



Nunatsiavut's Public Health Surveillance in Response to a Changing climate: A Baseline Study



Report from ArcticNet project 4.5 Surveillance and Management of
Climate Change Impacts in the North: Implications for northern public
health policy and infrastructure: The Nunatsiavut case study

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NUNATSIAVUT'S PUBLIC HEALTH SURVEILLANCE IN RESPONSE TO A CHANGING CLIMATE: A BASELINE STUDY

SandraOwens¹, PierreGosselin^{2,4}, Chris Furgal³, Daniel Martin⁴

1 Community Health Practitioner, Quebec, Quebec

2 Faculty of medicine, Laval University, Quebec, Quebec

3 Indigenous Environmental Studies Program, Trent University, Peterborough, Ontario

4 Public Health Research Unit, CHUL, Quebec, Quebec

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Pierre Gosselin, as principal investigator, chose to focus his extensive experience in health surveillance as well as in climate change investigations on the North where the need for capacity building was evident especially given the significant amount of accumulated evidence indicating that climate change was already having effect among Northern populations. Don Wigle, co-investigator for the first year of the project, provided his expertise in epidemiology and in surveillance systems until other responsibilities called him away from the project. Chris Furgal, co-Investigator to the project has contributed as the voice in the team with much Northern experience. Sandra Owens has coordinated the development of the project and is the focal point for training the case study researchers and seeing the reports to completion. More recently, Victoria Edge, Senior Epidemiologist with the Public Health Agency of Canada has joined the team and will lead the next incarnation of this initiative. This next phase will focus on specific capacity building projects and environmental health problems associated with climate change such as drinking water and food contamination, UVB exposure, responses to extreme climatic events, and others.

For the Nunatsiavut case study, Daniel Martin carried out Informant interviews and prepared an early first draft of this document. Sandra Owens furthered the investigation process resulting in this report.

Executive Summary

This report presents the Nunatsiavut Region results of a multiple case study of public health surveillance and environmental monitoring among four Inuit regions of the Canadian North. The motivation for undertaking this project are the many Inuit as well as scientifically reported changes taking place in the North as a result of climate change and the great potential for adverse as well as positive impacts to the health and well-being of its inhabitants. The case studies represent the initial or “baseline” component of this project, which aims to support Public Health Authorities in protecting population health by ameliorating capacity in public health surveillance in response to climate and related environmental changes.

This report describes the core surveillance activities, and environmental monitoring currently taking place in or for the Region to provide a scan or portrait from which to identify priorities and mechanisms to move forward. The case study also presents the context in which these activities need be considered, particularly the geopolitical, demographic, social, and health portrait of the Region and its population. While brief, these descriptions help to ground the interpretation of the results and the report’s recommendations. The policy recommendations may prove to be as critical and useful for enabling progress on key issues as the identification of specific gaps in the Region’s current health surveillance capacity.

This case study drew on documentation available through the Internet, libraries, and provided by Informants. Key Informants played a critical role in providing insights about the strengths and weaknesses of the systems, and in identifying the individuals to interviews to obtain detailed information on the way surveillance data is collected, stored, analysed and ultimately utilised to protect health. For Nunatsiavut 30 individuals in either the public health or environmental sectors gave of their time and knowledge through interviews administered where possible in person, and alternatively over the telephone when distance and resources did not permit otherwise.

This study identifies a number of the strengths and unique characteristics of current public health surveillance and environmental monitoring activities and the context within which these operate in Nunatsiavut. It is important to note however, that this report represents a work in progress,

that is to say that either updated, or additional information remains to be added to further the completion of the portrait. This is due to both the complex nature of the case study which sought to collect information on a large variety of fronts, and also for logistical reasons including the lack of availability of potential informants during the time that interviews were being done, or the limited time available to the case study researcher to complete the significant task. Although ideally this report would be very up to date and complete, we feel that it is nevertheless a solid basis from which to move forward as a group of collaborators interested in the objective of the project. It brings a level of common knowledge about the public health surveillance and environmental monitoring systems and networks in terms of adaptation to climate change to those who will collaborate together in this endeavour.

Chapter One: Background

This chapter will provide the context for the work leading up to this report as well as describe how this initiative hopes to have an impact in the future. Its focus is providing the link between public health surveillance, environmental monitoring and climate change in the northern Inuit context. It provides an overview regarding climate change in Northern Canada, as well as of its potential effects on health, particularly among Inuit populations. Secondly, key concepts are presented, and the purpose and objectives of this case study are described. Finally, the case study region of Nunatsiavut is introduced, with a brief overview situating the place and its people.

1.1 Introduction

In the Canadian Arctic, Aboriginal inhabitants are observing significant environmental changes (e.g. Communities of Labrador et al. (2005); Furgal et al., 2002; Huntington, Fox, Berkes, Krupnik & Whiting (2005); Krupnik & Jolly (2002)). In fact, a number of large scale scientific assessments have been published since the turn of the century and attest to the mounting evidence on the nature of climate change and its associated impacts in the circumpolar world (e.g. Arctic Climate Impact Assessment, 2004, 2005; Chapin et al., 2005; Intergovernmental Panel on Climate Change, 2001, 2007; Lemmen, Warren, Lacroix & Bush, 2008). The level of knowledge and data is ever increasing in specificity and coverage enabling society and the human systems within to take concrete actions in preparation for, and in response to recent trends in climate and environmental shifts that are currently observed and expected to continue. This is also true for the northern regions of Canada, perhaps in response to the fact that polar regions were identified as being susceptible to a greater level of warming than more southern regions (Maxwell 1997; Serreze, Walsh et al. 2000).

Furgal and Prowse (2008) show how many components of the Arctic climate and environment are experiencing change. Temperature and precipitation are on the rise, with resulting reductions for permafrost, sea ice, lake ice and snow. Sea level rise and the stability of coasts where almost all northern communities are located are also at play. In the biotic world, shifts in terms of diversity, ranges and distribution are being observed, and more are predicted. These changes are predicted to have significant implications on many levels for the human populations living in the

North, including over several economic sectors and of course influencing many determinants of health, of culture and of well-being.

Climate change is considered by the World Health Organisation as representing one of the greatest public health challenges of the century given its potential to impact the stability of several ecosystems on which human populations depend (McMichael, Haines, Sloof & Kovats, 1996). Both internationally and here in Canada, the capacity of public health surveillance systems has been identified as critical services in support of health for all¹, as well as being assessed as deficient and progress toward improvement as very limited. However, while Canada has been developing a Canadian health surveillance “infostructure” the Auditor General stated in 2002 that “...national surveillance is still weak; many systems still lack timely, accurate, and complete disease information; and gaps in surveillance continue.”². Among the deficiencies noted, the auditor highlighted the collaboration across different jurisdictions and an overall very limited rate of progress.

For northern regions, quality, standardized and locally accessible data is not always available (Berner & Furgal, 2004; Canadian Institute for Health Research [CIHR], 2003; McDonald, Harner, Fyfe, Loeng, & Weingartner, 2003) and this challenges the ability of northern health professionals and others to accurately assess and address impacts of a changing environment on northern residents’ health. The surveillance of health as well as of environmental information in this case, is central to identifying community health trends and supporting interventions to protect and promote health. However, many northern regions are challenged with regards to access to current surveillance technology, local scale data or trained and supported personnel to collect, organize and analyse this information (CIHR 2003, Canadian Secretariat International Polar Year, 2005). In some cases activities are taking place in an informal manner (e.g. hunters providing samples of wildlife tissue from hunt to local wildlife officer on ad hoc basis for analyses of zoonotic diseases or abnormalities) that must be identified and considered as they are valuable parts of the local monitoring network for health surveillance. The purpose of this project is to assess the capacity of northern environmental health monitoring and surveillance networks (formal and informal aspects) and, in cooperation with northern health professionals and

¹ World Health Organisation. 7-16 May 1998. Fifty first world health assembly: Documentation World Health Assembly: A51/5 Health for all in the twenty-first century, page VI, target 9: Geneva, Switzerland, http://ftp.who.int/gb/pdf_files/WHA51/ea5.pdf, Accessed May 13, 2006.

² <http://www.oag-bvg.gc.ca/domino/reports.nsf/html/20020902ce.html>, Accessed May 13, 2006.

Aboriginal organizations develop, implement and evaluate pilot strategies to address identified challenges and enhance or further support existing strengths. This project is currently ongoing in 4 regions of the Canadian North (Nunatsiavut, Nunavik, Nunavut and the Inuvialuit Settlement Region) funded under the Arctic NCE, ArcticNet.

Furgal (2008, in press) takes a broad yet detailed look at the context of Northern populations, climate change and health. Aboriginal populations inhabiting northern regions are identified as being particularly exposed to climate change in its varied facets, as well as vulnerable to an ensuing array of impacts to determinants of health or directly to health status. Their relationship with the land in terms of food, livelihood, identity and well-being as well as their collective health status, considered to be compromised by standard indicators, are among the primary factors rendering them particularly vulnerable to the environmental changes taking place. Moreover, Aboriginal populations are facing change on social, cultural, economic and other fronts, and these, over what is considered a short period of time for such adaptations. Research in these areas has been identified as being in its infancy (Berner, 2005; Furgal and Seguin, 2006; Hassi et al., 2005; as quoted in Furgal, 2008, in press). However, what is known to date is sufficient to motivate public health and environmental actors to collaborate now, in order to head off the worst of it, and address these emerging concerns by integrating climate change impacts into operations, as recognition of an adaptation to the order of business.

Adapted public health surveillance then, is among the critical infrastructures needed to support the adaptation of northern Aboriginal populations to these changes. This project seeks to begin just this; by working with Northern managers to identify the current state of these systems and networks, and to identify where short and longer term efforts might lead to the greatest positive impact in terms of increasing the protective capacity of northern public health systems.

Recognition must however, be given to the inherent characteristics and nature of the North, and its associated particularities when looking to adapt systems and infrastructure already in place, such as that of public health surveillance. Remote and small communities over expansive territories, negotiating traditional and modern ways, the role of work at the community level, informality, and local ways of communicating are among some of these considerations. Multiple pressures on limited resources also mean that stakeholders must develop strategies to take

advantage of opportunities. For this and other reasons, public health surveillance in responding to the risks of climate change may need to stretch somewhat from its usual ways of doing.

Recognition must be given to the inherent need to draw closer than ever public health and environmental networks to address many of the risk scenarios brought on by climate change in the Northern Aboriginal context, and the many challenges this implies. Environmental monitoring offers critical information for health protection – ice thickness and distribution, location and abundance of individuals of a critical species, rate of coastal erosion, and rate of sea level rise, are but some of the media and parameters of interest.

Recognition must also be given to the nature of climate change, as a fundamental and ever present component of every day life, acting directly in several ways, and indirectly in even more ways. The interactions and feedback loops between the many mediating factors represent a largely virgin pool of scientific evaluation, barely yet on the research radar.

Fortunately, roughly a decade of work on climate change and health in the North provides a knowledge base on which to build. Furgal et al. (2002) synthesize both Inuit and scientific knowledge on the topic and propose a framework which outlines potential health impacts associated with the various ways that climate change can act on people (Tables 1 and 2). These mediating factors were reported as acting directly on health status through a causal relationship with a condition or disease such as hypothermia or injury during a severe storm, for example. Mediating factors were also found to act indirectly on health status through various ways, including increasing risk scenarios for transmission of infectious disease, permafrost melting forcing the relocation of residential housing or other critical infrastructure, or changes in ice distribution having an adverse influence on traditional food security by reducing access to resources.

Table 1 Summary of potential direct climate related health impacts in Nunavik and Labrador (Furgal 2008, in press)

Identified climate related change	Potential Direct Health Impacts
Increased (magnitude and frequency) temperature extremes	Increased heat and cold related morbidity and mortality
Increase in frequency and intensity of extreme weather events (e.g. storms, etc.) Increase in uncharacteristic weather patterns	Increased frequency and severity of accidents while hunting and traveling resulting in injuries, death, psychosocial stress
Increased UV-B exposure	Increased risks of skin cancers, burns, infectious diseases, eye damage (cataracts), immunosuppression

Table 2 Summary of potential indirect climate related health impacts in Nunavik and Labrador (Furgal, 2008, in press)

Identified climate related change	Potential Indirect Health Impacts
Increased (magnitude and frequency) temperature extremes	Increase in infectious disease incidence and transmission, psychosocial disruption
Decrease in ice distribution, stability and duration of coverage	Increased frequency and severity of accidents while hunting and traveling resulting in injuries, death, psychosocial stress Decreased access to country food items, decreased food security, erosion of social and cultural values associated with country foods preparation, sharing and consumption
Change in snow composition (decrease in quality of snow for igloo construction with increased humidity)	Challenges to building shelters (igloo) for safety while on the land
Increase in range and activity of existing and new infective agents (e.g. biting flies)	Increased exposure to existing and new vector-borne diseases
Change in local ecology of water-borne and food-borne infective agents (introduction of new parasites and perceived decrease in quality of natural sources)	Increase in incidence of diarrhoeal and other infectious diseases Emergence of new diseases
Increased permafrost melting, decreased stability	Negative impacts to stability of public health, housing and transportation infrastructure Psychosocial disruption associated with community relocation (partial or complete)
Sea level rise	Psychosocial disruption associated with infrastructure damage and community relocation (partial or complete)
Changes in air pollution (contaminants, pollens and spores)	Increased incidence of respiratory and cardiovascular diseases, increased exposure to environmental contaminants and subsequent impacts

This framework provides the conceptual basis from which the data collected over the course of the case study was analysed thus informing on the state of public health surveillance and environmental monitoring for each of the mediating factors (see Table 7).

The outcome of the case study will be the observations gleaned from this analysis, enabling the identification of specific gaps to be addressed, as well as strengths on which to build. The information gleaned from this case study could lead to the development of specific initiatives aimed at improving the capacity of regional systems to protect health. For example, the monitoring of environmental measurements such as average ice thickness near a community relying heavily on ice travel during winter months; the survey of key wildlife species in a region where warming annual temperatures are thought to support the survival of new zoonotic diseases (e.g. Bradley, Kutz, Jenkins, & O'Hara, 2005); the recording and identification of new insect species in a region where warming is occurring and insects may act as vectors for the introduction of new human infectious diseases (e.g. Parkinson & Butler, 2005); or the monitoring of water temperature and incidence of water-borne organisms in local freshwater ponds used for human consumption (e.g. Warren, Berner & Curtis, 2005), are all potential new avenues to pursue in the adaptation process. Such information can support the community's ability, as well as that of the professionals servicing them, to know what changes are occurring, what changes are likely to take place, and what impacts these changes may have on residents' health and well-being.

1.2 Defining Concepts: Public Health Surveillance and Environmental Monitoring

Public Health Surveillance

Surveillance is a component of public health practice used to identify both service and research needs, but which excludes research from its activities (Teutsch & Thacker, 1995). The continuous surveillance of the health status of the population is defined as one of four essential functions of public health along with those of protection, promotion and prevention (Ministère de la santé et des services sociaux, 2003). In this context, surveillance is defined as:

Public health surveillance is the ongoing, systematic collection, analysis, interpretation, and dissemination of data regarding a health-related event for use in public health action to reduce morbidity and mortality and to improve health (Centers for Disease Control and Prevention, 2001, Background section, para. 1).

Health surveillance data are useful in: triggering interventions when clusters and cases of a health problem appear within a population; the identification of new and emerging health problems; the appropriate allocation of resources, making a business case for continuing and/or augmenting initiatives; monitoring the effectiveness and impact evaluation of programs and initiatives, identifying high risk groups and developing programming to address their needs; providing more extensive data for research and trending; and, to measure progress of community health status (World Bank, 2002, p.5).

McNabb, Chungong, Ryan, Wuhib, Nsubuga & Alemu (2002) identify core activities of public health surveillance leading to action as: detection, registration, reporting, confirmation, analysis and feedback. The four supporting activities are communication, training, supervision and resource provision (Figure 1).

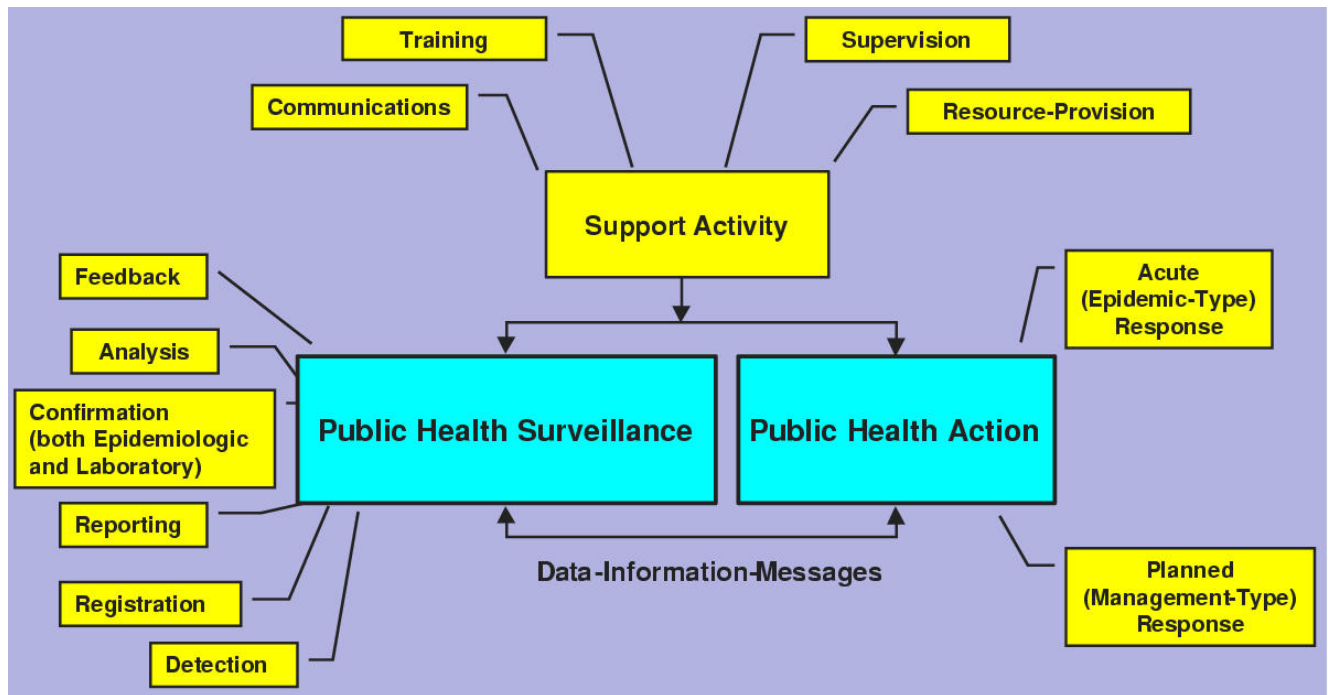


Figure 1 Conceptual framework of public health surveillance and action, McNabb et al. (2002)

Table 3 Defining Core and Supporting Public Health Surveillance Activities for both Health and Environmental Events, adapted from McNabb et al (2002)

Core Activity	Health		Environmental
	Notifiable or Vital Statistics or Chronic disease registries	Other	
Detection/ Measurement	The case or event is identified by physician or nurse	The health event is recognised and recorded in some form (patient record, police data, social services data)	Sampling of specific parameter in env. media or detection of event such as avalanche
Registration	Formal reporting through a standard procedure	Not done, with the exception of crimes	Formal reporting through a standard procedure (e.g. Drinking water quality)
Confirmation	Lab results to confirm the case, for some diseases the lab reports to DPH	When tests are done to confirm the event or some critical aspect (lab tests, autopsies, other?)	Lab results which precede Registration
Reporting	To the Director of PH (DPH)	A record of the incidence of the event is reported to another level within the system for collation	Any link with public health officials; publications, reports, communication of results.
Analyses	DPH will take action appropriate to the number of cases and the situation	Data on the health events are synthesized/analysed into a form that can be interpreted and with which action can be taken. A report is produced periodically.	Precedes reporting. Raw data that are synthesized into interpretable format.
Feedback	Detection criteria and registration forms are updated from time to time and are available to physicians, nurses and labs.	Information on aspects of Detection, Registration, Confirmation and Reporting are fed back to those who do these.	Feedback to those detecting/measuring on ameliorating use of data for public health ends.

Because northern populations live in close proximity to the land, the physical environment can be considered among the most critical determinants of health. The onset of climate change

represents a stressor in relation to the physical environment, and health surveillance for northern populations therefore necessitates connection with environmental monitoring. Environmental monitoring is considered to be the “systematic observation, measurement and calculation of the condition of the environment, emission of pollutants, or populations and species, which are necessary for the assessment of the condition of the environment, the development of environment policies, and the planning of environmental protection measures, as well as the control of the effectiveness thereof.” (Food and Agriculture Organization of the United Nations, 2000). More specifically for this study, monitoring of the environment pertains to those components which are affected by the phenomena of climate change. The mediating processes presented in Tables 1 and 3 speak to these and include weather, ice used for travel, ambient water, permafrost, biota, and air.

Both public health surveillance and environmental monitoring are usually done through the adoption of specific indicators, which are “...measures that summarize some aspects of a relationship within a phenomenon in a way that can support specific program goals.” (Eyles & Furgal, 2002)³.

1.3 Purpose and Objectives of the Project

This case study report of the state of public health surveillance and environmental monitoring in relation to climate change health impacts in Nunatsiavut is a component of a larger project which spans four Inuit regions of Northern Canada. This project is titled Surveillance and Management of Climate Change Impacts in the North: Implications for northern public health policy and infrastructure. Its purpose is to work with Northern managers, organisations and individuals to build capacity in supporting surveillance and management of climate change related health-events in the North, now, and into the future. Capacity building includes working to augment and/or improve human, technological and financial resources as determined by Northern managers.

The case study was undertaken to circumscribe the current state of health surveillance and action for northern populations to provide detailed information for gap analysis and for identifying what could be done on a priority basis to achieve some success in augmenting the health surveillance

³ See section 2.2 of this report for more information on the range of health and climate change indicators.

capacity. Such an undertaking is necessarily a long term and substantial planning endeavour (Teutsch & Thacker, 1995) requiring the participation of several partners, both from within the northern regions and outside partners in various sectors.

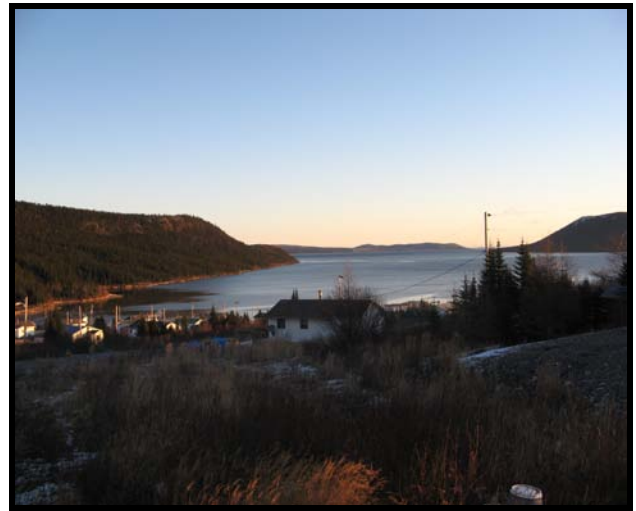
The project is seeking to inform and mobilize the necessary stakeholders and other resources to move towards the building of a system and programs, through education and training, partnerships and information sharing, pilot projects, fund mobilization and other mechanisms. This reflects the adoption of an action research approach deemed to be appropriate and functional for a capacity building initiative in the Canadian North. Their leadership and initiative in moving beyond the results of this case study will be critical.

The following are the key objectives of the project:

1. Assess the present adequacy of surveillance tools to support northern managers' ability to identify and monitor acute and chronic diseases, exposures, and other health determinants related to climate change and economic development impacts. (case study)
2. Identify policy implications for surveillance infrastructure, risk management frameworks and tools for sound interdepartmental and intergovernmental cooperation, at the regional, national and international levels.
3. Facilitate, through a collaborative approach with stakeholders, options and recommendations on the above-mentioned topics to develop capacity-building initiatives;
4. Identify and implement pilot projects for enhancing the health surveillance programs in the areas of mortality, morbidity (including mental health), injuries, lost persons, biomonitoring, social determinants of health, and community wellness.

1.4 The Case Study Region of Nunatsiavut and its Population

Labrador is the easterly portion of the large land mass shared with Nunavik (Québec in Figure 2) and represents a transition zone of arctic and sub-arctic climates. It is an area of relatively abundant marine life, due to the mixing of arctic and sub-arctic waters of the Gulf Stream. Characterized by a relatively harsh environment for its latitude, local weather patterns are much affected by the Labrador current and sea ice (Williamson 1997). Labrador features three distinct sub-arctic zones. In the south is boreal forest with mixed woodlands of spruce, tamarack and aspen. Moving north, the taiga, a transition zone of spruce forest, and farther north the tundra where the tree line ends, with only a few stunted conifers, willow and a diversity of alpine plant species. The region is the eastern edge of the Canadian Shield. A succession of ice masses sculpted the land and carved out the fjords, lakes and the deep valleys.



Together, the Labrador peninsula and the island of Newfoundland make up the province of Newfoundland and Labrador, recognised as such by the provincial government in 1964, and then by the Constitution of Canada in 2001. Labrador's population of approximately 28,000 is composed of 30% Aboriginal peoples including Inuit, Innu and Métis. (Newfoundland and Labrador, n.d.)

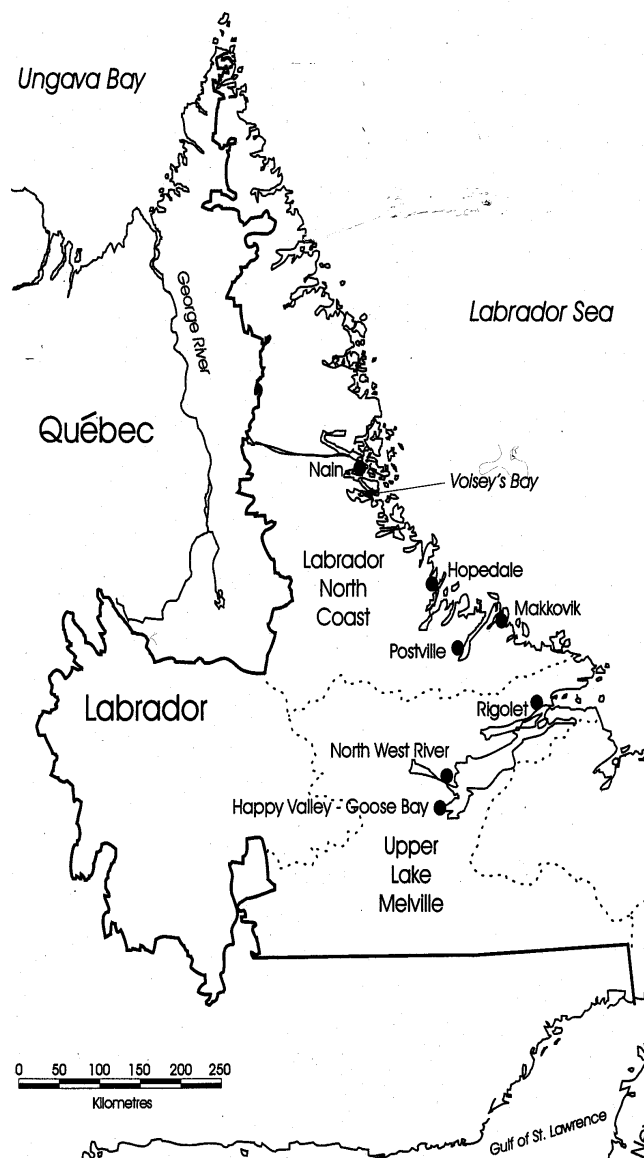


Figure 2 Map of Labrador

In June, 2001, Labrador Inuit and the federal and provincial governments signed an Agreement-in-Principle, paving the way for Labrador Inuit self-government, to be called

the *Nunatsiavut* Government. Ratification of the final Agreement began in 2003. On May 26, 2004 Labrador Inuit voted overwhelmingly in support of the Agreement. On December 6, 2004, the Newfoundland and Labrador House of Assembly passed the *Labrador Inuit Land Claims Agreement Act* and the Act received Royal Assent the same day. Bill C-56, an Act to give effect to the Labrador Inuit Land Claims Agreement and the Labrador Inuit Tax Treatment Agreement, received first reading on Monday June 6, 2005. The area covered in the *Labrador Inuit Land Claims Agreement*, called the *Labrador Inuit Settlement Area* consists of 72,520 km² of land in Labrador and 44,030 km² of sea (in orange below). According to the agreement, Labrador Inuit will have special rights related to traditional land use. Within the *Settlement Area*, Labrador Inuit will own 15,800 km² designated as Labrador Inuit Lands (in red below). These lands will be governed by the *Nunatsiavut* Government. In addition, 10,101 km² will be set aside for Torngat Mountains National Park. The Inuit region of Newfoundland and Labrador is now called *Nunatsiavut* ("our beautiful land"). (Nunatsiavut Government, n.d. (b))



Figure 3 Labrador Inuit Association Land Claim Settlement Area, Nunatsiavut Government (n.d. (b))

Nain is the administrative capital of Nunatsiavut, and Hopedale is its legislative capital (see Figure 2). Five communities inhabit the region and these from North to South are, in Inuktitut and then English, Nunainguk: Nain; Aqvituq: Hopedale; Qipuqqaq: Postville; Marruuvik: Makkovik; Kikiak: Rigolet.

Of the approximately 2,414 people who live in Nunatsiavut's five communities, 2,195 self identified as Inuit during the 2006 Census (see Table 4). Happy-Valley Goose-Bay, although not part of the Land Claim Settlement Area, is the town with the greatest single number of Inuit residents in the province, with 1,280 according to the 2006 Census. The majority of Inuit live in these six communities, with the balance of approximately 1,240 Inuit living in various communities throughout the rest of the Province.

Table 4 Population data for the Nunatsiavut Settlement Region, Census Division No. 11, 2006, Statistics Canada (2008)

Region/ Community	Total Population	Inuit Population	Median Age of Total Population	Population 65 years old or older (%)
Nain	1,034	935	26.4	5
Postville	219	200	32.8	9
Hopedale	530	475	25.5	1
Makkovik	362	310	29	4
Rigolet	269	240	31.2	6
Nunatsiavut Settlement Region*	2,414	2,160	27.8	5
NFLD and Labrador	505,469	4,715	41.7	14

* For the 2006 Census, Census Division No. 11 includes the communities within Nunatsiavut exclusively.

Nunatsiavut has a young population, with a median age of almost 28 as compared with that of almost 42 for the province. Inuit communities are also characterised by having a low proportion of older people with only 5% of the population 65 years of age or older.

Tradition harvesting continues to be a central part of the way of life in Nunatsiavut. As reported by Statistics Canada, about three quarters of adults in Labrador harvest country foods, the second highest reported, behind Nunavik, among all Inuit regions in Canada. Moreover, 56% of Inuit households reported that at least half of the meat and fish consumed were made up of country foods (Statistics Canada, 2001). In terms of store bought food, their cost is significantly higher than the same items purchased in the South, however, food prices in Nunatsiavut are reported as less elevated than for other Inuit regions (Statistics Canada, 2001, see table 1.1). Overall, while

the relative income status for the coastal Inuit population is improving, it remains significantly lower than that for Canada⁴.

Inuit populations including that of Nunatsiavut are, according to traditional health indicators, characterised by having a poorer health status than other Canadians (Inuit Tapiriit Kanatami (ITK), 2007a; 2007b). Life expectancy in Nunatsiavut⁵ is estimated at 67.4 years in comparison to 79.5 years for all Canadians, a difference of 14 years (ITK, 2007a). Some of the factors contributing to this undesirable situation are higher infant mortality and suicide rates, the later particularly among youth (ITK, 2007b).

Priority issues include children's health, for which chronic and infectious disease rates are high, particularly those of a respiratory nature (Alaghebandan, Gates & MacDonald, 2007; ITK, 2007b). As well, high injury and poisoning rates are associated with substance abuse, and finally smoking rates are much higher among Inuit populations than among the general Canadian population (ITK, 2007b).

⁴See Charts for "Income, Consumption and Leisure", for the Local area of "Labrador North" at <http://www.communityaccounts.ca/CommunityAccounts/OnlineData/default.htm> for supporting data

⁵ Calculations pertain to Inuit and non-Inuit as well the population of Happy-Valley Goose Bay

Chapter Two: Methods

The approach for the project is one of participatory research, whereby collaboration between the research team headquartered in the South and managers of the North drives the initiative. The research team can provide expertise and skills, support, training and communicate the priorities identified by Northern partners to funding and other agencies.

In participatory research a number of techniques and tools can be drawn upon at different phases of capacity building. For the initial phase, the goal was to compile a baseline document from which all stakeholders could work, and this is that document. The document would describe the state of the health surveillance and environmental monitoring in a way that would enable the identification of challenges, gaps and priorities. Subsequent phases of the work may draw on other techniques such as holding a workshop to increase the interactions between the health and environment networks.

2.1 The Case Study Approach

A case study approach (Creswell, 1998) was adopted to investigate and describe a portrait of the health surveillance activities and the network of organisations and individuals operating its services, as well as the complimentary environmental monitoring activities, taking place in Nunatsiavut. In contrast to a survey, a case study takes into consideration the context of the case, allowing for local characteristics to emerge. The modest size of the population, as well as the potential for volatility in recruitment and retention of expert stakeholders in northern communities also lent weight to the choice of adopting a qualitative approach. A case study could deliver recommendations that were of specific use to the network of managers and experts for each Northern region participating in the project.

Several sources of data were consulted for this case study and these are: key informant and informant interviews, published documents and web pages. Appendix B provides lists of the various roles of interest for the identification of potential informants that participated in the case study. For the Nunatsiavut case study 30 Informants were interviewed from various organisations.

Key informants are senior managers or individuals with extensive knowledge in either public health surveillance or environmental monitoring for the region. The role of key informants is twofold: primarily to participate as experts in their field, in addition to the identification of other potential informants as well as facilitate access to them. For example, the Chief Medical Officer of Health or Director of Public Health are key informants for their region. Their role is akin to one of collaborator to the project and is absolutely critical. Informants are people with more specific areas of knowledge, often pertaining to one group of specific indicators such as permafrost, or lost persons.

Interviews with key informants were unstructured as they focussed on identifying the network of organisations with a role in either environmental or public health surveillance as well as those individuals best positioned to act as informants to the project. Informant interviews on the other hand were semi-structured, carried out with an interview guide (some key informants also played the role of informant and participated in a semi-structured interview). The guide probes on the status of all eight core and four supporting surveillance activities⁶ for a wide range of indicators potentially associating climate related changes and impacts to health status. As such the guide is lengthy and is not designed to be administered in its entirety with each informant, but rather only the section pertaining to the groups of indicators relevant to the informant's area of expertise would be covered in the interview. The series of interviews seek to complete the interview guide completely once by carrying out a number of interviews with those individuals identified as experts by the key Informants.

2.2 Interview Guide

Furgal (2003) proposed a list of indicators for monitoring relationships between climate variables and health events. This list, Climate Change and Health Indicators for Northern Communities, was generated from a northern workshop and was adapted for this project and is provided in Appendix A. There are three broad categories of indicators – environmental, health and action indicators, with the later referring to indicators of the existence of programs in place to protect health from any of the range of direct and indirect impacts of climate change on health. Organization of the interview guide was designed to address broad categories of environmental (e.g. sea, permafrost) or health endpoints (e.g. mortality, morbidity). This list formed the

⁶ See Appendix B

conceptual basis for the development of the interview guide which is organised around each group of indicators. Finally, within each group (e.g. weather) is a list of the specific indicators that are considered to play a critical role in understanding the link between environmental and health events. For example, data on extreme weather events and incidence of cardio-respiratory events are needed to investigate if a relationship exists between the two. Specific questions in the interview guide spoke to the third category, the group of action indicators on the state of surveillance and risk management. Analysis followed a process of reduction, presentation, conclusions and verification (Miles and Huberman 1994).

2.3 Analysis

Documents and web-based information that were accessed as data for this case study were primarily used for assembling a description of the Nunatsiavut Settlement Region and its population (Chapter 1) and of the Public Health and Environmental Organisations which play a role in either surveillance or monitoring for the Region (Chapter 3).

Notes were taken during informant interviews and these were transcribed to a word processing file immediately following the interview. These interview reports, along with documents and web-based information informed the status of public health surveillance and environmental monitoring core activities as presented in Chapters 4 and 5.

These data were then analysed with respect to each of the ways in which climate change is reported to potentially act directly or indirectly on health (Tables 1 and 2). Results are presented in Table format in Chapter 6.

2.4 Ethics and Approvals

Ethics approval has been provided from the ethics committees for research from Laval University. As well, the Research Office of the Nunatsiavut Government has provided approval to carry out the project.

A consent form is presented to the informant prior to the undertaking of an interview. The presentation of the consent form will provide opportunity to clearly explain what participation in the project will entail and allow for any questions to be addressed.

Confidentiality will be assured through the application of an alphanumeric coding system to interview notes and personal information shall be stored separately under lock and key for a pre-determined length of time, after which time interview material will be destroyed.



Chapter Three: Overview of Public Health and Environmental Organizations

This Chapter provides an introduction to the major organisations involved in either public health or environmental monitoring in terms of their responsibilities and areas of expertise to these ends. Presently the Nunatsiavut and provincial governments work together in an effective partnership to provide health services in Nunatsiavut. As time passes, greater responsibility is shifting towards the Nunatsiavut Government for the delivery of services as negotiated under their Land Claims Agreement. The federal government, particularly Statistics Canada offers a number of datasets with health surveillance relevance. For environmental management in the region, the Nunatsiavut Government has the lion's share of responsibility. Federal-provincial agreements oversee the collection of a modest amount of monitoring data for the region and some federal departments play significant roles for monitoring of important species for the region.

3.1 The Evolution of Health Services for Nunatsiavut

During the 1700s, the Moravians offered limited care in Labrador. Later the International Grenfell Association (IGA), a charitable organization began operating in the region and assumed services in remote northern Newfoundland and Labrador. Once Newfoundland joined the Confederation in 1949, there was provision of some funding by the federal government for basic acute care services that made its way to the Labrador region, although the terms of union did not make specific reference to Aboriginal people. The federal Department of Health and Welfare subsidized the IGA through the payment of a daily rate for each patient under treatment at North West River or St Anthony hospitals. Nursing stations were built at Makkovik, Hopedale, Davis Inlet, and Nain, with funds coming entirely from the federal government. (Baikie, 1990)

It was not until the late 1980s that the federal government began to provide non-insured health benefits for example, for Aboriginal people within the province. In the interim, the provincial government provided, and continues to provide the lion's share of primary health services through Regional Health Authorities.

The inhabitants of the region began to negotiate for themselves. Incorporated in 1975, the Labrador Inuit Association (LIA) was a non-profit organisation representing approximately 5,300 members of Inuit and Kablunângajuit (of mixed Inuit and European ancestry). In 1982, the LIA set up an affiliate called the Labrador Inuit Alcohol and Drug Abuse Program (LIADAP) and in

1989 the Labrador Inuit Health Commission (LIHC) with funding from the federal government. The LIA has since transitioned into the Nunatsiavut Government. In terms of health services, the Department of Health, Education, Social and Economic Development has been created with Deputy Minister of Health and Social Services Michelle Kinney, headquartered in Happy Valley-Goose Bay.

Today, the Labrador-Grenfell Health Authority works in collaboration with the Nunatsiavut government Department of Health and Social Development. There is ongoing effort to look at integration of programs among the various jurisdictions involved in providing health services, including public health surveillance, to the population of Nunatsiavut.

3.2 Nunatsiavut Government Health Services

The Nunatsiavut Department of Health and Social Development has created and filled three senior positions - Director of Health Services, Director of Community Programs, and Director of Mental Health and Addictions (Nunatsiavut Government, 2006a). The Department is in the process of building programs, defining policy, and staffing positions.

The Nunatsiavut Government provides community health services in the coastal communities, as well as in Northwest River. These include public health nurses, public health aides, mental health workers, a psychologist, community service workers, child care workers and a diabetes specialist. A number of programs are delivered pertaining to home care, diabetes, addictions, child care, disease control, non-insured health benefits and environmental health. As negotiated through the Land Claim Agreement Act, the Nunatsiavut Government will eventually take responsibility for the community clinics, presently operated by the Labrador-Grenfell Health Authority. The infrastructures from which the community health services are offered are separate from that of the community clinics, with the exception of Nain where the same building houses both organizations' services.

Currently, Labrador-Grenfell Health (see below) represents the coastal population when interfacing with the provincial government, while an objective is to have direct representation of Inuit and coastal issues in all negotiations with the province.

3.3 Labrador-Grenfell Health Authority and Provincial Health Services

The Department of Health and Community Services⁷ is one of two provincial government departments responsible for the administration of the Health and Community Services Act. The Act stipulates its relationship to the Labrador Inuit Land Claims Agreement (LILCA), whereby the LILCA takes precedence over the provincial Act as follows,

This Act and regulations made under this Act shall be read and applied in conjunction with the *Labrador Inuit Land Claims Agreement Act* and, where a provision of this Act or regulations made under this Act is inconsistent or conflicts with a provision, term or condition of the *Labrador Inuit Land Claims Agreement Act*, the provision, term or condition of the *Labrador Inuit Land Claims Agreement Act* shall have precedence over the provision of this Act. (House of Assembly Newfoundland and Labrador, 1995, section 2.1)

This Act allows for the establishment of regional health boards that are responsible for the provision of health, continuing care and community services. Today, four regional integrated health authorities provide health and community services throughout the province: Eastern Health, Central Health, Western Health, and Labrador-Grenfell Health. On April 1, 2005 the Health Labrador Corporation (HLC) and Grenfell Health Services merged to form the Labrador-Grenfell Regional Integrated Health Authority. More recently, the entity was renamed simply Labrador-Grenfell Health. It delivers a range of primary and secondary health services to the region's populations including that of Nunatsiavut, the Innu Nation, and the Labrador Métis. It operates three hospitals, three community health centers, fourteen community clinics/nursing stations, three long term care facilities and offers child, youth and family services. (Labrador-Grenfell Health, 2007)

Figure 4 below shows the HLC service region and to its right, that of the Grenfell Region, which spans the southern tip of Labrador and northern tip of the Island across the Strait of Belle-Isle.

⁷ The following information on the Department of Health and Community Services is taken from <http://www.health.gov.nl.ca/health/>

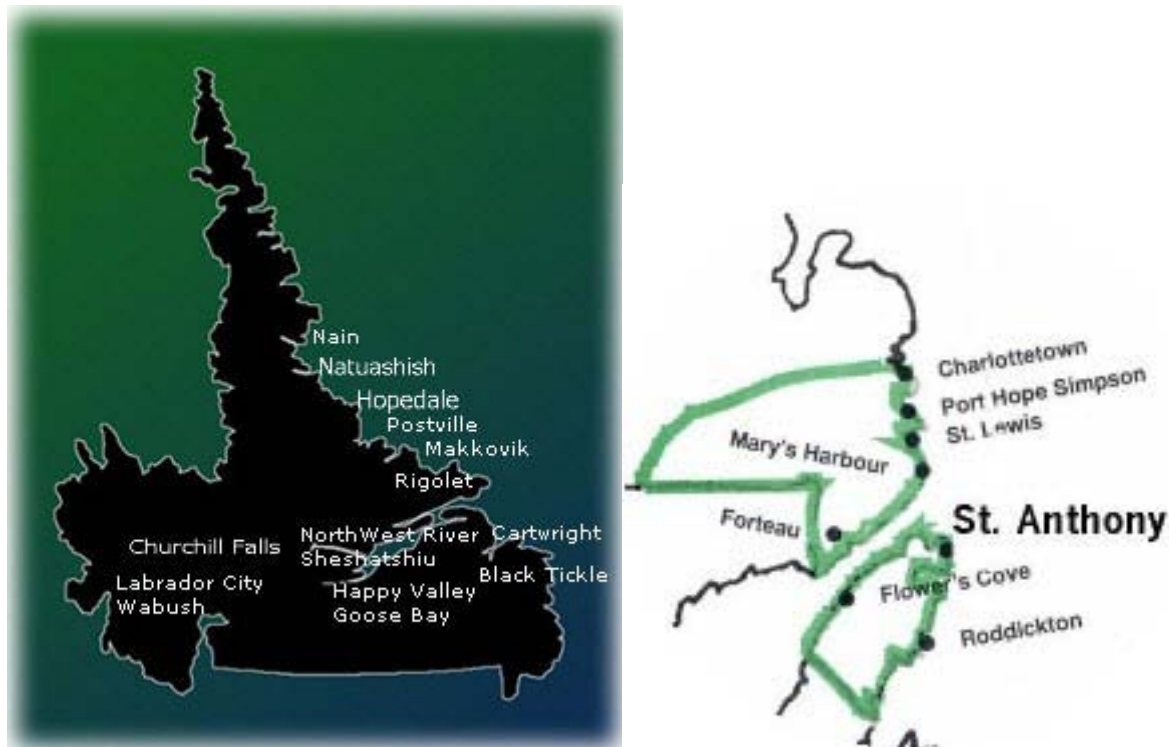


Figure 4 Health Labrador Corporation Service Area (L); Grenfell Region Service Area (R), now merged to form the Labrador-Grenfell Integrated Health Authority

The Health Authority has a Medical Officer of Health, Dr. Maureen Baikie, whose populations include that of Nunatsiavut, as well as the other aboriginal and non-aboriginal populations within the Health Authority region.

There are three Environmental Health Officer (EHO) positions that are provincial positions and which cover the Labrador-Grenfell Health Authority territory. As of March 2008, there is one EHO in Happy Valley Goose Bay servicing the Nunatsiavut region. EHOs investigate and report cases of communicable diseases and animal bites, they also issue boil water advisories and perform a number of inspections in schools, child care homes, correctional facilities, food premises and others. All inspection reports are sent to the Health Authority's Director of Environmental Health.

The provincial Department of Health and Community Services with the Health Authority provide disease surveillance, disease control, and environmental health services. The Division of Disease Control receives, compiles and analyzes reported communicable diseases as outlined in the

Communicable Diseases Act and the Venereal Diseases Act. The EHOs investigate and control outbreaks of food and water-borne illness, tuberculosis, measles, and unidentified symptoms or disease syndromes in the population.

Vital Statistics Registries are housed within the Department of Government Services.

Community Accounts⁸

Community Accounts is an initiative of the Government of NFLD and Labrador. This online data retrieval system allows the access to information through a single source of community, regional, and provincial data including data on household spending, income, social, health, labour market, production, demographics, education, resource/wealth and environment and well-being. The site allows users to compile indicators from each of the above domains to develop a better understanding of the factors that determine the status and progress of their communities and regions. Information can be retrieved by 400 communities, 80 census consolidated subdivisions (local areas), 20 economic development zones, Rural Secretariat Regions, Health Authorities, School Districts, and Human Resources Development Canada Regions, and the province. See section 4.6 *Social Determinants of Health and Community Wellness* for a general review of its applicability to the population of Nunatsiavut.

Newfoundland and Labrador Centre for Health Information (NLCHI)⁹

The Centre is one of a kind in Canada as a comprehensive health information centre and a model for other jurisdictions. Its function is to make available quality health information to various users. Initiatives of interest include the development of an electronic health record (EHR) for each individual which in turn involves the development of various components including registries, drug information, diagnostic imaging, and laboratory information systems, Telehealth, electronic medical records and infrastructure. The Labrador portion of Labrador-Grenfell Health has installed the Diagnostic Imaging/Picture Archiving and Communications System (DIPACS). DIPACS moves diagnostic images such as x-rays to an electronic format (NLCHI, 2007).

As well there is the work of the Research and Evaluation Division. The latter prepares and analyzes statistical health information from databases of coded information. They work with various partners such as Memorial University and Health Canada in carrying out applied health

⁸ www.communityaccounts.ca/CommunityAccounts/OnlineData/default.asp

⁹ (NLCHI, n.d.)

research in areas such as evaluating electronic health record initiatives, prescription medication utilization, health performance indicators, childhood development, chronic disease, and social and mental wellness.

Among the documents available from the Centre's web site, none offered information that was either more recent or geographically specific than what is available from Statistics Canada. Of interest to the development of health surveillance systems may be the services of the Health Information Division which provides health information systems consulting services to, among others, the health authorities. Other initiatives such as the development of a comprehensive laboratory information system are in the early stages of development and offer other opportunities for capacity building in health surveillance. As well the Research and Evaluation Division is open to collaboration and has personnel with the range of skills that fit appropriately with surveillance activities.

The Community Health Division of Memorial University of Newfoundland has undertaken the Newfoundland Adult and Community Health Survey, with cycles completed in 1995 and 2001. The first survey included questions on health status, health practices and behaviours, and access and opinions about medical care utilization. The survey however did not include the Labrador population in its sample. (Community Accounts, n.d.)

Other

The Provincial Rural Secretariat offers complimentary programs to health and safety. The Labrador Region office is situated in Happy Valley Goose Bay. The Torngat Recreation Commission is a partnership between coastal communities which host training events including wilderness first aid and recreation staff development. The Healthy Communities Project was established in southern Labrador in July 2003. Capacity building workshops have been sponsored. Labrador Youth Online promotes the successes of youth in the Labrador region and provides information to youth. From the Labrador Strategic Social Plan (SSP) region, the Violence Prevention Initiative and Labradorians for Peaceful Communities (LFPC) partnered to address safety and security issues in Labrador through a series of video conferences on topics such as the Roots of Empathy Program and the Youth Criminal Justice Act to increase

community awareness of programs and services available in Labrador. (Rural Secretariat Executive Council, n.d.)

3.4 Environmental Management in Nunatsiavut

The Nunatsiavut Government has created a Department of Lands and Natural Resources. Its areas of responsibilities include the co-management of renewable (including fisheries) and non-renewable resources; the application of LILCA provisions for resource development; Inuit water rights; the management of Labrador Inuit Land and Specified Materials lands; land use planning; harvesting and hunting matters; and environment assessment, protection and monitoring. (Nunatsiavut Government, n.d.)

In terms of fishing, hunting and harvesting as renewable resources, they are planning to negotiate the Upper Lake Melville fishing agreement and license; establish schedules of fees for permits, leases, licenses and access to Labrador Inuit Lands, finalize forms for transfer of harvesting rights, and provide training for guardians to take on the role of enforcement officers (Nunatsiavut Government, 2006b).

The Newfoundland and Labrador's Department of Environment and Conservation was created in 2004. Among its three Branches, only the Lands Branch has an office in Happy-Valley Goose Bay, the closest to the Nunatsiavut Region. They report that the Inland Fish and Wildlife Division work with the Nunatsiavut Government to support stewardship initiatives in Labrador. These include firearm and hunting education programs including for youth and Aboriginal people. The Department also reports that aerial photography of 1:40,000 scale provides recent coastal mapping of Labrador over 5876 km². (Department of Environment and Conservation, n.d.)

In terms of environmental assessment legislation, the Newfoundland and Labrador Government report the following applies to the Nunatsiavut context:

“The federal and provincial environmental assessment laws will continue to apply throughout the Settlement Area. The Inuit Central Government may make laws respecting the environmental assessment of projects in Labrador Inuit Lands, but federal and provincial laws prevail if there is a conflict between the laws.

The Inuit Central Government will be consulted and may participate in assessments which are being carried out by the province or the Government of Canada in the Settlement Area outside Labrador Inuit Lands.” (Government of Newfoundland and Labrador, May 10, 1999)

The prior Labrador Inuit Development Corporation (LIDC) has transitioned into the Nunatsiavut Development Corporation and has ownership interests in a number of economic initiatives in the region. It focuses on traditional skills and on training and skills transfer for emerging opportunities.

The Nunatsiavut Government’s has a Research Office which functions as a focal point for incoming researchers. It oversees the research review and approval process, promoting that Inuit concerns are addressed through the research projects. At the time of preparation there was no inventory yet available of monitoring activities taking place in the region. (J. Lampe, personal communication, November 22, 2007)

Different federal departments associated with environmental management, the Department of Fisheries and Oceans, Parks Canada and Environment Canada in particular, are involved in specific monitoring activities in the Nunatsiavut region. These will be discussed in Chapter Five, where specific environmental monitoring initiatives are described.

The Institute for Environmental Monitoring and Research¹⁰ is based in Happy Valley-Goose Bay. Created in 1995 in response to a recommendation made by an independent environmental assessment review panel, it conducts multidisciplinary scientific research in Labrador and North-eastern Québec on the effects of low-level flying, as well as on the socio-economic effects of the military activities. The Institute offers scientifically supported recommendations to the Ministers of Environment and National Defence. Of the nine voting seats on the Board of Directors are the Nunatsiavut Government, the Inuit of Nunavik, as well as other indigenous groups from the two regions. Research topics are on: Osprey, caribou, waterfowl, River Valley, contaminants, economic impact of military flight training in Labrador and North-eastern Québec, and flight track monitoring, impacts of supersonic flights on environment.

¹⁰ see <http://www.iemr.org/>

Sikumiut Environmental Management Ltd¹¹ is a private enterprise providing a range of services for environmental management. They have been involved with a number of environmental monitoring activities. Established in 2002, it has three offices in the province including one in Nain.



¹¹ see <http://www.sikumiut.ca/>

Chapter four: Public Health Surveillance Core Activities in Nunatsiavut

This chapter presents the results of the investigation for each group of health indicators in terms of what data is collected and what trajectory that data follows from its collection (detection), registration, reporting, confirmation, analysis and feedback, where applicable. It also begins with a general overview of patient records for the region.

4.1 Patient Records

For Nain, Hopedale, Makkovik, Postville, and Rigolet patient visits are recorded on paper and kept as part of the patient's ongoing medical chart within each of the Labrador-Grenfell Health clinics. Some individuals have more than one volume of records at their community clinic. As well, an administrative tool referred to as "E-Books" are kept within each clinic. E-Books are hard cover ledgers that have been used for some time and record age, gender, a coded final diagnosis and some description of the reason for a visit ¹². While more detail resides within the medical charts, the E-books lend themselves more readily to surveillance ends. For client visits to either or both the Health Centre (Hospital) in Happy Valley-Goose Bay or the Hospital in St. Anthony, a hospital discharge record is generated and submitted to the Canadian Institute of Health Information (CIHI) to their Discharge Abstract Database (DAD). The DAD contains data on hospital discharges across Canada from all hospitals in every province and territory except Québec (CIHI, 2007). If clients are transferred to the hospital in St. Anthony, on the Island, another report will be generated upon discharge. Each record identifies the patient's community of residence (R. Haire ¹³, personal communication, December 18, 2007). However, a protocol for the release of data respecting patient confidentiality applies.

As well, public health records for immunization are sent to a central provincial registry, once the client reaches a certain age. Some immunization records are kept at the Labrador-Grenfell Health Authority (system referred to as CRMF) but these do not apply to all beneficiaries.

¹² An assessment of the quality of these records will be carried out by a field epidemiologist with the Public Health Agency of Canada, for more information contact Dr. Victoria Edge at Victoria_Edge@phac-aspc.gc.ca. Another assessment of the quality of the records for the former Davis Inlet community before and after their relocation is currently underway – contact TBD

¹³ Newfoundland and Labrador Centre for Health Information

There are three levels of Laboratories available to Nunatsiavut clients. There is the local lab at the Health Centre in Happy-Valley Goose Bay, Meditech. This lab run tests of a more routine nature and results are produced electronically and on paper, although currently Nain is the only coastal community that can access the electronic results. The provincial or “Public Health Lab” is situated in St. John’s where samples related to reportable diseases are sent. Finally there is the National microbiological lab in Winnipeg which does TB strain genotyping, among other tests.

4.2 Mortality

A death certificate is completed by the attending medical personnel and sent to provincial Vital Statistics. The cause of death is confirmed by attending medical personnel with the use of either Labrador-Grenfell Health or provincial public health laboratory results. Data for the Nunatsiavut region are neither routinely analysed, nor reported.

4.3 Injuries

For intentional or non-intentional injuries that bring patients to a community clinic, a record is kept by Labrador-Grenfell Health but is not reported to any higher level institution. If an injury is such that the patient goes to the hospital in Happy Valley- Goose Bay, a hospital separations record will be forwarded to the Canadian Institute for Health Information (CIHI) from which data can be accessed. Protocols for divulgence of information pertaining to small incidence numbers apply. In the case of a fatal injury, the information in section 4.2 applies.

CIHI's Discharge Abstract Database (DAD) contains the following patient demographic elements (CIHI, 2007b):

Group 03—Patient Demographics	
01	Health Card Number
02	Postal Code
03	Residence Code
04	Gender
05	Province/Territory Issuing HCN
06	Responsibility For Payment
08	Birthdate
09	Birthdate is Estimated
11–27	Province/Territory Ancillary Data
derived	Age

4.4 Morbidity

Communicable Disease

There are three lists of reportable communicable diseases that apply to the population of Nunatsiavut and are legislated by the provincial government under the Communicable Diseases Act and the Venereal Diseases Act. Lists A, B and C are Appended (E) and represent three categories of reporting— immediate/same day, next business day and aggregate. For suspected cases within Nunatsiavut, the required sample is taken at the community clinic and flown to the laboratory in Happy Valley Goose Bay for a screening and then some samples are sent onto the provincial laboratory in St. John's. The Labrador-Grenfell Health Communicable Disease Nurse receives all laboratory reports relevant to such cases from within the region and submits the data

electronically on a weekly basis to the provincial Department of Health and Community Services' Division of Disease Control. There an analysis is done by hand, as the case numbers are modest. A communicable disease report is prepared every two months. These are sent to the Health Authorities, who then redistribute the reports to medical practitioners, and other key stakeholders. Such data dates back to 1990. One issue identified was the need to access this dataset at the community level. It was thought that the eventual implementation of a pan-Canadian surveillance system, such as Panorama¹⁴, would eventually remedy this situation.

The province uses the Public Health Agency of Canada's definitions for communicable disease and report for the latter for the Labrador-Grenfell region and not for Nunatsiavut or any other division smaller than the Health Region. The Division of Disease Control produce weekly, monthly and annual reports for the province, report to the Public Health Agency of Canada, and maintain disease registries. There are seven current disease registries; Tuberculosis, Syphilis, Hepatitis B, Hepatitis C, HIV and AIDS, Measles, Meningococcal Disease which include demographic, treatment (TB only) and epidemiologic data. The Division also provide policy and guidelines for disease control – a manual is currently under preparation. The Division is not fully staffed.

There are also records of investigations of notifiable (reportable) diseases initiated by the Health Authority's Director of Environmental Health. In the case of a potential outbreak, a full scale public health investigation is undertaken, and for isolated cases an interview with the person is done to identify how the illness was acquired and that appropriate measures are taken to contain the illness.

There is also what informants referred to as the "TB bible". These are paper records dating back many years which follow along family lines the incidence of tuberculosis in each community. The originals have been archived with Torngâsok Cultural Centre, and copies have been provided to the Medical Officer of Health and the provincial Division of Disease Control.

The reporting of notifiable diseases is mandated by the provinces and territories; notifiable diseases may vary from province to province. Reporting by the provinces and territories to the federal level is voluntary; however, agreement is reached by consensus of representatives from all provinces and territories. (PHAC, 2003a)

Chronic Diseases

The Newfoundland Cancer Treatment and Research Foundation (NCTRF) have a cancer registry for the province. The Oncology Patient Information System (OPIS) collects information about all new cancer cases in the province. Every attempt is made to electronically collect all source data for cancer registrations by linking cancer registry files with hospital abstracts and vital statistics (NCTRF, n.d.). Analysis for regions smaller than Health Authorities are not generally done. The Foundation does not report data for regions where incidence numbers of 11 cases or smaller occur in order to protect patient confidentiality.

For other chronic diseases that bring patients to a community clinic, a record is kept by Labrador-Grenfell Health but is not reported to any higher level institution. If the patient is admitted to a hospital, a separations record will be forwarded to the Canadian Institute for Health Information (CIHI) from which data can be accessed. Protocols for divulgence of information pertaining to small incidence numbers apply.

Screening, treatment and prevention of diabetes are a priority for the Nunatsiavut health system. In collaboration with Labrador-Grenfell Health individuals attained with diabetes are visited at home by home case nurses in order to assist with the regulation of their diabetes. Prevention initiatives are implemented including school visits, and screening for the disease at the early age of 40 is done in community clinics. In terms of surveillance however, there is not thought to be an adequate system in place for diabetes.

4.5 Mental Health and Well-being

There are two streams of mental health services for the Nunatsiavut population. The Nunatsiavut Government have a minimum of one mental health worker in each of the coastal communities, depending on the size of the community. The service level in any community varies with the level of training of each worker. Service providers vary from psychologist, to therapist, to councillor, to community health worker.

Following a visit of a mental health or addiction nature to a community health office, a record is made by the worker with enough detail for another worker to follow up on the case, but without divulging confidential information. Each community's Team Leader (one in each community reporting to the Department of Health and Social Development) compiles statistics of these

records and sends them to the Director of Community Programs. However, if the patient goes to the community clinic rather than the community health office, then the event is recorded by Labrador-Grenfell Health.

There are Crisis Response Teams which operate on a volunteer basis. Use of this service is also reported to the Department of Health and Social Development senior management.

Labrador-Grenfell Health also has mental health and addictions services at the Health Centre (hospital) in Happy-Valley Goose Bay.

As for data related to suicides or attempts, the data is not centralised within the Nunatsiavut Government, however hearings were held across the Nunatsiavut region in 2007 to gather information on mental health and addictions and a report will be forthcoming.

4.6 Determinants of health and community well-being

A population health approach recognizes that health of populations extends beyond traditional indicators such as death, disease, and disability. It emphasizes that health is determined by complex interactions between social and economic factors, the physical environment and individual behaviour. These factors are referred to as the ‘determinants of health’. Determinants of Health as defined by the Public Health Agency of Canada are (PHAC, 2003b):

1. Income and Social Status
2. Social Support Networks
3. Education and Literacy
4. Employment/Working Conditions
5. Social Environments
6. Physical Environments
7. Personal Health Practices and Coping Skills
8. Healthy Child Development
9. Biology and Genetic Endowment
10. Health Services
11. Gender
12. Culture

All factors above with the exclusion of “physical environment” and “biology and genetic endowment” are social determinants of health. Other experts and organizations recognise other social determinants of health such as housing, food security, social exclusion, and family violence (e.g. Edwards, n.d.).

Table 5 shows the relative percentage of the population represented by the Inuit of Nunatsiavut within different organizational regions most likely to have data of health relevance to report. The 2006 Census, which includes the Aboriginal Population Profiles, provides data specific to the five coastal communities of Nunatsiavut, and which is labelled Division no. 11. The Nunatsiavut Government and Statistics Canada have signed a data sharing agreement under which specific changes to the Aboriginal Peoples Survey (APS) have been made making the survey data of greater relevance to beneficiaries of the Land Claims Agreement. The Nunatsiavut Government will receive all the data stripped of identifiers, enabling them to perform their own analyses, although Statistics Canada continues to offer data analysis services.

For the 2001 Census, the coastal communities were subsumed into a larger region labelled Division No. 10. Data can however be retrieved for four of the five communities (Hopedale is excluded) individually. Census data covers a broad range of parameters with relevance to determinants of health such as on education, language, labour activity, health, communication technology, mobility and housing. The health section presents responses to three questions, one on perception of health status, one on use of health care services and one on long-term health conditions.

Data from the 2001 Census Aboriginal Population Profile reports data for whole communities where the Aboriginal population is over 250. To access data that may be relevant to the Nunatsiavut population select “Community Profiles”, then “Census Aboriginal Population Profiles”, then “select a community from a list”. Among the list are Census Division No. 10, Happy Valley-Goose Bay, Health Labrador Corporation, and the five coastal towns of Nunatsiavut, including Hopedale. Information on population, education, earnings, work, income and families and dwellings is provided. Aggregate data for Nunatsiavut is not available on-line, however it may be possible to request that such an analysis be done.

The Inukshuk Economic Development Corporation includes the five coastal communities of Nunatsiavut plus the Innu Nation community of Natuashish (see Table 5).

Table 5 Inuit Populations by Organizational Region

Organisational Region	Total All Persons	Inuit Population*
2006 Census Division No. 11	2,414	2,160 89.5%
Inukshuk Economic Development Corporation	3,220	2,365 73%
2001 Census Division No. 10, Labrador	27,864	3,880 13.9%
Labrador-Grenfell Health Authority (2005+)	39,783	3,945 9.9%
Health Labrador Corporation (<2005)	23,930	3,845 16.1%

Although analysis and reporting of data from the Health Authorities is not undertaken to any significant extent at the present time, it is noteworthy that the reorganisation which took place in April of 2005 represents a change in the specificity of data that could be reported at this level for the Inuit of Nunatsiavut. Formerly, under the Health Labrador Corporation, the Nunatsiavut population represented 16.1% of the population, whereas under the new Health Authority, it represents 9.9%, as shown in Table 5.

Statistics Canada also administers other surveys with relevance to health, aboriginal populations, or rural populations. A description of these is provided in Appendix D. For the 2005 Canadian Community Health Survey (CCHS), the smallest data agglomeration that is presented on-line is for the Labrador-Grenfell Health Authority. A sample size of a maximum of 500 was collected for what was then Health Labrador Corporation and includes persons aged 12 and over who are

living in private dwellings. Subjects cover diseases, health, health care, health status indicators and households. The Common and Optional content subjects for Newfoundland and Labrador for 2001 are listed in Appendix D. Certain persons are excluded from this survey and it is not clear whether any of the communities of Nunatsiavut participated in this survey.

Other Statistics Canada surveys have less recent and less geographically specific data. The National Population Health Survey has data available for the province and dates back to 1998-99.

The Newfoundland and Labrador community accounts¹⁵ is a main repository of data on determinants of health as well as major health indicators. Each community report contains: 1) a brief description of the community, 2) well-being accounts, 3) demographic accounts, 4) income accounts, 5) labour market accounts, 6) health accounts, 7) education accounts, 8) social accounts, 9) household spending accounts and 10) the proper data sources. However, while the list of data sources is quite comprehensive, it does not include the APS. The list is provided on the community accounts site under “data sources”.

There have been studies carried out that touch on various food related topics, such as on the nutritional impacts of the Food Mail Program (i.e. Lawn & Langner (1994) and on nutritional transition and changing dietary patterns (Kuhnlein, Receveur, Soueida & Egeland, 2004).

Up and coming in the summer of 2008 is a health survey¹⁶ that will be administered from aboard the CCGS Amundsen, the ice breaker from which ArcticNet research is undertaken. Similar to the Inuit Health Surveys conducted in previous years in Nunavik, Nunavut and the Inuvialuit Settlement Region, the 2008 mission will undertake the Inuit Health Surveys in Nunatsiavut. This survey will gather a wide range of information and data pertinent to a range of health determinants, including food security.

Another health research initiative that is scheduled for the region is the Urqsuk Program¹⁷ which is looking at the role of marine fats and lipids in the prevention of specific health outcomes as well as at perceptions and attitudes towards traditional and contemporary fats.

¹⁵ <http://www.communityaccounts.ca>

¹⁶ IPY project led by G. M. Egeland see http://www.ipy-api.gc.ca/intl/index_e.html

¹⁷ IPY project led by E. Dewailly, for more information contact S. Bernier at susie.bernier@crchul.ulaval.ca

Another potential source of data that may be of use in developing indicators related to social determinants of health and/or community wellness is data collected by the RCMP related to social disruption/criminal activity.

4.7 Lost persons and Search and Rescue

The RCMP is primarily responsible for search and rescue (SAR). Volunteers from the community make up local Ground SAR groups. Members in Nain have training in avalanche recovery, coast guard radio operations, and hypothermia. All the volunteer members are hunters and travellers that know the area and ice conditions in good and bad weather.

The RCMP, the Ground SAR and the family have the authority to declare a person as lost or missing. When someone is reported lost or missing to the RCMP, they contact the local SAR group. One of three captains is contacted and this person contacts available volunteers to carry out the search mission.

Records (on paper) of the following information are kept by both the RCMP and the SAR:

1. How long the person is overdue
2. Last time sighted
3. Information as to : how many people, how many skidoos
4. Children
5. What kind of gear
6. Route they took
7. Time of arrival-departure

In terms of prevention, Ground SAR put out messages on the local radio; they give talks at the school and put out warnings on current hazards (e.g. water locations that don't freeze in winter because of the tide).

4.8 Biomonitoring

In terms of human biomonitoring activities in relation to environmental contaminants, no ongoing research or monitoring activities were identified.

The Nunatsiavut Interim Government follow guidelines proposed by the Canadian Council of Ministers of the Environment's for guidelines for PCBs, heavy metals, and hydrocarbons.

4.9 Emergency Preparedness

The Medical Officer of Health is responsible for emergency planning for the health sector and there is a Health Emergency Planning Coordinator with the Labrador-Grenfell Health Authority. There is ongoing work in this area and both the health sector plan and community based all hazards plan are in various stages of revision or development. The health sector plan includes preparedness for pandemic influenza. As well, a regional plan has been drafted that applies to all health facilities including community clinics in Nunatsiavut. There is however, no database of hazards having taken place which could for example be used to improve responses in cases of emergency.



Chapter five: Environmental Monitoring in the Nunatsiavut Region

This chapter presents the results of the investigation for each category of environmental media reported as potentially or currently changing and deemed relevant to assessing potential effects of climate change on health determinants and/or outcomes, in the northern context. A description is provided of what data is collected and what trajectory that data follows from its collection through to reporting, analysis and dissemination, where applicable.

5.1 Drinking Water

Drinking water quality standards for Nunatsiavut are set by the province. Bacteriological, physical and chemical parameter standards are adopted from *Guidelines for Canadian Drinking Water Quality* 6th Edition, 1996 published by Health Canada. These, as well as sampling and disinfection standards are detailed on the Department of Environment and Conservation Web site¹⁸. The province is also responsible for drinking water quality monitoring and 'boil water' advisories and maintains publicly accessible databases for these. While Health Canada performs drinking water monitoring and surveillance in First Nations communities, the Nunatsiavut population falls outside of the mandate of Health Canada's First Nations and Inuit Health Branch.

In the Nunatsiavut region, the province provides funding to the municipalities to hire and train individuals to collect bacteriological samples, and send them by air transport to the accredited laboratory in Happy Valley Goose Bay. Results are faxed to the Environmental Health Officer for the region who distributes the advisories as needed. Municipalities also have the authority to disseminate an advisory on the basis on mechanical or other problems, even without sampling results. The recipients of this notice include the users of the water, the MOH, the Director of Environmental Health, the Municipality, the Department of Municipal and Provincial Affairs, Government Services, Environment and Conservation. The later maintains an electronic document that lists all boil water advisories for the province by community or by date¹⁹.

¹⁸ <http://www.env.gov.nl.ca/Env/env/waterres/Policies/WQ-Standards-Microbiological.asp>

¹⁹ <http://www.env.gov.nl.ca/Env/env/waterres/CWWS/Microbiological/BoilWaterAdvisories.asp>

In each of the coastal communities sampling takes place monthly for bacteriological parameters and daily for chlorine parameters, although informants were not sure that the daily sampling was occurring everywhere on a regular basis. Finally, the province samples surface and tap water for chemical parameters on a seasonal basis. The provincial web site provides both sampling schedules and results of chemical and physical sample analysis by community.

Previously, Health Canada provided funding and training to communities to perform water quality monitoring in some of the coastal communities and this included sampling of open sites of non-treated water used mainly over the summer months.

A study carried out in 2006 by Martin et al. (2007) on drinking water quality and climate change included a perception survey among residents of Nain and Rigolet, as well as performing drinking water testing. Results indicate that concern exists in these communities as to the quality of their drinking water. Water quality analysis however, indicate that tap water is of good microbiological quality and safe to drink. The survey also reports significant use of land-based untreated sources for drinking water.

No information regarding the monitoring of salt water intrusion into drinking water was found.

5.2 Water, Sea and Ice

Water Quantity

Changes in sea level can influence human health by disturbing coastal communities. Higher water levels can inundate inhabited areas and force temporary or permanent relocations. Activities related to sea level monitoring fall under the jurisdiction of the federal government. In terms of in-land waters, the concern is the reverse, the lowering of water levels and what this can entail in terms of sufficiency and quality of raw sources of drinking water.

A number of agreements between the federal and provincial departments exist to streamline water monitoring activities in the province. The major contributor from the federal side is the Water Survey of Canada, responsible for standardized water resource data on water quality, quantity and sediment transport providing real-time, current year and historical information for a network of over 2,200 sites in Canada. It also maintains a database containing historic data for some 5,300 non-active sites for the country. Of the handful of sites located within Labrador, many are not

active, and only one is possibly located within the Settlement Region. (Water Survey of Canada, 2004)

Additional monitoring stations are operated under agreements with other organizations such as hydro power and mining companies. Figure 5 shows the current active and discontinued sites in the Labrador Inuit Settlement Area for ambient water quality and quantity, under these agreements. Of the 11 hydrometric stations, 7 are active and 4 discontinued. All active stations are equipped with digital data loggers and satellite transmission, and provide real time data²⁰. The majority of the sites are concentrated in the Voisey's Bay region.



²⁰ see http://www.env.gov.nl.ca/env/Env/waterres/Template_CanNfld.asp#mark, accessed November, 2007

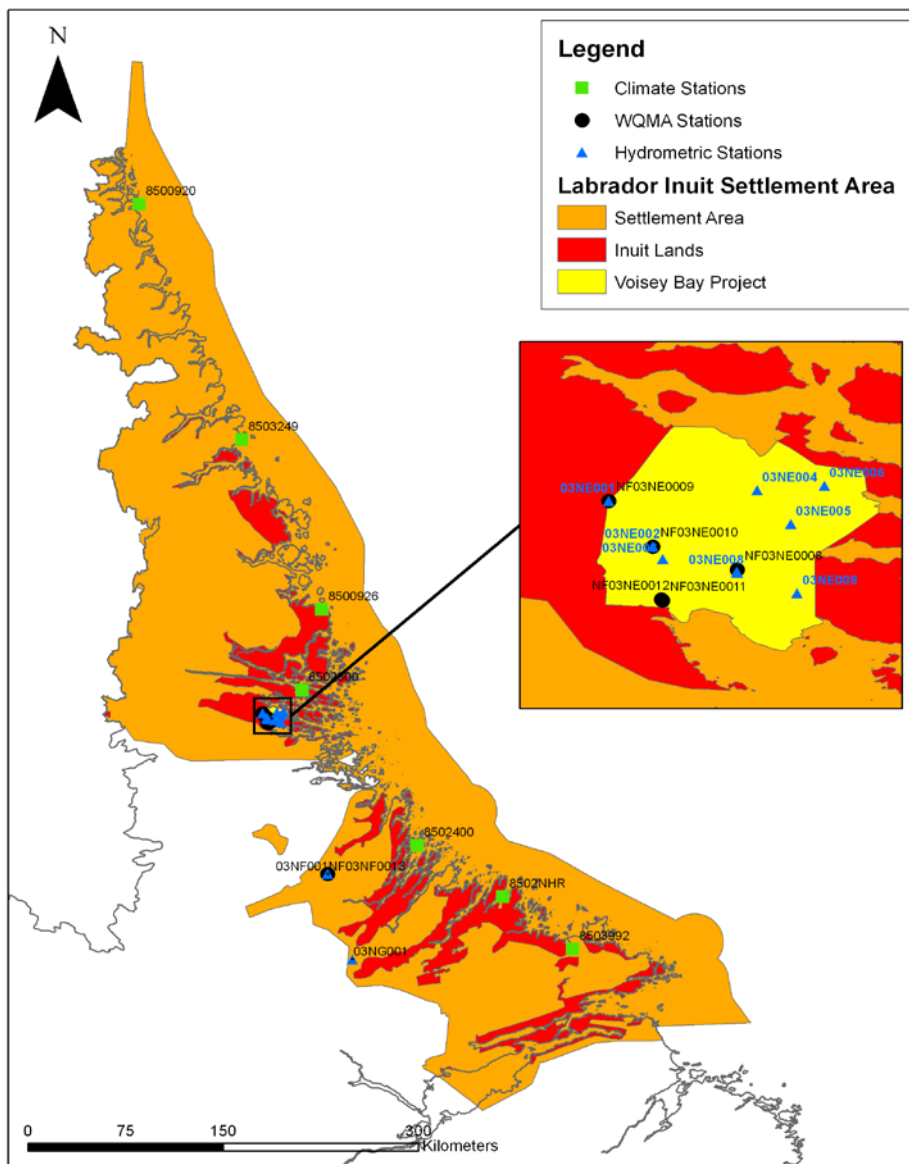


Figure 5 Climate stations, water quality and hydrometric stations in the Labrador Inuit Settlement Area

Source: Water Resources Management Division, Department of Environment and Conservation, Newfoundland and Labrador Government

“Canadian Tide Tables” are also available in which tidal predictions (times and heights) for over 700 stations are available²¹. Among these stations are three in Nunatsiavut (Nain, Rigolet, Makkovik), several in Nunavut, and some in Inuvialuit. The data provided are high and low

²¹ <http://www.waterlevels.gc.ca/english/DataAvailable.shtml>

waters as well as hourly height values are given in graph, tabular and text form, for 7 day periods up to a year in advance or in the past.

Ambient Water Quality

Under the Canada-Newfoundland Water Quality Monitoring Agreement (WQMA)²² ambient surface water quality has been monitored since 1986 at selected sites in Labrador. Of the 109 sites (77 active) in the province, 6 active sites are situated within the Settlement Area (see Figure 5). With the information provided in Table 6, data can be retrieved directly from the Department of Environment and Conservation web site²³. The categories of variables monitored are physical and chemical parameters, major ions, nutrients and trace elements and metals.

Table 6 Water Quality Monitoring Agreement Stations within the Labrador Inuit Settlement Area

STATION NUMBER	STATION NAME	STATION TYPE	START DATE	LATITUDE	LONGITUDE
	Reid Brook at the outlet of Reid Pond	Real Time	2003-07-16	56,37278	-62,16194
	Well after Tailings Dam (VBNC)	Real Time		0,00000	0,00000
	Tributary to Reid Brook	Real Time		0,00000	0,00000
	Reid Brook below Tributary	Real Time	2003-07-16	56,30508	-62,09275
	Camp Pond Brook below Camp Pond	Real Time	2003-07-16	56,34222	-62,10667
	Ugjoktok River		1999-03-29	55,23333	-61,29917

Source: Water Resources Management Division, Department of Environment and Conservation, Newfoundland and Labrador Government

²² <http://www.env.gov.nl.ca/env/env/waterres/WQMA/WQMA.asp>

²³ <http://www.env.gov.nl.ca/env/env/waterres/WQMA/WQMA.asp>

Ice

Ice monitoring is relevant to health protection because it is a surface on which Northern inhabitants travel frequently for several months of the year, and therefore are exposed to the potential dangers of accidents and injuries that may take place due to unexpected changes in ice quality. The Canadian Ice Service provides information about ice conditions in Canadian waters including ice hazard bulletins, daily iceberg bulletins and charts south of 60N, an ice warning service, and conduct ice reconnaissance with an aircraft and a helicopter. They also provide various charting and mapping tools, and a range of historical and current information is accessible through their web site. All of their services and data however, are oriented towards supporting shipping activities, rather than community level uses of ice for travel. There has been some pilot work to this end in Pond Inlet, Nunavut, looking at providing floe edge information on a scale and frequency that would serve communities²⁴. Specific data and analysis requests can be made to their Science Group, although no formal process is set up for making such requests.

Sikumiut Environmental Management Ltd is monitoring ice measurements as indicated below for the Nunatsiavut Government's shipping route, particularly the in shipping route going to Anaktalak Bay situated immediately North of the Voisey's Bay site.

Measurements:

- ice thickness
- after freeze up
- snow depth
- free board
- azimuth for regular ice cracks
- freeze up January – break up late May or June

5.3 Permafrost and Shoreline Erosion

Permafrost melting like sea level rising, can be highly disruptive to residential housing and municipal infrastructure such as health services and public works, potentially contributing to a host of human health problems. Based on the Atlas of Canada map of permafrost zones, the coastal communities of Nunatsiavut are either in the sporadic discontinuous (0-50%) zone, shown

²⁴ see <http://www.noetix.ca/floeedge/>

in green, or in the isolated patches (0-10%) zone, shown in yellow in Figure 6. The blue area is labelled as “water area”, while, the purple as Continuous (90-100%) permafrost.

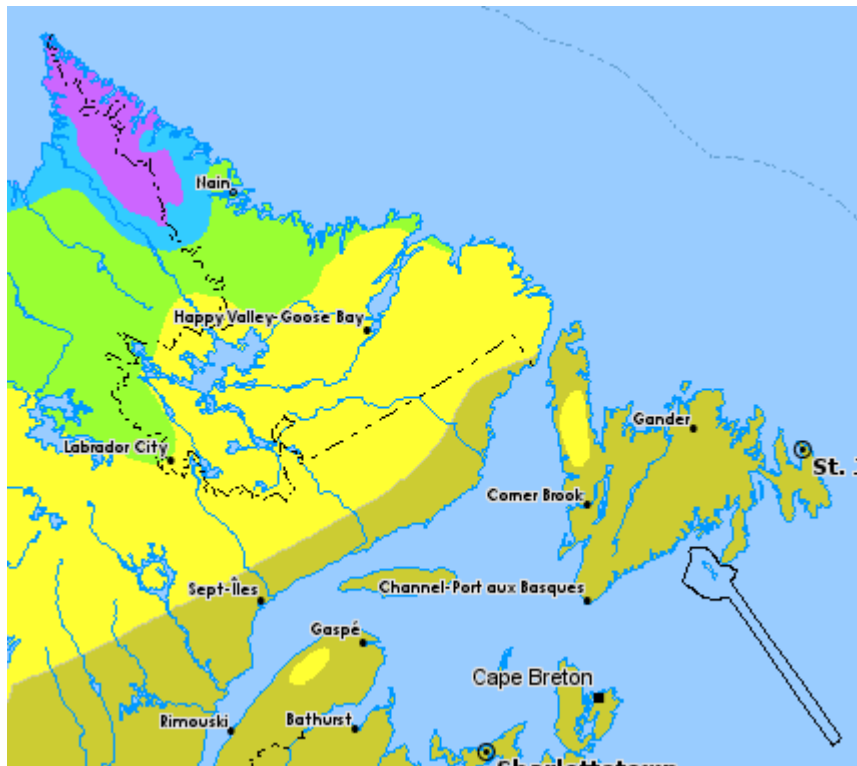


Figure 6 Permafrost Zones in the Newfoundland and Labrador region
Natural Resources Canada, 2003

Natural Resources Canada’s Geological Survey (GSC) performs services with respect to the monitoring, mapping and modelling of permafrost in Canada²⁵, however they are not presently active in the Labrador region. National Permafrost Databases on both ground temperatures and permafrost thickness have been created and are accessible by Internet access. The data were compiled from observations of over 500 government, university and industry boreholes. Information on site characteristics such as air temperature, snow cover and vegetation which influence the ground thermal regime and the permafrost distribution has also been compiled. The reference for each site is also provided and may be consulted for further information. The entire database and complete text are published (see Smith & Burgess, 2000, 2002) however, the majority of the sites for both the Ground Temperature Database and the Permafrost Thickness

²⁵ http://gsc.nrcan.gc.ca/permafrost/mapping_e.php

Database are inactive. Only for the Mackenzie Delta region does the GSC maintain active monitoring sites. As well the GSC is involved in climate change and permafrost studies, which are primarily located in the Mackenzie Valley and Delta²⁶. These include studies on coastal processes and community infrastructure impacts.

As part of the Nunatsiavut Nuluak project (ArcticNet project 3.7), some monitoring activities with application to understanding changes to permafrost and shoreline erosion are being carried out. Substrate mapping and benthic habitat classification of three Fjords is ongoing and sampling will continue in 2008 and 2009. As well, sediment sampling and analysis is looking at indicators of environmental change in sediment going back over 150 years. Such changes are associated with the Voisey's Bay mining activity and/or changes in precipitation and/or stream flow and shoreline erosion regimes.

5.4 Biota

This section reports on the monitoring of populations and the health of land based and aquatic mammals, fish, birds, and molluscs, many of which serve as resources for Inuit people, food in particular, as well as clothing, cultural and economic activities. This area of monitoring has health relevance in terms of food security, culture, as well as income and social status issues. The subject matter is not exhaustively covered but rather some key activities are highlighted. The section wraps up with information gleaned from an interview with provincial veterinarian, Dr. Hugh Whitney on rabies monitoring.

Whales

The number of Beluga whales along the Labrador coast is believed to be quite small. For this reason, there is no dedicated monitoring program in the region. DFO's Northern Quebec Beluga whale monitoring program follows animals to and from Hudson's Bay, James and Ungava Bays. Satellite telemetry data indicate that a small number of whales travel across the Hudson Strait and down the Labrador Coast further than Hebron for the spring months. The DFO program relies on samples provided by Nunavik hunters and includes some genetics sampling and contaminant testing

²⁶ http://gsc.nrcan.gc.ca/permafrost/suppdoc_e.php

Seals

The Department of Fisheries and Oceans (DFO) Marine Mammal section working out of St. John's focus a significant amount of their work on the Harp Seal (*Phoca groenlandica*) and Hooded Seal (*Cystophora cristata*) due to their impact on the commercial fishery. Diet survey data for these species reside with the Department. Their research scientists also undertake population and animal health related research activities for key species, the Ringed Seal (*Pusa hispida*) and the Bearded Seal (*Erignathus barbatus*), in particular.

The Ringed Seal, also known as the Jar Seal has much significance for traditional Inuit uses. Ecologically, the species is at the top of the food chain for not only humans but for many species including polar bear, fox and others, rendering it a species of interest for monitoring.

The monitory strategy is founded on a close collaboration with hunters from the coastal communities and consists of three components: a biological sampling program, sea ice conditions monitoring and the use of RADARSAT images. From the biological samples obtained from hunters, diet, reproductive status and the general condition of the animal are assessed. There is data from 1985 through 2007 for Ringed Seal, and Bearded Seal, with a smaller sample size for the latter. Data reside with the DFO and are as of yet unpublished, although analysis are underway. The purpose of this monitoring is to look at long term change in these species. Hunters are trained on sample collection and keep a log book for noting unusual observations of aquatic mammals. Traditional knowledge interviews are done with hunters on their observations of change over time dating back to the 1980s.

The same group within DFO also look at the effects of change in sea ice conditions for Ringed Seal pupping habitat. This dataset dates from 2001-2007 and are primarily collected in the month of March, and some in May. Data is collected by trained hunter teams. The three GPS sites are in the vicinity of Nain, Hopedale and Lake Melville. Parameters such as snow depth, drift development (min-max), and ice roughness (presence/absence) are measured and recorded. This data serves as ground-truthing the radar image data. The impetus of this work is to look at the nature of the changes in terms of rapidity and severity. Together these data provide information on the changing availability of suitable sea ice for Ringed Seal pupping.

DFO also have two Harp Seal tagging datasets to look at migration patterns. One pertains to 1995-96 and is for approximately 24 animals and the other is for 2004 and 2007 for

approximately 30 animals. As part of ArcticNet Phase 2, future work may involve Ringed Seal tagging of approximately 20 animals to monitor their movements in relation to contaminant body burdens. Despite this significant array of seal monitoring activity, it was identified that the lack of population surveys for Ringed seals was a weakness in their approach to monitoring this critical seal species.

Marine Birds

A comprehensive analysis of conservation issues for Labrador for marine birds was prepared by Russell & Fifield (2001) for the Canadian Nature Federation and the Natural History Society of Newfoundland and Labrador. The document highlights conservation issues and provides a status overview for marine bird populations.

Migratory Birds

The Canadian Wildlife Services (CWS) study and monitor migratory bird populations and their habitat for the Labrador Peninsula, including the Nunatsiavut Region. One biologist is situated in Happy Valley-Goose Bay for the region. A range of species are studied and field work takes place annually from spring to fall, for which a variety of databases are kept by CWS. Scientific publications are available.

Keith Chalk, Senior Biologist at CWS located in Happy-Valley Goose Bay informed that Labrador is a range edge for most birds, lending itself well to monitoring effects of climate change. His concern for bird habitat are more long term, focussing on sea level rise, the loss of offshore islands and the introduction of species. New migratory bird species are not monitored by CWS.

Peregrine Falcon

Peregrine Falcon monitoring has taken place in Labrador at intervals dating back to 1970, and last undertaken in 1995. Surveys comprised one part of an ongoing impact monitoring program for the Department of National Defence (SAGLEK) and were a part of the dedicated five-year monitoring effort under the direction of the Inland Fish and Wildlife Division of the (then) Newfoundland and Labrador Department of Tourism, Culture and Recreation. Parks Canada's contribution has enabled expansion of the survey into the northern Labrador region.

Caribou

The Institute for Environmental Monitoring and Research operate a tagging program on the George River caribou herd. Thirty-eight collared animals are followed by satellite for which data is retrieved every four days indicating the location of the herd. The data dates back to 1988. In neighbouring Nunavik, the Quebec Government operate a similar program with another 25 collars on the same herd. The data is sent to the Department of National Defence' Science Division and the provincial Environment and Conservation Department. The information is used to minimize impacts on the herd associated with military training and operations. See the following section for information on contaminants monitoring in the George River Herd.

Marine Ecosystem Integrity – Benthic Habitat, Clams and Sculpins

ArcticNet Project 3.7 by the title of Nunatsiavut Nuluak is conducting a baseline inventory and comparative assessment of three northern Labrador fiord-based marine ecosystems. The three fiord ecosystems of interest are Anaktalak Bay for its shipping route to the Voisey's Bay nickel mine, Saglek Bay which is contaminated with PCBs from previous military operations and Nachvak fiord adjacent to the Torngat Mountains, considered a pristine ecosystem.

Collaboration between the Ocean Mapping group at the University of New Brunswick and the Canadian Hydrographic Services and Professor Trevor Bell with Memorial University of Newfoundland is enabling substrate mapping and benthic habitat classification of the three Fjords. The substrate or seabed mapping data, done via remote sensing techniques is used to classify benthic habitat. Seabed mapping data in all three fjords was collected from the Amundsen ice breaker during its voyage along the Labrador coast in 2006.

A master's student at Royal Military College (Environmental Sciences Group), Jacqueline Bastick, is contributing to Parks Canada's Ecological Integrity monitoring initiative by developing protocols for marine monitoring in Canada's northern parks with fiord-based ecosystems. She collected data in Nachvak and Saglek fjords, Torngat Mountains National Park Reserve (TMNPR), during August 2007 and will conduct another field season in the summer of 2008. This study examines the feasibility of using clams and Shorthorned sculpin as indicators of long-term environmental change. These marine organisms are resident species in TMNPR and are also found in other national parks with fiord-based ecosystems, allowing the possibility of comparison with other regions.

Arctic Char

Scientists with the Department of Fisheries and Oceans have longstanding Arctic Char monitoring data for the region.

Atlantic Cod

The Newfoundland and Labrador population of Atlantic cod was listed as endangered by Environment Canada's COSEWIC, the Committee on the Status of Endangered Wildlife in Canada in May of 2003. Under SARA, the Species at Risk Act, the Atlantic cod is listed as a species with "Special Concern", pending public consultation for addition to the official list of wildlife species at risk.

Atlantic Salmon ²⁷

For the purpose of determining conservation requirements, the Nunatsiavut Government and the Department of Fisheries and Oceans operate a counting fence to assess the status of Atlantic salmon stock on the English River, situated in the Nunatsiavut region.

Rabies monitoring

Rabies monitoring dates back to the 1950s in Labrador, although many questions remain regarding patterns of the disease in animals. Rabies monitoring is such that data tends to be clustered around where a lab exists, and samples most often come from animals (e.g. fox, skunk) that wander into a community. A more representative sampling strategy would include animals that expire on the land.

Samples are generally collected by provincial wildlife officers. The samples, consisting of brain tissue, are sent to the laboratory at the Canadian Food Inspection Agency (CFIA) situated in Nepean, Ontario for analysis. Only animals that have been bitten by other animals are eligible for analysis. CFIA does not publish this data. There is a devolution taking place from the federal to the provincial level for rabies monitoring. The Newfoundland and Labrador Government provide information on rabies monitoring in Labrador (see Natural Resources, 2004).

²⁷ http://www.dfo-mpo.gc.ca/csas/Csas/DocREC/2001/RES2001_036e.pdf

The provincial veterinarian is also collaborating on research proposals looking at the three food borne diseases of Trichinellosis and Toxoplasmosis and cod worm (fish or seal) as well as a proposal looking at cysts in rodents.

5.5 Biomonitoring and Contaminants

The monitoring of environment media, fauna and flora for contaminants provides trend information that can be used to evaluate exposure risks to human populations. It is hypothesized that climate change may in some circumstances contribute to shifts in levels of contaminants present in certain media, and thereby increase the risk of human exposure to these harmful substances.

Approximately 30 kilometres from Nain is the site of the sizeable Voisey's Bay Nickel-copper-cobalt mining project. The Nunatsiavut Government has environmental monitors on site who have access to the construction site and the surrounding area and act as liaison between the mining company and Nunatsiavut interests. Annual Environmental Progress Reports are available for 2002 through 2006²⁸. The 2006 document reports results for marine and freshwater environmental effects monitoring (Voisey's Bay Nickel Company Limited, 2006). Impacts and Benefits Agreements exist between the Inuit, Innu Nations and the mining company. These confidential agreements cover issues of contamination of populations on which local peoples depend for wildlife consumption.

At both Saglek in the far north of the region and in Hopedale (see Figure 2), are military radar sites that are no longer in operation. The sites are contaminated with polychlorinated biphenyls (PCBs), heavy metals and hydrocarbons. Since 1997, the Department of National Defence (DND) has been investigating and remediating the site at Saglek. Contaminated soil has been transported away from the site. Investigations in Hopedale are also underway but no clean-up has taken place.

In terms of monitoring activities at the Saglek site, the DND in collaboration with the Royal Military College (RMC) in Kingston (On), have an ongoing program for contaminants in sentinel species of fish, mammals, including seal and caribou, and berries. A human health risk assessment was undertaken by the Public Health Research Unit (CHUL-CHUQ), and signs are

²⁸ <http://www.vbnc.com/ehs.asp>

posted at the site informing that the area is contaminated with PCBs. The Nunatsiavut Government have been consulted on how to manage and monitor the site throughout the decontamination process. Sikumiut Environmental Management Ltd, from Nain, have provided polar bear monitoring and ship advisory services for the decontamination project

Several researchers and the Nunatsiavut Government are collaborating on current ecosystem monitoring initiatives with a focus on: contaminants and ecosystem recovery, ecosystem health indicators (Torngat Conservation Area), impacts of activity associated with the Voisey's Bay Mining site (Anaktalak Bay shipping route), and indicators of climate change (sediment core sampling/algae). Extensive sampling was scheduled for 2006, with some follow up in 2007. PCBs and other POPs (persistent organic pollutants), and metals are among the contaminants that will be monitored. Some key species focussed on are sculpin, seal, char and sentinel birds. Analyses will take place at either of two accredited laboratories situated in Kingston (On), the RMC or at Queen's University.

Under the Northern Contaminants Program (NCP) temporal and spatial trends monitoring of ringed seal is headed by Derek Muir of Environment Canada.

Contaminant monitoring of the George River Caribou Herd is now a core NCP project. Sampling is scheduled to take place every five years, starting in the fall of 2007. Samples from approximately 20 animals will be obtained from hunters and include liver, muscle, kidney and teeth. The liver and muscle will be stored in a tissue bank in Whitehorse, Yukon owned by NCP and housed by the Department of Indian and Northern Affairs Canada (INAC). The kidney samples will be analysed for a suite of 32 contaminants, while the teeth allow the ageing of the animal. Results will be reported in 2008. The data is owned by NCP and will be made available to the Nunatsiavut Government.

5.6 Weather, UV Radiation and Ozone

Extreme weather events include thermal extremes, storms, floods, avalanches, falling rocks, and others. These can be associated with a range of health endpoints, including premature mortality, injury, infectious disease, psychosocial problems, as well as influencing social determinants of health given the potential for material loss. In the case of exposure to UV radiation, potential health problems include skin burns, rashes, blisters, cancer, and effects to immune systems and related susceptibility to infectious disease.

Under the jurisdiction of Environment Canada, weather is monitored generally at a station situated at local airports. There are two ways data is recorded in Nunatsiavut. In Nain, Hopedale, and Happy-Valley-Goose Bay the weather is recorded automatically 24 hours a day while for Makkovik as well as Nain, records are taken manually from approximately 7:00 to 16:00. Rigolet has recently received a weather monitoring station as part of their involvement in a research initiative entitled Weather, Water and Health²⁹ Only Postville remains without its own weather station. The parameters that are monitored are shown below. The automated stations produce hourly, as well as daily reports, while for the stations with manual data collection, only hourly data are available. In the Archive web site, data can be displayed by the following time interval variables: hourly, daily, monthly or almanac, for longer term comparisons, depending on availability.

Automated and Manual stations collect the following parameters:

Hourly Data Report for July 17, 1995										
T i m e	<u>Temp</u> °C 	<u>Dew Point Temp</u> °C 	<u>Rel Hum</u> % 	<u>Wind Dir</u> 10's deg	<u>Wind Spd</u> km / h 	<u>Visibility</u> km 	<u>Stn Press</u> kPa 	<u>Hmdx</u>	<u>Wind Chill</u>	<u>Weather</u>

The following variables are rolled up into the Daily Reports produced from data collected at the automate stations:

<u>Max Temp</u> °C 	<u>Min Temp</u> °C 	<u>Mean Temp</u> °C 	<u>Heat Deg Days</u> C 	<u>Cool Deg Days</u> C 	<u>Total Rain</u> mm	<u>Total Snow</u> cm	<u>Total Precip</u> mm 	<u>Snow on Grnd</u> cm	<u>Dir of Max Gust</u> 10's Deg	<u>Spd of Max Gust</u> km / h
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Data is sent to Environment Canada's Regional Climate Office in Fredericton, N.B. Exceptionally, automated data from the Nain station is sent to and stored in Dartmouth, NS. At the end of every month, monthly averages are sent to Fredericton, NB. The staff at the weather office analyse the data. In addition, a quality control person at Environment Canada's Fredericton office checks the analyses for potential errors. The analysed data is stored on a compact disc, which is released by Environment Canada and available to anyone at a cost.

²⁹ Weather, water and health is an initiative led by Victoria Edge et al. For more information contact Dr. Edge at Victoria_Edge@phac-aspc.gc.ca

In cases of predicted severe conditions weather bulletins based on data including that from coastal stations are issued from Gander for the Coast. Bulletins can be accessed by the public only while they are in effect, and thereafter are archived internally where they can be accessed by special request³⁰. Dissemination generally occurs through a process whereby the media access the information from Environment Canada. There are reports by local hunters indicating that dissemination of the coastal bulletins may not always be reaching the communities (Furgal, 2003) and there is a need to verify with local media services as to whether access and dissemination of pertinent information is taking place regularly.

An informant and hydrologist raised the issue that long-term weather stations are needed to monitor climate change. Present weather stations and predictions services are geared towards ensuring aviation and marine safety. Long-term weather stations might include technology such as tipping buckets which inform on the intensity of precipitation (i.e. through intensity duration curve) and measure different light and soil parameters. According to the informant, some such stations used to exist within the province but have been scaled back since the 1990s.

UV radiation and ozone monitoring is done by Environment Canada's Science and Technology Branch. The Brewer Monitoring Network for UV radiation maintains 12 sites in Canada of which one is located in Happy Valley-Goose Bay. These use the Brewer Spectrophotometer which measures UV radiation directly at ground level. The instruments measure total ozone and spectral UV irradiation (290-325 nm) every 10-20 minutes during the daytime. They can also measure ozone using the light of a full moon when the sky is clear, a useful feature in the Arctic winter. The information derived from the Brewer network is used for ozone and UV index forecasting. The monitoring station in Goose Bay is separate from the weather monitoring station. Some data is available on-line for the Goose Bay Brewer monitoring station³¹. UV radiation can also be estimated using a different technology which measures solar radiation at all wavelengths, not just UV. There are 42 of these sites in Canada, of which one is in Happy Valley-Goose Bay, two in Nunavik (Kuujjuak and Inukjuak), 7 in Nunavut, and one in Inuvialuit (Inuvik). (Environment Canada, 2005)

³⁰ To access information a request can be made to the Atlantic Region Climate Office in Fredericton 506 451-6005

³¹ http://woudc.ec.gc.ca/paper_data/UVI_climatology_US_Canada_0403/tab_brwr.txt presents hourly UV radiation index averaged over years 1997-2003 inclusively

5.7 Air Quality

The federal Canadian Air and Precipitation Monitoring Network³² has 1 of 29 station located in Goose Bay. The station collects data on precipitation chemistry, low level ozone, particles and related trace gases, nitrogen measurements as well as particulate matter (PM). The network is designed to monitor non-urban air quality with siting criteria designed to ensure that the measurement locations are not affected by local sources of air pollution.

There are three monitoring stations in the vicinity of the Voisey's Bay nickel deposit. The station located near the port measures PM; the one near the crusher measures mono-nitrogen oxides (NOx) and the one near the accommodations measures PM and NOx (P. Haring, personal communication, February 5, 2008).

The National Air Pollution Surveillance Network (NAPS) is designed to monitor urban air quality. The five NAPS stations in Newfoundland and Labrador are situated on the Island portion of the province.

In terms of indoor air quality, the Environmental Health Officer for the Labrador region will respond to requests or complaints by residents of Nunatsiavut regarding indoor air quality and offer advice. In the case of rental properties, they can perform inspections and make recommendations to property owners. However, no monitoring activities take place in the region.

³² http://www.msc.ec.gc.ca/capmon/index_e.cfm

5.8 Other

*The Ecological Monitoring and Assessment Network (EMAN)*³³

Environment Canada is the coordinating body for EMAN which is made up of organizations and individuals involved in ecological monitoring in Canada. Its purpose is to better detect, describe, and report on ecosystem changes. Partners include federal, provincial and municipal governments, academic institutions, aboriginal communities and organizations, industry, environmental non-government organizations, volunteer community groups, elementary and secondary schools and other groups/individuals involved in ecological monitoring. The northern component, EMAN-North has sites in the three territories as well as in northern Manitoba. EMAN sites include one in the Mealy Mountains just south of Lake Melville, from which the Labrador Highlands Research Group of Memorial University undertake research activities. The second site is in Kuujjuak, Nunavik.

The EMAN Data Management System on-line tool has been launched. This enables partners to enter, access, view, manage, search and share data that follow the standardized EMAN protocols³⁴. A search on the EMAN site with the word “Labrador” resulted in a match with 79 documents. However, a review of these documents was not carried out as part of this assessment.

Environmental Assessment

The federal government is involved in environmental assessments of projects such as large scale hydroelectric dams that trigger the Canadian Environmental Assessment Act. The Canadian Environmental Assessment Agency maintains a registry of documentation related to environmental assessments which provides a wide range of environmental monitoring data, as well as information on human populations.

³³ see <http://www.eman-rese.ca/eman/>

³⁴ see <http://www.on.ec.gc.ca/eman/index.cfm>

CANTTEX

The Canadian Tundra and Taiga Experiment (CANTTEX) is a network of researchers within Canadian universities and government departments collaborating to study climatic and ecological changes in the Canadian North. The objective is to establish an effective long-term observation network for detecting the effects of climate change in all major ecoregions. In addition to sharing in active research results, CANTTEX is now working towards the development of an integrated strategy for monitoring environmental change throughout the Canadian Arctic. CANTTEX reports available on the web site includes 1 entry for Labrador³⁵. Researchers with Memorial University are monitoring climate and plant community in both alpine tundra and taiga habitats in the Mealy Mountains area in central Labrador situated at 53.6°N, 58.8°W.



³⁵ Insert “Labrador” into the search string to locate the record from <http://www.emannorth.ca/canttex/database.cfm>

Chapter Six: Synthesis of Results

6.1 Presentation of Results

The information gleaned from both the interviews and documents and presented in chapters 4 and 5 have been summarised into a table format which is presented below. Table 7 is the synthesized core of this case study and is both a working tool and a work in progress to inform the development of observations, recommendations, conclusions, proposals, pilot projects, and policy initiatives or simply to stimulate ruminations on climate change and health in the Nunatsiavut region. The table has four columns, the first two of which remain the same for all four Inuit region case studies. The first column “Climate Change Mediating Factor” and second column “Possible Health Impacts” draw heavily, although not exclusively from Furgal et al. (2002) in which both science and Inuit knowledge on climate change and health in Labrador and Nunavik are synthesized. These present a wide range of possible and potential health outcomes of concern as mediated by direct and indirect influences of climate change. The third column “Surveillance and Monitoring Capacity in Nunatsiavut” is critical in that it succinctly presents the results of the investigation in terms of the state of public health surveillance and environmental monitoring. The fourth column allows for the addition of comment and query considered important to the interpretation of the row in question, and may also simply open onto the possibility of follow-up work or next steps. This fourth column is the most flexible of the four and invites contributions from any reader.

Table 7 Analysis of potential climate change influences on health and current surveillance and monitoring capacity in Nunatsiavut

Climate Change Mediating factor	Possible Health Impacts	Surveillance and Monitoring Capacity in Nunatsiavut	Questions, comments and project ideas
<i>Exposure to thermal extremes</i> Extreme cold Extreme heat (relative to norms) Mild winters	Hypothermia, frostbite Heat cramps, heat syncope, heat exhaustion, heat stroke Respiratory illnesses (infectious, chronic) affected by increased time spent indoors in crowded conditions during extreme events Death Reduction of excess rates of all	Weather stations in each community except Postville. Rigolet just starting up and data not part of Environment Canada forecasting network. When patient visits a community clinic, a diagnosis is recorded in E-book by a code and some description. If the patient visits a hospital there is a separation record in which a series of codes are assigned including resident code and three diagnosis related codes. Protocol in place for reporting of notifiable diseases Lists A, B and C. If not notifiable, each community clinic visit is recorded in E-book. Infectious disease emergency plan in place. A death certificate is completed by the attending medical personnel and sent to provincial Vital Statistics. The cause of death is confirmed by attending medical personnel with the use of either Labrador-Grenfell Health or provincial public health laboratory results. Data for the Nunatsiavut region are neither routinely analysed, nor reported.	Access to local weather prediction for coastal communities to be improved, it is up to the media to access the information from Env. Can Need to evaluate the records to assess the quality of the data in terms of evaluating a link between extreme weather and illness/condition. Recent studies indicate a warming trend, rather than cooling. For respiratory illnesses, it is likely that the link with weather would not be made on the consultation record. This could perhaps be verified against Environment Canada climate data Status of data for chronic respiratory disease? Are there codes/description for causes of death and how might these relate to exposure to thermal extremes?

Changes in frequency or intensity of other extreme weather events (floods, storms, avalanches, rock falls, etc.)	Respiratory illnesses (infectious, chronic) affected by increased time spent indoors in crowded conditions during bad weather events Death Injuries Material loss influencing income and social status	Search and Rescue (SAR) and RCMP for emergencies. Nain's SAR have avalanche rescue expertise Daily rainfall recorded by weather stations DOE weather bulletins are archived internally, access can be requested. Protocol in place for reporting of notifiable diseases Lists A, B and C. If not notifiable, each community clinic visit is recorded in E-book. Emergency plan in place for Pandemic Influenza. A death certificate is completed by the attending medical personnel and sent to provincial Vital Statistics. The cause of death is confirmed by attending medical personnel with the use of either Labrador-Grenfell Health or provincial public health laboratory results. Data for the Nunatsiavut region are neither routinely analysed, nor reported. For intentional or non-intentional injuries that bring patients to a community clinic, a record is kept by LG Health but is not reported to any higher level institution. If the patient is admitted to hospital a separation record will be forwarded to CIHI from which data can be accessed. Protocols for divulcation of information pertaining to small incidence numbers apply. TBD Surveillance protocol in place for notifiable diseases on Lists A, B and C. Reports of investigations by	Access to local weather bulletins for coastal communities to be improved, it is up to the media to access the information from Env. Can Long term weather stations needed for storm monitoring and adaptation Avalanche risk capacity? Flood risk? Status of data for chronic respiratory disease? How likely is it that the mortality record would indicate a link with the precise external causal event? For emergency room visits where a patient is not admitted, no record is forwarded to CIHI (hospitals in the region not CHIRPP ³⁶ participants) Insurance claims may be a source of information TBD
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³⁶ Canadian Hospitals Injury Reporting and Prevention Program

	Infectious disease related to bacterial proliferation and lack of availability of safe drinking water Stress related health impacts: - mental health disorders - Psychosocial disruption	EHO maintained by Director of EH. If patient visits either community health services or clinic a record is generated but not reported. If hospitalised, there is a separation record which is forwarded to CIHI. Crime statistics are compiled by RCMP. Emergency planning – there is little preparedness in place along the coast for events such as fires or floods, nor does a database of past emergency events exist. Tidal predictions are available for Nain, Rigolet and Makkovik.	List A,B,C are in Appendix C Are these useful for predicting dangerous conditions for each community?
Changes in ice distribution and stability, and snow composition and amount	Death related to travel on the land accidents	Ice monitoring takes place via satellite imagery in support of shipping. Sikumiut Ltd has monitored ice in relation to Voisey's Daily snowfall and snow on ground recorded by weather stations A death certificate is completed by the attending medical personnel and sent to provincial Vital Statistics. The cause of death is confirmed by attending medical personnel with the use of either Labrador-Grenfell Health or provincial public health laboratory results. Data for the Nunatsiavut region are neither routinely analysed, nor reported. For injuries that bring patients to a community clinic, a record is kept by LG Health but is not reported to any higher level institution. If the patient goes to	The scales are not designed to provide community level/travel safety information Traditional knowledge about snow and ice much more detailed, but not recorded How much detail is provided in the description and is a link with environmental conditions and travelling likely to be made or possible? For emergency room visits where a patient is not admitted, no record is forwarded to CIHI (hospitals in the region not CHIRPP)

+/- changes in marine species productivity and distribution (quantity) +/- access to land based resources	Injuries related to travel on the land accidents Missing persons events Changes in food security - amount of traditional foods - Traditional activities/traditional food security surveillance - nutritional impacts - access and travel safety - Socio-economic factors/ contribution to food basket at home and directly to income - Amount of replacement foods consumed which could aggravate: cardiovascular, diabetes, vitamin deficiencies, dental carries, anaemia, lower resistance to infections, obesity. Access to wood for heating, alternatives are very costly – effect to income and social status	hospital a separations record will be forwarded to CIHI from which data can be accessed. Protocols for divulcation of information pertaining to small incidence numbers apply. Records on paper are kept by both the RCMP and Search and Rescue. Monitoring of some species is taking place: Harp/Hooded, Ringed and Bearded Seals, migratory birds, Peregrine Falcon, Arctic Char, Atlantic Cod. Aboriginal Peoples Surveys Nutrition surveys (Lawn et al, 1990s data; Kuhnlein et al., 2004) Inuit Health Survey scheduled for summer 2008, similar to ones for Nunavik and Nunavut – nutritional studies, health status	participants) There is considerably more information/activities for Nunavik, Studies are up and coming (2 IPY projects) Income and social status is associated to health status in terms of life expectancy – other indicators may need to be developed. Check against survey tools, check for dental carry surveillance, anaemia? No known measurement tools.
Effects on range and activity	Diseases whose range may increase	Surveillance protocol in place for notifiable diseases	

of vectors and infective agents - warmer climate fostering extension of disease vectors - change in wind currents coupled with change in local climates, change in epidemiological patterns of diseases - longer shipping season, increase potential transport of insects, rodents acting as virus and disease vectors	in Canada with climate change over 50 years according to Furgal et al (2002): - Western/ Eastern equine Encephalitis - St-Louis Encephalitis - Snowshoe Hare Virus - <i>Malaria</i> - <i>West Nile virus</i> - <i>Encephalitis</i> - <i>Dengue fever</i> - <i>Yellow fever</i> - <i>Lyme disease</i> - Rocky Mountain Spotted fever - <i>Rabies</i>	on Lists A, B and C. Reports of investigations by EHO maintained by Director of EH. A major focus for the Provincial veterinary is rabies monitoring which has long standing data, but which may not be representative of trends over time given the sampling strategy. A devolution from Fed to Prov is taking place. Rodent population research proposal in progress. CWS do not monitor new migratory bird species Sikumiut monitors ice along the shipping route Shipping data? DFO? Coast Guard? TBD	List A,B,C are in Appendix C. Those diseases in <i>Italics</i> to the left, are on one of Lists A, B or C.
Changes in local ecology of water-borne and food-borne infective agents - reduced water availability/scarcity; + risk of exposure to microbiological contamination - lower efficiency of local sewage systems leading to + pathogens in water supplies	Increased waterborne disease	Seven water quantity monitoring stations concentrated primarily in the Voisey's Bay region. Six water quality monitoring stations concentrated in Voisey's Bay region Surveillance protocol in place for notifiable diseases on Lists A, B and C. Reports of investigations by EHO maintained by Director of EH. If patient visits either community health services or clinic a record is generated but not reported. Drinking water monitoring protocol in place, may be some gaps such as daily chlorine sampling. Martin et al. (Draft 2007) study reports that 1)	Insufficient monitoring. List A,B,C are in Appendix C, for list of diseases likely to be waterborne see Martin et al (2007, draft; p. 13) Chlorine sampling requirements may not be met. Untreated land based sources of water not monitored.

- longer hunting and fishing season - Influence on traditional preparation techniques - contamination of imported foods - poor animal health	Increased risk of Botulism and Trichinellosis Outbreaks of viral, bacterial or parasitic Rejection of animals and fish – decreased food security - Traditional activities/ traditional food security surveillance - nutritional impacts - Socio-economic factors/ contribution to food basket at home and directly to income - Amount of replacement foods	drinking water quality is good; 2) the majority of respondents perceive that residents get some drinking water from natural sources and 3) that many perceive drinking water quality as problematic Water, weather and climate project – source water quality (turbidity), treated water quality and GI outcomes. Botulism is on List A (immediate reporting); Trichinellosis on List B (next business day reporting) Surveillance protocol in place for notifiable diseases on Lists A, B and C. Reports of investigations by EHO maintained by Director of EH. Monitoring of some species is taking place by various orgs: Caribou, Harp/Hooded, Ringed and Bearded Seals, migratory birds, Peregrine Falcon, Arctic Char, Atlantic Cod. Aboriginal Peoples Surveys Nutrition surveys (Lawn et al 1990s data; Kuhnlein et al., 2004) Inuit Health Survey scheduled for summer 2008, similar to ones for Nunavik and Nunavut – nutritional studies, health status, Urqsuk Program (Arctic Marine Fat and Lipids)	Perception of water quality problems prevalent, perhaps indicating monitoring frequency insufficient. Are these surveys adequate to identify changes in traditional FS over time and their determinants? Verify against survey tools Are these on Lists A, B or C?
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- emergence of new or increase in seafood and fish related diseases	consumed which could aggravate: cardiovascular, diabetes, vitamin deficiencies, dental carries, anaemia, lower resistance to infections, obesity. E.g. Ciguatera fish poisoning Paralytic shellfish poisoning		New disease surveillance?
Changes in food productivity, accessibility and quality - warming causing + or – shifts in distribution of and introduction of new species of plants, fish, wildlife - changed weather and travel conditions influencing access to resources - increased revolatilization and redistribution of contaminants, potentially	Changes in food security - amount of traditional foods - Traditional activities/ traditional food security surveillance - nutritional impacts - access and travel safety due to changes other than ice and snow (see above) - Socio-economic factors/ contribution to food basket at home and directly to income - Amount of replacement foods consumed which could aggravate: cardiovascular, diabetes, vitamin deficiencies, dental carries, anaemia, lower resistance to infections, obesity.	Monitoring of some species is taking place by various orgs: Caribou, Harp/Hooded, Ringed and Bearded Seals, migratory birds, Peregrine Falcon, Arctic Char, Atlantic Cod. Aboriginal Peoples Surveys (and Arctic Supplement) Nutrition surveys (Lawn et al 1990s data; Kuhnlein et al., 2004) Inuit Health Survey scheduled for summer 2008, similar to ones for Nunavik and Nunavut – nutritional studies, health status, Urqsuk Program (Arctic Marine Fat and Lipids) Weather monitoring station in each community except Postville, however forecasting done based on HV-GB data which may not be precise enough for whole coast Contaminant monitoring primarily oriented towards past or present industrial or military activity, but is ongoing. NULUAK project looking at ecosystem health indicators across 3 fjords including one	New species detection? Verify against survey tools

influencing food chain contamination		considered pristine to inform on climate change and contaminants. NCP activities include ringed seal and caribou monitoring.	Knowledge of climate impacts on contaminant transport, deposition and redistribution limited. Are these projects sufficient to assess climate change as a factor in ambient contaminant levels?
Changes in distribution and composition of permafrost - Infrastructure damage to roads, airstrips and buildings including health and other essential services and residential leading to safety issues and service disruption - Possible population displacement (temporary or permanent) - Possible microbiological contamination of land based drinking water sources - Damage to ecosystems, habitat and consequences for animal and bird populations	Access to health services disrupted, range of medical problems potentially exacerbated Airstrip safety, the only mode of transport to the south in winter months (evacuations, medical emergencies) Range of health impacts associated with displacement (depression, PTSD, violence, etc.) Increased waterborne disease Traditional food security decrease - Traditional activities/ traditional food security surveillance - nutritional impacts	None in the region was found. Existing maps are based on data from boreholes etc. that are no longer active. Fed active in the Mackenzie region - research and monitoring. Nuluak Seabed mapping, habitat classification and shoreline assessment begins 2008 for two years of data collection If patient visits either community health services or clinic a record is generated but not reported. If hospitalised, there is a separation record which is forwarded to CIHI. Crime statistics are compiled by RCMP. No land based sites monitored for Nain and Rigolet sites. Some data from Martin et al (2007, draft) study available. Six fed-prov water quality sites in Voisey's area. Monitoring of some species is taking place by various orgs: Caribou, Harp/Hooded, Ringed and Bearded Seals, migratory birds, Peregrine Falcon, Arctic Char, Atlantic Cod. Aboriginal Peoples Surveys Nutrition surveys (Lawn et al 1990s data; Kuhnlein et al., 2004)	TBD – whether transport agency has any activities underway/ planned – who is responsible for airstrip infrastructure? Current monitoring would not allow for identification of local contamination of land based drinking sites.

	- socio-economic factors/ contribution to food basket at home and directly to income - Amount of replacement foods consumed which could aggravate: cardiovascular, diabetes, vitamin deficiencies, dental carries, anaemia, lower resistance to infections, obesity.	Inuit Health Survey scheduled for summer 2008, similar to ones for Nunavik and Nunavut – nutritional studies, health status, Urqsuk Program (Arctic Marine Fat and Lipids)	
Sea level rise leading to coastal erosion, floods and storms - Infrastructure damage to roads, airstrips and buildings including health and other essential services and residential leading to safety issues and service disruption - property loss - Possible population displacement (temporary or permanent) - salt water intrusion and inundation/contamination of	Access to health services disrupted, range of medical problems potentially exacerbated Material loss influencing income and social status Range of health impacts associated with displacement (depression, PTSD, violence, etc.) and/or material loss	11 hydrometric stations in the Settlement Area, 7 are active and most are situated in the Voisey's Bay region. Nuluak: Indicators of environmental change in sediment (precipitation, stream flow, run-off) TBD If patient visits either community health services or clinic a record is generated but not reported. If hospitalised, there is a separation record which is forwarded to CIHI. Crime statistics are compiled by RCMP. Emergency planning for Influenza in place. No salt water intrusion monitoring found.	Are these sufficient? Emergency funds? Land Claim specifications? Insurance claims may be a source of information

	contribution to food basket at home and directly to income - Amount of replacement foods consumed which could aggravate: cardiovascular, diabetes, vitamin deficiencies, dental carries, anaemia, lower resistance to infections, obesity.		
Changes in outdoor air quality / - weather affecting air quality - pollution concentrations, types and distribution of airborne allergens	Respiratory illnesses (asthma, allergies) Risk of Cancer (particulate matter) and premature death Cardiovascular disease	There is one CAPMoN station in Goose Bay and 3 in the vicinity of the Voisey's mining activity. If patient visits either community health services or clinic a record is generated but not reported. If hospitalised, there is a separation record which is forwarded to CIHI. There is a cancer registry and Oncology Patient Information System (OPIS) which collects information about all new cancer cases, requests for data can be made, data are not generally released if cases number less than 11 for a region DAD records associated with hospitalisation. Basic summary on communityaccounts.ca	Air quality issues are of lower risk in northern regions. However, are these monitoring stations sufficient to identify changes of public health interest associated with a changing climate? This study has not considered indoor air quality, and links with climate change.
Increased UV exposure	Skin burns, rashes, blisters	Two different stations and technologies in Happy Valley Goose Bay monitor solar radiation levels – one serves to forecast ozone and UV radiation and the other estimates UV radiation. If patient visits either community health services or clinic a record is generated but not reported. There is a cancer registry and Oncology Patient	How far back does the data go, can it be accessed? Does UV radiation vary much over distances on the order of the size of the Settlement region? Would UV levels be expected to be similar in Nain as in Goose Bay?

- disruption of productivity and damage to organisms, influencing food chain	Risk of skin cancer - incidence - death Infectious disease Eye damage (cataracts, snow blindness, pterygium, Labrador Keratopathy) Decrease in traditional food security - Traditional activities/ traditional food security surveillance - nutritional impacts - socio-economic factors/ contribution to food basket at home and directly to income - Amount of replacement foods consumed which could aggravate: cardiovascular, diabetes, vitamin deficiencies, dental carries, anaemia, lower resistance to infections, obesity.	Information System (OPIS) which collects information about all new cancer cases, requests for data can be made, data are not generally released if cases number less than 11 for a region Surveillance protocol in place for notifiable diseases on Lists A, B and C. Reports of investigations by EHO maintained by Director of EH. DAD codes (ICD 10 chapter XII codes) Monitoring of some species is taking place by various orgs: Caribou, Harp/Hooded, Ringed and Bearded Seals, migratory birds, Peregrine Falcon, Arctic Char, Atlantic Cod. Aboriginal Peoples Surveys Nutrition surveys (Lawn et al 1990s data; Kuhnlein et al., 2004) Inuit Health Survey scheduled for summer 2008, similar to ones for Nunavik and Nunavut – nutritional studies, health status, Urqsuk Program (Arctic Marine Fat and Lipids)	
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6.2 Observations and Recommendations

The principal objective of this study is to provide a portrait of both the environmental as well as health surveillance systems currently in place in Nunatsiavut, particularly with respect to any of the series of indicators that are thought to play a role in understanding the influence of climate change on population health. As well, the study sought to identify the connections between the environmental and health networks, or rather what interactions occur between the two. The synthesis of the data collection and analysis is presented in summary form in the table of the prior section.

Health Surveillance

For any disease, illness or condition for which a person consults the public health or medical system, a subset are reported to a higher level organisation and subsequently analysed and disseminated. These include Notifiable Diseases for which well defined surveillance procedures are in place, and events of hospitalization for which a hospital discharge record is created based on the International Classification of Diseases (ICD-10) system and submitted to the Canadian Institute for Health Information. For consultations that take place exclusively in a community clinic or with the public health services, records are created but are not reported, data are not analysed, nor disseminated. These records do not follow a standardized coding system such as with the hospitalization records. A more detailed evaluation of these records is currently underway and will provide information as to how these may be utilised in environmental health surveillance, particularly with respect to surveillance of gastroenteritis.

For new cancer cases and mortalities, there are registries. The cancer registry files are created based on hospital abstracts and vital statistics. A formal process is in place for capturing death events into the Vital statistics registry.

However, for any of these health events for which surveillance takes place, this study did not investigate whether the data that is routinely gathered in these processes would enable that potential associations with environmental mediating factors be explored. This primarily speaks to data that is recorded on death certificates, on hospital discharge records in the case of injury, infectious or chronic disease, or mental health disease, or on reports of notifiable disease. In the

context of future studies, this would undoubtedly be an early step in a project development phase. The same considerations apply to other data identified in this study, which have not yet been considered in the context of surveillance data but which offer interesting possibilities to explore such as the public health records, community clinic records, RCMP data, and search and rescue records.

A large number of parameters are collected at regular intervals as part of the Statistics Canada Census and other surveys such as the Aboriginal Peoples Survey in particular. These provide a wealth of data with relevance to a number of health determinants and are utilised by a number of organisations to provide information on health status and indicators. The collaboration between the Nunatsiavut Government and Statistics Canada means that perhaps for the first time, the population of Nunatsiavut will begin to more fully participate in a large scale standardised survey process and benefit from the rigour and statistical power this affords. Finally, the upcoming Inuit Health Survey will provide a wealth of current and Nunatsiavut specific information relevant to informing aspects of food security, a determinant which has the potential to be influenced by climate change through various mediating factors.

The Newfoundland and Labrador Centre for Health Information³⁷ is a tremendous resource which is moving the province towards the leading edge of health surveillance capacity with initiatives aimed specifically at integrating records and facilitating the linking of data – keystones to operating efficient health surveillance. Their research and evaluation group carry out applied health research and are open to collaboration and new partnerships. This study did not evaluate whether consideration was being given to the transitional context of health services for the population of the Settlement region, or whether any particular attention was being given to aboriginal populations of the province. It is recommended that this be done to provide opportunity for the consideration of their particular needs in providing adequate and quality data for health surveillance – including environmental health considerations. Further investigation with the Centre to explore how they could contribute to increasing the capacity of public health and environmental surveillance for the Settlement Area is recommended.

³⁷ <http://www.nlchi.nf.ca/index.asp>

On the whole, the release of data is subject to confidentiality protocols, which may limit considerably the data that could be analysed and disseminated for the relatively modest population of Nunatsiavut. Often, it may be necessary to work with data from a larger geopolitical grouping, thus introducing a margin of error for interpreting results for the Nunatsiavut population. Indeed, it is rare to find analysed data that is specific to the Settlement Area's population, and this may be an ongoing challenge for the present and future health care and public health systems servicing this area.

Ironically perhaps, there is an excellent on-line resource for the dissemination of data related to a wide range of health determinants for various populations within the province – the Community Accounts. This resource however has not incorporated some of the most relevant data for Aboriginal populations. A request could be made to this end.

The Nunatsiavut Government provides health services to its population through its Department of Health and Social Development. These compliment the primary health services which are provided through the Health Authority, an entity born from the provincial government. Other than the surveillance mechanisms discussed above, there is little else in the way of formal health surveillance for the region's population. There are records and databases that may be resources from which to build on in building surveillance capacity.

While Environmental Health Officers and their Director perform a range of critical functions, these pertain primarily to the indoor environment or to components of the built environment such as treated drinking water. They do however investigate and report cases of communicable diseases and animal bites rendering them critical contributors to public health surveillance, however their mandate does not include environmental monitoring per se. Moreover, indoor air quality monitoring, is generally not performed.

Environmental Monitoring

As compared with health surveillance, environmental monitoring is broader in that it touches a wide range of species, media and interests. There are a number of monitoring initiatives taking place in the region and these may be on the rise, in part due to ArcticNet Network of Centres of Excellence research, as well as International Polar Year research initiatives. Of note is the Nuluak project which is becoming an umbrella project connecting a large range of researchers from various natural sciences fields. A staffed field office has been set up in Nain.

Fisheries and Oceans Canada has contributed significantly for many years to knowledge about specific species and ecosystem functioning in the region. There are longstanding databases on sentinel or key species, such as Arctic Char, Harp, Hooded, Ringed and Bearded Seals. The new Torngat Mountains National Park is already contributing to the scientific knowledge of the natural ecology of the region. The Canadian Wildlife Service has one position in Happy-Valley Goose Bay, which until recently has been filled by a scientist with extensive experience and knowledge of the migratory birds of the area.

Generally speaking however, the bulk of federal activities focussing on climate change seem to be elsewhere, namely in more western regions. The Geological Survey has a number of permafrost initiatives in the Mackenzie Valley and the Canadian Ice Services have undertaken pilot work on floe edge monitoring and reporting at the community level in Nunavut. With respect to preparing for sea level changes, the Water Survey of Canada's thousands of active and historical monitoring sites, have but a few stations situated within Labrador, and only one in the Settlement region.

While the review of the provincial government's activities with direct relevance to or in, the Nunatsiavut region was not undertaken systematically in this case study, informants perspectives indicate that their presence in the region is minimal and that the Nunatsiavut Government has been left to its own resources for managing their environment with the exception of activities related to resource exploitation. For example the Water Resources Division, Department of Environment and Conservation provide data from extensive water monitoring networks, through agreements with various organisations including the federal government. Very little of this data however is taken from Nunatsiavut waters. While extrapolation may be a cost effective approach in assessing changes taking place in the Nunatsiavut environment, it is not clear

whether the question has been asked of whether extrapolation would provide good quality data for the particular climate and ecosystem – and communities - of the Nunatsiavut region, given its coastal character and north-south orientation.

Unfortunately, a number of the ongoing monitoring activities are associated with the polluting legacies of military or exploration initiatives. Contamination and clean-up and environmental legislation have meant that monitoring has become part of the landscape. The Voisey's Bay Nickel Company, National Defence, the Northern Contaminants Program, the Royal Military College, along with the Nunatsiavut Government are just a few of the organisations involved in either clean-up and/or monitoring of contaminants in water, sediment or biota. On the bright side, these activities have enabled the gathering of data that may inform other aspects of environmental management, as well as build capacity in the region. Sikumiut Environmental Management Ltd for example, is a local, registered Inuit business, whose owners know the Voisey's Bay area well and have been involved with the project's environmental assessment activities. It can provide a range of services, including environmental monitoring.

Drinking water quality and climate change in the context of small communities in northern regions raise some complex issues. Are the Health Canada guidelines of monthly sampling sufficient for small systems and how can these take into account the risk associated with climate change? Does more definitive work need to be done on the question of accessing unmonitored land based sources of water? These issues however, do not solely pertain to the Nunatsiavut region.

There are some significant gaps in environmental monitoring that would allow the identification of change over time associated with a changing climate and allow for mitigation and/or adaptation in terms of protecting population health. Changes in weather parameters appropriate to monitoring climate change, permafrost, ice, coastal erosion, sea level, in-land waters and drinking water sources - all key media to be monitored in preparation for adaptation to climate change, and none, with the exception of municipal drinking water, are presently undertaken in the region to any significant extent, if at all.

Wildlife monitoring, however seems to enjoy an appreciable level of activity, perhaps at levels enabling the foreshadowing of problems with accessing sufficient resources for food, cultural

activities and maintaining livelihoods. An evaluation of this specific issue however, remains to be undertaken.

Collaboration between health and environment sectors

To paraphrase an informant, it is externally driven research which forces environmental and health people to sometimes work together. To date the impetus for collaboration has not come from within any of the levels of government operating in the Nunatsiavut region.

Both the health and the environment Ministries within the new government were found to be in similar situations. The transition towards self-government is demanding and requires that meeting the stipulations of the Lands Claims Agreement be a first priority.

Exposure to thermal extremes

Weather bulletins (extreme conditions) for the coast are issued from Environment Canada and are based in part on the data from local weather stations from three of the coastal communities – all but Rigolet and Postville. Dissemination of bulletins however is not part of the weather service's mandate, rather the media is relied upon to access and disseminate the information. This study did not investigate whether the coastal communities were being informed adequately about extreme weather predictions that are specific to their geographical area. It is recommended that this issue be investigated and that the OKalaKatiget Society³⁸ be informed and invited to be involved.

While for some cases of health events caused by thermal extremes there is surveillance data, from detection to analysis with the possibility of accessing the data for reporting purposes, there may be a significant number for which there is no surveillance data beyond detection and recording at a community clinic. A more detailed evaluation of records is required.

³⁸ the Society provides a regional, native radio, television, and newsprint communication service for the people on the North Coast and the Lake Melville region of Labrador, see <http://www.oksociety.com/>

Changes in frequency or intensity of other extreme weather events (floods, storms, avalanches, rock falls, etc.)

Environment Canada monitors some of the weather conditions or events considered in this theme. The data is stored and is accessible through special request. A question has been raised as to whether long-term weather station data would better inform on changes in frequency and intensity of such events for the coastal region. Moreover, in terms of the issuing of bulletins to warn communities of incoming extreme weather, the same issue exists as in the above theme – dissemination is left in the hands of the media and thus it is unclear as to whether the coastal communities are being adequately informed of predicted extreme events.

For other extreme events such as avalanches and falling rocks or landslides no monitoring activities were identified through this case study, with the exception of an avalanche specialist located in Nain, who maintains a record of regional events. There is tidal predictions data available for the region and it remains to be investigated whether this represents a useful resource in terms of preparing for extreme weather events.

In terms of emergency response to extreme events, local Search and Rescue and RCMP made up the bulk of such capacity. Emergency response plans have not yet been developed for the communities for an event such as a flood.

While there is surveillance data available for some health cases resulting from extreme weather events, there may be a significant number for which there is no surveillance data beyond detection and recording at a community clinic. A more detailed evaluation of records is required. The question of the availability and usefulness of data related to material loss or damage, and to identifying potential effects to health determinants remains to be investigated. Similarly, the use of RCMP data in terms of assessing social disruption associated with extreme events remains to be investigated.

Changes in ice distribution and stability, and snow composition and amount

The monitoring activities that do take place were not designed to support land travel over ice or snow so presently there is no monitoring of ice or snow conditions for hunters, trappers, fishers and travelers.

Records are kept for deaths, injuries and missing persons events related to traveling incidents, however only a subset are subject to surveillance presently.

In terms of changes in marine species productivity associated with ice and snow distribution and its potential effects on food security there is a range of monitoring activities taking place. Several sentinel species are subject to some level of monitoring. In terms of food patterns or nutritional surveys for the region, prior studies have been published, and a significant one is planned for 2008. What remains to be evaluated is how these data could be utilised to identify whether climate change and its mediating factors are playing a role, and to what extent, in traditional food security for the region's population.

No data was identified that would inform on trends in ease of access to wood for heating and/or household heating costs. The later remains to be further investigated.

Effects on range and activity of vectors and infective agents

Surveillance and detailed reports of cases are maintained by the Director of Environmental Health of 7 of 11 infectious diseases identified by Furgal et al (2002) as those whose range may increase with climate change. The provincial veterinarian identified potential methodological problems with current rabies monitoring in animals, however he also indicated that the risk of an increase in the number of cases may reside more with the Island portion of the province. New migratory birds are not monitored as part of the Canadian Wildlife Service's activities in the region.

Verification of sources of data that would identify changes in the length of the shipping season is required.

Changes in local ecology of water-borne and food-borne infective agents

Ambient water quantity and quality is monitored but only in the vicinity of the Voisey's Bay project. Treated drinking water is monitored according to provincial regulations, although there may be some deficiencies with respect to the frequency of chlorine sampling. The quality of source water with respect to recommended guidelines is also to be verified.

While it is known that the traditional practice of consuming water from land-based sources continues, monitoring of water quality at such sites is considered challenging and resource intensive and may therefore not be a viable public health strategy for protecting those who choose to drink from such sources. Other strategies, such as educational initiatives may need to be considered in the prevention of the incidence of water-borne disease such as Giardia.

Botulism, trichinellosis and shellfish poisoning are captured as part of the standard surveillance practices for food- and water-borne illness . Environmental Health Officers investigate cases and produce a report for each, which are maintained in the office of the Director of Environmental Health. Since these infections are notifiable diseases, cases are reported to the Medical Officer of Health..

Here again, there is the potential for an effect on food security. Of interest is whether there is reticence among the population to consume traditional foods due to concerns over exposure to certain diseases. A verification of past, ongoing and up-coming surveys is required to evaluate whether there is data which speaks to this aspect of traditional food security.

Changes in food productivity, accessibility and quality

A number of the important types of traditional activities and species consumed are subject to monitoring. No systematic process is in place to detect or begin to monitor new species (with the possible exception of species influencing the commercial fishery – TBD). In terms of food security, the Aboriginal Peoples Survey and Arctic Supplement collect some information, and while not species-specific, provides information that could be used to monitor changes in food security over time. Other research initiatives which have taken place in the region are much more detailed about consumption patterns, but unlike the Aboriginal Peoples Survey data is not

collected periodically. A health survey is scheduled for 2008 which will also inform on food security (including nutritional and health status) in the region, both from traditional and commercial sources. It remains to be evaluated however, whether these sources of data are sufficient to detect the influence of climate change on food security.

No monitoring activities were identified in relation to travel and safety, or access to the land in relation to changing conditions.

There are a number of contaminant monitoring activities underway in the region. The Nuluak project is the only one looking at environmental contamination and climate change.

Changes in distribution and composition of permafrost

With the exception of one research project, very little monitoring is taking place with respect to changes in permafrost cover.. The coastal communities of Nunatsiavut are primarily located in a zone identified as sporadic discontinuous (0-50%) permafrost by the Atlas of Canada (printed in 1995) and so are vulnerable to changes in permafrost distribution. Further investigation on the extent of this vulnerability would identify the extent to which health and transportation infrastructure may be at risk in the event of permafrost melting and would inform as to whether there is an urgent need to initiate a permafrost monitoring system..

Should permafrost melting begin to affect local communities in the medium-term, current health surveillance would capture a subset of the health events indirectly associated with permafrost melting.

Sea level rise leading to coastal erosion, floods and storms

There are a small number of hydrometric stations in the Voisey's Bay vicinity and one research project looking at changes in sediment. Are these sufficient to identify coastal changes that may indicate longer term trends?

Given that the rise in the sea level may not have any significant impacts in the short and medium-term future, the pressing population health issues may not be to assess the readiness of public health surveillance to identify cases of health events associated with sea level rise. Rather,

the role of public health may be to lobby for the preparedness of governments to deal with the issue and the range of significant health issues that will be associated with it, should nothing be done in terms of preparation.

This is an excellent example of the how environment and health leaders need to collaborate in order to prevent significant population health issues by first establishing an environmental monitoring system that will inform predictions of timeframes within which action may be required, and identify localised zones that may be more at risk of the sea level rise and coastal erosion.

Changes in outdoor air quality

There is some air quality monitoring in the Settlement region. Neither persistent organic pollutants, nor pollens are among the parameters monitored presently and an evaluation remains to be done as to the adequacy of these data to inform on conditions which may contribute to a change in the incidence of health concerns associated with exposure to air pollutants. The public health surveillance system is presently set up to capture the more serious, health events associated with exposure to air pollutants. For health problems associated with changes in the distribution and types of airborne allergens however, it is not likely that these data would be reported beyond the community level at this time.

As for indoor air quality, also susceptible to changes associated with a changing climate, monitoring was not reported to be carried out.

Increased UV exposure

UV radiation is monitored in Happy Valley- Goose Bay. An evaluation remains to be done to determine: 1 whether one station is sufficient for the coastal population; and 2. whether the dissemination of this information is conducted at the community level.

The health surveillance system would capture the incidence of disease that may be associated with increased UV radiation levels. The milder forms of health issues such as rashes and burns however, will likely remain unreported. The latter data may be useful as indicators of trends and could be utilised in a cancer prevention or eye damage prevention programme.

In terms of the impacts UV radiation can have on food chain productivity, as is mentioned earlier in this section, there are a number of food security/nutritional research activities that have taken place or are in the planning stages. An evaluation remains to be done to assess whether these are sufficient in terms of detecting changes in food security over time or whether other monitoring tools looking more closely at UV radiation and food chain productivity would be appropriate to adopt to inform medium- to long-term health planning.

6.3 Conclusion

This investigation has found that some categories of health outcomes potentially influenced directly and/or indirectly by climate change, are subject to health surveillance; these are notifiable diseases, cancer and mortality. For all other categories of health endpoints included in this investigation, there are a range of potential sources of data that may be exploitable to evaluate associations between changing climate and outcomes, and to build the capacity of the public health system. The information sources include administrative databases, community level health records, records kept by organizations for public security and safety, and surveys and data produced through research. The recent specificity of Census data to the Nunatsiavut population, for example, represents a significant leap forward in providing data that is representative of this unique population within the province. However, the extent to which any of these records incorporate the specific information that would enable public health officials to identify and follow trends in the extent to which climate change is directly and indirectly influencing these health outcomes remains to be evaluated in greater detail and on a case by case basis.

Some of this specific information may be found among the monitoring records kept on various environmental media. This investigation describes the state of environmental monitoring for those media or phenomena identified from the literature as having a relationship between climate change and health outcomes. Significant gaps were identified for permafrost monitoring. Several media are monitored but perhaps not over a sufficient geographical area. Others, particularly critical or sentinel biota seem to be well-followed over time. While none of these were devised for the purpose of informing public health, there is interest on the part of environment to contribute to health protection. There is an openness to change that could be exploited.

A mechanism for feedback is a crucial component of a public health surveillance system. It facilitates communication between those that analyse and disseminate the data and those that collect it. In this way, data can be further refined to understand associations between, in this case, environmental change and health outcomes. Public health surveillance of a number of the health outcomes potentially associated with climate change was found to be effective and functional, however feedback was rarely found to be a significant part of the process. Incorporation a feedback method into existing and future public health surveillance processes for the Nunatsiavut population is a primary mechanism with which to move forward in terms of building the capacity of the system to protect its population from the adverse effects of climate change.

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1. ENVIRONMENTAL INDICATORS**1.1 WEATHER – GENERAL :**

- Temperature (air) (mean weekly and monthly)
- Extreme events (incidence of annual extreme warm and cold days)
- Precipitation (rain, snow) (mean monthly and any other characteristics)
- Wind velocity and predominant direction (max, min, average)
- Duration of fishing, hunting and recreational seasons - perceived by community residents
- Indicators of weather predictability

1.2 ICE

- Sea-ice (thickness, annual fast-ice edge distribution, annual date-in, annual date-out in local bay or nearest location, length of time for freezing, salinity)
- Glacier-ice (location, leading edge location, size)
- River-ice (thickness, distribution, date-in, date-out)
- Lake-ice (thickness, distribution, date-in, date-out, length of time for freezing)

1.3 DRINKING WATER

- Drinking water quality (fecal and total coliform) in municipal and local natural source
- Drinking water availability (availability of local natural sources)
- Salt water intrusions in ground water supplies (presence/absence)

1.4 CONTAMINANTS AND POLLUTION

- Level of contaminants in water and animal tissues (priority contaminants - organic and metals, priority food species) (PCB, Hg, Pb)
- Hazardous or toxic substances released in the ambient air (levels in local air sampling)
- Level of radionuclides in animal tissues (priority radionuclides, priority food species)
- Identification of "contaminant risk areas" (e.g. Dewline)
- Microbiological contamination of traditional foods
- Indoor air quality data
- local ambient water quality (emphasis on sources of raw drinking water)

1.5 BIOTA

- Fauna : Priority animals and wildlife populations (numbers, trends, and seasonal distribution) – Caribou (George River herd)
- Fauna : Priority fish and marine mammal populations (numbers, trends, seasonal distribution) – ringed seal (North Atlantic and Eastern Arctic populations), Arctic char (local stocks)
- New species reported within the region (species sited and identified, year and location, scale: regional or community)
- Fauna : Priority migratory bird populations (numbers, trends, seasonal migration routes) – species dependant upon data availability
- Changes in insects population and distribution (changes in local insect population numbers, appearance of new species) – dependant upon data availability

- Fauna : Surveillance of zoonotic diseases (incidence, cases)
- Flora : Priority plant species (numbers, trends, distribution)
- Phytoplankton and zooplankton production (primary productivity in marine areas)
- Observed changes in animal health (e.g. skinnier seals) and other abnormalities in wildlife – qualitative
- Reported change in taste and consistency of wild meat (potentially related to previous indicator)

1.6 PERMAFROST

- Continuous and discontinuous permafrost zones (limits of continuous zone and depth where data is available)
- Permafrost active layer (depth and changes over time)
- Adequacy of health supporting infrastructure : drinking water system, sewage, health services buildings (permafrost shifts and damage to infrastructures; costs; continuance of service)

1.7. MODIFICATION OF LANDSCAPE NOT RELATED TO PERMAFROST

- Erosion in sentinel locations (measures or reported from observation of community representatives)
- Shoreline erosion

1.8 UV-B RADIATION

- Incidence of UV-B in community (seasonal) – nearest location

1.9 SEA :

- Coastal level in sentinel locations
- Currents in sentinel locations

1.10 FRESH WATER - LEVELS

- Levels of freshwater in locally important waterways (spawning rivers, natural drinking sources)

2. HEALTH INDICATORS

Physical Endpoints

2.1 DEATHS

- Deaths due to respiratory problems
- Deaths due to non-intentional trauma
- Deaths due to intentional trauma (i.e. suicide)
- Deaths due to CV problems
- Deaths due to cancers
- Deaths due to infectious diseases

2.2 INJURIES

- Description by occurrence : intentional and non-intentional

2.3 DISEASES and physical responses

- Incidence of infectious diseases (diarrheal diseases, bacterial and parasitic diseases – botulism)

and trichinellosis)

- Incidence of respiratory diseases
- Incidence of cardiovascular diseases
- Incidence of zoonotic diseases (HPS, WEE, EEE, Lyme disease, etc.)
- Incidence of seafood related diseases (préciser : voir CCAF 1)
- Incidence of health problems related to diet shift for alternative sources (diabetes, vitamin deficiency, etc.)
- Incidence of ocular problems (cataracts, infections)
- Incidence of skin cancers
- Incidence of sun blisters and burns
- Incidence of snow blindness
- Perception of physical wellness and vitality

2.4 BIOMONITORING

- Levels of contaminants in human biological tissues (metals, organochlorines)
- Seroprevalence (for certain parasitic and viral diseases)

2.5 LOST PERSONS

Mental Endpoints

2.6 PSYCHOLOGICAL/MENTAL IMPACTS

- Quality of life indicator
- Mental health disorders (mood disorders, anxiety disorders (PTSD))

Social Indicators

2.7 SOCIAL IMPACTS ASSOCIATED WITH HEALTH OUTCOMES

- Cost of living (heating, food including travel)
- Food security (measure of and cost of)
- Cost of equipment for harvesting maintenance, repair and replacement
- Cost of home maintenance and repair wrt natural disasters and events (eg. Spring flooding)

2.8 COMMUNITY WELLNESS

- Incidence of various types of crimes
- Practice of traditional activities
- Community based cultural events

3. ACTION INDICATORS

- Education and prevention programs on UV-B exposure (e.g. hats, sunscreens, etc.)
- Communication and education programs on botulism and trichinellosis hazards
- Existence and adequacy of warning systems for extreme weather events and natural disasters
- Existence and adequacy of community search and rescue teams and emergency response program
- Programs to improve food quality and to promote traditional food consumption (including

prevention of new seafood diseases)

- Existence and adequacy of system to ensure access to safe and healthy traditional foods (e.g. community freezers)
- Availability of psychological assistance following natural disasters
- Vaccination campaigns against infectious diseases

Appendix B

Key Informants and Informants

Health

- General: Medical Officer of Health, Archivist, physician, Health Practitioners, EHO (Environment Health Officer), Social Worker
- Morbidity: MOH, Archivist, HPs
- Mortality: MOH, vital statistics, Archivist, HPs
- Mental: MOH, HPs, Social worker (SW), anthropologist
- Social: MOH, SW, vital statistics, Community Health Worker, anthropologist, GOV Dept: Stats, Revenue, Health (Socio-Economic analyst)
- Community: MOH, GRC (RCMP), anthropologist
- Lost persons: search & rescue, GRC (RCMP)
- Biomonitoring: MOH, RIs

Environment

- General EHO
- Weather/UV Environment Canada
- Ice Environment Canada, Research Institutes (RI)
- Sea level Department of Fisheries and Ocean (DFO), RI
- Drinking Water/Fresh Water Municipal/Public works, RI, EHO, Regional Governments
- Contaminants Researchers, RI, EHOs
- Biota RI, DFO, Wildlife Officers, Hunters and Trappers, EHOs
- Permafrost RI
- Landscape RI

Labs

Organizations

Inuit Tapiriit Kanatami (ITK)
Nunavut Tunngavik Incorporated
KIA
Labrador Inuit Association
Kativik Regional Government (KRG)

Key Informants

MOHs
Directors of Public Health
Heads of research at RIs
Collaborators
EHOs

Who are HPs (Health Practitioners):

- Physician, nurse (I)
- Head public health nurse
- Psychologist
- Directors within public health
- Medical Advisors, chief of staff

Nota: Medical transcriptioners?

Appendix C Reporting Notifiable Diseases

Newfoundland and Labrador - Report to your Local Medical Officer of Health

LIST A	LIST B		LIST C
Immediate(same day) reporting by telephone	Detailed ³⁹ reporting (if suspect or confirmed outbreak report immediately, by telephone)		Aggregate reporting
Anthrax	AIDS	Lymphogranuloma Venereum	Infectious Mononucleosis
Botulism	Amoebiasis	Malaria	Influenza-Like Illness (ILI)
Cholera	Brucellosis	Meningitis - Viral	Mycoplasma Pneumonia
Diphtheria	Campylobacteriosis	Mumps	Parvovirus
Haemophilus influenza type b	Chancroid	Mycobacterium -atypical	Respiratory Syncytial Virus
Hepatitis A	Chlamydia	Norovirus	Rotavirus
Legionellosis	Congenital Rubella Syndrome	Ornithosis/Psittacosis	Varicella - clusters
Measles	Creutzfeldt-Jakob	Pertussis	Note: Varicella - preventable is defined as cases in children who are eligible for varicella vaccine.
Meningitis - bacterial	Cryptosporidiosis	Pneumococcal -invasive disease	Varicella - clusters includes aggregate cases in children who are not eligible for varicella vaccine.
Meningococcal invasive	Cyclosporiasis	Q-Fever	
Plague	Cytomegalovirus	Salmonellosis	
Polio	Dengue Fever	Shigellosis	
Rabies	Epidemic Encephalitis	Staphylococcus - invasive disease	
Rubella	<i>Escherchia coli</i> - pathogenic	Streptococcal -invasive disease	
Severe Acute Respiratory Syndrome	Food-borne - epidemic/outbreak	Syphilis	
Shellfish Poisoning	Giardiasis		

³⁹ Next business day

Smallpox/Vaccinia	Genital Herpes	Tetanus	
Typhoid/Paratyphoid	Gonorrhea	Toxoplasmosis	
West Nile virus infection	Granuloma Inguinal	Trichinosis	
Yellow Fever	Hantavirus	Tuberculosis	
	Hepatitis B	Tularemia	
	Hepatitis C	Typhus	
	HIV Infection	Varicella - preventable	
	Influenza - Laboratory confirmed	Water-borne - epidemic/outbreak	
	Leprosy	Yersiniosis	
	Listeriosis		
	Lyme		

Please report confirmed cases of the above to your local Regional Integrated Health Authority Revised April 2006

Source: Cathy O'Keefe, Division of Disease Control, Health and Community Services, Government of Newfoundland and Labrador

Appendix D Description of a selection of Statistics Canada Surveys⁴⁰.

Aboriginal Peoples Survey – occasional survey

The Aboriginal Peoples Survey (APS) provides data on the social and economic conditions of Aboriginal people in Canada. Its specific purpose was to identify the needs of Aboriginal people focusing on issues such as health, language, employment, income, schooling, housing, and mobility. The survey was designed and implemented in partnership with national Aboriginal organizations and includes an Arctic component. The adult questionnaire is administered to respondents aged 15 and over while the children's questionnaire was directed at children and youth aged 0 to 14 years. Data for the 2001 APS is available, while the release date for the 2006 data is the fall of 2008.

Census Aboriginal Population Profile – every five years

The census is designed to provide information about the demographic, social and economic characteristics of the Canadian population and about its housing units. The Profile contains Census data for Canadian communities where the Aboriginal self-identity population is above 250. Community profiles based on 2006 data is available from the Statistics Canada web site, while the release date for the more specialised Census Aboriginal Population Profiles is the fall of 2008.

National Population Health Survey – North Component is discontinued

The NPHS North component ended after three cycles, i.e. in 1998-1999. Since 2000-2001 the Canadian Community Health Survey (CCHS) collects cross-sectional health data in the Northern Territories every two years. NPHS data is available only at the provincial level and not at the health authority level, nor for Nunatsiavut.

Canadian Community Health Survey – biennial

The first CCHS cycle 1.1 took place over 2000-01, the second in 2003, and the third for 2005. For 2005 the smallest data agglomeration that is presented is for the Labrador-Grenfell Health

⁴⁰ information is from: <http://www.statcan.ca/english/sdds/index.htm>

Authority. The central objective of the Canadian Community Health Survey (CCHS) is to gather health-related data at the sub-provincial levels of geography. A sample size of a maximum of 500 was collected for the Health Labrador Corporation. The primary use of the data is for health surveillance, such as in prevalence of disease and other forms of health research. Subjects cover diseases, health, health care, health status indicators and households. The CCHS targets persons aged 12 years or older who are living in private dwellings in the ten provinces and the three territories. Persons living on Indian Reserves or Crown lands, residents of institutions, full-time members of the Canadian Armed Forces and residents of certain remote regions are excluded from this survey. The Common and Optional content subjects for Newfoundland and Labrador for 2001 are as follows:

Content

The health region-level survey will consist of an interview of approximately 45 minutes. Thirty minutes will consist of common content to be asked of all sample units, to meet basic health data requirements on an on-going basis. Ten minutes will consist of optional content determined by each health region from a predefined list of questionnaire modules. Socio-economic and demographic content will complete the 45-minute interview.

The provincial-level survey will be approximately 60 minutes and will consist of some common content and one focus content topic per cycle. Focus content is intended to be an in-depth treatment of topical issues. Suggestions for focus content include mental health, nutrition and social support. It is also expected that a set of physical measures be taken for a sample of respondents at some point.

The following table outlines content for the first year of the CCHS, as identified in a cross-Canada content consultation that took place in June 1999: Optional Content for Newfoundland and Labrador is shown in **bold**.

Common content	Optional Content
• Administration • Alcohol • Alcohol dependence / abuse • Blood pressure check • Breastfeeding • Chronic conditions • Contacts with mental health professionals	• Breast examinations • Breast self examinations • Changes made to improve health • Dental visits • Depression • Distress • Driving under influence • Drug use

• Exposure to second hand smoke • Food insecurity • Fruit and vegetable consumption • General health • Health care utilization • Health Utility Index (HUI) • Height / weight • Household record variables • Income • Injuries • Labour force • Mammography • PAP smear test • Patient satisfaction • Physical activities • PSA test • Restriction of activities • Smoking • Socio-demographic characteristics • Tobacco alternatives • Two-week disability	• Eye examinations • Flu shots • Home care • Mastery • Mood • Physical check-up • Sedentary activities • Self-esteem • Sexual behaviours • Smoking cessation aids • Social support • Spirituality • Suicidal thoughts and attempts • Use of protective equipment • Work stress
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Source: <http://www.statcan.ca/english/concepts/health/cchsinfo.htm>