

# Chapter 1 - Introduction

## *Learning about ice, through Inuit eyes*

I clung to the back of a speeding snowmobile as we trailed an arctic fox across the sea ice. I treaded lightly - nervously - at the ice edge, a few inches separating me from the fast-moving water underneath and beyond the ice extent. I flailed to grab on to the *kamotik* (sled) lines as the dog team was off and running without me, despite several warnings that “go!” means “go right now!!” I hung on with clenched teeth as we manoeuvred an ice ledge attached to a steep cliff, with open water flanking the other side. These are just a few of the experiences I was privileged to have learned from during my time in Cape Dorset, Igloodik, and Pangnirtung, Nunavut. Facilitated by Andrew Dialla, Pootoogoo Elee, Eric Joamie, and Theo Ikummaq I was provided a small taste of the experiential and practical learning that is so critical in the development of Inuit sea ice expertise. They helped me to contextualize the depth and complexity of elders’ explanations of sea ice conditions, dangers, and terminology. It is challenging to adequately describe this research journey in words. I was led from books, to communities, to snowmobiles, to sea ice, to myself, and back again. As such, this thesis is my initial contribution to learning about sea ice, through Inuit eyes.

### **1.1 Inuit, sea ice, and scientists**

Sea ice is an integral component of Inuit life, and is the preeminent focus of numerous types of scientific research (Norton, 2002; George *et al.*, 2004; Nichols *et al.*, 2004; Laidler, 2006a). This dynamic, cyclical component of the arctic marine system has sustained Inuit for centuries, while also influencing regional climates around the world. The sea ice is of utmost importance to Inuit communities in the Canadian north as it: i) enables smooth, efficient travel; ii) creates habitat for marine mammals; and, iii) provides a hunting platform from which to access marine mammals (i.e. used for food, clothing, heat, light, and equipment). For most of the year, Inuit life is tied directly to the ice on the ocean (Nickels *et al.*, 2005). Therefore, knowledge of ice and

ice conditions are critical to survival, whereby sea ice use is a means of maintaining, and transmitting, Inuit culture and language. Meanwhile, sea ice formation and decay processes, sea ice influences on atmospheric and oceanic systems, and the advent of climate change has increasingly peaked scientific interest over the past century. The far-reaching implications of changing sea ice thickness, distribution, and extent also render this dynamic environment a primary target in efforts to model or project future scenarios of ice or climatic conditions. While the sea ice is a common focal point for both Inuit and scientists, there has conventionally been little interaction between the two, and thus minimal understanding of their differing perspectives on sea ice. So in a history of northern research where scientists often relied on Inuit, but where relationships were not always reciprocal in their benefits, the topic of sea ice continues to bring the two cultures together. Scientists are now having to respond to community, political, and institutional pressures to consult with, involve, and/or report their findings to Inuit in communities across Canada (Section 1.3.3). Furthermore, with an explosion of sea ice and climate change observations, investigations, and politics in the last few decades, scientific and Inuit interests have become increasingly intertwined.

## **1.2 Global to local and back again, the politics of sea ice and climate change**

A shrinking sea ice extent, or thinning ice cover, not only responds to warming but also contributes to enhanced change through positive climate feedback loops (e.g. surface albedo, and thermohaline circulation). Specifically, feedback mechanisms related to changes in sea ice extent, distribution, and thickness contribute to the projected amplification of warming trends – and thus environmental sensitivity – at high latitudes (Ledley, 1988; Ingram *et al.*, 1989; Bintanja and Oerlemans, 1995; Curry *et al.*, 1995; Lohmann and Gerdes, 1998; Lemke *et al.*, 2000; Holland and Bitz, 2003). While this type of research has raised the global profile of circumpolar regions, it has also sparked investigations into the human dimensions of climate change (Ford, 2000; Cruikshank, 2001; Fenge, 2001; Riedlinger and Berkes, 2001; Berkes, 2002;

Berkes and Jolly, 2002; Fox, 2002; Huntington, 2002; Duerden, 2004; Ford, 2005). Comparatively little is known about the vitality of sea ice extent, distribution, and thickness to daily life in arctic communities, much less how community members perceive climate change as it relates to their local environs. Therefore, scientific assessments of sea ice change and simulations of climate scenarios are inevitably related to Inuit concerns for their lifestyles, livelihoods, travel safety, and marine mammal health.

Sea ice and climate change are intimately linked within the realm of environmental investigation, but they are also becoming forefront in political arenas. Physical changes are being observed and experienced from global to community scales, and are occurring within the context of: i) global policy decisions; ii) federal politics; and, iii) Inuit asserting their rights through increased political control of their lands and people. Scientific evidence of human influences on the global climate system emerged in the international public sphere in 1979, at the First World Climate Conference (UNFCCC, 2005). Public awareness of environmental issues increased throughout the 1980s, as did government concerns with climate issues (UNFCCC, 2005). Therefore, by 1988 the governing bodies of the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) established the Intergovernmental Panel on Climate Change (IPCC) (IPCC, 2004; UNFCCC, 2005). The IPCC provides a forum for interaction between scientists and decision-makers, aiming for policy relevance but leaving policy decisions/implementation to national government discretion (IPCC, 2004). Through three assessment reports (1990, 1995, 2001), the IPCC has confirmed that climatic changes are underway – as influenced by human activities – and provided comprehensive assessments of scientific research on a myriad of related subjects (IPCC, 2004).

Adopted in 1992 at the Rio de Janeiro Earth Summit, the United Nations Framework Convention on Climate Change (UNFCCC) works closely with the IPCC. The UNFCCC came into force in 1994, and is one of the most universally supported international environmental

agreements (including Canada) (UNFCCC, 2005). Under the UNFCCC, the Conference of the Parties (COP) has convened member countries annually since 1995 (UNFCCC, 2005). These COP meetings also enable the IPCC and UNFCCC to share advice, findings, and proposals for future assessments or areas of investigation (IPCC, 2004). Such interactions led to discussions of commitments for industrialized countries to curtail greenhouse gas emissions, whereby the Kyoto Protocol was adopted in 1997 at COP3 in Japan (UNFCCC, 2005). However, it was only in 2005 that the protocol had sufficient ratifications to come into force (UNFCCC, 2005).

As a member of the UNFCCC, and a contributor to the IPCC, the Canadian government developed a *Climate Change Plan for Canada* that sets out specific targets for reducing greenhouse gas emissions to reach its Kyoto commitments (i.e. 6% below 1990 levels, between 2008 - 2012) (GC, 2002). The target area focusing on “Canadians, communities, and governments” specifies a national commitment to “ongoing **collaboration with Aboriginal and northern communities** to build capacity to address their particular priorities” (GC, 2002, 4 [emphasis in original]). As part of this effort, a Memorandum of Understanding (MOU) was reached between the Government of Canada and the Government of Nunavut in 2003. This MOU outlined interests to cooperate on climate change priorities and to link the Canadian action plan with the Nunavut climate change strategy, for a five-year period (GC and GN, 2003). The predominant focus of the Nunavut climate change strategy is the documentation of change, according to *Inuit Qaujimagatuqangit* (IQ - Inuit knowledge), around the territory (refer to DE 2005a, 2005b, 2005c, 2005d) (Section 1.3.1).

Concurrent with international and governmental efforts to address climatic change, Inuit groups and organizations have rallied their own efforts to influence national and international decision-making. Northern community members, especially elders who have a longer timeframe for comparison, have been observing and experiencing changes that they consider indicative of climatic change, including: i) different weather patterns; ii) altered

season durations; iii) diminished sea, lake, and glacier ice; iv) increased sun intensity; v) new species of birds and wildlife; vi) more skin conditions; vii) increased land, water, and animal contamination; viii) lower water levels; ix) heavier winds; and, x) more ships traveling in surrounding waters (NTI, 2001). As an advocate for Inuit rights, the Inuit Circumpolar Conference (ICC) has been championing these local concerns on the international stage for over a decade. Sheila Watt-Cloutier (ICC Chair) has been the main proponent for Inuit rights in the international climate change context. She has been fighting to highlight the regional and local implications of international actions, policies, and protocols for years. With the United States' resistance to ratifying the Kyoto Protocol, she embarked on a campaign to communicate Inuit perspectives to the COP held in Milan in 2003 (ICC press release, 2003), among other gatherings of national leaders. Because of the dangers of travel related to changing sea ice conditions, the decreased ability for hunters' environmental knowledge to evaluate weather or seasonal patterns, and altered wildlife habitat, Watt-Cloutier used the issue of human rights to:

“...prompt a dialogue with Arctic states, particularly the United States of America. It is our intent to educate not criticize, and to inform, not complain. By defending our human rights we will help the world achieve the unity and clarity of purpose it needs to tackle global climate change.” (Watt-Cloutier in ICC Press Release, 2003).

With little active response from the USA, she followed up with a formal petition to the Inter American Commission on Human Rights, on behalf of Inuit in Canada and the USA (Watt-Cloutier, 2005). This effort contested that the refusal of the USA to ratify the Kyoto Protocol – as the world's largest emitter of greenhouse gases – is a violation of the human and subsistence rights of Inuit to maintain their culture and lifestyle (Watt-Cloutier, 2005). Without seasonal ice formation, the reliability of local expertise, and the health of northern wildlife, Inuit health, livelihoods, and culture may be irreversibly altered (Watt-Cloutier, 2005). “The culture, economy, and identity of the Inuit as an indigenous people depend upon the ice and snow. Nowhere on Earth has global warming had a more severe impact than the Arctic.” (Watt-

Cloutier, 2005, 1). Therefore, since 1992 Watt-Cloutier's efforts, along with other local, territorial, and national Inuit leaders, have heightened the importance of the circumpolar Arctic in global environmental and political affairs (Fenge, 2001). Through political and scientific developments that support these endeavours (e.g. the Arctic Council, the International Arctic Science Committee (IASC), and the Arctic Climate Impact Assessment (ACIA)), northern Indigenous Peoples are thus in a position to exert significant influence in future global debates, including those on climate change (Fenge, 2001).

Through this overview of the political and scientific context within which climate change research is undertaken, it becomes clear that both scientists and Inuit play an essential role in improving our understanding of the relationships between sea ice, climate change, and northern communities. As scientific assessments of change move from documentation to exploration of adaptive and mitigative strategies (from environmental, economic, and cultural perspectives), both scientific and Inuit expertise are increasingly being considered alongside one another (Ford, 2000; Ford and Smit, 2004; Symon *et al.*, 2005). This is necessary to adequately incorporate the multiple stressors of northern life into assessments of resilience, or vulnerability, to climate change (McCarthy *et al.*, 2005). Indeed, Inuit want to be involved in this process in order to: i) share their own observations; ii) have their voices heard; and, iii) be taken seriously (Ashford and Castleden, 2001; Kusugak, 2002; ITK, 2005; Nickels *et al.*, 2005; NTI, 2005; Laidler, 2006b). This, along with my interest in working collaboratively and linking different forms of expertise, contribute to the formation of the rationale for my thesis research.

### **1.3 Rationale**

This project is driven by an interest to learn from Inuit about what sea ice means to them, how it is important in their lives. This links to how northern community members understand sea ice processes, and how they are experiencing sea ice and related changes around their communities. Beginning at the community level is imperative to pursue my other

interests of learning how to effectively work across cultures, and beginning the process of practically linking different knowledge systems. These personal interests are also tied to three broader issues that provide the rationale for conducting this research: i) Inuit knowledge (*Inuit Qaujimagatuqangit*) is a priority for inclusion in territorial and community government systems in Nunavut; ii) there is a need for increased understanding of local expertise on topics of sea ice and climate change; and, iii) the value of employing Inuit and scientific knowledge in complement is recognized, but more effort is required to understand the best processes for undertaking collaborative research.

### **1.3.1 Inuit Qaujimagatuqangit as a Nunavut priority**

Inuit efforts to gain recognition and consideration of their expert knowledge evolved along with negotiations for the Nunavut Land Claim Agreement (NLCA) and the Territory of Nunavut. While there is no mention of Inuit traditional knowledge (or *Inuit Qaujimagatuqangit*) in the NLCA, the agreement (finalized in 1993) was based on extensive studies to document Inuit land use and occupancy (i.e. Freeman, 1976) to solidify Inuit claims to land, ocean, and sub-surface rights (NTI, 2004). This traditional knowledge (also reflecting Inuit values) was to become the cornerstone of the programs, services, policies, and legislation to be developed under the new Government of Nunavut (GN) (NSDC, 1998). In these discussions, it is important to remember that the NLCA and the Territory of Nunavut are two different entities. The NLCA recognizes Inuit title to a large area of the former Northwest Territories (NWT), and provides Inuit with the right to use and make decisions about lands within the Nunavut settlement area (Wenzel, 2004). The Territory of Nunavut was negotiated between political bodies (i.e. the federal government, Inuit organizations, and the land claims organization Nunavut Tunngavik Incorporated (NTI)) later in the land claims process (Wenzel, 2004). These negotiations aimed to satisfy Inuit desires for political separation from the NWT. Through the establishment of a public government and administration, the GN would deliver services

formerly provided by the Government of the NWT, as well as alleviate some federal government responsibilities (Merritt *et al.*, 1989; Hicks and White, 2000).

Although the GN represents all Nunavut residents, with over 85% Inuit population the territorial government is empowered to address many of the issues where Inuit seek political responsibility and control (Wenzel, 2004). The GN is structured similarly to the non-native dominated NWT and Yukon Territory, but it has also made concerted efforts to incorporate traditional knowledge (TK) into its political mandate and operational approach (refer to Wenzel, 2004 for a more detailed account). A strategic outcome of a traditional knowledge conference held in Igloolik, Nunavut in 1998 (NSDC, 1998) was the conception of the terminology *Inuit Qaujimagatuqangit* (IQ) – actually a translation of “traditional knowledge” into Inuktitut (the language of the Inuit). Since then, the *Inuit Qaujimagatuqangit Katimajit* (IQ committee) was convened and IQ has been formally included as part of every GN departmental mandate (CLEY, 2003). Of course the degree to which IQ can, or has been, incorporated into government operations varies between departments; it is a conceptual and practical work in progress (Wenzel, 2004). Nevertheless, attempts to incorporate the guiding principles of IQ (Table 1-1) into government structures and systems is a GN priority (CLEY, 2003; GN, 2004). As such, these efforts provide impetus and support for research that seeks to better understand particular aspects of IQ. By focusing on Inuit knowledge of the sea ice environment I cannot respectfully claim to be researching IQ (Section 2.1.1), but I can state that

**Table 1-1:** Guiding principles of *Inuit Qaujimagatuqangit*.

Source: GN (2004)

| <b>Guiding principle</b>                  | <b>Description</b>  |
|---|---|
| <i>Inuuqatigiitsiarniq</i>                | Respecting others, relationships, and caring for people       |
| <i>Tunnganarniq</i>                       | Fostering good spirit by being open, welcoming, and inclusive |
| <i>Pijitsirniq</i>                        | Serving and providing for family and/or community             |
| <i>Aajiiqatigiinni</i>                    | Decision making through discussion and consensus              |
| <i>Pilimmaksarniq/Pijariuqsarniq</i>      | Developing skills through practice, effort, and action        |
| <i>Piliriqatigiinniq/Ikajuqtiigiinniq</i> | Working together for a common cause                           |
| <i>Qanuqtuurniq</i>                       | Being innovative and resourceful in seeking solutions         |
| <i>Avatittinnik Kamatsiarniq</i>          | Respecting and caring for the land, animals, and environment  |

this work contributes to GN efforts to learn about, promote, document, and apply IQ. Efforts to incorporate such principles into a public government also necessitate the exploration of effective methods of linking science and IQ in order to reflect, and possibly develop, GN policies and mandates.

### 1.3.2 Addressing research gaps

Several recently identified gaps in arctic climate change research were compiled and highlighted in reports by Thorpe *et al.* (2000), NCE (2000), and NRI (2002), such as:

- a) The state of documented traditional and local knowledge of climate change does not adequately reflect the state of traditional and local knowledge of climate change;
- b) There is an extensive body of literature on climate change trends and impacts based on Western science research, but climate change as observed, experienced, and explained through traditional and local knowledge has received less attention;
- c) Many documented sources of traditional and local knowledge are incidental and components of larger sources;
- d) In order to move towards a more comprehensive understanding of the impacts of change in the North substantial progress must be made in linking Western science-based climate change research with local knowledge;
- e) There is an imbalance in regional documentation of climate change from local perspectives;
- f) There is a lack of specificity in the descriptions of observations and impacts of change at the community level;
- g) Community-based research to document climate change focuses mostly on current observations rather than on historical context; and,
- h) There is a lack of identified specificity of observations of change as related to a particular community or region.

These gap analyses all provide important justification for additional, in-depth investigations of environmental and socio-economic issues related to community life, as understood and experienced by community members themselves. Sea ice is one of the most frequently referenced indicators of sea ice change by both scientists and Inuit (Johannessen *et al.*, 1999; Copley, 2000; Krajick, 2001; Nichols *et al.*, 2004; DE, 2005a; DE, 2005b; DE, 2005d; Nickels *et al.*, 2005); therefore, it became a valuable focus with which to expand our collective knowledge base while refining research methodologies.

### 1.3.3 Moving towards research partnerships

It is increasingly recognized that in order to address complex problems it is desirable to work collaboratively to incorporate different knowledge systems (Riedlinger and Berkes, 2001; Ford and Smit, 2004; Nichols *et al.*, 2004; NTI, 2005). To do so, ethical and effective means of working together must be explored. This requires the development of positive working relationships between scientists and communities so that both forms of knowledge can equally inform investigations (Thorpe *et al.*, 2000; ITK and NRI, in press). Creative methods, along with revisiting previously used methods, are necessary to more effectively communicate across cultures and across disciplines (NCE, 2000; Furgal *et al.*, 2005). It is imperative that Inuit knowledge be incorporated in sea ice studies in order to gain a truly *in situ* understanding of the role that ice plays in community dynamics, and daily life in the North. This inclusion has great potential for mutual learning, and thus for an improved comprehension of the importance of sea ice not simply in physical terms, but also in relation to community dynamics, identity, economy, tradition, communication, and safety. More efforts are needed to ensure the transition from simple recognition of local Inuit expertise, to substantive research partnerships (Krupnik, 2002; ITK and NRI, in press). Without such co-operative investigations, it will be difficult to develop adaptive strategies to projected climatic change that reflect community-specific socio-economic and ecological systems (Smit *et al.*, 2000).

### **1.4 Thesis statement**

I argue that community-based, collaborative research efforts to combine various forms of sea ice expertise could enhance ocean and climate research in the Canadian Arctic.

### **1.5 Thesis goals**

Within the scientific community there is a limited understanding of sea ice at local scales, especially in relation to Inuit culture, lifestyle, and socio-economic practices. As such, this thesis aims to:

- a) expand the current state of knowledge on sea ice and marine systems;
- b) provide a foundation from which to develop discussions, and knowledge-exchanges, between Inuit and scientists; and,
- c) establish joint local and scientific research priorities.

Therefore, this thesis furthers our understanding of the importance of sea ice processes, use, and change at the local level by characterizing these aspects based on Inuit expertise.

## **1.6 Thesis objectives**

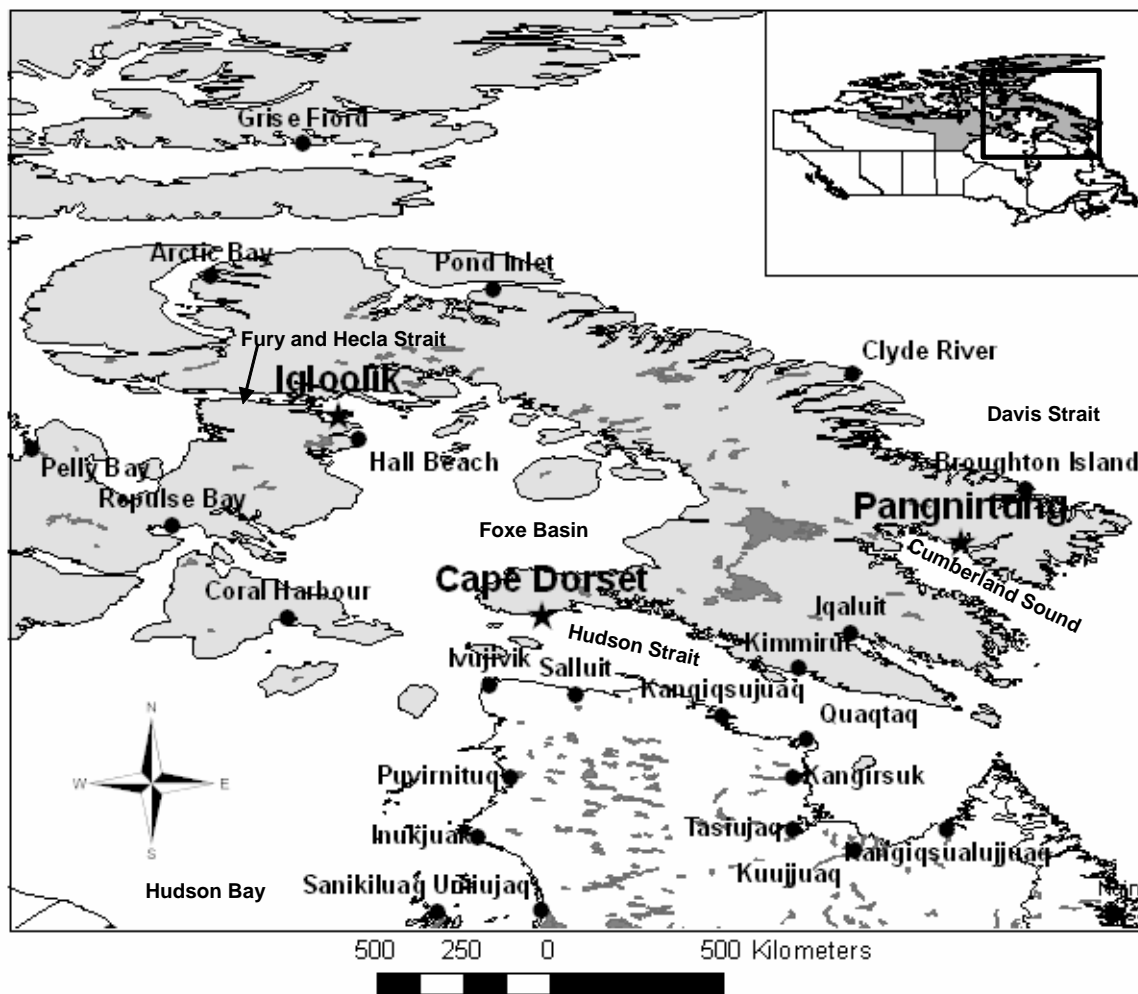
In order to achieve the goals listed above, this thesis has four objectives:

1. gain a better understanding of the importance of sea ice to Inuit by learning about their terminology and descriptions regarding ice conditions/cycles;
2. better comprehend the traditional and contemporary Inuit means of characterizing sea ice variability, and its relevance to human and animal activity, in the surrounding coastal environment (e.g. ice thickness, floe edge, seasonal extent, break-up timing, etc.);
3. evaluate a collaborative research approach for collecting, analyzing, and reporting Inuit knowledge to facilitate practical linkages with scientific knowledge; and,
4. identify future collaborative research/monitoring needs based upon the issues of greatest importance to Nunavut communities.

## **1.7 Communities involved**

Through discussions with northern and Inuit organizations (Section 3.1.1.2), the Nunavut communities of Cape Dorset, Igloolik, and Pangnirtung were selected to collaborate in this project because: i) they each have unique ice conditions and uses due to their geographic locations around Baffin Island; and ii) there was potential for collaboration with another researcher working in those communities. It was seen as beneficial to collaborate with someone who had already established a working relationship with community members. It would be easier to introduce my project idea to the community and may have eased logistical considerations. Despite the fact that the other researcher did not end up expanding into all three communities, I felt it was important to continue to pursue support from these communities. By involving multiple communities, there was also fascinating potential for regional comparisons of ice conditions, importance, uses, and change.

Cape Dorset is located on a small island of the same name off the southwestern tip of Baffin Island (i.e. Foxe Peninsula), in Hudson Strait ( $64^{\circ}14'N$ ,  $76^{\circ}40'W$ ) (Figure 1-1). This area was named by Luke Foxe who explored parts of Hudson Bay and Foxe Basin in 1631, with the cape being named after the Earle of Dorset (Freeman, 1976). However, in Inuktitut Cape Dorset is known as *Kinngait* (meaning “mountains”) (Milne *et al.*, 1995; Laird, 2004). In the past it has also been referred to as *Sikusilaaq* (meaning “where there is no ice”) because of the nearby presence of open water throughout the winter (Walk, 1999). A Hudson Bay Company (HBC) trading post was established in this area in 1913, which became the basis of community



**Figure 1-1:** Map showing the location of communities involved in this research project (i.e. Cape Dorset, Igloolik, and Pangnirtung, Nunavut are indicated with the stars).

**Where:** Nunavut is highlighted in grey in inset, and the square indicates the Baffin Island region shown in the larger map.

settlement in the 1950s (Freeman, 1976; Laird, 2004). Now with a population around 1148 (93% Inuit) (StatsCan, 2002), Cape Dorset is renowned for its art, cultural history, and proliferation of marine wildlife (Blodgett, 1991; Milne *et al.*, 1995; Walk, 1999; Doubleday *et al.*, 2004).

Igloolik is located on a small island of the same name, near the eastern entry of Fury and Hecla Strait, in Foxe Basin (70°35'N, 84°54'W) (Figure 1-1). Based on archaeological evidence, this island has always been an important Inuit settlement area due to abundant wildlife and fertile surrounding seas (Freeman, 1976; MacDonald *et al.*, 2004). The first contact with Europeans in this area occurred in 1822 - 1823 when the ships "Fury" and "Hecla" wintered in Turnton Bay, at Igloolik Island (Freeman, 1976; MacDonald *et al.*, 2004). In the 20<sup>th</sup> Century Igloolik people traded at posts in northern Baffin Island and Repulse Bay to the south, until the HBC opened a post in Igloolik in 1939 (Freeman, 1976). The present community of Igloolik was established in the late 1950s under increased federal administrative interest in the Arctic (MacDonald *et al.*, 2004). It now has a population of approximately 1286 (95% Inuit) (StatsCan, 2002) and maintains strong links to traditional cultural activities as well as being an important regional hub for the decentralized GN (MacDonald *et al.*, 2004).

Pangnirtung is located on the southeastern shore of Pangnirtung Fiord (on Cumberland Peninsula), off the northern shore of Cumberland Sound (66°7'N, 65°55'W) (Figure 1-1). Cumberland Sound was visited by John Davis in 1585, and the land north of the Sound was named Cumberland Island (later found to be a peninsula) by William Baffin in 1616 (Freeman, 1976). The community name of Pangnirtung is actually a poor spelling of the Inuktitut name *Panniqtuuq* (meaning "place of the bull caribou") (Harper, 2004). Cumberland Sound has been home to Inuit for over 1000 years, with seals, walrus, beluga whales, and bowhead whales frequenting the waters<sup>1</sup> (Harper, 2004). Since 1818, this area has been the focus of organized

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<sup>1</sup> The common names of wildlife species are used throughout this thesis. However, Appendix 1 provides a list of both the scientific and Inuktitut names for each species mentioned.

whaling activities (attracting Inuit and European whalers alike) (Freeman, 1976; Harper, 2004). An HBC post was opened in Pangnirtung in 1921, followed shortly by a detachment of the Royal Canadian Mounted Police (RCMP) (Freeman, 1976; Harper, 2004). From the mid-1950s to early-1960s the federal government began establishing a schooling and administrative presence, encouraging families in outlying camps to move into the community (Harper, 2004). Currently with a population of approximately 1276 (95% Inuit) (StatsCan, 2002), Pangnirtung is known for its commercial turbot fishery (Pangnirtung Fisheries), the nearby National Park (Auyuittuq National Park), and its unique weaving artistry (based at the Uqqurmiut Centre for Arts and Crafts) (Harper, 2004; Scott, 2004).

## **1.8 Thesis outline**

This introductory chapter is intended to provide the background context within which the research was conducted, as well as to present the rationale and objectives for undertaking this research. The dissertation is divided into nine chapters to adequately reflect literature and methodological descriptions, community-based results, and different foci for analyses.

Chapter 2 provides a background for interpreting and understanding subsequent chapters. It aims to familiarize the reader with current literature, and topics, related to both Inuit and scientific sea ice knowledge. An overview of Inuit sea ice expertise, use, and observations of change is provided in Section 2.1. The relationship between sea ice and climate is then presented from scientific perspectives (Section 2.2). This begins with a basic description of sea ice formation and decay processes, as well as an introduction to ice conditions around Baffin Island. This is followed by a summary of monitoring and modeling efforts undertaken to assess sea ice change (Section 2.3). Then, a theoretical discussion of ways to link Inuit and scientific expertise is used to highlight important considerations for addressing these issues more practically (Section 2.4).

Chapter 3 provides a detailed account of the methods employed in this project. Beginning with an outline of the collaborative research approach, the seven main research phases are described in Section 3.1. This is followed by a discussion of critical realism as the philosophy underlying my research (Section 3.2). Specific qualitative research methods are then explained in terms of how they were employed to ensure rigorous and representative research results in each of Cape Dorset, Igloolik, and Pangnirtung (Section 3.3). Preliminary community visits were undertaken first (Section 3.3.1), followed by several field research trips (Section 3.3.2) where semi-directed interviews, experiential sea ice trips, and focus groups were conducted. The description of data analysis stages includes details on transcript analysis, map analysis, focus group/terminology review, and methodological analysis (Section 3.3.3). Furthermore, the full communication strategy is outlined in Section 3.4, and issues of knowledge representation are highlighted in Section 3.5.

Results chapters were separated to present findings from Cape Dorset (Chapter 4), Igloolik (Chapter 5), and Pangnirtung (Chapter 6) individually – although section delineations mirror one another. There are four main parts to each of these chapters, with the first one providing community context on the local importance of sea ice (Sections 4.1, 5.1, 6.1). Secondly, sea ice processes are characterized according to local expert descriptions of freezing processes, melting processes, and wind and current influences on sea ice (Sections 4.2, 5.2, 6.2). These are accompanied by conceptual models to highlight the interactions between sea ice terminology and process descriptions for each community. Third are the sections that describe localized sea ice uses for travel or hunting purposes, along with wildlife habitat descriptions (Sections 4.3, 5.3, 6.3). Each of the results chapters are concluded with sections on observations of change, according to local indicators (Sections 4.4, 5.4, 6.4).

The analysis chapters are split in two, each with a unique focus. Chapter 7 compares the findings of Chapters 4 – 6 to evaluate the overlap or differences between community

descriptions of sea ice processes, use, and change. Therefore, sections in Chapter 7 follow the general format of those employed in the results chapters. Section 7.1 looks at the importance of sea ice in each community. Section 7.2 provides inter-community comparisons of sea ice processes (including freezing, melting, and wind/current influences on sea ice), with a focus on Inuktitut terminology and regional variations in ice conditions. Sea ice uses are then contrasted between communities, according to differences and similarities in sea ice travel and hunting (Section 7.3). A similar process is undertaken for observations of sea ice change around each community, in terms of: i) indicators of change; ii) implications of change; and, iii) considerations for assessments of change (Section 7.4).

Chapter 8 analyzes the opportunities and challenges involved in collaborative research. This begins with an evaluation of the collaborative approach employed to conduct this research (Section 8.1), including reflections on the utility of: i) preliminary research visits; ii) semi-directed interviews; iii) participatory mapping; iv) experiential sea ice trips; v) focus groups; and, vi) the communication strategy. Sections outlining community perspectives on working with researchers then highlight: i) previous community experiences with researchers; ii) life experiences that differentiate Inuit and scientific expertise; iii) methods of sea ice investigation and knowledge acquisition; and, iv) goals in investigating or using sea ice (Section 8.2). Finally, Section 8.3 provides some recommendations for linking Inuit and scientific expertise.

Chapter 9 is the concluding chapter, and the sections mirror the original thesis objectives. This chapter emphasizes opportunities for moving forward to build upon the research presented here. A summary of the local characterizations of sea ice processes, use, and change from each community is provided (Section 9.1). This is followed by a synopsis of the relevance of sea ice to human and animal activity around the communities (Section 9.2). The collaborative research approach is then synthesized to describe lessons learned in an effort to improve community-researcher relationships (Section 9.3). There are many ways in which

this research could expand, or be built upon, which provides numerous avenues for future research (Section 9.4). Finally, I conclude with a discussion of considerations in assessing community vulnerability and/or resilience to sea ice/climate change (Section 9.5).