Fisheries co-management: A case study in the Canadian Beaufort Sea Large Ocean Management Area

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Abstract

In the Inuvialuit Settlement Region (ISR), fisheries have been jointly managed by the Inuvialuit and the Government of Canada (DFO) through the Fisheries Joint Management Committee (FJMC) for over thirty years. Given such a long history of cooperation on a broad range of fisheries-related issues that go from developing joint workshops and integrating science and traditional ecological knowledge to the establishment of marine protected areas and fisheries management plans, it is recognized that co-management strategies have been implemented successfully in managing the fishery resources in the Beaufort Sea Large Ocean Management Area (BS LOMA). This research aims to identify the conditions that contribute to the success of fisheries co-management practice in the BS LOMA.

Key words: co-management, fisheries, Beaufort Sea Large Ocean Management Area, Inuvialuit Settlement Region, Fisheries Jointly Management Committee, beluga

Acronyms

AANDC	Aboriginal Affairs and Northern Development Canada
BSIMPI	Beaufort Sea Integrated Management Planning Initiative
CAPP	Canadian Association of Petroleum Producers
DFO	Fisheries and Oceans Canada
EIRB	Environmental Impact Review Board
EISC	Environmental Impact Screening Committee
FJMC	Fisheries Joint Management Committee
HTC	Hunters and Trappers Committees
IDC	Inuvialuit Development Corporation
IGC	Inuvialuit Game Council
IRC	Inuvialuit Regional Corporation
ISR	Inuvialuit Settlement Region
WMAC (NWT)	Wildlife Management Advisory Council (Northwest Territories)
WMAC (NS)	Wildlife Management Advisory Council (North Slope)

1.Introduction

The Canadian Beaufort Sea is located in the northwest corner of Canada. It stretches east from the Canada/Alaska border, past the Delta of the Mackenzie River, and to the eastern boundary of the Amundsen Gulf (Ayles, Porta & Clarke, 2016). Its surface is completely frozen during much of the year, until the ice starts melting in the near shore area around August and September (Marine Conservation Institute, n.d.). The Beaufort Sea Large Ocean Management Area (BS LOMA) is one of the priority areas identified for integrated ocean management planning by the Government of Canada and it encompasses the marine portion of the Inuvialuit Settlement Region (ISR) (see Fig.1) (Fisheries and Oceans Canada (DFO), 2017; Niemi, Johnson, Majewski & William, 2012). The Inuvialuit have been living in the land surrounding the Beaufort Sea for some 800 years, and they have systematically interacted with the marine environment and its resources (Inuvialuit Regional Corporation (IRC, 2018a). The BS LOMA is a very important bioregion in the western Arctic which includes a variety of fish, birds, and marine mammals (World Wildlife Fund Canada (WWF Canada, n.d.). Among those, fish and marine mammals play critical roles in supporting the Inuvialuit communities' livelihoods and maintaining cultural identities (Rompkey & Patterson, 2010). Although the social, economic and environmental context in the ISR has changed significantly in the last few decades and Inuvialuit individuals and communities are now engaged in a wage economy, hunting and fishing (especially subsistence fishing) is still of great importance to the livelihoods of the Inuvialuit communities (Ayles et al., 2007). The Inuvialuit have inhabited the shores of the Beaufort Sea, and of the Mackenzie River delta for generations (Beaufort Sea Partnership, 2018), and they now live in six communities (Aklavik, Inuvik, Ulukhaktok, Paulatuk, Sachs Harbour and Tuktoyaktuk).

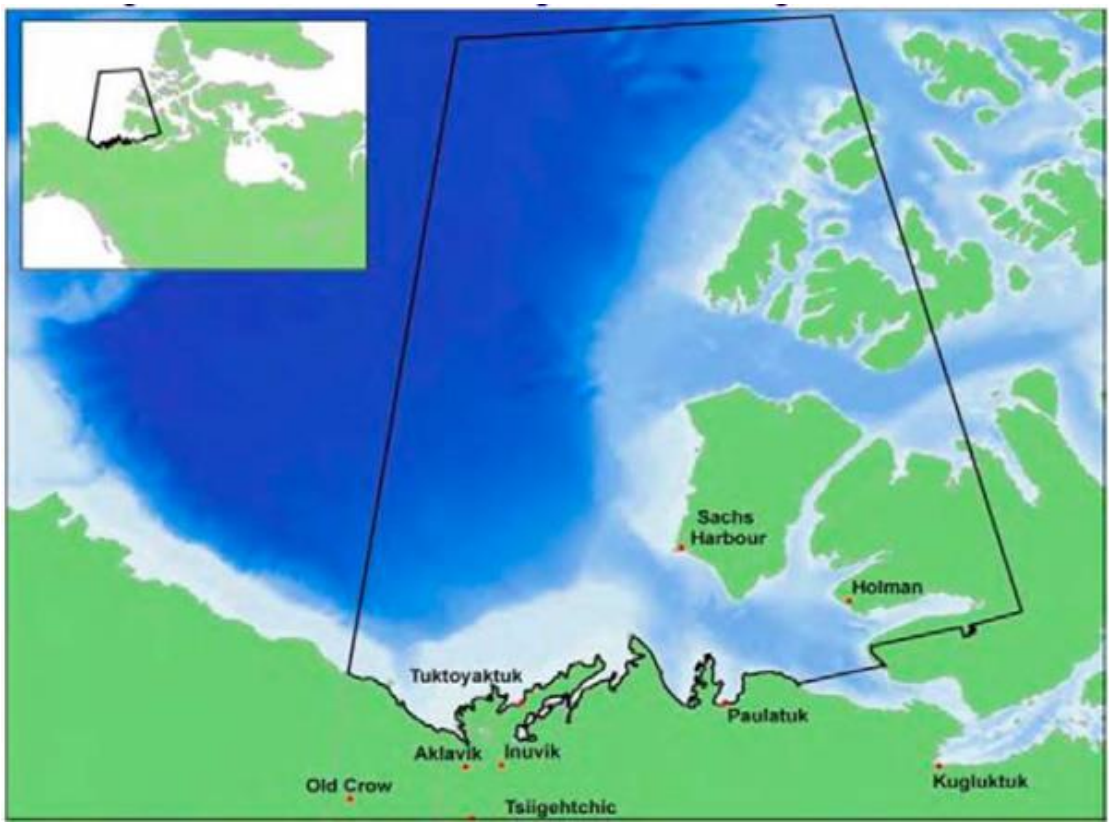

Figure 1: Beaufort Sea Large Ocean Management Area. DFO. (2016a).

In the ISR, fisheries have been jointly managed by the Inuvialuit and the Government of Canada (DFO) through the Fisheries Joint Management Committee (FJMC) over thirty years (FJMC, n.d.a). The FJMC is the co-management board with responsibilities for fish and marine mammals within the ISR (Joint Secretariat, 2018 a). The prominent reason for adopting a co-management approach to manage fisheries in this region derived from the provisions of the Inuvialuit Final Agreement (IFA) which was signed between the Inuvialuit and the Government of Canada in 1984 (IFA) (Ayles, Porta & Clarke, 2016). According to the IFA, Inuvialuit should be equally and meaningfully involved in the northern and national economy and society, and in protecting the Arctic wildlife, environment and biological productivity of the region (IRC, 2018a ; DFO & FJMC, 2014). Established by the IFA, the FJMC work closely with a broad range of partners, such as governmental agencies, resource users, resource councils and other land claim groups on a variety of activities (FJMC, n.d.b). It is recognized that the cooperation between those bodies covers a variety of fisheries

management issues ranging from organizing joint workshops on science and traditional ecological knowledge (TEK) and undertaking harvest and environmental monitoring to establishing fisheries management plans and marine protected areas (Ayles, Porta & Clarke,2016).

Social, economic and environmental changes are on the way in the region, as climate change is triggering sea ice retreats making the waters and thus the marine resources in the BS LOMA more accessible than in the past (Rompkey & Patterson, 2010). As a result, the long-term health of the fishery resources in the region could be affected by potential stressors, such as increased shipping, the development of commercial fisheries, aquatic invasive species and contaminants (DFO & FJMC, 2014). In a time of potential transformations, it is important to examine existing fisheries co-management systems in the BS LOMA and thus identify the system's strengths and gaps in order to help further improve the fisheries co-management regime in this region. This research aims to identify the conditions that contribute to the success of fisheries co-management in the BS LOMA, and to assess how this case may be of applicable elsewhere, particularly for other indigenous fisheries in Canada.

This paper will first describe the methodological approach followed for this study, as well as providing a background of literature on co-management and its application in fisheries management. Second, this paper will discuss fishery resources and the current management regimen of fisheries in the BS LOMA, with a focus on beluga management. Finally, through examining the fisheries co-management practices in the BS LOMA, especially the beluga management experience, the conditions that account for the success of fisheries co-management in the BS LOMA will be identified. The conclusion reflects on how this management regime could be of use by other indigenous fisheries in Canada.

2. Methodology

An analysis of fishery co-management practices in the BS LOMA was conducted mainly through a review of gray literature (e.g. policy documents, reports) and scholarly literature (journal articles and books on fisheries co-management). To figure out what are the criteria through which successful fishery co-management can be determined, literature was reviewed to identify a number of criteria that can measure successful co-management. A list of criteria that is applicable to the BS LOMA has been assembled. Additionally, literature review associated with the legislation, management plans and institutional arrangement and programs of fisheries co-management in the BS LOMA was conducted to identify the conditions that have contributed to the success of fisheries co-management in the BS LOMA. Among the co-management cases in the BS LOMA, especial consideration will be given to beluga, for several reasons. Beluga is a species of great importance the Inuvialuit, both culturally and socially, and it constitutes a cornerstone of the Inuvialuit subsistence diets (FJMC, n.d.f). Also, co-management strategies are well known, and have been implemented for a long time, helping to protect and conserve belugas and their habitats in the IS. These strategies included considering beluga monitoring and research as a priority for the Inuvialuit and the FJMC in the ISR (FJMC, n.d.d; FJMC, 2013). In this paper, the co-management of beluga was selected as a case study to explore the conditions that account for the success of fisheries co-management in the BS LOMA. Furthermore, a stakeholder analysis which focused on analyzing the key parties involved in the fisheries co-management regime in the BS LOMA was conducted. Through specifying the primary stakeholders' respective roles and responsibilities related to fisheries management in the BS LOMA, it is easier to understand the institutional arrangements established for co-managing fisheries and the interactions among these major participants.

3. Co-management and its application in fisheries management

3.1 The context for the prevailing of fisheries co-management

In Canada, ocean legislation has proposed co-management as a desirable management approach to include coastal communities in coastal and marine management (DFO,1999). The Canada's Oceans Act stated that DFO should collaborate with other agencies of the Government of Canada, with provincial and territory governments and with affected aboriginal organizations, coastal communities and other persons and bodies to facilitate the management of estuarine, coastal and marine ecosystems (Oceans Act (S.C. 1996, c. 31)). Furthermore, the proposed amendments to the Fisheries Act which were announced in February 2018 emphasized that the roles of Indigenous peoples in project reviews, monitoring and policy development related to fisheries, should be strengthened (DFO, 2018a). This initiative is in line with the Canada's adoption of the UN declaration on rights of Indigenous Peoples (UNDRIP), which recognized the necessity of fully respecting indigenous peoples' human rights, as well as rights with respect to self-determination, equality, resources, among others (Fontaine, 2016). With Canada endorsing UNDRIP, there is an increasing obligation to incorporate indigenous peoples into the decision-making process of policy and management measures that may affect their well-beings (Fontaine, 2016). In fact, in the Canadian Western Arctic, where the land claim agreements were in place, the requirement for enhancing the resources users' control over the natural resource is based on strong legal grounds (Ayles et al., 2016). Internationally, since the 1990s an increasing number of local or regional co-management mechanisms developed around the world (Linke & Bruckmeier, 2015). Additionally, in recent years, traditional fishery management regimes are questioned as fisheries in many parts of the world continue to be under pressure or in crisis, failing to ensure sustainable fishing practices (Sen & Nielsen,1996； Hoof, 2010). It is recognized that recurrent fisheries crises are indicators that the top-down, bureaucratic approach to fisheries management needs to be transformed and that new approaches should be tried out (Jentoft, McCay & Wilson, 1998). In particular, there has been growing recognition that user groups must become more actively involved in fisheries management if the regime is to be effective and legitimate (Sen & Nielsen,1996). In this context, "co-management has been proposed as a promising strategy to achieve sustainable

fisheries since it has the potential to strengthen community integration, enhance fishing stocks, empower resource users, adapt to changing conditions and incorporate both fishers' knowledge and scientific information in management strategies" (Rivera, Gelcich & Acuña, 2014, P. 300).

There are many definitions of co-management, but there is a broad understanding that co-management is a governance approach that is defined by sharing of power and decision-making responsibility between resource users and governmental bodies (Tyson, 2017; Sen & Nielsen,1996; Carlsson & Berkes, 2005). It is recognized that natural resources, such as fisheries, forests, watersheds, wildlife, protected areas and others, are difficult to be effectively governed by a single agency in a classic top-down approach (Berkes, 2009). The wicked nature of environmental problems, limited resources available to governments, and an increasing call from resources users to be involved in management decisions are making co-management in natural resources, particularly coastal and marine resources more prevailing (Fanning, 2000). According to Sajise (1995), community-based resource management is a process through which resource users are given the opportunity and responsibility to manage their own resources and to define their needs, objectives and to make decisions affecting their benefits. In fact, the involvement of communities in resource management is regarded as a central element of co-management (Pomeroy, 1998) because co-management ideally involves partnership arrangements among governments, resource users, and local communities (Coral Triangle Support Partnership (GTSP), 2013).

3.2 Types of co-management

Fisheries co-management arrangements have been classified into five broad types (Table.1) in terms of the degrees of power sharing and integration of local and centralized government management systems (Pomeroy & Rivera-Guieb, 2005; Sen & Nielsen,1996)

Table. 1 The five broad types of co-management.

Instructive:	Only minimum information is exchanged between the governments and fisher groups. It differs from traditional centralized management systems in that the mechanism for dialogue is in place for the users, but this process tends to be government informing fishers on the decisions they plan to make.
Consultative:	This involves mechanisms in place for governments to consult with the fishers, but all the decisions are led by the governments.
Cooperative:	Governments cooperate with the fishers equally in decision making.
Advisory：	Fishers advise the governments of decisions to be adopted and the governments endorses the decisions.
Informative:	Governments have delegated power of making decisions to fisher groups and thus the fishers are responsible for informing the governments of these decisions.

In reality, the amount and types of authority and responsibility that governments and communities have will differ in terms of place-specific circumstances (Pomeroy & Rivera-Guieb, 2005). Pinkerton (2003) suggested that complete co-management is one that includes the exercising of rights at multiple levels and the development of diverse connections among stakeholders. Also, it has been stated that real co-management requires that resource users are not only involved in decision making, but also given the authority to make and implement regulatory decisions (Fanning, 2000).

3.3 Conditions account for successful co-management

Literature review has allowed the author to identify a series of conditions/criteria for achieving successful co-management (Pomeroy, Katon & Harkesc, 2001；Fanning, 2000；Pomeroy & Mcconney, 2007). First, it is well recognized that supportive legislation and policy for adopting co-management need to be in place if the

co-management initiatives are to be successful (Pomeroy et al., 2001). Second, appropriate boundaries, which include the size of the area to be managed and the people with rights to fish in the bounded fishing area need to be clearly defined (Pomeroy & Mcconney, 2007). Third, research by Ostrom suggested that ensuring those affected by the rules can participate in modifying the rules is required for achieving successful co-management (Fanning, 2000). True co-management does not only seek to ensure that the resource users' voice can be heard but also to allow the resource users to be involved in making and implementing regulatory decisions (Fanning, 2000); Fourth, group cohesion is regarded essential as a certain degree of commonality among a group is importance for successful implementation of co-management (Pomeroy, Katon & Harkes, 1998). The share characteristics of fishing communities who dwell at the area being managed generally could be measured by different indicators, such as kinship, ethnicity, religion or even fishing gear type of the fishermen groups (Pomeroy et al., 1998). Fifth, the benefit of adopting co-management should outweigh the cost (Trimble & Berkes, 2015; Pomeroy & Mcconney, 2007). This means that individuals expect that the benefits of being involved in co-management practice should exceed the costs of investments in such activities, and this condition has been considered rather important to account for the success and sustainability of co-management (Pomeroy et al., 1998). Sixth, conflict management mechanism should be in place because "arbitration and resolution of disputes are imperative when conflicts arise over co-management and institutional arrangements." (Pomeroy et al., 2001). It is recognized that if mechanisms are established for dispute resolution, there is a better chance to address multiple interests among different stakeholders in an equitable and sustained manner (Castro & Nielsen, 2001). Finally, provision of financial resources/budget is also necessary for sustaining success co-management practices (Pomeroy et al., 2001). As mentioned previously, co-management is a process that include a variety of activities, such as identifying the management issue, developing working groups, making management plans, reviewing and assessing the implementation of management plans and so on (DFO, 1999; Pomeroy et al., 1998).

3.4 Adaptive co-management

The experience of co-management practices from a number of cases worldwide indicates that co-management is not a fixed state but a process that deals with evolving contexts and that includes processes of feedback learning (Berkes, 2007). This means that co-management should be adaptive in order to deal with natural resource management under variable, uncertain and complex conditions (Armitage, Berks, 2007). The critical features of adaptive co-management include the emphasis on learning-by-doing, integration of various knowledge systems, cooperation and power sharing among different stakeholders and management flexibility (Berkes, 2007). It is recognized that the parties and their relative influence, positions and activities are continuously changing within co-management systems (Carlsson & Berkes, 2005), and adaptive approaches are indeed imperative. Aside from changing relationships among the stakeholders within a co-management system, the environmental and contexts in which co-management exists also undergo uncertainties and change (Armitage, Berks, 2007). For example, in the Canadian Arctic, indigenous communities have gone through rapid social, economic, culture and environmental transformations in a matter of decades (Rompkey & Patterson, 2010), which including moving to permanent settlements and the negotiation and formation of the settlements regions (Inuvialuit Pitqusiit Inuuniarutait: Inuvialuit Living History, n.d.). The changing context is now exacerbated by the transformation brought in by climate change (Rompkey & Patterson, 2010). In addition, it is recognized that the policy context is evolving as Canada endorsed the UNDPIR in 2010, which requires more consultation with Indigenous Peoples on any legislation or administrative measures that affect their well-being (Fontaine, 2016). More recently, the amendments to the Fisheries Act were proposed this year, which shows the government's commitment to further promote the participation of indigenous communities in fisheries management to help achieve sustainable fisheries in Canada (DFO, 2018a). To better deal with changing circumstance and improve the adaptive capacity of institutions within co-management regimes, diversifying channels of

communication, building trust and establishing problem-solving networks are essential (Berkes, 2007), in particular in a cross-cultural context such as the Canadian Arctic.

4. The existing fisheries management system in the BS LOMA

4.1 Background of fishery resources and fisheries management

In the BS LOMA, fisheries resources consist of anadromous coastal fishes, such as Dolly Varden Char (Salvelinus malma), Arctic Char (Salvelinus alpinus), Arctic Cisco (Coregonus autumnalis) and marine mammals, such as Beluga (Delphinapterus leucas), and Ringed Seal (Phoca hispida). There are also stocks of marine fishes (e.g., Pacific Herring (Clupea pallasii), Saffron Cod (Eleginus gracilis)) (Niemi, Johnson & Williams, 2012). It has been noted that the Canadian Beaufort Sea is one of the last regions that has not experienced large scale development of commercial fisheries (Ayles et al., 2016). Although limited species of fish and marine mammals were commercially harvested for a period of time decades ago (DFO & FJMC, 2014), currently, all the fisheries in the BS LOMA are classified as subsistence (Niemi et al., 2012; DFO & FJMC, 2014). In reality, marine mammals and anadromous fish stocks are of great importance to the Inuvialuit as these resources are their major sources for food, and their harvesting is embedded in the identity of their culture since time immemorial (Rompkey & Patterson, 2010). Therefore, these resources are important in terms of both food and cultural securities. Among the fisheries resources in this region, beluga (Delphinapterus leucas) deserves special attention because this species plays a key role in supporting the Inuvialuit's livelihood and maintaining the continuity of culture identity (FJMC, n.d.f). It is also a clear example of successful co-management as it will be shown later.

In Canada, the Fisheries and Oceans Canada **(DFO)** is endowed with authority for managing fisheries in terms of the roles and responsibilities outlined in the Fisheries Act (DFO, 2016b). However, in the BS LOMA, where a comprehensive land claim

agreement is in place, fish and marine mammals and their habitats have been jointly managed by the Inuvialuit and the Government of Canada (DFO) through the FJMC co-management board (Ayles et al., 2016; FJMC, n.d.a). The FJMC is committed to ensure that the renewable natural resources, including fisheries of the ISR are managed and preserved for the sustainable use of present and future generations of the Inuvialuit (FJMC, n.d.a).

4.2 Legal basis of fisheries co-management

The FJMC was established in 1986 as a consequence of the Inuvialuit Final Agreement (IFA), which was signed between the Government of Canada and the Inuvialuit in1984 (FJMC, n.d.a). In the IFA, Inuvialuit consented to give up their exclusive rights of utilizing their ancestral lands in exchange for guaranteed rights in relation to land, wildlife management and money from the Government of Canada (IRC, 2018a). The main goals of the IFA include "…to preserve the cultural identity and value of the Inuvialuit within a changing northern society; to enable Inuvialuit to be involved equally and meaningfully in the northern and national economy and society; to preserve the Arctic wildlife, environment and biological productivity…" (IRC, 2018a). The signing of the IFA has provided solid legitimacy for implementing co-management strategies in the BS LOMA fisheries. It is recognized that "Federal legislation, including the Fisheries Act and discretionary powers under that Act, must be interpreted in light of the commitments made by Canada in the IFA. Where there is any inconsistency or conflict between the IFA and the Fisheries Act, the IFA prevails to the extent of the inconsistency or conflict." (Ayles et al., 2016, P. 250). Aside from FJMC, the IFA also led to the establishment of the Inuvialuit Regional Corporation (IRC) and the Inuvialuit Game Council (IGC) (Ayles et al., 2016). These two organizations are also major players in fisheries co-management in the BS LOMA (Joint Secretariat, 2018b), as will be further discussed in the following stakeholder description.

4.3 Major Stakeholders involved in fisheries co-management

a. FJMC

As the co-management board that is responsible for managing and preserving the fisheries and their habitats in the ISR, the FJMC has been working closely with the Inuvialuit and DFO over three decades (FJMC, n.d.a). In fact, the committee of the FJMC is comprised of two members appointed by the Minister of Fisheries and Oceans Canada and two members appointed by the Inuvialuit (Inuvialuit Game Council). The fifth member, the Chair, is selected by the appointed members (Joint Secretariat, 2018a). The constitution of the members of the FJMC ensures that the voices from both the Inuvialuit and DFO are heard, and thus reflect the representativeness of both groups equally (FJMC, n.d.c). The FJMC advise the Minister of DFO on fisheries issues and make recommendations on subsistence quotas for fish and marine mammals (Joint Secretariat, 2018a).

b. DFO

The Fisheries and Oceans Canada (DFO) is the federal lead for managing Canada's fisheries, oceans and freshwater resources, and safeguarding its waters (Government of Canada, 2018). In the Canadian Western Arctic, DFO is responsible for implementing obligations related to fisheries under a series of Canadian land claims agreements (DFO & FJMC, 2014). The responsibilities of DFO regarding fisheries management in the Canadian Beaufort Sea include conserving fish stocks, ensuring access to fish and marine mammals for subsistence purposes, regulating access to commercial, domestic and recreational fisheries and protecting fisheries habitat (Rompkey & Patterson, 2010). As one of the primary members of the fisheries co-management bodies, DFO plays an important role in helping assess fisheries management issues, and in developing working groups, management plans and research programs in partnership with the FJMC, HTCs, IGC and the Inuvialuit (Ayles et al., 2007).

c. IGC

As an Inuvialuit membership board, the IGC represents the collective Inuvialuit interest in managing and protecting the wildlife and wildlife habitat in the ISR (Joint Secretariat, 2018b). This responsibility endows the IGC with authority for dealing with matters associated with harvesting rights, renewable resource management, and conservation (Joint Secretariat, 2018b). According to its duties outlined in the IFA, the IGC is responsible for "appointing members to the co-management and other boards with any aspect of wildlife usage in the ISR; advising governments on policy, legislation, regulation, and administration regarding wildlife, conservation, research, management and enforcement; assigning community hunting and trapping areas; allocating quotas among the six Inuvialuit communities; reviewing and advising government on any proposed Canadian position for international purposes that affects ISR wildlife and appointing members to any Canadian delegations dealing with matters affecting wildlife harvesting in the ISR" (IGC, 2016). The IGC is comprised of a chair and two representatives appointed by Hunters and Trappers Committee (HTC) in each of the six ISR communities (Joint Secretariat, 2018b). Additionally, the chair is from any of the Inuvialuit communities and elected by the 42 HTC Directors (IGC, 2016).

d. IRC

The IRC is an Inuvialuit board that represents the collective interest of the Inuvialuit in dealing with governments and the outside world. Unlike the IGC, the IRC aims to improve the overall social, economic and cultural well-being of the Inuvialuit through implementing the IFA and other supplementary means (IRC, 2018b). The IRC is directly controlled by the Inuvialuit communities through the six Community Corporations which are made up of six elected directors and one chair (IRC, 2018c). There are no responsibilities related to fisheries directly assigned to the IRC, but IRC is responsible to control the Inuvialuit Development Corporation (IDC) and that means the IRC would eventually decide the role of any IDC commercial fisheries (DFO & FJMC, 2014).

e. HTCs

The Hunters and Trappers Committees (HTCs) in the six Inuvialuit communities have been established under the IFA (The Community of Aklavik, the Wildlife Management Advisory Council (NWT) & the Joint Secretariat, 2008). The HTCs' fisheries related responsibilities include: advising the IGC on the requirements of subsistence users with respect to fish, sub-allocating any Inuvialuit quota set for fish, assisting in collecting harvest data, participating in the regulation of the subsistence harvest and encouraging and promoting Inuvialuit's involvement in research, management enforcement and utilization associated with the wildlife resources in the ISR (Indian and Northern Affairs Canada (INAC), 1984). Each Inuvialuit community has a community corporation and the six Community Corporations (Aklavik, Inuvik, Paulatuk, Sachs Harbour, Tuktoyaktuk and Ulukhaktok) created the six HTCs and decided the qualification of the membership of the HTCs (IRC, 2018c). It is recognized that the presence of the HTCs is beneficial to encourage and promote the Inuvialuit participation in conserving, researching, managing, and utilizing the natural resources in the ISR (The Community of Sachs Harbour, Wildlife Management Advisory Council (NWT) & Joint Secretariat, 2008) .

Beyond the primary stakeholders mentioned above (who are regularly involved in the fisheries co-management in the ISR), there are others that may affect fisheries co-management practices in the BS LOMA under particular circumstances. At the governmental level, aside from the federal government (especially DFO), the territorial governments of the Northwest Territories and the Yukon may play roles in the fisheries management because they share overall management responsibilities in the ISR (Joint Secretariat, 2009). In addition, non-governmental organizations, such as the Wildlife Management Advisory Council (Northwest Territories) (WMAC (NWT)), Wildlife Management Advisory Council (North Slope) (WMAC (NS)), Environmental Impact Screening Committee (EISC) and the Environmental Impact Review Board (EIRB) may also be involved in the co-management process of fishery resources, appropriate to their responsibilities and interests (DFO & FJMC, 2014;

Joint Secretariat, 2009).

4.4 Institutional arrangement

The fisheries co-management in the BS LOMA is based on sharing of management responsibilities between the Inuvialuit beneficiaries and the related governmental agency (Ayles et al., 2007). After specifying the major stakeholders involved in fisheries co-management in the previous section, I will now discuss the institutional arrangement that are in place for implementing the co-management strategies in the ISR. As the Inuvialuit' rights of being equally involved in wildlife resources management in the ISR is legally guaranteed (INAC, 1984), their voices regarding fisheries and marine mammals are well heard within the co-management regime. In fact, the consultation and meetings with the six ISR communities and HTCs form an important part of the FJMC's activities (FJMC, n.d.d). In general, any problems or concerns associated with fisheries resources in the ISR would be raised by the Inuvialuit communities or the HTCs (Ayles et al., 2007). Any issues affecting the management of the fisheries can be formally discussed by the FJMC in partnership with the HTC, DFO, and others as appropriate (Ayles et al., 2007). Apart from the compilation of community issues and concerns with respect to fish and marine mammals through regularly scheduled meetings, diverse working groups are also established to assess concerns, evaluate the scientific information and traditional knowledge available, and develop management strategies (FJMC, n.d.e). It is recognized that although concerns and purposes differ in different working groups, they are important to guarantee the working relationships of the FJMC, HTC(s), and DFO, to develop and review goals, and to bring stakeholders together to discuss ongoing work and issues (FJMC, n.d.e). In this way, more opportunities are provided for direct involvement of the Inuvialuit and a shared decision-making process can be achieved (FJMC, n.d.d; FJMC, n.d.e).

Currently, the fisheries working groups that have been created in the ISR are:

Paulatuk Char Working Group (PCWG), Sachs Char Working Group (SCWG), Tuktoyaktuk-Inuvik Working Group (TIWG), Ulukhaktok Char Working Group (UCWG), West Side Working Group (WSWG) (FJMC, n.d.d). After hearing about a community's concerns or issues regarding fishery resources in the ISR and then establishing corresponding working groups to further assess the fisheries issues, fisheries management Plans (FMPs) would be developed by the FJMC, in cooperation with the DFO, HTCs and others (Ayles et al., 2007). To date more than ten FMPs that aim to conserve and manage key fish stocks or stock complexes, such as Arctic char (Salvelinus alpinus), Dolly Varden Char (Salvelinus malma malma) and Inconnu (Stenodus leucichthys), have been published (FJMC, n.d.e). In particular, in 2014, the Beaufort Sea Integrated Fisheries Management Framework (BSIMF) which aims to address the concerns of the six Inuvialuit communities with respect to potential development of large-scale commercial fisheries were jointly developed by the FJMC, IGC, IRC and the DFO (DFO & FJMC, 2014). The development of each fisheries management plan is an ongoing, cyclical process driven by working groups comprised of representatives from each of the involve partners (Ayles et al., 2007). It is the responsibilities for the working groups to "…assess the problem, consider diverse management alternatives, monitor the implementation of the consensus decisions, review the results, and modify the actions at the end of the planning cycle…" (Ayles et al., 2007, P. 127). Additionally, the HTCs, the DFO, and the FJMC are responsible for the final decisions and implementation as well as the reviewing and revision of management plans in the following years (Ayles et al., 2007; FJMC, 2013)

5. Case Study: Beluga co-management in the BS LOMA

5.1 Introduction of beluga resources

To better understand the practice of fisheries co-management in the BS LOMA, and to examine what conditions contribute to the success of this strategy, the beluga co-management case will be discussed in the following sections.

Beluga (Delphinapterus leucas) is a middle-size toothed whale which turns totally white when it reaches sexual maturity. Mating behavior usually occurs between late winter and early spring, and calves are probably born during June and August (DFO,2004). The life span of beluga whales generally ranges from 15 to 30 years and their diet comprises small fish and crustaceans, such as arctic cod and Greenland halibut (DFO, 2004). It is recognized that the Beaufort Sea supports one of the largest population of beluga whales around the world (The Pew Charitable Trust, 2014). Between May and June, beluga whales arrive in the Beaufort Sea after an offshore migration and gather in the Mackenzie River estuary in July (WMAC (NS), 2018). Beluga harvesting generally occurs among Inuvialuit communities that have access to the summer harvesting waters where beluga return each year (Tyson, 2017). It is recognized that Inuvialuit from Aklavik, Inuvik and Tuktoyaktuk usually harvest belugas from the Mackenzia River estuary each summer, and the residents of Ulukhaktok and Sachs Harbour also harvest belugas when they can access to the gathering location of belugas (DFO, 2000). In fact, belugas are one of the most important species to the Inuvialuit, as they have been a cornerstone of the Inuvialuit subsistence diet for generations (FJMC, n.d.f). Beluga whales are certainly part of the Inuvialuit identity (WWF Canada, 2011). Thus, exploring the management of belugas in the Beaufort Sea can provide with valuable insights about the implementation of fisheries co-management in the ISR, as this species has remained a priority for researching and monitoring (FJMC, n.d.f) due to both its cultural importance and its focus in conservation efforts. Beluga, therefore, is a species that is important for several stakeholders, including Inuvialuit communities, DFO, and environmental Non-Governmental Organizations.

5.2 Legislative and policy context

A series of acts and regulations have been enacted to help ensure the long-term health of the beluga population in the eastern Beaufort Sea (FJMC, 2013). First and foremost, as mentioned previously, the Inuvialuit Final Agreement (IFA) provides the Inuvialuit

with rights to co-manage the wildlife resources in the ISR (IRC, 2018a). This means the Inuvialuit are given the authority to control the harvesting and management of belugas in the BS LOMA. Moreover, it is recognized that the advent of the IFA and the subsequent establishment of the FJMC set a new stage of beluga management in the Beaufort Sea (FJMC, 2013). In addition, Canada's Oceans Act, which facilitates the implementation of integrated management of coastal and ocean environments as well as enabling the establishment of marine protected areas (MPA), is an important overarching legislation that provides a comprehensive framework for undertaking the management of Canadian Beaufort Sea belugas (Ayles et al., 2016). Furthermore, the Fisheries Act, which contains the Beluga Protection Regulations that prohibit intentional harassment of belugas also contributes to the protection of belugas in the Beaufort Sea LOMA[1] (Fast, Mathias & Storace, 1998). Nevertheless, when it comes to the aspect of cooperation of beluga management, the IFA is the primary legal framework that specifically stipulates implementing a co-management approach. Besides, it has been suggested that the present and future legislation, policy and management approaches should reflect the provisions of the IFA and to make clear the co-management responsibilities of the Inuvialuit (FJMC, 2013).

5.3 Management Plan

One of the crucial consequences of co-management of belugas in the BS LOMA was the creation of the Beaufort Sea Beluga Management Plans (BSBMPs), which have been regarded as a symbol of the success of cooperative wildlife management efforts established by the IFA (FJMC ,2013). The purpose of the BSBMPs is "to maintain a thriving population of beluga in the Beaufort Sea and to provide for optimum sustainable harvest of beluga by the Inuvialuit" (FJMC, 2013, P. 5). At this moment there are four iterations of BSBMP, from the first one published in 1991 to the latest one created in 2013. The creation of the first Beluga Management plan (BSBMP 1991)

[1] The recent amendments to the Canada's Fisheries Act are promoting better engagement of indigenous peoples in fisheries management, which can further contribute to the development of co-management (DFO, 2018).

was in response to several management issues associated to multiple activities in the Beaufort Sea, including oil, gas and mining exploration and the developments that coupled with these industrial activities, such as "dredging, drilling, seismic and sounding surveys, island/camp maintenance, vessel movements, helicopter and fixed-wing flights, and ice-breaking, shipping routes, port development, possible future commercial fisheries development…" (Fast, Chiperzak & Elliott, n.d. P. 98). The second beluga management plan (BSBMP 1998) was implemented in 1997 when the Canada's Oceans Act was enacted, providing a legal context to establish the BS LOMA (FJMC, 2013). Also, the passage of the Canada's Oceans Act made the creation of Marine Protected Areas (MPAs) a priority (Beaufort Sea Integrated Management Planning Initiative Working Group (BSIMPIWG), 2003). The subsequent revised version of BSBMP incorporated new information, such as more accurate data regarding harvesting of belugas, new data gathered from monitoring projects developed through the co-management process, and new knowledge derived from the Inuvialuit-Inupiat Beluga Whale Commission (FJMC, 2013). For the latest Beluga Management Plan, the most important revision is the inclusion of Tarium Niryutait Marine Protected Areas (TNMPA) (see Fig.3) and an updated science section which included modernized maps of the Canadian Beaufort Sea describing Zones 2 and 3 and the summaries of traditional harvest data (FJMC, 2013). It is recognized that the creation, implementation and continuing revision of the BSBMP highly relied upon the cooperation among the six HTCs, Inuvialuit beluga hunters, the IGC, FJMC and DFO (FJMC, 2013).

5.4 Beluga Hunting Bylaws and Guidelines

Aside from developing and revising the comprehensive BSBMPs, Beluga Hunting Bylaws and Guidelines have been developed by the six HTCs within the ISR, with the collaboration of the FJMC (Inuvialuit Hunters & Trappers Committees, n.d.). The establishment of the Beluga Hunting Bylaws and Guidelines is a good supplement to the BSBMPs because the ongoing specific implementation of these plans require the

commitment and coordination from the Inuvialuit (FJMC, 2005). Complying with these bylaws and guidelines is critical to ensure efficient and safe beluga hunting practices (FJMC, 2013). The by-laws address such topics as equipment needed on the boat, hunting methods and requirements for hunters of collecting samples and measurements (Inuvialuit Hunters & Trappers Committees, n.d.). It is recognized that implementing the Beluga Hunting Bylaws and Guidelines has resulted in several positive outcomes, including reduced struck/lost incidents, decreased wastage and safer hunting practices (FJMC, 2013). The critical point here is that these behavioral rules for beluga hunting were developed by the Inuvialuit representatives themselves (mainly through the HTCs), which has led to better compliance. This is consistent with what has been stated by several authors regarding how community participation generally leads to more effective management of natural resources, as it creates a sense of ownership in fishers/harvesters (Ayles et al., 2007).

In summary, the Beluga Management Plan, together with the associated Community Beluga Hunting By-laws, have been effective in managing harvest-related aspects of the management of the beluga whales in the Beaufort Sea (Fast, Mathias & Storace, 1998), facilitating partnerships between communities and government representatives in the co-management strategies.

5.5 Clearly Defined Boundary of Management Zones

To reflect how local differences must be taken into account in implementing beluga management measures, the latest edition of the Beluga Management Plan (BSBMP 2013) has divided the BS LOMA into five management zones (FJMC, 2013) (see Fig.2). One of the prominent change of the current version of BSBMP is the incorporation of the Tarium Niryutait Marine Protected Areas (TNMPA) which provides legislative protection to sustainable management of the beluga stocks and their habitats (FJMC, 2013). The TNMPA, established in 2010, is Canada's first Arctic MPA and consists of three individual areas called Niaqunnaq, Okeevik and Kittigaryuit (See Fig.3) (Beaufort Sea Partnership, 2018). Before the establishment of

the TNMPA, those areas were included in the 1A zones in the previous BSBMPs (FJMC, 2013). Together, the TNMPA covers approximately 1800 km^2 of the Mackenzie River estuary in the Beaufort Sea, which has been recognized as containing summer concentration areas for the eastern Beaufort Sea beluga stock (FJMC, 2013). The TNMPA recognizes the significance of a critical beluga harvesting and fishing area that has been used for generations of Inuvialuit, especially those residing in Inuvik, Aklavik, and Tuktoyaktuk (Fisheries and Oceans Canada (DFO) & Fisheries Joint Management Committee (FJMC), 2013). However, these beluga concentration areas also have abundant hydrocarbon deposits, and oil and gas exploration were conducted in those areas in 1970s and 1980s (Harwood, Iacozza & Loseto, 2014). Furthermore, there is renewed and considerable interest in developing hydrocarbon industry as well as transportation activities in the beluga concentration areas in the future (Pooler, 2003). Those industrial developments may have negative environmental impacts on the belugas and their habitats, directly and indirectly, resulting from "…underwater noise, oil spills, changes in stability or integrity of ice, timing of breakup, chronic hydrocarbon contamination of food species…" (Fast et al., n.d., P. 101). In this context, the members of the FJMC and Inuvialuit beneficiaries raised their concerns in relation to the absence of legally enforceable mechanisms available under the BSBMP (BSIMPIWG, 2003). In 1999, the IRC, the IGC, the FJMC, DFO, and industry represented by the Canadian Association of Petroleum Producers (CAPP) reached an agreement on working together to develop integrated management planning for marine and coastal areas in the ISR, which was called the Beaufort Sea Integrated Management Planning Initiative (BSIMPI) (BSIMPIWG, 2003). Afterwards, the BSIMPI Senior Management Committee (SMC), which consist of the key stakeholders of the BSIMPI mentioned above, formed a working group to start evaluating the advantages of establishing an MPA in the Zone 1(a) areas in 2001 (BSIMPIWG, 2003). Drafted copies of the assessment reports were reviewed by the working group members (IGC, the FJMC, DFO and industry representatives) and were revised according to the advice received from joint meetings between this working group and the FJMC (BSIMPIWG, 2003). Finally, after years of information

exchange and consultation meetings initiated by DFO and the FJMC in the six ISR communities as well as with industry stakeholders, the formal implementation of the TNMPA was announced in August, 2011 (DFO & FJMC, 2013).

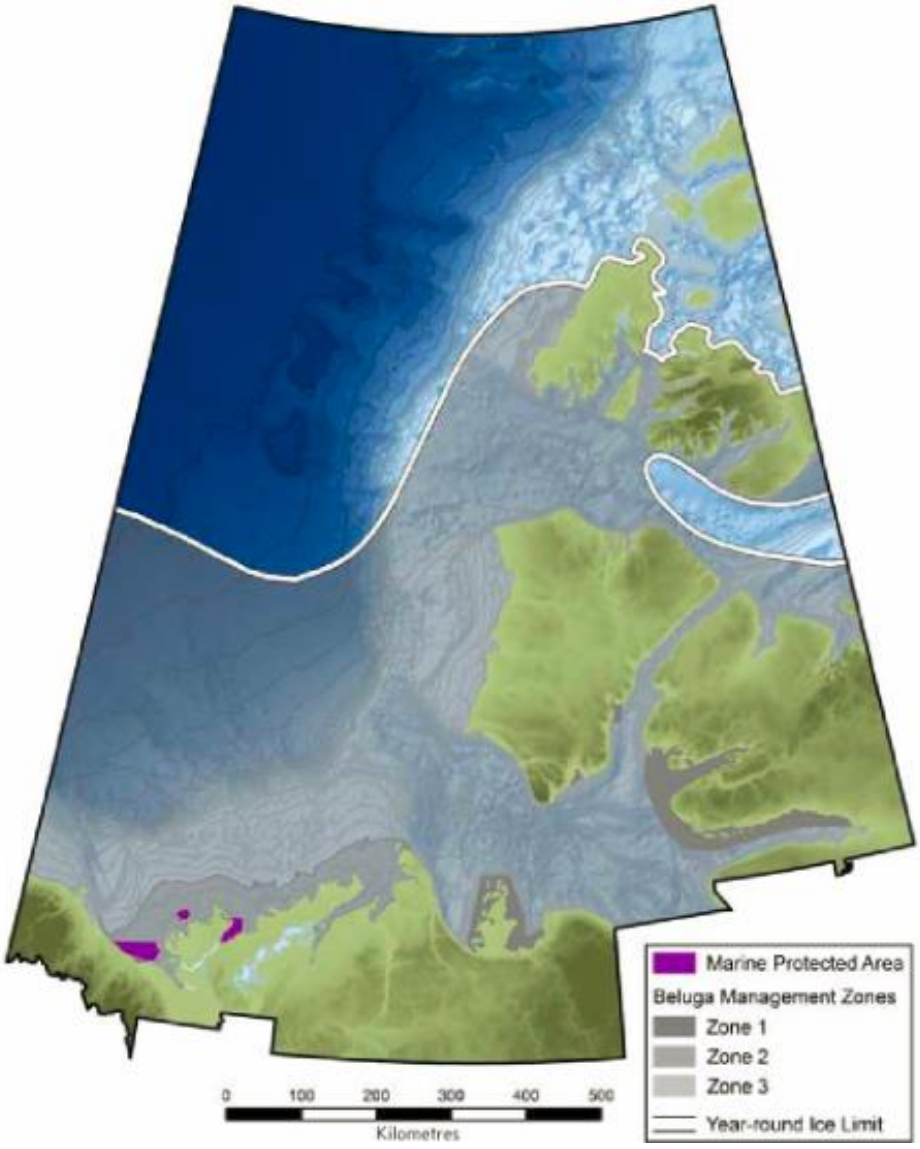

Fig. 2 The Beluga Management Zones in the ISR

beluga management plan 2013, showing Zones 1,2 and 3.

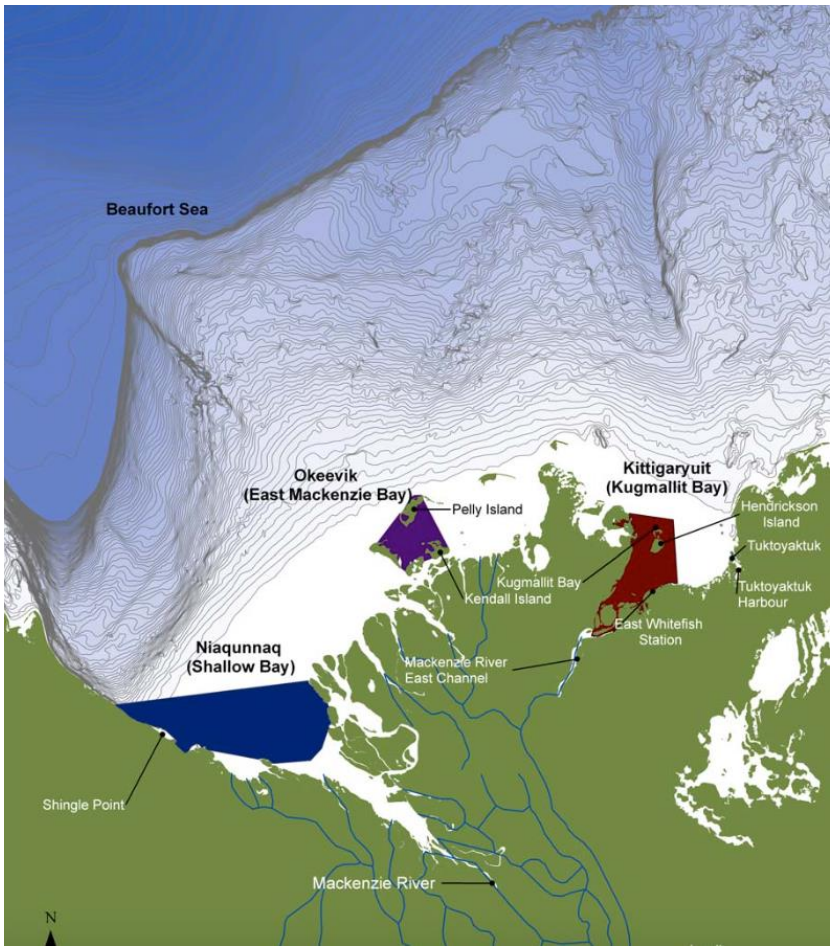

Fig.3: Tarium Niryutait MPA. (DFO. 2018b)

Unquestionably, establishing the TNMPA was not an easy task and its success relied upon the continuing collaborated efforts made by the DFO, the Inuvialuit, private industry, local stakeholders and governments (DFO & FJMC, 2013). Under the TNMPA management plan, clear guidelines were offered regarding activities such as fishing, dredging, drilling, oil or gas production, and research, which can be prohibited or allowed under certain circumstances in these areas (DFO & FJMC, 2013).

Aside from the TNMPA, guidelines for activities within the other four management zones have been developed to provide specific guidance to Inuvialuit cooperative management bodies, government agencies and environmental organizations for their use in the evaluation of development proposals (FJMC, 2005). The Zone 1A was

categorized as Traditional Harvesting/Concentration Areas, and the Zone 1B was categorized as Occasional or Potential Harvesting Areas (FJMC, 2013). Relatively strict regulations are applied to these two zones. Basically, oil and gas developments, mining activities, port development and related facilities are not be permitted within or on the shores of Zone 1 waters (FJMC, 2013). Also, activities such as hydrocarbon and mining production, even if occurring outside of Zone 1, should be evaluated for their potential adverse effects on water quality and on the salinity and integrity of ice in Zone 1 waters (FJMC, 2013). Furthermore, shipping routes and potential commercial fisheries proposal must be confined to particular areas or be evaluated (FJMC, 2013).

For Zone 2 and Zone 3, which encompass a major travel route used by eastern Beaufort Sea belugas to migrate to the various bays of the Mackenzie Estuary and the remaining geographic scope of beluga in the Canadian Beaufort Sea and Amundsen Gulf, less stringent rules on development activities are applied (FJMC, 2013). Zone 4 includes the activity range of the Canadian Beaufort Sea belugas outside of Canadian waters and addresses the need to cooperate with other nations regarding industry activities that may affect the health of belugas (Fast, Mathias & Storace, 1998). To ensure the protection of the belugas and maintain sustainable harvest, it is pointed out that the HTCs and the FJMC should be consulted with respect to any licenses, permits or operating approvals for activities within or adjacent to the management zones (FJMC, 2013).

5.6 Research and monitoring

Given belugas' great value to the Inuvialuit communities, beluga research and monitoring in the ISR has remained a priority for the Inuvialuit and the FJMC for a long time (FJMC, n.d.f). The beluga monitoring program in the ISR represents one of the world's longest and comprehensive monitoring programs for beluga whales (DFO, 2016c). Since 1980s, DFO and the FJMC have cooperated with the Inuvialuit

communities in monitoring beluga whales (DFO, 2014). Local Inuvialuit were employed as monitors by the HTCs and generally stationed in the traditional active whaling camps, such as those located in Kendall Island, East Whitefish, Hendrickson Island and Darnley Bay within the ISR (FJMC, n.d.d; DFO, 2014). Through monitoring of Inuvialuit harvest of the beluga whales in the ISR, information regarding hunt location, whether any whales were lost on hunt, whether calves were present or if fetuses were in the wombs of female whales, whale characteristic and measurements such us color, total length, sex, blubber thickness as well as samples of whales, have been collected (FJMC, n.d.f). Also, the monitors are required to keep track of local observations of aircraft traffic over whale camps and then submit incident reports in cases where aircraft may have harassed or disturbed belugas (FJMC, n.d.d). In 2015, a baseline health assessment of the beluga population in the ISR was conducted through the collaboration among the FJMC, DFO, HTCs and the Inuvialuit communities (DFO, 2015a). With the hunters' consent, 16 whales that landed on Hendrickson Island were completely sampled by the DFO staff and with the help from whale monitors, as well as with the engagement with community youth and hunters (DFO, 2015a). The careful examination of the harvested belugas showed that the beluga whales were in good condition as a whole (DFO, 2015a). Aside from monitoring harvested belugas and keeping an eye on potential harassment to belugas, research projects that assist in understanding beluga habitats have been initiated (DFO, 2014). The beluga habitat characterization project in Kugmallit Bay was undertaken during the summer of 2013 and 2014 before the arrival of belugas to figure out why they prefer certain areas of the Mackenzie Delta (DFO, 2015b). Furthermore, researchers collaborated with the Inuvialuit in studying beluga whales' diet and the potential effects of climate change on their energetics (DFO, 2014). It has been recognized that beluga whales in the Beaufort Sea are critically susceptible species that can reflect the health of the Arctic ecosystem (DFO, 2015a). Therefore, developing and conducting research and monitoring programs consistently to monitor beluga whales' status in the ISR not only improve our knowledge about belugas and their habitat, but it also enhances our understanding of the Arctic ecosystem,

especially under the climate change context in recent decades (DFO, 2014).

5.7 Capacity building and training

As empowerment is both a condition and an objective of fisheries co-management, it is recognized that capacity enhancement is an essential element to fulfill sustainable and effective fisheries co-management (Jentoft, 2005). In the beluga co-management case in the Canadian Beaufort Sea, capacity building and training for the Inuvialuit communities have been a priority for a long time (DFO, 2014; FJMC, n.d.d). The importance of offering education programs associated with beluga management activities for Inuvialuit communities has been highlighted in each edition of the BSBMPs since 1991 (FJMC, 2013; FJMC, 1991). Classroom instruction that aimed at teaching the Inuvialuit youth about history and tradition of Inuvialuit whaling, as well as guidelines of beluga management, has been implemented through collaboration of beluga harvesters, wildlife managers and educators (FJMC, 1991). A video documenting a traditional beluga hunt was created for educational use in schools and public awareness (FJMC, 2013).

More recently, the Student Mentoring Program that committed to provide Inuvialuit youth with skills and experience in relation to natural resource management has been developed by the FJMC (FJMC, n.d.d). Mentoring and encouraging young generations in the ISR to be involved in science has consistently remained a priority for the beluga research team (DFO, 2015b). These programs offer a good opportunity for the Inuvialuit youth who may be interested in becoming natural resource managers in the future, as well as preparing qualified Inuvialuit partners for co-managing fisheries. To ensure the proper participation and involvement of Inuvialuit in research and monitoring programs for beluga whales, a series of training programs has been offered to future harvesters and monitors (DFO, 2014; FJMC, n.d.d). During last few years in the summers, researchers were sent by DFO and the FJMC to Ulukhaktok to record beluga observations and train hunters on sampling whales (DFO, 2014). It is

indicated that research capacity of the Inuvialuit communities has improved by a number of training and employment opportunities in the ISR (DFO, 2014). At the same time, interviews with the Inuvialuit showed that they were willing to be involved in the research and monitoring programs (DFO, 2014), which is a positive signal of approaching successful fisheries co-management. Additionally, to help facilitate safe and responsible beluga hunting, video and written material has been prepared, explaining the by-laws and regulations of beluga management as well as hunting methods and techniques (FJMC, 2005).

5.8 Integration of Traditional Ecological Knowledge (TEK) and scientific knowledge

The co-management approach for managing fisheries in the ISR is also reflected through integrating Traditional Ecological Knowledge (TEK) and science. This integration is done through the cooperation among FJMC, DFO, IGC and HTCs, and it provides indications on how TEK could be integrated into the management of fisheries (Manseau, Parlee & Ayles, n.d.). It has been recognized that incorporating traditional knowledge can assist in redefining marine health indicators, enhancing data collection and promoting the analysis and interpretation of the results of data collection processes (Manseau et al., n.d.). These benefits are clearly seen in the case of beluga management in the ISR. The Inuvialuit have interacted with and studied beluga whales for generations and they have unique experiences and knowledge based on those interactions (DFO, 2014).

The inclusion of TEK and community perspectives has been found to fill up knowledge gaps on beluga and their habitant in the ISR (DFO, 2014). In the past few years, a series of community meeting and interviews were held to allow the Inuvialuit to share their perspective about belugas. These activities have been of great help to identify health indicators of belugas (Loseto, Hoover & Hynes, n.d.). Through joint research and monitoring as well as through the inclusion of the TEK, comprehensive

indicators such as diet, fat quality, disease, circulating hormones, contaminants, and so on, have been developed to define belugas' health (Loseto et al., n.d.). In addition, to help verify and match beluga observation from viewing boats, a hydrophone was anchored 200 meters from Hendrickson Island to record beluga vocalisations (2014 Bulletin). A variety of digital maps that reflect belugas' routes of the migration in the ISR has been created through the joint efforts made by the researchers from the DFO, FJMC, and the Inuvialuit residents (DFO, 2015b). From 2014 to 2016, a series of Beluga Whale Communications Summits were held in Inuvik to cooperatively undertake the review and update of science and traditional knowledge on beluga whales in the ISR (FJMC, n.d.d).

In fact, the importance of integrating expert and non-expert knowledge to problem identification, framing and analysis is widely accepted in most co-management contexts. And the value of TEK to help form sound fisheries management in the Canadian Beaufort Sea has been well recognized by DFO, which also explains the strong support for inclusion of TEK in the beluga monitoring programs (Rompkey & Patterson, 2010).

After more than thirty years of researching and monitoring beluga whales through the cooperation of FJMC, DFO, IGC, HTCs and the Inuvialuit communities, the understanding about this species' status in the region and their use of habitats has been greatly enhanced (Harwood., 2014). This partnership also had an impact in management measures.

At the early stage of beluga management in the Canadian Beaufort Sea, Total Allowable Catch (TAC) that represents a catch limit set for a fishery in a year or a fishing season (OECD) was proposed to help ensure responsible management and optimum utilization of belugas (FJMC, 1991). This TAC referred to the total number of belugas that could be taken without affecting the overall population (FJMC, 1991). However, it has been documented that the TAC can be a problematic approach, as

there are uncertainties regarding the size of the stock, its age structure, growth rate, natural mortality, and geographic distribution (Parés, Dresdner & Salgado, 2015). This situation was clearly seen with beluga whales in the ISR because in the early 1990s information about the species was insufficient, thus TAC could not be calculated effectively (FJMC, 1991). In this context, the harvest of beluga in the ISR was limited to the number required for substance needs (FJMC, 1998).

Attitudes about the need for establishing TAC for belugas changed since the release of the second Beluga Management Plan as the results from the 1992 aerial survey showed that there were far more belugas than the original estimates (FJMC, 1998). Since then, the establishment of TAC was considered not an urgent need and it was no longer mentioned in the latest beluga management plan (BSBMP 2013) (FJMC, 2005, FJMC, 2013). Systematic aerial surveys were conducted to observe surfaced belugas in the Mackenzie River estuary during summers between 1977 and 1992 (Harwood et al., 2014). The results from scientific monitoring approaches are used to further examine the trends of beluga health and their habitat use and to supplement Inuvialuit TEK (Tyson, 2017).

In conclusion, the development of scientific monitoring systems and research programs based on long-lasting partnerships with Inuvialuit (FJMC, n.d.f)) has increased the understanding of beluga status and their migratory routes (DFO, 2016c). The beluga stock was last assessed as stable or increasing (DFO, 2000) and the harvest of beluga in the Canadian Beaufort Sea is sustainable (FJMC, 2013).

6. Discussion

The implementation of co-management strategies in managing fisheries in the BS LOMA has shown to be comprehensive, and at the top range of the citizen participation gradient of co-management, as it involves several engaging mechanisms from informing and consultation to community control and self-management (Ayles et al., 2016; Ayles et al., 2007). Through examining the practice of fisheries

co-management in the BS LOMA, with a focus on the beluga management, it is recognized that the cooperation among the DFO, FJMC, IGC, HTCs is not just confined to informing and consulting, as authentic partnerships are actually incorporated in diverse fisheries management matters (Ayles et al., 2016). To account for *success* of fisheries co-management (FJMC, n.d.c), a series of key conditions were identified, and analyzed in the Beaufort Sea fisheries with the following results:

1) Implementing co-management strategies for managing the fisheries in the Beaufort Sea has a solid legal basis, with the signing of the IFA between the Inuvialuit and the government of Canada in 1984 (Ayles et al., 2007). As mentioned previously, the IFA specifically highlighted that the Inuvialuit should be involved equally and meaningfully in managing wildlife resources in the ISR (IRC, 2018a). The presence of this legal basis is of great importance to ensure the implementation of co-management in the Beaufort Sea LOMA. It is widely recognized that if co-management initiatives are to be successful，the establishment of supportive legislation and policy must be first addressed (Pomeroy et al., 2001). Furthermore, it is recognized that the most advanced forms of fisheries co-management usually exist under Canada's diverse land claims settlements where co-management is legislated (DFO, 1999). Under the principles described in the IFA, subsequent fisheries management policies and plans must be made in accordance with the directions established by this comprehensive land claim agreement.

It is also established that if there are conflicts between the IFA and federal legislation, such as the Fisheries Act, the IFA prevails to the extent of the inconsistency or conflict (DFO & FJMC, 2014). This shows the Government of Canada's determination to respect the Inuvialuit's tradition, values and rights of controlling their wildlife resources. Also, given the presence of supportive legislation to adopt co-management, there would be less difficulty in clearly defining partners' rights and roles (Pomeroy et al., 2001).

2) The boundaries defining the geographical scope of fisheries resources have been clearly defined, as well as the definition of who are the ones with the right to fish. The qualification of the individual fishers or hunters with rights to fish or harvest in the Beaufort Sea LOMA has been clearly described through the IFA (IRC, 2018d). In accordance with the IFA, "…a beneficiary of the IFA must be a Canadian citizen and on the official voters list used for approving the IFA or of the Inuvialuit ancestry…" (IRC, 2018d). Besides, "…a person could be eligible if he/she has Inuvialuit ancestry and is accepted by an Inuvialuit community corporation as a member or is an adopted child of a beneficiary" (IRC, 2018d). These Inuvialuit community members have been empowered with preferential harvesting/ fishing rights in the ISR (Tyson, 2017).

At the same time, the geographic boundaries associated with fishing and harvesting in the ISR have been identified through the IFA (Tyson, 2017). The map of the BS LOMA explicitly outlined the scope of the ISR. In addition, in the beluga management case, different management zones divided in terms of the diverse management requirements have been clearly described (FJMC, 2013). In particular, among the five zones of beluga management, the boundaries of the TNMPA (formally 1A zones) was clearly depicted to inform users or potential users regarding the restrictions of different activities (DFO & FJMC, 2013).

3) The participation of heavily affected groups, the Inuvialuit in this research, by fisheries related legislation and regulation has been ensured at multiple level of fisheries management. Through reviewing the general process of fisheries co-management in the ISR, it is clear that the organizations include multiple levels of participation by Inuvialuit (Ayles et al., 2007). Organizations such as HTCs, IGC, and the FJMC have been involved from in different processes, from the recognition of fisheries issues and the evaluation and assessment of management plans to the subsequent implementation and reviewing of the plans themselves (Ayles et al., 2007). Inuvialuit communities' voices are heard through regular consultation and community tours, resulting in such outcomes as the establishment of corresponding working

groups which consisting of representatives from the Inuvialuit organizations and communities and DFO (FJMC, n.d.d). In the beluga management case, the establishment of the TNMPA is regarded as a huge accomplishment for the Inuvialuit as this initiative sets legislative protection of important calving areas for beluga whales in the Beaufort Delta (DFO & FJMC, 2013). In fact, the formation of the Tarium Niryutait Marine Protected Area Management Plan relied upon a large amount of input from the Inuvialuit, especially from all of the Inuvialuit whale hunters (DFO & FJMC, 2013). In addition, to help guide specific hunting behaviors, the HTCs was given the authority to develop Beluga Hunting Bylaws and Guidelines, in conjunction with the FJMC (Inuvialuit Hunters & Trappers Committees, n.d). This is a typical case that ensuring that those affected by the rules can participate in modifying the rules.

4) Intensive capacity building for the co-management bodies, especially the Inuvialuit, has been carried out in the context of fisheries management practice in the BS LOMA (DFO, 2014; FJMC, n.d.d). Adopting co-management strategies means greater involvement and greater responsibility for the Key stakeholders (The Pacific Coast Federation of Fishermen's Associations (PCFFA), n.d.). It is recognized that capacity enhancement is an essential element to achieve successful and effective co-management practice. This is well acknowledged by the FJMC, and a series of training programs committed to improve Inuvialuit's technique and knowledge on harvesting, monitoring and observing critical fish stocks have been developed (FJMC, 2013, FJMC, 1991) with the participation of the Inuvialuit themselves. In the beluga management case, classroom instruction for teaching the youth knowledge of history and traditions of Inuvialuit whaling, as well as guidelines of beluga management has been provided (FJMC, 1991). Additionally, practical training aimed at potential harvesters has been offered to enhance their hunting techniques and to familiarize participants of the principles of beluga management (FJMC, 2005). Teaching aids, such as the development of a Hunting Manual and Video which can be used to convey the principles of beluga management and proper methods of harvesting beluga were

also implemented (FJMC, 2005). It is very likely that these capacity building efforts will pay back, as educated Inuvialuit will be in a better position to become responsible and professional hunters, fishers, research aids and even resources managers in the future (FJMC, n.d. d). In fact, the FJMC has decided to establish a trust fund through the IRC to encourage students to complete degrees in the natural resources field (FJMC, n.d. e).

5) The high degree of trust and respect that has been established among the co-management partners also accounts for the success of the fisheries co-management in the BS LOMA (FJMC, n.d.d). It is recognized that co-management arrangements could not survive without a relationship of trust and mutual respect between the co-management partners (Pomeroy et al., 1998). These attitudes have been developed over thirty years of collaboration between the Inuvialuit and the DFO through the FJMC (FJMC, n.d.a), in the context of fisheries co-management. During this long period, working relationship were developed between the Inuvialuit, HTCs, IGC, FJMC and DFO, resulting in the incorporation of different views, knowledge co-production (science and TEK) and opinions into management decisions (FJMC, n.d.c)). Within this co-management regime, the FJMC functions as a bridging organization that facilitates the connection and communication between different stakeholders in a broad range of activities (Rompkey & Patterson, 2010). It is recognized that the networking led by the fisheries co-management partners in the BS LOMA helps address conflicts, build trust, and develop common goals and processes (Ayles et al., 2016). The critical elements incorporated in the co-management partners' meetings are "…discussion until a consensus was reached; respect for differences in opinions among members; recognition of the importance of their own roles in resolving conflicts in resource management between hunters, fishers and the government; a strong sense of alliance and friendship between committee members…" (Manseau et al., n.d., P. 144). Judging from the feedback of the Inuvialuit representatives, co-management appears to be working well as a means of shared decision-making (Rompkey & Patterson, 2010). The value of TEK has been well

recognized by DFO, and a number of programs have been jointly developed to integrate TEK into fishery resources management decision making (Rompkey & Patterson, 2010). For example, TEK has been widely used in helping manage beluga whales in the ISR, and it has been noted that the knowledge from local communities is of great help to fill the knowledge gap as well as to identify ecological indicators for belugas (DFO, 2014). The integration of TEK and science has not only be helpful to develop a better understanding of fish and marine mammals and their habitats in the BS LOMA, but it has also shown government's respect for resource users.

6) The FJMC was given the right to allocate federal funding for fisheries management research and monitoring in the ISR, which has enabled the FJMC to directly control the prioritization of research efforts (FJMC, n.d.c). This is particularly important to maintain the independence of decision-making for the FJMC (FJMC, n.d.c) because usually interactions among interest groups could include conflicts over management priorities, the degree of inclusion of traditional and local knowledge, and the role of scientific monitoring over time (Tyson, 2017). The funding for resource-related activities with respect to the implementation of the IFA is provided by Canada through Aboriginal Affairs and Northern Development Canada (AANDC)[2] (FJMC, n.d.d). Though the funds that are used for supporting research and monitoring projects in the ISR are administered by the DFO, the specific projects and their budgets are identified by the FJMC (FJMC, n.d.d). Each year research and monitoring proposals are reviewed by the FJMC during the January meeting at DFO Winnipeg. The FJMC then allocates the funding based on Inuvialuit priorities for fish and marine mammals (FJMC, n.d.g).

In conclusion, most of the key criteria identified in the literature to help account for the success of co-management, are found in the fisheries co-management practice in the BS LOMA. These include: supportive legislation; clearly defined boundaries of

[2] The AANDC was split into Indigenous Services Canada and Crown-Indigenous Relations and Northern Affairs Canada in August 2017 (Indigenous and Northern Affairs Canada, 2017).

resource users and geographic areas; participation by those affected by management decisions; and conflict resolution mechanisms which rely on high degree of trust and respect within fisheries co-management bodies.

7. Recommendation

Although it is recognized that the co-management of fish and marine mammals in the BS LOMA is successful and a series of critical conditions that account for the success has been met (FJMC, n.d.c), there are considerations that should be kept in mind to help maintain and facilitate the performance of fisheries co-management in the BS LOMA, especially in the event of the development of commercial fisheries.

First, co-managing fishery resources in the BS LOMA could be improved by adopting the precautionary approach (PA) (FJMC, n.d.h). In recent years, PA has been widely accepted as a critical element of sustainable fisheries management (DFO, 2009). The application of PA in fisheries management decision making include efforts such as identifying stock status zones (healthy, cautious, and critical), setting the removal rate at which fish may be exploited, and adjusting removal rates in line with fish stock status variations (DFO, 2009). Applying the PA is particularly important to conserve the Beaufort Sea fisheries because the Arctic ecosystem is fragile (Sumaila, 2015) and climate change and the retreat of sea ice are making this region more accessible to potential developments (Rompkey & Patterson, 2010). Although commercial fisheries do not exist in the Canadian Beaufort Sea at the time of this writing (FJMC, 2013), the Inuvialuit communities have raised concerns and discuss the prospect (Ayles et al., 2016). The history of the development of commercial fisheries in the Canadian Beaufort Sea in the 1960s and 1970s was not positive as these fisheries turned out to be overexploited (Ayles et al., 2007； Ayles et al., 2016). Furthermore, at the present, it is recognized that knowledge associated with fish stock size, interaction between different species and beluga feeding ecology in the Canadian Beaufort Sea is not sufficient for accurately assess the effects of commercial fisheries (FJMC, 2013). In order to consider the development commercial fisheries or other industrial

developments, the PA should be seriously considered by the fisheries co-management bodies (FJMC, DFO, HTCs, IGC) of the BS LOMA. To avoid and mitigate adverse impacts, it is critical to fully understand the effects that developments may have on the fish, marine mammals, and their habitats prior to the advent of the developments (Rompkey & Patterson, 2010). Furthermore, adopting PA is consistent with opinions publicly shared by the Inuvialuit toward developing commercial fisheries in the BS LOMA (Ayles et al., 2016; "CBC News", 2011, para. 9).

Second, managing fisheries in the BS LOMA should focus on *adaptive* co-management (FJMC, n.d.h), in order to account for social and ecological changes. This would be particularly important in the event of the development of commercial fisheries. Rapid social, economic, cultural and environmental changes have been documented in the Canadian Arctic, and it is projected that these changes will be greater in the future (Rompkey & Patterson, 2010). In addition, the positions, consideration of different parties as well as the interaction and working relationship among interest groups within a co-management regime are constantly evolving (Carlsson & Berkes, 2005). Therefore, the management projects and related management plans need to be constantly reviewed and revised. The latest beluga management plan was published five years ago, and it has been almost ten years since the fishery management plans made for Arctic Char and Dolly Varden Char have been updated (FJMC, n.d.e). Adaptive co-management ensures that management measures are guided by up-to-date policy and social realities, and that they are based on up-to-date data of fisheries resources and their habitats.

Third, the meaningful involvement and participation of the Inuvialuit in managing fisheries resources in the BS LOMA should be always ensured, including in the development of commercial fisheries. Under the IFA, the Inuvialuit were given more control over natural resources in the ISR, but whether they could have preferential rights to new commercial fisheries was not mentioned (FJMC, 2015). Given the recognition that the development of commercial fisheries in the BS LOMA could have

adverse impacts on the fisheries and the ecosystem and thus may affect the livelihoods of the Inuvialuit communities (Ayles et al., 2016; FJMC, 2013), it is necessary to get Inuvialuit representatives involved in matters associated with the potential development of commercial fisheries in the Canadian Beaufort Sea. This is also DFO's attitude towards the potential development of commercial fisheries in the region (DFO & FJMC, 2014). DFO has made commitments to promote aboriginal participation in new fisheries, and it has specified that "…any exploratory or emerging fishery in the Beaufort Sea must involve proper representation of the Inuvialuit…" (DFO & FJMC, 2014, P. 18). Therefore, any applications for new fisheries that occur in the Canadian Beaufort Sea must be reviewed and approved by the joint representatives from the FJMC, DFO, HTCs and IRC (Ayles et al., 2016).

Fourth, to maintain and improve the effectiveness of fisheries co-management in the BS LOMA, TEK and scientific knowledge should be further integrated to help inform decision-making and enhance the empowerment of communities (Ayles et al., 2007). Canadian overarching fisheries policy has established that TEK should be taken into account in managing natural resources (Manseau et al., n.d.). Particularly, DFO has recognized the importance of TEK to promote sound fisheries management in the Canadian Arctic (Rompkey & Patterson, 2010). Meanwhile, efforts committed to bridge scientific knowledge with TEK have been made, including the development of beluga monitoring programs, which assist in establishing ecological indicators for beluga health and habit use (Government of Canada, 2016). However, it is suggested that documenting and including TEK needs to be further emphasized given the continuing transformations observed in all dimensions affecting the Inuvialuit communities, including cultural, economic and environmental (Waugh, 2016). To ensure that TEK held by the Inuvialuit residents can be timely and properly recorded, community meetings and interviews need to continue to be conducted in order to account for the changes mentioned above. Additionally, as the work of drafting a Traditional Knowledge Policy which provides guidance on the research, data collection and the use of TEK in the ISR will be developed in the coming years

(FJMC, n.d.g), the fisheries co-management bodies should actively provide input and also learn from the experience from other co-management boards in the ISR. Aside from co-production and bridging of knowledge, promoting the sharing of scientific knowledge and TEK is also important. In this regard, knowledge sharing platforms that can encourage the accessibility and application of TEK, such as the Inuvialuit Settlement Region Traditional and Local Knowledge Research Publication Catalogue (ISR Traditional and Local Knowledge Catalogue) (Joint Secretariat, 2018c) need to be further supported through the cooperation among the FJMC, DFO, IGC, HTCs and the Inuvialuit.

Finally, the co-management efforts should not be limited within Canada, as developing international cooperation is also necessary. This is particularly important to transboundary fishes and marine mammals, such as belugas in the Beaufort Sea. The Beaufort Sea is divided by an international boundary with Alaska, in the United States, and some ecosystem features and marine species, such as anadromous fishes and marine mammals are shared between the two countries (DFO & FJMC, 2014). In this context, it is recognized that industry activities that are developed in the United States may affect marine species and their habitats within Canadian Beaufort Sea waters (FJMC, 2013). Therefore, it may be advisable for the key co-management bodies (FJMC, DFO, IGC, HTCs) to establish partnerships with the USA in co-managing fisheries management issues under certain circumstances. In fact, the establishment of the Inuvialuit-Inupiat Beluga Whale Commission which aims to develop joint research and facilitate the sharing and exchanging of data related to belugas already set a positive example for developing bilateral agreements to jointly manage migratory fish and marine mammals (IGC, North Slope Fish and Game Management Committee (NSFGMC) & Kivalina Whaling Captains Association (KWCP), 2000).

8. Conclusion

Given the recognition that fisheries in many parts of the world continue to be under

pressure or in crisis, failing to ensure sustainable fishing practices (Sen & Nielsen,1996), the traditional fisheries management regime which is characterized by top-down, bureaucratic approach is being questioned (Jentoft, McCay & Wilson, 1998). On the other hand, applying co-management strategies in managing fisheries has been regarded as promising, as this approach can help to achieve sustainable fisheries, as well as empower coastal communities (Chuenpagdee & Jentoft, 2007; Rivera et al., 2014). It is recognized that co-management has the advantages of strengthening community integration, empowering resources users, adapting to evolving conditions and incorporating science and fishers' knowledge in management strategies (Rivera et al., 2014). Among the different degrees of implementation of co-management, it is recognized that the co-management regimes existing under the various land claim agreements in Canada's North are excellent examples of serious co-management practices (Ayles et al., 2007, DFO, 1999). Fisheries co-management practices in the BS LOMA are clear examples of inclusive co-management strategies. The fisheries in the ISR have been co-managed by DFO and the Inuvialuit through the fishery co-management board, the FJMC, for over thirty years (FJMC, n.d.a). The implementation of fisheries co-management is successful in the BS LOMA because the cooperation among the FJMC, DFO, HTCs, IGC include several processes such as fisheries management issue identification, evaluation and assessment of issues and concerns, establishment of working groups, and development and revision of FMPs (Ayles et al., 2007; FJMC, n.d.d.; FJMC, n.d.c). Also, with a long history of working together on the aforementioned fisheries management matters, the FJMC and its partners have been viewed as mature organizations with substantial experience in implementing co-management strategies (Ayles et al., 2016). This effective collaboration over a long period of time has increased levels of trust, and it has resulted in an increasing body of knowledge (both scientific and traditional) on the fish, marine mammals and their habitats.

To account for the success of fisheries co-management in the BS LOMA, a series of critical conditions are worth noticing. The signing of IFA in 1984 provides legal basis

for implementing a co-management approach to manage natural resources in the ISR. Additionally, the geographic boundaries of the ISR and the qualification of fishers and harvesters in the region are also clearly defined. Moreover, the affected groups by fisheries legislation and regulation in the BS LOMA, especially the Inuvialuit, are given authority to be involved in making decisions associated with fisheries policy and management plans. Furthermore, to ensure that the co-management partners are qualified for the responsibilities they have been given, capacity building and training are provided through diverse programs. Relative high degree of trust and respect has been built among the co-management bodies through a series of ongoing meetings, consultations and bridging of science and TEK. Finally, the FJMC is endowed with the authority to allocate funding, which ensures an inclusive approach for directly controlling the priority of research and monitoring programs in the BS LOMA.

The experience derived from fisheries co-management in the BS LOMA illustrates the key conditions that need to be met to achieve successful fisheries co-management. It is expected the lessons can provide valuable insights for other regions in Canada that commit to implement or improve their co-management approaches to help manage local fisheries. Understanding the way in which co-management works in the BS LOMA could be particularly beneficial for improving the effectiveness of other Canadian indigenous fisheries. This is particularly important in a time when indigenous rights regarding fish for food and well-being have been affirmed by the Constitution Act (Garner & Parfitt, 2006) and when Canada is moving towards engaging and respecting the rights of indigenous peoples over their fisheries resources (Liberal Party of Canada., 2017).

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