Indigenous-Driven Conservation:

Exploring the Planning of Qikiqtait Protected Area in Sanikiluaq, Nunavut

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ABSTRACT

Biodiversity loss is increasing worldwide due to anthropogenic pressures. Protected areas are viewed as a primary tool to prevent biodiversity loss. However, protected areas do not always meet local needs and biodiversity goals simultaneously. Increasingly, local, and Indigenous communities globally are initiating protected areas that better reflect local needs while at the same time meeting conservation objectives. The purpose of this thesis is to examine how an Indigenous, community-driven approach to protected area planning differs from the model more typically used by conservation and government agencies in Canada. Using literature and examples of community-based protected areas in Canada, this research sought to synthesize the current conservation framework. Focusing on the Belcher Islands, Nunavut, this research examines the proposed protected area of Qikiqtait, a community-based, Indigenous-led protected area initiated by the community of Sanikiluaq, Nunavut. Geographic Information Systems (GIS) spatially compare Priority Areas for Conservation (PACs) derived from two different approaches: the community of Sanikiluaq, and World Wildlife Fund Canada (WWF). The analyses indicated a large overlap between areas of importance for the community and areas of conservation importance for the region identified by the WWF. Overall, the community planning offers a finer spatial resolution more suitable to local planning, as well as encompassing a broader range of conservation and livelihood priorities. Following the literature review and spatial analysis, this research concludes that while Canada's conservation framework is increasingly making space for greater Indigenous leadership and participation, lessons remain on how to achieve optimum potential in community-based protected areas.

CO-AUTHORSHIP STATEMENT

Chapter Two, *Literature Review: Conservation and Communities in the Canadian Arctic* was written primarily by myself, with the help of my committee, Dr. Arn Keeling, Dr. Rodolphe Devillers, and Dr. Joel Heath. Dr. Arn Keeling offered support during the preliminary steps and with designing the goal of the literature review. I wrote the manuscript, and Dr. Arn Keeling offered continuous feedback and revisions. Dr. Rodolphe Devillers and Dr. Joel Heath provided feedback and revisions for the final version.

Chapter Three, *Linking Local Conservation a with Regional Conservation Vision* was a joint research effort between myself and my committee, Dr. Rodolphe Devillers, Dr. Arn Keeling, and Dr. Joel Heath. Dr. Joel Heath suggested this specific research topic, and through his relationship with Sanikiluaq and connections with World Wildlife Fund, acted as a liaison to initiate the project. During my first visit to Sanikiliuaq in March 2019, Dr. Heath introduced me to community members during the 2019 Protected Area Meeting and to the rest of the community during a Town Meeting. With Dr. Heath and Dr. Devillers' guidance, I designed the research questions and methods. Throughout the GIS spatial analysis, Dr. Devillers offered continuous guidance and consultation. During the interpretation of the results, both Dr. Devillers and Dr. Heath offered input and advice. After I wrote the manuscript, my committee including Dr. Keeling, Dr. Devillers, and Dr. Health offered input in terms of revisions and feedback. This chapter is intended for publication but has not yet been prepared for submission to a journal.

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List of Acronyms

AES – Arctic Eider Society

CBD – Convention on Biological Diversity

COSEWIC – Committee on the Status of Endangered Wildlife in Canada

GIS – Geographic Information Systems

IIBA – Inuit Impact and Benefit Agreement

IK – Indigenous Knowledge

IQ – Inuit Qaujimajatuqangit

ITK – Inuit Tapiriit Kanatami

IUCN – International Union for Conservation of Nature

MECCEA – Marine Ecological Conservation for the Canadian Eastern Arctic

MPA – Marine Protected Areas

NCRI – Nunavut Coastal Resource Inventory

NWA – National Wildlife Area

PAC – Priority Area for Conservation

QIA – Qikiqtait Inuit Association

TEK – Traditional Ecological Knowledge

TK – Traditional Knowledge

UNESCO – United Nations Educational, Scientific and Cultural Organization

WWF – World Wildlife Fund

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CHAPTER ONE

INTRODUCTION

1.1. Introduction

Located in a cluster of islands, the community of Sanikiluaq sits in the Belcher Islands, Nunavut, in the heart of Hudson Bay, Canada. Primarily Inuit, the community continues to heavily rely on the environmental health of the region, integrating subsistence hunting and traditional practices into their daily routine (McDonald et al., 1997). The community has been environmental stewards of the region for as long as they can remember, and in 2018, Sanikiluaq began the formal process of creating a protected area that would cover the entire Belcher Islands region. Qikiqtait, the Inuktitut name for the Belcher Islands and proposed name for the protected area, is based on a community-driven planning approach and is intended to preserve biodiversity of the region, as well as integrate Indigenous-knowledge and Sanikiluaq's traditions into the environmental management of the protected area. Qikiqtait is proposed to combine aspects of Marine Protected Areas (MPAs) and National Wildlife Areas (NWAs) to protect both the lands and waters of the region.

Historically, protected areas in Canada have excluded local and Indigenous communities from the decision-making and as potential land-managers (Binnema & Niemi, 2006; Indigenous Circle of Experts, 2018). By forcefully removing Indigenous people from their land, protected areas implemented during the 19th and into the 20th century perpetuated a colonial shaping of the landscape (Adams & Adams, 2005). During this era, protected areas were primarily established for tourism (Binnema & Niemi, 2006; Spence, 1996), but today are viewed as the most effective tool to preserve habitat and combat the current global biodiversity crisis (Dudley et al., 2018; Watson et al., 2014). While the colonial framework has been reshaped, many argue that

conservation in Canada still reflects a colonial approach to conservation (ICE, 2018). Critics argue that more space is needed in legislation in order for conservation initiatives to reflect an Indigenous vision and to fully reconcile Canada's historical relationship with Indigenous Peoples.

Conservation planning has shifted dramatically since the first formally legislated protected area, Yosemite National Park, was implemented in the United States in 1864. During the 20th century, protected areas were identified using ecological principles and natural science methods (Bennett et al., 2017; Infield et al., 2018; Mace, 2014), as well as for economic and aesthetic reasons such as tourism for the upper middle class (Binnema & Niemi, 2006). The field of conservation biology entered the academic world in the mid-1980s to apply science to conservation problems and support conservation planning problems (Meine et al., 2006; Soule, 1985). Yet, conservation biology is not solely used in every conservation scenario as many socio-political factors exist, thus the need for interdisciplinary conservation. Conservation planning today reflects a more interdisciplinary field, combining ecological assessments and surveys with economic cost and benefit-like analyses while accounting for socio-political factors (Armsworth et al., 2018; Mace, 2014; Murdoch et al., 2010).

Literature on community-based and Indigenous-led conservation was scarce until the 1980s, when the conservation framework began shifting to be more inclusive and interdisciplinary (Mace, 2014). While the conservation framework today embraces interdisciplinary perspectives, there are still gaps to address in terms of making space for greater Indigenous leadership and participation. While there is much literature on community-based and Indigenous-led conservation, especially from Australia, there are few examples from Canada of successful community and Indigenous-led protected areas that provide in-depth insight on successes and challenges. Therefore, examples and case studies are needed to create a definition of community-

based and Indigenous-led conservation within the existing conservation planning framework (ICE, 2018; Simon, 2017). There is also much literature that compares Western-based conservation approaches and Indigenous community-based approaches to conservation (Mills et al., 2012), however there is little literature that examines how these approaches could be used in harmony to complement each other.

Qikiqtait's planning process is aimed at reflecting a unique community vision in conservation planning to implement local approaches to management that support long-term sustainability of the region and local subsistence economies. At the same time of Sanikiluaq's protected area planning, World Wildlife Fund Canada (WWF), an international organization dedicated to conservation and biodiversity preservation, has initiated a conservation planning approach for the Eastern Canadian Arctic. WWF's approach reflects a more typical, natural science approach to conservation, employing a systematic conservation planning framework to design a network of potential protected areas. Sanikiluaq's Qikiqtait planning process thus provides a unique example of Indigenous community-based conservation planning paralleled by WWF's parallel efforts to identify Priority Areas for Conservation (PACs) in the region. This presents a unique opportunity to examine two approaches to conservation for the same region, eliciting similarities and differences to understand how compatible these approaches are.

1.2. Research Objectives and Questions

The purpose of this research is to understand how the conservation framework in Canada has evolved to be more inclusive of community-led conservation and how a specific Indigenous, community-driven approach differs from the model more typically used by conservation organizations and government agencies. This research examines how an Indigenous vision to conservation reflects Sanikiluaq's conservation and community values. Using Qikiqtait as a case

study, this research uses a geographic approach to examine conservation priorities from community-based planning (Sanikiluaq) and systematic conservation planning (World Wildlife Fund Canada), using existing data and literature to situate the findings in the current conservation context in Canada. By examining two approaches to conservation for the same region, this research sheds light on how systematic conservation planning and community-based conservation planning approaches could complement each other. In so doing, this research also seeks to demonstrate the value of including local and community input in conservation decision-making.

To achieve these objectives, this research is guided by the following questions:

1. *a) In the Belcher Islands, how do conservation priority areas compare spatially between a local Indigenous community-driven approach and a regional conservation plan from an international conservation organization?*

   b) How do these priority areas relate to species occurrence and species richness in the region?
2. *How do environmental values of the different actors influence the conservation priority areas?*

Overall, this study seeks to contribute to a greater understanding of what community-based and Indigenous-led conservation could look like in Canada. It was initiated by the community of Sanikiluaq and the non-profit organization Arctic Eider Society, a charity aimed to facilitate Inuit-led research and support self-determination that partially funded this study. Initially, research question two was to be answered using qualitative analysis of existing data, supplemented by community consultations and semi-structured interviews to elicit Sanikiluaq's environmental values, and how this was reflected in the development of their protected area plan. Due to the restrictions resulting from COVID-19, these interviews were canceled, and this section was

reworked as a hybrid literature review presented in Chapter 2. This literature review examines the principles and strategies for a community-based and Indigenous-led protected areas conservation framework, paying close attention to how environmental values are integrated into conservation decisions. This review also examines protected area management plans from the 15 co-managed protected areas in Canada to elicit broad similarities and differences and to identify any lessons and learnings that could help inform Qikiqtait's planning process.

Research question one was answered using quantitative spatial analysis. Using secondary data attained from the community pertaining to the planning of Qikiqtait and data from WWF on Priority Areas for Conservation (PACs) in the Eastern Canadian Arctic, Chapter Three spatially examines similarities and differences between WWF's PACs and Sanikiluaq's proposed protected area boundary for the Belcher Islands. An overarching objective of this chapter is to understand how an Indigenous, community-based approach differs from the approach more typically used by conservation organizations and furthermore, in order to demonstrate how a regional approach could be used to support Sanikiluaq's efforts in planning and implementing Qikiqtait.

1.3. Study Area

Prior to the arrival of the Europeans, Indigenous Peoples lived in virtually every region of the what is now known as Canada (Usher et al., 1992). What followed was a history characterized by colonization, crimes against humanity, and resistance from Indigenous Peoples as Euro-Canadians attempted to claim the land as their own (Macdonald, 2007). Understanding this historical and political context is key to fully understanding modern day land claims, treaties, and political issues, especially in the Canadian Arctic. While Canada became a country in 1867, Arctic lands were not included in its boundaries until 1870 for the territories of the Hudson's Bay Company and 1880 for the High Arctic islands and waters (Smith, 1961). During this time, Inuit

compliance was assumed as Euro-Canadians extracted resources and claimed Canadian sovereignty (Suluk & Blakney, 2008). Decisions by the Canadian Government regarding resource use and extraction did not reflect Inuit values or knowledge, resulting in a "distortion of their society and growing resistance" (Suluk & Blakney, 2008 p.64). Furthermore, government actions of residential schooling and the slaughter of Inuit sled dogs forced assimilation and resulted in relocation, loss of culture and traditions, and ongoing trauma (Qikiqtani Inuit Association (QIA), 2015).

Indigenous Peoples in Canada have been moving to reclaim self-determination and seek reconciliation, often through land claims or other means of regaining land rights (Usher et al., 1992). Specifically, in the late 1900s Inuit began reclaiming the territory of Nunavut. Nunavut, meaning "our land" in Inuktitut (Jull, 2001; Kikkert, 2007) was established as part of one of the first modern land claim agreements in Canada (Gombay, 2000). Concluded in 1993, the Nunavut Agreement was pushed by Inuit as a way to regain control of their lives and land (Hicks & White, 2000). In 1999, the Inuit territory of Nunavut was created, representing a huge milestone for Inuit in Canada in terms of Inuit self-governance and self-determination (Kikkert, 2007; Lewthwaite & Mcmillan, 2016).

Nunavut was founded on the principle of incorporating Inuit values and knowledge, known as *Inuit Qaujimajatuqangit* (IQ), into governing policies and decision-making (Lévesque, 2014; Tester & Irniq, 2008). A significant aspect of the Nunavut Land Claim Agreement and today's Nunavut government are the government bodies dedicated towards natural resource management. The Nunavut Wildlife Management Board, for instance, focuses on utilizing IQ to structure and inform regulations regarding hunting and harvesting quotas. However, the extent to which the government can use the full range of IQ is limited by the Euro-Canadian bureaucratic structure of

the of the government (Bowman, 2011; Tester & Irniq, 2008). Therefore, while Nunavut is dedicated to governing according to IQ, it is still limited by the bureaucratic system of Canada today (Tester & Irniq, 2008).

The Government of Nunavut outlines specific regulations protecting Inuit land rights. In the context of any development projects in Nunavut initiated by an external party, including conservation actions and protected areas, regulations require Inuit Impact and Benefit Agreements (IIBAs) between the Inuit community and third party. IIBAs are important because they shift the power dynamic and require third parties to clearly outline expected benefits from development projects, as well as expected positives and negative implications for both parties (Coppes, n.d.). While there are critiques of IIBAs (Cameron & Levitan, 2014), in Nunavut they have proven to be a promising means of changing a history where Inuit had no say over resource extraction and land rights. Protected areas in Nunavut are co-managed between a local Inuit community and relevant government body and require an accompanying IIBA. This further illustrates the connection between self-determination and land rights, as well as Nunavut's overall goal to increase Inuit self-determination.

1.3.1. Background: Indigenous Knowledge and Research in Nunavut

To understand the significance of incorporating IQ into policies and regulations, it is necessary to explain the complexity of IQ. Definitions of IQ run parallel to definition of Indigenous Knowledge (IK), Traditional Ecological Knowledge (TEK) and Traditional Knowledge (TK), however it pertains specifically to Inuit values, knowledge, and traditions (Tester & Irniq, 2008). While there are many definitions of IK, TEK and TK, there is no universally accepted definition of any of these terms (Snively & Corsiglia, 2001; Tester & Irniq, 2008). In the simplest form, TEK is passed down through multiple generations and embodies a full encompassing form of

knowledge, recognizing the interconnectedness of each ecosystem (McDonald et al., 1997). These observations tend to be qualitative and accumulate over a long period of time from the same spatial origin (Kimmerer, 2002). As well as ecological processes, TEK also encompasses "world views, values, ethics, cultures, processes, spirituality" (Simpson, 2001, p. 139). In Inuit ontology, humans and animals are intrinsically interconnected, meaning that "whatever might affect one will affect the other" (Poirier & Brooke, 2000). An Inuk from Chesterfield Inlet describes IQ best:

> "We, native people, have lived in our land since time immemorial. We know our lands, are experts in our environment. We do not study it for just a few years. It is a lifetime study. It is knowledge from the beginning passed on to us by our Ancestors" -Titi Kadluk, Chesterfield Inlet (McDonald et al., 1997, p. 1).

This quote illustrates how IQ differs from Western researchers' definition of knowledge. Not only does IQ encompass cultural and environmental values, but it is engrained in their community values and lifestyles. This knowledge system understands the complex relationships in the environment that impact animal behavior and decisions made by each community (McDonald et al., 1997).

Initially, researchers were under the impression that by integrating and documenting TEK, Indigenous people would be given greater control over the decisions that impacted their lands and communities (Simpson, 2001). Recently, this approach is being viewed with concern by Indigenous people, due to the westernization of their knowledge as it is written down and used for colonial purposes (Simpson, 2001). Sandlos and Keeling argue that Indigenous TEK is being confined to flora and fauna, rather than an encompassing understanding of the environment and its history. This poses a problem when trying to link TEK and western science, because Indigenous knowledge system becomes marginalized and treated as a supplementary data, "neglecting the

ethical and political claims embedded within Indigenous knowledge." (Sandlos & Keeling, 2016 p.280). It is also important to acknowledge that Indigenous knowledge is place-specific and will be distorted or misunderstood if it is taken out of context (Zeng & Gerritsen, 2015). Therefore, it is important that the use of TEK and IQ in context of regulations, research, and policy, is determined by the knowledge holders themselves.

As a means of self-determination, Inuit Tapiriit Kanatami, (ITK) a national organization of 65,000 Inuit, have published research strategies that call for the end of exploitive research (Inuit Tapiriit Kanatami (ITK), 2018). This document points out the racism and segregation that stemmed from the first explorations conducted in the North, which treated northern Indigenous people as bystanders and research subjects. In the ITK strategy, researchers conducting research in the North are strongly encouraged to partner with Inuit in order to reflect the needs and priorities of Inuit, and Indigenous people in general, and to prioritize community research needs (ITK, 2018). This research strategy also outlines the importance of Inuit knowledge holders being in charge of how and where their knowledge is used. The capacity of Inuit to envision and develop solutions for the challenges they face is greatly discounted, (Audla & Smith, 2014) making it difficult for Inuit to drive policy decisions.

While there have been challenges in navigating researcher-Inuit relationships, and histories of extractive research, natural science applications and knowledge are increasingly being requested by many Inuit communities to complement their knowledge of natural processes (Gearheard & Shirley, 2007). At the same time, many Inuit communities are calling for greater influence and control in defining science and research needs (Gearheard & Shirley, 2007). Reflecting this desire, is the Inuit community of Sanikiluaq, who have been leading and participating in scientific research of their ancestral and current homelands. Today, they are planning a protected area that

will reflect an Indigenous vision in conservation and incorporate IQ into their management plan. Sanikiluaq has been leading the planning and establishment of Qikiqtait Protected Area from the beginning, and self-determination in land management and research are key components of Sanikiluaq's planning strategy for Qikiqtait. Sanikiluaq worked with the Arctic Eider Society, a charity based out of Sanikiluaq, for support, such as facilitating planning meetings and planning logistics. As a researcher, my role was to assist and support Sanikiluaq via working with AES. My research tasks and processes were shaped by Sanikiluaq's research needs. Overall, Qikiqtait offers a unique case study of how Indigenous self-determination can be linked through conservation initiatives.

1.3.2. The Belcher Islands and Community of Sanikiluaq

With an area of 1,650,000 km^2 (Sly, 1994b), Hudson Bay is the world's second largest inland sea (Nunavuummi Tasiujarjuamiuguqatigiit Katutjiqatigiingit (NTK), 2008). Located in the heart of the eastern basin, the Belcher Islands Archipelago is a unique and sensitive ecosystem that is recognized as an area of interest for conservation and stewardship (Fisheries and Oceans Canada, 2011; Latour et al., 2008; Mallory & Fontaine, 2004; NTK, 2008; Stephenson & Hartwig, 2010; Stewart & Hamilton, 2007). Integrating this special region into their history, lifestyle, and culture, the Inuit community of Sanikiluaq identify themselves as the environmental stewards and representatives of the region (McDonald & Fleming, 1990; Canadian Arctic Resources Committee (CARC), Environmental Committee of Sanikiluaq (ECS) & Rawson Academy of Aquatic Science (RAAS), n.d.). Their history on the archipelago tells a story of centuries of sustainable hunting and harvesting, and a deep connection and understanding of the region (Heath & The Community of Sanikiluaq, 2011). This history fuels their actions towards implementing a protected area to cover the entirety of the Belcher Islands.

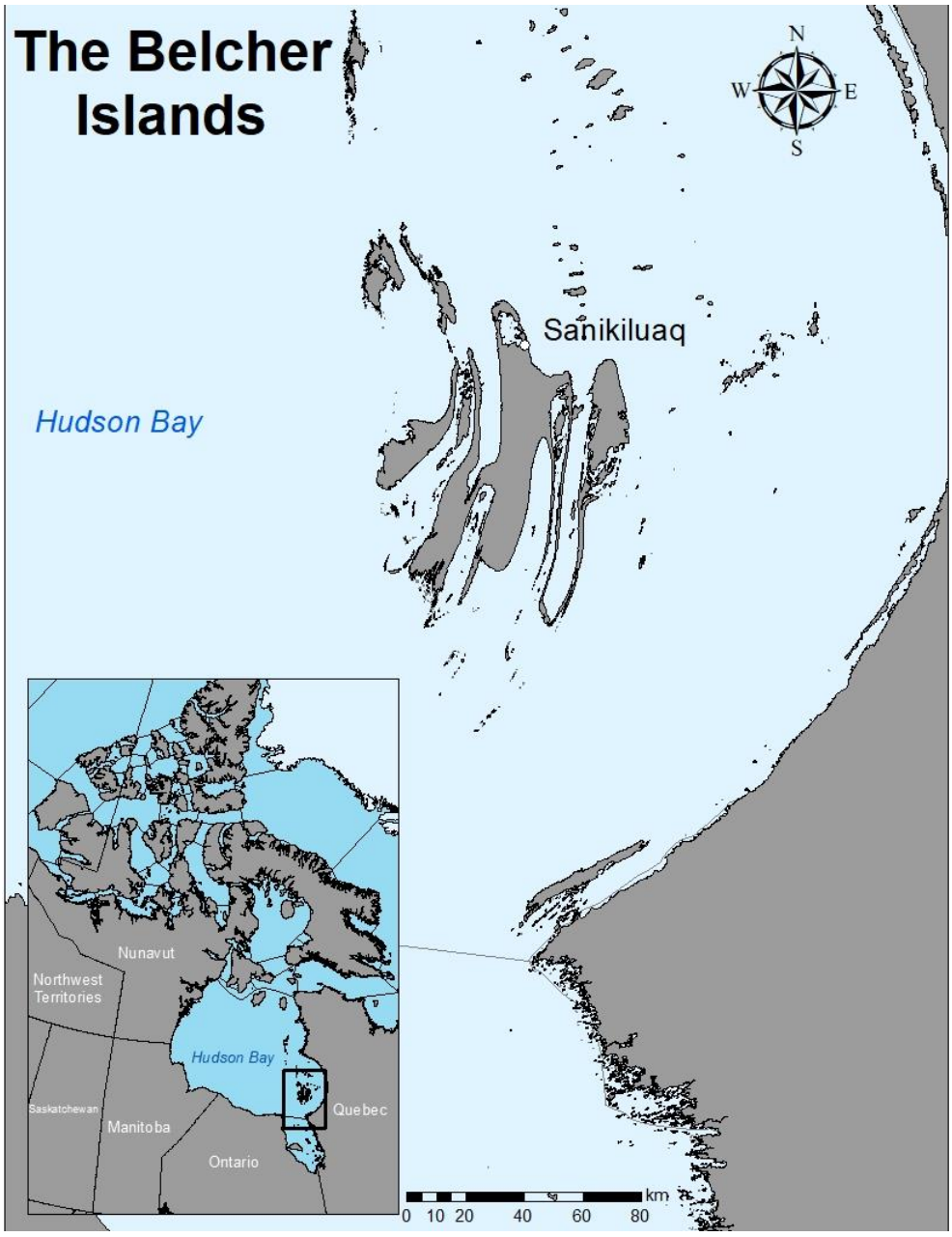


Figure 1.1 Study Area

The Belcher Islands show traces of Dorset Inuit culture dating back 3,000 years, (Lynch, 1990; Oakes, 1991; QIA, 2015). Today, Sanikiluaq, an Inuit community of about 900 people, is the sole community in the Archipelago. In 1749, trading posts were established on the mainland, however the long journey to these establishments restricted travel and trade, resulting in limited

interaction between Sanikiluarmiut and Euro-Canadians (Oakes, 1991). Robert Flaherty, a Euro-Canadian explorer, led an expedition in 1914 that marked the arrival of the first non-Indigenous researcher in the Belcher Islands (Flaherty, 1918; Oakes, 1991). In 1928, the first seasonal trading post with the Hudson Bay Company was established in the Belcher Islands, and the first school was built in 1960 (Oakes, 1991). During this time, Sanikiluarmiut were transient, living in small groups all across the islands (QIA, 2014). As government services were introduced to the islands and consolidated to Sanikiluaq, Sanikiluaq's transient lifestyle ended and everyone was moved to the community (Oakes, 1991; QIA, 2014).

While moving to Sanikiluaq drastically changed their nomadic lifestyle, Sanikiluarmiut continued to integrate their traditions and knowledge to sustainably hunt and harvest to support the community (Heath & The Community of Sanikiluaq, 2011). Their culture and lifestyle continue to reflect a deep understanding and reliance on the environment (Stewart & Lockhart, 2004; Nakashima, 1991; Oakes, 1991). Hunting sites and travel routes span across the islands (Department of the Environment, 2010), reflecting the importance of the Belcher Islands and surrounding waters as an entirety. Inuit from Sanikiluaq, or Sanikiluarmiut, continue to rely on subsistence practices and maintain a close relationship with the land and freshwater and marine ecosystems (Consilium, 2000; QIA, 2014).

Sanikiluaq relies on a mixed economy, meaning residents rely on both subsistence hunting and market resources (Fast & Berkes, 1994; McDonald et al., 1995; Quigley & McBride, 1987). In 2003, traditional practices comprised about 60% of the economy, meaning it was primarily subsistence based (Myers et al., 2005). The economy continues to rely heavily on fish, marine mammal and wildlife hunting (Quigley & McBride, 1987; Sly, 1994a), therefore disruptions in these food sources have direct economic and health impacts on the community (NTK, 2006). The

economic burden from restricted availability of resources is absorbed by the hunters through additional operating expenses and lost income (NTK, 2006). The main sources of cash income are the selling of soapstone carving, fur sales, teaching, and local government positions (Quigley & McBride, 1987; Imrie, 2009). Government employment provides the main source of full-time wage employment in Sanikiluaq. However, this cash injection is not sufficient compared to the cost of living (Quigley & McBride, 1987). Store-bought foods represent a tremendous economic burden (Fast & Berkes, 1994; Imrie, 2009; Wein et al., 1996). Not only do country foods save money and decrease the financial cost of living, but also contribute to a sense of cultural identity, good health and nutrition (Fast & Berkes, 1994; Imrie 2009; Wein et al., 1996).

In the Belcher Islands, staple food sources include the ringed seal, arctic char, bearded seal, common eider, reindeer, and shellfish such as mussels, sea urchins, sea cucumbers, clams and starfish (McDonald et al., 1997). Country foods are regarded as being direct factors of health and well-being (Van Oostdam, 2005). Specific foods have specific usefulness, for example seal is capable of generating bodily warmth and is therefore necessary for hunting excursions and going out onto the land (Van Oostdam, 2005).

Sanikiluaq has a unique relationship with local species, notably the non-migratory sub-species of the Common Eider (*Somateria melissima sedentaria)*, which are found only in eastern Hudson Bay and the Belcher Islands archipelago (Nakashima & Murray, 1988; Nakashima, 1991; Robertson & Gilchrist, 1998). Sanikiluaq is the only community in the Canadian Arctic to primarily have used bird skin, specifically eider skin, for clothing material (Nakashima, 1991). Caribou and reindeer skin were the primary material for winter clothing in virtually all northern communities. However, when the native caribou herd disappeared from the Belcher Islands in the late 1800s, Sanikiliuaq adapted and began using eider skin for their winter clothing (Nakashima,

1991). Eider continues to be a strong part of Sanikiluaq's culture and identity (McDonald et al., 1997; McDonald & Fleming, 1990; Nakashima, 1991; Oakes, 1991; Quigley & Mcbride, 1987; Wein et al., 1996).

For Sanikiluarmiut, the knowledge and traditions passed down from generations reflects intimate knowledge of the region, including knowledge of biophysical features such as the impacts of currents, sea-ice safety, climate and weather patterns, and a deep respect and understanding of the species living in the Belcher Islands (Arragutainaq & Fleming, 1993). Snowmobiles and off-road vehicles make it possible to maintain distance hunting and fishing sites (Sly, 1994). Due to the interconnectedness between the region and Sanikiluaq's lifestyle, the health and stability of the environment is directly related to their own well-being (McDonald & Fleming, 1990; Wein et al., 1996; McDonald & Arragutainaq, 1997).

Sanikiluarmiut have driven and participated in environmental monitoring, stewardship, and research for the last century (Arragutainaq & Fleming, 1993; Canadian Arctic Resources Committee, Environmental Committee of Sanikiluaq, & Rawson Academy of Aquatic Science, n.d.; McDonald et al., 1995; Sanikiluaq Hunters & Trappers Association, 2015; Stewart & Hamilton, 2007). While environmental stewardship in engrained in Sanikiluaq's culture, mass eider mortality events during the early 1990s acted as a catalyst for increased research programs and environmental initiatives. From 1992-1995, Sanikiluaq facilitated research initiatives including the *Hudson Bay Program*, a three-year initiative undertaken as a partnership between Canadian Arctic Resources Committee, Environmental Committee of Sanikiluaq, and Rawson Academy of Aquatic Science to identify key cumulative impacts from human activity (McDonald et al., 1995). Traditional Ecological Knowledge (TEK) and western science were used in conjunction to understand the environmental chance occurring in Hudson Bay. From this research,

Voices of the Bay was published with the support of the Environmental Committee of Sanikiluaq and the Canadian Arctic Resources Committee. *Voices of the Bay* compiled Inuit and Cree ecological knowledge of the ecosystem and environmental of Hudson and James Bay (McDonald et al., 1997). Sanikiluaq has also participated in countless sea-ice surveys; founded an organization to support Inuit self-determination in research (Arctic Eider Society); contributed to the making a documentary about the Belcher Islands and Sanikiluaq's relationship with eider (People of a Feather, 2011); facilitated and participated in the planning of the Hudson Bay Consortium – a round table event for communities in the Hudson Bay Region; and is now initiating a protected area, Qikiqtait, to cover the entirety of the Belcher Islands.

1.3.3. Ecological Importance of the Belcher Islands

The ecological productivity and the health of the Belcher Islands region directly impacts not only Inuit of Sanikiluaq, but also the entire Hudson Bay food web (McDonald & Arragutainaq, 1997). The Belcher Islands are an integral archipelago in the Hudson Bay marine ecosystem, consisting of about 1,500 islands (QIA, 2014). The Belcher Islands region contains terrestrial and marine habitats, providing seasonal summer refuge for migratory wildlife, and during the winter, the land-fast sea-ice platform surrounding the islands provides sanctuary to species that spend all year in the Belcher Islands (McDonald & Arragutainaq, 1997). The Hudson Bay food web is comprised of Arctic, freshwater and Atlantic species (Sly, 1994), with ice algae and phytoplankton at the base, and humans and polar bears as the main predators (Canadian Arctic Resources Committee et al., n.d.).

The Belcher Islands provide habitat to many species, with over 87 marine species catalogued by the Nunavut Coastal Resource Inventory (2010). Charismatic megafauna found in the Belcher Islands include polar bears, beluga, and ringed seal. Although relatively small,

populations of the Eastern Hudson Bay (EHB) and Western Hudson Bay (WHB) beluga return to the northern and western parts of the Belcher Islands each summer (Department of the Environment, 2010; Lewis et al., 2009). EHB beluga stock has been listed under endangered species by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (Canadian Science Advisory Secretariat Science Advisory (CSASSA), 2018). COSEWIC has also recommended that the Western Hudson Bay (WHB) beluga stock be listed as special concern (CSASSA, 2018). In the late 1800s, the EHB beluga population was over-hunted by the commercial fishing industry (Finley et al., 1982; Francis, 1977; Reeves & Mitchell, 1987, 1989). During the 1980s, older belugas were present in the EHB populations, revealing that while subsistence hunting had been ongoing, belugas were not being overharvested (Doidge, 1990; Reeves & Mitchell, 1989).

The Belcher Islands provide year-round habitat for polar bears, providing important sites during the winter and summer sanctuary in the northern Belcher Islands and Kugong Islands (Department of the Environment 2010). The current numbers vary, however each island group usually reaches about ten animals (Department of the Environment 2010). The winter range for polar bear, as reported by Sanikiluaq hunters, runs between Johnson Island and Bakers Dozen Islands (Department of the Environment, 2010), although their migration route appears to be shifting (NTK, 2008). Polar bears arrive to the area as soon as the ice forms, usually in December, and leave once the ice starts melting, usually around the beginning of June (Arragutainaq & Fleming 1993).

The Belcher Islands contain ecological and geological features that are not present anywhere else in the Canadian Arctic (Stewart & Lockhart, 2004), such as Omarolluk, or “omars” referring to a specific glacial erratic and are key for tracking glaciation (Prest, Donaldson, &

Mooers, 2000). The Government of Nunavut has identified Belcher Islands for its unique features and has been working together with the community to establish a park, which would be part of the territorial park Kingaaluk Park (Aarluk Consulting Inc., 2013). Important polynyas, areas of open water that remains ice free during the winter, have been identified by the community of Sanikiluaq and are under consideration to be formally protected by the Marine Wildlife Areas Program of the Canadian Wildlife Service (Gilchrist et al., 2005). Four Important Bird Areas (IBAs) have been identified in the Belcher Islands region (Bird Studies Canada, n.d.). These examples of important ecological and geological features support Sanikiluaq's case to protect the entire region.

The Belcher Islands have been identified as being ecologically important by government agencies, non-profit organizations, and Sanikiluaq alike. WWF Canada for example, has initiated a conservation project in the Eastern Canadian Arctic, known as MECCEA (Marine Ecological Conservation for the Canadian Eastern Arctic) (Roff et al., 2020). The purpose of MECCEA is to identify candidate protected areas while prioritizing conservation connectivity, and the Belcher Islands were included as a Priority Area for Conservation (PAC) based on important conservation features (such as species and habitats). Here, we have a unique case study to examine two approaches to conservation for the same region. On one hand, we have a systematic approach used by a regional conservation organization, and on the other, Sanikiluaq's, community-based and Indigenous-led approach to protected area planning.

1.4. Methods

This research uses Qikiqtait as a case study to understand how Indigenous values and knowledge can inform conservation planning frameworks. A case study is "an intensive study of a single unit with an aim to generalize across a larger set of units" (Gerring, 2004); therefore, using Qikiqtait as a case study was appropriate to contribute to a greater understanding community-based

and Indigenous-led conservation in Canada. Each step of the methods was shaped to meet Sanikiluaq's needs and support the planning and implementation process of Qikiqtait. This research primarily used existing data, and participant observation in the beginning stages to help build relationships between the community and myself. A core objective of this research that guided the entire process was to produce data and results that would contribute to the protected area strategy meetings and Qikiqtait planning. In order to do so, I used the methods and approaches of participant observation and GIS spatial analysis to dissect this case study and contribute to Sanikiluaq's planning process of Qikiqtait.

My research approach is based on collaboration with Arctic Eider Society (AES) and Sanikiluaq. In the fall of 2018, I began working with AES to create research questions for this thesis that would contribute to Sanikiluaq's planning of Qikiqtait. AES is a charity founded in 2011 by my committee member, Joel Heath, and Luccassie Arragutainaq, the manager of Sanikiluaq's Hunters and Trappers Association. AES's role in Qikiqtait's planning process was primarily to facilitate the planning process and assist with funding applications. All decisions regarding Qikiqtait were made and continued to be made by Sanikiluaq.

As a researcher, building relationships with community members and research participants is critical for reciprocal research projects, meaning projects that reflect local priorities and research needs (ITK, 2018). Developing long-lasting relationships takes more time than a master's program can provide; however, I benefited from the relationship that my committee member has established through working in the community for the past 18 years. In March 2019, Sanikiluaq held its second planning meeting for Qikiqtait. Leading up to this meeting, I participated in the ArcticNet Conference held in Ottawa in December 2018, and the Hudson Bay Consortium held in Timmins,

Ontario in 2019, in order to become acquainted with the Arctic Eider Team, as well as community members from Sanikiluaq who were involved with Qikiqtait planning.

Part of my involvement with Qikiqtait's planning process was to produce a background report that summarized the history of the Belcher Islands, as well as all existing research on the region to identify potential research gaps. During the protected area meeting in March 2019, I presented this report and community members used these research gaps to help them identify the areas in which surveys and assessments were needed. This background also contributed to the shaping of the research questions for this thesis. Furthermore, spatial planning for marine and terrestrial conservation for this region was identified as a research gap. Accordingly, this research sought examine how both community knowledge and Western science-based approaches could be used together and to fill this gap.

As described above, this research uses participant observation to help inform and guide the research questions and analysis. Originally, I was supposed to visit Sanikiluaq to attend another protected area meeting in the spring of 2020, however due to the shutdowns from COVID-19, all travel to the north was cancelled. Therefore, in this research, participant observation was primarily used in the beginning of the project in the development of research questions. Here, participant observation provided to opportunity to develop relationships with the community, as well as open community and dialogue between myself and community members to ensure that my research questions and intended methods reflected the community's bests interests. Therefore, while participant observation was initially planned to be a major part of the research methods, it was only used as research questions were being developed. Once travel restrictions to Nunavut are lifted, I plan to return to the community to formally present the results from this research, as well as offer any assistance to ensure that this research is mutually beneficial.

As conservation planning is inherently spatial, (Margules & Pressey, 2000), here, spatial analyses helps elicit a deeper understanding of Sanikiluaq's community-based approach. While this research does not follow a specific, previously defined framework, spatial comparisons conducted by Brown et al., (2004) and Mills et al., (2011), as well as input from my committee, guided my analysis and methodology. At the protected area meeting in March 2019, Sanikiluaq collaboratively determined the proposed protected area boundary, and identified areas within the boundary that were important to the community. Areas of importance were related to environmental factors, but also included complex community needs such as ecosystem services or areas of particular importance for a specific species. Numbered with priority values 1-3 (1 being the highest), community members collectively attributed these values to specific areas in order to guide future surveys and levels of conservation protection. While they identified regions of high conservation priority, participants unanimously agreed that the entire region of the Belcher Islands offers high conservation value and needs to be protected.

Using Geographic Information Systems (GIS), I used data of species distribution from the Nunavut Coastal Resource Inventory to understand how Sanikiluaq's proposed Qikiqtait boundary and Priority Areas for Conservation (PAC) related to the species living in the Belcher Islands. The NCRI is a catalog of species and resource-activities based on local knowledge and resource-use (Department of Environment, 2010). The NCRI for Sanikiluaq is the most comprehensive data base of species for the region and was provided for this research by the Government of Nunavut. While this data is likely a biased representation based on hunters routes and knowledge, it still offers a strong basis of where specific species are most likely found (Department of Environment, 2010).

To understand how Sanikiluaq's community-based approach differs from the approach more typically used by conservation organizations, this spatial analysis included data from WWF's MECCEA project. During the Hudson Bay Consortium in February of 2019, I was approached by a WWF representative to discuss the value of including data from a conservation project WWF had been working on. Known as MECCEA, WWF's has been using systematic conservation planning to identify Priority Areas for Conservation (PACs) in the Eastern Canadian Arctic. WWF provided MECCEA scenarios for this study, as well as selection frequency maps from the Marxan analysis and use of this data is in accordance to the data sharing agreement for this project. Using data from the Belcher Islands allowed us to analyze the spatial similarities and differences between the two approaches. These methods and the resulting analyses are presented in greater detail in chapter three.

1.4.1. Ethical Considerations and Positionality

> *"Research is a process not just a product. Part of this process involves reflecting on, and learning from past research experiences, being able to re-evaluate our research critically, and, perhaps deciding, for various reasons, to abandon a research project"* (England, 1994, p. 244*).*

In more ways than one, colonialism has been perpetrated through researchers, whose research is used in policies that further substantiate Western governments and societies (Louis, 2007; Ninomiya & Pollock, 2017). Historically, research has been conducted in Indigenous communities without consent or unethically (Ninomiya & Pollock, 2017). Research protocols and researcher-community relationships have been structured by Western values and are deeply rooted in colonial power structures (Louis, 2007; Smith, 1999). The positionality of the researcher shapes relationships in the field, consequently influencing results and analysis (Wesche et al., 2010). Researcher-community relationships can be reciprocal, but they may also be potentially

exploitative if the power dynamic is steeply shifted by the researcher taking a stance of intimidation or self-promotion (Smith, 1988).

Historically, many research projects conducted with or near communities were extractive, meaning data was collected "for the benefit of the researcher without returning anything to the community" (Schlosser, 2014 p.194). Eurocentric research methodologies perpetuated by Western researchers in and near Indigenous communities had the impact of damaging and eroding Indigenous ways of knowing (Battiste, 2014). Specifically, the relationship between natural scientists and northern, Indigenous communities resembled one of "blatant disrespect or profound ignorance" towards the communities (Wong et al., 2020). Recently, Indigenous Peoples are calling for greater inclusion of Indigenous research methodologies in western-based research practices (Louis, 2007; Wong et al., 2020).

In the context of research in the North, many Inuit communities refer to researchers as the Inuktitut term "sik-sik," meaning squirrels (Gearheard & Shirley, 2007). This name came from the pattern of researchers scurrying over the tundra during the summer, avoiding much contact with the community and leaving as soon as the weather began to turn. This type of research often resembled extractive research and perpetuated a distinct power imbalance between researchers and Inuit. According to Inuit Tapiriit Kanatami (ITK), a nonprofit organization representing over 65,000 Inuit, Inuit self-determination in research requires the government, researchers, and research institutions to stop ignoring and marginalizing Inuit research priorities (ITK 2018). Driven by organizations like ITK, Northern research methodologies and protocols are increasingly shifting to facilitate self-determination. However, in many cases research priorities and research relationships continue to be formalized according to southern terms (Moffit et al., 2015).

As I conducted my research, I constantly reflected on the ways which university researchers perpetrate and participate in those issues, as well as on my own methodologies. Throughout my research, I did my best to remain aware of the unique social, cultural, and environmental characteristics of Nunavut, as well as the historical and current issues of Indigenous marginalization and colonialism. However, my own understanding of these challenges is limited by my own research lens. Coming from a Western perspective, my own research lens is automatically framed in a colonial context. To compensate for this, my research methods and questions were continuously guided by AES to ensure that my research would be mutually beneficial. As stated by Castleden et al., (2012 p.173), "like our fellow human geographers, we need to get out of the ivory tower, into the community, and "listen (listen, listen) respectfully to the community members, leaders, and Elders concerning issues that are important to them."

Furthermore, working in the field in conservation that historically perpetuated colonization and the marginalization of Indigenous Peoples, I was continuously aware of the ways in which my research relied on methods that could reflect a colonial framework. Today, while much literature and research frameworks have shifted to create space for Indigenous participation and leadership, in practice, much conservation research and actions still heavily rely on western perspectives and research frameworks. While community-based conservation contributes to Indigenous self-determination, it still must fit into a western framework, and I continuously asked myself, in what ways does my research perpetuate western ideals? I did my best to remain flexible in my research methods and analysis, and to use lessons from the past to shape my methodologies; however, it is important to acknowledge the ways in which western ideas are pushed unknowingly or subconsciously.

Personally, having grown up in northern Washington State in the United States, my understanding of Indigenous histories and research was based on the history of the United States and my personal experiences. As I entered academia, first as an undergraduate at the University of Washington in Seattle, Washington, and then as a master's student at Memorial University of Newfoundland, I was pushed into a role as an "Indigenous student or researcher" that I did not feel like I had earned. Having been raised separate from my Indigenous culture, I did not identify as Indigenous prior to attending post-secondary education. Benefiting from being "ethnically ambiguous," I understand white privilege on general grounds, as well as in a researcher position. I have also dealt with racist assumptions asserted by those non-Indigenous, researchers and civilians alike.

That being said, I am from the South, and going to the North, I represented a Southern, white researcher. Research in the North has been primarily conducted by Southerners, reflecting a southern shaping of research methodologies and perspectives (Battiste, 2014; Desbiens, 2010; Wesche et al., 2010). Northern Canada has been romanticized in literature and research and defined primarily outside of the North (Stuhl, 2013). Therefore, it was critical that my research methods were designed to reflect and meet Sanikiluaq's research needs. While I am Indigenous, I am from the South, and I recognized the legacy that southern researchers had pushed forth and did my best to help break the cycle.

1.5. Thesis Overview

The purpose of this thesis is to understand how Canada's history with Indigenous peoples and protected areas has influenced the current conservation framework, and how Sanikiluaq's vision of Indigenous-led conservation differs from the model more typically used by conservation agencies. Separated into four chapters, each section sought to provide an overview of the current

conservation framework in Canada, paying special attention to Indigenous-led protected areas. Chapter Two provides a critical literature review and contextual framework within which this research is set. Starting with inception of the first national parks, this chapter follows the evolution of conservation in both practice and academia. Notably, the integration of interdisciplinary sciences, and concepts such as environmental values and ecosystem services are increasingly recognized in conservation planning and practice, and conservation planning no longer resembles a field based primarily on natural, western science. Including the concept of values and other complex human dimensions has opened the door and widened the conversation for greater local community participation and leadership. Specifically, Indigenous-led, co-managed protected areas have doubled in the last decade and today, Indigenous-led protected areas are seen not only as a means to combat global biodiversity loss, but also as a means towards reconciliation and Indigenous self-determination. The current protected area landscape has shifted to no longer resemble the Yellowstone Model, but lessons remain on how to make more space for Indigenous -led, decolonizing protected areas.

Chapter Three presents a spatial analysis of the proposed protected area, using secondary data from Sanikiluaq, namely maps representing the proposed Qikiqtait boundary and PACs within this boundary, and data from WWF's MECCEA project. The intent was to understand how these approaches differed from one another and furthermore, how WWF's regional approach could be used to support Sanikiluaq's local, community-based approach. This analysis concludes that the different spatial scales and contextual frameworks of these approaches could be used to complement one another and illustrates how WWF's regional approach could support the proposal of Qikiqtait.

Finally, Chapter Four summarizes key findings and synthesizes the main results. International conservation organizations and governments have taken steps to integrate interdisciplinary sciences within the field and practice of conservation planning, but in practice, this is yet to come to full fruition. Furthermore, community-based conservation is emerging at an increasing pace to reflect a conservation framework that recognizes complex facets, including environmental values, local knowledge, and ecosystem services. Qikiqtait not only preserves important habitat identified by both WWF and Sanikiluaq but represents a paradigm shift of protected area planning.

CHAPTER TWO

LITERATURE REVIEW: THE EVOLING PRACTICES OF INDIGENOUS-LED AND COMMUNITY-BASED CONSERVATION IN CANADA

2.1. Introduction

The conservation of nature is intertwined in human history (Holdgate & Phillips, 1999; Margules & Pressey, 2000). Dating back to over 2,000 years ago, natural areas have been preserved for different purposes, from the sacred groves in Asia and Africa (Dudley et al., 2012) to royal hunting grounds for the rich and powerful in Europe (Phillips, 2004). Today, the practice of nature conservation was designed to confront what some refer to as the Earth's sixth mass extinction, also said to represent a "biological annihilation" (Ceballos et al., 2017). The leading cause of species extinction is habitat loss and degradation from anthropogenic pressures (Ceballos & Ehrlich, 2002; Hobbs & Mooney, 1998; Johnson et al., 2017), Therefore protected areas are intended to prevent species diversity decline by preserving important habitat (Gray et al., 2016; Joppa et al., 2008; Xavier da Silva et al., 2018). Conservation actions and global initiatives are increasing, however species biodiversity continues to decline worldwide (Butchart et al., 2010; CAFF, 2013; Ceballos et al., 2017; Murdoch et al., 2010; Wuerthner et al., 2017).

Protected area planning and implementation has evolved from preserving sacred sites and hunting grounds, to protecting areas based on aesthetic features for public recreation and tourism in the late 20th century (Binnema & Niemi, 2006; Spence, 1999), to finally be used as a key tool to help prevent global biodiversity decline in the last decades (Watson et al., 2014; Xavier et al., 2018). Today, this field involves various fields and uses input from multiple stakeholders to both promote biodiversity and account for human aspects related to the environment.

Many Indigenous communities and nations worldwide have spearheaded conservation initiatives. These forms of protected areas often embed cultural, social and ecological values into

conservation planning (Berkes, 2004; Reyes-García & Benyei, 2019). In this literature review, I will outline the evolving field of conservation planning and practice, paying close attention to the inclusion of values and community-based approaches. Rather than conducting a systematic literature review, the design of this literature review was question driven. Through reviewing literature on the evolving practices of community-based conservation, and case studies and management plans of Indigenous-led protected areas, I sought to illustrate the current framework of Indigenous-led and community-based conservation in Canada and how it differs from the historical context of conservation. Focusing on Canada and specifically, the Canadian Arctic, I will examine and synthesize examples of Indigenous-led and co-managed protected areas. Using a case study from Nunavut, I will then tie in themes and lessons learned to a current example of Indigenous-led conservation. These examples and case studies of Indigenous-led conservation illustrate a new era of conservation in Canada, as well as global efforts to change the current protected area trajectory.

2.2. A Brief History of Protected Areas in Canada and the United States

The history of modern nature conservation often paints a picture of exclusive environmental management and Western-defined protected areas. While these concepts originated in North America in the nineteenth century, they were adopted world-wide. Every region in the United States and Canada that has been legislated into a protected area is former homelands to Indigenous peoples (Spence, 1996). Since the establishment of the first formal protected areas, national park planning and management reflected deep-rooted colonization and episodes of forceful removal of Indigenous peoples for the purpose of conservation and tourism (Adams & Adams, 2005; ICE, 2018; Spence, 1999). From this practice sprang the idea that environmental conservation is an exclusive practice (Sandlos, 2014). The concept of exclusive conservation

practice spread globally and contributed to the practice of removing Indigenous peoples from their ancestral lands for the sake of conservation (Adams & Adams, 2005; Spence, 1996). While steps have been taken to change those practices, many argue that the establishment of protected areas continues to discriminate against Indigenous peoples by excluding them from being potential land managers (Adams & Adams, 2005; Grey & Kuokkanen, 2019; ICE, 2018; Zurba et al., 2019). A quote from the Indigenous Circle of Experts (2018) illustrates this practice as it is known today:

"Imagine knowing that your grandparents' home had been burned to clear the way for 'conservation and protection.' Imagine not being able to gather your traditional medicines—as your peoples have done for millennia—because a stranger to the land says it damages the land and is a criminal act. Imagine not being able to feed your family or community because you have been forcibly prevented from accessing your traplines, hunting areas or fishing places. Imagine not even being able to get what is necessary for ceremony or to access a sacred area because of laws and regulations you had no hand in writing. Imagine having to fill out applications or forms to get traditional materials for your cultural practices, such as basket-making."

-Indigenous Circle of Experts, 2018, p. 28.

Protected areas were initially established for the purpose of public recreation for society's upper and middle classes (Binnema & Niemi, 2006; Phillips, 2004). In the United States of America, Yosemite National Park, established in 1864, was North America's first protected area, and Yellowstone National Park, established in 1872, was the first official national park (Spence, 1996). Implementing Yellowstone National Park was a pivotal moment in conservation history, providing a model for which most Western countries in the following decades based their protected areas (Adams & Adams, 2005; Ross et al., 2009). However, the "Yellowstone Model" prioritized wilderness protection and tourism over other land uses, often resulting in the removal of

Indigenous peoples for the purpose of environmental tourism and conservation (Adams & Adams, 2005; Ross et al., 2009; Stolton, 2007). Similar to the concept of "fortress conservation," this model does not account for local needs or participation (Infield et al., 2018).

Before it was a park, Yellowstone was frequented seasonally by the Indigenous Kutsundeka, Agaideka, and Bannock peoples, with one group of Shoshone known as Tukudeka who resided there permanently (Spence, 1999). In the 1870s, the construction of the Northern Pacific Railroad brought rapid environmental change to the region and sparked the establishment of Yellowstone National Park (Binnema & Niemi, 2006). As colonial settlers attempted to claim Yellowstone as their own, many different "wars" erupted, such as the infamous Nez Perce War in 1877 when 2,000 troops attacked and chased 750 Nez Perce men, women, children, and elders across Yellowstone on a 1,100-mile odyssey (Spence, 1999). Many other conflicts erupted during this era as white settlers attempted to claim Yellowstone as their own, for primary purpose of tourism for upper middle class white citizens (Binnema & Niemi, 2006; Spence, 1996).

Implementing Yellowstone National Park formed the framework for the majority of protected area planning in North America and globally. In Canada, the establishment of Banff National Park followed a similar trajectory as Yellowstone National Park, excluding Indigenous peoples from inhabiting or hunting in the area in order to preserve the region for tourism and recreation (Binnema & Niemi, 2006). However, conservation practice today is evolving away from this concept to a more inclusive framework. Since the genesis of national parks, the field and practice of conservation has evolved, namely going through four major shifts (Mace, 2014). Before the 1960s, conservation focused on preserving areas for aesthetic reasons, and by the 1960s was based on scientific foundations such as wildlife ecology, natural history, and theoretical ecology, prioritizing nature and habitats primarily without people (Mace, 2014). Born from this period was

the idea that wildlife resources could be owned by the state for the purpose of conservation, and this concept continues to be part of "modern" conservation policy worldwide (Berkes, 2007).

During the 1970s and 1980s, conservation shifted to a more socially inclusive paradigm (Hulme & Murphree, 1999). During this period, the scientific community gained increased awareness of the impacts of human activities, such as habitat destruction and overharvesting, feeding into intense debates about community-based management and sustainable use of wildlife (Hutton et al., 2005; Mace, 2014). As extinction rates escalated, it became clear that the current management framework was not as effective as intended, and in response the conservation management framework moved into a more integrated management style (Balmford et al., 2002; Costanza et al., 1997; Pimm et al., 1995). In the late 1980s and 1990s, conservatists began targeting communities with educational programs to inform them of scientifically informed conservation decisions (Infield et al., 2018). Conservation efforts began moving away from focusing primarily on specific species, to focusing on entire ecosystems (Turner & Daily, 2008). This eventually led to including important goods and services provided by nature that had previously been excluded from conservation decisions (Daily, 1997b). This shift allowed for the concept of ecosystem services — species, conditions, and process of natural ecosystems that contribute to human life (Daily, 1997a) — and complex economic values to enter conservation thought, debate, and practice (Mace, 2014). Conservation management began to recognize the value of preserving ecosystems for people and communities (Mace, 2014).

Currently, conservation is often viewed more holistically, joining people and nature together (Mace, 2014). This shift "emphasizes the importance of cultural structures and resilient interactions between human societies and the natural environment" (Mace, 2014). Conservation planning and protection strategies now recognize the value of context-specific knowledge, based

on human interactions and perceptions of the environment (Infield et al., 2018) and is increasingly interdisciplinary (Mace, 2014). Conservation projects that incorporate human dimensions are shown to be longer lasting than those that do not, because local support is often vital to the success rate of a protected area (Nadasdy, 2005). Furthermore, there is increasing recognition that environmental outcomes are directly linked to socio-political factors, such as how the environment is valued (Jackson, 2006; Mascia et al., 2003; Robertson & Hull, 2001). Local participation is critical in terms of management that reflects local needs (Ban et al., 2018). Incorporating social science in conservation planning allows for conservation planners and practitioners to better understand the human dimensions of protected areas (Bennett et al., 2017b). Research papers and conventions are increasingly calling for the inclusion of social sciences in conservation planning, (Bennett et al., 2017b). In practice, conservation organizations are still more likely to hire natural scientists than social scientists for input and consultation and social science remains rarely integrated into the design, implementation, and continued monitoring of protected areas (Sievanen et al., 2012).

Today, protected areas are viewed as a primary tool in mitigating the current biodiversity crisis (Joppa et al., 2008; Watson et al., 2014). Therefore, many countries, organizations, and global agreements set protected area targets to preserve a percentage of terrestrial, inland waters, and marine areas for the purpose of conservation, such as the Aichi Targets: 20 Targets and 100 indicators that were agreed upon by 196 nations in 2010 at the UN Convention on Biological Diversity (CBD) (Convention on Biological Diversity (CBD), 2010). Protected areas have evolved from preserving aesthetic environmental features, to now being used as a tool to preserve biodiversity globally, and in some cases, contribute to reconciliation.

2.3. Protected Area Planning Shifting

There are currently 258,608 designated protected areas globally, covering more than 15% of the earth's land surface and 7.6% of the world's oceans (UNEP-WCMC, IUCN, & NGS, 2020). The current definition of a protected area from the International Union of Conservation of Nature (IUCN) includes the possibility of Indigenous Peoples or a community as local management, defining a protected area as "a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values" (Dudley, 2008, p. 8). This definition recognizes the current framework of conservation, "people and nature" by incorporating inclusive conservation values and recognizing the value of a more multi-dimensional management framework.

Conservation targets, such as those set by CBD, reflect a commitment towards fighting the current global biodiversity decline, however protected areas goals and targets cannot alone ensure the protection of biodiversity (Geldmann et al., 2019). Furthermore, areas that hold global conservation importance will be impossible to protect without consent, leadership, and direct participation from Indigenous-governance (Artelle et al., 2019). An important contextual aspect of protected area effectiveness is the relationship between local communities and protected area management (Holdgate & Phillips, 1999). While studies show that protected areas can efficiently promote biodiversity (Gray et al., 2016), two challenges remain: applying effective management (Leverington et al., 2010) and limiting outdated policy (Butchart et al., 2010). According to a global review of protected area management effectiveness, only 22% of the 4,000 sites reviewed were shown to have effective management (Leverington et al., 2010). A global study from Butchart et al., (2010) concluded that political factors often negatively impacted conservation outcomes and

conservation efforts need to be strengthened by "reversing detrimental policies, fully integrating biodiversity into broad-scale land-use planning, incorporating its economic value adequately into decision making, and sufficiently targeting, funding and implementing policies that tackles biodiversity loss, among other measures" (p. 1168). In other words, the rate of global biodiversity loss will continue to increase until policies better reflect current conservation needs and protected area management is framed as a priority.

Community-based conservation is an approach to conservation practice that is driven from a community level rather than internationally or nationally (Western & Wright, 1994). In contrast to the "Yellowstone Model," it represents a "bottom-up" approach by offering more inclusive means to conservation. Here, the term community encompasses a complex, multi-scale phenomenon (Berkes, 2003). Communities are not an isolated group of people, but rather multi-dimensional, overlapping, social-political units or networks evolving throughout time (Carlsson, 2000). It is important to note that often, using the term "community" hides the complexity of community-based conservation. The practice of community-based conservation is not a novel concept, however the inclusion of this concept in academia and policy is relatively recent (Murphree, 2002; Western & Wright, 1994).

Studies show that community-based conservation effectively preserves habitat as well as integrating necessary human aspects (Cox et al., 2010; Plotkin & David Suzuki Foundation, 2018). Globally, there have been several phases of policy backed community-based conservation (Berkes, 2007). The first phase of community-based conservation that was funded and supported by government agencies started as community economic development projects. During the 1970s, the deficiency of top-down development projects came to light, which development experts attributed to locals being left out of the decision making process (Nadasdy, 2005). In the 1980s, the World

Bank and the Asian Development Bank funded many Integrated Conservation and Development Projects (ICDPs) that were based on the protected-area concept (Berkes, 2007). A decade later, community-based conservation projects went a step further and tried to establish a connection between local benefits and conservation actions (Berkes, 2007). Community-led protected areas yielded high conservation success and were longer lasting than other conservation areas that excluded community participation (Cox et al., 2010; Gaymer et al., 2014). Projects that were "bottom-up" were shown to be advantageous over "top-down" approaches because they were 1) more cost-effective by reducing overhead costs of centralized management; 2) local knowledge showed to be crucial to effective outcomes, and; 3) projects better reflected local needs and values, making them easier to implement (Nadasdy, 2005). By incorporating local values, projects were more likely to be supported by the community from the start.

Shifting the framework for development projects contributed to the development of community-based conservation (Nadasdy, 2005). While organizations such as International Union for Conservation for Nature (IUCN), the United Nations Educational, Scientific and Cultural Organization (UNESCO) (Bai et al., 2005) and the World Bank have recognized and supported community-based conservation in recent decades, there has historically been a dearth of successful examples of community-based conservation (Berkes, 2007). Biodiversity conservation as conceived by international conservation organizations often does not align with community defined conservation objectives (Berkes, 2007).

In 2003, at the 5th Worlds Parks Congress in Durban, South Africa, IUCN recognized "Community Conserved Areas and Indigenous and Community Conserved Areas" as being legitimate forms of environmental protection, representing a huge milestone for community-based conservation (ICE, 2018). Alongside this shift, new approaches to protected area governance and

management were emerging worldwide (Zurba et al., 2019). Today, IUCN more formally recognizes the importance of Indigenous conservation through Indigenous and Community Conserved Areas (ICCAs) that are defined as "natural and/or modified ecosystems containing significant biodiversity values, ecological services, and cultural values, voluntarily conserved by Indigenous, mobile and local communities, through customary laws and other effective means" (Dudley, 2008).

As indicated in the IUCN definition, Indigenous-led conservation is a specific form of community-based conservation, both referring to conservation practice taking place at a more local scale. Conservation initiatives led by Indigenous Peoples represent a global paradigm shift in how Indigenous knowledge and ways of knowing are incorporated into protected-area planning (Barnhardt & Kawagley, 2005), combatting the exclusionary "Yellowstone Model" and contributing to reconciliation (ICE, 2018; Simon, 2017). In 2008, the same year that IUCN recognized the UN Declarations on the Rights of Indigenous Peoples, IUCN released guidelines and categories to guide the effective implementation of a protected area (Dudley, 2008). These guidelines state that a protected area should be managed by one of four governance types: management by state governments, shared governance, private governance, or governance by Indigenous peoples and local communities (Dudley, 2008). These guidelines officialized Indigenous peoples' capacity to establish their own protected areas, encouraging self-determination in conservation practices (Szabo & Smyth, 2003).

Globally, Indigenous people have petitioned and asked for Indigenous knowledge and traditions to be included into the decision-making that affects their lands and waters (McGregor, 2013). Protected areas that embody Indigenous values and knowledge encourage the continuation of land-based traditions and culture (ICE, 2018). However, protected area management remains

primarily dependent on research produced by Western scientists, and Traditional Indigenous Knowledge (TEK) is often ignored by policies related to conserving and restoring ecological sites (Zeng & Gerritsen, 2015). A systematic literature review showed that only 11% of ecologically-focused conservation articles reviewed included "Indigenous stewardship, acknowledged the Indigenous Territory or lands, or named the Indigenous group on who territory the research was conducted" (Schang et al., 2020). While protected areas are increasingly shifting to acknowledge and promote the rights and self-governance of Indigenous communities (Muller, 2014; Simon, 2017; Szabo & Smyth, 2003; Watson et al., 2014), the full-potential of Indigenous-led conservation has yet to be met in practice.

For many Indigenous groups worldwide, resource use and protection are one in the same (Berkes, 2009). According to this view, "one has to use a resource to respect it and to have responsibility for it" (Berkes, 2009). On surface levels, there are similarities between Indigenous-led conservation and the western concept of conservation (Whyte, 2016). However, Indigenous conservationists tend to prioritize preserving specific plants and animals that are locally and generationally linked to their cultural and ecological values and beliefs (Whyte, 2016). Therefore, environmental stewardship, sustainable use, and protection are embedded in the lifestyles and belief system of many Indigenous communities (Indigenous Circle of Experts, 2018; McDonald et al., 1997). Accordingly, conservation without resource use is nonsensical because it separates people from their lands and stewardship responsibilities (Berkes, 2008).

For these reasons, identifying areas to protect by relying exclusively on scientific assessment is thought to marginalize local knowledge and values in the process (Raymond & Brown, 2006). For generations, Indigenous Peoples have used the traditions and knowledge passed down to effectively govern, use, and conserve their lands and waters (ICE, 2018). To understand

how land management and policy could be influenced, developed, and practiced by Indigenous Peoples, one must understand Traditional Ecological Knowledge (TEK) and Indigenous Science. While definitions for TEK, Indigenous Knowledge (IK), and Traditional Knowledge (TK) parallel each other (Tester & Irniq, 2008), Euro-Canadian and Indigenous understandings of TEK are not necessarily congruent (Spak, 2005). Indigenous science is understood in the English language as the idea that "Indigenous peoples have their own systems of knowledge for observing, collecting, categorizing, recording, using, disseminating and revising information and concepts that explain how the world works" using their own knowledge systems to contribute to the self-determination, health and livelihood of their communities' (Whyte et al., 2016 p.25). TEK is passed down through multiple generations and embodies a full encompassing form of knowledge, recognizing the interconnectedness of each ecosystem (McDonald et al., 1997). It embodies environmental values and knowledge (Fernández-Llamazares & Cabeza, 2018).

Including Indigenous involvement in research and policy development has been offered as a solution, however an unequal power dynamic remains because outside sources gain access to and control over Indigenous knowledge (De Leeuw et al., 2012). Integrating TEK and Indigenous science must be undertaken appropriately. While many discussions surrounding TEK emphasize the differences between western science and TEK, others argue that these two knowledge systems can complement each other (White, 2006). To a large extent, TEK has been defined within western standards, outside of Indigenous communities (Howitt & Suchet-Pearson, 2006; Simpson, 2001). TEK has often been more narrowly defined and primarily refers to biophysical processes and resources (Tester & Irniq, 2008). As Simpson (2001) argues, documenting Indigenous knowledge has the effect of separating the knowledge from the people whom it came from. In many cases, only pieces of TEK have been used to support state policies and research, effectively giving the

power to non-Indigenous policy makers and researchers to decide what components of TEK are important and which are not. Even participatory research and development still operate from a western paradigm. In many cases, local knowledge holders have become reluctant to share in fear that their knowledge will be exploited (McGregor, 2013). To combat the misuse of Indigenous knowledge, knowledge holders must maintain full ownership and the eliciting of their knowledge and stories must be Indigenous-driven (Simpson, 2001). This ensures and encourages self-determination.

Opportunities to include TEK and Indigenous science in environmental decision-making are increasing, especially in Northern Canada (Parlee, 2012). These opportunities stem from a combination of land claims requiring greater inclusion of TEK, as well as Indigenous organizations and communities demanding a greater voice in decision making (Nadasdy, 2005; Parlee, 2012). In terms of Land Claim Agreements, there are typically many requirements for wildlife and resource management. For example, wildlife and resource management within the land claim area is subject to "double administration," meaning co-management between the Indigenous nation/community and Canada (Spak, 2005). In the Inuit territory of Nunavut, the Nunavut Land Claim Agreement incorporates Inuit Qaujimajatuqangit (IQ) into policy and gives certain land rights to Inuit in the context of conservation and development. IQ has been variously defined, in both Inuit and non-Inuit contexts (Ellis, 2005; Parlee, 2012; Tester & Irniq, 2008). Focusing on Inuit Nunangat in Northern Canada, IQ encompasses knowledge, values, and principles specific to Inuit. As defined by the Government of Nunavut, (2013) IQ represents:

"(a) Inuuqatigiitsiarniq (respecting others, relationships and caring for people);

(b) Tunnganarniq (fostering good spirit by being open, welcoming and inclusive);

(c) Pijitsirniq (serving and providing for family or community, or both);

(d) Aajiiqatigiinniq (decision making through discussion and consensus);

(e) Pilimmaksarniq or Pijariuqsarniq (development of skills through practice, effort and action);

(f) Piliriqatigiinniq or Ikajuqtigiinniq (working together for a common cause);

(g) Qanuqtuurniq (being innovative and resourceful); and

(h) Avatittinnik Kamatsiarniq (respect and care for the land, animals and the environment)."

Since its inception in 1999, the government of Nunavut has attempted to appropriately and adequately incorporate IQ into policy (Lévesque, 2014; Parlee, 2012; Tester & Irniq, 2008). However, full integration of IQ into policy remains a challenge. A narrow definition of IQ that primarily focuses on biophysical information has been useful for co-management boards such as the Nunavut Water Board and the Nunavut Wildlife Management Board (Tester & Irniq, 2008). This is not to say that cultural and social values embedded in IQ are ignored, however less attention has been given to these aspects by the Nunavut Impact Review Board (Tester & Irniq, 2008). For example, hunting quotas, particularly for muskoxen, wolverines, and grizzly bears, under the Nunavut Wildlife Act, were derived primarily from western-scientific surveys. Hunters and their organizations objected and the Act was later passed after consultations with stakeholders (Tester & Irniq, 2008). This example illustrates that even though the Nunavut Wildlife Act includes IQ principles *Iliijaaqaqtallniq* (a), *Pijitsirniq* (c), and *Avatimik Kamattaiarniq* (h), incorporating both western science and IQ remains a challenge.

Understanding how Indigenous knowledge and worldviews relate to environmental values is essential for effective community-based conservation. Community-based approaches are intended to increase the capacity of Indigenous Peoples to bring community knowledge and values into discussions surrounding policy and governance (Ellis, 2005). Therefore, a bottom-up approach in conservation is more likely to meet the complex needs of the conservation framework

of “people and nature” by incorporating essential socio-cultural values. By giving TEK a greater role in environmental policy and research, Indigenous Peoples will in turn have greater capacity to contribute to and lead decision-making pertaining to their lands (Ellis, 2005). Indigenous-led conservation offers a step towards reconciliation and self-determination. In Canada, Indigenous governments and nations have been working within the current legislative framework to develop protected areas based on their knowledge and values. Still, lessons remain on how to effectively make space for greater local and Indigenous leadership in protected area management.

2.3.1. Case Studies and Examples in Canada

Canada has 55 different pieces of legislation for the development and management of a protected area, resulting in 72 different types of protected area. None of these however explicitly acknowledge Indigenous management (ICE, 2018). Canada still lacks legislation specifically for Indigenous-led protected areas (ICE, 2018). Therefore, Indigenous communities and governments are forced to work within the existing legislative framework, further perpetuating a colonial framework of conservation (Muller, 2014).

Nevertheless, many Indigenous nations and governments have been working within the existing legislative framework to develop protected areas that meet their conservation objectives. Environment Canada and Parks Canada are the agencies responsible for just under half of all terrestrial protected areas in Canada, with the rest under the authority of provincial and territorial law (Benidickson, 2009). As of 2009, Indigenous governments managed 1.2% of all protected areas (Benidickson, 2009) and since then, seven more Indigenous protected areas under federal legislation have been established. Out of the 211 existing federally legislated protected areas in Canada, 11 are co-managed by an Indigenous Nation (Table 1). Each protected area has a management plan that outlines key objectives and goals.

Conservation institutions in Canada increasingly acknowledge the importance of including Indigenous input and the concept of values in protected area planning and research. According to Parks Canada (2010), "Many of the values and guiding principles of Parks Canada align with the principles of *Inuit Qaujimajatuqangit*." In 2017, the Government of Canada financially supported the Indigenous Guardians Pilot Program, and since then, over 30 Indigenous Nations and communities have launched Guardian Programs (Indigenous Leadership Initiative, n.d.). Inspired by Australia's "Working on Country Initiative" the Indigenous Guardians Network is an Indigenous-led initiative that promotes self-governance and self-determination in conservation management (Indigenous Leadership Initiative, n.d.). It encourages and empowers communities to manage their municipal and federally allotted lands according to their Indigenous knowledge and values. While the Canadian government recognizes Indigenous land management, these areas are not formally legislated as protected areas.

Through modern treaties, land claims, and co-management structures, Indigenous Peoples are increasingly regaining rights to land management and sustainable resource practices. Indigenous-led protected areas represent a conservation framework that combines resource use and nature preservation. In Northern Canada, Indigenous communities have evolved from being purely subsistence-based to being widely recognized as mixed, subsistence-based (Usher et al., 2002), meaning their economies are comprised of both market goods and sustainable resource harvesting. Functioning in a mixed economy allows for the continuation of subsistence living and traditional practices. In addition to meeting ecological criteria such as important habitat or species at risk, protected areas managed by Indigenous communities contribute to healing and reconciliation by:

> "1. Supporting communities and individuals in regaining land-based life skills, 2. reconnecting youth their cultural traditions and language 3. Collecting and documenting Indigenous knowledge 4. Guaranteeing that there will always be 'places that are theirs'" (Simon, 2017, p. 19).

They also contribute to the development of a conservation economy by developing "culturally-appropriate programs and hiring Indigenous peoples" for environmental monitoring, search and rescue, expanded or new guardians programs and vessel management and monitoring, among others (Simon, 2017).

Indigenous-led protected areas in Canada are co-managed between a Canadian government body and Indigenous government or organization. Here, I use "Indigenous-led protected area" to broadly reference any form of federally legislated protected area that is managed or co-managed by an Indigenous nation, government and/or community. While there is no universally accepted definition, in this context, the term "co-management" resembles the sharing of power between government and local stakeholders (Notzke, 1995). Co-management represents the merging of two different management systems (Notzke, 1995). On one hand, state management assumes ownership of natural resources and acquires power from the authority of the nation-state and legislation (Berkes, 2007; Feit, 1988). On the other hand, Indigenous management systems are based on self-regulation (Berkes et al., 1991) and authority comes from the local level, incorporating "community-based systems of knowledge, values and social conventions" (Notzke, 1995).

All co-managed protected areas in Canada have two similar key objectives: 1) to protect and preserve important species and habitat, and 2) to reflect values and principles of the respective Indigenous management committee. In practice, each protected area has a management committee that advises the relevant government bodies on relevant decisions and matters. The management

committees are unique to each protected area: in some cases, the management committee is comprised of Indigenous stakeholders and government representatives, in other cases only Indigenous stakeholders make up the committee. During the implementation process of each protected area, most committees conducted both an Indigenous knowledge study of the area, and surveys and assessments guided by the relevant government body. The resulting protected area management plans represent the unity of Indigenous knowledge and values with ecological criteria set in place by the Canadian government. In each of the management plans, both local principles and ecological criteria are clearly outlined in terms of park management and objectives.

Before 2015, all Canadian co-managed protected areas were established as National Parks under the National Parks Act, and an agreement between the Canadian Government and respective government Indigenous body (Table 2.1). The National Parks Act requires a formal management plan, which articulates the vision and objectives of the co-managed National Parks. The co-management of these protected areas reflects mutual prioritization of protecting species or importance or endangerment, and the subsistence and cultural practices of the communities in and around the protected areas.

About 100 years after the first Canadian national park, Banff National Park, was established, the first co-managed national park, Ivvavik National Park was established in Yukon Territory in 1984. Ivvavik National Park was established as part of the Inuvialuit Final Agreement and is co-managed with Inuvialuit and Parks Canada. Since its creation 15 more protected areas have been established on the foundation of co-management with a Canadian Government Department and Indigenous Nations or communities (Table 2.1). Many of these national parks have emerged as part of agreement between Indigenous governments and the Canadian

Government, such as Auyuittuq National Park, Sirmilik National Park, and Quttinirpaaq National Park were part of the Nunavut Land Claim Agreement.

Table 2.1 Federally Legislated Protected Areas in Canada that are Co-Managed between Indigenous Governments and the Canadian Government

Protected Area	Established	Legislation	Location	Size (km^2)	Management
Ivvavik National Park	1984	Inuvialuit Final Agreement and National Parks Act (NPA)	Yukon	9,775	Inuvialuit and Parks Canada
Quttinirpaaq National Park	1988	Nunavut Land Claims Agreement and NPA	Nunavut	37,775	QIA and Parks Canada
Nahanni National Park Reserve	2001	Nahʔą Dehé Interim Park Management Arrangement and NPA	Yukon	30,000	Dehcho First Nations and Parks Canada
Sirmilik National Park	2001	Nunavut Land Claims Agreement and NPA	Nunavut	22,200	Inuit Park Committee and Parks Canada
Torngat National Park	2008	NPA	Labrador	9,700	Inuit Park Committee and Parks Canada
Auyuittuq National Park	2010	Nunavut Land Claims Agreement and NPA	Nunavut	19,089	QIA and Parks Canada
Aulavik National Park	2012	Inuvialuit Final Agreement and National Parks Act (NPA	Yukon	906,430	Inuvialuit and Parks Canada
Ukkusiksalik National Park	2014	Nunavut Land Claims Agreement and NPA	Nunavut	20,880	Inuit Park Committee and Parks Canada
Qausuittuq National Park	2015	National Parks Act	Nunavut	11,000	Inuit Park Committee and Parks Canada
Tsa Tue International Biosphere Reserve	2016	UNESCO	Northwest Territories	93,313	Deline and Parks Canada
Edehzhie Protected Area	2018	Dehcho Law and Edehzhie Agreement	Northwest Territories	14,218	Dene Dehcho First Nations and ECCC[1]

[1] Environment and Climate Change Canada (ECCC) is a department of the Government of Canada responsible for coordination environmental policies and programs

Tallurutip Imanga National Marine Conservation Area	2018	National Marine Conservation Act	Nunavut	108,000	QIA and Parks Canada
Thaidene Nene National Park Reserve	2019	Protected Areas Act	Northwest Territories	26,376	Dene First Nations and Parks Canada
Tuvaijuittuq Marine Protected Area	2019	Oceans Act	Nunavut	319, 411	QIA and Department of Fisheries and Oceans

From reviewing the management plans from the co-managed protected areas listed in Table 2.1, each follow a similar format, outlining objectives for species preservation and goals for how Indigenous knowledge and values should guide ongoing management. These protected areas were selected because they are under federal protected area legislation and have a formal management plan available to the public. For simplicity, protected areas that are co-managed under provincial law are excluded from this table, not to discount their importance but rather to create examples that can be compared effectively and are based on similar legislation. The purpose of protected area management plans is to outline the goals and objectives of the protected area for a specific timeline, typically 5-10 years. In each plan, community values are explicitly expressed as leading the protected area establishment and are integrated throughout the document(s). Each plan lists several objectives to guide the management and maintenance of the protected area and in this context, environmental values unique to each Indigenous nation(s) are at the forefront of each document and are incorporated into each objective.

Ivvavik National Park, the first co-managed protected area in Canada, set an example of how Indigenous knowledge and values could work in unison with western science to plan and manage a protected area. The establishment of Ivvavik was sparked by the Mackenzie Valley Pipeline Inquiry threatening the Porcupine caribou herd that have been the traditional subsistence

wildlife resource for thousands of years (Parks Canada, 2018). Caribou are particularly vulnerable to environmental changes, sparking calls for conservation initiatives from both Inuvialuit and external conservation organizations (Parks Canada, 2018). During the creation of the Inuvialuit agreement, Ivvavik National Park was included in order to preserve important habitat and species, integrating Inuvialuit law and traditions (Parks Canada, 2018). This history is outlined in the management plan and continues to guide management of Ivvavik. The significance of the region to Inuvialuit is outlined throughout the plan, emphasizing the importance of incorporating community and cultural values. Clearly illustrating the TEK and western science working together, Objective 1.1 states "management decisions are informed by scientific and monitoring evidence and Inuvialuit traditional knowledge" (Parks Canada, 2018). Documentation on how well these knowledge systems weave together to inform decisions is not available to the public.

In Nunavut, the management plans formed under the Nunavut Land Claims agreement stand out for outlining the participation of Inuit as a front-line priority. The Nunavut Land Claims Agreement of 1993 outlined and solidified the rights and ownership of lands and resources, and the rights of Inuit to participate in decision making regarding those resources (Simic et al., n.d.). A key aspect of the protected area management plans in Nunavut are Inuit Impact and Benefit Agreements (IIBA). Section 8.4.4 and 9.4.1 of the Nunavut Land Claims Agreement state that an IIBA must be resolved prior to establishment of a park or conservation area (Tunngavik Federation of Nunavut et al., 1993). In the context of protected areas, IIBAs assure that land rights and management responsibility are delegated to the relevant Inuit party. Specifically, protected areas under federal legislation implemented in Nunavut, such as MPAs or NWAs or National Parks for example, require IIBAs between the federal government, regional government, and relevant local government. While management plans also delegate and outline these responsibilities and

objectives, IIBAs go a step further to establish Inuit as primary rightsholders. Here, Indigenous leadership and participation is framed as a necessary component of protected area development and management.

According to the umbrella Inuit Impact and Benefit Agreement (IIBA) for Quiitinirpaaq, Auyuittuq, and Sirmilik National Parks, the purpose of these parks is:

> "1. To protect for all time a representative natural area of Canadian significance in the Eastern High Arctic Natural Region;
>
> 2. To respect the special relationship between Inuit and the area; and
>
> 3. To encourage public understanding, appreciation, and enjoyment of the park, including the special relationship of Inuit to this area, so as to leave the park unimpaired for future generations" (Parks Canada, 2009).

Similar to these national parks, all other National Parks established in Nunavut emphasize the importance of encouraging and maintaining the relationship between Inuit and the land. Unique to co-managed national parks is the confluence of human dimensions and conservation goals listed as primary objectives. These objectives are similar to principles of IQ, as well as meeting conservation objectives from Parks Canada, representing the confluence of values and priorities. Here, conservation follows a "nature with people" framework, reflecting a shift to a more inclusive conservation practice and the integration of Indigenous knowledge and values.

Moving beyond the co-management framework, the first Indigenous Protected and Conserved Area (IPCA) was established in 2018. IPCAs are co-managed between an Indigenous government/nation and the federal government, similar to the examples of co-managed protected areas in Canada. In 2018, the Dehcho Dene First Nations established Edehzhie IPCA in the Northwest Territories (Lavoie, 2018), based on the framework of Indigenous and Community

Conserved Areas as established by IUCN. While there is no legislation for the establishment of IPCAs in Canada, Edehzhie IPCA was designated a Dehcho Protected Area under Dehcho law, and the Edehzhie Agreement was signed by the Dehcho First Nations Grand Chief and the Government of Canada on October 11, 2018 (Environment and Climate Change Canada (ECCC), 2019). The establishment of Edehzhie "stemmed from the initiative and desire of Dehcho First Nations to protect a fundamental part of their traditional territory and culture." Edehzhie also meets ecological criteria with nationally significant habitat for migratory birds species at risk and unique and unusual wildlife habitat (ECCC, 2019).

One year after the introduction of the first IPCA in Canada, Canada set the goal to establish up to 27 IPCAs as a way to meet the *2020 Biodiversity Goals and Targets* (ECCC, 2020). To help meet the *2020 Biodiversity Goals and Targets,* Canada set aside a fund known as the Nature Fund which is intended to support the establishment of these IPCAs as well as other forms of Indigenous-led conservation initiatives (ECCC, 2020). While the Nature Fund is not exclusively for Indigenous-led protected areas, the Nature Fund explicitly includes conservation initiatives led by Indigenous communities and nations, supporting Canada's efforts of reconciliation through conservation.

2.3.2. Qikiqtait Protected Area

A recent Indigenous-led protected area project in Canada is Qikiqtait Protected Area in the Belcher Islands. The Inuit community of Sanikiluaq proposed Qikiqtait to preserve the unique environment of the Belcher Islands archipelago, and to ensure that they may continue to live, manage and use the natural resources of the Belcher Islands in the foreseeable future (Arctic Eider Society (AES), 2019). Similar to the existing co-managed protected areas (Table 2), environmental stewardship and management based on community values and principles of IQ are at the forefront

of the planning stages for Qikiqtait Protected Area. Qikiqtait Protected Area is supported through the Nature Fund and is proposed to be comprised of a mosaic of Marine Protected Areas and National Wildlife Areas that could protect both marine and terrestrial species. The proposal for Qikiqtait incorporates many of the strategies for co-managed and Indigenous-led protected areas.

In 2018, Sanikiluaq began taking formal steps to establish Qikiqtait Protected Area (Municipality of Sanikiluaq & AES, 2018). However, informal planning for Qikiqtait began much earlier. The community have always been environmental stewards of the region, and in 2013, Sanikiluaq indicated to the Nunavut Planning Commission that the community wanted to protect the entire region (Nunavut Planning Commission, 2013). In March 2019, Sanikiluaq hosted the second Qikiqtait Protected Area Planning meeting with Sanikiluaq Hunters and Trappers Association (HTA), Sanikiluaq Municipal Council and representatives from the Arctic Eider Society (including myself), Qikiqtani Inuit Association (QIA), Environment Canada (ECCC,) and Department of Fisheries and Oceans (DFO) (Municipality of Sanikiluaq & Arctic Eider Society, 2019). At this meeting, the community collaboratively identified priority areas for conservation within the proposed Qikiqtait boundary based on their collective knowledge and values of the region. These areas were expressed spatially and will be used to focus species monitoring and levels of protection as well as guiding the implementation of their environmental values and knowledge of the region.

Qikiqtait's planning proposal lists several key objectives and goals, including preserving biodiversity, incorporating Inuit values and knowledge in management, and meeting several social, economic, and cultural goals (AES, 2019). Reflecting the conservation framework of "people and nature," both ecosystem services and community values are included in the Qikiqtait's proposal. Here, protecting the region includes the sustainable use of resources for the community as well as

biodiversity conservation, reflecting the worldview that conservation and use go together. Ecosystem services also embody environmental values, representing aspects of the region that are useful or bring value to the community (Daily, 1997a). Sanikiliuarmiut continue to hunt eider, ringed seal, reindeer and harvest sea cucumbers, urchins, and mussels among other species for community food and their daily diet (McDonald et al., 1997). By protecting the region through sustainable hunting and harvesting, the goal of Qikiqtait is to contribute to biodiversity, food-security as well as meeting socio-cultural needs and values (AES, 2019).

Representing the complexity of modern conservation projects, implementing Qikiqtait is expected to produce benefits beyond biodiversity conservation to the community. Many expected social benefits are included in the proposal for Qikiqtait (AES, 2019). Part of maintaining Qikiqtait would involve surveys and other stewardship programs, providing potential opportunities for youth engagement. During the protected area meeting in March 2019, participants expressed youth engagement and knowledge transfer from elders to youth as a priority. Other social benefits identified included food security, local employment such as natural history film crews and guiding, and reconciliation (AES, 2019). Here, Qikiqtait shows similar themes to other forms of Indigenous-led conservation, reflecting complex, multi-dimensional conservation goals embedded within the goal of biodiversity preservation.

Similar to the co-managed protected areas established in Nunavut, Qikiqtani Inuit Association (QIA) is facilitating in the development of Qikiqtait. QIA represents the region that Sanikiluaq falls within and is a department of the Nunavut government. Integrating IQ values and Inuit governance are priorities of QIA and therefore, will be a major part of Qikiqtait planning and maintenance. QIA has also supported other Inuit-led protected areas, including Tallurutiup Imanga National Marine Conservation Area (QIA, 2019). Tallurutiup Imanga was officially was officially

established in 2019 and is Canada's largest body of protected areas. This protected region includes five Inuit communities is based on a whole-of-government approach, as advocated by QIA. This model is being adopted for the planning of Qikiqtait. While QIA is an arm of the Nunavut Government, Qikiqtait still represents a bottom-up approach to conservation because it was initiated at the local level. The proposal clearly states that "this is an Indigenous project by and for the community of Sanikiluaq for the benefit of future generations of Sanikiluarmiut [Inuit from Sanikiluaq]" (AES, 2019). By representing a bottom-up approach to conservation and support from QIA, Inuit governance is expected to guide each step of Qikiqtait's implementation and management. In Nunavut, there is a holistic vision for Inuit governance of protected areas and in the broader context of Canada's conservation framework, Inuit are setting precedents of Indigenous-led protected areas.

Qikiqtait represents a shift in the conservation framework of Canada. Similar to the other Indigenous-led protected areas in Canada, Indigenous and community values are at the forefront of planning and management. Written into Qikiqtait's protected area proposal are goals and targets focused on both biodiversity conservation and Inuit values and knowledge. Qikiqtait and the existing co-managed protected areas in Canada reflect a new era of conservation where local priorities are prioritized along with biodiversity objectives and needs.

2.4. Conclusion

Since the inception of the first legislated protected areas, environmental conservation has constantly evolved in academia and in practice. During the 19th century, Yellowstone National Park was a promising enterprise that represented an important shift towards environmental conservation. While it is easy to criticize "The Yellowstone Model" for its colonizing vision of the landscape, Yellowstone sparked the introduction of federally legislated areas for conservation,

paving the way for a wave of government-led environmental conservation which was an important step in terms of mitigating biodiversity loss from human-induced stressors. On the other hand, co-management and the federal legislation behind protected areas are argued to embody a colonial motive because the federal government continues to hold unequal power (Grey & Kuokkanen, 2019; Sandlos, 2014).

Indigenous-led protected areas reject the Yellowstone Model and are becoming a means for reconciliation and self-determination. The current era of conservation resembles an interdisciplinary practice that recognizes social science and community-based, "bottom-up" approaches in protected area planning and management. However, challenges remain when integrating concepts such as "environmental values" and "ecosystem services" into conservation planning, and fully incorporating the human dimensions of conservation remains difficult. The introduction by the IUCN of an internationally accepted definition of protected areas that include social aspects and dimensions has helped shape a conservation framework that better reflects local and societal needs.

In Canada, Indigenous-led protected areas in the current legislative framework have manifested in co-managed protected areas. The Qikiqtait Protected Area will represent similar guiding principles that led the other six Inuit-managed protected areas to success. While these examples help define what Indigenous-led conservation looks like in the existing conservation framework, more data and research are needed from these protected areas to help future co-managed protected areas. Lessons on failures, successes, and challenges would better prepare future Indigenous and community led protected areas. The lack of reflections and assessments from Indigenous perspectives on the current co-managed protected areas makes it difficult to fully evaluate the relationship between co-management and self-determination.

In conclusion, protected areas are an effective means to slow the rate of biodiversity loss, however only when effectively managed. Proven to be more effective when using a "bottom-up" approach, community-based and Indigenous-led conservation offers a solution to the current conservation crisis. Indigenous-led conservation can be effective because in many cases, Indigenous values and frameworks align with biodiversity conservation. This form of conservation offers steps towards reconciliation by making space for Indigenous peoples to manage and lead conservation initiatives and offers more opportunities for greater engagement with the land. Qikiqtait Protected Area represents an Inuit vision of conservation that embodies community values as well as scientific research. Furthermore, Qikiqtait presents a unique opportunity to examine how well western science and IQ can complement each other, and to showcase what an Indigenous vision of conservation looks like in practice.

CHAPTER THREE

PUTTING COMMUNITY VALUES ON THE MAP: LINKING LOCAL CONSERVATION PRIORITIES WITH A REGIONAL CONSERVATION VISION

3.1. Introduction

Environmental degradation and habitat destruction are predominant contributors to the global decline of species diversity (Gray et al., 2016; Jones et al., 2018; Pimm, 2001). Therefore, protected areas work to preserve species and habitat and are shown to retain higher biodiversity than unprotected natural areas (Geldmann et al., 2013; Gray et al., 2016). Conservation planning constitutes identifying, designing, and setting objectives for potential protected areas (Pressey et al., 2007) in order to combat global biodiversity decline (Barry et al., 2017; Gray et al., 2016; Jones et al., 2018; Watson et al., 2014). Inherently spatial, conservation planning helps conservation practitioners allocate conservation resources, set conservation targets, and implement actions (Harris & Hazen, 2006; Mair et al., 2018; Pressey et al., 2007).

While biodiversity decline is a global issue, the Arctic is especially vulnerable to habitat loss (CAFF, 2013) due to processes such as ice-albedo feedback (Kashiwase et al., 2017). According to the Arctic Climate Impact Assessment (2004), stressors such as climate change, commercial resource extraction, and invasive species negatively affect marine species and habitats, consequently impacting the health and subsistence lifestyles of Indigenous peoples in the Arctic. These stressors contribute to habitat loss and biodiversity loss, and while protected areas will not directly mitigate each of these factors, they actively protect against stressors such as commercial resource extraction and development. In 2013, the Arctic Council recognized that protected areas are necessary for the Arctic environment in order to support sustainable development, lifestyles and human well-being (Arctic Council, 2013).

Due to its high ecological and cultural value, the number of protected areas in the Arctic region has almost doubled since the 1980s (Barry et al., 2017). In the Canadian Arctic, a number of conservation projects and protected areas have been established, including 16 protected areas under co-management between local Indigenous governments and the Canadian Government, covering about 691,737km^2 of terrestrial and marine area. These protected areas are prime examples of local and federal authorities working together, utilizing Indigenous Knowledge and planning strategies, as well as ecological assessments performed by Canadian government departments.

World Wildlife Fund Canada (WWF) is spearheading a recent conservation project in the Arctic, known as 'Marine Ecological Conservation in the Canadian Eastern Arctic' (MECCEA), which uses systematic conservation planning to identify areas of conservation interest in the eastern Canadian Arctic. Systematic conservation planning entered the conservation scene in the 1980s, providing a more systematic approach for data collection, collecting expert and local input, and setting spatial conservation targets (Groves et al., 2002; Margules & Pressey, 2000). Targets are typically expressed as a percentage of the spatial coverage of identified conservation features, such as a specific species or habitat (Margules & Pressey, 2000). Targets are based on priorities for conservation, reflecting levels of importance of each conservation feature to ensure that features with the highest level of threat receive highest potential protection (Margules & Pressey, 2000). Based on these targets, specific areas of the study region are identified as potential protected areas (Groves et al., 2002). WWF is using this approach for the MECCEA project to identify potential networks of protected areas for the eastern Canadian Arctic. Included in their geographic study scope are Inuit communities who have also been leading conservation projects and initiatives.

Increasingly, conservation practitioners and researchers are seeking Indigenous Knowledge, also referred to as Traditional Ecological Knowledge (TEK), from local knowledge holders to fill environmental knowledge gaps (Shackeroff & Campbell, 2018). Many researchers and conservationists argue that most protected areas are "paper parks," meaning they are used as political tools to show actions towards conservation but the effectiveness is less than promised (Geldmann et al., 2013; Watson et al., 2014). Protected areas that are informed by local knowledge and stakeholder input is a step away from being a "paper park" and a step towards greater biodiversity conservation and longer lasting success (Xavier da Silva et al., 2018). In the context of conservation planning, mapping and geomatics have been important tools in Indigenous-led resource management (Poole, 1995). Inuit in Canada led the charge in community mapping in the 1970s, using innovative cartographic tools to develop maps that eventually supported the creation of the territory of Nunavut (Berkes et al., 1995; Poole, 2003). Since then, community mapping has been harnessed throughout the world by Indigenous peoples and used to defend their land and resources (Chapin et al., 2005). In the past 30-40 years, Indigenous knowledge is increasingly expressed spatially, through mapping exercises to support Indigenous-led resource management, economic planning, the documentation of history and culture, and political organization (Chapin et al., 2005).

For this study, we examine a community-based approach to conservation planning for the Belcher Islands in Nunavut in the eastern Canadian Arctic, as a case study for the identification of spatial conservation priorities. The Inuit community of Sanikiluaq in Nunavut used a community-based approach to design a spatial conservation plan that includes a proposed protected area boundary and Priority Areas for Conservation (PACs) within the proposed boundary. Using WWF's MECCEA approach to conservation planning in the eastern Canadian Arctic, we elicit

how systematic conservation planning and community-based planning spatially differ and align for the study region. For this research, we participated in Sanikiluaq's protected area meetings as observers and contributed to the planning with existing data of the study region. The key objective is to examine two approaches to conservation in the same region in parallel, and to examine the differences and similarities between the approaches. A key question that guided this analysis was: How do conservation priority areas compare spatially between a local Indigenous community-driven approach and a regional conservation plan from an international conservation organization?

3.1.1. Background Information

A recently proposed protected area in the Canadian Arctic, Qikiqtait Protected Area, is being planned and designed by the Inuit community of Sanikiluaq, located in the Belcher Islands archipelago. Composed of 1,500 islands and situated in the Eastern heart of Hudson Bay (around 56-57ºN) (Figure 1), the Belcher Islands Archipelago has long been recognized for its ecological importance. Characterized by its unique and sensitive ecosystem, the Belcher Islands have been identified in various contexts as an area of interest for conservation, research, and stewardship (see Fisheries and Oceans Canada, 2011; Latour et al., 2008; Mallory et al., 2009; Municipality of Sanikiluaq, 2006; Stephenson & Hartwig, 2010). The Belcher Islands are also home to historically significant sites providing archaeological evidence of the Dorset culture dating back to 3,000 years (Lynch, 1990; Oakes, 1991; QIA, 2014). Today, Sanikiluaq, a community of approximately 900 people, is the only community on the Archipelago. For centuries, the community has sustainably managed and used the natural resources in the region, and continues to do so (Arragutainaq & Fleming, 1993b; McDonald et al., 1995).

The Belcher Islands are part of Canada's Southern Arctic ecoregion (Marshall et al., 1999). Year round, the Belcher Islands provide habitat to many species, such as the Hudson Bay common

eider (*Somateria mollissima sedentaria*) an ecologically and culturally significant sub-species to Sanikiluaq, spending all year in the Archipelago. While the species *Somateria mollissima* are found all around the Arctic, this sub-species of eider is unique to Hudson Bay (Abraham & Finney, 1986). During the winter and spring, the Belcher Islands are known for their consistent and stable occurrence of polynyas, areas of open water surrounded by sea ice (Imrie, 2009). Polynyas provide critical habitat for many species, including: ringed seals (*Phoca hispida),* which are listed as species of 'Special Concern' by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC); the Eastern Hudson Bay beluga population (*Delphinapterus leucas*), listed as 'Endangered' by COSEWIC; the Western Hudson Bay beluga population, listed as "Special Concern" polar bears (*Ursus maritimus)*, listed as 'Special Concern' by COSEWIC and 'Vulnerable' by the International Union for Conservation of Nature (IUCN) Red List of species; and the Hudson Bay common eider. During the summer months, the Belcher Islands become a hub for migratory species, providing nesting grounds for at least 53 species of migratory birds (AES, 2019; Freeman, 1970), as well as feeding and breeding grounds for migratory marine animals, such as the Eastern Hudson Bay Beluga population and Western Hudson Bay beluga population (de March & Postma, 2003; Fenge, 1997).

Sanikiluaq's environmental stewardship is engrained in the community's history and lifestyle (Arragutainaq & Fleming, 1993b; McDonald et al.,1997; Nakashima, 1991; NTK, 2008). The community's economy is about 60% subsistence-based, meaning they continue to heavily rely on hunting and harvesting practices, actively integrating community knowledge and values to guide their hunting practices (English, 2008; McDonald et al., 1997), such as not hunting eiders during the nesting season and only hunting and harvesting what is needed for the community (Arragutainaq & Fleming, 1993a). Along with resource management, Sanikiluaq has been working

with the government since the 1970s to develop sustainable regulations regarding natural resources, including working with the government to develop Arctic char fishing regulations for the region that better support stable char populations (Canadian Arctic Resources Committee, Environmental Committee of Sanikiluaq, & Rawson Academy of Aquatic Science, n.d.). The community has initiated and conducted many research projects and species monitoring within the Belcher Islands (Canadian Arctic Resources Committee et al., n.d.; Fleming & Nunavut Hudson Bay Inter-Agency (NTK), 2006; Robertson & Gilchrist, 1998; Sanikiluaq Hunters & Trappers Association, 2015).

3.1.2. Sanikiluaq Community Conservation Planning Process

The planning of the Qikiqtait Protected Area offers a unique conservation opportunity in the Belcher Islands. This planning process involves local (Sanikiluaq Hunters and Trappers Association, Sanikiluaq Municipality and Arctic Eider Society), regional (Qikiqtani Inuit Association) and federal (Department of Fisheries and Oceans) government levels, embodying an integrative governance approach initiated and led by Sanikiluaq. Inuit from Sanikiluaq, known as Sanikiliuarmiut, are the lead decision makers for Qikiqtait planning and development, supported by Qikiqtani Inuit Association (QIA), the regional Inuit association for the Qikiqtani region of Nunavut. Currently in the pre-implementation planning process, Sanikiluaq intends to develop Qikiqtait as a blend of Marine Protected Areas (MPA) and National Wildlife Areas (NWA) to protect both marine and terrestrial area. Qikiqtait would be established on federal (national) and Inuit-owned terrestrial and marine territories, covering the entire region of the Belcher Islands. This would represent an area up to 3 million hectares, including over 1,500 islands, 286,600 hectares of terrestrial and freshwater area, and stretched over 5,000 km of coastline (Arctic Eider Society, 2019).

Qikiqtait Protected Area planning officially began in 2018, starting with a formal meeting hosted in Sanikiluaq (Municipality of Sanikiluaq & Arctic Eider Society, 2018). In March 2019, Sanikiluaq held their second protected area meeting attended by local, regional, and federal representatives. During this meeting, community members unanimously agreed that all of the Belcher Islands area is important, and that the entire Archipelago should be protected, including both marine and terrestrial areas. With this general principle in mind, community members identified more specific areas that represented heightened environmental importance to the community, such as areas used by belugas during the spring and summer months or areas used by the community for harvesting mussels and urchins. Other areas included summer and winter habitat for eider, such as nesting grounds and polynyas. The purpose of identifying these regions was to help target conservation efforts and to contribute to a longer-term management plan for the protected area, such as areas that should be a focus of monitoring. Each community member attending the meeting identified priority areas on maps based on their own knowledge of the environment and region. Then, they collectively examined each area, discussing the importance of each area then assigning levels of conservation importance. These conservation priority areas were prioritized into three categories organized by importance: Category 1 is of highest importance while Category 3 is of relative lowest importance. Four maps (Figure 2) came out of this meeting: three illustrating priority areas organized by level of importance and one showing the proposed boundary of Qikiqtait.

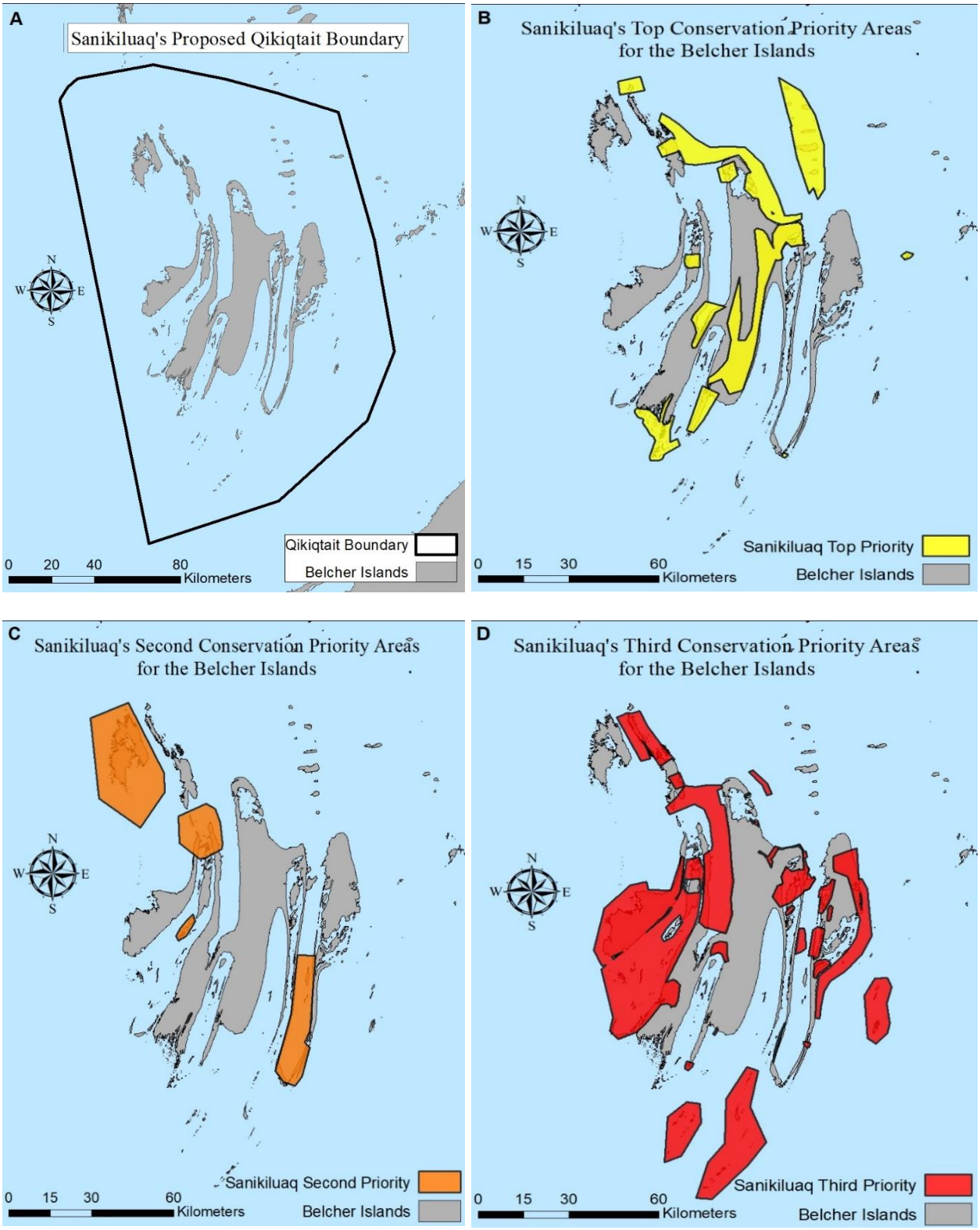


Figure 3.1 Proposed protected area boundary (A) and priority areas for conservation (B-D) in the Belcher Islands identified by Sanikiluaq.

3.1.3. WWF Canada Eastern Arctic Conservation Planning Process

Also focusing on the Canadian Eastern Arctic, the WWF MECCEA initiative aimed to inform a regional conservation planning approach. While looking at a much larger region than the Sanikiluaq community, the geographic scope of this planning exercise includes the Belcher Islands region. The following information regarding WWF's approach is from the MECCEA Final Report (see Roff et al., 2020).

The purpose of MECCEA is to identify Priority Areas for Conservation (PACs) that could potentially lead to a protected area network in the Eastern Arctic region, as well as being used to inform and support future conservation actions in this region, but also possibly at a more local level. This initiative was spearheaded by a working group of WWF-Canada staff, volunteer "experts" and consultants and uses a systematic conservation planning approach. MECCEA was guided by three conservation objectives:

"-To protect distinctive, unique, rare or endangered species and ecological features:

-To protect representative examples of each type of identified ecosystem and habitat:

-To ensure that the PACs are integrated into the wider landscape and seascape by patterns of connectivity."

Data included in this study falls into the following categories: "biological *in situ* data, geophysical in situ data, remote sensing data, data from Indigenous knowledge sources, and socio-economic data" (p. 16). They include data from the Nunavut Coastal Resource Inventory, data from publicly accessible databases and additional data provided by experts (see report or contact WWF Canada for more details) (Roff et al., 2020). An end goal of this project was to share the results and collaborate with local stakeholders as well as "encourage the Canadian Government to institute a sound Arctic marine protected area network as part of its international commitments to marine conservation" (page vi).

Systematic conservation planning is a process that involves establishing conservation objectives, identifying conservation features (e.g., components, structures, or processes of biodiversity related to the conservation objectives), and setting spatial targets for each feature (Margules & Pressey, 2000). Here, the MECCEA process distinguishes conservation features as being either *distinctive features*, referring to specific species or habitats, or *representative features*, meaning attributes used to define the seascapes and geography of the region, such as salinity or ocean currents. Targets for each conservation feature were all set as percentage of their spatial distribution and were designed to select the smallest possible area that would maximize the conservation potential. Targets set for each feature were set by the working group and based on the current ecological status, vulnerability, and rarity/uniqueness of the feature (Ardron et al., 2014).

Three scenarios were produced for MECCEA (Figure 3.2), using different target levels: High Target Scenario, Medium Target Scenario and Low Target Scenario. Those scenarios identified 47%, 39%, and 30.6% of the study area respectively as PACs. The conservation planning software Marxan was used to support the SCP process, a tool widely used to identify potential protected area networks that can meet specific conservation targets (Watts et al., 2009). All three scenarios included in this analysis used a high boundary length modifier (BLM), a parameter used by the Marxan software to design more compact MPA networks. Area was used as a cost data by Marxan (see WWF report for details). Marxan produced a number of output data, including many possible protected area network options (i.e., scenarios) and a selection frequency map (Figure 3.2) indicating how many scenarios selected a given location (i.e., planning unit). In this case, Marxan analysis ran 25 iterations, meaning that a single area polygon could be selected a maximum number of 25 times, resulting in a maximum possible value of 25.

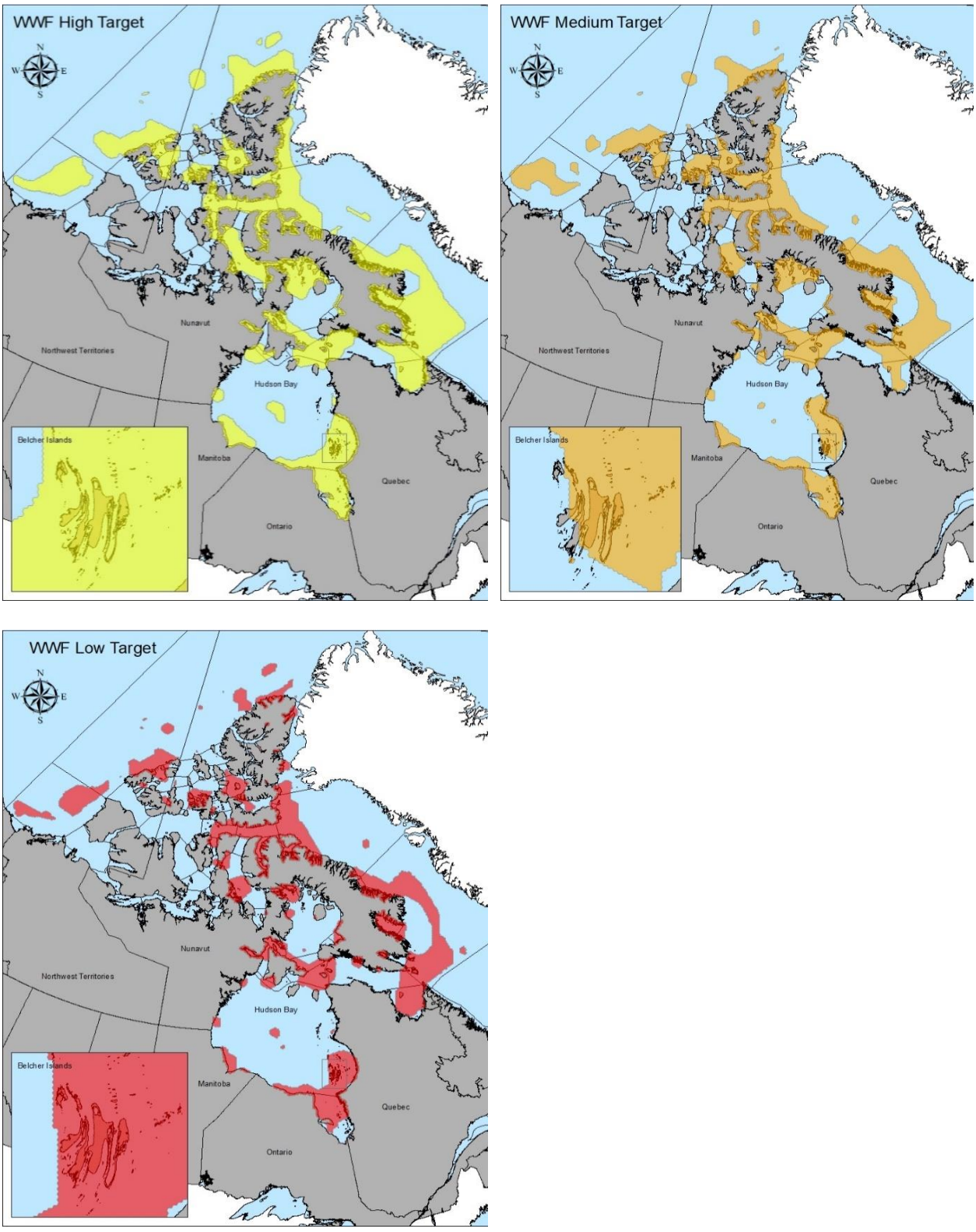


Figure 3.2 Priority Areas for Conservation (PACs) identified by WWF Canada for the Eastern Canadian Arctic. The insets are the best solutions produced by Marxan and present the proposed selection for the Belcher Islands region. Shapefiles courtesy of WWF Canada.

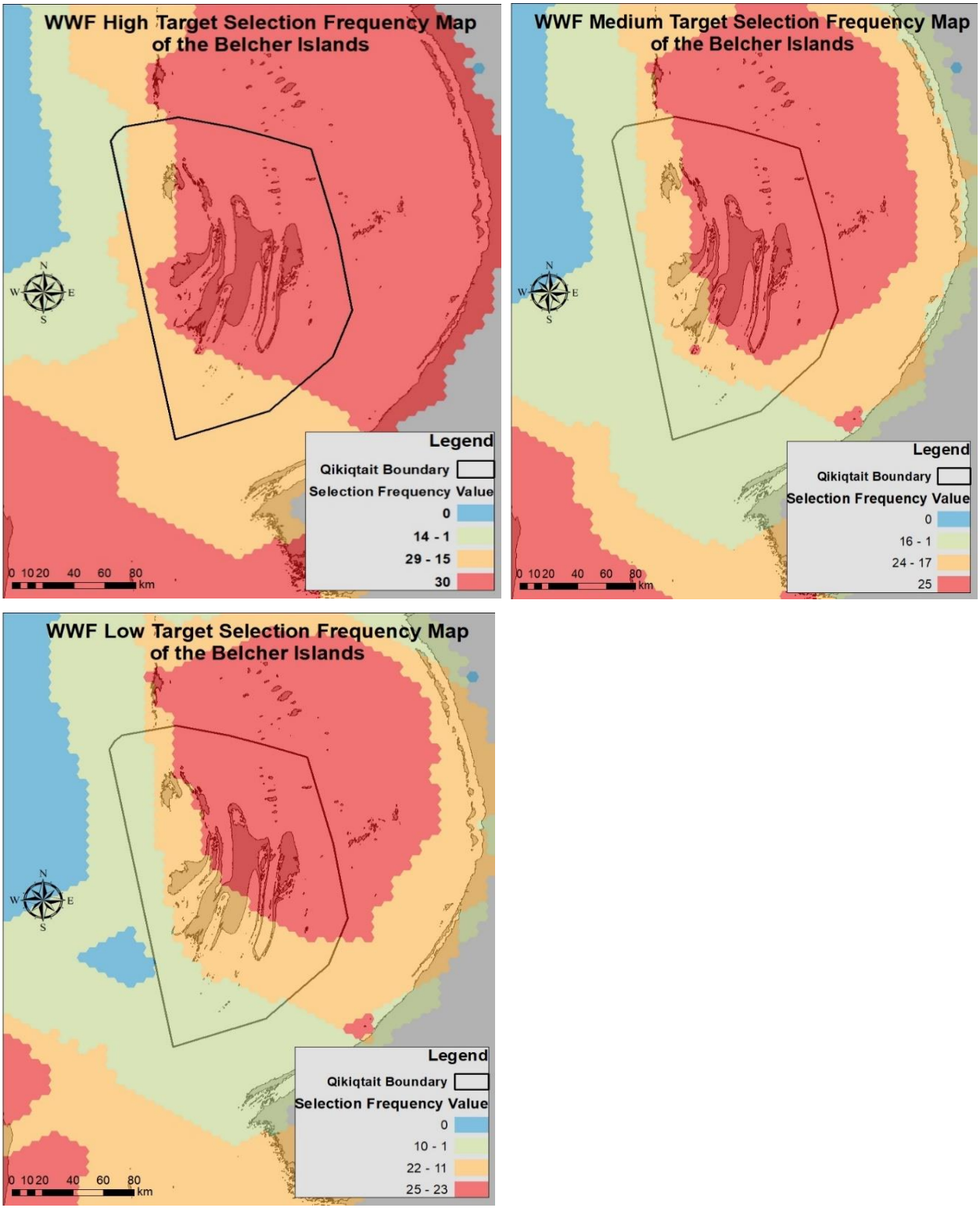


Figure 3.3 Selection frequency maps from WWFs Marxan scenarios identifying priority areas for conservation. Selection frequency classes represent quantiles of each dataset. Data distribution is unique to each scenario. Shapefiles courtesy of WWF Canada

3.2. Methods

In this chapter, we analyzed the spatial outputs from two conservation planning approaches to elicit major similarities and differences between their resulting PACs. We examined 1) the similarities and differences between the PACs from each planning process, 2) how each PAC relates with known species occurrence in the Belcher Islands, and 3) how the PACs related to species richness. Each step helped illuminate how these approaches spatially align and differ in relationship to one another, particularly in reference to marine species occurrence in the area.

3.2.1. GIS Spatial Analysis of Priority Areas for Conservation

This research used five geographic datasets (Table 5): Sanikiluaq's PACs of the Belcher Islands, Sanikiluaq's Proposed Protected Area Boundary, WWF's PACs of the Belcher Islands, WWF's Marxan Selection Frequency Maps, and shapefiles on species occurrence from the Nunavut Coastal Resource Inventory (NCRI) for the Belcher Islands. The NCRI is a collection of inventories from all 26 Nunavut communities (Department of Environment 2010). It was documented in 2010 by the Government of Nunavut for the purpose of cataloging Inuit Knowledge of the species and coastal resources in the territory (Department of Environment, 2010). These spatial inventories depict marine species, resources, and activities, based on interviews conducted by the Government of Nunavut from each community (Department of Environment, 2010). The NCRI for Sanikiluaq is the most comprehensive database of coastal resources and community activities (Department of Environment, 2010). It includes GIS data on 88 marine species, hunting routes, and areas of ecological and cultural importance. Of the 88 species included in NCRI, 11 species have been assessed by COSEWIC (Table 3.2) and 32 species have been documented by the community as being explicitly ecologically and culturally important to the region (Table 3.2) (Arragutainaq & Fleming, 1993b, 1993a; McDonald et al., 1995). Of those 32 species, we list 17

that are thoroughly documented in existing research from the community (McDonald et al., 1995). We used Sanikiluaq's NCRI GIS data to create a baseline understanding of species geographical occurrence in the Belcher Islands, and to help assess the level of protection that each approach can provide to species of importance.

Table 3.1 Datasets used in this study.

Data Set	**Source**	**Year**	**Description**
Sanikiluaq's Proposed Boundary Map	Sanikiluaq	2019	A community-made map of the proposed boundary of Qikiqtait
Sanikiluaq's Priority Areas Maps	Sanikiluaq	2019	Community-identified priority areas for conservation within Qikiqtait
WWF's Protected Area Scenarios	WWF Canada	2018	Protected area scenarios identified using the systematic conservation planning tool Marxan
WWF's Selection Frequency Maps	WWF Canada	2018	Overlap of all solutions in each Marxan scenario
Sanikiluaq's Nunavut Coastal Resource Inventory (NCRI)	Department of Environment-Government of Nunavut	2010	Shapefiles of species geographic extent for the Belcher Islands based on community knowledge and existing data

Table 3.2 Species or other taxonomic groups included in the study region with the type of use made by the community and the species' COSEWIC status. ND: not documented.

Species Common Name	**Species Latin name**	**Community Use**	**COSEWIC Status**
Beluga, Eastern Hudson Bay Population	*Delphinapterus leucas*	Food source	Endangered
Ross's Gull	*Rhodostethia rosea*	ND	Threatened
Lumpsucker	*Cyclopterus lumpus*	ND	Threatened
Beluga, Western Hudson Bay Population	*Delphinapterus leucas*	Food Source	
Atlantic Walrus, Central / Low Arctic Population	*Odobenus rosmarus rosmar us*	Food source	Special Concern
Ringed Seal	*Pusa hispida*	Food source	Special Concern
Three-spined Stickleback	*Gasterosteus aculeatus*	ND	Special Concern
Narwhal	*Monodon monoceros*	ND	Special Concern
Polar Bear	*Ursus maritimus*	Financial source (hunted, with quota), food source	Special Concern
Bearded Seal	*Erignathus barbatus*	Food source	Data Deficient
Bowhead Whale	*Balaena mysticetus*	ND	Special Concern
Harbour Seal	*Phoca vitulina concolor*	ND	Not at Risk
Hudson Bay Common Eider	*Somateria mollissima sedentaria*	Food source and cultural importance	Not Assessed
Arctic Char	*Salvelinus alpinus*	Food source	Not Assessed
Sea Cucumber	*Holothuroidea*	Food source	Not Assessed
Sea Urchin	*Echinoidea*	Food source	Not Assessed
Ross's Goose	*Chen rossii*	Food source	Not Assessed
Northern Horse mussel	*Modiolus modiolus*	Food source	Not Assessed

Using the Esri ArcGIS software (version 10.6.1), we first analyzed how PACs from the WWF scenarios relate to Sanikiluaq's proposed protected area boundary, measuring the area and the percentage of overlap between each scenario. By overlaying Sanikiluaq's proposed boundary

with each WWF scenario, we elicited the spatial similarities and differences in terms of size and area. Next, we analyzed selection frequency maps produced by WWF's Marxan analysis. We used the selection frequency maps due to their importance in identifying core areas that could benefit from protection and compared these areas with Sanikiluaq's conservation priority areas. Although Sanikiluaq's PACs are not directly equivalent to the selection frequency quantiles, Marxan planning units that have a higher selection frequency are locations that play a more consistent role in Marxan solutions. We hence used selection frequency as a proxy for the importance of a location that could be compared to PACs. While selection frequency maps are rarely used on their own, this step allowed us to assess spatial similarities and divergences between both approaches. We classified each selection frequency map into four quantiles to rank planning units that were selected more often by Marxan. We calculated the area and percentage of each quantile within the Qikiqtait boundary, to assess which areas within the proposed boundary were the most frequently selected in Marxan.

Next, we overlaid NCRI shapefiles of marine species geographic extent with each PAC to understand the spatial relationship between PACs and species occurrence and highlight potential gaps in species conservation. We reported which species were included in each PAC, in Sanikiluaq's proposed boundary, and in each WWF selection frequency maps. For each species, we elicited the percentage of their geographic extent within each PAC to understand how much of each species' spatial occurrence is included in the PACs. We also documented the species and percentage of their extent beyond the Qikiqtait boundary to elicit if any species of interest were excluded from the proposed boundary.

Taking a closer look at individual species, we examined the overlap between the geographic extent of eight priority species and Sanikiluaq's PACs. These species (Arctic char

(*Salvelunis alpinus)*, Atlantic walrus (*Odobenus rosmarus rosmarus)*, bearded seal (*Erignathus barbatus)*, beluga (*Delphinapterus leucas)*, Hudson Bay common eider (*Somateria mollissima sedentaria)*, polar bear (*Ursus maritimus)*, ringed seal (*Pusa hispida)*, and three-spined stickleback (*Gasterosteus aculeatus)*) were chosen based on their COSEWIC status (Threatened or Endangered), and/or documented community value.

In the last step of the analysis, we used the NCRI data to create a species richness map of the Belcher Islands and analyzed how much species richness each PAC captures. For this step, we converted each NCRI species' polygon into 100m resolution raster data indicating species' presence or absence. We then combined individual species' data to create a species richness layer. We then overlaid identified PACs from Sanikiluaq and WWF with the species richness map to analyze how the plans and conservation priorities correlate with areas of species richness. Using ArcGIS Zonal Statistics, we calculated descriptive statistics (minimum, mean, maximum etc.) on species within each priority area map. For this analysis, we call the study area the boundary of total NCRI species extent.

3.3. Results

Sanikiluaq's community consultations identified the entire Belcher Islands region to be of interest for protection, while WWF's scenarios only identified part of the region as a priority area for conservation. Qikiqtait's proposed boundary was designed by the community with both terrestrial and marine species in mind, while WWF's scenarios were created explicitly based on marine conservation features. WWF's high target scenario, being based on the most ambitious conservation goals, has the highest percentage of overlap with Sanikiluaq's priority for the region as a whole, covering 97.07% of the proposed boundary of Qikiqtait. WWF medium target scenario

overlaps with 56.08% of Qikiqtait's proposed boundary, while the low target covers 87.61% (see Figure 3.4).

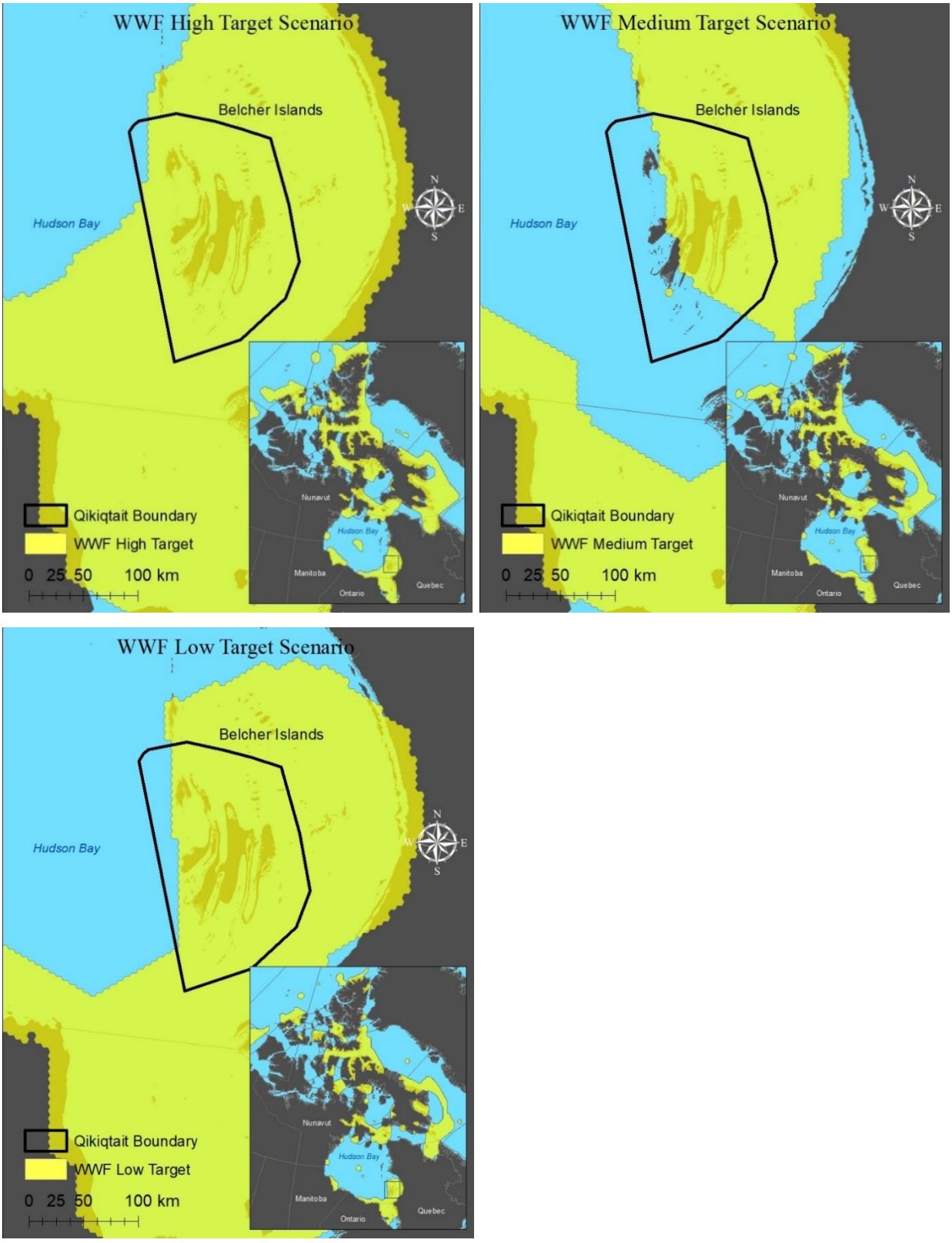


Figure 3.4 WWF's PACs in reference to the proposed Qikiqtait boundary. WWF PAC shapefiles courtesy of WWF Canada.

By visually examining Sanikiluaq's PACs and WWF's selection frequency maps, we found that areas identified with high conservation importance from each approach have some overlap (see Figures 3.2 and 3.4). Sanikiluaq's PACs are more specific and separate from one another, while WWF's selection frequency maps increase in size with conservation target levels. For example, all the area identified in Sanikiluaq's Top PAC was also included in WWF's High Target, most selected region. This region, which is important habitat for beluga and Arctic char (Department of Environment, 2010) was partially included in the most selected region for WWF's other scenarios. Another example of a divergence between the approaches is the southwest corner of the Belcher Islands. This region is included in the top PAC from in Sanikiluaq's plan and is of particular importance for eider; however, it was only included in WWF's High Target, most selected region, being mostly missed by the other two selection frequency maps.

Next, using NCRI data, we examined how well each PAC spatially captured species distribution (Table 3.3). The proposed Qikiqtait boundaries include geographic extent from all 88 marine species listed in the NCRI. Looking at WWF's PAC scenarios, the high target scenario and low target scenario also capture all of the NCRI species extent, with the medium target including 98% of NCRI species, only excluding a fish species documented as "unknown" located in the southwest region of the Belcher Islands. Here, we also examine the areas not explicitly included in Sanikiluaq's three PACs but within the Qikiqtait boundary and refer to this area as Sanikiluaq 4th Priority (Table 3.4). While this tells us the percentage of total species included in each PAC, it does not tell us how much of each species extent is included. We found that of the 88 NCRI species, seven species have geographic extent that extends beyond the proposed Qikiqtait boundary: 38% of walruses' extent, 11% of polar bears extent, 8% of lumpsuckers extent, 1% of Arctic char's extent, 29% of hollow stemmed kelps extent, 30% of edible kelps extent, and 11% of bearded seals

extent, meaning that the majority of species and their respective distribution is captured by the Qikiqtait boundary. WWF's high target scenario includes 100% of these species, but similar to Qikiqtait, the medium scenario and low scenario do not include 100% of the geographic extent of total species.

Table 3.3 Priority areas for conservation and percentage of species geographic extent included in each boundary

Priority Area for Conservation	**% of Species Included**	**% of Study Area**
Qikiqtait Proposed Boundary	100%	84%
WWF High Target Scenario	100%	100%
WWF Medium Target Scenario	98%	72%
WWF Low Target Scenario	100%	99%

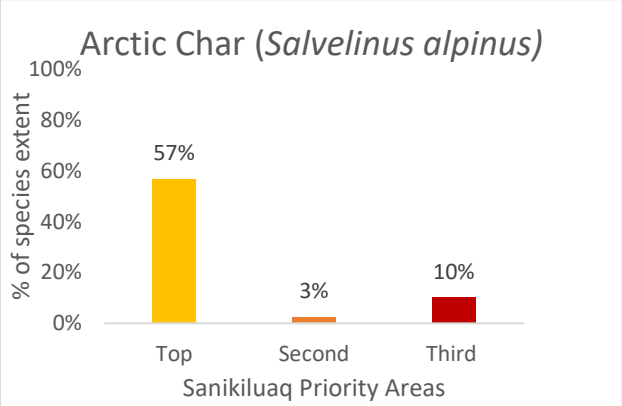
Using Sanikiluaq's PACs and WWF's selection frequency maps, we examined how these areas overlap known species distribution (Table 3.4). For simplicity, study area refers to the geographic extent included in the NCRI shapefiles for the Belcher Islands. Here, Sanikiluaq's fourth priority represents the entirety of Qikiqtait excluding priorities one through three, as the community had expressed that the entire protected area is a conservation priority. Sanikiluaq's top priority shows the highest efficiency level (i.e., protects more species for a small area), covering 7% of Qikiqtait, 11% of the study area and 92% of species' geographic extent (Table 3.4). For each of the WWF selection frequency maps, the planning units selected during every iteration cover the most area for each respective scenario. Within each target, as the frequency of selection decreases, the percentage of species included also decreases. In other words, in each scenario, areas selected the most often include the majority of species, with the lower classes only containing a few species and these species are of highest importance.

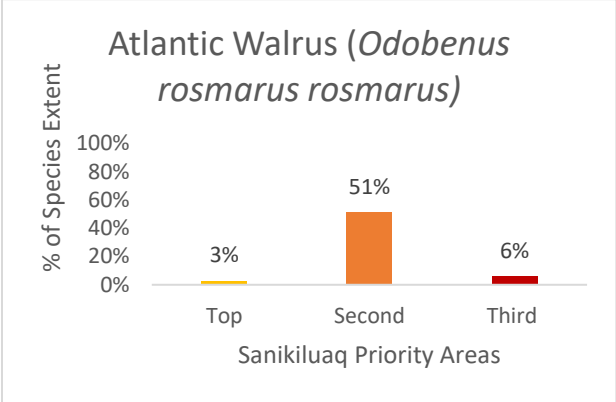
Table 3.4 Percentage of the total species geographic range (all species combined) included in Sanikiluaq's PACs and WWF's Selection Frequency Maps

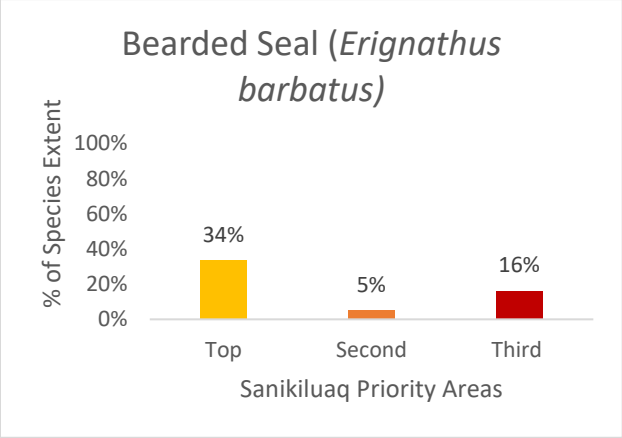
Priorities and Selection Frequency Maps	**% of Species Included**	**% Study Area**
Sanikiluaq Top Priority	92%	11%
Sanikiluaq 2nd Priority	41%	9%
Sanikiluaq 3rd Priority	68%	21%
Sanikiluaq 4th Priority	66%	43%
WWF High Target, Most Selected Region	100%	90%
WWF High Target, 2nd Selected Region	18%	10%
WWF High Target, 3rd Selected Region	2%	0%
WWF High Target, 4th Selected Region	0%	0%
WWF Medium Target, Most Selected Region	99%	78%
WWF Medium Target, 2nd Selected Region	30%	26%
WWF Medium Target, 3rd Selected Region	3%	3%
WWF Medium Target, 4th Selected Region	1%	0%
WWF Low Target, Most Selected Region	95%	56%
WWF Low target, 2nd Selected Region	56%	40%
WWF Low Target, 3rd Selected Region	18%	3%
WWF Low Target, 4th Selected Region	2%	0%

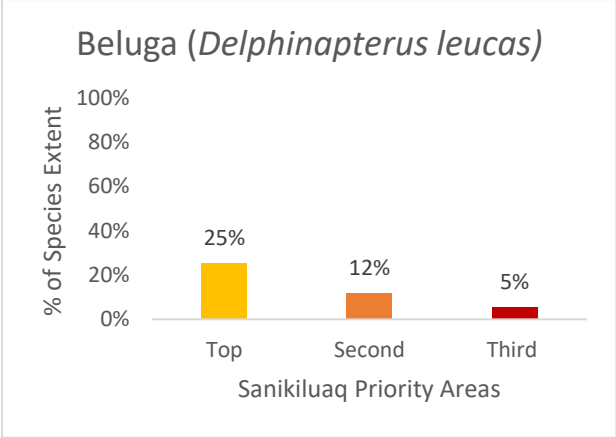
When examining the percentage of geographic extent for each priority species within each PAC, for most priority species, Sanikiluaq's top PAC appears to capture more of their extent than the other PACs (Figure 3.5). Sanikiluaq's top PAC overlays 57% of Arctic char's geographic extent and 70% of three-spined sticklebacks' geographic extent. Looking at beluga, compared to Sanikiluaq's second and third PAC, there is relatively high concentration of beluga occurrence in Sanikiluaq's top extent (Figure 3.5). 40% of common eiders extent is captured by Sanikiluaq's top PAC and Atlantic walrus's extent is heavily captured by Sanikiluaq's second PAC. Contrary to

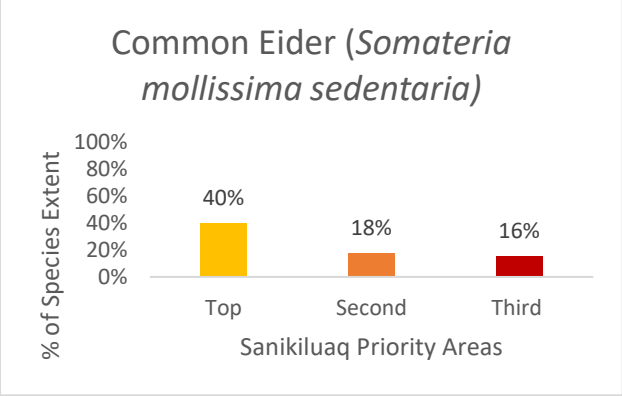
the other species, polar bear and ringed seal appear to have more of their geographic extent captured by the third PAC.

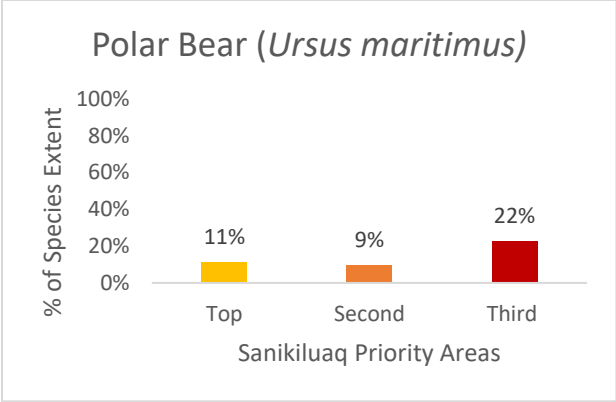












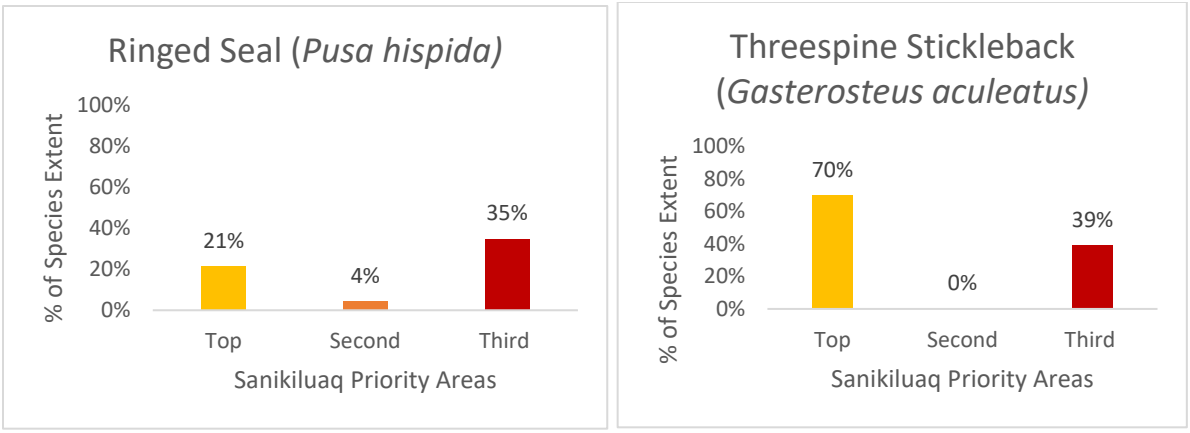


Figure 3.5 Percentage of priority species extent within each of the Sanikiluaq's PACs.

To gain a broader perspective on the relationship between species occurrence and Sanikiluaq's PACs, we created a species richness map and found the areas of high species diversity (Figure 3.6).

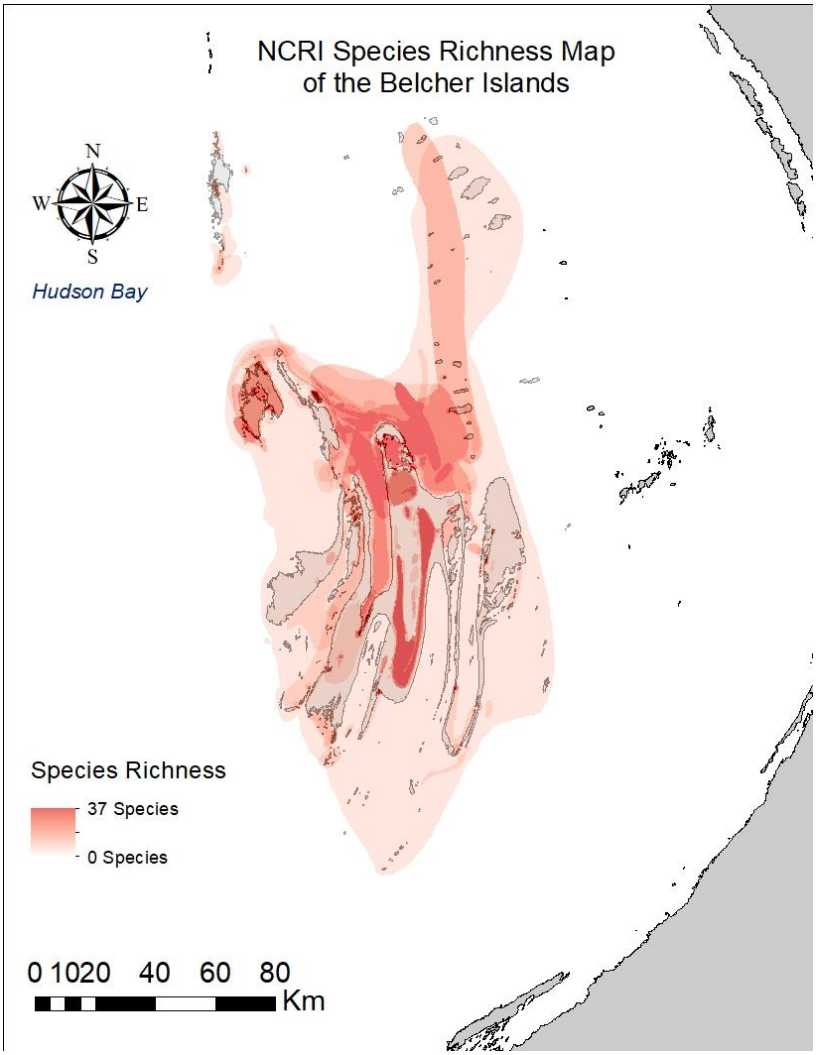


Figure 3.6 Species richness map based on NCRI species data for the Belcher Islands. Species Shapefiles courtesy of Government of Nunavut.

Overlaying Sanikiluaq's PACs with the species richness reveals some visual relationship between Sanikiluaq's top PAC and areas of high species richness (Figure 3.7). To further investigate the relationship between species richness and PACs, we ran statistical analyses and found that Qikiqtait's proposed boundary and WWF's top target scenario equally capture species richness (Table 3.5). We found that Sanikiluaq's Top PAC had the highest average species richness and each of WWF's scenarios were relatively similar in statistical values (Table 3.5).

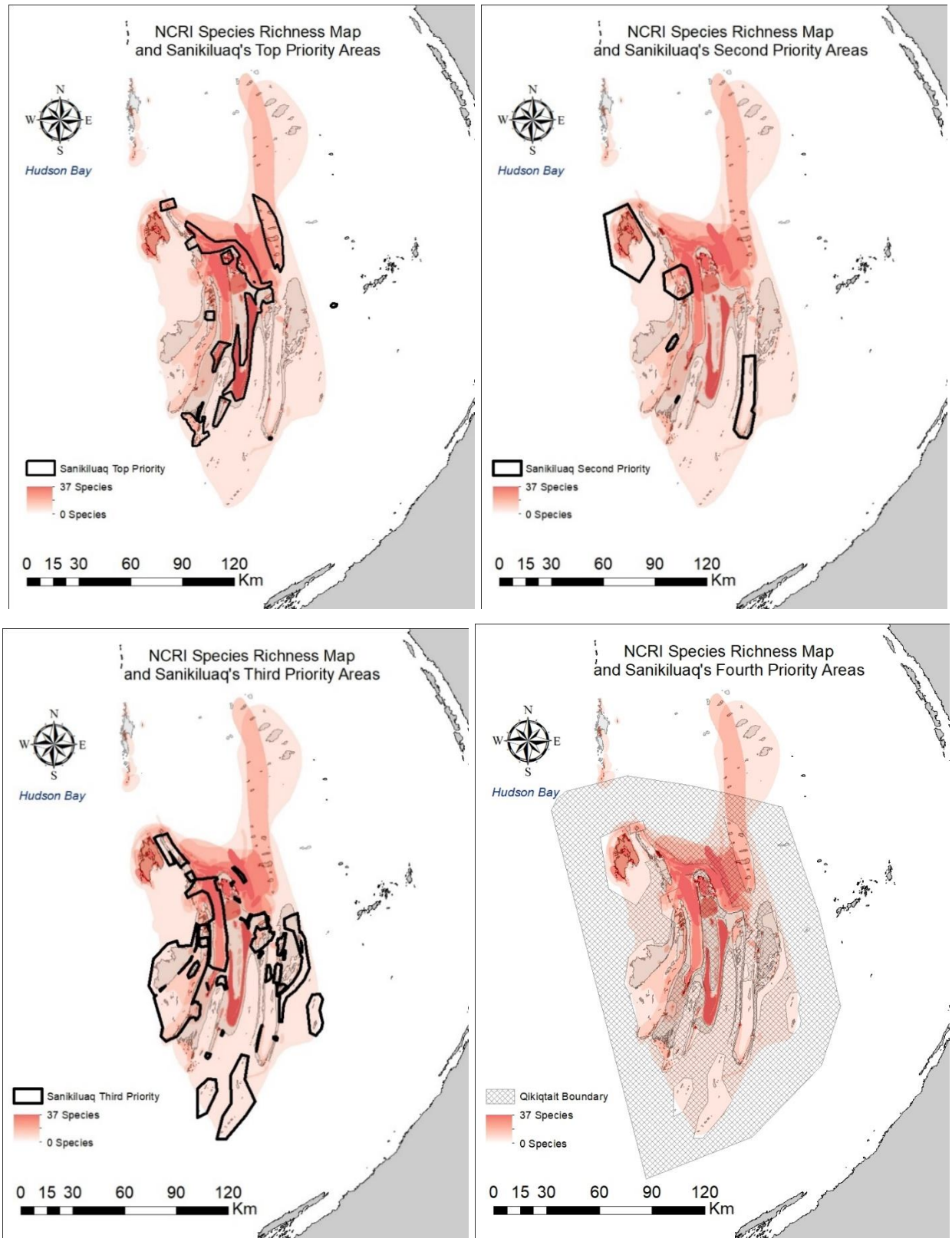


Figure 3.7 Sanikiluaq's priority areas and proposed boundary overlay the NCRI Species Richness Map. Species shapefiles courtesy of Government of Nunavut

Table 3.5 Species richness statistics for Sanikiluaq Priorities and WWF Scenarios

	Max	Mean	Majority	Median
Sanikiluaq Top Priority	37	4.18	3	4
Sanikiluaq 2nd Priority	9	2.10	1	1
Sanikiluaq 3rd Priority	12	1.90	1	1
Sanikiluaq 4th Priority	13	0.77	0	0
Qikiqtait Boundary	37	1.29	0	0
WWF High Target Scenario	37	1.29	0	1
WWF Medium Target Scenario	37	1.51	0	1
WWF Low Target Scenario	37	1.34	1	1

Sanikiluaq's top PAC, the proposed Qikiqtait boundary, and each of WWF's scenarios have a maximum value of 37, which is the highest possible value. Looking at the mean value, Sanikiluaq's top three PACs have the highest average species per pixel size. Here, majority represents the number of diverse species most commonly counted per pixel. In summary, while Sanikiluaq's priority areas have the highest mean number of diverse species, WWF's scenarios and the Qikiqtait boundary consistently have the highest maximum number of diverse species. Here, Sanikiluaq's approach, Qikiqtait, and WWF's High Target Scenario equally capture species richness.

3.4. Discussion

Examining Sanikiluaq's PACs and the selection frequency maps in parallel, Sanikiluaq's top priority has the highest conservation efficiency, with 92% of species within 11% of the study area (Table 3.4). This is further illustrated by the species richness map with Sanikiluaq's top priority overlaid. Sanikiluaq's top PAC clearly overlays some of the hottest spots on the map. Sanikiluaq's second and third priorities also include "hot spots," and further examination showed that areas that do not appear to include high species richness include species that hold high

conservation and community value, such as common eider and beluga. While WWF's PACs and selection frequency maps include "hot spots," they do not appear to capture them as precisely as Sanikiluaq's PACs. Furthermore, looking at the southeast corner of the Belcher Islands, an area specifically pointed out by the community as being important for eider, represents a mismatch between WWF's scenarios and Sanikiluaq's approach. This region is not included in WWF's medium target, and the selection frequency maps greatly miss this area except for the High Target Scenario. This is important, because if the Medium Target was exclusively used to support the identification of PACs in practice, this would miss an important area that only local knowledge holders had identified. Reasons for this could point to the data used, for example the eider data in the Belcher Islands NCRI is incomplete. Other reasons could include the tools used such as Marxan, No matter the reason, this discrepancy illustrates ways in which Sanikiluaq's approach is advantageous based on the place-specific knowledge used.

These two conservation approaches covering the Belcher Islands archipelago were conducted at different spatial scales and in different planning contexts. While they diverge in some instances, such as prioritizing different regions within the study area or overlapping with difference species occurrence, we found that the conservation solutions could be used to complement each other. Sanikiluaq's approach offers local perspectives and generational knowledge in a region that is otherwise scarce of biological and ecological data. Lessons used were passed down from elders and carry messages of respecting the environment, never taking in excess, and learning from the animals, tides, weather, and climate (McDonald et al., 1995, 1997). This approach complements WWF's approach by offering in-depth, local-scale data to a regional, systematic approach for the Eastern Canadian Arctic. WWF's MECCEA project was initiated in the context of supporting efforts to increase conservation connectivity in the eastern Canadian Arctic and protect vulnerable

species and habitats. Using Marxan, MECCEA sought to achieve high conservation efficiency, meaning protecting minimal amount of area while still reaching high conservation objectives. Sanikiluaq's plan sought to protect the entire study region, not explicitly accounting for large scale conservation efficiency into their decision-making process. Yet, while these approaches were designed in different contexts and at different spatial scales, they have a great deal of spatial overlap between the proposed Qikiqtait boundary and WWF's PACs.

Here, WWF used systematic conservation planning to identify PACs at a regional level while accounting for connectivity and prioritizing species and habitats at risk. In terms of conservation connectivity, regional solutions encourage connectivity by connecting large landscapes which are important for species prosperity (Cushman et al., 2009). WWF's approach is valuable because it can be used regionally to support the implementation of protected areas within the eastern Canadian Arctic, contributing to regional and national conservation goals and targets at a large scale. Systematic conservation planning also allowed WWF to use the limited data available while providing robust solutions (Roff et al., 2020).

Sanikiluaq on the other hand used a local community-based approach and a narrower geographic scope. Community-based approaches account for local goals and constraints, including integrating input from local communities and stakeholders (Mills et al., 2012). In this context, local knowledge is particularly valuable due to limited biological and ecological data of the Canadian Arctic. However, local conservation projects are argued to miss regional objectives by being implemented and maintained in isolation (Pressey & Tully, 1994). Based on this argument, using Sanikiluaq's plan that reflects diverse values and place-based knowledge in congruence with WWF's regional plan provides an even more robust argument to protect the Belcher Islands. As

Margules and Pressey (2000) recommend, local stakeholder input is a vital part of effective systematic conservation planning.

While WWF's PAC's for the Belcher Islands were spatially similar to Sanikiluaq's proposed protected area boundary, they also expand beyond Qikiqtait's proposed border, identifying PACs outside of Sanikiluaq's scope. Sanikiluaq's planning process for Qikiqtait is limited to remain inside Nunavut while WWF is under no such pretext. In fact, priority areas were identified by the community that extend beyond the boundary of Qikiqtait, however were not included here due to complicated jurisdictional challenges. There areas are planned to be addressed in a larger context of conservation projects after Qikiqtait is established. Here, WWF's approach contributes perspectives not included in Sanikiluaq's approach. Further discrepancies between Qikiqtait's proposed boundary and WWF's PAC scenarios were that WWF's medium target scenario is only 56% similar to Qikiqtait, however this scenario still accounted for 98% of NCRI species extent within the Belcher Islands (Table 6). Here, both approaches account for nearly 100% of NCRI marine species extent for the Belcher Islands, portraying similar results in terms of species.

Based on the literature, effective environmental management and conservation planning requires knowledge that originates from different spatial scales (Berkes, 2009; Borrini-Feyerabend et al., 2004). Hence, these approaches complement each other, offering perspectives, data, and approaches from different spatial scales and sources that when combined, offer comprehensive PACs for the Belcher Islands. In conservation literature, there is much discussion on how the resolution of data used affects the conservation outcome, and many argue that the scale of the data used should match the scale of the conservation problem (Rouget, 2003). Based on this, WWF's MECCEA scenarios should only be used in the context of setting priorities at the scale of the

eastern Canadian Arctic; however, we argue that it can also be used to support local conservation decisions.

WWF's PAC scenarios offer robust conservation solutions, based on a framework that is globally accepted as an effective means to conservation planning (see Margules & Pressey, 2000). One could argue that an advantage to WWF's process is that for the data used, each step of the process is documented, making it more accessible to users outside of the project team and context. This aspect allows for MECCEA to directly contribute to literature on regional conservation planning and in practice, can be used by external organizations to support conservation efforts in the region.

By contrasting, it can be argued that models can only produce results that are as good as the data used, and in the Arctic, data available to conservation planners limited (Roff et al., 2020). Sanikiluaq's maps offers a nuanced approach that directly facilitates community needs as well as biodiversity conservation objectives. Sanikiluarmiut use the islands on a daily basis year-round for the majority of key priorities species, and as such, they have extensive knowledge that contributed to the nuanced approach, and therefore were not subject to the same data limitations relied upon by conservation models. They have extensive local knowledge which is comprehensive of the region as a whole for making informed decisions about what areas are important. A background report of the region produced as part of this research implicitly revealed that local knowledge holders possess more data on the species, weather, climate, and ocean system than existing, western-produced data. Hence, local knowledge offers a more comprehensive database of knowledge of the region. While some of this knowledge is documented (see Arragutainaq & Fleming, 1992, 1993a, 1993b; McDonald et al., 1995, 1997), consultations and meetings in the community illustrated the extent of community knowledge of the region. In this context, this is

especially important because models can only produce results as good as the inputted data. Therefore, we argue that Sanikiluaq's proposed Qikiqtait boundary and PACs are based on data that more accurately reflects the region and the needs of the community.

3.4.1. Interpreting the Similarities and Differences Between the PACs: Species Occurrence and PACs

Here, we have examples of species and areas being prioritized by both approaches but not necessarily for identical reasons. Areas identified in WWF's scenarios that overlap with Sanikiluaq's top PAC contained species important to the community and high conservation targets identified by WWF, such as beluga and walrus. Atlantic walrus and beluga are hunted primarily seasonally and consumed as community foods, being shared with whomever needs or desires it (McDonald et al., 1995). The Eastern Hudson Bay population and Western Hudson Bay population are the primary pods that frequent the Belcher Islands (de March & Postma, 2003). Research from de March & Postma (2003) revealed genetic distinctions between beluga populations in Hudson Bay, and found a sub-population that may be genetically specific to the Belcher Islands, however this has not been verified by other sources. According to COSEWIC, the Eastern Hudson Bay population is listed as "Endangered," and the Western Hudson Bay population is listed as "Special Concern." Looking at Sanikiluaq's second priority, while only 41% of all NCRI species extent is included, these species represent species of high conservation and community priority, such as both beluga populations.

In both Sanikiluaq's and WWF's PACs, ringed seal habitat is prioritized. Ringed seal is the primary prey for polar bears and are an important species for Inuit across the Canadian Arctic. According to COSEWIC, in the next three decades ringed seal populations are predicted to decline due to loss of sea ice and suitable pupping habitat. Currently, the estimated ringed seal population

is at about 2 million individuals, and local knowledge holders report local populations as stable (COSEWIC, 2019). Community members have expressed concern for the health of seals, having spotted sick or weak seals, some with boils on their skin (Arragutainaq & Fleming, 1993b). Of their extent included in Sanikiluaq's PACs, both polar bear and ringed seal are primarily captured by Sanikiluaq's third PAC, however this does not mean that Sanikiluaq values Arctic char and three-spined stickleback over polar bear and ringed seal. Here, it is important to recall how adamant Sanikiluaq was to express that the entire region is important. Furthermore, the community recognizes the interconnectedness of species as being vital for the health of the entire region and ecosystem, which is reflected in their intent to protect the entire region (McDonald et al., 1995, 1997).

Examining how priority species' geographic extent is included in each of Sanikiluaq's PACs, there is some distinctive relationship between priority level and food source. Arctic char is a primary food source during summer months and is noted by community members for its valuable role in the Hudson Bay food web as well as being an important part of the summer diet (McDonald et al., 1995). There is also some relationship between PAC and species that directly interact with each other. For example, three-spined stickleback are prey to Arctic Char, and both have geographic extent that falls within Sanikiluaq's top PAC. Here, the relationship between species is an important factor contributing to how species occurrence was included by different PACs.

Figure 3.6 portrays the amount of species extent captured within each of Sanikiluaq's priority areas. Interpreting the graphs, the story is more about species distribution and size of Sanikiluaq's PACs rather than how each species in valued. For example, for polar bear, the graph at first glance reflects that each priority area sequentially captures more extent. However polar bear's geographic extent covers the entire study region and the fourth priority, which is the rest of

the protected area, is the largest. Therefore, it makes sense that the fourth priority has the highest overlap with polar bear's geographic extent. While Sanikiluaq's PACs reflect conservation value, the number values cannot be taken at face value. More research and consultation with the community is needed to fully understand the logic behind each PAC.

In summary, the size of planning units can directly affect the outcomes of the conservation solution, meaning that a plan designed using planning units for a large region may not be as effective when used locally (Pressey & Logan, 1995). In Sanikiluaq's case, we use the term "planning unit" loosely, to indicate the different spatial scales used. WWF's systematic planning scenarios provide region-wide protected area networks for the Eastern Canadian Arctic but lack local PACs designed specifically for the Belcher Islands. While the selection frequency maps illustrate how frequently areas were selected in each Marxan iteration, they do not explicitly represent priority areas for conservation within each PAC scenario. WWF's model is also limited by the inputs used and here, Sanikiluaq has a greater understanding of the local species and natural processes based on generational knowledge and IQ. Sanikiluaq's community-based approach is place-specific, including PACs within the proposed protected area but is limited to remain within the Nunavut border. WWF's approach lacks direct input from Sanikiluaq or any other northern community, and Sanikiluaq's approach received minimal input from external experts and conservation organizations. Therefore, using these approaches in parallel can help fill gaps that the other approach may have, and support Sanikiluaq's efforts to protect the Belcher Islands.

3.5. Conclusion

The goal of this analysis was to spatially analyze two approaches to conservation planning in the Belcher Islands in parallel, and examine how these approaches could complement each other. This research examines how data from different scales and knowledge frameworks can be used to

create a comprehensive understanding of the conservation value of a region. Sanikiluaq's community-driven conservation plan offers priority areas that reflect their in-depth knowledge and relationship of the region. On the other hand, WWF's approach, based on systematic conservation planning, offers regional, comprehensive PACs that promote conservation connectivity as well as prioritizing species and habitats at risk. The different scales of these two approaches offers challenges when comparing them but complements each other when used for the same objective.

Our analysis revealed that while both WWF's and Sanikiluaq agree that there is value in protecting the Belcher Islands and on average there is a high amount of overlap between the proposed boundary and WWF's High Target and Low Target scenarios, WWF's regional conservation model in isolation misses key ecological areas. Specifically, if used alone, WWF's medium scenario has the potential to neglect important habitats within the Belcher Islands. Sanikiluaq's conservation vision offers priority areas at a finer detail, based on a collaborative community approach. Therefore, while regional conservation planning can offer solutions at the larger scale, in this context, regional models should not be considered without community and local input. On the other hand, Sanikiluaq's proposed boundary is restrained by the Nunavut's border, missing habitat beyond that boundary. WWF's large study scope identifies PACs beyond that boundary as well as supporting important regions within Qikiqtait. WWF's approach also specifically prioritizes vulnerable species and habitats, providing useful information to be used by external organizations.

While the effectiveness of community-based conservation is debated (Berkes, 2007; Calfucura, 2018), the case study of Qikiqtait illustrates that community-led planning and a regional systematic conservation plan can have similar objectives. Furthermore, our analysis illustrates the usefulness of including knowledge and data from different spatial scales in conservation planning.

This research is limited to two approaches, existing data and literature, and therefore should not be used as a representation of systematic conservation planning or community-led conservation as whole. Further research on systematic conservation planning and community-led conservation in Canada is needed to help encourage space for more inclusive conservation practices. WWF's MECCEA project offers a basis for conservation for the Belcher Islands, and when used in parallel with Sanikiluaq's plan, supports the community's efforts to create Qikiqtait. Furthermore, this case analysis supports the argument that community-based conservation is effective. A bottom-up approach to conservation is key to effective management by the community and at the same time, contributes to reconciliation by making space for Indigenous communities to take the lead. In conclusion, while regional conservation initiatives offer valuable insight, local-scaled knowledge is needed to for a more comprehensive perspective. Regional models could benefit by exploring opportunities to stay informed through community engagement, knowledge, and participation.

CHAPTER FOUR

CONCLUSION

The objective of this thesis was to contribute to the understanding of how community-based conservation fits into the current conservation framework of Canada. Based on the contextual framework illustrated through a literature review, this research sought to highlight how Indigenous Knowledge, participation, and leadership in protected area management has shifted and increased throughout the decades, as well as the many challenges that comes with shifting the conservation framework. Through geographic data analysis, my research also sought to analytically help bridge the gap between a western science-based and community-based conservation planning by illustrating how Priority Areas for Conservation (PACs) for the Belcher Islands from different approaches spatially align and diverge. Furthermore, my research aimed to produce information that would contribute to Sanikiluaq's planning process of Qikiqtait protected area. By directly consulting with the community and the Arctic Eider Society, this research aimed to identify research gaps of the region to help guide future conservation research and to understand how an Indigenous, community-driven approach differs from the model more typically used by conservation organizations and government agencies.

4.1. Summary of Findings

In the context of the Belcher Islands, this research sought to understand how an Indigenous, community-based approach to conservation planning compared to a regional, systematic approach. Chapter Two was framed as a literature review to contextualize this research in the current conservation framework in Canada. This framework has evolved from an exclusive practice, often referred to as fortress conservation or the "Yellowstone Model," to a practice that is increasingly making space for Indigenous leadership and participation in conservation initiatives. However,

lessons remain on how to mitigate biodiversity loss while also accounting for complex human dimensions. While many agree that Canada is taking positive steps towards reconciliation through promoting and supporting Indigenous-driven protected areas, many argue that the current framework of co-management continues to perpetuate colonial motives (Grey & Kuokkanen, 2019; Spak, 2005; White, 2006). The case study of Qikiqtait is planned to be one of 16 co-managed protected areas in Canada and represents many commonalities with other co-managed protected areas, especially those in Nunavut. A clear literature gap is documented lessons, success, and challenges from the examples of co-managed protected areas in Canada that could guide the implementation of future co-managed and Indigenous-led protected areas. This would help other Indigenous-led protected areas, as well as contribute to the shaping of a conservation framework that better accounts for Indigenous leadership and participation. Hopefully, this research can contribute to this definition and to the creation of more Indigenous-managed protected areas.

Chapter Three was guided by the research objective to spatially examine two approaches to conservation for the Belcher Islands: Sanikiluaq's community-based approach and WWF's regional systematic approach. This analysis revealed four key results: 1) both Sanikiluaq's and WWF's approaches agreed that the entire region of the Belcher Islands should be protected; 2) Sanikiluaq's PACs better represent place-specific knowledge and directly reflect human dimensions of conservation; 3) WWF's scenarios offer robust solutions, primarily targeting vulnerable and important conservation features and; 4) the different spatial scales of these approaches is useful in terms of using key findings from each approach to support and complement the other. Examining these approaches in parallel brought to light the strengths of each, as well as how a regional conservation plan could support local conservation efforts.

Examining Sanikiluaq's community-based approach and WWF's systematic regional approach in parallel disclosed three main differences: the context in which these plans were conceived, data used, and the scale each plan. The results of these differences can be seen directly via Sanikiluaq's PACs for the study area and WWF's selection frequency maps. WWF's selection frequency map and Sanikiluaq's PACs both represent features and areas that hold specific importance to each respective party. Areas selected in WWF's selection frequency maps were centered in the northeastern region of the study area. Sanikiluaq's PACs, on the other hand, are not spatially related to each other and were selected for place-specific reasons, rather than based on systematically identified conservation features. These differences offer an opportunity to fill the gaps from each approach and for the approaches to complement each other. Sanikiluaq included an area in the southwest region of the Belcher Islands that was largely missed by WWF; the latter's selection frequency map was centered in the northeast region, which was included in Sanikiluaq's PAC but not prioritized in the top PAC.

In terms of how species occurrence was captured by each PAC, the major differences were how each party approached species of interest, and each party's motives. Species richness and occurrence were equally captured by the proposed Qikiqtait's boundary and WWF's three scenarios. The main difference was again between Sanikiluaq's PACs and WWF's selection frequency maps. A key factor that WWF had to account for was how to protect enough of an important conservation feature without being able to protect all of it. Sanikiluaq's PACs on the other hand were identified by the community for various reasons and were identified based on what was important at the local level. Many species included in Sanikiluaq's top PAC represented species and areas of direct importance to the community, such as eider nesting habitat, and areas used for harvesting mussels, urchins, and sea cucumbers. Areas for hunting and cultural reasons

were also included, directly accounting for Sanikiluaq's community needs. However, while the selection frequency maps and PACs do not necessarily match, the proposed boundary and WWF's High and Low Target have a high percentage of overlap.

It is important to note that these approaches were conceived in parallel and initiated in different contexts. WWF's approach was not designed for the Belcher Islands, but rather included the Belcher Islands based on important conservation features. This adds value to the similarities between the approaches, and the results should further validate Sanikiluaq's efforts to protect the Belcher Islands.

4.2. Recommendations

Based on the results from this analysis, local input needs to be at the forefront of protected area planning and management, and greater space needs to be made by conservation agencies and organizations for more Indigenous-led initiatives. I recommend that WWF makes space for local communities to provide input on their PACs before recommending these areas for protection to any organizations or legislating bodies. The current model of systematic conservation planning recommends conservation practitioners to receive input from local stakeholders throughout this process (Margules & Pressey, 2000), as conservation projects that include local values and needs from the beginning are proven to be longer lasting and overall, more successful (Cox et al., 2010; Gaymer et al., 2014). Indigenous knowledge included in the Marxan analysis was primarily of marine mammal features. During the post-Marxan analysis phase, spatial information including hunting sites, cultural sites, campsites etc. was used to create overlay maps for the Marxan scenarios (Roff et al., 2020). However, it remains unclear how areas of use directly affected the identification of PACs. Therefore, local input would better reflect current areas of use and perhaps help fill data gaps.

From the literature review, a clear gap was lessons and learnings from existing co-managed protected areas in Canada. As Sanikiluaq plans and implements Qikiqtait, these findings suggest reaching out to other Indigenous governments, especially in Nunavut, for recommendations and key points in how to navigate the legislative framework, and as well as lessons from implementing their own protected area. Dialogue between communities would be helpful in designing a vision of Indigenous-led conservation, as illustrated by The Indigenous Circle of Experts (2018).

4.3. Limitations and Future Research Needs

Chapter Three examined two approaches to conservation for the Belcher Islands, that represented different spatial scales, data, and contexts. Specifically, this analysis only focused on the spatial outputs from each approach. While this research touched on the processes behind each approach, future research could further study the conservation process that led to those plans. An in-depth analysis that included aspects such as worldviews, environmental values, assumptions, and social limitations and expectations may highlight greater overlap and divergence between these two approaches.

Secondly, the analysis in Chapter Three is limited by the current conservation framework. While we sought to understand an Indigenous approach to conservation, Sanikiluaq's planning is limited by the legislation that Qikiqtait must fit into; federal legislation makes it impossible for communities to completely protect and manage under their own laws. In Canada, there is no legislation for federally protected areas that are solely planned and managed by an Indigenous nation, government or community. Protected areas managed by an Indigenous community must be co-managed with a federal department. Therefore, Sanikiluaq's approach is limited to remain within the existing colonial framework, but by integrating community knowledge, conservation

priorities, and resembling a bottom-up approach represents a departure from its historical counterparts.

This analysis is also limited by the research lens of the research team. Being outsiders of the community, our capacity to understand Sanikiluaq's PACs and knowledge of the region in limited. For example, we used shapefiles from NCRI to understand how the identified PACs correlate with species occurrence and species richness. However, as we illustrated in Chapter One and Two, using the NCRI data without direct community engagement effectively separates place-based knowledge from the knowledge holder. On one hand, separating knowledge from its source has been criticized to perpetuate a colonial framework of research. Furthermore, our ability to fully understand the depth of this knowledge is limited without consultation and guidance from the community. To address this challenge, we would need grounded community engagement and verification of this information. As stated previously, these consultations were initially planned but were cancelled due to closures from COVID-19.

During the planning process of this research, we proposed to examine the potential of a conservation economy in Sanikiluaq, and the cost and benefits of implementing Qikiqtait. Currently, there is minimal research on the economic relationship between Indigenous communities and protected areas. For many Indigenous communities, use and conservation go together (Berkes, 2004), as preserving hunting and harvesting grounds allows a sustainable use of the land that contributes to food security. Eliciting monetary values of conservation could help support and encourage more community-based conservation projects. There is a fair amount of research on the cost and benefits, and economic efficiency of conservation (Armsworth et al., 2018; Duke, Dundas, & Messer, 2013; Laycock et al., 2009; Naidoo & Ricketts, 2006), however more research on how protected areas directly influence communities would contribute greatly to

communities' efforts in implementing protected areas. After further examination on how to address this research problem, we determined this was beyond the scope of this research, as well as beyond the academic scope of my committee. This research problem remains and would be best fit for a researcher with a background in environmental economics.

I had initially also planned to conduct an in-depth literature review of the Hudson Bay Program (Canadian Arctic Resources Committee, Environmental Committee of Sanikiluaq, & Rawson Academy of Aquatic Science, 1995; McDonald et al., 1995) to elicit environmental values from Sanikiluaq, followed by a series of consultation interviews to guide my understanding and interpretation. The Hudson Bay Program (HBP) was a research initiative conducted in 1992, 1993 and 1994 with the goal of collecting all existing research on the area and holding workshops with representatives from the 26 communities in the regions to collectively share community and Indigenous knowledge of the area. Sanikiluaq helped organize and participate in these workshops. While these reports were published almost 30 years prior, they remain the most comprehensive data source of local knowledge of the area, and consultations were proposed to in order to address changes over time and verify any interpretations made. The purpose of this review was to gain a deeper understanding of the motives and logic behind the proposed Qikiqtait boundary and Sanikiluaq's PACs. I wanted to explore the concept of "environmental values" and how Sanikiluaq's environmental values influenced their conservation priorities and actions. Due to the closures from COVID19, consultations were cancelled. As the literature review could not alone accurately depict environmental values without community feedback, this portion of the research was cancelled. Many research gaps remain in terms of understanding how environmental values influence protected area planning, therefore more research is needed to fill this gap and contribute to a protected area landscape that better accounts for human dimensions.

4.4. Conclusion

Indigenous-led protected areas in Canada have doubled in the past decade, signaling a paradigm shift in Canada's conservation landscape. These examples of Indigenous-led conservation link community values with conservation objectives as well as reflecting a movement away from the model that historically excluded Indigenous and local stakeholders. Furthermore, Indigenous-led protected areas offer steps towards reconciliation and self-determination. Qikiqtait's current planning is similar to other Indigenous-led protected areas in Canada, especially in Nunavut, integrating principles from IQ and representing a bottom-up approach supported by QIA. The Nunavut Land Claim agreement has given greater land rights and power to Inuit, however, there remains some critique on the effectiveness of integrating IQ into policy (Tester & Irniq, 2008). Land and resource management continues to better reflect Indigenous needs and knowledges, however more lessons are needed to help future improvement.

Indigenous-led protected areas offer a more holistic approach to conservation, as well as a step towards reconciliation. This form of conservation better reflects a "people and nature" framework than the model more typically used by conservation organizations and agencies. While co-managed protected areas are an important start, protected areas that are solely managed by an Indigenous community/nation without affiliation to the Canadian government will offer a greater step towards self-determination. In fact, critics of co-management argue that this form of conservation management further reflects a colonial power dynamic. Primary challenges of Indigenous-led conservation include management issues, issues related to state institutions, and issues involving external actors and influences (Tran et al., 2020). While many lessons remain in how to effectively create a conservation framework that actively decolonizes as well as meets conservation objectives, co-managed protected areas are a step in the right direction.

As Indigenous-led protected areas increasingly enter the conservation scene, initiatives like WWF's can be helpful to inform these actions and put them back in a larger conservation agenda. WWF's approach primarily accounted for natural and biophysical features, and while this should not imply that explicitly environmental conservation objectives cannot implicitly include human dimensions, this approach is very different from the examples of co-managed protected areas in Canada where community values are at the forefront of the plans. Therefore, initiatives like WWF's should be used to support local conservation actions and not be used alone, and as this analysis proved, these two approaches complement each other well. Furthermore, conservation actions like Sanikiluaq's show the effectiveness of Indigenous-led, community-based conservation, and support the argument that community planning and management are perhaps the best step towards biodiversity conservation.

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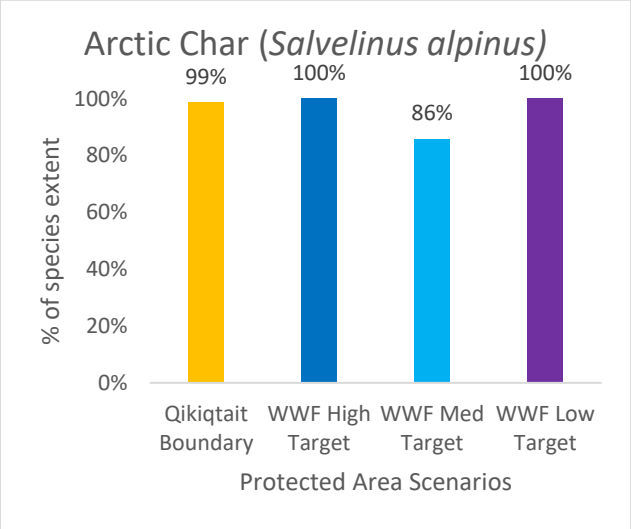
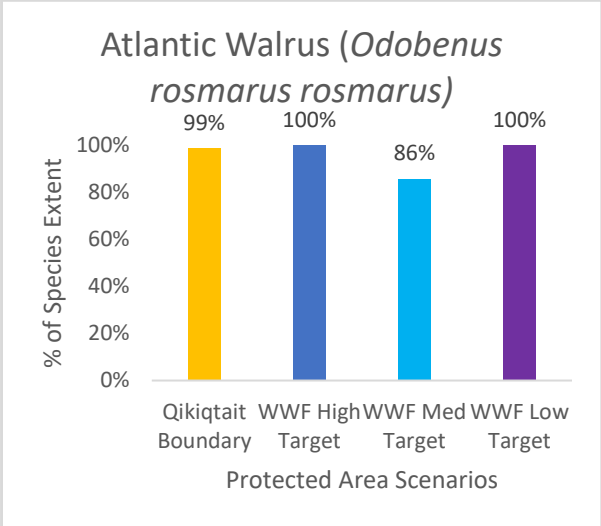
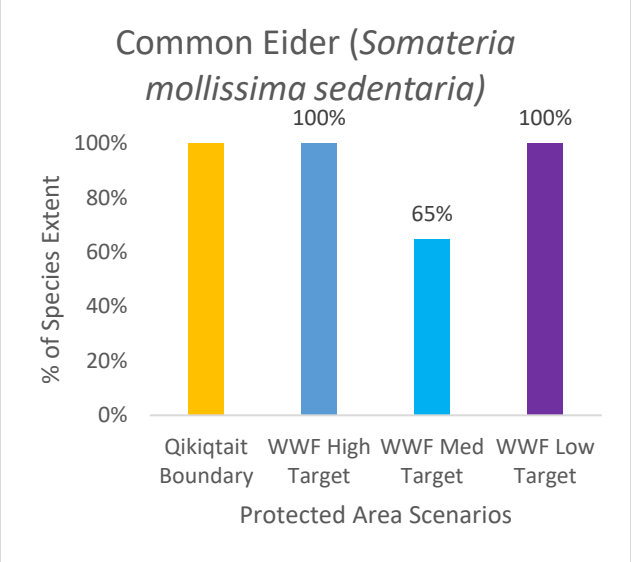
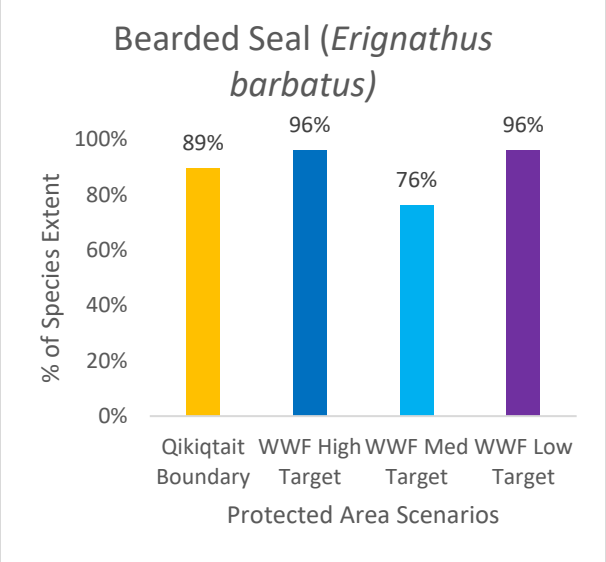
APPENDIX

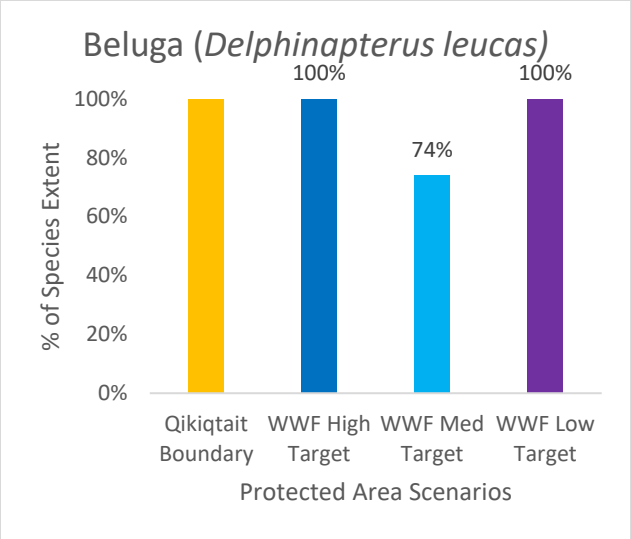
Appendix I: Total Extent of Priority Species in the Proposed Qikiqtait Boundary and WWF's PACs

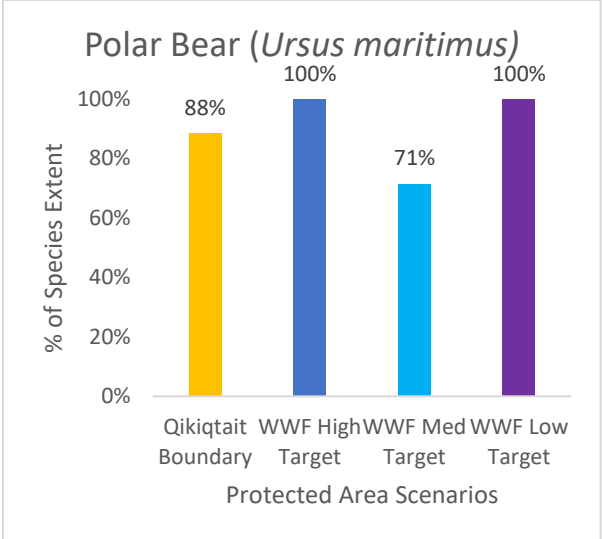


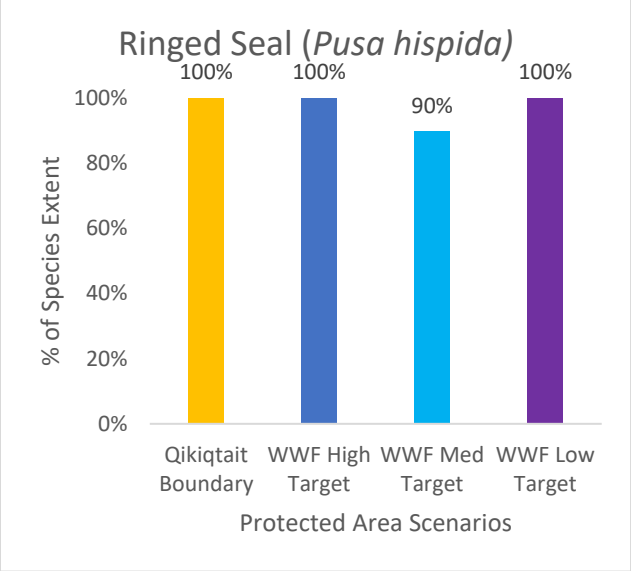


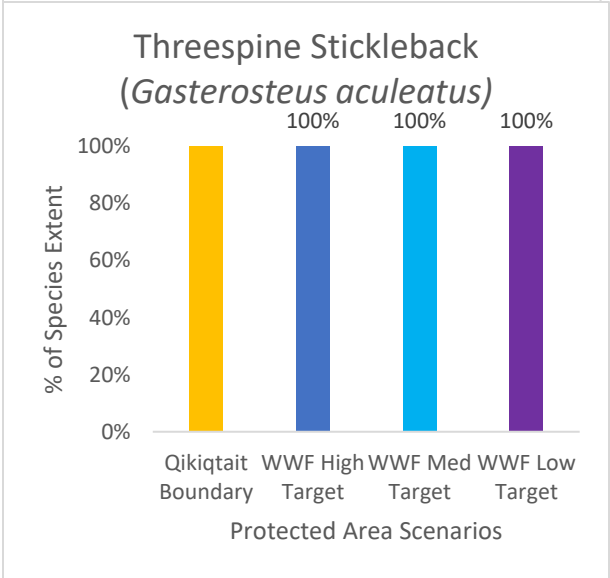





Beluga (*Delphinapterus leucas*)
100%
100%
74%
100%
100%
80%
60%
40%
20%
0%
% of Species Extent
Qikiqtait Boundary
WWF High Target
WWF Med Target
WWF Low Target
Protected Area Scenarios


Polar Bear (*Ursus maritimus*)
88%
100%
71%
100%
100%
80%
60%
40%
20%
0%
% of Species Extent
Qikiqtait Boundary
WWF High Target
WWF Med Target
WWF Low Target
Protected Area Scenarios


Ringed Seal (*Pusa hispida*)
100%
100%
90%
100%
100%
80%
60%
40%
20%
0%
% of Species Extent
Qikiqtait Boundary
WWF High Target
WWF Med Target
WWF Low Target
Protected Area Scenarios


Threespine Stickleback (*Gasterosteus aculeatus*)
100%
100%
100%
100%
80%
60%
40%
20%
0%
% of Species Extent
Qikiqtait Boundary
WWF High Target
WWF Med Target
WWF Low Target
Protected Area Scenarios

Appendix II: NCRI Identified Species and Taxonomic Groups Included Within Sanikiluaq PACs and WWF PACs

Species	*Latin Name*	Sanikiluaq Priorities	Included in Qikiqtait?	WWF Scenarios
Alpine Pond Weed	*Potamogeton alpinus*	4	Yes	Top, Medium, Low
American Black Duck	*Anas rubripes*	1, 2, 3, 4	Yes	Top, Medium, Low
Arctic Char	*Salvelinus alpinus*	1, 2, 3, 4	Yes	Top, Medium, Low
Arctic Cisco	*Coregonus autumnalis*	1, 2, 3, 4	Yes	Top, Medium, Low
Arctic Cod; Polar Cod	*Boreogadus saida*	1, 3, 4	Yes	Top, Medium, Low
Arctic Eelpout	*Lycodes reticulatus*	1	Yes	Top, Medium, Low
Arctic Flounder	*Liopsetta glacialis*	3, 4	Yes	Top, Medium, Low
Arctic Moonsnail	*Cryptonatica affinis*	1, 2, 3, 4	Yes	Top, Medium, Low
Atlantic Cod	*Gadus morhua*	1, 3, 4	Yes	Top, Medium, Low
Atlantic Herring	*Clupea harengus*	1, 3, 4	Yes	Top, Medium, Low
Atlantic Spiny Lumpsucker	*Eumicrotremus spinosus*	1	Yes	Top, Medium, Low
Atlantic Walrus, Central / Low Arctic Population	*Odobenus rosmarus rosmarus*	1, 2, 3, 4	Yes	Top, Medium, Low
Atlantic Wolffish	*Anarhichas lupus*	1	Yes	Top, Medium, Low
Aurora Pout; Aurora Unernak	*Gymnelus retrodorsalis*	1, 3, 4	Yes	Top, Medium, Low
Barnacle	*Cirripedia*	1,2	Yes	Top, Medium, Low
Basket Star	*Euryalina*	1	Yes	Top, Medium, Low
Bearded Seal	*Erignathus barbatus*	1, 2, 3, 4	Yes	Top, Medium, Low
Beluga	*Delphinapterus leucas*	1, 2, 3, 4	Yes	Top, Medium, Low
Black Guillemot	*Cepphus grylle*	1, 2, 3, 4	Yes	Top, Medium, Low
Boreal Armhook Squid	*Gonatopsis borealis*	1, 3, 4	Yes	Top, Medium, Low
Bowhead Whale	*Balaena mysticetus*	1, 2, 3, 4	Yes	Top, Medium, Low
Brook Trout	*Salvelinus fontinalis*	3, 4	Yes	Top, Medium, Low
Bull Trout	*Salvelinus confluentus*	1	Yes	Top, Medium, Low
Cackling Goose	*Branta hutchinsii*	1, 2, 3, 4	Yes	Top, Medium, Low
Capelin	*Mallotus villosus*	1, 2, 3, 4	Yes	Top, Medium, Low
Common Cockle	*Cerastoderma edule*	1 ,2 ,3 ,4	Yes	Top, Medium, Low
Hudson Bay Common Eider	*Somateria mollissima sedentaria*	1, 2, 3, 4	Yes	Top, Medium, Low
Common Merganser	*Mergus merganser*	1, 2, 3, 4	Yes	Top, Medium, Low
Common Tern	*Sterna hirundo*	1 ,2 ,3 ,4	Yes	Top, Medium, Low
Dolly Varden	*Salvelinus malma*	1, 3, 4	Yes	Top, Medium, Low

Dulse	*Palmaria palmata*	1, 2 ,3 ,4	Yes	Top, Medium, Low
Edible Kelp	*Laminariales*	1, 2, 3, 4	Yes	Top, Medium, Low
Flexed Gyro	*Gyraulus deflectus*	1	Yes	Top, Medium, Low
Greater Scaup	*Aythya marila*	1, 2, 3, 4	Yes	Top, Medium, Low
Greenland Cod	*Gadus ogac*	1, 2, 3, 4	Yes	Top, Medium, Low
Greenland Halibut; Turbot	*Reinhardtius hippoglossoides*	1, 3	Yes	Top, Medium, Low
Harbour Seal; Ranger Seal	*Phoca vitulina concolor*	1, 4	Yes	Top, Medium, Low
Harp Seal	*Pagophilus groenlandicus*	1, 2, 4	Yes	Top, Medium, Low
Hermit Crab	*Paguroidea*	1, 4	Yes	Top, Medium, Low
Hollow Stemmed Kelp	*Laminaria longicruris*	1, 2, 3, 4	Yes	Top, Medium, Low
Icelandic Scallop	*Chlamys islandica*	1, 2, 3, 4	Yes	Top, Medium, Low
Jellyfish	*Aurelia*	1	Yes	Top, Medium, Low
King Eider	*Somateria spectabilis*	1, 3, 4	Yes	Top, Medium, Low
Lake Cisco	*Coregonus artedi*	1, 3, 4	Yes	Top, Medium, Low
Lake Trout	*Salvelinus namaycush*	1	Yes	Top, Medium, Low
Land Locked Char; Red Lake Trout	*Salvelinus alpinus*	1, 3	Yes	Top, Medium, Low
Least Cisco	*Coregonus sardinella*	1	Yes	Top, Medium, Low
Long-tailed Duck	*Clangula hyemalis*	1, 2, 3, 4	Yes	Top, Medium, Low
Lumpsucker; Lumpfish	*Cyclopterus lumpus*	1, 2, 3, 4	Yes	Top, Medium, Low
Lutken's Eelpout	*Lycodes luetkenii*	1	Yes	Top, Medium, Low
Naked Sea Butterfly	*Clione limacina*	1, 3, 4	Yes	Top, Medium, Low
Narwhal	*Monodon monoceros*	1	Yes	Top, Medium, Low
Northern Hagfish	*Myxine glutinosa*	1, 3	Yes	Top, Medium, Low
Northern Horsemussel	*Modiolus modiolus*	1, 2, 3, 4	Yes	Top, Medium, Low
Northern Shrimp	*Pandalus borealis*	1, 2, 3, 4	Yes	Top, Medium, Low
Polar Bear	*Ursus maritimus*	1, 2, 3, 4	Yes	Top, Medium, Low
Polar Eelpout	*Lycodes reticulatus*	1, 3	Yes	Top, Medium, Low
Polar Sea Star	*Leptasterias polaris*	1	Yes	Top, Medium, Low
Pough; Hamecon; Rough Hookear Sculpin	*Artediellus scaber*	1	Yes	Top, Medium, Low
Rainbow Smelt	*Osmerus mordax*	1, 2, 3, 4	Yes	Top, Medium, Low
Ringed Seal	*Pusa hispida*	1, 2, 3, 4	Yes	Top, Medium, Low
Rock Ptarmigan	*Lagopus muta*	1, 3, 4	Yes	Top, Medium, Low
Ross's Gull	*Rhodostethia rosea*	1, 3, 4	Yes	Top, Medium, Low

Ross's Goose	*Chen rossii*	1, 2, 4	Yes	Top, Medium, Low
Round Whitefish; Frost Fish	*Prosopium cylindraceum*	1, 3	Yes	Top, Medium, Low
Sea Colander	*Agarum cribosum*	1, 2, 3, 4	Yes	Top, Medium, Low
Sea Cucumber	*Holothuroidea*	1, 3	Yes	Top, Medium, Low
Sea Urchin	*Echinoidea*	1	Yes	Top, Medium, Low
Shorthorn Sculpin	*Myoxocephalus scorpius*	1	Yes	Top, Medium, Low
Shulupaoluk	*Lycodes jugoricus*	1	Yes	Top, Medium, Low
Slimy Sculpin	*Cottus cognatus*	1, 3	Yes	Top, Medium, Low
Snow Goose	*Chen caerulescens*	1, 3, 4	Yes	Top, Medium, Low
Spiny Sour Weed	*Datura stramonium*	1, 3, 4	Yes	Top, Medium, Low
Surf Scoter	*Melanitta perspicillata*	1, 2, 3, 4	Yes	Top, Medium, Low
Thorny Skate	*Amblyraja radiata*	3, 4,	Yes	Top, Medium, Low
Threespine Stickleback	*Gasterosteus aculeatus*	1, 3, 4	Yes	Top, Medium, Low
Threespot Eelpout	*Lycodes rossi*	1	Yes	Top, Medium, Low
Toad Crab	*Hyas araneus*	1, 3, 4	Yes	Top, Medium, Low
Toothed Cod	*Arctogadus glacialis*	1, 3, 4	Yes	Top, Medium, Low
Tortoiseshell Limpet; Plant Limpet	*Cellana radians*	1, 3, 4	Yes	Top, Medium, Low
Truncate Softshell Clam	*Mya truncata*	1, 2, 3, 4	Yes	Top, Medium, Low
Tundra Swan	*Cygnus columbianus*	1, 3, 4	Yes	Top, Medium, Low
Twohorn Sculpin	*Icelus bicornis*	1	Yes	Top, Medium, Low
Unknown Fish	n/a	3	Yes	Top, Low
Variableleaf Pondweed	*Potamogeton gramineus*		Yes	Top, Medium, Low
Whelk	*Bussinum undatum*	1, 3, 4	Yes	Top, Medium, Low
Whitestem Pondweed	*Potamogeton praelongus*	1, 3, 4	Yes	Top, Medium, Low
Winter Flounder; Black-back Flounder	*Pseudopleuronectes americanus*	1, 3, 4	Yes	Top, Medium, Low