

CONTRIBUTIONS OF INUIT ECOLOGICAL KNOWLEDGE

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ABSTRACT

Inuit ecological knowledge (IEK) can contribute new information, enhance existing knowledge, and provide hypotheses to guide further research concerning the impacts of climate change. Since time immemorial, Inuit have made links between climate, the environment and wildlife that have enabled their subsistence survival in harsh and changeable weather conditions. This paper focuses on these linkages to demonstrate the utility of IEK in contributing an understanding of climate change impacts on the Bathurst caribou herd in Nunavut, Canada.

Within these complex ecological linkages, Qitirmiut (Inuit of the Kitikmeot region) have observed increasing temperatures since the 1950s that have led to earlier spring-melt, lateTw

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DEDICATION

For My Grandparents

What is the true value of knowledge? That it makes our ignorance more precise.

Anne Michaels 1998, 210

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Qitirmiut Elders and other community members taught me a lifetime of stories in our moments sharing *mukpauyuq* and *mipku*. *Quana* for your brilliance, patience, forgiveness, graciousness and compassion. Most of all, thanks for morning tea and laughter, even when I couldn't speak a word of Inuinnaqtun! You have shown me a glimpse of the ocean through a crack in the sea ice.

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1.0 INTRODUCTION

Climate defines the Canadian Arctic and the resolute people who live within it. Compared to other regions of the earth, the Arctic is particularly susceptible to climate changes caused by human and natural causes (Cohen 1997; Maxwell 1997). Here, a slight variation in temperature can generate both local and widespread effects that influence how much snow will fall, how cold winds will be, where plants and lichen will

significant gaps in our understanding of Arctic climate change (Ferguson 1997; Fox 1998; Ferguson, Williamson and Messier 1998; Riedlinger 2000). In this paper, I will help fill our gap in understanding by presenting Inuit ecological knowledge of climate change impacts on caribou in the Kitikmeot region of Nunavut. In doing so, I will demonstrate the utility of Inuit ecological knowledge.

1.1 An Introduction to Inuit Ecological Knowledge

Inuit ecological knowledge (IEK), the focus of Chapter Two, must be defined before I can demonstrate how Inuit can contribute to our understanding of Arctic climate. As an introduction here, based on my years of living in Nunavut and working with Inuit, I understand IEK to encompass:

the intergenerational survival skills, insights, spirituality and experiences of people who demonstrate an acute awareness of dynamic interactions between themselves, lands and resources.

In the words of Sandra Eyegetok, community researcher for an Inuit ecological knowledge project, “we are talking about that which we’ve always known” (pers. comm. 1999). This definition speaks to the intergenerational nature of IEK whereby environmental observations are told through stories and passed from one generation to the next.

There are nine characteristics of IEK that I discuss in this paper. IEK is aggregating, changing, orally passed, intergenerational, multifaceted, local, iterative, adaptive and spiritual. I introduce each of these points below and further discuss them in the next chapter.

A key strength of IEK is that it is based on local observations. These observations may

(Cohen 1989, 10). In my experience, Inuit make their climate observations on a local scale and do not apply these outside a spatial area with which they are familiar. I perceive this to be partially because of a cultural norm whereby people are not comfortable speaking about that which they have not seen.

IEK is continuously expanding and changing depending on the person making observations or hearing stories from elders and hunters. That is, “the knowledge of the . . . past is not simply given or handed down but is continuously and actively gathered and dissected” (Cohen 1989, 10). It has been suggested that IEK withstands the test of time, as it is passed from one generation to the next.

There could be no better measure of intelligence than the ability to thrive in the Arctic with a technology limited to what could be made with ivory and bone, antler, soapstone, slate, animal skins and bits of driftwood that were as precious as cold. The Inuit did not endure the cold. (Davis 1998, 39)

As always, knowledge that is passed down is filtered through the receiver and categorically understood within that receivers’ experience. IEK changes with each new listener in a way that is iterative and adaptive. Consequently, knowledge of the present is contributed.

Past knowledge is not “lodged in...a series of texts” in the way a written tradition such as western scientific knowledge may be, but instead, it is “engaged in and derives from arrays of social activity” (Cohen 1989, 11). IEK is not fixed in one period of time. Instead, IEK is continuously updated and enhanced by contemporary observations before being passed from one generation to the next. In this way, it is aggregating. At the same time, much information within this knowledge can be lost when it is not orally carried from one generation to the next or if it is not recorded. Like all knowledge, IEK changes over time.

One of the strengths of IEK is that it is multifaceted. Inuit recognize complexities within the ecosystem, particularly the linkages between ecological variables. Further, these

social elements. Accordingly, each of these elements contributes to IEK.

In my experience, another key element of Inuit ecological knowledge is that it is infused with spiritual underpinnings related to animism as well as other traditions, for example, Anglican and Catholic. Ecological phenomena are often explained within the context of these beliefs, especially when no obvious or tangible reason exists. I provide an example of this in Chapter Seven.

Unlike other knowledge systems that inform our understanding of climate change, IEK is local in scale, changing, aggregating, iterative, adaptive, based on oral tradition, intergenerational, multifaceted, and permeated with spiritualism.

1.2 Scientific Monitoring of Arctic Climate Change

IEK can enrich our relatively nascent scientific understanding of climate change and enhance current climate monitoring programs. As earlier mentioned, scientific monitoring of Arctic climate began in the 1950s when an expansive meteorological network was established (Maxwell 1980). In the 1960s and 1970s General Circulation Models (GCM) were used to predict global climate responses to scenarios of change, for example, in the levels of greenhouse gases (Cohen 1997; Riedlinger 2000). In the 1980s, GCM results and instrumental data indicated that fluctuations in global temperatures might lead to global warming. In fact, data were showing that global warming had already begun and that an anthropogenically manufactured hole in the ozone layer existed over the poles. Results from research in the Mackenzie Delta of the Western Arctic show that temperatures have warmed an average of 1.5 degrees Celsius over the last 100 years (Dyke and Jasper 2000). Further, recent GCM predictions are that by the year 2100, global annual temperatures will increase by 1–3.5 degrees Celsius with Arctic temperatures increasing by 5-7 degrees Celsius in the winter and as much as to 5 degrees Celsius in the summer (Dyke and Jasper 2000). Information such as this, recently led governments, industries, universities and nongovernmental organizations to seriously consider global change and act to curb human causes of global warming through domestic and international policies to reduce greenhouse gases.

Canada is a signatory on several international agreements to decrease human causes of atmospheric and climate change. Starting in 1987 with the international Montreal Protocol on Substances that Deplete the Ozone Layer, Canada committed to working towards reducing the production and consumption of compounds that deplete stratospheric ozone by 2000. Canada also participated in the 1992 Earth Summit where it joined other countries in becoming bound by international law to reduce human causes of global warming. This was followed by the Kyoto Convention in 1997 where Canada agreed to reduce greenhouse gas emissions to 6% below 1990 levels before 2012. This commitment necessarily entails continued climate change monitoring and research and represents an opportunity to consider both scientific and IEK knowledge of climate.

In response to international commitments to combat climate change, Canadian governments have increased funding for climate studies to assist scientists in researching and predicting global change. Scientific theory and research confirms that global temperatures have warmed since the industrial revolution, particularly since the 1920s (Overpeck et al. 1997). Natural causes (e.g. increased solar irradiance and decreased volcanic activity) and human activities (e.g. intensive agriculture, deforestation, burning fossil fuels and releasing industrial waste gases) have led to this recent warming trend (Kane et al. 1992; Svoboda and Nabert 1994; Overpeck et al. 1997; Walsh 1993).

Recently, human activities have contributed to a warming trend, but looking farther back in the climatological record, increased temperatures have been experienced before (Kane et al. 1992; Koihok pers. comm. 1998; Omilgoitok, M. pers. comm. 1998; Overpeck et al. 1997). McGhee (1996) describes a general warming trend about 2, 600 years ago. More recently, Inuit elders Annie and Mackie Kaosoni recalled to me their grandparents' stories about a cool period in the late 1800s and early 1900s when temperatures never increased enough for the lakes to melt during the summer (Kaosoni, A. pers. comm. 1999; Kaosoni, M. pers. comm. 1999). From scientific and Inuit observations we know that climate changes, but how, how much and why are questions of time scale. Many Inuit elders suggest that climate changes are common. Predicting the periodicities of climate changes is a function of how long you have lived, the stories

you have heard, and the condition of your memory (Kuptana pers. comm. 1998; Koihok pers. comm. 1998). To improve predictions of future climatic trends and assess patterns of the last 100 years (the period when humans have had the greatest impact on global change), we must look towards both Inuit and scientific knowledge.

1.3 Problem Statement

One reason that IEK can contribute to the current western scientific understanding of climate is because it offers detailed local observations rather than the generalities common to scientific thought and models. The following section elaborates on how IEK can provide localized observations. Next I discuss the skepticism that surrounds both IEK and western scientific knowledge. In doing so, I present the current context faced by people who are trying to have IEK recognized as useful.

Since Inuit observations are localized and detailed, they can enrich known observations, enhance existing data, or contribute new insights to complement scientific research, particularly since the current scientific climate change paradigm is typically applied broadly across the Arctic and does not account for specific regional phenomena observed by Inuit (Ferguson 1997; Ferguson, Williamson and Messier 1998). For example, a hunter may be able to discuss annual variations of ice thickness for a particular region. These observations may support scientific theories on how temperature fluctuations influence freeze-thaw cycles. Further, IEK can help scientists ask the right questions and follow meaningful lines of inquiry.

IEK can enrich current western scientific understanding of weather at a local scale. For example, Freeman (1994) recalls that her:

father and grandfather and uncles could not go out hunting unless the weather was right for them. The right weather also depended on what

to the centrality of weather to Inuit life. These localized observations can contribute to an account of climatic phenomena that are more generally understood across Nunavut.

The product of this research is a series of local observations of climate change that can contribute to understanding the effects of a changing climate on vegetation and caribou that will add to the current debate concerning the utility of IEK (Cruikshank 1981; Bielawski 1984; Winkelaar 1990; Wolfe et al. 1991; Johnson 1992; Nahanni 1992; Inglis 1993; Freeman 1994; Sallenave 1994; Gombay 1995; Stevenson 1996; Howard and Widdowson 1996; Wolfley 1998; Berkes 1999; Freeman 1999). Although I elaborate on this debate in Chapter Three, at this stage it is important to introduce the skepticism that surrounds IEK. One anonymous government official, now legally and politically required to integrate IEK into his work, regards IEK as “hearsay and folklore” (Anonymous A pers. comm. 1994). While these may be components of IEK, they do not necessarily render all IEK as invalid. Others view IEK as merely religion and spiritualism (Howard and Widdowson 1996). Certainly these are important qualities of IEK that should be considered, but they do not necessarily detract from the utility of IEK.

People may recognize the value of IEK, but avoid it in their research because of the political, social and practical difficulties associated t int1993;kelaad 8caokeas caion and.n acony

the fact that their research opportunities and dollars are potentially threatened¹. It is understandable that many scientists may not support *any*

environmental features of this particular area. As a result, the dialect is precise for those ecological features (e.g. climatic variables) that are central to Inuit ways of living.

The precise nature of Inuinnaqtun (and, for that matter, Inuktitut) can be illustrated through the fact that there are many words for snow depending on its texture, age, depth, density, grain, consistency, or surface wind pattern (Kadlun-Jones pers. comm 1999; Omilgoitok, M. pers. comm.1999). Snow covers the ground for 10-11 months of

Sea

Bay

Many elder men and women knew names for different plants better than did the elder women. This is probably because they travel and hunt on the land often and therefore have more opportunity to note vegetation. Further, they have observed the vegetative remains in caribou skulls while butchering. Men also look for grazing signs on plants to see how recently an animal has passed by which again forces them to focus on

tundra vegetation. However, even though elders and hunters are usually best at identifying different types of tundra vegetation, many still refer collectively to all plants as *nuna*. From my experience working with elders, it appears that even when people know the different names, they do not think differentiating between them is important. Alternatively, people may not think that it is important for me to know the different names.

**1.4.1 *The New Dialect of Inuinnaqtun:
Phonetics for the Future of the Qitirmiut***

There are two language systems for Inuinnaqtun: the old and the new. In this paper, have used the new system because it is phonetic and therefore easier for non-Inuinnaqtun speakers to learn. Implementing the new system throughout the Kitikmeot

Inuit research on climate change. Finally, a discussion of the Inuinnaqtun terms used in the paper follows.

Chapter Two provides a detailed discussion of Inuit ecological knowledge, including what it comprises and how it is acquired, applied and verified. The concept of patterned thought is introduced and followed by a discussion of why elders are considered to be experts.

In Chapters Three and Four, the methods for this research are presented. This includes a detailed discussion of how participant observation, participatory action research, participatory rural appraisal and experiential data were used in an Inuit ecological knowledge study called the Tuktu and Nogak Project (TNP). It is from the TNP that the research materials were derived for this paper. Chapter Three closes with a discussion of research challenges. Chapter Four details the methods of how interview transcripts from the TNP were considered for this research paper in combination with consultations with key informants.

Chapters Five, Six and Seven present the research results. Chapter Five describes Qitirmiut observations of a warming climate. Chapter Six presents the impacts of a warming climate on the environment and how these, in turn, influence caribou according to elders and hunters. Chapter Seven details local comments about the weather becoming increasingly more variable and difficult to predict. These examples of IEK held by the *Qitirmiut* (Copper Inuit) fill information gaps, contribute useful forms of knowledge, and enhance our current scientific and collective understanding of the effects of climatic changes on vegetation and caribou in the Kitikmeot region of western Nunavut. This adds to other research concerning the utility of IEK in our understanding of climatic change.

Chapter Eight presents a list of hypotheses generated by Qitirmiut observations detailed in this paper and suggests that these are starting points for future research. Taking these hypotheses one step further, additional hypotheses are presented based on Qitirmiut knowledge as well as my research and experience. Finally, a call is made to integrate local knowledge and western scientific knowledge to further our understanding

of climate change. In presenting these hypotheses, the results of this research paper contribute new information and enhance existing information about the effects of climate change.

2.0 INUIT ECOLOGICAL KNOWLEDGE

Inuit and non-Inuit organizations across Nunavut are currently discussing how to define Inuit ecological knowledge as the first step in any formal process that involves the application of Inuit ecological knowledge (Irlbacher 1997; Ferguson pers. comm. 2000; Tigguluraq pers. comm. 2000). This discussion runs parallel to a thirty-year old academic debate concerning how to term ecological knowledge held by indigenous peoples (Wenzel 1999; Neis and Felt in press). Perhaps the most commonly used term within academic and Inuit circles is traditional ecological knowledge (TEK) although local knowledge, indigenous knowledge and *Inuit Qaujimanituqangit* are also used.

Through the evolution of ideas about ethnoscience, cultural ecology and oral history and the current process of finding a working definition for Inuit ecological knowledge (IEK), members of Inuit and Nunavut organizations and academia are understanding better the intricacies of this complex way of knowing (Berkes 1999; Anderson 2000; Tigalluraq pers.

acquired, applied and verified. First, I introduce the concept of sensory pattern-thought as a way that Inuit acquire and apply their ecological knowledge based on Ross (1992). Finally, in order to illustrate that IEK undergoes a rich review process, I present examples of how IEK is verified between and among communities. By introducing the way that IEK is defined, acquired, applied and verified, I provide an overall context for how and why IEK is useful in contributing to our understanding of climate change effects.

2.1 Academic Definitions

Most scholars use the broad terms “traditional ecological knowledge” or “indigenous ecological knowledge” even when they are referring to knowledge held specifically by Inuit. Although I choose to not delve into this nomenclature debate within this brief paper, I reject both terms and prefer to be more precise by using “Inuit ecological knowledge” (IEK)⁴. I understand this to mean knowledge held by Inuit across Nunavut and “Qitirmiut ecological knowledge” (QEK) to mean knowledge held by Inuit living in the Qitirmiut region of Nunavut. Of course, QEK is a type or subset of IEK.

In presenting the following academic definitions for IEK as the first step in demonstrating the utility of IEK, I include definitions applied to both traditional and indigenous ecological knowledge. I take this liberty because most authors use these broad terms even if it is only knowledge held by Inuit that they are discussing. Further, these broad terms encompass Inuit ecological knowledge and their definition therefore applies.

Several academics highlight the nine properties of IEK mentioned in the previous section. As Neis and Felt explain, IEK is “cumulative over generations, empirical in that it must continuously face the test of experience, and dynamic in that it changes in response to socioeconomic, technological, physical or other changes”(Neis and Felt in

⁴ Please see Berkes (1999) and Wenzel (1999) for further discussions of the nomenclature debate.

press, 3). Further, Wenzel highlights that IEK encompasses an understanding of non-static ecological components in suggesting that IEK is knowledge of “the dynamic interactions that occur among all the elements, cultural as well as biophysical, within the Northern ecosystem,” (Wenzel 1999, 114). Berkes puts forth a comparable working definition for TEK as “a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission about the relationship of living beings (including humans) with one another and with their environment” (Berkes 1999, 8).

Others provide similar definitions that suggest that this knowledge embodies adaptive and self-management practices through a relationship of respectful reciprocity with the environment (Nakashima 1986; Feit 1988; Gunn, Arlooktoo, and Kaomayok 1988; Nakashima 1993; Pinkerton 1994; Gombay 1995; Davis 1998; Fox 1998). In other words, living on the land and depending on ecological resources for survival, forced Inuit to be iterative in their approach to “managing” themselves within their local environment. A valuable asset of this knowledge is that it has been applied and revised over the course of generations. Accordingly, Pinkerton argues for continued inclusion and application of local knowledge in co-management regimes because the “loss of the traditional management regimes often entails the loss of the resources as well” (Pinkerton 1994, 51). However, the inclusion and application of local knowledge in co-management regimes should occur in a way that is respectful of the traditional knowledge and practices of the Inuit people.

well as social, cultural, and spiritual values.

2.1.1 A Caveat to Defining Indigenous Knowledge

Critics caution that ecological knowledge held by indigenous peoples should not be romanticized to be more than it really is or taken out of context (Howard and Widdowson 1997; Cruikshank 1998; Krech 1999). In the 1990s, backlash resulting from government abuse of indigenous people in Canada (e.g. residential schools, stolen lands) may have swung the pendulum in the opposite direction so that some people consider all indigenous ecological knowledge as valuable (Irlbacher 1997). Acceptance of local knowledge without a critical eye can be more damaging or disempowering to indigenous people than if it were not accepted in the first place. One key criticism, elaborated below, is the claim that indigenous knowledge is not based on conservation any more than it is on economy.

Shepard Krech in his controversial book entitled *The Ecological Indian*, critiques the

actively created choices for themselves, defined new roles, found paths in the new order in myriad and sometimes contradictory ways, and did not become dependent either rapidly or predictably. (Krech 1999, 152)

In both explanations, Krech suggests that Indians consciously decided to abandon a conservationist ethic. However, I would propose that since the European industrial economy was a new paradigm, the consequences to wildlife, the environment and social order were unknown. The ecological balance understood by locals was upset and a new equilibrium had to be reached, but the speed at which changes occurred was too fast for people to adapt. While it is true that prior to European contact, indigenous peoples were trading pelts for important social and political reasons, the difference was that these exchanges were more sustainable prior to the consumptive pressures brought forth by a European industrial economy.

Cruikshank (1998) points out that deeming the indigenous person or hunter a “noble savage” and suggesting that s/he lived in harmony with the environment prior to European contact is problematic in part because it can be “used as a weapon when indigenous people fail to pass arbitrary test of authenticity,” (Cruikshank 1998: 60). Indeed, all contemporary ecological knowledge may be discarded because of the actions of a few indigenous people who do not conform to the noble savage stereotype. Wenzel (1991) provides an example of suggesting that the anti-sealing and harvesting campaigns first embraced Inuit conservation ethics and philosophies and later turned these against Inuit who have adopted modern hunting techniques. The same could be said of the controversy surrounding the bowhead hunt in Nunavut in 1998.

To summarize, while IEK should be understood as useful, as will be demonstrated in this paper, one should not unconditionally accepted any form of knowledge without placing it within a context and recognizing both it’s strengths and limitations.

2.2 Inuit Definitions

The previous sections have highlighted how academics and non-Inuit define and critique Inuit ecological knowledge. In this section, I provide Inuit definitions for their ecological

knowledge. In particular, I emphasize how Inuit differentiate between knowledge and wisdom and why wisdom is of more value as a commodity and contribution to an understanding of climate change impacts.

When I asked Inuit to define IEK, I was told often that it was difficult because many Inuinnaqtun terms do not translate accurately into English (Atatahak pers. comm. 1999; Maghagak pers. comm. 1999). Even if they do, many concepts do not fit easily into a western framework.

The complexity, interconnectedness and wealth of information that characterize IEK can be lost when it is translated and written down rather than explained, demonstrated or acquired through experience. As Berkes asserts, writing a definition down “will never be an adequate format for the teaching of indigenous knowledge,” (Berkes 1999, 28). In other words, a young boy will learn more from watching and listening to his grandfather hunt a caribou and then experiencing the hunt himself, rather than by reading a book about hunting. This was the case for Alooook Ipellie, an academic Inuk who speaks to IEK as a unique way of knowing:

I was often in awe of the extraordinary abilities of my elders to understand the season, in knowing the behaviour of all Arctic animals species and to co-exist with their fellow Inuit in a common goal to survive as a collective. In the Arctic's harsh environment, one mistake or a lapse in judgement could spell certain disaster. By observing, listening and practising what my elders did, I was instilled with the will to survive for the moment and go on for another day. (Ipellie 1997, 98)

Gerry Atatahak provided a definition for IEK based on his experience running the *Naonayaotit* Traditional Knowledge Study (NTKS), a project to document IEK in the Kitikmeot region: IEK is *engilgaat* (long ago) *elihimayaghait* (what they should know) (pers. comm. 2000). Margo Kadlun-Jones (pers. comm. 2000), in reviewing this definition (and paper), added that the word *elihimayaghait* is stronger and is more accurately translated as “what they must or have to know”. In fact, she suggests that the Inuinnaqtun word *pitquhiit* would be better in that it encompasses what is known, what has always been known and what must be in a holistic sense. This word does not translate easily into English.

Atatahak further explained that “this information has been passed down through the generations as what [Inuit] know from their fore fathers or mothers and it is a way of still doing things (i.e. beliefs, tradition, art of surviving etc...)” (Atatahak pers. comm. 2000). In this way, the spiritual connection of Inuit ecological knowledge was emphasized as “beliefs”. Gerry also spoke to “the art” of surviving which implied that certain talents or skills are acquired in order to endure the harsh Arctic climate.

Another key component of IEK that was emphasized by Gerry is longevity that makes IEK an accumulated knowledge that is revised, enhanced and then passed down from one generation to the next. In the Arctic, the western scientific record of wildlife dates back approximately 200 years (Gunn, Arlooktoo and Kaomayok 1988) whereas Inuit ecological knowledge can be traced for millennia (Gunn, Arlooktoo and Kaomayok 1988; Fox 1998; Gordon 1996; Berkes 1999; Eyegetok pers. comm 1999; Atatahak pers. comm. 2000; Hakongak pers. comm. 2000; Riedlinger 2000; Tigullaraq pers. comm. 2000). The fact that IEK spans generations is one attribute that distinguishes it from other ways of knowing and makes it valuable as a contribution to our understanding of climate change.

Inuit recognize the importance of first defining their knowledge before integrating it into everyday policies, procedures, and educational programs. Leading the way in this regard is the *Inuit Qaujimanituqangit* Working Group (IQWG), a small association of people working for the Department of Sustainable Development (DSD) in the Government of Nunavut (GN). Joe Tigallaraq, member of the IQWG, explained that the group rejected an earlier definition of *Inuit Qaujimajatugangit* which “refers to objects ideas, ways of doing things, songs, beliefs etc...that were originally known by Inuit” (Tigallaraq pers. comm. 2000). Instead, members of the group preferred *Inuit Qaujimanituqangit* (IQ) which “refers to the wisdom of Inuit (Elders) rather than what they (Inuit or Elders) know” (Tigallaraq pers. comm. email 2000). In this revised definition for IQ, people have specified wisdom as a higher level of knowledge or a special form of expertise.

While all people have knowledge, not all knowledge is wisdom. Members of the working group sought to emphasize that the IEK based on wisdom is most valuable and that

knowledge is not valuable simply because it is Inuit. Instead, knowledge is valuable

barometer, had correctly forecast an approaching blizzard.’ (de Coccola and King 1989, 22-3).

As in the past, Inuit elders today continue to be considered experts because of their years of experience and ability to assess ecological phenomena.

In Inuit culture, youths’ knowledge is not considered as valuable or reliable as elders’ knowledge. Of thirty–four community members that I interviewed, the three youngest interviewees were the only people who wanted to remain anonymous. In contrast, all of the elders were adamant that their names be used: they were proud and wanted recognition. When I asked George Kuptana, eighty-two years old, if he had any questions or concerns about our interview, his only worry was that we be sure to air the interview on CBC radio!

My interpretation of the younger peoples’ apprehension in providing their names was that they believed they were too young to be experts. I spent months at a time over several consecutive years living with these particular three people. Although all were parents in their twenties with at least a decade of experience hunting, fishing and providing for their families, they thought of themselves as young not only in years, but also in experience. As a result, when I asked questions they were hesitant to provide information and commonly responded “I do not know”, “How should I know?”, “Somebody would know that” or “You should ask an elder that”.

While Qitirmiut can hesitate to take responsibility, often it is not because people are incapable of a task or without relevant knowledge. My research partner, Sandra Eyegetok, explained that people might know the answer or how to do something, but they fear having to take responsibility in case something goes wrong (Eyegetok pers. comm. 1999). During my five years of partnerships with Sandra and other community research partners, people often wanted me to take responsibility for actions that may be judged. For example, I was often asked to write letters or ask contentious questions during a meeting. This was primarily because people wanted to avoid confrontation, a practice that has always been part of Inuit culture. In fact, avoiding confrontation is a key component in keeping harmony and surviving in a nomadic group (Ross 1992).

A good example of Qitirmiut wanting to avoid responsibility was when my Inuit partners were hesitant to ask a question about traditional Inuit ways for fear that their elders would scorn them for not knowing the answer. In this case, they wouldn't be wrong, only forgetful of their heritage. To ameliorate this situation, my partners often said that it was me, the *qaplunaaq* (literally the one with bushy eyebrows, or the white person), who was asking the question. This happened during an Inuinnaqtun interview with an elder woman when I asked about how caribou are used for *kamiks* (fur slippers). My co-researcher, Sandra, listened to the answer but wanted to know more about how to traditionally sew them. She was afraid to admit she had forgotten what her mother had taught her so she said that I was the one wanting to know. This freed her to ask more "silly" as well as probing questions.

Another reason why these interviewees wanted to remain anonymous is that being wrong is particularly difficult to accept within Inuit culture. As a result, they preferred to remain anonymous in the event that what they shared was incongruent with that reported by the expert Inuit: elders.

2.2.2 Select Wisdom

Although elders are considered experts on account of their aged experience, not every elder has identical wisdom. Like any culture, experts contribute best depending on their particular life experience and expertise. Just as a scientific expert on tropical plants may not contribute much to a dialogue on Arctic vegetation, an expert from western Nunavut may not add to an understanding about caribou migrations in eastern Nunavut. Only experts with relevant knowledge should be consulted to further our understanding of any ecological phenomenon. As discussed earlier, not all Inuit are expert historians and while all Inuit "have knowledge ... not everybody has wisdom," (McMullen pers. comm. 1998). Certain people have had access to more stories and have had more personal experience that renders them experts in different disciplines (Cohen 1989). It may be true that elders are experts, but, like scientists, their expertise differs and is relevant depending on the issue considered.

In my experience, the topic at hand determines which elder is consulted as an expert.

the following sections.

2.3 Acquiring IEK: Pattern-Thought

Since time immemorial, travelling throughout the Arctic and depending on this environment for subsistence has enabled Inuit to acquire types of knowledge through a way of thinking unique to their experience. The Inuit thought process has roots in hunter-gatherer times and continues to evolve today. Ross (1992) explains that the success of the hunter-gatherer

depended upon [an] ability to accurately read the innumerable variables which each season, day and hour presented. Those variables, however, presented patterns which, over time and with great attention, one could learn to recognize . . . [I]t constituted . . . a very specialized form of thought. (Ross 1992, 70)

Ross terms this way of thinking “pattern-thought” and suggests that it develops at a sensory level whereby repeated feelings and observations comprise a “complex and compacted form of reasoning” (Ross 1992, 74). Pattern-thought undergoes a filtration process whereby information is sorted and links between variables are made. For example, Inuit may observe cracks in the sea ice, link these with the influx of seals basking in the sun, and further connect this with an increase in the number of polar bears. Chaos in the environment is broken into smaller components and relationships

More than just intuition or feelings, Inuit *sense* ecological phenomena and categorize them within their extant understanding. For example, an Inuit hunter may explain that he is certain where the best hunting grounds are located because they are what “he has always known” (Eyegetok pers. comm. 1999). This subjective explanation appears incongruent with the scientific method, yet “what has always been known” is not simply subjective intuition. It has been developed through observations that are, at once, frequent, systematic, sensory and objective.

The Inuit thought process is distinct, yet it shares many properties with western scientific thinking. For example, an expert physicist understands the law of gravity and so he or she builds a conduit such that water will drain downhill. While the physicist deliberates about at the exact angle the conduit must be built, he or she knows it must be more than

starved to death. (*In de Coccola and King 1989, 28*)

Since caribou were more critical than any other wildlife species to the survival of the Inuit they had to understand, explain and predict climatic influences on caribou in order to survive. In this case, the spiritual aspect of IEK is highlighted in the explanation of why the caribou were scarce. In predicting caribou movements, based on my discussions with local Qitirmiut, people might go to hunting grounds where caribou were most plentiful during previous summers or falls that were characterized by similar weather conditions. For example, an early spring-melt might mean caribou go to the west side of Bathurst Inlet to calve while a late spring-melt might suggest that caribou will go to the east side of the Inlet.

Inuit success in enduring harsh conditions was because they applied sensory pattern-thought to daily routines and dilemmas. Through years of experience on the land and listening to ancestors' stories, Inuit acquired adaptive management strategies and skills based on a relationship of respect and reciprocity with the environment. These skills were grouped into manageable categories, often linked with the spiritual world, according to an Inuit way of identifying patterns. For example, weather conditions were, and continue to be, repeatedly observed and linked with caribou hunting conditions. What is "sensed" (warming spring temperatures) is associated (with poor travel conditions for hunting) in a patterned process. What is unique is the way

Coccola and King 1989). In my experience, the frequency that people visit one another is astounding. In *Umingmaktuuq*, a community of thirty, it is not uncommon for community members to meet for tea up to fifteen times per day in various households. I was told that frequently “having tea” has always been an important fabric of community relations and served as an important forum for information exchange (Coady pers. comm. 1996; Hakongak pers. comm. 2000). During these meetings, Inuit talk about the environment, often repeating and comparing observations from one household to the next. In my experience, sometimes there will be no discussions during a visit, but the simple act of being together brings people and family members closer. Meeting regularly is an important tradition that fosters close personal relations, improves memory, and ensures that critical information is shared.

Travelling to other communities remains a part of daily life for many Qitirmiut, especially for those from *Umingmaktuuq* and *Qingauk*, and serves as an important way to share and compare observations. Frequently, people do not hesitate to travel great distances even though a journey by skidoo or boat can take days or entail grueling discomfort. Upon arrival at a new destination, particularly a small community, the first priority is to start visiting. This consists of going from house to house over the course of several hours and repeating discussions of travel conditions, for example, ice and snow quality and wildlife availability. Communicating regularly is an important tradition that fosters close personal relations, conserves food resources, improves memory, and ensures that information about the environment, such as weather and hunting conditions, is shared.

Inuit have been conditioned to verbally communicate which is why repetition and memorization are critical for a hunter who depends heavily on his/her memory on a daily basis for hunting and survival. Memorization is made easier through the process of repetition. Qitirmiut repeated a phrase or concept up to four or five times in one conversation. For example, when I asked Bobby Algona (1999) of *Qurluqtuq* about the annual caribou cycle, he repeated the time of year (fall time) that he was talking about several times:

I'll start out with the *fall time* I guess. *Fall time*. I like the *fall time* better than all the other seasons. You can walk around, you can skidoo a little

bit. Do stuff with a skidoo a little bit, but you still walk around on soft snow. Go shoot a caribou. Before the winter's coming, stock up on caribou. (emphasis added)

Later in the interview, he emphasized how tame some caribou are:

They're one of the *tamest* animals too. The *tamest*. That Bathurst caribou, one of the *tamest* animals. You can call them right up to you. (emphasis added)

Another example of repetition was when Frank Analok (1998) described how Inuit used the moon to tell the seasons:

Oh yeah, they used the *moon* only, the *moon*. The *moon*, the *moon* was used to *tell the seasons*. Like it's June right now. They used the *moon* as a way to *tell seasons* long ago. It was a way to *tell the seasons*. When the moon would come during the spring thaw, when there's water, the caribou are calving and the birds are nesting. That's how it was used, in the month of June. (emphasis added)

At eighty-two, Analok was one of the eldest people that I interviewed. He also repeated himself more than any other person. This is telling, considering that he has little experience with the written world and he was talking in his own language.

Another reason for repetition is that Inuit traditionally maintained an oral rather than written tradition. It is my perception that since things weren't written down, they had to be remembered. As a result, I propose that people had to repeat important information to ensure it would be passed down from one generation to the next.

Repetition gives the listener time to digest key information and the opportunity to ask probing questions. It provides numerous chances for the listener to offer his/her knowledge to be compared and verified with that of the speaker. As any parent or teacher well knows, repetition serves as an educational tool in that a person is less likely to forget what s/he has been told time and time again.

Although people commonly used repetition as a learning tool, Qitirmiut are not renowned

for talking about happenings outside their experience nor are they comfortable speaking on another person's behalf (Briggs 1970; Eyegetok pers. comm. 1999; Kadlun-Jones pers. comm. 1999; Thomson pers. comm. 1999; Stern pers. comm. 2000). It is more common for hunters to share their personal observations and experiences and compare these with other hunters directly. This ensures that IEK is verified on a first person level.

2.6 Spirituality in IEK

IEK is infused with spiritual underpinnings that are closely linked with an ethic and respect for the natural world and often used to help Inuit explain uncertainty associated with ecological phenomena. In my experience, Inuit extend the same or greater respect to caribou as they do people in a way that contributes to a precautionary approach and conservation ethic. The ecosystem is viewed to have integrity and balance in a holistic way. Although spirituality is integral to IEK as a worldview, this dimension of IEK is too broad to address in this paper. Instead, I focus exclusively on the ecological dimensions of IEK. The role of spirituality in local knowledge has been debated in other work (Inglis 1993; Kofinas 1998; Berkes 1999; Krech 1999).

2.7 Summary

Nine properties of IEK are recognized by academics and Inuit alike and together render IEK valuable as a contribution to our understanding of ecology, in general, and climate change impacts, in particular. Specifically, IEK is aggregating, changing, orally passed, intergenerational, multifaceted, iterative, adaptive and spiritual. Inuit distinguish wisdom from all other knowledge and understand this to be most valuable. As elders are particularly wise, they are equipped to contribute by educating others about ecology.

Inuit acquire knowledge (and ultimately, wisdom) through a pattern-thought process particular to their culture and environment. Since time immemorial, this knowledge has been applied and Inuit have persevered despite harsh climatic conditions. In the process of applying this knowledge, Inuit continuously verify and revise their knowledge through frequent discussions with community members.

3.0 THE TUKTU AND NOGAK PROJECT: METHODS AND DATA SOURCES

I lived with *Qitirmiut* for an average of five months per year during the last five years. The opportunity to spend these concentrated, intermittent periods in *Iqaluktuuttiaq* (Cambridge Bay), *Qingauk* (Bathurst Inlet), *Umingmaktuuq* (Bay Chimo), and *Qurluqtuq* (Coppermine) came through my role as principal researcher for an Inuit ecological knowledge study known as the *Tuktu* (caribou) and *Nogak* (calving) Project (TNP). The TNP is funded by the West Kitikmeot/Slave Study Society,⁶ a multistakeholder alliance that sponsors projects to develop baseline environmental information for the Slave

In Section 3.1, I present a theoretical background for qualitative research methods. I discuss how these methods relate to both the TNP and this analysis in Section 3.2. Participatory action research (PAR) was my main method, but I also incorporated components of participant observation (PO) and participatory rural appraisal (PRA). As a researcher, my cultural and experiential framework informed the manner in which I conducted this qualitative research. Accordingly, I discuss the nature of my experiential data as a central component of my methods.

In Section 3.3, I outline some of my research challenges that impacted the way in which I collected primary data for the TNP. These are important to my analysis of the interview

Figure 2:

Methods and process for the Tuktu and Nogak Project

The advisory board suggested and I agreed, that conducting interviews in communities and “out on the land” was an ideal way to collect Inuit ecological knowledge from elders

Figure 3:

Methods for the TNP and paper research

semi-directed interviews to inform my research. This process is elaborated in Chapter Four.

The semi-structured and semi-directed interviews were transcribed t ouand34d19(s34d19(0.212 16(s

3.1 Qualitative Methods: A Methodological Framework

In the following sections, I present a theoretical background for qualitative research methods, namely, participant observation, participatory action research, and participatory rural appraisal. In doing so, I provide a background for the following sections in which I explain how I implemented each of these methods for this paper.

3.1.1 Participant Observation

Participant observation is defined as fieldwork where the researcher “participates as well as observes by developing relationships with informants” (Burgess 1984, 81). This model of participant observation matured into participatory action research as social scientists realized that the researcher is an actor and not merely an observer (Spradley 1980). In this way, the researcher alters happenings within a given situation.

Early social scientists tried to mask their insider perspectives by minimizing the influences of one becoming an active participant in community life. In contrast, contemporary researchers work to become more integrated into communities while at the same time documenting how they are influential actors in the research process (Whyte 1991; Greenwood, Whyte and Harkavy 1993).

3.1.2 Participatory Action Research

Participatory action research is “a form of action research in which professional social researchers operate as full collaborators with members of organizations in studying and transforming those organizations” (Greenwood, Whyte and Harkavy 1993, 177) through the process of “mutual inquiry and local ownership” (Chataway 1997, 747). Important components of PAR include the following between community members and outside researchers:

- collaboration
- incorporation of local knowledge
- eclecticism and diversity
- case orientation

- emergent process; and
- linking scientific understanding to social action (Greenwood, Whyte and Harkavy 1993, 179).

participatory rural appraisal and experiential data, in this section I described how I implemented these methods in my research. For the TNP, I began with participant observation then moved towards participatory action research as my guiding methods. Insofar as I continue to conduct qualitative research in partnership with community members, I adopt elements of participatory rural appraisal also. Participant observation, participatory action research and participatory rural appraisal are all closely related and are inevitable in a social science situation. They are, at once, modes, tools, techniques and methods.

3.2.1 Participant Observation

I was a participant observer early in the research process for the TNP. This occurred before I was comfortable working with Inuit and thus, before community members had confidence in me. In addition, later in the research process I switched between being more of an observer versus participant during times when I did not want to get entrenched in a community situation. Like Kofinas, I oscillated between "...offering support in various activities where solicited; and at other times purposefully avoiding direct intervention in a process where I felt that intervention would dramatically alter the course of events" (Kofinas 1998, 53). With time I was able to periodically distance myself in order to gain objectivity. This was particularly important when voicing my opinion would have been consequential.

As I became heavily involved in community life, my methodology shifted towards participatory action research. In this way, I started to recognize that I was an actor in the research process and that the Inuit world was not a fishbowl to be viewed from a distance.

3.2.2 Participatory Action Research

There are two reasons why participatory action research was my primary method for the TNP. First, although community members and I collaborated, they ultimately drove and directed the research process. Research agreements I signed with the community advisory board specified the various ways in which community members and I would

elders chose research partners with whom I was to work. These partners, Margo Kadlun-Jones and Sandra Eyegetok, were paid well and charged with the responsibilities of maintaining community consultation, running home offices, conducting interviews, analysing interview transcripts and writing reports. In this way, skills were transferred and capacity was built.

The second key concept of PRA that I implemented was a preparedness to “accept that the team . . . merely provided a ‘trigger’ for local action and that no particular outcomes [were] guaranteed,” (Webber and Ison 1994, 109). Working together, one of our team roles was to provide impetus and respond to inspiration for community research on caribou and calving areas. At times this was difficult given the uncertainty in the nature

articles, presenting at an international conference, and being interviewed for newspaper articles, television documentaries, and radio shows. For the first time in her life, she

exclude are often arbitrary, rarely neutral, and always powerful” (Nader 1996, 4). I hope to make these as transparent as possible in providing the reader with information about my background in this chapter as well being explicit about my methods in the next chapter.

I am an environmental scientist trained in the physical and biological sciences. For most of my life I have resided in Vancouver, but for the last six years I have also resided in Yellowknife, *Umingmaktuuq*, and *Iqaluktuuttiaq*. For the last five years I have documented Inuit ecological knowledge of caribou for the TNP. In contrast, during my first years in the North I worked as a scientist for the federal government, environmental consulting companies, and mining corporations. These jobs required me to travel throughout the Kitikmeot region conducting water quality and quantity studies, wildlife research, and environmental assessments.

My interest in the social sciences, and ultimately this research, was sparked when I was working for the Ekati diamond mine located 400 kilometres Northeast of Yellowknife. This was the first time I was exposed to IEK and it caused me to be more aware of the limitations of western scientific paradigm.

3.3.1 Researcher as Scientist: My Introduction to IEK

At Ekati I was informed that I had to meet with an Inuit elder, Jack Kaodluak, and his grandson, Colin Kaodluak, from *Qurluqtuq* (Coppermine) so that we could incorporate their observations into baseline wildlife data. At the time, I resented the inconvenience and disruption to my schedule. I was dubious of the elder’s ability to recount his experiences not only because he had not travelled to the region for over 30 years, but also because at that time, he had come by skidoo and dogteam rather than by helicopter. Viewing the land from the air is an entirely different perspective than from the land and I wondered if he would be able to adjust since he had never been in a helicopter before.

Within the first few hours of Jack and Colin wandering around the claims block, I was proven wrong. Jack helped us to locate important denning habitats and landmarks near

traditional camp locations, caribou crossings or other important sites. I had been working for the mine for 3 months, out in the helicopter every day, yet still I could not easily decipher specific lakes, boulder fields and eskers. I had trouble adjusting my southern lenses to see more than just an endless expanse of nondescript tundra. After spending time with Jack I realized that for me to shift my observation skills from rugged mountains to intricate tundra was a far bigger challenge than for him to change from a terrestrial to aerial viewpoint.

This pivotal experience inspired me to open my mind to conducting research in ways other than those that I had been taught. The more I worked with Inuit community members, the more intrigued I became by both the differences and similarities between our methods of acquiring knowledge and knowledge itself. In particular, I wondered what Inuit could contribute to our understanding of climate given their intimate relationship with the environment. Soon after, I began working for the TNP with the goal to document IEK of caribou for the Bathurst herd.

Research for this paper has been greatly enhanced my northern experiences working as the principal researcher for the TNP and as an environmental scientist for numerous Arctic organizations because I have a more balanced appreciation for both disciplines. Although I have spent years in the North, I am still a “southerner”. An unwritten rule in the North is that you must live there many years to earn the status of a “northerner”. I still do not know how many years this constitutes, but even given my experience living in the North, I remain a southerner albeit one with a healthy appreciation of northern living.

3.3.2 *Southerner as Researcher*

Many Inuit call southern researchers *hik hiks*--or ground squirrels--because we only poke our heads North in the summer (Kofinas 1998). In the words of an Inuk scientist who now lives in southern Canada, scientists are “those...my people love to hate, those who occasionally arrive in the Arctic only at a certain season” (Freeman 1994, 4). This short time frame for interaction between researchers and community members can compromise the quality of research and lead to feelings of uneasiness, disappointment and even mistrust in the community (Eyegetok pers. comm. 1999). Knowing this from

the outset, I committed to spending significant time in the North in all of the seasons; participating in community life and working closely with Inuit in an ethical and appropriate manner. This entailed months of contributing to daily community activities and learning the language of Inuinnaqtun in order to build the foundations of trusting relationships between community members and me.

Frequent visits to the communities were critical given that nurturing Northern relationships from a distance was at times impossible, particularly with community members who have little or no access to phones, or are unable to speak or read English. Even so, it is important to realize that establishing rich relationships is not always possible during the limited duration of one or two field seasons typical of a Master's degree. I believe it is difficult, if not impossible, for a southerner to conduct reliable IEK research without spending numerous extended periods living in Nunavut and becoming part of a community.

3.3.3 Researcher as Community Member

Throughout my research, I lived and worked in Nunavut for several periods so that I

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the Kitikmeot, I travelled by skidoo on an 18 hour journey overland from *Iqaluktuuttiaq* to *Umingmaktuuq*. Although I was travelling with experienced Inuit, we missed a critical

3.4 Research Challenges

My role in the community influenced how the research both evolved and proceeded. Challenges that I face in conducting qualitative research for the TNP relate to:

- cultural differences
- language barriers
- time spent in the field; and
- my age and gender.

As I will explain, it was not always better or possible to overcome these challenges.

3.4.1 Cultural Differences

There are many differences between western or *qaplunaaq* (white person) and Inuit culture that were difficult to identify and overcome. Ross (1992) presents a rich account of cultural differences between Cree, Ojibway and western culture, many of which hold true for Inuit culture as well. For example, he explains that Cree and Ojibway have different concepts of time and priorities than non-Cree and non-Ojibway. Compared to Inuit culture, I found that western culture operates on a more rigid time schedule and is less grounded in spirituality and animism. For example, Qitirmiut believe that if a caribou comes close to town that it is an old relative coming to visit (Kaniak 1998).

When I patiently waited, the interviewee usually continued to develop a thought. Like learning the non-verbal ways to say “yes” and “no”, this important cultural difference took me some time to discover.

Other examples of cultural differences, such as non-verbal communication and the act of taking responsibility, were illustrated best through stories. During the first week that I lived in *Umingmaktuuq*, I was sewing with Alice Keyok, a young mother, and her *nuka* (younger sister), Doris, who was home for two weeks from her job at a local mine. We sat in a circle on the floor of my seaside cabin and talked about elders as we stitched. I was curious to know peoples’ names and family relations and so I asked the women about their parents. After awhile I looked at Alice and asked her if she thought that her father, Charlie, would be interested in being interviewed. In response to my question, Alice acknowledge me with expressive wide eyes. She didn’t answer me aloud so I wondered, “Is she scorning me for asking?” and “Did I not ask the question loudly enough?”

I returned to my sewing for a moment, then asked again, but this time I practically yelled my question. Once more, she looked at me with wide eyes. Again, her lack of response was frustrating me. This time, I began to take it personally. I thought, “How could she be so rude as to not answer me?” and “Why did she not say yes or no to me?”

Resigned, I gave up on my question and, as time passed and stitches were sewn, our silence became comfortable again. Soon my fingers tired and I put my sewing aside to melt some ice for tea. While tending the Coleman stove, I turned to ask Doris and Alice if they wanted some tea. In response, they both looked at me, but this time, Doris had wide eyes and Alice a scrunched nose. Suddenly it hit me: wide eyes means “yes”, scrunched nose means “no”! To test my realization, I asked if they wanted sugar. Yes and no they answered with their eyes and nose. “What about milk?” I asked. Again, their facial expressions told me their preferences. This was my first lesson in understanding non-verbal ways of communication in Inuit culture.

3.4.2 Language Barriers

As if non-verbal communication differences were not enough to challenge my research, verbal communication difficulties plagued me as well. It would have been much easier to conduct interviews and ask probing questions if I would have been able to speak Inuinnaqtun, or, alternatively, if there had been more translators in the region. Having to interview unilingual Inuinnaqtun speakers was my most significant, albeit unavoidable, obstacle. Elders and others taught me to speak some Inuinnaqtun while I lived in the Qitirmiut region, but it was not enough for conducting interviews.

My research partners were not always able to translate my questions in the way I had asked them. Sometimes this was because my questions were inappropriate or offensive. In other cases, finding the exact translation for an English word or phrase was impossible because it didn't exist. Since one of my guiding principles was to build capacity and because of the paucity of trained translators, often I worked with community members who were not perfectly fluent. Not surprisingly, fluent speakers are gainfully employed, overworked and unavailable. As a result, my research partners varied in their ability to speak and understand both English and Inuinnaqtun.

Ironically, my inability to speak Inuinnaqtun and my research partner's difficulties in translating sometimes led the dialogue towards a more appropriate direction. As one Inuk interviewing another, a community researcher knew how to phrase a question better than I. In some cases, particularly when I was new to the TNP, I asked poorly worded questions or too many all at once. When this occurred, my research partner was able to rephrase or alter a question so that it was more concise.

3.4.3 Life in the Field: How Long is too Long?

Throughout my research, determining the 'right' amount of time to spend in a community during one visit was a formidable task. At first I spent extended rather than shorter periods in communities, for example, in 1998 I spent my longest consecutive stay of six and a half months. This precluded me from stepping back to assess my research situation in two ways. Since living in a community became my reality, I had difficulties

reflecting upon my daily routine and keeping up with my field notes. It seemed tedious to record my daily chores of fetching ice to melt for drinking water or catching fish for dinner. In the same way, it would have been odd for me to document my daily routine while I lived in Vancouver. Once community living became my life, it was difficult to analyze it. I may have avoided this situation if I had spent shorter time periods and visited more frequently instead.

Although I didn't realize this at the time, I became over-stimulated and burned out when I spent long stints in one place. What length of time that 'too long' constituted, varied for me over the years and often depended on my personal state. In general, I found four feelings that defined "too long" for me: overwhelmed with research material, detached from community members, lonely for southern family and friends, and unable to decipher important versus superfluous research material. Perhaps there comes a time when the boundaries get overly blurred, the primary research objective is lost and one becomes too much of a participant!

In accordance with a key tenet of PAR, I found that spending long periods in a community was, at once, both a burden and benefit to the research process. For example, when I felt at ease I was able to ask certain questions and partake in special expeditions or events. This advantageously steered the direction of the research process in that I gained access to happenings such as a hunting expedition, cutting meat or preparing caribou stew that I might not have otherwise. On the other hand, I may have steered the process away from a more natural path and therefore burdened the research. For example, people may have acted differently, for example while butchering a caribou or identifying popular caribou forage in order to please me. Since participatory action research necessarily entails that a researcher spend meaningful time living or working in communities, it is important to reflect upon exactly how this level of involvement both positively and negatively influences the research process.

3.4.4 *Young and Female*

Being female and in my twenties exposed me to different field experiences than if I were a male or in my fifties, for example. It is impossible to say *exactly* how my research

experiences would have differed, but my sense is that I would have been able to identify and connect with male hunters better if I were a man. This might have enhanced the breadth, depth and quality of my observations.

At first I thought my gender and age might hinder my research since hunting is usually “a man’s job”. I’d been told stories such as the *qaplunaaq* woman who was discouraged from seal hunting with some Inuit men although her husband was invited. She was told she couldn’t come because there was “nowhere for her to pee on the sea ice” (Thoms pers. comm. 1995). To my surprise, once I had spent extended periods of time in the communities and developed relationships, I found that hunting was a joint passion between men and women and, with time, one that I too was able to share.

In *Umingmaktuuq*, because most of the elders are widows who hunt for themselves, I was able to join them on several expeditions. These women, backs bent from years of gruelling work, easily hop onto their skidoos and race across the ice with rifles slung across their backs and determined looks frozen upon their faces. Once I had demonstrated my eagerness to learn, and my commitment to the community, I was invited to join the hunts. Contrary to what I had expected, I connected with these hunters primarily *because* of my gender. Further, I participated in “women’s work”: butchering and preparing the meat after the hunt. This gave me first-hand experience handling caribou and learning about meat condition from accomplished hunters. Discussions among women and myself, as we laboured over meat and skins, contributed a significant amount to my research materials.

My young age was another advantage because community members conversed at a basic level so that I would clearly understand what they were explaining. Upon arriving into communities, I was often treated as a child because my level of local knowledge was on par with (and in most cases, below) that of a child. This meant that people took extra time to explain ideas and concepts. If I had been older, I think I would have been more threatening and less easily categorized as “naïve”. Not only for my safety living in a harsh climate, but also for my education, it was important for me to admit ignorance, reveal vulnerability, and ask “stupid” questions. It was easier for elders to talk about caribou, climate, vegetation or Inuit ways of living at an elementary level because I was

an eager young *qaplunaaq* who didn't know any better.⁷ The more I learned, the more they elaborated.

⁷ In fact, when my Inuit research partner wanted to ask a question to which she ought to have known the answer, she would tell the elders that I was actually asking the question so that she would not be chided. In addition, my ignorance would more easily be forgiven.

4.0 METHODS: AN ADAPTIVE APPROACH

Research for this paper on IEK of climate change impacts evolved from the TNP when I noticed that many interviewees spoke about *Hila*, in particular, the relationship between climate, vegetation and caribou⁸. This is a result of the fact that the TNP and my thesis are examples of qualitative research based on adaptive approaches. In this way, the research designs were inductive, pliable, and responsive to input from community members. These research design qualities are critical in community research because “any significant pre-structuring of the methods [could have led] to a lack of flexibility to respond to emergent insights and [created] methodological blinders in making sense of the data” (Maxwell 1996, 63). The advantage of using an adaptive approach was that it allowed me the flexibility to focus on particular phenomena, in this case, the effects of climatic changes on caribou.

⁸ The importance of climate change became obvious after I reviewed transcripts from the TNP. One reason that people spoke about climate when talking about caribou was because it is not typical of Inuit culture to speak of just one ecological variable without linking this variable to biological, social, cultural and ecological phenomena. In fact, only sixty percent of the IEK documented for the TNP relates to caribou. Other than caribou, other topics of discussion were: fish and wildlife (e.g. grizzlies, ground squirrels, wolves, wolverines), traditional values; sewing techniques; gender relationships; views on death, tragedy and loss; Inuit culture; transitions from traditional to contemporary ways of living; starvation; *qaplunaaq* (white person) and Inuit conflicts; and women’s issues (e.g. pregnancy, abuse). Inuit provided important insights on each of these issues although they do not specifically relate to caribou or *Hila*. This points to the problem of vivisectioning IEK into western compartments: information is either lost or removed from a context. I will not attempt to do justice to this important issue in the confines of this paper. For more discussion, see Berkes (1999) and Stevenson (1998) for example.

Several sources of evidence informed this research. These include:

- A representative subset (n=27) of a set (n=34) of semi-structured and semi-directed interviews conducted for the TNP between 1997 and 2000.
- Unstructured interviews and personal communication (email, telephone, and written correspondence) with key informants from Inuit and Nunavut agencies (n=5).
- My personal memos, journal entries and research notes from frequent and extended periods of qualitative research conducted from September 1996 to December 1999 as part of the Tuktu and Nogak Project.

I elaborate on each of these sources in the following three sections.

4.1 Deriving a Data Set: Semi-Structured Interviews about Climate

As a result of using an adaptive approach, I assessed 27 of 34 interview transcripts from the Tuktu and Nogak Project that were relevant to climate. In order to select which transcripts to assess, I engaged AskSam, a data management program, to systematically categorize sections within each interview transcript (n=34) according to keywords (n=200) that I assembled (Appendix A). For this paper, I programmed AskSam to sort through the transcripts according to six keywords:

- climate change
- warming trends
- cooling trends
- environmental effects
- vegetation; and
- caribou.

After I coded the transcripts, the necessary condition to include a transcript in this research was that a discrete section within a transcript contains any combination of at least two of these six keywords. For example, “caribou” and “cooling trends” or “vegetation” and “climate change”. Accordingly, 27 transcripts met this criterion, as illustrated in Figure 4.

The interviewees from these 27 transcripts are generally representative of the age and

gender of the 34 interviewees. As shown in Table 1, the subset of interviewees are from all four study communities and range in birth years from 1911 to 1956 with an average of 1934 (or 66 years old). Table 2 shows the full list of interviewees (n=34).

Table 1:

Interviewee transcripts considered for IEK of climate change impacts

Interviewee	Community	Born	Age*	Male	Female
Akana, John	<i>Umingmaktuuq</i>	1934	66	M	
Akoluk, Martha	<i>Qingauk</i>	1957	43		F
Algona, Bobby	<i>Qurluqtuq</i>	1956	44	M	
Algona, May	<i>Qurluqtuq</i>	1934	66		F
Alonak, Jack	<i>Qurluqtuq</i>	1925	75	M	
Analok, Frank	<i>Iqaluktuuttiaq</i>	1917	83	M	
Angulalik, Bessie	<i>Iqaluktuuttiaq</i>	1936	64 (D)		F
Angulalik, Mabel	<i>Iqaluktuuttiaq</i>	1925	75		F
Hagialok, Jessie	<i>Qingauk</i>	1927	73		F
Hakongak, Naikak	<i>Iqaluktuuttiaq</i>	1963	37	M	
Hikok, Nellie	<i>Qurluqtuq</i>	1911	89		F
Kailik, Buster	<i>Qurluqtuq</i>	1919	81	M	
Kamoayok, Lena	<i>Umingmaktuuq</i>	1939	61		F
Kaniak, Mary	<i>Umingmaktuuq</i>	1932	68		F
Kaasoni, Annie	<i>Iqaluktuuttiaq</i>	1918	80 (D)		F
Kaasoni, Mackie	<i>Iqaluktuuttiaq</i>	1918	80	M	
Keyok, Charlie	<i>Umingmaktuuq</i>	1938	60	M	
Koihok, Moses	<i>Iqaluktuuttiaq</i>	1921	77	M	
Komak, Archie	<i>Iqaluktuuttiaq</i>	1946	77	M	
Kuptana, George	<i>Umingmaktuuq</i>	1916	82 (D)	M	
Nalvana, Connie	<i>Qurluqtuq</i>	1921	78		F
Omilgoitok, Bessie	<i>Iqaluktuuttiaq</i>	1939	59		F
Omilgoitok, Paul					

Table 2:

List of interviewees for the Tuktu and Nogak Project.

Interviewee	Community	Born	Age*	Male	Female
Akana, John	<i>Umingmaktuuq</i>	1934	66	M	
Akoluk, Martha	<i>Qingauk</i>	1957	43		F
Algona, Bobby	<i>Qurluqtuq</i>	1956	44	M	
Algona, May	<i>Qurluqtuq</i>	1934	66		F
Alonak, Jack	<i>Qurluqtuq</i>	1925	75	M	
Analok, Frank	<i>Iqaluktuuttiaq</i>	1917	82	M	
Angulalik, Bessie	<i>Iqaluktuuttiaq</i>	1936	64 (D)		F
Angulalik, Mabel	<i>Iqaluktuuttiaq</i>	1925	75		F
Hagialok, Jessie	<i>Qingauk</i>	1927	73		F
Hakongak, Naikak	<i>Iqaluktuuttiaq</i>	1963	37	M	
Hikok, Nellie	<i>Qurluqtuq</i>	1911	89		F
Kailik, BusterK			a		

This subset of 27 interviewees provided ample data for consideration and generally represented a cross section of the communities in terms of age and gender, family groups and traditional hunting areas.

Table 3 illustrates how both the full set and subset of interviewees is representative of the four study community populations.

Table 3:

Total number of interviewees per community comparing the TNP and 699 research.

Community	Total	M	F
<i>Iqaluktuuttiaq</i>	14 / 10	9 / 6	5 / 4
<i>Umingmaktuuq</i>	9 / 6	4 / 4	5 / 2
<i>Qingauk</i>	5 / 5	2 / 2	3 / 3
<i>Qurluqtuq</i>	6 / 6	3 / 3	3 / 3
TOTAL	34 / 27	18 / 14	16 / 13

Note that the first number is for the full set of interviews (n=34) and the second number is for the subset (n=27).

4.2 Personal Communication

Over the last five years, I have built many working relationships that have developed into close friendships with community members. Consequently, I have maintained an informal dialogue with several Inuit who work for wildlife or other related agencies and these people became key confidants who guided me both personally and professionally throughout the research process. Our relationships form the second of three evidence sources for my research.

When appropriate, I kept a record of key discussions with informants in a daily journal. These notes helped in understanding an Inuit perspective of climate change effects from decision-makers and chart the differences in what people communicated over the course of several years. For the purposes of this research, I draw from discussions with the five people as listed in Table 4.

5.0 QITIRMIUT OBSERVATIONS OF CLIMATE CHANGE

In this chapter, I present Qitirmiut observations of a warming climate and, in doing so, set the context for the next two chapters in which I present Qitirmiut reports of three direct effects of a warming climate, specifically, earlier spring-melt, later fall freeze-up and unpredictable weather (Figure 5). Further, I frame these three direct effects into causal relationships of warmer temperatures, and show how they have an indirect impact on caribou. In presenting this local knowledge, I suggest that IEK has utility in contributing new information and enhancing existing information and propose how this utility is grounded in the fact that IEK is the richness in information about the complexity and interconnectedness between ecological variables. Further, these examples illustrate the valuable nine properties of IEK that I first proposed in Chapter Two.

The signs of a warming climate are obvious to *Qitirmiut* as they observe and travel through their local environment. In this chapter, I present their accounts of warmer temperatures and discuss how they view this phenomenon as having both positive and negative elements. Next I outline a Qitirmiut explanation for this warming trend and illustrate how it may be an example of pattern thought first discussed in Section 2.0. Finally, I outline four factors that may have influenced interviewees when they talked about climate getting warmer.

5.1 Temperatures are Getting Warmer

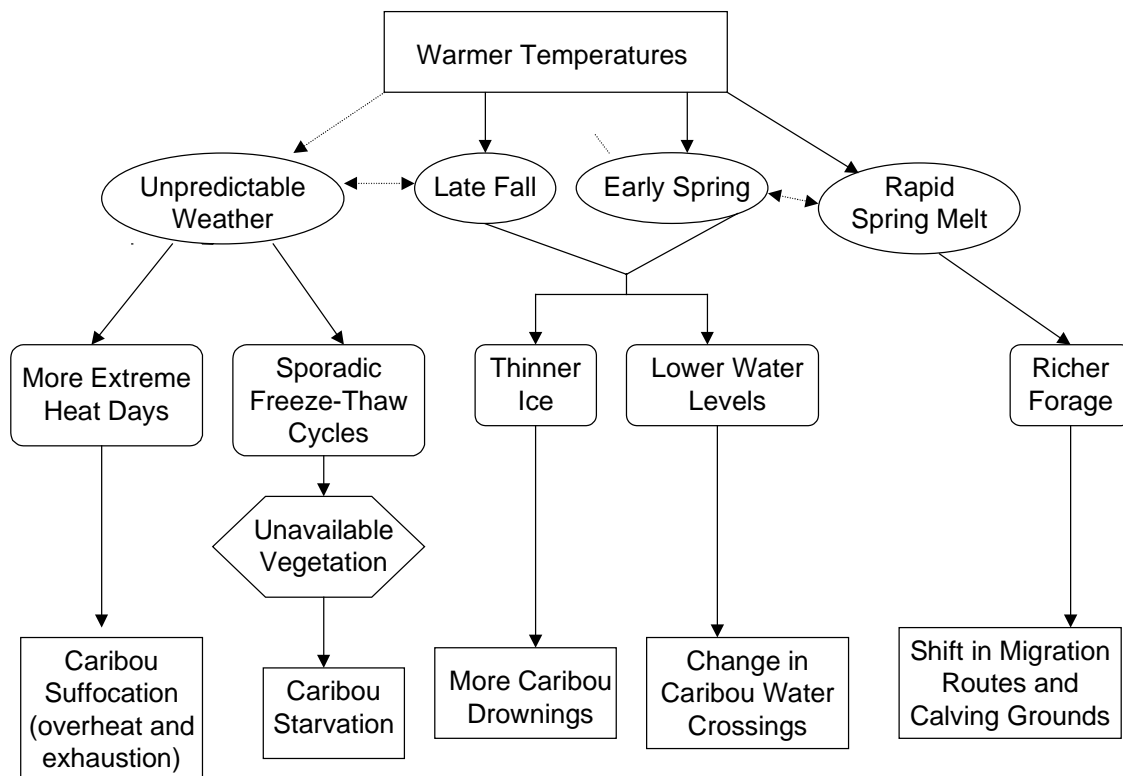
Of the twenty seven transcripts I reviewed, eleven people spoke about temperatures increasing and one person spoke of temperatures decreasing. May Algona (1999) explained that:

it never gets as cold as it used to...it used to 8(ies 8 Tci"0.191 Tw00.002 1(f)8 Td)-11T9.21 T7

a long time ago, Cambridge Bay was usually cold. Nowadays ... the weather gets too hot sometimes.

Figure 5:

Qitirmiut observations of causal relationships resulting from warmer temperatures



Note that this framework is a combination of relationships articulated by Qitirmiut as well as my interpretation of observed linkages. This figure is an oversimplification of the complexity and interconnectedness of these ecological variables, but it serves to illustrate some identifiable associations.

In addition to these interviewees, numerous other locals elaborated on their observations of recent climate changes during our informal discussions (Hakongak pers. comm. 1998, 1999, 2000; Omilgoitok, M. pers. comm. 1998).

Qitirmiut have noticed that temperatures during the 1990s were much warmer than in earlier decades (Algona, B. 1999; Hakongak pers. comm. 1998; Corey pers. comm. 1999; Kadlun-Jones 1999; Stern pers. comm. 2000). Bobby Algona (1999) explained that:

it was so much warmer the last few years, in the 1990's and the late 80's.

An anonymous interviewee (1998) asserted that:

It has been quite warm, though, [compared to] other winters...in the last 4-5 years I guess.

Some people (Angulalik 1998; Komak 1998) complain that these warm years have brought *too hot* (Komak 1998; Kailik 1999) temperatures that are *not so nice* (Angulalik 1998). Hot temperatures are one of the deleterious effects of Arctic warming. In the following section, I present *Qitirmiut* reflections on how warmer temperatures are both positive and negative in how they impact daily life.

5.1.1 Some Pros and Cons of Warm Weather to a Subsistence Way of Life

Qitirmiut

thnce]6()11(g)Ses arm so0(ic w)12(a)-osits sbaandmaes.

arrived earlier and lasted longer (Kakolak pers. comm. 1998). Birds were more plentiful and arrived North earlier than usual which made geese hunting and egg gathering more fruitful.

Along with these positive impacts, warm weather during the summer can also bring unfavourable conditions for subsistence activities. Recently, there have been *hot hot* and *humid summers* which has made the land *drier* (Bobby Algona 1999) and brought more bugs, especially mosquitoes (Analok 1998; Kakolak pers. comm. 1998; Kamoayok pers. comm. 1998; Kaniak pers. comm. 1998; Panegyuk, E. pers. comm. 1998). Frank Analok (1998) explained that:

There weren't many mosquitoes back then [in the 1970s]. They would only be around for a short time.

That said, Qitirmiut explained that the number of mosquitoes increases with temperature but only until a threshold at which point the mosquitoes cannot survive. This threshold was crossed during the 1998 summer when the mosquitoes were a nuisance for only one instead of two weeks which are normally observed by community members (Kamoayok pers. comm. 1998; Hakongak pers. comm. 1999).

Locals reported that another negative impact of warmer temperatures during the summer is that some days are simply *too hot* (Komak 1998; Kailik 1999). For *Qitirmiut* who are not acclimatized to such heat, these days can be difficult to bear. During the 1998 summer, a family from *Umingmaktuuq* travelled to Yellowknife for a medical reason and holidays. Instead, they returned earlier than planned because, in the high

outside of *Umingmaktuuq*. Our plan was to spend the weekend camping, fishing and hunting. Instead, the family decided that the mosquitoes and heat were so unbearable that we left after just one night. In this case, the temperatures were hot yet not above the threshold for mosquitoes.

Finally, new birds and animals are being seen for the first time that people can remember. Robins and an unidentified yellow songbird have flown as far North as Victoria Island which are not reported to be common by locals (Haniliak pers. comm. 1998; Analok 1999; Eyegetok pers. comm. 1999).

For the first time in living memory, grizzly bears were seen crossing from the mainland Northwards to Victoria Island in 1999 (Corey pers. comm. 1999; Omilgoitok, M. pers. comm. 1999). Community members from *Umingmaktuuq* and *Qingauk* said that during the spring of 2000 there was an unusually high number of grizzlies and grizzly tracks (Maghagak pers. comm. 2000). This is a concern for Qitirmiut because they said that the bears might start visiting areas where people have their outpost camps, for example, on the south coast of Victoria Island (Hakongak pers. comm. 1999).

Those outlined above are examples of general changes considered to be either positive or negative. In the next chapter, I present impacts of a warming climate that are specific to vegetation and caribou that have been observed by *Qitirmiut*.

5.3 Influences to Observations of a Warming Climate

That eleven interviewees reported warming temperatures strongly supports the conclusion that locals perceive climate to be warmer. However, four factors may have influenced *Qitirmiut* in their statements about climate change made during their interviews.

The first possible influence follows from the fact that families have moved from outpost camps into communities within the last fifty years and now enjoy the warmth of a permanent home rather than a snow house or *iglu*. Consequently, people might think that the weather is getting warmer when really it may be their change of lifestyle that causes their perception of temperature to change. People can escape the elements better today than in the past. Therefore, they might not remember the bitter cold as well as when they faced it out on the land.

A second factor, alluded to earlier, that may influence interviewees is that news of global warming has trickled into the North. However, most media are in English and therefore are not understood by the majority of the elders. This being said, it is possible that some knowledge of global warming was gained through word-of-mouth and this *a priori* knowledge could have contributed to their comments about a warming climate. During interviews, some people made reference that weather media effectively reaches and educates some people. For example, Bobby Algona (1999) said that:

Five years ago now...*Qurluqtuq* was the hottest spot in all of the North America.

He could not have known this except by television, newspaper or word of mouth. Clearly, weather and climate news had reached some interviewees and could have influenced perceptions.

A third possible influence is that people have a better memory of more recent events. The interviewees would better recall climatic conditions in the 1990s than 1950s and likely be more specific about contemporary events.

The fact that people remember recent years best is relevant to this research in that most interviews were conducted during the record-breaking hot year of 1998 (Jeffers 2000). Consequently, people may have over-emphasized the presence of a warming trend. People were not expecting the heat to be intense enough to melt most of the snow and ice in just a few hot days in May. Caribou meat that was kept cool safely outdoors in a snow bank, suddenly went bad and was unfit to eat. Two teenagers who were skidooing in *Umingmaktuuq* nearly drowned while trying to travel over ice that had been safe just the day before. To summarize, the fact that the hottest year on record was fresh in the minds of interviews may have influenced people to conclude that temperatures are increasing.

It is impossible to know how, if at all, these four possible influences entered into the interviews. Regardless of the magnitude of how they may have had an impact on the interviews, the fact remains that eleven interviewees observed a warming trend and reported concomitant impacts on the local environment. The similarities in the

as examples of cause-effect relationships. Next, I present observations of lower water levels in rivers and the ocean and suggest how these might influence caribou during their migration.

6.1 Earlier Spring-Melt

Five of twenty-seven interviewees commented that the spring-melt occurred sooner in the 1990s than in the past. Archie Komak (1998) observed that

[t]he weather is warmer now...the snow seems to go earlier in the late spring (*upin'ngaaq*).

The sea ice is also melting earlier compared to a

long time ago [when] the ice on the ocean used to go away late (Analok 1998).

The heat generated by buildings, traffic and human activity leads to even earlier snow melt in communities compared to out on the land. As communities get larger, so does the capacity of the community to generate heat. Mabel Angulalik (1998) commented on how people have an impact on snowmelt at a local scale.

Here in town...the snow seems to melt earlier...because the traffic makes the snow melt...because when . . . people are gathered in one area, the snow seems to go quicker.

This is an example of local knowledge that can contribute to research on the impacts of earlier and more severe melting, for example, how decreased snow cover will affect caribou.

6.1.1 Shift in Migration Routes: Leads Open Earlier

Qitirmiut mentioned two reasons why caribou shift their migration routes as a result of warmer temperatures. On a large scale, warmer spring temperatures cause the ice to melt earlier, which creates patches of open water known as “leads”. Locals reported that

leads influence caribou during their spring and fall migrations across sea ice. For example, if a lead is too wide to swim across, caribou will turn around and go back to shore or they will move parallel to the lead until they find an area where the ice is thick enough to continue on their route. Sometimes caribou swim across leads if the open water stretches from the ice edge to the shore. Otherwise, Qitirmiut said that caribou rarely swim across leads because it is difficult for them to get out of the water and on to the ice. When leads are particularly wide, caribou are forced to shift their migration routes.

One interviewee commented that leads along a traditional caribou-crossing route have been opening earlier in the last few years near the community of *Qingauk* (Anonymous B 1998). According to locals, a traditional caribou-crossing route is an area where caribou have been observed by generations of Qitirmiut either swimming or walking across the ice year after year. As a result of leads opening earlier, some caribou have not been able to migrate from the west to east and across the sea ice at the southern region of Bathurst Inlet (Anonymous B 1998, Anonymous C 1998; Hakongak pers. comm. 1999). This was the case during 1997 and 1998 when caribou remained on the west side of the Inlet to calve rather than crossing over to the east side. Locals stated that the reason had to do with the animals' inability to access the southern region because they could not cross to the east side:

[The caribou] mainly come through there [across from Elliot Point in southern Bathurst Inlet] when they are calving on the east side. For some caribou, it is still the same...The caribou...come around through from Portage Bay off Kuadjuk Island...they come south then go around again. They cannot hit that open water down there...That open water has always been the same...[but] it opens earlier and way bigger [nowadays]. (Anonymous C 1998)

Qitirmiut make careful note of which leads open first and how these leads shift throughout the melting period from one year to the next. For example, certain places in Elu Inlet and Bathurst Inlet are known to be extremely dangerous during the spring and fall because of ocean currents that make the ice thickness unpredictable. Community members repeatedly warned me of these areas each time that I made a skidoo journey

between *Umingmaktuuq*, *Iqaluktuuttiaq* and *Qingauk*. This local knowledge is valuable to travelers' safety and may be of value to scientists who are assessing how caribou are influenced while making sea ice crossings. For example, researchers are currently looking at how traditional caribou-crossings on sea ice may be affected by ice breakers and the length of the season, or shipping window, during which these large ships would operate if a port facility were constructed in the southern region of Bathurst Inlet.

6.1.2 Migration towards Rich and Abundant Vegetation

In this section of the paper, I further explore locals' observations and understanding of caribou shifting their migration routes because of warmer temperatures. In addition to leads opening earlier, another possible reason for these shifts may be the availability of richer vegetation for forage and more lush vegetation for shade.

6.1.2.1 Richer Vegetation provides Forage

Qitirmiut noticed that vegetation was more lush, plentiful and diverse in the 1990s compared with earlier decades. Five locals reported that vegetation is larger and there are more individual plants of the same species, particularly shrubs, in certain traditional camping areas such as the Hiuqqittaaq River near Bathurst Inlet (Omilgoitok P., pers. comm. 1998; Omilgoitok B., pers. comm. 1998; Kamoayok pers. comm. 1998; Kaniak pers. comm. 1998; Koihok 1998). The number of different types of vegetation has also increased, especially at higher latitudes such as on Victoria Island (Omilgoitok, B. pers. comm. 1999; Omilgoitok, P. pers. comm. 1999). According to Moses Koihok (1998), nowadays there are some types of lichens and flowering plants on Victoria Island that he has never seen before.

On a small scale, caribou are attracted to areas where the vegetation is rich, moist and green. Frank Analok (1998) explained the caribou eat:

All sorts of vegetation, whatever is sprouting on the land...whatever is sprouting on the shores of lakes [and] river sides.

Locals reported that forage quality is a strong force drawing caribou to a specific

location, particularly for calving. George Kuptana (1997) suggested that:

They like it there. It might be much safer for them to have their young ones there and more food there for them. Older caribou must be used to it.

Areas that first become snow-free support abundant vegetation that is attractive to cows seeking forage rich in nutrients. When asked whether there was anything special or distinct about the vegetation at calving grounds, Naikak Hakongak (1998) speculated:

Must be, maybe it's probably a little more richer. Maybe it comes out, maybe it's exposed earlier in the spring so that it has time to grow...they find a spot where the snow goes the soonest, the vegetation grows quicker maybe.

Later in the same interview he elaborated that:

The vegetation would have to be better too. I think the food would have to be a bit richer because the calves need to grow quickly because they start walking soon after they are born but they need to eat all the nutrients as fast as they can before the fall or winter set in. It's going to be a long winter so what they eat probably has to be a little bit richer than what they normally eat.

Locals have observed that tundra that first becomes snow-free has more exposure to the sun. As a result, vegetation is typically rich with fresh green shoots and new bark, both

the way up [North] and the next year they'll move over a little bit...

Before temperatures started to warm, it was common to have freeze-up begin in the late summer: late August or September. In the late 1990s, it started in October or November (Hakongak pers. comm. 2000). According to Archie Komak (1998),

sometimes in the late summer years ago it would freeze-up. Now it seems to freeze-up late and other times it would freeze-up earlier. Sometimes it would freeze-up late. That's how it is...This happened for many years. A long time ago the ice on the ocean used to go away late. Nowadays it goes earlier so waiting isn't so bad anymore.

In this passage, Archie speaks to the variable nature of the timing of freeze-up. At the same time, as the earlier quotes illustrate, Qitirmiut have noted a recent pattern of a later freeze-up and earlier break-up within this variability.

6.2.1 Thinner Ice

With warmer temperatures, longer summer-like conditions and shorter winters, the ice does not have as much time to become as thick as in the past. Buster Kailik (1998) of *Qurluqtuq* explained how

This is comparable to what May Algona (1999) of *Qurluqtuq* noticed:

The water level seems to have gone down in the lakes and the rivers do not flow as strong as they used to. The lakes seem to dry out too...I wonder why that is happening.

Annie Kaosoni (1998) of *Iqaluktuuttiaq* agreed:

The water level seems to have dropped. It seems like there is less water. The lakes seem to be smaller and dry out.

In all four study communities, elders noticed the same phenomenon of decreasing water levels in lakes, rivers and the ocean. Nobody specified why this is occurring, but based on other observations made by Qitirmiut, I would speculate that water levels are likely dropping for a combination of reasons related to warmer temperatures: earlier break-up, later freeze-up, increased evaporation, and decreased snow-pack.

There are two ways that decreasing in water levels may influence caribou, according to locals. With less water in rivers, caribou do not have to swim as far as they used to from one side of the river to the other. Qitirmiut identify crossings by hoof prints leading into and out of the water, and by the presence of caribou fur washed up onto the shore:

That's what they're called: crossings. Sometime during the spring, there would be a lot of caribou hair at a crossing (Bessie Angulalik 1998).

On a local and small scale, I suggest that not having as far to swim at crossings might benefit caribou because it conserves their energy.

The second way that dropping water levels can influence caribou relates to the importance of shorelines as key habitat as observed by Qitirmiut. Charlie Keyok (1998) suggested that:

[caribou eat] along the shores of lakes and the ocean...close to water, where there's moisture...they'd eat along the shore...by the lakes on the land. Things must be different now because the water level is dropping on the ocean.

There would be trails by the lakes, and along the mouth of the river. The trails look like they've been drawn in when you're flying over the lakes. (Koihok 1998)

It is probable that changes to shorelines caused by lower water levels affect caribou, but it is unclear how. Several interviewees commented on the importance of shoreline habitat for caribou because it provides grazing potential as well as a cool and shady refuge from both the sun and mosquitoes.

In the summertime, in the evening, when it gets dark, they'd walk along the shore and graze. Caribou like to eat on the lakeshores where the grass is plenty. When it is hot outside the caribou would go on the shores of the ocean where it is cooler. (Angulalik 1998)

The caribou . . . stay along shore in the summer in June and July...To stay away from the bugs and to keep cool [caribou] stay by the ocean and the islands. (Koihok 1998)

The caribou usually go to the ocean along the coast. They can also be seen swimming in the lakes, staying away from mosquitoes. (Analok 1998)

When it is hot outside the caribou would go on the shores of the ocean where it is cooler. They stay in the shaded areas as well. They'd lie on the patches of the remaining snow as well to keep cool. (Angulalik 1998)

One reason cited by Qitirmiut may have to do with the fact that shorelines are important habitat for caribou because they provide easy access to water which is an escape from predators.

6.3 Summary

Locals observed that the combination of earlier break-up in the spring and later freeze-up in the fall has led to a longer period of summer-like conditions. This may have some benefits to caribou, for example, in providing richer forage or more abundant vegetation that provides shade. However, most locals suggest that the effects of warming temperatures and the accompanying longer period of summer-like conditions are negative because they can lead to caribou fatalities. Ice is thinner and can cause caribou to drown during their instinctual drive northwards to their calving grounds and southwards to their wintering grounds. Alternatively, they may inefficiently expend energy by being forced to take less direct routes during their migrations. Lower water levels make river crossings shorter for caribou thereby conserving energy, but at the same time they influence shoreline habitat that is important to caribou for grazing and escaping the heat, insects and predators.

Qitirmiut have observed important cause-effect relationships contribute to our understanding of the indirect and direct effects of a warming climate on the environment and, in particular, on caribou.

7.0 UNPREDICTABLE WEATHER

With the onset of warmer temperatures, Qitirmiut have found weather forecasting more problematic. Based on my interviews, I have identified two possible cause-effect relationships articulated by locals that are associated with warming temperatures as illustrated in Figure 5. First, Qitirmiut have observed that there are more sporadic freeze-thaw cycles that lock vegetation in frozen sleet and make it unavailable as caribou forage. Locals also report that this can cause caribou to become malnourished or die. Second, days of extreme heat are perceived by locals to be more common in the 1990s. High temperatures make caribou overheated and exhausted. Local suggests that both of these relationships can result in decreased caribou population levels.

In this chapter, I discuss how Qitirmiut use their ecological knowledge to interpret and understand the effects of a changing climate on caribou and the predictability of weather patterns. In doing so, the nine properties of IEK discussed in Chapter Two are demonstrated.

7.1 Qitirmiut Seasons

In the spirit of their mystical world-view, Qitirmiut believe that intangible forces may guide the weather. This concept is a tenet of animism that underlies much of Inuit culture. It cultrofe6discus1

- summer is *aujaq*.

Locals reported that before the days of calendars, months were identified by phases of the moon and grouped together according to environmental conditions such as weather events and wildlife activity. For example, winter includes the months that are bitterly cold (*ijji*) where as fall and early spring include the months that are just cold (*alappaa*

inherently links patterns led Qitirmiut to classify seasons. That is, linking these patterns to wildlife activity and moon phases enabled people to combine days into months and months into seasons through a very specific thought process characteristic of Qitirmiut. Charlie Keyok (1998) provided a good example of connecting weather conditions to wildlife:

When there're too much water in the spring...when it rains too much, the number of squirrels would go down. That's how it is.

Another common way to predict weather is to watch the behaviour of birds.

I remember when Bessie [Omilgoitok] talked about weather predictions. She said, 'The loons are circling high. The weather will be funny tomorrow.' Later I asked her how she knew. . . She said that animals can sense weather changes which makes their behaviour different and that it was taught to her to use animals unusual behaviour to predict weather. (Sandra Eyegetok pers. comm. 2000)

Qitirmiut that I have travelled with use patterns in the snow and ice, changes in the wind strength and direction, and temperature fluctuations to forecast what the weather will be like. In other regions, it has been reported that "when clouds obscure the sun. . . Inuit study the reflection of the ice on the underside of low clouds (Davis 1998, 35).

In making these linkages, Qitirmiut predicted some weather conditions associated with certain months and seasons. In the 1990s, this element of predictability changed as a function of warmer temperatures and increasing variability in weather patterns.

7.2 Predicting Weather Today

Three interviewees commented that it is becoming increasingly difficult to predict the weather.

Back in the 60's I could almost say I could predict the weather any day. Whereas nowadays you might think it's going to rain... or snow back then but today there's nothing. Turn back and no [snow] dump...That's the big difference from the 60's and today. (Algona, B 1999)

Bobby Algona (1999) suggests that other community members have observed the same phenomenon:

Everybody I talked to said they can predict the weather in the 60's. It's more predictable and stable, whereas, nowadays it's unstable...any kind of weather any day. You can have rain in February sometimes nowadays. Or snow in August. Hail in August. Hail or even snow in July. I can remember...six or seven years ago, we had a snow bank outside my door in August. That one night it really snowed and froze and a big snow piled outside my tent in August. About seven years ago (1992), I think it was...And next day it was all gone again.

Although weather seems to be more difficult to predict, Qitirmiut are cautious to point out that weather can never be predicted with perfect accuracy.

You never know the weather...it's a fact that the weather is never the same...every year is always different...everything is always changing. Right now it seems to be getting worse. That I've noticed in my lifetime. It used to get real nice outside when I was younger, right after a storm. Right now when the weather gets bad, it seems consistent. We do not know the weather. It has a caretaker of its own. (Analok 1998)

This quote speaks to an element of Inuit culture that I discussed in the introductory paragraph of Section 7.1. That is, inexplicable forces control weather and all other ecological variables. It follows that Qitirmiut try not to take chances with the weather given that it can be so unforgiving.

7.2.1 Freeze Thaw Cycles

Since the weather has become more difficult to predict as a consequence of warmer temperatures and greater variability, Qitirmiut have also noticed more short-term temperature fluctuations. At times these fluctuations cause a repetitive and sporadic freeze-thaw cycle. This occurs when a few days of warm weather that start to melt the ice and snow are followed by a sudden cold period that causes the melt-water to freeze and form an icy layer on top of the snow. These freeze-thaw cycles can happen in both the spring and fall, particularly during the times of break-up and freeze-up.

Local observations of the freeze-thaw cycle illustrate Qitirmiut understanding of the

of unpredictable and unstable weather.

High temperatures can cause caribou to overheat and die of exhaustion according to five interviewees. In extreme cases, caribou are thought to overheat and then fall unconscious. In some cases, this can lead to death.

We saw dead caribou; they had died of exhaustion. We saw this in the recent past. (Komak 1998)

An indirect effect of hotter summer days is an increase in the number of mosquitoes. Caribou are said to suffocate on hot days because they run frantically to escape insects:

When there are too many mosquitoes [the caribou] would gather and go in circles to get rid of the mosquitoes. Sometimes when they shook the flies off it would make the sound like thunder. There would be so many mosquitoes that they would look like snowflakes, you can see, even from a distance. (Koihok 1998)

Bessie Angulalik (1998) observed that same event.

During the summer when there are a lot of mosquitoes in the warm weather they would die of exhaustion...when the weather is too hot for them.

Another indirect effect of hot temperatures is that they increase the number of forest fires in the southern regions of the Northwest Territories and Nunavut. Wind effe noywa,43 TDi"0.30
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Seven interviewees mentioned that mushrooms are an important part of the caribou diet as they provide nutrients as well as water.

[Mushrooms] are what the caribou use to keep their mouths moist when they walk. They need water and that's what they use when they're thirsty...they'd keep these mushrooms in their mouths because they're moist inside. Wet, really wet...When caribou are walking around, they could smell [mushrooms] right away and they go after them...[They] last a long time. The caribou would keep them in their mouths at the back of their cheeks...Just like whale blubber...just like snuff. (Alonak 1998)

Bessie Omilgoitok (1998) agreed.

8.0 HYPOTHESES AND CONCLUSIONS

IEK. Cruikshank (1998) comments on this.

Even more ironic is the expectation that [indigenous people] should make these contributions at national and international levels, as members of conference panels and regulatory boards, rather than at a local level where such knowledge could make an actual difference. Such a formulation seems to suggest that indigenous traditions should provide answers to problems created by modern states in terms convenient for modern states. (Cruikshank 1998, 51)

Recently, efforts to implement local knowledge into decision-making, such as through the implementation of the Nunavut Land Claims Agreement (1993), have empowered Inuit as holders of valuable and useful knowledge. This empowerment is supported by the research documented in this paper, in particular, local ecological relationships observed by Qitirmiut.

8.1 Qitirmiut Hypotheses for Further Research

In order to demonstrate the utility of IEK, I list the following useful hypotheses that can contribute new information and enhance existing information regarding climate change. In doing so, I assert that IEK is both useful and valuable. These hypotheses are relevant to the Kitikmeot region and may be considered as starting points for future research conducted by both western scientists and Inuit researchers.

1. On average, spring-melt occurred earlier in the 1990s than in the 1950s through 1980s.
2. On average, fall freeze-up occurred later in the 1990s than in the 1950s through 1980s.
3. In the 1990s, vegetation was more abundant and lush than in previous decades between the 1950s and 1980s and in the Bathurst Inlet area versus other parts of the Kitikmeot region.
4. Certain types of vegetation, particularly flowering plants, grew on Victoria Island in the 1990s and not during the decades between the 1950s and 1980s.
5. In the 1990s, ice on lakes, rivers and the ocean became thinner in and around Bathurst Inlet and on southern Victoria Island than in previous decades.
6. In the 1990s, water levels in rivers, lakes and the ocean dropped in and around Bathurst Inlet, Qurluqtuq and Iqaluktuuttiaq than in previous decades.

7. Shoreline habitat is critical to caribou as an escape from the heat and insects as well as predators.
8. Shoreline habitat is important for caribou to regulate body temperature.
9. Snow cover and the time of the season are key determining factors as to whether caribou are specific or general in their foraging behaviour.
10. In the 1990s versus decades between the 1950s and 1980s, weather was more variable and difficult to predict because it was windier, stormier, and warmer.
11. In the 1990s, variability in weather patterns increased compared to previous decades between the 1950s and 1980s.
12. In the 1990s, freeze-thaw cycles were more frequent compared to previous decades between the 1950s and 1980s.
13. In the 1990s, there were more extreme heat days compared to previous decades between the 1950s and 1980s.
14. In the 1990s versus the decades between the 1950s and 1980s, there were more incidences of Bathurst caribou drownings owing to thinner sea ice and changes in the timing of spring-melt and freeze-up.
15. In the 1990s, Bathurst caribou shifted their migration routes as a function of the timing of spring-melt, in particular, thinner sea ice and the opening of leads in the sea ice.
16. Bathurst caribou population levels drop with extreme heat and warmer temperatures because of deaths due to insect harassment, suffocation, overheating and exhaustion.

8.2 Researcher Hypotheses

Throughout this paper, I suggest that IEK is uniquely aggregating, changing, orally passed, intergenerational, multifaceted, local, iterative, adaptive and spiritual. In highlighting that a key strength of IEK is that it contributes local knowledge, I must also point out that IEK has the potential to be understood by non-local people, for example, outside researchers such as myself.

The fact that I presented and interpreted local knowledge in this paper suggests that both QEK and IEK can be interpreted easily by a larger audience. That I was able to consider local knowledge and then present observed ecological interactions, relationships and phenomena speaks to the capacity of local knowledge to be understood by people from other cultures. Further, the ease at which I was able to make

linkages between Qitirmiut observations of climate change impacts, even where causal relationships were not articulated, is encouraging given the current efforts to integrate western scientific knowledge and Inuit ecological knowledge. One way to ease this integration is through the formulation of hypotheses based on Qitirmiut ecological knowledge of climate change impacts in the Kitikmeot region.

1. Water levels in lakes, rivers and the ocean dropped in the 1990s compared with levels in the decades between 1950s and 1980s for a combination of reasons related to warmer temperatures, specifically, earlier break-up, later freeze-up, increased evaporation, and decreased snow-pack.

fall, early spring and rapid spring melting which are linked to more days of extreme heat, sporadic freeze-thaw cycles, thinner ice, lower water levels, ocean leads opening earlier and more abundant, rich and lush vegetation, as observed by locals. The effects of these conditions on caribou have been numerous. For example, locals have noticed that caribou have suffocated, overheated, become exhausted, starved, drowned and shifted their migration routes. This paper has presented these local ecological observations of causal relationships that were documented through a systematic, consistent and rigorous research process and interpreted easily by an outsider.

The product of this research suggests the utility of IEK in advancing our understanding of climate change effects on caribou. Further, it demonstrates that Inuit and non-Inuit, insiders and outsiders, local scientists and western scientists, can work together to further our understanding of climate change phenomena. The next challenge for decision-makers is in the application and integration of local and western scientific knowledge.

8.3.1 Reconciling Methodological Differences in Knowledge Systems

Given the nine properties of IEK that I have highlighted throughout this paper, there are some methodological challenges to integrating IEK and western scientific knowledge in furthering our understanding of climate change and deciding how and where the contribution of IEK can be fully realized. For example, a formidable task is to determine where integration versus the exclusive application of local knowledge and western scientificurthowhlih[(w)1nabcpr(som)-22(fE)-8(i)2nd her,i7(i)3(o1nab)3(c)1(pr)-7c9awatidable atidabinlin

challenge to integrating IEK and western scientific knowledge. Although the dimension of spirituality is too broad to address in this paper, one key challenge is that the “rational” scientific method does not allow for the subjectivity that spirituality may suggest. Rather than trying to discredit IEK on this basis, perhaps examining the spiritual component of IEK can further our understanding of the logic and reasoning that underlies IEK. For example, recall the hypothesis presented in Section 5.2 that warmer temperatures in the 1990s were because the sun and earth were closer together than in times between the 1950s and 1980s. One could use this hypothesis to dismantle IEK or one could view such speculations as insights into the logic and reasoning processes underlying IEK. This may be the first step in bringing Inuit and non-Inuit knowledge of ecological relationships together and furthering our collective understanding.

Despite methodological challenges, my experience suggests that local knowledge has tremendous potential in providing very systematic, local, and detailed observations over a given period of time. These observations can contribute best both in and of themselves and as hypotheses for further research, as I have presented in this paper.

8.4 Closing Remarks

In this paper, I have presented a collection of Qitirmiut observations of climate change and climate change impacts and thereby demonstrated the unique and important ways in which local knowledge can contribute new information and enhance existing understanding of causal relationships. Specifically, that IEK is local in scale is one quality of IEK that differentiates it from other systems of knowledge and renders it best to contribute at various spatial and temporal levels on a small scale.

In an effort to demonstrate the utility of IEK as a starting point for further research, I formulated Qitirmiut observations into hypotheses and supplemented these with hypotheses that were not articulated by Qitirmiut, but which I suggest are likely realized by locals. In doing so, this research will facilitate further works in advancing both Inuit ecological and western scientific knowledge that will ultimately enhance our understanding of climate change and climate change impacts.

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Appendix A: List of Keywords for TNP

Keywords for Coding the TNP Interview Transcripts (English/Inuinnaqtun)

<i>Category</i>	<i>Sub Category</i>	<i>Sub-Sub Category</i>
Interview Information	date/qanga place/humi interviewers/apiqhuijut tapes/nipit maps/nunauyat	
Biography/inuuvia	born/inuuvia died/tuquyuq spouse(s)/aippait children/nutaqqat siblings	
Place Names/atiit nunat		
Camps/initurliit	winter/ukiug summer/aujaq spring/upiningakhaq or upin'ngakhaq fall/ukiaknaq travel/aullaaq	child/nutaraq youth/inulrammiq adult/inirnilrammiq elder/inirniq
People/Inuit	aging/getting old/inirinngulirniq white people/qaplunaaq families/qatangutiit traditions/pitquhiit culture/ilitquhiit olden days/ingilraat transition/nutaanguqtirniq story telling/unipkaarniq trap trapping/naniriaqtuqtut	lots of words
	snare trapping/nigaqtaqtuq starvation/aqiarualiqutut trading/niuwaajuq caribou hunting/tuktuhiurniq survival/ayuqhaqtut	
Residence/Iglu	previous/past/ current/present/tajja future/qakugu	
trading/niuwaajuq Posts/niuva	CanAlaska HBC/kapanit	

Travel Routes/aullaariarniq	early spring/upin'ngakhaq late spring/upin'ngaaq summer/aujaq early fall/akiaknaq fall/ukiaq winter/ukiuq travel to sea/ataaqpaqtun travel inland/tigvau getting ready to go/haniyutut	
Caribou/tuktut	behaviour/pitquhiat	feeding (diet)/niriniaqtut heat relief/niglaqhiqtuq mosquitoes/kikturiat instinct/ learning/ayuiqhaqtut mortality/tuqutpalliavaktut moving/aulaniq overheat/ivyan'nguyuyq postpartum/nurralliuqtaaramik pregnancy/najjitaqtuq

caribou/tuktu	habitat	impacts heat relief/niglaqhiqtuq shade/tarrarmi water/imaq
	human usage/inuit atuqpagait	bedding/qaaq clothing/aannuraat medicine/havaut sewing-clothing/miqhuq tools/ingilrutit traditional foods/ingilraat niqigivagait caribou hunting/tuktuhiurniq
	movements and migrations/ingilrauillu at	spring migration/kilumuuqtut fall migration/atiqtat daily/ubluq tamaat water crossings/naluktut or nalluq land crossings/nunapkuuktut winter grounds/ukiiviit summer grounds/auyiviit leaders/hivuliqtit aggregation/katimavaktut
	names/atiit	cows/kulavak bulls/pungnik calves/nurraq cow with no calf/nurraituq young bull/anguhalluq young summer fur/hagvaaruqtuq thick winter fur/tulruhiyuq belly fur/pukiq winter caribou/pitikaakkat summer newborn calves/auyalingnik yearling/nukatukkaa fall caribou/ukiakharnitaq spring caribou/upin'ngaaliq
	post calving/nurritaaqhutik	grounds
	population/qaffiniit	changes/aallannguqtirniq comparison/aajjikuhiurniit/aajjikkiiktirutin herd interaction/aallatqiit tuktut katitpakt Island caribou

caribou/tuktu

predators/niqikhaqhiuqtut

wolf/amaruq
grizzly/akhaq
human/Inuk
other/aallat
musk-ox/umingmak

range/

condition
location/humi

Gender	division of labour politics power traditions/pitquhiit other	
land use/nunamik aturniq	exploration and development mining/uyarakhiuqtut	pros/good/naamaaktuq impacts locations/humi cons/bads/iuangittuq recommendations/pitququayut trust/ukpiruhuktat
	hunting grounds/tuktuhiurviit tourism/aquivigiyaayut traditional land use/ingilraat nunamik atuqpauhiit visiting/pulaaqtut fishing/iqalukhiuqtut seals/nattiit bears/akhat	
Scientists/	interactions with/katimayut other/aallat	
Youth/inulrammiit	advice to/uqautivagait education/ilihaiyut camp/initurliit elder-youth/iningnirit-inulrammiit other/aallat	
Project/havaanguyuq	comments/uqautigiyait dating/qanga Inuit consultant/inuit ihumatuyut money/manik validity/itquumattiarniq/ keyword/uqautigilluaqtait text/titiraqhimayut	
Terms/uqauhiit or attiit	(Inuinnaqtun words)	
rules/maligakhat	culture/pitquhiq customs/ caribou hunting/tuktuhiuqniq	
Placenames/Nunat attiit		

