INUIT OBSERVATIONS OF ENVIRONMENTAL CHANGE AND EFFECTS OF CHANGE IN ANAKTALÂK BAY, LABRADOR

by

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Abstract

As in many arctic regions, impacts of increasing environmental stressors such as climate change and industrialization (particularly mineral exploration and mine development) have led local Inuit in northern Labrador to notice changes in their environment. In addition, they have expressed concerns that research and monitoring programs aimed at understanding and tracking these changes are lacking in many areas and do not accurately reflect their knowledge and concerns. Many communities feel powerless in the face of these changes as they lack the resources needed to respond. In consideration of this, an integrated regional approach has been initiated in Nunatsiavut to ensure concerns from all stakeholders, including Inuit as well as major industrial and governmental organizations, are adequately addressed.

The purpose of this study was to further the understanding of environmental changes in Anaktalâk Bay (the shipping route to the Voisey's Bay Nickel mine) and the effects of these changes on local Inuit in order to inform the development of a multi-partner monitoring (MPM) program for the area. The research was conducted using a participatory approach that included documenting Inuit knowledge (IK) obtained during a workshop involving 14 long-term residents of Nain (>25 years; both genders) in December 2006. Trends identified during the transcript analysis highlight that often the most severe perceived effects on Inuit occur when environmental stressors work synergistically. Key linkages between environmental changes and effects were also identified.

The workshop findings document the local desire for a monitoring program to track ecosystem-based changes, as well as the social, economic and environmental effects of these changes, to ensure that Inuit are able to mitigate these changes, and adapt when mitigation is not possible or sufficient. Workshop participants voiced an interest in participating in future monitoring activities and it is anticipated that program development will give both researchers

and community members an opportunity to continue to work together and learn from each other, in order to develop and implement relevant and appropriate local solutions. Ultimately, this program should begin to address the Inuit desire in this region to strengthen and protect their relationship with the environment.

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List of Abbreviations

ABEKC	Arctic Borderlands Ecological Knowledge Co-op
ACIA	Arctic Climate Impact Assessment
AK	Aboriginal Knowledge
ESG	Environmental Sciences Group
IK	Inuit Knowledge
IPCC	International Panel on Climate Change
LIA	Labrador Inuit Association
MPM	Multi-Partner Monitoring
MKO	Manitoba Keewatinowi Okimakanak
NG	Nunatsiavut Government
PC	Parks Canada
SE	Sikumiut Environmental
VBNC	Voisey's Bay Nickel Company

Chapter 1: Introduction

In many northern regions, increasing environmental stressors such as climate change, modernization, industrialization and their resulting impacts have led local inhabitants to notice changes in their environment. In such situations, it is important to develop mitigation and adaptation strategies in order to reduce, and possibly even prevent, damaging changes and their impacts (Huntington, Callaghan et al. 2004). Integral to the development of such strategies is a thorough understanding and monitoring of the environment. However, this information is not well documented in many northern environments given that the scientific studies required to gain this information are often costly (Fenge 1997). In addition, many of the studies that have been conducted focus on one of these stressors in isolation, which is not how these stressors actually affect people in their daily life; "to many people on the ground, their daily concerns about weather and sea ice shifts are hardly separated from other critical issues, such as oil and mineral exploration, contaminants, animal rights campaigns, and land-claims negotiation" (Krupnik and Jolly 2002: p.3).

The purpose of this study is to identify and understand the environmental changes that have occurred in Anaktalâk Bay and the effects of these changes on local Inuit, as well as to document participant monitoring desires for this area.

1.1 Origin and Evolution of the Study

The present study evolved over time as more information was learned about Inuit concerns and research needs through discussions with residents of Nain and the Labrador Inuit Government, the Nunatsiavut Government (NG). As Figure 1 indicates, the study was initiated in January 2006 when a proposal was submitted to the ArcticNet Centre of Excellence to study three fiords in northern Labrador, including Anaktalâk Bay. This proposal involved a multi-disciplinary team of researchers, industry and government, including the NG and the Environmental Sciences

Group (ESG), located at the Royal Military College of Canada, who were co-leads in the study. The goal of the study in Anaktalâk Bay was to address Inuit concerns regarding the ecological integrity of the marine environment by acquiring a better understanding of the impacts of industrialization on the bay. Inuit were concerned with the potential environmental impacts of new nickel-copper-cobalt mine and mill that Voisey's Bay Nickel Company (VBNC) started operating in 2006 on the land adjacent to Anaktalâk Bay. The impacts of winter shipping were of greatest concern to Inuit as the port is located in the bay and the ship's route traverses much of the bay.

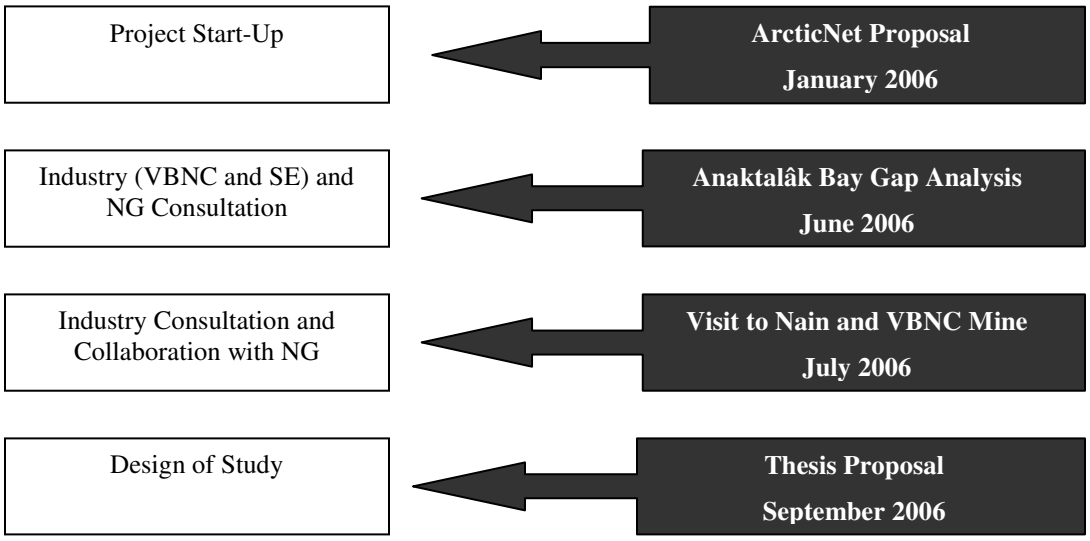

Figure 1. Steps Taken to Develop the Research Purpose and Objectives.

In order to gain a better understanding of Anaktalâk Bay, all of the existing scientific information and Inuit knowledge (IK) about Anaktalâk Bay was compiled in a report. This information was presented at a stakeholder meeting in June 2006, which included representatives from VBNC, NG, Sikumiut Environmental (SE - an Inuit owned environmental consulting company with an office in Nain), Parks Canada (PC – concerned about the effects on the newly established Torngat National Park Reserve in northern Labrador) and ESG. At this meeting, gaps

in knowledge were identified and it was agreed that there was a need to increase the understanding of the Anaktalâk Bay marine ecosystem, especially the relationships between the different parts of the ecosystem, from Inuit perspectives. This was not a surprise, as these gaps in environmental knowledge are often uncovered in the development of monitoring initiatives in the north, especially where aboriginal groups are involved (Sallenave 1994).

A visit to the VBNC mine and mill site, and the community of Nain, was carried out in July 2006. The purpose of the mine visit was to increase the knowledge of the current monitoring programs in operation at the site. This was facilitated through meetings with VBNC environmental health and safety staff. In addition, several days were also spent shadowing and talking with one of the NG environmental monitors to discuss Inuit views of the monitoring programs. In Nain, informal meetings with NG staff and community members were held to discuss Inuit views regarding the direction and method of the research project. The results of the discussions expanded the scope of the project in Anaktalâk Bays to include potential impacts from all environmental stressors, including, but not limited to, climate change, harvesting and the mine and mill. In addition, the effects of these environmental stressors on local Inuit were also included in this expanded focus.

These three activities in the research process (i.e. the ArcticNet proposal, gap analysis, and visit to Nain and mine) helped form the final purpose and objectives of the study, which are discussed below.

1.2 Research Purpose and Objectives

Labrador Inuit have noticed changes in the environment over the past several years. As they rely on the environment for food, transportation, health and sometimes income, it is important for Inuit to be able to track the changes that are occurring in order to identify ways to mitigate

problems where possible, and adapt if needed. In order to develop an effective multi-partner monitoring (MPM) program, the environment needs to be examined at a holistic level. Through the data compilation process, it was discovered that numerous scientific and several IK studies have been conducted on the bay, which have increased the knowledge of the ecosystem components. However, many of these studies were conducted more than ten years ago and as such it is unknown whether the information they contain is still accurate. In addition, many gaps still exist, especially in regards to the relationships between these components, as well as the current changes and effects of change that are occurring in Anaktalâk Bay and the surrounding ecosystem. Furthermore, the relationship between the environment (including the associated changes) and local Inuit have yet to be fully investigated. The purpose of this study is to increase the current understanding of Inuit perspectives of environmental changes, as well as the effects of these changes, on the environment in Anaktalâk Bay and the local Inuit.

The objectives of this study, as developed in consultation with local Inuit and other stakeholders, were:

1. To document IK and observations of environmental change in Anaktalâk Bay and the effects of these changes on local Inuit in order to increase our understanding of this area.
2. To document Inuit desires and recommendations regarding monitoring of the Anaktalâk Bay environment.

It is important to note that the results of the study represent the *participants' understanding and perceptions* of the events that are occurring in their environment and how they are affecting their community. The study did not attempt to verify those changes that can be quantified and/or measured since this was not the intent of the study. For example, reports of a

change in wind direction or thinner ice during certain times of the year were not further investigated or verified quantitatively.

In order to ensure that the results documented in this thesis accurately portray the participants' views, several participant verification meetings were held. These meetings gave participants a chance to review the information documented in the thesis, as interpreted by the researcher, and to make any necessary changes. This process is discussed in more detail in section 4.5.

1.3 Organization of Thesis

The remainder of this thesis is organized into seven distinct chapters. First, a review of relevant literature is included in Chapter 2. This chapter is followed by a more detailed description of the literature as it relates to Anaktalâk Bay, in order to provide the necessary background to the research project. Chapter 4 describes the methods that were used to conduct the research, including a brief review of the literature related to methods used in similar studies. The results of the study are stated in Chapter 5 and are illustrated by participant quotes and summary tables. This chapter is broken up into several sections, including participant characteristics, Inuit boundaries of Anaktalâk Bay, Inuit observations of change and effects of change, linkages between changes and effects, monitoring suggestions and finally linkages between changes, effects and linkages. Overarching themes that emerged from the workshop proceedings are the focus of Chapter 6, and include effects from climate change, modernization, industrialization, cumulative effects, monitoring and gender differences. The last section of this chapter addresses the recommendations that emerged from this project. Finally, Chapter 7 summarizes the conclusions of the research project. Supplemental material appears in the appendices following the last chapter.

Chapter 2: Literature Review

2.1 Introduction

This chapter details the academic literature that was needed to inform the project design, as well as to interpret the results. This includes a description of environmental stressors that have been documented in the Arctic, the principles of MPM programs and a summary of IK.

2.2 Arctic Environmental Stressors

Environmental impacts on Aboriginal peoples' traditional lands have been of growing concern over the past decades. Stressors such as climate change, industrialization, contamination, tourism and harvesting activities, either alone or in combination, have the potential to affect the environment in these areas. Often these changes affect other ecosystem components, as well as the economy, society and health of Aboriginal peoples and their communities (McCarthy and Martello 2004). Impacts from some stressors, such as climate change, may be easily observed by local residents, however, those from other stressors, especially contaminants, are much more difficult, if not impossible, to observe. This uncertainty, especially with regard to the safety of country foods and drinking water, leads to much concern in communities. In many northern communities, residents feel that they have no control over these changes and their impacts. In addition, the results of environmental sampling analyses and/or monitoring activities conducted by local industry and/or outside researchers are not always effectively communicated to people in these communities.

While effects of climate change are being felt all over the world, the Arctic is experiencing the most severe changes (ACIA 2004; Duerden 2004; McCarthy and Martello 2004). Many scientific studies have focused on climate change issues; these include large-scale studies and reports such as the Arctic Climate Impact Assessment (ACIA) and the International

Panel on Climate Change (IPCC), as well as studies aimed at understanding specific processes (e.g. ice melt). Aboriginal knowledge (AK) studies aimed at documenting arctic residents' environmental knowledge, observations and perceptions of changes and effects have been increasing since the 1990s (Duerden 2004). Not surprisingly, both AK and scientific studies have documented similar effects and changes, such as increasing storm frequencies, shifts in wildlife location and range and related economic and social impacts of these changes (Duerden 2004). Changes in sea ice conditions and snow cover have also been documented (Fox 2002; Duerden 2004; Communities of Labrador, Furgal et al. 2005; Laidler 2006). Residents in the north are most concerned about the impact of climate change on "the structural integrity of buildings, modifications of the community economic base, impacts on traditional food harvests and transportation, and shifts in industrialization, flooding, forest fires, and landslides" (Duerden 2004: p.205). The unpredictable nature of the weather and sea ice are also of specific concern; these concerns will continue to rise as the frequency and severity of the variability also increases (Duerden 2004).

While the majority of effects of climate change appear to be negative, some positive changes have resulted as well. For example, an increase in the abundance of plant foods, such as berries, have allowed some people to collect more berries to eat, store and even sell (see sections 5.4.5 and 5.5.1 for more details). New species of wildlife are also appearing in communities, some of which may be new source of country food for residents.

Every year, more scientific and AK studies that address the impacts of climate change are created and conducted. Many of these are based on large geographic areas, such as those of represented in the ACIA and IPCC reports, and provide general trends of climate changes and their social and environmental impacts (Duerden 2004) to decision-makers, namely government agencies. These studies provide federal governments with the information necessary to make

policies that are appropriate for large and diverse geographic areas. However, the variable nature of the composition of communities and local environments in the Arctic necessitate the inclusion of place-based studies, which can be used to formulate appropriate mitigation and adaptation strategies at the community level (McCarthy and Martello 2004). Examples of recent place-based studies include those documented in "Voices from the Bay" (McDonald, Arragutainaq et al. 1997) and "Unikkaaqatigiit- Putting the Human Face on Climate Change: Perspectives from Labrador" (Communities of Labrador, Furgal et al. 2005). As Duerden (2004) notes, these studies recognize that "changing environments will be experienced differently in each of the communities dispersed across Canada's highly diverse northern landscape…[and] even communities within the same eco-zone may experience different effects from identical climate-related events because of marked local variations in site, situation, culture and economy" (p. 205). Although climate change is an important environmental stressor in the Arctic, it is clear that there are others that need to be considered. This need is highlighted by the responses of Inuit in the eastern Arctic, who focused on a variety of stressors when asked specifically about the effects of climate change (Duerden 2004).

Another cause of environmental stress in the north is industrialization. Activities such as resource extraction, shipping and military surveillance are among the most common forms of industrialization in the Arctic. Increasingly, developers are taking advantage of the many rich mineral, oil and gas deposits are found in the north, as well as the numerous opportunities for development of hydro-electric power and logging projects (Sallenave 1994). While these developments have provided jobs for northern residents, they have also caused concern in many communities, especially in regards to the environmental effects of the projects. A second environmental stressor is the presence of northern military sites, such as the Distant Early Warning Line, which have released polychlorinated biphenyls (PCB) into the environment of

many northern areas in Canada, including coastal areas in northern Labrador (Kuzyk, Stow et al. 2005). Oil spills are another well-known source of water contamination in the Arctic. One of the largest spills to date is that from the Exon Valdez, which occurred in Alaska in 1989. This prompted the aboriginal Alutiiq people to voice their concerns about the restoration program for the area, as well as to demand to have their knowledge and observations included in the research (Bliss, Aplet et al. 2001).

Effects of industrialization are not limited to activities occurring in the north; long-range transport of chemicals released from industrial activities in the south are carried via the atmosphere and deposited in the Arctic (McCarthy and Martello 2004). This includes chemicals such as PCBs, dichloro-diphenyl-trichloroethane (DDT) and metals (e.g. mercury) (Barrie, Gregor et al. 1992). These potentially toxic chemicals have been found all over the Arctic and in almost all the parts of the environment (e.g. soil, water, air, wildlife, plants, etc.) (Barrie, Gregor et al. 1992), including country foods (Duerden 2004). For people who live in the north, the most visible manifestation of these chemicals is the phenomenon of arctic haze in the winter months. Many of the contaminants are lipophilic, thus they bioaccumulate in fatty tissues of animals and may also biomagnify through the food chain. Fatty country foods, such as seals and whales, pose a particular concern to arctic residents since these animals often contain high levels of contaminants.

Although they will not be discussed in this thesis, it is important to note that other factors may affect and/or contribute to societal (including health and economic) changes observed in communities. For example, effects of past events, such as the relocation of Inuit to formal settlements, as well as children's experiences in residential schools, have changed many aspects of contemporary Inuit culture. These changes may be the primary cause of changes in communities, or they may interact with other changes, such as those previously mentioned (i.e.

climate change, modernization and industrialization) and further discussed in the remainder of this thesis.

Although these environmental stressors often interact to produce cumulative effects, most of the scientific and AK studies to date have focused on documenting changes and effects of single stressors (McCarthy and Martello 2004). There are many probable explanations for this trend, most of which focus on money, time and difficulty. For example, studying cumulative effects often increases the scope of projects, which require more time and money to plan and execute. In addition, it can be difficult to establish causal relationships when examining cumulative impacts. Climate change appears to be the most frequently studied stressor, which is most likely due to its increasing impact in communities all over the world. However, recognition of the importance of studying cumulative impacts is growing and is being acknowledged by large-scale reports such as the ACIA. Furthermore, AK studies are increasingly being used to document climate change impacts in the north. Although the problem of establishing casual relationships still remain (McCarthy and Martello 2004), these studies can help increase the understanding of environmental changes and their impact on communities, which "governments and other decision makers [can use] to help them identify and implement appropriate approaches to ameliorate the effects" (Duerden 2004).

2.3 Inuit and Aboriginal Knowledge

Harvesting activities, both commercial and subsistence, are an integral part of Inuit life in the Arctic. Commercial harvesting provides an income for many Inuit, while subsistence harvesting provides fresh food in relatively remote locations, where these may be otherwise expensive, unavailable or of poor quality. Harvesting takes place year round, although the specific activity varies from season to season.

While Inuit are harvesting, they have an especially close relationship to the environment as large amounts of time is spent outdoors during these activities. In addition, Inuit have learned to pay close attention to the environment as the success of harvesting activities is highly dependent on local knowledge of the environment (Huntington 2000; McCarthy and Martello 2004). Such knowledge includes but is not limited to: weather and ocean circulation patterns; animal migration, habitat and population patterns; plant locations; and environmental stewardship. In the literature, this type of knowledge is given a variety of names, including AK, local knowledge and indigenous knowledge, with accompanying varying definitions (Usher 2000; Huntington, Brown-Schwalenberg et al. 2002). To ensure the clarity of information in this paper, all of these forms of knowledge are referred to as AK, which refers to "the system of experiential knowledge gained by continual observation and transmitted among members of a community" (Huntington 1998: p.237). Furthermore, for the purposes of this paper, the knowledge that specifically pertains to Inuit is called IK. As the definition alludes to, AK is passed from one generation to another through cultural traditions such as oral histories and stories as well as experiential teaching and learning (Turner, Ignace et al. 2000). Aboriginal knowledge is also transferred within members of the communities through everyday discourse (Turner, Ignace et al. 2000).

Aboriginal knowledge is not evenly distributed between members of a community (Grenier 1998). As noted by Hawley (2004), "certain individuals within the community may be considered more knowledgeable about certain aspects of life" (p.40). In addition, AK is comprised of the collective knowledge of residents in an area; thus, residents' knowledge as a whole should be included in order to gain an accurate picture of the AK in a community (Hawley, 2004). A number of factors, including age and gender, determine the type and extent of AK an individual possesses (Grenier 1998). As AK is mainly developed and transferred through

experiential learning, it makes sense that older people would possess more IK; elders are usually thought to hold greater knowledge than younger residents (Hawley, Sherry et al. 2004). However, it is important to note that elders who no longer use the land are not as knowledgeable about current environmental changes (Kofinas, Community of Aklavik et al. 2002).

Gender is a key determinant of AK. Traditionally, the responsibilities in a community, as well as in a family, are divided between men and women (Grenier 1998); similar trends have also been observed in Inuit societies (Berkes and Jolly 2001). For example, in the collection of food, men are often responsible for hunting, while women focus on activities such as processing and preserving food. As a result, "women's and men's knowledge reflect their labour responsibilities" (Grenier 1998: p.29). It is important to note that, until recently, AK of women has been viewed as inferior to that of men in many communities (Grenier 1998); however, the AK from both genders must be included in order to obtain an accurate picture of a community's AK.

Aboriginal knowledge has numerous strengths. According to Davis and Wagner (2003), "one of its greatest strengths is that it is dynamically mutable, in so far as it has the capacity to incorporate each new generation's experiences, understandings and needs, thereby remaining current and vital" (p.467). In addition, AK is holistic, as it considers reciprocal and interactive relationships between components of the environment (Grenier 1998; Turner, Ignace et al. 2000). Rarely is one aspect of the environment, which includes ecological, as well as social and economic aspects, discussed without reference to at least one other component. These strengths illustrate some of the benefits of inclusion of AK in environmental monitoring and decision-making.

Many researchers and decision-makers have expressed doubt regarding the validity of AK (Huntington 2000). However, several studies have shown that information based on AK is often consistent with the results of scientific studies (Grenier 1998; Kofinas, Community of Aklavik et al. 2002; Huntington, Callaghan et al. 2004). It is important to note that AK, similar to science, is not infallible and should be verified (Usher 2000). Verification can take place by comparing the AK to scientific information, although this approach is under debate as AK and science often represent different subsets of knowledge and are thus difficult to compare (Usher 2000; Huntington, Callaghan et al. 2004). More commonly, this verification occurs in research through a participant verification process (see section 4.5 for more details on participant verification).

In terms of knowledge of environmental stressors and their effects, arctic communities have much to contribute. Furthermore, they are eager to contribute, as they are the ones who are feeling the effects of these changes. As Krupnik and Jolly (2002) note, "Arctic Indigenous people have a special stake in modern studies of global environmental change. They also have a lot to contribute – when and if they are given the chance and the appropriate means to participate fully in the ongoing global change discourse" (p.2). For example, the information resulting from AK studies has been used by many communities to inform decision makers (e.g. governments and industry) of their knowledge, needs and rights regarding natural resource management (Davis and Wagner 2003). The potential to build capacity and empower communities through AK studies is vast, and must be acted upon.

2.4 Monitoring

Increasingly, communities in all parts of the world are partnering with industry, government and academic researchers to develop and build on monitoring programs in response to concerns about

changes in their local environment (Bliss, Aplet et al. 2001). As noted by Krupnik and Jolly (2002), this is especially true in the Arctic, where "residents are witnessing far-reaching changes in their environment, and they are ready to create partnerships with scientists, to document their observations and to make their voices heard" (p.3). Through the development and implementation of MPM program, Aboriginal peoples can respond to these changes and 'make their voices heard'. As the name implies, MPM program aims to bring together interested parties (e.g. government, citizens, industry, etc.) in a monitoring partnership. The purpose of the partnership is to build on existing monitoring programs, as well as to identify and fills in the gaps between these, in order to increase the "understanding of particular issues and/or places" (Milne, Rosolen et al. 2006).

Multi-party monitoring programs are gaining popularity for several reasons. First, as previously mentioned, their development is often driven by increasing concerns in communities regarding local environmental issues such as pollution of water and country foods from industry (e.g. mining, forestry and oil). This type of monitoring is often referred to as advocacy monitoring (Whitelaw, Vaughan et al. 2003). Second, MPM programs can empower communities. Appropriate communication of monitoring results can increase residents' knowledge of the local environment, which allows communities to identify changes and thus help them mitigate the cause or adapt to the change (Duerden 2004). In turn, this empowers residents to have control over their lives (Freire 1970; Cuthill 2000; Milne, Rosolen et al. 2006). As Cuthill (2000) notes, "without accurate monitoring data it is difficult to determine either human or natural impacts on marine systems or specific sites, or how to respond accordingly" (p.128). This knowledge can also be used to inform decisions by industry and government that may impact, directly or indirectly, the community. By establishing partnerships with governments

and/or industry, transfer of knowledge to decision-makers can be increased (Whitelaw, Vaughan et al. 2003).

In addition, MPM programs can empower communities by increasing their involvement in the development and implementation of monitoring activities. Many communities lack the capacity required to develop and participate in these programs (Brian 2006; Milne, Rosolen et al. 2006); however, partnerships between communities and resource-based industries such as mining have been shown to accelerate "the momentum for stronger participation by First Nations" (Brian 2006: p.81). Other partners can include government and non-governmental agencies (Brian 2006; Milne, Rosolen et al. 2006).

Several monitoring programs in northern Canada have been built upon monitoring partnerships, all of which include AK to varying degrees (Autsyl K'e Dene Elders, Ellis et al. 2002; Autsyl K'e Dene Community Members, Krieger et al. 2005; Brian 2006). There is an opportunity to learn from and build upon their experiences. The first example focuses on the Autsyl K'e Dene First Nation in the Northwest Territories (Autsyl K'e Dene Elders, Ellis et al. 2002; Autsyl K'e Dene Community Members, Krieger et al. 2005). A monitoring plan was "of critical importance for the traditional territory, particularly due to the unprecedented resource pressures the region ha[d] experienced in the recent past from diamond mining, hydro and tourism interests" (Autsyl K'e Dene Elders, Ellis et al. 2002: 7). The community was very concerned about the cumulative effects of these pressures; it was hoped that the monitoring program would address these concerns, as well as base the monitoring program on the AK of the Dene. Researchers partnered with community members to develop and implement this program. The first phase of this project focused on documenting AK of environmental change in the area, which led to identification of potential monitoring indicators. In the second phase, the context for

these indicators was sought to help in their interpretation. This was achieved by documenting oral histories and legends. Knowledge gaps from the first phase were also filled at this time. An AK-based environmental monitoring plan was developed and tested during the third phase, which focused on tracking both natural and un-natural changes in the local environment. The monitoring trial lasted one year, after which time the program design was re-visited and necessary changes were made.

The Arctic Borderlands Ecological Knowledge Co-op (ABEKC) is the focus of the second example. In this case, government agencies, indigenous communities, First Nations, Inuvialuit organizations, university researchers and co-management boards formed a collaborative alliance to carry out monitoring of the effects of climate change, contaminants and regional development on the migration range of the Porcupine Caribou Herd (Kofinas, Community of Aklavik et al. 2002). This area includes both the United States (Alaska) and Canada (Yukon and Northwest Territories), and was chosen since these caribou are considered a keystone subsistence species by local aboriginal communities. Regional developments of concern in these areas include both oil and gas exploration projects (e.g. the Mackenzie Valley Pipeline). The ABEKC is relatively unique, in that it "is not a one-shot research project but an effort to establish on ongoing monitoring program that will be maintained into the future" (Kofinas, Community of Aklavik et al. 2002: p.58). In addition, the program addresses impacts from multiple sources, as previously mentioned. A major strength of this program is its incorporation of existing monitoring activities into the overall monitoring program, which includes both scientific information and AK. The ABEKC illustrates one way in which these two systems of knowledge can be complementary; aboriginal peoples' observations of environmental change can serve as early warning signals that can be furthered investigated by scientific inquiry (Kofinas, Community of Aklavik et al. 2002).

The last example illustrates one aboriginal community's response to the effects of mining on their environment. In the early 1990s, Aboriginal harvesters from Manitoba Keewatinowi Okimakanak (MKO), located in northern Manitoba, noticed a change in the taste of their drinking water, as well as a change in the taste of country foods harvested from areas close to a copper-zinc mine (Wavey 1993). As a result, these harvesters refused to drink the water, and eat fish or beaver caught in this area. To address this concern, a joint initiative between the MKO and Environmental Protection Laboratories was developed. Based on interviews with MKO harvesters, sampling sites and sampling components were identified, which were then included in the development of an AK-based monitoring program. In addition to being based on AK, the monitoring program was also directed and operated by MKO residents (Wavey 1993).

2.5 Summary

Individuals who inhabit and utilize a certain environment can provide detailed and valuable knowledge regarding their environment (Huntington 2004), which explains why researchers are utilizing the knowledge of local inhabitants to increase their understanding of northern environments. This knowledge can be used to inform the development of monitoring programs, which can track changes in the environment, and communicate these findings to decision-makers, as well as to the communities. With this information, appropriate changes to policy, as well as daily living practices, can be implemented to help reduce the effects of these ever increasing environmental changes.

Chapter 3: Anaktalâk Bay Background

3.1 Introduction

This chapter presents a more focused literature review as it pertains to Anaktalâk Bay, including a brief description of the geography and ecosystems in Anaktalâk Bay, the history of human activities in the bay, potential environmental stressors and current environmental monitoring activities.

3.2 Geography and Ecosystem

Anaktalâk Bay is a fjord located in northern Labrador (see Figure 2). The shoreline in the bay is scattered with peat-lands, as well as moraines and large boulders, and is bounded by forested valleys and rocky mountains. Numerous islands of varying size are found throughout Anaktalâk Bay.

The climate in the bay is relatively harsh as it is located in the transition zone between arctic and sub-arctic climates. In the coldest months (January and February), the average temperature is approximately -18.5°C, while the summer months (July and August) bring averages of approximately +10.5° C (Environment Canada 2002). Precipitation normally falls in the form of snow from November to May, with averages depths ranging from 15cm to 104cm (Environment Canada 2002). The area commonly experiences gale force winds year round with prevailing winds coming from the northwest (Williamson 1997; Environment Canada 2002). The maximum wind speed ranges from 65 km/h (August) to 117 km/h (December) (Environment Canada 2002).

The marine ecosystem in Anaktalâk Bay is composed of a variety of organisms including marine mammals, fish, plants, algae and microscopic organisms (see Appendix A for a diagram

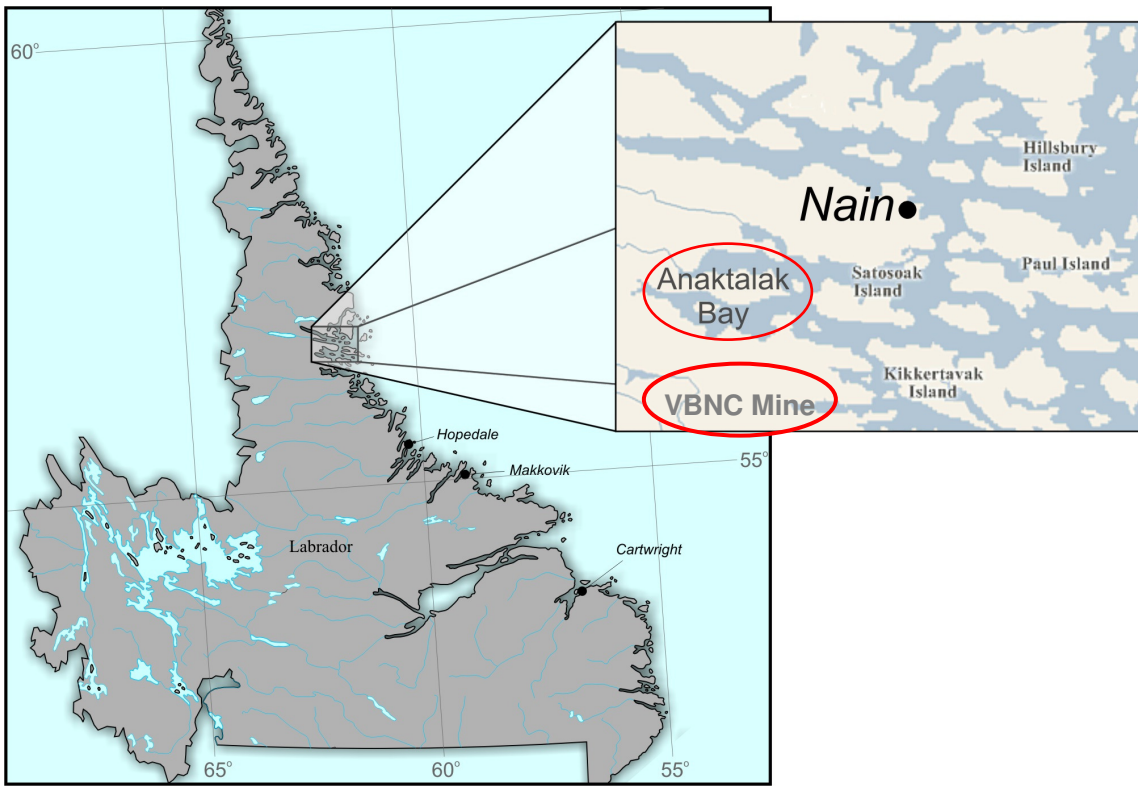

Figure 2. Location of Study Area (Anaktalâk Bay, Labrador).

of the arctic marine ecosystem). Some common species include, but are not limited to, seals (ringed, harbour, grey), whales (narwhal, minke, beluga), fish (arctic char, rock cod, capelin), invertebrates (mussels, scallops), berries (bake apples, partridge berries), seaweed, and birds (partridges, seagulls, black guillemots). While information regarding many of these individual components has been studied and documented (Golder Associates Ltd. 1997; Newfoundland Geosciences Ltd. 2003), information on the interactions between these components is lacking.

The terrestrial ecosystem around Anaktalâk Bay has received less scientific attention than its marine equivalent. This is partly due to the fact that most studies were carried out to satisfy environmental assessment requirements for the VBNC mine and mill in the late 1990's, and the major concerns of people at the time regarding this development were marine based (e.g. the

effects of winter shipping on the ice and effluent discharge into Edward's Cove). Large mammals (e.g. caribou and black bears), fur bearers (e.g. foxes, wolves), birds (e.g. raptors, songbirds), berries (e.g. blue berries and red berries), trees and insects (e.g. black flies) are common species of flora and fauna in this area. Several of these species were also included in the marine ecosystem description above, which reflects the inter-connectedness and overlap between these two ecosystems.

As with the marine ecosystem, the terrestrial studies have documented some information about these ecosystems, however, there are still many gaps in our knowledge. In particular, the linkages between these components are especially lacking. Furthermore, the inclusion of humans in the ecosystem, as well as the effects of the changes in the rest of the ecosystem on humans, is also lacking. Although several studies have investigated the relationship between environmental changes due to climate change and Inuit, especially health, in northern Labrador (including Nain) (Nickels, Furgal et al. 2002; Furgal, Martin et al. 2003; Communities of Labrador, Furgal et al. 2005), more studies are needed to identify the impacts of environmental change on Inuit in this area.

3.3 Human Activities and History

The closest human settlement to Anaktalâk Bay is Nain, which is located 35km northeast of the bay. Nain is the northernmost community in Labrador and had a population of 1,034 people in 2006 (Statistics Canada 2006), the majority of which are Inuit. The next two closest communities are Natuashish and Hopedale. Residents from all three communities continue their traditional use of the land and water in this area for subsistence and commercial harvesting.

Harvesting activities are an integral part of Inuit life in northern Labrador (Williamson 1997). Commercial harvesting provides an income for many Inuit, while subsistence harvesting

provides fresh food in relatively remote locations, where these may be otherwise expensive, unavailable or of poor quality. Harvesting takes place year round, although the specific activity varies from season to season (Williamson 1997). For example, seal hunting, ice fishing and egg collecting occur in the spring season whereas berry picking, open-water fishing, and arctic hare, seal, caribou and bird hunting occur in the autumn season (Williamson 1997).

Since IK is an oral tradition, for the most part, it is not well documented (Huntington 2000). The Nain region of Northern Labrador is an exception to this statement. In response to the environmental impact statement and environmental assessment process initiated by the VBNC proposal, several IK studies were conducted. However, many Inuit women from this area felt that their knowledge and concerns were not properly researched and documented during this process (Archibald and Crnkovich 1999). In addition, they felt that VBNC had failed to carry out research on the impacts of the mine on Inuit women. One report that was commissioned by the Labrador Inuit Association (LIA) documented IK from both men and women, and highlighted women's IK in a separate chapter. This report, entitled "From Sina to Sikujaluk, Our Footprint: Mapping Inuit Environmental Knowledge in the Nain District of Northern Labrador" written by Tony Williamson and published in 1997. Ten years have passed since the publication of most of these documents, and during this time there have been many changes in the Anaktalâk Bay environment. For example, the VBNC mine and mill was built and started operations during this time. In addition, effects from climate change are continuing to be felt in the Arctic (Fenge 1997; McDonald, Arragutainaq et al. 1997; Riedlinger 1999; Berkes and Jolly 2001; Furgal, Martin et al. 2003; Huntington 2004; Communities of Labrador, Furgal et al. 2005; Ford, Smit et al. 2006). Thus, there is a need to revisit IK of the environment in this area to take into account these changes, in order to compose a more accurate account of the area.

3.4 Potential Environmental Stressors

Several environmental stressors, including humans, have the potential to impact the Anaktalâk Bay ecosystem. Climate change effects have already been documented in many parts of the Arctic, including northern Labrador (Fenge 1997; McDonald, Arragutainaq et al. 1997; Riedlinger 1999; Berkes and Jolly 2001; Furgal, Martin et al. 2003; Huntington 2004; Communities of Labrador, Furgal et al. 2005; Ford, Smit et al. 2006). However, it is likely that there are other stressors at play as well. Northern Labrador has become more industrialized in recent years, with the development of projects such as the VBNC mine and mill in Anaktalâk Bay, which began operations in 2005. This mining operation, as well as harvesting (commercial and subsistence), also have the potential to stress the local environment.

In 1993, several mineral deposits were discovered in northern Labrador, including one large nickel, copper and cobalt deposit located just below the earth's surface (called the ovoid) on the land between Anaktalâk Bay and Voisey's Bay. Several years later, in 1996, VBNC proposed to build a mine and mill at this location. They intended to first mine the ovoid in an open pit and then switch to an underground mine once the ovoid deposit was exhausted. The mined ore would then be concentrated to nickel sulphide concentrate or copper sulphide concentrate in the mill and finally shipped for further processing via an on-site port. The company estimated that the mine and mill would operate for approximately 30 years.

VBNC's proposal to build this complex triggered an environmental assessment in 1997. At this time, a joint federal and provincial environmental assessment panel was created since the project was situated on land that was currently under land claims disputes by Labrador Inuit and Innu. This panel conducted hearings and consultations between 1997 and 1998, and included IK in the process through submissions from the LIA (now called the Nunatsiavut Government (NG)).

Labrador Inuit had many concerns about the project, especially in regards to the potential effects of shipping on the marine ecosystem as well as on Inuit travel and harvesting during periods of ice cover. Submissions from VBNC included reports from studies that they had funded to investigate the effects of the mine and mill on the local marine and terrestrial ecosystems. For the most part, the marine studies were limited to the Edward's Cove region of Anaktalâk Bay since the company believed that this area represented the footprint of the mine and mill. In contrast, the LIA believed that the marine impacts would extend to the end of Anaktalâk Bay and were therefore more extensive than VBNC claimed (see Appendix D for maps representing each view).

In 1999, the panel made many recommendations regarding various aspects of the project. One of the most significant was that, pending Labrador Inuit consent, the project be approved by the federal and provincial governments. The Labrador Inuit Association gave this consent, and the project was approved. Approval of the project was also contingent upon the success of the company's mitigation measures. Furthermore, the panel recommended that further studies were necessary to understand the ecosystem and the environmental effects of the project. The creation of two agreements, the Impacts and Benefits Agreement and the Shipping Agreement, between the Labrador Inuit and VBNC were also recommended by the panel.

A Shipping Agreement was signed by both VBNC and LIA on March 30, 2005. As previously mentioned, Inuit were concerned about the effects of shipping on the marine ecosystem in Anaktalâk Bay, especially the effect on whelping seals, as well as the disruption of travel across the ice and the spring seal hunt. To reduce shipping during these times, the Shipping Agreement stipulated that winter shipping would be limited to four trips each season (January 22-April 6), and that no shipping would take place between April 7 and May 21. Inuit were also concerned that the ice would not form properly in the fall if ships were constantly breaking the ice, thus another shipping closure period was established from December 7 to

January 21. The Shipping Agreement also required that further studies be conducted in order to gain a holistic understanding of the marine ecosystem in Anaktalâk Bay.

The Impacts and Benefits Agreement contained many legally binding agreements, including the creation of a monitoring partnership between VBNC and LIA (now NG). The monitoring partnership is responsible for ensuring appropriate environmental monitoring of the project, as well as collaboration on environmental issues of importance to both Inuit and VBNC. In addition, the Impacts and Benefits Agreement included the provision that an Inuit environmental monitor would be on site at all times. This position is funded by VBNC. The role of the monitor is to be the 'eyes and ears' of Labrador Inuit on the site, and report any items of concern to the NG and/or the company.

In 2002, VBNC began construction of the mine, mill and port site on the southern side of Anaktalâk Bay. After three years of construction, they began open pit mining and mill operations in the fall of 2005 and shipping concentrate to markets in the south that November. Future initiatives include the development of the underground mine around 2018, as well as an expansion of the processing plant.

3.5 Environmental Monitoring

For as long as Inuit have lived in the area, they have tracked changes in their environment and made the adaptations necessary to ensure their survival and livelihood (Williamson 1997; Berkes and Jolly 2001; Riedlinger 2001). Most of these changes were the result of natural processes and occurred slowly, over long periods of time. This made it easier for adaptation to occur. Recently, though, Inuit have been noticing more changes in their environment; many of these changes are occurring so quickly that Inuit are finding it difficult to adapt (Riedlinger 2001; McCarthy and Martello 2004). These impacts need to be identified and monitored to allow all problems to be

identified and dealt with properly. In some cases, such as the effects from climate change, mitigation will not be possible. Instead, monitoring can provide Inuit with the information that they need in order to adapt to these changes, which, in many cases, is crucial for their survival.

Currently, the majority of monitoring programs that are in place in Anaktalâk Bay are those operated by VBNC. However, on behalf of NG and VBNC, SE has been collecting information from 30 Nain harvesters since 2002. This study documents the locations that harvesters travel to when they are out on the land, as well as the number and type of animals that they catch. Additional observations such as the health of the animals or any other pertinent information are often included. The results of this study indicate that some hunters are moving away from their traditional southern hunting spots, including those in Anaktalâk Bay and Voisey's Bay, to more northern areas. While this information would be very useful for decision-makers to have, as well as informative for community members, this information is not being communicated to anyone at the present time.

Most of the VBNC monitoring activities are compliance monitoring programs that are required by various federal and provincial regulations, as well as by legally binding agreements such as the Impacts and Benefits Agreement and Shipping Agreement. For example, the Metal Mining Effluent Regulation is one of the applicable federal regulations. This requires the monitoring of all three sources of effluent that VBNC discharges; Edward's Cove, South Sedimentation Pond and Port Sedimentation Pond. If these regulations are not met, VBNC could be held legally responsible for any potential impacts their operations have on the environment but only as a result of the violation. The ice along the shipping route is also monitored for VBNC by SE, especially for refreeze times, which fulfils one of the requirements laid out in the Shipping Agreement.

The Impacts and Benefits Agreement required that VBNC develop and implement an Environmental Effects Monitoring program to address Inuit environmental concerns not included in compliance monitoring. This program is supposed to be ecosystem based and "include meaningful participation of LIA…in all aspects of the environmental monitoring program in all phases of the development" (Voisey's Bay Nickel Company Ltd. 2006: p.1). As such, it focuses on components of the ecosystem such as plants, animals, air and water, but does not include humans - they were included in a separate socio-economic monitoring program, which is discussed in the next paragraph. The monitoring area is constrained by the boundaries of the project footprint (i.e. land between Voisey's Bay and Anaktalâk Bay, and water in Edward's Cove and along shipping route). The plan was implemented in 2006, although the results have yet to be released. A socio-economic monitoring program is also in the process of being developed by SE, on behalf of VBNC. It is unclear whether this program has been implemented.

While it is important to monitor the socio-economic impacts of the mine project, some of these effects are inextricably linked to the environmental changes and impacts of the project. The close link between the environment and people of the Arctic makes the relationship between them even stronger (Riedlinger 2001). For example, a decrease in commercially harvested species such as char might result from the effects of the mine (e.g. shipping disturbances, pollution, etc), which could result in financial problems for local harvesters. However, it appears that there is minimal cross-over between these two areas (i.e. environment and socio-economic) in the monitoring programs, which prevents a holistic view from occurring and thus problems to be addressed in the most effective way. Despite efforts from VBNC to communicate the findings of their monitoring programs to the community, especially those related to the status of ice along the ship's track (e.g. posters up in town, a toll-free phone number), many Inuit are not aware of, or do not trust, the monitoring results (Rowell, J. pers. comm. 2007). Instead of using these sources to

find out the safety of the ship's track, many people contact employees of SE that live in Nain (who conduct the ice monitoring) or an Inuit VBNC employee in Nain since they trust these sources.

It is important to note that Inuit concern about the environment extends beyond the effects of the mine and includes stressors such as climate change. As VBNC is solely responsible for monitoring impacts of the project, other monitoring programs are needed to track changes in the environment from other stressors, as well as in areas outside the footprint of the project. To address the effects of climate change and industrialization on the coast of northern Labrador, an ArcticNet funded research project called Nunatsiavut Nuluak was created in 2005. By studying three fjords, Anaktalâk (this study), Saglek (historic PCB contamination) and Nachvak (pristine national park), the project aims to identify and link environmental changes caused by climate change and industrialization. The project, with the exception of this study, is science-based. The information collected from all three fjords could help to fill in the gap regarding monitoring of environmental changes caused by climate change in Anaktalâk Bay. Voisey's Bay Nickel Company also funds this project, since they recognize that climate change is affecting the environment in Anaktalâk Bay, as well as along the rest of the Labrador coast.

3.6 Summary

The monitoring activities that are already occurring in Anaktalâk Bay are not sufficient to satisfy Inuit concerns. They do, however, contain information that would be useful to include in any future monitoring programs. This includes the development of a MPM program. In addition, there are multiple environmental stressors in Anaktalâk Bay which have the potential to interact with each other. Thus, it is also important to account for this in a MPM program.

Chapter 4: Methods

4.1 Introduction

In order to document IK and observations of environmental changes in Anaktalâk Bay and the effects on local Inuit, a workshop comprised of three focus groups with Inuit who have in-depth knowledge of the area was held. This participatory method was chosen as the primary research tool based on a survey of available literature on methods used to document IK and AK (Grenier 1998; Huntington 1998; Autsyl K'e Dene Elders, Ellis et al. 2002; Fox 2002; Huntington, Brown-Schwalenberg et al. 2002; Davis and Wagner 2003; Communities of Labrador, Furgal et al. 2005). However, it should be noted that methods used to document this type of knowledge is lacking in the literature. As noted by Davis and Wagner (2003), "even when reporting the results of specific case studies, many researchers fail to provide detailed descriptions of their methodologies" (p.468). In light of this fact, personal communication with a researcher who has performed similar research in northern Labrador was an invaluable source of methodological information (Furgal, pers. comm. 2006). The workshop, including the three focus groups, was video and audio taped and subsequently transcribed in its entirety by the researcher. The resulting transcripts were coded for themes and each theme was analyzed. Maps and other visual aids from the workshop were also documented and included in the coding.

4.2 Choice of Methodology

Focus groups are similar to interviews in that they function by facilitating discussions of interest to the researcher and the participants (Berg 2001). Facilitators, or moderators, often serve as the guide in these discussions; however, the degree to which the discussion is guided varies. Similar to one-on-one interviews, the discussion can be strictly guided (i.e. standardized interview), partly guided (i.e. semi-standardized interview) or unguided (i.e. unstandardized interview) by the

facilitator (Huntington 2000; Berg 2001). The number of participants in each group also varies between studies, as there is a lack of consensus among researchers as to what size of group is most effective. However, "one thing seems for certain: The more complex the research problem, the more effective it is to have smaller size (5-7 people) focus groups" (Berg 2001: p.130).

There are many benefits to using the combination of plenary and focus groups. First of all, it increases the efficiency and consistency of information presented to the participants at the beginning of each session in a plenary setting. For the main discussions, the limited number of participants in the focus groups optimizes the time available for all participants to speak and comment on others' ideas, which enables deeper and more detailed discussion than is possible in a large group (Grenier 1998; Huntington, Brown-Schwalenberg et al. 2002). In addition, workshops and focus groups allow participants to interact and draw information from one another. This can stimulate discussion on topics (Huntington 2000; Huntington, Brown-Schwalenberg et al. 2002), and also results in "a far larger number of ideas, issues, topics, and even solutions to a problem [to] be generated…than through individual conversations" (Berg 2001: p.112). Some researchers call this phenomenon the "synergistic group effect" (Berg 2001). Focus groups also give shy participants the chance to share their knowledge and thoughts in a less threatening situation (Grenier 1998). Furthermore, the accuracy of the information produced is often higher in groups than in individual interviews (Grenier 1998).

Workshops have been successfully used in similar studies where AK was has been sought to increase the ecological understanding of an area, including that of the community (Huntington 2000; Parlee, Basil et al. 2001; Clarkson and Andre 2002; Huntington, Brown-Schwalenberg et al. 2002). Community workshops and focus groups have also been used in studies to aid in the development of MPM programs (Milne, Rosolen et al. 2006), which is a goal of this research. Workshops allow for conflicting and supporting views to emerge and to be commented upon,

which is a benefit of this method (Grenier 1998). Another benefit of workshops in which researchers and holders of AK are both present is that "the two groups may also find common understanding and jointly develop priorities for management and future research" (Huntington 2000: p.1271). One large disadvantage of using workshops and focus groups is that "vocal people, people in positions of authority (for example, administrators, politicians), and men tend to dominate the discussion; knowledgeable individuals — women, the elderly, and people who are young or shy — may not participate fully, so some of the desired information may be withheld" (Grenier 1998: p.29).

4.3 Workshop

The purpose of the workshop was to document Inuit observations of environmental change in the Anaktalâk Bay ecosystem and the effects of these changes on local Inuit, as well as Inuit suggestions for future monitoring initiatives in the area. The workshop was held in Nain in December 2006 and took place over a period of two days. Nain was chosen as the workshop location as it is the closest community to Anaktalâk Bay; as such, residents of this community will feel the greatest effects of any environmental change in the bay.

4.3.1 Selection of Participants

A total of 14 participants were involved in the workshop. Appropriate selection of participants was important to ensure that valid and reliable information was documented from experts, as environmental knowledge is not equally distributed among communities (Davis and Wagner 2003; Hawley, Sherry et al. 2004).

A three-step process was used to select the participants. Since the researcher did not have intimate knowledge of potential participants in the community, the NG and PC, which are both located in Nain and thus have appropriate knowledge of the community, were asked to produce a

ranked list of people based on their relative knowledge of Anaktalâk Bay. This approach is similar to that described in Huntington (2000), where it is suggested that "the community council can be asked to help select the most knowledgeable persons" (p.1271). Both organizations were asked to include males and females, since the two sexes have been shown to hold different knowledge of an area, as well as have different concerns (Grenier 1998). In addition, they were also asked to include people of varying ages. Elders were important to include, as they had witnessed changes in the bay over the longest period of time. Young adults and children were excluded, as it was felt that they would not have had enough experience in the area to provide detailed enough information.

Once these lists were submitted, the researcher identified people who were included on both lists. These people were automatically placed on the participant list. The remaining participants were chosen from the original two lists, in discussion with the NG and PC. The factors that were used to determine the remaining participants were their knowledge of Anaktalâk Bay, as well as their sex. More males were included that females since, in Labrador Inuit communities, males use the area more for hunting and fishing than females do (Furgal, C. pers. comm. 2006). Thus, they have more in-depth knowledge on these harvesting activities, along with the related components of the ecosystems (e.g. animal migrations, population dynamics and size, etc). However, females often are more knowledgeable in other areas, such as berries and the quality of meat, since berry picking and food preparation are mainly performed by females in these communities.

The first two steps resulted in a list of 15 desired participants. These participants were contacted by the NG and invited to attend the workshop. Some of the selected participants were not able to attend, due to prior commitments, thus the second step was repeated and more

participants were selected to attend. After several repetitions of these two steps, a list of 14 participants was finalized.

The participants were then placed into one of three focus groups. The first factor used to determine group placement was gender. It was decided that the focus groups would be composed of the same sex, with two groups of five males and one group of four females. This decision was based on evidence that male and female Inuit hold different IK about the ecosystem and the community, and as such, discussions in each group would be more valid if members had knowledge in similar areas. In addition, Grenier (1998) highlights another important reason to separate males and females; "women often feel most comfortable among other women, and in some communities, women (especially younger women) keep quiet in the presence of men" (p.29).

The composition of the two male focus groups was decided based on two additional factors. First of all, members of the same family were put in different groups, as it was thought that they may have similar information to offer. By putting the participants in different groups, this information would be subjected to discussion, and thus verification, by two groups, rather than one. It was hoped that this process would increase the validity of the information documented in the workshop. The second factor used to determine the composition of the two male groups was age; as previously mentioned, IK is thought to vary with age, thus it was decided that it would be best for each group to include both elders, as well as younger participants.

4.3.2 Workshop Format

The format of the workshop was based on a strategy that has been successful in past workshops in Nain, as well as other northern areas in Canada (Huntington, Brown-Schwalenberg et al. 2002;

Communities of Labrador, Furgal et al. 2005). The workshop lasted two days, and each day was broken into four sections, for a total of eight sessions. In order, the topics of the sessions were introduction, boundaries of Anaktalâk Bay, understanding of Anaktalâk Bay, observations and causes of change in Anaktalâk Bay, effects of change, monitoring indicators and next steps. Only seven topics were covered, as the observation and causes of changes session required twice the amount of time to adequately cover. A complete description of the workshop format is included in Appendix E.

The first session allowed for an introduction of participants and facilitators, an explanation of the purpose of the workshop and signing of consent forms.

During the second session, the boundaries of Anaktalâk Bay were discussed, in order to clarify the area that people were referring to as Anaktalâk Bay during the discussions that followed in the remainder of the two days. This step was crucial, as there are many different views on where Anaktalâk Bay begins and ends, even within members of the same community. To facilitate and document this discussion, participants were asked to mark the boundaries on large maps, as shown in Appendix B. These maps extended south to Voisey's Bay, north to Nain, west to the land just inside Edward's Cove in Anaktalâk Bay, and east to the open ocean where some small islands are located. Participant comments were recorded onto flip chart paper by the recorder, which allowed for participants to make corrections or add further details to the notes if necessary.

The third session focused on increasing the understanding of animal migration, harvesting periods, and the timing of physical and chemical processes (e.g. ice freeze-up). Another key goal of this exercise was to establish linkages between various components of the ecosystem. Past studies (McDonald, Arragutainaq et al. 1997) have successfully used a seasonal

cycle diagram (see Appendix C) to facilitate discussion of these aspects in other northern communities, so it was decided that this method would be used in this study. Using the month or season as the starting place, participants related the details of the harvesting activities they generally take part in during this period. The diagram was also used to record and spark conversations regarding biological observations (e.g. wildlife migration times), as well timing of physical events (e.g. ice break-up). Participants were also asked to note any components that were related to each other on this diagram. For example, this pictorial representation of these relationships and activities also provided a recording method that was quick and easy for the note taker to use, and also easy for participants to understand.

Observations of change in the Anaktalâk Bay ecosystem were the focus of the fourth session. During this activity, participants identified changes they had observed in the bay, as well as the potential causes of these changes. These changes included biological (e.g., wildlife population numbers and health), chemical (e.g., salt concentration in the bay, contaminants, etc.) and physical (e.g., thickness of ice, direction of wind, etc.). The biological component was not limited to wildlife, as humans are considered part of the ecosystem in IK. The identified changes were recorded on cue cards by the note taker, and locations were noted on maps when necessary.

Participants were then asked if, and how, these observed changes were affecting them, as well as the community. This constituted the focus of the fifth session. Participant comments were recorded on the corresponding cue card to assist in ease of analysis.

It should be noted that in this study, *changes* only refer to changes in the Anaktalâk Bay environment, whereas *effects of change* are restricted to those felt by humans. It is possible that one environmental change may then lead to another environmental change. Instead of calling

these ‘effects’, they were labelled ‘first order’ changes and ‘second order’ changes. Further discussion of this topic occurs in section 5.6.

The sixth session focused on monitoring: what should be monitored, how it should be monitored, who should be responsible for carrying out the monitoring and how the results should be communicated to the community. In addition, the objectives and/or reasons for monitoring in Anaktalâk Bay were also discussed. Flip chart paper was used to record observations, and maps were used to record locations where necessary.

The topic of the final session was next steps. At this time, participants and researchers discussed how the results of the workshop would be used, and how participants would be included in this process. It was agreed that participants would view any documents related to this workshop before circulation, in order to ensure that their knowledge and observations were accurately reflected.

With the exception of the introduction and monitoring sessions, the sessions followed a similar format: a brief introduction of the topic and exercise for the session to the plenary, followed by focus group discussions of the topic, ending with a summary of findings from each group to the plenary as presented by the group facilitator. During each focus group session, participants were encouraged to speak to the topic identified in the plenary introduction. These sessions were semi-standardized. Facilitators were provided with a list of key questions to ask, however, they were instructed to use this only in the case of an extended lull in conversation. The decision to run the focus groups in this manner was based on a both a desire to encourage participants to take the conversation in a direction that they felt was important, with the recognition that there was limited time to address each topic. Sometimes, as an outsider, the researcher wondered about the relevancy of the topics being discussed in the focus group;

however, the information that resulted from these 'tangents' may not have been discovered if participants were interviewed separately, and/or asked a specific set of questions. This benefit has also been acknowledged in other AK studies (Huntington 2000). The main purpose of the plenary at the end of each session was to allow the entire group to comment on the other groups' discussions.

There were three facilitators in total, one for each focus group. Both the previous environmental coordinator for the LIA, as well as the current environmental coordinator for the NG were facilitators. These people were chosen based on their knowledge of the Anaktalâk Bay ecosystem, including some history of environmental stressors and change in the area, as well as their knowledge of and relationships with the residents of Nain. The researcher was the third group facilitator, as well as the facilitator for the plenary sessions.

4.3.3 Recording Methods

Several different recording methods were used to capture the IK and observations that emerged in this workshop. A note taker in each group kept written records using various methods. In addition, participants also created some written records. Several of these methods were mentioned in the previous section, however, they will now be expanded upon.

For some topics, note-takers recorded observations on chart paper that were visible to all participants in the group. This allowed participants to watch as their observations were recorded, and to make corrections when necessary. This helped ensure the accuracy of the recorded information. In other instances, index cards were used to document environmental changes. A separate card was used for each change. In the next session, effects were documented on the corresponding change card, where appropriate. This also allowed observations that had a

geographical context to be linked to locations on maps, by placing corresponding numbers (or letters) on the card and on the map.

Maps and diagrams (e.g. Appendix B and Appendix C) were also used to record observations. A large overview map was especially useful in the exercise where participants were asked to define the boundaries of Anaktalâk Bay; the map was made as large as possible in an effort to avoid confining the area participants could include in their definition. More detailed maps were particularly useful in documenting specific places that participants had noted environmental changes and effects. Similar to findings from other IK studies, the maps and diagrams also proved useful in helping to stimulate discussions (McDonald, Arragutainaq et al. 1997; Parlee, Basil et al. 2001; Fox 2002) and to convey information that is difficult to verbalize (Jolly, Berkes et al. 2002). As noted by Fox (2002), "even if they were not familiar with the maps, once they got oriented, many participants found the maps useful for communication and places on the maps would job their memories about some story or piece of information to share" (p.26). Maps have been found to be especially useful in workshops and focus group settings, where participants use the map to identify common areas of observations, similar observations in different areas, and areas of particular concern (Fox 2002).

In order to obtain accurate documentation of the oral workshop proceedings, video and audio recordings were taken for the entire workshop. These recordings were then transcribed in their entirety by the researcher onto a computer. The transcripts from each group were then coded as three separate groups using topical coding (Richards 2005) to pull out themes from the workshop. Nvivo, a qualitative software analysis program, was used to help identify all references to a particular theme, which were then stored in separate files to simplify the analysis process. Memos and notes were also added to the transcripts in order to record the researcher's thoughts during transcription and analysis. As previously mentioned, not all of the information

from the workshop could be analyzed or included in this report due to the size constraints. However, the researcher chose to transcribe the entire proceedings to make the information accessible to future researchers (they can be obtained by contacting the NG.) By personally transcribing the proceedings, the researcher also became very familiar with the observations. This information was invaluable during the analysis process, as the researcher was able to include observations that may have been lost if someone else had transcribed the proceedings (Richards 2005). In addition, the familiarity with the material allowed the researcher to better understand what was said and thus more accurately portray and interpret the results.

After transcription, each focus group was analyzed separately. This separation occurred for several reasons. As previously mentioned, verification of knowledge within groups is an advantage of this workshop format (Furgal 2006). However, this would not hold true if the information were mixed subsequent to transcription. In addition, this method enabled the identification of overlapping observations between groups, as well as gender differences in observations. Observations that appeared in more than one group were important since it could be inferred that they represented observations that were unanimous or nearly unanimous, which increased their validity (Davis and Wagner 2003). For data analysis, it was important to keep the knowledge between genders separate in order to represent female and male views. As previously mentioned, several visual aids were used during the workshop to stimulate discussion, as well as to document IK. Information from these aids was incorporated into the resulting coding categories whenever possible.

Although every effort was made to ensure that the coding of themes was consistent throughout the transcripts, it is important to realize that this process is somewhat subjective. Studies have shown that what one researcher deems as a reference to a specific topic and thus codes, another may not (Richards 2005). When these topics are analyzed and written for

inclusion in reports, the researcher is also exerting their own bias through the selection of quotes and topics to include. Due to the subjective nature of qualitative research, it is important for participants to verify the researcher's interpretation of the information. This is especially true when the information that is presented is an attempt to document other people's knowledge.

4.4 Selection and Organization of Results

Since the entirety of the workshop proceedings were transcribed, an abundance of information was documented. Not all of this information is discussed in this thesis, as it was too large. However, it is hoped that all of these results will be used in the future to enhance our knowledge of environmental changes and their effects on the ecosystem, including local human communities. The definition of Anaktalâk Bay and its boundaries, changes and effects of change, as well as monitoring, were the categories selected to be included as this information will be most useful to aid in the development of a monitoring program. Each of these categories is presented as a separate chapter in this report to make the information easier to find. Ideally, changes and effects would be presented together as these observations are often linked. However, due to the organizational structure of the results chapter (as described in the next paragraph) this was not possible. Instead, separate sections are included that illustrate the relationship between environmental changes and effects of change, as well as changes, effects of change and monitoring recommendations. The identification of these relationships will help inform the development of the monitoring program, as changes that have the most effects on community are most likely to be desired components of this type of initiative.

There was also an abundance of information within each category, which meant that further selection was required. The selection of information to include in each category was based on the occurrence of this information in the three groups. These selections were not only

made to ensure that a manageable amount of material was presented, but also to increase the validity of the reported observations. According to Davis and Wagner (2003), "one of the more important principles that has been reported [in the literature]… is that of assigning the highest reliability to information that has been verified by several local experts" (p. 485). Based on this evidence, all information that was mentioned in all three groups was included, as these observations are the most reliable. Next, observations that were deemed important and/or unique by the researcher and appeared in two groups were included. Although information that is uncorroborated is usually omitted (Davis and Wagner 2003), the researcher chose to include some observations that only appeared in one group. In these cases, the observations were often confirmed by other group members, which enhances the reliability of these observations. It was especially important to use this discretion when selecting observations from the female group, as they have been shown to possess different knowledge than males in many cases (Grenier 1998). If this information had been excluded, a valuable source of IK would have been lost.

4.5 Participant Verification

In order to verify the information that emerged from the workshop analysis, workshop participants were asked to meet with the researcher in October 2007. Members of each group were then invited to attend a dinner (males and females separated), or drop in at their leisure if they could not attend, to discuss this information. Five males (50% of male participants) and three female (75% of female participants) participants attended the verification meetings. The results of the workshop were presented using a computer slide show. The presentation was conducted in English and simultaneously translated into Inuktitut (during the male verification only since the female who required translation was unable to attend the meeting). The summary tables of changes, effects and monitoring recommendations that are presented in Chapter 5 (i.e. Table 2, Table 3 and Table 5) were used to convey most of the observations. The overarching

trends that are discussed in Chapter 6, including the effects of climate change, modernization, industrialization and cumulative effects, were also included. Whenever possible, diagrams and tables were used to present information, to make the information more accessible, as well as to highlight the key points. Finally, the presentation concluded with suggestions on how the information from the workshop could be used, which included a discussion of the development of a monitoring program.

Feedback during the verification meeting suggests that the vast majority of information was conveyed correctly. Several minor adjustments, such as the description of crawlers and the spelling of place names, were recommended by participants and subsequently incorporated into this paper. Participants commented on several observations made during the workshop by providing information as to the status of these changes and effects since the workshop. These updates were also incorporated into this paper.

4.6 Limitations of Method

Although the workshop method provided numerous benefits to this study, several limitations of this method were encountered. These included limitations with the methods used to record the information, as well as the factors that may have affected accuracy of the information that was documented.

As previously mentioned, participants were chosen based on their use of Anaktalâk Bay in the past, and thus their knowledge of the area. While transcribing the proceedings of the workshop though, it became apparent that several participants, for many reasons, had spent limited time in the bay since the mine was built. Some of these reasons included their dislike of its presence, concerns about potential contamination, the atmosphere, and hassles signing in and out of the site. Thus, some of the participants' observations may not be as current as desired.

The participant form determined how often people go hunting and fishing, however the location of these activities was not limited to Anaktalâk Bay.

A translator was used to converse with several participants. While the translators made every effort to maintain the accuracy of their translations, some accuracy and detail may have been lost in this process. As Hawley (2004) noted, "it is difficult to express or convey certain concepts and values using English as opposed to an indigenous language" (p.38). This did not affect the results of the study, as only two people used translators and both people were able to understand English, but felt more comfortable speaking in Inuktitut. Since they could hear and understand the discussions occurring in their group that followed their contributions, they would have been able to tell if the information was mistranslated. In addition, many of the participants spoke both Inuktitut and English, and therefore could understand when the participants were speaking Inuktitut.

Although efforts were made to standardize the area that we would talk about for the workshop, the definitions of Anaktalâk Bay between, and even within, groups varied. Thus, it is difficult to know what areas the observations that were discussed pertain to. In addition, many observations people were noting could have been from Nain, and not Anaktalâk.

4.7 Summary

A workshop that combined both focus groups and plenary sessions was the main method used to document IK and observations in this study. This method was chosen to give participants the most chance to voice their concerns and their observations in a limited amount of time. The use of focus groups allowed for the separation of genders and thus the chance to compare observations from both sexes. In addition, this arrangement was selected to maximize participant

comfort levels during discussions. The information that resulted from this workshop will be discussed in the following chapters.

Chapter 5: Results

5.1 Introduction

The results of the study are highlighted in this chapter. They are broken down into several sections: participant characteristics and demographics, boundaries of Anaktalâk Bay, observations of changes, observations of effects, linkages between observations of changes and effects, monitoring recommendations, and the linkages between observations of changes, effects and monitoring.

5.2 Participant Characteristics and Demographics

A total of 14 Inuit participated in the workshop- ten men and four women. At the beginning of the workshop, all of the participants were asked to voluntarily fill out participant profiles. Out of these 14 participants, almost all of the males (nine out of ten) completed the profile, whereas only half of the females (two out of four) responded. Therefore, the following information is representative of the male group (90% response rate), as well as the entire group (80% response rate), but the information from the females cannot be considered representative due to the low rate of response (50%).

The ages of the participants are shown in Figure 3. The age of the entire group ranged from 30 to 69 years, with the majority (36%) of participants in the 36 to 45 year age bracket. This was also the most common age bracket for the male participants (40%). Although two female participants did not provide a profile, after meeting these individuals, the researcher estimates that they would also be part of the 36-45 year age bracket. This means that the majority of female participants (75%) would also fall into this category.

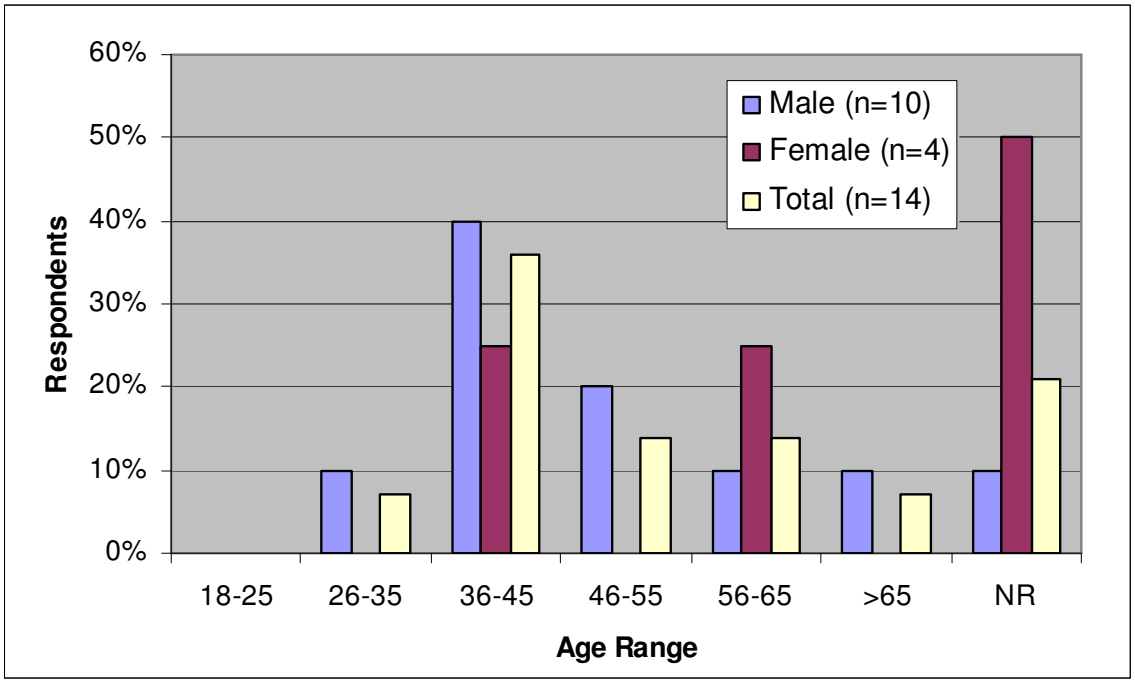

Figure 3. Age Range of Participants.

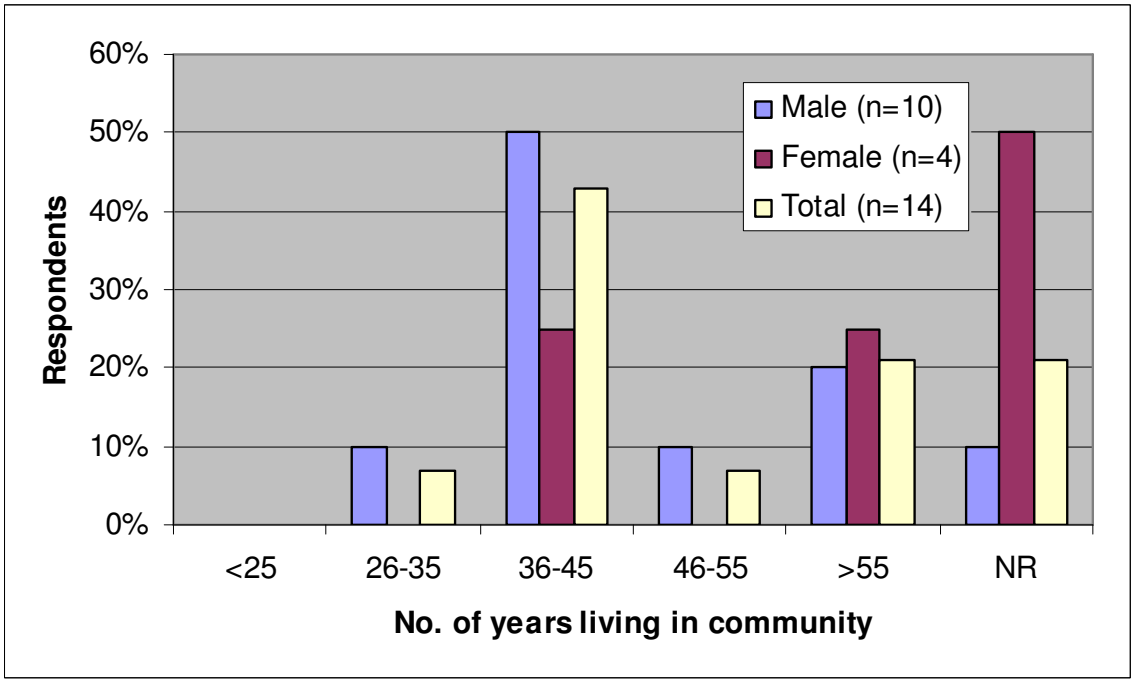

Figure 4. Residence Times of Participants Living in Nain, Labrador (NR=no response).

The age ranges that participants started being involved in harvesting activities (i.e. hunting, fishing and berry picking) are shown in Figure 5. All the participants that responded indicated that they started harvesting before they were 15 years old, with most participants indicating that they started harvesting before the age of five (29%). Three age ranges tied as the most common (30% each) ages that male participants started harvesting; 5 and under, 6-10 and 11-15 years of age. Only one female responded to this question, and indicated that she started harvesting by the age of five.

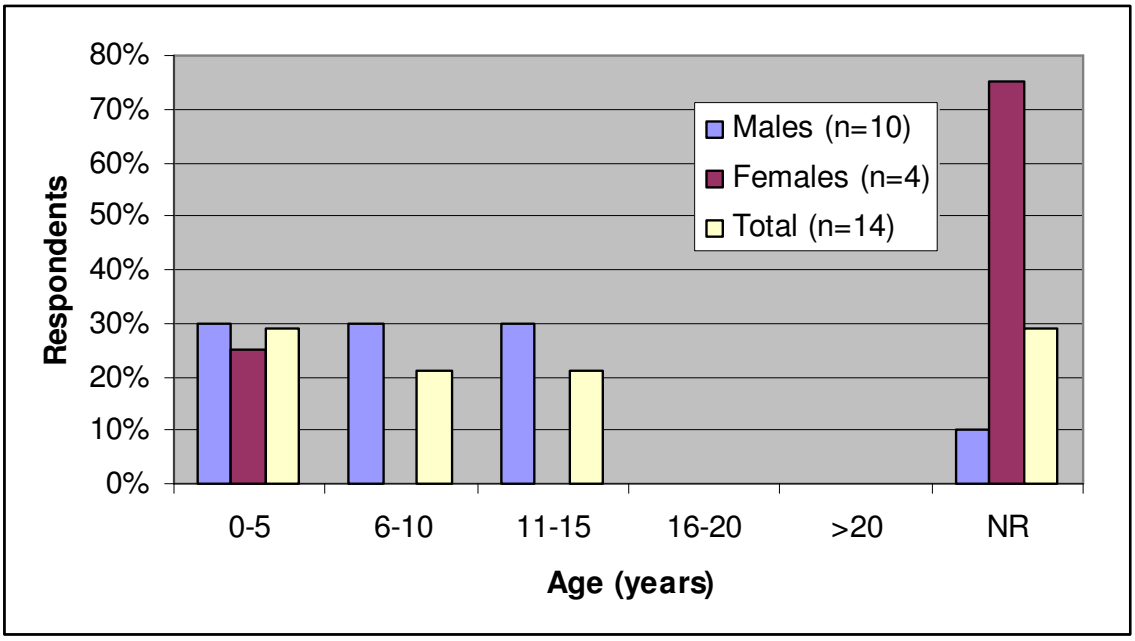

Figure 5. Age that Participants Started Harvesting Activities, including Hunting, Fishing and Berry-Picking (NR=no response).

The frequency of participant's involvement in hunting, fishing and berry picking are shown in Table 1. Since this was an open-ended question on the profile form, participants responded using various time frames, some of which were very vague. This makes it difficult to compare the frequency of harvesting activities (i.e. hunting, fishing and berry picking) between participants. One conclusion that can be drawn from the responses is that all participants that

responded still participate in all three types of harvesting activities in the area, although to varying extents.

Table 1. Participant's Frequency of Harvesting Activities.

Sex	Frequency of hunting	Frequency of fishing	Frequency of picking berries
M	3-4 times/week	5 times/year	5 times/season
M	Whenever gets a chance and weather cooperates	Whenever gets a chance and weather cooperates	August, September and October
M	Every year	Every year, all year	When the berries are ready to pick; August-October every year
M	Not everyday as before	Whenever I feel like it	Whenever the berries grow and are available
M	As much as work or weather permits	Different times for different seasons	Fall and spring
M	A few times, mostly when needed	More in the summer time when the fish start coming out of the rivers	In the fall
M	Every weekend	Several times a year	Every fall
M	Every chance I get	Every chance I get, depending on seasons	In the fall
M	3-4 times/week	Depends if I get enough at once	Every fall when berries are ripe
F	Every weekend if possible, weather permitting, but realistically twice/month	Couple weeks in summer, month in spring, couple weeks in fall, couple times during winter	3-4 times/year

As was stated earlier, the participant selection factors included age, sex, as well as length and frequency of harvesting activities in Anaktalâk Bay, since all of these variables could contribute to the amount of IK and observations the individual would possesses relating to Anaktalâk Bay. The above figures and table illustrate that the participants who responded fit this criteria, and as such, should possess a reasonable amount of IK. Specifically, most participants had harvested in the area for at least 20 years, with the majority having harvested for

approximately 40 years on a regular basis. This long-term, regular exposure to the environment allows participants to build-up large numbers of observations, and thus refines their IK of their surrounding environment.

5.3 Inuit Boundaries of Anaktalâk Bay

One of the first sessions in the workshop asked participants to define what they meant geographically when they referred to Anaktalâk Bay. This exercise was necessary since many people have different opinions of the boundaries of this area and it was important to know which areas participants were talking about in the two days of discussion that followed. Participants in each group were not required to come to a consensus, although many did.

As previously mentioned (see section 4.4), not all observations are included in the result section due to an abundance of information. The observations that are included in this section, as well as the following results sections, include all unanimous observations (i.e. observations from all three groups), as well as select observations that were near unanimous (i.e. observations from two out of the three groups) or that only appeared in one group. These selections were made by the researcher based on the perceived importance of the information. Efforts have been made to provide an idea to which group(s) each observation is attributed; however, if it is unclear, summary tables are included at the end of most sections in the results chapter, which link each observation with its corresponding source.

5.3.1 Area of Importance

All three groups agreed that the land that is important to them is a large area that encompasses both land and water. This area includes the mine site, but extends much past it, out to where the effects of the mine will be felt. As can be seen in the map in Appendix B, the town of Nain is included in this definition, as well as to the north of the town. The ocean, out past the small

islands to the open water is the eastern border, and the land and water just south of Voisey's Bay represents the southern border. The western border on the map found in Appendix B does not include much land since the initial intention of the workshop was to focus on the marine ecosystem. Many people indicated that the area that is important to them goes much farther inland than is shown, and was included in the workshop discussions.

> "All that area here [land below Nain Bay to Voisey's Bay, including land and out to inside edge of outer islands] is all important, to all of us I think. It's not just that area there…The area where the mine is, wherever you want to talk about. It's all that area cause all that's going to be affected, going to affect the wildlife and it's going to affect us. What we eat, go hunting, live off the land."

5.3.2 Definitions of Anaktalâk Bay

Participants in two groups defined Anaktalâk Bay based on the extent of the ecosystem, which encompasses much more land and water than just Edward's Cove. The mixing of the water that occurs with tides and currents, as well of the migration of animals (e.g. seals, fish, caribou), connects Anaktalâk Bay with Voisey's Bay, Anaktalik Bay and the open ocean. The knowledge that the whole area is "all connected anyway with tides, with the tides going in and all the animals migrating through there" is true all year, even when ice covers most of the bays.

> "For me, Edward's cove is all connected to all the bays with all the tides. Low tide, high tide. Water comes out, goes into here…high tide…like that. And Voisey's Bay and goes back to Edward's Cove, something like that."

Anaktalâk Bay is very important to Inuit since "every part of that [is] being used by Inuit already" and has been used for many years. Land and water use is not limited to Anaktalâk Bay though; it extends to the borders of the map (see Appendix B). Numerous activates take place in Anaktalâk Bay and surrounding areas, including hunting, fishing, berry picking, travelling, boil-

ups and spending time at their cabins. When people are discussing Anaktalâk Bay and its boundaries, it is usually in relation to one of these activities. As operations at the VBNC mine have begun, people also relate their use to the mine activities, such as winter shipping.

> "The shipping route is only going through there [Anaktalâk Bay] and even through here [outer islands between Voisey's Bay and Anaktalâk Bay]; the Inuit use all of that as roads during the winter. In the spring it's already used by Inuit. And these areas here [bottom of map by outer islands of Voisey's Bay] are a useful area for char, the commercial char fishery. I wrote down the boundary of where...used...this area [almost whole of large map] and that's how the people understand...Even north of Nain, you can say all belong to this particular area here [Anaktalâk Bay]."

The area that people define as Anaktalâk Bay often depends on what activity they are talking about, as well as in which season the activity occurs. For example, different boundaries of Anaktalâk Bay are used when talking about harvesting activities, including winter caribou hunting, open water seal hunting, and fishing.

> "Depends though cause you've got char migrating and if you're going when they come out of the brook first, you're probably going to go up here [Edward's Cove and brooks] farther, but if they're doing their run in or out [length of Anaktalâk Bay], you could go out farther. It's all this run [whole of Anaktalâk Bay]."

The definition also varies depending on time the time of year. For the same activity, such as caribou hunting, the boundaries are different in the winter and in the summer. This is partly because different access routes are based on the ice conditions (i.e. frozen and safe to travel on skidoo, or open water for boats), as well as the presence of snow on land for skidoo travel.

Two different definitions exist for Anaktalâk Bay; one for hunting and access routes, and one for the ecosystem. Inuit are aware that these two definitions exist and they believe that they

are both necessary in order for people to convey the correct information when talking about locations of places.

> "Like what I'm trying to say, I know that's all affected by the water and all that. Like if we're going hunting here [island east of Sâttusuak] we don't say we're going to Anaktalâk. Even though that's affected by all of the same things."

Inuit have used, and continue to use, Anaktalâk Bay for many different activities. Based on theses activities, two different sets of definitions exist for Anaktalâk Bay. One is based on harvesting activities, including seasonal differences with harvesting the same species. The other is based on the extent of the Anaktalâk Bay ecosystem and its interactions with neighbouring water, land and wildlife. It is important to keep these definitions in mind when reading the following chapters, especially observations of changes and effects of change, as people may mean different areas when referring to Anaktalâk Bay. However, in the observations made in the workshop, most people use Anaktalâk Bay to refer to the entirety, or at least the majority, of the large Anaktalâk Bay map (Appendix B).

5.4 Inuit Observations of Environmental Changes in Anaktalâk Bay

Many themes emerged during the workshop transcript analysis, a number of which represent components of the marine and terrestrial ecosystems. This section will focus on the changes that have been observed in the Anaktalâk Bay ecosystem. Components that are discussed include: weather, atmosphere, water (salt and fresh water), ice, vegetation and wildlife.

5.4.1 Weather

All groups agreed that the prevailing winds have changed directions. Northerly winds used to be dominant, but lately the prevailing winds are to the west. Strong winds come later in the fall now. These northwest winds used to arrive in September, but these winds are usually felt in

October now. This makes bird hunting more enjoyable for people since there is less of a chance of getting caught on the land.

> "After the bird season opens, everyone goes off bird hunting and the wind picks up and you get caught out. These past two, three years (2003-2005) it's better, the winds are calmer."

People are used to seeing lots of snow on the land and ice in the winter. There used to be so much snow in the winter that it would bury houses and trees. In recent years, there has been much less snow on land and ice in Anaktalâk Bay, as well as to areas north of Nain. Some possible reasons for the lack of snow could be due to stronger winds blowing the snow away, or less snowfall due to a late first snowfall. Winds are a likely possible cause, since several people noted that the snow blows away easier and faster than it used to. The resulting lack of snow causes travel by snow machines to be much harder than it used to be.

> "Seems like the measurements we were taking the last two years, snow on the ice, there's not so much snow on the ice."

The weather has been changing a lot during the last couple of years. There has been more bad weather, stronger and faster winds, more rain and freezing rain in the winter, and warmer temperatures all year, especially in the winter. The temperature fluctuates more now, especially in the winter. This affects the type of precipitation that falls, which may account for the increase in rain and freezing rain that has been observed in the winter. There is less rain in the summer and the rain is occurring at different times. It used to rain for one month, but last year they only had three weeks. The rain is also starting earlier; it used to start in August but last year it began in mid-July. These changes make it much harder for Inuit to predict the weather, which is crucial for their survival when out on the land.

> "Everything's changed today…we had a few good cold weather spells and its mild again."

> "We had rain a couple of times in January and February. That's weird, that is. Weather like that."

5.4.2 Atmosphere

There has been an increase in dust in the Anaktalâk Bay environment, both in the air and on the land, ice and snow, especially around the mine site. The summer is a particularly bad time for dust in the air as the weather is so dry at this time and the wind easily blows the dust around. The female group also noticed an increase in smog over the last several years. The smog and haze are especially bad in the summer around Nain.

5.4.3 Water

Inuit from all groups noted that Camp Pond and Reid Brooks were contaminated due to previous mine spills. There is uncertainty whether this is still the case.

The water temperature of the ocean has been observed to be warmer now. Inuit are also worried that the ocean is getting fresher, especially in and around Edward's Cove. VBNC releases large amounts of treated wastewater into Edward's Cove, which people think may dilute the salinity of the water in Anaktalâk Bay. Females observed that the salt water ponds around Nain are becoming shallower, and some have even dried up.

> "When you go hiking or walking in Nain area, not talking about Anaktalâk area, all the little ponds are all dried up. Dried up ponds."

5.4.4 Ice

Break-up and freeze-up times have also changed and are unpredictable, according to members from all three groups. Break-up used to occur in mid-June every year, but in recent years break-up has been occurring in May, about two or three weeks earlier than normal. In 2006, the ice broke up even earlier; that year it happened in March. Some people think that the earlier break-

up is partly caused by the VBNC ship breaking ice, since the ice has been noted to go earlier around the ship's track. The timing of freeze-up is also changing. Freeze-up used to occur around the end of December, but lately, freeze-up has been happening much later, usually around Young Men's Day (January 25th). The cause is unknown, but some Inuit think the earlier break-up may be caused by climate change and/or by normal climate cycles. The sea ice edge (sina) is closer to the land now, which some people think may be due to climate change as well.

> "You can see the difference now, with climate change. Usually some time right after Easter, the brook starts opening up...but it's getting different all the time. It's hard to say now when exactly the brooks will open up. And there was sometime even in May when a lot of people used to go inland. It's hard to say now what the weather condition's going to be like sometimes we have an early freeze-up and all of a sudden, mild weather comes on. So, it's hard, hard to say now…at one time the bays used to freeze over first, before the outer islands where people go to their camping places and when the bays were frozen over, the rest of the bays froze over and sometime they could be able to come home for Christmas when it froze over."

As well, normal changes in the ice are happening at a faster rate. For example, break-up and freeze-up are occurring much faster than they used to. This makes it very difficult for Inuit to know when it is safe to travel on the ice.

Dust and concentrate have also been noticed on the ice. In the springtime, Inuit observed that there is a lot of dust on the ice in the harbour. Some people have noticed the concentrate blow off the ship and form black spots on the ice.

Inuit have also noticed a lack of water on top of ice lately. During the spring melt and break-up, water used to sit on top of the ice. Now, the water seems to soak through the ice like a sponge, which prevents water from staying on top of the ice. Some people are scared because this 'sponge' effect has also made the ice soft.

> "One of the things that we've noticed too is that it used to get watery too, the ice, deep water, you can go up through it and there'd be deep waves all the way across the run. Now it's just watery and it just soaks through and it's the texture of the ice, it's soft. The water drains through without any drain holes. I mean, there's a certain number of drain holes, but years ago it would be a lot of drain holes and you'd see the water going into those drain holes. Now the water's all there, but it just settles through everything. So that's the scary thing that is."

Some participants observed that rattles (areas of open ice) are appearing earlier than they used to in the spring. Some have even appeared before the end of April, which is unheard of.

> "This year too, the cracks on the ice, they tend to thaw out more in that area a lot faster than before."

Lately the ice has been weaker, less solid and forms in layers. The layers are made up of alternating sections of hard and soft ice. Some people do not even think it is ice and they call it hard snow instead. The strength of the ice seems to be dependent on the presence of snow; snow makes the ice turn slushy.

> "It's not ice, it's not solid ice. Like if you get nice clear days like this, it freezes, freezes solid ice but like…it gets snow on it, it's still ice but it's like a slushy or something…if we put any heat to it, it disappears…but with solid ice we could even heat and take forever to melt. It's like…all slushy now… it's not hard ice, it's just hard snow."

Women have noticed several changes in the ice that may be related. For example, they have observed that there is less salt in the ice now, which may partly explain why the ice formation is different lately. It has also been suggested that the wind and/or tides may play a role in this process as well.

Participants used to see water on top of the ice in the spring, which they perceived as the top of the ice melting. Water is usually not seen on top of the ice anymore, which makes people

think that the ice is melting at the bottom, instead of at the top. It is also thawing faster in some places. The change in ice formation may be the cause of this different thawing pattern.

> "And it seems like the, I know some years that the ice can be thawing from the bottom but in the past it used to thaw more from the top because of the heat, but now it seems now it's thawing from the bottom rather than the top of the ice."

5.4.5 Vegetation

All groups observed that berries are now bigger and more plentiful than usual. In 2006, many people were able to pick more berries to make jam for the winter and to fill their freezer in a shorter period of time.

> "I don't know what happened but there was berries everywhere! One week we had enough berries for the wintertime!"

Trees and plants around the mine site are now coated with dust. Inuit are concerned that the dust will affect these plants.

> "When you're talking about the dust blowing from there up on...think about the trees and the plants that grow on them going to be affected."

Trees have been seen drying up around Anaktalâk Bay and in Ten Mile Bay as well. This also happened in the past, about six years ago, but at a slower pace. At this time, some of the trees died. People have suggested several reasons why they think this is happening now, including an infestation of insects and/or an increase in mice, which eat the tree bark.

> "Everywhere. It happened six years ago...they were all dried up there too."

5.4.6 Wildlife

All three groups noted that less caribou have been sighted and there are less available to hunt now. This observation is confirmed by tracking of satellite collars (this information is available online to Inuit in Nain as part of an unrelated study). People are not sure if this is part of the natural cycle that caribou go through with migration and population, or if it is because of something else, such as dust or pollution. Male Inuit have also noticed that caribou are leaving earlier in the fall and are also leaving faster. Some people think that they are leaving early because there is not enough food to eat. The increase in freezing rain caused the land to be coated in ice, which made it very difficult for caribou to get food. This may have caused them to leave earlier to search for food in other places. In addition, caribou are not as healthy as they used to be. More are caught now with signs of sickness, including sores on the body, worms in the meat and infections, which used to be rare. Several changes in caribou have been noted by males. The meat is bloodier and less greasy, and their migration route has changed. There are mixed opinions as to the cause of the route change; some people think it is because of the presence of the mine, while others think it is part of normal fluctuations. Regardless of the cause, Inuit find it difficult to predict their location when they go out hunting.

> "That would be the migratory route of caribou they're going through here [water partway through Voisey's Bay], but not through there [land from Voisey's Bay to Anaktalâk Bay] anymore, because of the mining there. They have their route changed altogether; they come from across here [water through Voisey's Bay]."

> "You got an example of that now with the caribou coming around here, a lot of people wondering why they didn't stay around right. They want them to stay around and they're in the woods. Why are they down there? Because the hills are all iced up. They're pure ice in places and they can't get their food so, they're not going to stick around where they can't dig now. They know more than we do. And they know what's coming,

> they can, I don't know how they know, but they know that it's going to be icy, they move on."

Lately, there have been more 'crawlers' (seals that are stuck on the ice) and dead seals on the ice. The majority of crawlers die on the ice; they are either killed by predators or die from starvation and/or exposure to the cold. One male group attributed this change to the lack of snow on the ice. Less snow on the ice means young seals have no place to hide from predators after they are born. There is also less rough ice, which is also used by seals to make their dens and provide protection from predators.

> "They don't get the snow like used to anymore, so we don't have the rough ice and we don't have the snow banks so they can make their dens."

In 2006, there were less of all types of seals, except harps. Inuit are not sure what caused this change, although more seal predators were seen on the ice that year. These predators may have been attracted by the increase in exposed young seals on the ice. In addition, the seals that Inuit catch are skinnier now and have less fat on them. This is especially true in the spring, which makes it difficult to get seals at this time because they sink when they are shot. Some people think that they are skinny because they are starving.

> "Last winter, I don't know, I don't know what happened last winter. But there was hardly any seals, not like the winter before like when the ice broke up really early two years ago so, the place was black with seals but last spring there was hardly anything."

Seals have also been observed to whelp in the ship's track in previous years. Some male participants think this is because the ship creates rough ice when it breaks the ice, which is ideal habitat for seals. Seals are drawn to this area because lately there has been little snow cover on the ice, as well as rough ice, which usually provide protection from predators.

> "Another thing we found interesting was, when all the snow melted at the end of April, it just became icy. Only a little bit of ice was in the track itself. It was young seals…a little bit of snow in the track. Young ones being born in there with a little bit of snow cover."

Birds, including ducks, are not nesting on islands that they used to. Some islands have no nests anymore at all and others have much less, but still may have one or two. There have also been sightings of abandoned nests with eggs in them on some islands. Robins and other birds such as geese, gulls, ducks, loons and shell birds are appearing earlier in the spring. Inuit have also observed robins staying later in fall; they used to be gone in September, but recently people have seen them in November and even during the winter.

> "Well they're these little islands here. They're good nesting spots for ducks. There might be only one or if you're lucky two nests there now."

Polar bears are coming in closer to the land now, including Nain, because the sina is moving closer to the land. Inuit never used to see polar bears in this area before.

> "Well, the polar bears are getting a lot closer now because of the ice conditions. The most I've ever seen on Black Island was this year."

There has also been more capelin in the area lately, although the numbers are increasing slowly. There are still not as many as their used to be; Inuit say that there used to be so many that they would cover the whole harbour in Nain. In addition, the capelin that have been observed are smaller than they used to be and they no longer stay in the bays either. Some people think their return may be due to the warming of the ocean. Elders say that their return is causing cod to start coming back, although Inuit have seen more rock cod than Atlantic cod. Char and salmon are also starting to come back. Closure of the salmon fishery is thought to be the reason why there is more salmon in the area, and char conservation efforts are thought to have helped increase the

char population. As these fish come back into the area, they are being fished and caught more, especially rock cod.

> "I heard some elders say the Atlantic cod is following the capelin. So the capelin came first and the cod is following the capelin."

> "Yep, you caught more rock cod than you would cod. Rock cod catch them first I think. Take their spot."

Lately, char comes out of the rivers and brooks earlier in the spring and they also go back in earlier in the fall. Char used to come out in June but now they come out in early May. Some people think they are spending less time in the bay because there is not enough capelin (even though the numbers thought to be increasing) so it is hard for them to find food now. Due to this lack of food, char are skinnier and also look different than they used to.

> "Char's earlier eh, coming out now…A lot earlier. Because we were up to the bay last spring and it was early May, first or second and our brook was busting out. But there wasn't any char, but usually when we're living up there, as soon as the brook was cleared out, they would come out, so it's early May now, compared to what, June eh?...they don't stay in the bays like they used to. Cause the capelin used to be in the bays, there's no capelin so there's no food...they head straight out, so it's not the traditional places that we used to go...their taste; the taste wasn't like, like it used to be ...this year."

New species of wildlife have recently been observed in Anaktalâk Bay and Nain, including unidentified insects, bees, city pigeons, musk-ox, unidentified ducks and birds, as well as morning doves. One of the new ducks is similar to a shoveller and one of the new birds is a type of songbird. In the summer of 2006, Inuit saw a new kind of insect with a stinger on its back, which causes swelling and pain. Inuit have also observed moose around Anaktalâk Bay. Some people think that the moose are starting to come north because of climate change.

> "One thing I've never seen here was doves. They're here now."

> "Here, you know the pigeons they get in Goose Bay and in cities, there was two here in town."

Over the past years, Inuit have seen changes in the appearance of some animal's meat and bones. Caribou marrow is more watery now, and the meat sometimes has white spots on it. Seals have been found with worms in them, and there are also more sick and skinny fish. More eggs are being found with no shell, as well as eggs with double yolks in them.

> "I think that some of the fish is sick too, cause they've got big heads and they're so skinny in the body. Some of them are sick too I think."

However, some female participants noted that the animals that are returning to the area, such as caribou and capelin, are not coming back into Anaktalâk Bay; instead, they are going into other bays and parts of the ocean.

> "The animals that we're seeing coming back doesn't necessarily mean that they're coming back in Anaktalâk Bay. They're coming back in other areas. Maybe something's driving everything out. Maybe everything's going outland rather than inland. I don't know. But like if the caribou is not going to be in Anaktalâk Bay, and we're seeing less caribou, maybe we'll see them popping up more in a different route, say out in Voisey's Bay area, or up in Nain Bay area."

Inuit think that the presence of the mine and the resulting noise and air pollution, as well as the presence of more ships and planes/helicopters in the area, has caused some animals to leave the area. For example, people have noticed that none of the islands that have navigation aids with lights have nests on them anymore, although they used to. They think the reason for this is that the navigation lights, as well as the noise from the passing of the ship, is preventing birds from nesting on these islands. Inuit also think that the noise pollution from planes is causing the ducks to leave their eggs and nests.

> "The ducks were not there anymore with all the planes coming by and ducks leaving their nest, leaving their eggs to rot."

In addition to the increase of planes and helicopters, more of these aircrafts have been seen flying low to the ground around Anaktalâk Bay. More researchers and hunters are coming into this area, some of which use helicopters to look for wildlife, including different types of birds and caribou. Since the discovery of the nickel deposit at Voisey's Bay, more people have been using aircrafts to prospect for mineral deposits. Many animals are scared off due to these low flying aircrafts and Inuit are concerned about how this will affect the wildlife in the future.

> "They flew low…into all the towns' areas looking for birds…looking for caribou… trying to see where the animals were…disturbing geese."

5.4.7 Summary of Changes

A summary of the changes discussed above are shown in Table 2.

Table 2. Summary of Changes Observed by Each Focus Group.

OBSERVED CHANGES	Male Group 1	Male Group 2	Female Group
WEATHER			
Wind direction is unpredictable and changing; prevailing winds in winter from northwest.	●	●	●
Stronger and faster winds.	●		
Strong winds occur later in the fall.		●	●
TEMPERATURE			
Temperature fluctuates more.	●	●	
Warmer temperatures all year round.	●		
PRECIPITATION			
Less snow on land and ice.	●	●	●
Snow blows away easier / faster.	●		●
More rain / freezing rain in winter.	●		

OBSERVED CHANGES	Male Group 1	Male Group 2	Female Group
Less rain in the summer / occurring earlier.			●
More dust / sediment / concentrate on snow.	●	●	●
STORMS AND EXTREME EVENTS			
More bad weather.	●		
Weather is unpredictable.	●	●	●
ATMOSPHERE			
More dust in the air.	●	●	●
Sky is hazy / more smog.			●
WATER			
Water temperature is warmer.	●		●
Camp Pond and Reid Brooks were / may still be contaminated from past VBNC spills.	●	●	●
Salt water ponds / rivers / brooks shallower / drying up.			●
ICE			
Changes in ice occurring faster.	●		●
Melt water is no longer seen on top of the ice.	●	●	●
More dust / sediment / concentrate on ice.	●	●	●
Earlier break-up of ice.	●	●	●
Later freeze-up of ice.	●	●	●
Timing of break-up and freeze-up are unpredictable.		●	●
Sea ice edge (sina) closer to land.	●	●	●
Rattles appearing earlier.	●		●
Ice weaker / less solid / forms in layers.	●		
Ice is less salty.			●
Ice thaws from the bottom up instead of from the top down.			●
VEGETATION			
More berries / bigger berries.	●	●	●
Trees and plants are growing faster.		●	

OBSERVED CHANGES	Male Group 1	Male Group 2	Female Group
Trees and plants around mine covered in dust.	●	●	●
Trees drying up.		●	●
WILDLIFE			
Presence of mine and related noise / air / light pollution has caused animals to leave Anaktalâk Bay area.	●	●	●
Concern that increase in low flying aircrafts are affecting wildlife.	●	●	●
Less caribou / sicker caribou.	●	●	●
More 'crawlers' (seals trapped on ice).	●	●	●
Birds are not nesting on islands that they used to / leaving their nests (with and without eggs).	●	●	●
Birds are larger now; not as many young birds.		●	●
More young dead seals on ice.	●	●	
Migration of caribou / birds timing has changed.	●	●	
Less young ringed seals / more harp seals.	●		●
Seals / caribou are skinnier.		●	●
Seals are whelping in ship's track.	●		
Polar bears coming closer to land.	●		●
New species of wildlife / insects or birds.	●	●	●
More capelin / rock cod / char or salmon.	●	●	●
Capelin smaller / don't stay in bays anymore.	●	●	
HUMANS			
Construction and operation of a mine, including shipping.	●	●	●
Inuit knowledge is not being passed to youth or others.	●	●	●
Elders want to pass on Inuit knowledge and observations, but fear/doubt of knowledge due to changing conditions.		●	
More technology in communities.	●	●	
Access to mine site is restricted.		●	●
Most people have not visited mine site / would like to visit mine site.			●

OBSERVED CHANGES	Male Group 1	Male Group 2	Female Group
More people have jobs that require them to work during the week.	●		

5.5 Effects of Change

This section will focus on the effects of change on Labrador Inuit. The effects are grouped into the following categories: economic, knowledge and culture, vehicles, housing, food, water, health, recreation and harvesting activities, travel, and development and pollution. If it is unclear to which group(s) an observation is attributed, see Table 3 at the end of this chapter, which links each observation with its corresponding source.

5.5.1 Economic

Commercial fishing, especially char, is thought to be slowing down in the area to the point where people do not see it happening at all. The fish plant used to process a lot of char, but it now relies more heavily on scallops. As a result, participants think that scallops have been fished intensively over the last couple of years. However, at the participant verification meeting, some participants noted that in 2007 the scallop fishery greatly decreased due to the low market prices for scallops, which made it no longer profitable to fish for scallops. As a result, the fish plant closed in July of 2007 (the normal closing time is in September); this is the earliest the fish plant has ever closed, according to the participants' memories.

Char are also fished for subsistence purposes by local Inuit and some people contend that they need to continue to fish char in order to feed their families. There is a concern that these species are being over-fished, and the fish plant may close down if the char population does not increase. If the fish plant closes, this will negatively affect the community since there will be less work.

> "And we're not fishing [char] commercially anymore. We're just going to get enough for a meal, that's it."

Some residents of Nain took advantage of good berry harvest in 2006 and sold them to other residents for profit. This gave more people an opportunity to make money, in a town where employment can be hard to get.

> "A lot of people this fall. More than ever I think picked berries to sell them. So they made bigger, bigger money."

A number of people from the community have worked, or still do work, at the mine. Most people were drawn to this job because of the good wages, but some have quit because the money itself was not enough to make them happy.

> "I mean now we all know that money doesn't buy happiness. That's the truth. People say it now. Before they didn't really put a value on it, but now you know, you make the big bucks and everything, but hey, are you happy?"

Many people appreciate the free wood that VBNC makes available to residents of the surrounding communities. Using this wood saves people money, and some people even make money by selling it back in Nain. There is some concern that the wood is very sandy and is hard on the equipment, but people have been told that the wood in the future should be much better.

> "There's some people who get wood from there and sells it for sixty or seventy bucks!"

5.5.2 Knowledge and Culture

All groups noted that IK and observations, including knowledge of ice conditions and the geography of the land, are no longer being passed on to many youth. This is an ongoing problem in the community and it is continuing to get worse. Instead of IK, some people are using technology, such as GPS, to help navigate their environment. This technology can be helpful, but

should not be relied upon since they are not totally dependable. For example, GPS can be broken and/or lost while out on the land. If the person using this technology did not have any other way to navigate their way home, they could easily get lost on the land or in the water. As a result, many people, especially elders, want IK passed on because it helps keep Inuit safe.

Inuit are increasingly using technology to help them hunt. Satellite collars, like those researchers have placed on caribou around Anaktalâk Bay to track their movements, make it easier to hunt caribou and GPS is especially helpful for people who do not know their way around the land. Having access to this technology can cause problems though. Some Inuit think that this technology can replace IK and choose not to learn the traditional ways of hunting and finding their way around the land. On the other hand, some people see this technology as a good way to transfer knowledge to youth since many have computer access, both at home and at school.

> "Yeah, because, younger people too, that's where they get their information now, computers. I mean, they're all good at it...it's a real good way to information out too."

For hundreds of years, Inuit have relied on their ability to predict the weather and ice conditions in order to keep them safe while out on the land. However, lately many Inuit are discovering that they can no longer make these predictions. Inuit can no longer tell when freeze-up and break-up of the ice will occur, nor when storms or high winds will come through the area. For example, a female participant described how Inuit used to know that the ice was no longer safe to travel on after they had seen three instances when melt water stayed on top of the ice and then disappeared. However, as previously mentioned, this phenomenon is no longer occurring, which makes it very difficult to predict the time of break-up and unsafe ice. As a result of these changes, more Inuit listen to the forecast on the radio or television. If bad weather is predicted, many Inuit will stay home instead of going out harvesting. Unfortunately, this prediction is

sometimes wrong and people become frustrated because they feel they have wasted their day at home. In contrast, sometimes they predict good weather, so people go out on the land and they get caught in bad storms. This makes travel more dangerous and increases the chance of people getting stranded on the land.

Inuit find it difficult to predict areas of bad ice now, and areas that were traditionally safe are not anymore. In the past several years, people have gone through ice because of unsafe ice in unusual spots and Inuit are worried that this will continue to happen unless people have the proper knowledge. This is especially a concern with the ship's track because they lack the knowledge of how to check when the ice is safe to cross. People do not know why these changes have occurred, but some think it may be caused by strong winds blowing sand on to the ice, which can make the ice weaker.

> "And a lot of the people don't know the difference now between bad ice and safe ice. It's kind of hard to tell lately."

Elders want this knowledge to be passed on, especially before they pass away, because they know that it is crucial for survival. However, some people now doubt their knowledge and are worried about passing on knowledge that no longer applies due to the recent rapid environmental changes that are occurring in the area. In addition, many youth do not want to learn anything about IK, but some youth are interested in learning if it is presented in the right way. There are several opinions as to how this should be taught. Some people feel that this information should be passed on the same way it has been for many generations; by youth going out on the land with elders and other holders of IK. However, many people do not have the time to do this and they also worry that youth would scare away the food they need to catch to survive. Other Inuit think that this information should be taught in schools instead.

> "And Edward said that when he passes on, that's something [how to read the ice] he thinks that the younger generations have to know."

Many people have limited information about the activities at the mine, and their potential negative affects. For example, some people are not sure what contaminants may be found at the mine, and what affect they might have if they were released into the environment. In addition, many do not know that VBNC is doing some monitoring around the mine, and those that do are not sure of the details. Most people have not been to mine site and this unknown is quite frightening to them. Inuit want to visit the mine site so they can see for themselves what is happening there. By visiting this area, it would also make it easier for people to talk about the changes that are occurring in this area, both within the community, as well as with researchers (including government, industry and academic).

> "It would be hard to comment on the moss and that in that area because no one's hardly allowed in there now. In there close."

People working at mine are restricted from their traditional activities and diet. Inuit are used to going out on the land on a regular basis and harvesting whatever food they come across. However, workers of the mine are not normally allowed outside of the mine buildings (unless they are working in areas that require them to do so) although recently some people have been allowed to go on organized hiking trips in the area.

Many workers wanted to live at home while working at the mine and travel to and from the mine by boat or skidoo, but this is not allowed either. As a result, workers are away from their families two weeks at a time, which can be very difficult for both the worker and their family at home since this is not the way Inuit normally live.

> "The food is totally different. The lifestyle is totally different because you're used to working 12 hours a day, but in the other

> eight hours, you're outdoors. You're in Anaktalâk. You want to be able to go for a walk without being harassed ...you're not allowed, you're not allowed…when it first started too, people said well how come I can't come home in the evenings? It's just an hour's ride...everybody had a way of getting home... even if you're not from Nain, you know, you hitch a ride, you know, but hey, you know, that was the first year. People couldn't understand why they had to stay in there."

Some Inuit workers at the mine feel looked down upon by other workers and their supervisors. They are not treated with respect, even by other Inuit who they may know and have been friends with previously. This makes working at the mine very hard on some Inuit workers' self-esteem, as well as makes them feel lonely since there are there for two weeks at a time.

> "People when you're in their...they treat people under them...make people feel lower...their supervisors and ignoring cause they've got a different hat they won't treat you with respect...you're used to working with people who you know, you've got a good rapport going on. You say hello to them, little things, you know, like when you're passing somebody. But when you're in the camp, first of all, you're there for at least two weeks, you don't know three quarters of the people and I don't want to say unfriendly, or anything like that but... [women] have got different jobs too right. I mean, they've got the janitorial work. Laundry service and work like that. So, being aboriginal, I think that they get …a lot more...stressful…a lot more responsible for things."

People are learning to adapt to environmental changes that are being felt by making changes in their lifestyles. Many of these changes affect their safety, health and ability to hunt animals for food, which makes adaptation a necessity for their survival. For example, people have changed their travel routes because the areas of unsafe ice have changed. They are only eating wildlife and drinking water from certain areas, because they are not sure of the safety of these things in other areas. Not everybody is adapting though. Many youth, as well as adults, do not take into account recent changes in their environment. For example, some people continue to use traditional travel routes even though they may no longer be safe.

> "Cause we're changing. Even us, with all of our experience of going around year after year, we're changing our ways too. And we've got to...we don't have a choice."

> "We changed a lot of our habits, because we don't know what's good to eat...it happens all the time, you know, you adapt to it and the ice, there's always different patches of ice that are bad."

5.5.3 Vehicles

Travel by skidoo in the spring can be difficult due to the lack of snow of the ice and land, and can even damage the machinery which is costly to fix. The lack of snow usually causes many people to put their snow machines away. However, the earlier break-up of ice in recent years has caused people to put their machines away sooner in the spring, usually before the second week in May.

> "But now it's, you're lucky if you get into the second week, brook trout in May on skidoo. Some people do, but most people put their skidoos away…last year hardly anyone got out because the ice got bad early and the snow melted, they couldn't get around like normal years."

5.5.4 Housing

The presence of the mine in Anaktalâk Bay bothers people who have cabins in the area. Some people feel so strongly about this that they are moving their cabins to other locations to get away from the mine, even though some of these cabins have been in same spot for at least 35 years and there is a strong emotional connection to the area.

> "That's where we grew up, you know, I mean my children not me...my husband and I and my family have agonized, we want to build a new cabin, because our cabin is small and our family is bigger. And it's falling down and falling apart with age and stuff, but we contemplated on whether we're going to build in the same spot. I'm telling you, I've just made up my mind. We are not going to rebuild there…if we're sitting down on our front porch when we're at our cabin and we turn this way and we see all the dust and the tractors driving by and the helicopters whatever. And you turn this way and you see loons and…our

> kids…don't like going there, 'cause it's boring. There's no animals, there's no fish you know."

5.5.5 Food

Participants from all groups expressed their concern about contaminated country foods in Anaktalâk Bay. Many people are worried because they do not know what contaminants are in the environment around the mine and they think that the wildlife may be ingesting mine dust through water and food sources. There is no way for them to tell which wildlife is safe to eat and they are frustrated and scared that they have to rely on other people to communicate this information. As a result, some people avoid harvesting in certain areas, especially around the mine. Many species that Inuit eat travel around the area, including fish and seals, so they even question the safety of wildlife caught in areas away from the mine site. For example, one participant said that they only eat berries that are on islands now because they are not sure what contaminants may be present in other areas. In addition to berries, people are concerned that the fish and caribou that live around the mine are contaminated, either by bilge that is released in the water, or by eating contaminated food. Many people are changing their harvesting habits because of this.

> "We can go up there, we can go up caribou hunting, duck hunting, seal hunting and we can go get our ducks and all that. The stuff that we eat and whatever's coming out, whatever's going in the water, is going in the air that we can't see, that we need others to find out for us and let us know is a scary thing."

Many Inuit have noticed that caribou and seal meat are also harder than they used to be, and the tastes have also changed. It was suggested that these changes in texture may be related to the decrease in the fat content of these animals. Some males noted that the taste of char has changed lately, which some people think is due to the lack of fat on char that was noted earlier.

> "They [seals] are a lot thinner than they used to be and the meat is harder and not so much fat anymore. At one point in time,

> they were so fat even, layer, layer up with fat on the meat, but that's changed."

Lately, the appearance of some meat has made females think that the animal was sick. This includes multiple observations of tape worms in meat. As a result, more meat has been discarded, especially seal and caribou meat.

> "We had a seal up the sea this summer, we had to throw away, too skinny. Looked too sick."

5.5.6 Water

When Inuit go out on the land, especially when they go to their cabins or go camping for several days, they rely on freshwater sources, such as rivers and streams, to cook with and drink from. However, now some people are worried that these freshwater sources are contaminated, and/or that the water quality has decreased. This is especially hard for people to determine since the water may appear to be clean, but may contain contaminants that they cannot see.

> "I was going to say one of the bigger concerns for me is the stuff that you can't see with the mine there. Invisible stuff that we can't see that could be going in the water."

5.5.7 Health

In 2005, two people went through the ice and died. They were travelling in March, when the ice is normally safe, and following a 'road' on the ice that is used by many people. Experienced Inuit could tell that the ice was not safe several days before the accident, but many young people are not observant of the ice conditions when they travel. Many people think that the unpredictability of the ice poses a serious health risk to Inuit, since there may be more deaths, or injuries, from similar instances in the future. However, if people are more careful on the ice and learn how to identify bad areas, it is hoped they will be able to stay safe.

> "I think one of the, ah, good examples that we don't want to see happening is those two people that went through the ice. And I think that was directly attributed to climate change because we've been following that road for years, and the ice went a week or two earlier than. Because Bill, my brother Bill came up through there the day before and he saw their skidoo tracks...and he said there's somebody going to be going through the ice there, if they following the same road that they're using because he could see it all black. But I guess driving on it, they thought it was okay...this [the location of bad ice] is one of the things that young people aren't taking notice of and that's the end result of it. And if we don't start taking notice, that's going to start happening more. I mean that's a big change right, I mean with the ice, it's out two weeks, two to three weeks early is a big time compared to what we're used to...it's not going to enter your mind that it's water there, because it was good when you passed the day before, two days before. Just because you don't, it's a change that we've got to take notice of if we want to survive."

Being stuck in the community and getting sunburnt more quickly are two changes that affect Inuit health, according to one male group. Sunburns occur much faster now, so many people get more each year. The mental health of Inuit is also affected in the spring and fall, when they are stuck in the community for extended times, and not able to go out on the land. This usually happens during break-up and freeze-up of the ice, since Inuit are not able to travel by boat or skidoo. At this time, the only method of transportation is walking, which limits the distance that people can go. Many people really dislike when this time of year and say it drives them stir crazy.

> "You'd be surprised how many people wait for the sea ice to freeze...they're itching to go...we can't do much in the fall and the spring."

According to female participants, some people have experienced health problems, both mental and physical, from working in the mine. Inuit have developed rashes from skin contact with some of the minerals. Other people have quit or switched jobs at the mine because they were worried about breathing in the dust and the related health effects. The noise levels at the

mine are also a health concern for some workers since it can cause ear damage, as well as stress in people. Some workers also experience stress and fatigue due to the long hours they work while on site for their two week shift.

> "My husband, you know, they don't just work 9 to 5. It's 24 hours a day, the noise, the dust, the pollution. Everything. 24 hours. 365 days, 364."

5.5.8 Recreation and Harvesting

All groups noted that Anaktalâk Bay used to be a traditional harvesting location since it is home to many animals such as seals and partridge, and is relatively close to Nain and Hopedale. Since the mine has been built, many Inuit from Nain and Hopedale no longer harvest in this area. The noise and activities of the mine drive many of the wildlife away, so people find it hard to catch animals there. The physical presence of the mine also takes away from the experience of being out on the land. Inuit not only avoid the land, but also the ocean in the area since the ship travels along much of Anaktalâk Bay. As well, access to the land around the mine site deters many people. Despite all of these concerns, some people still go to Anaktalâk Bay to hunt for caribou because it is difficult to get caribou anywhere else. Many people also avoid Anaktalâk Bay for traditional recreational activities, such as boil ups, because of noise and light pollution from the mine.

> "Well I don't go very much in there. I never been in there since the mine site started. I don't know why I just don't like it…just the fact that's it's there…I think the only time I'd probably go through there is to hunt caribou inland and I have to go get caribou...the people are never going to stop using it. That's for sure. That's the main routes of caribou hunting."

Recent changes in the ice, as well as animal habitat and migration, have limited people's ability to harvest, go to cabins or visit with friends and family, especially in the spring. Last year,

the earlier break-up of the ice and geese migration meant that many people were not able to hunt geese at all. Those that did found it difficult to catch anything since the decrease in wind made it easier for the geese to hear them coming.

> "Windy too eh, for duck hunting, for geese especially. 'Cause I mean, we try to go goose hunting when you know there's a little bit of a breeze on 'cause you don't want the geese to go flying."

Caribou are also more difficult to get to because of changes in freeze-up and break-up of the ice, as well as their migration routes. For example, caribou may be on the other side of a body of water that Inuit cannot cross because the ice has broken up earlier than normal. Inuit are also going out farther to find eggs because they cannot find them around Anaktalâk Bay anymore. Some people were not able to hunt anything last spring because of these changes.

Both male groups observed that over the past couple of years, several changes have caused hunters to become more concentrated in smaller hunting areas. The presence of the mine, changes in ice due to climate change, more structured work schedules and faster travel methods have all influenced this change. Inuit who used to hunt in Anaktalâk Bay now travel to different areas to harvest, which are usually areas north of the ship's track and are often someone else's traditional hunting area. People are also changing their harvesting areas due to increased areas of weaker ice. In addition, many people work during the week now, so their only time to go out on the land is on the weekends. As more and more hunters use the same area of land and water, Inuit are worried that animals will be 'hunted out' because of this increased pressure. Faster travel methods, such as skidoos and boats, are adding to this pressure since people can cover more ground in the same time, which allows them to harvest in more areas.

> "Forces all of us go to the same place almost. We can't spread out anymore so we get sick of each other."

> "Less chance of getting animals now too eh? More people jammed into one spot now…land fast is breaking up faster…so the people are all jammed together in the same spots."

Some animals, such as caribou, have been easier to hunt in the winter due to the increase in freezing rain. The resulting increase of ice on the hills drives the animals down to areas where they are more accessible to hunters.

5.5.9 Travel

Travel has been limited since the ship starting breaking ice in the winter since the refreeze time is variable, and can take up to four days. This variability makes many people afraid to cross the shipping route because they are worried about their safety. Some people from Nain will not cross the shipping route at all, which limits their travel to the area north of the ship's track when they visit friends and family and when they go harvesting. Inuit from communities south of Nain, such as Hopedale, are similarly affected by the ship's track in the winter when they wish to travel north. Furthermore, many people find it hard to see markers that identify the ship's track on the ice as well and sometimes do not even realize where the track is until they are about to cross it.

> "A couple of times we couldn't get to our cabin because the track wasn't froze…but if this global warming keeps going on, you're not going to be able to cross anywhere except designated places where there's crossings, man made mechanical structures which limit us…you won't be able to travel freely like you used to if this global warming keeps up…the northern route cuts out hunters from going out to all these other [places]."

Some people, especially women with their children, are afraid to travel on ice due to the recent unpredictable nature of the ice. The concern that their children may fall through the ice is strong enough that it prevents many women from going to their cabins with their children during certain times of the year.

> "People who go out to their cabins, the women don't seem to want to go because they're afraid of the ice. They won't bring their kids out there."

Some Inuit are not used to checking on the safety of the ice in the ship's track and often forget to do this before they go out on the land. If they reach the track and it is unsafe to cross, they either have to turn back, or to make detours in order to go around it. This also happens when people are coming back from being out on the land, and some people have commented that it makes them feel 'trapped'.

> "But I think that since there's been several incidents this year with one or two people...I think that's the only way that people are going to learn from, if they have an accident. I mean yes, they know it's there. They know sometimes the exact day. People don't really have it logged on their calendar, because we don't know on the calendar when we're going to go off. You know. If we're heard that there's a caribou in certain areas, we'll get ready for them the next day. That's the only thing we think about. Now we have to think about, oh, ship's coming in today. You know, we don't think about that."

Voisey's Bay Nickel Company workers are required to travel to and from the mine site by charter plane at the beginning and end of their two-week work period. However, this travel is dependent upon suitable weather conditions and workers sometimes get 'stuck' on the site until the weather clears, which may take hours, or days.

> "My first husband used to work in there eh? And he was...to come home and the weather was down. And so he was stuck in there for about four days."

As noted earlier, more dust is seen on the snow and ice around the mine site in the winter. Some Inuit are concerned that the dust causes the ice to thaw quicker and makes it dangerous to travel on. As a result, these people may avoid this area entirely when they are travelling or harvesting.

> "You've got this huge blue warehouse building that's probably three times the length of everybody's house in Nain. It's right at the point. And then you've got your road that leads right to it, and it's all along the shore. Like right here. And when you that way now, all you see if dust, right, from the air, and if you get the wind, I mean of course it's going to blow somewhere…I mean that's a lot of sand. To us, that's a concern because we take that route right, even though there's no boat coming in we try not to use that route now because we notice all of the dust and sand that's flying up from those huge trucks. So if the wind is blowing all the sand onto the ice it's going to thaw faster, so we don't, we definitely don't go there."

5.5.10 Pollution and Development

The contamination of Reid Brook and Camp Pond Brook due to a previous mine spill, as well as their proximity to the mine, was a concern in each group. The brook is a traditional fishing spot, which makes the safety of the fish in the brook important for Inuit. A spill in Camp Pond Brook in 2005 upset many people since it killed many fish.

> "Where they've got the mine now is, Camp Pond there, Reid Brook is right there. Just a couple hundred meters from it. I know they had a sludge spill on Camp Pond and it went down Reid Brook and killed a lot of fish. That was last year…There's a lot of us that goes up, because again, it's right by Reid Brook, they had a big spill there. That was really bad because a lot of people were fishing up there."

Three sources of dust have been observed in the area; vehicles on mine roads, concentrate unloading and the airstrip in Nain. Trucks travelling along the mine roads cause a lot of dust to go in the air. Voisey's Bay Nickel Company waters the roads to try and reduce the amount of dust, but many Inuit feel that there is still too much dust present. Some people have also seen dust released into the air when the concentrate is unloaded into the A-frame. Dust has also been observed in Nain Bay around the airstrip. This has been attributed to high winds blowing dust off the strip onto the ice, as well as dust being carried farther by the winds when planes take off.

> "You do see a lot of dust after they unload the material into the A-frame."

Many Inuit believe that the mining activities in Edward's Cove will lead to the destruction of the surrounding ecosystem in the coming years. Effects of this are already being seen, such as animals leaving the area and trees drying out and dying. They are also aware that it will take a long time for the ecosystem to recover.

> "They'll be no ecosystem for years and years. Just that regrowth takes years in itself, before animals come back. I mean, look what they're doing now. They're taking it away now and animals, and birds or whatever and fish, they're drying up the pond up there."

There has been an increase in noise and light pollution since the mine has been around. Machines on site, as well as the increase in flights in both Anaktalâk Bay and Nain, are cited as the cause for the increase in noise. Noise from the mine travels a long way, as people can hear it when they are on the land around Nain. Light pollution around mine has also gotten worse; some people have even compared the way Anaktalâk Bay looks at night now with Christmas lights in town. The lights not only light up the bay at night, but also the surrounding islands because of the presence of the navigation aids in these areas.

> "The bottom in Anaktalâk there, we were having a boil up in the bottom of Anaktalâk there, we had a boil up there, all you could hear was...and machinery going and stuff. When it got dark, you could see all the lights. It's really bright."

There were less ringed seal in the winter of 2006 but they were plentiful the year before. Some male participants think the decrease may be due to the ship traveling through the bay, both in the summer and the winter. Last year the seals left when the boat came in and then returned after the ship left. There is a concern that if seals continue to use the rough ice along the ship's track for whelping, then the young seals that are born in the track might be killed since they will

not be old enough to move at that time. This was not a problem during the winter shipping season in 2006 and 2007, as the ships did not travel until after the seals were old enough to move away from the track. Some Inuit think that the ship may also affect the seals in the summer too, because they have noticed that seals leave the area when the ship comes through, and come back when it has left.

> "I don't know what's going to happen. I guess they will get squished, because last year the ship left before birthing and when the track was refrozen they had their young in the tracks. But this year they'll be coming, the ship will be coming back after the young is born…I don't know how many they'll kill."

Women have noticed that the air is hazier now. Both forest fire smoke and smog are thought to be the cause. Smoke from forest fires in Quebec travels to the Nain region and causes the air to be hazy. Smog also travels from other parts of the country and possibly even the world, which end up in the Nain region. Air currents and wind are thought to cause these particles to travel to this area.

> "We'll always have a number of days where it's very foggy. That's because of smoke and forest fires in Quebec or Ontario, they come all the way, the wind."

5.5.11 Summary of Effects

A summary of the effects discussed above are shown in Table 3.

Table 3. Summary of Effects of Change as Observed by Each Focus Group.

OBSERVED EFFECT OF CHANGE	Male Group 1	Male Group 2	Female Group
ECONOMIC			
Commercial char fishing appears to be slowing down.	●		
Concerned that scallops and char are being over harvested.	●		

OBSERVED EFFECT OF CHANGE	Male Group 1	Male Group 2	Female Group
Fish plant relies on scallops now.	●		
Some people sold berries last year (2006) and made a good profit.	●		
People are making more money by working at mine.			●
Some people selling wood get from VBNC for free			●
KNOWLEDGE AND CULTURE			
Hunting ways are changing.		●	
Hard to predict break up and freeze up times.	●	●	●
Hard to predict weather now.	●	●	●
Hard to predict bad areas of ice now.			●
Increased reliance on government weather predictions.	●		
Youth and other people continue to go by traditional knowledge, and do not take into account recent changes (e.g. continue to use same travel routes even though may not be safe because of ship's track)			●
Lack knowledge about activities and potential concerns of mine (e.g. contaminants and monitoring).			●
Mine workers feel looked down upon by co-workers.			●
Working at mine restricts traditional activities, diet and home life.			●
Decreased IK of land, wildlife, etc around mine site.		●	●
People are adapting/changing lifestyle because of changes.		●	●
VEHICLES			
Snow machines are put away earlier in spring.	●	●	
INFRASTRUCTURE AND HOUSING			
People are moving cabins because of presence of mine.			●
FOOD			
Concern that country foods are contaminated	●	●	●
Discarding more meat.			●
Taste and texture of caribou / seal /char meat have changed.		●	●
WATER			
Worried that drinking water is polluted/water quality has decreased.		●	●
HEALTH			
People have gone through ice and died in the spring (early break up).	●	●	●
Concern that people will fall through the ice in the future and be injured / killed.	●	●	●

OBSERVED EFFECT OF CHANGE	Male Group 1	Male Group 2	Female Group
Sunburns occur much faster / get burned more often.	●		
Cases of spring fever when stuck in community.	●		
People have quit / switched jobs at mine because worried about their health.			●
Concern that mine workers may get sick if exposed to too much concentrate dust.			●
RECREATION AND HARVESTING ACTIVITIES			
People are avoiding Anaktalâk Bay for harvesting and recreation activities, as well as travel.	●	●	●
Hard to hunt some animals because of changes in habitat location and migration.	●	●	●
Hunters have changed harvesting locations / concentrated in smaller areas.	●	●	
Shorter spring season cuts down available time to harvest, go to cabins or visit in the spring.	●	●	
Ability to go hunting is limited because of work during week	●		
Easier to hunt some animals when freezing rain occurs; drives animals off of the hills.		●	
TRAVEL			
Travel is more limited due to open water from ship's track in winter.	●	●	●
Some people will not cross ship's track at all.	●	●	●
Women are concerned about traveling with their children.	●		●
Forget to check status of ship's track before travel; causes problems	●		●
Travel from VBNC dependent on weather; workers often get stuck.			●
Concern that dust on ice will make ice thaw quicker and dangerous to travel on / people avoid Anaktalâk Bay.			●
DEVELOPMENT AND POLLUTION			
Chemical contamination of Camp Pond and Reid Brook from past mine spills at VBNC a concern.	●	●	●
Increase in dust around mine site.	●	●	●
Concern that young seals born in ship's track will be harmed by ship.	●	●	
Worried that Anaktalâk Bay ecosystem will be destroyed.		●	●
Increase haze in air due to pollution travelling from other locations.			●
Noise pollution from the mine can be heard in and around Nain.			●
Light pollution from navigation aids at night.			●

5.6 Linkages between Changes and Effects of Change

The focus of this section is to highlight the linkages between changes and effects of change, which are summarized in Table 4. However, it should be noted that each linkage may not have been identified by every group. For a complete listing of changes and effects, including the groups that identified them, refer to Table 2 and Table 3. The extent of the effects of these environmental changes varies; some have multiple effects on local Inuit, while others only affect one aspect. In the case of multiple effects, these can all occur in one part of Inuit lives (e.g. knowledge and culture) or they can occur in distinct parts of Inuit lives, which is most often the case. In addition, some of these effects may be classified 'first order' or 'second order' effects, where a change results in an effect that then spurs on another effect.

Table 4. Linkages between Changes and Effects Indicated by Participants.

	CHANGE	EFFECT ON...
Weather		**Knowledge and Culture**
	• Weather is unpredictable.	• Hard to predict weather. • Increased reliance on government weather predictions.
		Travel
	• Weather is unpredictable. • More bad weather.	• Workers often get stuck at mine site.
Atmosphere		**Health**
	• Sun is stronger now.	• Sunburns occur much faster / get burned more often.
Ice		**Knowledge and Culture**
	• Changes in ice occurring faster. • Timing of break-up and freeze-up is unpredictable.	• Hard to predict break-up and freeze-up times.
	• Hard to predict bad areas of ice now.	• More dust on ice.
		Vehicles
	• Earlier break-up of ice. • Timing of break-up is unpredictable.	• Snow machines are put away earlier in the spring.
		Health

	CHANGE	EFFECT ON...
	• Timing of break-up and freeze-up is unpredictable. • Earlier break-up of ice. • Inuit Knowledge is not being passed to youth or others.	• People have gone through the ice and died in the spring.
	• Earlier break-up of ice. • Timing of break-up is unpredictable.	• More cases of spring fever.
		Recreation and Harvesting
	• Earlier break-up of ice.	• Shorter spring season cuts down available time to harvest go to cabins or visit in the spring.
		Travel
	• More dust on ice.	• Concern that ice is dangerous to travel on in Anaktalâk Bay.
	• Timing of break-up and freeze-up are unpredictable.	• Women are concerned about travelling with their children.
Vegetation		**Economic**
	• More berries / bigger berries.	• Some people sold berries last year (2006) for a profit.
Wildlife		**Recreation and Harvesting**
	• Birds are not nesting on islands that they used to / leaving their nests / fewer eggs in nests. • Migration of caribou / birds timing has changed.	• Hard to hunt some animals because of changes in habitat location and migration.
		Food
	• Sicker caribou / seals.	• Discarding more meat.
	• Seals / caribou are skinnier.	• Taste and texture of seal /char / caribou meat have changed.
Humans		**Knowledge and Culture**
	• More technology in communities. • Inuit Knowledge is not being passed to youth or others.	• Hunting ways are changing.
	• Most people have not visited mine site / would like to visit mine site. • Access to mine site is restricted.	• Decreased IK of land, wildlife, etc. around mine site.
		Infrastructure and Housing
	• Construction and operation of a mine, including shipping.	• People are moving their cabins.

	CHANGE	EFFECT ON...
		Food
	• Reid and Camp Pond Brook were / still may be contaminated from past VBNC spills. • Construction and operation of a mine, including shipping.	• Concern that country foods are contaminated.
		Water
	• Reid and Camp Pond Brook were / still may be contaminated from a past VBNC spill. • Construction and operation of a mine, including shipping.	• Worried that drinking water is polluted / water quality has decreased.
		Recreation and Harvesting
	• Construction and operation of a mine, including shipping.	• People are avoiding Anaktalâk Bay for harvesting and recreation activities, as well as travel.
	• Access to mine site is restricted. • Construction and operation of a mine, including shipping.	• Hunters have changed harvesting locations / concentrated in smaller areas.
		Travel
	• Construction and operation of a mine, including shipping.	• Travel is more limited due to open water from ship's track in winter.
		Pollution, Shipping and Aircrafts
	• Construction and operation of a mine, including shipping.	• Some animals have left Anaktalâk Bay area.
	• Construction and operation of a mine, including shipping. • Seals whelping in ship's track.	• Concern that young seals born in ship's track will be harmed by ship.
	• Construction and operation of a mine, including shipping.	• Worried that Anaktalâk Bay ecosystem will be destroyed.
	• Construction and operation of a mine, including shipping.	• Noise pollution from the mine can be heard in and around Nain.
	• Construction and operation of a mine, including shipping.	• Light pollution from navigation aids at night.

The concept of a chain of effects is illustrated by following the observed change in the timing of sea ice break-up (see Figure 6). This one change has caused multiple 'first' and 'second order' effects, which are felt in several areas of Inuit lives, including travel, harvesting and recreation activities, as well as health and safety. The earlier break-up of ice has a 'first order' effect on Inuit travel since it forces people to put their snow machines away earlier. One 'second order' effect of the earlier storage of snow machines is the increase in spring fever in the community, as people are stuck in the community when they really want to be out on the land. At this time, the ice and snow are not suitable for snow machines, and there is too much ice left to use boats. This causes Inuit to get 'spring fever' or go 'stir crazy', as they wait to get back out on the land.

As the spring sea ice break-up has occurred earlier each year for the past several years, some people have been caught out on the ice when it is not safe to travel. As a result, several people have fallen through the ice and died in the spring. This represents another 'first order' effect of earlier sea ice break-up. A 'second order' effect of Inuit falling through the ice is that it has led many people, especially women, to be more anxious when travelling on the ice. This 'first order' effect has also caused women, especially with children, to travel less in the winter, which represents another 'second order' effect.

Multiple changes can also interact to produce more effects. For example, Figure 7 shows how the change in timing of animal migration can interact with the effects caused by the earlier break-up of sea ice to produce two more effects. The 'first order' effect of putting snow machines away combined with the change in the timing of animal migration (e.g. geese) causes a decrease in the length of the spring harvesting season. As a result, it is harder for Inuit to harvest the same amount of country food as they have in the past.

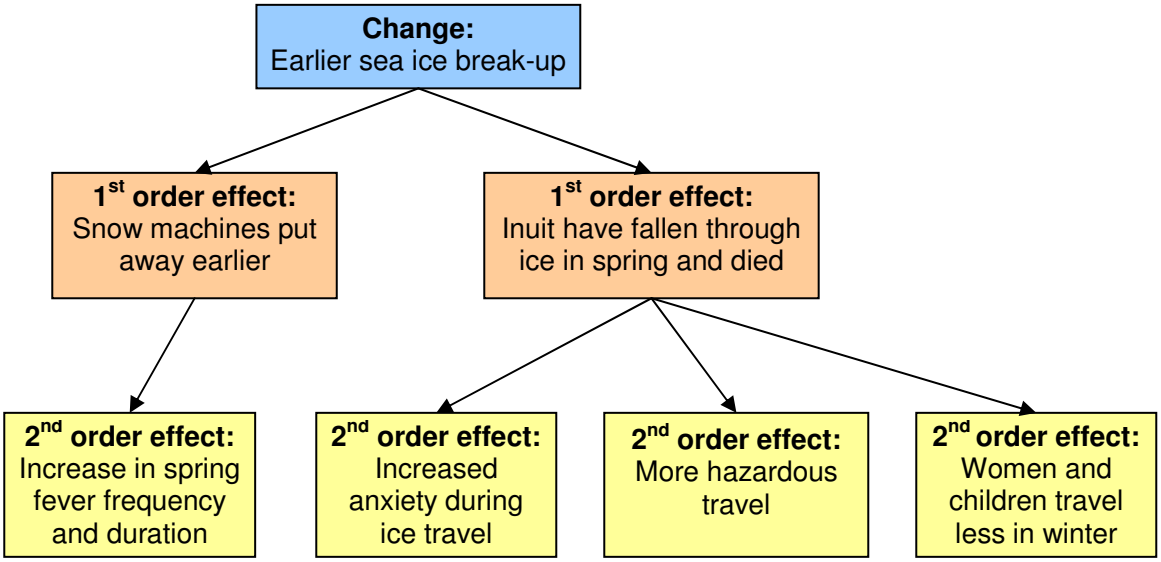

Figure 6. Multiple Effects of Change in Break-Up of Sea Ice.

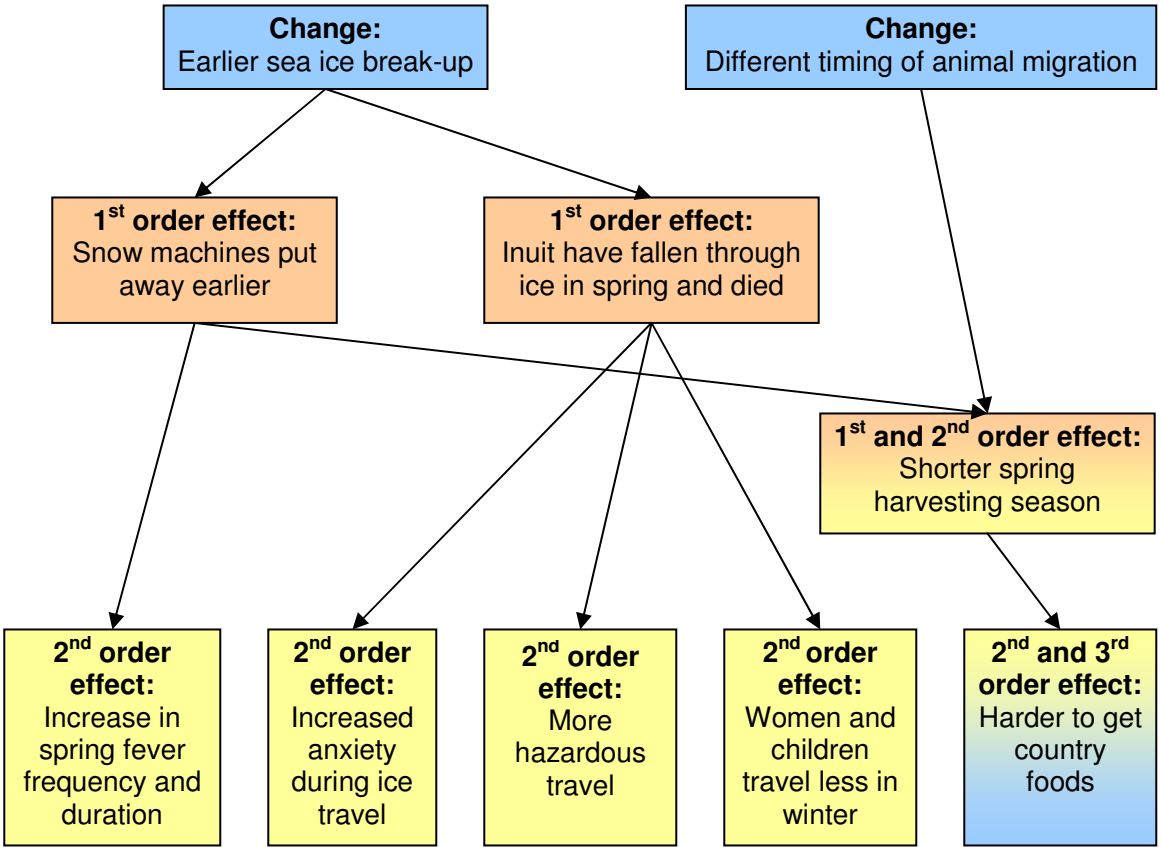

Figure 7. Effects of Changes in Timing of Break-Up of Sea Ice and Animal Migration.

5.7 Monitoring Observations and Suggestions for Future Initiatives

Many observations and suggestions about monitoring emerged during the workshop transcript analysis. This section will focus on monitoring that is currently taking place, as well as suggestions regarding future monitoring initiatives.

First, Inuit traditional views of monitoring are presented, which is followed by IK of the existing monitoring initiatives in Anaktalâk Bay. Then different components to monitor are discussed, including ice, ocean, rivers and brooks, weather, atmosphere, vegetation, wildlife and human health. Finally, suggestions are made regarding who should monitor, as well as the frequency, length, outcomes and geographic areas to monitor.

5.7.1 Inuit Traditional Views of Monitoring

Monitoring has been part of Inuit culture for hundreds of years, as it is crucial for their survival. By keeping track of changes in their environment, Inuit are able to predict things such as when it will be safe to travel and which animals are safe to eat. This knowledge also helps prevent over-harvesting of resources, as Inuit will know what the limits of the ecosystem are by previous monitoring observations. The knowledge gained through this monitoring is passed between people in the same manner that is responsible for other types of IK; by listening to other people's observations of change. Through these experiences, Inuit have learned that even small changes in the environment will have impacts that need to be monitored.

> "I would only know by my knowledge what is changing and by hearing other people talking about change. But ah, you would also know about the animals you saw and you can tell by the fur or the meat what's going on. It's contaminated or not…we've got a beautiful landscape. You take one little rock for something, now there's a mine, it's changed altogether and we as a whole group would have to monitor everything that's around there."

Monitoring is about people talking to each other and transferring knowledge between generations. As previously mentioned, Inuit have been using IK and observations to informally monitor their environment, including Anaktalâk Bay, for hundreds of years. This monitoring includes the parts of the ecosystem that we traditionally think of, such as the water, animals, and weather, but also extends to monitoring of all people. In this way, Inuit would take care of each other and help each other out.

> "One way of monitoring would be talking to each other. Not that, not just the monitoring by itself, but for all of the people. Like for example, I mentioned earlier today, when I go out on the ice, the new ice, I would say to another person who's ... that's one way of monitoring and so you can help someone else…the older generation, and they monitored everything going on, even monitor each other. Looked after each other. So Norman and Ernie and his father, and John, so if we all help each other help we'd be able to tell what's called monitoring. And ah, the older generation would give us their knowledge and we would have to pass on our knowledge to the next generation of our children, of our grandchildren. This is one way of monitoring, by helping each other out."

5.7.2 IK of Existing Monitoring Programs

Several people were aware of monitoring initiatives being carried out by SE in Anaktalâk Bay (see Chapter 3 for a more detailed description of this program). Under contract to NG, SE have been tracking the harvesting habits of 30 Inuit since 2002. This monitoring includes the location, number and condition of animals that each person harvests, and is done on a monthly basis. It was suggested that this information would be useful to incorporate in any future monitoring initiative.

According to the responses and comments of some of the female participants, many residents of Nain do not know very much, if anything, about the VBNC monitoring program. In

fact, some participants were not aware that they were conducting any monitoring in Anaktalâk Bay and/or on site.

> "The actual mine, like where they're mining, do they sample the air sometimes?"

5.7.3 Ecosystem Components Participants Want to Monitor

Participants had many suggestions as to what ecosystem components should be monitored in Anaktalâk Bay, which included residents of the community of Nain. Often these suggestions were accompanied by potential ways to accomplish this task. These suggestions are organized by ecosystem, or community component, and described below.

5.7.3.1 Ice

It was suggested that several components of the ice should be monitored, including changes in composition and thickness. By examining the ice composition, it is possible to get an idea of the particles that are in the atmosphere, since they can be blown around by the wind and eventually dropped onto the ice. Changes in ice thickness, as well as areas of bad ice and rattles, are important to monitor because knowledge of areas of thin ice and rattles are crucial for survival while travelling on the ice in winter. It was suggested that this information be shared with residents of northern Labrador by posting their GPS locations on the Internet. Areas of open ice are especially important to monitor along the shipping route, since people have observed that areas that were traditionally covered in ice in this area are now kept open in the winter; they think this change is due to the presence of the ship's track.

> "I remember we used to have ice all the way up [to the outer islands]…the ship's track keeps that area open now, and that's something that has to be watched."

5.7.3.2 Water

A common monitoring suggestion was detailed monitoring of salt and fresh water in and around Anaktalâk Bay, including salt concentration, water temperature, contaminant levels and water levels. Several people suspect that the water and ice are becoming fresher; they would like to monitor this component to verify this observation, as well as keep track of it in the future. There is a suspicion that ships going to VBNC may dump their bilge in the area, even though this act is against the law. As a result, participants indicated that they would like to see water contaminant monitoring occur all the way along the ship's track.

> "The water sampling, I think we should keep an eye on it, especially around Edward's Cove, that area there. A lot of water gets pumped into the bay from the site itself is going to have some kind of effect I guess…I'd like to see more sampling of salt water…Not the salt content, but there's going to be a lot of shipping. They just don't pass through the sea, the bilge. I'd like to see constant sampling of the water. See what's in the water along the shipping route I don't know exactly what you'd test for, oil mostly."

Both Little Reid Brook and Camp Pond Brook are areas that male participants want to monitor for water quality (including sediment), as well as species diversity and health. These brooks are located below roads at VBNC, which causes concern about the amount and composition of dust and other pollutants that may enter these waterways. In addition, a spill occurred in Camp Pond Brook in 2005, so people believe that it is important to monitor the recovery of the fish (both health and number), as well as the water quality in this area.

> "…go back to Camp Pond Brook to see if there was fish starting to come back there, back after the waste water spill last fall. It's the one thing that we need to watch in there anyways, see how long it takes for…them [brook trout] to come back after something like that major happens?"

Similar to males, females would like to monitor the brooks in the area for water quality. However, they are concerned about the water since they drink from these sources when they are out on the land, as well as at their cabins. They are concerned about the safety of the drinking water for themselves and their families.

5.7.3.3 Weather

Wind speed and direction are important to monitor because of the potential effects variations in these components may have on temperature, and especially ice formation. As in other parts of the country and world, winds from the south are generally warmer than winds from the north. The direction of the wind can therefore make the air temperature warmer or cooler. The direction of the wind also has an effect on ice formation and break up. Winds from one direction can promote or prevent ice formation, while other winds can do the same for ice break up.

> "When we say temperature changes, we don't just mean the temperature just rising and falling but the wind add to it ...along with that. Because all of that could lead to other effects of ice formation."

5.7.3.4 Atmosphere

Many participants want to monitor the air quality, including the dust content, around the A-frame at the mine (in Edward's Cove), as well as at a location further away. The location away from the mine is particularly important to participants since they are concerned about the distance that dust and other contaminants can travel. The amount of dust could be measured qualitatively by observing the amount of dust seen on plants and other vegetation around the mine, as well as at further locations. One of the participants thought that VBNC already monitors air quality.

> "Because of all the dust in the summer time from the heavy equipment, because our land's known for windy conditions. I

> think observations should be done not just in Edward's Cove alone, like it should go out, maybe for the whole area."

Female participants also feel that the temperature of the air is important to monitor. This monitoring would ideally occur year round, in order to determine temperature fluctuations, as well as abnormally high or low temperatures, throughout the year. In addition to air temperature, they would like to monitor is the amount of noise coming from the mine site.

> "Like temperature monitoring. Have people noticed warmer weather in certain months or longer extended warmer temperatures or maybe colder temperatures than usual, to record all of that too."

5.7.3.5 Vegetation

As previously mentioned, many people would like to monitor the trees and other plants around the mine site, as well as locations further from the mine, for dust. People would also like to monitor the vegetation for any other contaminants that would be harmful to the plants, as well as humans. Some of the suggested plants to monitor include berries (raspberries, red berries, blue berries, black berries, bake apples and currants), willows and caribou moss.

> "Of course berries can be contaminated. They should be tested for all that too."

Berries were commonly mentioned as plants that would be good to monitor, since they are eaten by many Inuit. However, some females also felt that it is important to monitor bushes and other plants they do not eat, including caribou moss and willows. These plants could be monitored for contaminants, as well as growth.

> "Is it drying out because of a lack of rain, or is it drying about because too many caribou were in the area and ate it all. Or is it just not growing because of contaminants in the area. There's a number of factors I guess that you have to take into consideration."

5.7.3.6 Wildlife

Many participants suggested that species that live in Anaktalâk Bay year round (e.g. clams, mussels, seals, etc) should be monitored since they would most accurately show evidence of contamination from Anaktalâk Bay. Clams are thought to be the ideal species, since they live in the area year round, are easy to get and live in the sediment, where contaminants can accumulate. Also because they have a relatively short life span and therefore changes in their population growth and distribution can be detected over a relatively short time span. To help in this process, shell dust from older clams could be collected and used to compare to newer clams.

> "If you're going to monitor, you might as well monitor stuff that is going to stay here…clams, mussels, seals. Stuff that's already there. Like, whatever is there, barnacles, mussels, anything that lives underwater for."

Inuit feel that other bottom feeders, such as crabs, mussels, snails (wrinkles) and sea urchins, are also important to monitor due to their relation to ocean sediment and thus potential sources of contamination. Contaminant levels in these species are important for Inuit to know and monitor since many are country foods.

> "And if, they are, what are they contaminated of? Cause if you're talking about this dump of water that's going into the sea, in to the bay, the minerals spin off. I want to make sure we're not eating the minerals. Um, what other kind of contaminants could there be, besides from the actual minerals? I mean, there's like the...mercury or ore or whatever spills."

Migratory species are also consumed by Inuit, including seals (ringed and harps), birds and caribou, and as such, are also species that participants want to monitor. For each of these species, contaminant levels, population numbers, location, health and migration patterns are all aspects that people would like to monitor. The nesting locations, number of eggs, and health of eggshells are important to monitor in birds, such as ducks and geese, due to the changes that have

been observed lately. A comparison of old versus young in each species is also wanted, as people have been noticing a shift towards more young species and less older ones, especially in fish. As in other monitoring components, it was suggested that migratory species monitoring should occur in, as well as in areas further away from the bay. There is a concern though, that any changes that are detected in these animals will be difficult to attribute to a specific source due to their migratory nature. This is especially true for the identification of contaminant sources.

> "I would say with the migratory animals like caribou and geese, and migratory birds. Maybe what you might want to do is take samples for Voisey's Bay and Anaktalâk Bay and outside of that area, and maybe along the coast of Natuashish, Hopedale. That way you might have something to go by and compare to."

> "How are they, are they..., like, are they, numbers again. Are they spotted more or less frequently. Like we find that the migration route is changing…is this just in the meat or in the marrow too, in the bone, the brain. Because we eat it all."

In order to determine which species to monitor, some male participants suggested that first we need to figure out which species are most affected by contaminants. This could be accomplished by taking samples of various species and testing for contaminant levels.

> "To start monitoring, I would say is that you take samples of each species and find out which ones have more contaminants than normal and then you could follow that food chain, right?"

According to female participants porcupines are important to monitor. This includes their habitat, as well as population numbers. People feel that porcupines may be threatened since they rely on trees to live and trees are being cut in Anaktalâk Bay. Some people also eat porcupine and would like to monitor contaminant levels in their tissues.

Other country foods that participants would like to monitor include fish, partridge and arctic hare. Inuit traditionally eat a lot of fish, including char, sculpin, rock cod, lake trout and

capelin. Similarly to other previously mentioned species, these species should be monitored for contaminants, as well as population health, numbers and locations.

Black bears used to be abundant in the area; now they are hardly ever seen. This has spurred people to want to monitor this species, especially for population numbers and locations.

> "So I would personally be interested to see if there's any changes say, in the past ten years for black bears, cause I see, I never see them anymore."

There is a concern about the methods used to monitor wildlife. While many people would like to know more about the species in their area, they do not want the methods to be too invasive. This relates to the frequency of the monitoring as well; too high a frequency could cause undue stress to species.

> "When we start talking about monitoring, sometimes you know we kind of hesitate too because we try not to disturb them as much as possible. Like when you're talking about the ducks and geese and checking their eggs and stuff. I mean, how else would you get to know and study them, right, but still."

> "Just as long as this monitoring isn't constant and interferes with their laying or birding."

5.7.3.7 Humans

The health of the mine workers is important to monitor, according to male participants. Many of the workers live in Nain, and may be friends and family of the participants. There is a concern about human exposure to different chemicals while on site, especially those in the dust, so monitoring their health would be a priority to the workers, as well as the rest of the community.

> "They should be sampling all of the workers too up there."

5.7.4 Who Should Monitor

Many participants expressed that samples of country foods would be easy to obtain from people who return from harvesting activities on the land. This would reduce the unnecessary killing of an animal for only a small sample; instead, residents could keep the majority of the animal and give appropriate samples to the monitors. For example, it was suggested that caribou would be easy to monitor because it is easy to get the meat from hunters in town. In this way, eggs could also be provided by harvesters as well. In order to compensate harvesters for their time, as well as the portion of meat that is contributed, it was suggested that a small fee could be paid to the hunter, or free gas could be given to cover some of their travel expenses.

> "You could just get somebody to pick one up for you if you wanted to. They're there anyway. We could volunteer our time for that...out to our cabin, check for anything. Mussels, clams."

> "I think a lot of people out here have been, traveled by snowmobile and by boat, and gas can get so expensive. I'd say, if you offered, okay, well, why don't you just go up to the bay and get a couple of items on this list and we'll pay you ten gallons of gas. People go hunting anyways."

There is concern about people from the community taking samples. In the past, results from similar collection methods have been brought into question, and people do not want to have a repeat of this incidence. In order to prevent this from happening again, it was suggested that sample collectors should be trained with the proper skills, and only these people would be able to contribute samples to the monitoring program.

> "But I think you, with the researcher, I think you really need to have there. I know we can take some samples, but I think the researchers, I think the results we get have to be taken right and so the results will not be in question. We've come up with that problem before…if the scientists or researchers don't see it, it's not there...the results have to be rock solid."

Participants acknowledged that although both the NG and the Innu Nation have one monitor at VBNC at any time, more monitors are needed to carry out a monitoring program. In fact, the role of these monitors is to ensure that operations on site are compliant with regulations and guidelines set out by various government departments, which would mean that they could make little, if any, contribution to a monitoring program. Thus, many people would need to be recruited and trained to carry out the monitoring program desired by the participants.

> "One person not going to monitor all that!"

Male participants have various opinions as to who should be responsible for carrying out the monitoring program. Some people think that Inuit workers should monitor while they are on site, while others think this is a responsibility of VBNC and the Canadian government. There was also the recognition that VBNC is currently involved in some monitoring of the area, although participants were not sure of the details of the programs.

> "I think whoever's in there, mining should be the people who know all the areas and …monitoring whatever needs to be monitored in there. Their own people are working, either Nunatsiavut..."

> "Yeah. Mining companies and maybe the, federal government."

5.7.5 Frequency and Length of Monitoring

Most people thought that monitoring measurements and observations should be carried out at least once every year. This frequency would allow for changes to be identified in a reasonable amount of time; there is concern that monitoring on a less frequent basis is not adequate, as so many changes can occur is this timeframe.

> "You mentioned just now that it's done ever five years. But in between, are there samples taken anyway? Like every year?…A whole lot could change within just one little year…rather than

> every five years, because a lot could change within that five years."

Some male participants suggested that the monitoring should be more frequent than once a year; they thought that 3-4 times a year would be best. Within this group, several people were more specific and thought that these monitoring activities should occur once during each season. The reasoning was that this time schedule would make it easier to rule out seasonal variability in observations.

> "The yearly cycle. Like summer, fall, winter and spring."

> "You should also be taking the samples, like clams, you've got clams, mussels, stuff like that and getting samples of those three, four times a year and do that every year for about five, six years and see if there's any difference or anything like that."

There was more variation in participant's opinions regarding the duration of the monitoring program; some of the suggestions included 'ongoing' and 'for our lifetimes'. Others did not want to restrict the length of the monitoring program at all, and thought instead that it should just be considered 'long-term'. This would allow the monitoring program to continue as long as it was deemed necessary and appropriate.

> "I don't think there should be a limit put on it. The changes are going to be gradual; they're not going to be overnight. Some might but you would, it would be long term."

5.7.6 Outcomes and Methods to Communicate Outcomes

The use of a website to communicate the information obtained through monitoring was suggested by male participants as a method that could reach many people in the community. The website could contain items such as locations of thin ice, observations of the health of the monitored species, as well as the frequency of animal observations. Information about the location of

caribou is already available to people in the community via the Internet and is used regularly by numerous hunters.

> "When we were talking about where the ice is getting bad I was going to point them out too on the map there, like there, some young fellas might take off and don't know about this rattle there or, boat, the boat track. Had that on computer, where the bad parts are."

Several female participants want to ensure that the information collected in the monitoring program is communicated to the community, and is used to inform the appropriate bodies (e.g. government regulatory agencies, VBNC, etc.) so that they can take any necessary action. The participants were concerned that this might not happen since they have had previous experiences in which the information from studies never made it back to the community and/or they felt the information was not given to the appropriate agencies.

> "I want to know too. After you get your results back from your studies, from your samples, let's say the levels are high with contaminants, what happens next?"

One way in which the information could be used is to decide which programs to fund in Nain and areas. For example, if the monitoring shows that there is a lack of IK transferred between youth and elders, then more on the land activities could be funded to facilitate this exchange of information. Programs could also be developed to address the lack of information about VBNC activities, including monitoring; this could be facilitated by organizing visits to the mine site.

> "I would like that study to show clearly, and the survey will show, that there's a need for more programming. Whether it's for learning about the mine or training or programming itself."

5.7.7 Area to Monitor

Many participants stressed their desire to monitor not only Anaktalâk Bay, but the surrounding areas as well (i.e. the area shown on the large map in Appendix B- north of Nain, east to open ocean, south of Voisey's Bay and west to area inland of Edward's Cove and VBNC). This area would encompass the region where they live, as well as harvest and travel, all of which are important areas to northern Labrador Inuit. Participants felt that any environmental changes that occur in Anaktalâk Bay may have an effect on surrounding areas, as well as the bay itself. Therefore, it is necessary to monitor all of these areas.

> "Alright, if you're doing all your samples in the Anaktalâk Bay area and the other two areas, are you doing it outside? You should be."

Any environmental changes that occur on the land surrounding Anaktalâk Bay, as well as Voisey's Bay and areas to the north, have the potential to affect the adjacent marine and terrestrial ecosystems. Changes on the land in Anaktalâk Bay were especially a concern for male participants due to the presence of the mine in this area. Activities, such as drilling and transporting the concentrate, as well as the infrastructure (e.g. the roads), that occur on the mine site have the potential to cause environmental changes in the surrounding ecosystems. Examples of such changes have already occurred, as previously described in section 5.5.10; dust from the mining roads and spills into the brooks surrounding the mine have caused environmental changes to occur in the area.

> "Go right around the mine. They're drilling around there [land between two bays] too. All that's going to be...And that's what, the high grounds, isn't it? And the rivers go both ways."

5.7.8 Summary of Monitoring Observations and Recommendations

Table 5. Summary of Monitoring Observations and Recommendations from Each Focus Group.

MONITORING OBSERVATION / RECOMMENDATION	Male Group 1	Male Group 2	Female Group
ATMOSPHERE			
Air temperature			●
Air quality in EC and farther out in AB; also dust	●		●
Noise levels in AB			●
WEATHER			
Wind speed and direction			●
HEALTH			
Health of mine workers			●
WATER			
Salt concentration	●		●
Water temperature	●		●
Sediment samples	●		
Contaminants			●
Water quality	●		●
ICE			
Composition	●		
Ice changes		●	
Areas of bad ice		●	
Extent of ice along shipping route		●	
VEGETATION			
Dust on trees and plants	●		●
Berries, willows and caribou moss for dust, contaminants			●
Growth of caribou moss			●
WILDLIFE			
Non-migratory species (e.g. clams, mussels, seals, etc)	●		
Migratory animals (e.g. caribou) and birds (e.g. geese) in and out of Anaktalâk Bay	●		
Monitor eggs of birds	●		
Clams for contaminants	●		
Mice	●		
Species most affected by contaminants		●	
Habitat and population numbers of porcupine			●
Seals (population, health, contaminants, location)			●
Fish (char, sculpin, rock cod, lake trout, capelin)			●

MONITORING OBSERVATION / RECOMMENDATION	Male Group 1	Male Group 2	Female Group
Shellfish (crabs, mussels, snails, sea urchins)			●
Black bear population and location			●
Caribou, partridge and arctic hare (population, migration, health)			●
Ducks and geese (health of eggs, location of nests, number of eggs)			●
Country foods for contamination (population numbers, number of old vs. young)			●
EXISTING MONITORING			
Sikumiut- Inuit harvesting study		●	
VBNC- air, berries, water	●		
AREA TO MONITOR			
Area of large map (South of Voisey's Bay to north of Nain; inland to outer islands and open water)	●		
Inside and outside of Anaktalâk Bay			●
MONITORING FREQUENCY			
Seasonal	●		
3-4 times a year	●		
Many years	●		
Ongoing		●	
Lifetime of participants		●	
Yearly			●
WHO SHOULD MONITOR			
Inuit	●		●
VBNC	●		
Sikumiut	●		
Federal government	●		
Many people	●		●
OUTCOMES AND COMMUNICATION			
Website		●	
Used to decide which programs to fund			●

5.8 Changes, Effects and Monitoring Linkages

Section 5.6 described linkages between changes and effects of change; this section will take the linkages one step further and add monitoring suggestions to the chain, where appropriate. Many of the monitoring suggestions were driven by participants' observed changes in the environment

and their effects on Inuit, thus it is important to identify and discuss some of these linkages. Some monitoring suggestions were also based on concerns about effects of certain environmental changes, as shown in the quote below.

> "How much of that treated water will make the salt water different water? That is, there will be, they're continually pouring water right through, into that bay, how much can it change the water system in that portion of the bay? And then, affect it upstream and then downstream."

The establishment of a monitoring program will produce observations that may back-up these observations or confirm these suspicions, which will allow appropriate action to be taken. Observations may also show that some concerns were unfounded, which will hopefully reassure Nain residents about the safety of their environment.

Table 6 summarizes the linkages that were made between changes, effects and monitoring. It should be noted that not all of the groups that identified a change also identified the same effect(s) of that change as other groups did, as well as the same monitoring suggestions. In addition, each group did not suggest monitoring methods for all changes and effects that were discussed. For a complete listing of change and effects observations, as well as monitoring suggestions, including the groups that identified them, refer to Table 2, Table 3 and Table 5.

Table 6. Changes, Effects and Monitoring Linkages

	CHANGE	EFFECT ON...	MONITORING
Weather		**Knowledge and Culture**	• Wind speed and direction
	• Weather is unpredictable.	• Hard to predict weather. • Increased reliance on government weather predictions.	
		Travel	
	• Weather is unpredictable. • More bad weather.	• Workers often get stuck at mine site.	

	CHANGE	EFFECT ON...	MONITORING
Ice		**Knowledge and Culture**	• Composition • Thickness • Ice changes • Areas of bad ice
	• Changes in ice occurring faster. • Timing of break-up and freeze-up is unpredictable.	• Hard to predict break-up and freeze-up times.	
	• More dust on ice.	• Hard to predict bad areas of ice now.	
		Vehicles	
	• Earlier break-up of ice. • Timing of break-up is unpredictable.	• Snow machines are put away earlier in the spring.	
		Health	
	• Timing of break-up and freeze-up is unpredictable. • Earlier break-up of ice. • Inuit Knowledge is not being passed to youth or others.	• People have gone through the ice and died in the spring.	
	• Earlier break-up of ice.	• More cases of spring fever.	
	• Timing of break-up is unpredictable.		
		Recreation and Harvesting	
	• Earlier break-up of ice.	• Shorter spring season cuts down available time to harvest, go to cabins or visit in the spring.	
		Travel	
	• More dust on ice.	• Concern that ice is dangerous to travel on in Anaktalâk Bay.	
	• Timing of break-up and freeze-up are unpredictable.	• Women are concerned about travelling with their children.	

	CHANGE	EFFECT ON...	MONITORING
Wildlife		**Recreation and Harvesting**	• Ducks and geese (location of nests, number of eggs) • Caribou (migration)
	• Birds are not nesting on islands that they used to / leaving their nests / fewer eggs in nests.	• Hard to hunt some animals because of changes in habitat location and migration.	
	• Migration of caribou / birds timing has changed.		
		Food	• Seals (population, health, contaminants) • Caribou (health, population)
	• Sicker caribou / seals.	• Discarding more meat.	
	• Seals / caribou are skinnier.	• Taste and texture of seal /char / caribou meat have changed.	
Humans		**Food**	• Country foods for contamination (population numbers, number of old vs. young) • Dust and contaminants on berries • Clams, seals, fish, shellfish, duck/geese eggs and caribou for contaminants
	• Camp Pond and Reid Brook were / still may be contaminated from past VBNC spills.	• Concern that country foods are contaminated.	
	• Construction and operation of a mine, including shipping.		
		Water	• Water quality and contaminants
	• Camp Pond and Reid Brook were / still may be contaminated from past VBNC spills.	• Worried that drinking water is polluted / water quality has decreased.	
	• Construction and operation of a mine, including shipping.		
		Travel	• Extent of ice along shipping route
	• Construction and operation of a mine, including shipping.	• Travel is more limited due to open water from ship's track in winter.	
		Pollution, Shipping and Aircrafts	• Location and

	CHANGE	EFFECT ON...	MONITORING
	• Construction and operation of a mine, including shipping.	• Some animals have left Anaktalâk Bay area.	migration of seals, caribou, birds (ducks and geese)
	• Construction and operation of a mine, including shipping.	• Concern that young seals born in ship's track will be harmed by ship.	• Seal population
	• Seals whelping in ship's track.		
	• Construction and operation of a mine, including shipping.	• Noise pollution from the mine can be heard in and around Nain.	• Noise level in Anaktalâk Bay

As previously mentioned in the above paragraph, a number of changes and effects that were observed by Inuit in this workshop were deemed important to monitor. For example, some participants observed that birds were no longer nesting on the islands they had in the past and discussed this as an environmental change in Anaktalâk Bay. One of the effects of this change is that it is more difficult for Inuit to hunt these birds, as well as harvest their eggs, since they are harder to find. As a result, it was suggested that the location of duck and geese nests should be monitored.

Another change that was discussed is the earlier break-up of sea ice in the spring. This change has had several effects on Inuit; snow machines are put away earlier, people have gone through the ice and died, spring fever is getting worse and there is a shorter spring season for harvesting, travelling or going to cabins. In order to track the trend in the break-up of sea ice, many participants recommended that the composition of the ice, ice thickness and areas of bad ice should be monitored in the area.

The above two examples of monitoring suggestions were based on changes and effects that Inuit had observed. However, as previously stated in the above paragraphs, some

participants suggested components that should be monitored based on concerns and/or suspicions they had about environmental changes and/or their effects on Inuit. For example, two environmental changes have caused people to be concerned about the safety of their drinking water and country foods: the construction and operation of the mine (including shipping) and the previous mine spill that contaminated Camp Pond and Reid Brooks. To investigate this concern further, many participants indicated their desire to include water quality and contaminant levels in country foods such as berries, seals, fish, shellfish, duck/geese eggs and caribou in any future monitoring program. Monitoring would confirm that their suspicions were correct and that they should not drink the water and/or eat certain country foods, or would ease their worries and show that the water and country foods are safe to drink and eat.

5.9 Summary

The results from the workshop, discussed above, highlight the numerous environmental changes that are being observed by Inuit in northern Labrador, as well as the effect these changes are having on their lives and their community. It is clear that these participants are concerned about these effects and would like to have a system in place to track the changes and their effects, although their recommendations regarding the potential design of a monitoring program varied. The following chapter will expand on some of these results and identify key themes of the discussions.

Chapter 6: Discussion

6.1 Introduction

An abundance of information regarding environmental changes in Anaktalâk Bay, the effects of these changes on Labrador Inuit and the development of a monitoring program was documented during this workshop. The previous chapters have summarized some of the key points from each of these categories; however, there are several themes that recurred throughout the workshop that need further attention.

These overarching themes will be the focus of this chapter. They are separated in to several sections, including the area of value to Inuit, effects of climate change, effects of modernization, effects of industrialization, cumulative effects, monitoring and adaptation strategies, and gender differences. From these observations, the next steps of the project will be identified, as well as recommendations for changes to existing policies and organizational structures.

6.2 Value of Anaktalâk Bay to Inuit

Although the workshop started out with a focus on Anaktalâk Bay, it quickly became apparent that the area that participants value, and thus wanted to discuss, is larger than what is commonly thought of as Anaktalâk Bay. This area encompasses all the land and water shown on the large map (see Appendix B). As previously mentioned, this bay and the surrounding areas are frequently used for many traditional activities, including harvesting, travelling and recreation. This has caused many Inuit in the area to have a strong emotional connection to Anaktalâk Bay; participants told stories of hunting and fishing in the area with their parents as a child, as well as raising their own children in cabins located in Anaktalâk Bay. This connection to the area makes

it very difficult for Inuit to see the bay change in response to stressors such as climate change and industrialization.

6.3 Effects of Climate Change

It is apparent that Inuit in northern Labrador are currently experiencing environmental changes, and their related effects, that are most likely the result of climate change. This coincides with the findings of other research in northern Labrador, as well as other areas of the Arctic, which have shown that climate change has been occurring in these areas for many years (McDonald, Arragutainaq et al. 1997; Riedlinger 1999; Riedlinger 2001; Fox 2002; Nickels, Furgal et al. 2002; Furgal, Martin et al. 2003; Huntington 2004; Nichols, Berkes et al. 2004; Communities of Labrador, Furgal et al. 2005; Leduc 2007).

Some of the common environmental changes in northern Labrador, as noted by workshop participants, include earlier migration of animals (e.g. caribou and geese), change in wind direction and more storms. These changes have also been noted in other arctic areas by Inuit, as well as other Aboriginal peoples (Fox 2002; Krupnik and Jolly 2002).

Similarly, the unpredictable nature of the weather that was discussed in this workshop is occurring in other arctic areas as well (Riedlinger 2001; Fox 2002; Krupnik and Jolly 2002). The recent difficulty in predicting the local weather has caused many people, especially elders (who have used this skill successfully for many years), to become frustrated (Fox 2002). One participant in the present study expressed similar frustrations, which were exacerbated by the inaccuracy of government 'experts' predictions.

> "I don't know if Environment Canada has trouble predicting the weather anymore but check the weather every morning and a lot of times boy it's wrong. They forecast strong winds so you sit at home and…it just doesn't happen…hard to plan anything. When

> they call for calm winds, you got out…you're lucky to make it back."

The ability to predict weather is crucial for Inuit, as it helps keep them safe while harvesting out on the land. Without this knowledge, Inuit face greater danger while out on the land, as well as a decrease in time spent out on the land which can translate into less country food for Inuit. In addition, it makes elders less unsure and fearful of passing on their knowledge to other people since they are worried about its accuracy in the light of recent rapid environmental changes.

New species of wildlife have also been observed in Anaktalâk Bay and Nain recently, including unidentified insects, ducks, birds, bees, city pigeons, morning doves, musk-ox and moose. Some people think that some of these new animals are moving farther north because climate change is shifting their habitat in this direction. The effects of these new animals on Inuit are varied. Some people find the new insects annoying, especially the ones that sting. The new ducks, and especially moose, are welcomed by many hunters as a potential new source of food, but are also a source of frustration since Inuit are not allowed to hunt moose in the area. This phenomenon has also been observed in other studies (Berkes and Jolly 2001; Krupnik and Jolly 2002) and it has been recommended that wildlife officials re-visit the species that people are allowed to hunt, in order to address this problem.

Hunting is also affected by the cumulative effects of two environmental changes that are likely caused by climate change. The first change is that many animals, especially birds (e.g. geese, gulls, ducks) are migrating earlier in the spring and vegetation (e.g. berries) is also ripening earlier. The second change is the increasingly variability in climate conditions, which makes it difficult to predict the weather and ice conditions. In general, the ice has been breaking up earlier and freezing up later, there has been more rain in the winter, the wind is changing

direction and the timing of strong winds are later in the year, and there are more storms. Since animals are migrating earlier in the spring, hunters also need to go out earlier to catch them. However, the earlier break-up of ice in recent years has made it dangerous, and often impossible, to travel on the ice to reach the traditional hunting locations. The combination of these two changes results in a shorter hunting season, or in the worse cases, no hunting season, for these animals. Similar effects have been noted in other areas of the Arctic, where Inuit have found their spring hunting season greatly decreased, or even non-existent (Riedlinger 2001; Fox 2002). Weather changes have also impeded access to traditional harvesting areas in the Northwest Territories and the Yukon, which has prevented many people from securing enough food (Kofinas, Community of Aklavik et al. 2002).

> "You can see the difference now, with climate change. Usually some time right after Easter, the brook starts opening up but, the main month was usually called the month where the brooks opened up but it's getting different all the time. It's hard to say now when exactly the brooks will open up. And there was sometime even in May when a lot of people used to go inland. It's hard to say now what the weather condition's going to be like sometimes we have an early freeze-up and all of a sudden, mild weather comes on. So, it's hard, hard to say now."

6.4 Effects of Modernization

The recent increase in access to technology (e.g. GPS and computers) in Nain has caused several changes to occur in the community. This section will describe both the positive effects technology has had on hunting, as well as the negative effects on IK.

Increased access to technology, such as GPS and computers, in arctic communities has allowed more people to use these applications. People who do not know their way around the land use GPS to help them navigate their travel routes (both on skidoos and in boats), and research websites that use satellite collars to track the movement of animals, such as caribou, are

accessible to communities and make these animals easier to locate, and thus hunt. These technologies can be helpful, but do not solve the problem, as they often increase the gap between the physical knowledge of the environment and the users of the technology (Duerden 2004). This sentiment is expressed by elders who are worried that people will not see the need to learn and pass on IK in the presence of these technologies. Participants pointed out that technology can fail, which can be very dangerous if it happens out on the land. On the other hand, IK is always accessible to people once they have learned it. Thus elders want IK passed on because it helps keep Inuit safe. Similar feelings have been expressed in Inuit communities in Nunavut. According to Fox (2002), "though some residents now use GPS units for travel on the land, these devices are not always dependable...and many Inuit stress the need to still know about and use the traditional methods" (p.40). In Nain, several people have gone through the ice and died in recent years, and Inuit are worried that this will continue to happen unless people have the proper knowledge. This is especially a concern with the ship's track because they lack the knowledge of how to check when the ice is safe to cross. Another result of this lack of IK is that people do not know the land anymore and Inuit are worried that they will get lost.

> "Some people don't know the ice at all right now. Some people don't want to learn about ice conditions. Dying out too from the young people. Nobody don't want to learn anything anymore. Affects everybody eh?"

6.5 Effects of Industrialization

The recent industrialization of Anaktalâk Bay has resulted in several major changes, which are discussed in this section. First, the erosion of IK due to industrialization and the related changes in Inuit culture is discussed. This is followed by a discussion of the presence of the VBNC mines site, and the resulting Inuit avoidance of Anaktalâk Bay for harvesting and recreational activities.

Finally, a discussion of the general lack of information about activities at the VBNC site (e.g. monitoring, spills, etc.) and the resulting fear this creates is discussed.

Inuit knowledge and observations, including knowledge of ice conditions and the geography of the land, are no longer being passed on to many youth. This is an ongoing problem in the community and it is continuing to worsen. Similar erosion of AK in other societies has also been documented and is partly attributed to the increase in modernization and industrialization in these communities. As noted by Grenier (1998), "because [A] K is transmitted orally, it is vulnerable to rapid change — especially when people are displaced or when young people acquire values and lifestyles different from those of their ancestors." (Grenier 1998: p.9). Disruptions in normal methods of communication are often one cause of this problem (Grenier 1998). For example, Inuit traditionally would spend a large amount of time outdoors harvesting plants and animals from the land and water in order to feed, clothe and house themselves. Children would accompany their parents or other elders during these activities, which facilitated the transfer of IK (Turner, Ignace et al. 2000). However, industrialization in communities has resulted in more people involved in formal employment during the week, which leaves less time available to go out on the land (Duerden 2004). Instead, the money that is earned from this employment is used to support themselves and their families.

The presence of the mine in Anaktalâk Bay has caused people to avoid the area for recreational and harvesting activities. This bay was always intensively harvested since it is home to many animals such as seals and partridge, and is also close to Nain and Hopedale. Since the mine has been built, many Inuit from Nain and Hopedale no longer harvest in this area. The noise and activities of the mine drive many of the wildlife away, so people find it hard to catch animals there. The physical presence of the mine also takes away from the experience of being out on the land. Inuit not only avoid the land, but also the ocean in the area since the ship travels

along much of Anaktalâk Bay. As well, access to the land around the mine site deters many people. Despite all of these concerns, some people still go to this bay to hunt for caribou because it is difficult to get caribou anywhere else. Many people also avoid Anaktalâk Bay for traditional recreational activities because of noise and light pollution from the mine. In addition, some people who have cabins in the area are moving their cabins to other locations to get away from the mine, even though some of these cabins have been in same spot for at least 35 years and contain many memories. Many participants appeared sad or upset about this change, as they have an emotional connection to this land. Similar results have been found in other studies. In Nunavut, Inuit are no longer able to use certain areas for travel and/or hunting due to restrictions such as shallow water, which causes them to miss the land, but also feel a loss in the sense of their identity (Fox 2002).

> "That's where we grew up, you know, I mean my children not me...my husband and I and my family have agonized, we want to build a new cabin, because our cabin is small and our family is bigger. And it's falling down and falling apart with age and stuff, but we contemplated on whether we're going to build in the same spot. I'm telling you, I've just made up my mind. We are not going to rebuild there…if we're sitting down on our front porch when we're at our cabin and we turn this way and we see all the dust and the tractors driving by and the helicopters whatever. And you turn this way and you see loons and…our kids…don't like going there, 'cause it's boring. There's no animals, there's no fish you know."

Participants from all groups expressed their concern about contaminated country foods in the area. Similar concerns have been voiced in other northern areas. For example, participants in this study, as well as those by monitors and community members in the ABEKC, voiced concern about dust on berries and whether this 'contaminated' the berries (Kofinas, Community of Aklavik et al. 2002). In addition to contaminants on berries, many participants in this study are worried about the potential presence of contaminants in wildlife that feed and drink in the

environment around the mine site. There is no way for them to tell which wildlife is safe to eat and they question relying on other people to let them know if it is not safe. As a result, some people avoid harvesting in certain areas, especially around the mine. Many species that Inuit eat travel around the area, including fish and seals, so they even question the safety of wildlife caught in areas away from the mine site. For example, one participant said that they only eat berries that are on islands now because they are not sure what contaminants may be present in other areas. In addition to berries, people are concerned that the fish and caribou that live around the mine are contaminated, either by bilge that is released in the water, or by eating contaminated food. Many people are changing their harvesting habits because of this.

> "We can go up there, we can go up caribou hunting, duck hunting, seal hunting and we can go get our ducks and all that. The stuff that they eat and whatever's coming out, whatever's going in the water, is going in the air that we can't see, that we need others to find out for us and let us know is a scary thing."

Many people have limited knowledge about the activities at the mine, and their potential negative effects. For example, some people are not sure what contaminants may be found at the mine, and what affect they might have if they were released into the environment. In addition, many do not know that VBNC is conducting some monitoring around the mine, and those that do are not sure of the details. Most people have not been to mine site and this unknown is quite frightening to them. Inuit want to visit the mine site so they can see for themselves what is happening there.

> "People don't know what it's like in there. You talk about, so what kind of effect do you think this is going to have? We don't know 'cause we've never been in there. I've never seen the site inside…So our people, our groups, our organizations, our workforce, our women, our schools, any group allowed to go in there and take a look at it. Yes, I know it's probably a possibly with all the paperwork that has to be filled out, safety regulations, blah blah blah, but really, do they only have certain

> numbers of people and groups in to do tours or exactly what are people shown? If you want people to try and understand better of what this is really all about, people have to see it. Really. What about human resources and labour employment? People who are on monitoring haven't seen it. They think that they have no say. They think that they'll never have a job. Let's go see it."

Another arctic environmental stressor caused by industrialization is long-range transport of contaminants from other parts of the world (Barrie, Gregor et al. 1992). As previously mentioned these contaminants are carried by wind currents and have varying effects on the environment. One effect noted by participants in this study is the increasing presence of smog (or haze) in the area. Participants attributed this phenomenon to the accumulation of chemicals that resulted from activities outside of Labrador, such as forest fires in Quebec and industrial activities in other parts of the world. However, this is not a new phenomenon; observations of arctic haze resulting from long-range transport of chemicals have also been noted in other studies (Barrie, Gregor et al. 1992).

> "We're like a big old bridge for all those air currents, for all those smoke and all those smog, just stays there and hangs there right over Nain."

6.6 Cumulative Effects

As previously mentioned, some of the effects observed by Inuit in Anaktalâk Bay are the result of interactions between environmental changes from the mine, as well as those from climate change and/or modernization. In many cases, these environmental changes have acted together to cause greater effects than they would have had in isolation. However, it is important to study these interactions in order to better understand why changes are occurring and thus what needs to be monitored, and who is responsible for the monitoring.

One example of the combined effects of climate change and industrialization is the recent decrease in ice safety (see Figure 8), which has also been observed in other areas of the Arctic (Riedlinger 2001). People are much more concerned about going through the ice now because it is much thinner. This change is partly due to climate change effects (i.e. warmer temperatures and increased winds blowing dust onto ice) as well as effects from the mine (i.e. dust and other

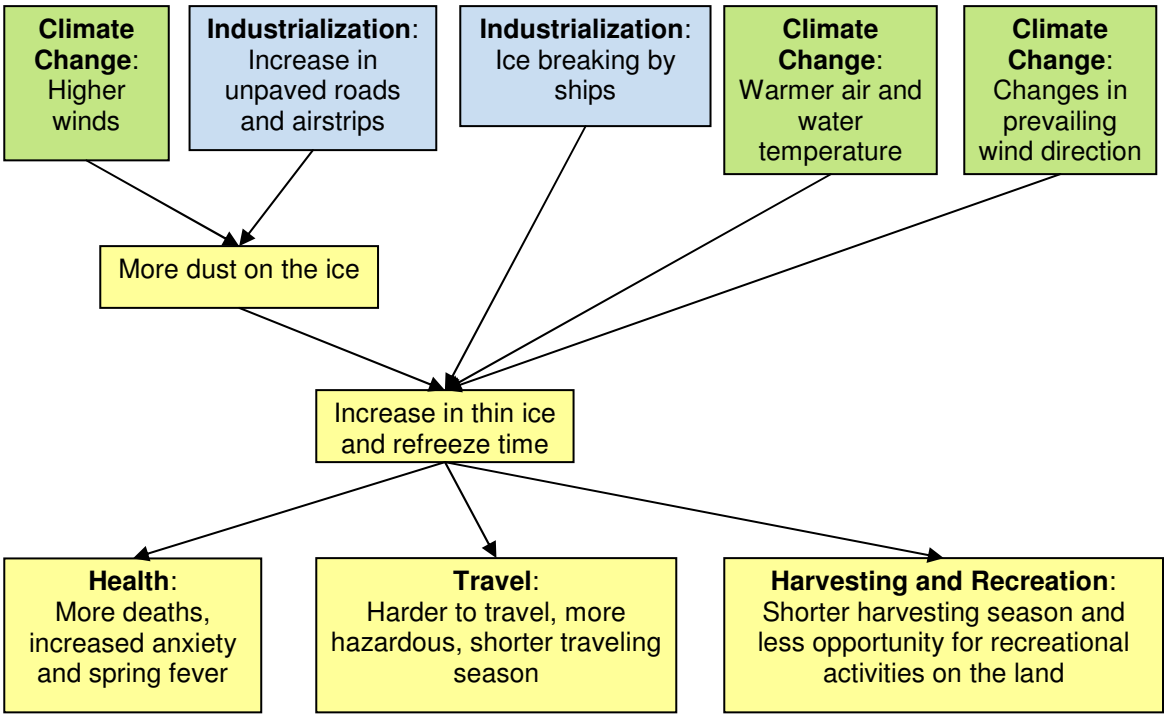

Figure 8. Cumulative Effects of Climate Change and Industrialization on Ice and Inuit.

sediment on ice, as well as ice breaking by ship) and the Nain airstrip (i.e. dust on ice). The combination of these factors causes ice conditions to be worse than they are in isolation. Several people commented that they avoid the areas around the mine and Nain airstrip where they see the most sediment and dust on the ice, since they know this ice is particularly weak.

> "You've got this huge blue warehouse building that's probably three times the length of everybody's house in Nain. It's right at the point. And then you've got your road that leads right to it, and it's all along the shore. Like right here. And when you that

> way now, all you see if dust, right, from the air, and if you get the wind, I mean of course it's going to blow somewhere…I mean that's a lot of sand. To us, that's a concern because we take that route right, even though there's no boat coming in we try not to use that route now because we notice all of the dust and sand that's flying up from those huge trucks. So if the wind is blowing all the sand onto the ice it's going to thaw faster, so we don't, we definitely don't go there."

People also avoid the ship's track, especially if a ship has recently gone through the area. The uncertainty of the safety of the ice along the track is the primary factor, as the refreeze time is variable and can take up to four days. This is much longer than originally predicted.

This variability also makes many people afraid to cross shipping route because they are worried about their safety. Some people from Nain will not cross the shipping route at all, which limits their travel to the area north of the ship's track when they visit friends and family and when they go harvesting. Inuit from other communities, such as Hopedale, are similarly affected by the ship's track in the winter. Many people find it hard to see markers that identify the ship's track on the ice as well and sometimes do not even realize where the track is until they are about to cross it.

> "A couple of times we couldn't get to our cabin because the track wasn't froze…but if this global warming keeps going on, you're not going to be able to cross anywhere except designated places where there's crossings, man made mechanical structures which limit us…you won't be able to travel freely like you used to if this global warming keeps up…the northern route cuts out hunters from going out to all these other [places]."

The combination of these changes affects Inuit health, travel and harvesting and recreation activities. For example, people do not go out on the land as often; this is especially true of women travelling with children, who are increasingly staying at home while their husbands go out onto the land to harvest or to go to their cabin because the concern that their children may fall through the ice is so strong. There have also been more deaths lately as a result

of people falling through the ice. Since travel is limited, more Inuit are experiencing 'spring fever', a form of anxiety that occurs when people are not able to get out on the land. In addition, this makes it more difficult to get to harvesting areas, which decreases the length of the harvesting season (Riedlinger 2001).

> "People who go out to their cabins, the women don't seem to want to go because they're afraid of the ice. They won't bring their kids out there."

Anaktalâk Bay used to be a traditional harvesting location because it is home to many animals such as seals and partridge, and is also close to Nain and Hopedale. Over the past couple of years, several changes have caused hunters to become more concentrated in smaller hunting areas. The presence of the mine, changes in ice due to climate change, work schedules and faster travel methods have all influenced this change. Inuit believe that the noise and activities of the mine drive many of the wildlife away, so people find it hard to catch animals there. The physical presence of the mine also takes away from the experience of being out on the land. Inuit not only avoid the land, but also the ocean in the area since the ship travels along much of Anaktalâk Bay. As well, access to the land around the mine site deters many people.

> "Well I don't go very much in there. I never been in there since the mine site started. I don't know why I just don't like it…just the fact that's it's there…I think the only time I'd probably go through there is to hunt caribou inland and I have to go get caribou...the people are never going to stop using it. That's for sure. That's the main routes of caribou hunting."

Inuit who used to hunt in Anaktalâk Bay now travel to different areas to harvest, which are usually areas north of the ship's track and are often part of someone else's traditional hunting area. People are also changing their harvesting areas due to increased areas of weaker ice. In addition, many people work during the week now, so their only time to go out on the land is on the weekends. An on-going study of 30 harvester's hunting and fishing habits has also

documented the increase in concentration of harvesters north of the ship's track in recent years (Sikumiut Environmental, pers. comm.. 2006).

As more and more hunters use the same area of land and water, Inuit are worried that animals will be 'hunted out' because of this increased pressure. Faster travel methods, such as skidoos and boats, are adding to this pressure since people can cover more ground in the same time, which allows them to harvest in more areas. Inuit consciously avoid hunting in the same areas, as they have learned from previous generations that "people always had to spread out as much as possible in order not to exhaust the resources of a particular area" (Them Days 1997: p.5 [as cited in (Williamson 1997)]). As a result, people find it harder to get the same number of animals that they used to, and the experience of harvesting has changed. At one time, people could go out on the land to harvest and not see anyone; for many people, this was something they enjoyed. However, this is no longer the case. Now many harvesters complain about frequently seeing other Inuit when they are out harvesting because it ruins their solitude and overall enjoyment.

> "Forces all of us go to the same place almost. We can't spread out anymore so we get sick of each other."

> "Less chance of getting animals now too eh? More people jammed into one spot now…land fast is breaking up faster…so the people are all jammed together in the same spots."

6.7 Monitoring

The desire for monitoring appears to partly stem from fear of the unknown and a lack of trust in communication of important information to the community. For example, several people commented that they are not sure about the safety of the food around the mine site anymore so they avoid it entirely. They are using precaution in an attempt to safeguard their health, as well as

the health of their family. These fears may be unfounded, but because they are not communicated in a way that Inuit understand, many people continue to question the safety of their food. In addition, many Inuit do not trust the information with which they are provided, and/or believe that they will not be informed if there is a spill, or some other problem that compromises that safety of the wildlife and water. As noted by Huntington, Callaghan et al. (2004), "there is often a distrust of scientists or at least a lack of understanding of what they do and why" (p.25) among arctic residents.

> "I was going to say one of the bigger concerns for me is the stuff that you can't see with the mine there. Invisible stuff that we can't see that could be going in the water…We can go up there [AB], we can go up caribou hunting, duck hunting, seal hunting and we can go get our ducks and all that. The stuff that they eat and whatever's coming out, whatever's going in the water, is going in the air that we can't see, that we need others to find out for us and let us know is a scary thing."

Many workshop participants were eager to create and implement a monitoring program that would address their concerns about the ecosystem and their community. Through involvement with such a program, residents could investigate areas of concern, such as potentially contaminated water and food and use this information to decide where and what to harvest. In addition, this information could be presented to decision makers, both government and industry, to support their concerns. As previously mentioned, this type of monitoring is called 'advocacy monitoring' and is gaining popularity in communities all across the world, partly due to its ability to empower communities through the collection of knowledge.

However, several people were sceptical about the use of such a program. This attitude seems to stem from previous experiences where Inuit have been told about the results of a scientific study, and then never hear anything afterwards. As a result, people think that the information is not being used for any purpose. Similar findings have been documented in several

studies (Duerden 2004). For example, after the Exon Valdez spill in Alaska in 1989, Huntington, Brown-Schwalenberg et al. (2002) noted that residents "resented the failure of most researchers to report results back to the community" (p. 783). Several participants indicated that they wanted the monitoring results to be used to initiate change; this can be facilitated by including decision-makers in monitoring activities and partnerships (Milne, Rosolen et al. 2006).

> "I want to know too. After you get your results back from your studies, from your samples, let's say the levels are high with contaminants, what happens next?"

One example of such a partnership involves the Department of Resources, Wildlife and Economic Development in the Northwest Territories and the Inuvialuit (Berkes and Jolly 2001). Monitoring activities documented a change in the timing of polar bear migration as well as changes in ice conditions that made it difficult for people to hunt polar bears. As a result, the government created an agreement that allows communities to adjust polar bear hunting times based on yearly regional changes in migration and ice conditions. A similar type of arrangement may be beneficial to Inuit in northern Labrador if the observed changes in animal migration and ice conditions continue to make hunting very difficult, if not impossible, during the legal hunting periods.

An underlying theme of distrust and wariness ran through the discussion of monitoring in one group, specifically in relation to the suggestion that Inuit collect samples for the program. This concern stemmed from the fact that previous findings from Inuit samples and observations have been questioned in the past, as illustrated by the quote below. As a result, some of the participants seemed to have lost confidence in their ability to take samples and are wary to take on this responsibility.

> "But I think you, with the researcher, I think you really need to have there. I know we can take some samples, but I think the researchers, I think the results we get have to be taken right and so the results will not be in question. We've come up with that problem before…if the scientists or researchers don't see it, it's not there...the results have to be rock solid."

Unfortunately, this experience is not unique to residents of Nain; scepticism and other negative attitudes towards AK have caused "some local people and communities [to lose] confidence in their ability to help themselves and have become dependent on external solutions to their local problems" (Grenier 1998: p.9). In Nain, as in other communities where there has been a loss of confidence in AK, the knowledge systems may be so damaged that they will need to be rebuilt (Grenier 1998).

This experience highlights several important points. The first is that training is crucial as it provides community monitors with the proper knowledge to carry out monitoring activities, such as sampling, which aids in the credibility of the resulting information and also helps improve participant's confidence in their sampling abilities. Secondly, and more importantly, it illustrates the need for the scientific community, as well as decision-makers in government and industry, to treat AK and knowledge collected by properly trained community monitors in the same manner they would treat other information (Huntington 2000; Kofinas, Community of Aklavik et al. 2002; Milne, Rosolen et al. 2006). As Huntington (2000) notes, "what is needed is a broader willingness to consider [AK's] relevance, to attend to the information it offers, and to incorporate the expertise that is available" (p. 1273).

6.8 Gender Differences

The workshop participants were selected to include both male and female perspectives, as previously mentioned in section 4.3.1, which allowed for a comparison of observations based on gender. One of the reasons for this separation is the acknowledgement by researchers that males

and females often possess different knowledge, especially in aboriginal communities (Grenier 1998; Usher 2000). This disparity is usually attributed to the different roles that males and females fill in the community. In this workshop, it was found that women focused more on social, health and personal perspectives, while men had more of a utilitarian perspective that focused on the boundaries of Anaktalâk Bay as related to harvesting activities.

These different perspectives are illustrated by the content of the discussions regarding the boundary of Anaktalâk Bay. It appears that this component is very important to men, as the boundary was discussed in great detail. The discussions were very practical and focused on the use and importance of Anaktalâk Bay, and the related definitions, which were mainly based on harvesting and ecosystem functions (e.g. tides connecting bays). Several males highlighted that the ecosystem functions of the bay extend over a large area. For example, many of the animals that live in the bay will travel between different areas in and outside of the bay. Thus, any animals that they hunt in Anaktalâk Bay may have travelled from other bays. The reverse is also true, and very important to note; any animals that are hunted outside of Anaktalâk Bay may have spent time living, feeding and travelling in this bay. Males felt this connection was important since some participants are not sure of the safety of country foods harvested in Anaktalâk Bay, and thus avoid this area for hunting. However, animals hunted outside of Anaktalâk Bay may also be unsafe to eat if they are also spending time in this bay. In addition, mixing of the water by tides is crucial for this definition, since this can also transport contaminants over large distances.

In contrast, women only briefly touched on the definition of Anaktalâk Bay and its boundary. Instead, they focused on avoidance of this bay, which they related to observations and concerns about social and health effects that are being seen. For example, women talked about

the decrease in ice safety around Anaktalâk Bay due to the increase in dust on the ice, and how this makes them afraid to travel in the area, especially with their children.

A similar trend was seen in the monitoring discussions. Both men and women talked about the need to monitor chemical, biological and physical components of the ecosystem, but men discussed this aspect in greater detail. Conversely, women focused more on monitoring human aspects, such as the health of mine workers. Women also were more concerned with the outcome of the monitoring information; they were passionate that the results be communicated to the appropriate people, including the community, and be acted on in an appropriate way. For example, they wanted to ensure that Inuit would be made aware of any findings that could endanger their health. Women also felt that it would be important to use the social changes identified by the monitoring program to inform and develop youth programs.

Males and females also had differences in their view of economics in the area. Males talked mainly about profit, especially in relation to the abundance of berries in 2005. Economic issues were also brought up by females; however, they discussed the negative effects of having more money in their community (e.g. an increase of drinking, domestic abuse, etc.). They also highlighted the fact that some of the people from Nain who worked at the mine have quit because they realized that the money itself was not enough to make them happy.

> "A lot of people this fall, more than ever I think, picked berries to sell them. So they made bigger, bigger money."

> "I mean now we all know that money doesn't buy happiness. That's the truth. People say it now. Before they didn't really put a value on it, but now you know, you make the big bucks and everything, but hey, are you happy?"

These comments and concerns echo those that were voiced during a workshop with female Inuit from northern Labrador in 1998 (Archibald and Crnkovich 1999). As indicated by

the date of the workshop, these concerns were based on predictions of the impacts of the mine, as the mine starting operations in 2005. One of the topics women were asked to comment on was the effects of an influx of money in the community due to increased employment rates and wages, as predicted by VBNC. Women predicted that the extra money would lead to an increase in alcohol, drugs, smoking, and bingo in the communities and that families would experience more fighting, stress and tension. It is interesting to note that many of the concerns that were voiced at this time continue to be important to Inuit women.

6.9 Recommendations

In light of the knowledge documented in this study and that found in the literature, several recommendations for future activities can be made. These recommendations are specific to Anaktalâk Bay, but may also be applicable to other similar situations.

Despite the monitoring that is already occurring in Anaktalâk Bay, Inuit in Nain still have concerns, fears and in some cases misinformation about the environmental changes occurring in Anaktalâk Bay. This is partly due to the fact that many of the results of these activities are not being communicated in a way that reaches Inuit. Another cause for concern is the disparity between what Inuit would like to monitor, and what is currently being monitored.

The existence of the monitoring programs mentioned in section 3.5 by SE, VBNC and Nunatsiavut Nuluak, presents an opportunity on which to base future monitoring initiatives. By combining these efforts, the partnership would allow gaps between the existing programs to be identified and addressed by the involved parties. This partnership would also increase the geographic area and the environmental stressors that are monitored, while ensuring that there is no overlap in activities. For example, the environmental and social-economic effects of the

project that are currently monitored by VBNC, with the help of SE, would help address the issue of modernization and industrialization in Anaktalâk Bay and Nain, while the Nunatsiavut Nuluak study could contribute information on climate change and long-range contaminants.

In addition, the NG should be included in the partnership, since studies have shown that government agencies help to facilitate the transfer of knowledge gained from the program to decision-makers (Huntington 2002; Whitelaw, Vaughan et al. 2003). The workshop proceedings also indicate that Inuit should be included in the partnership, as they have an interest in being involved in the development and implementation of monitoring programs. This is especially true with the selection of monitoring indicators, frequency and location of monitoring, as well as the collection of samples.

An appropriate and responsible authority would be needed to initiate an integration of all of this related work. The monitoring partnership that exists between the NG and VBNC would be a perfect candidate for this role, as the project falls under their mandate and they have a budget to facilitate the organization of the partnership and monitoring activities.

Thus, it is recommended that:

- A partnership be created with VBNC, NG, SE, Nunatsiavut Nuluak and Inuit to monitor the environmental and social effects in Anaktalâk Bay and Nain.
- The monitoring initiative should be the responsibility of the existing monitoring partnership between VBNC and NG.
- The observations of change and effects documented in this workshop should be used to enhance and complement the scientific information garnered from existing monitoring programs in Anaktalâk Bay (e.g. to inform the development of VBNC's socio-economic monitoring program).

- A major component of this partnership should include communication strategies that are easily accessible to Inuit (e.g. GIS that can be accessed through personal computers and a centrally based computer for those in the community who do not have a computer).

Chapter 7: Conclusions

It is clear that Inuit in northern Labrador, specifically in Anaktalâk Bay and Nain, are noticing changes in their environment due to multiple environmental stressors. These stressors include, but are not limited to, modernization, industrialization and climate change. For example, climate change is thought to have caused the animals to migrate earlier (e.g. caribou and geese), the wind direction to change and the number and severity of storms to increase. The erosion of IK, which is partly due to the increased access to technology (e.g. GPS), and Inuit avoidance of Anaktalâk Bay for harvesting and recreational activities due to the presence and / or effects of a mine, are examples of effects of modernization and industrialization, respectively. However, the most severe perceived effects on Inuit occur when environmental stressors work synergistically.

While many Inuit are concerned about the environmental changes and effects they have observed, the most feared changes and effects are usually those that cannot be seen. As a result, there is a strong desire among Inuit to develop and implement a monitoring program in the area to track these changes. In addition to the communication of observations to the community, which would allow residents to adapt to the changes, Inuit see the key function of the monitoring program as identifying problems that can be mitigated and communicating these problems to the appropriate people to ensure action is taken. Workshop participants voiced an interest in participating in future monitoring activities and it is anticipated that program development will give both researchers and community members an opportunity to continue to work together and learn from each other, in order to develop and implement relevant and appropriate local solutions.

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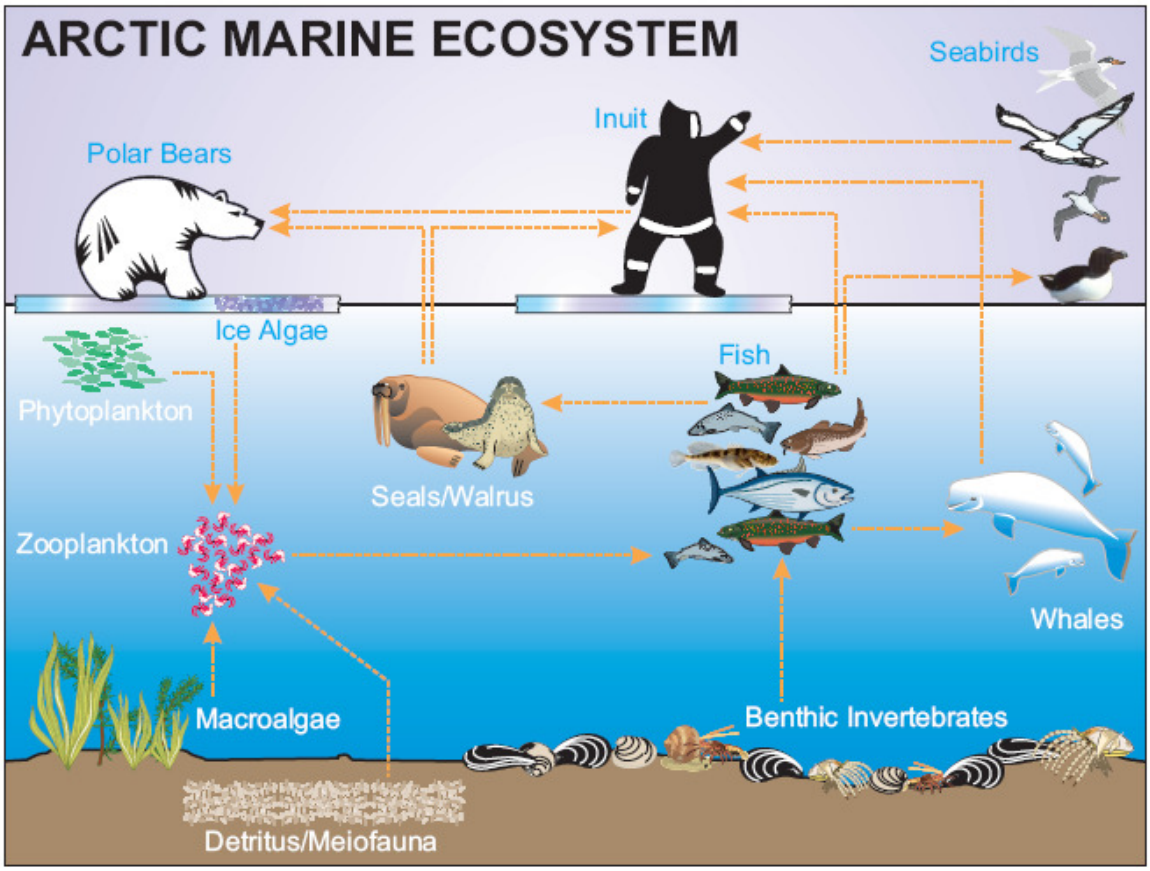
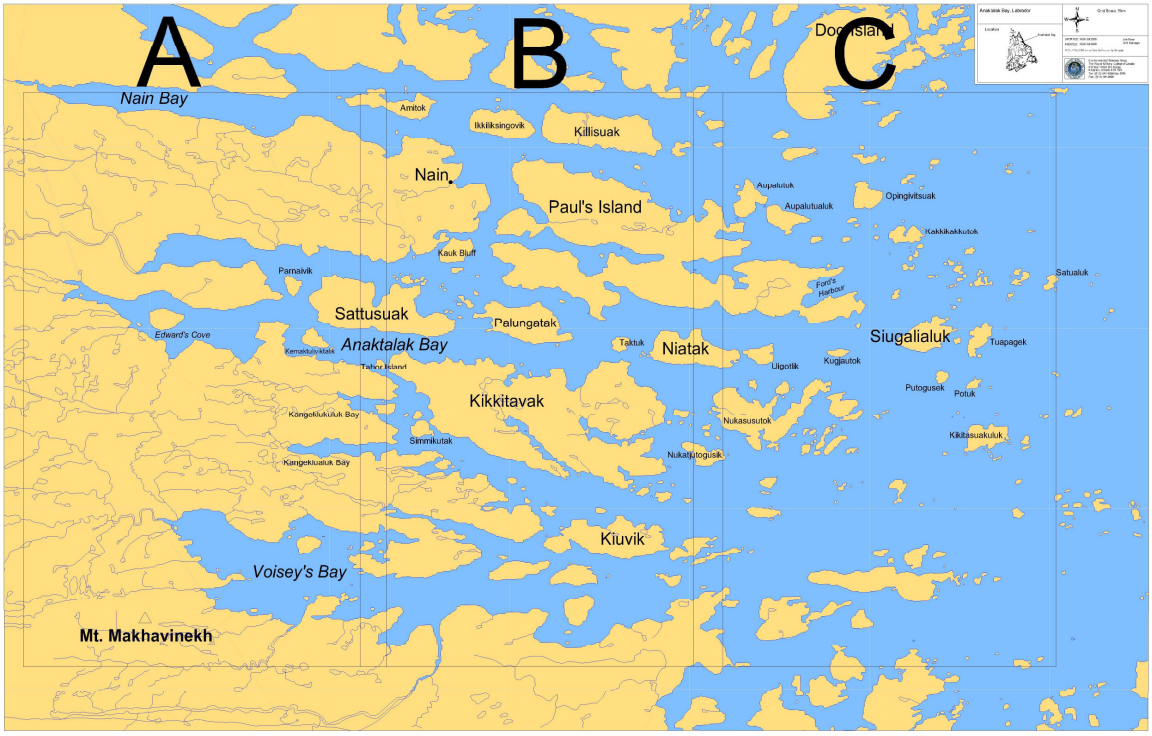
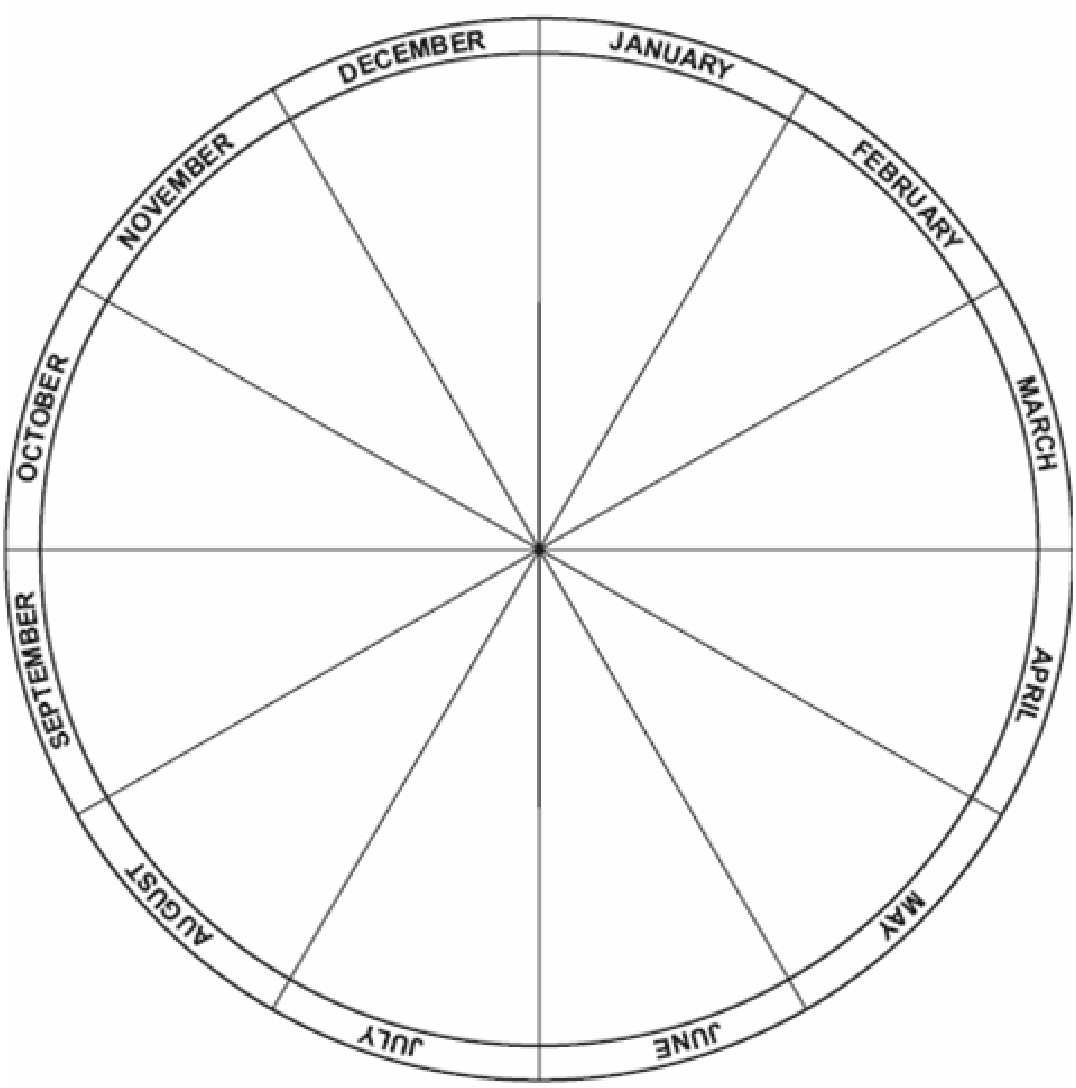
Appendix A: Arctic Marine Ecosystem Diagram



Appendix B: Map Used to Identify Anaktalâk Bay Boundaries



Appendix C: Seasonal Cycle Diagram



Appendix D: Defined Boundaries for Anaktalâk Bay

Appendix E: Workshop Agenda

DAY 1

Session #1 (9-10:30am): Introduction

- Welcome from William Barbour
    - NG Minister of Lands and Natural Resources
- Personal introductions
    - Facilitators, participants, note takers, observers
- Purpose of workshop
    - To build on knowledge of Anaktalâk Bay gained from past workshops and ongoing surveys
    - To emphasize IK of the bay
    - To understand the current state of the marine ecosystem in Anaktalâk Bay
    - To identify observations of change and their causes
    - To discuss potential monitoring indicators
- ArcticNet involvement
    - Chris
- How information will be used
- Community consultation in February
    - Community input/information
    - Verification of information
- Acknowledgement of input
- Consent forms
- Knowledge of Anaktalâk Bay
    - Tony Williamson's report
    - Scientific studies
    - Data compilation and gap analysis reports
    - Marine ecosystem diagram

Coffee Break

Session #2 (10:45am-12:00pm): Setting the Agenda

- Answer questions to set agenda
    - Answers recorded on flip chart paper by note takers
- Plenary discussion
    1. What do you hope will be the results of the workshop?
- Split into 3 focus groups (4-6 participants per group); answers recorded on flip-chart paper by note takers
- Questions to guide discussion:
    1. What do you consider to be the boundaries of Anaktalâk Bay?
        - Have participants draw boundaries on a map
    2. Do you have any concerns about Anaktalâk Bay? If so, what are they?
    3. Do you have any other concerns related to Anaktalâk Bay that you would like included in this workshop?
- Plenary discussion
    - Identify commonalities and priorities to set agenda

Lunch

Session #3 (1:15-2:45pm): Understanding Anaktalâk Bay

- Seasonal cycles exercise
- To understand what's happening in Anaktalâk Bay, based on season
- In focus groups, have participants relate their understanding of Anaktalâk Bay based on seasonal cycles
    - Include when animals are hunted, animal migration, links between components (animals, plants, insects, physical, chemical)
    - Questions to stimulate discussion (only if needed):
        1. Do you harvest in the spring/summer/fall/winter? If so, what do you harvest?
        2. When do you start and end this harvest?
        3. What is the physical environment (e.g. wind, current, tides, ice, etc.) like at this time?
        4. What is the chemical environment (e.g. salt in ice/water) like at this time?
        5. Are any of these parts on the diagram related? If so, which ones and how?

- Note takers record observations on diagram

- In plenary, discuss findings from each group
- **This session may continue after the coffee break if more time is needed

Coffee Break

Session #4 (3-4:30pm): Observations of the Anaktalâk Ecosystem and Causes of Changes

- Split into focus groups again
- Participants identify changes they have observed in Anaktalâk Bay in their memory, as well as potential causes of these changes
    - Note taker records each observation and cause on a separate index card (or the participant can record their own if they are more comfortable this way)
    - Locations of changes recorded by placing a number on the index card, and then using the same number to identify the location on the map
    - Questions to stimulate discussion (only if needed):
        1. Have you noticed any changes in the number, size, health or location of plants or animals in the bay (e.g. fish, seal, caribou, berries, etc.)?
        2. Have you noticed any changes in the migration routes of fish and animals in the bay? Is the timing of these migrations the same?
        3. Have you noticed any new plants, animals or insects in the bay?

        * For each question add: "What are the causes of the changes in Anaktalâk Bay? Why do you think these are the causes?"
- After session, stick the index cards on flip chart paper
    - Keep each group separate
- If time, group the observations (on index cards) into categories
    - Possible categories include:
        - Ice, Plants, Animals and Insects, Water, Weather, Currents and Tides

DAY 2

Session #5 (9-10:30am): Observations and Causes of Changes (cont'd)

- Morning summary
- Agenda update
- Facilitators provide a summary of observations and related causes from each group

- Plenary discussion

Coffee Break

Session #6 (10:45am-12:00pm): Effects of Change

- Break into focus groups
    - Identify both potential and existing effects
    - Record on flip-chart paper
- Key questions:
    1. Are / how are the observed changes affecting your life (as an individual)?
    2. Are / how are the observed changes that were discussed earlier affecting the community?
- Plenary discussion
- Facilitators from each focus group summarize effects

Lunch

Session #7 (1:15-2:45pm): Monitoring and Indicators

- Intro.
    - What is monitoring?
    - Why is it important?
        - objectives of monitoring
    - What is an indicator?
    - How are they used?
    - Examples (related to marine diagram- one for each)
        - Goals
        - Types of indicators
        - Their use
- Question for plenary discussion
    - What do you think should be the objectives / reasons for monitoring in AB?
- Break into focus groups
- Key questions; facilitators record answers on flip-chart paper

1. To do this, what should be monitored in Anaktalâk Bay? Why?
2. What methods should be used to monitor? Why?
3. Who should do / manage the monitoring? Why?
4. How should the findings of these monitoring activities be communicated to the communities, organizations including the VBNC?

- Plenary discussion
  - Facilitators from each group summarize ideas
  - Whole group comments on ideas
  - What is currently being monitored in Anaktalâk Bay?
  - Role of Inuit monitors at VBNC

Coffee Break

Session #8 (3-4:30pm): Next Steps

- Summary of information learned during workshop
  - Slides put together night before and at lunch
  - Include pictures from workshop in slides of flip-chart papers to emphasize key points
- Analyze and compile information from workshop
  - Current state of Anaktalâk Bay
  - Changes in Anaktalâk Bay
  - Monitoring
    - Potential indicators, methods and organizations to carry out monitoring
- Community consultation in February/March
- Written report to all partners
  - Most likely summer 2007
- Mid-late 2007
  - Another researcher will take information from workshop and design a monitoring program
  - May be purely focused on Anaktalâk Bay or on Nain region

Appendix F: Final List of Workshop Participants

Male Group 1

Ernie Ford
Norman Andersen
Edward Flowers Sr.
Ron Webb
Edward Sillitt
William Barbour

Male Group 2

Gus Dicker
John Flowers
Harry Haye
Hamlin Lampe
William Fox

Female Group

Louisa Flowers
Emily Merkuratsuk
Heather Angnatok
Katie Winters

Appendix G: Participant Profile Questionnaire

All information will be kept confidential and you do not have to answer any questions that are not comfortable for you. You can decline giving a response without prejudice if you want

1. Age: _____

2. Sex: M ☐ F ☐

3. How long have you lived in Nain?

If you have moved from another village please name the village and the main differences with Nain re: harvesting species and conditions?

_____

_____

4. How old were you when you first started hunting / fishing / collecting berries?

_____

5. How often do you go hunting?

_____

_____

6. How often do you go fishing?

_____

_____

7. How often do you collect berries?

_____

_____

Appendix H: Participant Profiles

Age (years)	Sex	Residency in Nain (years)	Age started harvesting (years)	Frequency of hunting	Frequency of fishing	Frequency of collecting berries
54	M	54	10	3-4 times / week	5 times / year	5 times / season
39	M	39	When he could walk, parents took him with them	Whenever gets a chance and weather cooperates	Whenever gets a chance and weather cooperates	August, September and October
64	M	64	Teen's	Every year	Every year, all year	When the berries are ready to pick; August-October every year
69	M	69	13 (fishing), younger for hunting	Not everyday as before	Whenever I feel like it	Whenever the berries grow and are available
40-50	M	Almost whole life (grew up in Webb's bay, north of Nain)	When I could lift a gun (5-6)	As much as work or weather permits	Different times for different seasons	Fall and spring
30	M	30	10	A few times, mostly when needed	More in the summer time when the fish start coming out of the rivers	In the fall
45	M	45	5?	Every weekend	Several times a year	Every fall
40	M	40	12	Every chance I get	Every chance I get, depending on seasons	In the fall
40	M	40	Soon as I started walking	3-4 times/week	Depends if I get enough at once	Every fall when berries are ripe
41	F	41	5	Every weekend if possible, weather permitting, but realistically twice/month	Couple weeks in summer, month in spring, couple weeks in fall, couple times during winter	3-4 times/year

Appendix I: Expanded Summary of Observed Changes

OBSERVED CHANGES	Male Group 1	Male Group 2	Female Group
WEATHER			
Weather is more unpredictable.	X		
Stronger winds.	X		
Wind is faster.	X		
September is not so windy and wind is weaker.			X
Strong winds in fall arrive one month later (October now).		X	X
Prevailing winds have changed.	X	X	X
Winds are warmer in the fall.			X
Wind direction changes faster now.		X	
TEMPERATURE			
Temperature is warmer year round.	X		
Temperature fluctuates more.	X	X	
Winters are milder.	X		
PRECIPITATION			
Less rain in the summer.			X
More rain and freezing rain in the winter.	X		
Less snow on land and ice.	X	X	X
Snow blows away more easily/faster.	X		X
Snow melts faster.			X
Snow covered in sand and dust.	X	X	
STORMS AND EXTREME EVENTS			
More storms.	X		
More bad weather.	X		
More avalanches.	X		
SKY/SUN/MOON			
Increase in smog.			X
Sky is more hazy			X
More dust in the air.	X	X	X
Fewer northern lights.		X	
Sun's heat is more intense.	X		

LAND			
Increased erosion.	X		
MARINE SYSTEMS			
Water is less salty.		X	X
Water temperature is warmer.	X		
More sediment	X		
FRESH WATER SYSTEMS			
More sediment	X		
Rivers, lakes, ponds, creeks are drying up/more shallow.			X
Contamination of brook water due to mine related spills	X	X	X
ICE			
Ice is weaker now (not as hard, more soft)	X		
Earlier break up of ice.	X	X	X
Earlier thawing of ice.	X		
Later freeze up of ice.	X	X	X
Melt water staying on top of the ice less now.	X	X	
Ice seems to be in layers.	X		
Ice is forming differently now.			X
Ice contains more freshwater and less saltwater now.			X
Changes in ice occurring at a faster rate (e.g. break up, rattles getting bigger)	X		X
Rattles appearing earlier.	X		X
More areas of open water (rattles)		X	
More concentrate and sediment seen on ice.	X	X	
Sea ice edge (sina?) is closer to land now.	X	X	X
Ice is thawing from the bottom up instead of the top down.			X
Some areas of ice that are usually safe are now dangerous			X
VEGETATION			
Berries are larger.	X	X	X
More berries.	X	X	X
Berries (bake apples) ripen earlier.		X	X
Trees break due to weight of freezing rain.	X		
Trees and plants around mine are coated with mine dust.	X	X	X

Trees are drying up.		X	X
More dead trees seen along shore.			X
WILDLIFE			
General			
Animals staying away from mine			X
Animals that are coming back into the area are not coming back into AB			X
Animals being scared off by planes and helicopters flying low	X		X
Fur bearers' velum stays black longer in season.		X	
Fur bearers get 'stink' earlier in the season.		X	
Caribou			
Less caribou	X	X	X
Not seen in traditional areas.			X
More sick caribou	X	X	X
Caribou leaving earlier in the fall.	X		
Meat is bloodier and less greasy		X	
Meat has white spots.			X
Marrow is more watery now.			X
More difficult for caribou to access food (ice layer).	X		
Caribou are starving.		X	
Caribou are skinnier in the spring.			X
Caribou have different colouring.		X	
Caribou migration route has changed.		X	
Rumours of dead caribou around mine site		X	
Caribou don't stay around as long		X	
Seals			
Less seals	X		X
More predators on ice		X	X
Seals are skinnier		X	X
More harp seals	X		X
Seals are making dens in ship's track; ship may kill young seals when passes by next shipment.	X		
Ranger seals disappeared in some areas; more in other areas		X	

More seals killed because no snow on the ice for cover.	X	X	
More "crawlers".	X	X	X
Dead harp seals in Anaktalik			X
More sick seals; have worms in them			X
No more young lassies			X
Concern that ship will affect (and even kill) seals.	X	X	
Polar Bears			
More polar bears.			X
Polar bears coming closer to land.	X		X
Black Bears			
Swimming to more islands.	X		
More black bears around mine site.	X		
Less black bears in AB			X
Black bears less scared of people.			X
Black bears coming out earlier in spring.			X
Foxes and Wolves			
Seen out on ship's track.	X		
Foxes are acting like their rabid			X
Mice			
More mice.			X
Porcupines			
More porcupines.			X
Fatter porcupines.			X
Birds			
Robins appearing earlier in spring and staying later in fall.		X	X
Birds are coming out earlier in the spring.		X	X
Robins appear in the winter sometimes.		X	
Less birds around mine site.	X		
Birds are not nesting on islands that they used to.	X	X	X
Gulls are bothersome.		X	
Young ducks on islands are disappearing.		X	
Dead ducks outside of AB.			X

Partridge are easily scared now.			X
Ravens more brazen.		X	
Finding eggs with no shells.			X
More eggs with double yolks.			X
More of these:			
Harlequin ducks	X		
Gulls		X	
Ravens.		X	
Geese around mine site fall 2006.			X
Spruce partridge.			X
White owls (have been gone for a long time)			X
Killdeer (has been gone for a long time)			X
Fewer of these:			
Ducks			X
Partridge			X
Canada geese	X		X
Fish			
More sick fish.			X
Less fish.			X
Less old fish.			X
Dead fish in ponds around mine.			X
Fish are smaller when ice fish.			X
Less fish in Camp Pond Brook because of VBNC spill.	X	X	X
Changes in specific species:			
See more capelin now.	X		X
Capelin don't stay in the bays anymore.		X	
Capelin are smaller.	X		
Less salmon; harder to get.	X		
Salmon are starting to come back.	X		
Char are starting to come back.	X		
Char comes out earlier now.		X	
Char are skinnier when they come out of the brooks.		X	
Char are going back into the streams earlier.		X	

Char looks and tastes different		X	
Cod's starting to come back.	X		
Catch more rock cod than cod.	X		
Shellfish			
Clams are bigger now.	X		
More clams.	X		
Insects			
More ants			X
More horseflies			X
Seeing insects earlier in spring			X
New species			
Moose	X		X
Harbour porpoise or dolphins.		X	
Herring/mackerel	X		
Squid	X		
Bees	X		X
Pigeons (city)	X		X
Unidentified duck	X	X	
Unidentified birds	X	X	
Morning doves	X	X	
Unidentified flies (like black flies but smaller)	X		
Unidentified stinging insect	X		
Musk ox	X		X
Black birds		X	
Sandhill cranes		X	
Daddy long legs		X	
White whale			X
Minke whale			X