The Importance of Traditional Ecological Knowledge during times of Change in the Sahtú Region

by

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In

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Abstract

This study aims to provide insight into the phenomenon and impacts of climate change in the Canadian Subarctic region, based on research with youth and elders from the community of Déljne located on Great Bear Lake (GBL) in the Mackenzie River Basin. In collaboration with the Sahtú Renewable Resources Board, the thesis research focused on understanding two key questions. What is climate change from the perspective of Déljne Got'ine people and their traditional knowledge (oral histories) of climate in the region? What are the impacts of climate change on the fishing livelihoods of the Déljne Got'ine people? Over the course of one month, 21 semi-structured interviews were carried out and the results were analyzed and verified with community members. In addition to contributing practical outcomes to decision-makers in the community and the region, the work may also be considered important to the territorial and federal government whose climate change policies have been based on limited traditional knowledge. Given that the majority of research on climate change involving Indigenous peoples in Canada has focused on the high arctic and marine environments, the work is unique in its focus in the sub-arctic region and relative to freshwater ecosystems and livelihoods.

Preface

This paper-based thesis is original work completed by Chelsea Martin. The research project, of which this thesis is a part, received research ethics approval from the University of Alberta Research Ethics Board, Project Name "Tracking Change in the Mackenzie River Basin", Project Number Pro00065907 on June 22, 2016.

Some of the research conducted for this thesis forms part of an international research collaboration, led by Dr. Brenda Parlee at the University of Alberta, with Dr. Parlee also being the lead collaborator. The semi directive questionnaire referred to in chapter 2 was designed by myself, with the assistance Deborah Simmons and Dr. Parlee. The thematic data analysis in chapters 3 & 4 are my original work. I was responsible for the data collection and analysis. Mandy Bayha and Michael Neylle assisted with the data collection and verification edits. Dr. Parlee was the supervisory author and has been involved since the beginning of this project.

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Lastly, I would like to thank the funders of this project: Tracking Change, Social Sciences and Humanities Research Council of Canada (SSHRCC), Northern Scientific Training Program (NSTP), and the Department of Resource Economics and Environmental Sociology at The University of Alberta.

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Abbreviations

CBPR - Community Based Participatory Research

DGG - Dél̨ne Got'ı̨nę Government

GBL – Great Bear Lake

IPA - Interpretative Phenomenological Analysis

IPCC - Intergovernmental Panel on Climate Change

NWT – Northwest Territories

PAR - Participatory Action Research

SRRB - Sahtú Renewable Resources Board

TEK – Traditional Ecological Knowledge

TK – Traditional Knowledge

UNEP - United Nations Environment Program

UNESCO - United Nations Educational, Scientific and Cultural Organization

WMO - World Meteorological Organization

Chapter 1

Introduction

1.1 Introduction

Freshwater fisheries are among the species most affected by climate change (Brander 2007). Given freshwater ecosystems are interconnected with the economic, social and cultural ways of life of many communities around the world, an equally concerning trend is the potential impact of climate change on fishing livelihoods (Badjeck, et al. 2010).

In northern Canada, 'it is expected that the effects of climate change will be felt earlier and more keenly in the polar latitudes than elsewhere in the world' (Berkes & Jolly, 2002, p. 2). A more recent publication notes that air temperatures in the Arctic are also rising 2 to 3 times faster than anywhere else on the earth's surface (Wright, 2019). Northern fishing communities understand that environmental conditions are likely to fluctuate and vary, but it is when those particular settings become abnormal or unprecedented that people become incredibly concerned (Berkes & Jolly, 2002). In order to identify these uncharacteristic ecological shifts, a research collaboration was developed with Sahtú Got'ine community of Déljne (formally known as Fort Franklin), located on Great Bear Lake in the Sahtú Settlement Area of the Northwest Territories.

1.1.1 Objectives Section

In the Canadian context, particularly in the Inuit and Inuvialuit regions (Riedlinger, 2000; Nuttall et al. 2005; Landauer & Juhola, 2019) there are a significant number of traditional knowledge studies that have helped to understand the impacts of climate change. However, there has been comparatively less research concerning the impacts of climate change and related experiences of First Nations in the Canadian Subarctic. This includes the Sahtú Got'ine people of Great Bear Lake (GBL) and the Mackenzie River Basin. In this context, the goal of this thesis project is to:

Obj.1 Explore more about the phenomenon of climate change based on the traditional knowledge of the Sahtú Got'ine people,

Obj. 2 - Investigate the impacts of and adaptations to climate change of fishing Sahtú Got'ine fishers.

1.1.2 Project Background

This study was part of a larger academic project (entitled: Tracking Change) which focuses on strengthening the voices of subsistence fishers and Indigenous communities in the governance of major fresh water ecosystems. This wider project is funded by *the Social Sciences Humanities Research Council of Canada* and led by the University of Alberta under the supervision of Dr. Brenda Parlee. Over a six-year period (2015-2022), in conjunction with sister projects in the Lower Amazon and Lower Mekong River Basins, Tracking Change will collaborate with communities in order to 'advance scholarship around the linked nature of local traditional knowledge systems and address partner needs for local traditional knowledge in watershed governance' (http://www.trackingchange.ca/about/).

1.2 Setting

The Dene people living around Great Bear Lake would come to Fort Franklin (now Délįne) to trade with the North West Company as well as the Hudson's Bay (Osgoode 1931). It was in the twentieth century that this area was recognized as a district for the surrounding Dene people and have since then been called the Bearlake Dene (Paul Dana, Brent Anderson, & Meis-Mason, 2009). The people of Délįne (known as Délįnęot'ıné) collectively identify as Sahtúot'ine (pronounced "sah-tu-ohtinay,") or Sahtu´ Got'ine, meaning Bear Lake people in the North Slavey dialect of the Dene language (Caine, 2013). These terms will be used interchangeably throughout the thesis.

1.2.1 Community Background

Délįne, formally known as Fort Franklin, is located in the Northwest Territories at 65° N, 123° W, on the western end of Keith Arm on Great Bear Lake, which is about 10 km from the outlet of Great Bear River (Woo et al., 2007). According to NWT Bureau of statistics (2017), the current population is approximately 515 and 491 of these individuals identify as Aboriginal. It is a community recognized for its deep spiritual and cultural importance as well as its unfortunate colonial history associated with uranium mining between 1930 – 1950 (Gilday, 2000; Board, S. L. U. P., Territories, N., Sahtú GIS Project, & Auld, J, 2005). It is a thriving fishing community that continues to maintain its distinct identity through the use of dene customs and traditions that utilize

the pristine resources of Great Bear Lake. The undeniable importance that Dél̨ine places on the land and environment is beautifully expressed by Morris Neyelle in Paul Dana et al. (2009) article: *"As Aboriginal people, our land is very important to us. All the animals live on the land. Water, animals, fish, we live by it, and so that's why it's real important to us…. I will protect them with my life. Because without them, it's useless for me to live. This is like the last – the last place on earth where nothing has been touched."* (p. 103). Increasingly people are noticing significant abnormal environmental shifts, which is critically important for the sustainable future of Dél̨ine livelihoods and is the unfortunate motivation for this thesis.

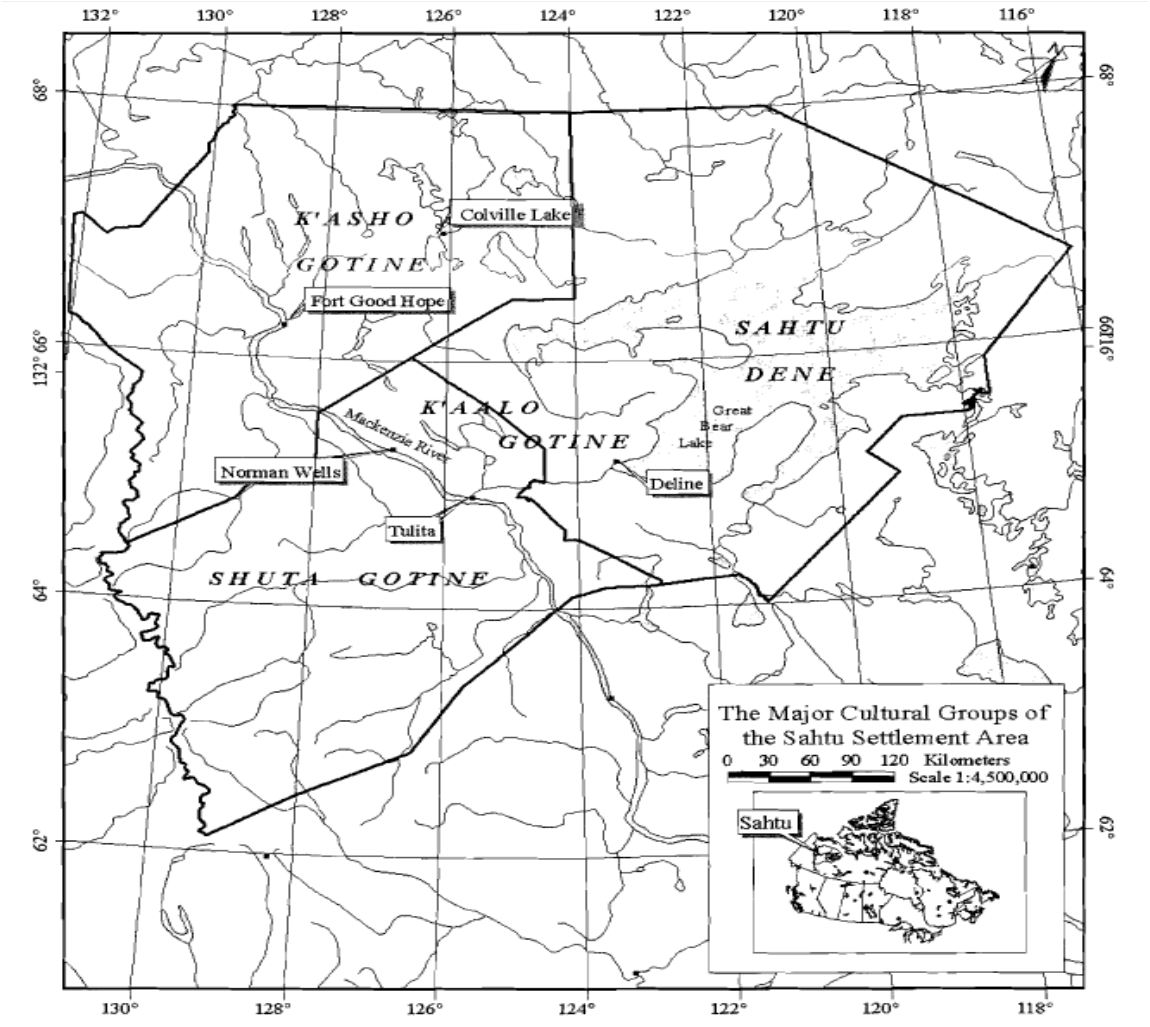

Figure 1.1: Sahtú Settlement Region (McMillan, 2012).

1.3 Overview of the literature

1.3.1. Climate Change

Climate change is a major issue globally; but has many different implications in different areas around the globe including the subarctic of northern Canada. According to the literature, the increase in atmospheric carbon dioxide may cause the Earth's surface to warm by 1 to 3.5°C during the next century and as a long-term trend, climate change is expected to have a significant impact on both the Earths landscape and human life (Riedlinger & Berkes, 2001). A more recent publication indicates that Arctic is currently experiencing constant unprecedented warming temperatures because of strong positive feedbacks that are unique to polar regions (Pendleton, et al., 2019). In the Canadian north, climate change becomes a significant issue for Indigenous communities since many continue to heavily rely on surrounding land and water resources for traditional livelihood activities. A leading example of a resource-dependent dene society that continues to utilize a traditional country lifestyle includes the Sahtú Got'ine people of Déljne. The accumulated traditional knowledge associated with their local ecosystems has been absolutely critical to the sustainability of country-based livelihoods, which has allowed the community of Déljne the capacity to thrive. However, climate change related issues and increased levels of abnormal environmental variability are starting to become more substantial, which generates newfound unforeseen obstacles for the community. Perceptions of climate change and how traditional knowledge is employed to understand its impacts becomes an important investigative problem because it has been vastly overlooked in previous research initiatives. For example, previous climate related research has focused on identifying newfound health related vulnerabilities. Furgal & Seguin (2006) explore the potential direct and indirect climate related health impacts in Nunavik and Labrador, which include increased risk of skin cancer, decreased stability of public health as well as increased severity of accidents (p. 1966). Other climate change projects have concentrated on the accumulated financial costs of climate change as well as what the potential costs are for individuals from small northern communities (Huntington, Goodstein, & Euskirchen, 2012). Finally, a large portion of climate change research has focused specifically on TK and meaningfully incorporating it into climate mitigation strategies (Golden, Audet, & Smith, 2015). The literature covered within this paper-based thesis is not an extensive literature review or assessment on science regarding climate change. The academic papers enclosed within

this thesis focus on the social implications of climate change and its emerging presence within social science related disciplines.

Although TK is a newly emerging topic within social science research, the literature gap concerning its involvement with climate change research still remains. Perhaps one of the reasons is because there is still a significant amount of ambiguity and insecurity concerning the rate and extent of climate change impacts, especially in the Canadian north (Riedlinger & Berkes, 2001). According to Riedlinger & Berkes (2001) northern climate science is particularly complicated because there is a scientific knowledge deficient regarding physical and ecological processes in the Arctic. Furthermore, there are negligible amounts of historical baseline climate data, which makes it extremely difficult to compare current climate conditions. However, by including Indigenous insights and oral histories into the climate change equation – a better and broader understanding of how to best adapt to these changes can be developed. As Usher (2000) describes "TEK can thus contribute to environmental assessment by providing a broader and deeper understanding of baseline conditions and a fuller understanding of local environmental processes, at a finer and more detailed geographical scale, than conventional scientific knowledge can offer…because it deals with outcomes and prediction: what people think will happen and why" (p.187).

1.3.2 Fishing Livelihoods

Fishing livelihoods are an important area of study globally and also considered to be an essential dimension of many northern Indigenous communities. Over many generations Déljnes ideal aquatic location has fostered the development of valuable fishing related knowledge, practices and institutions that are deeply integrated with the Sahtú Got'ine spiritual worldview. Furthermore, the importance of fishing is not limited to a contribution of food resources, but also underpins healthy respectful relationships between people and cultural landscapes. However, as climate related issues increase and levels of abnormal environmental variability emerge, so does the importance of defining how these changes directly affect fishing livelihoods and traditional knowledge of the Sahtú Got'ine people. New research regarding the effects of climate change is constantly emerging and so is the academic field specific to its impacts on fish and fishing livelihoods. In the global marine context, Harley et al. (2006) examines how coastal marine

systems respond to the effects of climate change by examining indicators such as deviations in species composition, diversity and community structure. Similarly, Brander (2007) explores the climate changes impact on fisheries as well as global fish production. The commonality that these two articles share, along with many other articles concerning climate change and fish, is that their methods heavily rely on statistical data in order to formulate models, inferences or future predictions. There are significantly fewer studies that focus on experiences of climate change from the local fisherman perspective. Although there is an increasing amount of social science literature emerging connecting TEK with fishing livelihoods, most of the research has not been completed within a Canadian context. Furthermore, majority of this literature is written for the purpose of incorporating TEK into administration policy or co-management regimes, not specifically climate change related. For example, Olsson and Folke (2001) focus specifically on local knowledge utilized by a Swedish fishing association, and how it is utilized in the management of the Lake Racken crayfish ecosystem. Their findings reveal that although the local knowledge is robust in many different ways, it is still inadequately incorporated within conventional resource management policy. This example is particularly interesting because it highlights how knowledge from local institutions, whose management authority is legally recognized and maintain positive cooperative relationships with management agencies, is still perceived as unnecessary in ecological management policy (Davis & Wagner, 2003). This fishing livelihoods literature reiterates the fact that policy still explicitly favors western science over traditional knowledge as well as the necessary shift in policy regime towards a more integrated and holistically sustainable environmental system.

1.4 Outline

1.4.1 Format

The presented paper-based thesis includes both introduction and conclusion chapters, but Chapters 3 and 4 are written as independent papers in journal-article format. The organisation is as follows: Chapter 2 describes the methodology used within this particular research project, while Chapters 3 & 4 present the results from this qualitative study and Chapter 5 outlines conclusions as well as recommendations and future research initiatives.

Chapter 3 will offer various academic contributions related to climate change as well as other disciplines that heavily focus on traditional knowledge scholarship. Findings from this chapter will further expand our collective knowledge regarding northern perceptions and Indigenous frameworks of climate change in the Canadian subarctic as well as how communities are utilizing traditional knowledge (TK) to understand abnormal environmental variations. Correspondingly, chapter 4 discoveries will also further develop our collective knowledge regarding the current status of fishing livelihoods in the Canadian subarctic as well as how communities are developing adaption strategies for abnormal environmental variations. Furthermore, this thesis specifically helps to addresses the literature gap concerning Indigenous knowledge and the sustainability of fishing livelihoods in a Canadian context. It is hoped that the findings from this thesis can be used as a guiding tool that will help the Sahtú Got'ine people develop climate adaption strategies that incorporate TK, prophecies and elders teachings within their policies. Additionally, it is also anticipated that by exploring how Sahtú Got'ine land users understand climate change, that outsider policy makers will begin to shift their settler worldviews in order to accommodate sustainable approaches utilized by these traditional conservationists.

1.4.2 Wider Contributions

Academic literature that specifically investigates Indigenous people and their unique social and cultural contexts is constantly expanding (Nelson & Wilson, 2017; Lowan-Trudeau, 2018; Goodman et al., 2018). This particular project is interested in exploring and contributing to academia associated with traditional ecological knowledge (TEK), climate change and fishing livelihoods. TEK scholarship covers a wide variety of topics where some of the main subjects include using TEK within scientific methods or in adaptive management frameworks (Berkes et al., 2000; Huntington, 2000). One of the continuing literature gaps consists of its relationship with climate change related policy. On a local scale, what this project exclusively offers TEK and climate change related research is detailed contextual insight to the Sahtú Got'ine worldview & how their knowledge becomes critical for understanding climate change in the Sahtú region across both time and space. This individual project also offers different nuances and findings pertaining to fishing related research domains. For example, how certain species populations are noticeably declining or how certain fish are increasingly covered in cysts. In conjunction with one another, the accumulation of project findings increasingly adds to the discussion on traditional knowledge

and its important inclusion within climate change related policy. In a global context, this project illustrates the necessary equal inclusion of TEK as a legitimate source within climate change policy. Especially since it has been demonstrated that including indigenous knowledge within policy is linked to increased participation, cost effective strategies as well as sustainability (Nyong et al., 2007). By documenting Sahtú Got'ine TK, this project serves as a starting point for further documentation of other Dél̨ne community members as well as the four other important communities located within the Sahtú region. Through further investigation, region comparisons and ecological distinctions can be the focus of future climate related research initiatives. Through discussions that potentially link ecological similarities cross culturally, regionally, nationally and transnationally, projects similar to this studies nature can help further advance scholarship related to local and traditional knowledge systems and its equal placement within policy.

In addition to literature related influences, this particular project offers many different contributions towards the project outcomes outlined within Tracking Change (www.trackingchange.ca). The broader goal of Tracking Change is to collaboratively work with local communities in order to document traditional knowledge related to socio-ecological change in the Mackenzie River Basin. By working with community members and established organisations, such as the Sahtú Renewable Resource Board and the Dél̨ne Got'ı̨nę Government, this project was able to accurately and meaningfully reflect community research needs. By including multiple perspectives within focus group sessions as well as maintaining open avenues for communication, community members were able to remain cognizant throughout the research process. In agreement with the Tracking Change project objectives, this particular study was able to identify patterns of change and potential variabilities associated to fishing livelihoods in addition to observed changes in health, diversity, and distribution of fish species valued for subsistence in GBL. By examining these specific indicators within the Sahtú Region, comparisons can be evaluated across Canadian contexts in addition to Tracking Change collaborators in the Mekong and Amazon regions and potentially the globe. By concurrently accomplishing these project outcomes alongside Tracking Change, future research projects can continue to be inspired to work collaborative with indigenous communities and follow endorsed community-based research practices (Castleden et al., 2012; Christensen, 2012; Darling, 2016) and continuously expand

research jurisdictions to include overlooked regions in order to expand our collective knowledge concerning TEK and its connection to environmental variability.

This thesis project is a requirement to graduate with a degree in risk and community resilience and in terms of contributions made within these disciplines, and other related transdisciplinary realms, this study offers a variety of insights. According to social ecological resilience literature, theory tends to emphasize interdependence and coevolution of both social and natural systems, the importance of change cycles, thresholds as well as relationships across time and space (Ross & Berkes, 2014). Through in-depth interview exploration, this project identifies ways in which the Sahtú Got'ine people experience risks associated with climate change and demonstrate resilient attitudes in order to defend against it. Some of the observed related changes including thinning ice, warming winter temperatures, changing fish populations, changes in fish health and the possibility of lower water levels. These changes directly relate to their relationship and interdependence on their surrounding environment because livelihood capacities heavily rely on the GBL ecosystem. The Sahtú Got'ine firmly believe that a healthy environment is of the utmost importance and understand that they become increasingly vulnerable climate change and its associated risks if these fluctuations continue to increase. This is directly related to resilience disciplines because the Sahtú Got'ine genuinely understand the costs associated with climate change and will therefore make the necessary adjustments in order to accommodate their changing natural environment. Furthermore, trust in traditional knowledge has served as a combative resilience mechanism because according to interview findings, climate related changes have always been predicted by elders' stories. This forewarning provides the Sahtú Got'ine psychological strength and added coping durability that help the Sahtú Got'ine be mentally prepared for upcoming environmental shifts. Although there are a wide variety of transpiring changes, the Sahtú Got'ine resilient attitudes radiate through their continuation to engage in traditional fishing activities. Fishing is not only a part of their culture, but who they are as a people that live on the lake.

Chapter 2

Methodology

2.1 Introduction

The research project was developed as a collaboration with the Sahtú Renewable Resources Board and the Sahtú Got'ine community of Déljne. This collaboration was important to ensure that the community had a strong voice in guiding and implementing the research process as well as interpreting and sharing of research results.

The approach may be described as a kind of decolonized research (Smith, 2013) in that it aims to address the conventional power imbalances that were characteristic of many kinds of academic research in the past. According to Wilson (2008) older modes of research did not deeply involve or incorporate Aboriginal people into the research and researchers were merely in it for the collection of data. This has consequently led many Indigenous people to feel resentful towards research in general. In order to combat this particular narrative and colonial research paradigm, this thesis utilized methodological practices that emphasize traditional knowledge and are qualitative in nature.

The research approach was also inspired by principles of participatory action research (PAR). PAR approaches challenge the researcher-participant relationship because rather than conducting research *on* people, researchers utilize these methods to conduct *with* the people, particularly those whose voices have had limited impact in decisions about such issues as land and resource development, health, or education (Kemmis, 2006; Baum et al., 2006; Datta et al., 2015).

Participatory action research is a methodology that has been well used and adapted to research involving Indigenous peoples, and traditional knowledge including work in the Sahtú region (Johnson and Ruttan, 1993; Cochran et al., 2008). There are many definitions of PAR which have evolved over time. Among the key themes: "PAR is a process of empowering participants by respecting and giving importance to participants' thoughts, experience and spirituality…Second, PAR is a collaborative process where participants and researchers both benefit…Finally, PAR is accountable to the participants" (Datta et al. 2015, p. 582).

A related methodology, is community based participatory research (CBPR), where the fundamental assumption is that the research is adapted to "the culture and context of the participants" (Christensen, 2012). According to the literature, this particular research model entails that community members engage directly in the design and implementation of a project, receiving training to allow the independent administration of future projects, and retaining control over study results (Fletcher 2003). Since CBPR methods have been used in many different Indigenous contexts around the world (Merriam et al., 2001; McClymont & Myers, 2012; Castleden, Morgan, & Lamb, 2012) and have become a well-recognized practice when researching Indigenous contexts or cross-cultural communities, these methods will also be utilized within this thesis project. Lastly, and in addition to the above citied community-based literature, this projects' methodological design was also motivated by academia concerning other qualitative methodologies, such as interpretative phenomenological analysis (IPA). According to Alase (2017) IPA offers certain advantageous elements to research because of 'the bonding relationship that the approach allows for the researchers to develop with their research participants'. These bonding relationships become possible because IPA methods "allow for multiple individuals (participants) who experience similar events to tell their stories without any distortions and/or prosecutions" (Alase, 2017). It is directly through qualitative and narrative based methodologies that research can provide the opportunity for those without a voice to highlight their concerns to larger audiences and perhaps institute stronger global change. As stewards of the land, Indigenous people must continue to maintain the right to protect their lands and it is with the assistance of academia that their important knowledge and voices can be heard by governments or policymakers worldwide.

2.2 Methodological Background

A well-recognized tension in social science research is the relationship between the researcher and others participating in the research process. Although decolonizing methodologies and participatory action research (above) over guidance on how to address inequities in power relations associated with these roles, a researcher must be conscious of the etic (insider) and emic (outsider) dynamics.

Etic and emic perspectives have a long-standing history within social science methodologies and literature (Morris, Leung, Ames, & Lickel, 1999). According to Darling (2016), etic-emic theory was introduced into social science literature in 1967 by U.S. linguist and anthropologist Kenneth Pike in his book *Language in relation to a unified theory of the structure of human behavior*. Emic, or inside(r), perspectives include approaches that aim to understand "accounts, descriptions, and analyses expressed in terms…and categories regarded as meaningful and appropriate by those native members of the culture being studied" (Darling, 2016). Whereas etic, or outside(r), perspectives include narratives "that yield accounts, descriptions, and analyses expressed in terms… and categories regarded as meaningful and appropriate by the community of scientific observers" (Darling, 2016). Although academia has conventionally favoured etic and scientific perspectives as absolute truths, more recently literature has highlighted the importance and scientific legitimacy of emic/native member perspectives as well as traditional knowledge (Coombe, 2001; Ellis, 2005; Woo et al., 2007). The major advantage to including this kind of knowledge within academia and scientific literature is that emic/insider approaches respect community perspectives and tends to illuminate novel, nuanced, more valid findings of the culture being studied (Morris et al., 1999). The proposed projects central aim is not only to complement and supplement traditional knowledge literature but to also further document, justify and highlight emic/Indigenous perspectives as a legitimate source of knowledge concerning climate related issues in the Canadian north.

According to the literature, researchers in cross cultural research contexts absolutely need to be familiar and constantly aware of any power differentials they may experience with prospective research participants (Francis, 1992; Batterbury, 1994). This expanding field further highlights the etic/emic narrative and how it is assumed that being an 'insider' automatically means that one will have easier access to more meaningful information (Merriam et al., 2001). According to Merrium et al. (2001) "the indigenous-insider is one who endorses the unique values, perspectives, behaviors, beliefs, and knowledge of his or her indigenous community and who can speak with authority about it. I want to stress with great importance that while I have legal status as a First Nations woman and considered to be a community member of the Canadian Indigenous collective, I genuinely understand that I still am an outsider to the community of Dél̨ine and therefore must be highly sensitive to possible uncertainties of my presence. Lockhart (1982) is

just one example of an academic that has expanded on the topic of insider-outsider frictions and believes that "an insider–outsider dialectic should be intentionally suffused in all relationships…to facilitate dual flows of knowledge and agency both inward and outward… [this way] outsiders serve not only as a bridge to new perspectives and outside ideas; they can also assist in expanding the sphere of influence of community leadership". Though I did hope that my interviews would be considered more of a natural conversation that helped produce new knowledge, rather than a formal exchange of information, I still strongly believe it would be more accurate to define my company in Dél̨ne as an 'external-outsider', which "is socialized within a community different from the one in which he or she is doing research" (Merriam et al., 2001).

Additionally, I believe it is important to also acknowledge the various responsibilities I maintained as an Indigenous student that represents the University of Alberta. Although university prestige is respected in certain contexts, they are also institutions that archetypally emphasize western scientific paradigms, colonialism and institutionalization. This becomes extremely problematic when working with Indigenous communities, similar to Deline, that have been knowingly subjected to colonialist regimes in the past (Davis, 2002). As a university student I understand that I am going to have to be extremely aware of both visible and invisible power imbalances between myself and research participants as well as my positionality within the community. While Dél̨ne and its people are well acquainted with research and its devices, because of its extremely unfortunate relationship with the Port Radium mine, (Deline Uranium Team, 2005; Gilday, 2000; Chambers, Wiatzka, & Brown, 2013) it is also important to recognize that negative perceptions of researchers are not unsubstantiated considering that earlier research has generally positioned Aboriginal peoples as 'objects' of research that are frozen in time because of their 'inadequate' knowledge structures (Battiste, 2002). It is anticipated that through the use of participatory action research methodologies, which focus on the political empowerment of people through participation in knowledge construction (Merriam & Simpson, 2000), that this project will afford Dél̨ne community members the power to be gatekeepers to their own distinct traditional ecological knowledge.

Lastly, I would like to highlight that since I was born, raised and educated within Alberta I know that it may be near impossible to completely rid myself of any characteristically western (and southern) impositions or biases I may unconsciously inflict. However, I hope that because I

have been surrounded by my own Indigenous family and exposed to many different cultural practices around the world that I can successfully employ receptive and considerate research mechanisms towards Déljne worldviews.

2.3 Methodological Theory

Canadian First Nations people have conventionally occupied a central position within research topics, questions and dissertations. This is well reflected within the particularly important phrase that circulates throughout academic groups as well as academia; 'Indigenous people have been studied to death'. According to Wilson (2008) older modes of research did not deeply involve or incorporate Aboriginal people into the research and researchers were merely in it for the collection of data. This has consequently led many Indigenous people to feel resentful towards research in general. In order to combat this particular narrative and colonial research paradigm, the present study utilized methodological practices that emphasize traditional knowledge and are qualitative in nature. The study's present model accentuates a relational research framework that has been considered respectful and appropriate for conducting cross-cultural social research in many Indigenous contexts (Fletcher, 2003; Wilson, 2008; Tobias, Richmond & Luginaah, 2013; Datta et al., 2015).

2.3.1. Participatory Action Research

In the context of researching Indigenous peoples, there is an increasing amount of methodological literature concerning the modernization and decolonization of Eurocentric scientific research paradigms. Since western worldviews are 'premised on a belief in scientific method as the basis of knowledge' (Hoare, Levy, & Robinson, 1993) and Indigenous realities are shaped through relationships and their environment (Wilson, 2008) it is absolutely inappropriate to try and fit Indigenous people within a research model that does not truly accommodate their spiritually rooted belief system. One operational example as to how researchers have aimed to reconceptualize scientific approaches is through the use of participatory action research (PAR).

Although PAR models are traditionally western methodologies and have been used for scientific based disciplines, their fundamentals can be redefined and used towards creating respectful research practices that recognize traditional knowledge and Indigenous ways of knowing. PAR approaches challenge the researcher-participant relationship because rather than

conducting research *on* people, researchers utilize these methods to conduct *with* the people being studied. Richards & Morse (2007) emphasize that this approach is less likely to undermine the self determination of participants and helps to incorporate their participant opinion within research design. According to Hoare et al. (1993) PAR is "an integrated approach involving the participation of community members to investigate social reality, build local skills and capacity for the purpose of increasing community autonomy through a process of praxis... It relies on the experience of the people, it values the culture, and it builds human capacity within the community". Since the relational elements of PAR methodologies and Indigenous knowledge are both participatory in nature, Indigenous knowledge research therefore becomes a suitable candidate for PAR styles and methods.

According to Datta et al. (2015) PAR approaches are also considered unique for three different reasons; "First, PAR is a process of empowering participants by respecting and giving importance to participants' thoughts, experience and spirituality…Second, PAR is a collaborative process where participants and researchers both benefit…Finally, PAR is accountable to the participants" (p. 582). Fostering empowerment through newfound accountable relationships and creating increased autonomy for communities is the central purpose of Indigenous community research and further highlights that PAR methodologies can be utilized as an appropriate research device within Indigenous contexts. Datta et al. (2015) also emphasize this discourse, however they claim that it can only be truly implemented properly 'if researchers have empathy for their participants and aim to be accountable to Indigenous communities in their research' (p.582). PAR systems have a longstanding history in the Canadian north; they were first administered on a large scale through the Berger inquiry in the 1970s (Fletcher, 2003). Since then, they have been adapted and reconfigured in order to adapt to a wide variety of different community contexts as well as included within studies concerning traditional knowledge, which supports the decolonization of western scientific epistemological and ontological assumptions (McMillan, 2012).

2.3.2 Community Based Participatory Research

Comparable to PAR research methods is community based participatory research (CBPR), where the fundamental assumption is that the research is adapted to "the culture and context of the participants" (Christensen, 2012). What is key to keep in mind is that the development and

construction of the methodology is highly dependent on the context in which is it applied, especially within Indigenous communities. According to the literature, this particular research model entails that community members engage directly in the design and implementation of a project, receiving training to allow the independent administration of future projects, and retaining control over study results (Fletcher 2003). Comparable to Hoare's definition of PAR, Tobias, Richmond, & Luginaah (2013) state that "CBPR initiatives with Indigenous communities should ideally pursue a set of common objectives: to equalize power differences within the research process; to build trust between the researchers and the community; and to foster a sense of ownership tied to generating momentum toward social change" (p. 132). CBPR methods have been used in many different Indigenous contexts around the world (Merriam et al., 2001; McClymont & Myers, 2012; Castleden, Morgan, & Lamb, 2012;) and have become a well-recognized practice when researching Indigenous contexts or cross-cultural communities.

There are many important factors at play that help to drive and motivate effective CBPR methodologies. According to Tobias et al. (2013) relational accountability and mindful reciprocity are considered imperative to building ethical research relationships. According to Kovach (2009), relational accountability acknowledges the importance of relationships, as they exist through all aspects of the research, requiring that special attention be paid to these relationships throughout the entire process. Correspondingly, mindful reciprocity challenges researchers to participate in thoughtful and compassionate relationships with community collaborators (Pearson & Paige, 2012). These two highly important elements drastically emphasize the need for establishing relationships with Indigenous community members which was incredibly important to me when working with elders and fishermen in Dél̨ine. Another vital factor that directly influences and affects CBPR methods is the participation element. Participation separates CBPR from other research methods because it aims to reverse historically entrenched inequalities by engaging directly with researchers in order to develop and implement a particular project. Although participation is of key importance, it can also be considered a significant obstacle. Tobias et al. (2013) identify many different challenges when engaging in CBPR, such as what elements define participation and what is considered an adequate level of participation? Other authors indicate that there are other risks that also need to be deliberated, such as the inclusion of inaccurate information or the research could become more vulnerable to political influences (Hoare et al. 1993, David

2002). This does not mean that CBPR methods are inappropriate in Indigenous contexts or should be rejected, it is just to highlight that researchers must be highly cognizant of navigating power dynamics within northern communities.

2.3.3 Research as Storytelling; Storytelling as Education

Story telling is distinctly characteristic of Indigenous culture and worldview; it becomes uniquely intertwined with everyday activities that it almost becomes undetected. This is not to imply that storytelling is average, ordinary or mundane but instead to focus on the versatility of storytelling and how it can be applied as an educational tool within communities (Christensen, 2012). Research, specifically qualitative research, is also very similar to storytelling in that they both aim to explore, describe, explain and provide deeper insights into certain issues. The difference between the two is that one is rooted within generations of experience and on the land practice, while the others foundation is rooted in scholarship and science related disciplines. However, modern research has moved towards a blending of methodologies and has begun to utilize storytelling as a way to better incorporate Indigenous voices within research. This project heavily relied on the power of storytelling to not only demonstrate the crucial importance of family history within Déljne, but to also used research as a tool to further provide strength and sovereignty for traditional knowledge narratives. To put it as eloquently as Christensen (2012) "at its heart, research is storytelling. As a researcher, I listen to stories through interviews and focus groups, I reflect upon those stories and interpret them, and then I too become a storyteller as I share these stories, along with my own experiences and ideas, with different audiences" (p. 232). I personally want to emphasize that the stories I share here are not my own, but I have been given special permission to share with the world. The stories come from Dene elders, fishermen, women and youth who have lived off the land and continue to respect their environments the best way they know how. As a researcher, I understand myself a facilitator for storytelling and a vessel for knowledge sharing. I do not possess the same capacity of rich knowledge that my friends have shared with me and use this thesis project as a way to share their stories with a wider audience.

2.3.4 Interpretative Phenomenological Analysis (IPA)

From an Indigenous perspective, knowledge is subjective and collaboratively produced through culturally significant modes of sharing and relationship (Cruikshank, 1990, Christensen,

2012). This understanding of Indigenous worldviews made it easy to select qualitative research methodologies as the basis for this thesis project because it allowed me to be more flexible with interviews as well as understand the real lived experiences within Dél̨ne. In addition to the above cited community-based literature, this projects research design was also motivated by academia concerning other qualitative methodologies, such as interpretative phenomenological analysis (IPA). According to Alase (2017) IPA offers certain advantageous elements to research because of 'the bonding relationship that the approach allows for the researchers to develop with their research participants'. These bonding relationships become possible because IPA methods "allow for multiple individuals (participants) who experience similar events to tell their stories without any distortions and/or prosecutions" (Alase, 2017). Creating real and lasting friendships with Dél̨ne community members was a major concern for me because I did not want to be viewed negatively or understood as *just* an objective researcher. I understand that I am much more than that and my presence in the community would be questioned, so I was not afraid to answer any enquiries that community members may ask of me. Transparency and honesty went a long way in Dél̨ne and I strongly believe that it helped future participants to trust me a little bit more than if I had maintained a strictly 'researcher' façade. Being my true self allowed community members to quickly see me as more of a friend rather than a student from an institution, which I think allowed interviews to flow much more naturally in conversation and without feelings of judgement or examination.

Additionally, the IPA approach allows researchers to best understand the lived experiences of research participants (Alase, 2017). For me, the main purpose of this project is not to publish; the central goal is to deeply understand, highlight, and document traditional knowledge as well as current climate conditions that the community of Dél̨ne faces. It is directly through qualitative and narrative based methodologies that research can provide the opportunity to voice community concerns to larger audiences and perhaps institute stronger global change. As stewards of the land, Indigenous people must continue to maintain the right to protect their lands and it is with the assistance of academia that their important knowledge and voices can be heard by governments and policymakers worldwide.

2.4 Case Study Research

Helping an Indigenous community in some significant way has always been a close personal goal of mine but I was never really sure what the best approach would be, until I met Dr. Brenda Parlee. It was then that I realized that research and working with Dr. Parlee on the Tracking Change project would be the best way to help me achieve my goal because it directly works with communities to serve community needs. In August of 2016, Dr. Parlee allowed me the opportunity to travel to Dél̨ne to attend a cross cultural research camp and to scope out communities to conduct my future research with. Upon further investigation at the cross-cultural research camp, it became clear that there was an investigative problem surrounding climate change and that a case study could be the best way to explore this particular phenomenon.

According to VanWynsberghe & Khan (2007) there are more than 25 different case study definitions that encompass and describe what they involve. For example, a case can be considered any 'phenomenon for which we report and interpret only a single measure on any pertinent variable' (p. 81), or simply any problem that needs to be studied that will then reveal in-depth understandings (VanWynsberghe & Khan, 2007). Although there are many definitions and explanations to choose from, for this particular project it was necessary to use more flexible approaches. Building theory from case studies is a research technique that involves using one or more cases to create theoretical constructs, propositions and/or midrange theory from case-based, empirical evidence (Eisenhardt & Graebner, 2007). One of the main advantages to phenomenon driven research is that it is significantly more flexible than theory driven studies because the researcher does not have to frame the context within a theory but instead in terms of the importance of the phenomenon and the lack of plausible existing theory (Eisenhardt & Graebner, 2007). This flexibility is also portrayed within VanWynsberghe & Khan (2007) article explaining the 'prototype view' of a case study, which includes 7 key features such as small N, contextual detail and natural settings. These adaptable frameworks offered this project the necessary capacity to utilize methodological procedures that are catered to Dél̨ne's cultural, environmental and social systems. In doing so, this project was better equipped to effectively and efficiently answer the projects leading questions.

Another reason that I was drawn towards this region was because my parents originally met in Norman Wells, which is another community within the Sahtú. In some ways, it really resonated with me that I would be traveling to the same land claim region that that my parents originally met in and personally believed it was a positive sign. It was shortly after arriving there that I knew I made the right decision because I was instantly welcomed by all elders, youth and researchers at the camp and never once felt like an outsider. The openheartedness and kindness that I experienced made it easy for me to pick Délįne for my community project without any hesitation or doubts.

Fast-forward to June 2017 where I once again got to travel to Délįne to conduct my own research activities. During my stay, I was able to live with Morris and Bernice Neyelle - two amazing community members that introduced me to all their friends and extended family. I am incredibly grateful for their hospitality because if it was not for them I would have had to stay at the hotel, which would have been lonelier and much more secluded. Their hospitality allowed me to interact with a large amount of community members on a much more informal basis. Almost every day people would invite me into their homes or take me out fishing and share stories about their unique history. I was also lucky enough to be in the community during Aboriginal Day and Sahtú Day, where people would participate in community events such as potato sack and wheelbarrow racing – which I also cautiously partook in. These natural and non-research related interactions made it much easier for me to ask people (when the time was right) to be a participant in my research study and they almost always said 'yes'. These once strangers have now become my friends, which motivates me even more to complete my thesis and help document, empower and authorize Indigenous knowledge relating to abnormal environmental change.

2.5 Research Focus

Fishing is an important livelihood activity for many northern Indigenous communities including the Sahtú Got'įnę of Délįne, NWT. Since this community directly resides on the banks of Great Bear Lake, it has allowed for the exemplary development of valuable fishing practices. It is critical to understand that fishing not only contributes necessary food resources, but also underpins healthy respectful relationships between people and cultural landscapes such as Great Bear Lake (Andrews & Buggey, 2012**)**. The accumulated traditional knowledge associated with

fishing practices and cultural landscapes has been critical to the sustainability of fishing livelihoods. But as the stresses of climate change continue to grow, traditional fishing knowledge becomes even more important to the survival and future of Dél̨ne. Therefore, it is important to investigate problems such as climate change and its impact on Indigenous ecological practices, because it directly effects fishing livelihoods and Sahtú Got'ı̨nę traditional knowledge.

A significant number of traditional knowledge studies have helped understand the impacts of climate change in northern Canada, particularly in the Inuit and Inuvialuit regions of northern Canada and in Greenland (Riedlinger, 2000; Nuttall et al. 2005). Few studies have focused on the climate related knowledge and experiences of First Nations including the Sahtu Got'ı̨nę of the Mackenzie River Basin. With the impending threat of climate change and its strange impacts on water ecology, it is important to understand how weather changes are impacting fishing livelihoods in Dél̨ne as well as how people are adapting. The traditional knowledge that they have historically relied on is now having to change and adjust to abnormal weather patterns, which creates brand new knowledge that will be passed on to future generations. These changes are important to record and I expect that my research contribution will significantly help Dél̨ne. By providing insight to changes impacting fishing livelihoods, Dél̨ne can begin to develop Indigenous derived strategies that can protect their cultural and traditional knowledge.

2.6 Research Approach

During my master's coursework, it was countlessly reiterated that Indigenous Northern research is highly controversial and that researchers must conduct themselves with the utmost respect for the community, however that has not always been the case. Some of the literature within my coursework highlighted variously different research misdemeanors that academia has wrongfully imposed on Indigenous people, such as misrepresentation of First Nations, appropriation of their distinct knowledge and use of their knowledge without consent (Castleden, Morgan, & Lamb, 2012). These disrespectful research practices constantly reminded me to ensure that my research project ***must*** be motivated by methodologies that directly involve Dél̨ne residents and to safeguard against any colonial impositions against the community. This is a strategy that Dr. Brenda Parlee strongly encourages within her own research practice as well as for her graduate students and colleagues working together on the Tracking Change project.

Not only should I, the Indigenous researcher, give the community of Dél̨ne the respect it deserves - but I also understand that I have to *earn* the respect of the community as well. Based on the stories and literature concerning fishing on Great Bear Lake, it is blatantly obvious that Sahtú Got'ı̨nę people deeply pride themselves on the freshness of the water as well as the abundancy and size of the fish. As an Indigenous woman, I should possess a certain amount of traditional on the land skills like my aunties and grandmother, however my actual skill set is significantly lacking in comparison; something that I have been striving to improve upon. I truly feared that this would impact my ability to earn respect within the community because how on earth does an Indigenous girl conduct a thesis on fishing when she has only fished maybe three times in her entire life? Not only was I fearful that they would see me an imposter but another large fear I had was that Dél̨ne community members would see me as a 'bad' Indigenous woman because I don't have much on the land knowledge or skills. Once I arrived, it became extremely apparent that people in Dél̨ne truly do centralize their lives around fishing. Unless the weather was terribly ruthless, I would always see people out setting nets/lines or ice fishing on the ice sheets. My imposter syndrome anxieties quickly dissipated because as soon as people found out that I was there to research fishing practices, people would jump at the opportunity to take 'mermaid' (my given nickname) out on the lake. People were particularly keen on teaching me how to fish on Great Bear Lake and I think this excitement was especially amplified by the fact that there were still ice sheets on the lake and the fisherman wanted to show off their fearlessness while simultaneously testing my fear levels and willingness to jump the ice sheets as well. I believe that stepping outside my comfort zone and forcing myself to expand my traditional skills set significantly helped me to earn respect from community members and allow them to see me in a non-academic light. I think that immersing myself within their culture and community helped me to better conduct my research because these people became my friends, which allowed me to invite them into a conversation rather than an interview for collecting official data for a research study. By having a conversation surrounding their concerns rather than a formalized interview, I believe it added to my research approach and truly exemplifies CBRM.

A community research collaborator (Mandy Bayha) was hired along with a community translator (Michael Neyelle). These colleagues were extremely important throughout the entire

research process. Their participation was specifically important during interviews with elders and fishermen because they both maintain the ability to speak the North Slavey language. Without their participation, these interviews would have been tremendously difficult or near impossible. Furthermore, they were both extremely flexible with their time and would make interview scheduling a priority, something that I thanked them for every single day. Although I did have few community contacts upon arrival, they continuously asked people if they would be willing to participate in the research as well as introduced me to interview participants that I may not have been exposed to. Outside of formal research activities, both Mandy and Mike would share stories over coffee or tea and always remind me to slow down and take a break (something that I am still trying to learn). Their participation was absolutely key to the successful outcomes to this particular project and cannot thank them enough for all their hard work. Mahsi Cho!

2.6.1 Scoping

Fletcher (2003) makes the point that 'making contact' is the most critical phase of a research project, as it lays a foundation for developing working relationships and trust. My initial point of contact was actually in August 2016, when I participated in the cross-cultural research camp at ʔǫk'aıbə (Whiskey Jack Point). It was after the on the land research camp that I actually first spent some time in Délı̨ne and got to interact with people for the very first time. It was an especially important time in the community because I had the benefit of being there during Spiritual Gathering, an annual event held on the anniversary of the prophet Ehtseo Ayha's birthday where people from the Sahtú congregate in Délı̨ne to participate in discussions and workshops for spiritual, religious, and healing purposes as well as Ehtséo Ayha's wisdom and prophesies (Auld & Kershaw, 2005; Northwest Territories Tourism, 2018). Deborah Simmons and Christine Wenmen helped me establish relationships with stakeholders within the community and assisted with preliminary interviews. We pretested some of the semi-structure interview questions in order to assess if climate related changes truly are impacting fishing livelihoods on Great Bear Lake. The detailed information that we received from participants indicated that there are signs of climate related changes happening around Délı̨ne and this was also crucial for community selection for my thesis. These interviews were transcribed, coded and presented at the Tracking Change Global Knowledge Symposium in Thailand along with other projects involved with Tracking Change.

Fast forward to May 2017, where I once again arrived in Déljne to finally conduct fieldwork for my own research project - but this time on a much bigger scale. Instead of pretesting my questions, I was ready to broadly distribute my questionnaire as well as conduct interviews with key stakeholders in order to get a better idea about fishing practices from the community. Fletcher (2003) recommends to "focus research onto issues of importance to community members" and with the help of Deborah Simmons and Michael Neyelle, a focus group presentation was prepared in order to re-introduce my project to the community and gain any feedback for the project. An invitation letter was sent out to request certain people's attendance to the focus group, indicate honorarium for the focus group as well as summarized the proposed research project (See Appendix 6.3). A request was also made to present to the Déljne Got'jnę Government (DGG) at their monthly meeting, however due to short notice, they were not able to fit me into their already set schedule.

It was my understanding that the central reason for the focus group was to present my proposed project, gain insight and feedback and then go through the questionnaire so that we could omit questions that were considered irrelevant or inappropriate. The morning session went according to plan; I presented my project and Michael graciously translated for those who could not speak English. Afterwards, an open discussion was held to allow people to ask questions and indicate any issues they may have had – it was at this point that everyone involved (from my perspective) was on board with the project because they had not voiced any significant reservations or serious issues with my research. It was after lunch that I thought we were going to do a dry run of the questionnaire, however a document that I had helped produce for the 2016 cross cultural research camp was instead distributed amongst focus group participants in order to debrief them on what is happening with the information. I was unaware that this was going to happen and was worried about participant fatigue, considering it was a full 8-hour day for the focus group. As anticipated, once we finished reviewing the cross-cultural research document, participants grew tired and began to ask when they could go home. I knew I couldn't keep them past 5:00pm so I tried my best to go through the questionnaire as quickly but as detailed as possible. However, tensions were rising and people grew very bored or tired. Majority of participants stated that my questionnaire was too long and that it needed to be shortened. I have my own theories and beliefs about the questionnaires length, however my opinion is not what matters – it's the community

voice that matters and I respect their judgement and all feedback. It was not until after *a lot* consultation with my supervisor and Deborah Simmons, that it might be best to abandon the questionnaire due to limited remaining time in the community and to just move forward with the community approved semi structured interview questions.

As previously mentioned, 'making contact' is one of the most critical parts of a research project. Although I do strongly agree with this statement, I also firmly believe it is important that community members to see academics or grad students outside the context of research and in much more unofficial ways. For myself, I think that this helps to break the scientific mold that the title 'researcher' imposes on us and helps community members to truly see us as 'regular people' with actual personalities and interests outside of academia. The ways in which I personally fulfilled this objective was by attending community functions, social visiting, tagging along with fishermen, helping obtain wood for the upcoming winter, attending church, exercising/walking around town as well as hanging out with family or friends of Morris and Bernice Neyelle.

When I first arrived into Délįne, the first thing that Morris Neyelle did was drive me around and introduce me to all of the officials working in the Band office, Sahtú Secretariat office as well as the Land Corporation office. I was incredibly grateful to have this opportunity presented to me so quickly after my arrival because the last thing I wanted was for people to be asking 'who is that girl'? I really wanted to be able to introduce myself in person to as many people as I could instead of people hearing about me through the grapevine. Even though I am terrible with names, I would always try to make sure that I would say hi to all those individuals that Morris introduced me to in order to constantly remind myself of their name and position within the community. Not only did Morris introduce me to all the important office people but he would always invite me to his friends' and family dinners as well. Most times I felt bad for the last-minute intrusion I caused being another mouth to feed, but Morris and dinner hosts always told me 'don't worry so much' and that I was always welcome. I firmly believe that without Morris and Bernice Neyelle my trip would have been entirely different and meeting community members would have been much more difficult. For this reason alone (not to mention the million other things they did for me outside of this example) I am deeply grateful for their help and willingness to help me.

Once it got out that there was a new girl in town, people were curious to meet me. Every evening after dinner I would always take an hour break to just walk around town - not only to get in a little exercise but to also see who else is out and about. Sometimes I would stop and talk to some of the familiar faces at the Co-op or Northern Store, other times I would stop by people's houses just to say hi. Occasionally I wouldn't see any people at all and would just end up taking pictures of the lake. During the times where I didn't see a lot people directly, there were still plenty of people that were 'out for a drive' so I would always wave to them as they drove passed. Regardless of who I saw or talked to, I believe the walking helped people become more familiar with my face and this also aided as a conversation starter for people who hadn't met me yet (i.e.: 'I saw you walking around last night').

There were three significant community functions that occurred during my stay, and I was only aware of two of them before I arrived. The mystery event was the high school graduation, where I was severely underdressed but encouraged to attend anyway. I knew that Bernice Neyelle was in charge of organizing the dinner so I told her to tell me exactly how I could help out. She assured me there was nothing I could do but I persisted because in all honesty - I did not want to be seen at a graduation wearing U of A sweatpants. As soon as the convocation walk and awards ceremony was over, I rushed to the kitchen where I knew Bernice and others teachers would be making dinner preparations. As soon as I walked in Bernice roared to just start prepping food plates because they were not ready in time. I grabbed a paper plate and started down the buffet line piling on food so that it to be delivered to the awaiting tables. After what felt like an eternity of absolute food prepping chaos, everyone in the gymnasium had been fed. It took approximately 10 teachers, 3 school administrators, 2 or 3 children, one graduate student and Bernice to execute this overwhelming task but I was extremely happy that I was able to help because it was a very stressful time for everyone involved. Not only did I successfully avoid being widely seen in sweatpants at a high school graduation, but I also was able to specifically repay Bernice in a nonmonetary way for all of the dinners she had provided me.

The other two recognized community events that were celebrated were Aboriginal Day and Sahtú Day. I knew it would be virtually impossible to organize any interviews during these two days so I made sure that if I was not working on finding participants to interview, I was

participating in the daily activities. The first day celebrated was Aboriginal Day, where the community hosted all different kinds of events and games including raffles and prizes. Some of the scheduled events I would directly participate in, such as wheel barrow or potato sack racing – other events like dry fish making or duck prepping, I would observe and cheer people on. Sahtú Day was very similar in structure so I participated a little bit more in different events because I knew what was to be expected. Each day concluded with a drum dance, which was my absolute favorite part of each day. I would alternate from joining in the dance circle to just observing other people enjoying the beat. These two days produced some of my favorite fieldwork memories because it was so great to witness firsthand the community organize themselves to celebrate their heritage, ancestry and culture together – it was truly amazing.

As I had mentioned before, earning respect within the community was a very important target. The first time I was put to the test was when a particular candidate agreed to an interview but on the condition that I help him get wood for his winter wood supply. Although beyond terrified that we would meet a bear or wolf, I agreed but forewarned him that I had never cut down a tree before. He said 'that's okay – ill teach you like I teach the others', which was really comforting because I know from previous experience that he is an expert in on-the-land skills. We hopped on the quad and drove up into an area that he claims in his special secret wood spot. He immediately started cutting down trees with his chainsaw and showed me where to stand, how to push the tree down as well as how to properly carry it back. We cut and hauled trees until he believed we had enough to replenish his supply. Once all the longer logs were cut into smaller pieces we were done – we loaded up the bin and made our way back into Déljne. Although it was slightly disappointing not seeing any wild game, I was completely delighted that I had accomplished this intimidating task with minimal negative feedback. I found out later through the Déljne grapevine that he was quite pleased with my work and that he thought I was a very teachable student, which I was excited to hear because this particular person is also known for being a 'Clint Eastwood' style of teacher. What I mean by this is that he is a fair but firm teacher; the type of man that does not like to repeat himself – so you better be listening. He is not afraid to tell you <u>what</u> and <u>how</u> you are doing something wrong but also takes the time to explain everything you need to know beforehand. Although he may be particular about how something is done, he is also aware that it's important to take breaks and it's not necessary to rush. It was an incredible learning

experience and I am so glad that I was able to make this trade. This exchange was symbiotic; I was able to pay back a community member in a way that a 50$/hour honorarium cannot compare to and I was able to go out on the land in a way I had never experienced before.

2.6.2 Data Collection

Qualitative research methodologies are the primary means utilized throughout this project. Although there is no single accepted way of performing qualitative research, it is important to choose mechanisms that are ethical, sensible and responsible in nature; especially when working with northern Indigenous communities. This project endorses the well-rounded definition concerning qualitative measures from Denzin & Lincoln (2011), which states that "qualitative research is a situated activity that locates the observer in the world. It consists of a set of interpretive, material practices that makes the world visible. These practices ... turn the world into a series of representations including field notes, interviews, conversations, photographs, recordings and memos to the self. At this level, qualitative research involves an interpretive, naturalistic approach to the world. This means that qualitative researchers study things in their natural settings, attempting to make sense of, or to interpret, phenomena in terms of the meanings people bring to them" (p.3), which exactly what this project aims to accomplish. While qualitative research methods have a strong precedence in Northern Canada (Minore, Boone, Katt, Kinch, & Birch, 2004; O'Connor, 2009; Daley, Castleden, Jamieson, Furgal, & Ell, 2014) this is especially true for Déljne because of the colonial and exploitive history it shares with Port Radium (Woo et al., 2007; Paul Dana, Brent Anderson, & Meis-Mason, 2009). The first research project of this nature implemented in Déljne was influenced by Joan Ryan, who assisted in the development of the Déljne Uranium oral history project (Déljne Uranium Team, 2005). Continuing with this research precedent, this particular project draws upon ethnographic methods from cultural anthropology (Spangenberg, 1990) and follows protocols for ethical research established by the Sahtú Renewable Resources Board (SRRB). In order to complete successful collaborative research, I carried out interviews with Elders, active fishers as well as youth who are still learning from traditional experts. These interviews were made possible by working in conjunction with my community research collaborator (Mandy Bayha) and community translator (Michael Neyelle). The interviews resulted in the documentation the oral histories of Sahtú Got'ıne elders to learn about the beliefs and practices for sustaining fishing livelihoods. It is hoped that by conducting

collaborative research with the community, the results from this research can be utilized in meaningful ways that can advance climate change self-determination initiatives in Dél̨ne.

2.6.3 Methodology

In order to better understand the traditional knowledge concerning climate change, this research project relies heavily on qualitative research approaches including participatory workshops, semi-structured interviews and fieldwork. Most of the interviews were conducted with active fishermen but interview narratives also include perspectives from elders, youth and women. A community focus group was held in June 2017 as a quality assurance measure in order to directly introduce the projects basic questions and methods to various stakeholders within the community. A quantitative survey was originally included in order to better understand and document changes to fish harvest and fishing techniques. However, after community consultation, it was decided the survey was too long; there was also concern by other researchers working in the community that the statistical information could be used against the community in the future.

When drafting a research design agenda, there are various different avenues that can be explored. For this particular project, in addition to in depth interviews, it was originally intended that this study would survey as many voluntary participants as possible in hopes to gauge community wide perceptions regarding climate change and its impacts on fishing livelihoods. The goal was to write a thesis that encompassed both qualitative and quantitative research methodologies in order better understand the climate change phenomenon in Dél̨ne. Although the survey was excluded, because of variously different negative feelings and opinions, there are many different reasons why the lead author felt it was an important inclusion for this study. One of the major motivations for including the survey was to engage as many community residents as possible because survey type research generally has larger samples (Kothari, 2004). Furthermore, 'surveys are only concerned with conditions or relationships that exist, opinions that are held, processes that are going on' (Kothari, 2004, p. 120), which is exactly aim of this project. Although the in-depth interviews provided extremely rich illustrations of climate change in Dél̨ne, the time-consuming method significantly limits of generalizability of the findings as well as excludes certain voices from the community. Had there of been more time to deliberate the survey in further

detail during the focus group, it is possible that the survey may have been included. However, due to research time constraints it was believed to best move forward with a project that strictly utilizes qualitative research methods instead.

2.6.4 Recruitment

Before arriving in Dél̨ne, I had hoped that I would be able to obtain approximately 50 completed surveys in addition to 25-35 in depth interviews with elders, fisherman and youth. However, after the survey was eliminated – I had to adapt and alter my original desired outcomes in order to realistically finish my field work with the remaining time I had left in the community. I told myself that if I was able to complete 1 interview a day, then I would be happy with the sample size. In order to begin the process, I first interviewed Morris Neyelle because I knew he has a long and extensive history on Great Bear Lake. Afterwards, I had asked him for recommendations for who else to interview and went from there. The use of snowball sampling proved to be very effective for my project and allowed me to interview very knowledgeable people.

In addition to snowball sampling techniques, I followed the suggestion of my supervisor to recruit interview participants through the use of posters. I created a small poster that advertised my presence, summarized my research project as well as provided my contact information so that people could contact me directly (See Appendix 6.4). Thankfully my research collaborator and translator, Michael Neyelle, is also the host of the local radio station in Dél̨ne and he suggested to do an interview on air in order to let more people know about my project. I am so incredibly grateful for his effective idea because throughout my stay people would constantly say that they heard me on the radio. Research participants were identified based on their legal age, inclusion with fishing practices, understanding of climate related changes as well as community recommendation. A final sample size of 21 interviews was obtained, which is less than what I had originally hoped but I firmly believe that the data that I received is rich in detail, important for this thesis and contributes greatly to the overall work completed for the Tracking Change project.

2.6.5 Semi-Directed Interviews

Interviews were orally conducted in conjunction with at least one or sometimes both of my research collaborators - Michael Neyelle and Mandy Bayha. Originally the interview questions were composed of just open ended, but when the survey was removed from the project my

supervisor and I decided to add some closed ended questions as well (See Appendix 6.5). Participant responses were documented with handwritten notes and all but one interview was recorded on audio. If participants wished to receive a copy of their audio, a CD was provided to them so that they could listen to their interview again. Upon request, a copy of their transcripts will also be provided to them at time of data validation.

My main goal with each interview was to make it seem like more of a causal conversation than an interrogation, so the order of the questions was always catered to the context and direction of each person's narrative. The more familiar I got with the order of the questions the more I was able to memorize question wording, which enabled me the ability to redirect conversations that started to veer off topic. I felt that flexibility was particularly important so that participants felt comfortable during the interview as well as in my presence. Interview location varied on participant preference. Some people preferred to conduct the interview in their home while others desired elsewhere such as the hotel or their smoke shack. I made sure never to invite myself into their homes because I did not want them to as if I was being intrusive or invasive. At the end of every interview, participants were asked if they wanted to voice any concerns they may have had. They also had the option to revisit some of the questions we discussed in order to make sure that each person said everything they wanted.

Environmental changes surrounding fishing livelihood activities as well as perceptions and conceptions concerning climate change are the two main topics that emerged from interviews and form the basis of this thesis. Every interview would start off with a very broad question asking about their personal history on GBL and depending on the answer, I would guide the conversation towards specific topics. For example, if interviewees discussed previous fish populations, I would ask them about present fish populations as well as to expand on their beliefs concerning current fish yields. Some themes were found in almost every single interview, whereas other interviews completely negated what others had previously stated or denied the presence of certain changes. Although this may seem like an obstacle, it is crucial to understand that small communities like Dél̨ne are not homogenous in perspective or priority. Presenting these contrasting perspectives is not to negate or debunk traditional knowledge in anyway. The goal is instead to demonstrate that these small communities are also influenced by factors such as age, gender, wealth, economic

activities, and power, which is likely to influence each participants perspective and view on a certain issue. These differences are recognized as normal and to be inherently a part of the research process because if everyone unanimously reported the exact same perspective – then this research project would be considered abnormal.

2.6.6 Fishing Livelihood Interview Approach

During the interviews that discussed fishing livelihoods and the respective changes that participants observed, six themes and subthemes emerged: the importance of fish/fishing & respecting fish, water related changes (temperature and levels), changes in fish population, changes in ice, changes in winter weather, as well as changes in fish health. When it comes to customs related to respecting fish in GBL, there is a lot of consistency in what is considered to be the best practice. Community members discussed how to engage with the land and water in respectful ways so that they can continue to be graced with necessary food sources from the creator. The relationships that people established between themselves and their environment were one of the most important relationships discussed within interviews. In addition to themes of respect, there was plenty of discussion regarding environmental changes that directly impact Dene fishing practices. More specifically, water temperatures were unanimously believed to be increasing, the ice is not as thick as it once was, certain fish populations are declining and people are beginning to notice a more prominent presence of cysts and softer flesh within GBL fish.

2.6.7 Climate Change Interview Approach

While discussing fishing practices and the endured environmental related changes, climate change perceptions emerged – which was divided in five themes: defining & understanding climate change, causes and pointing blame, contributions to climate change, adaption and resilience and finally, trust in traditional knowledge. While changes in weather patterns was an important part of defining the term 'climate change', other conversational themes with elders, experts and youth encompassed within their definition was their intrinsic relationship to the land. Unsurprisingly, when asked what causes climate change many participants pointed towards the production of fossil fuels or extractive resource industries such as oil, gas and mining. Interestingly, this subject matter also encompassed the same land and animal relational element that climate change definitions included, which further emphasizes their substantial dependence on their surrounding natural

environment. In general, the Sahtú Got'ine people believe that they hardly contribute to the acceleration of climate change and believe they are much less wasteful when compared to other places in the world. However, they also understand that their lifestyle has negatively shifted towards the use of fossil fuels and that the reality of adopting modern technology and urban methodologies is a small lifestyle change that is going to have huge environmental impacts. While discussing adaption and resilience strategies, no concrete examples were explicitly given. However, their resilience strategies are written in their profound narrative and how they are determined to remain Dene - apart of the land. Lastly, people unsurprisingly favored traditional knowledge over western science and interestingly revealed that climate change is not considered to be a new concept to the community because these changes were always predicted and prophesized. While there were many other topics that were discussed throughout the interviews, the focus of this thesis will be surrounding changes that significantly impact fishing livelihood practices and the perceptions surrounding those environmental changes.

2.7 Consent and Ethics

2.7.1. Consent

Any research project that involves human participants requires free and informed consent, which according to the Tri-Council Policy Statement is considered to be "the dialogue, information sharing, and general process through which prospective subjects choose to participate in research involving themselves…[it] also stipulates that informed consent should ordinarily be obtained in writing" (Davison, Brown & Moffitt, 2006). Although this checks and balances system is needed within research, it can be interpreted as inappropriate within Indigenous contexts. Davison et al. (2006) state that there are a number of reasons as to why this procedure is unsuitable for Indigenous research. For example, some communities already have established culturally acceptable protocols for obtaining informed consent, such as giving tobacco, and consider written documents to be insulting to their orally centralized customs. Although Délı̨ne is well aquatinted with research processes and understands its procedures, requesting participants to sign the consent form was always the most awkward part of any interview.

Before every interview, all study participants received a participant information document that was orally reviewed together before every interview. The information within this pamphlet

included study objectives, project benefits, as well as a summary of what will happen with the information they decide to provide (See Appendix 6.6). Once participants agreed to continue with the interview, a consent form was also distributed and orally reviewed in order to safeguard against any confusion or misinterpretation. One particular section that I always tried to specifically highlight was their option to pass on any question and that they could end the interview at any time. Participants were also made aware that they could remain anonymous in any publications resulting from this study. Lastly, I informed participants that I would be coming back to meet with them in order to verify their consent and interview data.

Obtaining written consent from participants was easier in some cases than in others. For the more difficult instances, I made sure that I was understanding instead of insistent. For example, some participants were hesitant to sign the document before the interview because they were unsure of what they would reveal. I personally believe that this is because of the colonial underpinnings that is associated with signing documents, which has also been reflected within academic literature as well (Davison et al., 2006). In these cases, I offered the option to sign the document afterwards and remind them that they always had the option to withdraw their interview. For example, one particular participant wanted the opportunity to also listen to their audio before signing the consent form. In the end, I was able to acquire signed consent forms from every participant within my sample and believe that respect and flexibility played a large role that attainment.

2.7.2 Compensation

Interview participants received gift card compensation for taking the time to participate in my study. Compensation was based on time involved with the interview, which also included the time it took to describe and complete the consent form. A $50 Co-op gift card was awarded for the first completed hour, then increased by $50 for every half hour after that (ie: 60 min/$50, 90min/$100, 120min/$150, etc). Most interviews were between 75-90 minutes. It was hoped that by giving gift cards instead of cash, people would be less likely to spend it on smokes or alcohol and spend it on food items they might not normally purchase. Compensation was also provided to those who attended the focus group. Non-salaried focus group participants were offered $200 honorarium for the full day.

2.8 Validation and Analysis

2.8.1. Verification

Interview material that was audio recorded was transcribed and taken back to Dél̨ne in April 2018. I sat down with each available participant in order to reintroduced the ideas and concepts that were previously discussed in June 2017 as well as provide each contributor with a copy of current working chapter and a page highlighting their specific quotes. We went through the chapter identifying where their quotes were used while validating that their words are accurate, true and still permitted to be incorporazted within the thesis. Each participant was gifted a $50 Co-op gift card for their time. If participants chose to contribute more and discuss the key concepts further, those people were further compensated for their time and their contributions in some cases were integrated into the thesis.

2.8.2 Analysis

This particular study emphasizes an individual's narrative, so in order to effectively scale down large bodies of text and shrink them down to much more manageable sizes – content analysis was employed. According to Smith (2000) this type of analysis is much more reflective of an individual's constructs as well as the contextual organization of experience, which is the exact focus of this research project. Furthermore, this project utilizes semi directive interview methods that posed open ended questions, which according to Smith (2000) means that content analysis is the primary method of analyzing findings. According to Smith (2000) there are three components that comprise a coding system: definition of units, categories of classification and rules for applying the system. Defining units simply means identifying the material subjugated to analysis, which in this instance are the interview transcripts. Categories of classification refers to the information pursued or requested by the researcher (Smith, 2000), which for this particular project includes qualitative descriptions of climate change as well as aspects related to fish and fishing livelihoods. Lastly, rules explain how to apply the coding system as well as how to handle exceptions that are not directly addressed by the system (Smith, 2000). For the purposes of this research project, the 'rule of thumb' was if its related to fishing (directly or indirectly) or climate change – highlight it. A list of included and excluded categories is recorded below, however the lead author believes that the included thesis classifications accurately reflect the samples climate

change perceptions and fishing experiences on GBL.

Each participant transcript was printed and read multiple times in order to reintroduce the author to each interview as well as to get a better sense of what major themes emerged. Once better affiliated with each transcript, the lead author went through each record to highlight the predominant themes and then compared individual transcript themes to the total sample. Table 2.1 lists the emerging predominant themes both included and excluded from the thesis.

Table 2.1: Categorized Content Analysis Themes

Themes Included within Thesis	Themes Excused from Thesis
• The importance of fish/fishing & respecting fish	• Family Histories
• Water related changes (temperature and levels)	• New species
• Changes in fish population	• Fishing locations
• Changes in ice	• Things that encourage/discourage fishing
• Changes in winter weather	• Barriers to Fishing
• Changes in fish health	• Quotes concerning youth
• Describing & understanding climate change	• Trust in Government
• Causes and pointing blame	• Trust in Water & Fish
• Contributions to climate change	
• Adaption and resilience	
• Trust in traditional knowledge.	

There are various reasons to explain why certain themes were included over others. For example, some participants chose to discuss traditional trap lines or duck hunting locations while talking about their ancestors. Although these family history narratives were extremely interesting, they did not necessarily relate to fishing or climate change and were therefore left out. Another reason that some of the themes were excluded was because they were not universally discussed. For example, not everyone was willing to converse about fishing locations because some people consider their casting spots to be top secret. Other reasons for thematic exclusion include minimal explanation or discussion, unclear explanations or just simply not related to climate change & fishing livelihoods.

The themes that were chosen to be included offer rich detailed information regarding the GBL ecosystem as well as comprehensive material concerning people's perceptions surrounding climate related changes. They expressively highlight the great importance of fish and fishing on GBL as well as precisely describe and depict how things are changing around Dél̨ne. Included participant quotes were chosen on a variety of criteria including reader impact, eloquence, shock, and nuance. Repetitive or matching answers was the main reason why certain quotes were left out, however the lead author did attempt to include as many different voices and perspectives as possible. Most of the included themes were consistent across the sample, however there were particular instances where narratives diverged from majority viewpoints (i.e. water levels). These differences are important for future discussions pertaining to forthcoming research as well as potential recommendations.

2.9 Data Management

In keeping with the principles of OCAP (Schnarch, 2004) and the respect for the intellectual property rights of traditional knowledge holders, the results of the study including raw data will be shared with the Sahtú Renewable Resources Board so that it can be archived within their traditional knowledge database

2.9.1 Storage

During my field work season, audio files were immediately transferred from the recording device onto my password protected laptop and then deleted from the microphone. These audio files were then backed up onto my encrypted hard drive. The transcripts from the recorded interviews are also backed onto these encoded devices. As previously mentioned, copies of interview transcripts will also be given to all accessible participants during the data validation trip.

2.9.2 Ownership

Unless otherwise specified, interview transcripts that participants have consented to are to be owned by the Dél̨ne Got'ı̨nę Government and will be given to the Sahtú Renewable Resources Board at the conclusion of the study.

2.9.3 Benefits

There are many benefits to this project that not only impact Dél̨ine but also myself, my supervisor and academia at large. Besides being the core of my Masters' thesis, this project benefitted me greatly by allowing me to step outside the Edmonton vortex, explore the amazing Northwest Territories, learn more about the intricacies with the research process and 'get comfortable with being uncomfortable' – a piece of advice a colleague once told me. Like most graduate students, I like to think that my newfound set of research related skills compliments my CV and increases my chances of finding a job in the current job market.

Dr. Parlee and the University of Alberta will also directly benefit from this project because this study will hopefully be source for academic publication. Additionally, this project will address gaps in the literature on Indigenous knowledge and the sustainability of fishing livelihoods.

Research that includes the involvement of Indigenous people must always provide positive impacts as well as enduring benefits for the community. As a participant in this study, people had the opportunity to help shape policy related to climate change and fishing livelihoods in Dél̨ine and Great Bear Lake. Other benefits of this project include documenting local dene perspectives about climate related changes as well as identity and focus on theories of Indigenous climate change.

Chapter 3
Community Perspectives Surrounding Climate Change

3.1 Background & Introduction

Climate change has become a significant issue for many Indigenous communities globally, particularly for those who heavily rely on land and water resources for their traditional livelihoods. The Sahtú Got'ine people of Déljne are among those communities in northern Canada who are experiencing climate change in their region of the Mackenzie River Basin. This subarctic community is situated on the western end of Keith Arm directly on Great Bear Lake (Sahtú), which is also very close to the Great Bear River (Sahtú Dę) (Woo et al., 2007). Over many generations, the Sahtú Got'ine people have developed valuable fishing related knowledge, practices and institutions that are deeply integrated with their spiritual worldview (Andrews & Buggey, 2012). The accumulated traditional knowledge associated with their local ecosystems has been key to the sustainability of fishing-based livelihoods and has allowed the community of Déljne the capacity to thrive. However, climate change related issues and increased levels of abnormal environmental variability are starting to become more substantial, which generates newfound unforeseen obstacles for the community.

Climate change is an issue that has been well defined in scientific models and projections; measurements of sea ice melt, temperature change and decreasing precipitation help us understand its significance around the world. However, climate change is also a cultural construct which has different meanings in different regions and based on different kinds of knowledge. Traditional knowledge (TK) can help us understand the nature of climate change through the narratives of Indigenous peoples. The language, stories and practices that have developed over time by the Sahtú Got'ine, not only provide insight about the phenomenon but can also guide understanding about the kinds of problems that are most significant in a given locale and indicate the solutions that can be most effective. According to Spence et al. (2011) individuals who have direct experience of a climate phenomenon are likely to be concerned and more inclined to undertake sustainable behaviors. In recent years, climate change research and its connection with Traditional Knowledge has received a lot of attention. For example, Golden, Audet, & Smith (2015) explore changing 'blue ice' perceptions of the Cree, Ojibwe, and Ojicree Nations in northern Ontario and

how these recorded observations are attributed to climate change in addition to their perspectives about climate change. Another article (Turner & Clifton, 2009) explores how Indigenous people from British Colombia have noticed increased signs of environmental change such as species decline, abnormal weather patterns and the overall declining health of their surrounding environment. Although this genre of foundational research is important and absolutely necessary, there are still many literature gaps that need to be addressed. One interesting characteristic is that majority of previous climate change research shares is that a lot of the work has been completed in high arctic or coastal regions (Riedlinger & Berkes, 2001; Dolan & Walker, 2006; Furgal & Seguin, 2006). Much less climate change research has been carried out in Canadian subarctic, which includes the Sahtú region of the Mackenzie River Basin. This chapter was a part of a paper-based thesis and written as a manuscript intended for future publication in order to address that gap by specifically focusing on the climate change narratives of the Sahtú Got'ine.

The work will add to the literature in evidencing the ways in which climate change is understood and experienced Indigenous peoples in Canada. The research is unique in that it specifically focuses on the Mackenzie River Basin; a region that has been previously been of limited focus in both natural science and social science on climate change in Canada.

3.2 Traditional Ecological Knowledge & Western Science

Traditional ecological knowledge (TEK) has not always been widely valued or recognized within academia, scholarship or society at large. According to Dove (2006) it was not until the Twentieth Century that traditional knowledge became fully recognized specifically because the previous global discourse of development was very dismissive of local ecological knowledge. Berkes, Colding & Folke (2000) state that the reasoning behind this long-awaited acknowledgement is especially difficult in western societies because of the innate differences between scientific knowledge and TK. The foundations of traditional knowledge emphasize "the symbiotic character of humans and nature. It offers an approach to local development that is based on co-evolution with the environment, and on respecting the carrying capacity of ecosystems. This knowledge—based on long-term empirical observations adapted to local conditions—ensures a sound use and control of the environment and enables indigenous people to adapt to environmental changes" (Mazzocchi, 2006, p. 463-464). By contrast, the fundamentals of western science greatly

differ in that they rely heavily on systems of objectivism and analytics. Furthermore, Lopez (2017) states that another core difference between TK and western science is that "scientific knowledge is about concepts generated in a controlled environment, considering the environment as static; it tends to reduce the parts and separate the parts of a whole, generalizing in absolute terms" (p. 9). Although these two worldviews differ, effective community-based research depends on finding ways to draw effectively on both systems to accomplish what neither can on its own. Academia has evolved to establish methodological precedents that include both western and traditional knowledge. Some of the topics explored within these frameworks include resource management, environmental impact assessment and climate related changes (Donovan & Puri, 2004; Moller, Berkes, Lyver, & Kislalioglu, 2004; Folke, 2004; Wolf, & Moser, 2011). One example of merging TEK and western science together includes combining traditional knowledge philosophies regarding wildfire with western science perceptions of forest health in order to improve stewardship of natural resources in western Montana (Mason et al., 2012). This thesis aims to further contribute to the investigative movement connecting science and TEK together in order to better understand the Sahtú Got'ine perspective and climate change experience.

Although TEK is a particularly challenging term to define, this paper chooses to engage the Berkes et al. (2000) definition, which states that 'traditional ecological knowledge is interpreted as a cumulative body of knowledge, practices and representations that describes the relationships of living beings with one another and with their physical environment, which evolved by adaptive processes and has been handed down through generations by cultural transmission' (p.1252). This definition is impartial and inclusive in that it does not limit which Indigenous groups can fit within its parameters as well as incorporates a relationship aspect, which is particularly important for the Sahtú Got'ine people and their distinct connection with Great Bear Lake. This chapter heavily relies and places great importance on both TEK and TK[1] strictly because quantitative research methods only describe one side of the climate change story.

[1] For the purposes of this thesis, there is a notable difference between TK and TEK. TEK is classified as "knowledge about the environment, knowledge about the use of the environment, values about the environment, and the knowledge system itself" (Usher, 2000). Whereas TK frameworks outline two key elements; the sacred and the intangible. The sacred "is used to refer to any expression of traditional knowledge that symbolizes or pertains to religious and spiritual beliefs, practices or customs' and the intangible 'simply means incorporeal…and it is quite distinct from the possession by museums of sacred objects belonging to aboriginal peoples" (Garvis, 2003).

Table 3.1: Comparison of traditional and scientific knowledge styles (Woo et al., 2007).

Traditional Knowledge	Scientific Knowledge
Assumed to be a best approximation	Assumed to be the truth
Sacred and secular together	Secular only
Teaching through storytelling	Didactic
Learning by doing and experiencing	Learning by formal education
Oral or visual	Written
Integrated, based on a whole system	Analytical, based on subsets of whole
Intuitive	Model- or hypothesis-based
Holistic	Reductionist
Subjective	Objective
Experiential	Positivist

3.3 TEK and Climate Change Literature

According to Berkes (1999) traditional knowledge has contributed to academia in many different ways, including biological information and ecological insights, resource management, protected areas, biodiversity conservation, environmental assessment, social development, as well as environmental ethics. Although TK is an emerging topic within social science research, the literature gap concerning TK and its involvement with climate change research still remains. Perhaps one of the reasons is because there is still a significant amount of ambiguity and insecurity concerning the rate and extent of climate change impacts, especially in the Canadian north (Riedlinger & Berkes, 2001; Boulanger-Lapointe, et al., 2019; Chan, et al., 2019). According to Riedlinger & Berkes (2001) northern climate science is particularly complicated because there is a scientific knowledge deficiency regarding physical and ecological processes in the Arctic. Furthermore, there are negligible amounts of historical baseline climate data, which makes it extremely difficult to compare current climate conditions. According to Cruikshank (1981) in most parts of the Canadian arctic and subarctic, temperature records only begin in 1930. However, by including Indigenous insights and oral histories into the climate change equation, a better and broader understanding of how to best adapt to these changes can be developed. As Usher (2000) describes "TEK can thus contribute to environmental assessment by providing a broader and deeper understanding of baseline conditions and a fuller understanding of local environmental

processes, at a finer and more detailed geographical scale, than conventional scientific knowledge can offer…because it deals with outcomes and prediction: what people think will happen and why" (p.187).

One of the first examples of combining climate change research with TK was in 1969 where Spink's project demonstrated the important value of Inuit oral history in corroborating evidence for isostatic rebound and sea-level change (Spink, 1969; Riedlinger & Berkes, 2001). Cruikshank (1981) provides another example where traditional knowledge and oral histories can be combined with western science in order to better understand the northern environment. Her project aimed to merge the two epistemologies in order to provide deeper insight and broader perspective on the natural Yukon environment including glacier movement, flora, fauna as well as climactic fluctuations. Although it is clear that there is worldwide evidence to support that TK can enhance our collective understanding of climate change (Riedlinger, 1999; Ford, 2000; Leonard, Parsons, Olawsky & Kofod, 2013; Sherry, et al., 2019), there are few studies that focus specifically on the traditional perspectives and ecological insights of Aboriginal communities from the Canadian subarctic. This chapter aims to address this void in hopes that future local climate strategies will begin to heavily rely on Indigenous culture, traditional knowledge and oral histories in order to best attain a holistically sustainable environmental system that rural land-based communities can utilize well into the future.

3.4 Methods

The research underlying this thesis focuses on methodological theories and tools from specific disciplines such as Native Studies and Sociology (Caine, Davison, & Stewart, 2009). Furthermore, this project is inspired by Dene teachings and stories of Sahtú community leaders like Morris Neyelle, Michael Neyelle, Morris Modeste, Leon Andrew, Camilla Tutcho and Walter Bayha. Lastly, this article is also guided by Indigenous scholars such as John Borrows and Taiaiake Alfred (Alfred, 2005; Borrows, 1997) as well as non-Indigenous academics such as Fikret Berkes, Ken Caine and Mark Nuttall (Nuttall et al, 2005; Berkes, 2012).

This research project builds upon previous ethnographic, sociological and ecological research within the region (Muir, Leonard & Kruegar, 2013) as well as the broader literature on

traditional knowledge and climate change (Riedlinger & Berkes, 2001; Abu, et al., 2019). Since relatively little research has been conducted within the Canadian subarctic regarding climate change and environmental variability, this project aims to endorse a community-based research in order to determine how the Sahtú Got'ine understand, perceive and adapt to climate related changes. By initially focusing on local narratives surrounding climate-change, future climate research and policy can then expand on climate change priorities firmly established by the community.

Research activities took place during the summer of 2017 in settings considered ecologically and culturally significant to Dél̨ne residents. In order to accomplish the task of identifying respected elders and knowledgeable youth, the projects translator (Michael Neyelle) and community research collaborator (Mandy Bayha) played a major role. We were able to conduct 21 semi-structured interviews with various elders, fishermen and women as well as youth. By drawing on ethnographic methods from cultural anthropology (Spangenberg, 1990) and following protocols for ethical research established by the SRRB, these interviews resulted in the further documentation of Dene oral histories as well as contemporary observations of variability and change around GBL and the surrounding region. Each interview was audio recorded with the assistance of Michael Neyelle and/or Mandy Bayha, as well as transcribed and coded to identify themes related to TK and climate change. The most significant themes and sub-themes **(5)** are presented in this paper: describing & understanding climate change, causes and pointing blame, contributions to climate change, adaption and resilience and finally, trust in traditional knowledge.

3.5 Describing & Understanding Climate Change

"I always viewed it, as like, it's always been a negative connotation for me with climate change. Because for me it always indicated that something was not normal or wrong that was different in the environment. The environment was acting in a way that was not predictable. It was acting in a way or changing in a way that was too fast too soon [2]." – ***Mandy Bayha***

[2] The above quote distinctly highlights the relational aspect that Dél̨ne residents maintain with their environment. They understand the normalcies of their ecosystem and what changes are considered to be abnormal ecological disturbances. These perceptions are particularly important to document in order to further understand the accumulated impacts of climate change in the Canadian Subarctic.

The Intergovernmental Panel on Climate Change (IPCC) was established in 1988 by the United Nations Environment Program and the World Meteorological Organization (WMO). It is the leading international body for the assessment of climate change and its purpose is to review and assess the most recent global scientific, technical and socio-economic climate publications. According to their website, climate change is defined as "any change in climate over time, whether due to natural variability or as a result of human activity" (IPCC, 2018). Similar to climate change, their definition of climate variability refers to "variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all temporal and spatial scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing" (IPCC, 2018). The problem with these definitions is that they do not elaborate on the remarkable and noteworthy climate experiences of any Indigenous peoples. When considering the Canadian north, where a large percentage of Aboriginal people continue to utilize and respect the land for traditional economic purposes (Furgal and Prowse, 2007), it becomes imperative to include their perceptions within the climate change explanation because their observations and narratives add depth to an already complex phenomenon. Furthermore, it is also possible that northern climate portrayals and Indigenous accounts could fluctuate or waver from those who mostly analyze climate change with equations or a computer screen.

In the case of Déljne, a community whose identity is intrinsically tied to GBL and traditional fishing methodologies, their description of climate change is particularly interesting; Sahtú Got'ine climate descriptions also surrounded topics like changes in warming weather and specifically how climate patterns are becoming increasingly unpredictable. The following quotes depict indicators that the Sahtú Got'ine utilize in order to specify and describe their experienced changes.

"Climate change. Well you see a lot of weather changes, like before. . .how do I say? Before you can predict what's going to happen by the month but now it's all changed. It's hard to. . .like May we'll have a last snowstorm and they always come. Now it comes early, it comes late…Use to [be able to predict the weather]. Now you can't". ***– Chris Yukon***

"You have like thunderstorms are not like something new but when they happen when they don't usually happen. That's where the change is right? Or when you have really really warm weather in November." – ***Verna Firth***

"Well one of the other concerns that I have is it is getting warmer, like the summers are just going to be more hotter than ever, it's just hot in the whole McKenzie valley is it's always been hot but we're lucky we live by the lake…but it is creeping up, the dryness, the wind, constant wind and with not that much precipitation, not that much rain. It's so easy to get forest fire. – ***Mike Neyelle***

"Well the temperatures. I guess what I'm talking about is that it's not the same. Right now, it should still be cold. Remember when I said that our grandfathers were on the ice in the middle of June. So, you behave like the weather is, until it's time to put on your summer clothes and put away your winter stuff." – ***Walter Beazha***

Although changes in weather patterns was an important topic, other conversational climate themes with elders, experts and youth encompassed their intrinsic relationship to the land. These insights provide a deeper understanding as to how climate change specifically impacts northern communities as well as what it means to be a Dene land user in the Sahtú region. For the Sahtú Got'ine, climate change is not strictly understood in terms of weather pattern changes and warming weather. What the following quotes express is how climate change is more centralized around their relationship with the natural environment and how the animals are explicitly reacting to these changes. These quotes provide insights that demonstrate how truly important their ecosystem centred relationship is when living in a northern isolated community such as Délįne.

"Climate change to him just means just change in general. The land is changing, the weather is changing. Everything is changing, the patterns of things are changing. Even the entire ecosystem itself is changing… So, for him I guess climate change is about everything changing and how it encompasses all those things." – ***Mandy for Greg Kenny***

"Our relationship is changing…the land is changing and it's not normal. And this is the challenge. To learn and know the changes as fast as its changing, and that is huge…Hell we don't even know basics." ***– Walter Beazha***

"I definitely know for sure like up here in the north that its happening, these changes are happening a lot faster than it is anywhere else. Like we're the ones experiencing the changes the most and it's going to be more shocking and it's going to affect us more than anywhere else because 1) we live like off the land so much. And we, our whole culture and way of life revolves around the environment. And those changes are happening so much around us so quickly that it's difficult to really – it just makes you kind of fearful. You want to know more about it or how you can prevent it or how you can – I don't even know. But all I know is that we are going to feel it the most and we ARE feeling it the most in really real ways." – ***Mandy Bayha***

"To me – climate change is affecting water, the land and the atmosphere." – ***Camilla Tutcho***

"When you say that, what I thought about right now is all the weird animals that are coming up here like polar bears were here, the seals spotted in Fort Good Hope not far from here. White-tailed deer coming up here, when I see mountain lions in Tulita. I think they follow the deer. And actually, I see some weird birds in the past even when I was younger." – ***Yata Yukon***

"Not the animals, the animals are already changing. The plants are changing already, everything's changing. You guys call it global warming, climate change. [It's] Not just climate" ***– Danny G***

In addition to the important relational ties to the Sahtú ecosystem, other interviewees mentioned how traditional knowledge and elder's stories are also tied to their description of climate change. The succeeding quotes specifically highlight how prophecies, stories and old-timer knowledge have always predicted climate change.

"I guess it changes in the - everything, I guess; the animals, the lakes, the air - it's way different from when I was growing up in the 50s. Everything is changing because of the warm weather, probably pollutants - pollution…. And even before that, the elders had always talked about that.

That the world will change. It will get warmer; the world will shift - that's that they all said. And now we see the Inuit, are saying that too" ***– Morris Neyelle***

"No, it's just uh, like the elders always predicted change. They always said the change. But they never really talked about like our relationship with the change. Just that we would witness it. So, it's like when they predicted these changes…even our generation, they only started talking about holes in the ozone layer in like, my lifetime. But before I even existed, my great great grandfather was talking about holes in the ozone layer." – ***Mandy Bayha***

By examining climate change perceptions through the Sahtú Got'ine lens, the above-mentioned quotes demonstrate the various similarities and differences Délįne residents share with IPCC classifications and portrayals. The research presented here enhances our collective social and cultural understanding of climate change within the context of the Délįne. Furthermore, this information could be used to develop culturally relevant climate adaption strategies that strictly prioritize local issues. This option is extremely likely for Délįne because they have successfully negotiated a self-government agreement, which affords the community the power to create, develop and initiate whatever climate adaption strategies they deem acceptable. Additionally, this information could also be utilized as a building block that aids in the formation of a Sahtú wide climate adaption strategy that can incorporate knowledge pieces from all five Dene communities in the region.

3.6 Causes and Pointing Blame

"It's not our fault…we blame people out there …We were mad at those people out there. Us - we don't make pollutions here do we, no … See that's what I mean…They're the people that wants industries … Mines and everything that's going on, I think that's what starts polluting the air and that's what screws up the beautiful land.[3]*" –* ***Anonymous 1***

[3] A large amount of community members believe that a traditional way of life is the only way of life because those methods respect mother earth, GBL and are considered to be significantly less harmful on ecosystem dynamics. Another reason community members prefer these methodologies is because they are the same traditions their ancestors operated and developed. Outsider ways of living, especially those related to resource extraction, are viewed negatively because of their detrimental impacts on various ecosystems. This quote stresses the cultural significance of traditional ways of being and how community members view traditional harvesting methodologies in relation to causes of climate change.

Climate change research widely varies in focus. For example, one research domain includes pinpointing the root cause and blame of climate change, where topics include cities and greenhouse gas emissions, solar variability as well as indices of volcanism (Crowley, 2000; Dodman, 2009). There are various academic explanations that help to explain the unanticipated accelerated impacts of climate change, but there is little research concerning how northern communities and traditional land users choose to point the blame. In the context of northern Canada, the traditional economy is still considered to be very important for various regions – including the Sahtú. According to Furgal and Prowse (2007) "more than 70% of northern Aboriginal adults reported harvesting natural resources via hunting and fishing and, of those, more than 96% did so for subsistence purposes" (p. 65). The Sahtú community of Délı̨ne perfectly exemplifies this statistic since the community occupies and continuously utilizes their ideal fishing location on GBL. Over many generations this location has fostered the development of valuable fishing related knowledge, practices and institutions that are deeply integrated with the Sahtú Got'ine spiritual worldview. However, as increased levels of abnormal environmental variability become more evident, the search for the root cause becomes a fundamental point when discussing the topic climate change. By understanding the Sahtú Got'ine perspective regarding 'who' or 'what' directly causes climate change, community mitigation and adaption strategies can then directly reflect these perspectives when considering future proposed opportunities.

After discussing the topic of defining and identifying what encompasses climate change, the subject matter of blame naturally arose. Participants were asked a variation of the phrase 'what do you think specifically causes climate change" or "what do you blame all these environmental changes on". Responses did vary but accusations generally surrounded the production of fossil fuels or extractive resource industries such as oil, gas and mining. Respondents were also asked where they received information that helped to formulate their attitudes; answers included Facebook, newspapers, radio, and television.

"And when you think about it, the oil and gas industry is a huge money maker for our economy and for the government. And you look at the issue with the tar sands and how insanely harmful that is to the environment but what is really being done about it? Nothing really will be done

about it because its huge for the economy. So, unless they're really willing to – like how are they willing to change things?...It's usually a strong economy doesn't really go hand in hand with a strong environment for the government." – ***Mandy Bayha***

"He thinks it's probably due to what they call fossil fuels, not only that, maybe these big smelting companies like big factories…. He says development, it's just like oil sands. It's contributes to climate change, to environmental disasters contaminating water, contaminating the land. So, all wildlife is definitely going to be affected". – ***Michael Neyelle for Alphonse Takazo***

"As long as they can make this almighty buck, raping and pillaging the land, resources right now, they're going to do it. Until at some point they can't do it anymore, right". – ***Danny Gaudet***

"I don't really know [Donald Trump]. If that's what he said then I would disagree with him that climate change is an issue because of fossil fuel, that's number one to me and that's what bureaucrats or that's what these kinds of people are into. They're all in there for the money. They don't care about the land, the animals; they don't care". – ***Mike Neyelle***

"I think us humans are doing it … Ozone layer, burn and stuff like that. I think that's what it is … Acid rain. Places that don't have … Not polluted or to … Clean water gets dirty because of the acid rain coming from other countries, coming over our land then drops … You know those kind of things. It's not our fault, its happened we blame people out there …We were mad at those people out there. Us we don't make pollutions here do we, no … See that's what I mean. That's what … They're the people that wants industries … Mines and everything that's going on, I think that's what starts polluting the air and that's what screws up the beautiful land." – ***Anonymous 1***

"She says – like she's an elder and her husband is also an elder too and they went through life since they were young. And they know how it was way back and they can see the changes slowly happening. And today they notice a lot of changes and even their children are asking questions. 'How come this is changing. How come its happening?'. And her husband, as wise as he is – he says 'you know because of pollution. You see planes flying around close to the sky, you know those fumes from those planes you know, do have an affect'." – ***Mike for Camilla Tutcho***

What the above-mentioned quotes depict is how certain community members specifically hold extractive industries accountable for climate related changes and identify their harmful environmental actions as the core cause. Additionally, what is particularly interesting about these quotes is that they also incorporate that same land and animal relational element that community climate change descriptions included, which further emphasizes their substantial dependence on their surrounding natural environment as well as their motivation behind accepting future ecological initiatives. By identifying the sources that contribute to climate change and noting that development is a major factor, Dél̨ne can begin to develop sustainability agendas and protocols for future economic prospects to follow in order to ensure that responsible and environmentally friendly methods are being utilized. Furthermore, this affords Dél̨ne exclusivity so that they can be selective on potential future monetary opportunities they chose to move forward with. This power transferal in favor of the Sahtú Got'ine could help to facilitate a shift in industry perspectives to consider more environmentally conscious approaches when working with both Indigenous and non-Indigenous communities in order to prioritize the health of mother earth. By including Dene culture, perspectives and worldviews within the climate narrative, adaption strategies can reflect the priorities of the local land users who truly understand the GBL ecological system.

3.7 Contributions to Climate Change

"Well, the fact that I drive a vehicle and that I burn fuel and that I throw waste to a garbage dump – for sure in those ways I am definitely contributing [4]". – ***Mandy Bayha***

According to Lorenzoni, Nicholson-Cole & Whitmarsh (2007) much of the academic evidence points towards human influences as the cause of changing the world's climate. While the 2007 publication could be considered 'outdated', this rhetoric is continued within present publications as well. For example, Du Plessis (2019) states that warming climate trends observed over the past century are very likely due to human activities, especially in terms of the production of carbon dioxide and other greenhouse gases. Although there is significant research highlighting this detail, pinpointing the causes of climate change is only half of the equation. The other half

[4] Community members are well aware of the carbon footprint they regrettably leave behind. This quote demonstrates how mechanisms of modernization and technological change have impacted day to day activities in Dél̨ne. This passage also teaches us the importance knowing one's own ecological impact so that realistic solutions can be formulated and established.

includes identifying an individual's perspective as to how they personally contribute to climate change, or what actions they take in order to alleviate its pressures. By specifically investigating an individual's environmental consciousness and what they believe their contribution or suppression to climate change is, educational and mitigation resources concerning change can emphasize the correct strategies that individuals utilize as well as better inform methods that could benefit from adjustment or variation (Brandon & Lewis, 1999; Anderson, 2010; Anderson, 2012). Furthermore, strategies that work in certain regions can then be applied in the context of other northern communities or other widespread regions that also feel the effects of climate change (Chapin et al., 2006; Ford et al., 2007).

When discussing climate change in Dél̨ne, people were aware that fossil fuels and greenhouse gas emissions were a root cause of climate change. While on the topic of blame, participants were asked one of the following questions pertaining to their contributions to climate change: 'do you think you personally contribute to climate change?', 'in what ways do you combat against climate change?' or 'do you think that you contribute more or less to climate change than people in the south or other places in the world?'. The following quotes demonstrate how the Sahtú Got'ine people generally believe that they hardly contribute to the acceleration of climate change and that they are much less wasteful when compared to other places in the world. One of the main examples that people referred to was how 'southerners' heavily rely on motor vehicles for transportation or how much more wasteful their mind set is.

"So, I think in that way we are a lot less wasteful than people that can just dispose of anything they want to anytime they want to. And definitely more in the city too because you have to drive everywhere. To get from point A to B you have to drive all the time and here I walk everywhere. So, I mean I definitely think we leave less of a footprint here than I would there but when I first moved to Red Deer I walked everywhere. I didn't have a vehicle so my son carpooled and when I went to the grocery store it was literally a hike and a half and then I would use my sons jogging stroller and would load up all the groceries in his jogging stroller we would walk to the grocery store. We walked everywhere. So, but then after I got my vehicle, we were driving all the time. Like we never walk. My sons would be like 'can we walk please' and I would be like 'no we're getting in the vehicle'. But here I almost never really drive. Ever." – ***Mandy Bayha***

"Not that kind of lifestyle … [I follow] the old-timers' way. I'm not hurting anything … Not driving, nothing, that's how I want it." ***-Anonymous 1***

Even though the consensus is that that people outside Dél̨ine contribute more to climate change, there were still come people that understood that their lifestyle has negatively shifted towards the use of fossil fuels. Community members have acquiesced to the reality that adopting modern technology and urban methodologies is a small lifestyle change that is going to have huge environmental impacts. For example: one now has to purchase a boat or a snowmobile instead of relying on traditional methods such as moose skin boats or dog sleds as a means for transportation.

"And I don't know if we are contributing to it any less. I can't say 'oh it's not our fault' because we do it too right? It's part of our life, and we have to kind of figure out how we are going to go back…I think we're going in that direction way faster than we thought we were right? Or we didn't even think about it when we were…building all those trucks and using all those planes, and trains and whatever. We didn't think of that till it was too late." – ***Verna Firth***

"Well, the fact that I drive a vehicle and that I burn fuel and that I throw waste to a garbage dump – for sure in those ways I am definitely contributing." – ***Mandy Bayha***

"Recently, there's been a lot of new technology. In the past, it was hardly anything. They had no electricity, they had no machinery, nothing. But since machinery came in, generators, power plants, furnaces, skidoos, trucks, outboard motors, for sure that would have an effect… I asked him, "What about wood? Burning wood?" He says, burning wood should be okay, it's a way we survive but he thinks maybe if we burn spruce tree, there's something there's spruce [gum] in the spruce tree and that becomes really smoky. – ***Mike Neyelle for Alphonse Takazo***

What the above Sahtú Got'ine quotes demonstrate is that they truly understand that their actions have serious consequences on their surrounding environment and that blame isn't strictly forced onto others from the south. A key difference of the Sahtú Got'ine mindset is that the health and condition of the surrounding environment is of the utmost importance. People continue to harness this perspective while hunting and fishing in order to preserve GBL in pristine condition.

There are some people in Dél̨ine that have the skills and knowledge to utilize an almost truly traditional lifestyle that only incorporates some products of the modern world, which is key to combating climate related changes. By following their lead, the community can develop renewable resource options that are environmentally friendly and considered traditionally appropriate by these cultural community leaders. This newly established tactical knowledge could then be used to develop a climate education strategy that focuses on using traditional Dene methods and teachings, but also used in conjunction with scientific knowledge to further explain any necessary background information people may require. By combining both traditional and scientific knowledge in this way, community members will be able to determine which methods are considered to be the most ecologically friendly as well as why these methods are environmentally sustainable. For example, one of the traditional methods for exploring and traveling on the land is walking, rather than driving or taking a skidoo. Walking not only provides numerous health benefits but also allows people to deeply explore their environment since they are able to directly interact with it rather than passively driving by. In conjunction with atmospheric science to further explain how and why driving increases the production of greenhouse gases, and therefore climate change, people in Dél̨ine can begin to deeply understand why traditional methods are considered to be the best climate mitigation models. By combining scientific information with cultural worldviews of what is considered 'best' traditional practice, the Sahtú Got'ine can become experts in developing climate mitigation strategies, which could potentially be adopted and adapted by other communities in the north.

3.8 Adaptation and Resilience

"I think it's really just changed the timeframe that we do things because we still do the same things that we always do…we are still ruled by the weather and the things around us. The same way we were before but I think just that if the ice is melting sooner then we are just fishing less of the winter season and more of the summer season [5]." – ***Mandy Bayha***

[5] This excerpt further establishes the relational element that the Sahtú Got'ine people share with the dynamic GBL ecosystem. It also depicts which indicators the Sahtú Got'ine look for in order to adapt to their changing environment. Sahtú Got'ine actions are dictated by their surrounding ecosystem, which is exactly why it is so important to document what observable changes are presently unfolding. By focusing on specifically what is changing, a better understanding concerning how climate change manifests in the Canadian subarctic can be shaped.

According to Turner and Clifton (2009) climate related changes 'are difficult to document systematically because they are diverse and play out over different scales of time and space' (p. 180) but the literature seems to have a consistent theme; things are changing and people are increasingly concerned about the environment's future (Krupnik & Jolly, 2002 Berkes & Jolly, 2002; Guyot, Dickson, Paci, Furgal, & Chan, 2006; Prowse, Furgal, Wrona, & Reist, 2009; Willox, Harper, Edge, Landman, Houle,& Ford, 2013). Although documenting observations and climate change perspectives is very important, how people culturally frame their climate mitigation strategies to is also particularly imperative. For example, the adaption strategies and methodologies that the indigenous Haida people from British Colombia chose to employ will greatly differ from the practices utilized the Sahtú Got'ine, which according to Adger, Barnett, Brown, Marshall, & O'brien (2013) is key to understanding the motivation and meaning behind human responses to climate change.

In the context of Déljne, the various types of landscapes neighboring their traditional territory has nurtured their ability to effectively adapt to many different ecological situations. While discussing the different observable changes people historically and currently witnessed, the subject of adaptation naturally arose. Interview participants were asked how they are coping and adapting to these newfound changes. There were a variety of answers to this particular question but the dominating theme of the following quotes illustrates how people are still extremely motivated to actively participate in traditional on the land activities. What is important to understand is that although there may not be any specific examples that exclusively highlight <u>how</u> they adapt – their resilience strategies are written in their experiences and how they are determined to remain Dene – a part of the land.

"*I've never had a situation or experience myself where I was directed affected by not being able to predict the ice or something and putting myself in a dangerous position. But it's just that you would see that these changes are happening sooner than they would before so that you would just follow those changes that way….[we are] always going to fish because 1) we need fish. So we're always going to do those things so we need to make sure that those changes are happening around us. So, I think that's the only way, I think that's one thing that I can think of for sure is that we just*

need to be mindful of how we do things and mindful of how the environment is changing and then just do the things we have always done around those changes". – ***Mandy Bayha***

"*I'm human so we are adaptable" –* ***Nihtla Beazha***

"You know change comes whether you want it too or not. And if you don't embrace the change – you're going to lose. So there's nothing wrong with saying 'traditionally it wasn't done this way'. Times change. Traditionally we didn't live in these houses but were living here now. But were still Aboriginal. Were still the same people that lived 100 years ago. What's the difference? The time – the time is the difference. I always tell people I think I was born in the wrong generation. I think I should have been more 100 years ago. That lifestyle seemed more appealing – not to say I'm not grateful for what we have now – but imagine. Just imagine." – ***Verna Firth***

"You know, I mean, everybody's worried about global warming and all that kind of stuff and what's going to affect the lake, the trees, the plants, the animals and all that. But like … Aboriginal and all of that stuff adapted for thousands of years to get us where we are today. What makes you think all of a sudden, we can't adapt more, right?" – ***Danny Gaudet***

"No, I think Deline has always sustained itself and will always sustain themselves in the future. I don't think what is going around in the world will affect their livelihood" – ***Mike Neyelle***

Another subtheme that emerged while talking about adaptation was if people felt any anxieties or stress related to these changes. Responses did vary but the following quotes depict how participants understood that no matter what happens, they cannot give up their culture or traditions. Being Dene and taking care of their surrounding environment is of the utmost importance because it is necessary for the strong cultural continuance of the community.

"I'm not going to say that I stress out – I take notice but I don't want to stress out about it. Because like you know – even though how hard and fast we think we can make the changes and the difference but with how its going now – you know how you going to do it? You just stress yourself

out more, so the only thing is keep working on it and have the acceptance of what mother nature gives us." – ***Joe Dillon***

"We don't say it's because of climate change, dene people – one thing about our grandfathers is that they accept things as they are. To be a true human being. Because otherwise how in the world would mother earth survive?….We're not important in the long run, mother earth is." – ***Walter Beazha***

These aforementioned quotes demonstrate that the Sahtú Got'ine continuously exemplify what it means to be Dene – 'a part of the land'. The stories embody their perseverance to maintain cultural ties to the land and traditional activities. According to Turner and Clifton (2009) as the impending threats of climate change emerge, 'this kind of resilience – and models for social institutions that facilitate healthy and considered adaptation and response to change – are needed now more than ever', especially for Indigenous communities because 'homegrown processes or protocols that help guide and support people as they cope with climate change will be highly relevant and desirable' (p. 186). Furthermore, maintaining the cultural dimension within the climate change adaption discussion is critical and specifically important. According to Adger et al., (2013) 'if the cultural dimensions of climate change are ignored, it is likely that both adaptation and mitigation responses will fail to be effective because they simply do not connect with what matters to individuals and communities' (p.116). This is imperative in the context of Délįne because if saving the GBL ecosystem from climate related changes is not made a priority, then the community won't respect those strategies. Due to self-government, Délįne maintains the ability to create climate change policy that adheres to the above-mentioned themes and it is likely that their mitigation formulations will drastically differ from top-down methods both in theory and application. It is by meaningfully incorporating culture and Délįne perspectives within existing and expected adaptation strategies that future methods can become more inclusive of grassroots approaches and possibly utilized by a wider range of people throughout the north.

3.9 Trusting Traditional Knowledge

"So, well the first things is that since I was young I would always hear about the elders talking about things. About the future and the changes that are going to happen and so seeing those things

in my lifetime is really amazing because I'm like 'how did they know this?'. How did they understand? And I'm like wait 'they said this was going to happen, how did they know?[6]'." – ***Mandy Bayha***

Recently there has been an increasing amount of academic studies that explore notions of versatility, adaptability and applicability of traditional knowledge (Berkes & Jolly, 2002; Grant & Berkes, 2007; Berkes & Berkes, 2009), which helps to assert its legitimacy within both science and western societies. Following this momentum, climate change research then becomes the ideal example with which to further demonstrate this argument. According to Berkes (2009) traditional knowledge needs to be understood as a process, rather than just for content purposes, and climate change research is a suitable model to illustrate this point because "there cannot be a prior (or traditional) knowledge of climate change to be handed down from generation to generation. …what [elders] can do is to teach what to look for and how to look for what is important" (p. 152-153). The key point here is that TK is not just information that is passed on throughout generations, its information that is observed and then discussed in order to make sense of newfound information, what Berkes (2009) defines as 'indigenous ways of knowing'.

In the community of Déljne, TK and TEK are still very much a part of who the Sahtú Got'ine people are. The elders' stories, prophecies and on-the-land experience help to define how people interact or respect one another as well as guide their environmental actions. For example, Dene children are told that when they take down camp they should try to leave as little impact on the land as possible. This is not only to ensure that the environment is truly respected and kept in its unspoiled condition, but also subsequently instills notions of discipline and teaches habits of cleanliness. While discussing climate change and how people are adapting to the newly observed changes, some interesting themes of traditional knowledge and prophecy emerged. Firstly, the chosen quotes uniquely identify how people favored traditional knowledge over western science

[6] This quote exemplifies how environmental change has been prophesized and how this knowledge has been shared across generations. By listening and trusting elders' stories, current generations are able to compare what was said to what is currently unfolding in their surrounding environment. This knowledge is important to document because it offers deeper insight into the Sahtú Got'ine worldview as well as their overall perspective surrounding climate change.

because elders' omniscient knowledge is considered sacred because it will direct the community towards a sustainable ecological future.

"One thing that I've learned from the elders was that they had always said to bring your traditional way of life with you into the future; keep it, because it will come back and play again. And these things - energy, lights, electricity - it will all go. So, if that's the case then you can't depend on it anymore if it's dead. Then you have to, you know depend on your skills, traditional way of life will come back and play again. – ***Morris Neyelle***

Second, residents discussed how climate change is not considered to be a new concept to the community because these changes were always predicted and prophesized. This facet is particularly interesting because it plays a huge role in their climate change perspective. Since they have had ample time to conceptually prepare for these changes, their anxiety levels could be lower than an individual who is experiencing and reacting to these changes for the very first time. Having this insight has helped to nurture community psychological resilience because they have always known about these impending changes. The following quotes describe how community members do not consider climate a novel concept as well as how it has always been predicted.

"Well what I know like the elders they say it's going to happen and … Some of them are still living, they said they can tell the difference … You know the sunset, the weather has changed too fast for them, they said right away … That's what they said. And so I think we're living it like right now, the wind shift too fast. They said way back there's one-way wind comes in and it will be for a day … Whole day or two days, but nowadays it just shifts and turn direction right away, so I think that's what they said that one's…And the elders talk about it anyway … It's going to change. [Gókó agoderade] … They said it's going to get hotter, that's what they said" – ***Anonymous 1***

"So that's what her husband would say to the children…her husband would also say 'our prophets have prophesized that too'". – ***Mike for Camilla Tutcho***

"Well usually climate change in the past, the elders were the ones that always talked about it, and the way they look at it is by the migration of the animals, birds and fish. Changed the way of their pattern now; the migration of different species of animals start showing up means it's - something

is happening, it's shifting. And today like there's a lot of information for climate change; you see it every day on the news… talking about [climate change[- I always go back to what the elders had said and what they had prophesised on all of this, and it's all - like it's all written already, like it's in - right here…I hate to say it, but it's going to get worse in the future - maybe another 100 years, I don't know, that day will \eventually come. And [Great Bear Lake] - even this will dry up - one day. – ***Morris Neyelle***

"So, well the first thing is that since I was young I would always hear about the elders talking about things. About the future and the changes that are going to happen and so seeing those things in my lifetime is really amazing because I'm like 'how did they know this?'. How did they understand? And I'm like wait 'they said this was going to happen, how did they know?'. So that was like my first introduction to change is going to be happening. But I didn't understand 1) how they knew and I didn't know I would see it in my lifetime. And I still don't understand what that means for us then. and so that's when I first started becoming more aware of those things and looking out for it a lot more. Because it was just like holy man how did they know this. And then my own experiences in my life time. Like how I have seen those changes like. The fact that they said it and I have experienced and witnessed those changes and also. Well I mean that would be like traditional knowledge, and then my own experience. And then of course you hear it all over the news all the time. People in the south like Trump doesn't even think it exists so people think it doesn't exist, they think it's a myth. And some people think 'this is a real thing' and then we have the hard-core conservationists and you know the Suzuki people that come and say 'this is a real thing, we are going to have this movement' and this is really important and this is happening now and faster than we ever thought and you know we can be completely obliterated as a species if we don't come together right now. So, you have all of these people having conversations about it all around the world and they're seeing it everywhere. They're seeing it in the farmers and their crops, you're seeing it in every aspect of life where humans are interacting with nature and you are seeing people who don't even care or don't believe in it or people who are really trying to push to do something for it and then you have us that are feeling it right now the most because it's our livelihood. And it's literally our lives are tied to it." – ***Mandy Bayha***

One of the best examples of elder's predictions emerged from a particular interview where both the translator and community research collaborator were present. The following conversation

emerged while asking the question 'how the participant personally contributes to the effects of climate change'. The presented narrative demonstrates how culture shapes perceptions of climate change and highlights how interview questions can be unknowingly loaded with western biases and presumptions.

Mike Neyelle: well that's a tricky question. Trying to figure out how to say it. Like how can a human contribute to climate change?

*Mandy Bayha: that's really interesting, that's not something we really ask that way. Like slavey (*Athabaskan language)...

Chelsea Martin: is it the way its phrased in English?

Mandy: No, it's just uh, like the elders always predicted change. They always said the change. But they never really talked about like our relationship with the change. Just that we would witness it.

The aforementioned quotes in this section uniquely highlight how trusting traditional knowledge has been crucial for the sustainability and continued survival of customary livelihoods in Délįne. Learning from elders' stories and experiences has proved to be the best education mechanism because it provides a solid knowledge foundation for the community, which aids to preserve and maintain their distinct identity and bright culture. By listening to and absorbing this sacred prophesized knowledge, current generations can better understand and process climate related changes. Trusting traditional practices and 'old timers' knowledge is something the Sahtú Got'ine heavily rely on and this sense of trustworthiness can be used to teach younger generations the power of traditional knowledge as well as motivate the community to enforce Délįne driven climate adaptation strategies. The Dene interpretation of climate change has fostered resilient attitudes and is considered to be different than western climate conceptualizations because their worldviews are fundamentally dissimilar. By continuing to follow elder's insights and traditional knowledge, Délįne residents firmly believe their community will maintain resilience regarding climate related issues and culturally flourish well into the future.

3.10 Implications and Discussion

According to Dél̨ine elders, land users and youth, climate change is a serious issue that is starting to have a serious impact on community lives and traditional Dene livelihoods. One major topic of discussion was how people understand and specifically describe the term 'climate change'. Community depictions did include classic western indicators of climate change such as warming weather patterns as well as weather unpredictability. However, the Sahtú Got'ine description is distinguishingly unique because their portrayals feature a relational land characteristic as well as how foretold prophecies help to shape their current understanding and perceptions of climate change. Related to these community insights is what community members specifically determine to be the cause of abnormal environmental shifts. Majority of people deemed fossil fuel production, specifically from extractive resource productions and manufacturing industries, as the culprit for climate change around their community. Furthermore, people constantly reiterated the importance of the environment and their distinct relationship with the GBL ecosystem. These analogous narratives specifically highlight the tremendous importance that is placed on maintaining and prioritizing the surrounding environment, which has huge implications for how policy and adaption strategies will be shaped. Future climate strategies are likely be structured around what is considered best for the Great Bear Lake ecosystem. These 'grassroots' approaches are much more appropriate for community-based climate adaption strategies because top–down approaches heavily rely on scientific experts in program design (Castro, Barrera & Martinez, 2004) and not the local evaluations of the environment. Furthermore, in the context of climate adaption strategies, bottom up approaches are considered superior because they can be customized based on their own institutional, technological, economic and political capacities (Rayner, 2010). By exploring bottom up approaches that involve mobilizing communities to address a common concern (Castro, Barrera & Martinez, 2004), Dél̨ine customs can be well represented within climate adaption strategies as well as what methods are deemed most appropriate by elders, knowledge holders, livelihood experts and traditional knowledge principles.

Individual perceptions concerning their contributions to climate change was another significant finding, which was later discovered to be a harder question to answer. For those who responded as originally expected, community members were not blissfully unaware of the impact

their actions have on the environment. People genuinely understand that because they drive a truck and use a snowmobile in the winter or use a space heater, that they are contributing to increased levels of greenhouse gases and therefore climate change. Some of their choices are a direct consequence of modernization or increased standards of technology. For example, utilizing an electric shearing device rather than using traditional tools to work a moose hide. Regardless of the reason, they are consciously aware of their choices and want to create meaningful changes that help decrease their carbon footprint. For instance, it was suggested that the community institute a 'no drive Sundays' policy where everyone is asked to walk to their points of interest one day of the week. Related to contribution conversations, adaptation strategies and resilience insights were also a product of climate conversations. The Dene people continue to preserve their culture by pursuing their distinct land or water-based livelihoods and their consistent continued engagement with fishing strongly indicates that they are not simply going to just give up their way of life. This attitude contributes to a strong sense of community resiliency and further strengthens their relationship to the land. This robust worldview is what motivates the continued reliance on sustainable traditional livelihoods as well as is what separates the Sahtú Got'ine from other climate affected societies.

Lastly, traditional knowledge has played a significant role in shaping how the Sahtú Got'ine understand and perceive climate change. Elders, fishing experts and youth identified that the concept of climate change is not technically new to their community because environmental change have always been predicted by prophets and Dene leaders. Based on elders' teachings, the Sahtu Got'ine do not expect the modern world to stay the same, so any witnessed or experienced environmental shifts are not considered significantly alarming. They understand that change is inevitable so they continue to live their lives and adjust activities when needed. This is a particularly interesting outcome because published literature heavily relies on scientific projection models to predict various issues directly related to abnormal environmental variation (Giorgi, Jones, & Asrar, 2009; Mueter, Bond, Ianelli, & Hollowed, 2011; Honda et al., 2014). This Dene description further contributes to community resiliency because it provides further evidence that traditional knowledge and elders stories are accurate and dependable. By witnessing what elders have historically predicted, forthcoming Dene youth can compare what they witness and experience to the prophecies in order to solidify their own perceptions of climate change.

3.11 Conclusions

Among other things, climate change research focuses on providing sustainable, supportable and well-organized solutions for diverse societies and populations around the world. What is absolutely critical to understand is that climate change resolutions and responses are not universal and must be meaningfully developed in conjunction with local people, whole communities, and governments. A flooding mitigation strategy that effectively works in southern Alberta is not likely to be as applicable in the Northwest Territories not only because the physical environment is different, but the cultural foundation that motivates the biological understanding of the ecosystem is distinct. It is evident that the Sahtú Got'ine have a deep spiritual connection to the land and water surrounding their community. Their worldview radiates an intimate relational understanding of their land that cannot be unraveled from their distinct identity. This distinctiveness fosters the development of how the Sahtú Got'ine people construct their perceptions and understanding of climate change. The traditional oral histories that encompass abnormal environmental predictions have prepared the community for what is yet to come. The ways in which the community adapts include a strong cultural and resilient attitude that does not simply give up when novel challenges arise. Furthermore, because Délı̨ne has successfully negotiated a self-government agreement, the community has the power to create, develop and initiate whatever strategies they deem acceptable by their standards. This power shift also fosters the ability to decline potential outsider climate approaches that do not properly align with Délı̨ne worldviews. Culture specifically shapes how people understand certain concepts and climate change is no exception. It is imperative that adaptation strategies and mitigation processes are culturally relevant in order to ensure their long-term practice because without meaningful incorporation, other methods will likely be abandoned or ignored.

Chapter 4

Fishing Livelihoods and Climate Change Impacts

4.1 Background & Introduction

Fishing livelihoods are an important area of study globally and also considered to be an essential dimension of many northern Indigenous communities. Fishing livelihoods can be defined as 'the individuals, households or groups making a living, attempting to meet their various consumption and economic necessities' through fishing practices and techniques (Marschke & Berkes, 2006). The Sahtú Got'ine community of Délįne, formally known as Fort Franklin, occupies an ideal aquatic fishing location because it is situated on the western end of Keith Arm directly on Great Bear Lake (Sahtú), which is also very close to the Great Bear River (Sahtú Dę́) (Woo et al., 2007). Over many generations this location has fostered the development of valuable fishing related knowledge, practices and institutions that are deeply integrated with the Sahtú Got'ine spiritual worldview. Furthermore, the importance of fishing is not limited to a contribution of food resources, but also underpins healthy respectful relationships between people and cultural landscapes (Close & Hall, 2006; Buggey, 1999). For example, Great Bear Lake is conceptualized as the source or "heart" of the community and their livelihood (Rushforth, 1992; Andrews & Buggey, 2012). The accumulated traditional knowledge associated with their local ecosystems, including ecosystem dynamics, has been critical to the sustainability of fishing livelihoods and has allowed the community of Délįne to thrive as subsistence fishermen. However, climate-change related issues and increased levels of unpredictable environmental variability are starting to become more noticeable to northern Indigenous communities (Ford & Smit, 2004). This becomes an important investigative problem because these changes impact Indigenous ecological practices, which directly affect fishing livelihoods and subsequently the valuable traditional knowledge of the Sahtú Got'ine people.

New research regarding the effects of climate change is constantly emerging and so is the academic field specific to its impacts on fish and fishing livelihoods (Coulthard, 2008; Daw et al., 2009). In the global marine context, Harley et al. (2006) examine how coastal marine systems respond to the effects of climate change by examining indicators such as deviations in species composition, diversity and community structure. Additionally, McIlgorm et al. (2010) paper examines climate change implications for fishery governance using seven international fishery

case studies, including west coast Canada. Similarly, Brander (2007) explores the climate changes impact on fisheries as well as global fish production. A key commonality that many articles concerning climate change and fish share is that their methods heavily rely on statistical data in order to formulate models, inferences or future predictions. There are fewer studies that focus on experiences of climate change from the local fisherman's perspective. Coll et al. (2014) investigate fishers' perceptions in order to better understand changes in fishing activity in the Spanish Mediterranean Sea and Gulf of Cadiz. Moreover, Nyong, Adesina, & Elasha, (2007) examine the benefits of incorporating African Sahel Indigenous knowledge into formal climate change mitigation and adaption strategies. In the Canadian context, particularly in the Inuit and Inuvialuit regions (Riedlinger, 2000; Nuttall et al. 2005), there are notable numbers of traditional knowledge studies that have helped to understand the impacts of climate change. However, fewer studies have focused on the climate related knowledge and experiences of First Nations from the Canadian Subarctic, which includes the Sahtú Got'ine of the Mackenzie River Basin. This manuscript was a part of a paper-based thesis and is written for future publication in order to address this gap by exploring how livelihoods of Sahtú Got'ine fishers are impacted by or adapting to climate related changes. First, this project differs from other northern projects because it specifically focuses on the Mackenzie River Basin; a region that has been previously overlooked in earlier research projects. Some of the discovered fish findings enclosed within this thesis could be used to compare across the Mackenzie Basin or even contrasted with future fish research found across Canada. This assessment would allow potential findings to determine if results from the Canadian subarctic are applicable and replicated throughout all of Canada or only specific regions or areas. Second, findings from this project expand our collective knowledge regarding the current status of fishing livelihoods in the Canadian subarctic as well as how communities are developing adaption strategies for abnormal environmental variations. Third, this project specifically helps to addresses the literature gap concerning Indigenous knowledge and the sustainability of fishing livelihoods in a Canadian context. It is hoped that by making these contributions, more community-led solutions can be developed in order to better mitigate against the harmful impacts of climate change.

4.2 Traditional Ecological Knowledge

Since time immemorial, the Hare, Mountain and Slavey bands have traditionally used and occupied lands of the Sahtú Region (Paul Dana, Brent Anderson, & Meis-Mason, 2009). Although the local traditional Dene knowledge surrounding Great Bear Lake is long-established, TK and TEK are fairly new concepts within a large number of academic jurisdictions. According to Berkes (1993) some of the earliest systematic studies of TEK were completed by anthropologists, such as Conklin (1957) who documented traditional Philippines horticulturalists detailed knowledge surrounding local plants, animals and their natural history. Other pioneering studies involving the substantial importance of TEK include Johannes (1981) who evaluates fisheries TEK systems in Oceania. Brokensha, Warren, & Werner (1980) book which examines the application of TEK towards development, as well as Freeman, & Carbyn (1988) who examine TEK of northern ecosystems. These pivotal publications stimulated further development of research surrounding TEK and TK frameworks, because before the early 1990's these concepts were practically non-existent within scholarly or mainstream literature. For example, it was not until September 1991 that United Nations Educational, Scientific and Cultural Organization (UNESCO) Canada, Man and the Biosphere Programme and the Canadian Environmental Assessment Research Council organized a workshop on Indigenous knowledge that recognized the importance of TEK in planning and decision making for sustainable development (Inglis, 1993). Although the development and deeper understanding of these concepts has come a long way, there is still no universal definition available as to how to define or establish what Indigenous people know (Berkes, 1993). According to Mazzocchi (2006) there are multiple reasons why TK and TEK[7] are particularly difficult to define but typically it's because of the terms' different implications. He states that 'the word 'traditional'…places the emphasis on the transmission of knowledge along a cultural continuity but might ignore the ability of traditional societies to adapt to changing circumstances. Another widely used word, 'indigenous', is meant to highlight the autochthonous nature of this knowledge, but it might overlook knowledge from populations who are not officially

[7]Although used widely thought the thesis, there is a distinction that needs to be made between the terms TK & TEK. TEK can be classified as "knowledge about the environment, knowledge about the use of the environment, values about the environment, and the knowledge system itself" (Usher, 2000). Whereas TK frameworks outline two key elements; the sacred and the intangible. The sacred "is used to refer to any expression of traditional knowledge that symbolizes or pertains to religious and spiritual beliefs, practices or customs' and the intangible 'simply means incorporeal…and it is quite distinct from the possession by museums of sacred objects belonging to aboriginal peoples" (Garvis, 2003).

recognized as indigenous. [Lastly] the word 'local' can be applied to different geographic contexts, but it lacks specificity' (p.463). Similar to Mazzocchi's reasoning, other academics have explained why these specific terms have certain problematic implications. According to Berkes et al. (2000) 'tradition' is considered a problematic word because researchers in development and anthropology believe it represents '19th-century attitudes of simple, savage and static' (p.1251). Regardless of diction difficulties, TK and TEK have become established research domains within academia and understandings continue to progress as Indigenous based research inquiries continue to move forward.

This paper heavily relies and places great importance on both TEK and TK; this is because quantitative research methods only describe one side of the climate change story and it is the local Dene land user's perceptions, beliefs and worldview that provide deeper ecological insight to environmental related issues. Although it is a particularly challenging term to define, this paper chooses to employ the Berkes, Colding & Folke (2000) definition of TEK which states that 'traditional ecological knowledge is interpreted as a cumulative body of knowledge, practices and representations that describes the relationships of living beings with one another and with their physical environment, which evolved by adaptive processes and has been handed down through generations by cultural transmission' (p.1252). This definition is impartial and inclusive in that it does not limit which Indigenous groups can fit within its parameters and it incorporates a relationship aspect, which is particularly important for the Sahtú Got'ine people and their distinct connection with Great Bear Lake. The oral histories and traditional knowledge provided by interviewees is accredited and recognized as their own personal data and in no way does the lead author of this paper take any credit for the resulting information. Instead, the lead author understands that self-credit is paid exclusively in the form of a Master's Degree; an undertaking that was previously assumed to be unattainable or impossible, but is now seen as an unbelievable accomplishment.

4.2.1 TEK and Fishing Livelihoods Literature

According to Menzies (2006) "TEK is often described as an enduring, culturally unique, and habitat-specific set of knowledges that have enabled Indigenous peoples to live within their territories for millennia without noticeable ecological degradation" (p. 88). This concept has

become a relatively common topic within social science research and there an increasing amount emerging literature connecting TEK with fishing livelihoods, however most of the research has not been completed within a Canadian context. Furthermore, the majority of this literature is written for the purpose of incorporating TEK into administration policy or co-management regimes, not specifically climate-change related. For example, Eythorsson (1993) examines the conflict concerning the integration of TEK with conventional scientific knowledge as a foundation for resource management in northern Norway. The conflict exists between small-scale fjord-fishermen and Danish seine fishermen, where Eythorsson argues that fjord TEK can complement and supplement policy so that management regimes can better understand the structure of the ecological environment. Another example, written by Olsson and Folke (2001), focuses specifically on local knowledge utilized by a Swedish fishing association, and how it is utilized in the management of the Lake Racken crayfish ecosystem. Their findings reveal that although the local knowledge is robust in many different ways, it is still inadequately incorporated within conventional resource management policy. This example is particularly interesting because it highlights how knowledge from local institutions, whose management authority is legally recognized and maintain positive cooperative relationships with management agencies, is still perceived as unnecessary in ecological management policy (Davis & Wagner, 2003). This fishing livelihoods literature reiterates the fact that policy still explicitly favors western science over traditional knowledge as well as the needed and anticipated shift in policy regimes toward a more integrated and holistically sustainable environmental system.

In the case of the Sahtú Got'ine, understanding the immense intricacies of fish and fishing on GBL is of the utmost importance. Their unique fishing knowledge and worldview are directly tied to their profound ecological relationship with GBL. Fishing is innately apart of who they are as Dene people and in order to continue this distinct way of life, the Sahtú Got'ine believe that they must continue to respect the lake in order to maintain its pristine purity and resource richness. For example, *"Sahtu Kehwey"* translates to 'Great Bear Lake is the boss" and it is a phrase that is constantly repeated around the community. This phrase uniquely demonstrates how Sahtú Got'ine people genuinely understand how GBL regulates their life, while subtly affirming that their presence on the lake is essentially irrelevant; the Sahtú Got'ine need the lake – the lake does not need the Sahtú Got'ine. The underlying message of this expression is illustrated through their

unrelenting need to set a net and provide food resources for the community. It is this particular worldview that drives fishing livelihoods in Dél̨ne and provides purpose for future generations to continue to maintain this culturally significant tradition.

4.3 Methods

The research underlying this paper uses methods and tools from multiple disciplines such as Native Studies, Sociology, Anthropology and Cultural Studies (Caine, Davison, & Stewart, 2009; Ween, & Riseth, 2011). Furthermore, this project is inspired by Dene teachings and stories of Sahtú community leaders like Morris Neyelle, Michael Neyelle, Morris Modeste, Leon Andrew, Camilla Tutcho and Walter Bayha. Lastly, this article is also guided by Indigenous scholars such as John Borrows and Taiaiake Alfred (Borrows, 1997; Alfred, 2005) as well as non-Indigenous academics such as Fikret Berkes, Ken Caine and Mark Nuttall (Nuttall et al., 2005; Berkes, 2012).

This research project builds upon previous ethnographic, sociological and ecological research within the region (Muir, Leonard & Kruegar, 2013) as well as the broader literature on traditional knowledge and climate change (Riedlinger & Berkes, 2001). Since relatively little research has been conducted within the Canadian subarctic regarding climate change and environmental variability, this project employed a community-based approach in order to determine how these changes affect Sahtú Got'ine fishing livelihoods. By initially focusing on local narratives surrounding fishing livelihoods and climate-change within this thesis, future research can expand on priorities firmly established by the community through quantitative and longitudinal research frameworks.

Research activities took place during the summer of 2017 in settings considered ecologically and culturally significant in Dél̨ne. According to Berkes (1990), it is sometimes considered difficult to investigate and quantify subsistence fisheries. This is probably because subsistence fisheries can be considered context dependant and usually involve "(1) local operations; (2) customary, traditional or cultural; (3) undertaken for personal or family use; (4) primarily for nutritional needs (though excess resources may be sold to ensure food security); (5) based on minimal technology; and (6) undertaken by people with low cash incomes" (p.476) (Branch et al., 2002). Although there are many inclusive and exclusive definitions that attempt to

precisely define fisheries, this project defines it here as "local, non-commercial fisheries, oriented not primarily for recreation but for the procurement of fish for consumption of the fishers, their families and communities" (Berkes, 1990). In order to accomplish the task of identifying respected elders and knowledgeable youth, the project's translator (Michael Neyelle) and community research collaborator (Mandy Bayha) played a major role. With their much-needed help, we were able to conduct 21 semi-structured interviews with various elders, fishermen and youth based on traditional and local knowledge. An in-depth description is provided in the Methods Chapter (Chapter 2). By drawing on ethnographic methods from cultural anthropology (Spangenberg, 1990) and following protocols for ethical research established by the SRRB, these interviews resulted in the further documentation of Dene oral histories as well as contemporary observations of variability and change around GBL and the surrounding region. Each interview was audio recorded with the assistance of Michael Neyelle and/or Mandy Bayha, as well as transcribed and coded to identify themes related to climate change and fishing livelihoods. The most significant themes and sub-themes **(6)** are presented in this paper: the importance of fish/fishing & respecting fish, water related changes (temperature and levels), changes in fish population, changes in ice, changes in winter weather, as well as changes in fish health.

4.4 Importance of Fishing – A Local Perspective

"Long time ago, about 1946-47, around that time, all the people depended on fish. Sometimes there's caribou and sometimes there's moose. And the way that people survived here was they shared whatever they get. And in regards to fishing, you fish all season and, in the winter - if you set a net, sometimes you can leave the net for two nights. And after two nights, you check it, you catch lots of fish and most of them are still alive [8]". – ***Alphonze Takazo***

Fishing has always been critically important for the survival of Sahtú Got'ine people on Great Bear Lake. In an early report that documents this substantial fish dependence, Miller (1947) states that the lake-wide fishery at Great Bear Lake was estimated at 900 tons per year, and

[8] This passage describes the significantly important role that GBL fish play throughout the community. They are always abundant and available for harvest. Furthermore, it also highlights how fishermen were able to leave the nets overnight for extended periods of time, however this unofficial strategy is shifting because warming waters are causing fish flesh to soften much faster than before. This observation causes fishermen to check their net more frequently, which subsequently alters the practices and traditional knowledge that are passed down to future generations.

the harvest for direct human consumption at 3 tons per family per year. Dél̨ne residents also reminisce about how fish were traditionally used to feed the sled dogs when they were the primary means of transportation. Community members maintain that fish are still considered to be nutritionally and culturally important within the Dél̨ne diet, along with other staple country foods such as caribou, moose, and geese. The major distinguishing factor between fish/fishing and other traditional country foods is that fish are moderately accessible and available throughout the year, whereas other wild game are not always obtainable and require much more rigorous planning efforts to execute a successful hunt. This is not to say that fishing is easy, simple or stress-free by any means; fishing still requires extreme patience, discipline and specific important local knowledge about the weather, water temperature, fish species as well as fish migration patterns. It is extremely important to understand that not just anyone with a boat and a net or rod can fish on GBL and that the critical differentiating component is traditional local knowledge that elders and expert fishermen in Dél̨ne continue to utilize every day.

Outside of formal interview conversations, people in Dél̨ne consistently expressed their pride surrounding the world's biggest lake trout as well as how abundant these populations are in the lake. When discussing the importance of fishing within Dél̨ne, elders and experts provided various reasons as to why fishing itself is profoundly important. The following quotes depict how one of the most important features of fish is that they are a major food source. Another portrayed point of discussion that these quotes reveal is how GBL fish are so much cheaper than purchasing food at the northern store.

"It's extremely importance because it's our primary diet. It's important to my family and community because its, we live on GBL and that's what we eat a lot. The cost of food is expensive so it's free good food…When hunting was scarce we had fish… Everything out there is free and it's the absolute best for me…and it's just there for me but I have to work my ass of for it, but it's still free. And not just free but the absolute best to put into my body…But in the city, I don't have to work for anything. Everything is just there…and it's not necessarily the best for me". – ***Mandy Bayha***

"Food-wise…fish was the main source of food, because back then the caribou didn't come…So we depended on fish a lot…[it's] my life". – ***Morris Neyelle***

"Fishing is probably going to be the main livelihood which it has been since time immemorial and will be till the end of time". – ***Michael Neyelle***

"Fish [are] very important as [a] food source. Without fish, you won't have that – I forget what they call it – that oil that gives you life. And if you don't have that oil you will deteriorate. So, it's very important to have fish". – ***Joe Dillon***

"For elders, they can't really depend on meat. Other meat. Fish is always, has to be the number one food source… She says that fishing is our number one livelihood. Because if you go like for hunting – for caribou or moose. You have to go long ways. But for fish, it's just right here. You don't have to go too far so that's why its number one now.". – ***Mike Neylle translation for Camilla Tutcho***

"[Fishing] It's. . .what do you call it? It's life". – ***Chris Yukon***

One of the main follow up questions concerning the importance of fishing was 'what would it mean to you if you could not fish anymore?' Responses varied but the question was typically followed by feelings that could be categorized by concern, shock, or dismay. Interviewees stated that they had never thought about this question before because fish have always been abundantly available and to think otherwise would be simply irrational. Others reacted to the question with gestures of laughter; as if the question was a joke and that fishing practices will never fade away. Regardless of the resulting answer, this question invited participants to experience certain emotions that were not previously anticipated when drafting the research design. Upon completed analysis and reflection, it is asserted that future questions that explore this type of inquiry do so with extreme patience because future communities undergoing research may not be as forgiving or understanding as the Sahtú Got'ine people. The following quotes demonstrate how fishing is innately apart of Sahtú Got'ine identity and to take away fishing would be to strip them of their culture and tradition.

"That's just like saying 'don't do your tradition. Don't do your culture'. Because I've been taught that, I've been taught fishing for a very long time. It provides food. Feeds a lot of people. Feeds the town people and if you just got what you need, I'm pretty sure you give fish to other people". ***– Nihtla Bayha***

*"*GASPS*– oh my god, never even think of that. What would it mean to [me] if you couldn't go fishing anymore? May as well not even live here. Go live in the city. How sad is that?" –* ***Verna Mae Firth***

"Sell my boat. I never think of that! Never even crossed my mind". – ***Bruce Kenny***

"It would mean that I don't have the, that we lost, that they're taking away our tradition, our living. Not Dene…just human" – ***Mitchell Naedzo***

"Buy sardines. I don't know. Life would terrible without GBL". – ***Chris Yukon***

"Too hard…I can't eat solid food so I always depend on fish". – ***Camilla Tutcho***

"What would it mean to me? It would be devastation. Because fish is very important as the food source". – ***Joe Dillion***

While discussing the importance of fish and the lake itself a subtheme of respect emerged. Interviewees always elaborated on practices and traditions about how to respect GBL fish as well as how to keep the lake in its pristine condition for future generations. The following quotes reveal how community members continue to pick up after themselves in order to minimize garbage pollution in the lake. In terms of respecting the actual fish, interviewees discussed thanking the creator for their catch as well as to make sure humane harvesting methods are utilized. Lastly, an interesting quote highlights how some people don't catch fish over a specific weight because they are considered to be the 'elder fish' and are not to be consumed.

"I don't throw garbage in the lake … Because the lake belongs to the fish and it needs to be a clean environment for the fish. So that's the top of my list that I want to take care of the lake. And the lake we drink too". - ***Anonymous 1***

"And making sure that we're always clean. That we leave less of a footprint as possible…. And how we should be recycling a lot more, more mindful of the things that we are wasting…. I think for the most part a lot of people are aware and…making an effort to keep things as clean as possible. And I think Deline also as a whole, area really mindful of that also because we have so much respect for the lake, like that's our freezer. That's our food. That's our food source, our life source… Everything that we have to be healthy comes from our lake so I think we've always been mindful of that relationship. And there's even a saying that we say 'sahtu keway' – great bear lake is the boss. So, everything we do is surrounding GBL. So were always mindful of how the lake is doing or how were interacting with the lake.". – ***Mandy Bayha***

"I usually catch fish… I sometimes a say like a little prayer saying thank you to the Creator. That's the main thing the Elders always say is to pray for it, be thankful for what you get". – ***Mitchell Naedzo***

"Well what my dad tells me is that he would not eat over 25 pounds. He would never eat over 25 pounds…because uh, actually he just told me this yesterday. He said uh, its older than me and it's a fish elder". – ***Nihtla Bayha***

"[When you catch a fish] make sure, knock it out. Bang its head…take off the hook out of its mouth, [so] It doesn't worm out." - ***Nihtla Bayha***

These chosen quotes truly depict the importance of fish and fishing as well as further highlight the enormous cultural importance this food source provides for Dél̨ine. Fishing not only affords a mechanism for future generations to practice traditions and engage with traditional knowledge, but also provides people with the opportunity to maintain and strengthen their historical relationship with the land and GBL. The fish themselves clearly play a huge role in community relationship dynamics because elders heavily rely on fish as a food source as well as the fishermen that provide it. The master fishermen are absolutely necessary for the continued

survival of the community because they provide constant flows of food for their community and also continue to engage in food sharing structures with families, friends and elders. Based on these Dene passages, fish are clearly an important means to the Sahtú Got'ine, which is exactly why understanding the impacts of climate change on this resource is so imperative to the community as well as climate change research as a discipline.

4.5 Water Related Changes

"We wait like for the river to break up, so then we caught three [tubs full] … Anyways, just like for example with one net I check it two nights, I check it four times and 160 [fish] altogether[9]". – ***Anonymous 1***

4.5.1 Water Temperature

According to the literature, increasing water temperatures is one of the main driving forces causing changes in fish species abundance and distribution, which consequently also impacts species composition in marine ecosystems (Pörtner & Peck, 2010; Perry, Low, Ellis, & Reynolds, 2005). Much less research has been completed on freshwater sources and climate change, however an article published in 1992 examines some of the predicted changes. According to Carpenter, Fisher, Grimm, & Kitchell (1992) climate change will impact freshwater sources through changes in river channel formations, alterations in vegetation composition, distribution of freshwater fishes as well as changes in hydraulic patterns. Some of the changes stated in this article were also mentioned during interviews in Déljne. Specifically, the revealed changes were varying water temperatures and levels along with newfound variations in fish populations. The follow quotes illustrate a large consensus on how water temperatures are unquestionably increasing, however there were mixed perceptions regarding changes in water quantities as well as what specific fish species and populations were responding to these changes.

[9] Community members emphasize the plentiful fish populations all throughout GBL. This quote is referring to well-known fishing spot called Deer Pass Bay, which is recognized for its bountiful springtime fish yields. During spring break up, groups of fishermen will travel to this location in order to catch large amounts of fish. Although it is still considered an abundant fishing locale, warming temperatures may eventually shift spring break up timing and therefore alter travel scheduling in the future.

"It keeps getting worse. And they did the water temperature - students came here, I don't know what year, seven or eight years' ago, and they said the water went up - I think they said four degrees or something." – **Morris Nevelle**

"A little warmer yeah about 3, 4 degrees". – **Chris Yukon**

"I think it makes a big impact – the temperature of the water. Like you can feel it. I notice like when you put your hands in the water you can feel it -it's just warm. Usually you can't even put your hands in there for half a minute – your hands get numb. In the summer time I notice, it's just warm. It's warm and then some days it's so warm you can just, you know jump in the lake and just swim." – **Bruce Kenny**

"We did a science thing here – that was about 10 years ago I forget but we did a water temperature. A reading of the water temperature. And it went up four degrees from the year before?" – **Joe Dillion**

One of the major physical indicators that residents of Dél̨ine use to corroborate and validate their warming water perceptions is the quality of fish meat. Residents indicate that the ideal fish flesh should be firm and vibrant in color but due to warming water temperatures, the flesh is becoming softer, flakier and paler much faster than before. Subsequently, fishermen are having to check their net more often in order to obtain formerly established fish yields as well as maintain previous standards of fish quality. The following quotes describe how the fish flesh is specifically different than preceding years as well as how often previous generations were accustomed to checking their net.

"When you're cutting it up you can tell immediately like when the flesh is …Like the meat will fall apart against the blade…that's the reason we have to check [the net] more often because if you don't then a lot of your fish [are] not going to be super fresh…because for some reason the temperature warming up you have to check [the net] more often than not. But you'll find if you don't check your net often then a lot of the fish will be like that. Just because they're like dead longer. And they don't keep in the temperature for some reason." – ***Mandy Bayha***

"But my dad's generation…when you catch a fish in the net, they'll still be alive in two days…two nights. But nowadays just like I remember Deer Pass Bay, this trip, I set a net the other day, next morning we checked it, two of them were dead already." – **Anonymous 1**

"Like I've fished all my life - in the summer, especially in summer, having my net out there. And in 60s, going to 70s, like my dad went out there and we check it. And each day - every second day we'd check - like we'd check today, tomorrow, the next day, and we check it again, and it would be still fresh, the flesh would be hard, good for cleaning or making dried fish. But now, in 40 years' time, now I have to check it twice a day. But if I check it once a day, and I check it tomorrow, it will be mushy, like it's - it's soft." – ***Morris Neyelle***

*"And in regards to fishing, you fish all season and, in the winter - if you set a net, sometimes you can leave the net for two nights. And after two nights, you check it, you catch lots of fish and most of them are still alive. And he believes that is due to cold water. In those days***,** *he says in the summer time, you could leave the net for two nights because the water's cold. But recently, the water is warming, he says. So, you have to check the net every day."* – **Michael Neyelle for Alphonse Takazo**

"A fresh fish when you cut it open you don't feel the soft or mushy kinda – like its hard and slippery. When its mushy it's like old – not when you catch them by hooks but when they are caught by net they get spoiled fast though. Now they recommend you check your net twice a day. Once in the morning once in the evening." – ***Joe Dillon***

4.5.2 Water Quantity

Not only does GBL provide fresh drinking water (except for known contaminated areas), it also provides a means of travel for hunting/trapping as well as access to other communities in the winter and summer months. However, according to Schindler (2001) a warming climate will adversely affect Canadian water quality and water quantity. Water quantity is a topic of discussion that was mentioned within interviews in Dél̨ne and how water levels have been receding over the years. The following quotes describe how certain community members believe that the water levels have indeed declined over the years.

"I think they have receded. It's not a high as it use to be. And you can see that in certain places along the shore line…you can see where in certain places are sort of like…deteriorating…one of the tells is that there is a rock close by just over down by the shore here. And my mother and aunties and uncles grew up not to far away from that rock…and they use to always wash their clothes on that rock…It's a massive flat rock…they would go with their washboards and they would wash their clothes in the lake there. And that rock use to be like almost fully covered and you would have to skip and do all these ninja moves to get out there and now it's easy to get onto the rock. And every year I notice that too its more prominent. So, I think the water levels are decreasing." **– Mandy Bayha**

"She says, the water level use to be really high on bear river. And one of the areas around bear river, there's a huge rock. Boulder. That's right in the middle, and those days you couldn't see that big boulder…But since the 70s, when they boated over there they could see the rock was beginning to show. And uh, now you can see it." **– Michael Neyelle for Camilla Tutcho**

"I guess the water is low. The water level this time of the year – this year is a little different. But our water levels…I don't think we have the same level or the volumes of water that we had in Bear Lake. I think slowly, this year especially you can see…Last year we probably had a foot, two [feet] at least. Normally the water would be up two feet. Oh yeah, all those rocks would be under… Well you see where the sand is right there, high water would be above there. But I think over the years the volume of water is not there in Bear Lake. You notice that because of the volume of water on the river as well…its shallow. The way you use to go is not as deep anymore…the normal travel routes have to change because the water levels is not there". – ***Walter Beazha***

Although the dominant narrative expressed perceptions of decreased water levels, there were still some people within the community that believed that the water levels were actually increasing or not changing whatsoever. The succeeding quotes illustrate these points of discussion.

"Higher water, it's picking up the shores around here too. Like that beach down there used to be way bigger. Yeah and over here, those rocks, you were able to sit on them and now they're covered in water. I guess ice caps are melting. I'm not sure." **– Yata Yukon**

"Well I always put [my net] in the same spot, I catch a lot of fish there, so I just leave them … Nothing's changed. The depth didn't change, the water didn't change". – **Anonymous 1**

4.6 Changes in Fish Populations

"Before we used to catch lots [of Cisco's] at the mouth of river, now hardly any. How many times we set a net there, [we would catch] three, four hundred…. Now it's only a few[10]*"* ***– Chris Yukon***

Climate change is not just about increasing air temperatures; it is about the worldwide ripple effect implications it directly causes, such as an accelerated retreat of mountain glaciers, reduced Arctic sea ice and an increased global sea levels. One of the other major climatic related consequences includes shifts that alter the frequency and intensity of climatic phenomena such as El Nino (McGinn, 2002). According to the literature fresh bodies of water in Canada are already feeling the cumulative effects of climate change. For example, in northwestern Ontario the Experimental Lakes Area mean annual air temperature rose by 2°C and evaporation rates increased by 30% from 1960 mid 1980 (Chu, Mandrak, & Minns, 2005). This temperature change has a huge impact on lake and fish dynamics because fish distribution is heavily influenced by climate at a regional scale (Tonn, 1990; Carpenter, Fisher, Grimm, & Kitchell, 1992; Chu, Mandrak, & Minns, 2005).

According to the literature, the distribution of freshwater fish is influenced by many different factors operating at variously different tiers (Tonn, 1990). At a regional scale, freshwater fish distributions in Canada are influenced by historical and environmental factors, whereas local scale distributions are influenced by abiotic (e.g. water chemistry) and biotic (i.e. species interactions) factors (Tonn, 1990). For example, according to Pörtner & Peck (2010), alteration in fish species composition may result as a direct effect of temperature on an individual species and this can lead to higher level effects in the ecosystem (p. 9). In an article written by Johnson (1975), he examines the distribution of fish species in GBL and where they are normally found. According to his research there are two species of lake trout, (salvelinus namaycush, and M.

[10] The location that this participant is referring to is the mouth of Broken Plate Creek. Similar to the spring time break up at Deer Pass Bay, this fisherman would wait for the ice to melt and the Cisco's to begin their annual fish run. However, as the participant notes, it seems that Cisco populations are declining which could become a huge food security issue in the future.

quadricornis) that tend to inhabit the lake at all depths and temperatures. Whitefish (coregonus clupeaformis) are commonly found in bays and are usually caught in areas that are shallower than 20 m deep (Johnson, 1975). There are three species are confined to the periphery of the lake, namely the walleye (stizostedion vitreum), burbot (lota lota) and the longnose sucker (catostomus catostomus). Lastly, Johnson (1975) reports that the lake chub (couesius plumbeus) and the trout -perch (percopsis omiscomaycus), are present in the headwaters and Great Bear River but have not been able to fully establish themselves in GBL. Since this research was completed in the mid 70s', it was important to get a better idea of past and present fish populations as well as how they may have changed over time. To better understand community perceptions regarding lake fish populations, participants were asked specifically how fish populations have or have not changed over their lifetime. The following quotes highlight that there is a general understanding that certain fish populations have indeed declined.

"Less Cisco's for sure…there use to be lots." – ***Chris Yukon***

"A long time ago she says she noticed too is that – way back in dog team days. When they use to set nets for herring in the same area around. They use to catch over thousands. And now it's no more than 30 maybe." ***– Michael Neyelle for Camilla Tutcho***

"My dad took us out a lot on the land. So I'd say yes, netting and fishing. Fishing on the cabin. We catch a lot of grayling. You notice there's less grayling down the river." – **Yata Yukon**

"He noticed that the herring population has just about totally disappeared. He says just recently …there's lower numbers of herring, now there's less bigger [trout]" – **Michael Neyelle for George Kenny**

"I noticed, since the beginning of November…there's no herring across in the summer time…one time I caught 600-700 in one night. That's all dog food eh. 1965. 600 something dogs in town…Working dogs, not racing dogs." – ***George Kenny***

"I didn't hear anything, but it's like, I don't know I guess it's dropped because we used to catch lots over there, but now I barely catch any." – **Dallas Roche**

None of the interviews mentioned trout or whitefish as fish populations that are in decline. Contrastingly, some of the above quotes mention Cisco and how the population is declining but according to Johnson (1975) this species is considered an enigma because 'they appear in some abundance in the bays of McTavish Arm prior to breakup of the main lake but are not caught in gill nets.' (p. 2000). Johnson (1975) does indicate that community members of Fort Franklin have caught cisco in the summer months, however there are no in-depth interviews within the article asking these land users their perceptive on the matter.

Similar to Cisco descriptions, community members mentioned that the grayling and herring populations are in noticeable decline. The interviews conducted in this study asked elders and fishermen their assessment on these important matters because they have utilized lake and fish resources all of their life. These on the land observations are more valuable than a short two-year study, that only looks at species presence models, because they are longitudinal in nature which allows the Sahtú Got'ine to notice abnormal environmental variability more accurately. What is even more interesting and important is that even the youth are starting to notice these significant changes within their lifetime as well. This intergenerational, longitudinal on the land knowledge becomes key for understanding historical and current changes to the lake, fish and lake ecology, as well as how to better maintain a sustainable future for the community.

According to the literature, freshwater biodiversity has declined faster than either terrestrial or marine biodiversity over the past 30 years (Xenopoulos, Lodge, Alcamo, Märker, Schulze, & Van Vuuren, 2005). Since northern communities heavily rely on country harvested foods to meet their nutritional needs, this increasing trend could cause a major shift; especially in fishing communities like Délı̨ne. Fishing is so much more than just a daily activity; fishing is considered to be a deeply cultural and spiritual pursuit and the knowledge associated with it is deeply rooted in Dene teachings and stories. Each fish species is critically important in their own significant way and to completely lose an entire species would also mean to lose the stories and TEK associated with that particular fish. For example, Mandy Bayha shared an amazing example highlighting the importance of traditional fish stories; she discusses the story about an old lady who falls into a river with a pack of tools and how those tools look like the bones found in the fish head. They share this story to teach young children to be mindful of the small bones so that they don't choke: '*You sit there and be mindful of the bones. "oh, see you can find the axe oh see if*

you can find the knife, how many tools can you find?" so as a child you are trying to make sure you get all the meat off the bones but being mindful of the bones and making sure not the eat them'. This particular Dene story further demonstrates how traditional knowledge is immensely important in order to share specific information across generations, but also emphasizes the significance of connecting with their environment and understanding fish complexities. To lose these kinds of stories would also mean to lose their identity because the Sahtú Got'ine of Déljne are complexly shaped by the fishing environment that surrounds their community. The importance of fish is clearly not just for its nutritional value and therefore climate mitigation strategies should reflect this prominence. The narratives originating from this thesis should be evaluated as more than just scientific information in order to draft community-based strategies that both reflect community objectives as well as incorporate traditional methodologies into policy.

4.7 Winter Related Changes

"Like when I was young I use to play and the snow drifts were way bigger than I was. And we use to play on those all the time, like it was the best time of my life we use to snowmobiles on the snow drifts – like we were kind of crazy but now, I mean like last year it's not like that anymore I think last year we didn't really get too much snow. I was here in like December and I could still see the willows. Like some of the willows sticking out where usually its completely covered [11]." – **Mandy Bayha**

4.7.1 Winter Temperature

In general, one key characteristic that primarily distinguishes the Canadian North from all other regions in the world is how bitterly cold the temperatures can be. For example, the coldest wind chill on record occurred at Kugaaruk (Pelly Bay), Nunavut on January 13th 1975 where the air temperature was -51°C but with the wind chill it was -78°C (Auld & Kershaw, 2005). Although Kuggaruk is much more north than Déljne, the community still experiences bitterly cold sub-zero winter temperatures. One key factor that plays a large and significant role in Déljnes climate is its location on Great Bear Lake, because large lakes have a considerable amount of influence on local

[11] Community members talked about how past snow levels would reach doorway heights and how just walking to school or on the land was an immense task. However, in recent years there has been a significant drop in the amount of show Déljne receives, which is one of the main indicators community members use to identify warming winter temperatures.

and regional climates (Eerola et al., 2010). According to Auld & Kershaw (2005), the climate in the Sahtú is also influenced by the solar radiation by the Earth's surface and atmosphere. The heat from the sun is distributed around the region by air circulation and in the winter the Sahtú is dominated by flowing air from the polar region. In general, the Sahtú experiences long, cold winters where the average temperature in January tends to be between -20°C to -30°C (Auld & Kershaw, 2005). Many participants mentioned specific changes regarding temperature in the winter season and the following quotes discuss some of the seasonal environmental related changes that are happening around Délįne,

"He says a long time ago it was really cold, it was very, very cold compared to today…he's talking about 40, 30 degrees. Today it's more than 20 or something. So, it's sort of warmer winters. In the past, he says they're always out on the land. And even on the land, it gets really cold, even the trees would explode, tear right apart. And the dogs would cry." – ***Michael Neyelle for Alphonse Takazo.***

"But the main part of the lake use to be cold all the time…we use to wear parkas but now we don't do that anymore…we don't have -40 weather anymore. You can check with the weather people but I don't think we did. Imagine that. Last year our average temperature was higher than Winnipeg – in the average in December." ***– Walter Beazha***

"And It use to be way WAY colder back then, -40…Also my dad said when he was a young lad he said if he left a red cap open, cracked…it will freeze ***– Nihtla Beyha***

As the aforementioned quotes illustrate, the overall consensus is that the winter temperatures are definitely increasing and these changes are becoming more noticeable. The following section discusses the key indicators that community members use to show that the winter season is significantly changing.

4.7.2 Ice & the Winter Road

Winter in Délįne a very important time of year since it is the longest felt season and also because of the winter road, which allows access to the outside world. In order for the winter road to be considered safe enough to open the ice must reach a certain thickness so that large

commercial and residential trucks can drive across the lake. Not only does the winter road allow access to other communities but also provides greater availability of resources such as a greater variety of food at the Northern Store or Co-op, as well as cheaper access to Yellowknife services that would normally only be accessible by aircraft. However, since the winters are becoming warmer the ice road is taking longer to freeze and the ice on the lake is tending to be thinner than before. The following quotes discuss late freeze up as well as specifically how the ice itself is becoming more slushy and wet rather than solid.

"And here, the ice is not as thick as it used to be. [It used to be] six feet plus. And he says sometimes it rains in the winter. That never used to happen. The one time it happens in like maybe April or May." – ***Michael Neyelle for Alphonse Takazo***

"The ice. The time of the freezing is longer than it usually was…it used to freeze around early November. [and this year] Late December, or like December, mid-December." – ***Mitchel Naedzo***

"Well when we were kids too, the ice used to be really thick. Now you're lucky if you hit five feet…. And the lake it takes longer to freeze. Like 5, 10 years ago I would cross in the middle of November but now sometimes you won't even cross in December the lake." – ***Chris Yukon***

"Because it's getting warmer. But one of the things I find now is when it starts freezing, it will take a long time to freeze, so it creates this slush all over. And that's what freezes…It creates all these bubbles…So when spring time comes, it just goes fast." – ***Morris Neyelle***

"It's easier. Use to set hooks 8 feet, 7 feet…yeah, a lot of work… ice chisel has to be the sharpest of the sharpest….to go down a long way. Lots of time I went in there and they actually pulled me out…its easier now because it's not as thick."– ***Mike Neyelle for George Kenny***

Another iconic indicator that people referred to was when the fuel tanker fell through the ice road. According to the CBC website, the incident occurred on March 5, 2016 and was halfway submerged roughly five kilometers from the community (Quenneville, 2017). This is drastically significant because according to the Northwest Territories government website, under the winter roads heading, the Délįne winter road is normally open until March 30th and this approval is based on a 15-year average (Highway Conditions, 2017). Although this information is based on long

term averages, clearly the environment is changing faster than people realize and decision makers should be including community perspectives when defining winter road safety regulations.

Warming winter temperatures not only means shorter winter road seasons and less access to necessary outside resources, but also huge safety concerns regarding on the land activities as well as travel. As mentioned within participant interviews, some people in Déljne continue to set net in the winter months and although it is a very rigorous task, the payoff is considered to be worthwhile. The traditional knowledge providing the ability to read the ice is absolutely essential when setting a winter net. If one is unable to read or predict the ice properly, it could result in tragedy or loss. Additionally, a lot of community members also talked about their cabins around GBL and the skidoos they use to gain access to these cabins. These pieces of equipment weigh a substantial amount and if the ice is becoming thinner every year, it is only a matter of time until one potentially accidentally falls through the ice. The ability to accurately predict the approximate ice thickness throughout the winter months has provided confidence and security for Déljne residents. However, as the ice becomes more unpredictable, confident feelings could be replaced by fear or anxiety resulting in a decline in on the land travel. Maintaining this level of confidence is extremely important for the future of Déljne because preserving traditional activities and youth participation in these activities is a major concern. There is significant cultural stake associated with traditional winter practices, so the overall wellbeing of future generations heavily relies on the ability to set net in the winter or safely travel to the family cabin. The rapidly thinning ice is something that community members have never endured and should be taking the above perceptions into consideration when considering possible solutions. By doing so, policy can reflect community standpoints more accurately and better achieve a solution that respects the environment and the relationships residents continue to maintain with the earth.

4.8 Changes in Fish Health

"Deer Pass Bay one time we were there in the fall time, there was hardly [any eggs in there] usually they spawn there in the fall time, but not that much…We checked a few, but some of them

just [are] thin…not ready to lay eggs. So just maybe [this year I got about thirty] fish … Maybe five or seven … all it has eggs like this [12]" – ***Anonymous 1***

Fish and fishing are a source of pride for many individuals in Dél̨ı̨ne; there is a lot of dialogue surrounding how people from all over the world come to Great Bear Lake on the off chance they will catch one of their world-famous fish. As previously mentioned, Great Bear Lake fish are considered to be hugely important for nutritional and cultural reasons, which is why maintaining the pristine health of the fish is so important. Community members continually mention how important it is to take care of the lake for future generations so that the much-needed resources can continue to feed the community. However, one of the topics of discussion that arose from interview conversations was the increase in visible cysts found on the fish. Perceptions varied in what causes this issue and if the fish were still satisfactory to eat, but the following quotes emphasize that there was a large consensus that the overall health of the fish is definitely changing in GBL.

"My dad just told me this. Cysts. If there's no cysts in the fish then it's really healthy." – ***Anonymous 1***

"In the last few years I've noticed a lot of cysts in the ciscos. And I've noticed in the last maybe 5 years…like cysts in trout. I've never really seen them in trout before…Maybe one fish…or two fish or something that I've seen with the cysts. But before that I've never really seen them before. But the Cisco's there's definitely [cysts], its normal sometimes that you would expect out of a bunch of fish that you are cutting up that at least a good percentage of them would have one or two cysts or something."– ***Mandy Bayha***

"Well I did once. We squeezed it out and cut it off. We didn't throw it back. The cysts that you can see are inside the fish, you can't see them outside of the fish. That's what I'm saying." – ***Nihtla Beazha***

[12] Significant changes in fish health was a major point of discussion during interviews. This particular passage describes how certain fish size and egg abundance could have changed in certain populations but this specific interviewee is not sure if this was a 'one-off' chance or if this change is a part of a repeating pattern. This is just one example of what fishermen look for when inspecting a fish in order to determine if it is healthy or not.

"He says sometimes when you cut fish open, you look at the meat. The meat sometimes you'll see some white stuff on it. If you see that, you're not supposed to eat it…the whole fish" – ***Michael Neyllle for Alsphonse Takazo***

"But she says just recently George Dolphus…he set a net for herring and he caught lots of herring. And gave some to Cam to make dry fish and when she works on making dry fish…she has to throw away at least 10 or more, of these little herrings." ***– Mike Neyelle for Camilla Tutcho***

*"Try and spell that…****batayhalah (parasite)*** *George says that some of the fish they have it – it's like a puss. Cysts…. He's looking for fish without those...those cysts. They're not real a really health problem. You can cut it out. You can cut it out and it's still good." –* ***Michael Neyelle for George Kenny***

"It's okay to eat. Eat it. Just cooked." – ***Chris Yukon***

4.9 Discussion & Implications

4.9.1 Discussion

According to community perspectives, a variety of things are changing around GBL and these newfound environmental fluctuations are having an impact on individual as well as community dynamics. Water related changes were considered to be one of the greatest deviations people experienced and this has had the most impact on traditional knowledge practices.

4.9.2 Water Temperature

According to the literature, increasing water temperatures is one of the main driving forces causing changes in fish species abundance and distribution, which consequently also impacts species composition in marine ecosystems (Pörtner & Peck, 2010; Perry, Low, Ellis, & Reynolds, 2005). In 1975 Lionel Johnson conducted a study that aimed to record certain characteristics about Great Bear Lake and one of the key characteristics documented was water temperatures around the lake. According to his work, when the lake was covered by approximately 1.5-2.5 m of ice, the recorded winter temperature of the water 20m below this ice was 0.06°C. Furthermore, at the 200 m mark the recorded temperature actually increases to 3.52°C. In 2008, Rouse, Blanken, Bussières, Walker, Oswald, Schertzer, & Spence expanded on this research and recorded updated

water temperature on Lionel Island (65.5°N, 122.0°W), a small landmass located in Great Bear Lake that is about 200 km east of Norman Wells and 60 km east of Déljne. Contrasting the 1975 Johnson findings, Rouse et al. (2008) revealed an increase in water temperatures at the 40-meter depth mark, where temperatures ranged between 4.8° and 3.5°C. This particular project lasted two years and these documented recordings are the average temperature readings from that time period. When comparing the findings from Johnson (1975) and Rouse et al. (2008) it is important to acknowledge that the conflicting recorded temperatures were taken at different water depths and Rouse et al. (2008) findings are an average of yearly logged temperatures. Additionally, GBL is considered to be a monomictic lake, meaning that the lake mixes water from top to bottom at one point during the year (Blackie, Weese, & Noakes, 2003) which could also help explain the rather large degree increase.

In the context of Déljne fishing dynamics, checking one's net more than once a day is a significant livelihood change. This change not only requires additional resources and maintenance upkeep costs, but community members also have to consider the additional time it will take depending on how near or far they set their net. If people are unable to accommodate these newfound lifestyle changes, then perhaps food security issues could become more prominent since there will be less viable fish harvests available. While poor quality fish meat can still be used for trapping purposes, superior fish meat is still absolutely necessary for the continuation of traditional food preparation or community sharing practices. These community quotes further accentuate that fishing is more than just a physical practice; fishing requires a social and cultural dimension that includes relationships with their environment as well as others within the community (Natcher, Davis, & Hickey, 2005). The water temperature citations cannot be considered strictly climate data, but also understood as insights that reveal the deep social and cultural importance that fishing practices provide. The above mentioned Déljne insights provide newfound understandings concerning the importance of Dene traditional knowledge as it relates to climate change as well as help to fill the literature gap concerning traditional knowledge and sub-arctic environmental variability. Furthermore, these perceptions regarding how Déljne understands and adapts to climate change is absolutely pertinent when developing mitigation strategies or climate policy. Lastly, the quotes also provide deeper insight that can help lead policymakers towards improved

community-based climate solutions that include sustainable and traditional harvesting methodologies.

4.9.3 Water Quantity

Freshwater is one of the most important resources in the world. Since water has always been so abundant, residents of Délįne have heavily relied on it for thousands of years for a multitude of reasons. Not only does Great Bear Lake provide fresh drinking water (except for known contaminated areas), it also provides a means of travel for hunting/trapping as well as access to other communities in the winter and summer months. However, according to Schindler (2001) a warming climate will adversely affect Canadian water quality and water quantity. For Schindler (2001) the question is not if climate change will create more perceptible water related issues – it is a matter of *when.* He goes on to discuss how there is a niche need to properly document baseline information on many Canadian waters, including Great Bear Lake because it has 'never been comprehensively studied' (p. 25). Furthermore, Schindler discusses climates relation to water quantity and how increase air temperatures are related to increased levels of evaporation and lower water levels. This is a topic of discussion that was mentioned within interviews in Délįne and how water levels have been receding over the years.

There is minimal completed research concerning water quantity levels in Great Bear Lake. The most modern study was completed in 1997 and looked at factors such as historic water levels, precipitation, lake outflow and inflow, evaporation as well as lake balancing procedures in both Great Slave Lake and Great Bear Lake. According to Kerr's (1997) study, due to the regulatory effects of both lakes, 'climate change will *not* produce sudden dramatic flow or water level changes in the NWT portion of the Mackenzie River Basin' (p.89). However, the author does project that the current lower inflows will result in lower outflows and this is a major concern for navigation reasons. The differing Délįne perceptions presented in this study highlights the niche need for a more updated comprehensive study involving Délįne and Great Bear Lake in order to better assess water quantity related factors such as evaporation or drainage.

Furthermore, the Délįne insights presented in this paper further highlights why access to water is so important to northern communities. Without adequate water levels in the lake,

navigation and travelling issues become more prominent. If water levels are in fact decreasing, the historic traditional knowledge that afforded community members the ability to safely travel around the lake for generations becomes extremely vulnerable. For example, traveling down the Great Bear River is no easy endeavor; in order to safely maneuver the river, one must be precisely skilled in boat procedures, the various water depths as well as thoroughly understand the boats capacity to withstand those depths. If there was a significant drop in river water levels, the once well-travelled route could potentially become impossible to safely navigate. Analogous to traveling issues, if water levels are significantly decreasing it is also likely to have a large effect on lake ecology dynamics (Scheffer, & van Nes, 2007), such as water chemistry and the location of certain fish species. Feeling extremely confident in ones' own capacity to deeply understand environmental dynamics, such as when and where to find the best fish or the winds relationship with the lake, is key to fishing on Great Bear Lake. However, this ecological knowledge becomes extremely susceptible to modification if people are unable to trek traditional routes or successfully harvest fish from historically important areas. This possible change could have huge social, cultural and economic ramifications in the community because if people cannot completely trust their traditional knowledge, then what knowledge can they trust? Traditional knowledge has always been *the* reliable source for Dél̨ı̨ne residents, but if the environment is changing faster than they can effectively adjust – then mitigation strategies must be established. The surrounding environment is more than just a physical space to Dél̨ı̨ne residents, the relationships that stem from fishing, sharing and hunting are key to the sustainability of traditional practices within the community. The perceptions shared by local Dél̨ı̨ne experts in this study can be used as a starting point for new water and land-based research initiatives in the NWT. Findings from future longitudinal and collaborative research with Dél̨ı̨ne can then be utilized to formulate mitigation strategies to combat against traveling issues or possible food security concerns as well. By using traditional knowledge to understand water quantity, research can begin to cohesively create data that better understands the dynamic intricacies of GBL.

4.9.4 Changes in Fish Health

In an early fish study concerning observations specific to the trout in GBL, the authors mention the presence of parasites and cysts. According to Miller and Kennedy (1948) a specific species of tapeworm (Triaenophorus Crassus) was commonly found in the intestines and muscles

of trout. This particular tapeworm is an important parasite in GBL trout because it occurs in plerocercoid (larval) form encysted in the muscles chiefly between the head and dorsal fin (p. 187). Miller & Kennedy's detailed analysis highlights that cyst occurrence is light in most locations but severe in Conjuror Bay and is also considered to be fairly severe in Richardson Island area. It was also noted that about one-third of the fingerling lake trout in Bear River had one or two conspicuous bulges on their backs that interfered very noticeably with swimming (Miller & Kennedy, 1948). According to Lawler and Scott (1954) the known range of this particular genus of tapeworm lies between "42°N latitude (Indiana, U.S.A.), northward to 67°N. latitude (Great Bear Lake, Northwest Territories, Canada) and from the lower St. Lawrence River northwesterly to Alaska" (p. 890). In the same year, Meyer (1954) states that these cysts are harmless to man but are objectionable in appearance, which renders the infected fish unmarketable.

According to the existing literature, there are no recommendations or suggestions found as to what the best practice is when encountering this tapeworm induced cyst. Perceptions in the community range between whether it is best to cut them out or if it is fine to cook and consume. Since there is no conclusive evidence stating which practice is supported, people are going to continue to applying whatever method they believe is best. The major issue with this resolution is for those people who consider cysts to be harmful because they are more likely to have smaller harvestable yields than families that deem the cysts edible. When factoring in the declining fish population issue that was mentioned previously, the current cyst dilemma further adds to the increasing food security issue. Another literature gap concerning these cysts surrounds the issue of how the consumption of these cysts could impact the human body. There is no scholarship highlighting the long-term effects of consuming cyst infected fish, which is highly problematic for communities that heavily rely on fish resources all year round. This intensifies the cyst problem because of the unknown possible health related consequences for those who wrongly determine that the cysts are acceptable to eat. What is interesting is that these current expert narratives mention how their fathers or grandfathers have known about the cysts for generations, but yet the published literature does not reflect this realization. Why is it that this issue has been recognized for generations but yet academia does not prioritize traditional ecological knowledge with the same importance as other scientific objectives? There is a long colonial history related to that question but what these current Dél̨ne narratives contribute to the literature is that there is an increasing

presence of cysts within the fish in GBL but an unknown understanding to the possibility of health-related threats they could cause the community. There is a research need at the community level to investigate the long-term health related effects of cysts and new research should reflect this requirement. Specifically, there needs to be more studies concerning the particular genus of tapeworm so that findings can better inform Dél̨ne community members with a deeper understanding of what these cysts are, what they are caused by and what they should do when they encounter them.

4.9.5 Implications

Water related changes were considered to be one of the greatest deviations that Sahtú Got'ine people experienced and this has had the most impact on traditional knowledge practices. Due to increasing water temperatures causing the fish flesh to soften, people are having to check their net more frequently (2X a day), which is drastically different than what elders described to be the historical norm (once a day). This increase in net inspection frequency consequently requires an increase in necessary fishing expenses, such as fuel, as well as increased maintenance expenditures for boats, engines and nets. Related to this issue of warming water temperatures is changes in winter weather and therefore the lake ice as well. Community perceptions about ice fishing season or open winter road periods are having to adapt to thinning ice patterns because these terms are not as long as they once were. Although thinner ice is making ice fishing a more moderate task, it also means necessary winter vehicles are increasingly vulnerable to falling through the ice. This is a huge safety concern for community members as well as large shipping trucks that can only transport certain resources into the community during the winter road season. Increased risks on the winter road could increase overall shipping costs or in an extreme instance - potentially eliminate trucking services altogether. Lastly, community anxieties surrounding falling through the ice could eventually peak, which could potentially prevent future generations from traveling on the land during the winter season. These new perceptions and experiences surrounding current water and ice patterns could become the new standard of traditional knowledge, which demonstrates its resilience and adaptability, but also suggests that new knowledge will be passed down to future generations and the potential for lost knowledge concerning the of old ways of living.

Softening fish flesh has huge food security implications because if people are unable to check their net twice a day, due to poor/unsafe weather conditions, then viable fish harvests will decline. With a potential decline in harvested traditional country foods, people may become more heavily dependent on purchased foods from the northern store. This is considerably important because like many other northern Indigenous groups, the Sahtú Got'ine place a certain cultural, symbolic and spiritual value on these foods and cannot simply be reassigned onto industrial foods (Freeman, 1988, Ford & Beaumier, 2011). In addition to a shift in dietary customs, the increased incurred costs could push more people towards paid employment and pull them away from traditional fishing activities. Since cultural continuity has been meaningfully important for developing Indigenous identity and overall well-being (Chandler & Lalonde, 2008; Wexler, 2009; Parlee & Furgal, 2012; Snowshoe, Crooks, Tremblay, & Hinson, 2017) it is critically important that the Sahtú Got'ine to continue to practicing sustainable fishing methodologies so that future generations can continue to maintain a deep understanding about what it means to be a Dene. This is not to say that the community will stop fishing altogether, because it is inherently a part of who they are, but to raise awareness that financial drivers may start to have a larger impact on lifestyle choices. Finally, the noticeable decline in fish population and increase in fish health related issues also directly relates to food security concerns. In general people in Délı̨ne are undecided about consuming fish that develop cysts, but in conjunction with declining populations and softer flesh – previously viable fish harvests become extremely vulnerable to sharp declines. Without the promise of large yields of consumable fish, it is possible that people could begin to share smaller portions of food with friends, family and elders. Consequently, this could cause a shift in dependence towards industrial and purchased foods. Again, this is not to say that people will abandon fishing; fishing will always be a part of Délı̨ne – but instead to increase awareness that Délı̨ne heavily relies on country foods and that this particular food source is changing at an alarming rate that will likely continue to deteriorate for as long as climate change effects continue.

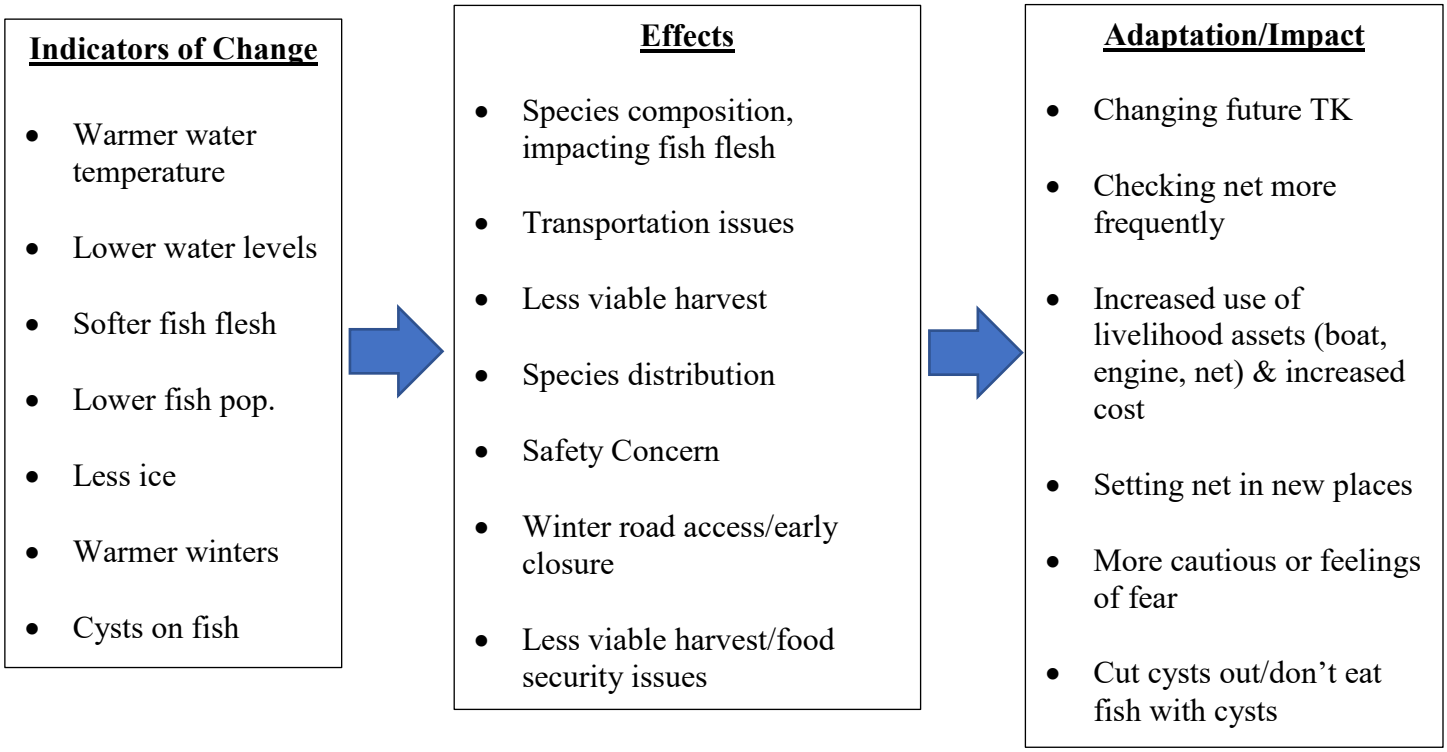

Figure 4.1: Climate change in the Sahtú – Impacts and Pathways. Inspired by Badjeck et al., (2010).

Research and published literature can help further explain why distinct cultural differences impact social responses to climate change. For example, according to Adger, Barnett, Brown, Marshall, & O'brien (2013) "cultural perspectives help to explain differences in responses across populations to the same environmental risks". In the context of Dél̨ı̨ne, the importance of fishing and the significance of GBL has heavily influenced their adaption response. Their resilience is demonstrated through their refusal to stop engaging in fishing activities; whether it's the act of consuming fish or going out to set net in undesirable conditions – fish and the act of fishing is how they identify as people from the Sahtú.

4.10 Conclusion

Climate change is one of the major challenges of our time and adds considerable stress to our societies and to the environment (UN.org, 2018). This becomes increasingly obvious when we look at the increasing amount of research concerning its impacts on natural and social systems.

For example, climate change and northern Indigenous people. This study looked at how climate change is beginning to effect fish and fishing livelihoods in Déljne, a small community located in the NWT. Participants claimed that a variety of things are changing in and around their community, the most noticeable included increased water temperatures, potentially declining water levels as well as an observable decline in certain fish populations, ice thickness and overall fish health. The subsequent effects from these climate related changes include softening fish flesh, less viable harvests, composition changes for specific fish species as well as safety concerns. The adaptation strategies that community members are choosing to employ include checking their net more frequently, setting their fish net in new places – which subsequently means adapting and extending TK for future generations - as well as cutting out cysts from fish flesh. These changes are not going to stop the community from continuing to fish because fishing is innately a part of who they are. The Sahtu Got'ine continue to will always adapt to their changing environment, an indication of their resilience and also of the cultural significance that Great Bear Lake has for the community.

Chapter 5

Conclusions

5.1 Summary of the Thesis

A chapter in the Arctic Climate Impact Assessment written by Nuttall et al. (2005) urgently calls for "extensive, regionally-focused research on the impacts of climate change on hunting, herding, fishing, and gathering activities". The chapter goes on to state that this "research that will contribute to a much greater understanding of climate change impacts, as well as to place these impacts within the much broader context of rapid social, economic, and environmental change" (Nutall et al., 2005, p. 650). Correspondingly, it is becoming more widely known that there is little completed research exploring the legitimate contributions that traditional knowledge can provide to climate change research (Reidlinger & Berkes, 2001). The presented paper-based thesis is a stepping stone for broader climate related research because it begins to address the previously mentioned literature gaps while specifically focusing on a community located within the Mackenzie River Basin (a region that that has been overlooked in earlier research projects). Second, this thesis is also expanding the collective knowledge concerning northern perceptions and Indigenous definitions of climate change in the Canadian subarctic as well as how communities are utilizing traditional knowledge to understand or adapt to abnormal environmental variations. Third, this project findings further expand our collective knowledge about the current status of fishing livelihoods in the Canadian subarctic and lastly, how the community of Dél̨ı̨ne continues to demonstrate resilience to the above mentioned abnormal environmental variations. The newfound findings from this thesis also help to address the ongoing literature gap concerning Indigenous knowledge and the sustainability of fishing livelihoods in a Canadian context. Fourth, this project specifically illustrates the importance of including TEK within policy because it is imperative for future sustainability agendas. Furthermore, this project helped contribute to project outcomes associated with Tracking Change in order to further advance local knowledge systems related to watershed governance. Although this project offers a few different academic contributions related to social sciences and traditional knowledge scholarship, it is considered to be a starting point for future climate change research in the Sahtú region, Canadian Arctic and Subarctic, as well as the Mackenzie River Basin as a whole.

Over many generations the Sahtú Got'ine people have developed a distinctly innate relationship with their surrounding environment. Consequently, their traditional activities and longitudinal observations have afforded the community sacred ecological knowledge concerning GBL ecosystem processes and dynamics. By practicing unique Dene fish harvesting methods and regularly engaging with their surrounding environment, Sahtú Got'ine observations become distinctly essential for understanding climate change because their sacred knowledge spreads across both time and space. This sacred knowledge has helped to specifically uncover and identify how climate change is impact fishing livelihoods in Déljne (Chapter 4), as well as how community members utilize traditional knowledge and elders' teachings to understand and perceive climate change (Chapter 3).

Chapter 3, entitled Community Perspectives Surrounding Climate Change, investigates Sahtú Got'ine perceptions surrounding climate change and how traditional knowledge plays a significant role in conceptualizing and considering its impacts. This particular thesis question has been vastly overlooked in previous research because investigative initiatives have explored different routes such as health and climate related vulnerabilities as well as the increasing monetary costs caused by abnormal environmental change. The cited literature within this chapter first explores the ongoing discussion concerning the legitimacy and applicability of traditional knowledge when compared with western science and how their foundational elements are polar opposites. Although there are many examples of merging TEK with western scientific methods for the purposes of resource management or environmental impact assessment, there still remains a large literature gap surrounding the inclusions of TEK within climate change research methodologies and frameworks. An early example of incorporating TK within research parameters dates back to 1969, where Spink's project demonstrated the important value of Inuit oral history in corroborating evidence for isostatic rebound and sea-level change (Riedlinger & Berkes, 2001). Another project led by Cruikshank (1981) targeted to merge western science with TK in order to provide deeper insight and broader perspective on the natural Yukon environment including glacier movement, flora, fauna as well as climactic fluctuations. In order to further assert TK as a corresponding equal to western epistemologies, chapter three was written as a manuscript intended for future publication and incorporates the five significant themes that emerged during participant interviews in Déljne. It is hoped that future publication will shrink the TEK and climate

change literature gap, as well as utilized by the community to formulate municipal derived climate mitigation strategies that are holistically sustainable and employed well into the future. Those five themes include defining & understanding climate change, causes and pointing blame, contributions to climate change, adaption and resilience and finally, trust in traditional knowledge.

Community interviews revealed that there is some thematic overlap with western descriptions of climate change. For example, many participants included warming weather patterns within their explanation as well as specifically how climate patterns are becoming unpredictable. However, other explorational themes with Sahtú Got'ine elders, experts and youth encompassed their intrinsic relationship to the land as well as elders' stories predicting change, which is critically important since these insights profoundly illuminate how climate change specifically impacts northern communities as well as what it means to be a Dene land user in the Sahtú region. Indicating blame and responsibility for climate change was another evolving theme, where participant accusations generally pinpointed the production of fossil fuels or any extractive industry to be the central cause. Furthermore, residents also trust that they hardly contribute to the acceleration of climate change and believe they are much less wasteful when compared to other places in the world because they utilized land and water resources in sustainable and respectful ways. However, community members also understood that some of their individual actions also contribute to the effects of climate change. For example, one now has to purchase a boat or a snowmobile instead of relying on traditional methods such as moose skin boats or dog sleds as a means for transportation. Although some lifestyle modifications have had to be made, Sahtú Got'ine land users still trust their traditional skills and are particularly motivated to actively participate in on the land activities. This overall sense of pride and sense of overwhelming trust in traditional knowledge is the foundation of the fourth & fifth theme of chapter three, which is exactly what makes the Délı̨ne community so resilient to current and future abnormal environmental change.

Chapter 4, entitled Fishing livelihoods and Climate Change Impacts, specifically explores how climate change directly impacts fish and fishing livelihoods in GBL. The literature cited within this chapter includes a short summary outlining the importance of TEK scholarship as well as how some of this knowledge has been applied to fishing livelihood research contexts around

the globe. The literature reveals that majority of it is written for the purpose of incorporating TEK into administration policy or co-management regimes. Since this is the case, Chapter 4 was also written as a manuscript intended for future publication because the literature is not specifically climate change related. Furthermore, the literature tends to reiterate the rhetoric that policy still explicitly favors western science over traditional knowledge (Olsson & Folke, 2001; Davis & Wagner, 2003), which is something this thesis strongly aims to repeal and dispute. With the help of Michael Neyelle and/or Mandy Bayha, participating community members engaged in an audio recorded interview which was then coded to identify the 6 main themes of chapter four: the importance of fish/fishing & respecting fish, water related changes (temperature and levels), changes in fish population, changes in ice, changes in winter weather, as well as changes in fish health.

All community members truly recognized the extreme importance that fish and fishing practices play within community dynamics. The most commonly mentioned reason for why fish is so deeply important is because it is the main food source for the community and since no one can imagine their lives without it they consciously ensure that their actions express respect and gratitude towards the lake and its abundant resources. For example, community members mentioned thanking the creator for their catch as well as safeguarding against any actions that could potentially contaminate or harm the lake. Another emerging theme involves water related changes. Specifically, how some community members have observed how temperatures have been increasing over the years and this trend has been directly affecting the quality of fish meat in GBL. Subsequently, this warming trend is causing Dél̨ne fisherman to check their net much more often than before in order to obtain previously established fish yields and standards of fish quality. Another interview subject that emerged involves GBL water levels and how some participants firmly believed it has declined, whereas others considered it to either be increasing or unchanged. It is recommended that future research and community monitoring initiatives aim to expand on Kerr's (1997) water quantity study in order to better assess current and future water quantity trends in GBL. One of the most significant changes experienced by Dél̨ne fishermen was abnormal shifts in fish populations and distributions. The particular species mentioned included ciscos, herring and even grayling. Some of the mentioned winter specific related changes include how average winter temperatures have significantly increased which has successively also affected lake

ice thickness and winter road safety. The final theme that emerged from participant interviews surrounds the topic of cysts and fish health in GBL. Perceptions varied on what causes this issue and if the fish were still satisfactory to eat, but there was a large consensus that the overall health of the fish is definitely changing.

Although chapters 3 and 4 were written as independent manuscripts intended for future publication, they are inextricably linked to one another. One of the core ways each manuscript relates to the main themes of this thesis includes how the impacts of climate change are becoming more noticeable much faster than expected in the Canadian North. This finding also relates to the heavy dependence on the importance of the surrounding GBL environment. Additionally, another merging theme between each chapter involves how community members are unable to separate fishing livelihoods from their identity. These core connections help reiterate why fishing for Dél̨ne residents is so important for the continuance of their unique culture as well as why climate mitigation strategies are so essential to their sustainable future.

5.2 Recommendations and Future Research

It is undeniable that climate change is affecting normal environmental patterns in the Canadian north. This study examined how these changes impact fishing livelihoods for the Sahtú Got'ine people as well as how they utilize traditional knowledge to construct their understanding of this concept. Future research could explore the same thematic subjects in other Sahtú in order to establish a more baseline data as well as a more comprehensive understanding of climate change in the Sahtú settlement region. Furthermore, future research could also expand into other regions in the Northwest Territories, such as the Decho or North and South Slave regions, so that cross cultural comparisons and environmental change distinctions can be emphasized.

This particular study utilized interview research methodologies to explore the impacts of climate change in Dél̨ne, but there still remains many unanswered questions. First, it is recommended for the continuation of water temperature research within GBL as well as inquiries that explore how water temperature is related to the softening fish flesh. It is also suggested to implement community fish monitors that are scientifically trained to monitor and track specific fish species abundance, composition and distribution. Additionally, these monitors should be

encouraged to utilized non-invasive techniques, as opposed to catch and release methods, and any traditional knowledge related to understanding fish composition in GBL. Another recommendation resulting from thesis findings asserts that more investigation must be completed surrounding the question of water levels throughout the lake. Findings from future longitudinal and collaborative research with Dél̨ine can then be utilized to formulate mitigation strategies to combat against traveling issues or possible food security concerns as well. The third and final research suggestion encourages the implementation of a study surrounding the cysts and tapeworms that were mentioned within participant interviews. The Sahtú Got'ine people have the right to know if the fish they eat is safe and having clarity surrounding this issue would provide relief to those who are unsure about its potential impacts.

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Chapter 7

Appendix

7.1 Research Ethics Approval Document

Notification of Approval

Date:	June 22, 2016
Study ID:	Pro00065907
Principal Investigator:	Brenda Parlee
Study Title:	Tracking Change in the Mackenzie River Basin
Approval Expiry Date:	Wednesday, June 21, 2017

Approved Consent Form:	Approval Date	Approved Document
	6/22/2016	Information Sheet
	6/22/2016	Consent Form

Sponsor/Funding Agency:	SSHRC - Social Sciences and Humanities Research Council	SSHRC

RSO-Managed Funding:

Project ID	Project Title	Speed Code	Other Information
RES0016416	SSHRC Resources and Sustainable Development in the Arctic	40942	

Thank you for submitting the above study to the Research Ethics Board 1. Your application has been reviewed and approved on behalf of the committee.

A renewal report must be submitted next year prior to the expiry of this approval if your study still requires ethics approval. If you do not renew on or before the renewal expiry date, you will have to re-submit an ethics application.

Approval by the Research Ethics Board does not encompass authorization to access the staff, students, facilities or resources of local institutions for the purposes of the research.

Sincerely,

Anne Malena, PhD
Chair, Research Ethics Board 1

Note: This correspondence includes an electronic signature (validation and approval via an online system).

7.2 Aurora Research Institute License

August 24, 2017

Notification of Multi-Year Research Renewal

I would like to inform you that Scientific Research Licence No. 16160 has been renewed by:

Dr. Brenda L Parlee
University of Alberta
507 GSB
Faculty of Agricultural, Life and Environmental Sciences
Edmonton, AB
T6G 2H1 Canada
Phone: (780) 492-6825
Fax: (780) 492-0268
Email: bparlee@ualberta.ca

to conduct the following study:
Tracking Change... Local and Traditional Knowledge in Watershed Governance

This is year 2 of a 5 year project.

Please contact the researcher if you would like more information.

SUMMARY OF RESEARCH
This licence has been issued for the scientific research application No.3798.

The broad goal of the project is to create opportunities to collaboratively document and share local and traditional knowledge (LTK) about social-ecological change in the Mackenzie River Basin, Lower Mekong, and Lower Amazon Basins and determine its' role in watershed governance. The project will fund 8-10 community-based and collaborative research activities in the Mackenzie River Basin that deal with all or some of following themes and priorities:

1) historical and contemporary observations and perceptions of conditions and change in the health of the aquatic environment (e.g., water quality, quantity, flow, groundwater, permafrost conditions);
2) historical and contemporary observations and perceptions of conditions and change in fish species (population, movements, diversity, invasive species) and other aquatic species (e.g., geese, beaver);
3) sustainability of fishing livelihoods (e.g., harvesting levels and practices, diet, health, access issues, perceptions of change in the health of valued fish species); and,
4) implications of change for governance (e.g., how to maintain healthy relationships to the aquatic ecosystem, maintaining respectful and spiritual relationships, respecting treaty rights);

This project was developed in collaboration with the Traditional Knowledge Committee of the Mackenzie River Basin Board project developed in recognition that river systems are important social, economic, cultural and ecological places that contribute significantly to the well-being of many communities. Many river users have been observing and experiencing what is going on in the same places, in the same way, using the same signs/signals for many generations. Such tracking of change, has been more than a technical process; people watch, listen, learn and communicate about change because they care about the health of the land and the health of their communities. Many residents are increasingly concerned about the stresses being created by petroleum resource development, mining, hydro-electric development as well as climate change. How can local and traditional knowledge generated over many generations help ensure the continued health and sustainability of the Mackenzie River Basin?

The Aboriginal organizations, government and co-management boards involved in the project have each submitted research proposals to "Tracking Change..." that address the following:

What are the patterns of variability and change in fishing livelihoods being documented and experienced in the Mackenzie-Mekong-Amazon? What kinds of variability and change are being observed in the health, location, diversity, distribution of fish species valued for subsistence in each? What kind of social networks exist for sharing knowledge related to the condition of the fisheries? How have/are fishing practices and outcomes changing in response to these ecological shifts (e.g., changes in practices, harvest, food sharing patterns, food security)? How are/can communities work together (upstream/downstream) to deal with these social- ecological changes in ways that ensure the continued sustainability fishing livelihoods? How are fishing livelihoods interconnected at different scales (local, regional, global)? How are fishing livelihoods sustainable in the face of emergent stresses of resource development and climate change?

The Aboriginal organizations are collectively leading research activities in their own communities and regions with support from academic team members. They will use a combination of semi-structured interviews and participatory mapping to answer these broad thematic questions on change in water quality, water levels, flow, fish population dynamics, diversity and condition as well as implication of such ecological change on the livelihood of communities. The outcomes of the research activities will be shared and synthesized at the end of the study respecting their choices on consent forms (i.e., some don't want their names used in reports etc.). Community and regional government consent is assumed to be given by virtue of their submission of their individual proposals. Only knowledge shared by the Aboriginal organizations through a reporting process will be used by academic team members in publications, graduate student theses etc.

The project is a collaboration of multiple Aboriginal organizations, governments and co-management boards who are guiding the project under the governance of the Mackenzie River Basin Board Traditional Knowledge Steering Committee. The collaboration will create opportunities for funding small community-based research projects that involve youth, elders and active harvesters as participants and community researchers. The ultimate aim is to building capacity among the Aboriginal organizations in all of the regions of the Mackenzie River Basin to document their own knowledge regarding the sustainability of the aquatic ecosystem (water, fish) and share that knowledge with others upstream and downstream so as to gain a more holistic understanding of social and ecological changes occurring in this important freshwater ecosystem.

The Aboriginal organizations, governments and co-management boards, leading the community projects will develop their own reports with the support of graduate students who are participating upon invitation of these organizations. These reports will be made public unless otherwise indicated by the Aboriginal organizations.

The fieldwork for this study will be conducted from August 24, 2017 to December 31, 2017.

Sincerely,

*** original signed ***

Jonathon Michel,
Manager, Scientific Services

DISTRIBUTION
Aklavik Hunters and Trappers Committee
Denendeh Resource Committee
Deninu K'ue First Nation Environment and Conservation Committee
Fort Providence Resource Management Board
Gwich'in Renewable Resources Board
Inuvik Hunters and Trappers Committee
Ka'a'gee Tu Hunters and Trappers Association
Lutsel K'e Dene First Nation - Wildlife, Land and Environment Committee
Sahtu Renewable Resources Board
Tlicho Government
Wek'èezhìi Renewable Resources Board

7.3 Letter of Invitation

P.O Box 163
Deline, NT X0E 0G0
Tel: (867)589-8112 Fax: (867) 589-8101
E-mail: drrc_manager@gov.deline.ca

Ɂekw'ahtı̨dǝ̀ Raymond Tutcho
Délı̨nę Got'ı̨nę Government

Dolphus Tutcho, Chair
Tsá Túé International Biosphere Reserve Stewardship Council

Hand delivered

RE: Introduction to *Tracking Change: Local and Traditional Knowledge in Watershed Governance* research project

Dear Ɂekw'ahtı̨dǝ̀ Tutcho and Dolphus Tutcho:

The Délı̨nę Ɂehdzo would like to invite the Délı̨nę Got'ı̨nę Government and Tsá Túé International Biosphere Reserve Stewardship Council to send two representatives to a focus group to discuss objectives and design for a survey in partnership with University of Alberta's cross-regional program called *Tracking Change: Local and Traditional Knowledge in Watershed Governance* (www.trackingchange.ca). The focus group will take place at **9 am-5 pm on Wednesday, June 7 at the Délı̨nę Knowledge Centre Boardroom.** Mandy Bayha and I will be working with Master's student Chelsea Martin to design and conduct the research during her stay here, June 1-29. Chelsea and I have also offered to present about the project to the upcoming meeting of the Délı̨nę K'aowǝdo Kǝ́ on Friday.

The working title of Chelsea's project is *The Importance of Fishing during Times of Change in the Sahtú Region.* This project was inspired by the 2016 cross cultural research camp at Ɂǫk'aıbǝ as well as follow up interviews with community members regarding changes in the area. The four main questions guiding the research are: 1) What are the changes? 2) Where are the changes; 3) How do these changes affect you? and most importantly 4) How are people coping?

This project supports maintaining a strong fishing livelihood in Délı̨nę, which is a key component of the *Belare Wíle Gots'ę́ Ɂekwę́* plan. It is consistent with research priorities identified in the Tsá Túé International Biosphere Reserve Research and Monitoring Plan. The research also builds on other ongoing projects sponsored by the Délı̨nę Ɂehdzo Got'ı̨nę: the Human Biomonitoring study with University of Waterloo; the long term Great Bear Lake Fisheries program with Fisheries and Oceans Canada; and the Food Security project with Wilfrid Laurier University.

Together with results of surveys from the 12-15 other communities participating in the *Tracking Change* program, it is our hope that the results of the Délı̨nę survey will be important in documenting dene climate adaptations as well as address gaps in the literature on Indigenous knowledge and the sustainability of fishing livelihoods.

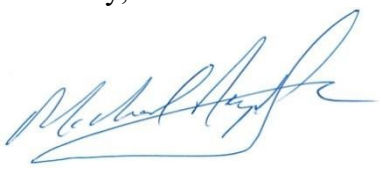
The steps in the research project will be as follows: 1) a focus group of leaders and knowledge holders to discuss research approach and design (Wednesday June 7); 2) a general

survey that covers various topics such as fish catching, sharing, trading and storage; 3) semi-structured interviews(Fish changes, health, responses to change) ; 4) validation of research results (tentatively October November); 5) publication of a Master's thesis and associated journal articles, co-authored with my community research collaborators.

Non-salaried focus group participants will be offered $200 honorarium for the full day. For every participant who completes a survey the minimum amount of a $50 gift card will be awarded to them for their time, with additional award value for longer semi-structured interviews.

I look forward to working together as well as any and all feedback that you may have regarding this project.

Sincerely,



Michael Neyelle
Secretary-Treasurer

7.4 Poster

HEY YOU –YEAH YOU!!

Do you actively fish or participate in fishing activities?

Do you notice significant changes in the Great Bear Lake area?

Do you want your observations and concerns to be heard?

My name is Chelsea Martin and I am a student from the University of Alberta. I am looking for volunteers (**ages 18+**) to take part in a study that involves fishing and climate change.

As a participant in this study, you would be asked participate in a **short or long** interview regarding fishing and climate change. The short will take approximately 45 - *60* minutes to complete. The longer interview **COULD** be an additional 60 – 90 minutes.

In appreciation for your time, short interview participants will receive $**50 Co-op gift card**. Volunteers who complete the longer interview will be compensated based on time.

For more information about this study, or to volunteer for this study, please contact:

Chelsea Martin at (780) 298 7969 ***OR***

Mandy Bayha at (867) 447 2285 **OR**

Michael Neyelle

7.5 Interview Guide

Fishing Biographies

- Can you tell me more about your history in this area?
- How long have you lived in Deline? In what ways are the lake/river and fishing important to you and your family?
- Do you fish? If so, how long have you been fishing for?
- Who taught you how to fish?
- Do you have children? How do you share your knowledge with them? (or others if no children?)
- What season do you fish the most in?
- How do you respect the fish?
- Can you use any parts of the fish for traditional medicine purposes?
- Have you always used the same size of net? If not – how has it changed?
- For a single trip - How long do you usually go fishing for?
- Other than a net or rod – what other type of fishing gear do you use?

Historical Changes in Fish Populations

- Has fishing always been important within your community? Why or why not?
- Do you remember a time where people couldn't fish? Do you remember why?
- Have you always depended on fish no matter what time of the year?
- Seasonally - are there times in a year where fishing is more difficult? Why?
- What encourages/motivates you to keep fishing?
- Does anything/anyone discourage you from going out and fishing?
- What would it mean to you if you could not fish?

Fish Health Indicators

- What tells you the fish is healthy? What indicates a healthy fish?
- What indicates a healthy fish population?
- What indicates that a certain area is good for fishing?

Rules for Respecting Fish and Fishing Areas

- What are the ways people should be taking care of the land to ensure fish are healthy now and in the future?
- Are there specific local or traditional rules about when, where and how to fish?
- Are there traditional rules about how to store or keep fish?
- Are there traditional rules related to sharing fish in the community or outside of the community?

Climate Change

- What do you think of when I say 'Climate Change' - How do you culturally define climate change? What does climate change mean to you?
- How much do you know about Climate Change?
- Where do you get most of your information on Climate Change?
- Do you think you are contributing to Climate Change? In what ways?

- Do you believe in climate change? Why or why not?
- Do you think that climate change is altering your role within the community? (As a man, women, youth?)

Responses to Change

- Are you worried about these changes? Why?
- How do these changes make you feel?
- How do they impact you & your future?
- What do these changes mean for you? Your family? Your community?
- What do you think can be done to address these changes?
- Have these changes made it harder/easier to go out on the land/fish/hunt, etc.?
- Do you have to change the way you do things when you go fishing? What do you have to specifically change?
- Has the community made any changes to help adapt? What are they?
- Have these changes been hard or easy?
- Do these environmental changes impact some people in your community differently than others?
- Are there any new barriers to fishing? – such as new local or government rules?
- Do you work with anyone to address these changes (i.e., universities, governments, foundations, NGOs etc.)
- Who would you like to work with?
- What would you like to see happen in the future? (policy wise, interventions, support networks, etc)
- How would you like things to be for your children and grandchildren?
- Is there anything else you would like to say before we end this interview?

Age: _____
Male ____ Female _____ Other _____

Name (if consent has been provided)
Last Name _____First Name _____
Middle Initial _____

7.6 Participant Information Document

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PARTICIPANT INFORMATION SHEET

THE IMPORTANCE OF FISHING DURING TIMES OF CHANGE IN THE SAHTÚ REGION

Research Lead / Organization

Chelsea Martin, Master's student, University of Alberta
Michael Neyelle and Mandy Bayha, community researchers

Principal Investigator

Dr. Brenda Parlee, Canada Research Chair
University of Alberta

Why am I being asked to take part in this research study?

You are being asked to participate in this study because you are considered to be knowledge about the importance of and changes occurring in Déljne of the Mackenzie River Basin. We are interested in interviewing you about your knowledge, observations and experiences related to four key questions: 1) What are the changes? 2) Where are the changes; 3) How do these changes affect you? and most importantly 4) How are people coping?

Before you make a decision, a researcher will go over this form with you. You are encouraged to ask questions if you feel anything needs to be made clearer. You will be given a copy of this form for your records.

Why is this research being done?

Many communities in the Mackenzie River Basin are experiencing changes in the environment and their communities. A major concern expressed by many Indigenous organizations is about the sustainability of water, fish and fishing livelihoods. Dr. Brenda Parlee is working with researchers from the University of Alberta and other universities in Canada and internationally to help document the importance of water, fish and fishing livelihoods and any changes that people have seen in their lifetimes. There are 12-15 projects this year in which communities are going to be asking similar kinds of questions about the water, fish and fishing livelihoods. The study is funded by the University of Alberta through the *Social Sciences and Humanities Research Council.* Together we will be able to link our stories together to get a much better understanding of how the Mackenzie River Basin as a whole is changing.

What will I be asked to do?

You will be asked to participate in an interview lasting approximately one and half-hours. However this depends on participation in the short or long interview. We would like to audio record the interview and ask you to record information on maps if possible. This interview will focus on your observations and experiences of areas that are important to you and/or changes in Déljne and Great Bear Lake.

What will you need to do?

You will converse with an interviewer and you are free to tell him/her anything that you think is relevant to the study. You will also have an opportunity to provide feedback on materials prepared based on the results of the research.

What are the benefits to me?

As a participant in the study, you will have an opportunity to help shape policy related to climate change and fishing livelihoods, and to learn from the results of the study both at the community level and arising from the broader national and international study. You will receive a Co-op gift card honorarium and that will be based on time. Other benefits of this project include documenting local dene perspectives about climate related changes as well as identity and focus on theories of Indigenous climate change. Lastly, this project will address gaps in the literature on Indigenous knowledge and the sustainability of fishing livelihoods.

Do I have to take part in the study?

You do not have to participate in the study, and you can stop the interview anytime.

What will happen to the information?

- The stories that you share including any mapped, audio and video recordings will be held by researcher **Chelsea Martin.** Another copy will be held at the University of Alberta for a minimum of 10 years. These transcripts will not be used for any other purpose. The community and partnering organizations will also receive a copy.
- We would like to acknowledge you by name in these reports. If you do not wish your name to be included, we will give you a anonymous identity (e.g., A1).
- You will receive a copy of the transcript of your interview after the interview is completed.
- You, the Délįnę ʔehdzo Got'įnę and the Délįnę Got'įnę Government will have a chance to review any documents or publications that result from this study.
- If you decide to withdraw or edit your contribution, you will have 30 days to do so; after that 30 day period, however, we may not be able to remove information from reports etc. if it has already become public.
- A summary from the project will be developed and shared with other communities in the Mackenzie River Basin so they can learn more from you about changes you are experiencing; you will receive summary reports from the other regions as well. The lead organization will not include information in the summary reports that it considers confidential or information you do not wish to be shared publically.
- In addition to the summary reports from your region, Chelsea Martin will work with other organizations and universities to create academic outcome as well as a book and video documentary that shows how changes occurring in your region are the same or different from other areas.

What if I have questions?

If you have any questions about the research now or later, please contact Chelsea Martin @ 780 298 7969. OR

Research Lead / Organization

Michael Neyelle or Ed Reeves
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Principal Investigator

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The plan for this study has been reviewed for its adherence to ethical guidelines by a Research Ethics Board at the University of Alberta. For questions regarding participant rights and ethical conduct of research, contact the Research Ethics Office at (780) 492-2615.