in October 2006 to Ushkan-shipiss, the last place anywhere in Innu territory where the shaking tent ceremony was performed.

- There are *uanan* (ouananiche – *Salmo salar*) in Lobstick Lake, but there appear to be none in Mishta-shipu (P2.22.11.06). However, there may be ouananiche at the mouth of Etuat-shipiss (P3.24.11.06).

Uapushkakamau-shipu

- *Kukamess* (Lake trout), *matamek*^{u} (brook trout) (on occasion), *tshinusheu* (pike), and *makatsheu/mikuaishai* (suckers) were caught at the mouth of Uapushkakamau-shipu. "Some of the suckers caught by a small island here were huge. We fished with a line, float and baited hook. Dry wood was used for floats. You could see the float bobbing up and down when the fish were nibbling at the bait" (P3.24.11.06).

Tshiashku-nipi

- All kinds of ducks are found here in the spring, migrating through from the south. Other species found here at this time of the year include *muak*^{u} (common loon), *ashu-muak*^{u} (red-throated loon), *shesheshu* (greater yellow-legs), and *nutapashkueshu* (whimbrel) (P3.24.11.06).

No specified location along Mishta-shipu

- *Shakuaikanish* (tree swallow) nests in river banks on Mishta-shipu (P3.23.11.06).
- *Utshissimanishu* (belted kingfisher) is a summer bird that eats small fish and nests in holes along the banks of Mishta-shipu (P1.25.1.07).
- There are two types of woodpeckers here: (1) *pashpashteu* (black-backed three-toed woodpecker) which stays all year long; and (2) *kanakuneu* (northern three-toed woodpecker) which spends only the summer months in the Mishta-shipu region (P4.1.12.06).
- A small bird called *shakau-pineshish* (possibly the common redpoll or yellow warbler) is another small bird found up Mishta-shipu in the summer (P3.23.11.06).
- *Shesheshu* (greater yellowlegs) is found everywhere including Mishta-shipu. They like the marshes and along grassy, muddy shorelines (P3. 23.11.06).
- *Pipitsheu* (American robin) is everywhere including Mishta-shipu.
- *Teshtueshtshish* (spotted sandpiper) and another bird called *aiapish* (possibly the least sandpiper - *Calidris minutilla*) are seen on sandy beaches along Atatshi-uinipek^u (Lake Melville), as well as along Mishta-shipu in summer.
- *Mishue* (pine grosbeak) lives in the area all year round. Innu used to eat this bird. (P3.23.11.06).
- *Kamushkuashit* (Wilson's snipe) is found in the marshes up Mishta-shipu. You hear it in the spring time (P3.23.11.06).
- "*Uapinekushish* (snow bunting?) is seen in late March or April not in December, January, or February, and therefore it is *nipin-pineshish* (summer

bird). They are seen in flocks heading south in November, and yes, they are seen in Mishta-shipu" (P1.26.1.07).

- *Mukamishu* (American bittern) is found along rivers, but not many are seen inland (P3.23.11.06).
- *Kashkanatshish* (rock ptarmigan) are found in the barren areas on the mountains, for example, on *Penipuapishk^u* (Red Wine Mountains) and *Akamiuapishk^u* (Mealy Mountains). They eat *atikupemak^u* (tundra dwarf birch) which is like a small willow only smaller (P1.8.12.06). They have been seen in the *shakau* (bush, shrub) along the shore of Mishta-shipu, but they were probably just traveling through on the way to the barrens (P1.25.1.07).
- "You find *mishtapush* (arctic hare – *Lepus arcticus*) in the barrens but not in the south. Snowshoe hare are found in the south, including in the Mishta-shipu area" (P1, P5.6.12.06).
- Utshîtnâkuesh (possibly the blue-spotted salamander - *Ambystoma laterale*) is found in Labrador, and Innu have seen it at Kamikuakamiu-shipu (Red Wine River), Mitinissiu-shipu (Beaver River), Uashikanashteu-shipu (Goose River), and Tshenuamiu-shipu (Kenamu River). It could also be in the Mishta-shipu area (P1/P5. 28.11.06).
- "*Utshashumek^u* (Atlantic salmon) can go up any small brook as long as there are no major falls. We saw *utshashumeku-esh* (eastern pearl mussel) in many brooks, but we never saw them in the brooks going into Mishta-shipu below Manitu-utshu, so the fish wouldn't spawn there. It is sandy at the mouths of these brooks" (P2. 22.11.06; P3. 23.11.06).
- *Upau-anukutshash* (northern flying squirrel) are found everywhere. There are a lot of them at the 7 mile mark along the road between Sheshatshiu and Goose Bay (P1.28.11.06).
- *Nipiu-apukushish* (possibly water shrew - *Sorex palustris*) are seen everywhere in the country. They live in the marshes, and they swim in small ponds. You see their paths, small ones, in the marshes. Foxes eat them. They can be quite large; up to two inches long. They might eat grass (P4.1.12.06).
- *Tshinishtui-apikushish* (pygmy shrew) are everywhere in the country, especially by brooks. They get into cloth and take it to their nests to keep them warm. That is why they take fur – for warmth. They can damage people's furs (P4.1.12.06).

Species not seen on Mishta-shipu

In asking the ITKC members about a wide range of species known to frequent the Quebec-Labrador peninsula, a number of them were said not to occur in the Mishta-shipu valley. The following observations pertain.

- *Nutshipaushtikueshish* (harlequin duck) are generally not seen on the calm sections of rivers, and are rarely seen on Mishta-shipu anywhere. They are found in rapids. They have not been seen at Tshiashku-paushtik^u but are known to frequent a river that empties into Mishta-shipu. This river is called Kaku-shipiss (Fig River) (P1.6.12.06; 25.1.07).[52]

- The baby *Nutshipaushtikueshish* can follow their mothers up the rapids six or seven of them in a line. There were a lot of them at Kakuetipapukunanut ('where someone capsized in the current') in the old days before Meshikamau-shipu was dammed (P1.6.12.06; 25.1.07).
- *Upimishui* (eel) have never been seen up Mishta-shipu, but they have been seen in a small tributary of the Pukut-shipu (St. Augustine River) (P3. 23.11.06). They have also been seen on Kamikuakamiu-shipu (Red Wine River) (P4.28.11.06).
- There are no *munaishan* (soft-shell clam?) in Mishta-shipu, nor a large char-like fish called mĕmîkushkətĕu that is found at Enakapeshekamau.
- There are no *shushashu* (arctic char) up Mishta-shipu although they are caught occasionally at Uhuniau (North West Point). There are lots of *papakatishu*[53] near Sheshatshiu and at the mouth of Tshenuamiu-shipu (Kenamu River), but these are never seen up Mishta-shipu (P3.23.11.06).
- *Auiu* (long-tailed duck) nest up north, not in the Mishta-shipu area (P1, P5.6.12.06).
- "We never saw *mitshikutan* (surf scoter) moult in the country, so we believe that it moults in the coastal area" (P1.6.12.06).

8. *Aueshish*: animal behaviour, intelligence and other observations

The members of the ITKC volunteered information that applies in general terms to all of the fauna in their territory not just to animals found in the Mishta-shipu valley. This information constitutes an Innu "natural history" of the fauna of Labrador, but what is presented here can only be considered a partial exploration of this knowledge base. Far richer descriptions have been provided by Clément in various publications dealing with Innu knowledge of individual animal species (e.g. 1985a, 1985b, 1986a, 1986b, 1986c, 1987-88, 1992) as well as his ethnozoology published in 1995. While some novel information was obtained from the ITKC members, much of what they shared during our meetings and individual interviews resonates closely with the descriptions collected by Clément. I have included examples of specialized vocabulary for various aspects of animal anatomy, behaviour, life-cycle, and reproduction, but this is only scratching the surface. Readers interested in learning more are invited to explore Drapeau's (1991) dictionary or the aforementioned publications by Clément.

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[52] The source of this information concerning the presence of harlequin ducks on the Fig River is most probably the co-facilitator's knowledge of biologist Ian Goudie's harlequin duck surveys there, which makes this a good example of the contribution of western scientific data to Innu knowledge construction.

[53] Unidentified species of flat fish. Clément (1995:545) lists a number of species for this lexeme including halibut, flounder, etc.

Why *mashk*^{u} (black bear) is intelligent and other notes

- "*Mashk*^{u} (black bear) is tricky. He'll make "alarms" to help him hear you. One must be skilled in approaching the bear. Bear goes back and forth near his den, he back tracks, makes big circles. He approaches his *uatashk*^{u} (den) from the south, not the north, trying to get you to walk from the north so that he can get your scent. *Mashk*^{u} does it three times when the den is close. He will walk on fallen trees and jump away from the track. Sometimes, when the snow melts, there's no tracks left. He does this all the time – he tries to confuse you. Walking around and around, backtracking, to steer people away from den. Sometimes *Mashk*^{u} sits just outside the den listing. He makes a kind of shield using his paws to keep you away. If you are getting close to the den, *Mashk*^{u} sends a partridge, as well as caribou and porcupine tracks to get one to stop thinking about him. He creates distractions in this way to throw one off the den. Finally, he points his ass at the hunters as they get very close. At this point, the bear is found" (P3.28.11.06).[54]
- "*Mashk*^{u} eats berries first before going into the den. When he knows that the snow is coming, he looks for a den. Ntūkât means 'looking' and məshk^{u} ntūkât means 'bear is looking for its den'. When he leaves his den, he can travel a long way, and he is very smart to know where to find his den again. Sometimes *mashk*^{u} walks days and nights to get to the den. The way he thinks, it's as if he knows how Innu hunters think. He will find ways to trick Innu, so he doesn't go in a straight line. He avoids detection in various ways, for example, walking on fallen logs. Sometimes fresh snow will melt, at which point you can't see the black bear's tracks. He may walk sideways and or backwards when the snow melts, so you won't see the tracks" (P3.12.2.07)
- "*Mashk*^{u} is very intelligent. Before he goes in his den, he uses boughs. He does not take boughs from high up the tree; he takes the ones that are very close to the ground so as to be inconspicuous. The reason he doesn't take branches higher up is so hunters can't see the boughs; the cut marks are under the snow. They don't leave a lot of signs. They also use moss in their dens, so they are not cold in winter. The bear is very *matenitam*"[55] (P4.7.2.07).
- "When Innu kill *mashk*^{u} at its den, a couple of years later another black bear will occupy the vacant den. They are like humans; they tell one another

[54] Similar descriptions of the black bear's deceptive ways have been reported by Clément (1986:52-53) and Tanner (2007, 1979:148-150). An interesting point here is that the account of the bear's efforts to confuse the hunter, including the use of "magic" to send forth distractions, is embedded overtly in an *atanukan* (myth) in Tanner's account, whereas for the ITKC members, it is presented as empirical information concerning bear behaviour. As with the Cree, the Innu version may also derive from *atanukan*, one which was not elicted during the ITKC meetings. Nonetheless, this account serves as a good example of how *atanukan* can serve as authoritative "gospels" to explain animal behaviour and physical attributes, how empirical information concerning behaviour can be mythically based, or alternatively how the behavioural attributes of animals in myths can be empirically based (see Clément, 1995).

[55] The co-researcher glossed this term as 'intelligent'. It is a transitive inanimate verb that Drapeau (1991) defines as 'he feels something, senses the presence, the effect of something; he senses that something will happen' (my translation).

where their dens are. Like me; I have a cabin on the Trans-Labrador Highway. When I'm not around, other people use my cabin. *Mashk*^{u} is like this, and it's the same with *atik*^{u} (caribou) and *amishk*^{u} (beaver). It's natural that they are like that" (P1.8.12.06).

- "When we are at the garbage dump, the black bears just stand close to us. They are not afraid. They eat at the dump. But in the country, they are wild; they are afraid of Innu. For example, in Akamiuapishk^{u} (Mealy Mountains) when the men hunted bear in a burnt area, the bear took off; they couldn't get close to it" (P2.29.11.06).
- "Only *mashk*^{u} can understand when Innu speak to him. Sometimes a bear claws a tree in the spring nearby its den, and Innu would find the claw marks. Innu would then find the den, and dig it out. '*Unuiu nimushum* ('go outside grandfather')', Innu would say. *Mashk*^{u} would stick his head out and you would shoot him in the upper chest" (P3.12.2.07).
- "A black bear den is warm; like it has a tent stove" (P4.1.12.06).
- "Some *anishku-enik*^{u} (ant) can fly. But the ants are working insects. They build their house where they live. When *mashk*^{u} (black bear) comes along, he listens by the hollow trees, or ant hill, and he can hear the ants, so he bites a hole, and sticks his tongue inside to get at the ants" (P3.12.2.07).

Why *atik*^{u} (caribou) is intelligent and other notes

- *Atik*^{u} (caribou) is able to see its reflection in the water. "Caribou do this and it gives them information about the state of their antlers. The image they see is like a photo of themselves. It's a story/information about their antlers. [Depending on what they see], they may eat *ushkuai-pishim* (tree fungi) to harden their antlers, after they have scraped the velvet off them. This is when they are getting ready to rut in October" (P3.24.1.07).
- "Other animals were very intelligent/wild in the past.[56] The other older hunters say this as well. For example, the caribou would go a long way when they sensed danger. But they are not as intelligent/wild as they used to be. The caribou sit on the road, and don't care about the noise. In the past, when they heard noise, they would take off" (P3.12.2.07).
- The name of a male caribou that has lost its antlers in winter is *upinu*. A big stag with antlers in August is called *iapeutik*^{u} while a smaller male is called kutəkuəniâpěshîsh. *Ushkau-atik*^{u} is the name of the male at the beginning of the fall (*ushkau-pishim* - September) when it loses its antler velvet. In October, when the caribou is in rut, it is called *uishak*^{u}, and only the male caribou is called this. When the caribou fight (the two *iapeutik*^{u}), the loser goes off by himself and is called mîuněkən. After rut, around the last week of October or first week of November, the male is called mînâushněu. A mature female caribou is called *nushetik*^{u} while a two-year old female is called *pashetikush*. Atshětîku is the

[56] *Innishu* was translated as "intelligent," however, I could not sort out the semantic relationship between "intelligent" and "wild" in this context. ITKC members see some kind of correlation between an animal's level of intelligence and its wildness. The more tame an animal, the less intelligent it is considered to be. This matter requires further investigation.

name of the female caribou when she is pregnant and then gives birth. *Pinetik*^{u} is a cow that is giving birth. A caribou is called *umanishish* when it is a foetus, but from the time it is newborn to the time it is about one year old, the male or female caribou are called *atikuss*. A male calf is *napeu-atikuss*, and a female one is *nushetikuss*. îatshâtîk^{u} is the name of a caribou that is found separate from a main group that you have been following. "For example, when you kill a group of caribou (all of them), but then you encounter some other ones that are part of a different group, these are îatshâtîkut" (P4.30.11.06).[57]

- The caribou are not always in herds. They would gather together for the rut in September. After rut they would separate into small groups or individual males (P4.30.11.06).

Why *amishk*^{u} (beaver) is intelligent and other notes

- Another animal that is *mishta- innishu* ('very intelligent') is *amishk*^{u} (beaver).[58] They make preparations for winter in the summer and fall. They construct their *uisht* (lodge) and gather food, with all the small trees gathered by the *uisht*. They make sure that some of the food sinks close to the *uisht*, under water. To make their *uisht* warm, they cover it with slush using their tails. They keep an air vent. The beavers know they will not come out of the water in the winter, so they keep their food under the water (P3.12.2.07).
- *Amishk*^{u} (beaver) makes *uat* (hole, *uata* plural) around the edge of a pond in order to hide (P8.7.12.06).
- *Amishk*^{u} is intelligent. For example, if you miss the beaver in the trap the first time, you won't be able to get it again, because it is now məshuîau (P4.7.2.07).[59]
- A baby beaver is called *auetiss*, a two year old beaver is pueuess, a three year one is *patamishk*^{u}. An old beaver is called *tshishemishk*^{u}. An adult male beaver is called *napemishk*^{u} while the adult female is called *ishkuemishk*^{u}. A small, solitary beaver male or female is called *peikumishkuss* (P4. 30.11.06; P5/P1.6.12.06).
- Some beavers are very dark and are called *kashteuamishk*^{u} while some are an orange-yellow colour and are called *uishauamishk*^{u} but they are more an orange colour than yellow (P6. 30.11.06).
- Beavers sometimes make two dams and this is called nishuau nâtuâtshəpĕmut. An area flooded by beavers is called nəssəssn (ITKC.5.12.06).[60]

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[57] Clément (1995:343) records *aiauatik*^{u} for solitary, male, adult caribou for Mingan, while Dominique (1979:53) records *utshehatik*^{u} for Natashquan.
[58] Drapeau (1991) defines *innishu* as 'he is intelligent, informed, the age of reason; he (animal) is sly, wily, cunning, crafty' (my translation).
[59] This is probably the same word as *mishuieu* collected by Drapeau (1991) She defines *mishuieu* as 'he acts in such a way as to make him fearful and distrustful towards him, scare away' (my translation).
[60] Drapeau (1991) records *nissipeu* meaning 'it is flooded, submerged; *ushkutim* – beaver dam; *ushkutimitsheu* – he makes a dam, a dyke' (my translation).

- *Amishk*^u^ may open their dams a little to let water out, but if the water is low they shut their dams again. They regulate water levels (P3.5.12.06).

Why *maikan* (wolf) is intelligent and other notes

- "The other intelligent animals who make things, who do things to support themselves, are those who run around in the winter, for example, *maikan* (wolf). and *matsheshu* (fox). *Maikan* thinks like a hunter. When wolves see a caribou, one of them intercepts the caribou while the others wait. They do what Innu hunters do. One time I saw six wolves, and caribou in the marshes. The caribou were sitting in the marshes. They have their own paths, and if you chase them, they will follow these paths. The wolves must have seen the caribou feeding. Two of them waited on the paths used by the caribou. Two other wolves circled around the caribou and then chased them towards the ambush. This is what Innu hunters would do. This is nâtâmūkâtshĕu – walking around the caribou in order to chase them into an ambush. Kâitâmūkâtshet is the name of the one who walks around to circle the caribou.[61] *Ashuapameu* (kâishuâpet) is the name of the one who lies in ambush. The wolf makes the caribou head in "this direction" - miam tətâmūkak^u^ – caribou are heading where you want them to go. Wolves can only kill one caribou at a time using this method. As soon as they finish, they find another caribou and set up the same ambush. It's the same with Innu. All hunters don't kill a lot at one time" (P3, P6.12.2.07). "This method always works when it's deep snow. In summer, however, caribou can run in any direction, so you must figure out which way they are likely to run" (P3, P6.12.2.07).

Other intelligent animals

- There are times when the weather affects the behaviour of *uapush* (snowshoe hare) and *pineu* (partridge). For example, they are tame in the morning when there is no wind. When the weather is bad, they stick out their heads, and they are very "wild." When they are "tame" (nənūshkətshu) you can get close to them. Only *uapush* and *pineu* are nənūshkətshu (P3.12.2.07).
- *Matsheshu* (fox) are *mishta-innishu* ('very intelligent'). For example, sometimes they listen to mice in the marshes, and then they suddenly jump and squash the mice. Sometimes the fox just run along the shores looking for mice. The kits jump about like they are playing. Sometimes, they look for *utshashk*^u^ (muskrat) lodges (*uisht*), and they dig them out when they find them. They wouldn't survive if they weren't *mishta-innishu* (P3.12.2.07).
- *Utshashk*^u^ (muskrat) makes its own den and gathers food under water. They are *innishu* ('intelligent') in order to survive in the winter (P3.12.2.07).
- *Pishu* (lynx) is *innishu*. It is a night hunter. It sits on the side of uapush (snowshoe hare) paths waiting for them to run by during the night. It can see at night time. *Pishu* just claws it (P3.12.2.07).

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[61] Drapeau (1991) records the transitive animate verb *itamukueu* meaning 'he makes the animals flee in such a manner, in a given direction in relation to someone' (my translation).

- The animals that make preparations for winter are all certainly *innishu* ('intelligent') (P3.12.2.07).

Observations concerning reproductive behaviour

- *Uishikatshan* (gray jay) nests in January as does *patshakaishkashish* (boreal chickadee). They have their eggs in January. The gray jay nests are very hard to find; very rare. The gray jays nest in the rotten trees (P1.6.12.06).
- *Uapinniship* (northern pintail) nests up north, not in the Sheshatshiu or Mishta-shipu area (P1, P5.6.12.06).
- *Shashteship* (black scoter) nests inland, on small islands in lakes that are moss/grass covered and have alders. They have their nests in the grassy areas, outside of the alder (P1, P5.6.12.06).
- *Ashu-muak*^{u} (red-throated loon) has nests in grass on small islands as (P1, P5.6.12.06).
- *Inniship* (black duck) nests in marshy areas close to trees (P1, P5.6.12.06).
- *Mitshikutan* (surf scoter) nests in the vicinity of *uauak*^{u} (kettle hole). Some *uauak*^{u} have small islands that the surf scoters nest on because they are afraid of *matsheshu* (fox), *atshikash* (mink), and *uapishtan* (marten). Sometimes *tshiashk*^{u} (gull) eat their eggs (P1, P5.6.12.06).
- The male *mitshikutan* (surf scoter) abandons his wife and chicks and returns to salt water by himself (P1, P5, P6.6.12.06).
- *Umamuk*^{u} (white-winged scoter) are the same as *mitshikutan* (surf scoter) in that they nest on islands in *uauak*^{u} (P1.6.12.06).
- *Uapinnishipiss* (green-winged teal) nest inland. They have nests close to the woods, in marshy areas, beside the ponds. They lead their chicks to lakes as soon as they can walk to avoid the predators (P1, P5.6.12.06).
- *Nutshipashtikueshish* (harlequin duck) nests on grassy islands on rivers (P1, P5.6.12.06).
- *Mishikushk*^{u} (common goldeneye) nests in rotten trees. The female lays 12 to 15 eggs (P1, P5.6.12.06).
- *Mishtishuk*^{u} (common merganser) nests on islands in big rivers (P1, P5.6.12.06).
- *Ushuk*^{u} (red-breasted merganser) nests on islands in big rivers (P1, P5.6.12.06).
- *Aiakuss* (greater scaup) and *kaiashinikanikutesht* (lesser scaup) nest in grassy areas along the shores of lakes or on the islands (P1, P5.6.12.06).
- Only *nishk* (Canada goose) and *inniship* (black duck) have nests in marshes (P1, P5.6.12.06).
- *Muak*^{u} (common loon) nests on islands in marshy areas, or along shores (P1, P5.6.12.06).
- *Ashu-muak*^{u} (red-throated loon) nests by *massekupi* (marshy, ponds), and on islands (P1, P5.6.12.06).

- Ducks take their chicks to larger lakes to avoid *matsheshu* (fox) and other predators (P1.6.12.06).
- Every duck uses grass for nest (P1.6.12.06).
- *Mitshikutan* (surf scoter) sticks its head out from a hole/nest where its eggs are (P1.26.1.07).
- *Utshissimanishu* (belted kingfisher) nests in holes along the banks of Mishta-shipu (P1.25.1.07).
- *Shakuaikanish* (tree swallow) nests in river banks on Mishta-shipu (P3.23.11.06).
- *Pashpassu* (ruffed grouse) are heard beating their wings in the spring when they are mating.[62] Only *pashpassu* beats its wings when mating (P1.25.1.07).
- *Innineu* (spruce grouse) males have red eyes during mating in the spring. The male is called *napeneu* and the female *ishkueneu*.
- *Makatsheu/mikuashai* (suckers) may spawn just below the rapids up Etuat-shipiss, from its junction with Mishta-shipu. There is a small portage there along the side of the rapids. Just below the rapids, we saw a lot of suckers there (P3.24.11.06).
- *Utshashumek^u* (Atlantic salmon) spawn (*amiu*) close to rapids. Their *uakuana* (eggs) stick. After they spawn, the eggs turn into esh (shellfish), and what's inside the shell emerges as a fish. As the fish grows, the shell opens, and *utshashumek^u* comes out (P9.22.11.06).[63]
- "*Utshashumek^u* (Atlantic salmon) spawn in pools where they get stuck. I have seen a lot of *uakuana* (eggs) in pools.[64] I don't know how salmon have their eggs, except whenever there are salmon, there's lots of *esh* (shellfish) around, so perhaps the salmon grows from the shell. Perhaps they grow their scales inside the shells. There's a lot of *esh* at the mouth of Kaneshekau-shipiss (Cape Caribou River). Salmon go up that river" (P4.6.2.07; P6.22.11.06).
- There are some animals such as *uapush* (snowshoe hare) that have a kind of deformity, with their foetus in a lump on the side of the body. Sometimes *atik^u* (caribou) have this deformity as well. This rare phenomenon is called pukətshənîshut, and there is a muddy area along Mishta-shipu that bears this same name because it is lumpy. These animals are not sick. The caribou foetus develops in a lump on the side of the *napeu-atik^u* (male caribou), between the skin and the stomach. The *napeu-atik^u* dies, and the foetus comes out of this lump. It is a fully formed caribou when it emerges; it looks like an adult caribou,

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[62] The term provided for a ruffed grouse during the mating season is *uishakuneu*. Drapeau (1991) does not record this lexeme, but she does record cognate terms such as *uishakuapishu* (loup-cervier en rut), *uishakutsheshu* (renard en rut), etc.

[63] Clément (1998:62-66) recorded the same proposition in Utshimassit (Davis Inlet). "An elder also recalled a story to the effect that *utshashumekat*, salmons (sic), were once thought to originate from special shellfish found in the interland….This could explain the name of that shellfish which is known in Utshimassit as in other Innu communities as *utshashumeku-esh*, 'the salmon shellfish', which corresponds to the eastern pearl mussel (*Margaritifera margaritifera*)."

[64] ITKC members provided the term *uakuana* for fish eggs, the plural form of an inanimate noun. Clément (1995:360) also recorded *uakuana*, plural inanimate noun. However, Drapeau (1991) collected *uakunat*, the plural form of an animate noun.

and it has antlers, but it is small. It looks like a small dog, but it is fully adult (P2, P9.22.11.06). This theory of certain animals being *matau* (abnormal) is discussed further in section 10.1 dealing with the state of the environment below.

Observations concerning alimentation

- "*Mukamishu* (American bittern) is found in rivers. It can dive. Eats toads. When dogs eat toads, they drool a strange fluid from their mouths. Slimy saliva. This is the only bird I know that eats toads" (P3.23.11.06).[65]
- *Uishkatshan* (gray jay) eats black hairs (old man's beard) on the trees (P3.23.11.06).
- *Uhu* (great horned owl) can kill *kak*^{u} porcupine and can swallow a porcupine head (P3.24.11.06).
- *Uhu* (great horned owl) and *uapikunu* (snowy owl) eat *uapush* (snowshoe hare), *pineu* (partridge), *kak*^{u} (porcupines), and *apikushish* (mice), but not fish (P3.24.11.06).
- *Nutshineueshu* (gyrfalcon) eat *uapineu* (willow ptarmigan), *innineu* (spruce grouse), and *uapush* (snowshoe hare) (P1, P5.6.12.06).
- *Kashkanatshish* (rock ptarmigan) eat *atikupemak*^{u} (tundra dwarf birch) which is like a small willow only smaller (P1.8.12.06).
- "The reason animals are attracted to *akushamesheu* (osprey) nests, is because the osprey drop fish sometimes, and the animals smell these 'scraps'. As soon as the osprey feeds its young, it drops scraps and the u*apishtan* (marten) and *atshikash* (mink) feed on these scraps" (P3.24.11.06).
- *Akushamesheu* (osprey) is different than *mitshishu* (eagle) because they only eat fish. They build their nests close by fish concentrations (P3.24.11.06).
- *Shiship* (duck) and *nishk* (Canada goose) eat different types of berries (P1.28.11.06).
- *Pipitshish* (merlin) eats small birds like *pipitsheu* (American robin), *uishkatshan* (gray jay), etc. (P1.25.1.07).
- *Atshikash* (mink) eats *atshakashameskush* (cisco). *Nitshik*^{u} (otter) and mergansers (*ushuk*^{u}/*mishtishuk*^{u}) eat this fish as well (P3.23.11.06).
- *Matsheshu* (fox) eats berries and animals. *Uapush* (snowshoe hare) eat alder and birch boughs. *Nitshik*^{u} (otter) eat small fish. Martens eat berries and rabbits (P1, 28.11.06).
- *Matsheshu* (foxes) eat *nipiu-apukushish* (possibly water shrew - *Sorex palustris*) (P4.1.12.06).
- *Kak*^{u} (porcupine), *pineu* (partridge), *uapush* (snowshoe hare) eat from trees. Partridge eat berries (P1, 28.11.06).
- *Kak*^{u} (porcupine) eats birch, white spruce, black spruce, tamarack, balsam fir, trembling aspen, alders from the rivers. They eat grasses in the spring – first growth. Regarding trees the porcupine eats branches, needles, and bark. He eats this from the main trunk (P1, 28.11.06) *Kak*^{u} does not kill the trees. He just eats the bark. They eat something inside the bark. They start to eat this in early

[65] See also Clément (1995:260).

September. In summer they eat *shakau* (bush, shrub) and *uapikun* (flower plant). They eat the buds of *shakau* before they flower (P4.7.2.07). *Kak*^{u} also eat mətshəkəssi(a) [an unidentified leafy plant, lacking berries that grows close to the ground]. Its leaves look like *inniminanakashi* (low sweet blueberry) or *uishatshiminakashi* (redberry) leaves. *Kak*^{u} eat this after the snow falls, because the plant sticks out, and this is what they eat (P1.8.2.07).

- *Amishk*^{u} (beaver) eat birch, *mitush* (trembling aspen), balsam fir, black spruce, tamarack, and alders. Trembling aspen is the most favourite food. He eats the fresh grass in the spring. They also eat *ushkatamui* (water lily rhizome) (P1.28.11.06).
- *Amishk*^{u} (beaver) eat *utshashk*^{u} (muskrat) sometimes. The reason for this is because in the early spring, when the animals run out of food, the beaver may find a muskrat in its lodge, and it will kill and eat it. Same thing with otters; they may kill and eat young beavers (P3.28.11.06).
- *Utshashk*^{u} (muskrat) eats grasses (P1.28.11.06).
- *Mashk*^{u} (black bear) eat berries, fish and animals, including caribou, insects (ants, spiders, bees), young beavers, partridge, porcupine, young snowshoe hare. They eat plants as well; spring times – grasses as well as other types of new growth including pussy willow buds – *atimussat* (little dogs). “Bear breaks open a rotten tree to get at insects. Bear hears that there are ants in the rotting tree and so he breaks it up and sticks his tongue into it” (P1, P3, P7.28.11.06).
- “In the spring, *mashk*^{u} (bear) breaks up the beaver lodge to get at the beavers inside. He waits for the beaver to return to fix the lodge, then gets them. *Maikan* (wolf) eat beavers as well. Wolves and bear wait for beaver to leave the water to chew trees and they get them on dry ground” (P3.28.11.06).
- “If *mashk*^{u} (bear) eats porcupine quills he will die. I saw a dead bear outside its den in November. I found quills inside its stomach. There were quills in the bear’s heart as well. In the fall, the bear only eats certain foods – just berries and insects” (P1.28.11.06).
- “*Mashk*^{u} (black bear) does not defecate in his *uatashk*^{u} (den). He eats the layer just inside the bark of *ushkuai* (birch). He chews this *unatsheshk*^{u} (bark). It is a red colour, this inner bark and is called ushkəntsheshkuâ. It is used to rub into caribou hide to make it red” (P1.28.11.06).[66]
- “*Uinashk*^{u} *(*woodchuck) is like the bear in the way that it hibernates and eats birch bark to stop up its intestines to prevent defecation in its den during hibernation. Woodchuck are found in the western part of Atatshi-uinipek^{u} (Lake Melville)” (P6.28.11.06).
- “All animals are the same. All animals that eat different kinds of plants are thin (lean) in May. Not much fat on them. When it greens up in June-July, all the plant-eating animals get fat again. The young animals eat the new growth and are fat by the fall. This cycle repeats itself from one year to the next” (P3.28.11.06).

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[66] See Clément (1995:288-290) for related information obtained from Quebec North Shore Innu concerning black bear hibernation and fecal or intestinal plugs.

- "Only *anukutshash* (red squirrel) eat cones. They also eat meat, for example, caribou meat. *Shikush* (least weasel) also eats meat….Squirrel also eats mushrooms" (P3.28.11.06).
- *Atik^u* (caribou) eat *uapitsheushkamik^u* (caribou lichen). It grows on top of hills, and sometimes on marshes, for example, small islands in the marshes. *Massekushkamik^u* (sphagnum moss, generic) is a type of moss in the marshes, but caribou doesn't eat it (P6.26.1.07).
- *Atik^u* (caribou) eat *ushkuai-pishum* (tree fungi, probably *Fomes spp*.) after they scrape their antlers off (velvet). Eating the "mushrooms" hardens their antlers in readiness for rut. It also eats the mushrooms on the ground; the soft ones (P3.28.11.06).[67]
- *Atik^u* (caribou) and *mush* (moose) eat mâtâpək, a type of water plant that grows in marshes (P4.7.2.07).
- *Upau-apikushish* (little brown bat) eats insects, mosquitoes, butterflies; also a stinging insect that has a long barbed tail [that resembles a smoky horntail or pigeon horntail] (P6, P9.29.11.06).
- *Matsheshu* (foxes) eat *nipiu-apukushish* (possibly water shrew - *Sorex palustris*) (P4.1.12.06).
- Woodpeckers (*kanakuneu*, *pashpashteu*) eat a worm called *manitush*. Perhaps they know exactly where they are; smell them and therefore punch holes to get at them in the winter (P4.1.12.06). "This worm is found in rotten, dry trees. The worm can chew the inside of the tree, making paths. They leave a kind of sawdust behind them" (P6.1.12.06).
- *Makatsheu/mikuashai* (suckers) eat mud (P3.28.11.06).
- *Kukamess* (lake trout) eat mice, insects in or on the water such as butterflies, small fish such as cisco, small suckers and small burbot, as well as something that looks like mud. We have not seen lake trout eat frogs (P3.28.11.06).
- *Kukamess* (lake trout) eats *nipiu-apukushish* (possibly water shrew). I found one in the stomach of a lake trout at Penipuapishku-nipi (Hope Lake). Big lake trout eat *uatshishk^u* (muskrat) according to my grandfather who had found one in a stomach. It had been eaten head first (P6.1.12.06).
- *Tshinusheu* (northern pike) eats mice and insects such as butterflies" (P1.28.11.06). "Pike also eats fish – any kind of fish it can find and it eats toads (*anik^u*)" (P4.1.12.06).

Miscellaneous observations

- "*Akushamesheu* (osprey) is a suicidal bird because it can kill itself hunting. My father and uncle once saw an osprey accidentally claw its own head, and Innu hunters found dead ones with their claws stuck in their heads. It happens upon impact with the water" (P3.24.11.06).

[67] Anthropologist Robert Paine, who has worked with the Saami of Norway since the early 1950s, tells me that reindeer eat large quantities of mushrooms just before the rut and are hard to control at this time of the year (personal communication, 6 June 2007).

- “You cannot catch *atikamek*^{u} (whitefish) and *makatsheu/mikuashai* (suckers) on a big hook. You can only net these. I’m not sure if they take flies” (P4.1.12.06).
- *Uinashk*^{u} (woodchuck) have *uatik*^{u} (dens) as do *apikushish* (mouse), *tshinishtui-apikushish* (shrew), *atshikash* (mink), and *nitshik*^{u} (otter). They have holes in the ground (P4.1.12.06).
- “There’s some animals that stay outside and don’t take cover, for example, *pineu* (partridge), *atik*^{u} (caribou), *uapush* (snowshoe hare), *uapishtan* (marten), winter birds such as the gray jay and boreal chickadee. Pishu (lynx) doesn’t go under the snow; it sits on top of the snow to stay warm” (P4.1.12.06).
- *Atshikash* (mink), *nitshik*^{u} (otter), and *uapishtan* (marten) don’t come out very much in the coldest months. They stay in their *uatik*^{u} (dens) under the snow. Sometimes, otter and mink stay under the ice in air pockets along the shore (P1. 24.1.07).
- Certain *manitushat* (insects) live in rotten wood in the winter, and they come alive again in the spring (P4.1.12.06).
- *Uapishtan* (marten), *nitshik*^{u} (otter), *amishk*^{u} (beaver), *utshashk*^{u} (muskrat), *atshikash* (mink), *shikush* (weasel), *anukutshash* (squirrel), *kak*^{u} (porcupine), *innineu* (spruce grouse), *pashpassu* (ruffed grouse) and *uapineu* (willow ptarmigan) live under the snow (P4.1.12.06).
- *Kak*^{u} (porcupine) makes holes under trees, or under rocks, in cracks in rock faces in cliffs (P6.1.12.06).
- *Upau-apikushish* (brown bat) it is a summer animal. It hibernates like a *apikushish* (mouse). It is related to *apikushish* (P9.29.11.06).
- “I saw *anukutshash* (squirrel) attack a small *kanakuneu* (northern three-toed woodpecker) once. The squirrel bit the bird all over its body. It would have killed the bird had I not killed the squirrel. I rescued the woodpecker. Squirrels eat birds” (P6.1.12.06).
- Animals stick out their tails when they sense danger (P2.22.11.06). Moulting ducks that do not fly are called *pashkuship* (P1/P5/P6.6.12.06). Last year’s *nishk* (Canada goose) sheds its feathers and has new ones in the fall. They do this every year. Geese do not moult the first year (referring to new borns), but in subsequent years they moult. All ducks are like this as well as geese. When the newborns migrate south and return the next spring, they moult (P1.6.12.06).
- *Shiship* (ducks) and *nishk* (Canada goose) arrive at different times in the spring. In general, the order of arrival is as follows: (1) *mishikushk*^{u} (common goldeneye); (2) *inniship* (American black duck), *uapinniship* (northern pintail), *uapinnishipiss* (green-winged teal); (3) *ushuk*^{u} (red-breasted merganser), *mishtishuk*^{u} (common merganser) *nutshipaushtukueshish* (harlequin duck), *kaiashinikanikutesht* (lesser scaup), *aiakuss* (greater scaup); (4) *nishk* (Canada goose); (5) *mitshikutan* (surf scoter), *shashteship* (black scoter), *umamuk*^{u} (white-winged scoter), *auiu* (long-tailed duck); and (6) *ashu-muak*^{u} (red-throated loon), *muak*^{u} (common loon) (ITKC.26 Apr. 2007).

- The *tshiashk*[u] (generic gull) in the country look white and clean, but the ones around Sheshatshiu are dirty because they hang out at the dump. So it is hard to tell what kind of gulls they are (P6.26.1.07).
- *Pipunamu* is a big slinky salmon that migrates inland to various lakes in the fall, spends winter there and returns to the ocean in the spring. It is fat in the fall, and Innu would get it in the net.[68] It looks like a salmon, but it's not the real *utshashumek*[u] (Atlantic salmon) which goes inside in July. Innu used to find these fish close to Meshikamau, for example, up Amishku-shipu (Beaver River), Kamikuakamiu-shipu (Red Wine River), and Meshikamau-shipu (Naskaupi River). Not many of these are seen on Manatueu-shipiss (Traverspine River) and Mekenitsheu-shipiss (McKenzie River) (P4.6.2.07).
- *Nipinatamek*[u] (sea run trout) goes inland as well.[69] It can be caught just below Manitu-utshu, on Mishta-shipu, not above, and it is found up Manatueu-shipiss (Traverspine River). Where the brooks and rivers meet Lake Melville is where you will find *utshashkumek*[u] (Atlantic salmon) and *nipinatemek*[u] (P4.6.2.07).
- *Utshashkumek*[u] (Atlantic salmon) can go back out to sea again, and no person ever saw dead salmon on the rivers. They can feel the cold water and go back out again (P4.6.2.07).

9. *Nutshimiu-natukun* ('country medicine')

ITKC participants spoke frequently about their knowledge of *nutshimiu-natukun* ('country medicine') derived from various plants and animals found in the Mishta-shipu area as well as more generally throughout their territory. Much of this knowledge concerning the medicinal properties of plants and animals is shared throughout the wider Innu population in Labrador-Quebec, but it is now largely confined to a small and rapidly dwindling number of older people. Innu knowledge of country medicine has been documented to some extent in three publications, Malec, et al.'s *Nutshimiu-natukuna* (1982), Clément's *L'Ethnobotanique montagnaise de Mingan* (1990), and Inkpen's *Plant Medicine of the Innu*, which can be consulted for additional information and comparisons with the data presented here.

Systematic documentation of this body of knowledge is beyond the scope of the present study, and as a result, the data presented here cannot be considered complete by any stretch of the imagination. These data were volunteered by ITKC participants as examples of their expertise in country life, as ethnic boundary markers to distinguish Innu from non-Innu (symbolic opposition), and as icons of pre-settlement life when Innu enjoyed relative autonomy from Euro-Canadians and their institutions. Examples of country medicine were also volunteered in the context of concerns about the impacts of dam construction and flooding on these medicines (more on this topic later in the report).

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[68] Drapeau (1991) defines *pipunamu* as 'saumon noir d'hiver' ('black winter salmon').
[69] Drapeau (1991) records *uinipeku-mashamekush* for sea trout. Innes recorded *nipanatimek*[u] as a synonym for *uinipeku-matamek*[u] (sea trout) (personal communication).

One ITKC participant stated that he is reluctant to describe country medicines in any detail because he believes that knowledge about such matters has been stolen from Innu people in the past and used for commercial benefit. “In Matamekush (Schefferville), Innu revealed *pitshuatik*[u] medicine to a non-Innu. The non-Innu person made medicine and then sold it to the Innu” (P1.5.12.06). [70]

ITKC members appear to classify *nutshimiu-natukun* in terms of a hierarchy of strength in which some medicines are considered “stronger” than others, however, this matter was not systematically explored due to time limitations. Nonetheless, some differences in “strength” were mentioned by the participants. *Assiuashik*[u] *(*Canadian Yew*, Taxus canadensis*) is considered to be one of the strongest medicines, while *uapineu-mitshim* (willow) and *mashkuminanakashi* (northern mountain ash) are considered to be less strong. The idea of “strong” medicine is conveyed through the use of the inanimate intransitive verb *shutshishimakan*, meaning “it is strong, solid” (Drapeau, 1991).[71] While ITKC members also referred to country medicine as “real” or “good” (in translation), I did not record the lexical items for these terms in Innu-aimun.[72]

If *nutshimiu-natukun* can be classified hierarchically in terms of strength, they can also be classified spatially, in the sense that the ITKC members believe that the strong medicines are found in river valleys while the less strong ones are found outside of these geographic areas, in highland and barren-ground places, for example. We heard repeatedly that “The valleys are the best places for medicines. *Uapineu-mitshim* (willow) and *mashkuminanakashi* (northern mountain ash) are the few medicines that are found outside the valleys, but they are not very strong” (P9.29.11.06).

Of all the medicines mentioned, one was considered “rare” – *assiuashik*[u] *(*Canadian yew*, Taxus canadensis*), found on a small island on Mishta-shipu just above Tshiashku-nipi (Gull Island). Two ITKC members said that this island is called Assiuashiku-minishtik[u] (Canadian yew Island), and this is where botanists found the plant in question while surveying the Mishta-shipu valley as part of the Project environmental assessment.[73]

ITKC participants hold a theory concerning the transmission of medicine or medicinal properties from one species to another. Trees, berries, and other things that grow in the earth contain *natukun*, and animals including the beaver and otter eat these things that grow from the land. As a result, they contain *natukun* as well. Humans eat medicines directly in the form of berries and

[70] I first heard of this concern about non-Innu stealing Innu recipes for *nutshimiu-natukuna* in Unaman-shipu (La Romaine) in 1982-83.
[71] Inanimate intransitive (ii) verbs have an inanimate subject, but no object. *natukun* (medicine) is an inanimate noun, *natukuna* - plural.
[72] “The rivers are important because that’s where the real medicine is. A lot of good medicine comes from the rivers” (P9.17.11.06).
[73] Susan Meades, personal communication, e-mail to P. Armitage 2 February 2007.

medicinal concoctions, but also by consuming animals and fish that contain medicinal properties. Eating *nutshimiu-mitshim* (country food), much of which contains *nutshimiu-natukun*, is therefore considered an important requirement for wellness among these older Innu. "The kind of diet that Innu had [pre-settlement] is why they were healthy. They [the food] had a lot of medicine in them. Now that we have changed our diet, we are sick" (P8.29.11.06). More than 70 years ago, anthropologist, Frank Speck, noted this relationship in Innu thought between wellness and the medicinal properties of plants and animals:

> We note a most important and logical belief, at least from the angle of native thought: that the food of the native game animals, the caribou, moose, bear, and beaver, being vegetal substance, and the vegetable kingdom being the original source of medicine agency, the virtues of plant pharmacy are conveyed from the original growths to man through this diet. No wonder, then, the proper food of the tribe being either directly wild fruits or indirectly vegetable through the diet of game animals, that with their food in whatever form consumed, the Montagnais-Naskapi are 'taking medicine'. Thus, the native game diet is prophylactic to mankind. A deep significance lies beneath this doctrine (1977[1935]:78-79).

Examples of *nutshimiu-natukun* volunteered by ITKC participants are provided below. I have classed them under two headings: medicines that derive from animals; and those that derive from vegetal sources, that is, "things that grow from the earth."

Aueshish natukun **(animal medicines)**

- *Uishinau-amishk^{u}* – beaver testicles given to a woman who is in labour to drink (P9.7.12.06) This concoction is called *uishinauapui*.
- *Uitui* (musk gland) is found in beaver, mink and otter. It is used to cure rashes (nitshik^{u} uîtuî), ear aches and infections (P8.17.11.06).
- The shell of *utshashumeku-esh* can be used as medicine. You crush the shell, boil it, and drink the liquid. It is used to cure bladder problems, if you can't pee. It makes one pee (P2.22.11.07).
- *Upimishu* (eel), found in salt water, can be used as a medicine for bad headaches. You place the skin over your forehead (P2.22.11.07; P3.23.11.06).
- The liver oil from *uanushui* (cod) can be used as medicine (P3.23.11.06);
- In fish you find *uishupui* (gall bladder). It's good for eye problems. Just put it in your eye (P9.29.11.06).
- The *uishupui* (gall-bladder) attached to the liver of the black bear is used for medicine. You use it to rub yourself" (P2.29.11.06).[74]
- Wherever you are sick in your body, you eat the part of the bear that corresponds to the sore part of your body. You have a sore leg, you eat the

[74] It is like a liniment, said the interpreter.

bear's leg. The old women used to eat the hind legs of bear when they had sore knees and legs (P2.29.11.06).

- Another kind of medicine comes from the goose gizzard. It's a small round part, the size of a "jam jam," and is called *utishishk*^{u}.[75] You dry them, boil them, and drink the broth (P2.29.11.06).
- The tongue of *pashpashteu* (Three-toed woodpecker, *Picoides arcticus*) has strong medicine in it because of the kind of insects it eats. The tongue is used as medicine for adult toothaches. The tip of the tongue is placed in the cavity and the *manitusha*t (infection) is removed (P3.5.12.06).[76]

Kanitautshiki tshekuana assit **- things that grow in the earth**[77]

- "My mother found a medicine that looks like balsam fir boughs. They grow along the ground near the river and are called *assiuashik*^{u}.[78] We crushed the needles, mixed with fat, warmed it up, put on a cloth, and placed on the forehead. My daughter, Enen, was seven-eight months old at the time and was sick, so I gave her this medicine. The next morning she was okay. There's a lot of this plant on an island just above Tshiashku-nipi [Gull Island]" (P2.29.11.06).
- Another good medicine is *mashkuminakashi* (Northern mountain ash) which is good for flu, coughs. It is found at Uhuniau (North West Point). You chew the berries. You can also boil the bark for a long time until it looks like molasses and apply on a cloth to the back. Used if you have a sore back (P2.7.12.06).
- "Once, at Uapush-shipiss, I cut my foot badly with an axe. The bleeding wouldn't stop, so my grandfather mixed *ushkuai-pishim* (mushrooms) with powder from a tanned caribou skin and tied this over the wound. The day after, they boiled *pitshuatik*^{u} and placed this on the wound, changing it regularly" (P8.29.11.06).

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[75] Clément (1995:108) includes the same term in his presentation of Innu lexical items for waterfowl anatomy. Drapeau (1991:887) records *utishishk*^{u}, gésier d'outarde (goose gizzard).

[76] The term *manitush,* plural *manitushat* in this case, usually refers to a class of non-edible, repugnant animals and non-human beings including insects, worms, snails, slugs, reptiles, etc. so it is interesting to see it used to refer to the agent causing sore teeth. *Manitush* is also the Innu word for cancer.

[77] As noted previously, Clément (1998:38) recorded this expression in Utshimassit (Davis Inlet). It derives from the inanimate intransitive verb *nitautshin* – something (vegetal) grows. *Kanitautshiki tshekuana assit* is the inanimate form of the expression. When questioned about its application in Sheshatshiu, my informants there said that they, too, could use the expression to classify trees, shrubs, fungi, mosses, and fruit plants, given that there is no generic term, "plants," in Innu-aimun. Clément (1990:17) recorded an animate form in Mingan – *ashtshit nte kanitautshiht*, literally, "in the earth, those who grow."

[78] This is most likely *Taxus canadensis*, Canadian Yew. Clément (1990:95) records it as *ashtshiuashishk*^{u} and describes its medicinal properties. Malec, et al. (1982:43) include *assiuashikuat* in their inventory of Innu medicines. Drapeau (1991:82) lists *assiuashik*^{u} as "buis de sapin" (Canadian Yew). *Assiuashik*^{u} is an animate noun.

- “Red berries are good for teething. One of my daughters had teething problems so I found red berries under the snow. It took only a couple of days to heal up” (P1.5.12.06).
- Birch, tamarack, spruce and fir cones can be used as medicine for stomach problems. You drink one cup of a broth made from the boiled cones and you vomit (P8.17.11.06; P1.5.12.06; 24.1.07).
- There is a light layer, inside the bark of *minaik*^{u} (white spruce) that is good cough medicine. Chew it, and swallow the saliva but not the bark (P1.24.1.07).
- The round thing that turns into powder*, kapiputepanit* (kâpîputest), is good for infections and nose bleeds.[79]
- *Ikuta* (Labrador tea) is used as medicine (preparation and application not specified) (P9.8.12.06).
- Kâuîshâkəpekəshâtshî (unidentified) is a plant that grows on the ground. It has thread-thin roots that come off the main root. It’s a medicine found anywhere (P3.8.2.07).

10. Mishta-shipu hydro project: discourses concerning potential impacts

In previous sections, we looked at how members of the ITKC know what they know, and then moved on to sample Innu knowledge concerning Mishta-shipu. The task now is to make sense of various propositions advanced by the ITKC about future impacts of the proposed Project. What are these propositions, upon what basis are they made, and in what context? An analytical tool known as “discourse analysis” will be used to assist with this task. I take note of Usher’s point that “The boundary between observation and inference is not always evident, however, because people may state as fact or consequence what scientists would characterize as inference or deduction” (2000:186).

“Discourse” is just another word for a written or spoken communication, a text, narrative, or conversation, and the study of discourse is a specialized field in the social sciences, so that one often hears the term “discourse analysis.” A detailed discourse analysis is beyond the scope of this report and would be a daunting task because it would require first and foremost a careful examination of large volumes of texts in Innu-aimun. Much of what is accomplished in discourse analysis, while of immense intellectual interest, is not necessary for our primary purpose which is to clarify Innu discourses concerning the anticipated environmental effects of the proposed project. Knowledge of the finer points of Innu rhetorical strategies, narrative styles, and other characteristics of their discourses are not necessary at this point in time, and so we shall restrict our focus to those aspects of Innu environmental discourse that relate to the potential impacts of the hydro project.

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[79] This is most likely the puffball (*Lycoperdon spp.).* Clément (1990:99) records it as *kapiputepishiti* and says it is used for nose bleeds. Drapeau has *kapiputepalit* - champignon vesse-de-loup (puffball).

Whereas the discourse structures of other Algonquian-speaking peoples have been studied in various ways (e.g. Spielmann, 1998; Valentine, 1995), they have been analyzed only to a limited extent for the Innu, and then primarily for linguistic objectives (Baraby, 1999; Drapeau, 1984-85). As a result, we have little understanding of how all the elements that comprise these structures are constituted in the Innu imagination; how propositions, opinions, attitudes, models, and schemata constitute ideologies, these being cognitive reflections of their "social, political, economic, and cultural 'position' within the social structure" (van Dijk, 1987:194).[80] Furthermore, while Innu discourses concerning hydro-electric projects in Labrador have been part of the society-wide discourse about such resource developments for at least two decades, they have never been considered in a systematic manner in relation to Innu environmental knowledge.

At the outset we should remember that the discursive environment of the Innu is constituted through a number of communications media. These include interpersonal interaction and dialogue, as well as modern media of mass communication including local and regional radio stations (e.g. open line shows), news papers, internet chat groups, and television. Moreover, discourses by ITKC members are embedded in a discursive environment that includes a variety of often interrelated subject categories, as has been observed among other indigenous peoples.[81] Ellis (2005:71) notes that "Traditional knowledge experts draw from a broad range of knowledge and experience when communicating. Environmental knowledge, cultural values, history, politics, and the broad concerns and aspirations of their people may often inform the speech of an elder or other land user participating in an environmental hearing or technical session." There is an historic component to this in that the current discursive environment is the result of 60 or more years of accumulating experience, individual contemplation, social interaction and discussion on the part of the ITKC members. Besides the Lower Churchill Hydro Generation Project, other discourses that they participate in relate to the Churchill Falls project and the flooding of Meshikamau (Michikamau Lake), the Voisey's Bay Mine-Mill project, commercial forestry operations such as Labrador Linerboard and even the Dickie Lumber Company operation, military flight training, highway construction, prosecutions of Innu under provincial game laws, settlement in government built villages, breakdown in the intergenerational transmission of knowledge, growth of various social pathologies and dependence on government institutions, and with this loss of personal and collective autonomy. Innu integration into the so-called global village of mass communication and consumer culture also helps give content and shape to this discourse environment.[82]

[80] This definition of ideology follows van Dijk's interdisclipinary approach to discourse and reflects his interest in cognitive psychology. I also use a standard anthropological definition of ideology elsewhere in this report related to religious ideology following Tanner (1979).
[81] Subject categories refer to single concepts such as "crime" or "education" which stand for a large social or political domain or a complex issue.
[82] Pundits say that TEK is politicized because of its embeddedness in a broader discourse environment, however, this does not distinguish it from western science for which there is plenty

Discourse analysis focuses on major levels of “discourse structure, such as topics, overall schematic forms, local meanings, style and rhetoric, as well as their relations with cognitive processes of production and understanding, and their socio-cultural and political contexts" (van Dijk, 1991:x).[83] For the purpose of this study, however, I shall limit the analysis to two analytical units – propositions and themes.[84] Propositions refer to a conceptual structure comprising a predicate and one or more arguments. Thus the predicate "will ruin" can be combined with the arguments "flooding" and "country medicine" to form the proposition "flooding will ruin country medicine.” Themes (topics, macropropositions) on the other hand, are the global, overall meaning structures of a text derived from the propositions of the sentences of the text. The theme reduces the complex information of the text to its essential gist. Themes refer to specific events, actions and people. Hence, "travel" is the theme of the sequence of propositions "I went to Goose Bay," "I bought a snowmobile," "I put gas in the snowmobile," "I went partridge hunting at Tshiashku-nipi on the snowmobile," etc.

In examining ITKC member propositions and themes concerning predicted hydro dam impacts, I have wanted to pay careful attention to the ways in which these are expressed in the Innu language, in part because I have not always trusted the translation to convey all of the nuances in the original Innu-aimun. I first encountered this issue in the context of the environmental assessment of military flight training, where speculative comments about the impacts of low-flying jets were interpreted as definitive cause and effect statements. Maintaining a cautious stance *vis-à-vis* translations is important because some interpreters infer the intentions of the people they translate for, what they think speakers intend to say versus what they actually say, thereby over translating the narratives and reading more into them than had actually been stated. In addition, unbeknownst to the third party, some interpreters insert their own observations or opinions into the translation.

Given the fact that I am not a fluent speaker of Innu-aimun, I have had to count heavily on the interpretation skills of my co-researcher to communicate all the necessary subtleties of both the Innu and English languages. Furthermore, virtually all of the “data” for this report and the subsequent analysis relies on his interpretation and the English texts that they have generated. From the outset, I was anxious to ensure that the co-researcher paid particular attention to the

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of evidence, and argument, to show that it, too, is socially constructed, and/or shaped by “non-scientific” variables (see Kuhn, 1970; and Wilson, 1999).

[83] To learn more about discourse analysis, see van Dijk (1987). Discourse analysis is sometimes confused with content analysis, which is based on inferences resulting from the systematic quantitative analysis of themes, sources, lexical items and other semantic elements across a corpus of texts or narratives (see Bardin, 1977).

[84] The topic under discussion, here, Innu discourses about environmental impacts is called a “semantic macrostructure” dealing with the overall meaning of a text. We do not concern ourselves with the "truth" or "falsehood" of Innu propositions.

different ways that sources of information or knowledge are marked linguistically in Innu-aimun so that they could be translated properly into their English equivalents. To this end, we discussed some of the nuances in interpretation required for the work in advance of the ITKC meetings and individual interviews, and the co-researcher appeared to have no problem appreciating these issues. Thus, his occasional footnotes throughout the meetings to the effect that a speaker was providing "an inference" gave me some reassurance that important linguistic nuances were being conveyed.

Nevertheless, it was deemed prudent to subject a number of the narratives from the ITKC participants to a more detailed analysis by means of word for word written transcription and a close translation (see Appendix 2). This was done both as a way of spot-checking the quality of interpretation provided by the co-researcher as well as a vehicle for the exploration of the grammatical markers for different types of knowledge and reasoning underlying the discourse. This is as close as we can get to the primary Innu discourses concerning the future impacts of the hydro project, keeping in mind that interpretations provided by the co-researcher are always one-step removed from these discourses because they are provided in English, and are frequently glosses or summaries of the statements made by the ITKC participants. With the exception of the transcriptions and close translations, the discourses analyzed here are removed one step further because the majority of them are not verbatim transcriptions of what the co-researcher said, but are my notes of the translations of the Innu-aimun discourses taken during the meetings.[85]

Any in-depth discussion of Innu grammar is obviously far beyond the scope of this report, and in any event, the task of educating the reader about this grammar is better left to the linguists (Baraby, 1999; Clarke and MacKenzie, 2003; Drapeau, 1985). Nonetheless, it is worth touching on a few grammatical points that bear directly on the nature of Innu discourses concerning the impacts of the proposed hydro project. In addition, it is useful to identify key terms used in Innu-aimun to communicate about the project.

Most relevant to our interest in environmental impact discourses are the stylistic and grammatical strategies employed by the Innu to mark sources of information and which provide the means by which propositions can be made. As noted by Drapeau (1985:28, my translation), the Innu language "implements particular resources that permit the formal differentiation between the facts, information, knowledge of which is obtained by the direct experience of the speaker, and those which have been reported or brought to his attention in an indirect manner." At the grammatical level, the Innu employ different verbal modalities to mark the status of the "facts" being reported. Indicative verb forms "occur in statements of fact or in questions relating to factual information" (Clarke and

[85] Linguist Marguerite MacKenzie played the major part in analyzing the transcribed narratives, with me looking over her shoulder, yet collaborating equally in the assessment of whether they were speculative, definitive statements of fact, or predictive.

MacKenzie, 2003:88). However, propositions “may be weakened in force by the use of prefixes or preverbs which represent meanings such as ‘futurity’ and ‘potentiality’” (ibid.). Moreover, a verb stem may take what are called “dubitative” endings that mark probability or logical deduction (ibid.). Such endings are routinely encountered in sentences involving possibility, e.g. “perhaps” or “maybe”.

Table 8 lists grammatical modalities in the Innu language that mark sources of information, that alert the listener to the type of evidence used by the speaker in formulating a given proposition.

A number of verbal modalities were employed by the ITKC participants in the examples of impact discourses presented in Appendix 2. A few of the discourses examined here dealt with the impacts of other hydro projects in Labrador with which the participants are familiar, namely, the Twin Falls and Upper Churchill projects. However, in those instances where the impacts of these projects were mentioned, the verbal mode used was either affirmative, real or subjective, based on direct experience.

Table 8. The system of modalities in Innu-aimun (Baraby, 1999)

Status of the proposition	Affirmed (certain)				Not affirmed (uncertain)			
position of the event in the world	Real		Subjective		Possible			
strength of the affirmation (degree of certitude)	By direct experience	By indirect experience	By direct experience	By indirect experience	By deduction (necessity)	By speculation (possibility)	Potential situation	Hypothetical situation (counter factual)
Independant Present Past	Indicative	*-tak* *-shapan*	*(ka) + -wâ*	*(ka) + -tak + -wâ* *(ka) + -shapan + -wâ*	*-tshe* *-kupan*	*tshipâ tshî-*	*tshipâ*	*tshipâ + -pan*
Conjunctive	Indicative	*-kwe*					*-i*	*-âkwe*
Imperative Future	Present indicative	*-me*			*-kan*			

Most of the discourses included predictions about the impacts of the Lower Churchill Project. Here, the preverbs *tshe-* (‘will’) and *tshikut* (will be able) predominated, which indicates that the speakers are very certain about the project impacts. In the first example, the speaker is talking about beavers moving up tributaries away from the flooding.

Nete iat apishish <u>tshika</u> ituteu, nete nitamit itetshe <u>tshe</u> itutet.
There elsewhere a little bit they will go, there upstream they will go.

In the second example, the speaker predicts the impacts of the Lower Churchill Project based on his knowledge of the Churchill Falls dam.

Eukun nipa-iat tshe ishinakuak
The same thing will happen

A measure of uncertainty is introduced into the prediction in this next example, where *tshipa* marks a potential situation, that is, the water body will most likely be flooded. The speaker is not absolutely certain that flooding will occur.

Eku tshipa nassipeu nipi.
The water body will most likely flood

In this example, the verbal ending –tshe shows that the proposition is based upon deduction.

Ekute anite muk minushitshe aueshish, tshia?
Some places the animals must still be good, right?

Namesh nipauin, tshia? Minushitshe nete uin eka tshipaikanit uin.
Especially the fish, right? They must be good there because there are no dams over there.

In the next example, the speaker speculates about the future presence of black bears in the Mishta-shipu valley. The terms *tshipa tshi* are the markers for a possible future state, uncertainty, speculation.

Tshipa tshi tau mashk^{u} uin, tshipa tshi mitshu nete minashkuat.
The black bear may still be there, it may be able to go in the forest and get its food there.

Throughout the discussions about the impacts of the Project, three terms stood out in terms of the frequency with which they were used, namely *uinnakuan* (dirty), *akushu* (sick), and *minushiu* (good).[86] One must be careful when interpreting Innu discourses concerning hydro dam impacts because interpreters frequently infer that "sickness" refers to methyl-mercury, or that the "dirt" that makes water or fish "not good" is "contamination" (i.e. mercury). Here are some examples of these concepts from Innu discourse.

uinnakuan (it is dirty, something inanimate is dirty)

Mitshu nenu kapiuaputeua tshekuanu nete nipit e-uinnakuak, eukunu nenu miatshit nete e-uinnakuanit tshekuanu
It eats what is dispersed in the water, the dirt, it eats that, the dirty thing in it.

[86] Remember that Innu-aimun lacks technical vocabulary for water chemistry, physiological processes, and the mechanisms underlying methyl-mercury bioaccumulation.

akushu (s/he, something animate, is sick)

Ehe, nauitamakuitan, akushut namesh.
Yes, we were told, they are sick fish.

minushiu (s/he, something animate, is good) versus *apu minushit*

Note the use of the non-affirmed verbal mode here, the –*tshe* verbal ending that marks deduction.

Ekute anite muk minushi<u>tshe</u> aueshish, tshia? Namesh nipauin, tshia?
Some places the animals must still be good, right? Especially the fish, right?

Minushi<u>tshe</u> nete uin eka tshipaikanit uin.
They must be good there because it is not blocked off (dams) over there.

Several other key terms should be mentioned because of their important role in communicating propositions concerning the Project. Readers will note that a number of these terms are borrowed from the lexical repertoire normally used to talk about animal behaviour, beaver dams and damming being the best examples.

matenitam – he feels the effects of something.

matshi-natukun – poison, toxic chemical, often used to translate "contaminants" or "methyl-mercury."

minuinniu – s/he (animate entity) is in good health (Drapeau).

nanutakanu – to be ruined/wasted, from the verb *nanutau* – he wastes, ruins, spoils, renders something unusable (Drapeau).

nassipitakanitshi – it will be flooded, from the verb *nassipeu* – it is flooded, submerged.

mitshu tshekuanu – s/he eats something. "Something" is often translated as "contaminants" (the nature of this "something" is inferred by the interpreter). But it is not always clear that the "something" is methyl-mercury, and we know of one case where the reference was probably an oil spill at Churchill Falls and not methyl-mercury. The interpreter infers the chemical nature of "something" on the basis of a possibly false assumption about what the speaker was thinking.

pikupanu – it is broken, demolished, damaged, spoiled (Drapeau).

tshipaikanau – it is closed off, from the verb *tshipaim* - s/he closes an opening, shuts something up (Drapeau). This term is used to refer to beavers building dams and thereby closing off brooks, as well as to humans building hydro dams. On occasion beavers may build two dams which is called *nishuau natuatshipaimut*.

10.1 State of the environment (environmental health indicators)

Prior to discussing the anticipated impacts of the Project, ITKC members were asked to consider the current "health of the environment," that is the land, water, animals, trees, shrubs, and other biota in their territory. As noted above, their description of environmental "health" constitutes a benchmark by which to evaluate the anticipated impacts of the Project. It also provides some insight into what might constitute "ecosystem health indicators" for the ITKC members. As noted by Berkes (1999), ecological indicators are one way that Aboriginal people conceive and talk about environmental change. Parlee, et al. (2005:165-166) note that "the percentage of body fat of birds, caribou, and other animals at harvest is one ecological health indicator which appears to be common among many indigenous groups, including the Cree of northern Quebec…the Gwich'in of Alaska…and the Maori of southern New Zealand."[87]

The quality of an animal's body fat is certainly a consideration for Sheshatshiu Innu. For example, one ITKC member noted a difference in the fat of coastal versus inland country animals: "When the fat of the *shiship* (waterfowl) from the ocean gets smelly, the smell lasts a long time. *Utshashumek^{u}* (Atlantic salmon) comes from the ocean, and you can smell the fat. You can't keep it long. In contrast country ducks and fish don't smell of fat, and they keep longer" (P1.25.1.07). Various propositions concerning the quality of caribou fat and that of other animals have been noted with respect to Innu discourses about the impacts of military aviation on wildlife (Armitage, 1994).

ITKC members were asked to talk about the land, water, animals, trees, shrubs, berry plants, and other biota in territories that are distant from the Project where they have extensive land use, before talking about the project area specifically. However, the geographical range of the discussion wandered throughout the territory without a clear focus on any particular location. Most of this discussion related to the Akamiuapishk^{u} (Mealy Mountains) and Penipuapishk^{u} (Red Wine Mountains) regions as well as Sheshatshiu and the more barren area to the north at Kameshtashtan (Mistastin Lake). These are the areas where ITKC members have the most recent, direct experience. Here is a list of their observations about the current state of the environment.

[87] The quality of animal body fat is an Innu preoccupation.

Tshishik[u] (weather)

- "The weather is changing, and because of this there are new animals coming here. When I was in the country, I hadn't felt the change yet. There used to be lots of cold weather in the past, but I haven't felt the cold weather for some time. In the past I used to get frost bite on my face when out hunting" (P1, 26.2.07).

Nipi (water)

- "The water in nutshimit tastes good especially in the brooks. The only place where one cannot drink the water is in beaver ponds. When you boil the water from a beaver pond it turns black. The trees are dead here, and insects eat beaver shit in the water. You can't drink it" (P3, 16.11.2006).
- "The best water comes from brooks flowing from hills. You can drink water from marshes if you strain insects from it, but it's not that good" (P1, 16.11.2006).

Uinn (subcutaneous fat) and *uin* (marrow)

- "*Atik*[u] (caribou) hardly have any bone marrow in the spring. The reason their marrow is like that is from walking a long distance. The old people used to say all caribou are like that after walking long distances" (P4, 16.11.2006).
- "Animals start to get fat again in June after green-up when they can eat the fresh growth" (P3, 16.11.2006).
- "In the spring, you expect some animals to be very thin which is related to them being cold during the winter. Male caribou are thin in early November after rut. I once found a skinny porcupine that had died on the snow, but there was nothing unusual about this. One October, my sons killed a beaver that was very thin by a culvert near Anikutshash-shipiss (Cache River) on the Trans Labrador Highway. It should have been very fat at this time of the year; beavers are normally thin in the spring only. There was something wrong with the beaver" (P1.16.11.2006).

Population fluctuations and movements[88]

- "Sometimes porcupine populations crash. This is natural. When marten are gone, they come back again the next year. It's normal that there are more one year than the next" (P1.16.11.2006).
- "All kinds of animals eat berries, including partridge, foxes, martens, and geese. Partridge are found everywhere. Sometimes willow ptarmigan are in the barren area, in Penipuapishk[u] (Red Wine Mountains). After it snows, they move south to find willows. Sometimes they eat berries like many other animals. They move to areas where there are berries" (P3.16.11.2006).
- "Sometimes you won't see animals in one area because they have gone somewhere else to find food" (P5.16.11.2006).

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[88] I did not attempt to elicit a lexical item for this concept.

Mishtikua (trees), *shikaua* (bushes), *minakashi* (berry plants), *uapikuna* (flowers)

- "I was last at Atshiku-nipi (Seal Lake) in the spring of 2006. The only difference in the land from former times is that in the past there weren't many alders along the shore. Nowadays, there's lots of alder along the shore because the water level has dropped. The animals are healthy and the water tastes the same" (ITKC.16.11.2006).
- "I don't normally pay any notice to plants. In the country, everything grows normally, but near Goose Bay, the bake apples don't grow as they used to. Nowadays, there are absolutely no bake apples at Uhuniau (North West Point). We used to go berry picking there. There has been nothing there for the last three years. Probably Goose Bay or the village [Sheshatshiu] has an effect on the bake apples' (P1.16.11.2006).

Manitushat (reptiles, insects)

- "In the past there used to be a lot of toads along the shore [at Sheshatshiu], but now there are no toads there. At my cabin at Mile 95 [on the Trans Labrador Highway] there are still lots of toads. There used to be more shore birds here as well. Also, there used to be a lot of dragonflies along the shore at Sheshatshiu, but there are hardly any now. Innu know the *utshashumek^u* (Atlantic salmon) are in when there are dragonflies" (P1.16.11.2006).

Animal behaviour[89]

- "The caribou used to go a long way in the past when they sensed danger. But nowadays, they are not as intelligent as they used to be; they sit on the road. They don't care about the noise. In the past, when they heard noise, they would take off. Noise was not a factor in the past, but now, there is too much noise, too many roads" (P3.12.2.07).
- "When we are at the dump, the black bears just stand close to us. They are not afraid. They eat at the dump, but in the country, they are wild, they are afraid of Innu. For example, at Akamiuapishk^u (Mealy Mountains), when the men hunted bear in a burnt area, the bear took off; they couldn't get close to it. Now that the bear eats at the dump, you can't eat it any more. Contaminated. [It is good] in the Akamiuapishk^u area where the bears don't eat garbage. When Pinashue returned from Enakapeshakamau, he made bear fat and intestines for us, and they were good" (P2.29.11.06).
- "I worked for an outfitter in 1992 who said the Americans had an outfitter operation there at Atikonak River. They hunted caribou and fished. The caribou declined after they started to hunt the caribou there. There are lots of old caribou

[89] No lexical item was recorded for "animal behaviour." However, the absence of a lexeme does not necessarily mean the absence of a concept. Black (1967) demonstrated this with her examination of Ojibway taxonomy that includes unnamed taxa. See also Clément (1995).

paths all over the marshes there. There used to be a herd there. I guided for two years there at Riverkeep Lodge. It used to be a big herd. Libby Camps is using the old caribou hunting camp as a fishing lodge.[90] It had been built by the Americans in the 1950s. An old White guy said that a lot of caribou had been killed by people at this camp and this precipitated the decline in the herd" (P6.30.11.06).

Miscellaneous observations

- "When I was last at Kamashkatkutinau-nipi with P1 in the late 1970s I observed no change in the land there. Nothing had been disturbed and there were no White people there. The fish were healthy, the *kukamess* (lake trout) were very fat and there was lots of caribou" (P4.16.11.2006).
- "I was recently at Kameshtashtan (Mistastin Lake). I had been there a long time ago. On my recent trip, it looked the same. There were lots of caribou, mostly does, two year olds, some stags, no calves. The caribou pass through there in the fall and then they rut in October after which time the stags are thin. The stags rut as soon as the does scrape the last of the velvet from their antlers" (P5.16.11.2006).
- "I camped at the mouth of Ashkashkuaikan-shipiss, a brook entering Kakatshu-utshishtun (Grand Lake). The Settlers call this brook 'Waddies'. The land, and the animals there were the same as ever. The last time I was in the Akamiuapishk^{u} (Mealy Mountains) area I was at Enakapeshakamau. The land and animals there were the same as ever. There was nothing unusual about the animals, none were sick" (P3.16.11.2006).

To summarize the results of the discussion concerning the environment today, ITKC members identified a number of "environmental health indicators" including body fat, marrow fat in the case of caribou, water that tastes "good," absence of disease in animals, and absence of animals that have not died for no apparent reason. A relative scarcity of some species such as toads, dragonflies, and bake apples may be seen as an indicator of problems in the normal state of affairs, attributed in part to proximity to Goose Bay and Sheshatshiu, although the agents directly responsible for these changes were not identified.

An important variable that surfaced in the course of ITKC discussions not mentioned above was the idea of abnormal, unusual, strange or uncommon, designated by the root *matau*.[91] Anything that is *matau* is unusual in some way, and Innu dictionaries contain a number of terms that are constructed using this root. For example, the term *mataunakushu* means "he has an uncommon, curious appearance," and is used for strange looking people as well as deformed children at birth.

[90] See www.libbycamps.com
[91] It is component (root) of many lexical items, not a term in its own right.

The idea of *matau* is applied to animals that have died for no apparent reason (*mataunipu* - unusual death), but also to animals of unusual size, or displaying unexplained behaviour. ITKC members spoke of *matau-uapush* (a dwarf rabbit), *matau-kak*^{u} (dwarf porcupine), and *matau-atik*^{u} (dwarf caribou) (P2, P8, P9.29.11.06).[92] *Matau-atik*^{u} is of particular interest. Innu Elders say that the dwarf is birthed from an adult male caribou.

> There are some animals that have a deformity, a lump on the side with a foetus in it. These animals are not sick. Sometimes caribou have this deformity. The caribou foetus develops in a lump on the side of the male caribou, between the skin and the stomach. The *napeu-atik*^{u} dies and the *matau-atik*^{u} comes out of this lump (P9.22.11.06).

When it emerges from the lump, the newborn *matau-atik*^{u} looks like an adult caribou with antlers only it is a miniature version. It looks like a small dog, but is fully adult. Innu would sometimes see *matau-atik*^{u} where there are a lot of caribou. “It’s like the caribou are protecting the dwarf. My grandfather Shimun killed a big stag. It had a lump on the side that contained a ball of caribou hair. That might have been part of the dwarf caribou” (P6.22.11.06).

Knowledge of dwarf caribou and other animals has been recorded elsewhere in Innu territory. For example, Innu trading out of Utshimassit (Davis Inlet) in the late 1920s told anthropologist William Duncan Strong (1930:9) that “the abnormal dwarf caribou called *mah-tákw ah-tée-hoos*, which they have occasionally seen and killed, are carried by the male caribou for six years in a skin sack attached to the belly. Then they are dropped fully developed and accompany the herd.” Clément (1995:327-329) documented the same knowledge among Innu on the Quebec North Shore.

Knowledge of *matau-aueshisha* (unusual animals) may well overlap with beliefs and practices that we frequently label religious, and more will be said about this matter later in the report (see section on religious ideology). For the time being it is important to note that traditionally-minded Innu do not make particular distinctions between the sacred and the profane – knowledge of animals be they caribou or dwarf animals, or giant ones is a part of a unified belief system as far as the Innu imagination is concerned. Thus, when we consider what to ITKC members may be *matau*-, we seem to be faced with a continuum of unusualness, with the agency of industrial society at one end, human agency in the middle, and the non-human at the other. Where on this continuum of agency particular events and observations fall may not always be clear. Consider these examples.

- “Etuat Rich once called my grandfather on the radio to ask him if he ever heard of muskrat eating fish. He had left a sucker on the shore, and he saw

[92] Clément (1995:327) recorded *nanatau-atik*^{u} for the dwarf caribou, *nanatau-kak*^{u} for dwarf porcupine, and *nanatauapush* for the dwarf rabbit. He notes that A.W.F. Banfield (1958) examined a dermoid cyst on a specimen sent to him by Innu.

muskrat tracks in the snow. The muskrat had been eating the fish. My grandfather said he had never seen this. Etuat thought this was an omen (*ashieu*).[93] His wife died that year" (P6.28.11.06).

- "Shushep Abraham and I were hunting at Mitshishu-utshishtun when we saw unusual otter tracks. The snow was about one foot deep, but the animals didn't slide across the snow, they jumped. There were two of these animals, and their tracks, which looked like ordinary otter tracks and were the same size, went straight into the woods" (P4.28.11.06).

At times, the unusual can be fearful as the story of a white *utshishkatatak*^{u} (salamander) found up Tshenuamiu-shipu (Kenamu River) illustrates.[94]

> Have you heard a story from our grandfathers of a *utshishkatatak*^{u} on Tshenuamiu-shipu? They say it is small like an otter. I heard she got bitten by it, when she was removing the boughs from an old camp site. The late Austin [Settler man] told us he saw something there too, about the size of a baking powder container, but it was long and thin, white in colour. They used a salmon spear to puncture it. They cut it in half, but the pieces joined back together again on their own. They threw gasoline all over it, and lit it, and that killed it (P1, P3.28.11.06).

With the exception of unusual animals and events such as *matau-atik*^{u} and the white salamander, ITKC members said that they did not normally observe anything unusual about animals in the past. Some animals were crippled due to injuries or were not fat, but these were natural phenomena. Animals kill each other, and sometimes there is intra-species killing. For example, male caribou hurt each other in rut and subsequently die due to injuries. Their antlers get stuck together, and some drown. Predators such as the black bear wait by the rapids and hit *utshashumek*^{u} (Atlantic salmon), wounding them, so that they die later. Mink, otters, osprey, and eagles wound fish as well. ITKC members say that it is obvious when animals have been injured by predators because one can see the marks on their bodies. Osprey and eagles drop fish accidentally and then the fish die. Other factors also explain why fish die including old age. Some animals die from smoke inhalation during forest fires. These are all examples of naturally occurring mortality (P3.16.11.2006).

Nonetheless, in recent times, ITKC members say that they have discovered animals that have died for no apparent reason, contain growths, and show signs of sickness that they find quiet disturbing. If not stated explicitly, they infer that these unusual phenomena have something to do with the intervention of industrial society in their territory.

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[93] *ashieu* – 's/he foresees the death of someone in acting thus'.
[94] Probably *Ambystoma laterale* which are native to these parts of Labrador. Utshishkatatak^{u} is also the generic term for lizard.

- Various animal species were found dead for no apparent reason. “Once I saw a *mikuashai* (sucker) that was sick. There was something growing in its stomach, but I don’t know what caused this. I saw the sick *mikuashai* on a small lake between Kauassenekausht and Kuekuatsheu-ushui” (P4.16.11.2006).
- “My wife found a dead pishu (lynx) under a white spruce tree at Atshiku-nipi (Seal Lake). The fur was intact and it died for no apparent reason. It is unusual to see a dead lynx” (ITKC.16.11.2006).
- “Not long ago, I killed a small kak^{u} (porcupine). There was something growing on its liver, so we did not eat the porcupine. We never saw this growth in the past” (P4.16.11.2006).
- “You cannot tell if a caribou is healthy by the way it walks. You have to kill it to find out. Once, when hunting near Schefferville with Puniss, we killed a caribou. When we opened it up, it had something like black dirt on the surface of the lung. We had never seen that before” (P1.16.11.2006).

In the 1980s and 1990s, many Innu attributed unexplained animal mortality to low-flying military aircraft, and some of the ITKC members continue to posit some kind of causal relationship between mortality and jets.

- “In the past, we never saw unhealthy animals and no unhealthy fish. But since the military jets have been flying around, different Innu hunters have seen unusual death, dead animals, with no marks” (P5.16.11.2006).
- “I once found a dead moose at Shatshit, but I didn’t check it out. I don’t know what happened to it. The military jets were still flying at the time. The exhaust from the jets was ingested by the moose” (P4.16.11.2006).

Such discourse must be considered as part of an Innu assessment of the current state of the environment. One way to make sense of this discourse is to relate it to a type of inference that Western logicians label "argument by analogy." Copi states that "analogy is at the basis of most of our [Euro-American] ordinary reasonings from past experience to what the future will hold" (1961:338). It seems that Innu employ such inductive analogies when thinking about environmental impacts. A bare bones example of this, extracted from discourses about military flight training, may be represented as follows:

1. c. 20 years ago, there was no jet noise and exhaust fumes.
2. Innu never encountered animals that died for no apparent reason.
3. Today, there is jet noise and exhaust fumes.
4. Animals are found that died for no apparent reason.
5. Therefore the jet noise and exhaust fumes are causing animals to die.

Western-trained logicians also refer to this type of "argument by analogy" as "Mill's inductive Method of Difference" which is used to establish probable causal connections between agents of change and their effects. Copi describes that method thus: “If an instance in which the phenomenon under investigation occurs, and an instance in which it does not occur, have every circumstance in common save one, that one occurring only in the former; the circumstance in which alone the two instances differ, is the effect, or the cause, or an indispensable part of the cause, of the phenomenon" (Copi, 1961:369).

Presented schematically the argument advanced by the Innu may be represented as follows:

Logical structure of Innu argument

Instance	antecedent circumstances				phenomenon
c. 30 yrs ago	A	B	C	-	E
Today	A	B	C	D	F

A = animal populations
B = lakes, rivers, etc.
C = Innu people
D = military jets
E = animals die of natural causes
F = animals die of unnatural (unexplained) causes (unhealthy state of nature)

Therefore, the antecedent circumstance labeled "D" (military jets) is the (possible) cause or an indispensable part of the cause of the phenomenon, namely, animals that have died for no apparent reason.

This is not the only type of analogical thinking engaged in by Innu. Establishing structural parallels between animal and human behaviours and physical attributes is another form of such thought. One example from the ITKC process was the observation that *mashk*^{u} (black bear) communicate with one another whenever a den becomes vacant. "When we kill a bear at its den, a couple of years later another black bear will occupy the vacant den. They are like humans; they tell one another where their dens are. Same as me, I have a cabin on the Trans Labrador Highway. When I'm not around, other people use my cabin. *Mashk*^{u} is like this as well" (P1.8.12.06). Innu also make inferences or extrapolations about animal behaviour based on human emotions, behaviours and rationality. An example of this is the proposition that animals must be frightened by sudden, loud noises because humans certainly are.[95]

10.2 Observations of the Impacts of the Upper Churchill Project

[95] I recently heard a biologist make a parallel inference in relation to the possible impacts of kayakers on colonial nesting species of sea birds. "Just think about it. Sea kayaks are stealth vehicles and they can scare the nesting birds. Afterall, we are surprised when someone sneaks up on us, and the birds have the same reaction to kayaks" (Kayak Newfoundland and Labrador, presentation on "Bull-birds, tinkers and turrs," 11 Jan. 2007, Guv'nor Pub, St. John's).

Just as military flight training is part of the current environmental baseline as far as ITKC members are concerned, so too is the legacy of the Upper Churchill Project, with which all of the ITKC members have some kind of experience. Most of these experiences come from their involvement in the experimental commercial whitefish fishery at Lobstick Lake in the late 1970s and early 1980s, which is where they first learned about methyl-mercury, what they call *matshi-natukun* (poison, toxic chemical). The damming of Mishta-shipu and other rivers in the territory and the flooding of Meshikamau (Michikamau Lake) and other lakes frequently evokes a number of political issues for older Innu including members of the ITKC. These include the physical damage to the Meshikamau area, the lack of consultation with the Innu and lack of compensation. Over the years, the project has festered as a major sore point for the older generation of Innu people, and as a result, any discussion about the hydro project is often framed by the earlier hydro-electric project. It is an anchor point for ITKC members with respect to their thinking about future resource developments in Labrador. The following summary by one of the ITKC members concerning the anticipated impacts of the Project illustrates this point.

> The areas that the animals live [in the Mishta-shipu valley] will be affected when it is flooded. Not just us but also the animals will be affected. For example, the animals eat all kinds of berries and trees, which are plentiful in the river valley. It is not so good above the valley. All the bushes and trees eaten by animals are in the valley. The only animal that doesn't eat trees is the caribou, which eats *mashkushu* (grass). The trees provided materials for many tools. The impact will be huge as a result of the dam. Downstream to the mouth of the river and all the way to Uinuat (Rigolet) will be affected by contamination from the reservoir. We have seen the destruction from Meshikamau and this is the second project. We get our medicines from the trees and animals in the valley (P1.28.11.06).

The following are examples of observations and propositions advanced by ITKC members concerning the impacts of the Upper Churchill hydro project.

- "In the past, before Meshikamau was flooded, Upatauatshetshun (North West River) never froze over. There was strong current there before Meshikamau was flooded. But there is hardly any current there now, and one can taste salt water right up to Kakatshu-utshishtun (Grand Lake) when the tide comes in. Two years ago in the spring, when I was going over the small portage at Kakatshu-utshishtun [between Grand Lake and Little Lake], I could see the current running back into Kakatshu-utshishtun" (P1.5.2.07).
- "Everything changed after the flooding of Meshikamau. I can now walk along the shore on land I used to paddle over in the past" (P1.5.2.07).
- "After Meshikamau was flooded, I was driving around in a boat to set nets. We didn't know we were on top of old forest, and we wrecked our nets. When the water receded, we could see where the land was, the soil came up, and trees floated. It was a very messy place. Very messy along the shore" (P1.7.02.07).

- “Where we had our camp close to the shore [of Mishta-shipu near Ushkan-shipiss] there were hardly any alders. Nowadays, there are a lot more alders” (P8.22.11.06).
- “There used to be a lot of *nutshipaushtikueshish* (Harlequin ducks) at Kakuetipapukunanut in the old days before damming and flooding of Meshikamau” (P1.25.1.07).[96]
- “The fish have been affected already from previous damming. One can only eat fish from brooks that don’t flow from Meshikamau” (P2.17.11.2006).
- “When we were at Lobstick we could still eat fish from rivers that do not connect to Mishta-shipu” (P2.29.11.06).
- Tshaukuesh told us we cannot eat fish from Mishta-shipu because they are contaminated” (P2.29.11.06).
- “When working at the Meshikamau [Lobstick] fishery, we got our water from some kind of a well. We didn’t drink water from the reservoir because there were too many insects. It was dirty. We took water from brooks when we were hunting.
- “In the past, before flooding, you could see all the hills, but after flooding, the hills where they traveled are under water, and the animals that were there died” (P9.7.12.06).
- “The fish were good to eat before the roads and dams were built, and now the fish are no good to eat” (P2.7.12.06).
- “In the past, where we fished, there were a lot of fish, and we didn’t have to worry about what we ate. But after Meshikamau, we were told that they fish were no good, and we were afraid to eat the fish. We had all kinds of fish up Mishta-shipu except *utshashumek*^{u} (Atlantic salmon)” (P2.7.12.06).

10.3 An inventory of impact propositions

Having devoted three days in group sessions with the ITKC participants discussing the potential impacts of the Project on the land, water, animals, fish, trees, bushes, berry plants, and other biota, it became apparent that the participants believe that these impacts are obvious. The land and the various animal and plants species that live there will be flooded, and animals that do not evacuate the flood zones will die. It was not surprising, therefore, to encounter a certain impatience on the part of ITKC members when I tried to parse the range of impacts into smaller units, for example, the particular impacts of flooding on every species known to them in the project area.

The impact predictions advanced by the ITKC members take the form of propositions, but the actual causal mechanisms by which impacts may occur are not always transparent. This certainly pertains to propositions dealing with animals that the Innu say will be “contaminated” as a result of flooding; where it appears that they subscribe to a theory concerning the transmission of harmful

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[96] Kakuetipapukunanut (‘Where Someone Capsized in the Current’) is the name of some rapids near the former outlet of Meshikamau (Michikamau Lake) where it drains into Meshikamau-shipu (Naskaupi River, NTS map 13L/03E).

substances from one species to another. There is something in the water after flooding, they say, that is taken up in grasses, flowers, bushes, and other plants. Fish and terrestrial animals eat these plants, and Innu consume the fish and animals.

Whether this is an indigenous notion, that is, local invention, cannot be determined, but there has been lots of support for this theory going back to the Upper Churchill project. As mentioned previously, Innu were warned about methyl-mercury in fish and fish were tested as part of the commercial whitefish fishery in the 1970s and 1980s. In addition, some Innu have seen the CFLCO "Health Risk Advisory Sign" at Uinukapau (Winokapau Lake) advising people to limit their consumption of pike and lake trout "because of continued elevated mercury levels in the flesh of fish."[97] Those who have not seen it have been told of its message. As noted previously, in 2000, the Innu Nation embarked upon a "Harvest and Country Foods Contaminant Study" in conjunction with the Atlantic Veterinary College in P.E.I. (Pollock, 2004). A cognate study was conducted in 2002 by researchers at the Institute of Environmental Sciences at the Université du Québec à Montréal concerning human body burden of methylmercury from fish consumption (Canuel, et al. 2006). Also, Innu are certainly aware of the well-publicized oil spill mentioned previously resulting from a fire at the Churchill Falls hydroelectric plant on Mishta-shipu in September 1999. Furthermore, Innu believe that there is something in tap water that can make people sick which is why bottled water is sold in large quantities.[98]

All of this provides support for the notion that there is something in hydro reservoirs that amounts to a poison that will make fish, animals, and humans sick. There is no risk assessment, no idea that substances such as methyl-mercury are found naturally in the environment in low quantities, or that they become a potential health problem only when consumed in large quantities. ITKC members firmly believe that *matshi-natukun* (poison, toxic chemical) will be found in the Muskrat Falls and Gull Island reservoirs that will move up the food chain making fish and animals "no good" to eat.

Let us now review the various propositions advanced by ITKC members concerning anticipated environmental impacts.

[97] The text of this sign is reproduced in Newfoundland and Labrador Hydro's Churchill River Power Project Information Package, April 26, 2000.
[98] I know of one family in Sheshatshiu that obtains its drinking water from North West River rather than from the tap in their house, and I have witnessed Innu getting water from Birch Brook near Gosling Lake.

Propositions related to ***atik***^{u} **(caribou)**

- "*Atik*^{u} (caribou) will be driven away from the area because of noise from construction vehicles such as big trucks" (P2.7.12.06).
- "*Atik*^{u} (caribou) will sense/feel the destruction (damage to, breaking up) of the land and will not be seen in the area again" (P8.7.12.06).
- "The moss that the caribou eat will be scraped from the ground leaving only sand" (P8.7.12.06).
- "The food that the caribou eat will be contaminated. They will eat something that floats in the water. In the winter, it will be frozen and the caribou will walk around and eat the moss that is affected by the stuff that floats in the water. They eat the plants that grow early in spring, the plants that grow near the reservoir. They will drink the water from the reservoir" (P1.5.12.06).

Propositions related to ***mashk***^{u} **(black bear)**

- "*Mashk*^{u} (black bear) dens will be broken up/destroyed. The water will flood their homes" (P2.7.12.06).
- "The bear can make its den elsewhere as long as the flooding does not occur in the fall" (P2.7.12.06);
- "The bears will go somewhere else, in the hills, to find something to eat" (P1.5.12.06).
- "The bear dens will be somewhere else, on top of the hills" (P1.5.12.06);
- "There is a low-land area just upstream of Kamitinishkasht where there are red, muddy banks. This used to be a good area for black bears. Their dens were on the hills. There was lots of partridge here as well. This will be under water" (P1.5.12.06).

Propositions related to ***amishk***^{u} **(beaver) and *shuniau-aueshish* (furbearers)**

- "Mishta-shipu used to be good for *amishk*^{u} (beaver). If the flooding occurs in the fall, the beaver may not have enough time to move away, and their houses will be broken up/flooded. Otherwise, beaver will move away)" (P4.16.11.2006).
- "There are all kinds of *ushakamishk*^{u} (places where there are always beaver), in the Tepiteu-shipu area and these will all be under water. They will move up the brooks when they realize that the flooding is occurring" (P3.5.12.06).
- "If the beaver have built their lodges before the flooding, they will have to be killed [doesn't explain why they must be harvested prior to flooding]" (P3.16.11.2006).
- "The fish will be eaten by otter and mink, so they will be affected too. Just as humans get sick from eating the fish, so too will the otters and mink that eat the fish" (P1.5.12.06).

Propositions related to *pineu* (partridge)

- "There will be no more partridge in the flooded area because fir boughs that they feed on will be destroyed" (P8.7.12.06).
- "Partridges can survive easily, but their young, their nesting areas will be affected" (ITKC.7.12.06).
- "There is lots of *uapineu-mitshim* (willow) at Tepiteu-shipu. This will be flooded and so there won't be *uapineu* (willow ptarmigan) there" (P1.5.12.06).

Propositions related to *shiship* (ducks) and *nishk* (geese)

- "Feeding grounds for geese will be flooded, e.g. at the mouth of Tepiteu-shipu where there is a good feeding area for geese (P7.5.12.06). There won't be any *ushatshiss* (places where there are always geese). The *nishk* (Canada goose) will feed somewhere else because their feeding area will be underwater" (P1.5.12.06).
- "Young ducks won't find a place to rest on the reservoir. Geese can survive as well, but they won't be in the reservoir" (P8.7.12.06).

Propositions related to *namesh* (fish)

- "The fish eat in the water, and they will eat contaminants in the water. Expressed at *mitshu tshekuanu* (eat something) that will make them sick" (P5.5.12.06).
- "Innu will not be able to eat the fish" (P5. 5.12.06).
- "Tree bark floats around after flooding and the fish eat this. It has an impact on the fish" (P5.16.11.2006).
- "Fish will die" (P1.7.2.07).

Propositions related to *nipi* (water quality)

- "The water will be no good and will be undrinkable (P5.16.11.2006; 5.12.06). We used to have clean drinking water" (P1.7.2.07).
- "The water would be no good due to mercury. There's no word for this in Innu-aimun" (P7.5.12.06).
- "We will see an increase in 'contamination'. All the animals, for example, geese, that land in the water will be affected" (P5.7.2.07).
- Mercury levels will decrease over time (P7.5.12.06).
- The construction fuel spills will go in the water (P1.24.1.07).
- "You can't control insects. If you remove moss, you see all kinds of insects. The insects are in the trees as well. If you flood the land there's so many different kinds of insects. They'll all be floating around. In the marshes, there are insects in the water, but with the reservoir, there will be many insects in the water that do not belong there – land insects" (P1.5.12.06).

- “The flooding will not be as bad as Meshikamau, but it will be ‘contaminated’. We won’t be able to drink the water. We won’t be able to use the animals and fish” (P1.24.1.07).
- “You buy water these days in the store, so there must be something wrong with the water in the taps. Animals can’t buy water in the store” (P1.5.12.06).

Propositions related to *nutshimiu-natukun* (‘country medicine’)

- “All the different *natukun* (‘medicine’) will be destroyed” (P9.7.12.06).
- “All the things the animals rely on will be under water. The trees, berries, that we used as medicine will be wasted, all along the river. The berries grow mostly in the river valleys. Important berry plants will be under water” (P1.5.12.06).
- “*Mitush* (poplar) is real medicine. When they flood the areas where *mitush* and other trees are located, they will be destroyed. Alders and willows and berries that are on the bushes are medicine. These places will be under water” (P1.24.2.07).
- “That’s the reason I feel connected to that river and feel strongly about the damming. It’s because so much Innu medicine will be destroyed….I once used *pitshuatik^u* on my grandchild who was close to death; he couldn’t eat at the time. The non-Innu medicine didn’t work. I put the *pitshuatik^u* on his chest, and he was back to normal the next day….The reason Innu medicine works is because God made it, and the land, and the medicine comes from the land…Innu people treat their medicine with respect” (P9.17.11.2006).
- “There are real medicines that only grow in the river valleys. We should get these before they flood the river” (P2.7.12.06).

Miscellaneous propositions

- “A lot of dirt (dust) will cover the trees because of heavy vehicle traffic and the gases (fumes) from the vehicles will be in the air” (P8.7.12.06).
- “Trees will be destroyed” (P9.17.11.2006).
- “Animals will be killed” (P9.17.11.2006).
- “Many porcupines will die” (P9.7.12.06).
- “Lots of animals get their food along the shores of the river, for example, partridge and porcupine eat trees, the beaver eats alder. Some animals eat berries. The food that these animals eat will be affected by the flooding” (P1.16.12.06).
- “Many things will be ruined/wasted including trees and animals” (P1.16.12.06).

11. Ideology: Innu beliefs and Mishta-shipu

Religious ideology is a special kind of thought, namely, “motivated thought” which aims to totalize the information received by an individual concerning his/her natural and social environments, adding in the process additional levels of reality to that accessible through “common sense thought” (Armitage, 1992:64). As

Tanner notes, religious thought is “not unrelated to the practical goals of everyday life, but it stands apart from ‘common sense’ thought, in that if offers quite separate techniques to produce these goals’” (1979:208).
As we shall see shortly, Innu religious ideology is a source of many environmental values, and provides building blocks in the Innu knowledge system as it relates to Mishta-shipu. In Usher’s terms discussed previously, environmental values are “culturally based value statements about how things should be, and what is fitting and proper to do, including moral or ethical statements about how to behave with respect to animals and the environment, and about human health and well-being in a holistic sense” (2000:186). The “culturally based cosmology” is a foundation of the knowledge system, according to Usher, “by which information derived from observations, experience, and instruction is organized to provide explanations and guidance” (ibid.). Both environmental values and the culturally based cosmology comprise TEK categories in his view.

Before I deal with specifics as they relate to Mishta-shipu, a brief overview of traditional Innu religious ideology is in order. In providing this overview, I write about Innu religious beliefs in the present-tense, recognizing that they have suffered considerable erosion over the last 50 years since the Innu were settled in villages.

The best place to start is with the animal masters. As noted elsewhere (Bouchard and Mailhot, 1973), traditionally-minded Innu possess a well-developed taxonomic system that divides animals into different categories. However, various animal species are also organized in a parallel classification based on kingdoms (*tipenitamun*).[99] Here, each animal kingdom is controlled by an animal being called *utshimau* (chief or master) or *katipenitak* (controller) (ibid.:61-62).

One encounters small variations in beliefs about the animal masters as one travels from one part of the Innu territory to another. For example, in Unaman-shipu (La Romaine) on the Quebec North Shore, many animal species are thought to have their own animal master. *Papakashtshishk^{u}* is the master of caribou, *Kakuapeu*, the master of porcupine, *Uapineu-napeu*, the master of partridge, etc. At the same time, individual species are represented by a single master on the basis of certain shared traits. Thus, *Missinak^{u}* is the master of aquatic species including fish and beavers. The master of caribou is the most powerful of all of these masters and hence controls all terrestrial species, including most mammals, and birds (Clément. 1995:440-441).

Innu living in Labrador do not use the term *Papakashtshishk^{u}* to refer to the caribou master, preferring instead *Kanipinikassikueu.* In general, they believe that the caribou master is more powerful than any of the other masters, however, this too is open to question as Henriksen discovered in conversation with the late Kaniuekutet (1977:6-7).

[99] *Tipenitamun* – ‘authority, responsibility, jurisdiction, domain’ (Drapeau, 1991, my translation).

Traditionally-minded Innu live in a perpetual cycle of exchange with the animal masters. In return for following certain rules of respect, the animal masters provide animals under their control to the Innu. The rules of respect include sharing meat and other animal products, disposing the uneaten remains in the fire, in trees or on scaffolds, handling the caribou marrow with extreme care during the ritual feast known as *makushan*, not wasting meat or over harvesting, making prestations to the masters in the form of decorated clothing and hunting equipment, and using deferential language when referring to or communicating with the masters. The need for respect is paramount,[100] and people who do not show respect run the risk of offending the animal masters, and starvation at least in the pre-settlement days.

The idea of respect for animals was mentioned on several occasions by ITKC members. For example, one person said, "You don't leave bones around for dogs to eat. If we let a dog eat a partridge head, we won't get any partridge again because the partridge boss will be mad. The younger generation doesn't know what it's doing; leaving caribou bones outside the house, disrespecting the bones. Things have changed so much" (P2.22.11.06).[101] Another committee member said, "The most respected places were Akamiuapishk^{u} (Mealy Mountains) and Penipuapishk^{u} (Red Wine Mountains) because these are the places where caribou always were. They are like a super market. If someone breaks into the store, we'd get mad. If you don't respect the caribou, perhaps they won't go there. Nowadays, the government always seems to look after Innu animals,[102] but in the past, the old Innu did this, from one generation to the next. We have been doing this long before government started to" (P1.5.2.07).

Many more elements of the natural world were respected in the old days than now, and even objects that non-Innu consider inanimate had to be respected, such as rocks. In explaining this practice, one of the ITKC members referred to an *atanukan* dealing with the infamous trickster character, Kuekuatsheu (wolverine), who conversed with a boulder that followed him around. The rock ended up rolling on top of him, and would not budge. So Kuekuatsheu had to call on *nanimissu* (thunder and lightening) to help him, by striking the rock, and splitting it in two. This story was related in order to explain why Innu believe that rocks are "living things" (P1.5.2.07). Having heard this account, another member of the committee remembered his grandfather chastising him for rolling a rock off a cliff. This was viewed as disrespectful towards the rock (P6.5.2.07).

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[100] *ishpitenitam^{u}* – s/he respects something, *ishpitenimeu* – s/he respects someone.
[101] Parlee et al. report that many Dené elders "attribute the absence of caribou in some years to a lack of respect shown for the land and animals; they believe that people must respect the caribou or they will not come back to them.That respect is demonstrated in many ways. Good hunting practices and proper harvesting and preservation of meat are some ways to demonstrate this respect" (2005:34).
[102] He is referring to government wildlife management.

Respect is clearly at the core of the traditional Innu moral code, as noted by Henriksen.

> Man and nature are part of one spiritual world. Hence, [Barren Ground Innu] behaviour is guided not merely by what White people call 'rational principles', but also by the spiritual and moral principles which exist in nature of which Man is an integral part. They believe that a hunter does not kill an animal against its will, but with its consent. Hunters and hunted are alike part of nature. As long as the [Barren Ground Innu] follow the customs of their people, as handed down from their fore-fathers, and they do not offend the animals and their spiritual masters, they will continue to live in peace with each other and with nature" (1977:8).

Many older Innu believe that a generalized lack of respect is the cause of a wide range of social problems in the Innu villages, and that a number of tragic events can be directly traced to specific acts of disrespect. For example, a house fire involving significant loss of life was linked to the actions of a male householder who had <u>apparently</u> disrespected *mashk^u^* (black bear) by pouring gasoline into the den of a hibernating bear and setting fire to the animal. During the ITKC meetings in the fall, one of the committee members announced with considerable consternation and anger that someone had dumped a caribou carcass and large freezer bag of salmon at Uhuniau (North West River) which has road access from Sheshatshiu and North West River. "It's a sin," he said emotionally. "The community has gone a year without a suicide or a fatal accident, but what's going to happen now that there has been such a terrible act of disrespect? Why do people take too much animals if they end up wasting it," he asked? "It is very disrespectful to waste the animals like this. Innu like my father always respected the animals which they needed for their survival. The culture, the animals, must be respected" (P7.28.11.06).

Even horrific catastrophes in other countries such as tornadoes and the hurricane that ravaged New Orleans in 2005 are attributed to widespread disrespect towards the animal masters by Innu and non-Innu alike. In fact, the shaking tent ceremony discussed below can no longer be held, according to some Innu, because the *kakushapatak* (the officient) would surely be punished by angry animal masters over the disrespect shown them in recent years. As a Euro-Canadian, trying to make sense of this kind of belief, I suggest that the Innu follow the thinking of their closely related neighbours to the west, the James Bay Cree, who "accept two seemingly incompatible versions of reality…by implicitly acknowledging two distinct levels of determination of events, one practical and commonsense, and the other ideological and revelatory" (Tanner, 2007).

It is important to note, here, that not only are "other-than-human" beings such as animal masters considered sentient, intelligent beings, the animals controlled by these masters are also considered to be sentient, although in varying degrees. At the top of the list is *mashk^u* (black bear), followed by *maikan* (wolf), *atik^u* (caribou), *matsheshu* (fox), *amishk^u* (beaver) and other species that share human attributes in various ways or which are given important roles in the *atanukan* narratives. Even pîtshêpən (grasshopper) has some level of sentience. “You can talk to them. If you give some molasses to them, they will spit something brown” (P2. 22.11.06). I have provided examples previously of Innu thinking with respect to the intelligence (*innishu*) of certain animals; the tricky *mashk^{u}*, for example, that undertakes various deceptive manoeuvres in order to deflect hunters from his den. *Mashk^{u}* understands human speech, even when the latter are not within earshot.

Another example, which was cited previously, and which remains somewhat opaque to me, is the idea that animals are able to see their reflections in the water. According to one ITKC member, “Caribou do this and it gives them information about the state of their antlers. The image they see is like a photo of themselves. It’s a story/information about their antlers. [Depending on what they see], they may eat *ushkuai-pishim* (tree fungi) to harden their antlers, after they have scraped the velvet off them.   This is when they are getting ready to rut in October” (P3.24.1.07).

In addition to the animal masters, traditionally-minded Innu say that their territory was populated at one time or another with a variety of other beings including *Mishtapeu,* cannibals such as *Atshen* and *Meminteu*, giant beavers and eagles, various large, malevolent creatures in the *manitush* category, sneaking creatures like *Katshimaitsheshu* (aka *Uapanatsheu*), cave/rock creatures like *Memekueshu*, and *Tshiuetinishu*.[103] *Mishtapeu* is the attending, guardian spirit, a resident of *tshishtashkamik^{u}*, mentioned previously, who comes to the assistance of a shaman and assists him in his “negotiations” with animal masters and battles with malevolent beings and hostile shamans. *Tshiuetinishu* is a weather control being associated with the northwest winds. In addition to these non-human entities, Innu have also encountered spirit beings such as *atshak^{u}* (ghosts, souls) and *Kameshtashtaniuniss*, a humanoid being found at Kameshtashtan.

Communication with the animal masters, *Mishtapeu*, and other beings is possible through dreams, the shaking tent, steam tent, scapulimancy (shoulder blade divination), oracles, omens, and other media (see Armitage, 1992; Savard, 2004:97-105; Vincent, 1973).[104] However, only people with power can communicate with these beings, and in this regard the shamans were the most powerful. Known as *miteu* or *kamanitushit* (or its euphemism *kamataukatshiut*) to

[103] See Vincent and Bacon (1978:92) “…the Montagnais territory has always been populated by multiple forms of life: neighbouring Indian groups whose members came in person or whose shamans sent their spirits in the form of animals, groups of maleficent beings which arrived from far away, and which may have been a Montagnais representation of Iroquois or other Amerindians, dangerous groups which had to be repulsed to the margins of the territory “ (my translation).

[104] For the closely related James Bay Cree, Tanner (2007) says that “the Cree who believe in these entities would say that in principle they are empirical phenomena, but that in order to be encountered either certain rare conditions must be met, or some skilled shamanistic ritual must be performed.”

the Innu, the shaman could be *kakushapatak* or *kamushtatet*, the former term referring to the person who conducted a shaking tent ceremony, the latter to someone with power but who did not do the shaking tent. Shamans played a key role in reminding people of the rules of respect, in maintaining relations with the animal masters and other beings, and in rectifying problems when people had committed transgressions.

Moreover, shamans had frequent encounters with non-human and spirit beings. They played a leading role in interpreting daily events in terms of the bigger world of religious meaning available to the Innu. Thus, when members of the hunting group heard mysterious singing or drumming or saw a human-like being in the mist while hunting, the shaman would make sense of such phenomena.

As noted elsewhere in this report, the last shaking tent ceremony in Innu territory was held at the mouth of Ushkan-shipiss in November 1969 by *Uatshitshish*, the father of the one of the ITKC members. She and three other members of the committee were witnesses to this ceremony. *Uatshitshish* had also conducted a shaking tent ceremony on the portage by Manitu-utshu. In both cases, he had been asked to ascertain the whereabouts of caribou, and other animals. Given the importance of the shaking tent to the older Innu, it is not surprising that the Ushkan-shipiss area should figure prominently in the memories of the people who witnessed the last one ever conducted - in that spot. This was made clear at the ITKC meeting with the NLH and Innu Nation Task Force in February 2007, when the shaking tent ceremony was explained to the NLH representatives. “My grandfather did his last shaking tent at Ushkan-shipiss. This will be under water. That’s why we have to protect the land, because our grandfathers used this area” (P7.7.2.07).

In the days before settlement, animist beliefs, rituals, and experiences with animal masters and other beings embedded core values around which much of Innu society was organized. Speaking about Barren Ground Innu life in the interior, Henriksen noted that “Mythology, ritual life, hunting, the rules of sharing, leadership, and prestige are interconnected in such a way as to give a consistent frame of reference for one’s choice of actions in the Barren Grounds” (1973:54). They combined to provide the context in which fundamental dilemmas in Innu society – sharing versus having, and interdependence versus autonomy – could be resolved. In contrast, life in the village with its alternative economic strategies and dependence on non-Innu institutions meant that these dilemmas could not be resolved easily, with envy, political strife, and other examples of lack of social cohesiveness the result (ibid.85-90). When the staples of life could be obtained through wage employment or social security payments, the need to maintain ongoing respectful relations with the animal masters ceased to be of great importance. This is why some older Innu say that in former days, people paid much more respect to animal masters, because it was a matter of life and death back then. One risked starvation if one did not pay due respect to animal masters. The Innu were even careful not to mention the names of the masters for fear of offending them.[105]

Nonetheless, despite profound changes in traditional beliefs, there are many Innu people in both Sheshatshiu and Natuashish who continue to have religious experiences of one kind or another both on the land and in their villages, including omens and encounters with spirit beings and other entities. This demonstrates that Innu religious expression is not a static, ossified lore, but a body of beliefs that continues to inspire the Innu imagination and inform behaviour, and will continue to evolve in the future.

There are many examples of the influence of Innu religious ideology in Innu discourses about Mishta-shipu and the potential impacts of hydro-electric development on the river. One of the most important ones relates to the *nutshimiu-natukun* (country medicine) found in plants and animals in the Mishta-shipu valley. A deeply rooted idea that healthy food, and healthy living depend on the consumption of medicine-containing animals and plants appears to permeate the thinking of older Innu, and this makes sense of their concerns about the "wasting" of the medicine in the Mishta-shipu valley through flooding. The idea that the power of *nutshimiu-natukun* may be weakened through industrial development, including "contamination" of water by methyl-mercury, is a correlate of this concern about wasting. Furthermore, the strong possibility that animals will drown or in some other way be hurt as a result of hydro development may well offend the core values of traditionally-minded Innu related to respecting animal masters and the animals they control.

The hint of retribution as a result of disrespect was suggested in two ways by ITKC members, and both point to the idea that future environmental impacts may be compounded by non-human agents. In the first case, one of the ITKC members spoke of the commercial horse-logging operation at Mud Lake that dates back about 100 years.[106] The non-Innu loggers left many logs behind, which drifted ashore, and piled up, creating a big mess. The man in charge of the operation died of sickness upon his return home. According to an ITKC member, "The man who did the work did a lot of damage from clearcutting. The person who damages the trees without a purpose, it's like the trees killed him. That's history. I don't want this to be repeated" (P3.7.02.07).

The second case has been mentioned in passing at a number of places in the report so far. This relates to the large, otter or seal-like creature known as *uenitshikumishiteu*. The animal is classified in the *manitush* (malevolent animal) category and is controlled by *Missinak^{u}*, the master of aquatic species. For older Innu, it is as real as any other animal, and they adduce empirical evidence

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[105] P. Armitage *Tshishennuat* consultation in Natuashish concerning objects of religious significance, 1 April 2004.

[106] This is a reference to the commercial logging operation at Mud Lake by Dickie Lumber Company from Nova Scotia, in the period 1901-1910.

including eye-witness accounts, to support their propositions related to it. For this reason, including the animal in this discussion of Innu religious ideology does a certain disservice to their belief system, one in which no distinctions are made between the sacred and the profane, between religious and non-religious thought.

ITKC members said that *uenitshikumishiteu* live under the hill at Muskrat Falls called Manitu-utshu. In fact, the hill is so-named because of this animal; the toponym means 'evil creature mountain'. The hill is like a *uisht* (beaver lodge) and the entranceway is under the water. *Uenitshikumishiteu* can be very dangerous creatures and will attack people if they have been threatened or harmed in some way.[107] They can travel through the ground in the same way that a fish swims through the water, and they are thought to eat seals, of which large numbers used to congregate just below the falls. Innu once found seal bones by a shallow pond that was located at the top of Manitu-utshu. One ITKC member said he had visited the top of the hill in recent years and noted that the pond is no longer there. He thinks that it was drained by White people. One was seen on an ice-pan just downstream of Muskrat Falls by the father of one committee member. Another committee member was an actual eye-witness having seen a *uenitshikumishiteu* in the Manitu-utshu area. It was orange/yellow in colour. Shenum Pone saw four of them on one occasion, and Shimiu Pastitshi Jr. saw one on the smooth rocks at the side of the stretch of flat water between the two sets of falls at Muskrat Falls. Ishpashtien Nuna Sr. saw *uenitshikumishiteu* tracks in this area as well. Innu have also seen the tracks of *uenitshikumishiteu* along the shore in the cove on the north side of Mishta-shipu, just past Muskrat Falls. In addition, the animal has been seen a Netaukau (Sandy Point), and one of more of them is believed to have grabbed hold of a Settler's log boom on Kakatshu-utshishtun (Grand Lake) (P1, P2, P3, P7.24.1.07).

"Like any animal that can travel through the water, *uenitshikumishiteu* can travel through the ground. Once two men were hunting, and one of them killed a young *uenitshikumishiteu* whereupon the water started to bubble. The hunters took off. They could see the ground moving like water towards them. The one who shot the *uenitshikumishiteu* was killed, and his buddy heard him screaming. The fellow who hadn't shot the being wasn't bothered" (P2.24.1.07). "We have all heard this story about *uenitshikumishiteu* from the old people. It is very dangerous" (P1.24.1.07).

Uenitshikumishiteu appears in the lexicon of Innu from others parts of the Quebec-Labrador peninsula. Unaman-shipu (La Romaine) Innu were familiar

[107] One of the ITKC members said that one should not harm any strange-looking animal in principle. "When I grew up in the country, older Innu told me never to shoot at an animal if it looked unusual or it could kill me. I was always warned about this. So I took a good look at the animal before I shot" (P6.24.1.07).

with the animal when I discussed it with them in June 2006, and Clément listed it as an unidentified type of *nitshik*[u] (otter) in his *aueshish* (animal) taxonomy based on interviews with Innu from Ekuanitshu (Mingan) (1995:447). However, the first written account of the animal is from William Duncan Strong's fieldwork in the Utshimassit (Davis Inlet) area in the late 1920s.

> Two old men of the Davis Inlet band claimed to have seen one of these animals, called *wen-tsúk-ah-més-e-téy-oh*, in Seal Lake (on the Nauscaupee, not the Little Whale River drainage). The body was said to be blackish brown with white lower legs and feet, large ears, and the animal was of great size. It whistled *wheú-u-u*, on a low note, very much like the call of a quail, or so the Indians' rendition of the call sounded. This animal has not been seen for many years, but an old story tells of an Indian who killed the young of this species and was pursued by the mother otter who could swim under land as well as water. According to the story, she killed the man who destroyed her young, but his companion escaped to tell about it (Strong, 1930:9-10).

The fact that the "*uisht*" (lodge, dwelling-place) of *uenitshikumishiteu* is in Manitu-utshu was of special concern to the ITKC members because of the construction work proposed for the location. One end of the Muskrat Falls dam will be secured to it, and an access road and diversion tunnel will be built there. Committee members are concerned that the construction work will be disrespectful to *uenitshikumishiteu*. "I'm afraid that they might get mad and destroy the dam," said one person (P1.24.1.07). "It was never disturbed in the past, but it will be disturbed by construction," said another person (P2, 24.1.07). The concensus seemed to be that "*uenitshikumishiteu* won't let the project happen. If you don't touch the hill, destroy it, *uenitshikumishiteu* won't get mad" (P1, P2, P3.24.1.07). When asked directly, the committee members were unwilling to contemplate, or could not think of, any mitigation measures that would prevent *uenitshikumishiteu* from getting angry.[108]

12. Conclusions

There is little doubt that more focused research using thorough ethnoscientific and other methods would add considerably to the TEK presented in this report, and would explore regional differences between the environmental knowledge of Sheshatshiu Innu versus their relatives on the Quebec North Shore for whom extensive ethnobotanical and zoological information has been obtained (see

[108] I note a parallel reported by Tanner (2007) for the James Bay Cree. "I was conducting research with several Cree youth and elders in an area about to be flooded by a hydroelectric reservoir. I was told about a water monster that is reputed to live in the vicinity of the rapids where the dam was to be constructed. During this conversation I was asked if I thought the hydroelectric project would be stopped by Hydro-Quebec if, during construction, the engineers were to discover clear evidence of the existence of the creature in question. However, this could also be interpreted as one of many Cree stories that make it a point to challenge the White Man's well-known skepticism about their spiritual beliefs."

Clément, 1995, 1991; Bouchard and Mailhot, 1973) A thorough research program would involve a year or more of interviewing knowledgeable Innu, field trips to investigate Innu botanical, geographic and zoological concepts such as *ushakatik*ᵘ ('where there is always caribou'), and the field collection of species for the purpose of rigorous identification, and anatomical examination. An interdisciplinary team consisting of an ethnographer, with significant input from a zoologist, botanist, ecologist, and linguist working closely with Innu experts would be in the best position to obtain detailed TEK data and elicit Innu concepts about the land and its biota.

As pointed out previously, the ITKC process is by design a distillation of Innu knowledge about the environment with a particular focus on the Mishta-shipu area.[109] Furthermore, one of the goals of the Innu Nation and NLH in commissioning the ITKC is presumably to provide a vehicle for the Innu to have input into the environmental science of the assessment of the impacts of the hydro project. The assessment process is designed and controlled by people trained in western biological sciences with little experience in integrating TEK into their research designs. The question is, then, can the environmental knowledge and impact discourses presented in this report can play any role in the environmental assessment of the Project? For example, can they help identify vulnerable or rare species, assist in the formulation of testable impact hypotheses, or facilitate impact mitigation in some way?

Ultimately, such matters may best be addressed by the people tasked to conduct the biophysical impact assessment of the Project. Their interrogation of this report with the view to designing new field studies, comparing the results of existing studies with Innu knowledge, and developing testable hypotheses related to impact assessment and mitigation would hopefully be a productive exercise.

Although a comparison of Innu environmental knowledge and that derived from western scientific methods is beyond the mandate of the ITKC as noted previously, I would like to "kick-start" this interrogation by pointing to a number of potentially "useful" observations and propositions provided by ITKC members.[110]

- With respect to the identification of rare species, ITKC members said that they had identified *assiuashik*ᵘ (Canadian yew, *Taxus Canadensis* March) on a small island just upstream of Tshiashku-nipi (Gull Island). This information is no

[109] Nadasdy's critique of the compartmentalization of TEK gives us reason to reflect upon the nature of this enterprise. "The imperative of incorporating TEK into the state management system has caused researchers to focus on extracting from communities only that kind of information which can be expressed in a few very specific ways – that is, in forms that can be utilized within the institutional framework of scientific resource management, such as numbers and lines on maps contained in reports, books, and other written documents – and then to interpret it in a manner consistent with the assumptions of scientific wildlife management" (1999:9).
[110] "Useful" according to my criteria and biases. Biologists may well interrogate this report using different criteria.

longer novel because botanists conducting baseline data collection for NLH in relation to Project also found the species at this location. Is this the only known location of *assiuashik*^{u} in Labrador, and can the plants located on *Assiuashiku-minishtik*^{u} be transplanted as requested by one of the ITKC members?

- A number of “hotspots” were identified by ITKC members along Mishta-shipu where concentrations of various animal species were identified. *Amishk*^{u} (beaver) lodges were identified near the mouths of some of Mishta-shipu’s tributaries, and in small, protected channels along the main course of the river. Some of the ITKC members suggested that beaver would be able to escape the flooding and find alternative habitat, however, this may not be possible if the flooding occurs during the winter when the beaver are fully committed to their lodges and their winter food supply is under the ice. Can beaver be transplanted to productive habitat outside of the flood zone, and can the timing of the flooding be controlled in such a way to allow beaver to escape inundation and thereby reduce their mortality?
- Other denning animals such as *mashk*^{u} (black bear) and *utshashk*^{u} (muskrat) face the same predicament as *amishk*^{u} (beaver), and the same questions arise. Can they be transplanted pre-flooding, and can the flooding be controlled so as to give them time to establish dens and lodges in safe locations?
- Spring-time *ashkui* (‘open water’) at the mouths of tributaries were identified as good waterfowl habitat in the spring. Will reservoir creation alter the location of these *ashkui* and the timing of their appearance, and if so with what impacts upon waterfowl populations?
- *Nitshik*^{u} (otter) and *atshikash* (mink) sometimes live in air pockets under the ice along the shores of the river and its tributaries. These air pockets constitute habitat. What effect will flooding have upon such habitat and the species that occupy them?
- Partridge, porcupine and other species eat fir, willow, berries and other vegetation that will be flooded when reservoir creation occurs, and hence these species will lose access to food. What is an obvious consequence of flooding to the ITKC members begs the question as to the “significance” of the loss of habitat and food sources for the existing populations of these animals within the Mishta-shipu valley.
- I noted that the ITKC members advanced a theory concerning the transmission of *natukun* (medicine) or medicinal properties from one species to another. Trees, berries, and other things that grow in the earth contain *natukun*. Animals including the beaver and otter eat these things that grow from the land and so they contain *natukun* as well. Humans eat medicines directly in the form of berries and medicinal concoctions, but also by consuming animals and fish that contain medicinal properties. Surely, this theory invites us to remember the fact that the biota of the Mishta-shipu valley are part of an ecological community, and that the impacts of flooding must consider this community and the relationships among its members.

In conclusion, it is important to remember that the knowledge shared by ITKC members concerning the biota of Mishta-shipu as well as their propositions concerning the potential impacts of the hydro project are embedded within a knowledge structure and value system that is itself embedded or overlaps with their religious ideology. Tanner (2007) has noted the same with respect to the James Bay Cree. “Alongside pragmatic empirically-based knowledge about animals, explanations of environmental events can involve prophecies, divination, and the actions of spirits.” Thus, core values of respect for animal masters and the species they control, belief in the sentience of various animal species, and concerns about “wasting” *nutshimiu-natukun* (‘country medicine’) all derive from a broader, religious worldview. Taking these values and beliefs into account in planning and building the Project, for example, by attempting to design the project in a “respectful” way, according to Innu ideas of respect, or by mitigating project impacts in a way that is meaningful to the Innu in a framework of “respect,” could help some Innu comes to terms with what is currently an unacceptable, yet inevitable project in their minds.

Finally, Labrador Innu have a history with hydro-electric projects in their territory, and it is not a pleasant one as far as older Innu are concerned. The damming of Meshikamau-shipu (Naskaupi River), Kainipeshiu-shipu (Kanairiktok River), and Mishta-shipu (Churchill River) and with this the flooding of Meshikamau (Michikamau Lake) and other lakes on the Labrador plateau have left a legacy that informs current Innu thinking about the potential impacts of the Project. This is a legacy that both NLH and the Innu Nation must acknowledge in communicating with the Innu population at large about the environmental assessment of the Project, and planning meaningful mitigation measures to minimize project impacts.

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Appendix 1. Terms of Reference for the Innu Traditional Knowledge Committee

8.1 Purpose

The Parties will work cooperatively to document and appropriately incorporate Innu Traditional Knowledge in the environmental assessment of the Potential Development. The objective is to develop an understanding of the environment and the potential effects of the Potential Development that is informed by both western science and traditional knowledge, and to promote a dialogue between both systems that is based on communication, cooperation and mutual respect.

To facilitate this, an *Innu Traditional Knowledge Committee* (ITKC) will be established, which will serve as the primary mechanism through which Innu Traditional Knowledge will be documented, shared and discussed.

8.2 Composition

The ITKC will function as an adjunct to the Task Force, working separately but parallel to it with linkages and interaction between the two groups as required and appropriate.

The ITKC will be comprised of 4-6 Innu Elders who are respected as authorities on Innu Traditional Knowledge, as identified by Innu Nation. Other individuals within the Innu communities will also be consulted as required and at the discretion of Innu Nation. The ITKC will be assisted by a qualified and experienced Facilitator / Researcher to be jointly agreed to by the Parties, who will coordinate its work and be responsible for documenting and reporting on the process and its results.

Innu Nation and Newfoundland and Labrador Hydro Task Force representatives, while not formally serving as members of the ITKC, will attend meetings and discussions as required and appropriate to provide project and other information directly and to answer questions.

8.3 Mandate

The ITKC shall discuss, document and provide the following information to the Parties through the Task Force:

an Innu knowledge-based description of the key ecological, historical and cultural features of the project area;

- information on how Innu use this environment;
- comments on the environmental studies that have been and will be undertaken for the environmental assessment;
- perspectives on how the Potential Development may affect those components of the environment that are most valued by Innu; and
- comments on potential mitigation measures and their effectiveness, and on any likely residual environmental effects.

8.4 Information and Reporting

The ITKC will meet regularly, and the Facilitator / Researcher will provide regular status updates and reports on the above subjects to the Parties, according to a work plan and schedule to be agreed upon by the Parties pursuant to sub-section 1.4 of this Process Agreement.

The focus of the ITKC will be on documenting Innu Traditional Knowledge relevant to the environmental assessment. It is recognized that this information exchange must begin early and occur regularly, in order to ensure that it can be considered and incorporated in an effective and efficient manner prior to the finalization of the environmental assessment.

Intellectual property rights to Innu Traditional Knowledge shall reside with Innu Nation. The ITKC will make recommendations to the Parties concerning what elements of the Innu Traditional Knowledge documented by the ITKC may be directly incorporated into the public environmental assessment process. Innu Traditional Knowledge will be made public only in accordance with a Traditional Knowledge Protocol, which will be developed for the Parties by the Task Force pursuant to sub-section 1.4 of this Process Agreement. Innu Traditional Knowledge documented by the ITKC and discussed with the Task Force shall otherwise remain confidential. It is recognized that any such confidential information, while not cited directly in the environmental assessment, may be drawn upon through the Task Force discussions and taken into consideration in the environmental assessment as appropriate and agreed.

The ITKC will work closely with Innu Nation’s community consultation team, and will prepare and present a summary of its work to the Innu communities for input prior to the finalization of the environmental assessment. The Parties will also jointly prepare and present a summary of this process and its results as part of any eventual public hearings conducted during the environmental assessment of the Potential Development.

It is also recognized that an important role of the Innu Community Representative(s) on the Task Force is to consult with the ITKC and the Innu communities on the environmental and technical work being conducted in relation to the Potential Development, and to bring this information and perspective to the Task Force discussions.

Appendix 2. Analysis of Innu impact discourses

The Innu-aimun in these texts has been edited to a minimal extent, meaning that little effort has been made to apply the rules of the new spelling system (standard orthography) to the text. My intent has been to analyze the way in which propositions are presented by Innu speakers as they pertain to hydro project impacts. Therefore, "correcting" the spelling of Innu terms was undertaken only when misspellings corrupted the meaning of terms. The assistance of linguist Marguerite MacKenzie in conducting this analysis has been indispensable.

P3, excerpt5dec2006-1.mp3, CD1, T1

In this text, the speaker uses a conjunct future marker - *tshe* (will) - to predict the impacts of the damming and associated flooding. The speaker is certain about these impacts. There is no conditional or any other qualification applied. There WILL be the same effects as those that resulted from the Churchill Falls project.

Nishuau natuatshipaimut, tshia?
They make two closings right?

mak nishuau pimu ushkutam.
and there are two dams.

Muk-ma ne tshititinau,
Like I am saying

eukun-a miam ne <u>tshe</u> ishinakuak ne
it will be the same for
[*tshe* - will - is the future marker. Conjunct future]

nete issishuetau nete Mishta-paushtikut.
in let's say Churchill Falls.
Nenua mak shipua ka pakuaui-na
The rivers there are dry - dried up.

E-ua nete <u>tshe</u> ishinakuak?
Is this going to be the same effect too?
[*tshe* - will - future marker]

Ishe uatenauatshe nete ut meshkanau
You have seen passing, driving on the road

Nas <u>ka</u>-<u>p</u>akuaui tshia?
The river is dry - dried up, right?
[*ka-p* is a present relative clause, subjective, it appears to be]

Meshek^{u} ne ashini
All there is, is only rock

ute pet ka-akuatinaua Mishta-Paushtukut
in the area - Churchill Falls.
[*ka-a* is a present relative clause, subjective, it appears to be]

mak ume Twin Falls kaishinikateu-a.
also here in Twin Falls, they call it.

Nas-en pakuau iat.
It is dry there too.
[certain fact]

Eku nete tshepaikanitshi shipu, tshisseniten-a?
Now the closing of a river, you know

E-ua nete tshe ishinakushit mishtukut name ishpish nassipet
Are the trees going to be like that too, after the flooding
[*tshe* - will - future marker]

miam ne kaishinakushutshe Mishta-paushtikut katshipaikanua etapit mishtukut?
just like what happened to them at Churchill Falls the trees?

E-ua tshe itepit iat netshe mishtukut?
Will they be like that too, the trees?
[*tshe* - will - future marker]

P3, excerpt5dec2006-2.mp3, CD1, T2

In this narrative, the speaker makes a solid prediction about the flow of the water on Mishta-shipu using the analogy of beaver dam building. The future marker - *tshe* (will) is used without any qualification.

P6 - Eku ne nimushum P3 ka itan.
Okay, my grandfather P3.

Tshe nashtuten-a ne ka itan ne sheni kanitshe Tshiashkueshit
Do you understand that when Tshiashku-nipi (Gull Islands) opens (the Project)

tshe tshpish nashkunikanit ne nipi-a
the water will be let low
[*tshe* - will - future marker]

P3 - Miam nipa niteniten ne eshi tutak amishk^{u}, tshia?
It will be just like when a beaver makes its dam, right?

[*nipa* or *tshipa* - a marker of a potential situation, as in "it may be," "I suppose"]

Mate nitipaimuan nenu amishk^{u}.
I look at it just like the beaver.

Tipashkunikanitshe mate apu tshe tshi pashtupet.
It closes its dam so the water cannot go over it (dam).
[*nitshe* - marker for deduction. The speaker is certain about his statement]

Tanite tshika takun nete uet pimipanit nipi
Because it will let the water flow out
[*tshika* - future marker]

Nikakakuepinu iat tshia?
[unable to translate]

eukun uet tanite uet pimipanit nipi.
that's why the water can run through it.

Ishipaikanitshi tapue tshe papinit minuat nipi
If it closes the water will run in, of course
[the '*i*' at the end of *ishpipaikanitshi* means 'if/when', subjunctive mode, suggests an uncertain future, unrealized action or event; *tshe* – will – future marker]

Kie peikun iat eukun tshe ishpanit ume Manitu-utshu.
This is the same thing that will happen at Muskrat Falls.[111]
[*tshe* - will - future marker]

P5 and P6, excerpt5dec2006-3.mp3, CD1, T3

In this excerpt, the speaker presents a very solid, definite prediction about project impacts using the future markers, tshe (will), and tshikut (be able to).

P6 - Ne iat tshe ishinakuak Mishta-shipu tshe ui kuetshimitinau in, nassipepitakantshi
If you have any questions what it will be like when it is flooded like Mishta-shipu
[*tshe* - will - future marker]

P5 - Eukun nipa-iat tshe ishinakuak
The same thing will happen
[*tshe* - will - future marker]

Apu tshikut tshi nita tshi apashtaiak ne ka itapashtaiak.
We will not be able to use it like we used to.

[111] Even though the name Manitu-utshu applies to the hill beside the falls, Innu also use this place name to refer to the falls at Muskrat Falls.

[*tshikut* - to be able, apu is the negative]

Eku tshipa nassipeu nipi.
The water body will most likely flood.
[*tshipa* - marks a potential situation, i.e. most likely to be flooding]

Nutam ka takuak nete tshekuan apu tshikut nita takuak minuat.
What was there before we will never be able to use it again.
[*tshikut* – will be able, apu is the negative, nita - never]

Kassinu tshekuan apu tshikut tshi mitshinanut.
People will not be able to eat what is there.
[*tshikut* - to be able, apu is the negative

P5 and P6, excerpt5dec2006-4.mp3, CD1, T4

In this excerpt, the speaker expresses no doubt about the negative effects of the flooding. We see the use of the term *minushit* (good). Words containing *minu* are related to the quality of goodness, and throughout much of the discourse concerning project impacts, water, land, animals, fish and other qualities of the landscape are described as being "good" or "not good." The term *akushu* (s/he is sick) is used in relate to the state of animals to be affected by the project.

P6 - Ne ka tshetissishuenau, tshia, tshituk
Like you said before, right, he says

tshi nassipepatakanitshi apu tshikut minushit namesh.
after flooding, the fish will not be good.
[*tshi* in combination with the *-i* at the end of *nassipepatakanitshi* means 'when x will be completed. *tshikut* - to be able, *apu* - negative]

Ka-tshitissishuenau, tshia?
Like you said, right?

Tshekuan ne essishuein, tshituk?
What do you mean when you say this, he says?

Tshekuanu uet tshika ut minushit iteu?
Why won't it be any good?
['it' is an animate pronoun, as in fish; words containing *minu* are related to the quality of goodness, good]

P5 - Mitshu nenu kapiuaputeua tshekuanu nete nipit
It eats what is dispersed in the water,
[*piuaputeu* - it is dispersed by the current]

e-uinnakuak, eukunu nenu miatshit
the dirt, it eats that
[*uinnakuan*, intransitive inanimate verb - it is dirty, something inanimate]

nete e-uinnakunit tshekuanu
the dirty thing in it

P5 - kue akushishkakut nenu
then it makes it sick

eku apu tapuetakanit tshe tshi muakanit.
then it is not allowed to be eaten.
['it' is animate referring to fish]

P3, excerpt5dec2006-5.mp3, CD1, T5

In this excerpt, the speaker asserts without a doubt that fish in rivers subject to hydro development are "not good," and deduces that fish in water bodies elsewhere in the territory are good because there are no hydro dams there.

Mate, mate ne namesh-tshia
For instance, the fish right.

namesh apu minushit umuenu shipunu.
the fish is not good on this river.
[very certain statement - fact]

Patush nenua ka-aishpanui shipua nete nutshimit
Only those other rivers that are in the country

nete katat shashish nameshit, matimekut mate ne Minai-nipit.
the fish (is good there because) it has been there a long time, trout for instance at Minai-nipit (Minipi Lake).

Shashish nenu katat ka kusset.
People fished there before.

Ka nutshikuat Tshishe-utshimau iat namesha
The fishery officers from the government

ne kanutameshet Katshimaitsheshu-a
one of the officers was Katshimaitsheshu
[Katshimaitsheshu is the Innu name for Mr. Cooper]

Katshimaitsheshu-a tan etatapuna mak nete etat e-nutshikuat nenu namesha?
Katshimaitsheshu how many years was he there looking after the fish?

Eku itenimekupan, apu senimat neu Innut
He must have thought that the Innu had no knowledge of what
[*kupan* - marks past tense deduction]

shash nenu Innu tshissenimepanit, tshia?
but the Innu knew about it, right?

Kie umue Uapishkakamau iat umuenu taut matimekut
Also, there are trout at Uapishkakamau.

Kie nenu Mitshishu-utshishtun, iat nenu taut matimekut.
Also at Mitshishu-utshishtun, there are trout there too.

Kie nenu Anikutshash-nipi, iat nenu taut matimekut.
And at Anikutshash-nipi, there are trout there too.

Kie makatsheuat, mikuasheuat.
Also white sucker, longnose sucker.

Ekute anite muk minushitshe aueshish, tshia?
Some places the animals must still be good, right?
[-*tshe* suffix marks deduction; must be, probably/may be]

Namesh nipauin, tshia?
Especially the fish, right?

Minushitshe nete uin eka tshipaikanit uin.
They must be good there because there are no dams over there.
[-*tshe* suffix marks deduction; must be, probably/may be]

P1 and P6, excerpt5dec2006-6.mp3, CD1, T6

In this excerpt, the speaker starts with a more speculative assessment of project impacts on black bear, marking his uncertainty with the non-affirmative, uncertain modal – *tshipa tshi*. He has arrived at a conclusion as a result of speculation, so that conclusion is a possibility, not an absolute certainty. However, he then moves into the solid prediction mode. Bears and geese WILL move to higher ground.

P6 - Eku tan tshe ishinakuak tshi nassipitakanitshi, tshituk?
What impacts will do to animals after the flooding, he says?
[*tshe* - will - future marker]

P1 - Tshipa tshi tau mashk^{u} uin, tshipa tshi mitshu nete minashkuat.

The black bear may still be there, it may be able to go in the forest and get its food there.
[tshipa tshi - uncertain, speculative modality]

P6 - Eku tan tshe tit anitshe nishkat, tshituk?
What will happen to the geese, he says?
[tshe - will - future marker]

Nete man kaishpanutshe, katautshe nete nishkat, tshia,
When the geese would fly to where they were before, right,
[*man* - would, repetitive action; -*tshe* suffix on *kaishpanutshe* marks deduction]

shiakunitshi kie mak tekuatshinitshi
in the spring or fall?
[-*I* suffix on the end of *shiakunitshi* marks an unrealized action, as in when it will be spring]

Tan tshe tit tshituk, nishkat?
What will happen to the geese, he says?
[*tshe* - will - future marker]

P1 - It nipa tshika taut, tshia, nete ishpimit itetshe
They will go in another direction, right, in the upper land
[*tshika taut* - they will be]

nete nipissa kai-takunui, tshika ishpanut.
where there are small lakes and that is where they will go.
[*tshika* - future marker]

P6 - Tan tshe tit anitshe ushakashk^{u} nassipenitshi, tshituk?
What will happen to places where there are always black bears when flooding takes place, he says?
[*tshe* - will - future marker, *ushakashk*^{u} - place where there are always black bears]

P1 - Minashkuat nete tshika taut, pashtuteut, takut nete tshika it [rest of word illegible].
In the forest, they will go on top, they will stay on top.
[*tshika taut* - they will be]

P3, excerpt5dec2006-7.mp3, CD1, T7

In this excerpt, the speaker asserts that beavers will move up tributaries to Mishta-shipu to escape flooding, but he is uncertain about whether these tributaries will be blocked off as a result of the project. He is certain that the beavers will no longer be found on Mishta-shipu.

Umue issishuenanu tshisseniten, tshia,
What we are saying here, right,

Mishta mitshenua neta-she ka amitshueshkasht, tshia?
There are many of them in the upper area, right?
[“them” refers to beaver places as will be apparent shortly]

Neta-she takun peik, tshia, Manitu-utshit akutuessinu ekuata etakuak peik
There is one, right, at Manitu-utshit the one

minuat nete ka matshiteuatauakaua
another one is at the sandy point

eukunen, tshia?
right there, right?

Minuat nete ka upeneukauaua
Another one is at shoreline.

Minuat takun ne ushakumishk^{u}.
Again there are the places where there are always beavers.

Minuat ka amitshueshkasht takun.
Another one is at along the river bed.

Minuat nete takun niteim shipissit, tshia?
Another one is at the small river, right?

Mak nete pekuteikanit tekuak
And another where there is a large depression

nuam nete tamatum ekute tekuak.
the others that are under water.

Mishta mitshet nekan ushakamishkua nete tamatum
There are many places where are always beaver underwater there.
[The speaker talks in the present tense, but the time period could be past, because once past tense is used at the beginning of a discourse, a speaker can shift tense to the present. English speakers employ this style as well in using the simple present in vivid narratives (e.g. “There’s a loud bang behind us. Then I hear John crying. Nancy is upset....”).

Apu tshika tshi nita tshi tat.
They will never be there.
[*tshika* - future marker]

Nete tshika itashamu nitamit nenu shipissin.
They will go upwards north/upstream of the small river.
[*tshika* - future marker. The translator supplied "north" for *nitamit*, however, this term means "upstream." The speaker may mean that the beavers will move upstream small rivers that empty into Mishta-shipu until they reach higher elevations]

Minuat nete nitamit tshika tshipaim put
Again there upstream will be closed off perhaps
[*tshika* – future marker; put – perhaps]

kie nipissinu put.
and there is flooding perhaps.
[*put* – perhaps]

Muk nenu apu tshikut tat neta katat man.
They will never be there.
[*tshikut* – will be – future maker, *apu* – negative]

Nete iat apishish tshika ituteu,
There elsewhere a little bit they will go
[*tshika* – future marker]

nete nitamit itetshe tshe itutet.
there upstream they will go.
[*tshe* – future marker]

Tanite tshipa tshi tau neta
How could it be there
[*tshipa tshi* – uncertainty, speculation]

tamatum nenu tshika takunua ushakamishk^{u}?
that will all be underwater, places where there are always beaver?
[*tshika* – will – future marker]

P1, excerpt5dec2006-9.mp3, CD1, T9

Here, the speaker predicts the future with certainty. The partridge WILL no longer be there. The partridge's food, willow, WILL BE under water. The certainty of the prediction is expressed with future markers such as *tshikut tshi* (will be), and *tshika* (will).

P1 - Pineut mishta mitshetut tekuatshinitshi.
There are lots of partridge in the fall.

Nutam tamatum takunua shakau, tshia?
All the bushes [alder, willow] will be underwater, right?

Apu tshikut tshi tat nete uapineu.
The partridge will no longer be there.
[*tshikut tshi* – future marker, *apu* – negative]

Peter A. - Tanite?
Where?

P1 - Nete ka matshiteue shikaua - kamassiueukauaua
At the point bushs - where there is a marsh

nutam tamatum tshika takun, apu tshikut takuak.
all will be underwater, it will not be there.
[*tshika* – future marker, *apu* - negation]

Peter A. - Uapineu-mitshim?
Willows?

P1 - Ehe, uapineu-mitshim.
Yes, willows.

Mishtikut nete muk tshika taut iat
There will only be trees left there too.
[*tshika* – future marker – will be]

P6, excerpt5dec2006-10.mp3, CD1, T10

In this excerpt P6 speculates about the relationship between mercury, described as *matshi-natukun* (poison), and hair loss. Someone who consumes mercury MAY experience hair loss; it is not certain. He also frames his proposition as "opinion" (what he thinks), inviting, perhaps, contradictory or affirming opinions from others.

P6 - Nitautshin nete tshekuan, tshia?
Something grows from there, right?

Muk nameshit nenu mitshut, *mercury*.
Only the fish eat this, mercury.

Apu tshissenitaman nipa ishinikaten matshi-natukun put, tshia?
I don't know how to call it, poison perhaps, right?
[*put* – perhaps]

Eku nenu mitshet nenu Innu

If a person eats/consumes this

tan etutakutshe nenu, uashekapinitshe nenu put
that person can have a hair loss, perhaps.
[*nitshe* - marker for deduction; *put* – perhaps]

Nitenimau.
That is what I think.

P1, excerpt5dec2006-11.mp3, CD1, T11

The speaker makes solid predictions about the impacts of the hydro project. Everything will be under water, and everything will be ruined. There is no speculation or doubt about this prediction.

P1 - Issishuek ne tshekuan etenitamek tshitukunu, tshia?
Say something that you are thinking about, right?

Ne ma, tshi nassipitakanitshi tan etenitamek tshe ishinikuak name
After the flooding takes place what do you think will happen after
[*tshe* – will – future marker]

tshi nassipetakanitshi assi?
the flooding of the land?

Nete aiashkat tshe ishinakuak
What will happen in the future?
[*tshe* – will – future marker]

Miam ne P7 kaishi uauitamua.
Just like P7 said about it before.

Eukun ne tshe ishinakuak.
It is going to be just like that.
[*tshe* – will – future marker]

Kassinu tamatum tshika takun tshekuan.
Everything will be underwater.
[*tshika* – will be – future marker]

kassinu tshika nautin tshekuan.
everything will be ruined.
[*tshika* – will be – future marker]

Nete ka aitut aueshish, kassinu tamatum tshika takun.
And where the animals were, all will be underwater.

[*tshika* – will be – future marker]

Kie natukuna, kie minna
And the medicines, and berries

nutam nete takunua, kapimutauakuau.
they are all there, on top of this river.
[the translator said the “top of this river” refers to the “upper part.” Upstream?]

Nete shipit, tshia? Nutam nete takunua minna, tshia?
The river, right? There are all kinds of berries there, right?

Kie nete kaminashkuaua, apu takuaki nete minna
And in the forested area, there are no berries there

muk nenu ka kashteuaui takunua
except black berries only.

P1 and P6, excerpt5dec2006-12.mp3, CD1, T12

In this excerpt, we obtain some insight into the history of Innu concerns about “sickness,” “poisons” or “contaminants” in fish. The speaker had observed some fish sampling work in the context of the commercial whitefish fishery at Lobstick Lake in the late 1970s and early 1980s.[112]The speaker claims that he was told that the “fish are sick” and he speculates about the part of the fish where the sickness is located. He deduces (“I suppose”) the location of the “sickness” based on the part of the fish where the samples were taken from – the dorsal area.

P6 - Tshi uitamakuitau akushut namesh nete shashish ueshkat, tshituk?
Were you told the fish were sick, before, in the past, he says?

P1 - Ehe, nauitamakuitan, akushut namesh.
Yes, we were told, that the fish are sick.

Tshekuanitshe ne-ne, niupatinikuitan tshekuan, right?
What was it that was shown to us, right?

[112] “In cooperation with the Federal Dept. of Fisheries, the Project staff conducted some test fishing at Lobstick in July for the purposes of procuring samples for analysis at the Federal Fisheries Laboratories in St. John’s. The results of these analyses were satisfactory in terms of cyst counts but considered inconclusive because of the small number of specimens examined” (Report on Progress and Present Status of Michikamau Fisheries, LEAP Project 1975-1981, to John McGrath, Dept. of Rural, Agricultural and Northern Development, by Ben Andrew and Andrew Adam, Sheshatshit Band Council, July 2, 1981). In the summer of 1974, stomach samples were taken from various fish species at Lobstick and Sandgirt Lakes with the view to exploring the feasibility of a commercial gill net fishery (Bruce, 1975).

Ne atikamek^{u} uinamesheu ne Akaneshau.
The White person cleaned the white fish.

Ekute nete nianituapatamuat ushpishkunit nenu namesh, tshia?
He was looking at the back of the fish, right?

Tshe tshi takunit utakushim uiesh, right?
To see if it came from the back somewhere, right?

Eukuta nipa neta takunitshe namesh utakushun.
I suppose that is where the fish's sickness is located.
[*nipa* – I suppose (contracted expression); *-tshe* suffix – deduction]

P6 - Tshe tshissenimatau-a uet nanitussenimakanit ne namesh?
Did you know that he tested the fish?

P1 - Ehe, nissenimatan, nutshimaminan uapamepan.
Yes, we knew, our boss saw him too.

Kananituakapeusht ka ishinikatakanit, ka utshimamitutshit.
Kananituakapeusht was his name, our boss, then.

Nalcor Energy
Hydro Place. 500 Columbus Drive
P.O. Box 12800. St. John's. NL
Canada A1B 0C9

T. 709.737.1833 or 1.888.576.5454
F. 709.737.1985
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