

Traditional Knowledge in Marine Spatial Planning:

Addressing epistemological and practical challenges in the Arctic

By

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Submitted in partial fulfillment of the requirements for the degree

of

Master of Marine Management

at

Dalhousie University
Halifax, Nova Scotia

December 2017

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[Terms and Abbreviations]

BSP	Beaufort Sea Partnership
ERM	Environmental Resource Management
GIS	Geographic Information System
GPS	Global Positioning System
HTC	Hunters and Trappers Committee
ICZM, ICM	Integrated Coastal Zone Management
IGC	Inuvialuit Game Council
IRC	Inuvialuit Settlement Region
ISR	Inuvialuit Settlement Region
ISROP	Inuvialuit Settlement Region Online Platform
JS	Joint Secretariat
KOS	Knowledge Organization System
LOMA	Large Ocean Management Area
MSP	Marine Spatial Planning
NWT	Northwest Territories
OLM	Object-Level Metadata
RCC	Regional Coordination Committee
TEK	Traditional Ecological Knowledge
TK	Traditional Knowledge
TK data	Traditional knowledge that is converted into datasets, e.g. shapefiles, spreadsheets
TKH	Traditional Knowledge Holder
WWF	World Wildlife Fund

[Acknowledgements]

The author would like to thank Dr. Claudio Aporta (Dalhousie University), for investing considerable time and effort into this project, and providing invaluable critical feedback, Leah Beveridge (Dalhousie University) and Adrian Gerhartz-Abraham (Dalhousie University) for sharing their knowledge and providing support, Colleen Parker (WWF-Canada) for providing the opportunity to engage in innovative Arctic research, and Dr. Ian Stewart for undertaking the role of Second Reader.

[Abstract]

Citation

Bickford, M. 2017. Traditional Knowledge in Marine Spatial Planning: Addressing epistemological and practical challenges in the Arctic [graduate project]. Halifax, NS: Dalhousie University.

Abstract

Marine Spatial Planning (MSP) is a tool for comprehensive, integrated ocean management, used to mitigate anthropogenic impact on the environment and promote co-operation between ocean users. In the Beaufort Sea LOMA, the Inuvialuit are the primary users of coastal resources, making them a significant and necessary stakeholder in the MSP process. Inuvialuit possess a substantial body of knowledge and expertise related to management of the environment, and the Traditional Knowledge (TK) held by the Indigenous community is a valuable source of information in the context of MSP. In order for TK to be effectively integrated into MSP, challenges related to TK data integration must be addressed, and practices for managing, analyzing, and using TK must be explored and crafted. This research addresses epistemological and practical issues in using TK for environmental management, using an interdisciplinary approach to review best practices in TK integration, and suggest practices for using TK in MSP in relation to geospatial data and knowledge organization. The paper concludes that practices that foster transparency, accessibility, and the maintaining the context of TK as data are necessary for the successful use of TK in MSP.

Keywords: Traditional Knowledge; Indigenous Knowledge; Beaufort Sea; Inuvialuit; Marine Spatial Planning; Coastal Zone Management; Western Arctic; Inuvialuit Settlement Region

Chapter 1

Introduction

1.1 The Context

Recent decades have seen unprecedented pressure on coastal ecosystems, which has resulted in the widespread degradation of adjacent marine and terrestrial habitats around the world. Ecosystem services provided by these coastal habitats, such as food and protection, have been compromised by anthropogenic disturbance. This degradation is in tandem with ongoing effects of climate change, putting livelihoods of coastal peoples at risk (Bartlett et al, 2017).

Starting in the 1970s, but especially in the last two decades, Traditional Knowledge (also called *Indigenous Knowledge* and *Traditional Ecological Knowledge*) has become increasingly utilized in Environmental Resource Management (ERM), both as a supplement to scientific shortfalls in an increasingly changing environment, and as a means to further Indigenous rights (e.g. through land claims). This increase can be seen in both its direct use in management, and through the designation of Traditional Knowledge (TK) as a significant and useful source of information within policy and academic literature throughout the world. Recognition and use of TK in environmental management can increase the amount of available spatially specific information, and facilitate establishment of a larger management role for local Indigenous resource users.

Recent responses to anthropogenic impacts and competition over coastal space and resources between stakeholders (communities, organizations, government) in coastal

governance have focused on Integrated Coastal Zone Management (ICZM) and related approaches such as Marine Spatial Planning (MSP). In these contemporary management frameworks, sociocultural, ecological, industry, and recreational uses are all considered through an understanding of their relationships to one another, rather than individually. This process of integration exists in both governance and data analysis, and when coastal management involves Indigenous peoples, Traditional Knowledge (TK) must be documented *and* integrated into databases with other forms of data that form the knowledge-base for decision making, particularly when MSP is considered. In this sense, TK *should* be used in management because of the nature of the current management paradigm as holistic, integrated, and interdisciplinary. However, although there are many guidelines and best practices for collecting TK and applying TK to processes such as environmental impact assessments, there is a shortage in the literature to guide the proper integration of TK into MSP.

The use of TK in ERM is also codified into Canadian and international legal and regulatory frameworks, and therefore *must* be integrated into coastal management processes. In 2009, the *Integrated Ocean Management Plan for the Beaufort Sea: 2009 and Beyond* (IOMP) was published, a culmination of knowledge and experience acquired from earlier initiatives such as the Inuvialuit Community Conservation Plans, the Beaufort Sea Strategic Regional Plan of Action (BSStRPA), and the Beaufort Sea Integrated Management Planning Initiative (BSIMPI), created to address the fact that the Beaufort Sea was listed as one of Canada's five priority areas in the Oceans Action Plan federal initiative (2006) (BSP, 2009). The IOMP reflects the broader, global paradigm of Integrated Ocean and Ecosystem-Based Management (EBM), the framework promoted by the Beaufort Sea Partnership (BSP) and stimulated by Canada's Oceans

Act (1997). The IOMP incorporates social, cultural, economic and ecosystem values expressed by communities, Working Groups and members of the Beaufort Sea Partnership. Furthermore, the Inuvialuit are the primary environmental resource users of the coastal Beaufort Sea, and play a significant role in partnership. Thus, Inuvialuit Knowledge as a form of TK is emphasized as a significant source of information in the Beaufort Sea IOMP initiative and the Beaufort Sea Partnership.

1.2 The Research Question

Based on the premise that TK *should* and *must* be used in ICZM and MSP, this paper seeks to understand how TK can be effectively incorporated into coastal and ocean management. It focuses specifically on the integration of TK into MSP, and the process of structuring TK so that it is practical for planning while maintaining its integrity as a distinct and complex knowledge system. In other words, this paper seeks to understand TK within a wider context of use, and recognize best practices for incorporating TK into current governance structures such as Marine Spatial Planning.

1.3 The Problem

Traditional Knowledge (TK) has been recognized as a valid and essential source of information concerning the natural environment and its resources, and is endorsed by International organizations such as the United Nations (UN), the Canadian government, academia, and NGOs.

The Government of the Northwest Territories (NWT) and Yukon recognize TK as a significant source of data, and incorporate TK into Government decisions and actions through policy (e.g. GNWT, 2005). The incorporation of TK into environmental resource management and policy, however, is a relatively new phenomenon, especially in the context of coastal and ocean management. Despite the potential for TK to contribute to environmental management, there is little available guidance on how to effectively and appropriately use TK in this context (Usher 2000). Furthermore, TK is not consistently quantified, analyzed, or applied for environmental resource management (Danielson al., 2014).

It is important to recognize that TK and Western Scientific Knowledge reflect widely different paradigms or knowledge systems, which necessitate different procedures for documentation and analysis. Because of this, the task of integrating TK and Western Science has inherent epistemological and fundamental difficulties, as TK cannot just be arbitrarily incorporated into Western Scientific conceptual frameworks and datasets. Generally speaking, TK is holistic, multi-dimensional, oral, and community-bound, all of which create challenges for documentation, representation and integration in the context of Western Scientific methodologies and frameworks. F. Berkes (2009) notes that effectively contextualizing TK when communicating it remains “one of the biggest challenges in Indigenous knowledge research” (page 151).

This paper will focus its scope on the Beaufort Sea, as it provides an excellent case to understand how Indigenous knowledge can be used and potentially included into an integrated management plan. In order to explore this issue, this paper will first examine the context for

Inuvialuit Knowledge in MSP within the Beaufort Sea. It will then survey best practices associated with the use of TK as data in environmental management. In order to fully grasp the process of using TK in MSP processes, the paper will analyze methods involved in using TK as data, examining practical issues encountered when mapping TK via GIS software. Lastly, a discussion of TK management and data organization will be held, borrowing methodology from a variety of different disciplines and applying this methodology to Inuvialuit Knowledge.

This research is not intended to be a comprehensive prescription of methodology, but instead a review of themes and issues in data analysis that are often ignored or overlooked when dealing with TK. Discussions included in this paper are not just relevant to TK researchers, but also to environmental resource managers, as there is a growing necessity to include TK in integrated management. TK is typically documented by researchers, Indigenous organizations, or management/government agencies in collaboration with the local communities whose knowledge is being studied. By focusing on issues such as transparency and appropriateness of TK collection methods and metadata, representations of TK data that takes into account broader contexts, and organization of knowledge that reflects the TK worldview, a greater understanding of TK in MSP can be gained.

Within the context of the Beaufort Sea, this paper concludes that there are several considerations that must be taken into account to make TK data practical and effective in MSP planning processes, including transparency, accessibility, context, and engagement and communication with Inuvialuit stakeholders. These considerations are important in collecting

and applying TK data to management, and more specifically in map-making, data organization and data integration.

Chapter 2

The Context of Using Traditional Knowledge in MSP

2.1 Background

This research was motivated by questions that arose during a project undertaken by Dalhousie University at the request of WWF-Canada, which assisted in the preparation of the Oceans Use Workshop hosted by the Beaufort Sea Partnership in Inuvik in October 2017. The workshop explored the potential for using Marine Spatial Planning in the Beaufort Sea Large Ocean Management Area (LOMA), investigating Inuvialuit perceptions regarding the feasibility of Marine Spatial Planning practices in the area with the intention of creating a dialogue on next steps.

This paper uses the Beaufort Sea as a case study in order to engage with the broader issue of how TK can be appropriately and effectively integrated into Marine Spatial Planning. There is ample literature on issues related to integrating TK into environmental management (Fazey et al., 2013; Ford and Martinez, 2000; Friendship and Furgal, 2012; Stevenson, 1998; Crawford, et al., 2009; Menzies, 2006; Rathwell et al., 2015; Usher, 2000; etc.), and many documents outlining “best practices” for doing so (Armitage and Kilburn, 2015; Dene Cultural Institute, and Canadian Environmental Assessment Research Council, 1991; Fedirechuk et al., 2008a, 2008; etc.). However, there is a deficiency in the literature regarding how to address practical issues encountered during the actual application of TK as a source of data. In order to address this issue, this research looks at best practices for engaging with TK, practical issues

encountered when using TK as geospatial data, organization of Traditional Knowledge systems, and ways in which we can move forward and shift control of TK back to Indigenous communities. The intent of this study is, therefore, to understand the fundamental process that using TK as data entails, identifying practical problems one may encounter during this process, and collecting and examining potential solutions to these issues.

2.2 Methodology

The methodology used in this paper involved several steps of analysis. The first step in analysis was a literature review, designed to provide context for the potential of MSP in the Beaufort Sea. The second step was a stakeholder analysis, undertaken to provide insight into participants of Beaufort Sea MSP, focusing on Inuvialuit partnerships and community organizations. With this context, a data gap analysis was performed on available Inuvialuit data, using existent Marine Spatial Plans to gain an understanding of what data was needed for successful MSP. Lastly, an interdisciplinary assessment of TK analysis was conducted to identify recommendations for using TK in MSP and ICZM.

This study consulted online databases, policy documents, guidelines for best practices (acquired from environmental impact assessments (EIA), government documents, and academic literature), and library resources accessed through the Novanet Catalogue— a library catalogue comprised of academic libraries in Nova Scotia. The literature review involved recent white and grey literature. The review process focused on any literature regarding TK and

related terminology (e.g. Traditional Ecological knowledge, Indigenous Knowledge) in the context of integrated environmental management, MSP, and data management for governance. It was limited to sources published within a 10-year time frame (2007-2017), and focused on North American literature, although international literature was consulted when deemed relevant. The literature review served to produce the context for analysis of Inuvialuit TK data. Because little literature was available for TK data management in the context of MSP specifically, the literature review took a wider approach, adapting other disciplinary analyses for use specifically in MSP and ICZM.

The stakeholder analysis was conducted to compile and review a list of stakeholders with potential interest in marine activities within the Beaufort Sea LOMA. The stakeholder analysis listed and assessed any parties who are currently engaged in activities within the LOMA, exploring relationships between potential stakeholders and assessing potential for cooperation and conflict. The stakeholder analysis was not exhaustive, but was instead used to provide a framework for potential participants in the MSP process, as well as for identification of potential sources for geospatial data.

The primary segment of this research was based on a review and analysis of available TK datasets associated with the Beaufort Sea LOMA. A data-gap analysis was conducted, which provided an excellent starting point to assess the availability of data for an MSP. The analysis consisted in a review of the Inuvialuit Settlement Region Online Platform (ISROP), and a search for additional datasets provided by relevant stakeholders. A limitation encountered during the research process was that the researcher did not have access to confidential TK datasets

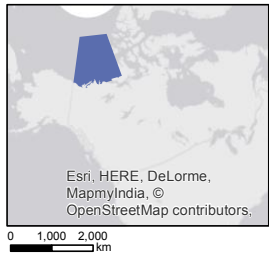
gathered by the Inuvialuit Regional Corporation (IRC). However, the researcher had access to historical data from Inuvialuit Community Conservation Plans, consisting of a series of six community-based plans prepared by the individual communities in collaboration with the Wildlife Management Advisory Council (NWT) and the Joint Secretariat, and published in 2008. The plans are comprised of detailed ecological information, recommended land use practices, and wildlife management practices for each community within the Inuvialuit Settlement Region (ISR) and its planning area—Aklavik, Inuvik, Ulukhaktok, Paulatuk, Sachs Harbour, and Tuktoyaktuk.

2.3 Limitations

Several limitations were encountered during research. Geographic distance and limitations in internet quality in the Western Arctic prevented the researcher from engaging Inuvialuit stakeholders to the degree originally anticipated, and participation in Arctic workshops and meetings was not feasible. Furthermore, it was not possible to use current Inuvialuit data collected by the IRC for the project in question. However, these limitations informed research, and provided insight into the challenges of remotely engaging TK in marine management. Many marine managers may not have direct access to engage with communities, and may rely on research collected by others. In this case, transparency and context are critical for worthwhile analysis.

2.3 Policy

The Beaufort Sea Large Ocean Management Area (LOMA) is one of five priorities areas identified by the Government of Canada for integrated ocean management planning (indicated in **Figure 1**). Located in the northwestern Canadian Arctic, the LOMA contains the marine portion of the Inuvialuit Settlement Region (ISR), an area established by the Inuvialuit Final Agreement (IFA) (Canada, 1984). The IFA synthesizes the fundamental goals of the Inuvialuit as being the “preservation of Inuvialuit cultural identity and values, enabling Inuvialuit to be equal and meaningful participants in the northern and national economy and society, and protecting and preserving the Arctic wildlife, environment and biological productivity” (Inuvialuit Regional Corporation, 2017). TK research had an important role in the formation the IFA, which was largely a result of the 1977 Inuvialuit land claim proposal – Inuvialuit Nunangat (Armitage and Kilburn, 2015). Since the establishment of the IFA, TK studies have been conducted for a multiplicity of purposes by territorial and federal government agencies, Indigenous authorities, environmental management organizations, industry, and academic institutions. TK research is needed in order to comply with legal requirements and policy and planning objectives, and TK knowledge must be given full consideration in environmental management, impact assessment, and resource management decisions (Armitage and Kilburn 2015, vii). Furthermore, the Mackenzie Valley Resource Management Act (1998), the Mackenzie Valley Joint Review Panel, and the McCrank Report to the Minister of Indian and Northern Affairs Canada also recommend that TK be considered in decision-making, resource management, and assessment (Government of Canada 2005; Keeping 1989; McCrank 2008; National Energy Board 2010, cited in Bennett and Lantz, 2014).



Beaufort Sea Large Ocean Management Area (LOMA)

- ISR
- LOMA

Created by: Mikaila J. Bickford
Date: October 20, 2017
Source: ITK, DFO, 2014, accessed through BSRP, 2017

Coordinate System: NAD 1983 Yukon Albers
 Projection: Albers
 Datum: North American 1983
 False Easting: 500,000.0000
 False Northing: 500,000.0000
 Central Meridian: -132.5000
 Standard Parallel 1: 61.6667
 Standard Parallel 2: 68.0000
 Latitude Of Origin: 59.0000
 Units: Meter

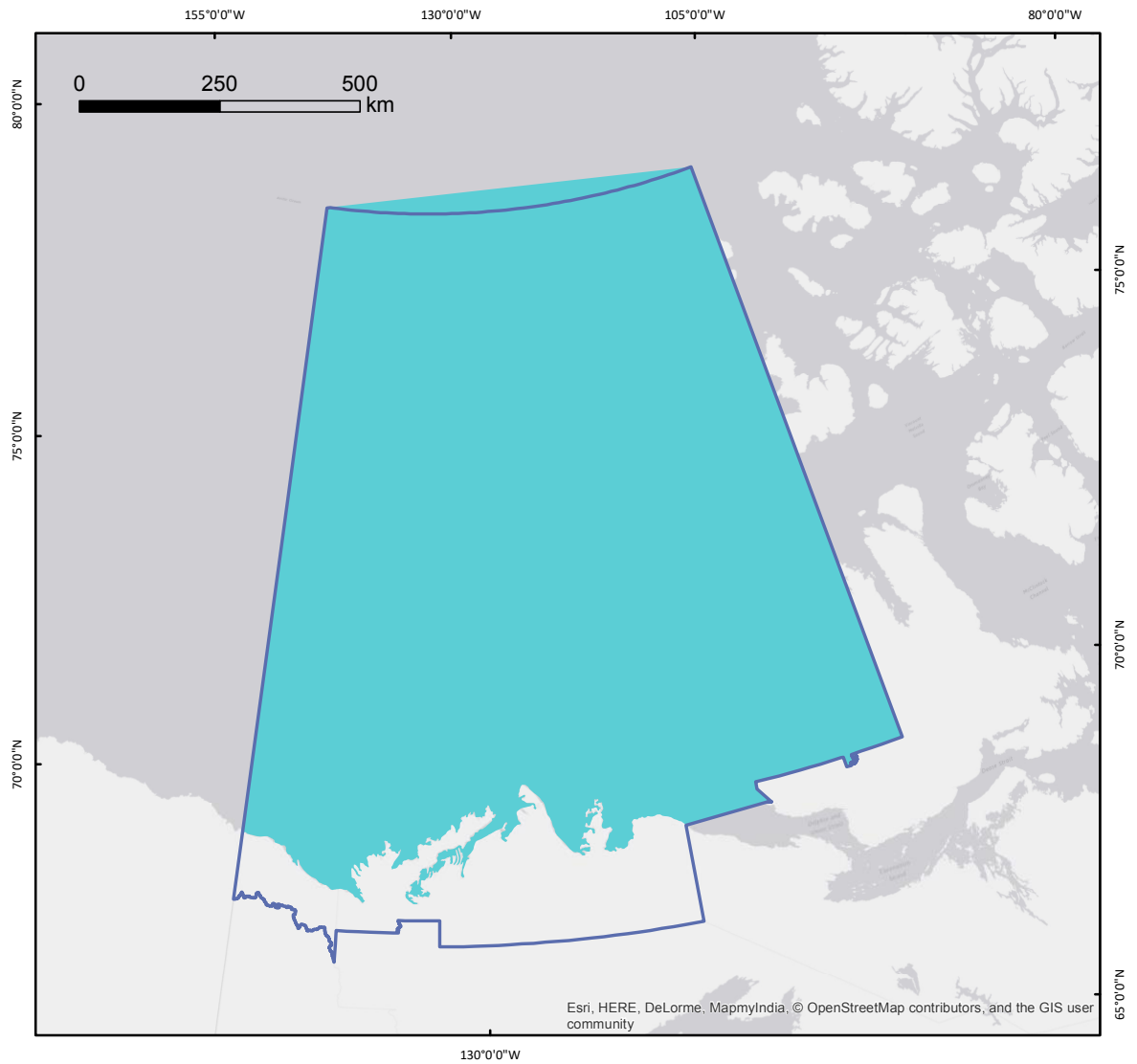


Figure 1: Map of the Beaufort Sea LOMA and ISR Boundary

The need for integrated management and TK documentation is exacerbated by evolving political, economic and environmental conditions. Ongoing changes in temperature, increased natural disturbance regimes, and growing industrial development are anticipated, and when coupled with the multitude of stakeholders with interest in the region, make the benefits of MSP attractive to the region (Bennett and Lantz, 2014). The potential for MSP in the LOMA was

already established in the Beaufort Sea Integrated Ocean Management Plan (IOMP), an initiative that builds on the knowledge acquired from a large number of previous projects, including the Inuvialuit Community Conservation Plans, the Beaufort Sea Strategic Regional Plan of Action (BSStRPA), and the Beaufort Sea Integrated Management Planning Initiative (BSIMPI). The IOMP initiative is a direct result of a 2006 Federal initiative known as Canada's Oceans Action Plan, the funding plan for Canada's Ocean Strategy (2002), which defined the vision and objectives necessary for managing Canada's coastal and marine ecosystems. Focused on a sustainable development model, Canada's Oceans Action Plan is a government-wide approach towards:

“[...] maximizing the use and development of oceans technology, establishing a network of marine protected areas, implementing integrated management plans, and enhancing the enforcement of rules governing oceans and fisheries [...]”

The Beaufort Sea LOMA is governed by two primary regional governance structures, designed to supplement national oceans governance processes. The Regional Coordination Committee (RCC) is the overarching planning body for the LOMA, and the Beaufort Sea Partnership (BSP) functions as the principal forum for stakeholder engagement. Working Groups have also been created by the RCC, and are accountable for producing substantive and regionally specific pieces for consideration by the BSP and the RCC. The working groups comprise experts from BSP member organizations, focusing on: community consultation; traditional knowledge; social, cultural and economic matters; biophysical issues/natural sciences; and geographic/spatial aspects of the planning area (Beaufort Sea Partnership, 2017).

2.4 Traditional Knowledge in Marine Spatial Planning

2.4.1 Traditional Knowledge

Numerous definitions of Traditional Knowledge have been advanced in the context of environmental resource management. A comprehensive literature review of policy documents and peer-reviewed papers suggests several common themes that define TK in Canadian and Arctic environmental management. TK is defined as a knowledge system that is intrinsically connected to Indigenous cultural approaches to the environment. It is commonly disseminated orally, passed down through generations, often via stories, legends, rituals, and songs (United Nations, 2012). Most importantly, it is a holistic knowledge system, encompassing ecological, social, and cultural knowledge as interconnected parts of a complex approach to the environment and its resources. This knowledge is largely context-specific, often bounded by the specific geographic area of the knowledge holders, but also connected to broader geographic and environmental phenomena. Furthermore, despite the implications of the term “traditional”, Traditional Knowledge is also a dynamic and adaptive type of knowledge, shifting to address both external and internal pressures and transformations. Traditional Knowledge:

[...] includes a system of classification, a set of empirical observations about the local environment and a system of self-management that governs resource use. Ecological aspects are closely tied to social and spiritual aspects of the knowledge system... With its roots firmly in the past, [TK] is both cumulative and dynamic, building upon the experience of earlier generations and adapting to the new technological and socio-economic changes of the present. (Dene Cultural Institute, 1995, cited in Stevenson, 1996 and Stevenson, 2005)

As defined by the Beaufort Sea Partnership Traditional Knowledge working group:

[Traditional Knowledge is] a shared, collective body of knowledge incorporating environmental, cultural and social elements. Therefore, TK is a combination of traditional environmental knowledge, traditional land use and traditional practices. It is a continuous body of knowledge passed on from generation to generation and continues to grow and evolve over time. The fact that TK is continuous and evolving over time and ensures that current knowledge is incorporated into the existing body of TK. (BSP, 2017)

Labeling Indigenous knowledge as *Traditional Knowledge* or Traditional Ecological Knowledge may imply that the knowledge system is static and unchanged. However, Indigenous knowledge systems are also intricately tied to contemporary non-traditional and non-ecological knowledge, and this must be considered when using the term TK in broader management processes such as MSP. As Stevenson (2005) eloquently explains:

“The traditional and ecological knowledge of Aboriginal peoples often are part of a broad, articulated system of contemporary meaning and understanding that most Aboriginal peoples use to mediate their relationships with the natural world. But the knowledge systems of many Aboriginal peoples also include contemporary non-traditional and non-ecological knowledge, all of which are intricately related. Although many Aboriginal peoples continue to attach great value to land and resource-based knowledge from previous generations, this knowledge is re-cast and its utility re-evaluated in the light of contemporary experiences, needs and values.” (4)

Despite the limitation of the term, this paper uses Traditional Knowledge (TK) as a broad concept for *Indigenous Knowledge*, *Traditional Knowledge*, and *Traditional Ecological Knowledge*, as it is consistently used in the relevant literature (including Indigenous-authored literature), and is widely used by the Inuvialuit to describe “[...] embodied, practical knowledge about the land, animals, plants and other living things [...]” (Armitage and Kilburn 2015).

An additional challenge in documenting and using traditional knowledge as part of datasets in MSP, is that significant contextual information connected to the knowledge may be lost in the documentation process, hence converting multidimensional knowledge into single-dimensional data (e.g. spatial data). Because Indigenous knowledge relies heavily on its social/cultural context for meaning and value, data collection and integration must also reflect the broader context, as it will be suggested in the recommendations section of this paper.

2.4.2 Traditional Knowledge in Marine Spatial Planning

Marine Spatial Planning (MSP) is a process in which marine space is rationally delineated and organized to balance demands between its users, reduce environmental impact, promote sustainable uses, and anticipate and mitigate potential conflicts. It is based on the premise that we can only manage human activities within marine areas, and not the actual marine ecosystems themselves. It is a continuous and adaptive process that has multiple steps and feedback loops, and considers both spatial and temporal uses of space (Ehler and Douvere, 2009). The considered uses can be current or projected. Generally, MSP requires a mapping process which involves the identification, collection, and integration of available data, which can aid in the visualization of competing demands and evaluate the impacts of new ocean uses

and management measures. MSP can also be used to assess potential scenarios, and help to anticipate imminent opportunities or threats, such as in considering the effects of climate change (Ehler and Douvere, 2009).

According to the Intergovernmental Oceanographic Commission (IOC) (2009), effective MSP has the characteristics of being:

- Ecosystem-based, balancing ecological, economic, and social goals and objectives toward sustainable development
- Integrated, across sectors and agencies, and among levels of government
- Place-based or area-based
- Adaptive, capable of learning from experience
- Strategic and anticipatory, focused on the long-term
- Participatory, stakeholders actively involved in the process

In this sense, MSP is a multi-sectoral process in which the spatial and temporal distribution of human activities in marine areas are analyzed and allocated to achieve ecological, social, and economic objectives. These objectives are defined through an adaptive political process that is inclusive of a variety of stakeholders.

MSP offers an integrated framework for management that provides a guide for, but does not replace management specific to each sector. Thus, in the Beaufort Sea LOMA, MSP has potential to incorporate diverse knowledge bases to realize co-operative use of marine resources while maintaining ecological sustainability. A stakeholder analysis conducted as part of analysis revealed a variety of interests and activities within the Beaufort Sea (**Figure 2**). The

first step in this analysis was to identify the various marine and coastal uses of the Beaufort Sea LOMA, and create a categorization system that would be representative of the diversity of stakeholders, while maintaining similarities and relationships between them. MSP can be used as a tool for addressing the interests identified in the area, as it encourages collaboration between actors with distinctive concerns. For MSP to succeed, a thorough understanding of inter-stakeholder relationships is crucial.



Figure 2: Categorization of interests within the Beaufort Sea LOMA

Through the stakeholder analysis, it became apparent that Inuvialuit parties make up a significant portion of groups and organizations that are engaged in activities and resource use within the Beaufort Sea LOMA (**Figure 2**). Although not a qualitative analysis of stakeholders, by comparing the quantities of discrete actors in each sector or resource use, **Figure 3** illustrates the important role Inuvialuit have in the management of Beaufort Sea LOMA resources. Thus, for participatory, integrated management to be achieved, Inuvialuit participation and knowledge must be integrated into the MSP process.

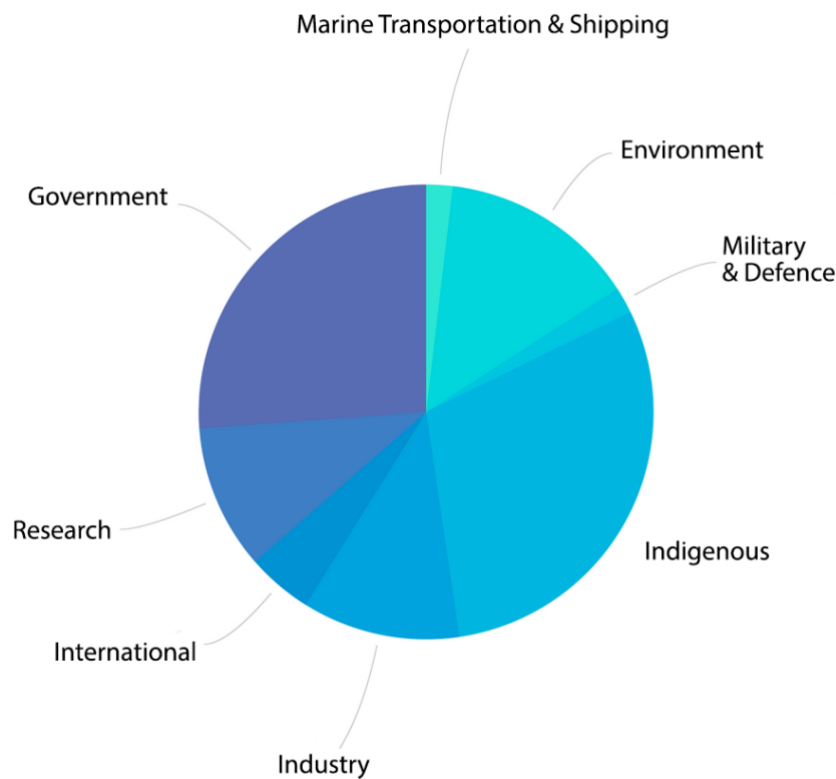


Figure 3: Potential stakeholders in the Beaufort Sea, classified by primary marine activity and use

In the analysis, stakeholders were identified and documented based on several criteria, including geographical presence in the Beaufort Sea and ISR, association or partnership to the BSP, or potential future influence on environmental management in the Beaufort Sea LOMA. Stakeholders were categorized by activity, with the assumption that their primary activities conducted in the area reflected their interests. Organizations involved in multiple activities were duplicated to avoid oversimplification of stakeholder interests. This exercise provided insight into the numerous interests needed to be addressed in the area, and what factors and processes may influence management decisions. The Indigenous majority in stakeholders indicates that the Inuvialuit have a significant social and political role in the LOMA, which must be considered when collecting and analyzing data for management.

Marine Spatial Planning (MSP) and Integrated Coastal Zone Management aim to incorporate the social dimension of ecosystem management, maximizing societal benefits while minimizing ecological impacts. There are many definitions for MSP, most of them derived from UNESCO's definition: "a public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives that usually have been specified through a political process" (Elher and Douvere, 2009). According to Pretty (2011), "many environmental sub-disciplines are concerned with developing holistic approaches that would enable understanding the dynamic relationships of societies and their ecosystems, but coordination between them is often lacking" (Pretty 2011 cited in Boillat 2013). MSP can be seen as a conceptual framework that supports the implementation of integrated approaches to management, as opposed to traditional single

resource approaches. There is significant potential in the use of TK in the context of properly designed MSP, as both MSP and TK involve holistic approaches to management and analysis.

Some researchers have praised Traditional Knowledge as a useful and untapped information resource that can address lack of integration, both in terms ecological understanding and integrated management. Pulsifer et al. (2014) discuss the value of TK as a thorough but cost-effective research method. Tam et al. (2013) discuss the temporal advantage TK offers when studying larger, localized environmental transformations such as sea ice deviations caused by climate change. According to Stevenson (2005), there are a variety of causes for the increasingly prominent status of TK among non-Indigenous Canadian agencies and institutions, including the limitations of western science and ERM in dealing with increasingly complex environmental issues (i.e. global warming), and the process in which Indigenous peoples and governments are seeking greater equity in natural resources. TK has been used to promote Indigenous involvement in ERM, often through co-management regimes and consultation.

TK has been codified in international and national policy, and its role in regional environmental management policy is particularly relevant to MSP. For example, the Government of the Northwest Territories (GNWT) established a government-wide Traditional Knowledge Policy in 1997, referred to as Traditional Knowledge Policy 53.03. According to the Policy:

The Government recognizes that aboriginal traditional knowledge is a valid and essential source of information about the natural environment and its resources, the

use of natural resources, and the relationship of people to the land and to each other, and will incorporate traditional knowledge into government decisions and actions where appropriate (Department of Environment and Natural Resources, 1997, revised 2005).

Practically, this policy has been addressed through the recruitment of Indigenous employees, who are able to incorporate a TK perspective to their work, and through the development of plans to facilitate transfer of TK and skills from elders to youth, including trapper training, youth ecology programming, and collaborative research and planning activities for conservation and protected areas strategies (Department of Environment and Natural Resources, 1997, revised 2005). As TK research has become part of the ERM practice and is more widely accepted and conducted in different contexts, the quality of the research widely varies depending on the initiatives (Armitage and Kilburn, 2015). Flawed methodology and lack of transparency in collection and use of TK data can create a distrust between researchers and TK holders, especially when findings are easily dismissed or challenged. In this context, MSP offers a new platform for data integration, as it involves assembling, integrating and comparing datasets from different sources, including scientific, industry-led, and traditional. The implications of this for TK (usually integrated as spatial data) has yet to be thoroughly explored.

UNESCO has established a “Step-by-step Approach for Marine Spatial Planning toward Ecosystem-based Management”, in which ten steps guide managers in initiating a marine spatial plan (**Figure 4**). This approach facilitates transparency and *best practices* by defining the scope of MSP, and how to put it into practice.

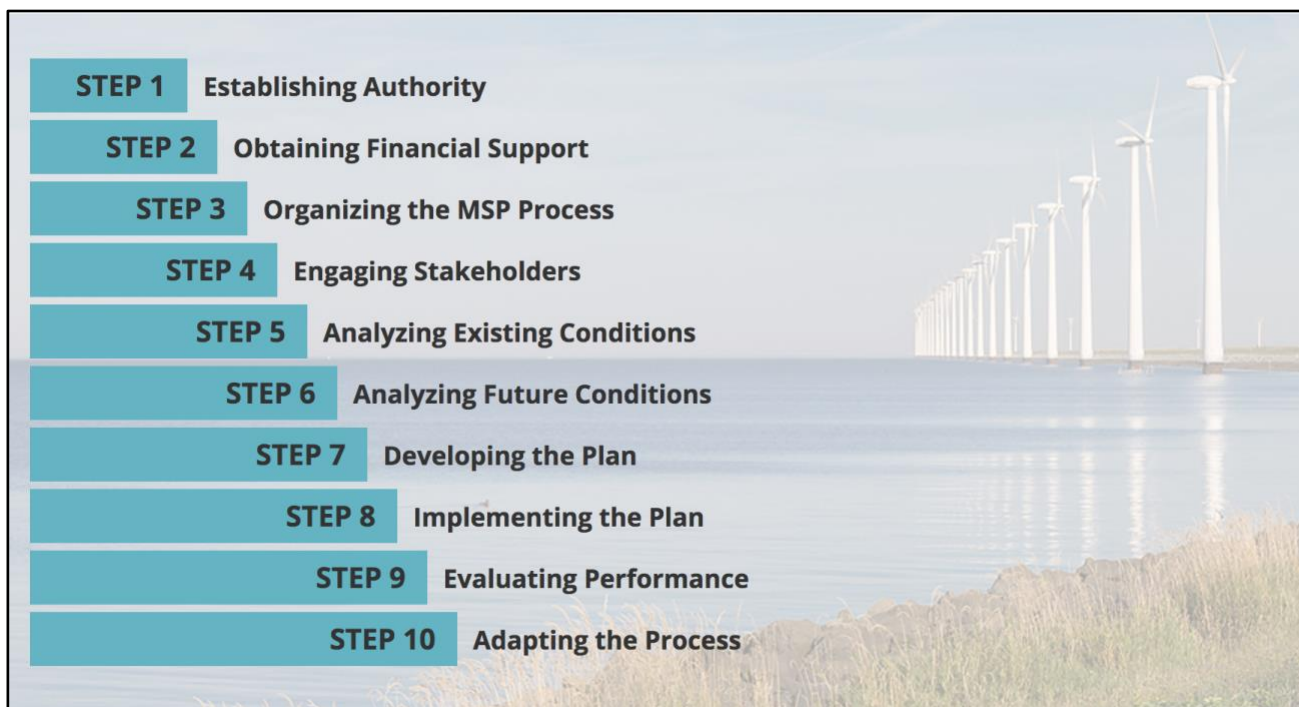


Figure 4: UNESCO’s Step-by-step Approach for Marine Spatial Planning toward Ecosystem-based Management, Retrieved from: <http://msp.ioc-unesco.org/msp-guides/msp-step-by-step-approach/>

(Elher and Douvere, 2009)

The Integrated Ocean Management Plan for the Beaufort Sea (2009) has operated to establish precedent for the initial 4 steps of the UNESCO approach. The next step in this process is the analysis of existing conditions (Step 5), in which an inventory of ecologically or biologically sensitive areas, current human activities and pressures, and possible conflicts and compatibilities among human uses and between human uses and the environment in the management area is amassed and analyzed (Elher and Douvere, 2009). The following chapters of this paper seek to understand epistemological and practical challenges encountered during this process, in the context of using TK alongside Western scientific knowledge in the course of planning.

Chapter 3

Best Practices for Using Traditional Knowledge

3.1 Overview of Best Practices

Protocols and *Best Practices* have been developed by many organizations for the collection, use, and sharing of TK data. Literature covered in this chapter includes guidelines and recommendations for the collection and use of TK. Most of this literature speaks to the general collection of TK, and broad social science and interview techniques. These best practices are useful to consult during the data collection phase of MSP, as integrating TK with a Western scientific approach creates challenges in data management.

Several documents that were reviewed in this overview assess and summarize TK literature, and a few offer guidelines and principles for the conduct of TK research (e.g., Burgess 1999; Fedirechuk, Labour, and Niholls 2008; GNWT, 2005). A small number of TK guidelines offer good methodological guidance for those wishing to design and conduct TK research (e.g. Davis and Ruddle 2010; Davis and Wagner 2003; Huntington 1998; Tobias 2009; Tobias 2000). These guidelines as a whole are general in nature, which reflects the fact that most publications reviewed did not provide clear descriptions of methodology regarding data collection and analysis. This lack of methodology in research could indicate a lack in transparency in TK collection and analysis methods, whether intentional or not (Armitage and Kilburn, 2015). This point is made by Davis and Wagner (2003), who surveyed 65 articles on the subject and found that only 22 had methodological descriptions, concluding that “social researchers are focusing

far less on ‘method’ than on the many epistemological, ethical, and property rights issues associated with the study of local knowledge systems” (p. 468).

However, several themes persist throughout the literature that can guide further analysis and provide a general framework to guide the use of TK within MSP. The first theme repeated throughout the literature concerns the ethical implications of collecting and applying TK. This includes issues of informed consent while conducting research, and understanding the value of TK to management. The second theme recurrent in the literature focuses on the presentation of TK within its own cultural context—all guidelines reviewed emphasized the need to interpret and present TK as a part of the traditional framework. Lastly, there was particular emphasis placed on the need to ensure Indigenous control over information. This standard includes issues such as data ownership, and community engagement.

3.2 Best Practices for Inuvialuit Knowledge in the Arctic

3.2.1 Best practices in the Northwest Territories

The Government of the Northwest Territories Traditional Knowledge Best Practices Summary (2005) outlines guidelines for good practices when gathering and using TK in the Arctic. These guidelines are consistent with the themes that are recurrent throughout the literature:

1. Understand and acknowledge the value of traditional knowledge
2. Establish and apply appropriate definitions of traditional knowledge
3. Ensure the protection of sensitive information
4. Adhere to community-based protocols

5. Ensure community engagement
6. Ensure informed consent
7. Ensure local ownership and control of information
8. Interpret and present traditional knowledge in the appropriate cultural context
9. Provide benefits for the use of traditional knowledge
10. Follow formal research licensing guidelines
11. Establish clear communication and reporting links

“[Ensuring] local ownership and control of information”, “[interpreting] and present[ing] traditional knowledge in the appropriate cultural context”, and “[providing] benefits for the use of traditional knowledge” are particularly important recommendations for the use of TK in management, which also present substantial challenges. Maintaining the context of TK when using it as data is especially crucial for TK to retain its integrity and value as information.

Ensuring local ownership and other benefits for the community is particularly important for researcher consideration, as because of the nature of TK as a shared knowledge system, it often falls under “public domain”, and when published is will not necessarily continue to engage the community (Muller, 2013).

3.2.2 Traditional Knowledge Guide for The Inuvialuit Settlement Region, Northwest Territories

In 2008, the Environmental Studies Research Fund published two associated reports: the first, a review and evaluation of requirements for TK in the Canadian Arctic, and the second, general guidelines for the use of TK in environmental impact assessment in the ISR. This report is distinct from previous guidelines as it provides detailed technical guidance and provides supporting rationale for best practices that should be fully considered by anyone

contemplating, undertaking and applying TK research in the Inuvialuit Settlement Region (ISR). It is a reference guide aimed at traditional knowledge researchers and relevant organizations, including government agencies, co-management bodies, environmental assessment boards, Indigenous communities, and industry.

The 2008 report can be considered best practices for TK research because of its depth and transparency. The report identifies all relevant policy and academic sources through an extensive literature review, and discusses the implications of the sources for environmental impact assessment in the Beaufort Sea area. Because the report extends its focus to environmental management in its entirety, it is relevant to the initiation of MSP and can be used as a reference guide for the conceptualization of MSP in the Beaufort Sea, including policy references, research guides, and general knowledge of TK in the ISR.

3.2.3 Conduct of Traditional Knowledge Research—A Reference Guide

In 2015, social scientists Peter Armitage and Stephen Kilburn published a report, which was an outcome of a project documenting Inuvialuit TK about *nanuq* - polar bears, in association with the Wildlife Management Advisory Council (North Slope). During this project, Armitage and Kilburn reflected on the methodology that stimulates comprehensive design, conduct and documentation in TK research—leading to the undertaking of the 2015 reference guide. This reference guide is the most extensive to be completed yet, and covers methodology including suggestions such as which room in a house to conduct interviews, or to how to store maps produced in the context of participatory research. This 2015 report is especially valuable in MSP as it emphasizes practical concerns in the use of TK data, including the documentation of data

through interviews, the mapping of geospatial data through digital and analogue methods, and storing data for use by managers.

Chapter 4

Geospatial Data Management and Traditional Knowledge

4.1 Introduction

This chapter outlines the process of transforming TK into data, best practices for TK data management in the context of MSP, and elements that must be considered during this process. Using TK for MSP requires a trans-disciplinary knowledge base, and a thorough knowledge of geographic information (GI) science is crucial to the successful collection and application of TK data. Consequently, this chapter provides an overview of issues that occur in the TK data process, and potential solutions to challenges and concerns that may arise. These concerns are analyzed under the premise that TK must be documented and structured in an ethical way that serves the needs of the local communities, but that can also be useful in the broader realm of environmental management, and more specifically in MSP.

4.2 Epistemological concerns of bridging knowledge systems

Numerous disciplines, including anthropology, sociology and philosophy, have sought to understand the meaning of 'knowledge systems'. These inquiries include: a) analyses of the role of power in the "construction, maintenance, and deconstruction" of knowledge, addressing political processes through which knowledge is created, confirmed, or denied; b) the environmental context of knowledge production, looking at the narratives "of different knowledge systems about environmental change,

examining how dominant knowledge systems reflect the power of dominant groups, potentially subverting the insights of marginalized people” (Rathwell et al., 2015, p. 856).

Weiss et al. (2013) have suggested that a major challenge to coastal governance is a lack of understanding of the epistemology of incorporating knowledge systems, which results in “superficial interactions” between traditional and scientific knowledge holders. They postulate that these processes of superficial engagement perpetuate power struggles and can restrict meaningful collaboration. Fazy et al. (2013) examine how knowledge is exchanged between actors and across scales, defining knowledge and information as entities that can be “moved”. They suggest knowledge exchange as a process in environmental management, as opposed to knowledge integration. Rathwell et al. (2015) and Reid et al. (2006) expand on this idea, proposing the concept of “bridging” Indigenous and Western knowledge systems for environmental management. Bridging knowledge systems involves “maintaining the integrity of each knowledge system while creating settings for two-way exchange of understanding for mutual learning” (Rathwell et al., 2015). This model recognizes the role of both a parallel approach to knowledge systems, as well as mutual learning and development of the shared knowledge base. Thus, when TK is used for management, knowledge must be exchanged between researchers and managers and bridged with Western knowledge systems.

Scassa and Taylor (2017) take a different approach to the problem of TK and data within their analysis of polar data repositories, and believe that the inclusion of TK within databases can generally be achieved in two ways, which are not mutually exclusive. The first scenario is when TK is extracted and incorporated into the framework of Western Scientific knowledge—this involves researchers gathering TK by interviewing TK holders, and analyzing the interviews by the current accepted theoretical and

methodological approaches. This is the most common scenario in TK research, and in many cases the research questions and priorities are defined and influenced by researchers and forces outside of the community. The second scenario is when TK is included and incorporated into databases using methodologies that attempt to reproduce the paradigm of TK through both its form and substance. In this scenario, TK can be documented using an assortment of instruments and techniques, but the recordings themselves are the knowledge output. TK outputs configured in this way are often preserved through multimedia atlases, for example the Inuit Siku Atlas which documents Inuit Knowledge around Baffin Island, Nunavut (www.sikuatlas.ca). This paper focuses primarily on the first scenario, however, as despite its problematic basis, it is the most practiced method, and most conducive to MSP.

4.3 The problem of TK and Data

When TK is used in an applied context, such as in decision making tools and governance processes like MSP, the multidimensionality and contextual richness of the knowledge is reduced to fit into the pattern of a particular set or type of data (e.g. geospatial data). TK datasets often become integrated into larger databases, which include datasets of scientific information, through Relational Database Management Systems (RDMS). An example of such a database is the Inuvialuit Settlement Region Online Platform (ISROP), a cloud-based platform designed for communication and collaboration. The ISROP contains over 100 spatial layers and aims to improve information distribution between BSP partners. Dynamically connected to several external platforms, it is capable of “conducting spatial analysis, application development, mapping, field data collection and feature editing” (Beaufort Sea Partnership,

2017, “ISROP”). It is currently in use by Government of Canada departments, co-management boards, NGOs, and Inuvialuit organizations (Beaufort Sea Partnership, 2017).

The nature of TK as a holistic, contextual, oral knowledge system makes the relation to other knowledge systems complex within a data platform. Information Science has reflected on the nature of information, or more precisely on the relationships between data, information, and knowledge. In a sense, integrating TK and science involves documenting knowledge and transforming it into data so that it is practical for management. The challenge is to maintain its contextual significance and its many interconnected dimensions. The classic DIKW hierarchy (**Figure 4**) suggests different levels of awareness and conceptualizations of reality. Although problematic, the DIKW pyramid illustrates conventional ways of understanding the differences between data and knowledge. The tiered model indicates that knowledge is more advanced and complex than data. In this conventional model, data, information, knowledge and wisdom cannot be mixed among themselves, and *new* data, information, knowledge, and wisdom are respectively added to their established base (Jean-Baptiste et al., 2008).



Figure 5: Classic DIKW hierarchy

Scientific knowledge is built upon scientific data (Jean-Baptiste et al., 2008). While data consist of numbers, text, or symbols— conventionally perceived as “context-free,” knowledge and wisdom are much more difficult to define and communicate. For example, data in the form of raw geographic facts are relatively easy to share and analyze. Knowledge, for example personal or traditional knowledge about a place or process, is more difficult to communicate between people, disciplines, and platforms. When knowledge becomes data, it may lose its wider context, which is deeply connected to individual and social experiences of place and the environment. As Longley et al. (2015) note, “[knowledge] can be considered as information to which value has been added by interpretation based on a particular context, experience, and purpose” (p. 10). In the Western Scientific knowledge system, researchers add value to data and information through processing and merging with other information, as well as with

analysis and interpretation. TK specifically involves value that is bestowed by the “knower” or knowledge holder (often not only an individual but also a community). Therefore, one of the main challenges of converting TK into data is to determine how knowledge can be shared in a way that is useful in multiple contexts (including management approaches such as MSP) while maintaining its relationship to specific geographic, temporal, cultural and spiritual dimensions. In this sense, TK data must reflect the context inextricably tied to the Indigenous epistemology, while maintaining standardized temporal and representational parameters that will make it consistent with other datasets for integration and analysis. This is an imperative issue in TK integration, as TK has been habitually “cherry-picked” by environmental managers and researchers, leading to de-contextualized information separated from the broader knowledge systems which it inhabits (Stevenson, 2005).

A more nuanced understanding of what TK is within a broader understanding of the data-knowledge debate will prove useful. Jean-Baptiste et al. (2008) raise the point that social interactions constitute a foundation for defining such concepts as data, information, knowledge, and wisdom. The authors suggest a reinvention of the DIKW hierarchy, in which no direct hierarchy or linear progression among data, information, knowledge, and wisdom is established. “For example, a new receptionist employed by an organization may not have any specific data about the customers but may have the wisdom required to manage customer relationships based on values instilled during the receptionist’s formative years” (Jean-Baptiste et al., 2008, page 11). In this model, one can acquire information and knowledge directly from an “understanding of existence”, without having to obtain raw data. Ingold (2000) argues that learning is a process of education of attention, and that knowledge is the product of interaction

with the environment, further complicating strict definitions of what constitute knowledge, information or data.

With this critical understanding of what knowledge actually is, Western Scientific data can also be defined as embedded within complex social relations and knowledge structures, rather than as independent, objective data. In reality, however, Western Scientific approaches, based on positivistic assumptions of universality and objectivity, allow for information to be detached from original contexts in order to be tested, verified and applied. TK, on the other hand, requires the context and individual and collective multi-dimensional connections to place in order to be properly understood.

The Traditional Knowledge Guide for The Inuvialuit Settlement Region (2008) (**Figure 5**), establishes clear differences between notions of scientific and traditional knowledge.

Traditional Knowledge	Western Science
<i>Knowledge and Learning</i>	
“Supremely concrete”	“Supremely abstract”
Subjective; does not exclude cultural values and perspectives	‘Objective’; tried to exclude culture and values
Apprentice-based learning	‘Book’ learning
Oral	Written
Long-term, local	Short-term, regional
<i>Social Organization</i>	
Communal	Individualistic, independent
Sharing, reciprocity, respect, humility	Trade, dominance, power, control
Cultural survival and identity	Technological improvements
Barter, non-market economies	Market economies
<i>Resource Management</i>	
Stewardship	Ownership
Precautionary, preventative	Risk management (mitigate and compensate)
Conservationist	Monitoring
Ecosystem-based	Population-based
Integrative	Hierarchical
Ability to absorb future events	Precision of future predictions

Figure 6: Traditional Knowledge Guide for The Inuvialuit Settlement Region, Northwest Territories, 2008

According to this table, TK is intricately tied to cultural values and perspectives, and learned via an “apprentice-based” system of knowledge bestowment, often through orally transmitted information, while western science is abstract in nature, perceived as being independent from

the knowledge producer and cultural norms. While this dichotomy, as discussed earlier, can be problematized, its general principles are useful for this analysis, as the representation of TK in databases, reports, maps, and scientific papers unavoidably reduces the multidimensionality of such knowledge. Recognizing such processes is critical in the context of MSP, where methodologies should be designed to minimize or mitigate potential distortion and losses. In this sense, TK must be “richly textured, credible, and well reported, accompanied by transparent and comprehensive methods descriptions” (Armitage and Kilburn, 2015). However, representing knowledge in this way is challenging, as Relational Database Management Systems may include standards of data structuring that conflict with the need to represent the multiple dimensions of TK. Consequently, a major challenge in the integration of TK in MSP is representing it in a way that minimizes distortion of the context, while allowing it to participate within databases and interact with other data.

4.4 The limitations of TK as geospatial data, maps, and GIS

Most aspects of TK are not necessarily spatial or mappable. Non-mappable aspects of TK include non-spatial dimensions of oral narratives, and experiential or tacit knowledge (i.e. skill gained through experience). Because of this, TK is not always fixed to exact geo-coordinates, but rather connected to broader knowledge systems and land-use activities, such as hunting, traveling, trapping, fishing, gathering, and other harvesting activities, which can often vary temporally and spatially. However, Geographic Information Systems (GIS) and GI Science have become a standard (and powerful) tool in TK studies. GIS is practical for geospatial

representations, but relatively ineffective in representing temporal or tacit information (Armitage and Kilburn, 2015). GIS does allow for inclusion of metadata and information that is not bounded to a specific location, and for geospatial data to be linked to other (online) sources. Although not yet ideal for communicating non-spatial information, advances have been made in expanding data that can be effectively communicated. In this sense, GIS constitutes an advance in relation to previous cartographic methods of TK collection (see Aporta 2016). Furthermore, different knowledge systems infer a different method of how people use and think about the world spatially, thus limiting the effectiveness of GIS in representing TK. Western cartography and GIS require a degree of commodification of the landscape, which may conflict with long-established ways of navigating embedded in traditional knowledge. For example, Inuit *wayfinding* is a method of navigation through knowing the specific order of, and adjusting the travelers' own movements in relation to ecological elements encountered, through a "continuous series of reversible transitions" (Ingold, 2000, pages 235-238; Aporta, 2003). This navigational process is facilitated by and reflected in the use of place-names and terminology of the surrounding environment, these descriptions forming a "narrative of a journey" (Aporta, 2009), which can be only partially documented through GIS. In the Arctic, significant geographic sites used for navigation and harvesting are defined through oral narratives; anecdotes cited in oral descriptions are tied to geospatial points and routes, but have inherently non-spatial components. Place names are, in fact, good examples of how Indigenous perceptions of place are better represented using local systems of spatial reference. As will be shown later, maps can be both problematic and effective means of communicating environmental TK.

Mapping spatial information to represent TK in order to establish Indigenous rights has been taking place since the 1970s in different regions of Arctic Canada. TK mapping initiatives continue to be primarily associated with traditional land-use studies and have origins in participatory methods, that today include approaches to what is known as public participatory GIS (PPGIS) (Olson, Hackett, DeRoy, 2016). Participatory mapping (including PPGIS) refers to the creation of maps by local communities, usually with the involvement and support of organizations and institutions affiliated to government, NGOs, universities, and other actors engaged in research and planning. Participatory maps offer valuable insight and visual representation of what a community perceives as its place and significant features within it. Researchers have identified PPGIS as a means to include socio-economic factors in the process of MSP. For example, Blake et al. (2017) have crafted a repeatable manual technique for mapping cultural coastal values as a way to address the challenge of producing spatial data for abstract cultural values that are challenging to extract and quantify. The authors acknowledge, however, that there is still work to be done for the mapped results of PPGIS to be effective for decision-making processes and spatial planning.

4.4.1 Map Biography

A typical method of documenting the spatial component of Traditional Knowledge is the *map biography*, a technique in which TK holders are surveyed about their land and marine use, or their observations of fauna and flora, particularly related to harvesting or observed changes. Memories of “locations where they have traveled across the land or water, hunted, trapped, shed, gathered wild fruits, cut firewood, and where dwelling places, burial sites, mythical,

spiritual, death and birth places, and place-names” are then inscribed onto base maps (Armitage and Kilburn, 2015, p. 22). This method generally uses paper maps to record data, which are then digitized via a GIS platform for further analysis. Researchers may also use digital methods, in which data is recorded directly into GIS software during interviews, as well as GPS tools that are used during trips in the field (see, for instance, Aporta, 2003).

4.4.2 Applying GIS

Collecting place-based TK data properly involves knowledge of GIS principles and techniques, but also awareness of the nature and characteristic of the TK knowledge system. Regarding the mapping process, a number of considerations must be taken into account, including proper selection of coordinate systems, projections, scale and extents.

The most basic step in mapping and analyzing geospatial data is choosing a coordinate system or projection to reference the data. Essentially, a projection is the geometric means through which geographic locations on the Earth’s sphere are transformed onto a two-dimensional plane. In order for data from a variety of sources to be integrated, they must reside in the same coordinate plane. Armitage and Kilburn (2015) recommend using Yukon Albers, NAD83 for representations of TK data in the Beaufort Sea and ISR, the official coordinate system of the Yukon Government, while the Government of the Northwest Territories employs the Canada Lambert Conformal Conic Projection, NAD 1983. The Governments of Alaska and BC also use their own respective Albers projections. These projected coordinate systems are conic, equal area map projections that use two standard parallels. Why is this important? Maps are merely a representation of reality, and how one

chooses to *project* the globe will always involve distortions of geographic features. In this sense, compromise between distance, direction, and area is always required, and is thus important to consider. This is especially relevant in the Arctic because all longitudinal lines converge at the pole and territorial representations near the magnetic north may differ across a map depending on its scale. This is why many default or standard projections, such as the web Mercator projection, are not suitable for the Arctic because of distortion.

Although distance, direction, and area are not entirely preserved in the Albers and Lambert Conformal Conical projections, their distortion is minimal between the standard parallels. Maps using these projections are also able to span multiple UTM zones without significant distortion (Environment Yukon, 2017). This is important to consider when documenting and digitizing TK in the Arctic for several reasons. TK is not necessarily confined to political boundaries or geospatial zones, and may span distances larger than what projections like UTM allow. Accuracy in distance, direction, and area is especially important when collecting TK data, as distortion in the TK itself is already present.

Accuracy in TK mapping is directly related to scale and resolution, and recognition of the appropriateness of scale is crucial in both TK documentation and MSP. Scale can refer to detail (fine versus coarse) and extent (large versus small). TK is often used to prescribe locally appropriate environmental resource management strategies, and in the Beaufort Sea these localities are generally coastal, but in many cases the local use extends far inland, with little demarcation of ocean/land divides (Aporta et. al, in press). As **Figure 6** illustrates, decisions of scale and boundaries can limit the value of TK data, as providing a finer resolution of detail in

the data, may require focusing on smaller areas. The extents of the representation are often demarcated by boundaries often established by management plans (e.g. an MPA), as opposed to actual use.

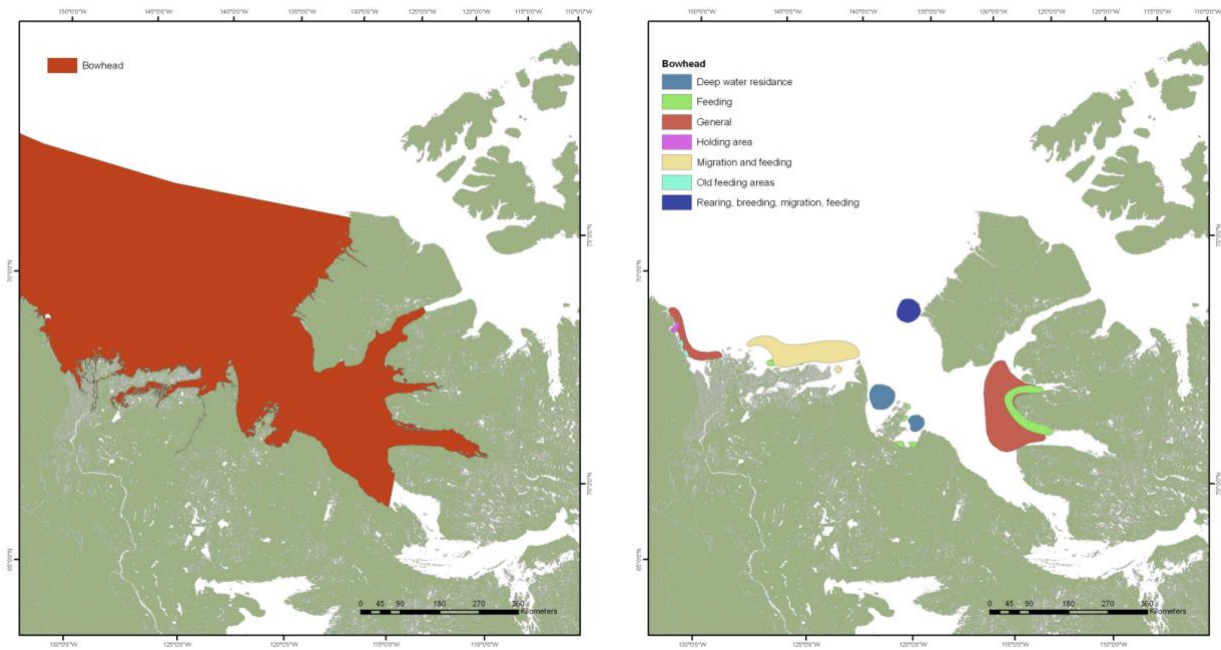


Figure 7: A comparison of DFO data (pictured left) and TK data (pictured right) depicting Bowhead whale activities. (Beaufort Sea MSP, Brown and Paylor, n.d., retrieved from: http://assets.wwf.ca/downloads/beaufort_sea_msp.pdf?_ga=2.15392246.1517935885.1513136194-1433388427.1512487989)

In figure 6, the TK data refereeing whale observations are related to whaling, but the areas are related to other activities, such as traveling from/to the communities. Scale of data may also vary by area depending on predetermined significance of space (e.g. in southern coastal areas of the Western Arctic that involve more human activities data resolution is finer than in more

northern islands and open ocean (**Figure 7**). Researchers must consider both the limitations and strengths of documenting process of TK when using it for spatial management, such as MSP.

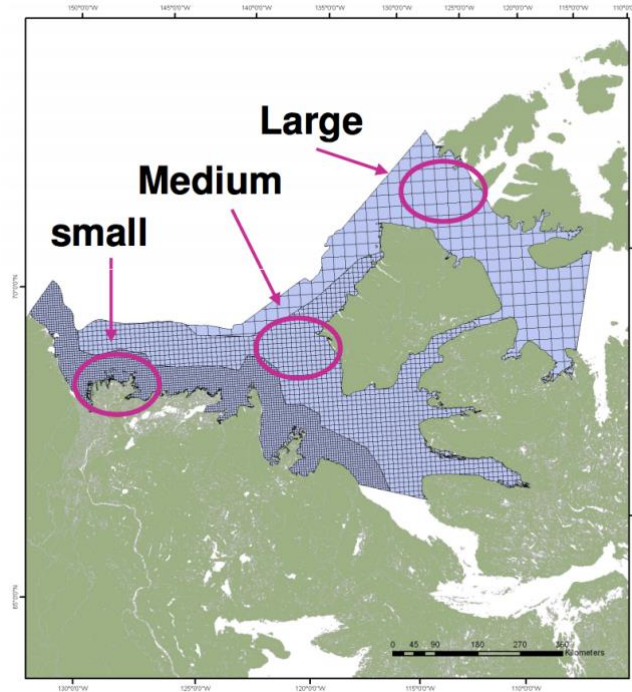



Figure 8: Different resolutions and scales in the Beaufort Sea LOMA (Beaufort Sea MSP, Brown and Paylor, n.d., retrieved from: http://assets.wwf.ca/downloads/beaufort_sea_msp.pdf?_ga=2.15392246.1517935885.1513136194-1433388427.1512487989)

4.4.3 Data Models and Spatial Objects

Use of GIS for documenting and analyzing TK also requires other practical decisions to be made, throughout the different phases of a project. The conceptual view of reality, data model, and types of spatial objects used must be identified, and although there is no *correct* solution, different representations of data are able to minimize misrepresentation and

mistranslations of TK, increasing the data’s utility and effectiveness. When designing data collection methodologies, researchers must choose conceptual views of reality to represent the data. For instance, whether there is a continuous field view, or discrete view of data collected often dictates how data is used, implying certain perspectives of the local environment. In this sense, for instance, a bay that is used for seal hunting may be connected to terrestrial watershed systems (e.g. a river or a lake). Management areas are generally expressed as discrete entities – geographic objects have well defined boundaries, and exist in “empty space”. However, TK relating to ecological, environmental, and social data is not so easily defined in space. For example, the use of points and lines as discrete objects on a map may suggest that the land between the said objects is not used. This may not be an accurate representation of actual land use, since Inuvialuit (and Inuit in general) will understand those features as both in narratives and actual uses. Figure 8 shows typical ways in which areas of interest to indigenous peoples are portrayed using GIS conventions.

Spatial objects		General Uses
	Points	Features that cover a relatively small, discrete location

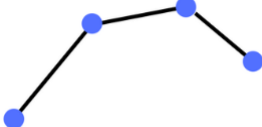
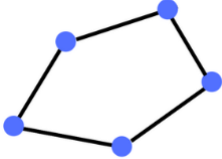
	<p>Lines</p>	<p>Direction and travel routes</p>
	<p>Polygons</p>	<p>Features that cover relatively large areas of a map</p>

Figure 9: Spatial objects and their uses in geospatial TK data collection and analysis

GIS standards are important because they determine the interoperability of the data (for instance, how DFO and Inuvialuit communicate about whales can be fruitfully integrated). Although the point/line/polygon has been used in representing TK, there are no specific and detailed rules for mapping TK, which may erode the validity of the use of TK data. This can be a limitation when integrating with other datasets within a mapping platform. Furthermore, a category of information can be responsive to more than one type of spatial representation. For example, points are often used for *place names*. Place names refer to the traditional names of places that are often descriptive in nature— landforms and geographic features are named for the climate processes that occur there, animals that inhabit the area, ways of traversing the area, land and resource uses that occur there—any significant occurrence (Boillat et al., 2013).

However, place names are not mere geographic locations, as they usually convey TK regarding where to find food, where the best routes to reach a place are located, etc. Inuvialuit have always used place names to remember where important locations were, and hence were part of a system that can be thought as alternative to maps. In the GIS representation process of a place name, however, place names are most often reduced to geospatial points (artificial geometric objects representing recognizable features in the landscape), ignoring connections to broader contexts of use and narratives.

An example of how GIS can deal with such limitation is the Inuvialuit Place Name Virtual Exhibit, compiled by the Tuktoyaktuk Traditional Knowledge Project via the Prince of Wales Northern Heritage Centre, which documents place names gathered by Inuvialuit elders (**Figure 9**). The map explores place names following a route along the Mackenzie River to the Beaufort Sea, illustrating methods of travel and points of interest.

[About This Exhibit](#) | [The Inuvialuit](#) | [Place Names](#) | [Nuligak](#) | [Ways to Travel](#) | **[Map and Journey](#)**

This virtual journey follows a route that goes along the Mackenzie River to the Beaufort Sea, and then east along the coast before heading south to Husky Lakes (Imaryuk). You can follow this route by beginning at Aklavik, or you can travel by yourself to any location shown on the map.



[SEARCH](#) | [SITE MAP](#) | [FEEDBACK](#) | [HELP](#)

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www.pwnhc.ca

Figure 10: Inuvialuit Place Names Virtual Exhibit, Prince of Wales Northern Heritage Centre (2003),

accessed 2017

This particular map represents a more general trend in place name documentation, in which place names are represented by points, artificial, zero-dimensional elements symbolizing information tied to a pair of x, y coordinates, but also connecting them with a broader mobility framework (routes). Although these objects are a simple and practical way of conveying non-

spatial information about a geospatial location, like place names, it may also be useful to consider alternative methods of representation. For example, Nalruriaq, is located beyond the Mackenzie Delta, near the mouth of a narrow channel that leads to Kitigaaryuk, and means “To Go Around” or “To Go Along”. The Inuvialuit Place Name Virtual Exhibit suggests that there is a sand spit that the name refers to, describing the feature through non-spatial data. However, this is not represented through the point feature, and users of the data cannot confidently infer this connection. Imilligyuaq, meaning “Lots of water”, refers to a pool of water found on top of a pingo, and is an important landmark to coastal travelers as freshwater is scarce in the area. However, the point feature does not indicate the body of water through the use of geospatial data, obliging users of the data to make assumptions regarding where the water is. TK databases are starting to deal with this issue through the inclusion of non-spatial data, for example quotes from elders providing the knowledge regarding the uses of the space, photographs, and links to other datasets which explain the geography of the area (e.g. NWT Exhibits – Inuvialuit Place Names; also www.sikuatlas.ca). However, non-spatial dimensions of data can be problematic for use in management, where information is usually stripped of other elements that may be crucial for Inuvialuit and other indigenous peoples. One way in which this problem can be mitigated is through the proper use of metadata techniques, which can provide some information regarding non-spatial dimensions of the data.

4.5 Metadata

Correct use of metadata in TK research is crucial for the practical and accurate documentation

of TK. Proper metadata can allow TK data to be searchable and used effectively, preventing research from being used incorrectly or being “cherry-picked” to support assumptions.

Metadata is essentially “data about data”. In GI Science, *Object-Level Metadata (OLM)* describe the contents of a single dataset. OLM should include information that makes the dataset useful to the user, including:

- Categories of information that can automate the process of searching archives and databases. This system is similar to that of library catalogues, but including other information such as geospatial references.
- Information such as scope, quality, and resolution that allows the user to determine whether a dataset is useful for a given project.
- Information that allows the user to handle the dataset effectively, including the technical specifications of the maps, format, software compatibility, and any relations of the dataset with broader databases.
- Information about the datasets contents, such as land cover of a particular feature, methodology in data collection, or features of importance. Features of importance are often used as reference points during research, in which certain features are marked on the map so that participants may situate other features in relation to them (Longley et al., 2015).

OLM “generalizes and abstracts the contents of datasets”, while also providing information that identifies the dataset as unique. Geospatial datasets should also include fundamental information about the following attributes:

- map projection and datum;
- scale (both as a representative fraction and as a scale bar);

- legend; and,
- data sources and dates.

TK data collection should follow a rigorous documentation process, thereby necessitating further information so that users can be certain about the validity of the data. The metadata, therefore, may include descriptions of methodology, reasons for collection (for example environmental assessments), or context of the TK. Metadata referring to TK data should include:

- Methodological approach (e.g. structured interviews; semi-structured interviews, including the map biography survey method; semi-directive interviews; opinion surveys; focus groups; and ethnography, including participant observation).
- The base map used for the data collection process, including the projection and datum used for documentation, and whether geospatial data was collected by analog (paper) map, digital map, or GPS.
- What features were used to facilitate identification of areas, i.e. logging roads, pipelines, contours, topographic information, place names from previous studies.
- How data was digitized (if necessary)
- Why data model and spatial objects used were chosen in data collection.

Including information such as the OLM listed above promotes transparency in the use of TK for management, as methods of TK data collection and mapping reshape the documented knowledge and may influence data analysis and data integration. Because of epistemological challenges of recording TK on maps, representations of geospatial data, like maps, must “serve as a proxy for the experiential knowledge of the TKH” (Armitage and Kilburn, 2015). Including detailed information on how the TK was collected and analyzed can help decision makers to

make culturally-sensitive decisions about how the TK data will be used, integrated and analyzed. Geospatial TK data must also be illustrative and accurate when used in MSP, as the process involves representing uses of marine space by multiple actors. Therefore, TK must be conveyed properly, both in content and geographic location. One of the main problems in data integration in the context of MSP is that it deals with datasets of different nature, created in different contexts and following diverse methodologies. Both metadata and spatial accuracy of TK are critical in order to be properly used in the context of MSP.

Chapter 5

Organization of Traditional Knowledge

5.1 Introduction

For TK to be effective in MSP and accessible to users, datasets must be organized ways that are both practical and respectful to the Indigenous worldview. Because of its holistic nature, this can be a difficult task. For example, the 1976 Inuit Land Use and Occupancy Project (Freeman, 1976) divides Inuit land use into two categories for organization— “hunting” and “trapping.” This categorization was connected to the needs of the land claims negotiations, but the use of TK in the context of MSP requires further exploration of the complex relationship between Inuit/Inuvialuit resource users and their environment. More recently, TK documentation projects have looked at “Place Names”, “Travel Routes”, “Culturally Significant Sites”, “Spiritual Significant Sites” and “Sea Ice Use” as categories for data organization. Understanding the history of Traditional Knowledge categorization, and reasoning behind such practices, is important when converting TK to “data”.

When organizing, categorizing, and cataloguing TK, researchers must be careful not to erase the ‘cultural logics’ of the knowledge system. These ‘cultural logics’ may include engrained relationships between knowledge holders and the environment, and principles of obligation and reciprocity with respect to the sharing of knowledge, characteristics of TK as a holistic knowledge system (Christen, 2012). On the other hand, human uses of marine space in MSP are often reduced to a list of discrete activities, such as recreation, oil/gas, shipping,

fisheries, and hunting. Therefore, the inclusion of interconnected indigenous uses and understanding of the marine environment within the conventional practices of MSP becomes challenging, as TK data may be simplified to fit the MSP requirements. However, proper use of MSP can potentially be inclusive of indigenous perspectives. For example, ecosystem-based approaches have defined ways in which we manage the biophysical environment through understanding of processes, connections, spaces, and scales—the entire process forming a basis for integrated coastal management and tools such as MSP. In ICZM, human influences/impacts can be understood through views of processes, connections, space, and scales that may not be too different from those of indigenous users (Ehler and Douvère, 2007). The way in which TK data is organized and categorized should reflect this management scheme, in which processes, connections, spaces, and scales within TK systems are demonstrated by data structures and categorizations that are sensitive to those of indigenous knowledge-holders. This will facilitate proper integration and use of TK in the MSP process.

5.2 Knowledge Organization and Categorization

The way in which data is organized and categorized affects both how it is used, and its accessibility. Several authors, including Scassa and Taylor (2017), have discussed the incorporation of TK into geospatial databases and repositories. Scholars in library and information science have also reflected on TK organization, and a brief assessment of this research will provide a more thorough understanding of this issue which will help better organize and integrate TK in MSP.

As the previous discussion of knowledge systems and alternative spatial structures illustrates, TK does not necessarily “fit into” Western Scientific analytical methods, at least not accurately. Classification of TK data is consistent with this premise, and the organization and categorization of data by Western scientists and managers may not correspond to the TK worldview. The integrated, holistic character of TK makes systematic organization and categorization difficult, as sociocultural, ecological, and economic information is intricately linked. One critical challenge that can be seen in the Inuvialuit case is the close integration of animals and humans in the use of the environment, both of whom are understood as dwellers. On the other hand, departments such as DFO often document species as discrete data entities. Some TK projects, focused on integrating TK into databases, have provided more complex categorization systems for using, organizing and classifying TK. These Knowledge Organization Systems aid in translating TK into data properly for use in analysis and management.

5.2.1 Knowledge Organization Systems (KOSs)

Designing TK research in the ISR must be informed by the way in which the Inuvialuit perceive the world. Researchers must understand the categories used by the Inuvialuit to make sense of the world around them in order to frame research, make it practical for planning, and make it accessible to the Inuvialuit themselves. The way in which TK data is categorized can frame the research, and structure it so it is both practical for planning and true to the Inuvialuit worldview.

Classification of TK in environmental resource management often makes assumptions about ways in which the world is organized, often drawing from scientific taxa and terminology.

Imposing outside categories can distort the nature TK. For example, Armitage and Kilburn note that “researcher terms and the concepts they label—such as “population”, “morphology”, “habitat”, “herd”, “stock”, “shoal”, “ecosystem”, “ecological landscape unit”, and “environment”—may have no direct equivalent in Inuvialuktun dialects and the thinking of traditionally-minded Inuvialuit, and even where TK Holders are bilingual or unilingual English speakers, one cannot assume that local meanings are identical to those of the researchers and external audiences” (2015, p. 28) Furthermore, TK Holders may not catalogue the world and knowledge into discrete categories such as “environment”, “religion”, “nature”, or “society.” As previously discussed, TK is a holistic and multifaceted worldview, in which many aspects of the world are intricately connected. Categorizing TK with discrete boundaries may overlook the nuances of how the knowledge is structured. For example, travel routes are complexly tied to narratives attached to place names. Such relationships must be understood both in the categorization and analysis processes.

Although the organization and classification of TK has not been discussed at length directly in relation to MSP, a relatively extensive debate on the subject exists in the discipline of Library Science. The general idea is that, while Indigenous communities have diverse traditional systems of knowledge, some common characteristics can be recognized, notably a holistic view of the world. In this sense, knowledge cannot be separated from broader worldviews of individual or group holding it. “Eurocentric partitions” within knowledge systems—for example, science and art, geography and history, religion and ethical philosophy, or nature and culture—are not existent in TK systems in the same way (Kamau Maina, 2012). For instance, the Inuvialuit have many descriptive categories of the natural world, but their knowledge of the

environment cannot be separated from subsistence practices, spiritual beliefs and relations to one-another (Armitage and Kilburn, 2015). The understanding that “the land is our library of our language, culture, history, way of life, beliefs” is a common belief within Indigenous communities (Iserhoff, 2006, cited in Cherry and Mukunda, 2015).

Discrepancies between Indigenous knowledge systems and traditional Library KOSs have been discussed since the 1970s, because of the structural inequalities that they uphold. Dominant systems of library classification have been analyzed and criticized for their inherent biases. Over the past four decades a number of researchers, including Sanford Berman, Hope Olson, and others, have scrutinized both the Library of Congress Classification (LCC) and the Dewey Decimal Classification (DDC) systems, finding biases that relate to the ways in which marginalized Indigenous groups are represented within the classification scheme. These researchers have noted inappropriate, misguided, and discriminatory categories and subject headings related to North American Indigenous communities and cultures. For example, many Indigenous resources were classed in “history,” giving the impression that Indigenous peoples and worldviews no longer exist (Webster and Doyle, 2008). This suggests a reform needed to the language of LCC and other dominant Library classification schemes, and in particular the terminology used in its categorization and organization. Furthermore, an investigation into the Library of Congress Classification by Lee (2011) found that “librarians and archivists interviewed by Lee said they would prefer an ‘entire classification dedicated to Indigenous Knowledge regarding all aspects of subject areas: religion, language, history, pre-history, science and technology’”, and wanted to see local epistemologies used to organize the system of classification” (Cherry and Mukunda, 2015). Participants in Lee’s study also brought up the fact

that subject headings and subject terms were often misleading, spelled incorrectly, out of date and sometimes offensive – for example names of nations and tribes were often spelled using obsolete anthropological terms that are different from the preferred local usage (Lee, 2011).

These observations are relevant to the integration of TK into MSP because they provide insight into the challenges involving merging TK with other datasets, and they offer some guidance into the ways in which TK data may be organized to align with Indigenous worldviews while providing a level of organization that makes the data useful in marine planning processes. Maintaining the connectedness of TK in databases while making it identifiable by non-Indigenous peoples is a challenging process, and Library Science scholars have already made significant progress towards better classifications systems. Alternative classification schemes and adaptations of mainstream systems have been developed to better reflect Indigenous North American schema and realities. For example, the Brian Deer Classification System (BDC) is a library classification system created for use in Indigenous contexts by Canadian Kahnawake Mohawk librarian A. Brian Deer, between 1974 and 1976. Deer organized library materials using Indigenous concerns of the time, coercing them to reflect the “action-based collections” that Indigenous communities used, and extending classification to cover subjects such as land claims, Aboriginal title and rights, treaty rights, and co-management.

The Brian Deer Classification System has since been revisited and adapted to reflect modern understandings of TK as a knowledge system. This new classification approach includes changes in vocabulary, for example using “Nature and Ecological Knowledge” instead of “Natural Resources”, “Wildlife Caretaking and Stewardship” instead of “Wildlife Management”

and “Worldview” instead of “Religion”, to better reflect the relationships Indigenous people have with the environment. While classification through the use of hierarchical schemes is a principal method for KOSs, adaptations to the BDC system have endeavoured to demonstrate relationships and preserve logical connections between the environment and culture. This is especially important for MSP management, as TK should be able to contribute information on the interconnectedness of environment and culture that reflect indigenous communities’ views and activities, for the cumulative result of integrated management. Using classification methods that exemplify holistic characteristics of the environment and culture can not only facilitate the integration of TK and MSP, but foster the integration of different sectors in management.

A literature review of KOS theory reveals several useful guidelines for the organization and categorization of TK that should be applied to TK databases for use in MSP:

1. Use correct subject headings and subject terms, avoiding obsolete anthropological terminology in favour of preferred local usage (Cherry and Mukunda, 2015, 2015, 551)
2. Avoid spatial segregation based on Western political boundaries
3. Organize knowledge within the context of community (Littletree and Metoyer, 2015)
4. TK knowledge organization systems should be adaptive – ability to adapt to changing stuff based on new research or changing
5. Classification schemes that will be most useful to members of the community are both specific and highly philosophically acceptable to members of the community (Moulaison, Sandy, and Bossaller, 2017)
6. Include Indigenous input

These principles have already been applied directly to the Canadian Arctic, but they are not regularly implemented in documentation/planning processes. The current Nunavut Libraries Online consortial catalog contains the databases of four major Nunavut library systems sharing a common Integrated Library System (ILS). The partners involved have adopted a “common set of descriptive cataloging standards for incorporating Inuit language materials into their library catalogs” (Rigby, 2015). These criteria involve a standardized way of writing syllabic Inuktitut, disseminated by the Nunavut Government and are highly controversial within the territory. The key principles in this process are that descriptions and points of access are made with the user in mind, are based on the way a community or individual describes itself. In using this controlled vocabulary, records are created to reflect the language or languages of the item being described. In fact, most adaptations of Library classification systems for Indigenous literature and data have been focused on organization *for* Indigenous people, creating systems that are accessible to those of differing knowledge systems.

Moulaison, Sandy, and Bossaller (2017) believe that the flexibility offered by developing knowledge systems, especially ones that adhere to emerging technology standards, might be the key to co-existence of multiple systems, empowering all contributors with authority over their own knowledge. Focusing on KOSs for user accessibility, the authors provide insight into ways in which TK can be organized so that it is consistent with the Indigenous worldview (i.e. adapting KOSs to users), thus making it more effective for information management. Subject access to all knowledge, including Indigenous knowledge, is imperative for libraries and other knowledge institutions, and obstacles to intuitive subject access present a social justice problem. Access can be provided or denied through classification and controlled vocabularies.

This is very relevant to Indigenous participation in MSP, as the data integration process is not significantly different to that faced by TK knowledge integration into a library system. In both cases the challenge is to maintain and respect indigenous worldviews while maintaining a classification system that can be used for identification within much broader knowledge/data contexts. The UN's Division for Social Policy and Development for Indigenous People states that policy should "promote full and effective participation of Indigenous peoples in decisions affecting them" (UN Inter-Agency Support Group on Indigenous Peoples' Issues, 2014). These decisions should include how TK is stored and made accessible for wider audiences and purposes (e.g. in MSP). Addressing this issue is critical when considering real and effective participation of Indigenous and TK holders in MSP. Expanding categorization systems in MSP and environmental management may allow Inuvialuit more meaningful participation in Western management processes.

5.2.2 ISR Traditional and Local Knowledge Catalogue

The ISR Traditional and Local Knowledge Catalogue (ISRTLK) is a clear example of best practices in TK data organization and management (**Figure 10**). The purpose of the catalogue is to "improve the accessibility and application of traditional and local knowledge research in the Inuvialuit Settlement Region (ISR). This catalogue is to encourage the use of TK in management decisions, by serving Inuvialuit community members and organizations, scientific partners and governmental agencies." (isrtlk.com, accessed October 2017). It is a product of the Beaufort Sea Partnership (BSP), supported by the Traditional and Local Knowledge Working Group discussed

previously. Contributions to the catalogue come from the Joint Secretariat, Inuvialuit Regional Corporation, and the Beaufort Sea Partnership, and only include TK materials.

1 Traditional Environmental Knowledge:

- Climate and Weather
- Ocean (sea ice, currents, etc.)
- Freshwater (Rivers and Lakes)
- Permafrost activity
- Land Erosion
- Contaminated Sites
- Terrestrial Habitat
- Ecology (species specific):
 - Population distribution
 - Population density
 - Feeding areas
 - Mating/Denning/Rearing
 - Migration route
 - Habitat use
 - Invasive species
 - Species health
 - Species reproduction
 - Disease

2 Traditional Land Use:

- Place Names
- Travel Routes
- Camps
- Cabins
- Burial sites
- Culturally significant sites
- Landmarks
- Historical sites
- Hunting Areas
- Trapping Areas
- Fishing Areas
- Gathering Areas

3 Traditional Practices:

- Art
- Dietary preferences and culinary practices
- Fishing
- Gathering
- Housing
- Hunting
- Natural Resource Management
- Recreation
- Religious spiritual practices and beliefs
- Trade
- Trapping

4 Local Knowledge:

- Includes any current knowledge held by community members

5 Integration of Traditional Knowledge with Western Science:

- Includes anything that discusses the conceptualization of traditional knowledge and how it can be, is, and/or must be integrated with scientific knowledge

Figure 11: The ISRTLK Catalogue knowledge organization design, retrieved from <http://isrtlk.com/>

The catalogue was designed by Inuvialuit knowledge holders, and it is clear that accessibility was a primary concern for its user interface. While categories are disconnected for clarity and organizational purposes, a more holistic image of TK is presented, paying attention to the complexity of the interconnecting themes. The ISRTLK Catalogue expands to include traditional land use practices such as *Place Names*, *Travel Routes*, *Culturally Significant Sites*, *Housing* and *Migration Routes*. The catalogue considers not only historical knowledge, but includes *any current knowledge held by community members*. Furthermore, the catalogue is designed to optimize the process of bridging TK and Western Scientific knowledge, using mutually practical categories and going as far to include non-TK information related to the integration of Traditional Knowledge with Western Science. The challenge remains on how these categories can be properly integrated in concrete MSP scenarios. For instance, an MSP designed to properly manage a Marine Protected Area may include such data as species abundance, shipping traffic, etc. But how would the Inuvialuit data be selected and integrated into the MSP process? Some emerging spatial analysis tools, such as Marxan with Zones, should be explored in connection with how “cultural value” can be quantified and portrayed, but the active participation of Inuvialuit stakeholders is critical from the beginning to the end of the process.

Chapter 6

Discussion and Recommendations

6.1 Discussion

Considerations of best practices, issues in data management, and organization of TK offer insight into several important themes present in the use of Traditional Knowledge in Marine Spatial Planning. The following themes and recommendations are mainly targeted towards effectively integrating TK within MSP processes.

6.1.1 Transparency

Transparency is of the utmost importance in the use of TK in environmental management and Marine Spatial Planning, as proper methodology (including proper use of metadata, culturally appropriate data collection techniques, etc.) provides context to the information, ensures that the knowledge was properly documented, and allows environmental and marine managers and decision makers to apply the TK data in informed ways. It also prevents managers and researchers from “cherry-picking” TK that corroborates their own interests or hypotheses, without properly understanding the intricacies of the data. However, a literature review of contemporary TK studies in the Western arctic revealed that transparency in methodology was often lacking in publications. By making methodology used by researchers accessible and replicable, issues in misinterpretation may be reduced. By making research open and accountable, TK can become both more practical for environmental management and planning, and more ethical to Indigenous communities.

6.1.2 Accessibility

Ensuring the accessibility of local communities to the TK data is crucial to make it an inclusive process. As discussed previously, TK is often collected and documented by researchers that are external to the Indigenous community, and incorporated into Western Scientific reports and papers. This process can easily become a one-way flow of information, as TK is often adapted to Western Scientific terminology and categorization systems and thus reshaped to exclude TK-holders from broader narratives. This process includes MSP, as knowledge-holders need to be capable of ensuring that their knowledge is properly used. One of the problems related specifically to MSP is the lack of technical capacity of communities to access the data in meaningful ways. In this sense, community capacity-building becomes critical for proper use of TK in MSP. Furthermore, if TK is documented through conventional social science methods, researchers must be cognizant of the accessibility of how the data is presented. Using correct terminology, and categorizing TK data so that it reflects Traditional Knowledge systems can make the data used for management accessible to TK-holders, Indigenous communities, Scientists, and managers – allowing it to adapt to new information presented by any party, and bridge knowledge systems to form a more comprehensive knowledge base for management.

6.1.3 Context

As discussed, representing the broader context of TK is imperative to using TK as a source of data for management. In actual practice, this is a complex task for data used in management and analysis, as management and analytical frameworks are often based on western-scientific thought. While context can often be added to supplement geospatial data in the form of

narratives, historical photos, and other multimedia, the process of using this information in geospatial management is difficult because MSP is mostly concerned with uses of marine space, and hence the most important dimension of data is its spatial attributes. Understanding how to preserve the integrity of TK through upholding the context of the knowledge system as it is converted into geospatial data is an important course for further interdisciplinary research.

6.2 Recommendations

Using TK effectively in MSP is a complex process that involves in-depth consideration.

Answering the question of how TK can be effectively used in and incorporated into MSP is a multifaceted endeavour which inevitably generates more questions to answer in future research. It is recognised that the multidimensional context of TK must be maintained when converting it and using it as data. Preserving the context of TK in management plans is not a straightforward task, but general standards may be proposed to foster this process. Armitage and Kilburn (2015) provide a notable starting point for this task in their *Traditional Knowledge Guide*, and other researchers may contribute to this discourse in finding best practices that foster the integration of TK in management. Perhaps the most important initial step is to recognize the complexity of the knowledge to data process concerning TK.

6.2.1 Mutual recognition and respect

Many Indigenous training and development programs within Canada have been designed through a “monocultural approach”—either exclusively ‘mainstream’ western training or

exclusively Indigenous training. However, many reports indicate that neither of these approaches successfully meet community needs to sustain Traditional Knowledge practices while ensuring the communities benefit from Western Scientific research. In essence, indigenous communities live in contemporary realities, and many have recognized the need to be prepared to engage in “both worlds” (Boven and Morohashi, 2002). The same need of knowing both knowledge approaches may be required by managers and decision makers involved in issues related to indigenous territory. Some sort of parallel knowledge systems, a thorough knowledge of both TK and western science, could make the use of TK in environmental management more effective and meaningful (Rathwell et al., 2016; Reid, 2006). A part of this process involves legitimizing socially and culturally embedded knowledge transmission methods. TK is generally communicated in socioculturally embedded mediums, like oral history, and legitimizing these alternative means of expression in environmental management can be an effective way of empowering communities. For example, local resource users offer unique, place-based narratives about their own environment, which have been found to challenge dominant narratives (Fairhead and Leach, 1995; Batterbury et al., 1997; Adger et al., 2001 cited in Rathwell et al., 2015). Oral knowledge is often dismissed as anecdotal evidence, but it has been extensively shown that indigenous oral knowledge is based on systematic observation, and subject to its own verification process (see Aporta and MacDonald, 2011). Validating alternative methods of information communication in management opens the range of possible new data sources, and it may also help find creative solutions to complex environmental problems. This is important because the demands of managing complex environmental change, such as that occurring within the Western Arctic, require “accommodating multiple perspectives and openness to hybrid solutions”

(Berkes and Armitage, 2010).

6.2.2 Technology and innovation in TK research

Technology and innovation in research may foster the accommodation of multiple perspectives and validation of alternative means of expression, preserving the context of TK and promoting equitable collaborations. Digital atlases and participatory photo mapping offer a potential way of legitimizing TK in its own context and voice. For example, working with local Hunter and Trapper Committees and the Inuvialuit Joint Secretariat, Bennett and Lantz (2013) have adapted participatory photomapping methods to document Inuvialuit observations of environmental conditions. These methods combine the visual and oral elements of Inuvialuit knowledge systems, using georeferenced photos to document and share Inuvialuit observations. Research projects like these can improve capacity to detect the impacts of environmental change and contribute to Arctic planning and management, while also legitimizing alternative methods of communicating knowledge, and creating a platform for innovation in data collection and analysis for planning. As mentioned earlier, new PPGIS techniques, and emerging spatial analyses (e.g. Marxan) can provide new tools and frameworks to represent and understand relationships among the many dimensions of TK, including proper representation of cultural value assigned to specific areas.

6.2.3 Ensuring Inuvialuit control over data

Ensuring Indigenous ownership over TK is essential to the ethical and effective use of TK in management. In the social science literature, there is growing support for the notion that, when

citizens are engaged in collecting, analyzing, and sharing data on the environment in which they exist in, they will “build their own capacity to adaptively manage local environmental resources” (Danielson et al., 2014). Furthermore, the Arctic has a history of researchers collecting TK and “taking it home with them”, providing no benefit to the Indigenous communities on which the data is based. By funding Inuvialuit research, and TK research that supports community initiatives, the process of creating TK data and using TK in management can involve Inuvialuit users in every stage. Engaging Inuvialuit communities and maintaining a collaborative approach through the co-production of knowledge can facilitate Inuvialuit control over their own data, and help redefine power relationships. As mentioned earlier, the most challenging part of this process is to create capacity in the indigenous organizations and communities to effectively have control of the data.

Chapter 7

Conclusion

Inuvialuit in the Western Canadian Arctic, as well as other indigenous communities in the Arctic, possess a substantial body of knowledge and expertise related to their environments, understood in connection to their own livelihoods. This knowledge can certainly be included into environmental management and Marine Spatial Planning initiatives (as shown before, Canadian legislation makes this inclusion an obligation). However, the process of integrating Traditional Knowledge with Western Scientific knowledge for environmental management is fraught with challenges. A better understanding of the challenges involved in data management and categorization of Traditional Knowledge will be a first step in more inclusive approaches to management. Such considerations as transparency, accessibility, and context, may allow TK to have a meaningful role as a knowledge base in Marine Spatial Planning. However, the main factor remains that communities may should the power and ability to both shape and control the data collection and management processes.

Rapid change in the Arctic environment provides an opportunity for Traditional Knowledge and Inuvialuit knowledge to make substantial contributions to the ERM discourse. If implemented carefully and effectively, integrated management processes such as MSP can foster this process of knowledge creation. Based on the premise that TK *should* and *must* be used in any implementation of MSP in the Western Arctic, this paper argues that certain steps must be taken to ensure the integrity of TK in the process of using it as data in management.

These steps include acknowledgement and integration of best practices in TK use in the Beaufort Sea, following proper guidelines when converting TK into geospatial data, and organizing TK in culturally-sensitive ways. Ensuring transparency in data collection and analysis, accessibility of data, and retention of context is essential in this process, and may be achieved through mutual recognition and respect. Innovation in spatial analysis technologies may also help to ensure Inuvialuit data is properly understood, and also help communities and organization to exercise control over data based on their traditional knowledge.

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