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Tallurutiup Tariunga Inulik

Inuit Participation in Determining the Future of Lancaster Sound



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 Qikiqtani Inuit Association

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Impact and Benefit Agreement negotiations. Parties to the feasibility process are QIA, Parks Canada and the Government of Nunavut. This report has been written in an effort to reaffirm QIA's interest in supporting the creation of a Lancaster Sound NMCA. It is QIA's intention that this report should inform the feasibility process and contribute to interim management plan (IMP) development and Inuit Impact and Benefit Agreement (IIBA) negotiations.

2.0 Why Lancaster Sound?

Beginning in the late 1970's a series of events related to possible natural resource extraction demonstrated the complexity of relationships between natural and human environments within Lancaster Sound. Coming from these events, a series of public policy inquiries led by the federal government further examined the intricate considerations involved in the region, ultimately culminating in a Green Paper on Lancaster Sound (Dirschl 1982). The Green Paper concluded with the following six alternatives for the future use of the region;

- 1) No development of any kind, including park or conservation areas and renewable resource development;
- 2) Protection of the environment and biological resources through a strategy of matching conservation requirements with appropriate levels of protection;
- 3) Development of the renewable resource base that would support the long-term economic requirements of Inuit compatible with traditional pursuits;
- 4) Limiting industrial activities to shipping, such as development of the Northwest Passage as a year-round shipping route allowing Beaufort and high Arctic oil and gas to be transported to market;

- 5) Careful and planned balance of renewable and non-renewable resource development with regard to social and environmental impacts;
- 6) On the basis of national interests, non-renewable resource economy giving priority to the extraction and shipping of the region's hydrocarbon and mineral resources within the context of existing regulatory processes.

In 1986, Parks Canada commissioned a report titled, *A Biological, Geological, Oceanographic Study of the Lancaster/Eclipse Sound Region for the Purpose of Potential Marine Park Boundary Delineation* (Harper et al., 1986). As evident from the title, the report focused upon examination of the Lancaster Sound region for the purpose of identifying and justifying potential boundaries for a potential marine park. It is important to note the contents of the report were substantially weighted towards the physical and biological features of the region, with limited observation of Inuit cultural, occupancy or harvesting elements. The report concluded by providing a series of options outlining potential boundaries along the western, eastern and southern reaches of Lancaster Sound.

In 1989, a detailed assessment of the feasibility of establishing a proposed national marine park in the Lancaster Sound region was commissioned and focussed on the non-renewable resource potential of the region (Smith et al., 1989). The report was developed in order to assess a body of information for the purpose of determining whether or not to establish a park, and if so where to locate boundaries. Though the report presents a number of conclusions about the resource potential and recommendations about future resource assessment approaches, the final statement was that there was sufficient information regarding the natural resource base in the region for the government to take a position on a boundary associated with a Lancaster Sound marine park proposal.

Evolving from the foundation of the Green Paper, the Lancaster Sound Regional Land Use Plan (LSRLUP) (1991) was developed for the purpose of defining the principles, objectives, and actions to guide land use activities in the region. The LSRLUP was superseded by the North Baffin Regional Land Use Plan (NBRLUP) (2000), a document which further defines the broad planning principles for the region. Included in the NBRLUP are several distinct provisions related to conservation, including the establishment of a northern concept of conservation and its importance. The NBRLUP also attempts to provide a process through which the development of new conservation areas can occur. Perhaps most importantly, the LSRLUP and the NBRLUP both recognize and affirm Lancaster Sound's interrelated environmental and sociocultural significance.

3.0 Current Context

On December 8, 2009 the QIA, the Government of Nunavut (GN) and Parks Canada (PC) signed a Memorandum of Understanding (MOU) to examine the desirability and feasibility of establishing a NMCA in the Lancaster Sound marine region. One of the features of the MOU is the provision that the federal government fund the participation of QIA through the process of NMCA creation..

In December 2010, following extensive internal discussions the federal Ministers of Environment, Natural Resources, Aboriginal Affairs and Northern Development and Health Canada announced a federal boundary proposal for the Lancaster Sound NMCA. Compared to previous federal boundary proposals the 2010 announcement is the most expansive. **Appendix B** of this report presents a series of federal boundary options, current boundary proposal as well as existing petroleum rights.

The December 2010 federal boundary proposal was released with a renewed commitment by the federal government to work towards the creation of a NMCA in Lancaster Sound. The federal government

also confirmed that oil and gas exploration would not occur within the proposed Lancaster Sound NMCA area, nor within the final boundary as determined through the establishment process.

In order to support QIA's activities related to the feasibility study, QIA and PC will sign a Contribution Agreement. Monies under the contribution agreement will be used to hire a project coordinator, cover the cost of travel, and meetings with local committees. QIA, GN and PC have established a Project Steering Committee which has developed a Terms of Reference and discussed project timelines.

It is anticipated the Lancaster Sound NMCA feasibility study will be concluded by December 2012 or early in 2013. The feasibility study requires that a boundary be recommended after appropriate studies are undertaken.

4.0 Boundary Selection Process

Defining a boundary is a key consideration in the establishment of a NMCA and a requirement of the feasibility process. Boundary selection requires consideration of several features such as; well-being and interests of communities, traditional ecological knowledge, ecologically sustainable use of living marine resources and mineral and energy potential.

As part of the feasibility process the federal government is updating a previous a Mineral and Energy Resource Assessment (MERA) to document the energy resource potential associated within the proposed conservation area. This review is being conducted within the boundaries defined in the most recent federal announcement. No new seismic or other information is being collected to complete the updated energy and resource potential assessment. Instead, the assessment is based on applying modern analytical methods to seismic information collected decades ago.

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The evolution of conservation planning in Lancaster Sound has resulted in a number of boundary options. Previous boundary options have primarily been weighted upon physical geography, biology and resource potential, but QIA hopes to arrive at a boundary that will include consideration for Inuit occupancy and conservation preferences. In an effort to further the feasibility study process, QIA has assembled a collection of maps derived from QIA's Inuit Qaujimajatuqangit database (see **Appendix A**). The maps provide direct insight into how Tallurutiup Tariunga has been, and continues to be used by Inuit. These maps and others will be used by QIA during the feasibility process to document with community members current land use practices. Community mapping sessions and discussions will be used by QIA to help determine where the boundaries for the Lancaster Sound NMCA should be placed.

QIA is also aware there has been a great deal of marine mammal science undertaken since the last comprehensive report by the federal government. Knowing the value of this information as it relates to natural resource evaluations, QIA has prepared a basic overview of recent species specific research (see **Appendix C**). It is QIA's ambition to see this research applied to the feasibility processes and final boundary selection.

5.0 Boundary Considerations

Although the federal government announced a proposed boundary for the Lancaster Sound NMCA in December 2010, it is important that it be understood as a proposal, subject to further refinement during the feasibility process. The federal boundary proposal should also be understood as one of the most extensive conservation area proposals ever presented for this Lancaster Sound region.

Before determining the final boundaries, there are some key factors to consider. A final NMCA boundary requires community consultations as well

as information from a number of key sources including Inuit Qaujimajatuqangit, biological sources, geographical considerations and mineral and resource potential. Given the historical and recent attention placed on better understanding Lancaster Sound, it is reasonable to assume many of the informational requirements associated with feasibility study determinations have already been fulfilled and are regional in nature.

Even though federal authorities concluded that no additional information collection would be required to properly assess the energy potential of the study area, the current energy review has been limited to the area within the December 2010 federal boundary proposal announcement. It is important to note that while many of the information sources contributing to the feasibility study are amendable to changes in boundary proposals, the energy assessment results may not be as flexible.

It is important to recognize that the boundaries put forth in a feasibility study can be subject to alteration. Although the feasibility process requires a boundary be selected, once created the *Act* allows for future expansion of a NMCA where supported by necessary studies and agreements. Additionally, the *Act* also allows for reductions from the boundary area based on consent from Parliament. Finally, a condition of NMCA creation is that ownership of all areas reside with the Crown, meaning a NMCA can only contain areas to which there are no third party rights.

The *Act* requires that the conservation area include zones within the boundaries, which must include at least one zone that fosters and encourages sustainable use of marine resources and at least one zone that fully protects special features or sensitive elements of ecosystems. The conservation area may also include other types of zones. The requirement for agreed upon zones is an element that will require significant contemplation and input by Inuit within the boundaries.

6.0 Beyond Project Feasibility

Once the feasibility study for a NMCA is complete (including boundary selection), the President of QIA and federal and territorial ministers will review the feasibility study results for the purpose of determining whether to formally recommend NMCA establishment. If all parties recommend NMCA establishment, the project will move ahead into interim management plan (IMP) development and IIBA negotiations.

An IMP is a tool that will define the NMCA goals and objectives from an operational perspective. The IMP is likely to contain the following elements; park purpose, park vision, management principles, interim goals, interim zoning, and strategic operational actions. It is anticipated that elements of this plan will be considerably informed by and developed during the feasibility process.

As required by Article 8 of the Nunavut Land Claims Agreement, prior to establishment a NMCA requires the ratification of an IIBA. Included in an IIBA are features such as: training, hiring, scholarships, business opportunities, language, access to services and facilities, outpost camps, and active information flow. Although a NMCA currently does not exist in Nunavut, there is considerable experience in the areas of national park management and IIBA implementation. It is anticipated negotiations will draw from current experiences with IIBAs negotiated in relation to national parks.

Recently, QIA and Parks Canada hired a consultant to prepare the following report: *7-Year Independent Evaluation of the Inuit Impact and Benefit Agreement for Auyuittuq, Quttinnirpaaq and Sirmilik National Parks ("7-Year Independent Evaluation")*. The *7-Year Independent Evaluation* concluded that:

1. Parties revisit the entire approach to the Joint Park Management Committee Secretariat, particularly in light of a possible additional IIBA's in the near future.
2. Additional capacity needs to handle National Park related responsibilities and provide required support.
3. Expectations for implementation have to be tied to objectives in the IIBA. In other words, there should be a mind-set among partners to reach the highest level of implementation standards, not the lowest. This is particularly important regarding park management and business planning.
4. Employment of Inuit must be improved. Right now, there are few Inuit in scientific and professional positions and a few only in technical roles.
5. The process of implementation has generally resulted in good working relationships between the parties and the communities. This experience should help in allowing the parties to look at challenges and on-going problems in a constructive way.

It is QIA's perspective that once IIBA discussions in relation to the NMCA are initiated, the content and conclusions of the *7-Year Independent Evaluation* will need to be taken into consideration. The challenge for this portion of NMCA establishment will be the degree to which parties are able to address previous IIBA implementation shortcomings.

7.0 Conclusion

Though long a homeland to Inuit, Tallurutiup Tariunga has often been the subject of intense debate over how to best plan for the future of this region. The proposed Lancaster Sound NMCA arrives at a time of increased awareness over the Arctic, often framed in the order of sovereignty, environment, and Inuit.

As **Appendices A, B and C** will demonstrate, Tallurutiup Tariunga is home to an abundance of species that frequent the area, often seasonally, in high densities. Protection of this area through the establishment of a NMCA would be a significant step forwards in acknowledging the significance of this region to Inuit, while also reducing known threats to the species that inhabit these waters.

As the report demonstrates, boundary lines alone will not result in a comprehensive approach to conservation. Lancaster Sound is a representative area with uniquely high concentrations of species, which also coincides with known physical and geographical features within an Inuit homeland. True conservation of this area requires a cooperative management approach that incorporates broader perspectives of species life cycles and interrelated conservation measures.

Approaches to conservation initiatives in Lancaster Sound, are placed into a larger context of national interests, such as transportation routes, and, access to potential resources. The current formula of a proposed NMCA is unique in that it offers a type of conservation that permits

the use of renewable resources while also promoting a role for Inuit to directly influence its creation and eventual management features. The NMCA process also requires integration of Inuit Qaujimajatuqangit and offers opportunities to directly apply community preferences in a conservation setting.

It is QIA’s intention, in conjunction with the Project Steering Committee, to visit the five north Baffin communities of Arctic Bay, Pond Inlet, Clyde River, Resolute Bay and Grise Fiord in order to discuss what the proposed Lancaster Sound NMCA offers Inuit and to determine how Inuit interests can best be achieved. Prior to a final feasibility study report, the items found in this report will be used to answer a question first posed in the 1980’s; what is the best plan for Lancaster Sound?

Finally, one particular challenge will be determining what the most effective management structure and programs can be for a NMCA. QIA and Parks Canada have learned a great deal from past IIBA’s; it is now a question of how that knowledge can be put to use in the creation of Nunavut’s first NMCA.



Courtesy: NTI/Niore Iqalukjuaq / ᐅᐁᐁᐁ ᐁᐁᐁᐁᐁᐁᐁᐁᐁᐁ ᐁᐁᐁᐁᐁᐁᐁᐁᐁᐁ

Appendix A: Inuit Qaujimajatuqangit Mapping

Appendix A, *Inuit Qaujimajatuqangit Mapping* presents materials drawn from the Inuit Land Use and Occupancy Project (ILUOP). The materials presented represent a small portion of the entire collection related to the Lancaster Sound region. The maps presented have been selected in order to demonstrate the general breadth and depth of Inuit Qaujimajatuqangit within the area. The ILUOP materials presented in this report contain Inuit land use and knowledge that extends back more than 60 years prior to the 1975 collection date. The collection contains interviews and maps for over 500 individual Inuit hunters and another 100 maps from individual or group interviews on Inuit knowledge of the physical environment and wildlife ecology.

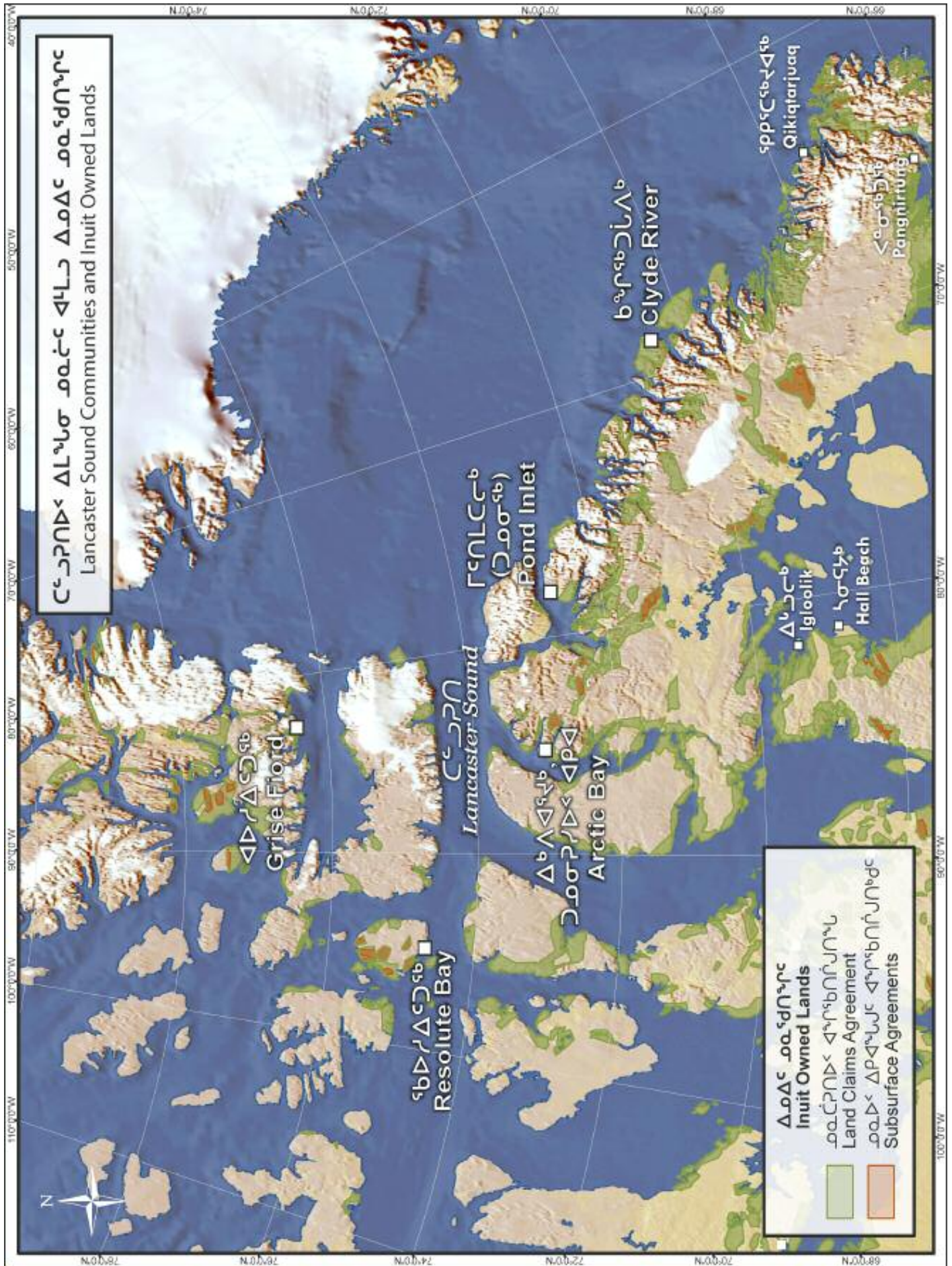
A number of maps are presented in Appendix A based on common themes such as; travel routes, place names, archaeological sites, harvesting areas and species specific maps. Although each theme represents a summary map, additional materials exist and can be applied to the proposed NMCA depending on the intended purpose. It is QIA's intention to use these maps as a basis from which North Baffin communities can contribute to feasibility process content development and boundary determinations. It is QIA's vision these maps be used to conduct further community mapping exercises, leading to more information being gathered from community members in an effort to expand the breadth of Inuit knowledge in the Lancaster Sound region.

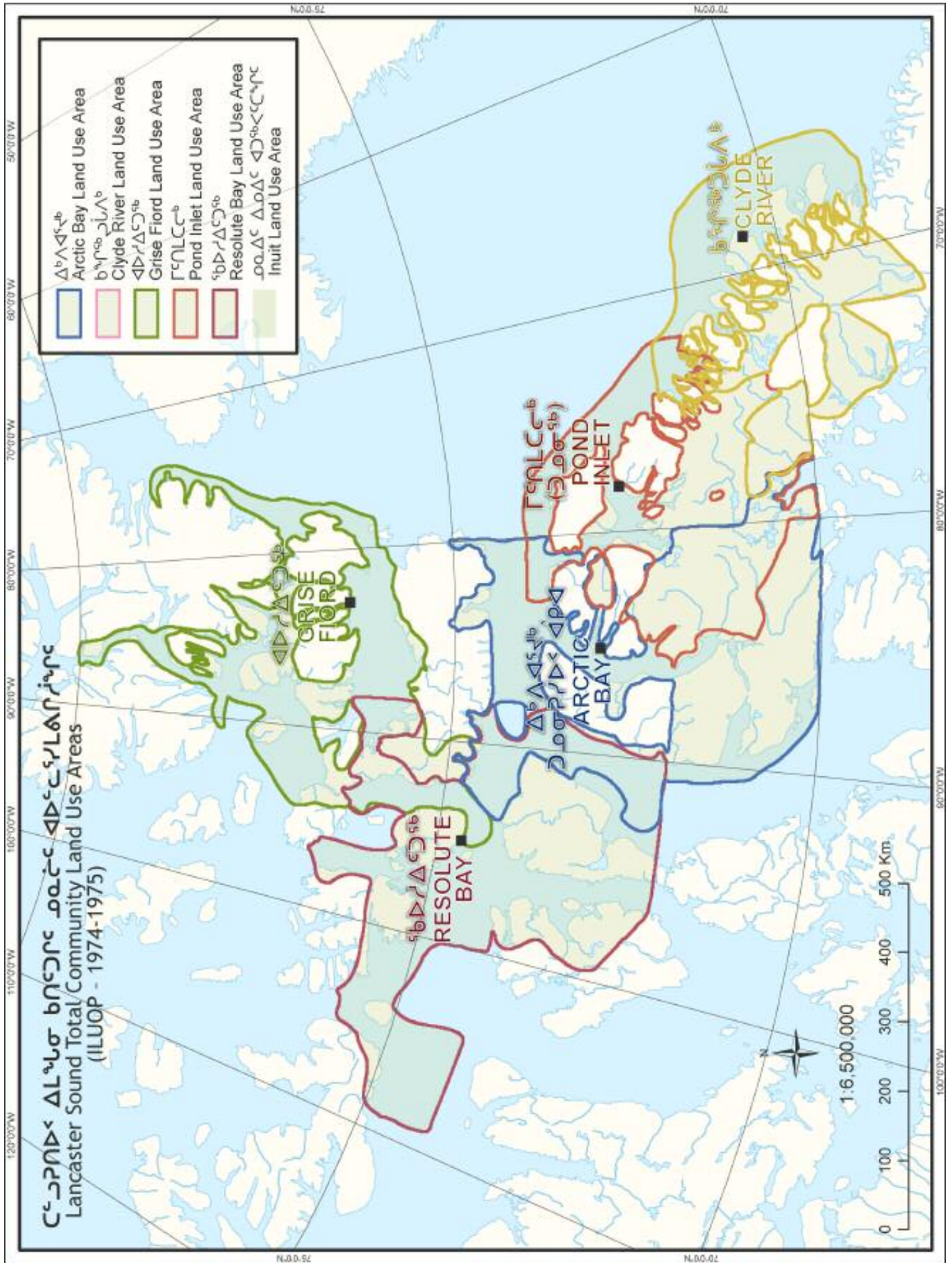
This component of QIA involvement in the NMCA processes is centered on four basic principles that will ensure the role of Inuit knowledge and participation in the NMCA feasibility process;

- Inuit leadership recognizes that both the immediate objectives of the feasibility study as well as the longer term objectives for the co-management of the Lancaster Sound region requires access to high quality and reliable information that is derived from the integration and application of different systems of knowledge.
- Inuit collective knowledge, experience and skills associated with the traditional and present day use and value of the marine, fresh water, land and wildlife resources of Lancaster Sound and its surrounding territory will be an essential source of this information.
- Maps are one of the most important tools to collect Inuit Qaujimajatuqangit and make it available for direct and sustained participation of Inuit in the integrated planning of the Lancaster Sound NMCA.
- The participatory framework governing the NMCA must recognize the importance of establishing protocols on the sharing of map-based and related information and on implementing measures to expand Inuit capacities for the collection, processing and application of Inuit Qaujimajatuqangit at the community and regional organization levels.

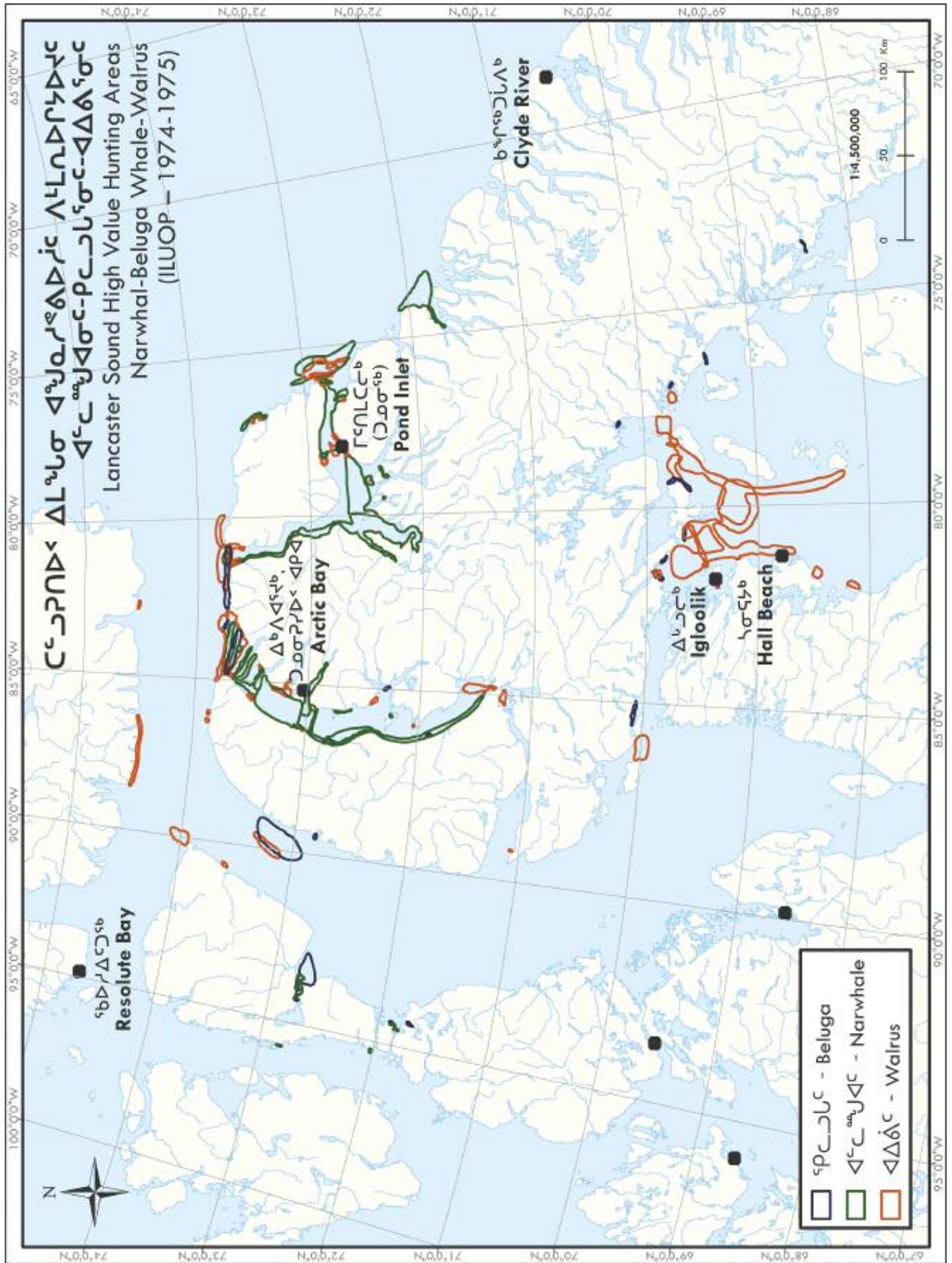
Observation of these four basic principles will ensure the best possible balance between the need to define, protect and manage the resources of Lancaster Sound.

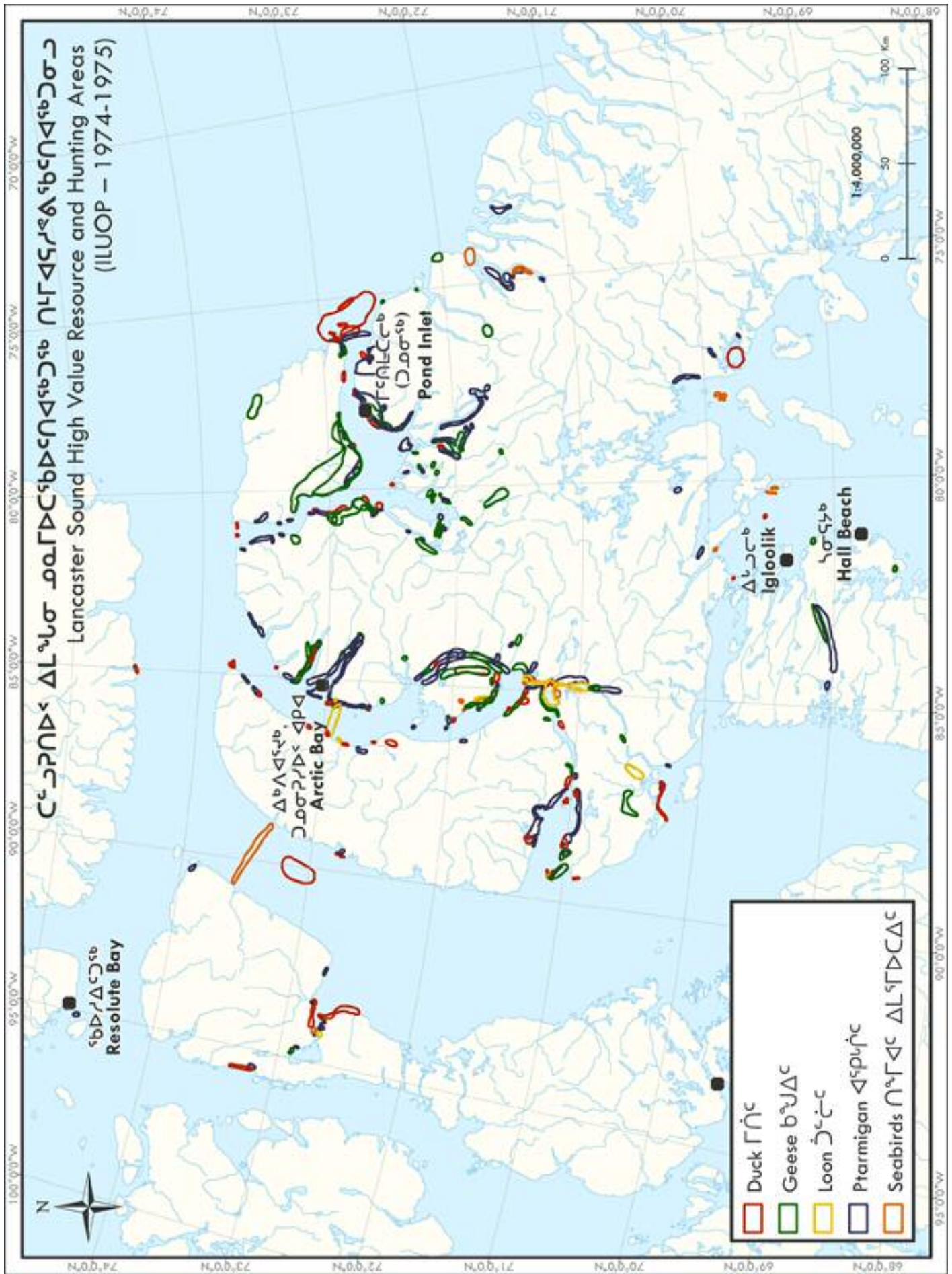
Map 1 / Map 1

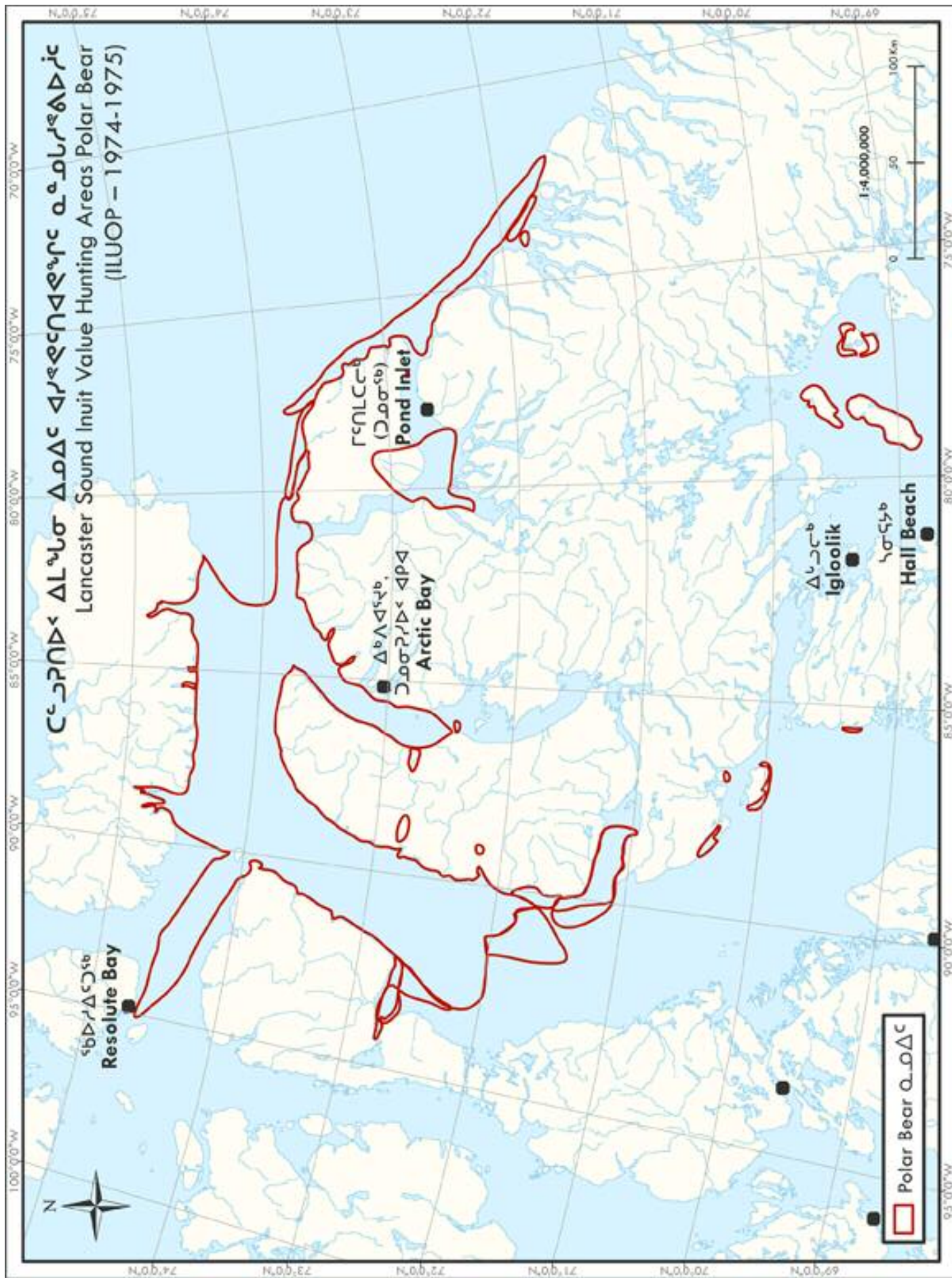


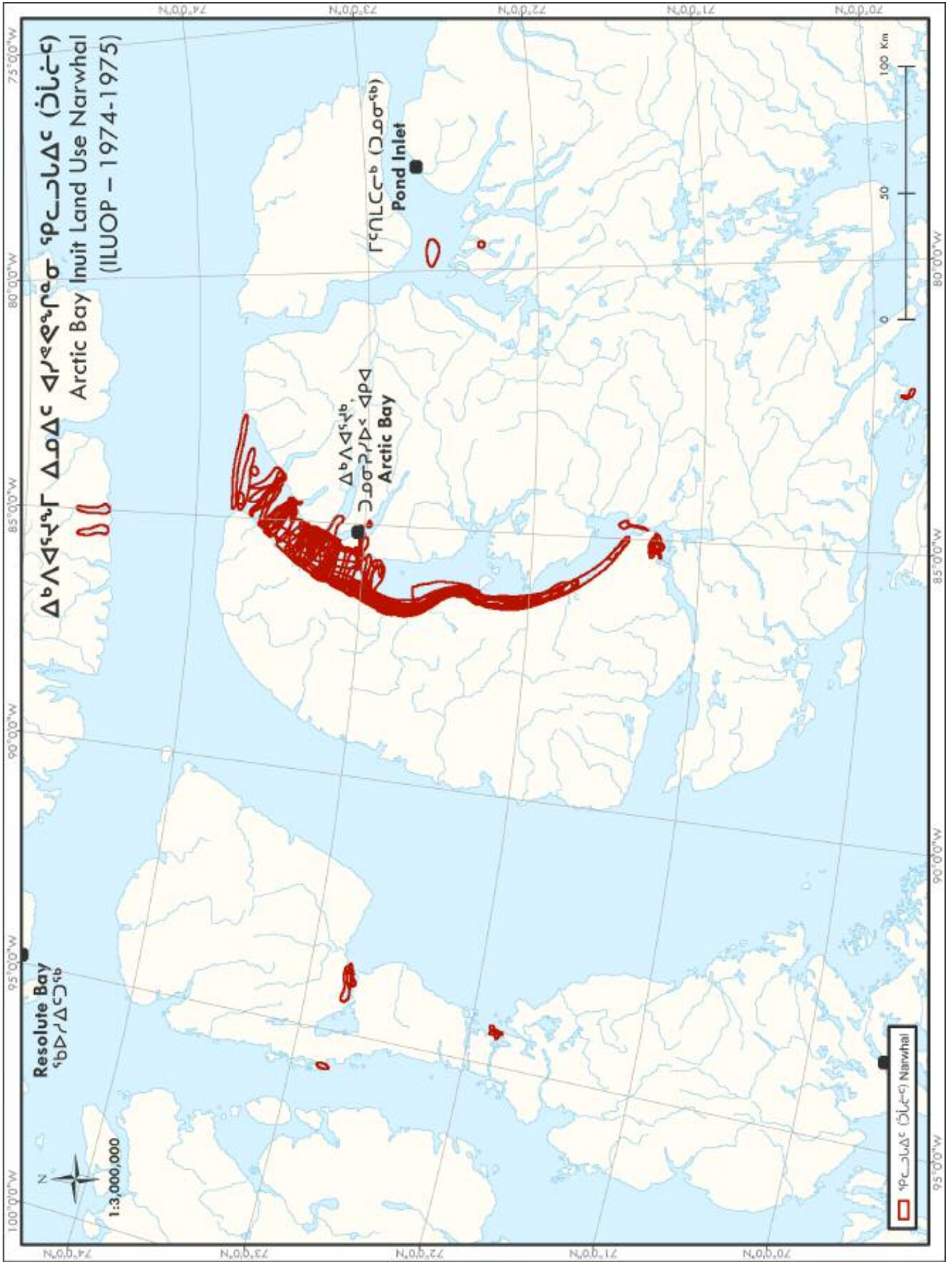


Map 3 / 3

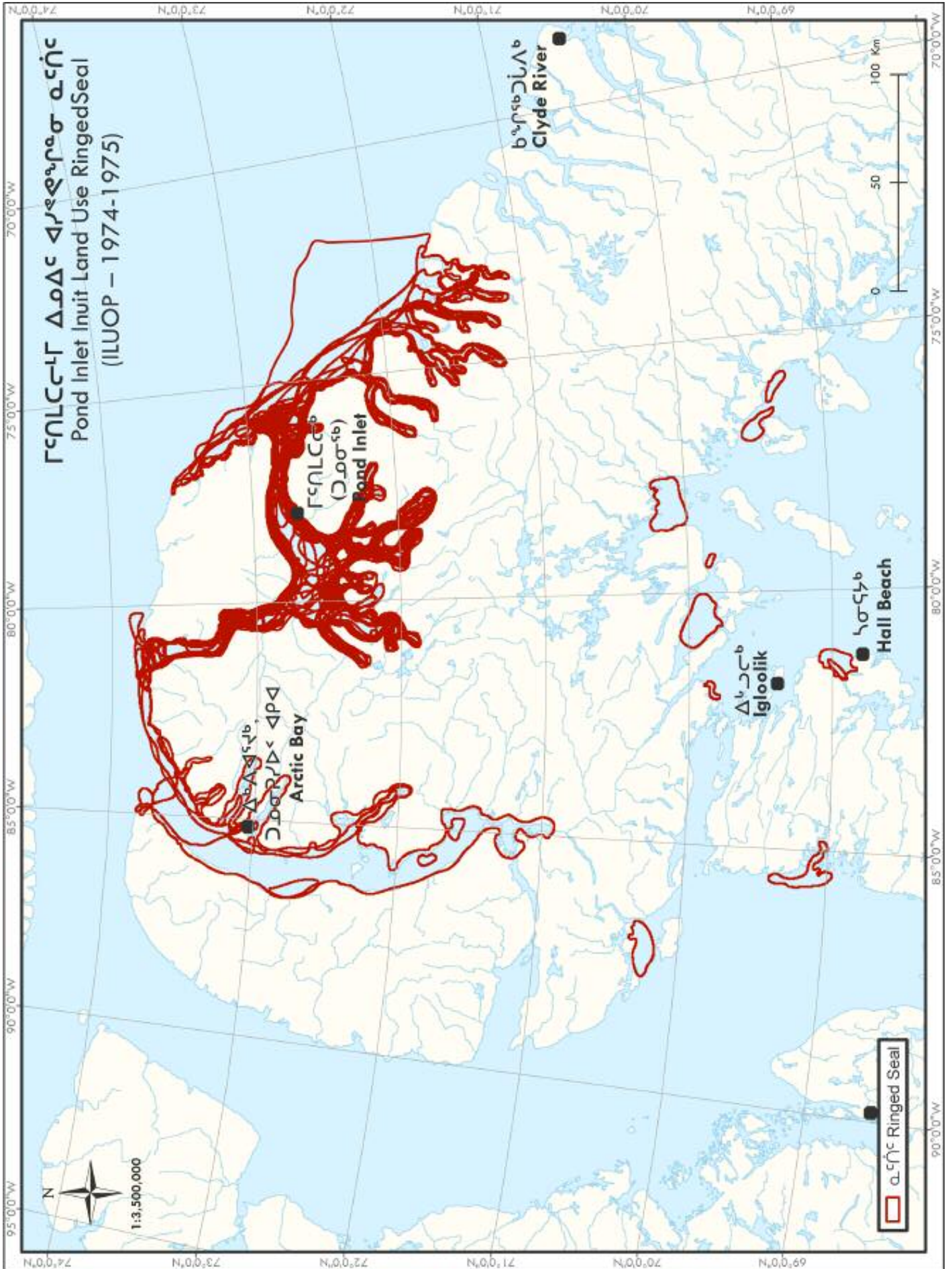




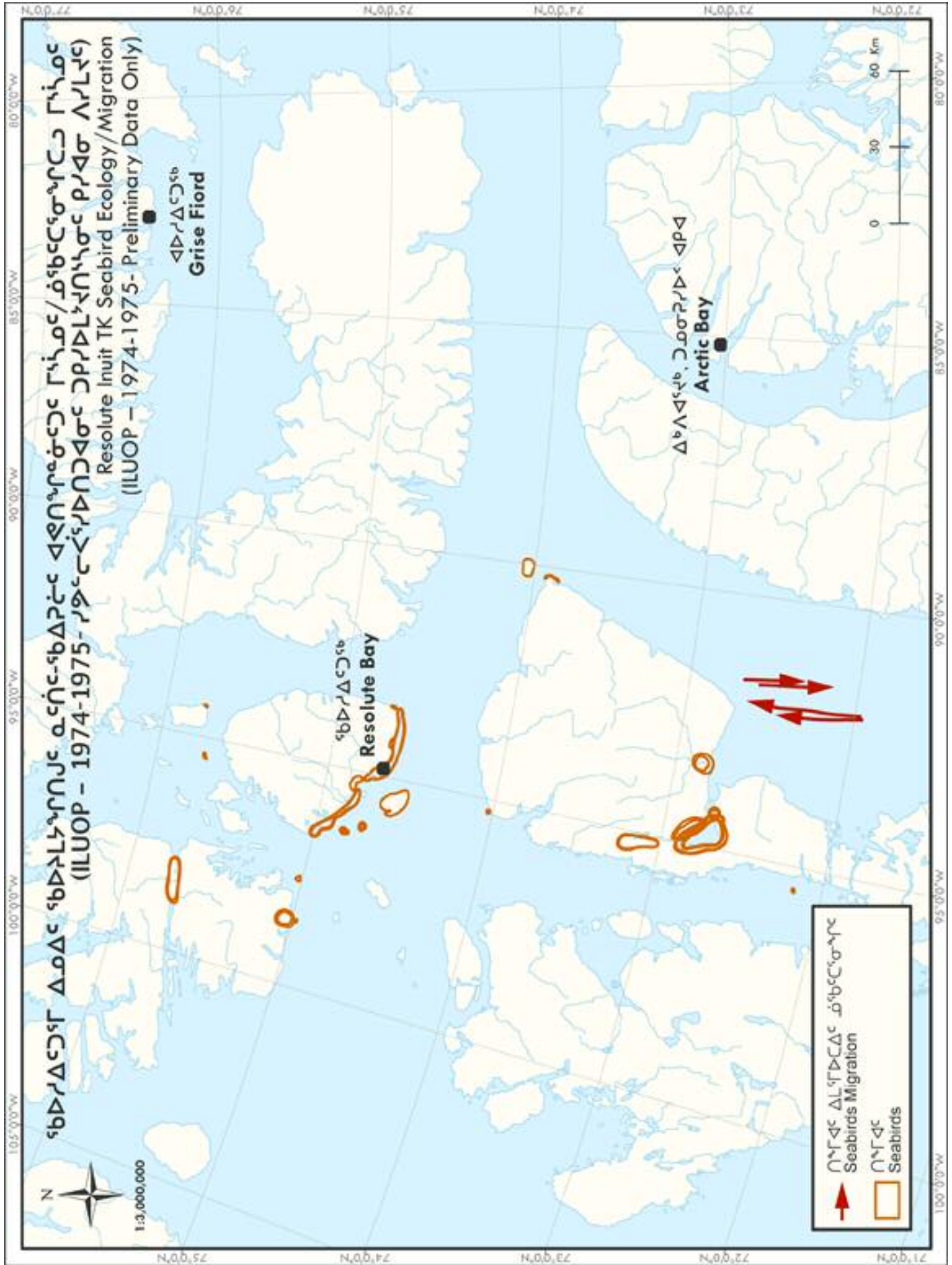


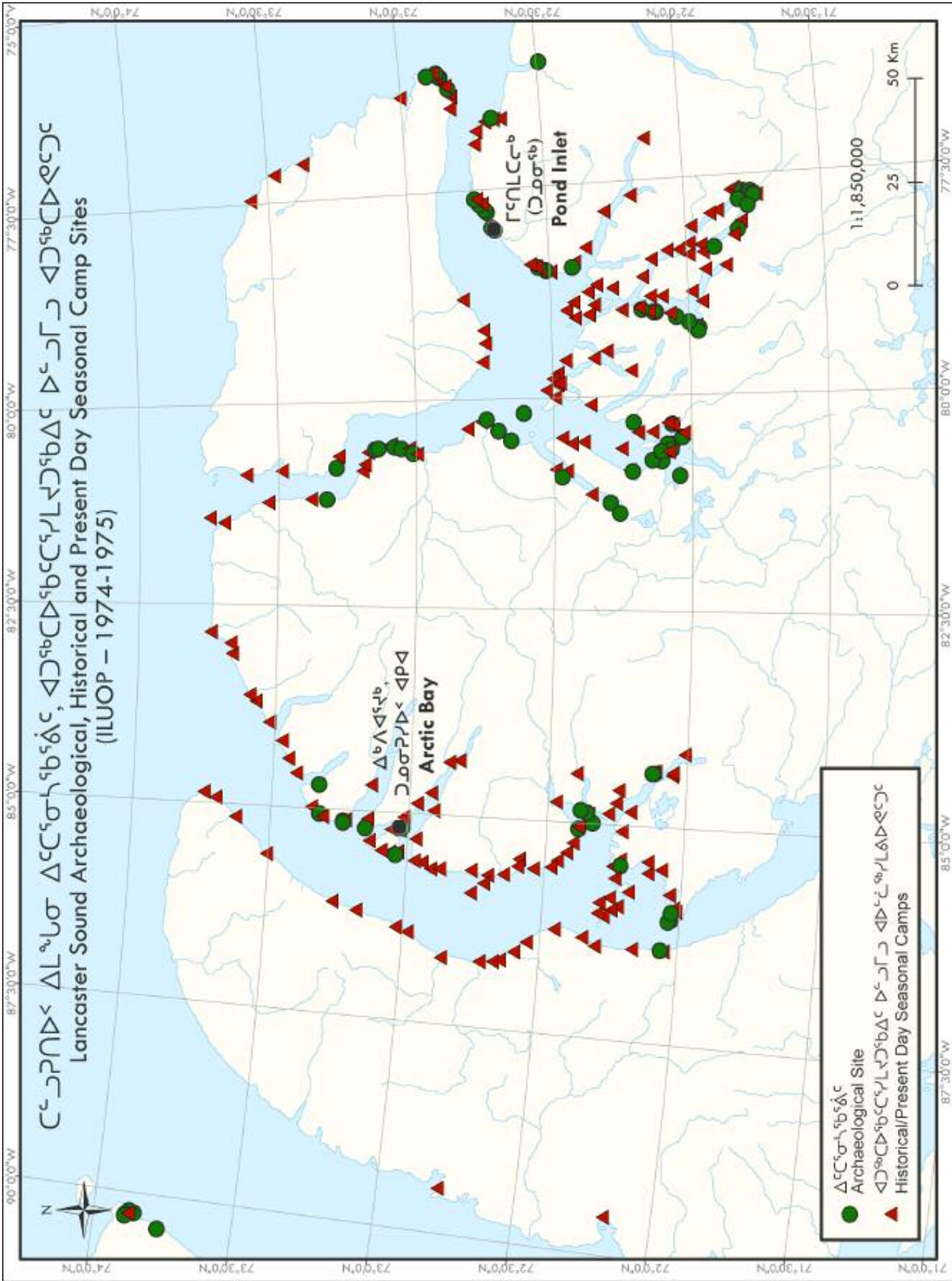


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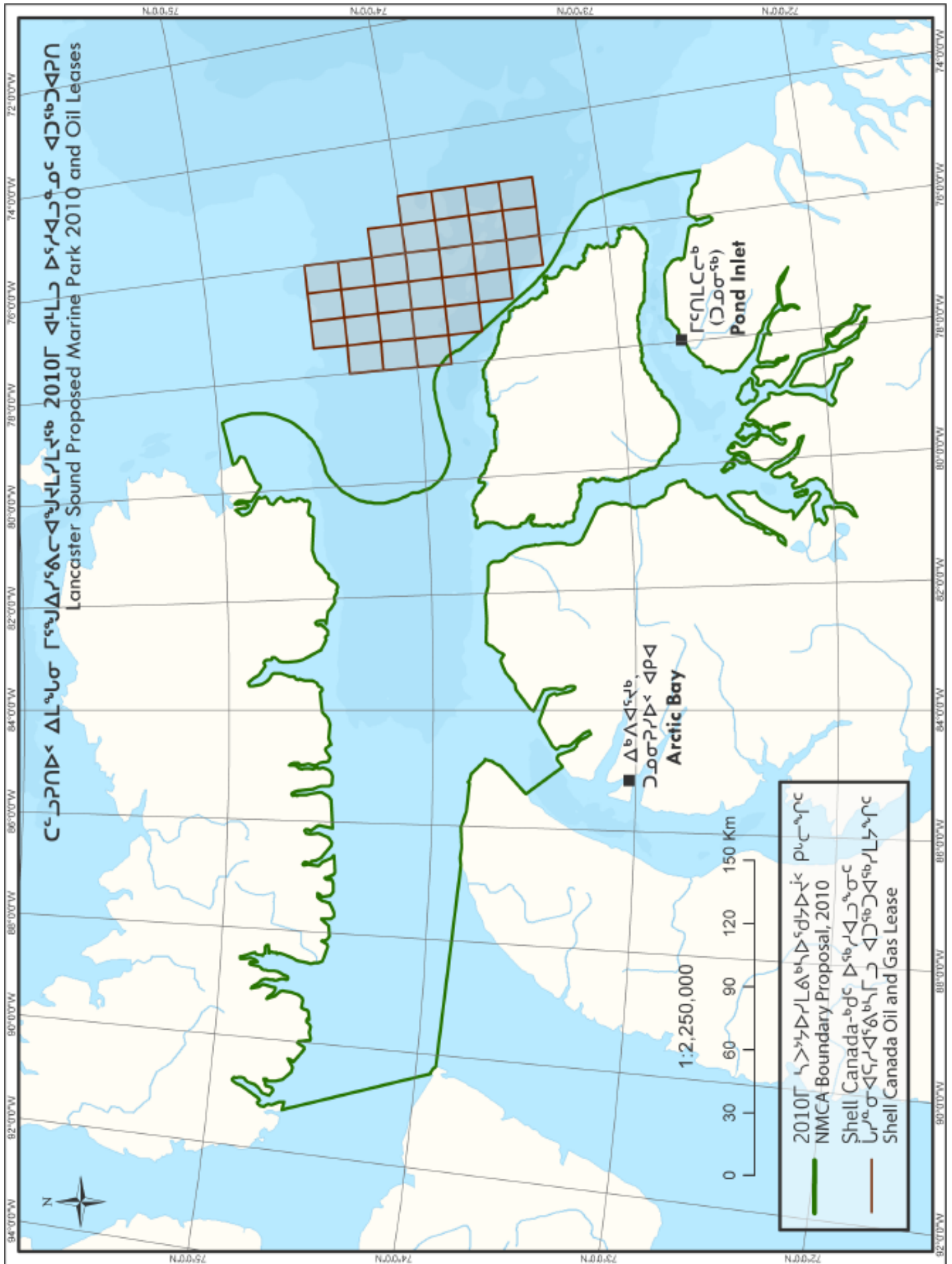
Map 9 / Map 9

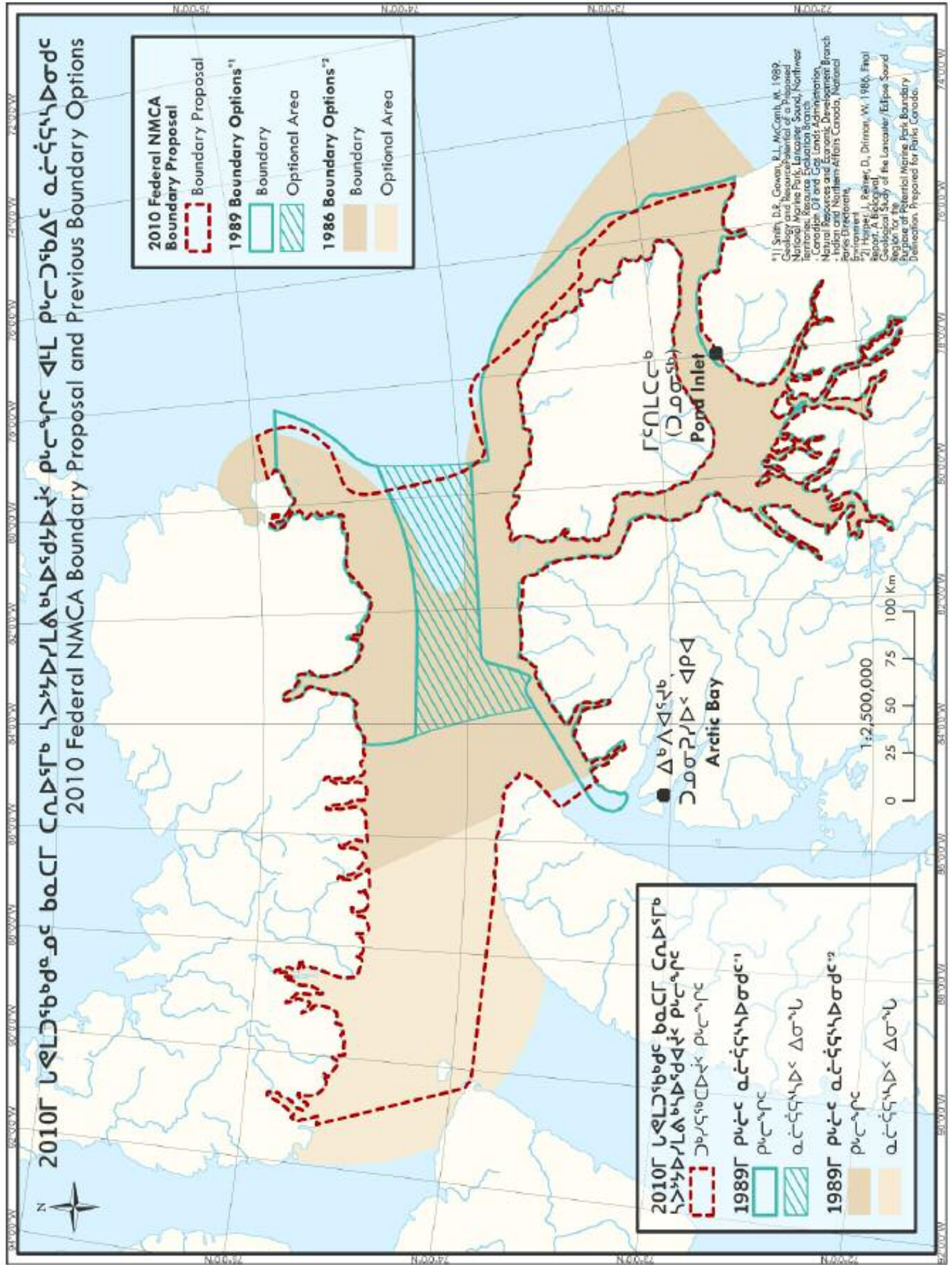


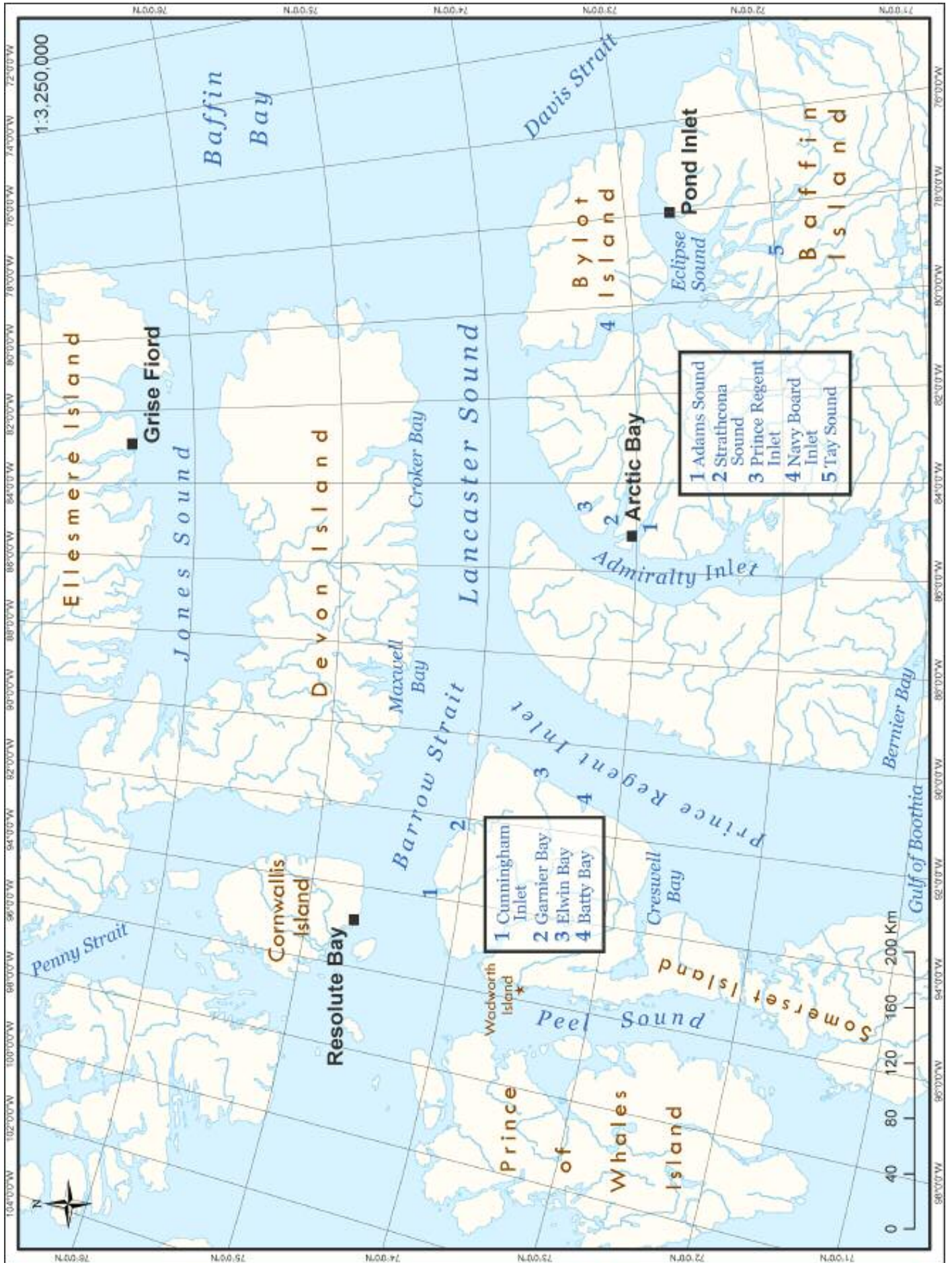


Appendix B: 2010 Boundary Proposal, Previous Boundary Options and Existing Petroleum Rights

Appendix B, *Federal Boundary Proposal and Existing Mineral Rights*, contains a selection of maps depicting previous conservation area proposals within the Lancaster Sound region. These maps provide an indication for where conservation interests have been focused relative to known marine mammal science and natural resource potential.







Appendix C: Recent Marine Mammal Science

Appendix C, *Recent Marine Mammal Science* contains an update and expansion of the knowledge base for marine mammals in the Lancaster Sound area since the initial 1986 Parks Canada report (Harper et al., 1986). This section summarizes marine mammal research by species including a brief description of geographical distribution, population size if known, and threats to their continued use of the area.

It is anticipated that the overview provided in this report, and the associated source documents will be used to enhance the body of knowledge and findings of the NMCA feasibility process.

Beluga (*Delphinapterus leucas*)

The beluga is a semi-circumpolar cetacean commonly inhabiting Canadian, American, Russian, and Greenland waters. There are twenty two populations worldwide (DFO 2010) with seven populations found in Canadian waters seasonally and year round (COSEWIC 2004). The Eastern High Arctic/Baffin Bay population is present in the Arctic year round inhabiting the Canadian Arctic archipelago in the vicinity of Lancaster Sound in summer and waters between Canada and Greenland in winter (NAMMCO 2005). This population was designated 'Special Concern' by COSEWIC in 1992 and 2004 due to uncertainties about stock separation and hunting pressure in portions of the populations range (COSEWIC 2004). This population may consist of two or more management stocks based on genetic information and wintering locations (de March et al. 2002).

The Eastern High Arctic/Baffin Bay population is known to winter in north Baffin Bay between the west coast of Greenland and the Canadian archipelago amongst heavy pack ice (Smith and

Martin 1984; Doidge and Finley 1993). Some belugas from this population, a larger number than was previously suspected (approximately 13,000 according to Heide-Jørgensen and Laidre (2004)), are also known to winter in the leads and polynyas, commonly referred to as the North Water, between North West Greenland and Devon and Ellesmere Islands (Richard et al. 1998; Heide-Jørgensen et al. 1998; Richard et al. 2001). Heide-Jørgensen et al. (2003) estimate that less than fifty percent of the total population winters in West Greenland with the rest inhabiting polynyas and leads in the North Water.

Summering areas in the Lancaster Sound area are known to be in Peel Sound, Barrow Strait, Prince Regent Inlet, and Lancaster Sound itself (COSEWIC 2004). Migration to wintering grounds begins in early fall, peaking in mid September, through Lancaster Sound along the south and east coast of Devon Island (Koski and Davis 1980; Smith and Martin 1994; Richard 1998; Richard et al. 2001; Stewart 2001; Heide-Jørgensen et al. 2003). Koski and Davis (1980) observed fall migration through Lancaster to occur rapidly, taking place over a period of two to three days. From wintering grounds, the beluga's return trip in the spring follows the receding ice and leads to the floe edge of Lancaster Sound. Belugas have been seen from aerial surveys at the Lancaster Sound floe edge in May and June (Smith et al. 1985) with the earliest reported sighting of calves in the area on May 31 (Cosens and Dueck 1990).

The Lancaster Sound area is known to be an important summering ground for belugas, particularly along the south and east coasts of Devon, the south coast of Cornwallis Island and around Somerset Island (Heide-Jørgensen et al. 1998). Belugas are considered to have high site

fidelity to seasonal habitats (Heide-Jørgensen et al. 2003), visiting the same areas each year, and select habitat based on factors including ice concentrations and water depth (Barber et al. 2001). They are known to frequent warm water estuaries that assist with the moulting process (Watts et al. 1991; Smith et al. 1992; Smith and Martin 1994), and deep offshore areas and bays, presumably for feeding, in the summer and fall seasons (Martin and Smith 1992; Smith and Martin 1994; Richard 1998). Major congregations in the area have been observed in the following areas: Maxwell and Croker Bays on the south coast of Devon Island; Elwin, Batty, Garnier, and Creswell Bays as well as Cunningham Inlet on the north and east sides of Somerset Island; an estuary north of Wadworth Island on the west side of Somerset Island in Peel Sound; Coningham, Willis and Transition Bays on Prince of Whales Island in Peel Sound; and a number of river estuaries on the northern portion of the Brodeur Peninsula (Smith et al. 1985; Smith et al. 1992; Doidge and Finley 1993; Smith and Martin 1994; Richard 2001). The Franklin Trench, in southern Peel Sound, has also been documented to be used daily by beluga in nearby Coningham Bay (Smith and Martin 1994; Richard 2001). According to Pond Inlet residents, some beluga summer in Eclipse Sound, Milne Inlet and Koluksot Bay with calving occurring in the latter two areas as well as the southern portion of Navy Board Inlet (Stewart 2001).

The most recent population estimate for the Baffin Bay beluga was published in 2002. Innes et al. (2002) estimated the population at 21,231 (95% CI 10,985 to 32,619) animals derived from visual and photographic surveys in Prince Regent Inlet, Peel Sound and Barrow Strait in 1996, corrected for observer and availability bias. Belugas have been seen to travel in groups of one-to-two-hundred animals in the region with an average group size of 3.8 (Cosens and Dueck 1991). Cosens and Dueck (1991) noted that beluga group size varied with ice type with the largest groups being seen later in break up within cracks in the ice and pan ice.

Potential threats to beluga in the area include increased disturbance from shipping (DFO 2010), bioaccumulation of contaminants (Doidge and Finley 1993), water pollution, noise pollution (Cosens and Dueck 1990), competition from commercial fisheries (DFO 2010) in Baffin Bay, and climate change (Tynan and DeMaster 1997, Laidre et al. 2008).

Cosens and Dueck (1990) suggest that any increase in shipping traffic in Lancaster Sound should account for the presence of young early in the season as the potential effects of underwater noise on calves are unknown and may alter the ability of mothers and calves to communicate.

Narwhal (*Monodon monoceros*)

The narwhal is a medium-sized toothed whale with a semi-circumpolar distribution, inhabiting European and eastern Canadian Arctic waters north of 60° latitude. Based on geographic summering locations, there are three narwhal populations globally. The most abundant, referred to as the Baffin Bay population, is located in the High Arctic in waters neighboring Canada and Greenland. Although currently managed as one population, additional stock separation based on summering location, migration timing and wintering areas has been suggested for management purposes (Dietz et al. 2008). The Baffin Bay population inhabits the eastern Canadian Arctic archipelago and waters off northwest Greenland in summer and Baffin Bay and Davis Strait in winter (DFO 1998). This population was designated 'Special Concern' by COSEWIC in 2004 due to uncertainty about population size, life history parameters, and sustainable harvest levels (COSEWIC 2004). It was previously designated in 1986 and 1987 as 'Not at Risk'.

Similar to the beluga, narwhal have high site fidelity and return to the same locations in the Arctic year after year (Heide-Jørgensen et al. 2003; Laidre et al. 2004a), making high use areas important habitat. Although little is understood about specific habitat

needs, it is known that narwhals prefer deep water in both summer and winter. In summer, narwhals range in coastal areas with both deep water and shelter (Richard et al. 1994; Kingsley et al. 1994). In the Lancaster region narwhals are present in the areas of Prince Regent Inlet, Barrow Strait, Peel and Eclipse Sounds and Admiralty Inlet (Richard et al. 1994). Winter is spent farther offshore in Baffin Bay and Davis Strait (Heide-Jørgensen et al. 2002; Heide-Jørgensen et al. 2003).

Narwhals arrive from Baffin Bay at the Lancaster Sound floe edge in May and June (Heide-Jørgensen et al. 2003) with the earliest reported sighting of calves in Lancaster Sound on May 27 (Cosens and Dueck 1990). Finley and Gibb (1982) noted narwhals feeding at the Pond Inlet ice edge in June. Narwhals migrate through Pond Inlet into Eclipse Sound and through Lancaster Sound into western regions as the ice breaks and leads form (Finley and Gibb 1982). Narwhals stay in the area from July through to September (Laidre et al. 2002) and are noted to be abundant in Prince Regent and Admiralty Inlets (Richard et al. 1994), as well as Eclipse Sound (Finley and Gibb 1982) in late summer. Studies have noted that narwhals visit more than the few fjords south of Eclipse Sound noted in the literature. They are known to visit all fifteen fjords south of Eclipse Sound on Baffin Island during the summer season (Remnant and Thomas 1992 as cited by Dietz et al. 2001).

Migration out of the Canadian archipelago into Baffin Bay has been recorded to take place in stages, based on summering areas (Dietz et al. 2008), over approximately a one month period (Koski and Davis 1980; Dietz et al. 2008). Narwhals tracked from summering grounds in Admiralty Inlet followed the south coast of Lancaster Sound during migration (Dietz et al. 2008) whereas, whales tagged near Somerset Island moved west on the north side of the Sound, following the south shore of Devon Island (Heide-Jørgensen et al. 2003). Whales summering in the Eclipse Sound area migrate easterly through Pond Inlet, south of Bylot Island and Lancaster Sound, into Baffin Bay

(Dietz et al. 2001). Koski and Davis (1980) noted in a survey taken in 1974, that fall migration out of Milne Inlet and Eclipse Sound began between September ninth and thirteenth. Highest densities at this time of the year were observed in Pond Inlet, while Milne Inlet and Tay Sound were considered to have medium densities, and Navy Board Inlet and Eclipse Sound showing low densities (Koski and Davis 1980).

The return trip south, to the dense pack ice of Baffin Bay and Davis Strait, through Lancaster and Eclipse Sounds occurs in September and October (Laidre et al. 2002), arriving in their winter range in late October to early November (Heide-Jørgensen et al. 2002; Heide-Jørgensen et al. 2003). Analysis of satellite tracking studies have suggested that whales summering in Eclipse Sound, Admiralty Inlet and Melville Bay have overlapping winter ranges in southern Baffin Bay and northern Davis Strait, where as those summering in the Somerset Island area winter further north in Baffin Bay (Dietz et al. 2008). Wintering grounds have been documented to be associated with the continental slope in Baffin Bay and Davis Strait (Dietz et al. 2001; Dietz and Heide-Jørgensen 1995). Narwhals travel up to 3,000 km over the course of the year to and from seasonal grounds (Heide-Jørgensen et al. 2002).

Satellite tracking studies in the Canadian archipelago have shown that the narwhal, one of the deepest diving cetaceans, increase their diving depths between summer and fall, reaching depths in excess of 1,000 m (Dietz et al. 2001; Heide-Jørgensen et al. 2001) in their wintering grounds. Narwhals have been observed to congregate in deep water zones, in depths exceeding 350 meters, in the Lancaster region in the summer months (Richard et al. 1994). Richard et al. (1994) suggests that their preference for deep water may be linked to feeding. Deep water fish, including polar cod (*Arctogadus glacialis*) and Greenland halibut (*Reinhardtius hippoglossoides*), have been found in analyses of narwhal stomach contents (Finley and Gibb 1982). The narwhal Baffin Bay stock is estimated to be in excess of 60,000 with the largest groups present in

summer around Somerset Island and in Eclipse Sound (Richard et al. 2010). Narwhals have been observed to travel in groups of one to fifty animals in the region with an average of three (Cosens and Dueck 1991) to three and a half (Marcoux et al. 2009) animals per group. Similar to beluga whales, Cosens and Dueck (1991) noted that narwhal group size varied with ice type with the largest groups being seen later in break up within cracks in the ice.

Potential threats to the Baffin Bay narwhal include the commercial fishery for Greenland halibut in Baffin Bay (DFO 1998; Heide-Jørgensen et al. 2003; Laidre et al. 2004b), noise pollution and shipping traffic (Cosens and Dueck 1993; Cosens 1995), contaminations (Muir et al. 1992; Wagemann et al. 1996), climate change related to preferred habitat (Heide-Jørgensen et al. 2003; Laidre et al. 2004a), ice entrapments related to changing ice conditions (Laidre and Heide-Jørgensen 2005a), seasonal prey intake, small number of prey species (Laidre et al. 2005b), and potential increase for predation by killer whales (Higdon 2007).

Bowhead (*Balaena mysticetus*)

The bowhead whale is the largest cetacean inhabiting Arctic waters. It has a broad distribution, similar to its pre-decimated historic range (Reeves et al. 1983), which is nearly circumpolar in nature, with only portions of the Canadian and Russian Arctic not inhabited (COSEWIC 2009). There are currently four populations worldwide. The Eastern Canada-West Greenland (EC-WG) population was previously considered two separate stocks called the Davis Strait-Baffin Bay stock and the Foxe Basin-Hudson Bay stock, and is now considered one population based on genetic data, tracking data, and age and sex distribution (Heide-Jørgensen et al. 2008). This population was designated 'Special Concern' by COSEWIC in 2009, a downgrade, or positive update, from 'Endangered' in 1980 and 'Threatened' in 2005 (COSEWIC 2009).

The EC-WG population has a broad summer distribution and is known to summer in northern Hudson Bay and Foxe Basin, along the eastern coast of Baffin Island, and south of Lancaster Sound in Pond Inlet, Eclipse Sound, Navy Board Inlet, Admiralty Inlet, Prince Regent Inlet, and the Gulf of Boothia. This population is known to winter in Hudson Strait (Koski et al. 2006), northern Hudson Bay, the mouth of Cumberland Sound, and along the pack ice edge in Davis Strait (Dueck et al. 2006). Hudson Strait is thought to have the largest proportion of the population in winter (Koski et al. 2006).

Bowhead whale migration is known to be closely associated with changes in sea ice (NWMB 2000). Bowheads follow the receding ice in spring and move into the Lancaster region from the east and west side of Baffin Island either through Baffin Bay, via the coast of Baffin Island (Dueck et al. 2006) or the west coast of Greenland and the North Water polynya (Heide-Jørgensen et al. 2003b) on the east, or the Gulf of Boothia via Fury and Hecla Strait from northern Foxe Basin (Dueck et al. 2006). Migratory periods have been suggested by satellite tracking studies to centre around April 3 for spring movements, July 22 to summering grounds and October 29 for peak movement back to wintering grounds for animals tagged in Canadian Arctic (Dueck et al. 2008). Tracking studies originating in West Greenland have seen similar migration timing with animals heading northwest for Lancaster Sound in May and on route south along Baffin Island in October (Heide-Jørgensen et al. 2006). Fall migrations occur in an easterly direction out of Lancaster Sound following Baffin Island south and in a southerly direction out of the Gulf of Boothia via Fury and Hecla Strait toward winter grounds (Dueck et al. 2008).

Seasonal distribution of the bowhead may be based on a number of factors including ice thickness and extent, bathymetry, prey distribution, predation, and costal features that provide shelter (Dueck et al,

2008; Ferguson et al., 2010; Finley 1990). Ferguson et al. (2010) found that bowhead whales prefer more ice in summer and less in winter based on seasonal ice availability. Prince Regent Inlet, specifically south of Creswell Bay, is thought to be a highly utilized area by bowhead in the summer season (Dueck et al. 2008), in addition to Isabella Bay on the east coast of Baffin Island (Finley 1990). In the spring, areas with heavy ice, relatively shallow waters and oceanographic features that provide a consistent food supply have been found to contain a large number of calves and cows and have been deemed calf 'nurseries'. Such areas have been found in northern Foxe Basin (Cosens and Blouw 2003).

The most recent population estimate for the Eastern Canada-West Greenland population is 7,309 (95% CI = 3,161-16,900) but is considered imprecise as only a portion of known summer range was covered in one season (Cosens et al. 2005). It is a commonly held belief within Nunavut communities that the bowhead whale population is increasing due to hunting restrictions (NWMB 2000) however, this is not a shared conviction in Greenland (Reeves and Heide-Jørgensen 1996).

Threats to the EC-WG population include anthropogenic disturbance such as increases in frequency and distribution of large ships, offshore oil and gas development, tourism and small boat activity, noise and water pollution (including debris that can be ingested by skim feeding) and hunting (COSEWIC 2009; Finley 2001). Change in seasonal ice cover due to climate change is also a real threat to the bowhead whale with unknown effects on distribution (Ferguson et al. 2010), potential for increased ice entrapment in winter, and potential increase in predation by killer whales in winter and summer (Finley 2001; Mitchell and Reeves 1982). Calving grounds are particularly at risk with decreases in ice concentrations compared to other seasonal locations, movements and activities due to the likelihood that they are traditional and less flexible (Dueck and Ferguson 2008).

Killer whale (*Orcinus orca*)

The killer whale is found in all Canadian coastal waters and all oceans globally, making it the mostly widely distributed cetacean in the world (Higdon 2007). Killer whales are considered one species with separate populations (Forney and Wade 2007, COSEWIC 2008), although subspecies have been suggested for groups in the Antarctic (Pitman and Ensor 2003). There are currently five Designatable Units (DUs) of killer whales recognized in Canada based on genetics, movements and distribution, feeding behavior, and acoustic studies (COSEWIC 2008). One of these DU's is the Northwestern Atlantic and Eastern Arctic. Although little scientific data is available on the presence of killer whales in the Canadian Arctic, the Northwest Atlantic/Eastern Arctic population is known to be found in the Canadian Arctic in the summer season. This population was designated 'Special Concern' by COSEWIC in 2008 due to its perceived small population size, life history parameters and social characteristics (COSEWIC 2008).

Satellite tracking studies of two whales tagged in Admiralty Inlet in August of 2009 showed summering and potential wintering grounds. The killer whales were tracked moving from Admiralty Inlet into Prince Regent Inlet and the Gulf of Boothia in September and movement out of the region as the ice began to form, via Lancaster Sound, in mid October. One killer whale was tracked into mid November off the Azores, a historic whaling ground (Matthews et al. Accepted December 2010).

Historic and recent sightings, and photographs, it is known that killer whales frequent waters of the Eastern Arctic, during the ice free season, where prey are plentiful. Killer whales are known to prey on belugas, narwhals, bowheads and seals (Westdal 2009; Higdon et al. Accepted November 2010). Killer whales are seen throughout the Lancaster region, generally in small pods and rarely solo (Westdal 2009). In Pond Inlet hunters have noted that killer whales are seen mainly in August, but have been seen at the floe edge in

June and July (Westdal 2010). In Arctic Bay hunters and community members see killer whales in July, August and September. Killer whales are most often seen on the west side of Admiralty Inlet near Kakiak Point. In 2008 community members saw killer whales relatively close to the community for the first time; in Arctic Bay, Adams Sound and Strathcona Sound (Westdal 2009). Higdon (2007) notes that the highest number of killer whale sightings to date are from southwest Greenland and Lancaster Sound, with notable areas in the Lancaster region being in the Pond Inlet/Bylot Island area, Lancaster Sound, and Admiralty Inlet.

Killer whales have a historic presence in the eastern Arctic (Westdal 2009), but Inuit around Baffin Island and in Hudson Bay have reported sighting killer whales more frequently (Higdon 2007; Westdal 2009). It has been suggested that this could be due to changes in sea ice extent making areas more accessible for longer periods of time (Ferguson et al. 2010), as well as increased sighting effort and or a population increase (Higdon 2007). The number of individuals in the Northwest Atlantic/Eastern Arctic population is not known at this time (COSEWIC 2008) however, Young et al. (*In Press*) have identified fifty three individuals from recent photographs.

Threats to this killer whale population include contaminants and water pollution, ice entrapments, hunting, and noise and disturbance associated with increases in Arctic shipping (COSEWIC 2008).

Walrus (*Odobenus rosmarus rosmarus*)

The walrus is a long-lived species of the order pinnipedia. There are currently considered to be two subspecies globally, the Pacific and Atlantic walrus, with the latter inhabiting coastal waters off Canada, Greenland and Svalbard (NAMMCO 2004). The Atlantic walrus is further broken down into eight sub-populations (Born et al. 2001) with research suggesting that the subpopulations contain smaller discrete stocks (Outridge et al.

2003; Stewart 2008). Walrus inhabiting Lancaster Sound may be considered a separate stock as the Baffin Bay stock appears to be three discrete stocks consisting of Baffin Bay, West Jones Sound, and Penny Strait-Lancaster Sound (Stewart 2008). The Atlantic walrus was designated 'Special Concern' by COSEWIC in 2006 due to the lack of information on individual populations, small population size in some areas, and sustainability of the current hunt (COSEWIC 2006). It was previously examined as two populations with the Eastern Arctic designated as 'Not at Risk' in April 1987 and May 2000 and the Northwest Atlantic population designated as 'Extirpated' in April 1987 and May 2000.

Walrus are generally found in near-shore areas in summer that provide haul out locations and shallow waters (less than 100 m in depth) suitable for providing access to preferred prey items on the ocean floor (Outridge et al. 2003). Walrus are thought to return to the same haul out and feeding sites each year (DFO 2002). From harvest records it is known that walrus inhabit the areas of Pond, Milne, and Admiralty Inlets, Bathurst and Cornwallis Islands, and Jones Sound in the Lancaster area in summer (Priest and Usher 2004). Miller (1955) reported walrus being abundant throughout Lancaster Sound. Walrus depart the area as the ice begins to form in the fall and head to areas with open water and mobile ice. Koski and Davis (1980) observed the majority of migration activity to occur in mid-October. They are known to winter in a number of places in the Lancaster region; the east and west ends of Jones Sound (Cardigan Strait-Fram Sound and around Dundas Island), the west end of Devon Island (south of Grinnell Peninsula), the floe edge of Lancaster and Jones and Sounds, and the North Water polynya (Born et al. 1995).

Threats to walrus in the area include pollution, loss of habitat including sea ice, fisheries that may affect prey habitat, noise disturbance, and physical disturbance. Walrus are especially sensitive to disturbance at haul out and feeding sites. Effects of

disturbance range from little to no effect, to temporary displacement, stampedes with assumed deaths (Born et al. 1995) and abandoning sites completely if continuously disturbed (DFO 2002).

Polar Bear (*Ursus maritimus*)

Polar bears have a circumpolar distribution, inhabiting all parts of the Arctic. Currently there are nineteen subpopulations worldwide with thirteen partially or completely in Canadian territory (Thiemann et al. 2008). The Lancaster Sound population inhabits the Lancaster region year round. Currently, the Canadian polar bear population is managed as one unit; however, Thiemann et al. (2008) suggest that polar bears can be considered in five separate designative units, based on geography and genetics. They suggest that bears do not all share the same conservation needs nor face the same threats throughout the Arctic and therefore, should be managed to reflect this. The polar bear was designated 'Special Concern' in Canada by COSEWIC in 2002 due to pollution concerns, slow reproductive rate, sustainability of the hunt, and climate change (COSEWIC 2002). The polar bear was previously designated as 'Not at Risk' in April 1986 but downgraded to 'Special Concern' in 1991, 1999.

In winter the Lancaster Sound region provides important habitat on shore and ice. Denning sites occur near the coast in the Lancaster area around Devon Island, on the north side of Lancaster Sound and the south side of Jones Sound (Stephenson and Hartwig 2010) with female bears exhibiting site fidelity to these areas. Females with newborn cubs have also been seen along the south coast of Lancaster Sound on the Brodeur Peninsula and Bylot Island (Schweinsburg et al. 1980). Preferred winter habitat for males and solo female polar bears in Lancaster Sound is in the western portion which is known to have high biological productivity (Welch et al 1992; Schweinsburg et al. 1982) and a higher density of ringed seals (Kingsley et al. 1985). Bears

however, have been seen along both coasts of Lancaster Sound in winter (Schweinsburg et al. 1980). Satellite tracking studies have shown that polar bears in the archipelago and in Baffin Bay select first year ice in winter and multiyear ice in spring and fall during minimum ice extent (Ferguson et al. 2000).

In spring and summer, bears in Lancaster Sound are forced to move from east to west onto multiyear ice (COSEWIC 2002) or into bays with land fast ice (Schweinsburg et al. 1982) and onto land as the ice recedes. Ferguson et al. (2000) found that bears in the archipelago used land fast ice in spring and summer more than Baffin Bay bears, which seem to prefer pack ice. Schweinsburg and Lee (1982) had similar findings for bears tracked in Lancaster Sound. Ferguson et al. (2000) suggest that spring and summer preferred ice habitat is related to seal pupping in both areas. Summer areas of use in the Lancaster region include the south and east coasts of Devon Island, the east side of the Brodeur Peninsula, Borden Peninsula, and Bylot Island. The west side of the Brodeur Peninsula and the tip of Somerset Island are suspected to also be summering areas (Schweinsburg et al. 1980; Schweinsburg et al. 1982).

Threats to the polar bear include management of a sustainable harvest in the face of other changes, prey availability, environmental contaminants, human disturbance, and effects of climate change (COSEWIC 2002; Thiemann et al. 2008). Many papers have been written on the potential effects of climate change on marine mammals, including polar bears. Potential effects include change in distribution, increased energy output to travel to preferred habitat and locate prey, access and availability of prey, reproduction rate and success, and ultimately population size and future (Stirling and Derocher 1993; Tynan and DeMaster 1997; Derocher et al. 2004; Laidre et al. 2008; Wiig et al. 2008; Molnar et al. 2010). Laidre et al. (2008)

suggest that polar bears are one of the most sensitive marine mammals to climate change due to their reliance on sea ice and feeding habits.

Harp seal (*Phoca groenlandica*)

The harp seal is a medium-sized seal with a large population that migrates seasonally in pursuit of prey, namely cod. There are three populations globally with the northwest Atlantic population inhabiting the Arctic and the Lancaster Sound area in the summer season and off the coast of northern Newfoundland and southern Labrador and in the Gulf of St. Lawrence in the winter (DFO 2000). The harp seal is not listed as a species of concern with COSEWIC.

Harp seals arrive in small groups in the Arctic in early to mid-June, with large numbers appearing in July, and follow the receding fast ice edges into the Canadian archipelago (Finley et al. 1990). Migration route north from wintering grounds is thought to be along the east side of Davis Strait and Baffin Bay, following the coast of Greenland (DFO 1982). High density areas are known to be in Jones Sound, Lancaster Sound, Navy Board, Eclipse and Pond Inlets, and down the east coast of Baffin Island (DFO 1994). Late summer aerial surveys indicate that the largest numbers of harp seals in the archipelago are found along the coasts of Devon and Ellesmere Islands (INAC 1983). Hunters from Pond Inlet indicate that harvesting of harp seals occurs in the fjords along Navy Board Inlet and Eclipse Sound (Finley et al. 1990). Surveys of the Bylot Island area in 1954 found harp seals in large numbers at Guys Bight (at the mouth of Pond Inlet) and the north end of Navy Board Inlet. Seals are known to migrate in large numbers into Tay Sound, south of Eclipse Sound, from Navy Board Inlet and Pond Inlet (Miller 1955). Harp seals stay in the high Arctic in summer for approximately 100 days (Finley et al. 1990).

Migration south occurs in October as the ice begins to form (Finley et al. 1990; Miller 1955). Koski and Davis (1980) observed harp seal fall

migration out of Lancaster Sound in both a southeast and northeast direction. Winter is spent off the east coast of Canada where breeding, whelping, and molting takes place on pack ice (Finley et al. 1990).

Threats to the harp seal population include changes in cod abundance and distribution, competition for food sources, and reduction in seasonal sea ice (Finley et al. 1990; Harwood 2001).

Bearded Seal (*Erignathus barbatus*)

Bearded seals are abundant in Hudson Strait, northern Hudson Bay and Foxe Basin. They are found throughout the Arctic archipelago in small numbers in summer (Finley 1983; Smith 1981), but are widely distributed in the Lancaster region (INAC 1985). In the Lancaster region they inhabit fjords in the summer months, mainly June through October (Finley 1983). High density areas are Lancaster Sound and the northern ends of Prince Regent, Admiralty and Navy Board Inlets (DFO 1994). Kingsley et al. (1985) suggest that bearded seals prefer broken ice and rotten annual ice within large floes. Moderate ice cover and waters of 100 m or less were also inferred as preferred habitat from aerial survey analysis (Kingsley et al. 1985). As bottom feeders, Koski and Davis (1980) suggest that distribution is partially based on water depths. Data from 1946 to 1954 shows bearded seals arriving at the Eclipse Sound ice edge prior to break up (six of the nine years) or within five days (Miller 1955). In September, surveys of Pond Inlet, Eclipse Sound and the Navy Board Inlet areas, found that Oliver Sound and Milne Inlet had the highest numbers of bearded seals (Koski and David 1980). During the ice free periods, namely August and September, bearded seals are found along the coast (INAC 1985). Bearded seals leave the area as fast ice begins to form to areas with moving pack ice. Bearded seals have been spotted in the North Water polynya in winter, but not in any large numbers (Finley and Renaud 1980).

As a species that is heavily dependent on ice for critical activities such as whelping, nursing, molting and resting, changes in sea ice due to climate

change may be a threat (COSEWIC 2002). Other threats to this species include physical or noise disruption due to their wide spread but sparse distribution and vocalizations (Smith 1981) and removal and/or disturbance to offshore areas where the seals are feeding (Smith 1981; Harwood 2001).

Ringed Seal (*Phoca hispida*)

The ringed seal is a small seal with a widespread distribution in the Arctic north of 50° latitude (Reeves 1998; NAMMCO 2002). There is no genetic or tracking data to conclude that the global population is comprised of individual stocks, however, the North Atlantic Marine Mammal Commission (NAMMCO) recognizes three stocks based on distribution, one of which is in the Baffin Bay area which includes Lancaster Sound.

Ringed seals are commonly distributed throughout the Lancaster region in summer and winter (Miller 1955), although the western portion of the Lancaster Sound region is known to have a higher density of ringed seals than further west into the archipelago (Kingsley et al. 1985). Ringed seals rarely occur in large clusters (INAC 1985) and have been shown to move large distances. They have been recorded crossing Baffin Bay from Greenland into the Eastern Arctic (Kapel et al., 1998; Teilmann et al. 1999) and from the North Water polynya into the west end of Lancaster Sound and down the east side of Baffin Island (Teilmann et al. 1999).

Ringed seals are known to inhabit land fast and pack ice in the winter with preferred habitat that includes annual ice, with high ice cover, that is fast to the land over shallow waters (Kingsley 1985). Koski and Davis (1980) noted that ringed seal densities increased in Lancaster Sound in late September with the formation of new ice. Similar observations were made for Pond Inlet in mid-October. Areas, including many fjords in the region, with seasonal and continual cracks, that have potential for a higher abundance of prey,

are known to have high densities of seals (Furgal 2002). Pupping is known to occur close to shore, on stable ice (Stephenson and Hartwig 2010) in late March or April (NAMMCO 2002). Bradstreet et al. (1982) noted in spring and early summer surveys in the Lancaster region that seals were in significantly higher densities within twenty four kilometers of the ice edge, rather than further away.

A rough estimate of the ringed seal population in the eastern Canadian Arctic and north Atlantic waters is 1.2 to 1.3 million (Kingsley 1998; NAMMCO 2002). Estimates are difficult due to a number of factors including birthing lairs under snow, and an unknown proportion of time spent on the ice or near the surface for detection.

Potential threats to the ringed seal include disruption to habitat by offshore activity and shipping, distribution and availability of prey, along with predicted changes in sea ice distribution and extent (Harwood 2001; NAMMCO 2002).

Harbour Seal (*Phoca Vitulina*)

The harbour seal, also referred to as the common seal, is a small pinniped with a wide ranging distribution in the northern hemisphere (Mansfield 1967). There are five recognized subspecies of the harbour seal, with the western Atlantic subspecies present in the Arctic year round and found in the Lancaster Sound region.

Harbour seal distribution in the Lancaster Sound area is not well known. Their presence is considered to be rare in Lancaster region and along the east coast of Baffin Island (Stephenson and Hartwig 2010). The Nunavut Wildlife Harvest Study provides further indication of their absence in the region with no record of a harbour seal harvest north of eastern Baffin communities (Priest and Usher 2004). No harbour seals were recorded during aerial surveys of eastern Lancaster in 1978 and 1979 (INAC 1983), however, they have been recorded

near Arctic Bay and Pond Inlet by hunters (Mansfield 1967). Harbour seals are known to travel in summer into estuaries and up rivers into fresh water (Mansfield 1967).

In the spring, females are known to form clusters along the shore where they have their pups (Mansfield 1967; Boness et al 2006). Harbour seals exhibit a high degree of site fidelity to pupping sites (Härkönen and Harding 2001) and are known to use a wide variety of habitats ranging from rocky shores to mudflats. In summer and winter, harbour seals prefer open water and the edge of the fast ice. They do not make breathing holes in the ice and thus are sparse throughout much of the Arctic archipelago in winter.

Hooded Seal (*Cystophora cristata*)

The hooded seal is a large migratory seal recognizable by its inflatable proboscis present in adult males. The hooded seal winters in Davis Strait

and off the coast of Newfoundland and Labrador and summers in waters off the coasts of Denmark, Greenland and Canada (DFO 1985).

Most hooded seals migrate from Davis Strait and the Newfoundland/Labrador coast to west Greenland and Denmark in the summer, however, a small number is known to migrate north to Baffin Bay and Lancaster Sound (INAC 1983). The hooded seal is considered uncommon in the Lancaster and north Baffin Bay region (Koski 1980; Koski and Davis 1979). They have been seen in Pond Inlet and Eclipse Sound, however Miller (1955) reports that no more than three have been seen in a year. The hooded seal is known to feed in deep water and to prefer the open water and depths of Baffin Bay in summer (Stephensen and Hartwig 2010).

The total population that summers in the Arctic is not known, but a spring survey of the whelping patch in Davis Strait estimated 10,000 pups (DFO 1985).

Appendix D: References

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