Toward sustainable shipping: Minimizing impacts on Inuit traditional harvesting in Tallurutiup Imanga National Marine Conservation Area through integrated coastal and ocean management (ICOM)

By

Olivia Choi

Submitted in partial fulfillment of the requirements for the degree
of
Master of Marine Management

at

Dalhousie University
Halifax, Nova Scotia

December 2018

Table of Contents

List of Tables

List of Figures

Abstract

With the decline in sea-ice cover in the Arctic, shipping is expected to increase in the eastern Canadian Arctic. While sea ice is often perceived as a threat to marine transportation, Inuit rely on the sea ice for travel and hunting. Thus, the loss of sea ice and increasing shipping activity threatens Inuit traditional way of life and food security. Tallurutiup Imanga is a proposed National Marine Conservation Area (NMCA) located in the North Baffin region of Nunavut. Commercial and recreational fishing, shipping and tourism are permitted within the NMCA and will continue to be regulated under existing legislation. This region has been identified as a high-risk shipping corridor due to the presence of environmentally sensitive areas and the likelihood to affect Inuit harvest areas and travel routes. However, the potential impacts of shipping on traditional harvesting and the seasonal variability of these interactions are not well understood. Harvest and vessel traffic/automatic identification system (AIS) data were mapped and analyzed to identify their spatiotemporal interactions in two communities adjacent to the NMCA, Arctic Bay and Pond Inlet. A policy analysis of the regulatory and non-regulatory measures for Arctic shipping in Canadian waters was undertaken to identify potential management gaps in the current governance frameworks. The results of the policy and spatial analyses found a lack of protection of Inuit marine and coastal use areas and harvest areas within the existing policy tools. Integrated coastal and ocean management (ICOM) is the proposed management approach to plan and manage activities within the NMCA. Improved coordination in the planning and management of the NMCA is required to minimize shipping impacts on Inuit traditional harvesting.

Keywords: eastern Arctic; traditional knowledge; Tallurutiup Imanga; Arctic Bay; Pond Inlet; shipping; traditional harvesting; food security; integrated coastal and ocean management; National Marine Conservation Area

List of Abbreviations

ACMC	Area Co-Management Committee
AIRSS	Arctic Ice Regime Shipping System
AIS	Automatic Identification System
ASSPPR	Arctic Shipping Safety and Pollution Prevention Regulations
CCG	Canadian Coast Guard
CHS	Canadian Hydrographic Service
DFO	Fisheries and Oceans Canada
DNLUP	Draft Nunavut Land Use Plan
EEZ	Exclusive Economic Zone
ECCC	Environment and Climate Change Canada
CLARC	Community Land and Resource Committee
HTO	Hunters and Trappers Organization
ICC	Inuit Circumpolar Council
ICOM	Integrated coastal and ocean Management
IIBA	Inuit Impact and Benefit Agreement
ILUOP	Inuit Land Use and Occupancy Project
IMO	International Maritime Organization
INAC	Indigenous and Northern Affairs Canada
IUCN	International Union for Conservation of Nature
IQ	Inuit Qaujimajatuqangit
JPMC	Joint Inuit/Government Park Planning and Management Committee
LOMA	Large Ocean Management Area
LSRLUP	Lancaster Sound Regional Land Use Plan
MBS	Migratory Bird Sanctuary
MEOPAR	Marine Environmental, Observation, Prediction and Response Network
MPA	Marine Protected Area
NBRLUP	North Baffin Regional Land Use Plan
NLCA	Nunavut Land Claims Agreement
NMCA	National Marine Conservation Area
NORDREG	Northern Canada Vessel Traffic Services Zone Regulations
NPC	Nunavut Planning Commission
NTI	Nunavut Tunngavik Incorporated
NuPPAA	Nunavut Planning and Project Assessment Act
NWA	National Wildlife Area
NWHS	Nunavut Wildlife Harvest Study
NWMB	Nunavut Wildlife Management Board
PNCIMA	Pacific North Coast Integrated Management Area
QIA	Qikiqtani Inuit Association
RWO	Regional Wildlife Organization
SMA	Special Management Area
SSCZ	Shipping Safety Control Zone
TINMCA	Tallurutiup Imanga National Marine Conservation Area
UNCLOS	United Nations Convention on the Law of the Sea
WCF	Wildlife Compensation Fund

Acknowledgements

I would like to thank my supervisor, Dr. Claudio Aporta for his patience, guidance and support throughout this project. I am grateful for his expertise and insight, which were invaluable to the completion of this project. Thank you to my second reader, Dr. Lucia Fanning, for her insight and recommendations. I would like to extend my gratitude to Maxime Lapierre for lending his GIS expertise and to Casey Hilliard, for his technical support with the AIS data. Thank you to the Marine Affairs Program faculty and my peers, who have made these past 16 months unforgettable. Last, but certainly not least, thank you to my family and friends for their continued love and support.

Chapter 1: Introduction

Recent trends show a substantial decline in sea-ice cover in the Canadian Arctic as a result of a greater melt season and later freeze-up, which lengthens the open water season and makes the region more accessible for shipping (Melia, Haines, Hawkins, & Day, 2017). Indeed, Arctic shipping has increased significantly in the past decade with the growth in natural resource development, fishing, tourism, and community re-supply needs (Pizzolato, Howell, Derksen, Dawson, & Copland, 2014). The global shipping industry is particularly interested in declining sea-ice cover in the eastern Canadian Arctic as there is growing potential for the southern route of the Northwest Passage to become a seasonally viable alternative shipping route (Pizzolato, Howell, Dawson, Laliberté, & Copland, 2016). While sea ice is often perceived as an impediment to transportation and access, Inuit communities, most of which are coastal, have a special relationship with sea ice, as they see it as an extension of their land (Aporta, 2002; Inuit Circumpolar Council [ICC], 2014). Hence, while the decrease in sea-ice cover and an extended shipping season may present opportunities, particularly for industry, Inuit also see this as a threat to their traditional way of life (Watt-Cloutier, 2015).

Tallurutiup Imanga, or Lancaster Sound, is located at the eastern entrance of the Northwest Passage and is a proposed NMCA created under the *Canada National Marine Conservation Areas Act, 2002.* It is a form of marine protected area (MPA) but differs in that NMCAs are intended for multi-use through zoning to balance conservation and sustainable use of the marine environment. NMCAs have smaller zones of high protection surrounded by sustainable management zones, while MPAs focus on conserving important marine ecosystems and species or areas with high biodiversity (Parks Canada, 2018a). Under the NMCAs Act, seismic testing, and oil and mineral exploration and development are prohibited. However, commercial and recreational fishing, shipping and tourism are permitted and will continue to be regulated under existing legislation.

Future activity in Inuit Nunangat – the Inuit regions of Canada – has implications on Inuit and a holistic approach to governance that includes social and cultural considerations is required in the context of evolving Crown and Inuit relationships and of Canada's obligations regarding indigenous peoples. Cooperation between the Crown and Inuit was at the forefront during the negotiations of the Nunavut Land Claims Agreement

(NLCA), signed in 1993. The NLCA paved the way for the creation of an independent government serving the interests of Nunavummiut and co-management bodies that "… guarantee Inuit meaningful involvement and participation in decisions relating to the preservation and future development of lands within the Nunavut Settlement Area" (Government of Canada, 2018, para. 2).

More recently, Canada has committed to a renewed Inuit-Crown relationship "based on the recognition of rights, respect, cooperation and partnership as part of its broader goal of achieving reconciliation between the federal government and Indigenous peoples" with the signing of the Inuit Nunangat Declaration (Inuit Nunangat Declaration on Inuit-Crown Partnership, 2017, para. 2). The Declaration led to the creation of the Inuit-Crown Partnership Committee to advance shared priorities between the Government of Canada and Inuit, including implementing the duties and objectives of the NLCA (Inuit Nunangat Declaration on Inuit-Crown Partnership, 2017). The establishment of the Tallurutiup Imanga National Marine Conservation Area (TINMCA) is an opportunity for Canada to achieve co-governance. In 2017, a Memorandum of Understanding was signed by the Governments of Canada and Nunavut and the Qikiqtani Inuit Association (QIA) – the Regional Inuit Association representing Inuit in the Baffin Region – which emphasizes a whole of government approach that ensures cooperation between the Crown and Inuit and the partnership sought in the Inuit Nunangat Declaration (QIA, 2018a).

1.1 Management problem

Tallurutiup Imanga has been identified as a high-risk shipping corridor due to a combination of risks to vessel and human safety, the presence of environmentally sensitive areas, and the likelihood of shipping activities to affect species at risk, as well as Inuit harvest areas and travel routes (The Pew Charitable Trusts, 2016). The risks posed by shipping include disturbance to wildlife through ship strikes and noise pollution, contamination of food sources through ship source pollution and oil spills, and changes to the sea-ice pattern and resilience, which can endanger travel over ice (ICC – Canada, 2014; Huntington, Daniel, Hartsig, Harun, Heiman, Meehan, Noongwok, Pearson, Prior-Parks, Robards, & Stetson, 2015; The Pew Charitable Trusts, 2016). However, there is limited knowledge of the potential impacts of shipping and the spatiotemporal variability

of these interactions (Nunavut Planning Commission [NPC], 2016), as these sites have not yet been adequately inventoried (Porta, Abou-Abssi, Dawson, & Mussells, 2017). Policy development for sustainable shipping within TINMCA – that minimizes impacts on traditional harvesting activities – first and foremost requires improved understanding of the location, types, and seasonal nature of these uses and their interactions.

1.2 Research aim and objectives

This study seeks to identify management strategies that will support the continuation of the Inuit way of life and access to sustainable country foods within TINMCA, while balancing conservation and sustainable use objectives sought in NMCAs. The objectives of this study are thus twofold: 1) identify spatiotemporal interactions between shipping and traditional harvesting activities in two communities adjacent to TINMCA; and 2) assess existing Arctic shipping governance frameworks to identify potential management gaps. A whole of government approach to managing TINMCA requires the application of Inuit insights into decisions and actions that affect their lives. Thus, it is imperative that management decisions within TINMCA are guided by Inuit Qaujimajatuqangit (IQ; Inuit traditional knowledge) and that the data used to make management decisions represent Inuit practices, including traveling and harvesting. Inuit harvest data represents a substantial source of information on Inuit use of marine and coastal resources and spaces and can be used in conservation planning to identify presence of animals and sensitive areas. Using traditional harvest data, this study identifies the potential spatiotemporal interactions between Inuit traditional harvesting and shipping within TINMCA. The proposed management approach described in this paper is in line with co-governance models envisioned for TINMCA. It consists of an integrated strategy that facilitates inter-governmental coordination to manage activities that may affect harvesting in the adjacent communities.

1.3 Overview of methodology

To achieve the objectives of this study, a combination of quanitative and qualtitative methods was employed (Figure 1). Harvest data from two comprehensive studies – the Nunavut Wildlife Harvest Study (NWHS) conducted by the Nunavut Wildlife Management Board (NWMB) and the Nunavut Atlas – were mapped to identify

spatiotemporal patterns of harvests in two communities adjacent to TINMCA, Arctic Bay and Pond Inlet. Vessel traffic data in the form of Automatic Identification System (AIS) data from 2014 through 2017 were obtained from the Marine Environmental, Observation, Prediction and Response Network (MEOPAR) and extracted within the boundaries of TINMCA. Through spatial analysis, potential interactions between shipping activity and seasonal harvest areas used by Inuit hunters from Arctic Bay and Pond Inlet were identified. Travel routes and place names in Arctic Bay and Pond Inlet were supplemental data that provided context about the movement of hunters and the significance of coastal areas for harvesting but were not included in the spatial analysis. A policy analysis was conducted to evaluate whether current management measures governing shipping in Tallurutiup Imanga provide sufficient protection to Inuit use of coastal and marine areas for traditional harvesting. Regulatory and non-regulatory measures relevant to Arctic operations and with stated objectives to promote safe and sustainable shipping were included in the assessment. Given the results of the policy and spatial analyses, a literature review was undertaken to assess a Canadian case study where marine and coastal areas are managed through horizontal (cross-sectoral) and vertical (inter-governmental) integration. This case study served as a model to inform the recommendations provided in this study.

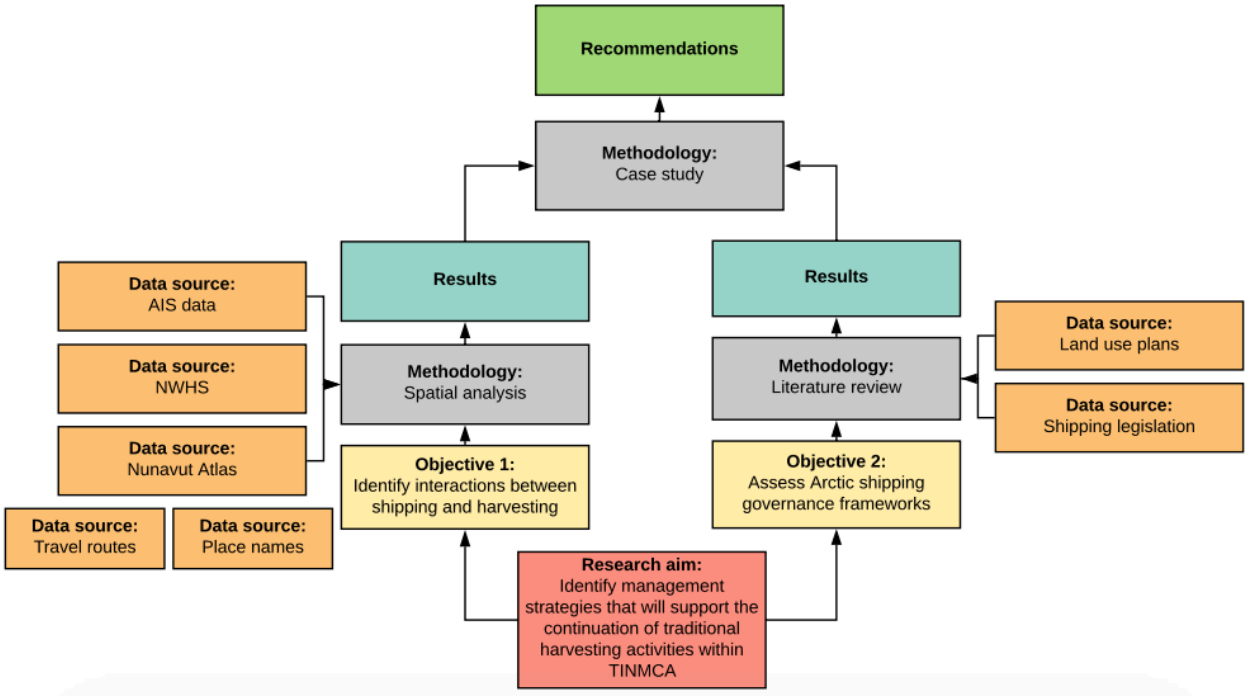

Figure 1. Methods used in this study.

1.4 Structure of the paper

This paper is divided into eight chapters. Chapter one introduces the study, including the management problem and the research aim and objectives, followed by an overview of the methodology used to accomplish the objectives. Chapter two provides context for the research objectives and methodologies used. Chapter three addresses the objective to identify interactions between shipping and harvesting; the methodology and limitations are described, and the results of the spatial analysis are presented. Chapter four addresses the objective to assess Arctic shipping governance frameworks and presents the results of the policy analysis. Chapter five introduces the concept of integrated management and examines a case study in which an integrated approach is taken to manage marine and terrestrial protected areas. Chapter six synthesizes and discusses the findings of the study. Chapter seven presents recommendations on the management strategies that may be employed within TINMCA to balance conservation and sustainable use objectives, and most importantly, to ensure the continuation of Inuit traditional harvesting activities. Chapter eight presents concluding thoughts.

Chapter 2: Context

2.1 Tallurutiup Imanga

Tallurutiup Imanga has been recognized internationally for its ecological and cultural significance; however, steps towards formal protection did not begin until 2007, when the federal budget provided funding for a feasibility assessment of establishing an NMCA (Lancaster Sound NMCA Feasibility Assessment Steering Committee, 2017). In 2010, the federal government announced a proposed boundary of 44,300 km^2 for an NMCA (Parks Canada, 2018b). Based on the findings of the feasibility assessment, the final boundary was expanded to 109,000 km^2 in 2017, which will make it Canada's largest marine conservation area (Figure 2; Parks Canada, 2018c). TINMCA will more than double the area of Canada's protected marine waters and will contribute to 1.9 percent of Canada's commitment to protect 10 percent of its oceans by 2020 (Parks Canada, 2017). The new boundary is connected to Prince Leopold Migratory Bird Sanctuary (MBS), Sirmilik National Park and Nirjutiqavvik National Wildlife Area (NWA), which together protect over 131,000 km^2 of Canada's marine and coastal areas

(International Union for Conservation of Nature [IUCN], 2017). The Governments of Canada and Nunavut and QIA are currently negotiating an Inuit Impact and Benefit Agreement (IIBA) for the NMCA, as per the NLCA, and simultaneously developing an interim management plan, which will include a draft zoning plan. The proposed timeline for negotiating an IIBA is March 2019, at which time TINMCA will be established under the NMCAs Act (Parks Canada, 2018b).

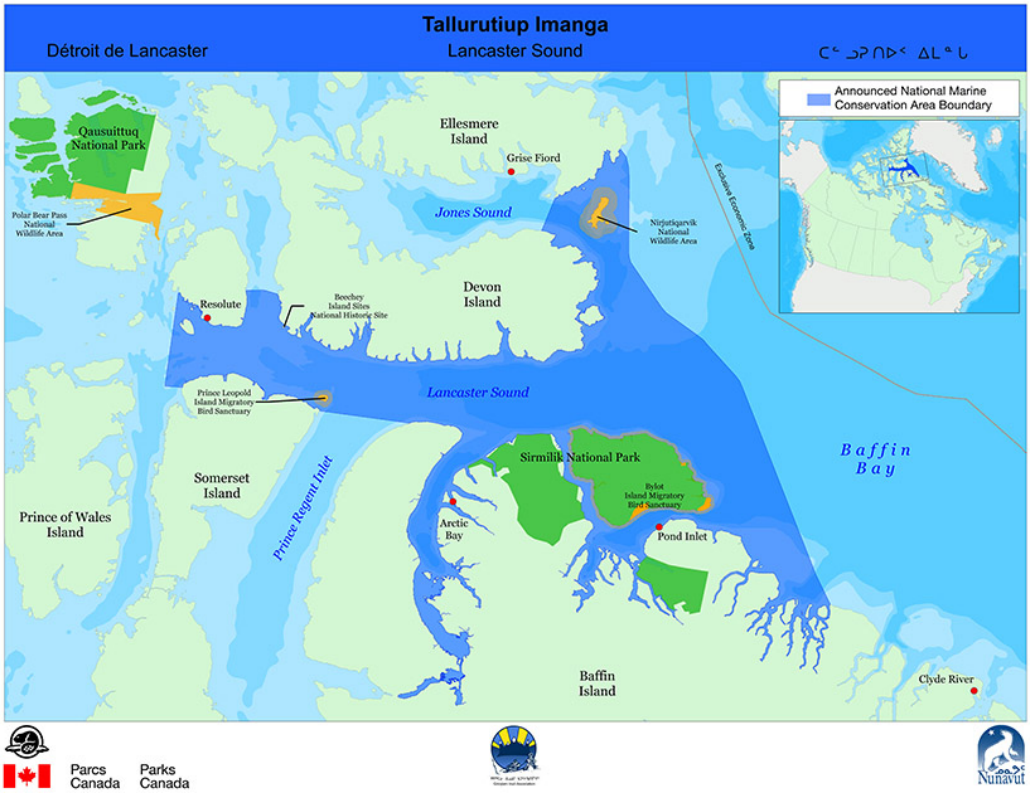

Figure 2. The final boundary of TINMCA (Parks Canada, 2018c).

Efforts to protect this area were initiated by Inuit in the 1960s when oil and gas development was proposed, leading to the creation of the 1991 Lancaster Sound Regional Land Use Plan (LSRLUP; QIA, 2018b). Inuit set out to document areas of use and identify constraints and opportunities regarding land use. The goal of the Plan was to provide direction to industry, government and communities on the future management of the Lancaster Sound Region, taking biophysical, social, cultural and economic aspects into consideration (Lancaster Sound Regional Land Use Planning Commission, 1991). The collection of studies and maps documenting Inuit land use is extensive (Milton

Freeman Research Limited, 1976; Dirschl, 1982; Lancaster Sound Regional Land Use Planning Commission, 1991; Riewe, 1992). These information sources have been pivotal to ensuring that decisions regarding resource development and environmental protection consider Inuit interests and are informed by IQ. Moreover, the Inuit Land Use and Occupancy Project (ILUOP; Milton Freeman Research Limited, 1976) and the Nunavut Atlas (Riewe, 1992) established the extent of historic and (then) present Inuit land use, which were used to determine the boundaries of the Nunavut Settlement Area during the negotiation of the NLCA (Riewe, 1992).

2.1.1 Ecological and cultural significance

Tallurutiup Imanga is a vast marine area defined by the presence of sea ice, and consisting of deep fiords, shallow bays, cliffs and coastal glaciers, which provide habitat for endemic and migratory species, contributing to the biological richness of the area (Lancaster Sound Regional Land Use Planning Commission, 1991). Currents, tides, coastal topography, upwellings and winds interact in a complex pattern to create polynyas – recurring areas of open water surrounded by ice (Hannah, Dupont, & Dunphy, 2009). These unique niches in the otherwise ice-covered waters are highly productive, drawing both people and wildlife. This dynamic environment provides abundant food sources for marine mammals and seabirds, which rely on the open water and thin ice associated with polynyas, shore leads and floe edges (IUCN, 2017). It provides critical habitat and encompasses 20 key habitat sites for migratory birds, including threatened and endangered species (Lancaster Sound Regional Land Use Planning Commission, 1991). Moreover, Tallurutiup Imanga is one of the most important marine mammal habitats in the eastern Arctic; it is home to 75 percent of the global narwhal population and supports one-third of North America's beluga population, as well as ringed, harp and bearded seals, and the once-endangered bowhead whale during the summer (Oceans North, n.d.; IUCN, 2017). This region also provides habitat to walrus and polar bear, as well as land mammals such as muskox and caribou – who rely on the sea ice to cross to Bylot Island during migration (Lancaster Sound Regional Land Use Planning Commission, 1991).

The complex and changing state of the sea and ice not only influence wildlife patterns, but also Inuit who use the region. There are five Inuit communities (hamlets)

adjacent to Tallurutiup Imanga: Pond Inlet, Arctic Bay, Resolute Bay, Grise Fiord and Clyde River. Extensive areas around each community are used regularly for hunting, fishing and, in the past, trapping (Lancaster Sound Regional Land Use Planning Commission, 1991). This intrinsic relationship between Inuit and the environment where they live is a fundamental dimension of Inuit culture, social organization, and economy. Traditionally, Inuit lived semi-nomadic lifestyles where their movement would be based upon seasonal changes and the presence of animals (Aporta, 2004). Hunters respond to changing snow and ice conditions by adjusting the time of their seasonal hunting, harvesting different species and using alternative travel routes and methods of transportation (Pearce, Ford, Willox, & Smit, 2015). At the appropriate times each season, hunters set out to find animals that are found according to predictable space-time patterns. These fundamental changes are marked by the cycles of snow, ice, water and light (Figure 3). Inuit recognize six seasons in Nunavut, but the start and end dates vary regionally (NPC, 2016). Table 1 shows the seasonal dates for the North Baffin Region. Freeze-up begins in early October and by December the waters are normally ice-covered. The ice regime is a mix of first-year ice, multi-year ice and icebergs. Landfast ice forms in sheltered inlets, fiords and bays, while Baffin Bay and Tallurutiup Imanga consist of unconsolidated ice that shift with winds, currents and tides (Lancaster Sound Regional Land Use Planning Commission, 1991). The harvest area is extended in the winter when the stable sea ice provides access to an extended travel surface from communities and seasonal camps (Dirschl, 1982). Spring is marked by the widening of cracks and leads, which occurs during the months of May and June (Lancaster Sound Regional Land Use Planning Commission, 1991). The open water season generally begins in July (when ice is no longer safe for travel), although the timing and length of this period depend on annual weather conditions.

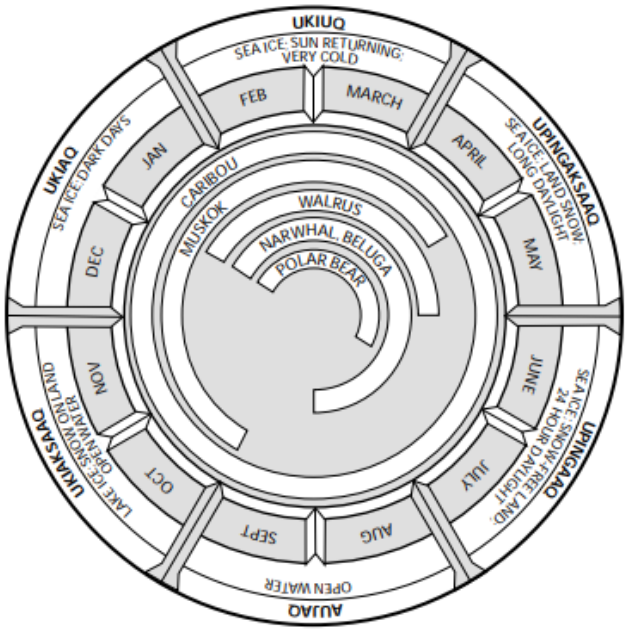

Figure 3. Annual snow, ice, water, light and harvesting cycles (NPC, 2000).

Table 1. Inuit seasons and dates for the North Baffin region (modified from NPC, 2016).

Season	**Ukiuq** Sea ice; Sun returning; Very cold	**Upingaksaaq** Sea ice; Snow free land; Very long daylight	**Upingaaq** Sea ice; Snow free land; Very long days	**Aujaq** Open water	**Ukiaksaaq** Lake ice; snow on land; Open water	**Ukia** Sea ice; Dark days
Dates	February 1 to March 31	April 1 to May 31	June 1 to July 31	August 1 to September 30	October 1 to November 30	December 1 to January 31

Harvests largely coincide with the seasonal cycles of the environment and of wildlife (Figure 3). Hence, the ecological significance of this area is intrinsically tied to its cultural significance to Inuit. Communities are usually located nearby feeding grounds for caribou, nesting areas for birds, and lakes and rivers where fish can be found (ICC Canada – 2008). At the same time, Inuit must also travel to places where they will find these seasonal sources of food. Hence, the free movement across land and sea is imperative to the continuation of traditional harvesting practices. Spring is a particularly important time, as hunters travel to the floe edge – where seal, beluga, narwhal and polar bear concentrate (Lancaster Sound Regional Land Use Planning Commission, 1991). However, harvest conditions also fluctuate from year to year, largely dependent on the

weather (ICC – Canada, 2008). Knowledge of the environment and the interconnectedness of humans and animals are thus key to Inuit survival. This knowledge, reflected in place names and travel routes, connect Inuit communities to harvest areas within Tallurutiup Imanga and its adjacent lands. This relationship is critical for Inuit food sovereignty and cultural integrity and is what makes environmental protection of the land and sea a priority (ICC – Canada, 2008). As climate change and reductions in sea ice affect the migration routes of animals, Inuit are reporting changes in the timing and location of harvests, which require hunters in some communities to travel further distances (ICC – Canada, 2014). Thus, Inuit are highly concerned that sea ice routes are reliably accessible by people and that the animals can continue to keep up with their mobility patterns. External factors, such as shipping, that may affect migration patterns or sea ice composition, are of high concern.

2.2 Potential shipping impacts on traditional harvesting

Since the establishment of permanent settlements, marine transportation has become central to the economic well-being of the region. Communities rely on ships as a means of transporting goods to service the region, a dependency that is increasing as population and development needs grow. This trend is also accelerating due to climate change. In the past decade, there have been significant reductions in sea-ice cover, while marine traffic has more than doubled in the Canadian Arctic (Dawson, Pizzolato, Howell, Copland, & Johnston, 2018), with some communities adjacent to TINMCA experiencing even more intensive growth in marine traffic. The community of Pond Inlet experienced three times the growth in vessel traffic of any Canadian Arctic community from 1990 to 2000 (Dawson et al., 2018). This increase is attributed to destination traffic, including tourism vessels, bulk carriers and tanker traffic related to the Mary River iron ore mine. Overall, the spatiotemporal trends in shipping throughout the Canadian Arctic reflect the varying needs of communities, opportunities for resource extraction and tourism, as well as opportunities presented by changing environmental conditions (Dawson et al., 2018). Moreover, declining sea-ice cover in the eastern Canadian Arctic is raising the possibility that the Northwest Passage could become a viable, alternative shipping route for transoceanic trade. The Canadian government has begun to identify corridors to direct ship traffic, including areas where icebreaking may be necessary, in an attempt to reduce

navigational hazards and chokepoints in narrow channels (Aporta, Kane, & Chircop, 2018). As mentioned before, while industry perceive sea ice as a barrier, Inuit use of marine waters is not constrained by sea ice.

The projected loss of sea-ice cover and increasing shipping in the Canadian Arctic is of growing concern for both people and wildlife in the region. In terms of impacts to wildlife, ships may: alter the behaviour and distribution of marine mammals due to noise pollution; lead to the mortality of marine mammals (e.g., the flooding of seal dens near ship tracks); cause oil spills that would have detrimental effects to habitat, seabirds and marine mammals; and cause the premature break-up of landfast ice and floe edges, resulting in changes to wildlife movements (i.e., caribou sea-ice crossings during migration) (ICC – Canada, 2008; ICC – Canada, 2014). Changes associated to the distribution and migration patterns of wildlife would inevitably affect harvesting activities. Communities, in particular, are concerned about the direct, adverse effects of shipping on harvesting activities (ICC – Canada, 2008). Icebreakers can disrupt the sea ice, cause earlier than normal breakups, and disturb traditional routes on the sea ice. Thus, it is imperative that shipping in the Arctic is conducted in a sustainable manner that recognizes Inuit uses of the sea including travel and traditional harvesting.

2.3 The Nunavut Land Claims Agreement

This section describes the rights and benefits guaranteed to Inuit that were negotiated with the Government of Canada in the NLCA, specifically rights to traditional harvesting and decision-making regarding wildlife. The Agreement was initiated in 1973 by the Inuit Tapirisat of Canada – the national organization representing Inuit in Canada – through a study that was undertaken to record Inuit land use and occupancy, and which was the catalyst for negotiating a land claim (Nunavut Tunngavik Inc. [NTI], 2004). The ILUOP showed present and historical Inuit use of approximately 1.5 million square miles of land and water, including harvest areas (Land Claims Agreements Coalition, 2017). Negotiations took place over decades starting in 1976, following a land claims proposal which was submitted by the Inuit Tapirisat of Canada (Government of Nunavut, 2007). In 1982, the Tunngavik Federation of Nunavut was established with the mandate to negotiate a land claims agreement with the Government of Canada (Land Claims Agreements Coalition, 2017). Following an Agreement-in-Principle which was signed in

1990, a final agreement was ratified in 1993 and the related *Nunavut Land Claims Agreement Act* was enacted, leading to the creation of the territory and the Government of Nunavut (Land Claims Agreements Coalition, 2017).

The broad scope of rights and benefits negotiated in the Agreement range from provisions related to wildlife (Article 5), parks (Article 8), conservation areas (Article 9), land and resource management (Article 10), land use planning (Article 11) and development projects (Article 12). These rights and benefits are based on the principle of promoting self-reliance and the social and cultural well-being of Inuit (NTI, 2004). Inuit self-sufficiency is inherently tied to the land and wildlife, which they depend upon for subsistence harvesting.

2.3.1 Inuit traditional harvesting rights

Inuit have relied upon the environment and animals for subsistence since time immemorial and their ties to the land remain strong today. As in the past, they continue to rely heavily on country foods, obtained through hunting, fishing and gathering. Traditional harvesting of country foods has significant social, cultural and economic value to Inuit. Country foods provide nutritional benefits at a reduced cost compared to store-bought foods and allow for the continuation of traditional practices and cultural ties to the land (ICC – Canada, 2008). Harvests are often shared within social networks, which reinforces the notion of community and provides households with access to nutritional foods (ICC – Canada, 2008). It has been estimated that $40 million of country food is produced annually by Inuit harvesters in Nunavut (Statistics Canada, 2006). Canadian Inuit experience higher levels of food insecurity than the average Canadian, with the high cost of store-bought foods being a contributing factor (Arriagada, 2017). Though food security has improved through the federal government food subsidy program, culturally relevant food is important to ensure the well-being of Inuit at different levels (Arriagada, 2017). Even for permanently employed Inuit, part-time or seasonal hunting remains a means of supplementing food supplies. Households with active hunters are more food secure and also allow for the transmission of culturally-relevant practices.

The NLCA guarantees Inuit rights to hunt, trap and fish, as well as the right to participate in decision-making regarding wildlife management and harvesting. To

facilitate the role of Inuit in decision-making, the Nunavut Wildlife Management Board (NWMB) – the board responsible for joint management of land, water and wildlife resources with government – was established by the NLCA (Tungavik Federation of Nunavut & Indian Affairs and Northern Development, 1993). The NWMB coordinates its activities with the 27 Hunters and Trappers Organizations (HTOs) and the three Regional Wildlife Organizations (RWOs), which oversee harvesting at the local and regional levels, respectively (NWMB, n.d). The NWMB, along with other joint management bodies, serve to ensure that Inuit rights are upheld in activities that take place in Nunavut.

The Agreement guarantees Inuit harvesting rights in marine areas outside of Nunavut, as well as those beyond Canada's jurisdiction. Inuit harvest wildlife in two marine areas beyond the boundaries of Nunavut: the waters beyond Canada's territorial sea, and the waters of Hudson Bay, James Bay and Hudson Strait (NTI, 2004). Decisions regarding wildlife in these areas require advice by the NWMB. The Outer Landfast Ice Zone off the east Baffin coast, located beyond Canada's offshore jurisdiction, has been used historically by Inuit to harvest wildlife (Figure 4; Tungavik Federation of Nunavut & Indian Affairs and Northern Development, 1993). The Agreement allows harvesting activities to continue in this area, with the exception of marine mammals. TINMCA encompasses a portion of the ice zone along the northeastern coast of Baffin Island. There is high likelihood for conflict between Inuit harvesting rights guaranteed under the NLCA and the multiple uses in the area, as well as mismatch in international, federal and territorial laws that govern shipping. Given the overlapping jurisdictions, there is a need for improved coordination in the management of this area to ensure the continuation of traditional harvesting rights and in the context of this study, to ensure sustainable shipping within TINMCA.

Figure 4. Outer Landfast Ice Zone (Tungavik Federation of Nunavut & Indian Affairs and Northern Development, 1993).

2.3.2 Inuit role in parks and conservation areas

Prior to the NLCA, there was no mechanism to protect community-identified areas of significance unless it met criteria for an existing protected area (NPC, 2000). The Nunavut Agreement sets out provisions to guide the development and management of parks and conservation areas. Conservation areas refer to MPAs, National Wildlife Areas (NWAs), Migratory Bird Sanctuaries (MBSs), Wildlife Sanctuaries, National Historic Sites, National Historic Parks, and other areas of cultural, ecological or archaeological significance (Tungavik Federation of Nunavut & Indian Affairs and Northern Development, 1993). Specifically, the NLCA requires parks and conservation areas to be established in consultation with Inuit; they must maintain a role in their planning and management to ensure decisions are informed by IQ and incorporate Inuit interests and priorities. Parks and conservation areas are established through public consultation and

input from organizations, including HTOs and RWOs. In the Qikiqtani (North Baffin) region, community input is further facilitated through Community Land and Resource Committees (CLARCs). Each community has a CLARC that provides QIA with knowledge of the environment, wildlife and local land uses, which contribute to land management decisions made by QIA (QIA, 2015).

Inuit Impact and Benefit Agreements (IIBA) are the mechanism for negotiating matters related to the proposed park or conservation area, which include obligations related to coo-management, Inuit harvesting rights and economic benefits (Tungavik Federation of Nunavut & Indian Affairs and Northern Development, 1993). The NLCA requires Joint Inuit/Government Park Planning and Management Committees (JPMCs) to be established through IIBAs for territorial and national parks (Tungavik Federation of Nunavut & Indian Affairs and Northern Development, 1993). For conservation areas administered by Environment and Climate Change Canada – NWAs and MBSs – Area Co-Management Committees (ACMC) are established through IIBAs (Figure 5).

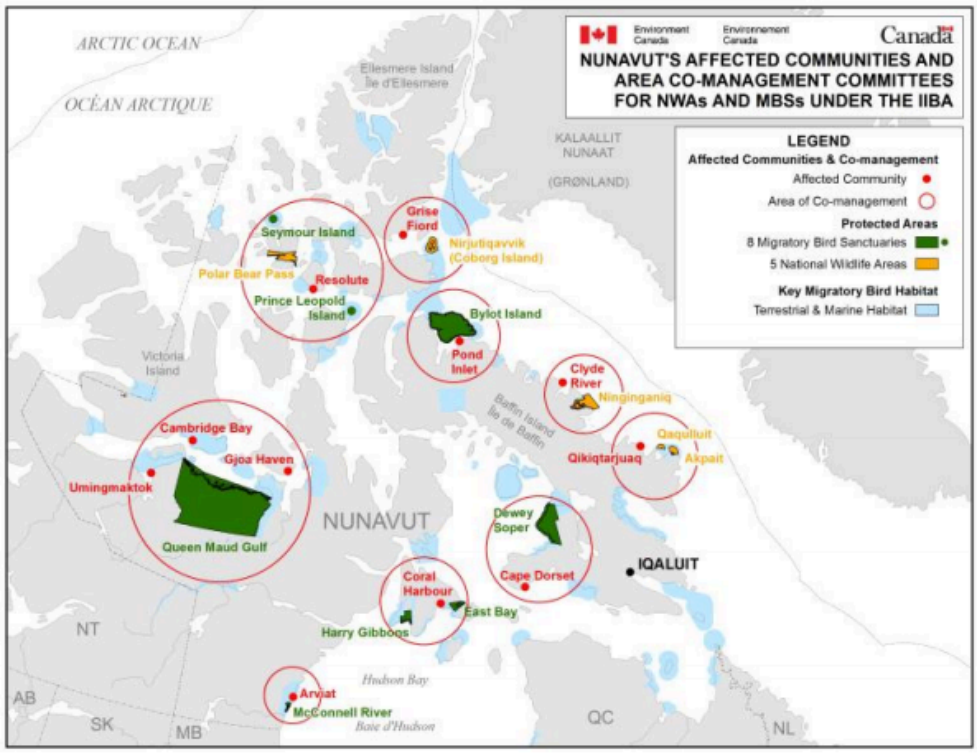

Figure 5. Existing ACMCs in Nunavut. Note: There are three ACMCs for conservation areas adjacent to TINMCA, in addition to the Sirmilik Joint Park Management Committee (SJPMC; Ahiak Area Co-Management Committee, 2018).

Chapter 3: Identifying interactions between shipping and harvesting

This chapter describes the spatiotemporal interactions between shipping and harvesting within TINMCA from the spatial analysis of harvest data and AIS data. Descriptions of the data sources, the methodology used to perform the spatial analysis, followed by the results are presented. Lastly, limitations to the methodology are discussed.

3.1 Methodology

The following sections described the methodology used to identify the interactions between shipping and harvesting within TINMCA. Inuit harvest data were mapped to identify important harvest areas used seasonally by hunters in Arctic Bay and Pond Inlet. The harvest spatial data were then combined with AIS data to identify overlaps between shipping and harvesting activities.

3.1.1 Mapping harvest data

Harvest data were mapped to identify harvest areas used by Inuit hunters in Arctic Bay and Pond Inlet and the seasonal variability in the location and importance of these areas. Of the five communities adjacent to TINMCA, Arctic Bay and Pond Inlet were chosen as the study sites to identify interactions between shipping and harvesting activities, as this area experiences the highest vessel traffic and is likely to see growth in tourism, in part due to Sirmilik National Park.

The maps produced in this study combine seasonal land use intensities documented in the Nunavut Atlas (1991) and harvest data from the NWHS (1996-2001), which are the most comprehensive harvest studies in Nunavut to date. The Government of Nunavut is compiling coastal resource inventories and producing maps of ecologically and culturally significant sites in each of the 25 communities. While these inventories have been completed and are publicly available for some communities, including Arctic Bay, the inventory for Pond Inlet was not made available at the time of the study. Hence, this data source was omitted from the analysis. The Nunavut Atlas, much like its predecessor, the ILUOP, is a compilation of land use and renewable resource information for the Inuit-occupied portion of the Northwest Territories, prior to the signing of the NLCA (Riewe, 1992). The Nunavut Atlas was compiled to update the data gathered in

the comprehensive land use research effort (the ILUOP), in order to have a better picture of the state of Inuit land use and wildlife. In addition, the maps produced for the ILUOP lacked indication of areas important to wildlife and the intensity of land use and therefore, were not entirely useful to establish the relative importance of lands used by Inuit (Riewe, 1992). The maps in the Atlas are based upon community-based research conducted in Nunavut and involving Inuit hunters and elders. The Atlas was developed using existing documentation of IQ and interview data collected between 1986 and 1987 (Riewe, 1992). The Atlas is divided into four sections and encompasses a series of maps illustrating the geographical extent of Inuit land use in each of the 27 communities and details of land use patterns and wildlife, including seasonal variations. The third section of the Atlas, which show major travel routes and intensity of land use by Inuit was of particular importance in this study. The Atlas subdivides land use intensities into three categories: 1) high intensity – areas used every year during the study period from 1986 to 1987; 2) medium intensity – areas used within the last 30 years, but not necessarily used every year; 3) low intensity – areas used prior to 1960 but rarely used by hunters in 1987 (Riewe, 1992). Land use intensity maps are accompanied by descriptions of the seasonal use of areas by hunters and the wildlife harvested (Appendix 1).

Harvest data from the NWHS were combined with seasonal land use intensities provided in the Nunavut Atlas to incorporate more recent harvest data into the study and to ensure robust data analysis. The NWMB collected harvest data monthly from Inuit hunters in all 27 communities for five years, from June 1996 to May 2001 (NWMB, 2004). The information collected includes the species type and quantity, their location, and the date of harvest. Harvests were assigned to the hunter's community of residence, even if they harvested in another community, thus capturing their movement and harvesting ranges (NWMB, 2004).

Travel routes were included in this study as they can provide insight into the movement of hunters, while place names are important in the Inuit oral approach to knowledge, and describe trails, activities and harvest areas (Aporta, 2009). Knowledge of the environment and the interconnectedness of humans and animals are reflected in place names and travel routes, which connect Inuit communities to harvest destinations. IQ and skills related to subsistence are based on historical and current observations by Inuit and

are transmitted inter-generationally as part of a rich oral history (Hoover, Ostertag, Horny, Parker, Hansen-Craik, Loseto, & Peace, 2016).

Areas of the land, water and ice are known and communicated by names which describe physical and cultural features in the landscape and icescape (Inuit Heritage Trust [IHT], 2016). These place names refer to areas of significance, whether describing a landmark, the animals that inhabit the area, the shape of an island, the features of the ice or a lake. For example, the place name Tuujjuk refers to a campsite where the surrounding ice "keeps moving and hitting the shores" to create open water where marine mammals can be harvested (Aporta et al., 2018). Place names, which are often located along coasts and trails, reveal the extensive and intimate knowledge Inuit have of the marine and coastal environment (Aporta, 2003). Place names were obtained from the IHT. Inuit travel routes were documented by Aporta in Arctic Bay and Pond Inlet, between 2008 and 2011. Elders and other knowledgeable people documented Inuit mobility networks (both sled trails and summer boat routes) in marine and terrestrial areas, including within TINMCA. These trails and routes show systematic use of coastal and marine areas, and geographic and environmental knowledge transmitted through generations (Aporta, 2009).

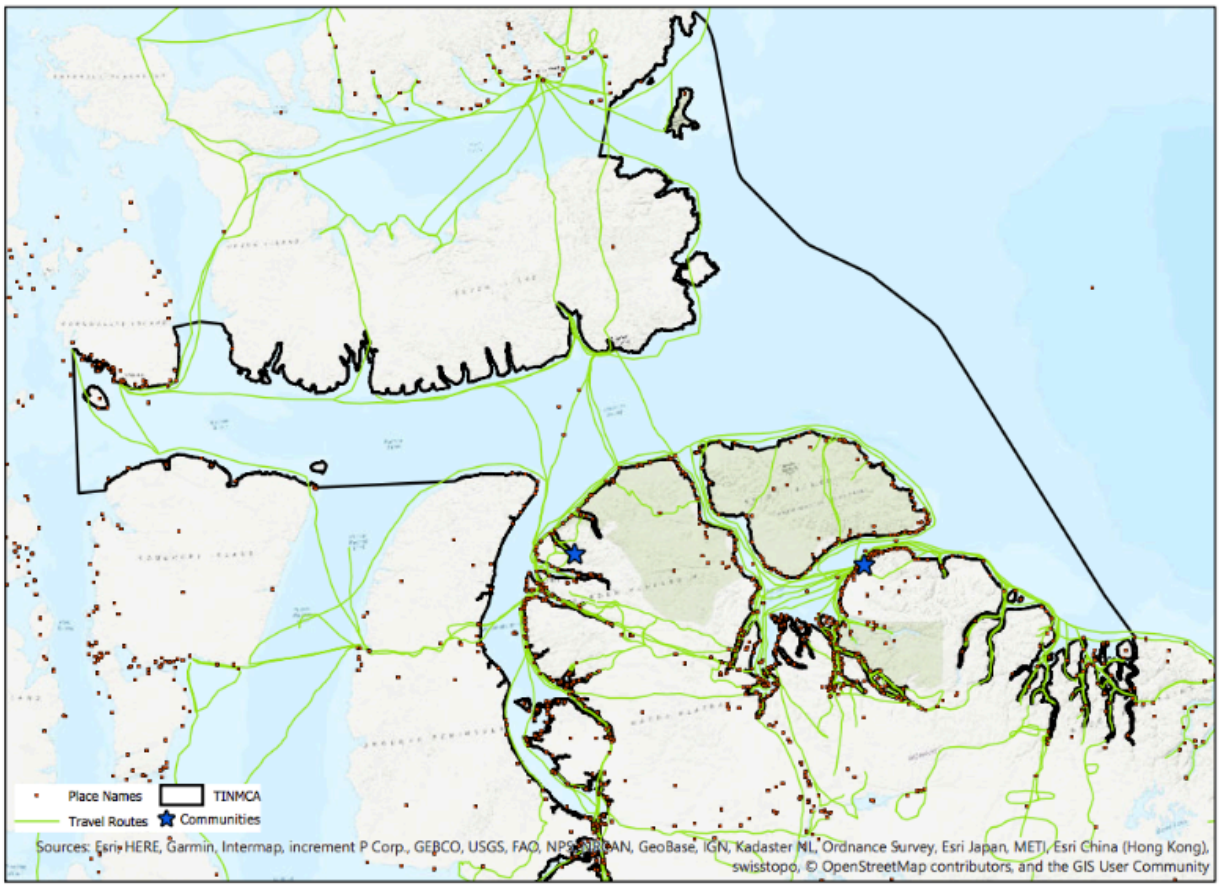

Figure 6. Place names and travel routes in Arctic Bay and Pond Inlet (modified from Aporta, 2009; IHT, 2016)

3.1.2 Spatial analysis of harvest data

Land use intensity maps from the Nunavut Atlas were digitized, which is the process of converting features on a paper map into digital format (Figure 7). The scanned maps were then georeferenced (i.e., the data pixels were assigned coordinates) and the associated attribute (qualitative) data were logged using ArcGIS. The land use intensities data layer was then transformed from polygons to rasters (i.e., cells). Raster data is useful for quantifying and visualizing spatial patterns in the data. The raster data were reclassified from attribute data to numeric values based on their corresponding land use intensity (i.e., each cell was assigned a numeric value between 0 and 3, where 0 was assigned to no data values, and 3 was assigned to high land use intensity).

Harvest data points from the NWHS were clustered using the Kernel Density tool to calculate the density of harvests in a given location. The data in the resulting raster

layer were then classified using the Jenks natural breaks classification method on ArcGIS, a data clustering method designed to arrange values into different classes (i.e., three), while reducing the variance within classes and maximizing the variance between classes. The resulting classes were once again reclassified into numeric values ranging from 0 to 3. Both reclassified raster layers were then summed to provide a density map showing seasonal variations in harvest areas used by Inuit hunters. The model shown in Figure 8 was used to produce each of four maps showing the spatiotemporal variability in harvest areas used by hunters during the fall (September to November), winter (December to February), spring (March to May) and summer (June to August). In addition to the four maps that show seasonal importance of harvest areas, a year-round harvest areas map was produced using the formula provided below.

$$\textit{Year-round output} = [(\textit{winter output} + \textit{summer output} + \textit{spring output} + \textit{fall output})/4 + (\textit{winter output} + \textit{summer output} + \textit{spring output} + \textit{fall output})$$

An overlay (sum) of the data layer containing the harvest densities and land use intensities for all seasons and the data layer containing the seasonal outputs divided by four results in an output that shows where there is an overlap between the two data layers. The resulting map shows the locations where harvest data were documented during each of the four seasons (i.e., the data output is not an aggregation of seasonal harvest data). The relative importance of year-round harvest areas is thus highest where harvest data for each season is available in both the Nunavut Atlas and the NWHS.

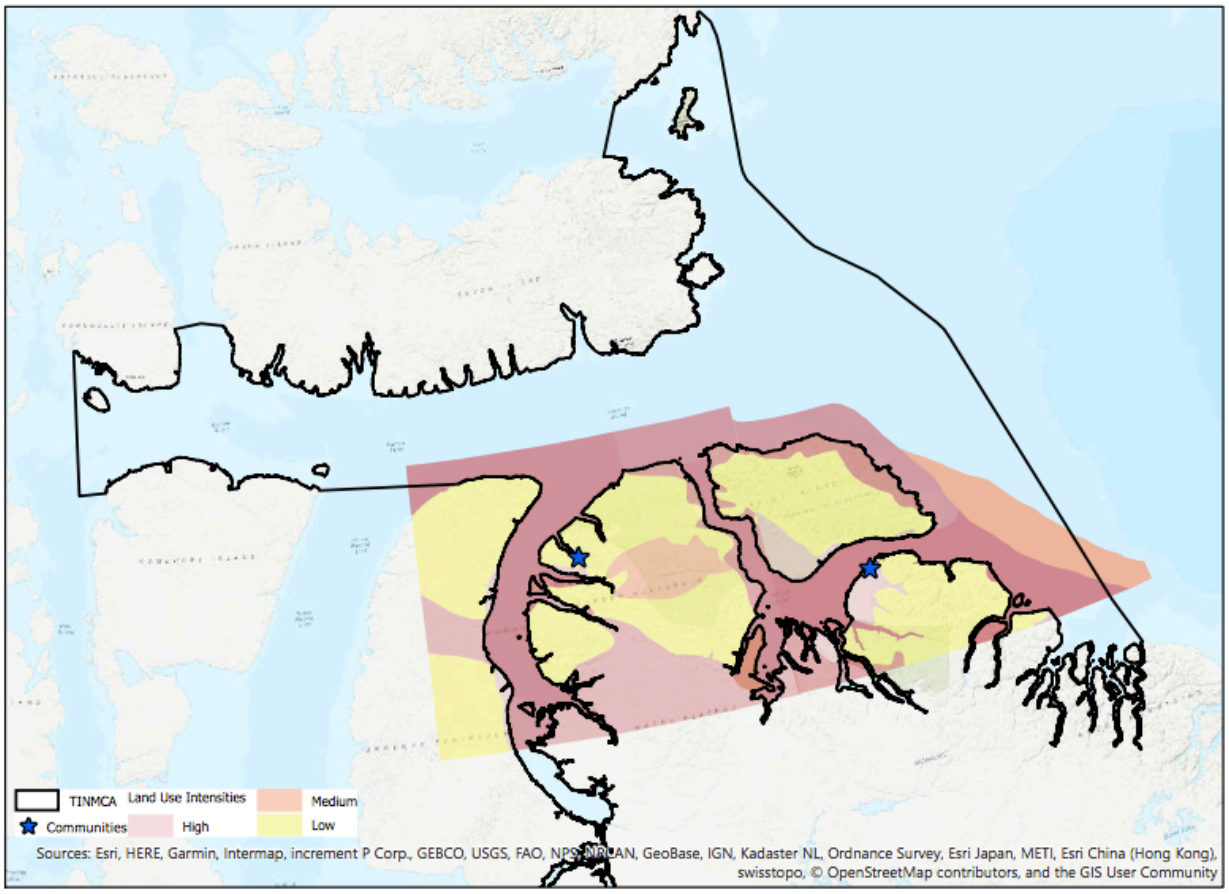

Figure 7. Digitized land use intensity maps from the Nunavut Atlas (modified from Riewe, 1992).

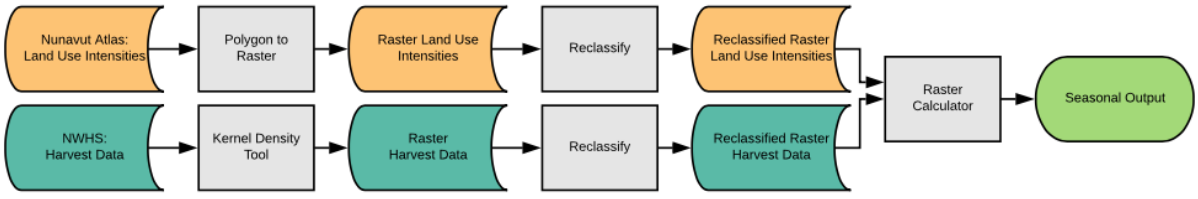

Figure 8. Model used to produce seasonal harvest area maps on ArcGIS.

One of the key objectives of this study is to identify spatiotemporal variabilities in harvest areas used by Inuit hunters in Arctic Bay and Pond Inlet. Table 2 shows the matrix that was used to classify the relative importance of harvest areas from the outputs described above. The rows and columns represent land use intensities and harvest densities, respectively. The sum of numeric values for harvest densities and land use

intensities ranged from 0 (no data) to 6 (highest land use intensity and harvest density). The matrix was used to ensure the range and distribution of the harvest spatial data (i.e., relative importance) are accurately portrayed in the maps.

Table 2. Matrix used to classify the relative importance of harvest areas.

		Harvest Density			
		0	**1**	**2**	**3**
Land Use Intensity	**0**	No Data	Very Low	Low	Medium
	1	Very Low	Low	Medium	High
	2	Low	Medium	High	Very High
	3	Medium	High	Very High	Highest

3.1.3 Mapping vessel traffic

To better understand the interactions between shipping and harvesting activities, AIS data were obtained and processed by MEOPAR and extracted within the boundaries of TINMCA. Spatial analyses were performed using ArcGIS to identify spatiotemporal interactions between shipping activity and seasonal harvest areas used by Inuit hunters in two communities adjacent to TINMCA, Arctic Bay and Pond Inlet. AIS data from 2014 through 2017 inclusive were used in this study to account for potential annual variability in sea ice conditions, that may have influenced the timing and frequency of vessels transiting TINMCA in a given year. Including four years of AIS data provides more accurate trends in vessel traffic and minimizes potential biases as a result of improvements in AIS technology and data collection. Specifically, the AIS data from earlier years may underestimate the actual vessel traffic through TINMCA.

The boundaries of TINMCA were defined as study site for which AIS data was extracted. Vessel trajectories were generated using a threshold of 360-minute tracks with ships traveling at speeds of less than or equal to 30 knots (i.e., individual AIS data points were merged at 360-minute intervals). Data points were merged to determine the number of days that distinct vessels were noted within TINMCA. The vessel days counts are categorized by vessel type and the month and year of their presence within TINMCA. This information was merged with the harvest data to identify spatiotemporal overlaps between traditional harvesting and shipping activity.

3.1.4 Limitations

The harvest studies used to identify spatiotemporal patterns in traditional harvesting are decades-old. While the harvest areas used by hunters have not changed significantly over the years, more recent, comprehensive harvest studies should be conducted to reflect present-day Inuit harvesting patterns. The ongoing coastal resource inventories initiative is a valuable contribution to the need to gather and preserve IQ to inform coastal management. With climate change, there may be changes in the range, timing and location of harvests, as well as changes in wildlife distribution and access to harvest areas. QIA has conducted studies to track the distribution and population of wildlife, and to monitor the impacts of shipping on harvesting, however, this data is not publicly available.

As previously mentioned, Inuit identify six seasons marked by the seasonal cycles of snow, water, ice and light. Thus, Inuit seasonal cycles are not synonymous with the four seasons based on the astronomical calendar. The Nunavut Atlas uses the terms spring, summer, fall and winter when describing the seasons associated with the land use. Hence, this study assumes that the four seasons described in the Atlas refer to the dates based on the astronomical calendar. Further clarification should be sought in the dates associated with seasonal land use and harvesting described in the Nunavut Atlas. Future research should aim to document harvest data based on the Inuit seasons so that the information is analogous to the seasons described in land use plans and in turn, can be effectively translated into management measures.

The spatial analysis of harvest data and AIS data provides insight into the potential spatiotemporal interactions between shipping and harvesting within TINMCA. These interactions were influenced by the timing and location of ships in a given year and sea-ice conditions. As the timing of these activities may vary in response to changing conditions – both in shorter- and longer-term, the interactions identified in this study may be lesser or greater from year to year. That being said, general trends in the interactions provide insight into potential conflicts between shipping and harvesting and can be used to identify management gaps and recommendations.

The measure of vessel days per month is a count of the number of the days that distinct vessels were noted within the area. A count of 10, for example, could refer to 10 different vessels, having appeared on a single day each, or one vessel for 10 different

days, or somewhere in between (e.g., one vessel for 6 days, two vessels for 2 days each, etc.). While these numbers provide insight into the overall vessel presence by type and month, as the number of vessel days rises, it becomes increasingly difficult to attribute vessel presence to independent factors, such as growth in the number of vessels transiting through TINMCA, or dependent factors, such as changing marine conditions, which make it more or less favourable for shipping. Thus, detailed vessel traffic data from Transport Canada and the Canadian Coast Guard [CCG] should be consulted when analyzing AIS data for a more holistic picture of Arctic shipping trends.

3.2 Results

This section presents the results of the study. First, harvest areas used by Inuit hunters in Arctic Bay and Pond Inlet are presented, and the spatiotemporal variability in harvest areas are described. Then, the interactions between shipping and harvesting within TINMCA are described.

3.2.1 Inuit harvest areas

This section presents the findings from the spatial analysis of harvest data in a series of maps that show the spatial variability in harvest areas by season and their relative importance based on harvest density. The darker areas represent harvest locations of high importance (high harvest densities), whereas the lighter areas represent those of lesser importance (low harvest densities). The numeric values assigned to each of the seven classes represent the sum of the land use intensity and harvest density in a given data cell. While there are seasonally important harvest areas, there are also marine and coastal areas that are frequented by hunters year-round. Coastal areas, particularly those adjacent to inlets, fjords and bays, are important year-round. Generally, there are buffers of important harvest areas surrounding the high-density harvest areas. Spring is the most important season for harvesting; the distribution and range of high-density harvest areas are much larger compared to the other seasons.

Travel routes provide much insight into important harvest areas and mobility across land and sea to harvest wildlife. The trails connecting Arctic Bay to Brodeur Peninsula are particularly important for summer and winter harvesting. Admiralty Inlet and Eclipse Sound are important travel and harvest areas, particularly in the spring and

summer. Place names also provide insight into Inuit land use patterns, including mobility and harvesting, which has been extensively documented in the literature (Goehring, 1990; Aporta, 2003; Keith, 2004). Place names are generally located along the coasts, where much of the harvesting takes place. In addition, clusters of place names coincide with high density harvest areas shown in the maps.

Figure 9 shows relative importance for year-round harvest areas, which include the coastal areas near Pond Inlet (1) and at the southern extent of Borden Peninsula adjacent to Admiralty Inlet (2), the eastern portions of Brodeur Peninsula (3) and Bylot Island (4), as well as the coastal areas adjacent to Eclipse Sound (5). Hunters travel over sea ice and water to access harvest areas year-round.

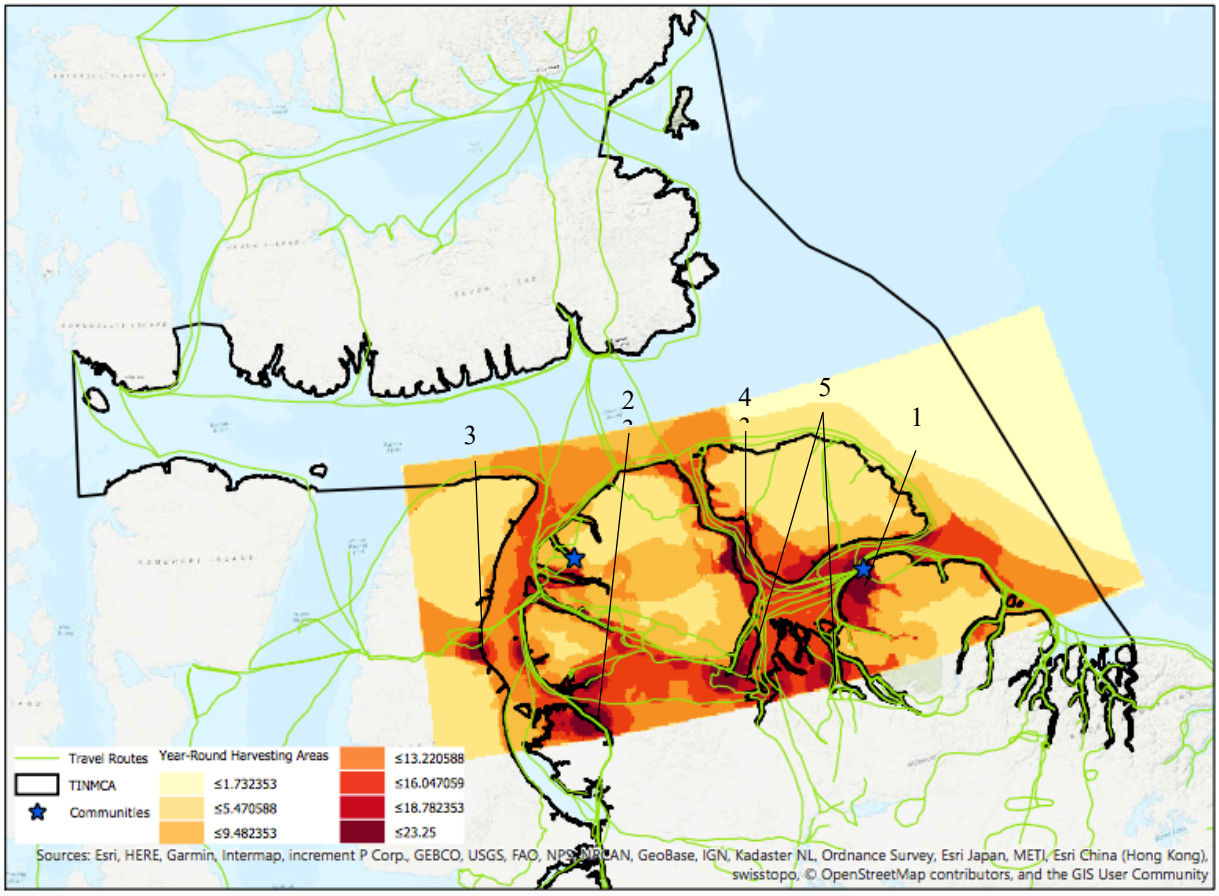

Figure 9. Year-round harvest areas used by hunters in Arctic Bay and Pond Inlet.

Figure 10 shows the relative importance of fall harvest areas. Areas of high importance fall harvests include the coastal areas near Pond Inlet (1) and adjacent to Admiralty Inlet (2), as well as the southeastern portion of Borden Peninsula adjacent to Eclipse Sound (3). Admiralty Inlet is an area of lesser importance for fall harvests, compared to the other three seasons.

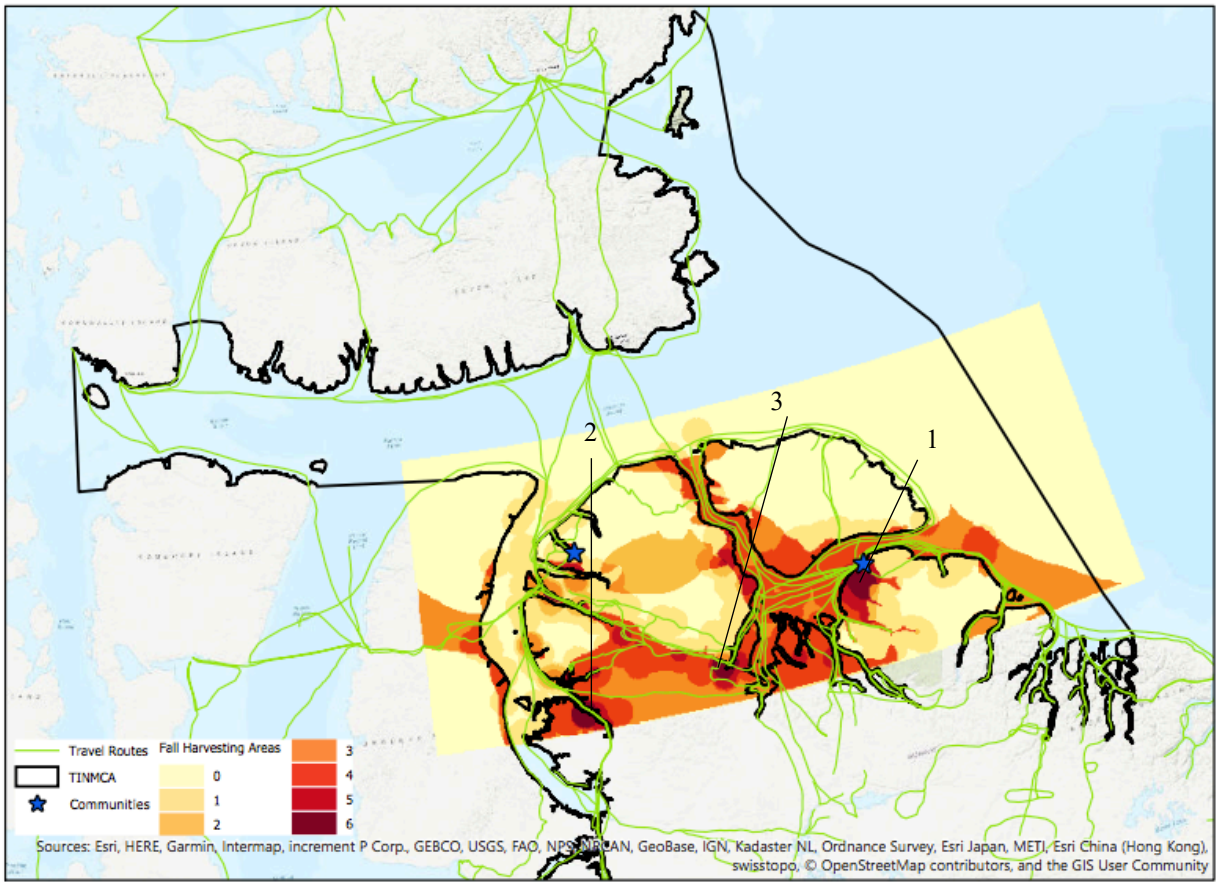

Figure 10. Fall harvest areas used by hunters in Arctic Bay and Pond Inlet.

Figure 11 shows the relative importance of coastal and marine areas for spring harvests. The mouth of Admiralty Inlet (1), the coastal areas of Bylot Island (2), Navy Board Inlet (3), the entrance to Eclipse Sound (4) and the coastal areas adjacent to Admiralty Inlet (5) are all significant to Inuit for spring harvests. Whereas harvesting takes place predominantly in coastal areas during the rest of the seasons, marine areas are used more widely for spring harvests. Eclipse Sound is a spring migration corridor for the Baffin Bay narwhal population (NIRB, 2018).

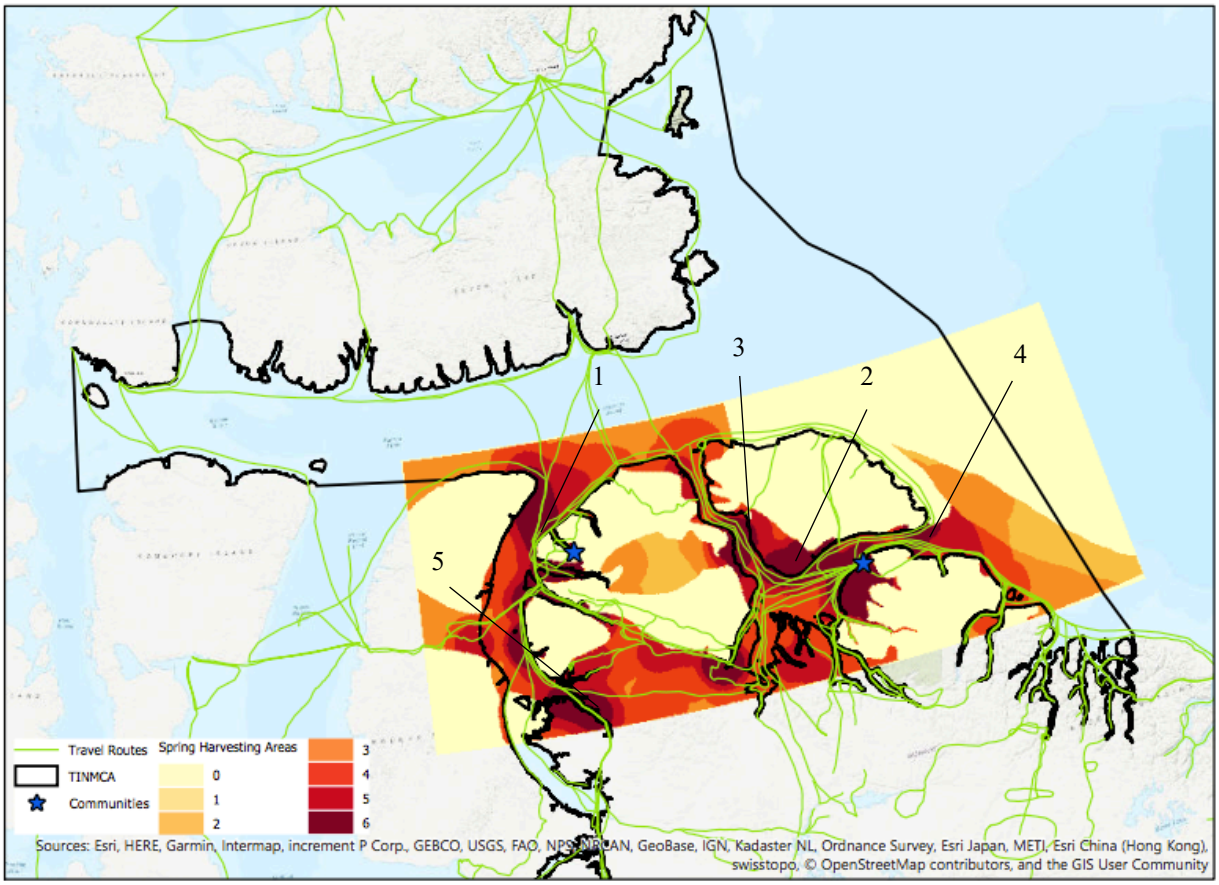

Figure 11. Spring harvest areas used by hunters in Arctic Bay and Pond Inlet.

Figure 12 shows the relative importance of summer harvest areas. he coastal and marine areas near Pond Inlet (1), Admiralty Inlet (2) and adjacent coastal areas (3), as well as Navy Board Inlet (4) are important summer harvest areas. In addition, the coastal areas adjacent to Eclipse Sound (5) are particularly important during the summer, compared to the rest of the seasons. Admiralty Inlet is a summering area for the Baffin Bay narwhal population from July to mid-September (Nunavut Impact Review Board [NIRB], 2018). The area is also used polar bears and is a feeding ground for bowhead whales during the summer (NIRB, 2018).

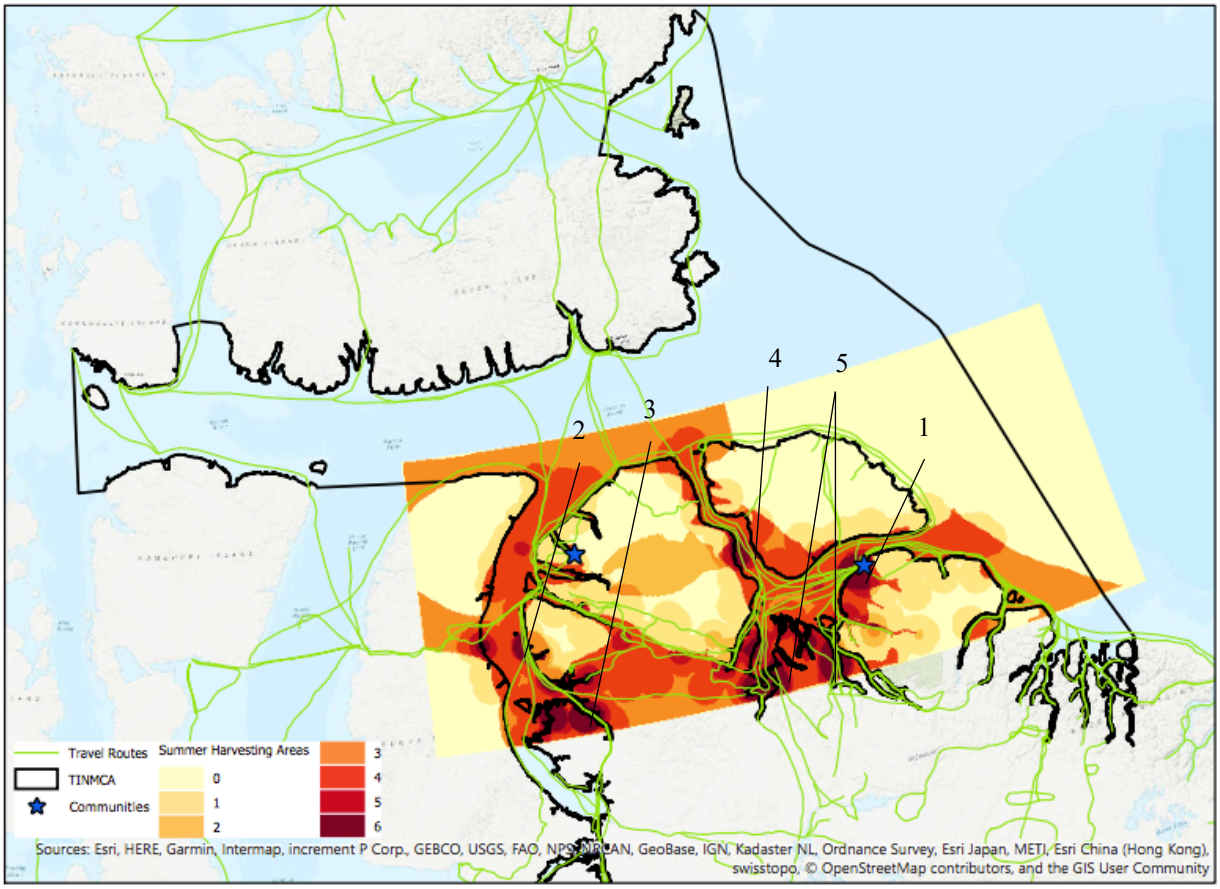

Figure 12. Summer harvest areas used by hunters in Arctic Bay and Pond Inlet.

Figure 13 shows the relative importance of winter harvest areas. Coastal areas near Pond Inlet are less used for winter harvesting, compared to the other seasons. The entrance to Eclipse Sound (1) and adjacent coastal areas (2), the eastern portions of Brodeur Peninsula (3) and Borden Peninsula (4), as well as Admiralty Inlet (5) and adjacent coastal areas (6) are particularly important for winter harvests.

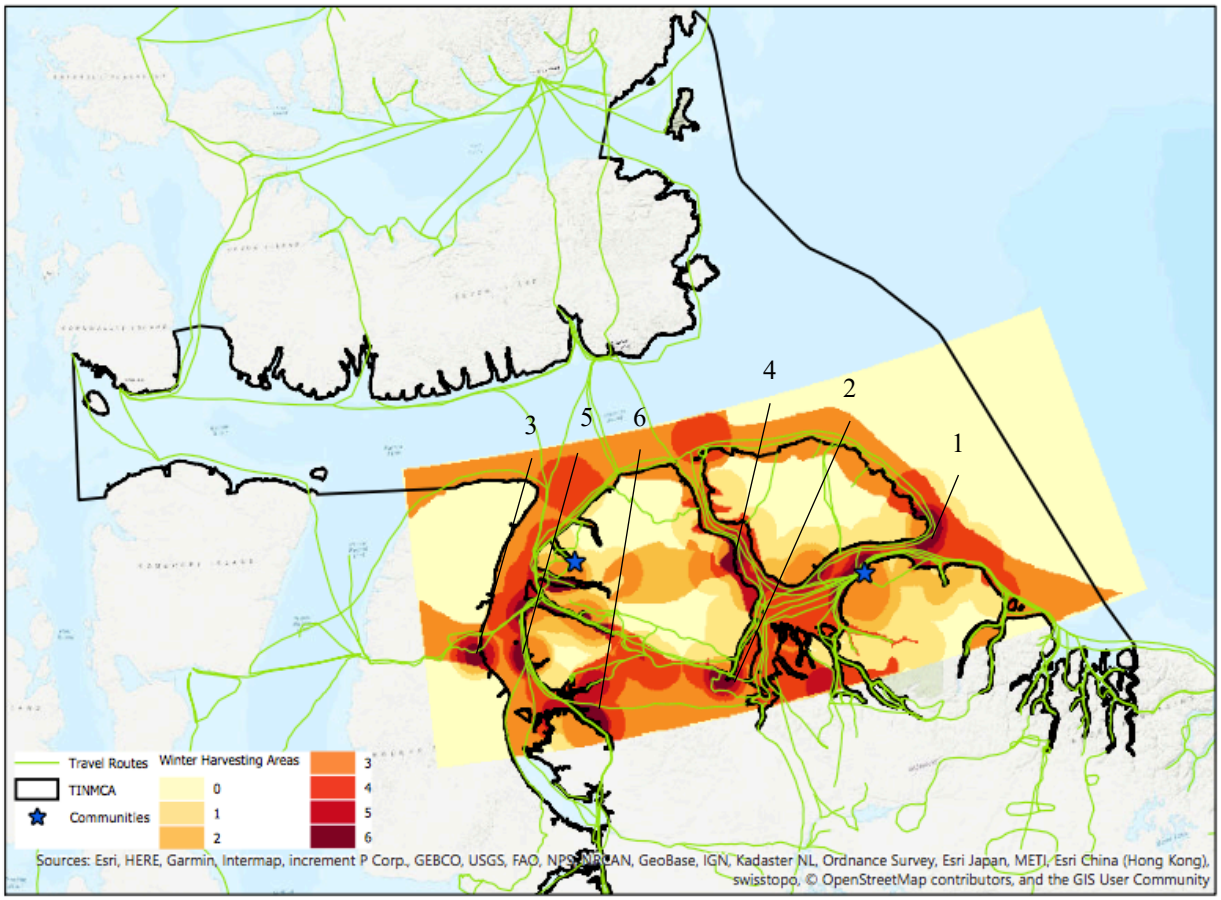

Figure 13. Winter harvest areas used by hunters in Arctic Bay and Pond Inlet.

The spatial analysis of harvest data indicates that there is much variability in the seasonal use of coastal and marine areas for harvesting. This suggests that shipping can have lesser or greater impacts on harvesting depending on the season. To identify the potential impacts of shipping on harvesting and management strategies, the spatiotemporal trends in shipping were assessed.

3.2.2 Trends in vessel traffic

The following figures and tables show trends in vessel traffic within TINMCA from 2014 to 2017. Vessel presence is broken down by month and vessel type. AIS data reveals that vessel traffic is greatest in Eclipse Sound, particularly the presence of cargo ships, which are used for community re-supply and to transport iron ore out of Milne Inlet, near Pond Inlet. It is not surprising that the spatial distribution of vessels, particularly tanker and cargo ships, are linked to the location of communities and the Mary River project. Vessel presence by cargo ships significantly increased within TINMCA, particularly in Eclipse Sound. From 2014 to 2017, tourism vessels, including sailing vessels, pleasure craft and passenger ships, accounted for 25 percent of the total vessel presence within TINMCA and had the highest presence of among all vessel types during the months of July and August. Figure 14 shows vessel traffic from 2014 to 2017 by type within TINMCA. The most noticeable observation is the high vessel presence by cargo ships in Eclipse Sound near Pond Inlet.

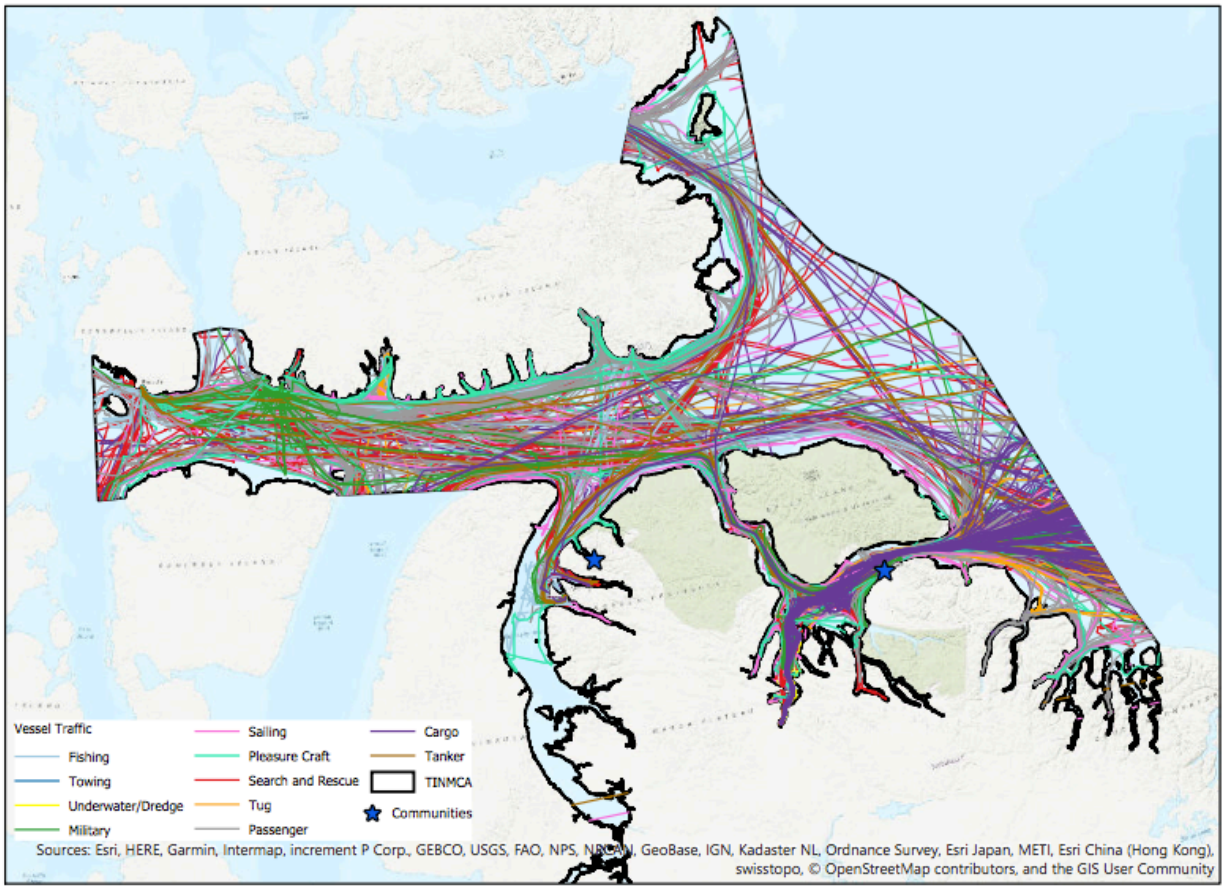

Figure 14. Vessel traffic by type from 2014 to 2017.

Figure 15 shows vessel traffic density within TINMCA as a percentage of the average number of ships per km^2 per year. Eclipse Sound near Pond Inlet experiences the highest vessel traffic year-round.

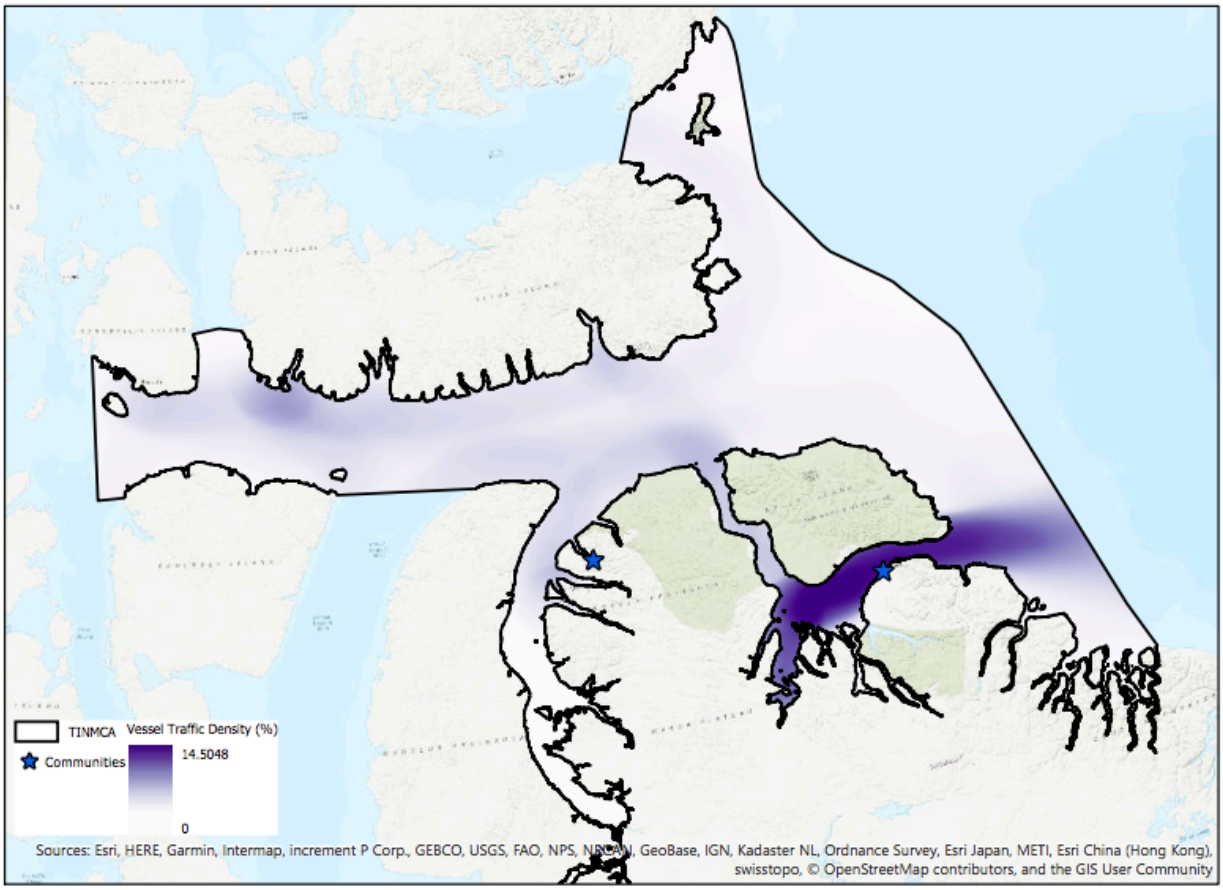

Figure 15. Vessel traffic density from 2014 to 2017.

Table 3 shows the breakdown of vessel days counts by type and month from 2014 through 2017 inclusive. Of the 11,105 total days of unique vessel presence within TINMCA, August had the highest vessel traffic (n = 5,895), followed by September (n = 3,698). During the month of July, sailing vessels had the highest presence among all vessel types. Among tourism vessels, sailboats had the highest vessel presence, followed by passenger ships, between 2014 and 2017. Cargo ships had the highest presence from August to October.

Table 3. Vessel days counts by month from 2014 to 2017 (* indicates the vessel type with the highest presence during the corresponding month).

Month	Vessel Type	Vessel Days	Total
February	Cargo	2	2
	Towing	1	
June	Sailing	1	2
	Sailing*	168	666
	Pleasure Craft	112	
	Search and Rescue	54	
	Tug	135	
	Passenger	19	
	Cargo	154	
July	Tanker	24	
	Fishing	199	5,895
	Towing	15	
	Military Operations	189	
	Sailing	991	
	Pleasure Craft	366	
	Search and Rescue	318	
	Tug	19	
	Passenger	909	
	Cargo*	2,689	
August	Tanker	200	
	Fishing	47	3,698
	Underwater/Dredge	177	
	Military Operations	2	
	Sailing	169	
	Pleasure Craft	82	
	Search and Rescue	581	
	Tug	42	
	Passenger	223	
	Cargo*	2,022	
September	Tanker	353	
October	Underwater/Dredge	31	826

	Search and Rescue	216	
	Tug	93	
	Cargo*	410	
	Tanker	68	
	Sailing	8	
November	Search and Rescue*	10	14
	Tug	4	
December	Fishing	2	2
Total			11,105

Figure 16 shows the distribution of the total vessel days count by type. From 2014 to 2017 cargo ships had the highest presence among all vessel types, followed by sailing boats.

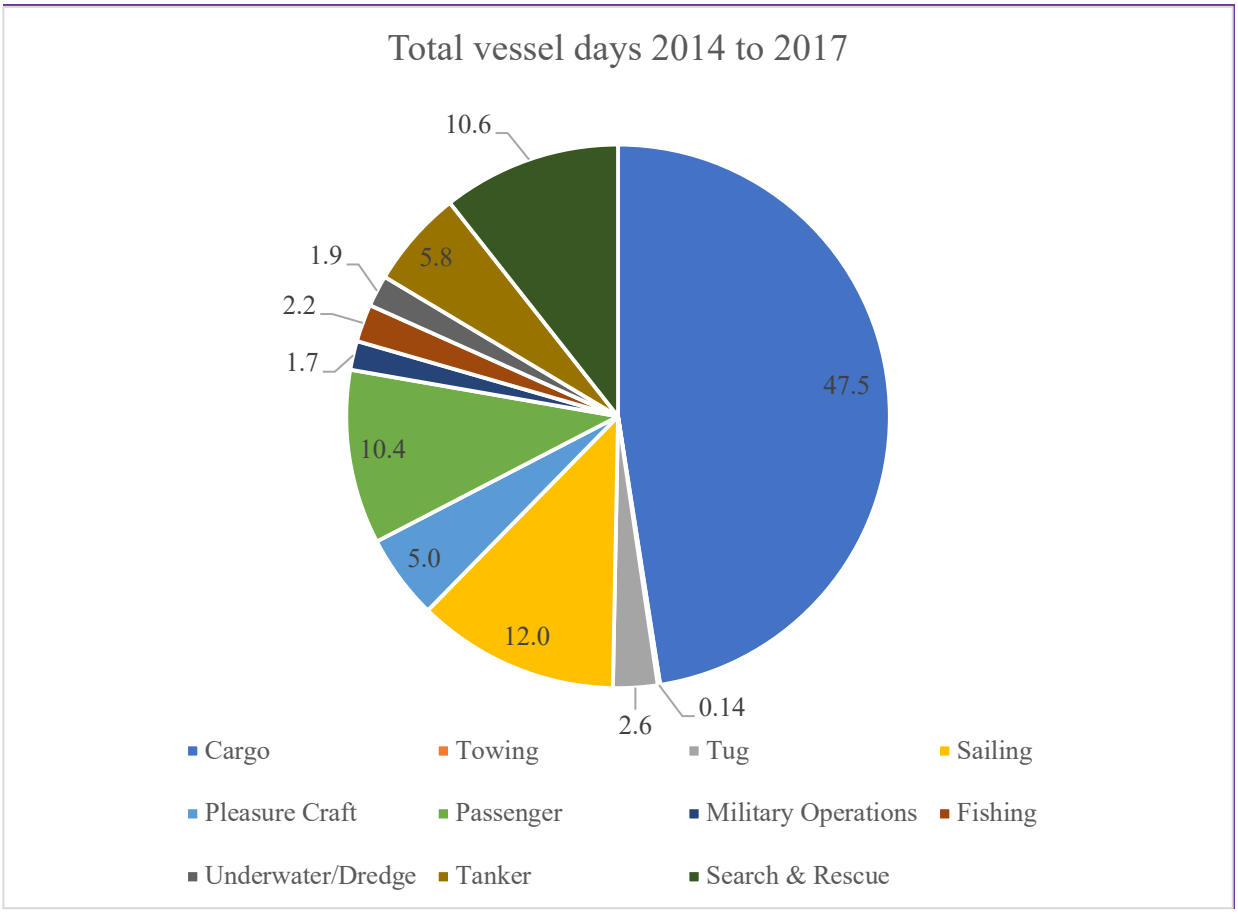

Figure 16. Total vessel days by type from 2014 to 2017.

Table 4 shows the percentage change in vessel days count by type and month within TINMCA. Given that satellite technology has improved since 2014, AIS data from 2016 and 2017 were chosen to measure change in vessel presence to minimize potential bias from improvements in data collection. The change in vessel presence for the months of February, June, November and December were omitted, given that the data available for these months is sparse. Overall, there was an increase of 9.69 percent in vessel traffic from 2016 to 2017. During the months of July through September, there was an increase in vessel presence, while October experienced a decline. Much of the growth in vessel traffic during the month of July was attributed to tug boats, while fishing vessels accounted for the highest increase in vessel presence during the month of August. Tug boats experienced the greatest increase in vessel traffic from 2016 to 2017, followed by fishing vessels. On the other hand, sailing vessels experienced the greatest decline in vessel presence, followed by tanker ships.

Table 4. Change in vessel presence by type from 2016 to 2017.

	July	**August**	**September**	**October**
Fishing		135.04%	100%	
Towing		-100%		
Military		100%	44.53%	
Sailing	37.03%	-31.15%	-34.90%	-100%
Pleasure Craft	64.05%	-43.10%	100%	
Search and Rescue	100%	17.09%	26.85%	25.45%
Tug	151.61%		100%	7.03%
Passenger	100%	44.40%	27.12%	
Cargo	-100%	85.85%	77.64%	33.57%
Tanker	100%	-60.76%	-56.90%	-53.89%
Underwater/Dredge			-100%	-100%

3.2.3 Spatiotemporal interactions between shipping and harvesting

The spatiotemporal interactions between shipping and species-specific harvest areas in Arctic Bay and Pond Inlet help to identify wildlife and harvesting activities that are at particular risk of encountering ships. Table 5 shows the overlap between harvest areas for the specified wildlife and shipping by month. These figures are expressed as a percentage and are a function of interaction counts divided by the total vessel days count from 2014 to 2017. Shipping activity in August had the highest interaction with

harvesting activities for all wildlife, with the exception of caribou and wolves. Figure 17 shows the overlap between vessel traffic from 2014 to 2017 and Inuit harvest areas for the respective wildlife. Overall, vessel traffic had the highest interaction with polar bear, seal and walrus harvest areas. While most of the interactions between shipping and harvest areas occurred in August and September, interactions also occurred outside of the open water season. While it is unknown whether these interactions took place in open water or on the sea ice, the interactions that occurred between October and November are likely to have been on the sea ice. Given that Arctic fox, caribou and wolves are land mammals and waterfowl are often harvested on land, these interactions, which collectively accounted for 31 percent of all interactions, must have occurred on the sea ice. These findings reveal that there is notable overlap between shipping and harvesting within TINMCA, thus highlighting the importance of regulatory measures to manage shipping in harvest areas, while taking into account spatiotemporal variations in the uses and their interactions.

Table 5. Overlap between shipping and harvesting by month from 2014 to 2017.

	February	June	July	August	September	October	November	December
Arctic Fox			13.81%	15.49%	17.04%	14.65%	7.14%	
Beluga Whales			6.61%	7.60%	9.52%			
Caribou			0.91%	0.51%	0.84%			50.00%
Fishing Sites			1.20%	1.34%	1.46%	0.12%		
Narwhals			12.16%	13.03%	12.66%	12.11%	14.29%	
Polar Bears	50.00%		17.27%	16.40%	17.90%	16.22%	28.57%	
Seals	50.00%		17.27%	16.35%	17.85%	16.22%	28.57%	
Walruses			16.37%	15.97%	17.20%	14.77%	14.29%	
Waterfowl			9.61%	9.99%	2.54%	0.73%	7.14%	
Wolves			0.61%	0.27%	0.57%			50.00%

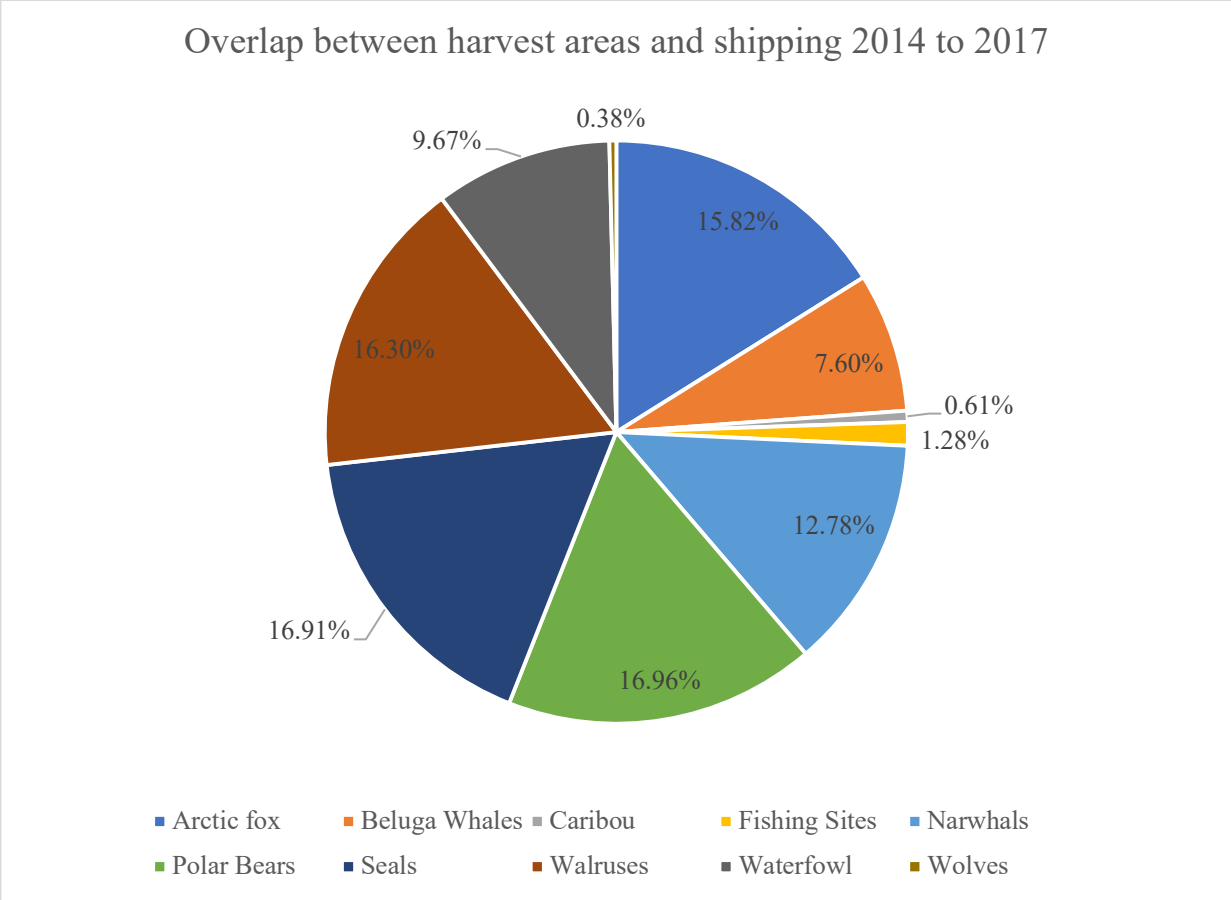

Figure 17. Overlap between shipping and harvest areas from 2014 to 2017.

Chapter 4: Assessing Arctic shipping governance frameworks

This chapter describes the governance frameworks for Arctic shipping in Canadian waters. Arctic marine transportation is governed by a system of international and domestic laws, as well as voluntary guidelines for safe navigation. In Nunavut, the land claims agreement provides a framework for how federal and territorial laws apply to Inuit and Inuit Owned Lands. Territorial governments oversee a variety of elements related to shipping including, wildlife management and the management of cultural resources; this triggers a project application and review process by the NPC and the NIRB under the NLCA and the *Nunavut Planning and Project Assessment Act* for shipping in the NSA (NuPPAA; INAC, 2015). At present, there are no corresponding regulations under the NMCAs Act. Thus, activities within NMCAs are governed by applicable existing legislation and in the case of TINMCA, provisions set out in the land

use plans. That being said, IIBAs may also contain provisions related to the protection and management of areas of cultural and historical significance, including archaeological sites and Inuit harvest areas. These negotiated provisions within IIBAs are reflected in interim and final management plans.

4.1 Methodology

A policy analysis was conducted to determine whether Inuit use of the sea is reflected and protected under existing policy instruments, including land use plans and maritime legislation. Specifically, regulatory and non-regulatory measures that are relevant to Arctic operations and aim to promote safe and sustainable shipping were included in the assessment. The analysis determined whether each of the criteria (defined by the research objectives) were addressed within the policy (Table 6). The following sections describe the shipping provisions in land use plans and international and national maritime legislation, followed by a summary of the results from the policy analysis at the end of the chapter.

Table 6. Criteria used to evaluate policy tools.

Criteria
Inuit use of the sea
Inuit areas of importance
Protection measures for Inuit areas of importance
Short-term or seasonal restrictions

4.2 Land use plans

The Nunavut Agreement led to the establishment of the NPC, the decision-making body responsible for creating land use plans and guiding how land and water are managed in Nunavut (Tungavik Federation of Nunavut & Indian Affairs and Northern Development, 1993). Land use plans guide resource use and development for marine and terrestrial components in the Nunavut. Under the NuPPAA, prohibitions on uses of lands and waters in Nunavut are enforceable by law (NPC, 2016). The role of the NPC is to ensure that land use activities adhere to the plan applicable for that area. There are three

planning regions throughout Nunavut: Kitikmeot, Kivalliq and Qikiqtaaluk (North Baffin), where land use plans exist for the latter two regions (NPC, 2018; Figure 18). The North Baffin Regional Land Use Plan (NBRLUP) and the Draft Nunavut Land Use Plan (DNLUP) are analyzed as these land use plans apply to the two case study communities.

Figure 18. Planning regions in Nunavut (ontheworldmap.com, 2018).

4.2.1 North Baffin Regional Land Use Plan

Land use planning and marine conservation efforts in Tallurutiup Imanga were initiated in response to pressure for offshore oil and gas development. Decisions on land use were often made with little regional consultation until the late 1970s, when a regional study of development options for the region was undertaken (Lancaster Sound Regional Land Use Planning Commission, 1991). In 1986, the Lancaster Sound Regional Land Use Planning Commission was formed, with the mandate to develop a land use plan for the region (Lancaster Sound Regional Land Use Planning Commission, 1991). The result of the study was a Green Paper entitled "The Lancaster Sound Region: 1980-2000" that set out resource development options to inform future planning in the region (Lancaster Sound Regional Land Use Planning Commission, 1991). Following the release of the

Green Paper community consultations took place, which led to the creation of the Lancaster Sound Regional Land Use Plan (LSRLUP; Lancaster Sound Regional Land Use Planning Commission, 1991). The Plan was finalized in 1989 and approved by Government in 1990 (Lancaster Sound Regional Land Use Planning Commission, 1991). In 1997, the NPC began a review of the LSRLUP to ensure that it complied with the NLCA (NPC, 2000). Following community consultations and a public hearing, the LSRLUP was replaced by the NBRLUP in 2000.

The NBRLUP identifies four types of Areas of Importance: Essential; Important; General Use; and Unknown or Little Known Importance (Figure 19; NPC, 2000). These Areas of Importance, which encompass wildlife species important for harvesting, travel routes, wildlife habitats, and archaeological sites, have been identified during the consultation process for the LSRLUP (NPC, 2000). A significant portion of Tallurutiup Imanga has been identified as an Essential Area for harvesting and supporting the biological productivity of wildlife (NPC, 2000). Much of the adjacent coastal areas were also identified as essential or important areas to communities and wildlife (NPC, 2000).

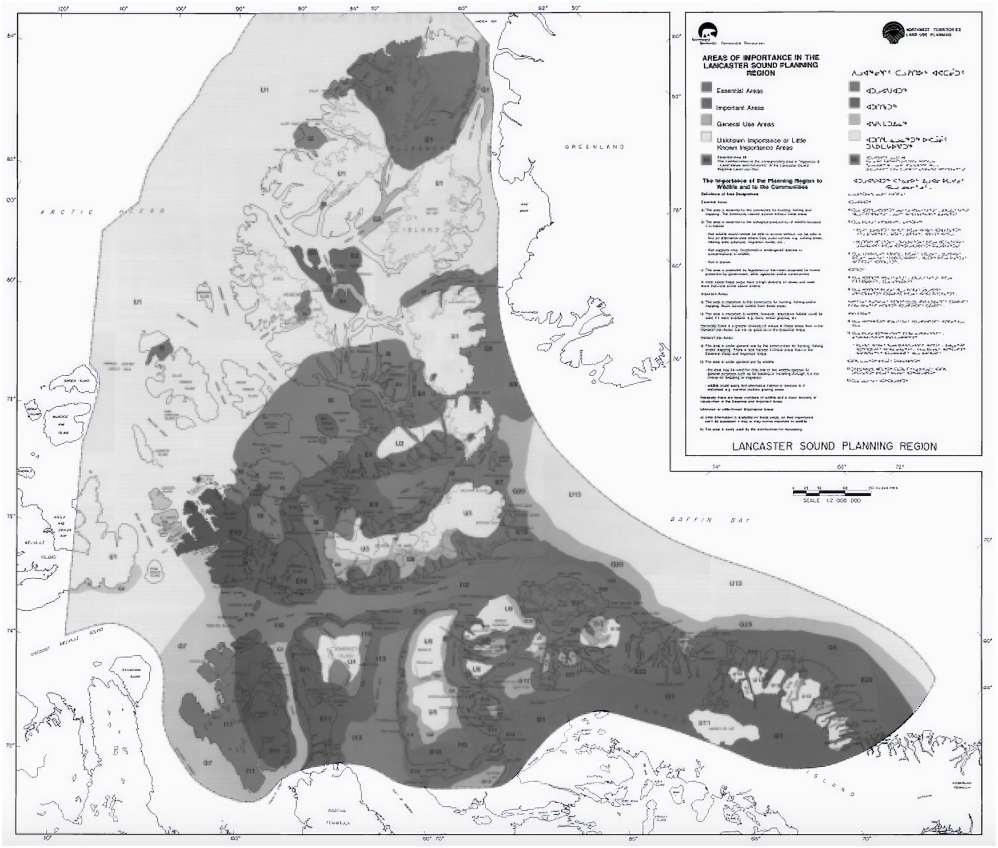

Figure 19. Areas of Importance map (NPC, 2000).

The NBRLUP calls for a coordinated approach to establishing protected areas and the use of seasonal or short-term protection measures to balance sustainable resource use and conservation (NPC, 2000). It requires that ships minimize transit through and around floe edges from April to June and maintain a distance of 10 kilometres from coastlines and at least 20 to 25 kilometres from the coasts of Tallurutiup Imanga (NPC, 2000). In addition, it addresses the need for the CCG to establish safe shipping practices through Essential Areas and through floe edges in the spring, and informing vessel operators of harvesting activities, the distribution of marine mammals and local sea ice conditions (NPC, 2000). Furthermore, the Plan identifies the need for regional shipping advisory committees and improved communication to provide communities with information on ship schedules and routes, particularly in the spring (NPC, 2000). A collaborative approach to managing coastal and marine areas that uses adaptive management techniques and harmonizes planning and policies to achieve sustainable development and conservation objectives is embodied in the concept of integrated coastal and ocean management (ICOM), which is discussed in detail in chapter five.

4.2.2 Draft Nunavut Land Use Plan

The NPC is in the process of developing the DNLUP, which will replace the NBRLUP upon its approval. The Nunavut-wide plan will apply to all projects in Nunavut, but it will not apply within established National Parks, National Historic Sites, Territorial Parks and NMCAs administered by Parks Canada (NPC, 2016). That being said, the DNLUP contains interim management provisions for TINMCA, identifying uses and prohibitions for the area. These provisions are to guide the management of TINMCA until interim and final management plans are approved.

The DNLUP identifies over 170 areas of interest including TINMCA, polynyas, walrus haul-outs, beluga calving grounds, caribou crossings and on-ice transportation routes (NPC, 2016). These areas of interest are assigned a Land Use Designation, which describes how land use will be managed. The DNLUP proposes three land use designations: Protected Areas; Mixed Use; and Special Management Areas (SMAs), which allow for case-by-case protections to account for factors such as economic potential and cultural priorities (NPC, 2016). It describes a number of shipping restrictions in Protected Areas and SMAs based on critical seasons for marine mammals

(e.g., breeding, moulting and feeding) and Inuit seasonal use of sea ice and waters. The DNLUP prohibits shipping activity in several areas of interest that protect Inuit use of coastal and marine areas. Specifically, there are seasonal restrictions preventing ships from transiting through the Lancaster Sound Polynya and Pikialasorsuaq (North Water Polynya), as well as year-round setback (minimum) distances from walrus haul-outs. In addition, communities identified Moffatt Inlet, adjacent to Arctic Bay, as an essential area due to its ecological significance. This Community Area of Interest will be designated as a Protected Area and will prohibit non-Inuit vessels from entering the area. Outside of the open water season (i.e., October to July), marine vessels are prohibited from crossing on-ice transportation corridors, including winter skid tracks used by Inuit to travel between communities and to harvest areas, without a robust ice bridging plan (NPC, 2016). Setback distances for migratory birds are applied in the extensive key bird habitat sites, MBSs and NWAs within and adjacent to TINMCA. Table 7 summarizes seasonal restrictions on shipping noted in the NBRLUP and DNLUP.

Table 7. Seasonal restrictions on shipping noted in land use plans (modified from NPC, 2000; NPC, 2016).

Land Use Plan	**Location**	**Provision**	**Timing**
NBRLUP	Floe edges	Minimize transit through/around	April to June
	Coasts of North Baffin	10km setback distance	April to June
	Coasts of Tallurutiup Imanga	20 to 25km setback distance	April to June
DNLUP	Moffatt Inlet (Arctic Bay)	Shipping prohibited	All year
	Lancaster Sound Polynya	Shipping, subject to safe navigation, prohibited	August to September
	Pikialasorsuaq (North Water Polynya)	Shipping, subject to safe navigation, prohibited	August to September
	Walrus haul-outs	5km setback distance	All year
	On-ice transportation corridors	Ships prohibited from crossing	October to July
	MBS: - Prince Leopold MBS - Bylot Island MBS outside of Sirmilik National Park	- 500m setback distance from seabird, seaduck and coastal waterfowl colonies - 2km setback distance from ivory gull breeding sites	Seasonal (when birds are present)
	NWA: - Nirjutiqavvik NWA		

	Key bird habitat sites: - Prince Leopold Island outside of MBS - Baillarge Bay outside of Sirmilik National Park - Eastern Jones Sound - Eastern Lancaster Sound - Pikialasorsuaq		

4.3 Maritime legislation

Arctic shipping governance is characterized by a suite of regulatory measures adopted under international, regional and domestic laws. In addition, there are guidelines that rely on voluntary compliance by vessel operators to enhance safety and protection of the Arctic marine environment. This section briefly describes the regulatory and non-regulatory measures that apply to Arctic shipping within Canadian waters, and more specifically within TINMCA, where applicable.

4.3.1 International regulations

The 1982 United Nations Convention on the Law of the Sea (UNCLOS) is an international treaty that underpins the legislative framework governing maritime activities. The convention delineates five maritime zones based on physical and geopolitical criteria: internal waters, territorial sea, contiguous zone, exclusive economic zone (EEZ) and continental shelf (United Nations General Assembly, 1982). Coastal states have varying degrees of jurisdiction and governance within these zones, as well as obligations, including the duty to protect and preserve the marine environment (United Nations General Assembly, 1982). In internal waters, coastal states are entitled to exercise full sovereignty and jurisdiction over ships, including the right to entry for foreign vessels (United Nations General Assembly, 1982). The same rules apply for archipelagic waters (considered internal waters), with the exception that innocent passage is admissible (National Defence & the Canadian Armed Forces, 2015). For foreign ships transiting through territorial waters, coastal states have the authority to enforce domestic laws and regulations to ensure navigation safety and environmental protection.

The International Maritime Organization (IMO) adopted the International Code for Ships Operating in Polar Waters (Polar Code), which entered into force in 2017, and

was made mandatory following the adoption of voluntary guidelines for ships operating in polar waters in 2009 (IMO, 2015). The Code is intended to cover a wide range of matters related to navigation in polar waters, including ship design and construction, operations, training, search and rescue, and protection of the environment (IMO, 2015). The Code is divided into two parts containing mandatory provisions and recommendations on: 1) safety measures; and 2) pollution prevention.

4.3.2 National regulations

The Canada Shipping Act, 2001 is the principal Act regulating marine transport in Canadian waters. The provisions outlined in the Act are implemented through several pieces of legislation, including the *Arctic Waters Pollution Prevention Act* (AWPPA) and the Northern Canada Vessel Traffic Services Zone Regulations (NORDREG). Canadian maritime jurisdiction is divided into non-Arctic waters and Arctic waters. Arctic waters are further divided into shipping safety zones, principally governed by the AWPPA and pursuant regulations (CCG, 2013). The Arctic Shipping Safety and Pollution Prevention Regulations (ASSPPR) incorporate the Polar Code into domestic legislation to provide detailed standards for construction, design and operation (Transport Canada, 2010a). The ASSPPR contains the Zone/Date System, dividing the Arctic into 16 Shipping Safety Control Zones (SSCZs), each with windows of operation for ships with various ice capabilities (Figure 20; CCG, 2013). Access to each zone was established based on historical data of ice conditions at different times of the year (CCG, 2013). Zone 1 is considered to have the most challenging conditions for transit and Zone 16 the least. TINMCA falls within the boundaries of Zones 6 and 13. Table 8 shows the operational windows based on location and vessel type. The categories include nine Arctic class ships based on the depth of ice that the vessel would have the strength to break, and five ship types (Transport Canada, 2010b). Arctic class vessels are designed and equipped to navigate in ice-covered waters, from seasonal to year-round operation and in varying ice conditions. Type A ships have the capacity to navigate in thick first-year ice, while Type E ships have no ice strengthening and can only operate during the open water season (Vanderzwaag & Rolston, 2009).

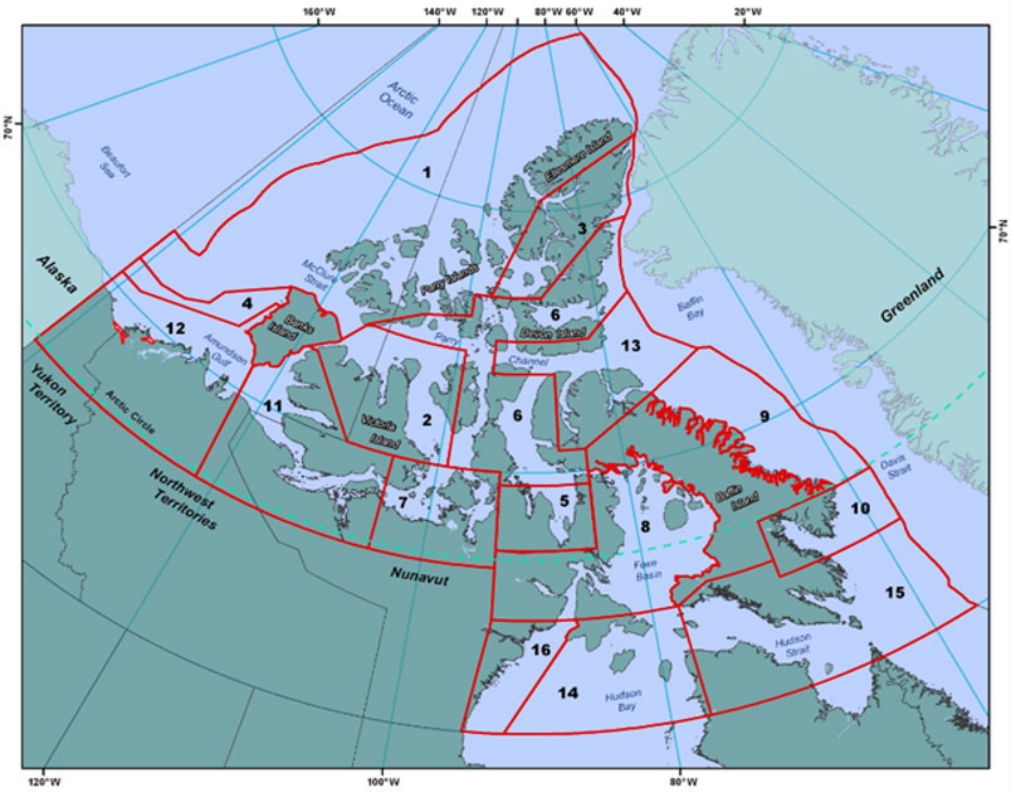

Figure 20. Shipping Safety Control Zones (Transport Canada, 2018).

Table 8. Zone/Date table (Transport Canada, 2010b).

Item	Col. I Category	Col. II Zone 1	Col. III Zone 2	Col. IV Zone 3	Col. V Zone 4	Col. VI Zone 5	Col. VII Zone 6	Col. VIII Zone 7	Col. IX Zone 8	Col. X Zone 9	Col. XI Zone 10	Col. XII Zone 11	Col. XIII Zone 12	Col. XIV Zone 13	Col. XV Zone 14	Col. XVI Zone 15	Col. XVII Zone 16
1.	Arctic Class 10	All Year	All Year	All Year	All Year	All Year	All Year	All Year	All Year	All Year	All Year	All Year	All Year	All Year	All Year	All Year	All Year
2.	Arctic Class 8	July 1 to Oct. 15	All Year	All Year	All Year	All Year	All Year	All Year	All Year	All Year	All Year	All Year	All Year	All Year	All Year	All Year	All Year
3.	Arctic Class 7	Aug. 1 to Sept. 30	Aug. 1 to Nov. 30	July 1 to Dec. 31	July 1 to Dec. 15	July 1 to Dec. 15	All Year	All Year	All Year	All Year	All Year	All Year	All Year	All Year	All Year	All Year	All Year
4.	Arctic Class 6	Aug. 15 to Sept. 15	Aug. 1 to Oct. 31	July 15 to Nov. 30	July 15 to Nov. 30	Aug. 1 to Oct. 15	July 15 to Feb. 28	July 1 to Mar. 31	July 1 to Mar. 31	All Year	All Year	July 1 to Mar. 31	All Year	All Year	All Year	All Year	All Year
5.	Arctic Class 4	Aug. 15 to Sept. 15	Aug. 15 to Oct. 15	July 15 to Oct. 31	July 15 to Nov. 15	Aug. 15 to Sept. 30	July 20 to Dec. 31	July 15 to Jan. 15	July 15 to Jan. 15	July 10 to Mar. 31	July 10 to Feb. 28	July 5 to Jan. 15	June 1 to Jan. 31	June 1 to Feb. 15	June 15 to Feb. 15	June 15 to Mar. 15	June 1 to Feb. 15
6.	Arctic Class 3	Aug. 20 to Sept. 15	Aug. 20 to Sept. 30	July 25 to Oct. 15	July 20 to Nov. 5	Aug. 20 to Sept. 25	Aug. 1 to Nov. 30	July 20 to Dec. 15	July 20 to Dec. 31	July 20 to Jan. 20	July 15 to Jan. 25	July 5 to Dec. 15	June 10 to Dec. 31	June 10 to Dec. 31	June 20 to Jan. 10	June 20 to Jan. 31	June 5 to Jan. 10
7.	Arctic Class 2	No Entry	No Entry	Aug. 15 to Sept. 30	Aug. 1 to Oct. 31	No Entry	Aug. 15 to Nov. 20	Aug. 1 to Nov. 20	Aug. 1 to Nov. 30	Aug. 1 to Dec. 20	July 25 to Dec. 20	July 10 to Nov. 20	June 15 to Dec. 5	June 25 to Nov. 22	June 25 to Dec. 10	June 25 to Dec. 20	June 10 to Dec. 10
8.	Arctic Class 1A	No Entry	No Entry	Aug. 20 to Sept. 15	Aug. 20 to Sept. 30	No Entry	Aug. 25 to Oct. 31	Aug. 10 to Nov. 5	Aug. 10 to Nov. 20	Aug. 10 to Dec. 10	Aug. 1 to Dec. 10	July 15 to Nov. 10	July 1 to Nov. 10	July 15 to Oct. 31	July 1 to Nov. 30	July 1 to Dec. 10	June 20 to Nov. 30
9.	Arctic Class 1	No Entry	No Entry	No Entry	No Entry	No Entry	Aug. 25 to Sept. 30	Aug. 10 to Oct. 15	Aug. 10 to Oct. 31	Aug. 10 to Oct. 31	Aug. 1 to Oct. 31	July 15 to Oct. 20	July 1 to Oct. 31	July 15 to Oct. 15	July 1 to Nov. 30	July 1 to Nov. 30	June 20 to Nov. 15
10.	Type A	No Entry	No Entry	Aug. 20 to Sept. 10	Aug. 20 to Sept. 20	No Entry	Aug. 15 to Oct. 15	Aug. 1 to Oct. 25	Aug. 1 to Nov. 10	Aug. 1 to Nov. 20	July 25 to Nov. 20	July 10 to Oct. 31	June 15 to Nov. 10	June 25 to Oct. 22	June 25 to Nov. 30	June 25 to Dec. 5	June 20 to Nov. 20
11.	Type B	No Entry	No Entry	Aug. 20 to Sept. 5	Aug. 20 to Sept. 15	No Entry	Aug. 25 to Sept. 30	Aug. 10 to Oct. 15	Aug. 10 to Oct. 31	Aug. 10 to Oct. 31	Aug. 1 to Oct. 31	July 15 to Oct. 20	July 1 to Oct. 25	July 15 to Oct. 15	July 1 to Nov. 30	July 1 to Nov. 30	June 20 to Nov. 10
12.	Type C	No Entry	No Entry	No Entry	No Entry	No Entry	Aug. 25 to Sept. 25	Aug. 10 to Oct. 10	Aug. 10 to Oct. 25	Aug. 10 to Oct. 25	Aug. 1 to Oct. 25	July 15 to Oct. 15	July 1 to Oct. 25	July 15 to Oct. 10	July 1 to Nov. 25	July 1 to Nov. 25	June 20 to Nov. 10
13.	Type D	No Entry	No Entry	No Entry	No Entry	No Entry	No Entry	Aug. 10 to Oct. 5	Aug. 15 to Oct. 20	Aug. 15 to Oct. 20	Aug. 5 to Oct. 20	July 15 to Oct. 10	July 1 to Oct. 20	July 30 to Sept. 30	July 10 to Nov. 10	July 5 to Nov. 10	July 1 to Oct. 31
14.	Type E	No Entry	No Entry	No Entry	No Entry	No Entry	No Entry	Aug. 10 to Sept. 30	Aug. 20 to Oct. 20	Aug. 20 to Oct. 15	Aug. 10 to Oct. 20	July 15 to Sept. 30	July 1 to Oct. 20	Aug. 15 to Sept. 20	July 20 to Oct. 31	July 20 to Nov. 5	July 1 to Oct. 31

The Arctic Ice Regime Shipping System (AIRSS) was introduced in 1996 as a more flexible system that uses actual ice conditions to determine whether navigation is permitted (Transport Canada, 2017). AIRSS is currently only used when determining whether access is permitted outside of the established dates (Transport Canada, 2017). With the objective of enhancing navigation safety, strengthening Canadian sovereignty in the Arctic, and pollution prevention, compliance to NORDREG was made mandatory in 2010 (Government of Canada, 2010). Vessels entering the NORDREG Zone are required to provide information including their position, destination and intended route (Figure 21). NORDREG applies to vessels of 300 gross tonnage or more, as well as vessels engaged in towing and those carrying cargo, but excludes small vessels (i.e. pleasure craft; Government of Canada, 2010).

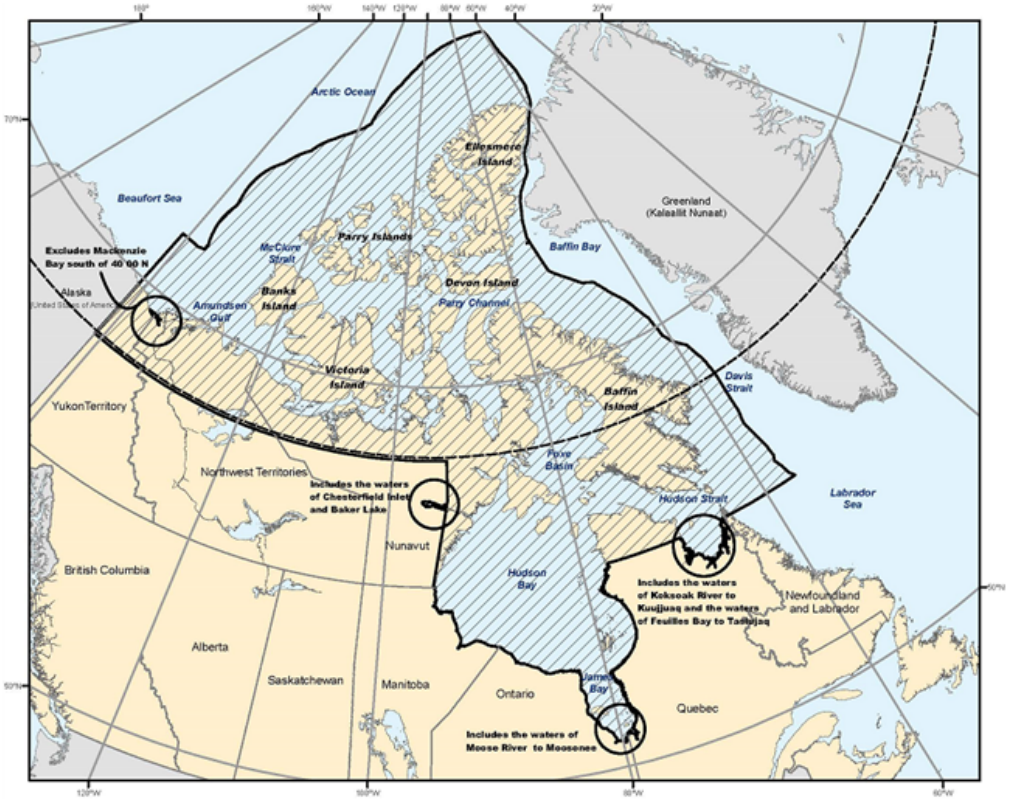

Figure 21. NORDREG Zone (Transport Canada, 2018).

4.3.3 Voluntary guidelines

To plan for potential growth in Arctic tourism, Transport Canada has developed voluntary guidelines to help cruise ships operate in a safe and sustainable way. The

Guidelines for Passenger Vessels Operating in the Canadian Arctic include information about ship safety, vessel traffic management, ice navigation and regimes, tourism affecting Arctic communities, and search and rescue (Transport Canada, 2018). The Guidelines recommend operators to consult federal and territorial governments to determine the location and extent of protected areas and make note of seasonal restrictions that may be in force to during breeding seasons of endangered species (Transport Canada, 2018). The Guidelines further advise vessel operators to work with communities to gather real-time information to avoid disruption of harvesting activities and stranding hunters on the ice (Transport Canada, 2018).

With declining sea ice and an increase in foreign vessel traffic, the Government of Canada has committed to establishing low impact shipping corridors. The initiative, led by the CCG and in collaboration with Transport Canada and the Canadian Hydrographic Service (CHS), aims to improve navigation safety and environmental protection by identifying priority areas for investing in infrastructure and aids to navigation using a risk-based approach (Beveridge, 2018). The initiative also incentivizes travel within the corridors through improved infrastructure and services, thus minimizing risks to vessels, wildlife and traditional harvesting practices (Beveridge, 2018). Inuit involvement in the management of shipping activities has been limited thus far. However, as part of the Oceans Protection Plan, Government has begun to engage Inuit in the development of low impact shipping corridors (Networks of Centres of Excellence of Canada, 2017).

4.4 Results

The findings from the policy analysis are summarized in Table 9. Short-term or seasonal protective measures, such as setback distances and access restrictions were identified in all policy instruments, except for low impact shipping corridors, which are in the developmental stage. Land use plans and voluntary guidelines for passenger vessels provide the highest level of protection for Inuit-identified areas of importance. Specifically, it is noted within these policies that additional precautionary measures should be taken by vessel operators when encountering known areas of use by Inuit and marine mammals, such as travel routes and seasonal migration areas. Furthermore, vessel operators are encouraged to work with local communities to inform them of their intended routes and to avoid disrupting fishing and hunting activities. While the Polar

Code addresses navigational risks related to the presence of protected areas, seasonal migration areas, and weather conditions, it lacks recognition of Inuit use of the sea and thus, the requirements are limited to environmental factors. Within Canada's domestic regulations, the scope of existing policy tools is limited to safe navigation and pollution prevention, hence there is no mention of duties required by vessel operators in the presence of culturally sensitive sites. While low impact shipping corridors are being developed in consultation with Inuit to identify ecologically and culturally significant sites, it is unclear whether additional short-term or seasonal restrictions will be implemented within the corridors. However, by incentivizing travel within charted areas, the aim is to minimize impacts to important ecological and cultural marine use areas.

Table 9. Summary of policy analysis.

	Policy						
Criteria	North Baffin Regional Land Use Plan	Draft Nunavut Land Use Plan	Polar Code	Arctic Shipping Safety and Pollution Prevention Regulations	Northern Vessel Traffic Services Zone Regulations	Guidelines for Passenger Vessels Operating in the Canadian Arctic	Low Impact Shipping Corridors
Inuit use of the sea	X	X				X	X
Inuit areas of importance	X	X				X	X
Protection measures for Inuit areas of importance	X	X				X	X
Short-term or seasonal restrictions	X	X	X	X	X	X	

Chapter 5: Integrated coastal and ocean management

The results from the spatial analysis of harvest data reveal that coastal and marine areas are not only important harvest areas, but also critical for travel to those areas. The free movement across land and sea, often over long distances, is thus intrinsic to Inuit traditional harvesting and food security. In addition, a policy analysis of Arctic shipping governance frameworks found management gaps in the protection of Inuit-identified areas of importance, including essential areas for harvesting, in both land use plans and shipping regulations. Specifically, there is a lack of recognition of Inuit uses of the sea in maritime legislation at the international and national level, while the DNLUP lacks protection of community-identified areas of importance in the LSRLUP and the NBRLUP. Hence, a coordinated approach that harmonizes the planning, management and policies that affect coastal and marine uses can increase the effectiveness of sustainable development and conservation efforts within TINMCA and the region more broadly. This chapter introduces the concept of ICOM and the role and value of ICOM in protected areas using a Canadian case study where planning and management of marine and coastal areas are coordinated through horizontal (cross-sectoral) and vertical (inter-governmental) integration. The case study served as a model to assess the applicability of ICOM within TINMCA and to inform the recommendations provided in this study.

ICOM is widely cited in the literature as an effective planning process for coordinating multiple uses to balance conservation and sustainable use of coastal and marine resources (Cicin-Sain, Knecht, Jang, & Fisk, 1998; Rutherford, Herbert, & Coffen-Smout, 2005; Kearney, Berkes, Charles, Pinkerton, & Wiber, 2007; Guénette & Alder, 2007). This approach seeks to maintain healthy marine and coastal ecosystems while reducing user conflicts and managing the cumulative impacts of human activities. Zoning is one of a suite of spatial planning and management tools to allocate spatiotemporal distributions of human activities to achieve social, economic and ecological objectives (Ehler & Douvere, 2009). An integrated approach uses adaptive management techniques based on the monitoring and evaluation of outcomes against the objectives and in response to changing conditions and the availability of new information (McCook et al., 2010; Fisheries and Oceans Canada [DFO], 2018). Adaptive management of the Great Barrier Reef Marine Park led to significant improvements in biodiversity protection by providing an opportunity to zone coastal areas that were not

included in the initial zoning and to address matters related to the operational experience (Kenchington & Day, 2011). Adaptive co-management is an emergent governance approach that links learning by doing and the vertical and horizontal integration of planning and decision-making (Plummer et al., 2012). ICOM refers both to the integration of objectives and the integration of policies, sectors and levels of government. It is a holistic approach that is well aligned with Inuit relationship and interconnectedness with the environment, as well the whole of government approach envisioned for TINMCA.

5.1 Canada's regulatory framework for integrated management

Canada's policy framework for integrated management recognizes the complexity of ecosystems and their interconnections and therefore, the need for inter-governmental and cross-sectoral collaboration to achieve the overarching goal of sustainable development of oceans and its resources (DFO, 2016). A collaborative approach requires institutional arrangements in which decision-making is shared by government and user groups (DFO, 2016). Canada's approach to integrated management emphasizes ecosystem-based objectives to establish Large Ocean Management Areas (LOMAs) and to guide the development of integrated management plans of various scales that are nested within LOMAs (DFO, 2016). These integrated management plans provide a framework for coordinating the development of a national network of marine protected areas, which is a key principle of Canada's Oceans Strategy (DFO, 2017).

The *Oceans Act* directs the Minister of Fisheries and Oceans to develop and implement a network of marine protected areas that will conserve and protect Canada's natural and cultural marine resources, in collaboration with ECCC and Parks Canada (DFO, 2017). While 'marine protected area' is a generic term referring to protected areas in the marine environment, whereas 'Marine Protected Area (MPA)' refers specifically to protected areas established under the *Oceans Act*. Hence, Canada's federal marine protected area network is comprised of MPAs established by DFO, Marine Wildlife Areas administered by ECCC, and NMCAs established by Parks Canada. In addition to these marine protected area programs, MBSs, NWAs and National Parks with a marine component may also contribute to the network (DFO, 2016). Canada's national network of marine protected areas is guided by the 13 marine bioregions delimited based on their

ecological and geographical characteristics (DFO, 2016). Network planning in these bioregions share a common vision, goals and management approach. To date, five LOMAs have been established across these bioregions.

5.2 Case study – Pacific North Coast Integrated Management Area

The Pacific North Coast Integrated Management Area (PNCIMA) is one of the five priority areas for integrated management (DFO, 2005). The PNCIMA plan was developed in collaboration with federal, provincial and First Nations governments and seeks to provide direction on integrated, ecosystem-based and adaptive management of marine and coastal activities in the planning area (PNCIMA Initiative, 2017). The PNCIMA covers 102,000 km^2 of marine area and two-thirds of British Columbia's coast (PNCIMA Initiative, 2017). It encompasses Haida Gwaii, an archipelago with a rich marine environment that has supported Haida for thousands of years, as evidenced by the many fishing sites and camps (Marine Planning Partnership [MaPP], 2015).

5.2.1 Gwaii Haanas National Park Reserve, National Marine Conservation Area Reserve and Haida Heritage Site

Haida Gwaii faces a range of threats from pressures from tourism, biodiversity loss, introduced species, resource extraction and climate change (Lee, 2012). Efforts to protect this area were initiated by the Haida in the 1970s in response to growing industrial logging practices (Government of Canada & Council of Haida Nation, 2018). Haida Gwaii was first designated as a Haida Heritage Site in 1985, which subsequently led to the protection of Gwaii Haanas – the southern portion of Haida Gwaii – as a national park reserve (Lee, 2012). In 1993, the Gwaii Haanas Agreement was signed, which describes cooperative management of the terrestrial area of Gwaii Haanas by the Haida Nation and the Government of Canada through the Archipelago Management Board – a co-management body initially comprised of Council of Haida Nation and Parks Canada representatives (Government of Canada & Council of Haida Nation, 2018). In 2010, Gwaii Haanas National Marine Conservation Area Reserve was established under the NMCAs Act, expanding protection to the marine area of Gwaii Haanas (Government of Canada & Council of Haida Nation, 2018). Inter-governmental management has now been established between Parks Canada, DFO and the Council of Haida Nation to

integrate management of the land and sea in the Gwaii Haanas Land-Sea-People management plan. The Land-Sea-People plan replaces the existing terrestrial and marine plans and includes an integrated zoning plan (Government of Canada & Council of Haida Nation, 2018). The mandate of the Board, which now includes representation by DFO, was extended into the marine area (Lee, 2012).

5.2.2 Coordinating planning initiatives

Gwaii Haanas is adjacent to a number of planning initiatives, including the Haida Gwaii Marine Plan co-developed by First Nations and the Province of British Columbia, the Northern Shelf Bioregion MPA Network, SGaan Kinghlas-Bowie Seamount MPA, as well as new terrestrial protected areas outside of Gwaii Haanas that resulted from the signing of the 2009 Reconciliation Protocol, which provides a framework for joint decision making by the province and Council of Haida Nation (Figure 22; Government of Canada & Council of Haida Nation, 2018). With the exception of the SGaan Kinghlas-Bowie Seamount MPA, management of these protected areas are directed by the PNCIMA plan. Hence, the role of the PNCIMA is to "provide an overarching marine ecosystem-based management framework that is available to guide marine planning and management at [multiple] scales" (PNCIMA Initiative, 2017, p. 28). The plan identifies the follow objectives: coordination and integration of ocean governance, management, planning and advisory processes among First Nations and government; promoting and facilitating information sharing among stakeholders; developing opportunities for incorporating different types of knowledge, including scientific, traditional and local knowledge into management and decision-making; and fostering integrated management, monitoring and coordination among First Nations and government (PNCIMA Initiative, 2017).

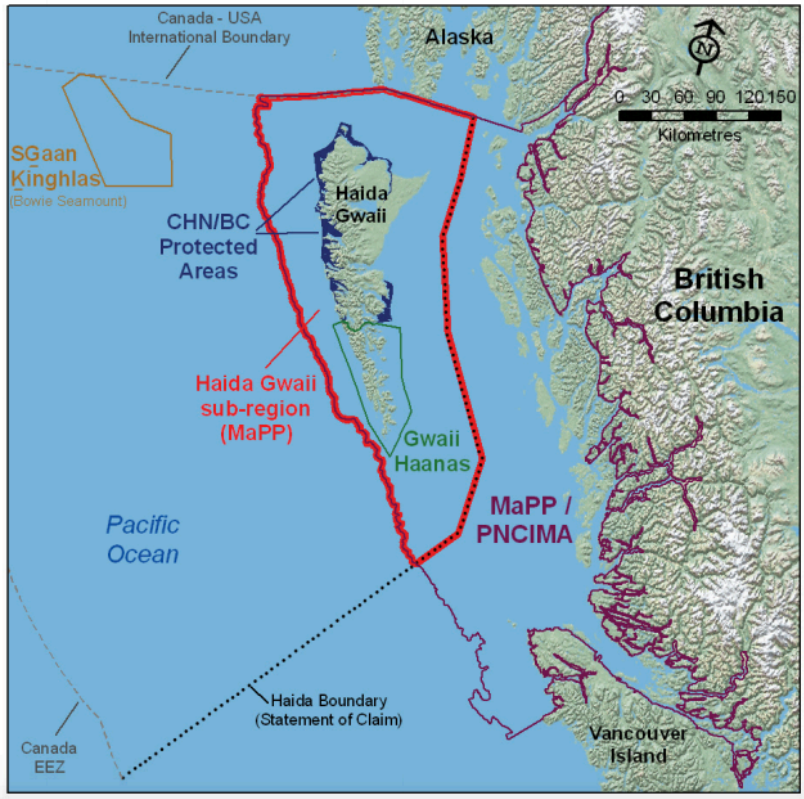

Figure 22. Planning initiatives within the PNCIMA (MPA Network of the Northern Shelf Bioregion, n.d.).

Gwaii Haanas was chosen as a comparative case study to assess the applicability of ICOM within TINMCA given that both marine areas are protected under NMCA designation and are adjacent to various planning initiatives at multiple scales. Moreover, Gwaii Haanas serves as a model for how institutional arrangements in an integrated approach (based on cooperation and shared decision-making) can facilitate a co-management system for protected area governance.

The results from this study found that coastal and marine areas are central to Inuit mobility and traditional harvesting. Sea ice is a fundamental feature of the landscape for eight months of the year and acts as an extension of the land, and in turn, a means for transportation and harvesting. Thus, it is imperative that TINMCA is managed in a way that reflects the interconnections between humans, wildlife and the environment identified by Inuit. Moreover, while shipping is governed by a mosaic of land use plans and maritime legislation at international and national levels, there is a lack of recognition and protection of Inuit use areas including essential areas for harvesting. The integrated

approach taken in Gwaii Haanas provides insight into how existing, fragmented management of coastal and marine areas can be coordinated to increase effectiveness of conservation and sustainable development efforts. Specifically, ICOM within TINMCA can harmonize planning, management and policies that affect shipping and traditional harvesting, and aligns with the whole of government approach sought by Inuit.

Chapter 6: Discussion

This study aimed to identify spatiotemporal interactions between Inuit traditional harvesting and shipping within TINMCA, as well as gaps in the Arctic shipping governance frameworks. The results from this study reveal the critical role of coastal and marine areas for harvesting. However, there is a lack of recognition of Inuit use of marine areas in the shipping regulatory frameworks at international and national levels. In addition, the lack of integration between land use plans results in weak protection of Inuit-identified areas of importance, including essential areas for harvesting. These findings point to the need for an integrated management approach for TINMCA that facilitates shared-decision making and the application of Inuit insights into decisions and actions that affect their lives. Moreover, an integrated strategy would coordinate the various planning initiatives in this area that govern shipping and Inuit harvesting rights to increase their effectiveness in supporting social, ecological and economic objectives. A co-governance system envisioned for TINMCA was similarly developed by the ICC in the Pikialasorsuaq. The Pikialasorsuaq Commission was established in 2016 with a mandate to undertake consultations in communities closely connected to the polynya in Canada and Greenland (Pikialasorsuaq Commission, 2017). The Commission identified a number of recommendations based on their findings, including the establishment of an Inuit-led management regime to guide monitoring and research and conservation of the Pikialasorsuaq, as well as the identification of a large management zone comprised of the polynya that will reflect the connection between the communities and natural resources within the polynya (Pikialasorsuaq Commission, 2017).

6.1 Threats to Inuit traditional harvesting

This study found that there are marine and coastal areas that are important for traditional harvesting year-round, particularly the inlets located next to Arctic Bay and Pond Inlet, which are also important navigable passages. However, the range and distribution of harvest areas used by Inuit hunters in these two communities vary seasonally. In turn, the interactions between shipping and harvesting within TINMCA vary on both a seasonal and interannual basis, in response to changing sea-ice conditions. During the open water season, when shipping activity is high, there is increased likelihood for potential conflict between shipping and harvesting. However, the nature of threats may in fact be greater during the fall and spring, especially given the lack of shipping provisions that apply outside of the shipping season. Moreover, planning and managing the risks posed by shipping is becoming increasingly complex in light of climate change and growing uncertainty. Data collection and monitoring are central to adaptive management and the cornerstone of the continuation of Inuit traditional harvesting under changing conditions and emerging uses within TINMCA and the region more broadly.

Spring is a particularly important time of year for harvesting, as wildlife gather at floe edges, making it prime location for harvesting. That being said, this season is marked by increasing risk to hunters. Although travel along floe edges is inherently dangerous, risk associated with this travel increase as thinning and unstable sea ice conditions are becoming more common (Ford, Smit, & Wandel, 2006). The increasing unpredictability of changing sea-ice conditions has implications for Inuit, who are finding it increasingly difficult to assess whether travel on ice is safe. Ice safety is determined by drawing on many sources of local and traditional knowledge and passed down skills. Though hunters are coping to changing sea ice conditions by adjusting the timing, location and methods of harvesting, as well as traveling closer to communities, Inuit remain vulnerable to climate change, especially with increasing shipping activity in the Arctic. Communities are seeing more ships earlier in the season with the growth in community re-supply needs, resource development and tourism. While TINMCA is closed to most vessels during the spring, the open water season has increased between five and ten weeks, and the spring break-up of sea ice is also occurring earlier than usual (Dickie, 2018). With significant sea ice reductions in the past decade and an increase in vessel voyages,

researchers are now suggesting that the spring could be marked by increasing shipping activity with icebreakers, which could have detrimental impacts on wildlife and Inuit hunters (Hauser, Laidre, & Stern, 2018).

As mentioned, Admiralty Inlet and Eclipse Sound are particularly important harvest areas used by Inuit hunters in Arctic Bay and Pond Inlet. This study found that coastal areas are widely used to harvest wildlife year-round, though the range of these harvest areas change with the season. During the spring, summer and winter, harvest areas extend from the coasts into the marine areas. This suggests that hunters travel across the land and sea in pursuit of wildlife, with the exception of late spring during the break-up of sea ice and in early fall when the ice is forming. While the coastal zone is often referred to as the land-sea interface, for Inuit, the land and sea are not distinguished as independent spaces, but rather seen as a continuum (Aporta et al., 2018). The sea ice permits travel across land and sea for much of the year. Whether frozen or open during the summer, the sea is a primary means of transportation and a residence (Aporta, 2002; ICC – Canada, 2014). The usually ice-covered sea acts as a physical connection between communities and provides access to animals relied upon for food. Hunters travel by boat to the open water in the summer and travel across the sea ice on snowmobiles or dog sleds in the winter. Ice-breaking can cut through Inuit travel routes and destabilize the structure of the sea ice (ICC – Canada, 2014), with consequences to hunters and animals. While winter ice-breaking is uncommon, it is permitted in some communities to serve resource mines. In 2017, Baffinland Iron Mines submitted a proposal to the NPC for a winter sealift that would require ice breaking near Pond Inlet (Frizzell, 2017). The NPC approved the proposal and was referred to the NIRB for screening, but Baffinland eventually dropped the proposal citing community concerns over winter ice-breaking (Frizzell, 2017). With the loss of sea-ice cover and more favourable conditions for shipping, it is crucial that Inuit use of coastal and marine areas is recognized in the development of shipping policies to ensure Inuit travel routes and access to wildlife are maintained.

6.2 Adaptive management

For Inuit, the sea ice acts a bridge between coastal and marine areas. The sea ice permits travel across land and sea for much of the year and provides access to animals

relied upon for food. Given that the interactions between shipping and harvesting vary in both time and space, there is a need for adaptive management and zoning within TINMCA. The management of TINMCA, and NMCAs more broadly, is based on multiple use, with zoning as a fundamental component of spatial planning. NMCAs typically include small, high protection zones within large, multiple-use zones to achieve conservation and sustainable resource use objectives (Parks Canada, 2018a). In the context of TINMCA, adaptive management is imperative given the emerging uses in response to growing demand for resource development and the complexities of seasonal and inter-annual variability. Moreover, the added complexity of sea-ice dynamics requires flexibility in the timing and size of protection zones in response to local conditions. Hence, effective monitoring and coordination among government, industry and local communities are fundamental to adaptive management.

The concept of adaptive management and the use of near real-time monitoring data to inform management decisions are becoming increasingly popular. SmartICE, for example, is a monitoring and information sharing system developed by a social enterprise that collects near real-time information on sea-ice conditions, which are accessible by local communities (SmartICE, n.d.). The technology uses sensors and satellite imagery to map sea-ice conditions in areas highly used by communities, but that are less predictable for travel (Zelniker, 2016). SmartICE is being piloted in Pond Inlet and will soon be piloted in Arctic Bay (SmartICE, n.d.). The availability of near-real time data has the potential to transform adaptive management and zoning within TINMCA by refining the spatiotemporal scale of management to better balance multi-use objectives.

Adaptive co-management, in which Inuit play a role in decision-making, is reflected in the management of Sirmilik National Park. The IIBA requires that the management plan include specific measures that protect Areas of Special Importance to Inuit and restrict or prohibit visitor access on a seasonal or year-round basis (Table 9; Parks Canada, 2016). These areas include coastal and marine areas that are important for wildlife harvesting, which are designated as zones of restricted or prohibited access during the spring and summer (Figure 23). These zones of seasonal protection overlap with the important harvest areas identified in this study, thus can provide extended protection to coastal and marine areas that fall outside of the boundaries of TINMCA. Within the ICOM framework, an adaptive co-management and zoning approach that

takes into account environmental and social feedbacks and shared decision-making will increase the effectiveness of management efforts in this area.

Table 10. Areas of Special Importance to Inuit and management measures (modified from Parks Canada, 2016).

Area of Special Importance to Inuit	Wildlife/Inuit Uses	Management Measures	Timing	Adaptive Measures
Southwest coast of Bylot Island	Egg harvesting	Closed to visitation	Two weeks in June – exact dates depend on availability of eggs	Parks Canada is informed by HTO when eggs are available
Coastal area southwest of Elwin Inlet	Harvesting at floe edge	Closed to visitation	June 16 to July 31	Not indicated
Borden Peninsula	Caribou calving and harvesting	- Closed to visitation from June to August - Guided visitation/access by snowmobile recommended	June 1 to August 31	May be closed during other seasons if visitor activities appear to be impacting calving or harvesting
Oliver Sound	Berry picking and caribou harvesting	- Speed limits to boats	Not indicated	Not indicated

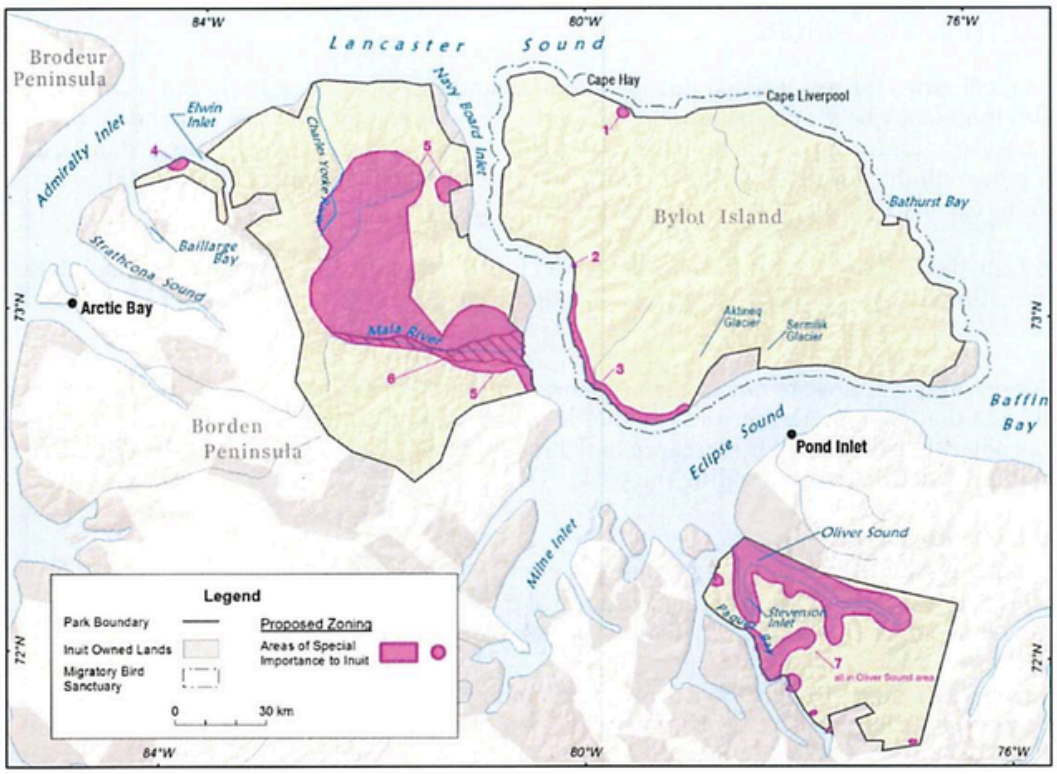

Figure 23. Areas of Special Importance to Inuit and management measures (Parks Canada, 2016).

6.3 Management gaps in Arctic shipping governance frameworks

Arctic shipping is governed by a suite of policy tools, that are both regulatory and non-regulatory. An analysis of the Arctic shipping governance frameworks found management gaps in relation to Inuit use of marine areas. While the Polar Code and NORDREG introduce mandatory requirements to enhance maritime safety and environmental protection, Inuit way of life and food security are threatened by the narrow environmental scope of international and national regulatory frameworks, which is limited to pollution (Chircop, 2016). Though shipping is permitted throughout most of Nunavut, land use plans provide a minimum standard of protection through ecological setbacks in polynyas, walrus haul-outs, and key bird habitats. The results from this study found an interaction between shipping and caribou harvest areas during the month of December, suggesting a need for enhanced protection of caribou sea-ice crossings. The DNLUP includes shipping provisions at caribou sea-ice crossings, however, there are no SMA land use designations to protect caribou crossings within TINMCA.

Both the LSRLUP and NBRLUP were intended to be living documents and the basis upon which land use planning would continue to develop for the North Baffin region. While the DNLUP includes a number of provisions that restrict shipping within TINMCA, it does not incorporate shipping provisions described in the NBRLUP, which were developed during the consultation process for the LSRLUP. Furthermore, most of the shipping restrictions in the DNLUP do not apply outside of the open-water season. The one exception is the restriction of ships crossing on-ice transportation corridors from October to July, though the plan does not specify the location of these transportation corridors.

Most vessel types had a high degree of interaction with harvest areas (i.e., more than half of their total vessel presence overlapped with harvest areas). Vessel traffic trends show that cargo ships had the highest presence among all vessel types that transited through TINMCA from 2014 to 2017, consistent with previous studies (Pizzolato et al., 2014; Dawson, Copland, Mussells, & Carter, 2017; Dawson et al., 2018). The creation of a Wildlife Compensation Fund (WCF) was negotiated in the Mary River IIBA to compensate for losses experienced by Inuit hunters as a result of activities at the project (QIA, 2017a). While the fund is designed to address potential impacts of the mine on hunters, including the loss or damage of wildlife and equipment, or interference with harvesting activities (QIA, 2017a), the lack of preventative measures to minimize potential shipping impacts on traditional harvesting will become increasingly problematic with increased vessel traffic around Eclipse Sound and Milne Inlet. That being said, a community-based monitoring project is being piloted in Pond Inlet to assess the impacts of increased shipping on harvesting activities. The information gathered includes observations of animals, as well as GPS data to track the distribution and population of wildlife, where the data is used to produce monthly maps and reports that will inform policy development (QIA, 2017b).

Tourism vessels, including pleasure craft (sailboats and yachts) and passenger ships, are becoming increasingly popular in the Arctic, with growing interest in last chance tourism (Lasserre & Têtu, 2013; Pizzolato et al., 2014; 2016; Dawson et al., 2017). A study from 1990 to 2015 found that pleasure craft traffic has increased the fastest, while passenger ships have slightly declined (Dawson et al., 2017). These trends are consistent with the findings from this study: vessel presence for sailing vessels and

pleasure craft combined was greater than passenger ships by 746 days between 2014 and 2017. Small vessels (i.e., less than 300 gross tonnes) including, pleasure craft and sailing vessels are not required to report to NORDREG, thus, it is likely that the vessel traffic data for small vessels underestimate actual presence within TINMCA.

6.4 Harmonizing policies through inter-governmental coordination

There are a number of planning initiatives adjacent to TINMCA that share common goals of environmental protection and maritime safety. To minimize the impacts of shipping on traditional harvesting within TINMCA, there is a need for inter-agency coordination that takes into account the multiple uses within the area and the policies that direct these uses. Spatial analysis of harvest data and AIS data found that the highest interactions occurred in polar bear, walrus and seal harvest areas. These interactions predominantly occurred during the month of August. Though there are some management measures that exist to protect harvest areas for these species, such as year-round setbacks from walrus haul-outs and shipping prohibitions in the Lancaster Sound Polynya and Pikialasorsuaq during the summer, species-specific management measures are required outside of these restriction zones. Where possible, existing management plans should be incorporated into policy development. For example, the Integrated Fisheries Management Plan for Narwhal seeks to maintain healthy narwhal populations capable of sustaining harvesting needs through the documentation of IQ to assess narwhal stocks and the protection of narwhal habitat (DFO, 2012). The protection of narwhal harvest areas within TINMCA requires inter-governmental coordination to ensure species management plans do not interfere with Inuit harvesting activities. Harmonized policies can enhance the protection of wildlife habitat, as well as Inuit harvest areas.

In 2015, Arctic shipping corridors were developed under the Low Impact Shipping Corridors Initiative (previously the Northern Marine Transportation Corridors Initiative), co-led by the CCG, Transport Canada and the CHS to minimize risks to vessels and the environment (Chénier, Abado, Sabourin, & Tardif, 2017). The design and development of the corridors lacked the integration and protection of environmentally and culturally sensitive areas in the region (The Pew Charitable Trusts, 2016). Under the Oceans Protection Plan, the Canadian government is seeking input from Inuit to guide the development of low impact shipping corridors. Recent studies have begun to assess the

impacts of shipping corridors on Inuit communities across the Canadian Arctic (Carter, Dawson, Joyce, & Ogilvie, 2017). Studies have found a high degree of overlap among shipping patterns, Inuit-use areas and environmentally significant areas (The Pew Charitable Trusts, 2016; Porta et al., 2017). Yet, there remains a knowledge gap in the level of overlap between Arctic shipping corridors and significant and sensitive cultural areas in the North Baffin region (NPC, 2016), as these sites have not yet been adequately inventoried (Porta et al., 2017). While it is impossible to exclude all sensitive areas from the corridors, effective management of these areas requires protective measures outside of the corridors, including special preservation zones and temporal zoning designations in land use plans (Porta et al., 2017). A coordinated strategy to manage ecologically sensitive and Inuit use areas can identify and address management gaps in the current, fragmented approach and in turn, provide a higher level of protection. In conjunction with low impact shipping corridors, TINMCA presents an opportunity to enhance protection of Inuit-identified areas of importance, including harvest areas through zoning and related policies.

Gwaii Haanas provides an example of how once fragmented management of terrestrial and marine protected areas was substituted by an integrated approach that streamlines the governance and management processes through the Land-Sea-People plan and one management body. The development of the Land-Sea-Plan and PNCIMA plans bridges the divide between management of the land and sea in provincial and federal legislation and policies to achieve holistic, ecosystem-based management. The PNCIMA serves as a model for TINMCA, specifically on how planning initiatives led by various departments, agencies and organizations can be coordinated in a high level, strategic plan that provides direction and commitment to integrated management of activities in the planning area.

Chapter 7: Management recommendations

Based on the findings from this study, the following recommendations are made for policy development to minimize shipping impacts on Inuit traditional harvesting within TINMCA:

1. **Adaptive zoning should be employed within TINMCA to account for seasonal variations in shipping and harvesting and their potential interactions.** Given the emerging uses as a result of the decline in sea-ice cover, flexible management is needed in this dynamic environment which is undergoing changing conditions and interannual variability. Hence, vessel trends should be taken into account to develop and implement appropriate seasonal restrictions to minimize shipping impacts on Inuit harvest areas. Furthermore, a co-governance approach requires the application of an Inuit worldview to decisions and actions that affect Inuit lives. Adaptive co-management should be based on the Inuit seasonal cycles, whereby the changing state of the sea and ice not only influence wildlife patterns, but also Inuit use of the region. The availability of new data, including monitoring data, should be incorporated into policy development and be informed by IQ to reflect Inuit priorities and interests. The results from community-based monitoring projects are a source of more recent harvest data, which can be used to identify potential changes in harvesting patterns and develop management strategies that recognize Inuit priorities within TINMCA. In light of growing tourism in the region, minimizing risk and interference with harvesting requires proactive vessel management and local monitoring programs.

2. **A whole of government approach is needed to improve coordination between national and territorial policies, and planning initiatives affecting shipping and traditional harvesting within and adjacent to TINMCA.** The development of the DNLUP, low impact shipping corridors and the management of shipping in adjacent parks and conservation areas should be coordinated as these initiatives share common goals of maritime safety and environmental protection. These planning initiatives can enhance the protection of wildlife that Inuit rely upon for food, as well as harvest areas within TINMCA. Marine planning at multiple spatial and jurisdictional scales requires inter-governmental and cross-sectoral collaboration to integrate decision-making processes. Improved coordination in decision-making harmonizes management measures that affect shipping and harvesting in this area to provide a clear policy direction for the multiple uses and initiatives in this area.

3. **Community areas of importance, including Inuit harvest areas and travel routes, should be identified and designated as SMAs in the DNLUP.** The DNLUP should incorporate areas of importance identified in the LSRLUP and NBRLUP, including essential areas for harvesting. Given that the DNLUP contains interim management provisions for TINMCA until interim and final management plans are developed, it is important that the same standard of protection provided in the DNLUP is met or exceeded in the TINMCA management plan. Furthermore, to minimize shipping impacts on harvesting within TINMCA, it is crucial that on-ice transportation corridors used by Inuit hunters are identified and that this provision from the DNLUP is incorporated into the TINMCA management plan. The important harvest areas identified in this study provide a starting point for identifying Inuit use areas to inform ongoing policy development including, low impact shipping corridors, protected areas management and land use designations that guide conservation and sustainable development.

Chapter 8: Conclusion

This study aimed to identify management strategies that will support the continuation of the Inuit way of life and access to sustainable country foods within TINMCA while balancing the conservation and sustainable use objectives sought in NMCAs. Overall, there is a high degree of overlap between shipping and traditional harvesting within TINMCA. These interactions vary in both time and space, as these uses adjust to the dynamic Arctic marine environment. As sea ice permits travel across land and sea for much of the year and provides access to animals relied upon for food, adaptive management is necessary to account for changing uses of this area in response to shorter-term sea-ice dynamics, as well as long-term sea-ice decline as a result of climate change. The availability of near-real time data has the potential to transform adaptive management and zoning within TINMCA by refining the spatiotemporal scale of management to better balance multi-use objectives. Though there is inter-annual variability in vessel traffic and harvesting, as well as their interactions, identifying areas of significance to Inuit is crucial to ensure resources are allocated to better inventory, protect and monitor these areas. The results from this study provide insight into

community areas of importance for traditional harvesting in two communities adjacent to TINMCA.

Given the lack of recognition in Inuit use of marine areas in international and national maritime legislation, it is imperative that shipping provisions provided in the TINMCA management plan exceed the minimum standard of protection provided in the DNLUP. Furthermore, existing protected areas adjacent to TINMCA provide some protection in coastal and marine areas used by hunters in Arctic Bay and Pond Inlet. Hence, inter-governmental coordination is necessary to identify synergies and gaps in the current management frameworks governing shipping in this area. An integrated approach, whereby coastal and marine planning, management and policies are harmonized, should be adopted to increase the effectiveness of conservation and sustainable development efforts within TINMCA.

References

Ahiak Area Co-Management Committee. (2018). Ahiak (Queen Maud Gulf) Migratory Bird Sanctuary Management Plan: Final Draft for Nunavut Wildlife Management Board Approval. Retrieved from http://www.nwmb.com/en/public-hearings-a-meetings/meetings/regular-meetings/2018-1/rm-002-2018-iqaluit-wednesday-june-6th-2018/inuktitut-documents/7071-inuk-tab-08-bird-sanctuary-management-plan-pdf/file.

Arriagada, P. (2017). Food security among Inuit living in Inuit Nunangat. Retrieved October 15, 2018, from https://www150.statcan.gc.ca/n1/pub/75-006-x/2017001/article/14774-eng.htm

Aporta, C. (2002). Life on the ice: understanding the codes of a changing environment. *Polar Record*, *38*(207), 341. https://doi.org/10.1017/S0032247400018039

Aporta, C. (2003). *New Ways of Mapping: Using GPS Mapping Software to Plot Place Names and Trails in Igloolik (Nunavut)*. *Arctic, 56.* Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.561.2969&rep=rep1&type=pdf

Aporta, C. (2004). Routes, trails and tracks: trail breaking among the Inuit of Igloolik, *28*(2). https://doi.org/10.7202/013194ar

Aporta, C. (2009). The Trail as Home: Inuit and Their Pan-Arctic Network of Routes. https://doi.org/10.1007/s10745-009-9213-x

Aporta, C., Kane, S., Chircop, A. (2018). Limn Shipping corridors through the Inuit homeland. Retrieved November 24, 2018, from https://limn.it/articles/shipping-corridors-through-the-inuit-homeland/

Arctic Waters Pollution Prevention Act, R.S.C., 1985, c. A-12.

Arctic Shipping Safety and Pollution Prevention Regulations, SOR/2017-286.

Beveridge, L. (2018). Arctic Pilots for Canadian Corridors: Is There a Role for Pilotage in the Canadian Low Impact Shipping Corridors? *Ocean Yearbook Online*, *32*(1), 409–426. https://doi.org/10.1163/22116001-03201016

Canada National Marine Conservation Areas Act, S.C. 2002, c. 18.

Canada Shipping Act, 2001, S.C. 2001, c. 26.

Carter, N., Dawson, J., Joyce, J., & Ogilvie, A. (2017). *Arctic corridors and northern voices: governing marine transportation in the Canadian Arctic* (Gjoa Haven, Nunavut community report). Ottawa: University of Ottawa.

CCG. (2013). Ice Navigation in Canadian Waters: Regulations and Guidelines. Retrieved August 29, 2018, from http://www.ccg-gcc.gc.ca/Icebreaking/Ice-Navigation-Canadian-Waters/Regulations-and-Guidelines

Chénier, R., Abado, L., Sabourin, O., & Tardif, L. (2017). Northern marine transportation corridors: Creation and analysis of northern marine traffic routes in Canadian waters. *Transactions in GIS*, *21*(6), 1085–1097. https://doi.org/10.1111/tgis.12295

Chircop, A. (2016). Sustainable Arctic Shipping: Are Current International Rules for Polar Shipping Sufficient? Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2847027

Cicin-Sain, B., Knecht, R. W., Jang, D., Fisk, G. W., (1998). *Integrated coastal and ocean management: concepts and practices*. Island Press. Retrieved from https://trid.trb.org/view/667068

Dawson, J., Copland, L., Mussells, O., and Carter, N. (2017). Shipping Trends in Nunavut 1990-2015: *A report prepared for the Nunavut General Monitoring Program*. Ottawa, Canada and Iqaluit, Nunavut.

Dawson, J., Pizzolato, L., Howell, S. E. L., Copland, L., & Johnston, M. E. (2018). Temporal and Spatial Patterns of Ship Traffic in the Canadian Arctic from 1990 to 2015. *Arctic*, *71*(1), 15–26. https://doi.org/10.14430/arctic4698

DFO. (2005). *Canada's Oceans Action Plan For Present and Future Generations*. Retrieved from www.dfo-mpo.gc.ca

DFO. (2012). *Integrated Fisheries Management Plan for Narwhal in the Nunavut Settlement Area Nunavut Community Consultations*. Retrieved from http://www.nwmb.com/en/public-hearings/2012-1/proposed-integrated-fisheries-management-plan-for-narwhal-in-the-nunavut-settlement-area-including-the-establishment-of-total-allowable-harvests-basic-needs-levels-and-non-quota-limitations-july-24th-26th/prop

DFO. (2016). Policies and Governance - Policy and Operational Framework for Integrated Management of Estuarine, Coastal and Marine Environments in Canada. Retrieved November 20, 2018, from http://www.dfo-mpo.gc.ca/oceans/publications/cosframework-cadresoc/page01-eng.html

DFO. (2017). Federal Marine Protected Areas Strategy. Retrieved November 19, 2018, from http://www.dfo-mpo.gc.ca/oceans/publications/fedmpa-zpmfed/index-eng.html#build

DFO. (2018). Policy and Operational Framework for Integrated Management of Estuarine, Coastal and Marine Environments in Canada. Retrieved November 19, 2018, from http://www.dfo-mpo.gc.ca/oceans/publications/cosframework-cadresoc/page03-eng.html

Dickie, G. (2018). Arctic sea ice melt season just got a big headstart. Retrieved November 22, 2018, from https://news.mongabay.com/2018/06/2018-arctic-sea-ice-melt-season-just-got-a-big-headstart/

Dirschl, H. J. (1982). *Green Paper The Lancaster Sound Region: 1980-2000 Issues and Options on the Use and Management of the Region Lancaster Sound Regional Study*. Retrieved from http://pubs.aina.ucalgary.ca/misc/9236.pdf

Ehler, C., & Douvere, F. (2009). Marine spatial planning: a step-by-step approach toward ecosystem-based management. *UNESO/IOC, 53*. Retrieved from http://unesdoc.unesco.org/images/0018/001865/186559e.pdf

Frizzell, S. (2017). Baffinland mine ramps up production, ships record amount, minor spills also increase. Retrieved November 22, 2018, from https://www.cbc.ca/news/canada/north/baffinland-shipping-spills-1.4361174

Ford, J. D., Smit, B., & Wandel, J. (2006). Vulnerability to climate change in the Arctic: A case study from Arctic Bay, Canada. *Global Environmental Change*, *16*, 145–160. https://doi.org/10.1016/j.gloenvcha.2005.11.007

Goehring, B. (1990). Inuit place-names and main-land relationships, Pelly Bay, Northwest Territories. https://doi.org/10.14288/1.0098558

Government of Canada. (2010). Government of Canada takes action to protect Canadian Arctic waters. Retrieved September 1, 2018, from https://www.canada.ca/en/news/archive/2010/06/government-canada-takes-action-protect-canadian-arctic-waters.html

Government of Canada. (2018). Organization Profile - Nunavut Wildlife Management Board. Retrieved November 14, 2018, from https://appointments.gc.ca/prflOrg.asp?OrgID=NWMB&type-typ=&lang=eng

Government of Canada & Council of Haida Nation. (2018). *Gwaii Haanas Gina 'Waadluxan KilGulGa Land-Sea-People Management Plan 2018.* Retrieved

November 9, 2018, from https://pcacdn.azureedge.net/-/media/pn-np/bc/gwaiihaanas/WET4/info/plan/PDFs/Gwaii-Haanas-LSP-Plan-2018_EN_lowres.pdf?la=en&modified=20181128185645&hash=B3C728260FAD857C7B2FC369708ED7849EBFCE99

Government of Nunavut. (2007). History of Nunavut. Retrieved October 28, 2018, from http://www.nunavut-physicians.gov.nu.ca/history.shtml

Guénette, S., & Alder, J. (2007). Lessons from Marine Protected Areas and Integrated Ocean Management Initiatives in Canada. *Coastal Management*, *35*(1), 51–78. https://doi.org/10.1080/10.1080/08920750600970578

Hannah, C. G., Dupont, F., & Dunphy, M. (2009). Polynyas and Tidal Currents in the Canadian Arctic Archipelago. *Arctic*. Arctic Institute of North America. https://doi.org/10.2307/40513267

Hauser, D. D. W., Laidre, K. L., & Stern, H. L. (2018). Vulnerability of Arctic marine mammals to vessel traffic in the increasingly ice-free Northwest Passage and Northern Sea Route. *Proceedings of the National Academy of Sciences*, *115*(*29*), 7617–7622. https://doi.org/10.1073/pnas.1803543115

Hoover, C., Ostertag, S., Horny, C., Parker, C., Hansen-Craik, K., Loseto, L., & Pearce, T. (2016). The Continued Importance of Hunting for Future Inuit Food Security - The Solutions Journal. *Solutions Journal*, *7*(4), 40–50. Retrieved from https://www.thesolutionsjournal.com/article/continued-importance-hunting-future-inuit-food-security/

Huntington, H. P., Daniel, R., Hartsig, A., Harun, K., Heiman, M., Meehan, R., … Stetson, G. (2015). Vessels, risks, and rules: planning for safe shipping in Bering Strait. *Marine Policy*, *51*, 119–127. https://doi.org/10.1016/J.MARPOL.2014.07.027

ICC – Canada. (2008). *A Contribution to the Arctic Marine Shipping Assessment The Sea Ice is Our Highway An Inuit Perspective on Transportation in the Arctic*. Retrieved from http://www.inuitcircumpolar.com/uploads/3/0/5/4/30542564/20080423_iccamsa_finalpdfprint.pdf

ICC – Canada. (2014). *Inuit Circumpolar Council The Sea Ice Never Stops Circumpolar Inuit Reflections on Sea Ice Use and Shipping in Inuit Nunaat*. Retrieved from https://oaarchive.arctic-council.org/bitstream/handle/11374/410/ACMMCA09_Iqaluit_2015_SDWG_Sea_Ice_Never_Stops_Inuit_Report.pdf?sequence=1&isAllowed=y

IHT. (2016). Inuit Heritage Trust: Place Names Program. Retrieved August 15, 2018, from http://ihti.ca/eng/place-names/pn-index.html

IMO, *International Code for Ships Operating in Polar Waters (Polar Code),* MEPC 68/21 (15 May 2015).

INAC. (2015). Nunavut Planning and Project Assessment Act (NuPPAA) - Before and After Coming Into Force. Retrieved November 3, 2018, from https://www.aadnc-aandc.gc.ca/eng/1436448330286/1436448390699

Inuit Nunangat Declaration on Inuit-Crown Partnership. (2017). Retrieved from https://www.itk.ca/wp-content/uploads/2017/02/English-Inuit-Nunangat-Declaration.pdf

IUCN. (2017). Canada's newest and largest Marine Protected Area: Tallurutiup Imanga – Lancaster Sound. Retrieved November 23, 2018, from https://www.iucn.org/news/protected-areas/201708/canada's-newest-and-largest-marine-protected-area-tallurutiup-imanga-lancaster-sound

Kearney, J., Berkes, F., Charles, A., Pinkerton, E., & Wiber, M. (2007). The Role of Participatory Governance and Community-Based Management in Integrated Coastal and Ocean Management in Canada. *Coastal Management*, *35*(1), 79–104. https://doi.org/10.1080/10.1080/08920750600970511

Keith, D. (2004). Caribou, river and ocean: Harvaqtuurmiut landscape organization and orientation. *Études/Inuit/Studies*, *28*(2), 39. https://doi.org/10.7202/013195ar

Kenchington, R. A., & Day, J. C. (2011). Zoning, a fundamental cornerstone of effective Marine Spatial Planning: lessons learnt from the Great Barrier Reef, Australia. *Journal of Coastal Conservation*, *15*(2), 271–278. https://doi.org/10.1007/s11852-011-0147-2

Lancaster Sound National Marine Conservation Area Feasibility Assessment Steering Committee. (2017). *A National Marine Conservation Area Proposal for Lancaster Sound Feasibility Assessment Report Submitted by the Lancaster Sound National Marine Conservation Area Feasibility Assessment Steering Committee*. Retrieved from https://qia.ca/wp-content/uploads/2017/08/NMCA-Propossal-for-Lancaster-Sound-ENG-April-4.pdf

Lancaster Sound Regional Land Use Planning Commission. (1991). *Lancaster Sound Regional Land Use Plan.* Northwest Territories Land Use Planning.

Land Claims Agreements Coalition. (2017). Land Claims Coalition. Retrieved October 24, 2018, from http://landclaimscoalition.ca/coalition_members/nunavut-tunngavik-inc/

Lasserre, F., & Têtu, P.-L. (2015). The cruise tourism industry in the Canadian Arctic: analysis of activities and perceptions of cruise ship operators. *Polar Record*, *51*(01), 24–38. https://doi.org/10.1017/S0032247413000508

Lee, L. (2012). *Building Leadership for Canada's Future.* Retrieved from http://www.actioncanada.ca/wp-content/uploads/2014/04/Haida-Gwaii-Environmental-EN-Oct-2012.pdf

MaPP. (2015). *Haida Gwaii Marine Plan*. Retrieved from http://mappocean.org/wp-content/uploads/2015/09/HGMP-WEB-2015-07-08.pdf

Melia, N., Haines, K., Hawkins, E., & Day, J. J. (2017). Towards seasonal Arctic shipping route predictions. *Environmental Research Letters*, *12*(8), https://doi.org/10.1088/1748-9326/aa7a60

McCook, L. J., Ayling, T., Cappo, M., Choat, J. H., Evans, R. D., De Freitas, D. M., … Williamson, D. H. (2010). Adaptive management of the Great Barrier Reef: a globally significant demonstration of the benefits of networks of marine reserves. *Proceedings of the National Academy of Sciences of the United States of America*, *107*(43), 18278–18285. https://doi.org/10.1073/pnas.0909335107

Milton Freeman Research Limited. (1976). Inuit Land Use and Occupancy Project: A Report Prepared by Milton Freeman Research Limited under Contract with the Department of Indian and Northern Affairs. Ottawa: ON.

MPA Network BC Northern Shelf Bioregion. (n.d.). MPA Network - Other Initiatives. Retrieved November 18, 2018, from https://mpanetwork.ca/bcnorthernshelf/other-initiatives/

National Defence & the Canadian Armed Forces. (2015). The Canadian Arctic Waters and UNCLOS. Retrieved from http://www.forces.gc.ca/en/about-reports-pubs-military-law-strategic-legal-paper/naval-ops-arctic-waters-unclos.page

Networks of Centres of Excellence of Canada. (2017). Inuit guide research to low impact shipping corridors. Retrieved from http://www.nce-rce.gc.ca/Research-

Recherche/Stories-Articles/2017/lowImpact-faibleImpact_eng.asp
NIRB. (2018). *Strategic Environmental Assessment for Baffin Bay and Davis Strait Environmental Setting and Review of Potential Effects of Oil and Gas Activities Final*. Retrieved from http://www.nirb.ca/publications/strategic environmental assessment/180601-17SN034-Environmental Setting and Review of Potential Effects Report-IEDE.pdf
Northern Canada Vessel Traffic Services Zone Regulations, SOR/2010-127.
NPC. (2000). *North Baffin Regional Land Use Plan*. Retrieved from http://www.nunavut.ca/files/North Baffin Regional Land Use Plan.pdf
NPC. (2016). Nunavut Land Use Plan: 2016 Draft. Retrieved from http://www.nunavut.ca/files/2016DNLUP/2016_Draft_Nunavut_Land_Use_Plan.pdf
NPC. (2018). Nunavut Planning Commission. Retrieved October 16, 2018, from http://www.nunavut.ca/
NTI. (2004). *Tukisittiarniqsaujumaviit: A Plain Language Guide to the Nunavut Land Claims Agreement*. Retrieved from http://www.tunngavik.com/documents/publications/2004-00-00-A-Plain-Language-Guide-to-the-Nunavut-Land-Claims-Agreement-English.pdf
Nunavut Land Claims Agreement Act, S.C. 1993, c. 29.
Nunavut Planning and Project Assessment Act, S.C. 2013, c. 14, s. 2.
NWMB. (n.d.). NWMB - Co-Management Partners. Retrieved November 19, 2018, from https://www.nwmb.com/en/about-nwmb/co-management-partners
ontheworldmap.com. (n.d.). Nunavut Region Map. Retrieved November 22, 2018, from http://ontheworldmap.com/canada/province/nunavut/nunavut-region-map.jpg
NWMB. (2004). The Nunavut Wildlife Harvest Study. Retrieved May 10, 2018 from https://www.nwmb.com/iku/publications/harvest-study/1824-156-nwhs-report-2004-156-0003/file
Oceans Act, S.C. 1996, c. 31.
Oceans North. (n.d.). Tallurutiup Imanga. Retrieved September 10, 2018, from https://oceansnorth.org/en/where-we-work/tallurutiup-imanga/
Parks Canada. (2016). *Sirmilik National Management Plan.* Retrieved from https://www.pc.gc.ca/en/pn-np/nu/sirmilik/info/~/media/684CCA108D3443A09C18B54FA9B44C67.ashx
Parks Canada. (2017). Tallurutiup Imanga/Lancaster Sound in High Arctic to be Canada's Largest Protected Area. Retrieved September 13, 2018, from https://www.canada.ca/en/parks-canada/news/2017/08/tallurutiup_imangalancastersoundinhigharctictobecanadaslargestpr.html
Parks Canada. (2018a). National Marine Conservation Areas. Retrieved September 15, 2018, from https://www.pc.gc.ca/en/amnc-nmca
Parks Canada. (2018b). Timeline and next steps - National Marine Conservation Areas. Retrieved September 13, 2018, from https://www.pc.gc.ca/en/amnc-nmca/cnamnc-cnnmca/tallurutiup-imanga/chronologie-timeline
Parks Canada. (2018c). Where is Tallurutiup Imanga? - National Marine Conservation Areas. Retrieved September 13, 2018, from https://www.pc.gc.ca/en/amnc-nmca/cnamnc-cnnmca/tallurutiup-imanga/emplacement-location
Pearce, T., Ford, J., Willox, A. C., & Smit, B. (2015). Inuit Traditional Ecological Knowledge (TEK) Subsistence Hunting and Adaptation to Climate Change in the

Canadian Arctic. *Arctic*, *68*(2), 233. https://doi.org/10.14430/arctic4475
Pikialasorsuaq Commission. (2017). People of the Ice Bridge: the Future of the Pikialasorsuaq. *Report of the Pikialasorsuaq Commission.* Retrieved from http://pikialasorsuaq.org/media/efa13559-9221-4407-8583-c47509b56e7b/6CkEoA/Reports/Report%20of%20the%20Pikialasorsuaq%20Commission%20Nov%202017_For%20e-distribution.pdf
Pizzolato, L., Howell, S. E. L., Derksen, C., Dawson, J., & Copland, L. (2014). Changing sea ice conditions and marine transportation activity in Canadian Arctic waters between 1990 and 2012. *Climatic Change*, *123*(2), 161–173. https://doi.org/10.1007/s10584-013-1038-3
Pizzolato, L., Howell, S. E. L., Dawson, J., Laliberté, F., & Copland, L. (2016). The influence of declining sea ice on shipping activity in the Canadian Arctic. *Geophysical Research Letters*, *43*(23), 161-173. https://doi.org/10.1002/2016GL071489
Plummer, R., Crona, B., Armitage, D. R., Olsson, P., Tengö, M., & Yudina, O. (2012). Adaptive Comanagement: a Systematic Review and Analysis. *Ecology and Society*, *17*(3), https://doi.org/10.5751/ES-04952-170311
PNCIMA Initiative. (2017). *Pacific North Coast Integrated Management Area Plan*. Retrieved from http://www.pncima.org/media/documents/2016-plan/2316-dfo-pncima-report-v17-optimized.pdf
Porta, L., Abou-Abssi, E., Dawson, J., & Mussells, O. (2017). Shipping Corridors as a Framework for Advancing Marine Law and Policy in the Canadian Arctic. *Ocean and Coastal Law Journal*, *22*. Retrieved from http://digitalcommons.mainelaw.maine.edu/ocljhttp://digitalcommons.mainelaw.maine.edu/oclj/vol22/iss1/6
QIA. (2015). *Qikiqtani Inuit Association Community Land and Resource Committee User Manual.* Retrieved from https://qia.ca/wp-content/uploads/2017/02/qia_clarc_manual_final_bod_2015.pdf
QIA. (2017a). QIA launches pilot community based monitoring project in Pond Inlet. Retrieved November 22, 2018, from https://qia.ca/qia-launches-pilot-community-based-monitoring-project-in-pond-inlet/
QIA. (2017b). Mary River Wildlife Compensation Fund. Retrieved November 22, 2018, from https://qia.ca/programs/mary-river-wildlife-compensation-fund/
QIA. (2018a). *A New Approach to Economic Development in Nunavut*. Retrieved from www.qia.ca
QIA. (2018b). Tallurutiup Imanga. Retrieved November 11, 2018, from https://qia.ca/wp-content/uploads/2018/01/Tallurutiup-Imanga-Presentation-Jan-8-FINAL-flattenedweb.pdf
Riewe, R. (1992). *Nunavut Atlas.* Edmonton: Canadian Circumpolar Institute and the Tungavik Federation of Nunavut.
Rutherford, R. J., Herbert, G. J., & Coffen-Smout, S. S. (2005). Integrated ocean management and the collaborative planning process: the Eastern Scotian Shelf Integrated Management (ESSIM) Initiative. *Marine Policy*, *29*, 75–83. https://doi.org/10.1016/j.marpol.2004.02.004
Shipping Safety Control Zones Order, C.R.C., c. 356.
SmartICE. (n.d.). SmartICE. Retrieved November 23, 2018, from https://www.smartice.org/
Statistics Canada. (2006). Harvesting and community well-being among Inuit in the

Canadian Arctic: Preliminary findings from the 2001 Aboriginal Peoples Survey - Survey of Living Conditions in the Arctic. Retrieved October 15, 2018 from https://www150.statcan.gc.ca/n1/pub/89-619-x/2006001/4079314-eng.htm

The Pew Charitable Trusts. (2016). *A report from The Integrated Arctic Corridors Framework Planning for responsible shipping in Canada's Arctic waters*. Retrieved from https://www.pewtrusts.org/~/media/assets/2016/04/the-integrated-arctic-corridors-framework.pdf

Transport Canada. (2010a). Arctic Shipping Pollution Prevention Regulations (ASPPR). Retrieved August 29, 2018, from https://www.tc.gc.ca/eng/marinesafety/debs-arctic-acts-regulations-asppr-421.htm

Transport Canada. (2010b). Zone/Date System (Z/DS). Retrieved August 28, 2018, from https://www.tc.gc.ca/eng/marinesafety/debs-arctic-acts-regulations-zds-1824.htm

Transport Canada. (2017). Arctic Ice Regime Shipping System (AIRSS). Retrieved August 28, 2018, from https://www.tc.gc.ca/eng/marinesafety/debs-arctic-acts-regulations-airss-291.htm

Transport Canada. (2018). Guidelines for Passenger Vessels Operating in the Canadian Arctic. Retrieved August 29, 2018, from https://www.tc.gc.ca/eng/marinesafety/guidelines-passenger-vessels-operating-canadian-arctic-tp13670e.html

Tungavik Federation of Nunavut & Indian Affairs and Northern Development. (1993). *Agreement between the Inuit of the Nunavut Settlement Area and her Majesty the Queen in Right of Canada,* Ottawa, Tungavik Federation of Nunavut, Indian Affais and Northern Development.

United Nations General Assembly. *United Nations Convention on the Law of the Sea*. UNTS 1833 (10 December 1982).

Vanderzwaag, D., & Rolston, S. (2009). *Analysis of the national laws and regulations of Canada*. London. Retrieved from http://pm.gc.ca/eng/media.asp?id=2016

Watt-Cloutier, S. (2015). *The right to be cold: one woman's fight to protect the Arctic and save the planet from climate change*.

Zelniker, R. (2016). Pilot project making winter travel safer for people in Pond Inlet, Nunavut. Retrieved November 13, 2018, from https://www.cbc.ca/news/canada/north/smart-ice-pond-inlet-nunavut-1.3764542

Appendix

Appendix 1. Descriptions of the seasonal use of areas by hunters and the wildlife harvested accompanying land use intensity maps in the Nunavut Atlas (Riewe, 1992).

Land Use	Intensity	Season	Notes
Polar bears	Medium	Spring	This offshore area of fast ice is used for polar bear hunting in some years, particularly in March to April when a combination of reduced current and presence of grounded icebergs permits growth of new fast ice.
Caribou	High	Fall, winter and spring	Caribou are hunted in the large area southwest of PI in fall, winter and spring when area is accessible.
Waterfowl	High	Spring, summer and fall	Goose hunting from spring to fall. Wet lowland tundra of SW Bylot Island is particularly important in this regard, and nesting geese provide a substantial food source to the people of PI. Coastal waters of SW Bylot Island are also used for duck hunting.
Not reported	Low	<Null>	No hunting or trapping has occurred in recent years.
Waterfowl	High	Spring, summer and fall	Goose hunting from spring to fall. Wet lowland tundra of SW Bylot Island is particularly important in this regard, and nesting geese provide a substantial food source to the people of PI. Coastal waters of SW Bylot Island are also used for duck hunting.
Polar bears	High	Winter	This coastal area is used to hunt polar bears from January to March. This marks the northeastern limit for hunters.
Waterfowl	High	Spring, summer and fall	Goose hunting from spring to fall. Wet lowland tundra of SW Bylot Island is particularly important in this regard, and nesting geese provide a substantial food source to the people of PI. Coastal waters of SW Bylot Island are also used for duck hunting.
Seals	High	Winter, spring, summer and fall	Ringed and bearded seals hunted year round by the Inuit from PI in all the marine areas.
Not reported	Low	<Null>	No hunting or trapping has occurred in recent years.

Waterfowl	High	Spring, summer and fall	Goose hunting from spring to fall. Wet lowland tundra of SW Bylot Island is particularly important in this regard, and nesting geese provide a substantial food source to the people of PI. Coastal waters of SW Bylot Island are also used for duck hunting.
Waterfowl	High	Spring, summer and fall	Goose hunting from spring to fall. Wet lowland tundra of SW Bylot Island is particularly important in this regard, and nesting geese provide a substantial food source to the people of PI. Coastal waters of SW Bylot Island are also used for duck hunting.
Not reported	Low	<Null>	No hunting or trapping has occurred in recent years.
Caribou	Medium	Winter, spring, summer and fall	This area is used occasionally by Inuit from AB and PI for caribou hunting. PI Inuit formerly used this area more intensively for caribou hunting.
Not reported	Low	<Null>	No hunting or trapping has been reported in these areas in recent years. It should be pointed out that a narrow strip at the seaweed margins of such areas is still used for camping and hunting.
Not reported	Low	<Null>	No hunting or trapping has been reported in these areas in recent years. It should be pointed out that a narrow strip at the seaweed margins of such areas is still used for camping and hunting.
Polar bears	High	Winter and spring	This is primarily a travel corridor for AB hunters heading to Prince Regent Inlet to hunt polar bears in winter and spring.
Waterfowl	High	Spring, summer and fall	Geese and ducks are hunted by Inuit from AB. Two of the more favoured locations to hunt waterfowl are along the north shore of Strathcona Sound and along the western shore of Admiralty Inlet. Other goose and duck hunting areas located along shores.
Caribou	High	Winter, spring, summer and fall	These areas are used by hunters from PI and AB for caribou hunting. The area east of Milne Inlet is used year-round while the area to the west is only used in spring and summer.
Waterfowl	High	Spring, summer and fall	Geese and ducks are hunted by Inuit from AB. Two of the more favoured locations to hunt waterfowl are along the north shore of Strathcona Sound and along the western shore of Admiralty Inlet. Other goose and duck hunting areas located along shores.
Waterfowl	High	Spring, summer and fall	Geese and ducks are hunted by Inuit from AB. Two of the more favoured locations to hunt waterfowl are along the north shore of Strathcona Sound and along the western shore of Admiralty Inlet. Other goose and duck hunting areas located along shores.
Caribou	High	Winter, spring,	These areas are used by hunters from PI and AB for caribou hunting. The area east of Milne Inlet is used year-round while the area to the west is only used in spring and summer.

		summer and fall	
Waterfowl	High	Spring, summer and fall	Geese and ducks are hunted by Inuit from AB. Two of the more favoured locations to hunt waterfowl are along the north shore of Strathcona Sound and along the western shore of Admiralty Inlet. Other goose and duck hunting areas located along shores.
Waterfowl	High	Spring, summer and fall	Geese and ducks are hunted by Inuit from AB. Two of the more favoured locations to hunt waterfowl are along the north shore of Strathcona Sound and along the western shore of Admiralty Inlet. Other goose and duck hunting areas located along shores.
Waterfowl	High	Spring, summer and fall	Geese and ducks are hunted by Inuit from AB. Two of the more favoured locations to hunt waterfowl are along the north shore of Strathcona Sound and along the western shore of Admiralty Inlet. Other goose and duck hunting areas located along shores.
Caribou	High	Spring and summer	Steensby Peninsula is used by hunters from PI and AB for caribou hunting. Most hunting activity occurs during spring and summer.
Waterfowl	High	Spring, summer and fall	Geese and ducks are hunted by Inuit from AB. Two of the more favoured locations to hunt waterfowl are along the north shore of Strathcona Sound and along the western shore of Admiralty Inlet. Other goose and duck hunting areas located along shores.
Waterfowl	High	Spring, summer and fall	Geese and ducks are hunted by Inuit from AB. Two of the more favoured locations to hunt waterfowl are along the north shore of Strathcona Sound and along the western shore of Admiralty Inlet. Other goose and duck hunting areas located along shores.
Polar bears	High	Winter, spring, summer and fall	PI Inuit use these coastal areas of Borden Peninsula, Bylot Island and Navy Board Inlet to hunt polar bear.
Not reported	Low	<Null>	No hunting or trapping has been reported in these areas in recent years. It should be pointed out that a narrow strip at the seaweed margins of such areas is still used for camping and hunting.
Polar bears	High	Fall, winter and spring	PI Inuit use these coastal areas of Borden Peninsula, Bylot Island and Navy Board Inlet to hunt polar bear
Polar bears	High	Winter	Polar bear hunting from January to March.
Seals	High	Winter, spring, summer and fall	Inuit from PI hunt ringed and bearded seals year-round.

Not reported	Low	<Null>	No hunting or trapping has occured in recent years.
Not reported	Low	<Null>	No hunting or trapping has been reported in these areas in recent years. It should be pointed out that a narrow strip at the seaweed margins of such areas is still used for camping and hunting.
Not reported	Low	<Null>	No hunting or trapping has occured in recent years.
Seals	High	Summer	This marine area is used by residents of AB and occasionally Hall Beach and Igloolik for hunting ringed and to a lesser extent bearded seals.
Waterfowl	High	Spring, summer and fall	Geese and ducks are hunted by Inuit from AB. Two of the more favoured locations to hunt waterfowl are along the north shore of Strathcona Sound and along the western shore of Admiralty Inlet. Other goose and duck hunting areas located along shores.
Seals	Medium	Spring	This offshore area of fast ice is used for seal hunting in some years, particularly in March to April when a combination of reduced current and presence of grounded icebergs permits growth of new fast ice.
Wolves	High	Fall, winter and spring	Wolves, associated with caribou herds are also hunted when encountered.
Waterfowl	High	Spring, summer and fall	Some snow geese hunting occurs on the southwest side of Tay Sound.
Seals	High	Winter	Seals are hunted south of Cape Walter Bathurst in winter.
Narwhals	High	Winter	Narwhals are hunted south of Cape Walter Bathurst in winter.
Walruses	High	Winter	Hunting for walrus occurs throughout the entire coastal area in winter.
Narwhals	High	Spring and summer	Most of this area with the exception of Oliver sound and Paquet Bay is used for narwhal hunting in spring and summer.
Walruses	High	Spring	Walrus are hunted primarily in spring along floe edge at eastern end of PI.
Polar bears	High	Fall and winter	Polar bears are intensively hunted throughout the area except south of Emerson Island.
Arctic fox	High	Fall, winter and spring	Coastal areas around PI are used for fox trapping in late fall, winter and spring.

Waterfowl	High	Spring, summer and fall	Duck hunting occurs in the marine area by southeast Bylot Island and in the waters of Guys Bight, Erik Harbour and Tay Sound.
Waterfowl	High	Spring, summer and fall	Geese and ducks are hunted by Inuit from AB. Two of the more favoured locations to hunt waterfowl are along the north shore of Strathcona Sound and along the western shore of Admiralty Inlet. Other goose and duck hunting areas located along shores.
Caribou	High	Winter, spring, summer and fall	This area is intensively used by AB hunters and occasionally PI hunters for hunting caribou.
Waterfowl	High	Spring, summer and fall	Geese and ducks are hunted by Inuit from AB. Two of the more favoured locations to hunt waterfowl are along the north shore of Strathcona Sound and along the western shore of Admiralty Inlet. Other goose and duck hunting areas located along shores.
Seals	High	Winter, spring and summer	Inuit from AB hunt ringed and bearded seals in most of Admiralty Inlet and southern part of LS. Ringed seals hunted in winter and spring. Bearded seals hunted in late spring or summer. Harp seals taken during summer. Victor Point is important sealing area
Arctic fox	High	Fall, winter and spring	PI Inuit use these coastal areas of Borden Peninsula, Bylot Island and Navy Board Inlet to trap Arctic fox.
Waterfowl	High	Spring, summer and fall	Waterfowl hunted along shores of Navy Board Inlet. Major snow goose hunting found on southwest Bylot Island.
Waterfowl	High	Spring, summer and fall	AB hunters kill nesting snow geese in this area.
Polar bears	High	Winter	AB residents hunt polar bears during winter in this area.
Narwhals	High	Summer	AB residents hunt narwhals during summer in this area.
Arctic fox	High	Summer	AB hunters trap Arctic fox in winter along coastline.
Waterfowl	High	Spring, summer and fall	PI Inuit hunt geese around Ipitalik Peninsula and off mouth of Tugaat River.
Arctic fox	High	Fall, winter and spring	PI Inuit use these coastal areas of Borden Peninsula, Bylot Island and Navy Board Inlet to trap Arctic fox.

Waterfowl	High	Spring, summer and fall	Waterfowl hunted along shores of Navy Board Inlet. Major snow goose hunting found on SW Bylot Island.
Waterfowl	High	Spring, summer and fall	PI Inuit hunt geese around Ipitalik Peninsula and off mouth of Tugaat River.
Caribou	High	Winter, spring, summer and fall	Caribou are sometimes hunted in this area.
Seals	High	Winter and summer	Seals hunted in open water during summer and at breathing holes in winter.
Walruses	High	Spring and summer	Walruses hunted in late spring at floe edges and during summer.
Narwhals	High	Spring and summer	Narwhals hunted in spring and summer.
Beluga whales	High	Summer	Inuit from PI occasionally hunt beluga whales during summer.
Walruses	High	Spring and summer	Walruses hunted during late spring and summer.
Polar bears	High	Spring	Polar bears hunted in early spring.
Arctic fox	High	Winter	Arctic fox trapped in winter.
Wolves	High	Spring and fall	This area is intensively used by AB hunters and occasionally PI hunters for hunting wolves.
Narwhals	High	Summer	Narwhals are hunted along the Admiralty Inlet floe edge in June and July and along the western shore of Admiralty Inlet in August.
Walruses	High	Spring and summer	In late spring and summer, walruses are hunted along the southern shore of Adams Sound and in the Giants Castle-Turner Cliffs area. Inuit also hunt walruses in areas off Strathcona Sound, Victor Bay and Cape Crawford.

Polar bears	High	Summer	Polar bears area hunted over a large area, primarily on the ice of Admiralty Inlet, and Adams and Strathcona sounds.
Arctic fox	High	Winter	The entire coastline of Admiralty Inlet is used for trapping Arctic fox in winter.
Not reported	Low	<Null>	No hunting or trapping has occurred in recent years.