Respecting ontology: Documenting Inuit knowledge of coastal oceanography in Nunatsiavut

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Abstract

Climate change is having profound effects in the Arctic environment and ocean (i.e. changing sea ice thickness and timing, increasing water temperatures, changing species distributions), effects which are increasingly impacting Arctic and sub-Arctic communities. This is evident in Nunatsiavut, where focusing on oceanographic variables may be used in support of decision making and planning for future change. The Labrador Inuit Land Claims Agreement, which led to the creation of Nunatsiavut, has provisions to include Inuit knowledge in decision making, and new waves of marine research are looking to engage it alongside western science. Currently, oceanographic data derived from Inuit knowledge in Nunatsiavut is limited. Using Inuit knowledge is challenging because methods of knowledge documentation and mobilization are largely shaped by western scientific paradigms, generating ontological tensions manifested through differences in perceptions of environment and/or knowledge communication and representation. When recording Labrador Inuit knowledge of oceanographic features, this research explores the question: what practices of documentation can be used to facilitate knowledge mobilization that respects the original ontological context? Through participatory mapping and semi-structured interviews in Rigolet and Hopedale, this question is addressed through two parallel approaches. First, through documenting Labrador Inuit knowledge of oceanographic features, this work identifies oceanographic trends and changes that Nunatsiavut communities are experiencing. Second, this research offers a case study to identify practices that marine researchers can incorporate when documenting Labrador Inuit ocean-knowledge. This work proposes a series of considerations including place names, narratives, seasonality, mobility, and relationality which can be represented in or attached to data derived from Inuit knowledge so as to respect the original ontological context.

Keywords: Inuit knowledge; Nunatsiavut; coastal oceanography; participatory mapping methodology; sea ice; ocean currents; Indigenous mapping; knowledge systems

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Chapter 1: Introduction

Temperatures in Arctic and sub-Arctic regions are warming at a rate two times faster than the rest of the world (Bush & Lemmen, 2019), a phenomenon known as polar amplification (Bekryaev et al., 2010) which is impacting both the atmosphere and environment (i.e. shifting weather patterns, changing sea ice thickness and seasonality, changing species distributions). Such climatic and environmental changes are having profound effects on northern communities, impacting the livelihood and wellbeing of local residents. Existing structures governing northern areas emerged under colonial regimes, often resulting in the exclusion of Indigenous peoples from decision-making processes (Truth and Reconciliation Commission of Canada, 2015). However, recent decades have seen the creation of modern land claims agreements which formalize Indigenous involvement in decision making. This is further supported by the Universal Declaration of the Rights of Indigenous Peoples (UNDRIP), to which Canada is a signatory. These factors, in conjunction with an evolving political climate, are leading to a transition from historic top-down (colonial) management approaches towards models of co-management, or co-governance. In this changing context, while scientific evidence still supports environmental decision making, there are structures that aim to better incorporate local expertise of citizens, rights holders, and stakeholders (Juntti et al., 2009; Armitage et al., 2011). This is especially relevant when seeking to understand and respond to wicked problems such as climate change. This process can be both implemented and reinforced through research that includes a variety of knowledge sources, or through co-governance arrangements which bring a diversity of voices to the decision-making table. Within these frameworks, utilizing local knowledge alongside scientific knowledge has the potential to bring a more holistic understanding into decision making.

Throughout Inuit Nunangat (Figure 1) – the Inuit regions of Canada – models of community-based research and management have emerged as a means of advancing Inuit rights while attempting to address issues such as climate change. The focus on equitable engagement of Inuit knowledge in Canada’s North may be attributed in part to international and national recognition of Indigenous rights, stemming from articles within UNDRIP (UN General Assembly, 2008), the United Nations *Agenda 21* and provisions set out in modern land claims agreements in Canada. Under some land claim agreements, co-management arrangements have been formally established and stipulations mandate the inclusion of Inuit knowledge in decision making (i.e. Labrador Inuit Land Claims Agreement [LILCA], 2005; Nunavut Land Claims Agreement, 1993). This political, social and environmental context have prompted rights holders, researchers, and managers to move towards models of management that engage multiple knowledge systems in order to widen the depth and breadth of potential solutions and adaptation strategies that may be forwarded (Oceans North, n.d.; Berkes, Colding & Folke, 2000; Johnson et al., 2016).

Figure 1 Map of Inuit Nunangat, identifying settlement areas and community locations (ITK, n.d.).

Bridging knowledge systems in research can be an effective path to creating equitable adaptation and management strategies, and large-scale marine planning initiatives are being guided by such a premise (*i.e. Tallurutiup Imanga National Marine Conservation Area; Beaufort Sea Large Ocean Management Area; Marine Plan Partnership for the North Pacific Coast).* In bridging knowledge systems, potential synergies can be captured through identifying complementary knowledge, skills and capabilities that otherwise may not be applied under one knowledge system alone (Berkes & Armitage, 2010). Doing so can expand the breadth of potential information available to develop strategies and achieve solutions relevant to managers, scientists, and Indigenous peoples. However, in practice there may be disparities insofar as how to support the convergence of multiple knowledge systems in marine research and policy development, as ontological tensions and the inequitable distribution of power can pose barriers.

Throughout Inuit Nunangat, researcher engagement with Inuit communities and local knowledge has been steeped in colonial legacies and power imbalances, resulting in the disempowerment and at times "dehumanization" of Inuit (Inuit Tapiriit Kanatami [ITK], 2018). At times, science has acted as 'boundary work', in which practices of distinguishing between science and other ways of understanding the world serve to assert the authority of scientific accounts, while undermining alternate ontological views (Bocking, 2011). The translation of such research into management decisions has at times served to justify policy restricting access to marine space and resources (Bennett et al., 2018). Although significant progress has been made towards equitably incorporating Inuit knowledge[1] into marine research and policy, many challenges still prevail. One such challenge revolves around how to effectively mobilize Inuit knowledge into marine research and governance frameworks, a question that is also being encountered across Canada and internationally (Weiss, Hamann & Marsh, 2013; Rathwell, Armitage & Berkes, 2015; Ban, Eckert, McGreer, & Frid 2017; Mantyka-Pringle et al., 2017; Raymond-Yakoubian & Daniel, 2018).

The discourse around Indigenous knowledge and western science has been framed in many different ways, from polarizing and at times incompatible to complimentary, supporting, or validating worldviews. Despite different ontological origins, the contemporary context of a globalized society makes it evident that worldviews have influenced one another over time (Agrawal, 1995). Simultaneously, distinct boundaries have been drawn between western science

[1] While specific cultural knowledge and terminology of Inuit cultural areas may vary (Tagalik, 2010), this research will use the term Inuit knowledge to express the historic and evolving body of Labrador Inuit cultural knowledge. Inuit knowledge may be defined as "a systematic way of thinking applied to phenomena across biological, physical, cultural and spiritual systems. It includes insights based on evidence acquired through direct and long-term experiences and extensive and multigenerational observations, lessons and skills. It has developed over millennia and is still developing in a living process, including knowledge acquired today and in the future, and it is passed on from generation to generation" (Inuit Circumpolar Council, n.d).

and Indigenous knowledge, fueled by the distribution of power and used to support varied political agendas (Berkes, 2018). While ontological differences provide distinctions between Inuit knowledge and western science, and boundaries are being negotiated both politically and philosophically, Indigenous knowledge holders have become the subject of ongoing research that has at times engaged with the knowledge and not the people who own and live that knowledge (Simpson, 2004). This trend is being challenged by new waves of ethical research engagement practices, many of which are permeating the way research in Canada is being done (i.e. Brunger, Schiff, Morton-Ninomiya, & Bull, 2014; Bull & Hudson, 2019). This is helping to refocus research to benefit knowledge holder and community needs. In the context of marine research occurring throughout Inuit Nunangat, this is particularly important given the environmental changes communities are experiencing, and the need to develop community-focused adaptive management agendas.

1.1 Management problem

In the Inuit region of Nunatsiavut, the LILCA incorporated provisions for the inclusion of Inuit knowledge in decision making. A number of co-management boards were established, in addition to the LILCA setting opportunities for the Nunatsiavut government to lead protected areas planning. Such structures provide an opportunity to create formal venues to bridge knowledge systems through collaborative management of natural resources. In realizing the LILCA both through the legal structure and the spirit and intent, there are opportunities and an overall impetus to mobilize Labrador Inuit knowledge into marine governance in Nunatsiavut (Snook, Cunsolo & Morris, 2018).

Although the LILCA indicates that Inuit knowledge should be included in decision making, the actual processes of knowledge mobilization are less clear. This is particularly the case when the institutions through which marine governance occurs are structured according to western ontologies, and practices of research and management favour western paradigms (as cited in Rathwell et al., 2015; Boudreau & Fanning, 2016). Challenges exist in converting an ontologically different knowledge system into datasets that can function cohesively in management guided primarily by western paradigms. Inuit knowledge is a holistic knowledge system which tends to favour oral tradition. Such characteristics do not readily fit into representation parameters favoured by western research standards (i.e. written expressions of ‘data’ or metadata) (Church et al., 2017). As such, processes of converting Inuit knowledge to data are at risk of omitting or excluding important contextual details which are integral components of Inuit ontology. These challenges are amplified when individuals or institutions that determine research and management agendas are guided by western paradigms. However, there are opportunities to address these challenges through marine management initiatives such as the Imappivut Marine Plan – a management plan driven by Labrador Inuit priorities, informed by local knowledge and scientific data (Imappivut Nunatsiavut Marine Plan [Imappivut], 2018). Given that Imappivut is in early stages of initiation and data collection, and the emphasis on Inuit values and knowledge, an opportunity exists to structure supporting research and future management to incorporate Inuit ontology.

Existing work has documented Inuit values and knowledge through land use and occupancy research throughout northern Labrador from around Lake Melville to as far north as Killinek (northernmost point of Labrador) (Brice-Bennet & LIA, 1977). However, limited focus has been placed on recording Inuit knowledge of oceanographic features, aside from some aspects of sea ice, resulting in a data deficiency in this regard. While Inuit knowledge and values can be documented qualitatively and accounted for (to a degree) in marine planning, the methods of incorporating Inuit ontology into oceanographic data have been less explored. In this context, processes of cartographically representing Inuit knowledge as data will be explored through a case study documenting knowledge of oceanographic features in the communities of Rigolet and Hopedale in Nunatsiavut. Recording community-based observations of coastal oceanographic features can contribute to an area with little data and help inform future marine management and climate change adaptation planning under the Nunatsiavut Government and the Imappivut Marine Plan.

1.1.1 Research aim and objectives

In the context of this case study recording Labrador Inuit knowledge of oceanographic features, this research seeks to explore the following question: what practices of documentation can be used to facilitate knowledge mobilization that respects the original ontological context? This question will be explored through two parallel approaches. First, through documenting Labrador Inuit knowledge of oceanographic features, the intention of this work is to identify and describe oceanographic features and related trends/changes that are important for and/or of concern to Nunatsiavut communities. Second, through analysing the methodology employed in this research, documentation of such knowledge provides a case study to identify practices to incorporate when documenting Labrador Inuit ocean knowledge. Practices identified by this research can be integrated into future research and policy development in Nunatsiavut.

Chapter 2: Context

Prior to introducing the methodology used in this research, a more detailed description of the context behind the development of the project will be explained. This chapter will introduce the oceanographic context that helped shape the project, as well as the ontological context, which forms the basis of the conceptual framework used throughout this research.

2.1 Oceanographic context for Nunatsiavut

Throughout the North, rapid and pronounced environmental changes are occurring (Lemmen, 2008). Such changes are evident in the region of Nunatsiavut, where the effects of climate change are influencing community livelihoods, subsistence activities, food security, physical and mental health (Cunsolo Willox et al., 2012; Ford et al, 2012). Simultaneously, as sea ice cover decreases and weather patterns shift, increased offshore marine activity is occurring in the Northwest Atlantic, which acts as a primary shipping corridor for accessing Arctic waters. As sea ice declines and the Northwest Passage is expected to open up, increased shipping is anticipated along the Nunatsiavut coast, making it increasingly important to document oceanographic variables (Bell, Briggs, Bachmayer & Li, 2014). Given the importance of the Northwest Atlantic for marine activity, there has been a push for more detailed documentation of the marine environment (Ocean Frontier Institute [OFI], 2019). The scope of observations for this area are often oriented in relation to concentrated marine activities such as shipping – at times covering a larger geographic area to account for the environment that ships must traverse. For example, while coastal sea ice trends are well documented in areas of concentrated marine activity (Government of Canada, 2019a), these are often documented at a regional scale (i.e. Statistics Canada, 2011), accounting for the entire Labrador coast and much of the offshore waters as well (Figure 2). While this scale is relevant for marine activities such as shipping, it does not effectively capture the intricacies of fjords, bays and islands in coastal Nunatsiavut with which Labrador Inuit regularly interact.

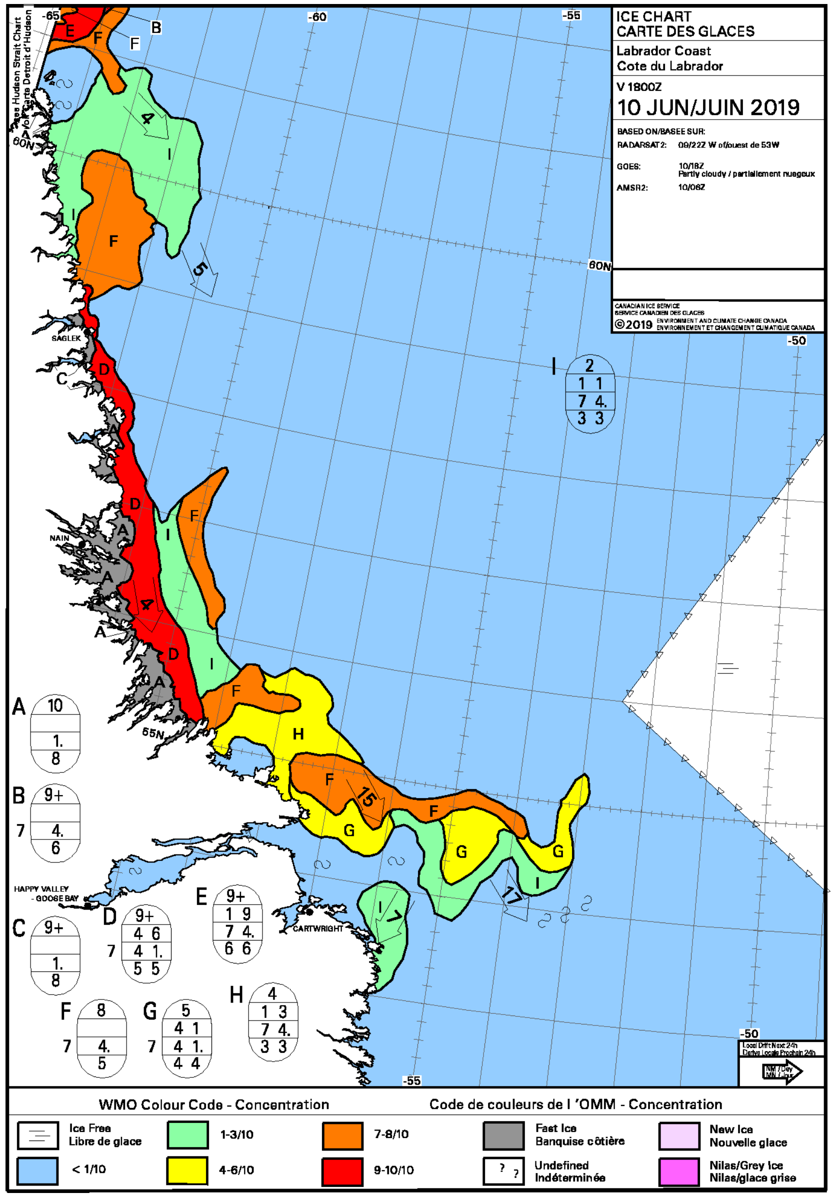

Figure 2 Daily Ice Chart - Concentration for the Labrador Coast: June 10, 2019 (Government of Canada, 2019).

While the presence of sea ice can act as a barrier to vessel activity in the Northwest Atlantic, to Labrador Inuit sea ice is an integral oceanographic feature that local livelihoods depend on (Brice-Bennet & LIA, 1977; Cunsolo Willox et al., 2013). Further, ocean currents are responsible, in part, for the distribution of sea ice, ocean temperature and salinity, primary productivity, and fisheries, in addition to other important physical environmental variables. Inuit communities in Nunatsiavut depend on predictable sea ice conditions for travel and to successfully hunt and fish for sustenance and to support of local livelihoods (Cunsolo Willox et al., 2012; Ford et al., 2012). Therefore, understanding and documenting the locations of oceanographic features in coastal Nunatsiavut (and how they may be changing), is critical for understanding implications for Inuit travel routes and harvesting and fishing practices.

While scientific observations provide one source of data to help understand oceanographic features around Nunatsiavut, Inuit knowledge offers another means of understanding such features. Using Inuit knowledge as a source of oceanographic data has the potential to generate data for decision making that reflects local observations and knowledge. As previously discussed, including Inuit values and knowledge in decision making is paramount for the Nunatsiavut Government. Given the limited scope of oceanographic data derived from Inuit knowledge in Nunatsiavut, this research is situated as a means of gathering data at a scale relevant to communities, while simultaneously seeking to explore methods of knowledge documentation that will support future research that prioritizes community needs and values. Prior to exploring the challenges associated with mobilizing Inuit knowledge into marine research and management, a brief overview will be given outlining the legal impetus to incorporate Inuit knowledge Nunatsiavut decision-making as outlined under the LILCA.

2.3 Inuit knowledge in Nunatsiavut decision making

2.3.1 Inuit knowledge and the Labrador Inuit Land Claims Agreement

The self-governing Inuit settlement region of Nunatsiavut was created in 2005 under the LILCA (Nunatsiavut Government, n.d.). The area was created as a result of nearly three decades of negotiation and advocacy for rights to the "land and sea ice in Northern Labrador" (Indigenous Peoples Atlas of Canada, n.d.), alluding to the inextricable link between Labrador Inuit and the coastal environment. The settlement area includes 72,520 km^2 of terrestrial lands and waters, and 48,690 km^2 of tidal waters (Figure 3; INAC, 2005) formerly under the jurisdiction of the Newfoundland and Labrador provincial government. In addition to including provisions of self-government and territorial delimitation, the LILCA also establishes the importance of Inuit culture and knowledge in governance. In Nunatsiavut (and throughout Inuit Nunangat), Inuit knowledge is tied deeply to cultural identity. Recognizing the distinct ties between knowledge and culture, the LILCA has provisions supporting the inclusion of Labrador Inuit knowledge in resource and territorial governance. The following section will summarize such provisions as outlined in the LILCA.

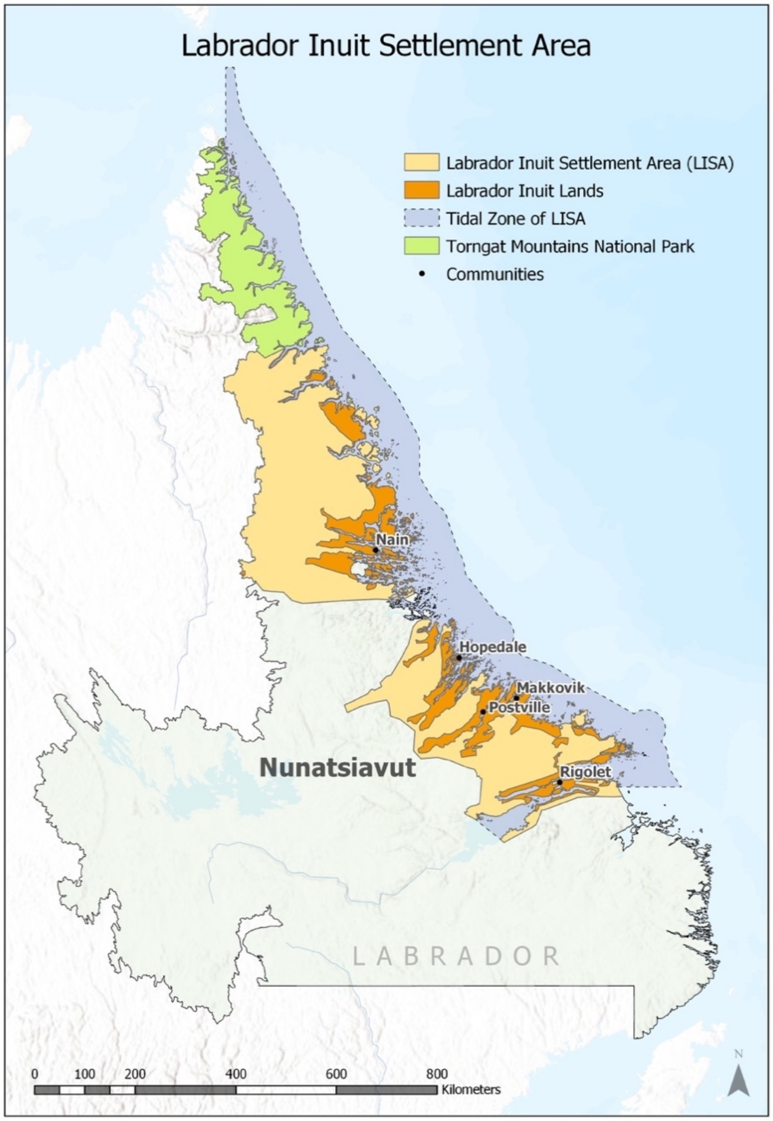

Figure 3 Map depicting the Labrador Inuit Settlement Area, including 48,690 km² of tidal waters.

The LILCA established the Nunatsiavut Government and confirmed its ability to pass laws pertaining to education, health, cultural affairs (Heritage Newfoundland & Labrador, 2008), language, justice, and community matters (Indigenous Peoples Atlas of Canada, n.d.). This is exemplified through Parts 12.7 (h) and 17.8 (c), referring to the powers of the Nunatsiavut Government in relation to Culture and Language, stating that laws may be made to preserve, promote and develop Inuit traditional knowledge (INAC, 2005). Additionally, section 2.4.27 of the *Nunatsiavut Constitution Act* outlines the Labrador Inuit Charter of Rights and Responsibilities regarding Language and Culture, including the responsibility (b) “to respect, preserve and advance the Labrador Inuit Culture” and (c) “share Labrador Inuit stories, knowledge, customs and traditions with other Inuit, particularly with younger generations" (Nunatsiavut Constitution Act, 2005). While specific to sharing knowledge with other Inuit, this responsibility alludes to the importance of Inuit knowledge as a venue for strengthening and reinforcing cultural identity. If done respectfully, marine research documenting Inuit knowledge has the potential to contribute to knowledge sharing in communities; however, methods of documentation will impact the degree to which this occurs. Further outlined in the LILCA are multiple references to the consideration and inclusion of Inuit knowledge in marine and natural resource management. This promotes documenting Inuit knowledge and applying it alongside other data and knowledge sources for things such as environmental assessments or for determining harvest quotas (*see LILCA; parts 8.7, 12.4, 12.7, 12.9, & 13.6*).

In the context of this research, documenting Inuit knowledge of oceanographic features can support knowledge preservation and sharing within communities, while simultaneously identifying community relevant oceanographic features and related trends or changes that may be occurring. These observations can help with planning for future change in coastal Nunatsiavut, while adhering to stipulations outlined in the LILCA. Further, documenting such knowledge can also support processes of knowledge transfer within communities, particularly through building intergenerational knowledge transfer into research methodology (see Chapter 3 methodology for further details on this process). It has been observed across Inuit Nunangat that there is an apparent generational gap, whereby younger generations may not be receiving the same degree of knowledge that older generations had received, which is influenced by changing lifestyles including but not limited to less time spent on the land, or less reliance on the land (Laidler et al., 2009; Heyes, 2011). In acknowledging this, it becomes even more important to build knowledge transfer mechanisms into research documenting Labrador Inuit knowledge.

While research recording Inuit knowledge strengthens cultural preservation and promotion, and supports Inuit resource and territorial rights, making it available to a wider audience puts the knowledge at risk of being decontextualized, misinterpreted or used as a form of cultural appropriation (Tesar, Dahl & Aporta, 2019). To help avoid these risks, co-management arrangements exist such as the Torngat Joint Fisheries Board which has representatives from Nunatsiavut, Provincial and Federal governments (Torngat Wildlife Plants & Fisheries Secretariat [Torngat Secretariat], n.d.). This structure supports bringing together different ways of knowing (Berkes, 2009) and ensures that the voice of Labrador Inuit remain at the forefront in decision making around marine initiatives such as fisheries management or protected area planning. Although risk of decontextualization still exists when Inuit knowledge is made available to a wider audience, having co-management structures in place can help to minimize such decontextualization in a management context.

2.3.2. Imappivut Marine Plan

One example that aims to support Inuit rights and values in marine management is the Imappivut Marine Plan. Imappivut translates as “our oceans”, and the Imappivut Marine Plan is being designed to recognize the connection, knowledge and rights that Labrador Inuit have to their ocean (Imappivut, 2018). Imappivut intends to fully implement Chapter 6 (Ocean Management) of the LILCA, incorporating the entire 48,690 km^2 of tidal waters into a marine plan governed by the Nunatsiavut Government. Additionally, in partnership with the Federal government, the intent is to extend a co-management area outward to incorporate the 200-mile Exclusive Economic Zone (EEZ) of Canada (Imappivut, 2018). Management of this area will include establishing marine protected areas in contribution to Canada’s biodiversity targets. Within protected area planning under Imappivut, a biophysical, ecological and cultural overview of the area is underway (conducted by Fisheries and Oceans Canada [DFO] Science) in order to help the Nunatsiavut Government and DFO Ecosystems Management Branch identify and refine conservation objectives (DFO, 2018). Importantly, Imappivut and any protected areas therein will be guided by community knowledge and input to identify areas of ecological, social, cultural and economic importance. Through this structure, the intention is to develop a marine plan that effectively represents Labrador Inuit (Imappivut, 2018). Designed by and for Labrador Inuit, it will be implemented in partnership with the Canadian government through engaging both Inuit and scientific knowledge – forwarding plans and policies that support community-identified priorities. While co-management initiatives such as Imappivut provide a venue to bridge knowledge systems, ontological tensions can still arise (Aporta, Bishop, Choi & Wang, *in press)*.

2.4 Ontological context

The previous sections have outlined the importance of including data derived from Inuit knowledge alongside western scientific data to help strengthen marine management in Nunatsiavut. There is an ethical impetus to move away from historic research and management practices that at times served to exclude, co-opt or misappropriate Inuit knowledge (ITK, 2018). Further, legal instruments (i.e. *Nunatsiavut Constitution Act; LILCA*) support the equitable consideration and inclusion of Inuit knowledge (or data derived thereof) in Nunatsiavut marine management. However, when seeking to engage multiple knowledge systems ontological tensions can emerge. While at times unnoticed, these tensions are manifested, for example, in different approaches to communicating knowledge (i.e. oral vs written), management, decision making, or negotiation practices (Aporta et al., *in press*). Such tensions can also arise from differing conceptualizations of the environment. For example, western ontology often frames the environment as a provider of services; something to be conserved, protected, or exploited. Alternatively, Inuit ontology frames the environment as a social space, homeland and place of cultural and historical significance (Aporta, 2009). Inherently, the formal structures used to 'manage' the marine environment (at least in a contemporary sense[2]) stem from western paradigms which require Inuit values to be imported into western ontological frameworks. While co-governance arrangements or Indigenous Protected Areas (IPAs) can help mitigate some ontological tensions that occur, other tensions may arise through the types of data or information that are used to inform marine management and policy development.

Often, marine management favours the application and use of western scientific information or data to inform decision making. Scientific data is mobilized into decision making structures through written or digitized forms, allowing it to be decontextualized from the larger study that generated it so as to support informed decision making amongst a variety of data sources. The emphasis on decontextualization stems from the western scientific approach. Empirically based, 'western science' is guided by scientific theory, which favors a methodological approach focusing on disproving hypotheses or providing supporting evidence via non-contradictory data collected in a neutral and reproducible manner. Data is analyzed from an (ideally) non-biased standpoint and conclusions are drawn, providing the basis for future research (Datta, 2018). Inherent in scientific methodology is the standardization of representation parameters, allowing data to be detached from any original contexts so that it can be tested and re-applied (Bickford, 2017). Written or digitized form takes precedence in western science (in contrast to the oral nature of Inuit knowledge), which allow it to be readily communicated and

[2] While many Indigenous peoples exhibit forms of environmental intervention or 'management' (i.e. controlled burning), the epistemological context driving such interventions is intrinsically unique from those guiding contemporary 'western' management interventions. Brice-Bennet & LIA identified such a discrepancy as perceived by a Labrador Inuk when reflecting on commercial harvesting practices around Hopedale "[they] aim short. They only think about what they're going after, char or salmon and nothing else. But people who live on this coast aim long" (George Flowers, Hopedale; as cited in Brice-Bennet & LIA, 1977).

disseminated within science and management communities (with increasing data and information reaching broader spheres through open data sharing practices). While scientific methodology is relatively structured, the western scientific approach is not static – it has changed substantially over time based on centuries of practice and development.

Validation and verification are key components in western scientific inquiry. As more researchers seek to engage both western science and Indigenous knowledge, it is often done through the lens of validation and verification, whereby western science is used to validate claims of Indigenous knowledge (or vice-versa). Some argue that this is problematic through making evident the primacy of one approach (western science) over another (Indigenous knowledge) (i.e. Bocking, 2011; Manytka-Pringle et al., 2017), while others argue that the validation process is necessary to mobilize Indigenous knowledge into management agendas (Gratani et al., 2011). This act of 'boundary drawing' reflects an assertion of power through creating a hierarchy, which diminishes the perceived value of other cultures 'scientific' traditions (Nader, 1996). Evident in these arguments is the prevalence of western ontology either in research or in management. However, cultural encounters can also challenge these views, particularly as some questions can be answered to a fuller extent with Indigenous knowledge, exposing the limitations of relying on only one form of 'science' (Nader, 1996). Through eliminating a hierarchical understanding and prioritizing cultural encounters, some projects can successfully incorporate both Inuit knowledge and western science in a responsible and respectful way (i.e. Laidler et al., 2009; Bartlett, Marshal & Marshal, 2012; Ban et al., 2017).

While both western science and Inuit knowledge can be empirically driven (Mantyka-Pringle et al., 2017), Inuit knowledge is inherently context dependent, experientially derived and oral in nature. It is grounded in cultural tradition, history, connection to the environment, and a social or relational quality that enables the generation and intergenerational transfer of knowledge. Documenting this way of knowing has evolved from misappropriation (at times) to methods that aim to reconcile, decolonize or indigenize research (Johnson et al., 2016; McGregor, 2018). To understand this change, it is important to look at how Inuit, or Indigenous knowledge more broadly is documented. To start, from a research standpoint Indigenous knowledge is converted to data in order for it to fit within the western scientific research paradigm (and representation parameters). Quite broadly, Indigenous knowledge is often converted to data through qualitative methods such as oral (interview) and spatial (mapping) documentation (Armitage & Kilburn, 2015). While this can allow knowledge holders to convey certain nuances, the degree to which knowledge can be effectively represented as data could be constrained by things such as the research purpose, researcher bias, temporal limitations, and linguistic differences (Aporta et al., *in press*).

Converting Inuit knowledge to data inherently restructures it in form and function. Inuit knowledge, and Indigenous knowledge more broadly, is often characterized as holistic; a body of knowledge and a way of being/knowing that is highly context specific (Assembly of First Nations, 2011; Pongérard, 2017), often having significant cultural and spiritual components. Because it has been developed and passed on for generations, it has been framed as a form of collective cultural heritage (International Institute for Environmental Development [IIED], 2005). When Inuit knowledge is documented through interviews, focus groups or mapping, the transformations that occur as oral narratives become data may impose discrete boundaries that overlook or omit the structural nuances of Inuit knowledge (Bickford, 2017). As an example, while sea ice data may be documented (i.e. average ice edge, ice conditions), the context of that knowledge is inextricably linked to cultural heritage and oral history (Inuksuk, 2011), containing a relational quality as well – all of which do not readily translate into data. In this context, data derived from Inuit knowledge can never be fully representative of the knowledge held by the individual or community, but instead is more of a compartmentalized rendition of experiential knowledge, structured to fit within a specific form of representation (i.e. cartographic data).

Adhering to typical research methodology, non-Inuit researchers may engage Inuit subjects through frames of western scientific understandings. This is a part of a longstanding colonial history of research-Indigenous relations (Smith, 2012; Obed, 2016). In these circumstances, questions guiding Inuit knowledge collection have been determined by the researcher, shaped by their personal priorities and biases, and analyzed from that perspective as well – effectively embedding Inuit knowledge within western knowledge systems (Scassa & Taylor, 2017). Data resulting from this method of documentation and analysis will likely reflect a fraction of what had been expressed by the knowledge holder, resulting in a possible change in form and content while still being labelled as Inuit knowledge. To further explore these challenges, an analysis of Inuit knowledge as it moves throughout a data-information-knowledge model will follow.

2.4.1 Inuit knowledge as data: exploring the data-knowledge-information model

The data-information-knowledge-wisdom hierarchy emerged in information sciences as a way to describe the evolution of knowledge (and wisdom) following structures of scientific inquiry (Figure 4). Based on this model, varying degrees of abstraction and ascribed meaning are attached to each level, with data being described as having the least meaning and lowest degree of abstraction, especially in the absence of a question or query (Hewitt, 2019). To exemplify this, consider the following example for physical oceanography seeking to understand sea surface temperatures (SST). Data would be the specific numerical measurements devoid of context and meaning. Information would be generated through introducing a pattern of organization that ascribes more meaning (Bates, 2006), for example winter SSTs in coastal Labrador (SST season and location). Knowledge would be generated through organizing information and integrating it with other contents of understanding (Bates, 2005). Continuing the oceanographic example, knowledge could be the conclusions drawn from contextualizing SST information – i.e. winter SSTs in coastal Labrador have changed, resulting in changing sea ice conditions. Not all data collected can be turned into information, and likewise for information into knowledge. This 'distillation' process is facilitated through introducing patterns of organization which enable meaning to be ascribed (or inferred) to each level illustrated in Figure 4.

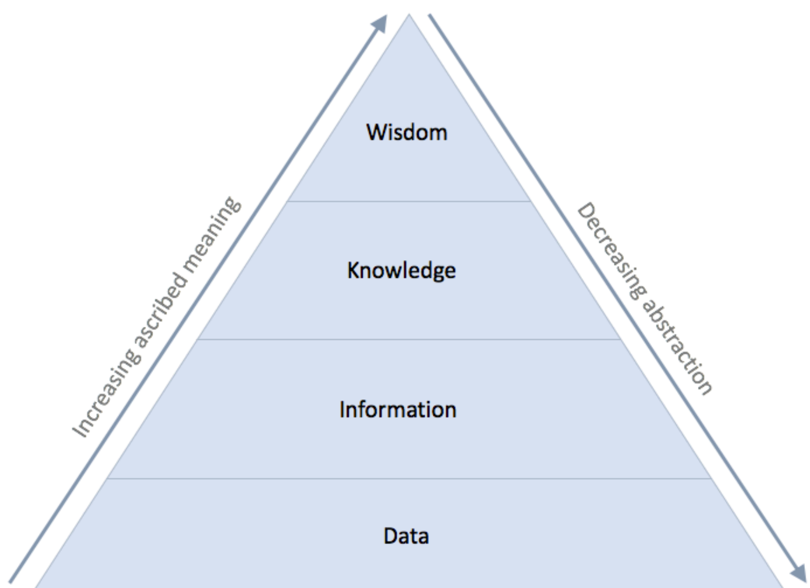

Figure 4 Conventional Data-Information-Knowledge-Wisdom hierarchy. Varying degrees of ascribed meaning and abstraction are associated with each level. This model is representative of methods of western scientific inquiry.

In the context of this model, documenting Inuit knowledge of oceanographic features as conventional data can effectively decontextualize it, removing characteristic features so that it may fit into frameworks of western scientific inquiry embodied by neutrality, replicability and non-biased understandings. However, as previously outlined, Inuit knowledge is inherently context dependent, and to decontextualize it is to strip associated values and ontological characteristics which should be incorporated into policy and decision-making in Nunatsiavut (and throughout Inuit Nunangat). Figure 5 offers a modification of the data-information-knowledge model to account for the transformations that Inuit knowledge is subject to as it is documented by researchers, converted into data and mobilized into subsequent decision-making (adapted from the decontextualization and recontextualization model introduced in Aporta et al., *in press*).

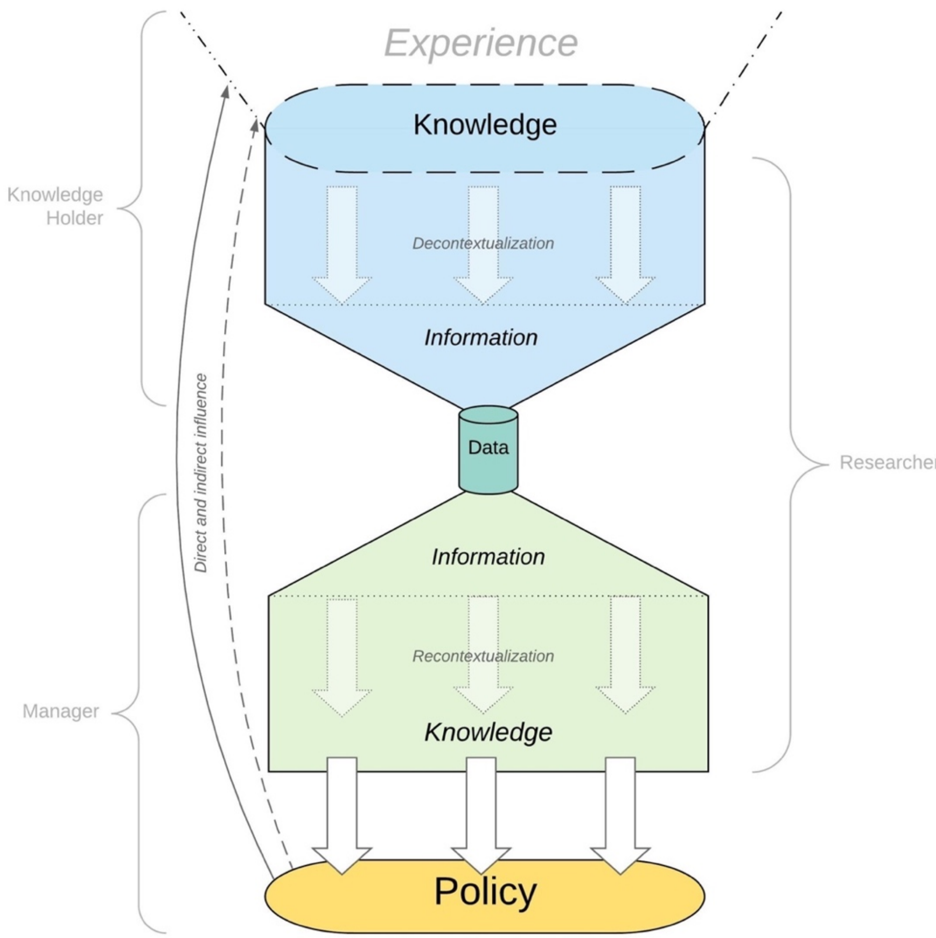

Figure 5 Inuit Experience-Knowledge-Information-Data transformations. As Inuit knowledge moves through this model, it is subject to decontextualization and recontextualization processes. Through contextualizing data derived from Inuit knowledge early on in the research process, knowledge used to inform policy (which directly and indirectly impacts Inuit socio-environmental experiences) can be more respectful of Inuit ontology.

Based on the conceptualization in Figure 5, Inuit knowledge is formed based on individual and collective experience and is characterized by ongoing social-environmental relations. As researchers document this knowledge, they can initiate a decontextualization process through converting knowledge into information (i.e. oral history converted into a textual representation) and then further converting that into data (i.e. distilling information for phrases to be analysed). Researchers are also engaged in a recontextualization process, mobilizing data back into information that managers and decision makers engage with (i.e. through analysing data for a specific purpose or question; Aporta et al., *in press*). The knowledge that comes from this information in conjunction with other understandings is then utilized to inform policy and decision making, which directly or indirectly impacts Inuit socio-environmental experiences. The recontextualization process can apply to Inuit knowledge explicitly, or Inuit knowledge being utilized in conjunction with western scientific data. As meaning is ascribed to data, varying degrees of transformation can occur, which can potentially modify the original form and content of Indigenous knowledge.

Through decontextualizing and recontextualizing transformations, data derived from Inuit knowledge can reflect only a portion of what was initially expressed by knowledge holders. This model aims to exemplify the importance of contextualizing data derived from Inuit knowledge early on in the research process so as to minimize what is lost through decontextualization / recontextualization processes that are inherent in western scientific research and management practices. In doing so, the data 'bottleneck' so to speak can be circumvented (to a degree), by attaching context to data (i.e. through the use of metadata) as it moves through processes of transformation in research and management. Ultimately, the knowledge used to inform policy can then reflect appropriately contextualized Inuit knowledge which in turn will directly and indirectly impact Inuit socio-environmental experience in a more equitable way (as compared to policy informed by decontextualized information).

2.5 Chapter conclusions

Given the historic and contemporary ties between Inuit and coastal environments, it is evident that there is a substantial body of local ocean knowledge. Across Inuit Nunangat, work has centered around documenting and understanding such knowledge, for example through explorations of local observations of sea ice dynamics (Aporta, 2002; Nichols et al., 2004;

Laidler et al., 2009). Additionally, the majority of land use and occupancy studies which have formed the basis for land claims agreements in Inuit Nunangat have focused extensively on the marine environment (i.e. Freeman, 1976; Brice-Bennet & Labrador Inuit Association [LIA], 1977). In Nunatsiavut, marine management initiatives are being developed so as to appropriately incorporate Labrador Inuit knowledge within decision making and planning for future change. Given the intrinsic ties Labrador Inuit have to marine and coastal spaces, it is apparent that extensive Inuit knowledge exists which can support ongoing community-focused research and management agendas. However, there are challenges in identifying and applying practices to effectively mobilize Inuit ocean knowledge in a way that respects ontological contexts. Retaining context for oceanographic data based on Inuit knowledge holds much significance, particularly because of the integral role that features like sea ice and ocean currents have for communities in Nunatsiavut.

Chapter 3: Methodology

3.1 Study area

Located in the Labrador Inuit Settlement Area (LISA) of Nunatsiavut, this research focuses on the communities of Rigolet and Hopedale. Additionally, this research was conducted as a component of a larger oceanographic research project, Community-based Observing of Nunatsiavut coastal Ocean Circulation (CONOC). This work focuses on developing a community-based ocean observing system for coastal Labrador, conducted in partnership with the Nunatsiavut Government, and led by Dr. Eric Oliver, an oceanographer at Dalhousie, and a Nunatsiavut beneficiary with family roots in Rigolet. Rigolet was chosen in part because of known and interesting oceanographic features (i.e. strong tides, year-round open water), and Hopedale was chosen based on input from the Nunatsiavut Government, informed by community members expressing interest in the topic. Additionally, the locations of each community represent a southern and central region respectively – two geographically distinct areas of coastal Nunatsiavut (Figure 6). The spatial extent of each community region was determined based on the extent of previous spatial data collected by the Nunatsiavut Government, and centered on marine and coastal areas.

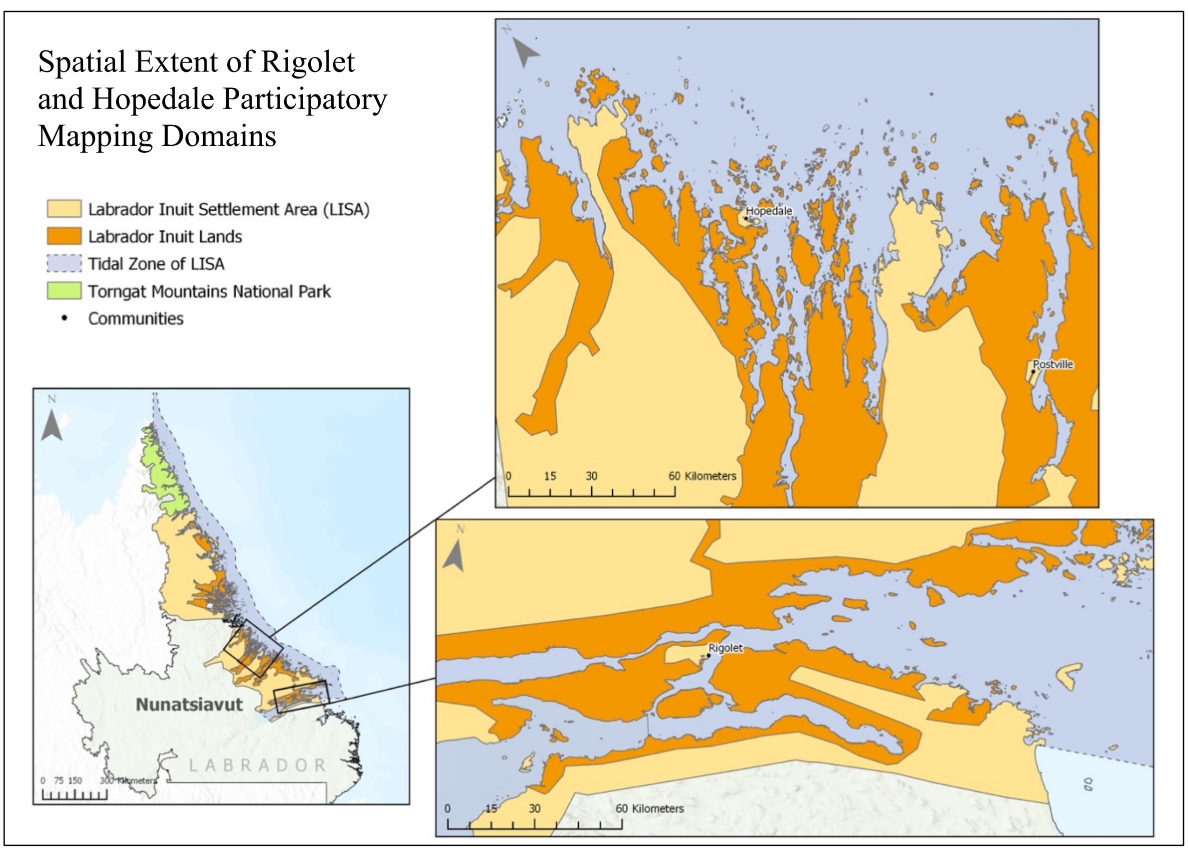

Figure 6 Labrador Inuit Settlement Area map identifying participatory mapping domains for Rigolet and Hopedale.

Rigolet (54.1799° N, 58.4288° W) has a population of about 305 people of whom roughly 92% identified themselves as Inuk (Inuit) in the 2016 census (Statistics Canada, 2017a). The community is located in a relatively sheltered cove on the west side of the Narrows, which joins Lake Melville to Groswater Bay (Brice-Bennet & LIA, 1977; Figure 6); about 65 km west of where Groswater Bay opens up into the Labrador Sea (Goldhar, Bell & Wolf, 2014). Because of its location, Rigolet is relatively isolated from the open ocean of the Labrador Sea, while the Narrows allows for very strong tides and open water year-round. Hopedale (55.4580° N, 60.2115° W), originally known by its Inuttitut name Arvertok ("place of the whales") (Tourism Nunatsiavut, n.d.) has a population of about 574 people, of whom 90% identified themselves as Inuk (Inuit) in the 2016 census (Statistics Canada, 2017b). The community is located in a relatively exposed coastal area in comparison to Rigolet, and the region is characterized by several large open bays that extend 24-40 km inland, with a fringe of small islands near the mouths of the bays (Figure 6) (Brice-Bennet & LIA, 1977). Given its relative exposure, residents of Hopedale have direct access to and experience of the Labrador Sea, including the Labrador Current and offshore pack ice.

3.2 Study design

This research employed a mixed methods qualitative approach consisting of a literature review, participatory group mapping (open to community observers) and one-on-one semi-structured follow-up interviews. This research received approval from the Nunatsiavut Government Research Advisory Committee and the Dalhousie Research Ethics Board (REB-2019-4712). Outreach and participant recruitment began after approvals were received. Participants were recruited through local contacts and with the support of the Rigolet and Hopedale community governments. Local contacts and government partners helped to share notices of research (posters), placing them on community bulletin boards and sharing to online communication groups. A radio announcement was intended, however at the time of research the local radio was experiencing technical difficulties. Through arriving in advance of the sessions taking place, informal conversations with community members also helped to spread the word about the mapping sessions. Additionally, because of the multi-day and public nature of the sessions, observers (and participants) asked permission to directly reach out to people they thought would have interest and relevant knowledge, doing so in both Rigolet and Hopedale. The conditions of recruitment were that participants be elders or others knowledgeable of ocean currents and related features (there were no gender preferences). Participants were given the option to be de-identified in the research, or to have their names included. While most participants elected to have their names included, some preferred to be de-identified. For this reason, there are differences in how quotes are attributed in the results chapter.

While not the basis for this research, language preservation and revitalization have been prioritized by the Nunatsiavut government. As such, incorporating aspects of language into research projects can be of value, and it was noted that through this research Inuttitut terminology for oceanographic features may be identified. Additionally, recognizing that potential participants may be more comfortable speaking Inuttitut than English, translation services were made available. In Rigolet, all participants spoke English fluently and did not require translation services. In Hopedale, because more of the population can speak Inuttitut a translator was made available however, all participants were also fluent English speakers. The translator was also a research participant, providing all of the Inuttitut terminology for oceanographic features identified in this research. This terminology was identified during the mapping session and written down by the participant at the time it was discussed.

3.2.1 Participatory mapping

The methodology used for this research was developed in part based on other participatory mapping work that has been conducted with Inuit communities across the circumpolar arctic (i.e. Aporta, 2009; Tobias, 2009). Two sets of large maps were brought to Rigolet (two identical maps, 9x21 ft) and Hopedale (two identical maps, 15x18 ft), with one map designated for documenting the ice-free season (approximately summer and fall), and the other map designated for documenting the sea ice season (approximately winter and spring). These maps were produced at a scale of 1:50,000, and included topography as well as bathymetry markings indicating shallow regions. The size of the maps and the features included were designed to create a more interactive mapping process, where participants could move around on the landscape they were interacting with, providing an immersive means of visualizing geographic features. The mapping sessions were open to the public in order to facilitate intergenerational knowledge transfer amongst participants and community observers, and participants were encouraged to explain what they were marking on the maps. Rigolet (n=5) and

Hopedale (n=6) participants arrived over the course of two days, based on when their schedules permitted them to. Because of this, some group mapping took place, as well as some individual mapping. Most participants were proficient at reading maps, and had no difficulty orienting themselves in relation to the maps. During the mapping sessions, participants were engaged in informal conversation, facilitating knowledge transfer to session observers, as well as contextualizing the information being mapped. Although not audio or video recorded, notes were taken during the mapping sessions.

In order to mimic how participants would interact with the marine environment in their daily lives, each mapping session started by asking participants to think about why they accessed marine areas during the summer or winter season, and to start by documenting the trails and routes they would use to access these areas. Once this was complete, for the winter map participants were asked to think about the ice features that they would encounter, starting with the typical ice edge and moving into features such as areas of unsafe or 'bad' ice[3], and areas of open water. Lastly, participants were asked to draw their knowledge of coastal ocean currents. Details including direction, strength, and any seasonal changes as well as changes over time were recorded on the maps. Before finishing, participants were given the option to add anything else to the maps that they thought would be important to include. In Hopedale this included the locations of cabins, and some details on area use (i.e. identification of seasonal fishing or hunting areas for species of significance). In Rigolet some place names were identified that had not been included on the base-maps, as well as sites of importance to individuals such as a cemetery or old summer and winter home locations.

The completed maps were scanned and imported into ArcGIS Pro, and georeferenced using 15 or more points to increase accuracy. The largest margin of error was approximately 10 m (+/-) where little to no feature data was located, and this margin of error was reduced to >1 m where data was concentrated. A conformal conic projection (NAD 1983 CSRS Statistics Canada Lambert), well-suited to high-latitude regions, was used to map the data. The maps were then digitized and checked against the scanned originals for accuracy. As features were digitized, a 'notes' column in the attribute table was populated with information that participants spoke

[3] In the context of this research, the term bad ice was used to describe areas of sea ice that would be considered unsafe to travel over. Such areas are often consistent in location and relative size, making them easily distinguishable for participants familiar with the region.

about while drawing those features on the paper maps (see Appendix I for example). After digitizing was complete, these features were revisited and any related details from the interviews were also added to the 'notes' column of the attribute table. The attribute table contains further details on the features that were mapped (i.e. season, associated community, current strength).

3.2.2 Semi-structured interviews

The intention of the follow-up interviews was to elicit and record more detailed descriptions of oceanographic features and peoples' connection to the ocean. This structure has been successful in other participatory oceanographic mapping work (i.e. Puniwai et al., 2016). The mapping sessions were not audio or video recorded, so the researcher noted points of interest that came up during discussion as follow-up questions for the semi-structured interviews. It was structured so that the interviews took place only after participants had completed the mapping. Rigolet (n=7) had two additional participants for the interviews. They were the spouses of people who had previously mapped and had been present during the entire mapping session, but did not have the confidence to make marks on the maps (although they contributed through conversation and feature descriptions). Because they regularly travelled with their spouse, and were familiar with the region being mapped, they asked to take part in the interview together. Total Rigolet interviews (n=4) included (n=7) participants, with 3 interviews consisting of two people each. Hopedale interviews (n=5) had one less participant than the mapping sessions due to a schedule conflict. All Hopedale interviews were conducted individually. Informed consent was obtained from all participants who participated in the mapping and interviews. The researcher transcribed the interviews which were then validated by a secondary researcher, and the transcriptions were used for analysis.

3.3 Analysis: inductive content analysis

Grounded theory methodology guided data analysis for this research, which favours detailed familiarity with the data (Bernard, 2006). Interview data was analysed, coded and categorized through constant comparison, where codes and categories were continually revisited to ensure consistency and accuracy – a key method of grounded theory analysis (Strauss, 1987). The use of constant comparison supported an inductive content analysis, whereby any conclusions reached were revealed through an in-depth familiarity with and analysis of the data. To achieve such familiarity, the researcher facilitated the mapping sessions, digitized and produced the resulting maps, was the primary interviewer for the semi-structured interviews, transcribed the resulting audio recordings and conducted the content analysis. Such a process allowed the researcher to establish a of level familiarity with the data as required for grounded theory. Data was analysed through multiple readings of the transcripts of 9 interviews conducted with 12 participants to identify key phrases, which were then coded. Out of 161 key phrases, 39 codes were developed, which were distilled into 6 themes for analysis. These themes were confirmed and modified throughout the analysis process. In addition to analysis being conducted in order to present the outcome of this research, the methodology employed during knowledge documentation was subject to analysis as well in order to highlight processes of documenting Labrador Inuit oceanographic knowledge. Methodological strengths and limitations have been used in part to inform recommendations of this research.

3.4 Limitations

The results presented for this research are based on participatory mapping and semi-structured interviews conducted with community members from Rigolet and Hopedale in Nunatsiavut. In both communities, participants expressed that there were other individuals (i.e. elders, experienced hunters) who travelled the regions extensively, and whose input would have strengthened the maps. Because of the timeframe of research, people who were not in the community (due to recent sea ice break-up and resulting access to fishing areas and summer cabins, or who were otherwise unavailable during the mapping session days) were unable to participate. As such, the information that is presented here represents a subset of each communities' knowledge of the marine space. Additionally, the map domains used for this research were determined based on the extent of data collection suggested by the Nunatsiavut Government. However, it was mentioned in both communities that more information could be documented if the map domains were extended to incorporate additional geographic areas. To account for this, future projects would benefit from collaborating in advance with community members/potential participants, to determine map domains.

Advanced collaboration with communities could also assist with defining seasons of importance in which to identify specific oceanographic features. While this research distinguished between the sea-ice and ice-free seasons, such distinctions generalize many seasonal nuances. It became evident during the mapping sessions that certain features were more prevalent during specific months of the year. Had a more detailed calendar been established with participants at the start of each mapping session, more information may have been documented. Further, while some features were specified as being seasonally relevant (i.e. fall mobility routes used before sea ice is solid enough for sled travel), representation parameters (for cartographic data) were designed to fit within summer or winter seasons only. Although participants did not express any issues with the seasonal distinctions used, a more thorough understanding of oceanographic features in coastal Nunatsiavut may be garnered through focusing on specific seasons of relevance to Labrador Inuit and using those to guide participatory mapping.

As previously mentioned, although semi-structured interviews were audio-recorded, mapping sessions were documented through written notes. This was done to respect the privacy of participants and session observers. The intention of recording the interviews was to document detailed descriptions and narratives depicting how individuals interact with the marine space. While the methodology was successful, there was also much discussion that occurred between participants during the mapping sessions that could have added further detail to the narratives from the interviews. Although notes were taken, the descriptions and conversations themselves offered rich contextual information to accompany the mapped features, particularly as some participants that mapped together also travelled and hunted together. It was indicated by one participant during their interview that the best way to capture narratives associated with mapped features would be to hold a group session where people who hunt and travel together can tell stories of doing so. This could be more effective particularly because when individuals participate in research projects, they are often focused on producing what the researchers are looking for (i.e. oceanographic data), and they may forget the stories/narratives that could be triggered by having friends or family groups map and interview together. Video or audio recording these settings could provide much more detailed descriptions and contextual details of mapped oceanographic features.

Because the semi-structured interview questions were designed to elicit descriptions about specific features, participant answers could be slightly biased by the researcher. In recognition of such limitations, a high degree of flexibility was built into how the interviews were structured, allowing participants to speak about features and related concepts that were of relevance to them. Another potential limitation is that the transcribed interviews were analysed using inductive content analysis, which was conducted based on grounded theory methodology. Drawbacks associated with this methodology include the potential for researcher bias, especially because researcher familiarity with the data is an integral component of grounded theory. Such familiarity could lead the researcher to favor certain aspects of the data that fit within their expectations. However, data familiarity also allowed the researcher to focus on how the research could be of the most relevance to the participants and their communities, which was of utmost importance for this work. Steps were also taken to eliminate potential bias, including constant comparison when analysing and coding the data, and continual reflection on codes to ensure that they were representative of the data in its entirety (accounting for both cartographic data and interview data). The potential limitations identified here were recognized and acknowledged when analysing and discussing the findings of this research.

Chapter 4: Findings

This chapter will outline the findings of two weeks of fieldwork in Rigolet and Hopedale that took place in early June 2019. As described in Chapter 3, mapping sessions (open to community observers) and semi-structured interviews documented Inuit knowledge of oceanographic features in Nunatsiavut. Based on an inductive content analysis of interview transcriptions, the results of the interviews have been categorized into the following themes: connection to the land and sea; knowledge transfer; sea ice features and trends; weather trends; and currents and tides. While these themes correspond with some concepts that guided the development of this research, each theme contains nuances specific to the individual, community, or Inuit experience of the marine environment. Prior to introducing the findings, this section will start by providing a brief overview of methodology and terminology used in this research. Participants' connections and interactions with the marine environment will then be summarized, followed by an explanation of knowledge transfer (how people learn what they know of oceanographic features). After providing this background/contextual information, community mapped features from Rigolet and Hopedale will be presented along with a series of maps for each community. Cartographic (oceanographic) data derived from this research will be presented alongside related narratives so as to better contextualize the data. Lastly, general trends that have been observed in both communities will be identified. This chapter aims to present the oceanographic features and any related changes and trends that are important for and/or of concern to community members in Rigolet and Hopedale. Simultaneously, the structure of this chapter also intends to demonstrate some methods that can support contextualizing data derived from Labrador Inuit knowledge.

4.1 Overview of participatory mapping methodology

At the start of each mapping session, participants walked around on the maps to orient themselves with the region being represented. Each individual looked for the location of their community and other areas of relevance to them (i.e. the location of summer or winter homes, hunting areas, fishing areas, or other areas of significance). Identifying such areas allowed participants to orient themselves prior to marking the maps. After becoming oriented, the participants started by identifying and marking winter routes (sled) and summer routes (boat, all-terrain vehicle) on the winter and summer map respectfully. Mobility routes were the starting point for documenting oceanographic knowledge because through sustained mobility and subsistence patterns, a detailed knowledge of ice topography is developed, allowing Inuit to be highly familiar with sea ice (Aporta, 2002) and other oceanographic features. Recognizing the breadth of sea ice knowledge, participants were asked to identify where the average land-fast ice edge would be located, referred to in Inuttitut, the Labrador dialect of Inuktut, as *sinâ* (Table 1). After marking the average land-fast ice edge, participants indicated where areas of unsafe or 'bad' ice were located. As described by Hopedale participants: 'good' ice must withstand 'two chops with the axe' (indicative of it being at least 5-6 inches thick), and ideally safe or 'good' ice is about 1 foot thick in the winter. While the land-fast ice is a stable travel surface, areas of 'bad ice' or even open water can exist within it, resulting in avoidance of specific locations for safety reasons. Often times when explaining these regions, participants described knowing of it because people had fallen through the ice (either recently or historically). In addition to areas of bad ice, areas of open water were also identified, which participants referred to as "holes in the ice", "areas of open water" or as "rattles"; terms which have slightly different nuances (see Table 1).

Table 1
Labrador English and Inuttitut terminology for oceanographic features

Labrador English term	Description	Feature
rattle	area of strong current (may or may not freeze over)	open water
tidy	area with a very strong tide	current
bay tide	currents that occur strictly as a result of tidal flow	current
Inuttitut term	**English Description**	**Feature**
inggiganik	rattle, when two tides come together	open water
inggiganialuk	strong tides, big rattle, never freezes over	open water
inggiganikoluk*	smaller rattle, may or may not freeze over	open water
Killak	hole in the ice (polynya)	open water
Kullutuk	spinning water, pulling things down (whirlpool)	whirlpool
kaivittuk	spinning water only on the surface (whirlpool)	whirlpool
sinâ	edge of the land-fast ice	ice formation

Note: Terminology and translations provided by Hopedale translator and research participant Gus Semigak (see Appendix III for additional terminology retrieved from external sources)
** possible spelling differences*

4.1.1 Defining rattles

While participants were able to identify and describe ice features quite consistently, there were differences in how meaning was ascribed to terminology used to describe areas of open water (that remain open throughout the year). English terminology in Nunatsiavut uses the word *rattle* to describe geographic areas (of varying size) influenced by particularly strong currents (see Table 1 for corresponding Inuttitut terminology). While the term rattle was used to describe open water by participants in both communities, the researchers were unclear on the exact definition. Therefore, participants were asked to describe a rattle to develop a definition for the term. In both Hopedale and Rigolet, rattles were described as areas of fast-moving water which are present year-round, and any ice that may form would not be not safe to cross. Rigolet participants emphasised that rattles are found in rivers (not the ocean), and Hopedale participants emphasised that rattles are found in the ocean (not rivers). Such differences could be representative of how participants interact with the geography around each community, although further exploration of such nuances was beyond the scope of this research.

According to the majority of Rigolet participants, rattles are located in rivers and brooks, with fast or rapid "water running over [a shoal], with rocks in it. It's deep on each side" (G. Baikie, 2019). Rattles are in the same location year-round, and "you [can] always hear the water running under the ice in the winter time, or [in] the fall and the spring you could hear [and] you could see it running" (H. Shiwak, 2019). In Hopedale, it was generally identified that a rattle is "a fast moving channel of water [in the ocean] that stays open most of the year, if not all of the year" (I. Winters, 2019). Additionally, most rattles do not freeze, and if they do it is a very thin layer of ice. As explained by one participant:

> *Rattles are not on any of the outside area. Our rattles, what was taught to me when I was growing up, is [that] you get them in almost every single bay. It's where it narrows up, and it keeps the waters going through at such a fast pace with high tide and low tide where it's coming in and out, it keeps it open all year (A. Vincent, 2019)*

Both Rigolet and Hopedale participants expressed that caution must be taken when traveling around a rattle, because although they typically do not freeze, any ice that would form is not thick enough to cross, and the rapidly moving water makes for unsafe ice. While in English oceanographic terms, 'polynya' would principally be used to describe an area of open water, and in the English spoken in Labrador local terms would be 'rattle' or 'hole', Table 1 demonstrates that Inuttitut has several words offering subtle variations that account for differences such as changes in size. Such nuances are also notable in Nunavut Inuktitut (and other dialects of Inuktitut spoken across Inuit Nunangat), where in contrast to English terminology, variations often depict a more detailed description of features with which Inuit would regularly interact (Aporta, 2003). The nuances revealed by Inuttitut terminology can be quite representative of specific oceanographic features and their relevance to Labrador Inuit.

4.2 Connection to the land and sea

Although the participatory mapping sessions took place prior to conducting any semi-structured interviews, detailing the interview findings will help introduce and contextualize the results obtained through the participatory mapping sessions. The following section will introduce results that emerged under the theme *connection to the land and sea*.

4.2.1 What it means to be out on the land and on the water

At the start of every follow-up interview, participants were asked to describe what being out on the land and on the water[4] meant to them. The purpose of this question was to capture a more detailed description of the participants' connection to the places and features being documented. These narratives are integral to contextualizing oceanographic data derived from Labrador Inuit knowledge. The majority of participants indicated that being out on the land and on the water was, in addition to supporting subsistence activities, a way of life, a part of who they are, and a significant part of Inuit cultural heritage, giving people a sense of pride and belonging. As one participant summarized, "to me it's keeping the tradition alive and it's something that we were taught from early [for] myself, from my grandparents, my grandfather especially and it's something that I wanted to keep the tradition going for myself, for my two sons" (A. Vincent, 2019). Many participants observed the importance of being able to access the land and water for activities like hunting, fishing, or travelling. For some participants, it was clear that there was an emotional connection beyond the words they used to describe it. For example, while one participant stated "Oh it means a lot. You feel a lot better when you're out going around" (G. Baikie, 2019); his tone, body language and facial expressions shifted when the question was posed, conveying a sense of serenity and calm – something that words alone cannot

[4] The term 'on the land' will be used hereafter in reference to activities that take place on the land and on the water, in contrast to activities 'in community'.

capture. Meanwhile, another participant provided a detailed description that conveyed much of what others spoke about:

> *Yeah, it's definitely good. I think it's just part of us, it's part of our heritage and it just becomes almost like part of you, and there's something happens when you go out on the land. It's… I can't explain it… it's… it definitely affects you physically and mentally, emotionally … every how I think. Spiritually too I suppose. Yeah. There's definitely something about being out on the land it does for you* (S. Baikie, 2019).

In addition to supporting cultural heritage, there was a very evident subsistence component to peoples answers as well, looking to the land and sea as a place to berry pick, fish and hunt for wild meat. These answers allude to the values participants place on accessing terrestrial and marine environments.

The transcribed interview responses under the theme "connection to the land and sea" were put into a word cloud generator and the results can be seen in Figure 7 (see Appendix IV for word frequencies). Some commonly used words were removed so as to avoid skewing the cloud (i.e. because, I'm, we, it's), and the size of the word reflects the relative frequency that it was used in participant answers. Throughout this word cloud, certain themes become evident: activities (hunting, fishing, travelling) species of importance (seals, salmon, caribou, geese); seasonality (winter, spring, summer); social relations (family, grandparents, parents); and features (ice, land, island, tide). While not the basis for data analysis, Figure 7 reinforces many of the values previously described. It should be noted that participants were predominantly male (n=10), with fewer female participants (n=2), which likely impacted the words generated in Figure 7.

Figure 7 Word tag cloud representing Rigolet and Hopedale participant connections to the land and sea

Quite broadly, participants interact with the marine environment in a number of different ways, but all interactions are primarily facilitated through travel – by sled in the winter and by boat in the summer. Traveling and subsistence activities are highly connected to seasonality. One participant commented, "for me and my family as growing up, there's a season for everything. No matter what, like spring, summer, winter, fall there's always something here that you can go ahead and hunt to help with the food that you're eating" (J. T. Lucy, 2019). Further, there is also a social dimension through which participants interact with ocean features, either through practices for travelling and hunting, or through how people came to know their surroundings. One participant expressed that "as soon as you can, you can go. And if you [have] a partner with you that's even better again [because] someone [is] helping you if anything should happen to you" (G. Semigak, 2019). While another participant described how social relationships shaped what he knows of ocean currents:

> *Currents I learned from my grandfather, and the area that he was summering in was more or less on the outside area than [where] we hunt with my father, up in the bays. And then from going to different areas with different hunters. Tradition here when I [grew] up was… you never hunted with your family basically all the time… you hunt with different people all the time, so your knowledge was throughout the whole village (A. Vincent, 2019).*

This statement alludes to practices of intergenerational knowledge transfer. The social dimension of people's connection to the land and marine environment was evident throughout both the interviews and the mapping sessions, and the value of social and experiential learning was reiterated by most participants.

4.2.2 Knowledge Transfer

Social learning is a very important aspect of how Labrador Inuit interact with the marine space. Rigolet and Hopedale participants indicated that they learned about ocean features through a combination of first-hand experience and learning from others (often grandparents, parents, fathers, uncles or brothers – terms which are evident in Figure 7). Social learning was facilitated through travelling (i.e. for hunting and fishing) and was strengthened by learning from people outside of immediate family members. A few participants spoke about the value of sharing knowledge within the community, which allowed participants to expand their area of knowledge with each additional person(s) they travelled with. It was observed by several participants that ways of sharing knowledge seem to be changing, and methods of knowledge transfer need to adapt to account for such differences in learning. For example:

> *[there are] some people older than we are and they [know] where to go, and where to hunt. And then the younger people won't get that, they won't know where to go. [Because] they don't go with the older people anymore, they just go by themselves or… young people just go on hunting and no questions asked, or not telling people where they [are] going. That's the problem (G. Semigak, 2019)*

Such generational differences in hunting practices impact intergenerational knowledge transfer within communities. This trend has been observed in other communities across Inuit Nunangat (i.e. Aporta & MacDonald, 2011; Inuksuk, 2011).

Some participants indicated that mapping oceanographic features and other areas of community interest could support intergenerational knowledge transfer. This could be observed in the mapping sessions, which were open to community observers. In Rigolet people who observed the sessions became quite engaged with the maps, not only listening to participants but also pointing and tracing routes they were familiar with (Figure 8). Participants expressed that the process and resulting maps could be helpful in passing on knowledge to younger generations, who seem to be learning differently than in the past. As explained by one participant:

> *most of us now rely on GPS. But it's always good to have like a map in front of you to, say for my sake to teach my two sons of good ice and bad ice and travel routes. GPS can tell you exactly where you are, but if you don't know the route like I've been taught, you're totally in the dark if you don't know… "if there's bad ice here, which way do I go?" (J. T. Lucy, 2019)*

Further, travel routes have to be modified based on environmental factors. As one participant explained: "the snow conditions could be all different then that route would have to be changed. But if you got a map that… what we're doing here as a community or say Nunatsiavut that would be much easier for outsiders, for younger generation to follow" (A. Vincent, 2019). Maps were seen by participants as a potential tool to support learning. Maps displaying *their knowledge* of the area seemed particularly important because of the information that could be embedded in them which GPS units or federally available maps do not display.

Figure 8 Participatory mapping session in Rigolet. One elder participant is speaking to session observers about some of the routes and features that have been marked. Because the mapping sessions were held at the community centre, youth and other observers were present and very engaged throughout the mapping sessions.

Participants also expressed a sense of urgency in documenting this knowledge, especially because of the pace of changes occurring in Nunatsiavut, and the generational knowledge gap that seems to be emerging. One participant expressed these concerns:

> *it gets very emotional about […] climate change and everything because it's really… it's really changing our way of life. And [are] our grandchildren, or great grandchildren down the road going to know what we know? Are they going to get […] to do the things that we see, and took for granted all our lives? […] And it's part of our heritage, it's part of our culture […], is there going to be so much climate change, is it going to be gone? Are we going to lose that part of our heritage? And that's scary when you think of that… (S. Baikie, 2019).*

Such concerns were also echoed by other participants in both communities. The implications of the emerging generational knowledge gap and the subsequent impacts on people's lives and their long-established cultural knowledge and traditions will be further elaborated in the discussion chapter.

4.3 Community specific oceanographic features and trends

4.3.1 Hopedale oceanographic features and trends

Participants in Hopedale were asked to document the summer and winter trails that they used, followed by ice features such as the ice edge, rattles, areas of bad ice, and the currents they interacted with. While this was the order suggested by the researchers, some participants wanted to mark rattles and bad ice first, before moving into travel routes. Flexibility was a key component of the participatory mapping methodology, enabling participants to document their knowledge based on personal preferences. This provided an opportunity to better document the landscape as seen and experienced by participants. As such, many participants identified features through describing them in relation to important hunting and fishing areas. These comments were noted and included in the attribute tables of the digitized features (Appendix I). Participants were also given the opportunity to add other areas of significance to the map and many indicated that it would be important to know the locations of cabins. Because of this, cabin locations around Hopedale were also documented. Some participants indicated that while most maps show the English names of islands and bays, there is significance and importance in knowing the names in Inuttitut as well. Given the scope of this research, place names were not documented during these mapping sessions however, other projects have focused on this, and a relatively large database of place names exists (i.e. Brice-Bennet & LIA, 1977; Natural Resources Canada, n.d.).

Figure 9 depicts all of the community mapped features documented in Hopedale. Following the identification of features, discussions took place to determine if any features had been observed as changing, and related trends or events that may have influenced such change. While such changes are not represented cartographically, descriptions are provided in the following paragraphs. Figure 9 does not intend to represent the diverse array of community knowledge of mobility routes and oceanographic features, but a subset of that knowledge as conveyed by participants present during the mapping sessions. The terms used in the legend are respectful of the terminology used with participants while mapping was taking place. Feature symbology was selected to mimic the symbology used to document specific features (i.e. dashed line for ice edge; arrows for currents and direction of ice drift) or based on narratives describing such features (i.e. bad ice is often recognized because of its darker colour). Some slight modifications in feature colour was done to allow for a clearer visual representation on the digitized map. While the original base-map domain is not depicted, the abrupt end to some features (i.e. floe-edge/open water off-shore) are indicative of the map limit.

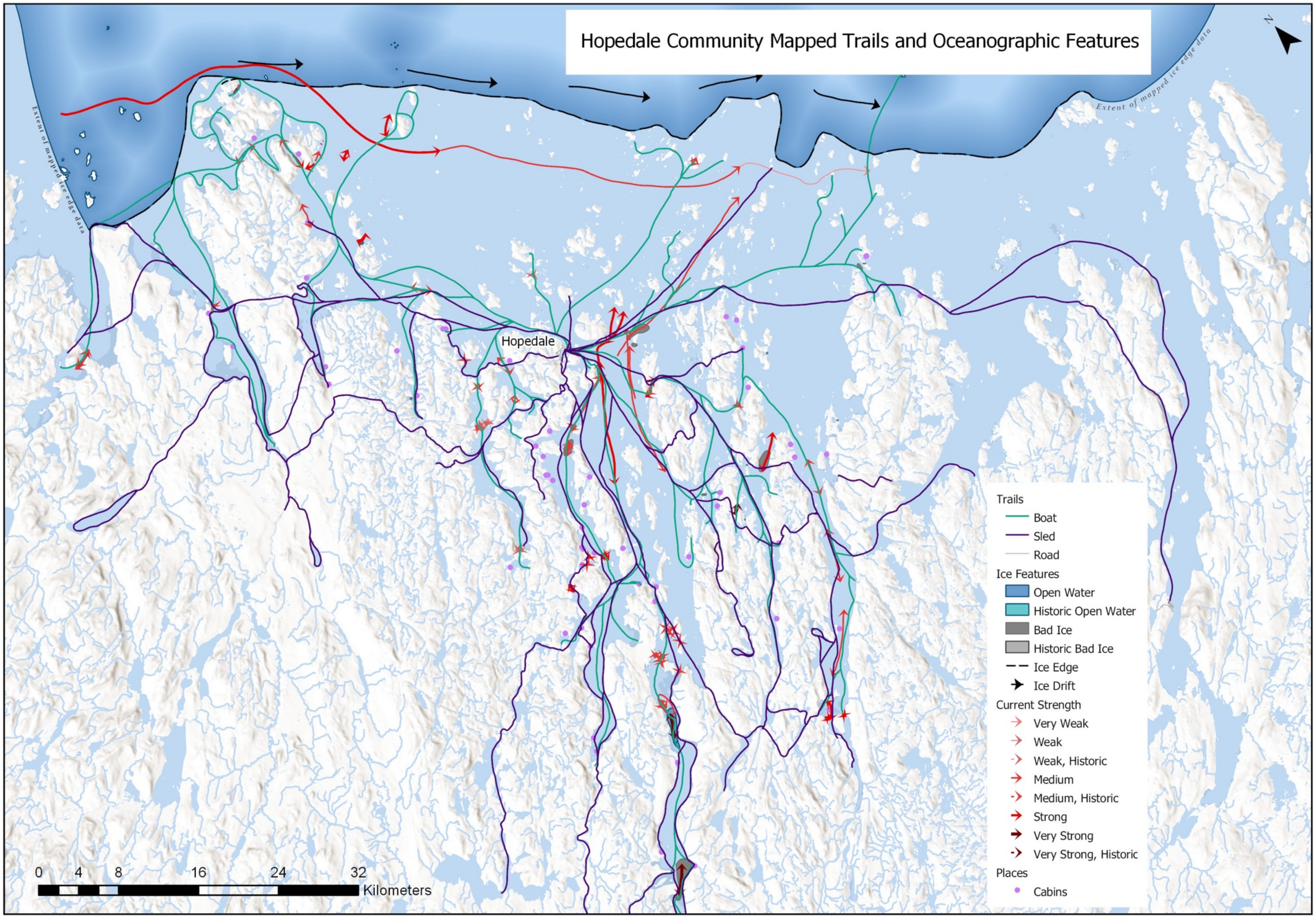

Figure 9 Hopedale community mapped trails and oceanographic features. Note: the open water area past the floe edge was added in for visual reference and was delimited based on where the community mapped ice edge ended.

4.3.1.1 Currents and tides

Hopedale participants documented many areas of ocean currents and tidal flows. Notably, participants differentiated between 'bay tides' and ocean currents, with bay tides impacting features in the bays, and ocean currents being in the off-shore area. Participants also indicated that these two do not interact much, and that they interacted with ocean currents primarily when hunting offshore. In the bays and fjords 'bay tides' were mostly associated with documented ice features such as rattles or bad ice. Although most of the currents included on the map were associated with bi-directional (tidal) flow, some were identified as flowing predominantly in one direction. Notable among these is the Labrador Current, associated with the southeastward directional arrows near the ice edge in Figure 9. It was indicated that this current changes in strength, being stronger further north. On the other hand, as it nears some of the larger bays in the area with more water outflow, the strength of the Labrador current seems to be felt less. One participant was particularly knowledgeable of the northernmost area of the map, expressing that he and his family had travelled there often (G. Semigak, 2019). In addition to the Labrador current being felt more strongly in this region, currents around the islands were identified as having different strengths associated with directional flows (Figure 10).

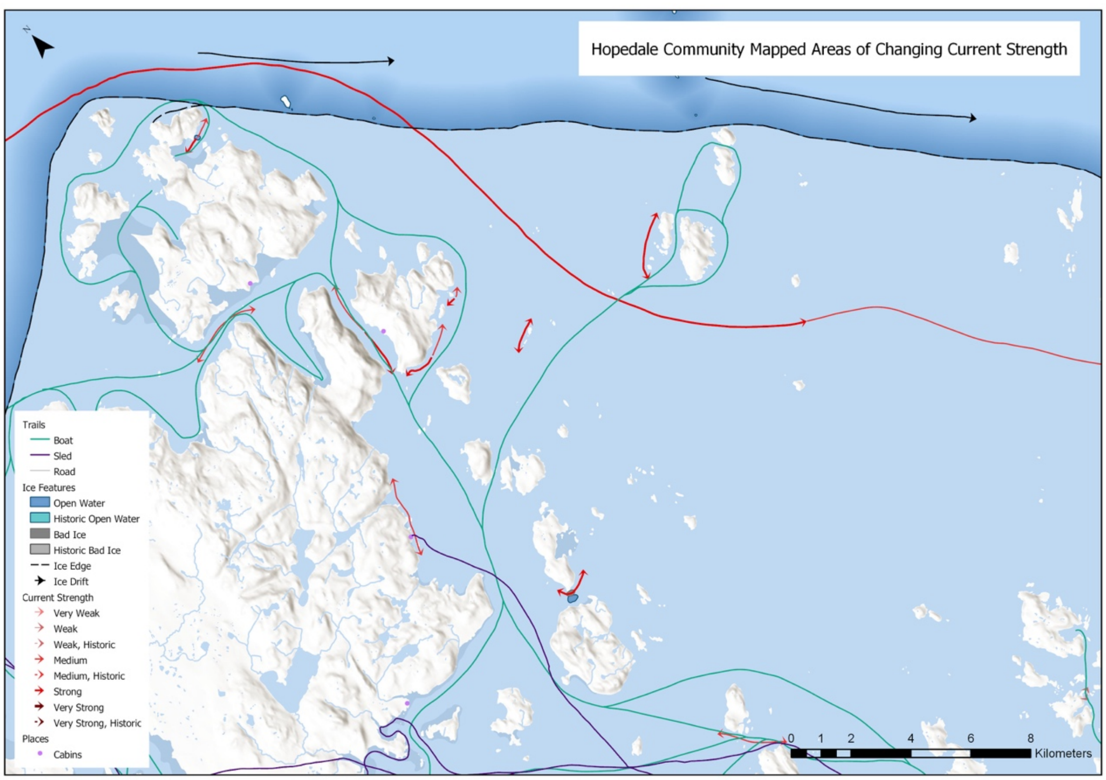

Figure 10 Areas of changing current strength north of Hopedale.

When asked if they had noticed any changes in the currents over the years, one Hopedale participant indicated that currents impacting the sinâ (floe-edge) seem to be bringing it closer to land than it used to be. However, another participant indicated that they had not noticed much change in the currents over the years, but a change in weather impacting ice features, including sinâ. While the causal factor may be attributed to different influences (currents, weather), the result was agreed upon (sinâ coming closer to land). It was noted that current strength also changes seasonally, and that throughout the seasons "there may be more current, depending on the area […]. If there's more run-off there's going to be more current in the spring […]; if there's more snow, there's more thawing and more run-off" (I. Winters, 2019). This makes evident the connectivity between features, and the multiple influences that impact currents around Hopedale.

4.3.1.2 Sea ice features and trends

The region around Hopedale is characterized by many large and small rattles and areas of bad ice (Figure 11). Most participants indicated that these features occurred more or less in the same location, although seasonal changes can impact their size, time of formation, and the amount of ice that may or may not form. Certain trends were also observed, with participants stating that there has been less snow in the fall and early winter, leading to delayed travel. It was also noted that the ice does not form as thick as it used to before snow starts to accumulate, as described by one Hopedale participant: "that's why the ice [is not] like before anymore. It's only covered up with snow and [in] the springtime like this, [it's bad] to go out [because] it's only covered with snow, no ice" (G. Semigak, 2019). This is further explained in relation to people's ability to travel:

> *A lot of people these days when it warms up, they [say] you're just riding on snow, which is basically all you're riding on [because] this past winter I think we may have gotten between 12 to 20 inches of ice before all that snow accumulated on top […] that ice was gone […] within 2 weeks. You were on skidoo, and within 2 weeks you were in speedboat (J. T. Lucy, 2019).*

Also, worth noting are the areas of bad ice that participants marked on the map. While some of these were noted as having bad ice throughout the year (Figure 11, grey areas), it was indicated that some areas had mostly bad ice during the fall and spring (freeze-up and break-up) but offered good traveling surfaces during the winter months (Figure 11, orange rectangle). These notes were added to the attribute table for each feature in ArcGIS, in order to add some context to the cartographic data. Such seasonal differences were also described in relation to ice quality, which will be elaborated on in section 4.4.2.2.

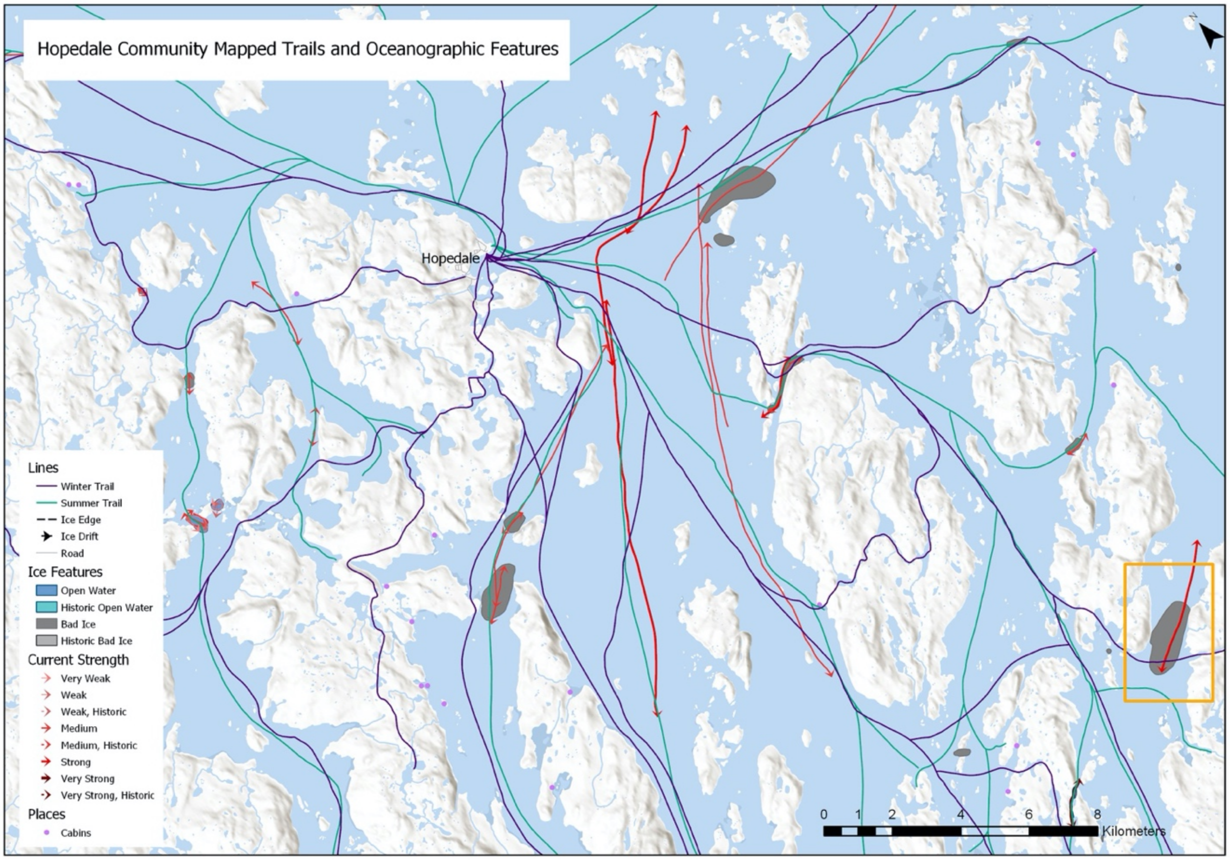

Figure 11 Close up of trails, currents and ice features around Hopedale. The orange box indicates an area of 'bad ice' that still freezes solid enough in the winter to support travel.

4.3.2 Rigolet oceanographic features and trends

Participants in Rigolet were also asked to document summer and winter routes, followed by ice features such as the ice edge, and areas of open water or bad ice, in addition to the currents they encounter when out on the water or on the ice (Figure 12). After identifying such features, discussions took place around any changes to the features that have been observed over time, and related trends or events that may have influenced such change. While many of the broader trends identified in Hopedale are also occurring in Rigolet, some notable changes were observed explicitly in the Rigolet area. Participants associated these unique phenomena with the Churchill Falls hydroelectric dam, developed in the 1970s. This section will outline the oceanographic features and general trends that participants identified for the Rigolet region, followed by a section addressing the trends associated to the Churchill Falls development.

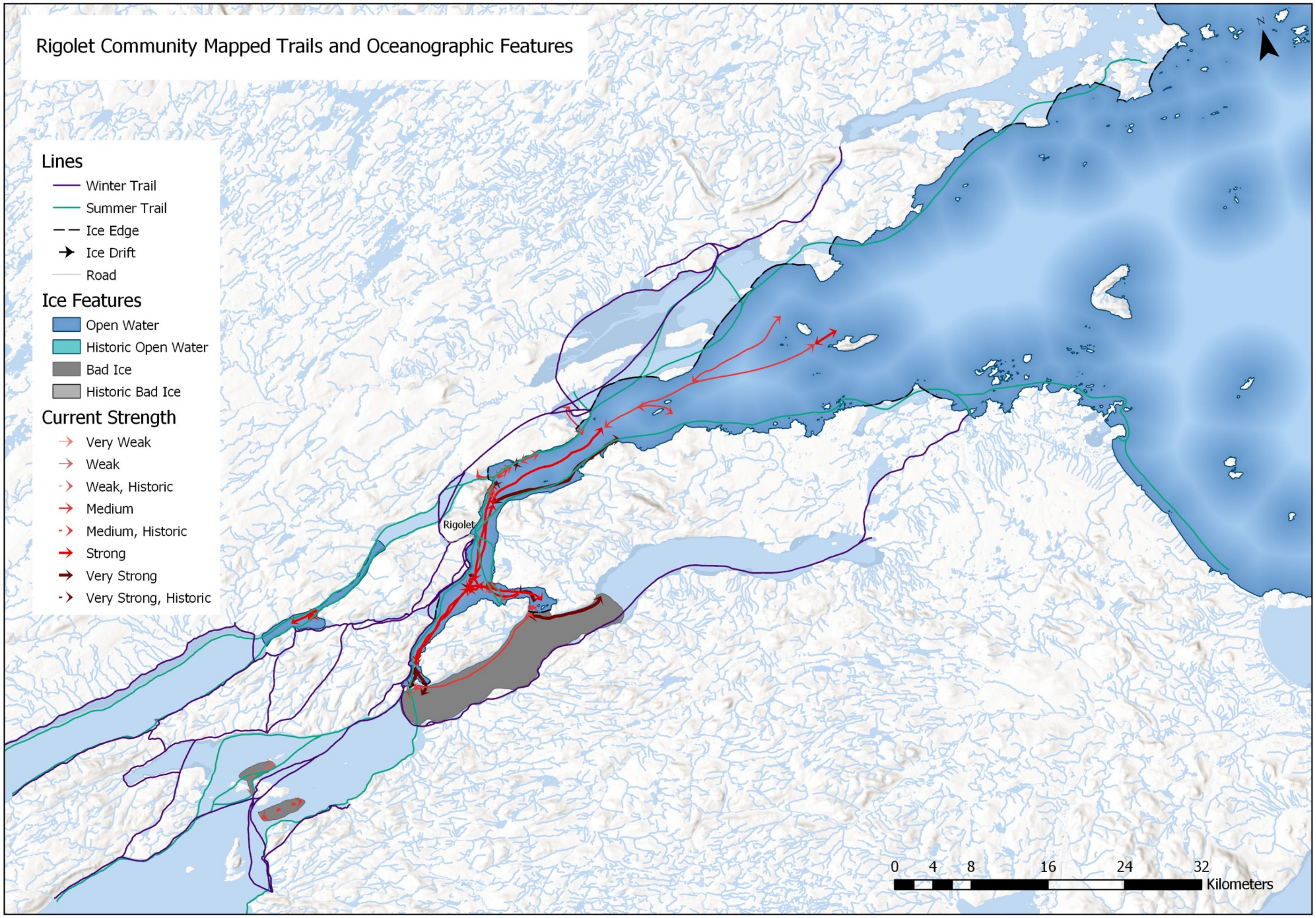

Figure 12 Rigolet Community mapped trails and oceanographic features.

4.3.2.1 Currents and tides

In contrast to Hopedale, which has an evident floe edge along the outside area and freezes up (mostly) solid into the bays, a large area around Rigolet ('the Narrows' (Figure 13)) stays open year-round. The Narrows links Lake Melville to the Atlantic Ocean. Participants noted that the Narrows is characterized by the strongest tides in the region, with a series of converging tides leading to the formation of whirlpools. As explained by one participant:

> *Boy we get sometimes hard tide. Now when the tide comes in, hits over here to Summer Cove point, really bad, especially at tide down, tide comes out, that's tide coming out from back bay and tide coming from up through the narrows there, and mix together, and a big 'ole whirlpool, big one. I never saw it but I heard it, but father said he could hear it from my summer place. But they told everybody that heard that, don't go over there (F. Shiwak, 2019).*

Some participants also noted that a boat sank around an area of very strong tide just past the whirlpools. As evidenced by Figures 12 and 13, this area stays open year-round, and participants observed that summer and winter currents (location and strength) remain more or less the same.

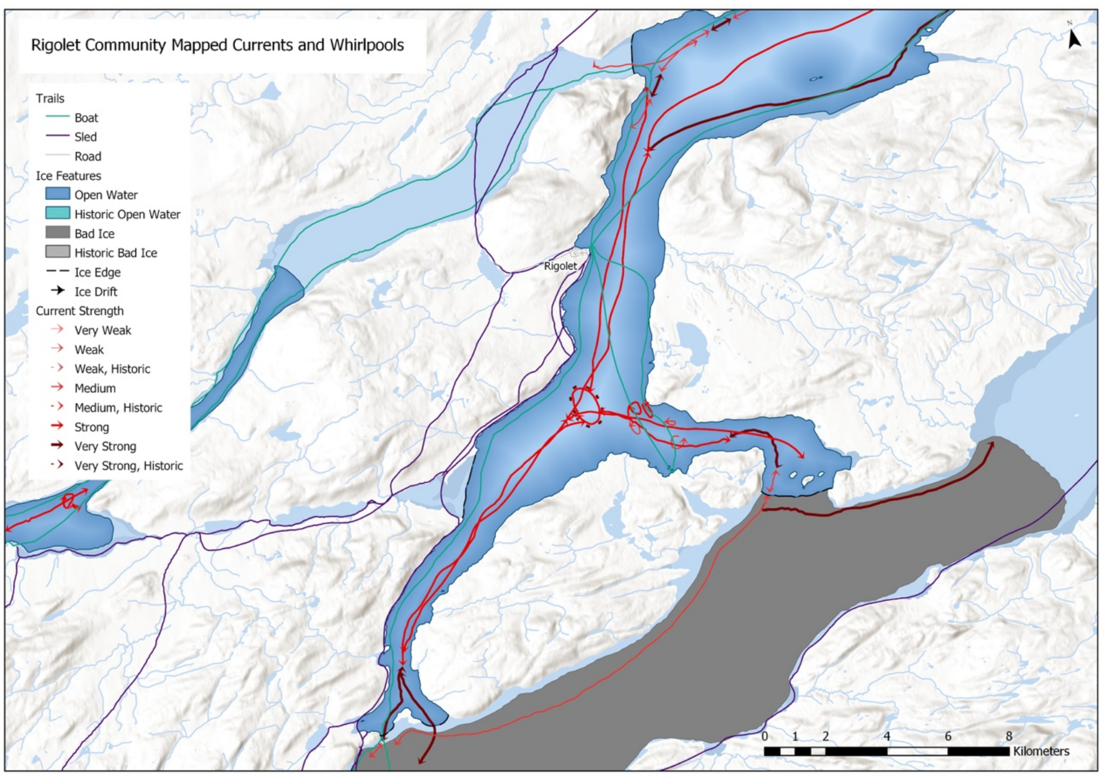

Figure 13 Open water and areas of strong tide in the Narrows. Currents are indicated by circular red lines.

Participants also noted another whirlpool that forms in Double Mer, in an area that remains (mostly) open water year-round (Figure 14, blue area). While travelling by boat during the ice-free season, it was observed that “when the tide is a certain way [the whirlpool] gets bigger and bigger… […] Because you can drive along by it, and feel the water just twirling around. It’s not safe to go through even. Especially if it’s blowing there” (G. Baikie, 2019). The whirlpool is in the same location year-round, and although it was indicated that this area is open water, during the spring it was observed that ice forms in the whirlpool. Further, during the winter months the whirlpool area was associated with the presence of ice as well. As described by two Rigolet residents:

> *I don’t know how the ice forms like that, but there can be no ice there; well it [does] freeze over in the winter time, but you can’t cross on in or nothing. But there is a bridge that runs across where the whirlpool is. They said that that’s where the… one time where the old people used to cross (G. Baikie, 2019)*

> *I crossed there I didn’t even know I wasn’t supposed to cross there and I went over and off right in the middle […] I was going along all smooth and all of a sudden you were going up like that like on a hill [gestures upward motion], and I looked behind me and you see it, like towards the land got a big hump in it, that’s where the strong tide is there, you know it build up and it hikes up the ice there or something like that (F. Shiwak, 2019)*

Despite the formation of ice in this area during the winter and spring, it was indicated that this area is not safe to cross. This is evidenced by the travel routes marked on Figure 14 (purple and green lines), showing that mobility routes around the area of open water tend to avoid the whirlpool. These narratives make evident the details that could be omitted through focusing primarily on cartographic representation of Inuit knowledge as data.

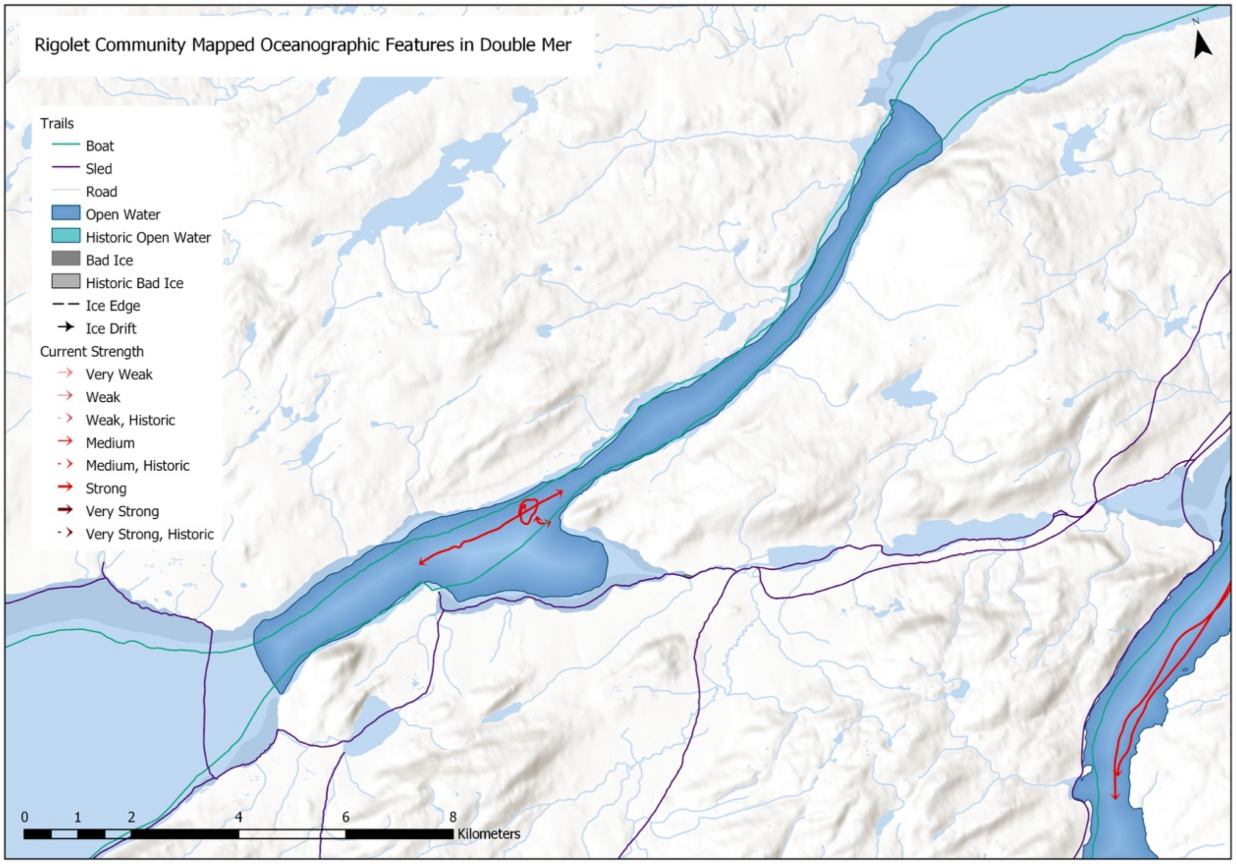

Figure 14 Open water and whirlpool (circular current area) in Double Mer

4.3.2.2 Churchill Falls

When asked about changes in the ice, currents or tides, every Rigolet participant noted that many changes occurred after the Churchill Falls[5] hydroelectric dam was developed in the early 1970s (1971-1974). For example, in Figure 13, it was noted that the whirlpools that form used to be considered 'very strong', but now they are considered 'strong'. As one participant noted, "I know that a lot of the old fellers said after they dammed Churchill […] the tide changed a lot, but I'm young to remember. There was a lot more tide there I would say" (Rigolet participant 06, 2019). Other participants who remember the Churchill development also described the weakening of tides in the area.

The change in tides also corresponded with changes in ice conditions, particularly noted in an area around what Rigolet residents refer to as Pelters Island. Figure 15 demonstrates the

[5] The Churchill River is one of four major rivers that drain into Lake Melville, providing a significant source of freshwater runoff to the region (Lu, DeYoung & Banton, 2014). The damming of Churchill river adjusted the seasonal variability of discharge into Lake Melville throughout the year (Nunatsiavut Government, 2016).

historic and present-day ice conditions in this area, with the change in conditions observed as corresponding with the Churchill Falls development. As explained by participants in the context of this map, the ‘historic conditions’ are associated with pre-development (pre-1970s conditions) and the ‘present-day conditions’ are associated with post-development (post-1970s conditions). Historically, much of this area was open water (Figure 15, left panel, light blue areas), and it was regularly travelled around for activities such as hunting or accessing winter cabins. A smaller portion of this area was considered to be bad ice (Figure 15, left panel, light grey area), and participants indicated that these areas had weak and medium strength currents running through them. In contrast, since the Churchill Falls development it was observed that the areas of historic open water are now bad ice (Figure 15, right panel, grey area), and the area of historic bad ice is now good ice, and this “only happen[ed] once they dammed the Churchill” (G. Baikie, 2019). As two Rigolet participants explained:

> *Since Churchill Falls was harnessed right. There’s a lot of change in the water, like up there where Pelters Island is […] it was all open water up inside of Pelters Island and Trout Cove way. Now you don’t see that anymore […] because people travel all over that ice now all winter long, don’t have to worry (H. Shiwak, 2019)*
>
> *Some people still won’t go onto [the ice] though because they still don’t trust it right? […] They say it still make bad there but you know it could… you never know eh, from one year to the next what the change is going to be (B. Shiwak, 2019)*

Participants who travelled in these areas expressed shock at the change in ice conditions, and concern over what other changes that may be taking place. Further, participants also expressed concerns over potential changes that may occur in the future with other proposed developments such as Muskrat Falls (ongoing hydroelectric development of the Lower Churchill River).

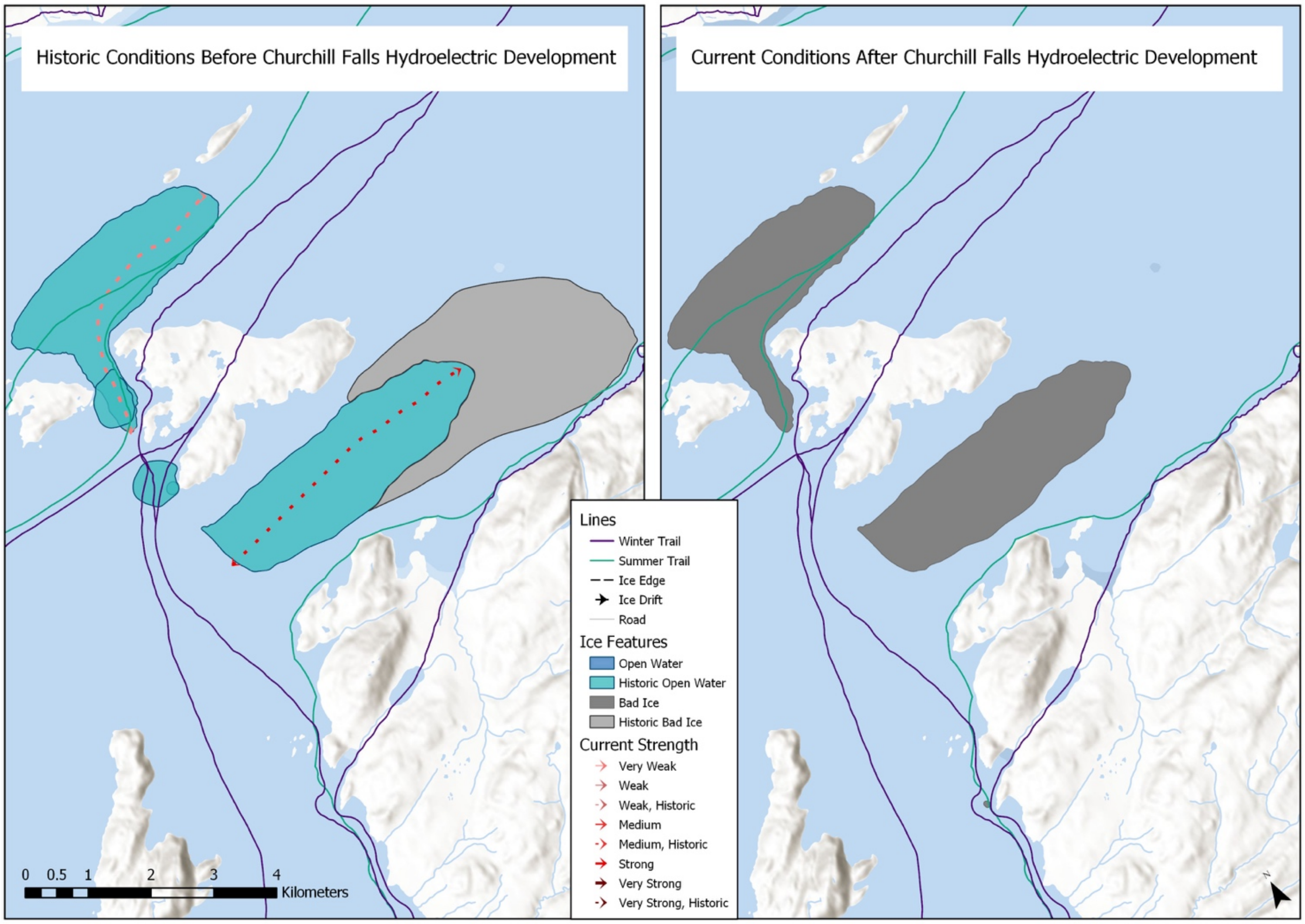

Figure 15 Contrast between historic and present-day sea ice conditions around Pelters Island.

In addition to changing areas of open water and areas of bad ice, the Churchill development was observed as impacting ice quality, with much softer ice forming now as compared to before the development. This change in ice conditions was associated with increased salt water in areas like Lake Melville, which used to be dominated by fresh water. As one participant described:

> *[increased salt water] made a lot of difference to the Lake Melville area. It made a lot of difference to the ice too. Like now the… Lake Melville used to be all fresh water one time, just about all fresh. And now it's salt right up […] Like up to Mulligan one time, you could go down and dip up water anytime and drink it… fresh water. Now it's just as salty as out here (G. Baikie, 2019).*

While these changes were not noted by all, the participant who observed the change in fresh water grew up in an area called Mulligan (in Lake Melville) and travelled regularly in Lake Melville throughout his entire life. Older participants had much more descriptive observations of the changes that were observed after the Churchill river was dammed, indicative of their first-hand experience in observing those changes (and subsequent impacts to ice conditions), and the degree to which their experience of the marine environment was impacted (i.e. through changing hunting and mobility).

4.4 General oceanographic features and trends

Although each community described and mapped features specific to their region, semi-structured interviews inquired about broader trends that may be occurring. This section is a synthesis of those broader trends identified by both communities. While the semi-structured interviews were based around guiding questions determined by the researchers (see Appendix II*)*, there was flexibility so that participants could speak about geographic areas and related features that they had the most knowledge of, as well as topics that were most relevant to them. Because of this, certain participants spent a lot of time discussing things like general ice trends, while others spent more time describing very specific features they interact with or changes they have noticed. Additionally, each participant had a specific geographic area that they were most familiar with, and while some had knowledge of the entire map domain, most provided detailed information on the areas that they were most familiar with. The focus of each interview will become evident through the quotes included in the following sections.

4.4.1 Weather

Participants in both Rigolet and Hopedale made note of several weather trends impacting when and how they get out on the land and on the water. Notable of these are a changing seasonality and abundance of snow, as well as increased storms and wind. As one Hopedale participant noted, there is "more storm, more wind. Seems like there's more wind every year, yeah. Lot of people say it" (Hopedale participant 13, 2019). The increasing wind is impacting how people interact with the marine environment, as explained by a Rigolet participant: "there is change from what it used to be. Like the… I don't know the water seems to get a lot rougher these days than it used to one time" (G. Baikie, 2019). This is linked to the changes in sea ice previously discussed, where increasing stormy/windy weather is delaying the ice season through making it harder for ice to form in late fall/early winter. Although this connection was not explicitly expressed by participants, the correlation became evident through analysing interview data.

Snow conditions were also observed as changing. Many Hopedale participants noted that there seems to be more snow than there used to be, and this is changing how people can travel as well. One Hopedale participant noted that:

> *even now with all the knowledge me and people like me have gotten from our fathers and forefathers that the ice is very unpredictable. You can travel… travel to places we always travelled and it may look like 30 years ago, but it's not […] take this year for instance, we had a huge amount of snowfall, which is the most I've ever seen in the past… well since I [was] in grade 7, which is probably 35 years ago. And all that snow accumulating onto the sea ice is covering up the bad ice, covering up the cracks and you can't determine how thick you're travelling on (J. T. Lucy, 2019).*

While participants observed that there is more snow, they also pointed out that the snow is arriving later than it used to. As one Hopedale participant observed:

> *I remember me and my father used to go out and look for Christmas trees long before Christmas, on the ice on dog team. You can't do that anymore. You're probably… you're lucky if you're going to go further than where we [go] in the fall or the […] first part of the winter. You can't go very far [because] there's no snow (G. Semigak, 2019).*

In addition to participants observing that the snow is arriving later than it used to, it was also noted that it seems to be melting quicker. One Rigolet participant explained:

> *the snow is going faster, […] I don't know how come the snow is going fast, I think it's the climate, I think the climate is getting, like the sun, the sun is getting so hot, it melts, I mean it melts all the snow and all that (F. Shiwak, 2019).*

This speed of melt seems to be increasing for both ice and snow, leading to a quicker transition between sled or snowmobile travel and boat travel in the spring.

4.4.2 Sea ice

Participants in both Rigolet and Hopedale noted differences in ice conditions as compared to 20+ years ago. Primary trends identified are that the ice does not stay as long as it used to, it does not seem as strong, and overall the conditions are much less predictable. Such changes are consistent with observed trends across Inuit Nunangat, where elders and other knowledgeable individuals have noted decreasing environmental predictability in comparison to previous experience and past knowledge (i.e. Laidler et al., 2009; Laidler et al., 2010). The implications of this were noted by both Rigolet and Hopedale participants, who expressed concern over existing knowledge being less applied by (or applicable to) younger generations, especially in light of environmental changes.

4.4.2.1 Seasonal changes

Participants in both communities noted changes in the timing of fall freeze-up and spring thaw. The shifting seasonality of climatic patterns have impacted people's ability to travel, as emphasized by two participants:

> *to me growing up as a child when we were here, we'd always get snow in October, everything would freeze up solid in November, we'd travel November. You could get in and out to your bay places well before Christmas. Now I've… I can't remember the last time I was up at my cabin before Christmas in the last 10 years (A. Vincent, 2019)*

> *Before, the ice used to freeze as early as middle of October, and then say middle of November you can go… late November you can go anywhere you wanted to go; haul your wood, partridge hunting and travelling in middle-late November. And then you go right on until… November, December, January, February, March, April, May, and even into June on snowmobile. But now the ice is taking longer to freeze due to warmer sea currents, […] windier conditions and warmer temperatures, which is making the ice season shorter. Like this year the ice froze late December, but it wasn't safe to go everywhere, not until middle of January I guess, late January. And then… so that's February, March, April, May – 4 months of travelling on the sea ice this year. Which is compared to 7 months 30 years ago (J. T. Lucy, 2019)*

Because of the flexible way that interviews were structured, not all participants discussed the seasonality of sea ice, but from those who did, a common consensus was that the sea ice freezes up later in the fall and breaks up much faster in the spring. One participant explained that in the past, you could still travel on the sea ice (by sled) when you were unable to use sleds on trails over land (due to snow melt). In contrast, now it seems that the ice will become unsafe for travel earlier, while people are still able to travel by sled on land trails. The changes that participants noticed were often described in relation to weather trends and their ability to travel on the sea ice throughout the seasons. Participants were also observing changes in ice quality impacting their ability to travel, as well as their confidence in predicting ice conditions.

4.4.2.2 Differences in ice quality

Participants in both Rigolet and Hopedale have observed changes in ice quality, primary of which being that the ice is not as solid or as predictable as it used to be. As described by participants from Rigolet and Hopedale respectively:

> *[it doesn't] seem that you [get] it like you used to eh? Not so heavy, not so like thick [as] it used to be. [Because] one time in that bay here, it wasn't that long ago it used to freeze right up and sometimes right into the point here […] But I haven't seen that in… it must [be] almost 20 years. And what ice is there now is not hardly fit to go on half the time anyways, it's so soft (Rigolet participant 06, 2019)*

> *The ice is unpredictable, it may look good but it's not as solid or thick as we think it is. The pack ice, rough ice which is outside of the sinâ is… is becoming more and more. There's more pack ice than there is solid ice (J. T. Lucy, 2019)*

While ice quality and predictability were observed as changing, other features were noted as remaining relatively consistent, including the size and location of areas of open water or bad ice.

4.4.3 Currents and tides

In both Rigolet and Hopedale, participants indicated that the currents documented on the winter map were the same as the currents present in the summer. The majority of currents that were identified on the winter maps and were associated with ice features. While summer currents were also identified, less emphasis was placed on them as the winter currents had already been identified and participants indicated that they were representative of summer conditions as well.

4.5 Chapter conclusions

The oceanographic features and related trends presented in this chapter are a result of direct observation and knowledge of the regions surrounding Rigolet and Hopedale. While it is a synthesis of individual and community held knowledge, it represents only a portion of that knowledge. The combination of maps and narratives in this chapter make evident that while cartographic data presented in the maps (Figures 9-15) depict a representation of how Labrador Inuit interact with and experience the marine space, such maps offer a limited understanding without narratives to accompany them. As such, this research emphasises narratives as a means to contextualize cartographic data, providing a more elaborate depiction of how Labrador Inuit interact with and experience oceanographic features and environmental changes. It is evident that while research methods documenting Inuit knowledge as data cannot entirely convey the holistic dimensions of Inuit ontology, there are some strategies that can be applied to respect the ontological origins of data derived from Inuit knowledge.

Chapter 5: Discussion

This research was conducted through two parallel approaches. The first approach documented Labrador Inuit knowledge of oceanographic features, identifying their location and characteristics, as well as related trends and changes that the community members from Rigolet and Hopedale have observed (as previously described in Chapter 4). The first part of this discussion will focus on interpreting such observations and exploring their implications. The second approach for this research utilizes the first approach as a case study to assess and identify practices to incorporate when documenting Labrador Inuit ocean knowledge. The latter part of this discussion will reintroduce the data-information-knowledge-policy framework presented in Chapter 2 (Figure 5) and use it to explore practices to document Labrador Inuit oceanographic knowledge that respect ontological contexts.

Chapter 4 outlined five key themes that emerged when documenting Labrador Inuit knowledge of oceanographic features in the communities of Rigolet and Hopedale (Inuit connection to the land and sea, knowledge transfer, sea ice features and trends, weather, and currents and tidal observations). In addition to documenting oceanographic features, community members observed several trends in local climatic and sea ice conditions. The most commonly described trends include changes in weather (through differences in seasonality and abundance of snow and increasing unpredictability of storms and wind), and changes in sea ice (through differences in the timing of freeze-up and break-up, and ice quality and conditions). From these themes, the following concepts were also identified: Inuit connection to place is centralized around mobility, seasonality, and social relations; and knowledge transfer occurs through social-experiential learning processes which seem to be changing between generations. Using these central themes, the following section will describe and assess the key findings of this research, discuss their implications and identify recommendations that can support future marine research and management practices engaging with data derived from Labrador Inuit ocean knowledge.

5.1 Changing weather and sea ice

5.1.1 Weather: storms, wind and snow

Increasing unpredictability of weather has been observed in Nunatsiavut and throughout the rest of Inuit Nunangat (Furgal et al., 2010; Kofinas et al., 2010; Fox, 2010). Although weather variability is not uncommon for northern communities, the changes that have been occurring seem to fall outside of what would be expected based on living memory and oral histories (Fox, 2010), with instrumental data also indicating that such changes are beyond known natural variability and long-term norms (i.e. Laidler et al., 2009). It was observed that snow seems to be arriving later, with most snowfall concentrated in March, April and May (A. Vincent, 2019; G. Semigak, 2019). This is in contrast to people's living memories, which reference enough snow in December to allow for travel by sled to get Christmas trees (in Hopedale which requires longer distance travel by snowmobile to access forested areas).

Altering seasonality and abundance of snow and increased wind, associated with storms, are also impacting people's ability to access harvesting areas, and less predictable conditions make doing so more challenging. Such trends can have significant implications on food security, particularly when many residents in Rigolet and Hopedale rely on access to wild food as their preferred food source, as a means of supplementing their diets, and/or as a way to offset the costs of store food. The cost of hunting equipment in addition to work requirements (i.e. full-time work in community) is resulting in a generational gap in traditional food skills and knowledge (Food First NL, n.d.). This could be further exacerbated through the increasing unpredictability of weather, which is limiting peoples' ability to get out on the land and access important harvesting areas (Kofinas et al., 2010). Further impacting people's ability to harvest wild food are changing climatic conditions, which are resulting in changing species seasonality, abundance and distribution (Furgal et al., 2010). All of the aforementioned trends influence people's ability to travel and hunt, particularly during the sea-ice season (winter-spring).

5.1.2 Sea ice: quality and timing

People's ability to access the marine space is also being affected through changing sea ice conditions. In Nunatsiavut, animals that are important for subsistence are hunted on seasonal cycles (Brice-Bennet & LIA, 1977; A. Vincent, 2019), and winter and spring months are particularly important for traveling and hunting on the sea ice to access species such as seals. The changing timing and quality of sea ice could compound the impacts of weather unpredictability, posing additional barriers to mobility and seasonal subsistence activities. The results presented in Chapter 4 indicate that the timing of ice formation, melt or break up, and the nature of the ice itself have all been observed as changing. Such changes correspond with those documented in Nain as well, where community members noted that in comparison to fifteen to twenty years ago, ice around the community is forming about one month later (January instead of

December) (Furgal et al., 2010). Further, Rigolet and Hopedale community observations documented for this research in June 2019 indicate that sea ice seems to be breaking up and clearing by May or early June. In contrast, community observations documented in Hopedale in 1975 indicated that sea ice typically cleared by June or July (Brice-Bennet & LIA, 1974), and accounts of Moravian missionaries (first Europeans to settle the Labrador coast in the late 1700s) indicate that late June or early July is when the sea would be open enough for European boats to pass (Olsthoorn, 2017). In contrasting such observations, it can be inferred that the timing of both sea ice freeze-up and break-up has shifted by approximately one month since observations made in both the late 1700s and early 1970s. Although such observations do not have precise dates attached to them, Inuit mobility and related activities are significantly impacted by such changes.

Further impacting Inuit mobility in Nunatsiavut is increasingly unpredictable ice conditions and quality. Community observations in Rigolet indicate that the ice seems to be saltier, and therefore less stable. Such observations, particularly in regard to decreased salinity and ice thickness in Lake Melville, correspond with modeled simulations of variations in freshwater discharge following the development of the Churchill Falls hydroelectric dam (Government of Nunatsiavut, 2016). While in Rigolet changes in salinity and ice quality were attributed to the changing influx of freshwater after Churchill Falls was dammed, similar observations have also been recorded in Nain (Furgal et al., 2010). These changes are impacting wildlife, safety, and the cycle of subsistence activities in communities (Furgal et al., 2010). As such, aspects that are at the core of the Inuit way of life are being directly affected by changing climatic and oceanographic conditions.

5.2 Embedding datasets with Labrador Inuit connection to place

Marine and coastal areas are essential for Labrador Inuit mobility, hunting and harvesting. Additionally, these areas hold an intrinsic value beyond that of subsistence. Evidenced through participant descriptions of their connection to place, there is a spiritual, physical, cultural, emotional and psychological significance in being able to ‘get out on the land’. While changing weather, sea ice and currents can impact people’s ability to travel and access marine resources, it also can impact physical and mental well-being (Cunsolo-Willox et al., 2012; Cunsolo-Willox et al., 2013). For example, while poor ice quality and less predictable weather can lead to negative effects such as increased stress or risk of injury, other less obvious negative health effects stem from disruptions to peoples' connection to place and related cultural and socio-historical contexts (Durkalec et al., 2015). As such, it is important to apply methods of documenting Inuit knowledge that respect connection to place beyond land use and subsistence values. When documenting coastal oceanographic features including the floe-edge, polynyas, areas of unsafe or 'bad' ice, ocean currents and tidal flows, as well as weather and climate features, the cultural and socio-historical circumstances influencing Inuit knowledge of such features are equally important to understand in order to respect the ontological context. This is increasingly important as climatic and oceanographic changes occur, because when seeking to mobilize such knowledge into marine management and planning for future change it is important to understand both the features and the people who interact with them, as well as the manner in which knowledge is obtained and maintained. As such, in order to equitably represent data derived from Inuit knowledge, context-keeping within the data is essential.

5.2.1 Accounting for place names & narratives

Inuit ontology is grounded in an inextricable connection to place. Place names are one way of demonstrating the depth of oral histories and longstanding connections to the land. Although not recorded within the scope of this research, oral history projects have documented place names throughout Nunatsiavut (Brice-Bennet & LIA, 1977). As previously identified, participants in Hopedale emphasised the significance and importance of knowing the Inuttitut names of the islands and bays. Significant context can be derived from such names, which allude to the history of Inuit engagement with that place through attached meaning and related narratives (Aporta et al. *in press*; Brice-Bennet & LIA, 1977). For example, in comparing mapped oceanographic features in Hopedale with place names documented in *Our Footprints our Everywhere: Inuit Land Use and Occupancy in Labrador*, three features documented through this research in June 2019 correspond with place names identified in 1975. The place names recorded, "Inganialuk" (a place with strong tide (always open and never freezes in winter); and "Inganikoluk" (a little place with a strong tide (never freezes over) (Brice-Bennet & LIA, 1977) are directly indicative of oceanographic conditions for the areas and correspond with feature descriptions that participants provided in 2019. This makes evident the historic and contemporary interactions Labrador Inuit have with such oceanographic features, and the potential for place names to offer a direct description of prominent oceanographic conditions.

Because of the (often) historical origins of place names, such names and associated narratives can allude to historic oceanographic conditions, allowing for an interesting comparison with present features being documented.

In addition to place names depicting historic cultural narratives, contemporary narratives are also indicative of connection to place while conveying important oceanographic characteristics. As outlined in Chapter 4, such narratives can represent a) the location of where a boat sank; b) the strength of the tides in the area; and c) a means of passing on knowledge to younger generations or people from outside of the community. Further, cartographic data alone may not be able to adequately represent details that can be derived from narratives (for example, refer to Chapter 4 section 4.4.2.1). Combining cartographic data with narratives (i.e. through the use of metadata) can embed data with context and help maintain the integrity of Inuit knowledge as it is converted to data. Most participants in Rigolet and Hopedale expressed the importance of including such narratives alongside cartographic data in the mapping process. Because place names and narratives depict multisensory notions of place (Henshaw, 2006), integrating such information into research projects documenting Inuit ocean knowledge can add further context to data, through identifying the depth of oral history and conveying Inuit connections to oceanographic features (such as sea ice or currents).

5.2.2 Structuring research around seasonality

Through participant observations documented in this research, it is evident that seasonality is still integral to how, why, and when Labrador Inuit are on the land and on the water. It is also apparent that seasonality does not necessarily correspond with the western four-season calendar, but instead follows climatic and species cycles resulting in seasons more reflective of the following division: fall, early winter, late winter, spring, early summer, and late summer (as identified by Taylor, 1974). While this example of seasonal cycles was proposed and defined by non-Inuit researchers, it is important to understand such seasonality as identified and defined by (or in collaboration with) Inuit, given the varied, multifaceted and changing ways that Inuit interact with the marine environment throughout the year and over time. As such, when documenting oceanographic features such as sea ice, ocean currents, or weather patterns, accounting for temporality and seasonality from the perspective of Inuit becomes important.

In very broad terms, travel and marine use can be divided into sea-ice and ice-free terms (sled travel; boat travel), which still account for specific seasonal activities. Although the methodology applied for this research focused on the sea ice season (approximately winter-spring) and the ice-free season (approximately summer-fall), intricacies within each 'season' could likely be captured in more detail had a calendar been established with participants in advance of mapping oceanographic features. While separate maps for each season would be unnecessary, establishing a calendar would allow documentation to follow more closely the seasonal cycles of Inuit interactions with the marine space and oceanographic features, resulting in more accurate data and a better conceptualization of context. Feature data could then be represented by seasons (i.e. through colour coding), and/or the attribute table could indicate the specific season(s) associated with documented features. This could allow contextual details (seasonality) to be embedded into data and associated representation parameters.

5.2.3. The importance of mobility

As the dominant method of winter travel transitioned from dog team to snowmobile in the mid-20th century, the range and speed of mobility increased (Brice-Bennet & LIA, 1977) in terms of how much could to accessed from a fixed place in a specific window of time. While across Inuit Nunangat there is evidence that seminomadic lifestyles allowed for a very large territoriality (Aporta, 2009), forced resettlement and centralization had significant implications for mobility patterns and the range of territoriality (Ford et al., 2013). Some participants in this research were subject to forced resettlement and centralization policies (while others were born after policies had already been enforced), which impacted the range of territoriality for some individuals. Further impacting mobility was the adoption of new technology (transitioning from dog team to snowmobile) which has resulted in slight generational differences in mobility patterns and territoriality, enabling people to travel further in shorter periods of time. This was demonstrated through the ways in which different generations interacted with the map when documenting their knowledge of oceanographic features.

An elder who was resettled in Hopedale and grew up travelling by dog team had detailed and precise knowledge of a very specific (smaller) geographic area (limited to the map domain that was used for Hopedale; Figure 10; see Appendix IV for a related narrative). In contrast, younger individuals whose experiences predominantly consist of travel by snowmobile have a much broader geographic area that they are familiar with (although perhaps less precise knowledge in some cases). At the core of this example is the inextricable way that Inuit knowledge of oceanographic features is linked to mobility, and how different patterns of mobility influence the generation and transfer of ocean related knowledge. While mobility facilitates access to marine resources, it is also a venue to support and strengthen social relations, on the land learning, and intergenerational knowledge transfer. As evidenced through participant explanations; experiential learning from family, extended family, or community members is essential in developing holistic knowledge of the marine environment.

Accounting for the significance of mobility to the Inuit way of life, the participatory mapping methodology employed during this research used mobility as the starting point for documenting Inuit knowledge of oceanographic features. For elders in particular, the mobility aspect seemed to be a prominent place to initiate the discussion, with much attention to detail and time spent documenting known trails and routes prior to moving on to document sea ice and ocean currents. In contrast, younger individuals seemed to favour a more flexible process, switching between documenting mobility routes and oceanographic features, at times documenting the oceanographic features prior to any trails or routes. This discrepancy can be seen in Figures 8 and 11, whereby some oceanographic features are represented without explicitly connected trails. While mobility facilitates knowledge of such features, spatial memories and knowledge can also be triggered by geographic features displayed on the base maps (i.e. through displaying topography). Despite such discrepancies, oceanographic data derived from Inuit knowledge will still benefit from incorporating mobility networks, particularly as that data is mobilized from research into decision making. The reason for this is that mobility data can make evident the degree to which Inuit interact with the oceanographic features being documented and prioritize these interactions in the subsequent representation of data. However, this cannot be adequately achieved without maintaining interconnected data.

5.2.4. Maintaining relationality

Structures that support cartographic data representation and decision making in marine governance (i.e. Geographic Information Systems [GIS], and other tools for marine planning) may favour datasets that are readily separable (or deconstructed) so that ‘relevant’ feature data can be utilized in a variety of applications. For example, this research cartographically documented Inuit knowledge of mobility routes, ocean currents and sea ice, and used the attribute table (in ArcGIS) to link related narratives to cartographic data. This represents a large amount of ‘excess data’, particularly if a researcher or manager is seeking to combine Inuit knowledge of sea ice features with datasets from other sources (i.e. western science). As such, to avoid ‘overcomplicating’ how this combined data would be represented, extracting the sea ice feature data from the rest of the dataset derived from Inuit knowledge may be favoured. However, extracting feature-specific data can also leave behind ontological details represented in the rest of the dataset, as expressed through the connectivity between features. This example illustrates how extracting feature specific data can lead to decontextualizing data derived from Inuit knowledge.

Through conveying Inuit experience of the landscape, cartographic data in the form of maps can be an effective tool (or ‘boundary object’) for facilitating communication and collaboration between different knowledge systems (Robinson & Wallington, 2012; Zurba & Berkes, 2013). In this sense, maps can act as a mechanism to represent and communicate Inuit ontology (Wood, Fels & Krygier, 2010). However, critical to this concept is that the map remains in its intended form (as originally documented by knowledge holders). In this case, extracting specific feature data may capture a component of the Inuit experience (i.e. changing ice conditions; Figure 16 A and B), while excluding the rest of the ontological context that can be embedded in the map (i.e. mobility, seasonality, harvesting narratives). When management frameworks consider coastal oceanographic data derived from Inuit knowledge, context-keeping can be supported through maintaining interconnected datasets. Doing so can support a visual (often cartographic) representation of relationality between features, which allows for data to more accurately reflect holistic knowledge (Olson, Hackett & DeRoy, 2016) that is characteristic of Inuit ontology (Furgal & Sheldon, 2013). Maintaining interconnected data in this example would result in Figure 16 (C and D), which portray spatial representations of oceanographic features and the relationality of such features to mobility routes used by Rigolet community members. It can be concluded (based on the mobility routes identified) that despite changing ice conditions, Rigolet community members typically maintain the same mobility routes. In combination with interview data embedded into the attribute table, this approach provides a more holistic understanding of oceanographic features which can support decision making and planning for future change.

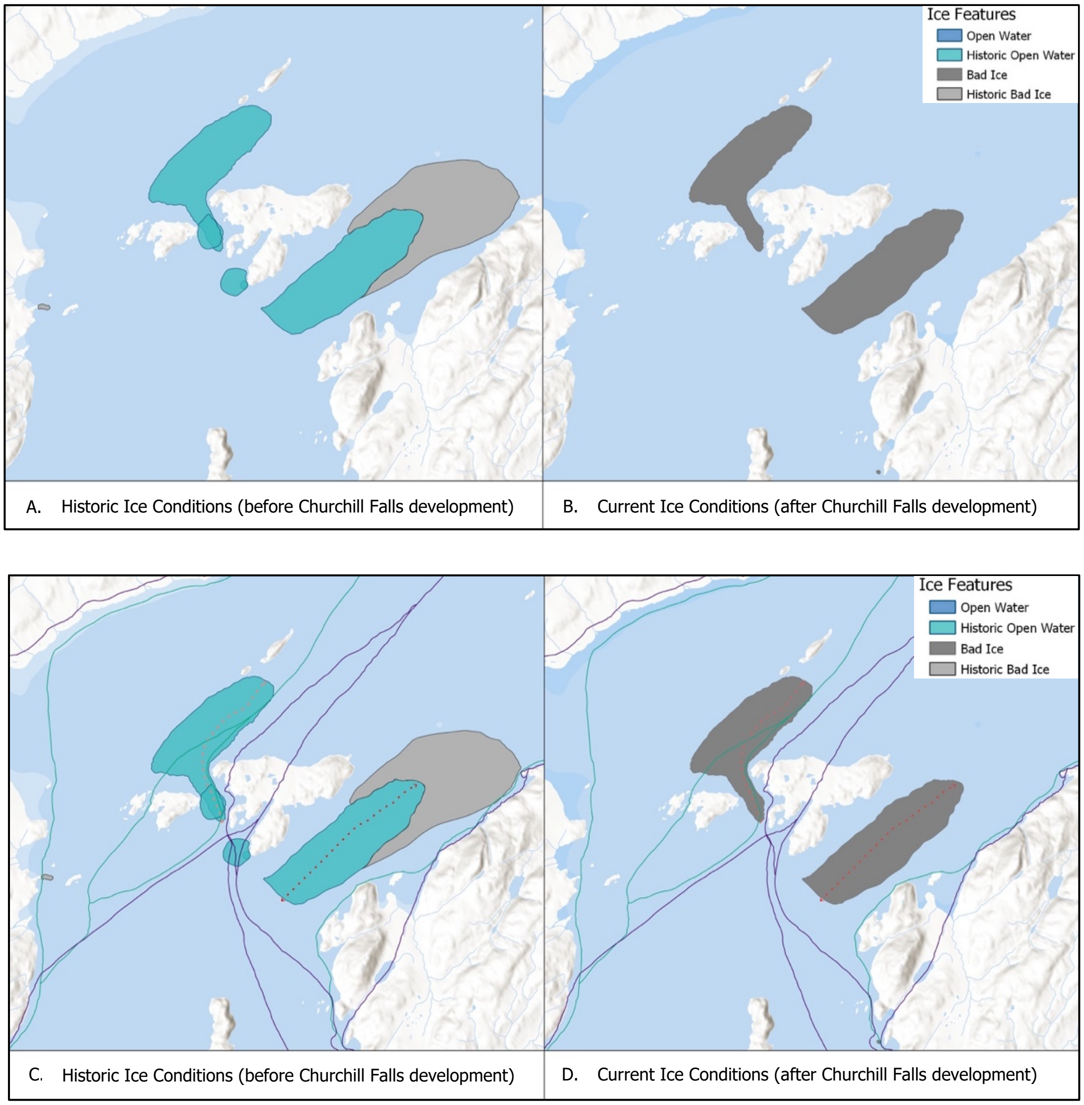

Figure 16 Comparative maps demonstrating extracted data (A, B) as compared to interconnected data (C, D). Interconnected data allows for the relationality between features to remain evident.

5.2.5 Prioritizing community needs and values

Community members expressed curiosity in knowing what scientists know, especially in regard to climate change and local phenomena. Because of an increasing unpredictability in weather and sea ice, community members expressed concerns that what was known and predictable before may no longer hold true. While Inuit knowledge is inherently adaptable to changing conditions (Pearce et al., 2015), the rapidity of change in conjunction with decreased ability to get out on the land is impacting the generation, application, and transfer of knowledge. This provides a space for researchers to design their work to meet community needs. Such work can and should be informed by Inuit knowledge, as there is a significant historical depth of oral histories, and "if you could talk to elders [… throughout] the whole of the North [there's] an awful lot you'll learn and receive and find out that [science could not account for]" (S. Baikie, 2019). Using such knowledge in conjunction with science can support the development of research that aligns with community needs and values, supporting management initiatives that do so as well.

5.2.6 Facilitating knowledge transfer

As a result of changing social and environmental conditions, intergenerational knowledge transfer amongst Labrador Inuit is being disrupted. This is not unique to Nunatsiavut, as it is being experienced throughout Inuit Nunangat (i.e. Ford et al., 2006; Laidler et al., 2009; Heyes, 2011). While climatic and oceanographic changes are impacting people's ability to get out on the land, knowledge transfer is being further disrupted through language loss or the imposition of southern educational structures that emphasize classroom learning over 'on the land' learning (Ford et al., 2006; Heyes, 2011). However, such disruptions to intergenerational knowledge transfer are recognized by Inuit, and many people emphasize the importance of being out on the land as a way of keeping the tradition alive and teaching knowledge and skills to younger generations (A Vincent, 2019; J. T. Lucy, 2019). In recognizing the disruptions to intergenerational knowledge transfer that are occurring, research documenting Inuit knowledge should integrate methods that facilitate and support transfer of knowledge within the community where the research is taking place.

The methodology employed for this research allowed the participatory mapping sessions to be open to community observers. Although very few observers were present in Hopedale, Rigolet had people observing most mapping sessions that took place. While mapping Inuit knowledge does not replace experiential 'on the land' learning, open sessions allow for the social component of learning to be maintained, whereby youth or less knowledgeable individuals are able to engage with and learn from elders and experts as they document and explain their knowledge (see Chapter 4, Figure 8). Despite this research having a pre-defined focus, leaving space for flexibility allowed participants to speak about additional features that were important to them and their understanding of coastal oceanography, which helped to integrate community concerns, values and objectives into mapping sessions, follow-up interviews and resulting data. Further, this also provided a space for telling and sharing stories, which contain a lot of contextual knowledge and often convey the significance of social bonds. As identified in the limitations section of Chapter 2, by not audio or visually recording the mapping sessions some of this rich contextual information went undocumented (from a research standpoint), however knowledge transfer amongst participants and session observers was still able to occur. Future projects should consider recording mapping sessions to help capture some of the intricate contextual information that can be derived from participant conversations. Although this research was structured so that the follow-up interviews were conducted one-on-one, future research should also consider conducting follow-up interviews as (open) focus-group sessions. As suggested by one participant, this setting would encourage people who travel and hunt together to share stories and experiences. Such a format can better support the social context of knowledge transfer, both amongst participants (and observers) and between the researcher and participants.

5.3 Summary of recommendations

As mobility and seasonal harvest cycles are affected by changing climatic and oceanographic conditions, accessing the marine environment will become ever more important to community members in Rigolet and Hopedale. Although timing for accessing the marine environment and its resources may change, continued access to the land supports food security, physical and mental well-being, and intergenerational knowledge transfer. As such, when documenting community observations of oceanographic features, it is important to recognize that seasonality, mobility, and social relations will continue to guide when and how people interact with the marine space. This points to the importance of including such conditions as a means of context keeping when seeking to document Labrador Inuit knowledge of coastal oceanography. Additionally, place names and/or associated narratives represent another way to embed context into oceanographic data. Furthermore, and of utmost importance, processes of documenting Inuit knowledge must prioritize community needs and values such as intergenerational knowledge transfer, and research methodology will benefit from flexibility in this case.

Figure 17 summarizes the preceding discussion and recommendations for contextualizing oceanographic data derived from Labrador Inuit knowledge. Through context keeping in such a way, management and decision-making pertaining to coastal oceanography can account for oceanographic features, trends or changes that are occurring, and how Labrador Inuit interact with, rely on, and are impacted by coastal oceanography. Revisiting the data-information-knowledge-policy framework presented in Chapter 2, methods of contextualizing data can help data derived from Inuit knowledge 'pass through' the data bottle neck in a way that maintain the integrity of Inuit knowledge through respecting aspects of the original ontological context.

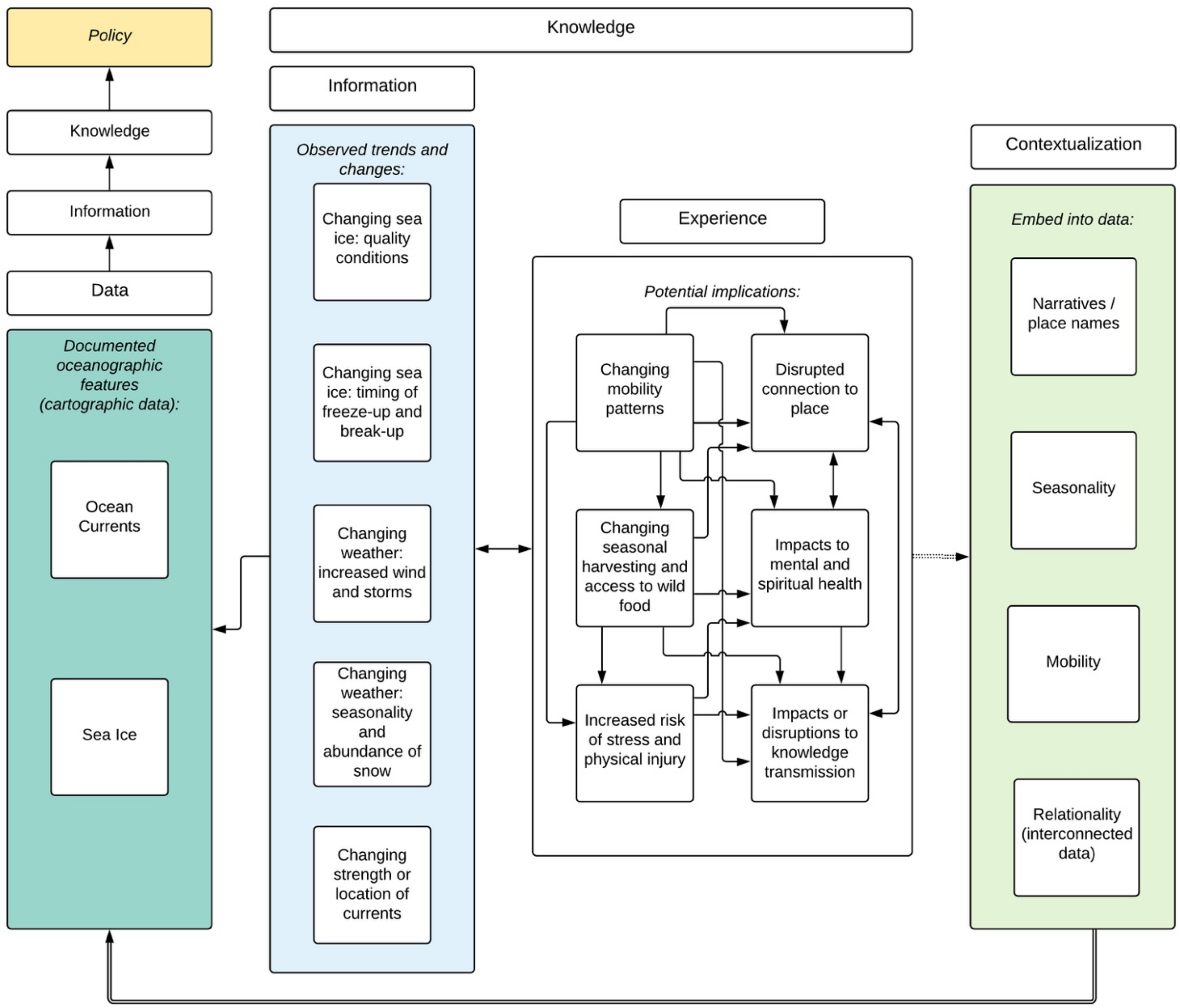

Figure 17 Embedding context into oceanographic data derived from Labrador Inuit knowledge

Figure 17 demonstrates how Inuit knowledge moves through research to inform policy/decision making. Data (i.e. cartographic representations of oceanographic features) stems from information (i.e. observed features, trends, and changes) which has been derived from Inuit knowledge (informed by experience). There is a feedback mechanism between knowledge/information and experience, whereby observed oceanographic trends and changes are in turn impacting Inuit experience and knowledge of the marine environment. In order to account for such contextual intricacies, certain approaches can be taken to embed data with context. As identified previously, and reiterated in Figure 17, these approaches include documenting narratives or place names, including seasonal or temporal qualities, using mobility as a starting point for data collection, and maintaining relationality between features (or interconnected data). These recommendations are not attempting to fit Inuit ontology into four grounding characteristics, but instead aim to identify *some* ontological aspects that can be represented in or attached to data derived from Inuit knowledge. While the data 'bottleneck' (as discussed in Chapter 2, section 2.4.1) may still exist in research, incorporating ontological characteristics into data derived from Inuit knowledge can help to circumvent that bottleneck (to a degree). This can ensure that data informing management and decision making are more respectful and representative of Inuit ontology from which it was originally derived.

Chapter 6: Conclusions

As environmental and climatic changes continue to impact communities throughout Inuit Nunangat, advancing research and management that incorporates Inuit knowledge alongside western science is of increasing importance. As more research projects aim to accomplish this, it is also imperative to consider how Inuit knowledge can be engaged respectfully, particularly accounting for the different ontological origins of Inuit knowledge compared to western science and (most) frameworks that guide marine governance. Differences in the perception of oceanographic features such as sea ice make such ontological differences more explicit. Whereas western science may frame oceanographic features are something to be observed, measured, recorded, and compared, they are integral components to the Inuit way of life, enabling mobility, supporting food systems and facilitating social learning and relationships. Therefore, to effectively document and represent Inuit knowledge of oceanographic features, accounting for such ontological contexts is imperative.

This research documented oceanographic features and related trends observed in the Nunatsiavut communities of Rigolet and Hopedale. Through this process, certain ontological characteristics were revealed that if embedded in or attached to data, could support data creation that respects the original ontological context of Inuit knowledge, while simultaneously generating a thorough understanding of oceanographic features of relevance to community members. Such characteristics include starting with mobility networks to document knowledge of ocean features; documenting place names and narratives; accounting for seasonality and temporality; and maintaining interconnected data in order to express relationality between features. Including these aspects in data derived from Inuit knowledge can help provide a more holistic and contextual dataset. Further, at its core marine research needs to be conducted to support community identified needs and priorities, which includes employing methods that support intergenerational knowledge transfer within communities. While these characteristics could never represent a complete understanding of Inuit ontology, they aim to respect the ontological context of Inuit knowledge, ultimately aiming to mobilize such contexts (and related values) into marine research and decision making.

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Appendix I: ArcGIS Attribute Table Example

This table demonstrates the use of a "Notes" column in the attribute table for cartographic data represented in ArcGIS Pro. In addition to metadata which can help contextualize the entire data package (i.e. current, mobility and sea ice data from Rigolet and Hopedale), the attribute table can be populated with feature specific contextual information (for example through including a field for socio-cultural value or additional notes). The notes field includes summaries of the descriptions made by participants while they were mapping their knowledge of ocean currents, in addition to some details that were directly recorded in semi-structured interviews. Notes were only included if participants indicated they had details about a specific feature that was being mapped, and not all features include additional notes.

Field: Add Delete Calculate Selection: Zoom To Switch Clear Delete Copy

Season	CurrentDirection	CurrentStrength	Category	Notes
Winter	Dominant	Medium	Current	Dominant flow out of the bay; ice gets bad here faster in the spring
Winter	Bidirectional	Very Strong	Current	Goose Hunting
Winter	Bidirectional	Strong	Current	Heavy current in spring with lots of run-off
Winter	Dominant	Strong	Whirlpool	Ice formation in whirlpool during spring; area of stong tidal current
Winter	Bidirectional	Strong	Current	Last place to freeze over in winter
Winter	Bidirectional	Medium, Historic	Current	Medium strength during summer, not as strong as in the Narrows
Winter	Bidirectional	Weak, Historic	Current	Medium strength during summer, not as strong as in the Narrows
Summer	Dominant	Very Strong	Current	More strong going out of the bay
Summer	Dominant	<Null>	Whirlpool_Area	Shallow with lots of rocks; whirlpools within area
Winter	Bidirectional	Very Strong	Current	Ship sank somewhere in this general area - how people recognized it a
Summer	Bidirectional	Strong	Current	Strong tidal current
Summer	Bidirectional	<Null>	Current	Tidal current
Summer	Dominant	<Null>	Current	Tidal current
Summer	Dominant	<Null>	Whirlpool	Two currents converge here and make for very rough waters
Winter	Bidirectional	Very Strong	Current	Two currents converge to make rough water; Goose hunting in spring
Summer	Dominant	Strong	Whirlpool	Used to be very strong. Less strong after damming Churchill Falls (197
Summer	Dominant	Very Strong, Historic	Whirlpool	Was very strong before Churchill Falls was dammed

Click to add new row.

0 of 114 selected

Appendix II: Semi-structured Interview Guide

This guide depicts questions / themes used by research to guide semi-structured interviews. Depending on participant interest, not all questions were necessarily touched on. There was a high degree of flexibility built into the interview structure to allow for participants to discuss what was of interest / importance to them.

1. Where and when were you born?

2. Did you travel on the land and ocean a lot as a child?
    a. What kind of activities would you travel for?

3. For how long have you been travelling to the regions you describe?

4. How did you learn what you know about ocean currents and sea ice patterns?

5. Could you tell me what it means to you to be out on the land and the water/ocean?

6. Could you describe a what a rattle is?

    a. *Follow-up:* Are there specific Inuttitut words you would use to describe other ocean or ice features? (i.e. rattle, area of open water, ice edge, whirlpool)

7. Have you noticed any patterns of change in the currents? *(over what kind of timeframe?)*
        i. *Over the years? (within your life time?)*
        ii. *What about during different seasons – do the currents change in strength?*
    b. Any changes in sea ice patterns?
        i. Changes in open water areas / rattles?
        ii. Any changes in where you find areas of safe or unsafe ice?
        iii. have there been more or less accidents or other events that you have noticed from bad ice, or other ocean changes?
    c. Have your travel routes change because of these changes to the ice or currents?

8. How do the ocean currents affect how you interact with or use the ocean?

9. When you look at the maps that were created yesterday, do you think that they represent what you know of trails, sea ice and ocean currents? Is there anything else that is important to include with the maps?

a. *Alternative prompt: When passing on knowledge to others using things like maps, what else is important to include?*
b. Follow-up: Do you find this kind of method (mapping) a good way to record your knowledge of ocean currents? Is there anything you can think to improve it?

10. When these maps are taken away and interpreted, do you think that some of your knowledge will be lost in the process? What other information (such as the stories) would be important to include with ocean knowledge that has been documented already?

11. How would you like to see the information collected in these maps come back to the community?

12. Is there anything else that you would like to add?

Appendix III: Labrador Inuttitut Oceanographic Terminology

This is a compilation of Labrador Inuttitut terminology related to oceanographic features. The table has been informed by Gus Semigak (Hopedale), and Labrador Inuttitut-English online dictionaries.

Table 1

Inuttitut terminology for oceanographic features recorded in Hopedale

Inuttitut	English description
inggiganik	rattle, when two tides come together
inggiganialuk	strong tides, big rattle, never freezes over
inggiganikoluk*	smaller rattle (may or may not freeze over)
Killak	hole in the ice (polynya)
Kullutuk	spinning water, pulling things down (whirlpool)
kaivittuk	spinning water only on the surface (whirlpool)
sinâ	edge of the fast ice

Note: Terminology above identified by Hopedale translator and research participant Gus Semigak

** possible spelling differences*

Table 2

Additional Inuttitut terminology for oceanographic and related features

Inuttitut term	English description
silak	weather, (climate)
ukiuk	winter
upingasâk	early spring
upingak	spring
aujak	summer
ukiatsâk	early fall
ukiak	fall
tagiuk	salt water
imappik	the sea

ikulliak	calm water
imappik	sea (outside, offshore)
atsânik	seaward, sea current
ingigganik	current (ocean or river)
ingiullik	sea swells
mallik	a wave
sâttuak	to drift away
tinik	low tide
tinitsuak	ebb tide
tinitunik	rare, exceptionally low tide
ulik	high tide
ulitsuak	rising tide
ulitunnik	very high tide
sikuk	pan of ice
Kupugâk	striae only on sea ice in formation
sikuliak	the first ice in the fall
kinuak	first thin ice
alutsâk	bad ice
âjugak	a crack in harbour ice
kivinik	water on ice under snow
tippapuk	the ice has drained
nilak	clear, fresh-water ice
siku	harbour ice
piKalujak	iceberg
tuvaik	ice breaks in spring
tuvailikKuk	the ice is breaking up
tuvak	firm winter ice
tuvaguttuk	the ice is thick
Kullutuk	crack in many places, ice in the intertidal zone
Kamutik	sled
imakkojut	they are travelling by water
ingiggak	travel

akKutik	a road; a path; a route
Kimutsik	to travel by dog team
akKunak	a storm
ikangâk	southerly wind
imujik	wind
kanangâk	easterly wind
Kavanganik	southeasterly wind
uanniluak	southwesterly wind
niggik (niKKik)	a northeast wind
pangâk	westerly wind
unangâk	to blow from the east
Note: Terminology above retrieved from Zippie Nochaasak's online dictionary (zippienochasak.tripod.com), and Labrador Virtual Museum Inuttitut-English dictionary (http://www.labradorvirtualmuseum.ca/home/inuttut_dictionary.htm)	

Appendix IV: Word Tag Cloud Frequencies

The word tag cloud presented in Chapter 4 was based on phrases identified and categorized under the theme “connection to the land and sea” using grounded theory methodology and open inductive coding. The following table summarizes what information was included, and the frequency of words used to generate the cloud. Duplicates based on capitalization or word variations exist, slightly skewing the frequency. The frequencies are based on 39 phrases or descriptions, from a total of 12 individuals (total number of interview participants in Rigolet and Hopedale).

Frequency	Word	Frequency	Word	Frequency	Word	Frequency	Word
14	hunting	4	started	3	bad	2	Rocky
14	time	4	around	2	grandparents	2	geese
12	way	4	people	2	activities	2	loves
12	winter	4	salmon	2	partridges	2	trips
9	right	4	always	2	partridge	2	early
9	cause	4	start	2	Ticoralak	2	moved
9	know	4	water	2	different	2	else
9	come	4	years	2	sometimes	2	eggs
8	summer	4	cabin	2	probably	2	fall
8	spring	4	nets	2	anything	2	work
8	fish	4	wild	2	earlier	2	knew
8	used	4	year	2	Rigolet	2	best
8	land	4	keep	2	Flowers	2	area
8	ice	3	experience	2	outside	2	said
7	travel	3	definitely	2	someone	2	mean
7	still	3	somewhere	2	anybody	2	call
7	along	3	Makkovik	2	anymore	2	made
7	food	3	parents	2	growed	2	seal
7	see	3	running	2	school	2	feel
7	one	3	telling	2	Easter	2	sons
6	everything	3	months	2	season	2	away
6	fishing	3	store	2	coming	2	take
6	eddy	3	every	2	faster	2	bay
6	much	3	sinâ	2	opened	2	two
5	caribou	3	feed	2	Island	2	yes
5	birds	3	bays	2	father	2	day
5	seals	3	meat	2	really	2	son
5	thing	3	open	2	family	2	try
5	times	3	lost	2	rather	1	emotionally
5	place	3	part	2	taught	1	Spiritually
5	edge	3	wait	2	better	1	communities
5	tide	3	look	2	lived	1	grandfather
5	good	3	boat	2	first	1	physically
5	back	3	Cove	2	black	1	Harvesting
5	can	3	eat	2	shore	1	difference
4	travelling	3	cod	2	catch	1	corrected
4	tradition	3	old	2	spawn	1	completely
4	usually	3	dad	2	ahead	1	especially
4	there’s	3	Bay	2	trout	1	traditions

Frequency	Word	Frequency	Word	Frequency	Word	Frequency	Word
1	unexpected	1	retired	1	guess	1	we’s
1	migratory	1	working	1	polar	1	will
1	wonderful	1	today’s	1	month	1	days
1	Wonderful	1	Hunting	1	Gulls	1	want
1	belonging	1	careful	1	eider	1	kind
1	fishermen	1	survive	1	might	1	Back
1	travelled	1	thought	1	bread	1	slow
1	plentiful	1	Kamutik	1	alive	1	burn
1	someplace	1	helping	1	stock	1	less
1	porcupine	1	younger	1	hares	1	sold
1	daughters	1	picking	1	gives	1	goes
1	traveling	1	growing	1	watch	1	home
1	relatives	1	haven’t	1	sense	1	soon
1	gathering	1	getting	1	tides	1	even
1	yesterday	1	without	1	pride	1	ever
1	teenager	1	weather	1	Cause	1	risk
1	thinking	1	culture	1	learn	1	life
1	memories	1	Summer	1	boats	1	fell
1	mentally	1	Egging	1	motor	1	hill
1	currents	1	edible	1	enjoy	1	long
1	building	1	People	1	makes	1	ease
1	teaching	1	uncles	1	Trout	1	team
1	backside	1	arctic	1	spots	1	seem
1	trouting	1	waters	1	froze	1	kept
1	heritage	1	rising	1	fella	1	he’s
1	survived	1	either	1	white	1	wood
1	whatever	1	shores	1	man’s	1	also
1	daughter	1	notice	1	south	1	hunt
1	declined	1	inside	1	Peace	1	help
1	spawning	1	anyway	1	speak	1	grew
1	changing	1	almost	1	seems	1	pass
1	suppose	1	little	1	mom’s	1	gets
1	affects	1	island	1	older	1	real
1	berries	1	buying	1	table	1	ones
1	rattles	1	mostly	1	least	1	need
1	keeping	1	formed	1	never	1	June
1	Mussels	1	Enough	1	Today	1	tell
1	whatnot	1	living	1	house	1	net
1	current	1	stayed	1	goose	1	run
1	trapped	1	person	1	camp	1	say
1	sustain	1	closed	1	stay	1	met
1	putting	1	Spring	1	self	1	gas
1	happens	1	hungry	1	deal	1	big
1	certain	1	August	1	turn	1	new
1	quicker	1	eating	1	bear	1	ago
1	pulling	1	matter	1	done	1	nob
1	nothing	1	wanted	1	char	1	dog
1	changed	1	trying	1	duck	1	sea
1	becomes	1	trails	1	Nain	1	bit
1	explain	1	happen	1	wife	1	stopped
1	animals	1	passed	1	find	1	leave
1	partner	1	within	1	name	1	able

Appendix IV: Gus Semigak Travel Narrative

This narrative was recorded with Gus Semigak as he explained how travel changed after transitioning from sled and dog team to snowmobile. The locations he is referring to correspond with the area represented in Chapter 4, section 4.3.1.1, Figure 10. This is the verbatim transcript.

Gus Semigak: We used to, myself, my father and my mother, and by the ways, I was adopted to my parents. We used to be tired of waiting for Easter to come, 'cause we couldn't travel Easter week we couldn't travel anywhere, so we had to stay here for Easter Monday, for the races and whatever the games they were playing – that's on the Monday. On Tuesday morning, we're gone, we're gone for spring. And when we were travelling, the only time we travelled was on dog team at that time. So, one year after we were going to the place where we were going to stay for the spring – my father went to stop in to one the islands so that we could do a little bit of hunting before we get to the place where we, exactly where we were going to be for the spring. So anyway, next day it was blizzard, bad weather, couldn't see very far. We was inside tent, and our tent tore, big piece right out the back, and then… so anyways that happened and we couldn't do nothing. So, my father had to harness the dogs. And my mother was getting ready. I was only small, but I remember quite well what happened. But anyway, we was getting ready, we put my clothes on – my mother put my clothes on; daddy was harnessing the dogs so we know... he knows where a small cabin was to – there's one up the bay, one in the bays there on this side, on the north side. So, we had no other choice to go, my father had no other choice, so we had to go to that small cabin and it was blizzard. Snowing hard, blowing, gee. So, we got everything ready, then my father, he laced up the stuff we was taking to the Kamutik, just about everything except our tent. So, all he said was "huit"; "huit" means let the dogs go. So, all he said dad was, I don't know how many times, 2 or 3 times I guess… and the leader, he listened to him and he went. We was on the island and when we got to the ice sometimes we couldn't even see our dogs – blowing so hard, blizzard. And my dad never spoke to the dogs after.

Eric Oliver: Right – they just… they knew where to go?

Gus Semigak: They knew exactly where they was going. So, it must have been 2, 3 hours on the ice without seeing the land, even seeing our dogs sometimes. So, when we got… I don't know, I remember real good – the only time the dogs stopped was by the cabin.

Breanna Bishop: Really, wow.

Eric Oliver: Wow.

Gus Semigak: By the cabin, that was it. You know, I couldn't believe it. Cause my father never spoke to them, but he used talk to my mother, that's all. Never said nothing to the dogs, just kept going until we got to the cabin.

Eric Oliver: That's amazing

Breanna Bishop: Wow, that's incredible

Gus Semigak: I couldn't believe it, yeah. I couldn't believe it. But like I said, if we had skidoo, we would be lost. We wouldn't know where we going. I told that story the first time… if you take care of your dogs, the dogs will take care of you. That's only true. So, that's my short story.