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Inuit Qaujimajatuqangit and Adaptive Co-Management: A Case Study of Narwhal Co-Management in Arctic Bay, Nunavut

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INUIT QAUJIMAJATUQANGIT AND ADAPTIVE CO-MANAGEMENT: A CASE STUDY OF NARWHAL CO-MANAGEMENT IN ARCTIC BAY, NUNAVUT

By

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THESIS

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ABSTRACT

Since 2001 the community of Arctic Bay, located on north-western Baffin Island, in Nunavut, Canada, has been experimenting with a new approach to narwhal management – 'community-based' narwhal management. The new management system has devolved some decision-making powers to the local Hunters' and Trappers' Organization, who are empowered/required to draft by-laws to govern the hunt. Community-based narwhal management links local, regional, territorial, and national actors and agencies in a co-management arrangement that draws its powers from, and is steered by, the Nunavut Final Agreement (1993), the comprehensive land claims agreement between the Inuit of Nunavut and Her Majesty the Queen in Right of Canada.

A primary purpose of the Nunavut Final Agreement, and the institutions created or empowered thereby, is to maximize Inuit participation in decision-making, and ensure that Inuit traditional knowledge (Inuit *Qaujimajatuqangit*) steers governance. In the field of resource and environmental management, the presumed benefits of knowledge integration (combining/comparing traditional knowledge with Western scientific knowledge) have been constrained by the fact that Western wildlife management institutions have co-evolved with Western scientific knowledge and do not easily accommodate alternate knowledge systems. However, knowledge integration has been recognized as a fundamental purpose of collaborative management, and a critical determinant of adaptive capacity.

Is Nunavut's community-based narwhal management process integrating Inuit and Western knowledge meaningfully? Is knowledge integration building capacity to buffer change and adapt to changing circumstances. Challenges and risks associated with knowledge

integration have not been adequately assessed, and collaborative narwhal management has not been understood in relation to its broader temporal and social-ecological context. This research, which draws heavily upon interviews conducted with resource-users and representatives of local, territorial and state management agencies, suggests that although devolution of some decision-making powers to community-level actors under the terms of the Nunavut Final Agreement is enabling knowledge integration, and adaptive capacity in turn, the presumed benefits of both have been slow to materialize.

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ACM	Adaptive Co-Management
CBNM	Community-Based Narwhal Management
CITES	Convention on International Trade in Endangered Species
DFO	Department of Fisheries and Oceans
HTO	Hunters' and Trappers' Organization
IQ	*Inuit Qaujimajatuqangit*
LEK	Local Ecological Knowledge
NTI	Nunavut Tunngavik Incorporated
NWMB	Nunavut Wildlife Management Board
RWO	Regional Wildlife Organization
TK	Traditional Knowledge
TEK	Traditional Ecological Knowledge
WSK	Western Scientific Knowledge

GLOSSARY OF TERMS

Adaptive Capacity	The ability of a system to change to accommodate changes in the environment in which it exists.
Co-management	Formal or informal sharing of decision-making power between two or more parties – typically co-managemnet partnerships include a user-group and the state.
Inuit Qaujimajatuqangit	The preferred term in Nunavut for a concept similar to that of Indigenous knowledge. A comprehensive and contemporary epistemology incorporating knowledge, values, and beliefs into an integrated whole
Maqtaq	Whale hair, skin, and blubber, eaten boiled or raw
Natchek	Ringed seal
Struck-and-Lost	In this context, struck-and-lost refers to marine mammals wounded through hunting activity but not recovered
Ningiqtuq	An informal economy of sharing and reciprocity
Qallunat	Any non-Inuit – thus commonly used to refer to people of Western/European descent
Qayak	A one person covered boat of Inuit design
Qomatik	A sled hauled by dogs or snowmobiles over snow and ice. Used to carry supplies and for shelter

1. INTRODUCTION

1.1 Overview

For at least the last four thousand years the hunting of marine mammals has been the cornerstone of Inuit culture, Inuit society, and Inuit economy (Freeman et al., 1998). Marine mammals provided many of the essentials for survival in the Arctic – oil for heat and light, pelts for clothes, *qayaks*, and tents, meat for sustenance, and bones for tools. Any or all of these commodities could then be bartered through inter/intra-settlement trade. Alternatively, surpluses were simply gifted to individuals/groups experiencing a deficit, giving rise to a culture of reciprocity, and a robust informal economy of sharing (*ningiqtuq*) (Wenzel, 1991; 99).

The ringed seal (*Phoca hispida*, or *Natchek* in Inuktitut), has been and is the most important harvested species, in terms of caloric intake, but more time and effort is dedicated to whaling than sealing, and no food-stuff is more highly prized than *maqtak* – whale hair, skin, and blubber (Wenzel, 1991; Reeves, 1993). Three species of whale are hunted by the Inuit of Arctic Canada – Beluga (*Delphinapterus leucas*), Bowhead (*Balaena mysticetus*), and, the focus of this research, Narwhal (*Monodon monoceros*). Other terrestrial and marine flora and fauna are also harvested, as part of a diversified livelihood strategy: institutions governing human interactions with each other, with wildlife, and with the broader ecosystems of which they are a part, grew up around this livelihood and birthed a circumpolar culture, technology, language, economy, philosophy, epistemology, and society which were, and are, uniquely Inuit (Rasmussen, 1931).

Contact with, and subsequent exposure to, Western-European society has altered these institutions. Early contact was economically and spiritually motivated – European and American whaling (c. 1800-1900), fur-trading (c. 1900-1950), and Christian missionizing (c. 1800+) operated with little government intervention. This period gave way to what has been termed 'the government era' (c.1950-present?), and the pervasive governance of Inuit social-ecological systems by the Canadian state, with little regard for the input of affected Inuit (Tester and Kulchyski, 1994; Wenzel, 1991).

Arguably, Inuit-State relations in Arctic Canada have entered a new age, the co-management era, where decision-making powers are shared, or jointly held, by Inuit and non-Inuit actors. Comprehensive land claims agreements, such as the Inuvialuit Final Agreement (1984), and the Nunavut Final Agreement (NFA: 1993), have provided Inuit with legally-defined management powers and a measure of self-determination – defined here as the right to self-determine the nature, likelihood, and desirability of future changes, and to devise and implement strategies to achieve or avoid them. The power of self-determination is tempered by non-Inuit participants representing the interests of the territory, the state, and the international community.

In the last 50 years, the 'government era' has evolved into, or been supplanted by, a system of co-management. Working in the context of narwhal co-management in Arctic Bay, Nunavut – a system characterized by change, uncertainty, and a plurality of perspectives (Armitage, 2005a) – this research will probe the relationship between three core ideas/concepts that may define this new era of co-management: 1) Collaboration, 2) Knowledge Transfer, and 3) Adaptive Capacity.

1.2 Narwhal and Narwhal Co-Management

Narwhal are the only exclusively Arctic cetacean. They are rarely found below 61°N, but have been sighted in coastal waters off Newfoundland (47°N). Their distribution is circumpolar in the Arctic Ocean; however, they are comparatively rare in the East Siberian, Chukchi, Beaufort, and Bering Seas (COSEWIC, 2004). There are (at least) two discrete narwhal populations in the Eastern Canadian Arctic – the Hudson Bay population, which is relatively small (~3,500 narwhal) and the Baffin Bay/Davis Strait population, which is relatively large (~20,000-70,000 narwhal) (NAMMCO, 2005; COSEWIC, 2004; Innes et al., 2002; Richard et al., 1994; Koski and Davis, 1994; Smith et al., 1985). The Baffin Bay/Davis Strait population is the subject of this thesis.

The Baffin Bay narwhal migrate seasonally from two seemingly discrete wintering areas amongst the consolidated pack ice of Davis Straight, to summering areas in the deep-water inlets and fiords of the High Arctic Archipelago and West Greenland (Heide-Jørgensen et al., 2003; Dietz et al., 2001). The Baffin Bay population is further divided into sub-stocks based on summer ranges. Sampling studies which assess molecular genetics and contaminant composition, satellite telemetry studies, and Inuit knowledge suggest that there are perhaps five semi-autonomous sub-stocks harvested by Canadian Inuit: Eclipse Sound, Admiralty Inlet, Somerset Island, East Baffin, and Cumberland Sound (NAMMCO, 2005). Stock delineation at this scale is inexact, and the degree of exchange among sub-stocks is unknown, but tagging studies (with small, non-random samples) do suggest a high degree of fidelity to summer and winter ranges (Heide-Jørgensen et al., 2003). That said, Inuit hunters and the scientific community

have also noted shifting distributions, and the presence of narwhal where none were previously thought to occur (NAMMCO, 2005; Remnant and Thomas, 1992).

Biological parameters (e.g., age, age of sexual maturation, fertility, natural mortality), abundance, stock delineation, and the degree of exchange among sub-stocks of narwhal are all highly uncertain (Armitage, 2005a; DFO, 1998). Total removal (harvest mortality) is also uncertain, as struck-and-lost rates (narwhal wounded or killed by hunting activity, but not recovered) vary. As a result, population models are imprecise, and "the statistical power to detect a trend, if there is one, is low" (COSEWIC, 2004: 22). The Baffin Bay narwhal population is not thought to be at risk of over-exploitation (DFO, 1998; Richard and Pike, 1993), but in 2004 the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) upgraded the Baffin Bay narwhal population from 'data deficient' to 'special concern', suggesting they are particularly sensitive to human activity or changing environmental conditions (Laidre et al., 2008; Laidre et al., 2005; COSEWIC, 2004; Tynan and DeMaster, 1997; IWC, 1997). To summarize, the Baffin Bay narwhal population is not thought to be at risk, and harvest levels remain relatively low, in comparison to population size. There do not seem to be any immediate and pressing management concerns, and narwhal therefore provide an opportunity to experiment with novel approaches to the governance of wildlife resources.

Hunting of narwhals and trade in narwhal products was first regulated in Canada in 1971. Quotas were first assigned to individual hunters (1971-1977) and then to communities (1977-1999) under the Narwhal Protection Regulations. The quota system during this period was characterized by conflict, "in large part because of the scientific uncertainty associated with narwhal population estimates" (Armitage, 2005a: 719).

Additionally, the quota system has been criticized on the grounds that a quota becomes a target – hunters may fear that a failure to harvest the full quota in a given year will be used as a justification for a quota decrease – and because the establishment of a quota necessarily adds a competitive element to harvest strategies, as it creates individual pressure to harvest narwhal quickly, before the quota expires (Richard and Pike, 1993). In a comprehensive review of community-based narwhal management conducted in 2003 the NWMB reported "concerns that if a community does not reach its quota, it may be thought that they do not need those animals and they may lose the quota in the future".

In 1999, with pressure from local resource-users and legally defined management rights provided by the NFA (1993), the Nunavut Wildlife Management Board (NWMB) implemented an experimental community-based narwhal management (CBNM) program. Five communities have been involved in CBNM: Arctic Bay, Qikiqtarjuaq (Broughton Island), Pond Inlet, Repulse Bay, and Kugaaruk (Pelly Bay). Arctic Bay is the focus of this study. Under this system there are still community quotas, but they are larger and more flexible: hunters may transfer 50% of the community quota to the following year, or borrow up to 15% from the upcoming year (for example, the community quota in Arctic Bay was raised from 100 to 130 and in 2004 seven unused tags were carried forward to 2005) (NWMB, 2005). This flexibility is intended to reduce incentives to harvest as quickly as possible, and to allow hunters to take advantage of favourable hunting conditions. Some decision-making powers have been devolved to the community level, and the local HTO (Hunters' and Trappers' Organization) in each of the participating communities is required/empowered to create, remove, vary, and enforce regulations related to quota allocation (i.e., who harvests, when they harvest, where they harvest,

how they harvest), although these regulations must conform with existing legislation (i.e., the Fisheries Act, and the Marine Mammal Regulations enabled thereby). The Department of Fisheries and Oceans (DFO), under advisement from the NWMB, retains the power to set, vary, and remove quotas. Community HTOs are also required to design and implement a system to accurately report all narwhal landed and struck and lost, and to develop a program for training young hunters. Community-based narwhal management provides the context for this study of collaboration, knowledge transfer, and adaptive capacity.

1.3 Guiding Principles: A Preliminary Theoretical Progression

Two streams of thought guide this inquiry: complex systems theory and adaptive co-management (ACM). The latter is in many ways an applied process reflecting the insights of the former. Both can be considered *pluralistic,* and are intended to address the perspectives of scientists, researchers, decision-makers, aboriginal groups, resource-users, and affected stakeholders within government and without (Berkes et al., 2001): both recognize that the 'state of the environment', to the extent that there is such a thing, is negotiated, and is largely a function of social and cultural preference (Ludwig, 2001). Complex systems thinking recognizes that social-ecological systems are characterized by high degrees of uncertainty. Moreover, systems themselves are in a constant state of change, as they shift within and between multiple equilibria. Governance/management of common pool resources is generally considered a complex systems problem (Grzybowski and Slocombe, 1988). Traditional management approaches - which typically perceive social, ecological, and economic systems as being somewhat separate, understandable, predictable, and controllable - are fundamentally incompatible with systems theory.

Systems theory perceives social-ecological systems as being linked, changing, unpredictable, and therefore unmanageable in the traditional sense (Gunderson and Holling, 2002). The era of management is not over, as Ludwig (2001) has asserted, but the nature of management has changed, fundamentally. Bureaucratic, technocratic, expert-driven, command-and-control, top-down management is out: collaborative, participatory, pluralistic, adaptive management is in.

Enter adaptive co-management. Adaptive co-management is an approach to sustainable natural resource management that recognizes the central importance of adaptation, learning, and collaboration in managing complex social-ecological systems characterized by change, uncertainty, and complexity. Adaptive co-management combines the iterative learning dimension of adaptive management and the linkage dimension of collaborative management (Berkes et al., 2007).

Encouraging the ability of a system to adapt to changing social-ecological circumstances has been stressed as a practical means of coping with system complexity (Berkes et al., 2007; Berkes and Kristofferson, 2005; Folke et al., 2002). Co-management, as a process, "is adaptive because it is based on learning through information sharing among stakeholders" (Berkes and Kristofferson, 2005: 263). Logically, adaptive capacity, defined as "a critical aspect of resource management that reflects learning and an ability to experiment and foster innovative solutions in complex social and ecological circumstances" (Armitage, 2005b: 703), hinges upon the collaborative processes by which knowledge is communicated across vertical and horizontal linkages. Knowledge of different types (old, new, traditional, science-based) must be integrated and interpreted to form newer, more complete understandings (Berkes,

2009). Without knowledge transfer there can be no learning, and consequently limited capacity for adaptation. Both of these processes (knowledge transfer and integration) require communication and collaboration, which are best studied at the points of linkage between actors.

The study of linkages has been identified as a means of assessing communication between actors and as a means of assessing the functioning of multi-level governance systems more broadly (White, 2006). This study will focus on linkages, in the belief that "greater attention to vertical and horizontal linkages...should help social actors and institutions respond to change, adapt and cope with uncertainty by improving communication, coordination and collaboration" (Berkes et al., 2007: 9).

In examining these linkages, a key issue relates to the diverse types of knowledge being shared (namely, traditional and scientific), and the degree to which they are compatible. Recently there has been much discussion regarding traditional knowledge (TK) and resource and environmental management (Peters, 2003). Much of this literature has been generated in Arctic Canada (where its inclusion in decision-making processes is mandated under claims agreements) and focuses implicitly or explicitly on understanding and defining the concept of TK itself, theorizing as to the role of TK in resource management, assessing the methods of collecting and documenting TK, and/or assessing the challenges and limitations associated with TK (Gilchrist et al., 2005; Pierotti and Wildcat, 2000; Huntington, 2000). Less commonly, but importantly, researchers assess the actual role of TK in specific management contexts, and the processes by which it is communicated and integrated in pluralistic decision-making forums (Todd, 2002). As noted by Huntington et al. (2002: 778) "the process of

exchanging information effectively and collaborating on interpretation, however, is often overlooked in the effort to incorporate TEK into research and management". Inclusion of TK is often presumed to result in better (more equitable, flexible, or sustainable, as the case may be) decisions, but there are significant challenges and risks associated with knowledge inclusion, and these are too often overlooked.

Like White (2006) I use the term 'traditional knowledge' in the preceding discussion as it is perhaps most prevalent in the academic literature. It should be noted that some authors prefer alternate terms such as traditional ecological knowledge, indigenous knowledge, local knowledge, or in Nunavut, *Inuit Quajimajatuqangit* (IQ). These carry slightly different connotations but are conceptually similar. Traditional knowledge is usually understood to denote an entire epistemology – it is a unified world-view incorporating all aspects of aboriginal society, spirituality, economy, and culture (White, 2006). Harvesting of wildlife has long been of central social, spiritual, economic, and cultural importance to aboriginal peoples, who have consequently developed intimate and detailed understandings of the complex ecological systems of which they are a part (Berkes et al., 2001). Traditional *ecological* knowledge is this ecological knowledge separated from belief systems and world-views, and is thus a subset of traditional knowledge. Other authors prefer the term indigenous knowledge and eliminate the word traditional – a temporal word implying the transmission of a fixed body of knowledge across generations through time: in fact, knowledge is fluid and constantly changing (White, 2006). The term 'local knowledge' is preferred by some as it emphasizes the fact that knowledge generated and held by resource-users (aboriginals included) is often limited to a fairly specific geographic context. It also recognizes that

detailed understandings of ecosystems are not only held by aboriginals but by non-aboriginal user-groups as well (Gilchrist et al., 2005)

In Nunavut the preferred term is *Inuit Quajimajatuqangit*, which is defined as "the combining of the traditional knowledge, experience and values of Inuit society, along with the present Inuit knowledge, experience and values that prepare the way for future knowledge, experience and values" (White, 2006: 405). Not only is this the preferred term in Nunavut but it is also particularly fitting in this study. It is holistic in that it incorporates traditional knowledge, experience and values – three broad themes which collectively encompass the whole of the social-ecological system. *Inuit Quajimajatuqangit* also recognizes that understandings are continually evolving, making specific reference to the past, the present, and the future: it is particularly well suited to a discussion of learning as it is itself a learning process – the combining of past knowledge with present knowledge to create future knowledge implicitly requires learning. However, despite "increasing recognition of the potential contribution of indigenous knowledge to questions of environmental and resource management, its incorporation into decision-making processes remains problematic" (Peters, 2003: 49).

1.4 Approach and Methods

This study will start with IQ and progress through the themes discussed above. To expand, the meaningful incorporation of IQ into environmental management is a formal requirement under the NFA and is increasingly recognized as a fundamental determinant of management success. Still, for many reasons, the integration of IQ and western scientific knowledge is a central challenge in co-managing natural resources (Huntington, 2000). Assessing the mechanisms and collaborative processes by which

knowledge is transferred across linkages will indicate the degree of communication between co-management bodies and the functioning of the multi-level government arrangement more generally. Diduck et al. (2005) look for evidence of social learning in the context of narwhal management but do not fully integrate this with an assessment of knowledge transfer and collaboration. In this study 'collaboration' is considered as a process of knowledge management. An assessment of knowledge management (collaboration) will be put into temporal context through an analysis of change and adaptation. This assessment of knowledge management/collaboration and adaptation will then be re-assessed in relation to the practice of ACM. Complex systems theories, which emphasize linkages between social and ecological systems, guide this study throughout and encourage a focus on breadth *as well as* depth.

The Adaptive Methodology for Ecosystem Sustainability and Health (Waltner-Toews and Kay, 2005; Waltner-Toews, 2004) will be employed heuristically, as a guide. The purpose of this framework is two-fold: to identify issues and create system definitions. Issues related to knowledge management are assessed relative to five processes identified jointly through dialogue with resource-users and representatives of local, territorial and state management agencies. These five processes include knowledge gathering, knowledge sharing, knowledge integration, knowledge interpretation, and knowledge application/decision-making. This understanding is then placed in context by developing a broader definition of the CBNM system – the focus is on change and adaptation. Respondents were asked to identify sources and effects of change. Finally, the issues framework and the system definition (both parts of the Adaptive Methodology for Ecosystem Sustainability and Health) are reassessed relative to an ACM framework

developed by Berkes et al. (2007). This framework is intended to assess the maturation of adaptive co-management processes – it consists of nine attributes considered to be core components of successful adaptive co-management applications: reason for being, degree of power sharing, worldview and sense-making, rules and norms, trust and respect, linkages and networks, use of knowledge, capacity to experiment, and learning.

This assessment is primarily qualitative and it draws on several complementary methods: policy analysis, document analysis, semi-directed interviews, participant observation, and direct observation. These are intended to examine the floe of knowledge within Nunavut's narwhal co-management system as a means of assessing the capacity of different actors to collaborate, and to adapt in light of complexity, uncertainty, and change. The guiding principle in all research activity is provided by White (2006: 402), who states that:

> in the world of politics and government, how an institution gathers information, processes ideas, reaches decisions, and formulates and implements policies may be just as important, if not more important, than the actual decisions it makes and the policies it develops.

1.5 Goals and Objectives

First and foremost, this is a study of knowledge. In the context of narwhal co-management, the goal of this research is to examine how knowledge is used/valued, how it is communicated, and how it relates to collaboration and adaptation. Three research questions are intended to illuminate these important issues:

1. What is the role of IQ in narwhal co-management: its role as perceived by actors at different levels, as prescribed by the NFA and related documents, and in practice;

2. What challenges and risks are associated with knowledge gathering, knowledge sharing, knowledge integration, knowledge interpretation, and decision-making;
3. What changes are affecting the narwhal co-management system and what is the role of IQ in encouraging the capacity to learn and to adapt in light of complexity, uncertainty, and change.

1.6 Summary of Thesis Organization

In *Chapter 1* I briefly introduce the historical context which has lead to the current narwhal co-management system. Further, I identify relevant bodies of literature, develop a preliminary theoretical progression, propose three strategic lines of inquiry, and outline the body of this manuscript.

In *Chapter 2* I review relevant academic literature from three related, and in many cases overlapping, fields: collaborative management, adaptive management, and traditional knowledge. Core concepts from each of these areas are explored, compared, and synthesized.

Chapter 3 is intended to develop a methodology appropriate to the tasks outlined in Chapter 1. The focus is on defining system boundaries (ie., scope) and developing a conceptual framework capable of organizing and making sense of results. Additionally, I present and justify the specific data collection methods employed.

Chapter 4 is the first of two results chapters, and is focused on challenges and risks associated with knowledge management. Data derived from semi-directive interviews illuminates these challenges and risks.

Chapter 5 is the second of two results chapters, and the focus here is on change and adaptation. Here too, interviews are the primary source of evidentiary data.

Chapter 6 is an analysis chapter. The results from Chapters 4 and 5 are synthesized and reexamined through the analytical lens developed in Chapter 2. The analysis explores change and temporal context, and integrates this into an understanding of the evolution/maturation of the adaptive narwhal co-management system.

In *Chapter 7* I conclude this thesis with recommendations for future policy directions and research.

2. LITERATURE REVIEW

2.1 Introduction

The purpose of this literature review is to trace an understanding from *Inuit Qaujimajatuqangit* through collaborative management to adaptive co-management. What is *Inuit Qaujimajatuqangit*, and what is its relevance in discussions of wildlife management? Does collaborative management, as it is practiced in Nunavut, allow for the meaningful incorporation of *Inuit Qaujimajatuqangit* into wildlife management and research? Is Nunavut's narwhal management system resilient/flexible, and does a focus on adaptive capacity facilitate knowledge sharing and learning? This review will provide a foundation for further exploring these important questions.

In the last several decades the incorporation of traditional knowledge into wildlife co-management, ecosystem management, and governance more generally, has become increasingly common (Peters, 2003). In Arctic Canada this commitment has coincided with (or been catalyzed by) the negotiation, ratification, and implementation of comprehensive land claims agreements which specify the sharing of management powers and responsibilities. Knowledge integration (the combining of traditional and scientific knowledge) has been advocated on the grounds that it will a) improve resource management decisions by adding new information, and/or b) empower local communities by validating traditional knowledge and traditional ways of knowing. Nevertheless, responsible (effective and culturally appropriate) knowledge integration remains a significant challenge, and there are concerns that efforts to document and validate traditional knowledge are exploitative and serve to reinforce colonial-style Aboriginal-State relations (Natcher et al., 2005; Nadasdy, 1999). This literature review will: (1)

explore the presumed benefits of knowledge integration, (2) assess challenges and concerns impeding this endeavor, and (3) explore the implications for adaptive capacity and collaborative management. In exploring these themes, the incorporation of traditional knowledge is considered to be a primary purpose of co-management institutions, and effective co-management may be considered a critical factor in adaptive capacity. These terms (traditional knowledge, co-management, and adaptive capacity) are further defined, and the relationship between all three refined. The focus is on resource and environmental management, and wildlife management more specifically. Most of the literature reviewed has been generated in Arctic Canada, but literature generated in other regions is also reviewed when necessary or appropriate.

2.2 Traditional Knowledge

There is no consistent definition of 'traditional knowledge', or related terms – instead authors seem to define the term so as to satisfy their purposes. Thus a definition of the concept may refer to specific informational knowledge (e.g., narwhal feeding behavior) or to an entire worldview that includes knowledge, as well as values and beliefs. Table 1.0 reflects this breadth of definition. The objective in this section is to develop a working definition of the concept of traditional knowledge as it is understood and applied in Nunavut. Traditional knowledge can be understood either relative to itself, or relative to Western scientific knowledge - I begin with the former and proceed to the latter.

Table 1.0 Sample TK Definitions

Source	Definition
Huntington, 1998: 237-8	"TEK is the system of experiential knowledge gained by continual observation and transmitted among members of a community. It is a framework that encompasses both ecology and the interactions of humans and their environment on physical and spiritual planes".
Duerden and Kuhn, 1998: 34	"Local geographical knowledge describing the world and providing a basis for decision-making and control over life".
GNWT policy statement, as quoted it Wenzel, 1999: 113	"Knowledge and values which have been acquired through experience, observation, from the land or from spiritual teachings, and handed down from one generation to another".
Hunn, 1977, as quoted in Wenzel, 1999: 114	"Knowledge developed by a given culture to classify the objects, activities, and events of its universe".
Berkes et al., 2000: 1252	"A cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment".
Nadasdy, 1999: 3	"A meaningless buzzword, its use masking more than it reveals".
Nadasdy, 1999: 5	"A way of life".

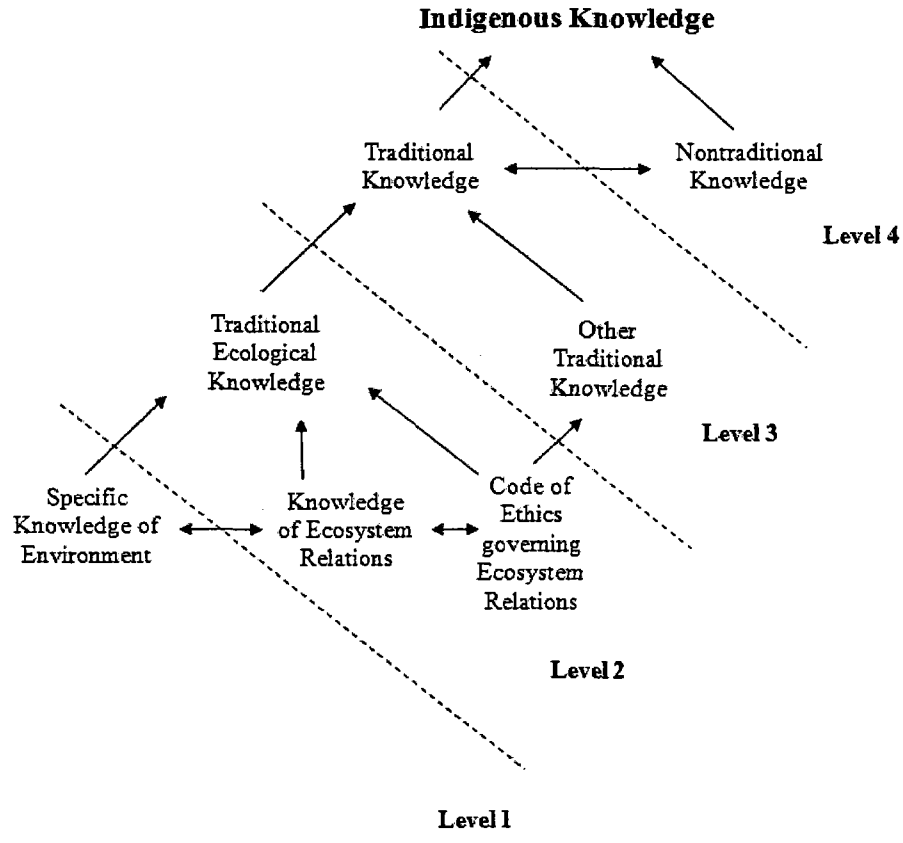
Traditional knowledge, as a concept, goes by many names: traditional knowledge, traditional ecological knowledge, local knowledge, Indigenous knowledge, and *Inuit Qaujimajatuqangit*. These terms carry slightly different connotations, but are conceptually similar. More inclusive terms, such as Indigenous knowledge and *Inuit*

Qaujimajatuqangit, refer not only to specific knowledge of wildlife and ecosystems, but to the unifying worldview that makes sense and use of this knowledge.

Usher (2000) provides a four point categorization of traditional knowledge: (1) experiential knowledge of the environment, (2) knowledge of past and present use of the environment, (3) a code of ethics regarding interactions between humans and the environment, and (4) a unifying cosmology or worldview. Notice that only category one is explicitly place-based and experiential – when authors use the term 'local knowledge' it is these qualities which they intentionally or inadvertently stress (Gilchrist et al., 2005). Experiential knowledge of the environment is also the only category which is scientifically verifiable, and it has therefore been the subject of most integrative efforts.

To complement the Usher categorization, Stevenson (1996: 281) provides a conceptual model of different elements of indigenous knowledge.

Figure 1.0 Conceptual Model of Indigenous Knowledge



(Source: Stevenson, 1996)

Notice that 'traditional ecological knowledge' is in level 2 of 4 and is a subset of 'traditional knowledge'. Stevenson's conceptualization also makes a fundamental distinction that the Usher (2000) model does not – namely, that traditional knowledge is not a static body of knowledge rooted in the past, but is constantly being combined with and contrasted against nontraditional knowledge to form contemporary understandings. Stevenson (1996) calls this contemporary understanding 'indigenous knowledge'.

In exploring the unfortunate temporal connotations associated with the term 'traditional', Wenzel (1991: 6) notes that "the word 'tradition' becomes a semantic

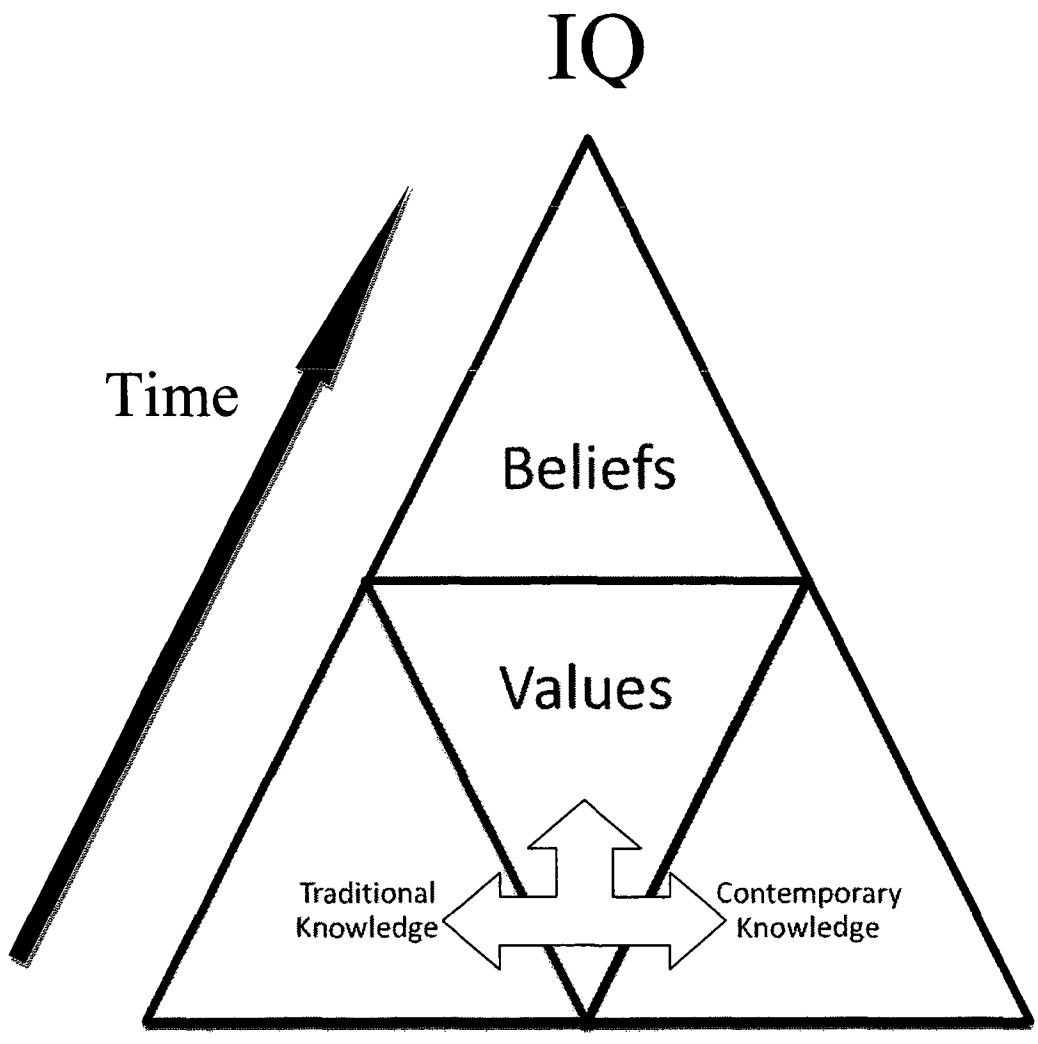
telescope that is used the wrong way round. What is distant is good: what is contemporary is bad because it has been tainted by modernity". He argues that *Qallunat* (non-Inuit) visitors to the Arctic do not see the igloos, harpoons, and dog teams they romantically expect. Instead, they see modern houses, rifles, and snowmobiles - they recognize these artifacts as being products of Western society, and they therefore conclude that Inuit culture is a thing of the past. In the words of Brody (1975: 141) "signs of modernity are signs of an ineluctably disappearing tradition". But Brody, like Wenzel, recognizes the "fallacy of defining tradition in the terms of classical social anthropology as the customs of pre-contact culture" (Brody, 1975: 141-2). Brody (1975: 140) explores different elements of traditional knowledge as well, and his listing makes contemporary aspects of 'tradition' explicit – he notes that knowledge of the syllabic writing system (adapted to Inuktitut in the 1870's) and Christianity "are included in the same association of traditional knowledge as hunting techniques, richness of language, geographical lore, animal behaviour and clearly defined authority in the family".

In Nunavut, the preferred term is *Inuit Qaujimajatuqangit* (IQ), which is defined as "the knowledge and understanding of all things that affect the daily lives of the Inuit and the application of that knowledge for the survival of a people and the culture – a knowledge which has sustained the past, to be used to ensure an enduring future" (Government of Nunavut, Community Government and Transportation, as quoted in Manseau, Parlee and Ayles, 2005: 153). Alternatively, IQ has been defined as the "combining of the traditional knowledge, experience and values of Inuit society, along with the present Inuit knowledge, experience and values that prepare the way for future knowledge, experience and values" (White, 2006: 405). In this definition, the word

'traditional' is used only in reference to the past – present knowledge, and future knowledge, are weighted equally. Moreover, knowledge is paired with experience and values. Learning from experience, and looking to the future, is the core of adaptive capacity, and this definition is therefore particularly well-suited to this study. Reference to values is also fitting, as collaborative management recognizes that the state of the environment is a matter of social-cultural preference – a matter of values (Nadasdy, 1999).

Inuit Qaujimajatuqangit is contemporary, and it is comprehensive. Building on these definitions, on the categorization of traditional knowledge advanced by Usher (2000), and on the conceptual model of Indigenous knowledge advanced by Stevenson (1996), IQ can be understood as a system, whereby traditional ecological knowledge is combined with contemporary ecological knowledge (scientific and experiential) to influence contemporary values, and contemporary beliefs in turn (see Figure 2).

Figure 2.0 Conceptual Model of *Inuit Qaujimajatuqangit*



(Compiled and adapted from White, 2006; Government of Nunavut, Community Government and Transportation, as quoted in Manseau, Parlee and Ayles, 2005; Berkes et al., 2000; Usher, 2000; and Stevenson, 1996)

The Nunavut Wildlife Act (2008) outlines 13 principles of *Inuit Qaujimajatuqangit*, which are used here as an approximation of the values that govern human-human and human-environment interactions:

1. *Pijitsirniq*, which means that a person with the power to make decisions must exercise that power to serve the people to whom he or she is responsible;
2. *Papattiniq*, which means the obligation of guardianship or stewardship that a person may owe in relation to something that does not belong to the person;

3. *Aajiiqatigiingniq*, which means that people who wish to resolve important matters or any differences of interest must treat each other with respect and discuss them in a meaningful way, keeping in mind that just because a person is silent does not necessarily mean he or she agrees;
4. *Pilimmaksarniq*, which means that skills must be improved and maintained through experience and practice;
5. *Piliriqatigiingniq*, which means that people must work together in harmony to achieve a common purpose;
6. *Avatimik Kamattiarniq*, which means that people are stewards of the environment and must treat all of nature holistically and with respect, because humans, wildlife and habitat are inter-connected and each person's actions and intentions towards everything else have consequences, for good or ill;
7. *Qanuqtuurunnarniq*, which means the ability to be creative and flexible and to improvise with whatever is at hand to achieve a purpose or solve a problem;
8. *Qaujimanilik*, which means a person who is recognized by the community as having in-depth knowledge of a subject;
9. *Surattittailimaniq*, also called *Iksinnaittailimaniq*, which means that hunters should hunt only what is necessary for their needs and not waste the wildlife they hunt;
10. *Iliijaaqaqtailiniq*, which means that, even though wild animals are harvested for food and other purposes, malice towards them is prohibited;
11. *Sirliqsaaqtittittailiniq*, which means that hunters should avoid causing wild animals unnecessary suffering when harvesting them;
12. *Akiraqtuutijariaqanginniq Nirjutiit Pijjutigillugit*, which means that wildlife and habitat are not possessions and so hunters should avoid disputes over the wildlife they harvest or the areas in which they harvest them; and
13. *Ikpigusuttiarniq Nirjutilimaanik*, which means that all wildlife should be treated respectfully.

(Source: Nunavut Wildlife Act, 2008)

Notice that of these thirteen principles, none are exclusively ecological in nature. Even principles nine, 10, 11, and 13, which refer directly to wildlife, have implications for social and spiritual well-being. Article 5 of the Nunavut Land Claims Agreement outlines nine complementary principles that allude to values, although it is unclear which (if any) are of Inuit origin:

1. Inuit are traditional and current users of wildlife;
2. The legal right of Inuit to harvest wildlife flows from their traditional and current use;
3. The Inuit population is steadily increasing;
4. A long-term, healthy, renewable resource economy is both viable and desirable;

5. There is a need for an effective system of wildlife management that compliments Inuit harvesting rights and priorities, and recognizes Inuit systems of wildlife management that contribute to the conservation of wildlife and protection of wildlife habitat;
6. There is a need for a system of wildlife management and land management that provide optimum protection to the renewable resource economy;
7. The wildlife management system and the exercise of Inuit harvesting rights are governed by and subject to the principles of conservation;
8. There is a need for an effective role for Inuit in all aspects of wildlife management, including research, and;
9. Government retains the ultimate responsibility for wildlife management.

(Source: NFA, 1993)

2.2.1 Traditional Knowledge and Western Scientific Knowledge

Many authors continue to debate the epistemological nature of traditional knowledge (TK), usually by way of comparison with western scientific knowledge (WSK). In the preceding section, traditional knowledge is defined and understood relative to itself. More commonly, authors explore and define traditional knowledge by way of comparison with western scientific knowledge. Herein lies a central debate – are traditional epistemologies distinct from those of science? Authors who argue that they are usually do so with reference to one or several of the attributes tabled below (compiled from Paci et al., 2002; Wenzel, 1999; Nadasdy, 1999; Stevenson, 1996; Stevenson, 1995; Agrawal, 1995).

Table 2.0 Attributes of Traditional and Scientific Epistemologies

Attributes of TEK	Attributes of WSK
Emic (culture-specific)	Etic (culture-neutral)
Holistic	Compartmentalized
Moral	Value-Free
Long Time Scales	Short Time Scales
Subjective	Objective
Inclusive	Exclusive
Nonsystematic	Systematic
Experiential	Experimental
Qualitative	Quantitative
Relative	Absolute
Oral	Literate
Inductive	Deductive

The ongoing debate centers on assessing the extent to which science and traditional ways of knowing are epistemologically distinct (Usher, 2000; Agrawal, 1995; Bielawski, 1992). Bielawski (1992) holds that Inuit knowledge, like science, is consensual, replicable, generalizable, incorporating, sometimes experimental, and somewhat predictive. Agrawal (1995) agrees, and concludes that most theoreticians identify differences on three grounds – substantive (i.e., differences in subject matter), methodological/epistemological, and contextual. He argues that "the attempt to create two categories of knowledge – indigenous/traditional vs. Western/scientific – ultimately rests on the possibility that a small and finite number of characteristics can define the elements contained within the categories. But the attempt fails on each of the three counts: substantive, methodological, and contextual" (Agrawal, 1995: 2).

Wenzel (1999), on the other hand, tentatively concludes that there are fundamental differences, and Berkes and Henley (1997: 30) assert that "the differences

are in fact many, including the ways in which knowledge is generated, shaped and transmitted". It is not my intention to enter this debate on whether, or to what extent, TK and WSK represent distinct ways of knowing, but an understanding of this debate is necessary to contextualize many of the challenges impeding knowledge integration. The very fact that there is a debate seems to legitimize a more moderate view – one that recognizes similarities, but allows for differences. Huntington (2000: 1270) holds such a view, and he maintains that "while there are important differences between the structure and purpose of TEK and those of scientific knowledge...TEK has an empirical basis and is used to understand and predict environmental events". With a moderate conclusion, that will serve to temporarily dismiss this issue, Huntington recognizes that similarities, and differences, are in degrees. The conclusion that truly matters is that traditional knowledge and scientific knowledge are both fallible and should therefore be compared – when they concur, confidence is increased. When they do not concur, the nature and sources of the divergence should be explored and new research should be designed collaboratively (Johannes et al., 2000). Collaborative management institutions encourage these comparisons.

2.3 Collaboration and Collaborative Management

Collaborative management, like traditional knowledge, goes by many names: cooperative management, co-management, community-based management, participatory management, joint management, and multi-party management. Plummer and Fitzgibbon (2004) review the usage of three terms – partnership, collaboration, and co-management – and find little clarity or consistency of use. In general, all of these terms refer to a sharing (presumably, a more equitable sharing) of decision-making power between the

state, resource-users (who are often, but not exclusively, Indigenous), and/or other affected stakeholders (private and commercial interests) (Plummer and Fitzgibbon, 2004). Pinkerton (1992: 331) defines co-management as "power-sharing in the exercise of resource management between a government agency and a community or organization of stakeholders". The Royal Commission on Aboriginal Peoples (1996) defines co-management as "institutional arrangements whereby governments and Aboriginal entities (and sometimes other participants) enter into formal agreements specifying their respective rights, powers, and obligations with reference to the management and allocation of resources in a particular area of Crown lands and waters" (Royal Commission, 1996: 667).

Arnstein (1969) suggests that power-sharing (public participation) arrangements can be assessed relative to an eight point scale – 'Arnstein's ladder'. From the bottom of the ladder (signifying the least amount of power-sharing), the eight categories are: 1) manipulation, 2) therapy, 3) informing, 4) consultation, 5) placation, 6) partnership, 7) delegated power, and 8) citizen control. Community-based management, a variation of citizen control, has been advocated as the appropriate level of devolution, as it empowers local communities and, so it has been argued, ensures the sustainability of ecosystems by giving stewardship powers to the people whose livelihoods depend directly upon the sustainability of said ecosystems. More recently, researchers have begun to rethink community-based management (see Berkes, 2004) and have recognized key management functions that are best performed by regional or state-level actors. These management functions can relate to scale (e.g., when a common pool resource is drawn upon by multiple communities, as is the case with narwhal management) or to capacity (e.g.,

when regional or state agencies or institutions have the human or financial capacity necessary to carry out specific management functions such as monitoring or enforcement). Not all capacity will be located at any one level; neither should decision-making powers be. This being the case, a partnership (the sixth rung of Arnstein's ladder) or delegated power (the seventh) may be considered a more appropriate degree of power sharing (Singleton, 2000). A multi-level institution that draws on the knowledge, capacity, and experience of actors at all levels is most capable of managing complex social-ecological systems. This, at least, is the rationale for co-management.

Castro and Nielson (2001) identify three types of co-management – crisis-based, claims-based (comprehensive), and community-based. They maintain that all three, to varying degrees, are crisis-based, and Mitchell (2002: 18) lists four types of conflict that give rise to these crisis: (1) differences in knowledge or understanding, (2) differences in values, (3) differences about distribution of benefits and costs, and (4) differences due to personalities and circumstances of interested parties. Differences in knowledge and understanding can lead to "conflict about whether a problem exists and/or about appropriate solutions to deal with it" (Mitchell, 2002: 18). Indeed, Bielawski (1992) argues that differences in knowledge are the root cause of all Inuit/non-Inuit conflict related to resource and environmental management. Therefore, integrating indigenous knowledge with scientific knowledge, with the intention of creating shared understandings, has emerged as the central means of co-management institutions. Effective knowledge sharing and integration has the potential to create more accurate understandings of complex social-ecological systems than either traditional knowledge or scientific knowledge could create alone. The presumed benefits of knowledge sharing

and integration are many, but there are significant challenges, and considerable risks, each of which is further discussed below. Challenges are barriers that can be overcome. Risks are somewhat inherent in Arctic wildlife co-management – the term is used here with reference to the possible outcomes of challenges not met.

2.4 Knowledge Integration

There is a long and rich history of Inuit knowledge being used by non-Inuit for exploration and trade (Duerden and Kuhn, 1998). Some Arctic explorers adopted Inuit technologies (e.g., clothing, transportation) with great success (e.g., Rae, 1813-1893), while others who did not met with less desirable fates (e.g., Franklin, 1786-1847). Similarly, Inuit knowledge enabled a robust Arctic fur trade, and allowed European/American whalers to find and kill Arctic whales while avoiding environmental hazards. Duerden and Kuhn (1998) note that in the years following the end of large-scale Arctic whaling (c.1900), Inuit knowledge was largely ignored or disregarded by broader Euro-Canadian society. Since the World Commission on Environment and Development (1987), Euro-Canadian interest in, and application of, Inuit knowledge has experienced a resurgence. This renewed interest is due to: (1) environmental impact assessments of Arctic megaprojects, (2) the negotiation of comprehensive land-claims, and (3) a growing environmental consciousness which looks to Indigenous peoples as role models (Duerden and Kuhn, 1998). Indigenous knowledge is now being incorporated in environmental impact assessment, parks planning, wildlife management, and fisheries management (Devin and Doberstein, 2004; Usher, 2000; Stevenson, 1996).

2.4.1 Presumed Benefits

Reasons for incorporating TEK into resource management and research are both practical and political. Practically, TEK often provides information which directs or complements scientific research; politically, the incorporation of TEK empowers local actors. In short, the incorporation of TEK yields many benefits, which range from the "narrowly technical and scientific to the broadly cultural and political" (Huntington et al., 2002: 779). Huntington (2000: 1270) lists presumed benefits of incorporating traditional knowledge into resource management and research – he concludes that TEK advocates promote its merits on the grounds that it: (1) adds "more and sometimes better information", (2) identifies "new paradigms by which we can understand the natural world and our relation to it", and/or (3) moves management "away from the positivist and amoral and toward the holistic and ethical". The third of these relates to the fact that values are an integral component of traditional knowledge, and incorporating traditional knowledge into management forums means values are incorporated as well. This is important in a domain which has traditionally professed to be value-free, but which, many would argue, never truly was (Nadasdy, 1999). An inspection of the culturally-rooted values that underlie traditional and scientific epistemologies challenges dominant paradigms associated with each, and forces critical thinkers, traditional and scientific, to reflect upon the premises and assumptions that colour their perceptions.

Politically, knowledge integration is a "potential means by which to resolve longstanding conflicts between indigenous peoples and state governments" (Natcher et al., 2005: 240). Brook and McLachlen (2005: 2) argue that the primary goal of all traditional knowledge research should be to "empower communities to contribute in meaningful ways and ensure that the studies are of local benefit". Thus, incorporation of

traditional knowledge is seen as a vehicle for negotiating and realizing self-government, and as a means of building local management capacity.

Gilchrist and Mallory (2005: 1) call this "socioeconomic rhetoric" intended to "satisfy political agendas or appease the politically correct". Gilchrist and Mallory, and others (e.g., Fergusson and Messier, 1997) take a more narrowly technical view of the potential usefulness of TEK. For them, the usefulness of TK lies in its ability to inform scientific inquiry. Traditional knowledge can inform scientific inquiries. In fact, "indigenous knowledge of local flora and fauna often exceeds that of professional scientists" (Duerden and Kuhn, 1998: 31). In managing wildlife populations, two types of information are deemed essential: social information related to harvest pressure, and biological information related to the life history, health, and abundance of the wildlife population being managed. Simplistically, but ultimately, the purpose of this information is to determine the number, sex/age composition, movements, and health of individuals in the wildlife population (as well as trends in same), and the number of individuals withdrawn from the population through harvesting. Traditional knowledge is critical in monitoring the status of wildlife, and in monitoring harvest pressure.

Surveys of harvest pressure are intended to assess the number of animals being withdrawn monthly or annually from a wildlife population, and to produce data related to the location of harvest, the season of harvest, and the age and sex of the animal harvested. Such reports are referred to generally as harvest reports, as 'kill surveys', or as 'kill data' (Usher and Brooke, 2001). As noted by Usher and Brooke (2001), harvest reports are a social survey and should not be confused with wildlife surveys. The former does not access information of wildlife populations directly, but documents human activity which

affects wildlife populations. Harvest effort and harvest success can be indicators of wildlife abundance, however Usher and Brooke (2001: 9) reaffirm that "drawing conclusions on trends, patterns or explanations for changes in harvesting patterns or success from kill data alone is tenuous at best. Recording discussions with Inuit on the conditions affecting their harvest (environmental and social) is considered extremely important". The key types of knowledge that can be gained from harvest surveys include (Stevenson, 1995):

1) Struck/lost ratios (correlated with the type of hunt, the weather, and the type of ammunition used)
2) Catch per unit effort
3) Harvest pressure
4) Sex/age composition of harvested animals.
5) Location of harvest
6) Season of harvest

Wildlife surveys, unlike harvest surveys, are intended to directly observe and document information regarding wildlife health, abundance, behavior, and distribution. Some standard scientific methodologies intended to assess health, abundance, behavior, and distribution, include: aerial surveys, tagging programs (satellite telemetry), and molecular genetic analysis (Reeves and St. Aubin, 2001). Traditional ecological knowledge can often improve the accuracy and reliability of information derived from these and other scientific methods. For example, TEK can be beneficial in identifying where and when aerial surveys should take place (Huntington, 1998). Below is a list of TEK observations that can improve understandings of wildlife populations (compiled from Usher and Brook, 2001; Stevenson, 1995).

1) The size of pods, herds, flocks
2) Sex/age composition of pods, herds, flocks
3) Direct observations of animal abundance
4) Indirect observations of animal abundance (e.g., tracks)

5) Occurrence of predators
6) Occurrence of disease
7) Observations on health and condition
8) Observations of behaviour
9) Frequency of encounters
10) Location of encounters
11) Noting of familiar individuals
12) Frequency of pregnancies/proportion of juvenile animals
13) Frequency of older animals
14) Occurrence of prey species (food supply)
15) Occurrence of associated species (sympatric relationships)

Moller et al. (2004) complement this listing with one of their own – a list of seven traditional methods of wildlife monitoring employed by indigenous hunters: catch per unit effort, body condition, breeding success, population density sensing, communal hunts, noting of unusual patterns, and observations of species composition. Additionally, Johannes et al. (2000: 257) conclude that "fishers can provide critical information on such things as interannual, seasonal, lunar, diel, tide-related and habitat-related differences in behavior and abundance of target species, and on how these influence fishing strategies". Lastly, Huntington (1998) holds that traditional knowledge holders often have detailed understandings of migratory patterns, local movements, feeding behaviour and prey patterns, predator avoidance, calving, bathymetry, ecological interactions, and human influences.

All of these potential contributions notwithstanding, actual cases of TEK influencing the outcome of biological research are few (but see Huntington, 2000; Fergusson and Messier, 1997). In the words of Huntington (2000: 1270) "much has been written about the potential benefits of documenting and applying TEK, but it is frequently in the future tense: 'TEK *will* be of use,' somewhere, sometime" (italics in original). This lack of successful integration is attributed to the fact (or perception) that traditional knowledge is

incompatible with scientific frameworks, which dominate wildlife research and management. This has led some researchers to conclude that if TK is to be applied, it must be documented in scientific terms, and must be verified scientifically (Gilchrist et al., 2005). Attempts to do so have met serious opposition.

To expand by way of example, Gilchrist et al. (2005) collected local ecological knowledge (LEK) pertaining to four migratory bird species. They then proceeded to compare this knowledge with WSK of the same species in an "attempt to examine the reliability" of LEK (Gilchrist et al., 2005). The fundamental flaw in this approach is that WSK of these species, and of Arctic wildlife populations more generally, is incomplete and highly uncertain. There is no suitable answer key against which LEK can be graded. This is tantamount to the belief that "science provides the 'gold standard' against which traditional management systems must be judged" (Moller et al., 2004: 10). Brook and Mclachlen (2005: 2) criticize the methods of Gilchrist et al. (2005), stating that "when LEK is validated using scientific studies, it aids in maintaining the balance of power in the hands of the scientists and marginalizing the contribution of local people". With this example of a heavily criticized attempt to integrate TK and WSK in mind, what specific challenges are impeding effective integration, and what are the risks associated with poor integration? And if poor integration maintains an inherited power imbalance, what does effective integration entail? Effective knowledge integration, first and foremost, must be culturally appropriate, and it should result in more accurate understandings of ecosystems and the human institutions that govern them.

2.4.2 Challenges

2.4.2.1 Bureaucratic Inertia

Like objects, bureaucracies in motion tend to stay in motion, and they tend to continue on their original trajectory (Peters, 2003). In other words, the *modus operandi* of management agencies has been institutionalized and is difficult/slow to change. Bureaucratic wildlife management has co-evolved with scientific methodologies and Western governance models – until recently, it has not been receptive to traditional knowledge or traditional ways of knowing.

2.4.2.2 Lack of Required Skills

Huntington (2000; 1273) summarizes this challenge: "many wildlife managers and researchers are unfamiliar with social science methods and are not prepared to attempt to use these methods to gain access to information that otherwise remains out of reach". Wildlife management has traditionally been the near-exclusive domain of biological and physical scientists. The skill sets they have consequently developed and refined are no less relevant in collaborative management contexts, but the skill sets of social scientists have emerged as a necessary complement.

2.4.2.3 Disciplinarity, Compartmentalization, and the Silo Effect

Interdisciplinary studies designed to combine physical and social methodologies are relatively few. Combining the knowledge of disparate academic disciplines, such as economics, conservation biology, and cultural anthropology, is perhaps as challenging as the process of combining traditional and scientific knowledge (Drew and Henne, 2006). Similarly, departmental compartmentalization, whereby one government department is responsible for marine mammals, and another for the marine environment, can lead to redundancies and competition (Dale, 2001; Bowonder, 1987). Like grain silos, which give rise to the term, the 'silo effect' refers to the fact that government departments

operate on parallel tracks, but do not necessarily exchange information efficiently. *Inuit Qaujimajatuqangit* is generally considered to be holistic – it links society with culture, the economy, and the environment; it blends together informational knowledge, values, and beliefs – it does not necessarily lend itself to the divisions of Western governance and research.

2.4.2.4 Documentation

As noted by Huntington, 1998: 238) "undocumented information is not portable, and the influence of...spoken testimony diminishes with distance in time and space". Usher (2000) suggests that TEK and WSK must be comparably documented if they are to be comparably weighted. The danger is that, in practice, this will mean documenting TEK in the terms of WSK systems, thus disassociating it from the philosophical worldview that gives it meaning. Nadasdy (1999) considers this a process of distillation, which reduces a rich and complete tapestry of social-ecological knowledge into a series of numbers and lines on maps.

2.4.2.5 Turn-over and Continuity

Huntington et al. (2002) stress the importance of continuity – of building relationships over time. Continuity also increases accountability, as participants can "make it clear when someone fails to deliver on promises" (Huntington et al., 2002: 787). In the Arctic, residence time of Western actors is often short. Consequently, management plans are assessed by people who never implemented them, and implemented by people who never negotiated them.

2.4.2.6 Language

Language shapes ideas and defines reality. As noted by Nadasdy (1999) terms such as 'subsistence' and 'conservation' have no equivalent in aboriginal languages – lacking these terms, it is impossible to interpret them accurately without compromising their meaning. Scientists, managers, and Westerners more generally, "assume that the contested terms refer to agreed-upon realities, when in fact they serve only to mask deep cultural differences" (Nadasdy, 1999: 3).

2.4.2.7 Willingness to Engage Conflict

Natcher et al. (2005: 241) conclude that the success of co-management initiatives "depends on the participants' abilities to engage rather than subvert differences in knowledge and cultural experiences". This willingness is sometimes lacking, either because there is a lack of continuity, because of cultural sensitivities, or because scientific discussions can be intimidating to individuals not familiar with scientific methodologies and terminology. Furthermore, the Inuit principles of *Piliriqatigiingniq* and *Aajiiqatigiingniq* stipulate that participants must be respectful of each other, and must work together harmoniously. Not challenging opinions different from one's own is a form of respect, and maintaining group harmony can necessitate conflict-avoidance.

2.4.3 Risks

2.4.3.1 Intellectual Property Rights

Wenzel (1999) discusses issues relating to the ownership of TEK and control of its application, present and future. Huntington (1998) provides an example that justifies Wenzel's (1999) concerns - he records a case where residents of an Arctic community shared detailed information regarding herring (*Clupea pallasi*) only to have that information exploited by competitors in the commercial fishing industry. Stevenson

(1996: 283) states that "many Inuit view the extraction of their TEK from its broader cultural context as a form of theft". Too often TEK information is used selectively, with selections being made by scientists, and important contextual information is lost (Duerden and Kuhn, 1998: 31).

2.4.3.2 Knowledge Distillation

In many research applications, traditional knowledge is "simply information", whereas to Aboriginal peoples it is always "much more" (Bielawski, 1992: 218). When the focus is on ecological knowledge, values and preference can be disregarded – a form of exclusionary compartmentalization. This risk stems from the fact that Western culture perceives humans as being apart from nature, while Aboriginal cultures perceive humans as being a part of nature (Paci et al., 2002). By extension, knowledge is separate from values, which is separate from society, which is separate from economy, which is separate from culture – there is a committee, a governmental department, an academic discipline, and a working group for each. Thus a study of ecology alone imposes a Western paradigm in that it ignores society and economy. Nadasdy (1999: 4) summarizes this risk succinctly: "when asked to share their knowledge about the 'environment' (native elders) are just as likely to talk about 'non-environmental' topics like kinship or respect as they are to talk about animals and landscapes. Every time researchers or bureaucrats dismiss or ignore these parts of an elder's testimony as irrelevant, they are actually imposing their own culturally derived standards of relevance".

2.4.3.3 Coercion

Some authors argue that attempts to integrate traditional knowledge with scientific knowledge, whether in collaborative management forums or research, serve to perpetuate preexisting power dynamics, and reinforce colonial-style Aboriginal-State relations (Natcher et al., 2005). Traditional knowledge is often recast and interpreted in scientific terms, or is appended to reports which are otherwise typically Western (Mauro and Hardison, 2000). Subsequently, decisions can be said to have integrated traditional knowledge - which increases community support. Incorporating IQ into Western reports is insufficient if IQ holders are not included in the process of interpreting and assigning meaning to that knowledge.

2.4.3.4 Disrespectful of Animals

When scientists presume animals to behave in certain ways because of instincts or impulses; when they explain away complex social behavior in terms of evolutionary theory; when they perceive every animal action as a reaction to environmental stimuli, they deny that animals are sentient, thinking beings. Nadasdy (1999: 7) quotes an Aboriginal hunter: "biologists think animals are stupid. They're not". Of course, not all biologists are as dismissive as they have been characterized above, but the point stands and is illustrative of a simple truism – Inuit and non-Inuit value animals differently, and ascribe to them different capacities for emotion, thought, and complex behavior.

2.4.3.5 Traditional Knowledge/Western Institution

As stated by Natcher (2005: 241), "First Nation representatives are being forced to participate in an institutional process that is in many ways culturally inappropriate". The institutional process is still one of scientific resource management – traditional knowledge that does not conform to this conceptual framework is not incorporated. The

risk is that important knowledge, important values, or important beliefs will be invisible to a system never intended to see them.

2.4.3.6 Burnout/Response-Burden

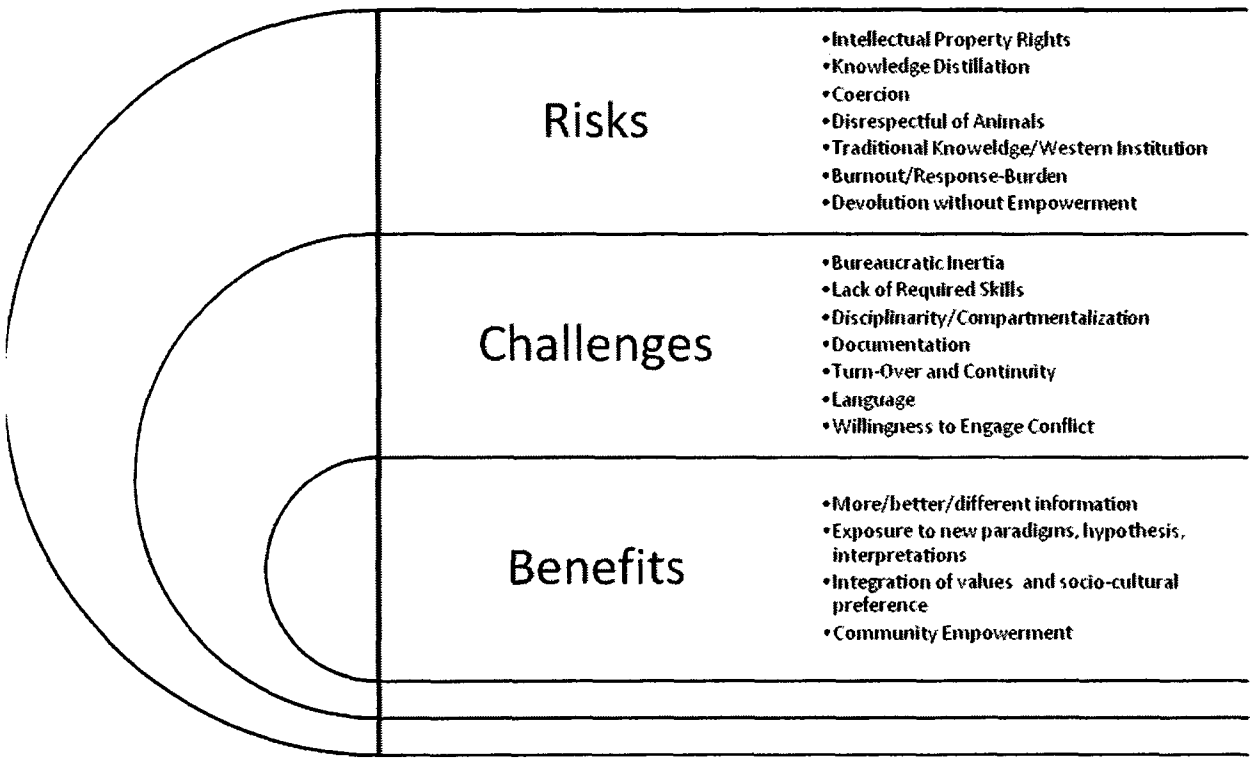
People can be left with the feeling of having participated in participation, nothing more (Arnstein, 1969). Arnstein (1969: 220) quotes a woman repeatedly asked to participate in attitude surveys: "nothing ever happens with those damned questions, except the surveyor gets $3 an hour, and my washing doesn't get done that day". What is more, "insistence on a TEK component of every ecological research and management activity will only succeed in reducing TEK to a token" (Huntington, 2000: 1273).

2.4.3.7 Devolution without Empowerment

Federal and territorial governments may view devolution of certain management responsibilities as a way of downloading costs (Plummer and Fitzgibbon, 2004). This is a risk when the management functions downloaded are better performed by the territory or state, or when community goals and objectives (e.g., economic development) are inconsistent with those of the state (e.g., conservation) (Berkes, 2004; Singleton, 2000). Devolution without empowerment occurs when "communities and local authorities are asked to bear the work and costs of resource management without any meaningful transfer of authority or decision making" (Castro and Nielson, 2001: 231). Castro and Nielson (2001) report that communities are sometimes presented with pre-established plans originating at higher levels of political organization, and acceptance or rejection are the only choices offered.

These risks, challenges, and benefits are summarized below in Figure 3.0. Benefits are shown in the center – these are impeded by a layer of challenges, and further complicated by an outer layer of risks. To realize the benefits of knowledge integration managers will have to carefully peal back and examine each layer, from the outside in.

Figure 3.0 Knowledge Integration: Summary of Benefits, Challenges, and Risks



2.5 Adaptive Capacity

Co-management alone has proven insufficient in avoiding these risks, meeting these challenges, and realizing these benefits. Evidently something is missing. That something, potentially, is a consortium of concepts related to 'adaptive capacity'. The consortium includes resilience, vulnerability, exposure, and sensitivity. Armitage (2005b: 703) considers adaptive capacity as a "critical aspect of resource management that reflects learning and an ability to experiment and foster innovative solutions in

complex social and ecological circumstances" As a concept, adaptive capacity is considered a determinant of resilience - defined by Folke et al. (2002: 437) as "the capacity to buffer change, learn and develop". It is also a determinant of vulnerability, which is understood to be a function of exposure (to changes affecting the structure or function of a system), sensitivity (to changes affecting the structure of function of a system), and adaptive capacity (the capacity to buffer, cope with, or even profit from changes affecting the structure of function of a system) (Smit and Wandel, 2006).

Adaptive capacity, as a concept, requires an elemental understanding of the term 'adaptation'. The concept of adaptation originates in the field of evolutionary biology – it refers to genetic or behavioral modifications that enable organisms or populations of organisms to survive in, and exploit, changing environments. Formerly used with exclusive reference to ecological systems, the concept of 'adaptation' has since helped to foster understandings of social, cultural, economic, and management systems, as well as linked systems that include several or all of the aforementioned (Leduc, 2006; Johnson, 1999a; Johnson, 1999b; Bowondor, 1987). For applications such as these, involving complex relationships between linked systems, 'adaptation' is best defined simply, as a "process of change in response to a change" (Denevan, 1983: 401). In understanding and managing linked social-ecological systems the concept of 'adaptation' has gained traction as an approach to decision-making. The process of change can be non-linear and synergistic, and drivers of change can and often do originate outside of the immediate system of interest (i.e., drivers network and reticulate across scales and levels to manifest themselves in sometimes surprising ways, in sometimes surprising places) (Waltner-

Toews and Kay, 2005; Waltner-Toews, 2004; Holling, 2001; Richardson, 1991; Holling, 1978).

Recognizing these attributes of complex systems, adaptive management (Holling, 1978) stresses the importance of monitoring and learning. Adaptive management views policy initiatives as experiments – as a source of new information, and a means of refining future policy initiatives. In short, adaptive management recognizes the complexity and uncertainty inherent in linked social-ecological systems, and counters it with learning and flexibility. Authors distinguish between several types of learning, but two related concepts are of particular significance in the context of this research – social learning, and experiential learning. Sayer and Campbell (2004: 58) define social learning as "a change in a widely shared set of beliefs...achieved by communities learning together through shared experiences". They define experiential learning as "learning by doing.... In natural resource management it captures the idea that people should not be taught new ideas or technologies but should be helped to experiment". Social learning (sometimes referred to as collaborative learning) is the core of collaborative management, as it emphasizes group learning through knowledge sharing and joint action. Experiential learning is the core of adaptive management, which emphasizes the "continual reinforcement of learning by experimentation and feedback" (Sayer and Campbell, 2004: 70). Adaptive co-management is linking the two.

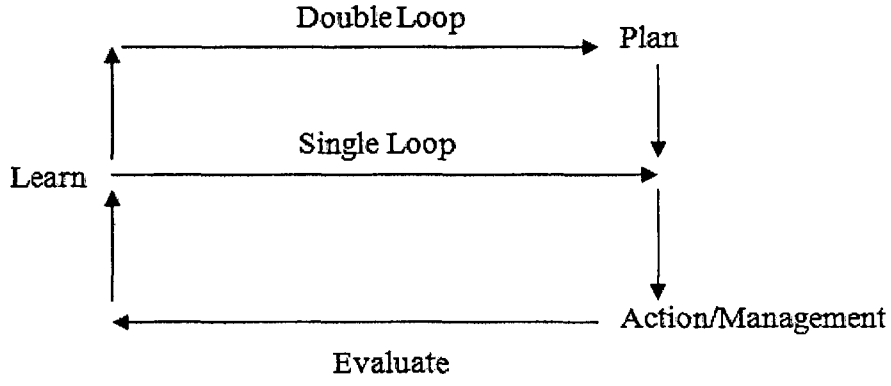
Sayer and Campbell (2004) also distinguish between single-loop and double-loop learning. Single-loop learning is pragmatic and practice-oriented. Double-loop learning is process-oriented and focuses on assessing/revising premises, assumptions, and worldviews (Armitage et al., 2009). Single-loop learning focuses on specific decisions,

and is highly applied (e.g., what is the maximum sustainable yield for Baffin Bay narwhal; how can struck and lost rates be reduced?), while double-loop learning focuses on the context that guides specific decisions (e.g., how can scientific knowledge and IQ be combined without compromising either?). Diduck et al. (2005: 271) summarize the distinction between single-loop and double-loop learning:

> Single-loop learning occurs when matches [between management intentions and outcomes] happen, or when mismatches are corrected by changing one's strategy or behavior while preserving basic values and norms. Double-loop learning occurs by correcting mismatches by first changing or supplementing existing values and norms, and then changing strategies or behavior.

Figure 4 is a conceptual representation of adaptive management and the single and double- loop learning processes that guide it.

Figure 4.0 Conceptual Model of Adaptive Management and Learning



2.6 Convergence: Adaptive Co-Management

In light of the challenges and risks associated with co-management, and consistent with evolving understandings of the complexities and uncertainties inherent in linked social-ecological systems, authors have begun to link adaptive management with co-management, combining the "iterative learning dimension of adaptive management and the linkage dimension of collaborative management" (Berkes et al., 2007). The

combination has resulted in an emergent management process which is greater than the sum of its component parts – adaptive co-management (Olsson et al., 2004; Buck et al., 2001; Ruitenbeek and Cartier, 2001). Linking traditional knowledge with scientific knowledge is both a purpose and an outcome of ACM processes. Adaptive co-management has been defined as "a process by which institutional arrangements and ecological knowledge are tested and revised in a dynamic, ongoing, self-organized process of learning-by-doing" (Olsson et al., 2004: 75). The focus is both practical, and process-oriented. In other words, adaptive co-management links knowledge sets and actors in an ongoing learning process intended to satisfy immediate management objectives and institutional/organizational objectives.

Co-management is premised on participatory problem identification, learning, planning, monitoring, and enforcement. As the capacity to carry out these and related functions does not reside solely at any level of political organization, neither should authority for these or related functions rest with any single actor or agency. Adaptive management encourages experimentation and learning, to cope with uncertainty and change, and adaptive co-management encourages experimentation that involves multiple actors, performing various functions, at multiple levels. The success of efforts to combine IQ with WSK in the context of narwhal co-management in Nunavut is best understood relative to this backdrop of collaboration (how is knowledge shared across levels and used within levels?) and adaptation (what are the key social-ecological drivers affecting the system and is the system capable of coping?). This understanding will culminate in an assessment of the adaptive co-management process. Berkes et al. (2007) identify nine core components of adaptive co-management: reason for being, degree of

power sharing, worldview and sense-making, rules and norms, trust and respect, linkages and networks, use of knowledge, capacity to experiment, and learning. These, they suggest, can be assessed relative to three stages of maturation: early, middle, and mature. A designation of early indicates a system that is inflexible and unresponsive to social-ecological feedback: a designation of mature indicates a system that is flexible, with collaborative learning-networks coming together to test and revise ecological knowledge and institutional procedures. Chapter Three will further refine these ideas and develop a methodology appropriate to assessing the relationship between IQ, collaboration, and adaptation.

3. APPROACH AND METHODS

3.1 Approach

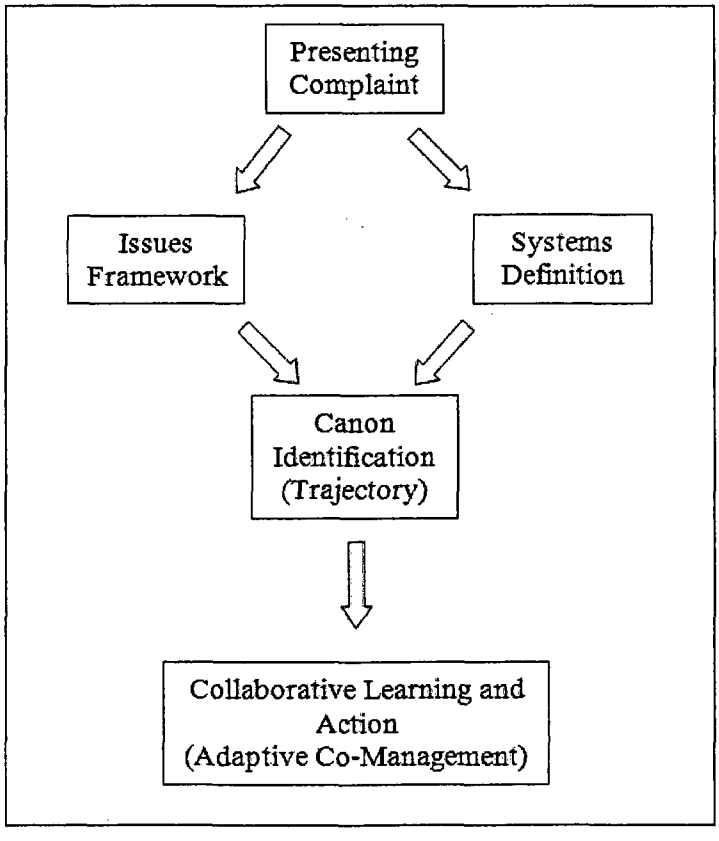
The methodology used to guide this research works from two academic traditions that are particularly well suited to the study of contextual dynamics – geography and history. Neither is defined by subject-matter, but rather, by perspective. Geography, at its core, is the study of space, and the defining perspective is spatial. The human dimension of geography, in particular, is firmly focused on the human-environment interface – the relationship between people and place. History, at its core, is the study of phenomena through time, and the defining perspective is temporal. This chapter outlines a methodology capable of recognizing and 'making-sense' of cross-scale, multi-faceted spatial-temporal dynamics, be they social, ecological, or economic in nature. This methodology must be capable of identifying issues and their owners and tracking the human-environment relationship through time. It must shed light on IQ and co-management, on challenges and risks associated with knowledge management, and on implications for learning and adaptive capacity.

Established methodologies from the related fields of complex systems and adaptive co-management are herein considered the most capable of exploring these questions. With that said, the methodology employed here has been tailored to the community-based narwhal management system, and is specific to it. Established methodologies, and the amalgam employed here, are further discussed below. For ease of reference each step of the approach being employed is presented in chronological order. This is followed by a short explanation and justification of specific methods of data collection and analysis, and a definition of scope.

3.1.1 Adaptive Methodology for Ecosystem Sustainability and Health

The Adaptive Methodology for Ecosystem Sustainability and Health (AMESH) is a pluralistic approach to resource and environmental management that actively seeks to incorporate the multiple perspectives (knowledge, values, preferences) of stakeholders (Waltner-Toews and Kay, 2005; Waltner-Toews, 2004). Underpinning the AMESH is a belief that expert-driven resource and environmental management is never value-free - that the state of the environment is negotiated, and negotiations are "driven by perspective and preference" (Waltner-Toews and Kay, 2005: 1). The methodology being employed in this study will draw on the AMESH – especially where it provides guidance on identifying issues and creating system-definitions (see Figure 5).

Figure 5.0 Simplification of AMESH



The AMESH usually begins with a problem definition (Phase 1), or, in the language of Waltner-Toews, a 'presenting complaint'. Examples of presenting complaints can include dead fish or birds washing on shore, increased incidence of human illness, or a population crash of a wildlife species. In the context of this research, the problem is unequal, ineffective use of knowledge. The first substantive step of this process is the identification of issues related to knowledge management. After identifying issues the focus broadens to create definitions of the social-ecological system. Finally, drawing on the issues framework (Chapter Four) and the system definition (Chapter Five) the process of adaptive narwhal co-management is assessed relative to a framework developed by Berkes et al. (2007).

3.1.1.1 Issues Framework

The issues framework contained within the AMESH provides a means of identifying issues and their owners - of recognizing stakeholders and the nature of their stake. Issues can be individual or collective, and as is often the case with ecosystemic environmental and resource management, cause-and-effect relationships can be difficult to identify and are seldom linear. Actually, in recognizing feedback as an inherent quality of complex systems, actions can often be seen as causes of, and solutions to, social, economic, and/or ecological 'problems'. For example, poaching in developing-world protected areas can be viewed as a problem (i.e., conservation) and as a solution to a problem (i.e., hunger/food-security), depending on perspective. Strengthening monitoring and enforcement in these protected areas can therefore be seen as a solution (i.e., conservation) and as a new problem (i.e., hunger/food-security), again, depending

on perspective. Waltner-Toews (2004: 95) expands on the downfalls of singular/linear cause-and-effect problem solving:

> setting *single* goals and implementing programs to achieve them without regard to everything else is almost always disastrous. We improve the economy and trash the environment. We improve the environment and create social or economic problems. We reduce disease and destroy cultures. So we not only want to play with the constraints (as any good artist would), but also to seek a kind of balance.

The Issues Framework requires a historical inspection of governance and institutional arrangements – in essence, a definition of the decision-making system. There are multiple issues, and multiple owners – this analysis will help to determine which issues are being addressed collectively, which individually, and which not at all. Furthermore, having explored the role of traditional knowledge in collaborative decision-making forums in the literature review (theory), this analysis will explore the role of traditional knowledge in the context of Nunavut's narwhal co-management system (practice), and identify any discrepancies between the two – it will contextualize the findings of Chapter Two. The focus will be on identifying issues related to knowledge sharing, knowledge integration, and decision-making.

3.1.1.2 System Definitions

Waltner-Toews (2004) recommends 'SOHO' system-definitions – definitions that recognize self-organization, holonarchical structure, and openness. Self-organization is considered a "combination of feedbacks, boundaries and openness" (Waltner-Toews, 2004; 15). In a self-organizing system "feedback loops become organized in such a way as to make more effective use of the entering resources, build more structure, and enhance their own survivability" (Waltner-Toews, 2004; 14). The concept of feedback – which is being employed in fields such as engineering, biology, economics, and

mathematics – is "intimately linked with the concepts of interdependence and mutual or circular causality" (Richardson, 1991; 1). Feedback may be either positive or negative: it is positive if it tends to amplify the effects of change, and negative if it tends to dampen the effects of change. To reiterate, the concept of self-organization is intimately linked with the concept of feedback – as noted by Kay et al. (1999), recognition of self-organization in complex social-ecological systems is essentially recognition that the dynamics of these systems are largely a function of positive and negative feedback loops. As an example of feedback and circular causality, harvesting narwhal produces capital, which increases capacity, which increases harvesting, which increases capital, et cetera. This example is purely illustrative of the concept, as harvesting is highly regulated (socially, politically, and economically) and Berkes et al. (1994) have demonstrated that ownership of boats, firearms, and snowmobiles (i.e., capacity) is largely independent of harvest pressure. Nevertheless, identifying potential feedback loops between system-components, and hypothesizing as to whether the relationship is positive, negative, or even relevant, is an end unto itself – it provides a jumping-off point, which enables dialogue around linked social, ecological, and economic attributes.

The term 'holonarchy' is preferable to 'hierarchy' because the latter does not explicitly recognize different levels within the hierarchy as being somewhat autonomous entities (Waltner-Toews, 2004). Although the term 'level' would seem sufficient, and is in common usage, it implies a certain amount of homogeneity within levels, and does not recognize that each is in fact a complex system unto itself. This perception of simplicity within levels has served as a major justification for 'community-based' management (community being the base level of a political hierarchy). Researchers are coming to

recognize that communities are not simple and homogenous, but are themselves complex systems composed of disparate knowledge sets, values, and interests (Agrawal, 1995).

In a holonarchy each holon is considered to be both a system unto itself and a subsystem of a larger holon. Each holon is seen as distinct from, yet embedded in, larger holons. Thus a human is seen as an individual, who is part of a family, which is part of a community, which is part of a region, which is part of a nation, which is part of the international community. But a human is not a base holon, and is not a simple system – a human is a collection of cells, organized into organs, incorporated into systems. Similarly, a narwhal at the Admiralty Inlet floe-edge is part of a pod, which is part of the Admiralty Inlet sub-stock, which is part of the Baffin Bay/Davis Straight population, which is part of the global narwhal meta-population. Holanarchical system definitions allow for the recognition of cross-scale interactions, and the identification of system-drivers that originate either above or below the immediate holon under inspection. This is essential as ecological system-boundaries seldom parallel political, jurisdictional, and administrative boundaries. In the context of narwhal co-management, which management functions are performed in which holons? How is knowledge communicated across holons?

Finally, open systems are those that "exchange information, energy, or materials with their environment" (De Greene, 1981: 87). In a world of interconnections, every social-ecological system is open to outside influences. Thus marine toxicity, which originates outside the Nunavut narwhal management system, affects the Nunavut narwhal management system. Similarly, the sources of climate change, presuming they are anthropogenic, originate outside the immediate system but affect narwhal habitat and

narwhal harvests, and thereby influence the likelihood of management success. Studying systems, whether they are economic, social, ecological, or economic, requires that the system-boundaries be clearly defined. But energy, information, and materials *are* exchanged with 'the environment' – those systems (holons) above and below the boundaries of the system under inspection – and these exchanges are no less relevant than those that occur within the system under inspection. For example, the practice of medicine takes the human individual as the system of interest, while community health focuses instead on the circumstances that lead to (cause?) human illnesses and disorders. Practitioners in both fields may 'treat' obesity, diabetes, fetal alcohol spectrum disorder, depression, and sexually transmitted infections, but they have drawn their system-boundaries in different places – they are approaching the same problem at different scales. With health care, as with wildlife management, boundaries and scale matter. Key influences originating outside of the narwhal co-management system, as it is defined for the purposes of this study, will also be explored.

3.1.1.3 Canon Identification: Collaborative Learning and Action

In the lexicon of system sciences, a 'canon' is defined as a "set of options available to a particular system" (Waltner-Toews, 2004: 57). The aim here is not to predict what will be, but rather to develop an understanding of what is possible, and what is desirable. Complex systems have been shown to change unpredictably, sometimes suddenly, and in response to the non-linear cumulative effects of actions and reactions (Holling, 2004). Instead of predicting, systems scientists "describe propensities of ...[complex systems]...to behave in certain ways, almost as if their internal dynamics draw them into a set of possible futures, or propel them into certain trajectories"

(Waltner-Toews, 2004: 57). Management approaches that draw on complex systems theory (adaptive co-management, for example) often incorporate some sort of visioning process – stakeholders identify possible future system-states and determine which are most desirable/feasible.

Soft systems methodologies, such as AMESH, and methodological tools associated with adaptive co-management, such as visioning and scenario-planning (See Olsson, 2007; Peterson, 2007), are primarily future-based explorations. That said, these methodologies differ substantially from traditional predictive sciences. Predictive sciences typically involve some form of forecasting – they attempt to predict the state of the social-ecological system *as it will be* at some point in the future, and governance systems then devise strategies to modify it. Adaptive co-management is also future-based, but the emphasis is on backcasting. Backcasting is the process of creating a shared vision of the social-ecological system-state *as it ought to be* at some point in the future, and governance systems then devise and implement actionable intermediary steps aimed at realizing this common vision.

Identifying the canon of the narwhal co-management system will effectively bound the system – it will identify the boundaries and constraints within which adaptive co-management processes must operate. This analysis will draw on an adaptive co-management framework developed by Berkes et al. (2007). The purpose of this analysis is to chart the evolution of adaptive narwhal co-management – to assess nine indicators (reason for being, degree of power sharing, worldview and sense-making, rules and norms, trust and respect, linkages and networks, use of knowledge, capacity to experiment, and learning) relative to three stages of maturation (early, middle, mature).

These nine indicators allow for a comprehensive analysis of the CBNM system. With an understanding of where the system has been (developed in Chapter Five) this framework will help to determine where it might go.

3.2 Methodology

Generally speaking, this research is qualitative and inductive. Miles and Huberman (1994: 1) discuss the merits of qualitative research:

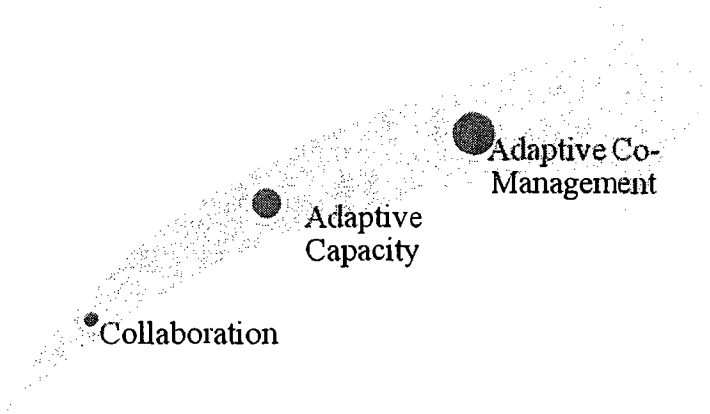
> [qualitative data] are a source of well-grounded, rich descriptions and explanations of processes in identifiable local contexts. With qualitative data one can preserve chronological flow, see precisely which events led to which consequences, and derive fruitful explanations. Then, too, good qualitative data are more likely to lead to new integrations: they help researchers to get beyond initial conceptions and to generate or revise conceptual frameworks.

Rather than working within a specific set of generalizations/assumptions, inductive research makes observation the first step in the analytical investigation. Inductive research can be said to be theory-building, while deductive research is theory-testing. This study will explore the relevance of emerging theories of traditional knowledge, collaboration, and adaptive capacity, but first and foremost, the approach is inductive. Inductive research does not set out to prove anything, but is better described as an exploratory learning process – the end-goal is a better understanding of contextual phenomena and a simplified model of complex reality.

The methodology being employed is in three parts. First, consistent with the issues framework outlined above, Chapter Four develops a systems understanding of knowledge management and identifies issues related to it. Second, to develop a broader definition and understanding of the community-based narwhal management system, Chapter Five identifies drivers and effects of change; the focus is on change and adaptation. Third, Chapter Six is intended to identify a canon and assess collaborative

learning and action by assessing the maturation of the adaptive co-management process. The purpose is to explore the role of IQ in collaboration, in adaptive capacity, and in adaptive co-management (see Figure 6).

Figure 6.0 Conceptual Methodological Model



This research has been designed as a single embedded case study (after Yin, 2003) with a single-species focus. A comparative case study contrasting experiences with narwhal co-management in two or more participating communities (or between participating and non-participating communities) would likely yield interesting insights, but a study-design involving multiple communities would have been substantially more time-consuming, labour-intensive, and costly. Similarly, the merits of a single-species focus were also explored. On one hand, a single-species focus is somewhat unnatural in a study that aims to highlight interconnections and interdependencies - on the other hand, a study-design with a multi-species focus would have been exceedingly difficult, given the sheer volume of documents, legislation, communiqué, and literature which would have to have been reviewed. Narwhal, and the Admiralty Inlet sub-stock more specifically, are the primary focus, but all interviews were semi-directed and participants

often made points by likening narwhal management to the management of other species – in particular, polar bear (*Ursus maritimus*) or bowhead whale (*Balaena mysticetus*). Comparing and contrasting the management of narwhal with the management of these and other species was not an initial goal of this research, but comparisons were common and were encouraged – they have been recorded and related insofar as they relate to the management of narwhal.

3.3 Methods

The first step in this methodology is a literature review (Chapter Two). Literature is reviewed from several disciplines, sub-disciplines, and schools of thought. Starting with the most general, and increasing in specificity, these include: environmental science, economics, anthropology, governance, complex systems, knowledge systems, collaborative management, adaptive management, and adaptive co-management. The purpose of the review was to analyze/explore the role of traditional knowledge in collaborative management, and subsequently, the role of collaboration in adaptive capacity. The breadth of literature reviewed is intentional – the methodology being employed is intended to identify cross-scale interactions between elements of social, ecological, and economic domains. Managing narwhal effectively, for the 'common good', is not simply a matter of determining maximum sustainable yields, allocating quotas, and implementing harvest regulations (environmental science); nor is narwhal management simply a matter of food security or of diversified livelihood strategies (economics). Narwhal harvesting is not just a link between elders and youth, between Inuit society past and present, nor just an expression of cultural identity and a means of cultural persistence (anthropology). Narwhal management is a complex system

encompassing all these things and more. Governance of narwhal, and Arctic wildlife resources more generally, is redefining Inuit-state relations in Nunavut, as individuals, institutions, and agencies develop power-sharing relationships (collaborative management) to incorporate disparate knowledge sets, values, perspectives, preferences, and beliefs. The extent to which they are successful in doing so may dictate the extent to which they are capable of adapting to changing social-ecological circumstances, decreasing vulnerability, and increasing resilience (adaptive capacity). Economic, social, political, and ecological aspects of narwhal harvesting and management will be traded-off against each other, as they always have been, for this is the nature of governance. The Adaptive Methodology for Ecosystem Sustainability and Health (AMESH) developed by Waltner-Toews (2004) and Kay (Waltner-Toews and Kay, 2005), provides a means of identifying and assessing these trade-offs. The methodological framework of Berkes et al. (2007) places this assessment in context by exploring the evolution of nine core components of ACM processes.

3.3.1 Data Collection

Yin (2003) identifies six sources of evidentiary data – documents, archival records, interviews, direct observation, participant observation, and physical artifacts. In keeping with the flexible approach being employed, all of these data sources were important, but none more-so than documents, interviews, direct observation, and participant observation. Each of these data collection methods is discussed below. Data triangulation, Yin's (2003) first principle of data collection, has guided all data collection activities. Triangulation requires evidence from multiple sources, combined to provide a more accurate understanding of context and phenomenon: the idea being that "any

finding or conclusion in a case study is likely to be much more convincing and accurate if it is based on several different sources of information, following a corroboratory mode" (Yin, 2003: 98). That said, in both results chapters interviews are the primary source of data, and the intention is to preserve and present perceptions, not to verify them.

3.3.1.1 Interviews

In the summer of 2007 fieldwork was conducted between June 15 and Sept 15 in Arctic Bay, Nunavut, and between September 15 and 25 in Iqaluit, Nunavut. For a complete list of interviewees see Appendix 1. All 39 interviews were semi-directed, and respondents were active participants in guiding the thematic scope of each discussion. Semi-directed interviews allow "participants as well as the researcher to guide the interview, so that associations made by the participant, and not just those anticipated by the researcher, are discussed" (Huntington, 1998: 240). All interviews focused on the core themes of traditional knowledge, collaboration, and adaptive capacity (a guiding interview protocol has been attached as Appendix 2).

Participation was solicited in accordance with principles identified by Davis and Wagner (2003) – participants were selected based on peer recommendation, availability, and familiarity with narwhal hunting and narwhal management. Initially community-level respondents were recommended by a community-based researcher/translator. Each respondent was asked to recommend three people to approach regarding participation in this research, and subsequent interviews targeted these nominees, as per the snowball effect. Community-level interviews were conducted with elders (male and female), with experienced active hunters, with younger, less experienced hunters, and with representatives of the *Ikajutit* Hunters' and Trappers' Organization. Interviews were also

conducted with members and staff of the Nunavut Wildlife Management Board, the Nunavut Research Institute, Nunavut Tunngavik Incorporated, and the Department of Fisheries and Oceans – these being the primary agencies responsible for narwhal management and research. Participants were selected based on their position within their respective organizations, availability, and on peer recommendation.

With the consent of interviewees, interviews were recorded with a digital voice recorder and were later transcribed for analysis (the informed consent form has been attached as Appendix 3). Interviews with Inuit community members were conducted in Inuktitut with the assistance of a community-based researcher/translator. Interviews were conducted at a time and place of the participants choosing, making the process less formal, and, hopefully, more comfortable for everyone involved. The community-based researcher/translator explained the nature and intent of the study before proceeding with further discussion. Furthermore, the author and the community-based researcher discussed the study design and rationale early and often, as recommended by Ferguson and Messier (1997). All interviews, save one, were conducted in person - the exception was conducted via telephone.

The sample size is small and non-random – a large sample size would have required a study-design that would likely include a survey, a questionnaire, and/or a highly structured interview protocol. But these tools neither allow respondents to stress what they feel is important, nor elaborate on points they feel worthy of elaboration. Furthermore, these methods can be confusing and/or intimidating, and above all, are presumptuous – an interview is an interactive process: the researcher can not presume to know which questions are important and which are not. In this study interviews were

conducted until a saturation point was reached – a point at which no new information or viewpoints were coming to light. The intention is to highlight the breadth of knowledge and opinion – where opinions differ, they are presented beside each other in a point/counter-point format.

3.3.1.2 Participant Observation

I hesitate to use the term 'participant' as it implies usefulness. At times, trying to stay warm, alive, and out of the way was the extent of my participation. Nevertheless, I was present during two narwhal hunts, and I did contribute when my limited knowledge and skill permitted.

Between July 5 and July 10, 2007, I had the good fortune to be present at the Admiralty Inlet floe-edge during a narwhal hunt. Guided by Naisanna Eecheack, a young hunter from Arctic Bay, and accompanied by another young Inuit hunter, his wife, and their son, we traveled approximately 60 kilometers across deteriorating sea-ice to reach the floe-edge on the morning of the third day (our progress was slow, as we waited for fog to clear and for reports from elder hunters). We traveled by snowmobile, and towed *qomatiks* (wooden sleds of Inuit design) containing provisions and supplies. The *qomatiks* also provided shelter for the duration of our stay. The linear floe-edge extends east-west from one side of Admiralty Inlet to the other (approximately 20 kilometers) and hunting camps separated by 25 to 500 meters were established continuously along this front. Our camp was situated in the middle of the front and the hunting activity of every other camp was observed with binoculars.

Between August 31 and September 2, 2007, I was present during an open-water narwhal hunt. Guided by Moses Koonoo, and accompanied by a young Inuit hunter and

an RCMP officer (who observed the hunt with interest, not in an official capacity) our party crossed Admiralty Inlet in a 22 foot trap-skiff equipped with two 90 horsepower outboard engines in the rear and a small fo'c'sle in the front. The trip across Admiralty Inlet took approximately six hours and, once across, a hunting camp was established on the far shore. The hunting strategy was similar to that employed at the floe-edge, but shooting positions were taken up on the beachhead rather than upon land-fast ice. Many narwhal (obviously numbering in the thousands) filed past the camp in a more-or-less continuous procession, traveling from south to north, near the surface, in shallow, near-shore waters.

3.3.1.3 Direct Observation

In September of 2007 I attended and observed (but did not participate in) the 52nd general meeting of the Nunavut Wildlife Management Board. I took particular note of presentations and subsequent discussions pertaining directly to the management of narwhal; more generally, however, the meeting offered insights into the bureaucratic workings of territory-wide wildlife management – the process itself.

3.3.1.4 Policy/Document Analysis

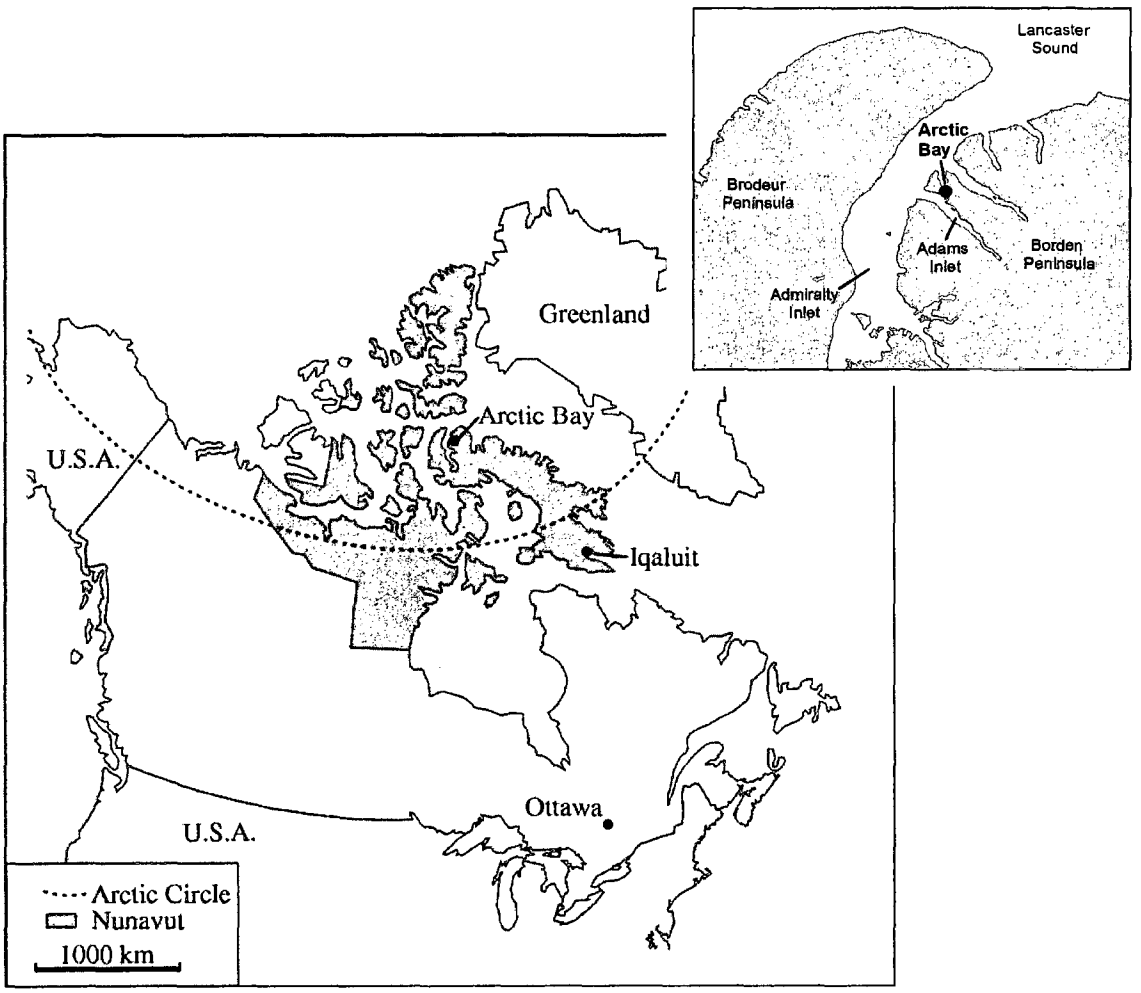
Policy/document analysis provides complementary sources to those outlined above. Several documents and bodies of legislation were of particular importance and are therefore worthy of special note: the Nunavut Final Agreement, the Fisheries Act, the Marine Mammal Regulations, the *Ikajutit* Hunters' and Trappers' Organization's by-laws governing narwhal harvests, the Nunavut Wildlife Management Board Harvest Study, and the Nunavut Wildlife Management Board Meeting Minutes. Other documents, including peer-reviewed academic articles, were also consulted and are referenced in text.

3.4 Case Study and Scope

This study focuses on breadth rather than depth wherever it is necessary or appropriate. Narrowly-focused, rigidly disciplinary methodologies may be less capable of recognizing complex interactions and are inappropriate in the context of collaborative management, where knowledge, values, beliefs, and ultimately, the state of the environment, are debated and negotiated. Even a focus on a particular pillar of the environment – social, ecological, or economic – is avoided, as such a focus would fail to recognize the interconnections between these semi-autonomous, but far from discrete, realms. To expand by way of example, European restrictions on the import of marine mammal products have altered Inuit livelihood strategies and have altered Arctic biological communities (Wenzel, 1991). In this example, far-removed economic sanctions affected a distant society, and, in turn, a distant ecosystem. But a system must be bounded if it is to be assessed.

The remainder of this section will concentrate on bounding the system of interest. The first holon (the 'community level') is the community of Arctic Bay, which is located south of Lancaster Sound, and east of Admiralty Inlet, on Baffin Island (73.03N: 85.17W), in the Qikiqtaaluk Region of Nunavut, Canada (see Figure 7).

Figure 7.0 Map of Nunavut with Arctic Bay and Admiralty Inlet Inset



(Source: Ford et al., 2007; 2006)

Arctic Bay was first settled in the 1950's and 1960's. It has a young, growing population, last estimated (2006) at 690: 640 (93%) of these residents identify as Inuit, and Inuktitut is the first and dominant language (Statistics Canada). The unemployment rate in Arctic Bay is high (higher since the closure of the Nanisivik mine in 2002) and income is comparatively low. Although Arctic Bay represents the first level of the system being defined, discussions broaden when appropriate to include all five

communities involved in community-based narwhal management (Qikiqtarjuak, Pond Inlet, Arctic Bay, Repulse Bay, and Kugaaruk).

Table 3.0 Comparative Social-Economic Indicators

Indicator	Arctic Bay, NU		Nunavut	
Demographics	2001	2006	2001	2006
Population	646	690	26,745	29,474
% Pop < 15	37.2	34.8	37.1	33.9
Median Age	19.7	20.8	22.1	23.1
Language and Identity				
Inuktitut Mother Tongue	595	640	19,310	21,170
Aboriginal Identity	610	640	22,720	24,915
Labour and Income				
Participation Rate	63.0	58.2	68.1	65.3
Employment Rate	49.4	46.2	56.2	55.2
Unemployment Rate	21.6	22.6	17.4	15.6
Median Income ($)	12,064	14,304	17,270	20,982

(Source: Statistics Canada, 2006; 2001)

The Inuit of Arctic Bay hunt narwhal (*Monodon monoceros*) from the sea-ice in late-spring/early summer, and from small open boats in late summer/early fall. Narwhal are a high Arctic cetacean that migrates seasonally from wintering grounds in Baffin Bay to deep-water inlets and fiords of the High Arctic Archipelago. The Admiralty Inlet sub-stock (one of five to frequent Canadian waters) arrives at the Admiralty Inlet floe-edge (where the land-fast seasonal ice meets the open water of Lancaster Sound) in June or July and advances into Admiralty Inlet as the sea-ice recedes. The Admiralty Inlet sub-stock is the focus of this research (it shares the first, or 'community' level with Arctic Bay) but discussions broaden to include all Canadian sub-stocks of the Baffin Bay

population, and the Baffin Bay narwhal population as a whole. The smaller and more southerly Hudson's Bay narwhal population is largely outside the purview of this research.

The Nunavut Final Agreement (NFA), executed on May 25, 1993 between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in right of Canada, was ratified and given the force of law on July 9, 1993 pursuant to the Nunavut Land Claims Agreement Act. The NFA established the NWMB as an institution of public government responsible for wildlife management and research in Nunavut. With respect to narwhal, the NWMB shares decision-making powers with the Department of Fisheries and Ocean, Nunavut Tungavik Inc., Regional Wildlife Organizations, and community hunters' and trappers' organizations. This research is focused on the community of Arctic Bay, and the Admiralty Inlet narwhal sub-stock, but the institutional focus is more inclusive. That said, the NWMB is the primary interface between *Inuit Qaujimajatuqangit* coming from below, and scientific knowledge coming from above – as such, it is worthy of the greatest attention.

With this understanding of scope, and a purpose, the first substantial task will be to explore challenges and risks associated with knowledge management. Chapter Four is an attempt to do so. It will then be possible to explore these challenges and risks relative to change and adaptation, and then relative to nine core components of adaptive co-management identified by Berkes et al. (2007).

4. *INUITT QAUJIMAJATUQANGIT* AND COLLABORATIVE MANAGEMENT

4.1 Introduction

An issues framework is an important component of the AMESH. In this case, issues related to knowledge are of particular interest. Collaboration can be considered as a shared process of knowledge management, and in this study that process is subdivided into five stages: (1) Knowledge Gathering, (2) Knowledge Sharing, (3) Knowledge Integration, (4) Knowledge Interpretation, and (5) Knowledge Application/Decision-Making. This five-point categorization is an outcome of this research, not an input – i.e., in discussing knowledge it became apparent that many of the issues raised relate to specific 'knowledge management activities', and not to others. As this typology evolved throughout the study, later interviews reflected it more than earlier ones. Upon reflection, this typology is consistent with the body of literature pertaining to traditional knowledge and wildlife co-management. Some authors have focused on knowledge gathering (see Huntington, 1998; Fergusson and Messier, 1997), on knowledge sharing (see Huntington et al., 2002), knowledge integration (Huntington, 2004; Agrawal, 1995), knowledge interpretation (Gilchrist et al., 2005; Nadasdy, 1999), or application (Peters, 2003). In a co-management context such as Nunavut's community-based narwhal management (CBNM) system, extensive collaboration is required during each of these five stages. The emphasis here is on challenges and risks specifically related to knowledge management – others, related to capacity and cost, are somewhat inherent, are common to all Arctic management contexts, and are not assessed in depth in this chapter.

4.2 Knowledge Gathering

Knowledge-gathering can refer to any of several activities that might include hunting, travelling, observing, directed scientific research, or census-like data collection. The last two are of particular interest to this study, as they represent an interface between community actors and the territorial/state management community. As noted in Chapter Two, two types of surveys dominate wildlife management – harvest surveys and wildlife surveys.

Harvest surveys are social surveys of the nature and intensity of harvests. The Nunavut Harvest Study (2004) is a territory-wide social survey that records all the harvesting activities of each of Nunavut's 27 communities. With respect to narwhal, the Nunavut Harvest Study records the number of hunters hunting in each month and the number of narwhal landed in each month. The Harvest Study lists three sources of error affecting the reliability of harvest estimates contained therein: the survey frame, survey coverage and non-response bias, and measurement issues and response bias. Some community actors expressed concern that the information they provide to harvest surveys will be used to justify further restrictions. For example, the NWMB (2003: 8) records "a concern among many hunters that the struck and lost information would be used to reduce their narwhal harvest limits".

Social surveys are intended to record human activity that affects wildlife. They are capable of documenting information pertaining to struck/lost rates, catch per unit effort, harvest pressure, sex/age composition of harvested animals, body condition, location of harvest, and season of harvest (Harwood et al., 2002). One of the primary goals of CBNM is to compile complete and accurate reports of narwhal that are struck

but lost. Under the CBNM agreement the *Ikajutit* HTO (the community HTO of Arctic Bay) is responsible for monitoring struck and lost rates and reporting to the NWMB. A form which hunters are required to fill out at the HTO office upon returning from narwhal hunts, records the location of the strike (on a drawing of a narwhal); the location of the hunt (on a regional map); an assessment of the severity of the strike; weather and sea conditions at the time of the strike; the sex of the animal; the caliber of rifle and type of ammunition used; the number of hunters in the hunting party, and observations of sex and age composition. One problem with the self-reporting process is that only hunters returning from successful hunts are required to visit the HTO office (to collect a tag), while unsuccessful hunters are not so obliged (NWMB, 2003). More importantly, the territorial, state, and international community have questioned the validity of self-reported struck and lost data *because* it is self-reported: "self-reported struck-and-lost information is useless. NAMMCO [North American Marine Mammal Commission] won't even look at it, and say 'don't bother bringing it – it's biased'" (Glenn Williams, Pers. Comm., 2007).

The potential contribution of Inuit to harvest surveys and wildlife surveys was recognized as early as 1977. In a technical report to the Fisheries and Marine Service, Smith and Taylor (1977: 15) concluded that:

> if the eventual accurate estimating of harvest levels and monitoring of population size from year to year is to be achieved, it must come from the hunters themselves. The simple presence of fisheries or game officers in the hunting communities has, to date, not accomplished much in this direction. The Inuit are more aware than ever of the importance of their renewable food and cash crops. With the advent of the first educated Inuit generation, the formation of local councils and hunters and trappers associations, the Inuit themselves are in a good position to gather information and report on these important matters

Notice that food crops are weighted equally with cash crops – that is to say, there is an established tradition and recognition of the importance of revenues generated through harvesting. Notice also the usage of the term 'educated', which may be indicative of the valuation of Inuit traditional knowledge. Finally, notice that Smith and Taylor (1977) suggest that Inuit be empowered to 'gather information and report', not to 'interpret information and make decisions'. Information gathering and reporting have been important functions of Inuit and IQ in the three decades since these roles were advocated by Smith and Thomas.

There have been systematic attempts to document IQ of the Baffin Bay narwhal population (Stewart, 2001; Stewart et al., 1995; Remnant and Thomas, 1992), and these are examples of wildlife surveys. The Remnant and Thomas (1992) study focuses on biological parameters, behaviour, morphology, abundance, and distribution - the authors interviewed hunters in Qiqiqtarjuak, Clyde River, Pond Inlet, Arctic Bay, Resolute Bay, and Grise Fiord. In Arctic Bay, ten hunters were interviewed – there was seldom agreement between respondents, and the methodology did not capture the reasons for peoples' understandings (i.e., it recorded their conclusions, but not their logic). There have also been systematic IQ studies of narwhal in other localities (Thomsen, 1993) and of beluga and bowhead in Nunavut (Kilabuck, 1998; NWMB, 2000a). More commonly, IQ is incorporated as a component of Western scientific studies - this is often accomplished through collaborative data-gathering.

4.2.1 Challenges and Risks

4.2.1.1 Lack of Required Skills

Wildlife managers and researchers are primarily trained in the biological sciences. Often, they are unfamiliar with social science methodologies necessary for accessing and incorporating IQ. Mary Ellen Thomas, Manager and Research Liaison with the Nunavut Research Institute, notes that "a lot of people [researchers] say they are going to include IQ, but they don't know how and they don't have the skills, so they end up not doing it" (Pers. Comm., 2007). Huntington, (2000) noted similar trends. With that said, at least some actors feel that "they [researchers] are working with the community *a lot more now*, so they are including IQ in their studies" (David Klluk, Pers. Comm., 2007, emphasis added).

Inuit managers and researchers may also lack required skills. As noted by one community actor, young people are more involved in research than are elders:

> when they [researchers] are actually in the field doing their study, they don't invite the elders to go along as advisors, they only get the young people, that are active, to be in the project (Moses Koonoo, Pers. Comm., 2007).

It is generally acknowledged that Inuit Elders have more IQ than do younger, less experienced Inuit. With that said, Inuit youth may have a better understanding of English, of math, of science, or of computers – having this knowledge, younger Inuit may be better able to participate in wildlife management and in governance more generally:

> what you have is a reversal of roles, because in the modern era you've got to have someone who can read, can write, can speak English, can negotiate with government. These are all fundamental skills to advance the interests of the community. The people that fit that bill tend to be the young generation, and not the old one (Robert Moshenko, Pers. Comm., 2007);

> the Hamlet has a leader, the mayor, and I'm not going against the mayor, but the people cannot ask the mayor about animals, because she wouldn't know what the

> answer is about animals. She would only know the administrative issues. Like when you ask the Elders about Qallunat [non-Inuit] - they have no idea about Qallunat too (Muctah Accumalik, Pers. Comm., 2007).

4.2.1.2 Disrespectful of Animals

Wildlife research that Inuit consider to be disrespectful of animals is disrespectful of Inuit. Research methodologies that require handling or tagging of animals are a source of conflict between the community and researchers:

> there are always disagreements and very uneasy feelings between the researchers and the hunters because, let's say for narwhal, when they were trying to study the narwhals they were using nets to net the narwhals, and they were handling them, and putting on satellites, and taking measurements and all that, but the hunters were saying 'that's not the way to deal with animals. We don't handle animals.' In that way, the hunters and the researchers are always in disagreement, because the hunters are trying to keep the animals at a distance – only to let them be, so they are living on them. But when the researchers are netting them, using their nets, they are handling them, and they are harassing the animals - in that way the hunters don't like the researchers because they're not going with the same mentality in terms of protecting the animal. Last year, the researchers on the narwhal, they killed two narwhals because they were taking their time to do their study – measurements, weighing, whatever they do there, like sampling and so on. They were taking so long that the two narwhals were killed - because they didn't consider the needs of that animal (Koonoo Oyukaluk, Pers. Comm., 2007).

Scientific methodologies intended to address knowledge gaps related to abundance, stock delineation, and behaviour often require that satellite tracking devices (tags) be attached to whales. Tagging procedures are described in Dietz et al. (2007; 2001). With most cetaceans, tags are attached to the dorsal fin. As an adaptation to life underneath ice, narwhals, belugas, and bowheads have a small dorsal ridge, but no dorsal fin. Female narwhal are tagged through the dorsal ridge, and male narwhals have tags attached to their tusks:

> the intrusiveness of the science that is done here is incredible. That's what we're going through right now with what we're doing with whales when they put these tags on. People are pissed-off. Inuit are really pissed off about it. Some of the science that we're doing here – it's the only place in the world that's bolting

> transmitters on to the backs of animals. They [researchers in other parts of the world] put them on fins, and on extremities; well we're putting them through the bodies of these animals. Because the animals are moving around all the time, the wound never heals, it ulcifies and eats its way out through the back until it's finally rejected by the animal. That would never be allowed anywhere else (Glenn Williams, Pers. Comm., 2007).

4.2.1.3 Inuit Knowledge: Western System

Collaborative research is a means of including Inuit in scientific enquiries. Inuit participation in community studies provides employment, helps to disseminate aspects of the study (e.g., purpose, methodology, or results) to the community, and promotes community ownership of findings. But in many research applications that might be described as collaborative, only the fieldwork (data-gathering) phase is collaborative. One Arctic Bay resident stressed that in applications such as this, Inuit *participation* does not equal IQ *inclusion*:

> Government hires Inuit as staff now, to work in the field with research groups - in their report the scientists say that the Inuit were involved in their research, but they only use the Inuit name, the person's name, as saying they are using the Inuit knowledge. It seems that they are abusing that...when an Inuit name is being used, they put it in the report and say that they included the Inuit knowledge, but it's not really that because the Inuit employees are only following the guidelines or policies of the Department, or whoever is doing the study, so it's not really IQ, because they are only using the person's name to say that Inuit were involved (Moses Koonoo, Pers. Comm. 2007).

4.2.1.4 Burn-out/Response Burden

Response burden is a risk of knowledge gathering processes (Arnstein, 1969). If participation is sought in every study, it may be reduced to a token, or people may lose interest. Researchers/managers may have one or two issues of interest, while community members typically have many more:

> there are many, many levels of government up here – there's a byzantine amount of bureaucracy. And each of these organizations has a mandate to facilitate communication and to consult with the communities. So on a weekly basis each

> community is being deluged with groups coming in... I think consultation fatigue has set in. You show up to have your tea and cookies and you just bugger off, because there's just so much (Joe Justus, Pers. Comm., 2007).

4.3 Knowledge Sharing

Knowledge sharing refers to any process where knowledge, be it scientific or IQ, is shared between management partners. Sharing knowledge is a significant challenge, for several reasons, and there are several risks.

4.3.1 Challenges and Risks

4.3.1.1 Documentation

The fact that Inuit knowledge is often verbal, and scientific knowledge textually documented, affects knowledge sharing between local and extra-local actors. Oliyuk Naqatarvik summarizes the relationship between oral and written knowledge:

> it used to be that the researchers and scientists had a document with them, and they would rely on that document, and because Inuit were oral they would try to tell them 'this is how it is', but the Inuit had no document to give to the scientists so the scientists only looked at their own document and said 'look, this is what it says', because the Inuit didn't have a document, so it was a barrier trying to pass that knowledge to the scientists. They rely very much on written documents. Let's say they study one year and they make a report – that's all they look at – they really believe the report, or the study, or the document. They can only believe what they read in a report or in a document, so they only follow what's written in a document, they only believe what's written down (Oliyuk Naqatarvik, Pers. comm., 2007).

4.3.1.2 Language

The fact that IQ is grounded in Inuktitut makes it a challenge to share that knowledge with non Inuktitut-speaking partners. As stated by one community-level actor:

> I can speak Inuktitut, and I know the traditional knowledge, but I have to use a translator to get that information across to you. If there was a direct communication link, you would have a better chance of having your questions answered, and I would have more opportunity to tell you about IQ. I try to only

> say what can be understood, but if I were talking to you directly I would say a lot more (Qaapik Attagutsiak, Pers. Comm., 2007);
>
> when you speak Inuktitut, or Inuit language, it's easier to talk about the IQ, becauseits related to the language (Andrew Taqtu, Pers. Comm., 2007).

A certain amount of knowledge, both IQ and scientific, is lost in translation:

> same with the English language – if you translate it into Inuktitut or other languages I think some level or deterioration will occur, because the word is often not expressed to the depth it is actually expressed in the original language (Joe Tigullaraq, Pers. Comm., 2007);
>
> you have to have an interpreter, and maybe they can't find the right words to translate, and the meaning gets muddled, and whether the idea is getting across or not is up for interpretation on both sides (Erin Calder, Pers. Comm., 2007).

One of the more problematic examples of misunderstandings arising from language differences relates to the term *Inuit Qaujimajatuqangit* itself. In most interviews conducted with Inuit in this study the term seemed to invoke descriptions of the way things were. In other words, the understanding of IQ developed in Chapter Two – an understanding whereby IQ is considered a contemporary blend of traditional and non-traditional knowledge, values, and beliefs – was not necessarily reflective of Inuit understandings and usage of the term. It became apparent that '*Inuit Qaujimajatuqangit*' may mean very different things to Inuit and non-Inuit. Leduc (2006: 28) cites Jaypeetee Arnakak, an Inuit policy worker and philosopher:

> the fact remains that Inuit Qaujimajatuqangit is a semi-literal translation of the original term in English – and in the passive tense at that. I have suggested on a number of occasions taking out the reference to "old" in Qaujimajatuqangit, and making the term an infinitive – Inuit Qaujimaningit – or simply, Inuit knowledge.

4.3.1.3 Intellectual Property Rights

Intellectual property rights, in this case, refers to the right to decide how knowledge is interpreted and how it is used – there is a risk that community knowledge

of narwhal abundance, behaviour, or harvest mortality will be used to justify restrictions once it has been decontextualized (shared):

> Inuit have very good reasons to be reluctant to report their struck and lost rates.... Arctic Bay, we felt, was the model community. They bought into the program, they take seriously their management of whales, and we believe they accurately reported their struck and lost. It's interesting – they participated fully, and did what they were supposed to, and now they may be hammered because they have a high struck and lost. Arctic Bay has been doing a good job of community-based management...they didn't do anything wrong...they just gave us the data we need (Joe Justus, Pers. Comm., 2007).

If decision-making powers devolved to Arctic Bay under CBNM are revoked or scaled back as a result of high struck and lost rates, what will be the implications for knowledge-sharing and collaboration in the future?

4.4 Knowledge Integration

Knowledge integration, in this case, refers to the process of integrating scientific knowledge with IQ - challenges and risks associated with knowledge integration relate primarily to what some consider to be essential differences between the two. Understood relative to WSK, some major differences between IQ and WSK become apparent. In discussing challenges and risks associated with knowledge integration, participants at all levels noted four key differences. These are consistent with findings from Chapter Two, and are tabled below for ease of reference.

Table 4.0 Differences between IQ and WSK Cited as Challenges and Risks

Attributes of IQ	**Attributes of WSK**
Holistic	Compartmentalized
Innumerate	Numerate
Long time scales	Short time scales
Moral	Value-free

(Source: key informant interviews, 2007)

4.4.1 Challenges and Risks Stemming from Differences

4.4.1.1 Holistic: Compartmentalized

The IQ principle of *Avatimik Kamattiarniq*, as it appears in the Nunavut Wildlife Act, states that "people are stewards of the environment and must treat all of nature holistically and with respect, because humans, wildlife and habitat are inter-connected and each person's actions and intentions towards everything else have consequences, for good or ill". Is Nunavut's Narwhal co-management system capable of accommodating holism? In the words of one territorial actor:

> we want to compartmentalize things. We don't want to mix everything together and have that holistic view of things, and Inuit don't want to compartmentalize everything (Robert Moshenko, Pers. Comm., 2007).

When marine toxicity was tabled for discussion at the 52nd quarterly meeting of the NWMB a territorial actor confessed to being "at a loss to see how marine toxicity relates to our mandate" (Anonymous, 2007). This sort of compartmentalization is consistent with the findings of Paci et al. (2002) and Nadasdy (1999), who argue persuasively that Western categorizations do not necessarily match those of Inuit, or of objeective social-ecological realities.

4.4.1.2 Innumerate: Numerate

Traditionally, IQ did not use numbers – western wildlife management does. For example:

> in the Inuit world numbers are not used to indicate abundance or absence of wildlife – Inuit simply say there are too many out there, there's enough out there, there's not enough out there, there's nothing out there, based on their needs. They don't say there's 1000 or 5000, the quantifiers are 'there's too many, there's enough, there's not enough, there's none' (Joe Tigullaraq, Pers. Comm., 2007).

These terms also further demonstrate the holistic nature of IQ in that the environment (narwhal abundance) is linked to society (need). Inuit knowledge of narwhal populations may be qualitative, and therefore imprecise, but scientific knowledge of narwhal populations is also highly imprecise: "low precision of the estimates and the counting biases do not allow sufficient statistical power to detect even a large change in population size" (Richard and Pike, 1993). The quantitative population survey conducted by Richard et al. (1994), for example, covered 8.44% of Admiralty Inlet, counted 469 narwhal and calculated a population of 5,556 (with lower 90% and upper 90% confidence limits of 3,759 and 8, 213, respectively). Quantitative findings such as these are imprecise to the point that they are, essentially, qualitative estimates. Quantitative measures of Western science might, in fact, be more or less equivalent to qualitative measures of IQ.

4.4.1.3 Short Time Scales: Long Time Scales

Scientific knowledge and traditional knowledge of Arctic wildlife populations are relative to different temporal scales. Typically, scientific knowledge covers only the last 30 to 50 years and methodological/technological changes limit the comparability of scientific results – it is difficult to detect trends and there is no baseline scientific data:

> Inuit believe that animal populations oscillate...and that they have to. This is not a herd of goats, this is not a herd of cows, these are free ranging animals. They are dependent upon cycles, and they are going to cycle (Glenn Williams, Pers. Comm., 2007).

This concept of population oscillation is not new to anyone familiar with biology, ecology, or resource management - still, at the NWMB quarterly meeting held in Iqaluit in September of 2007, a territorial actor cited research which prescribed the *ideal* number of caribou for South Hampton Island (Anonymous, 2007). There is still a tendency to

treat wildlife as static resources, but there is also a growing awareness of the value of IQ pertaining to change through time:

> this is a real strength of aboriginal knowledge...their temporal scale is way, way larger than the scientific scale that we're looking at. They [Inuit] see trends in populations going back hundreds of years, maybe more, and that brings a very important and different perspective (Kevin McCormick, Pers. Comm., 2007);
>
> when Inuit talk about traditional knowledge they're talking about hundreds and hundreds of years, not just 30 or 40 (Keith Pelley, Pers. Comm., 2007).

With that said, Inuit observations and records of historic population trends are holistic, qualitative, and oral - they are not necessarily compatible with contemporary wildlife co-management systems. In reference to this compatibility, or lack thereof, a territorial manager observed that:

> the notion of multi-decadal cycles is a view held at least, from my experience, from Alaska right through to Greenland. I believe that's probably the case, but even knowing that doesn't give us, the board, much comfort because our management decisions have to be immediate and fairly short term (Kevin McCormick, Pers. Comm., 2007).

So, is knowledge integration the goal, and should it be? Widdowson and Howard (2006) do not think that integrating traditional knowledge into scientific wildlife management adds value – they argue that values, practices, and beliefs do not constitute knowledge. Adaptive co-management shifts the focus slightly to emphasize the co-production of knowledge or knowledge pluralism (Armitage et al., 2009).

4.4.1.4 Moral: Value-Free

Inuit Qaujimajatuqangit can also be considered holistic in the sense that it blends together informational knowledge with contemporary and traditional values and beliefs:

> people refer to it as traditional knowledge, but incorporated into that is a whole set of values. A non-aboriginal person expects to hear a lot about knowledge and more often than not they hear a lot about values. There's a disconnect (Robert Moshenko, Pers. Comm., 2007).

Perhaps more appropriately, there is no disconnect. In many ways, Western science is designed to divorce knowledge from value and belief. The question becomes, have values and belief been separated from science, or have they merely been repressed? Heazle (2004) discusses how uncertainty related to scientific population estimates was used first by whaling nations as a justification for not reducing quotas, and later by non-whaling nations as a justification for quota reduction. In either case, he argues, value judgements guided subsequent scientific/political positioning. A territorial actor representing the NWMB, agrees:

> science is not without values, despite what all the scientists say. Marine mammals have probably been the worst case of where positions have been taken on relatively little scientific information (Kevin McCormick, Pers. Comm., 2007).

Regardless, *Inuit Qaujimajatuqangit* is moral, and informational knowledge is blended with values and belief – there is a risk that integrating IQ with WSK will lead to a distillation of the former, where values and belief are artificially removed by the latter:

> they [a governmental organization; not the NWMB] will interview people, and they'll take in all the knowledge, and they'll even maybe put it in their report. But then they glean from that the factual stuff. The stuff that is going to assist them in deciding whether this species [wildlife in general; not narwhal] is endangered or not.... When they're dealing with the knowledge holders they're not compartmentalizing anything, they're receiving everything, but then they sort of put on that other hat and they say, 'ok, out of all this important information that we have, what is specifically relevant to this question that we're asking.' I'm not sure how well that's working (Robert Moshenko, Pers. Comm., 2007).

Nadasdy (1999) is a vocal opponent of exactly this type of distillation. Widdowson and Howard (2006), on the other hand, have attached themselves to the belief that science is value-free, and they do not allow for definitions of traditional knowledge that acknowledge values, beliefs, and practice. They argue for distillation, on the grounds

that values, beliefs, and practice cannot be challenged and are, in effect, unscientific (Widdowson and Howard, 2006: 3):

> beliefs are the unverifiable assumptions of aboriginal elders about the existence of supernatural forces in the universe: they cannot be described as "knowledge" since they are justified by faith, not evidence. The values and practices referred to in various definitions also have nothing to do with knowledge *per se*. The former concerns normative judgements about the way things should be, not what they are, while a practice refers to how people act, not what is known. Although knowledge, or an understanding of natural processes, may inform values and practices, values and practices do not constitute knowledge.

But beliefs can be empirically based – they are beliefs nonetheless. Based on the best available evidence the scientific community used to believe that narwhal stocks were shared between Canada and Greenland – it now believes otherwise. And if values and practices are considered to be components of *Inuit Qaujimajatuqangit,* then Widdowson and Howard (2006) should be aware that delineating between sub-components forces the concept to conform to the Western tradition. Widdowsen and Howard (2006) do well to point out differences between *Inuit Qaujimajatuqangit* and Western scientific knowledge, but they go too far when they suggest that the rational for Western sub-divisions (between knowledge, beliefs, values, and practices) is intuitive and self-evident.

4.5 Knowledge Interpretation

Gathering and integrating knowledge from various sources is necessary but not sufficient for the purposes of resource management. Informational knowledge in and of itself is of little use until it has been assigned meaning (interpreted). The epistemologies and worldviews that underpin Inuit and scientific knowledge, and integrated compilations where they exist, colour interpretations.

4.5.1 Challenges and Risks

Challenges and risks associated with knowledge *integration* relate primarily to elemental differences between WSK and IQ. Challenges and risks associated with knowledge *interpretation* relate primarily to differences between Western and Inuit worldviews:

> the observations of both the scientists and the Inuit are actually complementary, it's the interpretation where they think folks out there are pretty acute observers of what's going on around them. But, the question is the interpretation of the observations (Michael D'Eca, Pers. Comm., 2007);
>
> sometimes when you read reports, you can see that the scientists and the elders or Inuit knowledge are common, you can see the same kinds of knowledge that they share, like scientists on their own, they learned that, Inuit learned that too, so you can see the common ground between the two (Moses Koonoo, Pers. Comm., 2007).

The informational knowledge of Western science and *Inuit Qaujimajatuqangit* are often complementary, but the worldviews that interpret and give meaning to that knowledge may differ substantially:

> there's quite a different worldview that's underpinning the approach to begin with. We both have the same set of goals, in terms of maintaining the population and always having them available, but there's a different set of assumptions, a different conceptual framework (Kevin McCormick, Pers. Comm., 2007).

Three examples highlight differences in world views. First, with IQ:

> if you don't hunt them [animals], they will start decreasing in numbers, but if you hunt them more because there's a need for them, they'll grow more, their population will grow (Ipeelie Koonoo, Pers. Comm., 2007).

This belief can be understood in the terms of biological science – the abundance of predators may increase with their own mortality rate (Abrams and Quince, 2005). For example, as narwhal mortality goes up, so does the availability of resources for the remaining population, which might increase reproduction and health, and abundance in

turn. The Inuit belief that wildlife abundance increases with harvest pressure (mortality) is not necessarily inconsistent with the biological sciences, but it does conflict with dominant Western wildlife management paradigms, where wildlife management is treated as a net equation balancing abundance estimation and population growth rates on the one hand, with removals on the other. In other words, wildlife populations are analogous to a bank account – where the maximum sustainable yield balances withdrawal (harvest pressure) with the rate of interest (the population growth rate) (Hilborn et al., 1995).

Second, if WSK and IQ both observe a decline in a wildlife population in a given area, IQ may be more likely to interpret that apparent decline as a movement, whereas WSK may be more likely to interpret the apparent decline as a true decline in abundance:

> animals are always moving around, so it's not that they're losing in numbers, that they're declining in numbers, it's not that, it's that they move around a lot to different areas (Oliyuk Naqatarvik, Pers. Comm., 2007);

> as Inuit, we know that animals travel to different areas, they don't always stay in that same area all the time, they move out in some years, but they always come back. The number is never the same. So, if they [scientists] say there is a decrease in the number of narwhals, then it wouldn't be true, it wouldn't be the accurate truth, because they don't know if maybe the whales went to that different place, but will come back again (Anonymous, Pers. Comm., 2007).

Gilchrist et al. (2005) encountered this problem in conducting their research of migratory birds – they dismissed the conclusion of traditional knowledge holders (that apparent declines reflected changes in distribution patterns) because it could not be scientifically substantiated.

Finally, in 1996 three communities in Nunavut's Kitikmeot Region, where narwhal are rare, applied for larger quotas – "to take better advantage of those rare occasions when narwhal do appear" (NWMB, 1996a: 8). The application was summarily

dismissed on the grounds that "rarity of wildlife occurrence is not ordinarily interpreted as a signal to establish larger quotas" (NWBM, 1996a: 8). Ordinary for whom?

There is a considerable risk that IQ will be interpreted via Western paradigms. Can a management system accommodate conflicting paradigms? Can conflicting paradigms be married without compromising either? These are questions that will have to be addressed if CBNM is to succeed. The first step lies in:

> recognizing what your own assumptions are, and what the others are, so you can at least start to address the gulf between. So often, it's invisible, and that's where you run into problems (Paul Frame, Pers. Comm., 2007)

4.6. Knowledge Application/Decision-Making

Knowledge application/decision-making refers to the process of using knowledge to make decisions – i.e., answering the questions: is there a problem? If so, what is it? What should we do about it? Participants did not note any challenges specific to decision-making/planning (although many of the challenges discussed elsewhere are present in this stage as well), but several risks were identified – these relate to conflict, conflict-avoidance, and coercion.

4.6.1 Conflict

Inuit may perceive conflict about animals as a risk – animals may be conscious of these arguments and may be impacted:

> we were told never to create conflict about animals, or say anything negative about an animal...the elders would advise us not to talk about animals, because they say that even if the animals are not listening, they are not here at present with us, they are still out there, and they know what the people are saying. So we were always told to be careful in how we deal with animal management (Ipeelie Koonoo, Pers. Comm., 2007);

> in the past the IQ, one of the big laws or rules that we had about animals was that we were not allowed to fight over, or argue, or discuss animals, period. There was no discussion of any kind about any kind of animal. Now we are fighting or arguing or discussing animals with DFO or NWMB or these different

> organizations...but the IQ, if it was strictly followed, there would be no need to make these management agreements, because it was not allowed. We should not discuss any kinds of animals to say how they are doing and so on. We didn't want to discuss those things because if you start discussing the animals, they will somehow be impacted (Andrew Taqtu, Pers. Comm., 2007).

4.6.2 Conflict Avoidance

Conflict can be seen as a risk, but so too can conflict avoidance. Western wildlife management can be adversarial – in co-management decision-making processes there is a risk that conflict avoidance will limit participants' willingness to engage conflict, and that the quality of decisions will suffer:

> even if they don't agree with it [the management agreement], they don't want to create that tension about animals, so they would rather just leave it the way it is.... The elders especially are kind of laid back on these kinds of agreements, because they don't want to create that tension, even though they don't agree with it. (Ipeelie Koonoo, Pers. Comm., 2007).

Similarly, Western actors may perceive:

> social pressures to be very careful what you say about IQ, and what it can and can't do. If we were being told something and we said 'no, that's not right', that would be bad. So, there's not a lot of open dialogue (Paul Frame, Pers. Comm., 2007).

Two Principles of IQ (*Piliriqatigiingniq* and *Aajiiqatigiingniq)*, as they appear in the Wildlife Act, refer not to wildlife, but to the human decision-making processes that govern wildlife. Together, they suggest the value placed upon group harmony and mutual respect:

> *Aajiiqatigiingniq*, which means that people who wish to resolve important matters or any differences of interest must treat each other with respect and discuss them in a meaningful way, keeping in mind that just because a person is silent does not necessarily mean he or she agrees

And,

> *Piliriqatigiingniq*, which means that people must work together in harmony to achieve a common purpose.

These principles do not translate into regulations, but are intended to steer policy development. Neither is necessarily compatible with Western governance, where competing interests argue their perspectives (and often resort to litigation) in pursuit of their interests.

4.6.3 Coercion

Coercion, in this context, refers to the regulatory environment, power dynamics, and the goals and objectives of CBNM. Under CBNM, participating communities are empowered/required to create, vary, and enforce by-laws relating to harvest management, and to document struck and lost rates. In exchange, formal quotas were raised (in the case of Arctic Bay, from 100 to 130). The *Ikajutit* HTO by-laws relate to: (1) records and reporting (3 by-laws); (2) quota allocation (1 by-law, in two parts); (3) enforcement (2 by-laws); (4) public safety (2 by-laws); (5) training and education (1 by-law); (6) wastage (1 by-law), and; (7) the presence and activities of non-members in hunting areas, in hunting seasons (1 by-law). The NWMB is empowered to create, vary, and enforce quotas, which are subject to the approval of the Minister of Fisheries and Oceans. Community by-laws are subject to, and must conform with, the Fisheries Act and the Marine Mammal Regulations enabled thereby. In fact, five Marine Mammal Regulations appearing in the Fisheries Act are reproduced in part, or in whole, in the *Ikajutit* HTO by-laws. The goals of CBNM are to reduce wastage, reduce struck and lost rates, and document struck and lost rates – these objectives do not appear to have originated in the community and community ownership of local regulation is low (NWMB, 2003). Some community actors stated that the process was/is coercive:

> they put conditions in to how they distribute the tags - 'if I'm going to give you those tags, you have to'.... The contents of the agreement were given to the community. The contents of the agreement were already written down, although

> the HTO kind of reviewed it and approved it. Even though they [the HTO] don't agree with a certain section of the agreement, they can't really change it. If they say, 'we're going to give you 130', that's all we get, we don't get any more than that. So the sections of the agreement that they [the HTO] don't really agree with, they still have to approve (Leah Klluk, Pers. Comm., 2007);
>
> the regulations or by-laws were given to the HTO to review. I don't know who exactly is responsible for those , because when you ask the HTO they say 'those guys did it', but when you ask those guys they say 'these guys did it', so you can't really tell who is responsible, who initiated the by-laws (Lisha Levi, Pers. Comm., 2007);
>
> the Government of Nunavut, or the Government of Canada, are the ones that create the legislation, so we only follow what is introduced to us as legislation...the government gives the tags to the community, but before they give the tags they say 'these are the conditions'. They are only following the federal or territorial governments' regulations, not IQ (Tommy Tatatuapik, Pers. Comm., 2007);
>
> the management regulations were initiated by DFO, because they were threatening the community to reduce the quota, so in order to prevent a decrease of the quota we had to come up with regulations to manage. Although Inuit knowledge, *Inuit Qaujimajatuqangit*, is kind of included in there, it wasn't really initiated by the Inuit – it was more for the DFO, so that they wouldn't take away the quota. (Oliyuk Naqatarvik, Pers. Comm., 2007).

Although community by-laws may not conflict with existing state legislation, they can contextualize it:

> we were only improving the existing regulations. In terms of wastage, it said in the Marine Mammal Regulations already that there should be no wastage of meat, so with that in mind we created these by-laws so there would be more activity towards that goal – minimizing the wastage of meat (Leah Oqallak, Pers. Comm., 2007).

4.6.4 Inuit Knowledge: Western System

Wildlife managers in Nunavut are struggling to find ways to incorporate IQ into decision-making - including Inuit is necessary but not sufficient if the system itself is Western:

> I think everybody is struggling to find a way to utilize Inuit knowledge in wildlife management today – nobody's really sure how to do it. People in the North have

> been saying we should have more Inuit employed in the government so that government will work more in a way Inuit want things done. In my view, that's not going to happen regardless of how many Inuit are actually employed by the territorial government. Even if we get 100% of Inuit working, things will still be the same as long as the policies that guide organizations and the way they do things exist as they are today. You have to change the policies and procedures of organizations, including the NWMB, in a way that Inuit values and principles are actually included in policies – they're not included right now. Regardless of good intentions by everybody or anybody that plays a part in the wildlife management system, policies will always get in the way if they're not appropriate to the values and principles of Inuit (Joe Tigullaraq, Pers. Comm., 2007).

As with collaborative research, Inuit participation in decision-making processes does not guarantee IQ inclusion: "as far of the application of it [IQ] in this system of management, it's so much like trying to put round pegs in square holes" (Glenn Williams, Pers. Comm., 2007).

4.7 Summary

Knowledge management can be understood as a system comprising five distinct activities. Challenges and risks associated with these activities, as they are perceived by local, territorial and state actors, have been recorded and presented here to satisfy the issues framework of the adaptive methodology for ecosystem sustainability and health. All of the challenges impeding effective knowledge management can be attributed to differences between IQ and WSK, or the worldviews that guide them. These differences might, for example, relate to language, or documentation, or scale, or tolerance for conflict. Risks attributed to knowledge management can be summarized more succinctly – the risk common to all knowledge management activities is that Inuit contributions are being marginalized or over-ruled, and that the continued primacy of Western scientific management and Western scientific thought is reinforcing the status quo and preserving power for traditional power-holders. To understand these challenges and risks, the

knowledge management system must be understood in context. Whereas this chapter is intended as an issues framework, Chapter Five is intended as a system definition. Chapter Four records perceptions of collaboration (which is understood as a system of knowledge management); in developing a broader system definition, Chapter Five focuses on change and adaptation.

5. CHANGE AND ADAPTATION

5.1 Introduction

In its simplest conception, the study of adaptive capacity is the study of change through time. This chapter represents an attempt to document changes affecting narwhal hunting and narwhal management in Arctic Bay, Nunavut. As such, the purpose of this chapter is to document how things were, to identify the drivers and effects of change, and assess implications for the future. More than anything else, change has defined the Inuit experience of the last 100 years: social, ecological, and economic adaptations to these changes have defined the social-ecological system (Brody, 1975). The emphasis here is on assessing perceptions of these changes and their effects. Table 5 introduces some of the key changes which have affected the narwhal co-management system.

Table 5.0 Temporal Context

Year	Event
1911-1912	Captain Bernier and his crew are the first non-Inuit to overwinter in Arctic Bay
1921	RCMP detachment to North Baffin Island Regional Centre, Pond Inlet
1936	Hudson's Bay Post (re)established in Arctic Bay (Hudsons Bay Company had opened a Post in 1926 but it closed the following year)
1937	Anglican and Roman Catholic Mission Stations established
1958	First school established – 30 pupils in 1960-61.
1960's	Inuit migration to Arctic Bay from surrounding areas
1971	Narwhal quotas for individual hunters established under Narwhal Protection Regulations
1972	End of commercial whaling in Canada
1972	United States of America passes the Marine Mammal Protection Act

1976	Nanasivik mine opens next to Arctic Bay.
1976	ITC Land Claims proposes division of former NWT.
1976	Hamlet of Arctic Bay established.
1977	Narwhal quotas for individual communities established
1980's	Hunters starting to hunt at the floe-edge
1982	Canada withdraws from the International Whaling Commission
1983	European Economic Community ban the importation of narwhal tusks
1984	Price of narwhal tusks plummets
1985	Canada passes the *Fisheries Act*
1991	Arctic Bay population 543
1993	Ratification of the Nunavut Final Agreement
1996	Arctic Bay population 639
1999	Official separation of Nunavut from the former North West Territory through the *Nunavut Act* and the *Nunavut Land Claims Agreement Act*
1999	Community-based narwhal management program established
2001	Arctic Bay population 646 (median age: 19.7)
2001	Arctic Bay joins community-based narwhal management
2002	Nanasivik mine closes
2002	NWMB review of community-based narwhal management (result: project extended for an additional five years).
2006	Arctic Bay population 690 (median age: 20.8)

5.2 'Traditional' Hunting, Management, and Use

5.2.1 Hunting

Before the adoption of the rifle, narwhal were hunted primarily in the summer:

> earlier people, they were hunting in the ocean, with their *qayaks*. Only when they introduced the guns, and rifles, they started hunting them in the leads. They only hunted them in the summertime without the rifles and guns. Before the guns were

introduced they were only hunting them from *qayaks*." (Koonoo Oyukaluk, Pers. Comm., 2007).

With the rifle, narwhal were hunted in the spring as they travelled through narrow leads (cracks) in the annual sea-ice. In the winter, narwhal were hunted at polynas, and in the summer and early fall they were hunted from small open boats in the open water. The technology used for hunting included rifles, harpoons, sealskin floats, and dog teams. Often, semi-permanent camps were established in areas where narwhal were known to occur.

5.2.2 Management

In the past, prior to 1971, narwhal and narwhal harvests were managed by Inuit – the goals of narwhal management, according to respondents, were sustainability and safety. Sustainability, in this context, refers to management practices intended to ensure narwhal kept returning to the same areas, and did not relocate elsewhere. What follows is a list of some traditional management rules-in-practice (or norms) that governed narwhal hunts. The listing is derived from key informant interviews. Rules 1, 2, and 3 are geared toward sustainability - rules 4 and 5 toward safety. Rules 7 and 8 relate to access and food-sharing, respectively. Rule 6 relates to access as well – notice that a Christian concept, the Sabbath, is integrated with 'tradition' (Brody, 1978). Although Inuit were organized in small groups, each with its own leader or group of leaders, these rules appear to have been universal:

1. traditionally, we used to manage the hunt in that the first pod of whales was ignored, because we wanted them to go by first to go inside Admiralty Inlet, so that they wouldn't go back out. Only the second pod of whales would be hunted, and we would choose from the second pod (Leah Klluk, Pers. Comm., 2007);

the first pod of whales was ignored because we wanted them to come into Admiralty inlet, but the second pod of whales were harvested (Muctah Accumalik, Pers. Comm., 2007).

2. The main rule we had was not to kill anyone (any animal) that you're not going to eat (Olayuk Kigutikarjuk, Pers. Comm., 2007).

3. No noise, they didn't want to scare off the narwhal coming in (Olayuk Kigutikarjuk, Pers. Comm., 2007).

4. They were not allowed to hunt narwhal at the floe-edge, only in the leads, where you could reach the other end of the lead with your harpoon (Olayuk Kigutikarjuk, Pers. Comm., 2007).

5. For other species, young people were allowed to carry guns. As soon as they were able to lift a rifle they were allowed to shoot any other animal. But the narwhal was the exception. No young person was allowed to hunt the narwhal. Even land mammals (caribou) were allowed. My father was trained to kill caribou at the age of eight or nine (Qaapik Attagutsiak, Pers. Comm., 2007).

6. It used to be one of the traditional knowledge rules that there should be no hunting on Sunday. Even though we see a lot of narwhals, you were not supposed to hunt them on Sunday (Leah Oqalluk, Pers. Comm., 2007).

7. Women were not allowed to hunt – now even the women are going out there with the same authority as the men, in terms of hunting the narwhals (Leah Oqalluk, Pers. Comm., 2007).

8. We were told to share the meat, especially the food or meat – it's very important for Inuit that you share it with others because you know that somewhere down the road you're going to need food too, so if you never gave it to anyone, why should they give it to you. You have to kind of keep it even, and if you give it freely, you'll get it freely too (Mishak Allurut, Pers. Comm., 2007).

5.2.3 Hunting and Use

Narwhal hunting yields several returns: *maqtak*, meat, sinew, oil, bones, and sometimes a tusk. All of these returns were valuable, and had uses:

> we relied on the animals for food, fuel, heating, light, and for dog food [dogs were used for transportation, hunting, protection, and companionship]. We were using *maqtak* to eat, and the meat was dried and eaten or fed to dogs – the fat was used in lamps, thread was made from the sinew – and the ivory tusk was collected to sell to traders (Leah Klluk, Pers. Comm., 2007).

The market for narwhal ivory is not new – the Hudson's Bay post at Arctic Bay was purchasing tusks in the 1920's and 1930's – and trading tusks for income or supplies can be considered a part of tradition:

> the price for tusks was low in those early years, but the goods were also very cheap (Tommy Tatatuapik, Pers. Comm., 2007).

Food, for humans and dogs, was the most important commodity, but:

> occasionally we tried to get the longest tusk that we see because we wanted to supplement our supplies from the store – to trade the tusk, to use it in the winter (Koonoo Oyukaluk, Pers. Comm., 2007).

Still, not all of the tusks were sold:

> they make very good tent poles (Olayuk Kigutikarjuk, Pers. Comm., 2007).

5.3 Change and Adaptation

5.3.1 Environment

Inuit respondents noted environmental changes related to climate, weather, and wildlife abundance/behaviour. Climate change is most acute at the poles – Inuit have noted this warming and accompanying decreases in the duration and spatial extent of annual sea-ice:

> there used to be a certain day, let's say July first, every year it was the same, when the first pod of whales would be sighted.... Right now, even in June, the ice starts eroding – it's not the right time. The ice starts eroding before the narwhals start coming (Kigutikarjuk Shappe, Pers. Comm., 2007).

The impacts of climate change on narwhal behaviour are unknown. Some respondents, and the traditional knowledge study of Remnant and Thomas (1992), noted that narwhal

are now present in areas where they did not previously occur – this may be a behavioural adaptation to changing environmental conditions, or to harvest pressure:

> in the 80's and early 90's there were no narwhals, or very seldom they'd see narwhals, in Pelly Bay. Now they get narwhals every year. We're seeing the narwhals moving farther into the interior of the Arctic islands: they're going into Peel Sound, they're going into Prince Regent – there never used to be that many narwhals there before (Glenn Williams, Pers. Comm., 2007);
>
> in Igloolik area they never had narwhals, but now because we're going to the floe-edge so early the narwhals are deterring to the Igloolik area. They can see more narwhals in that area, where they never used to have narwhals. We are scaring them away from here (Leah Oqallak, Pers. Comm., 2007).

It is also not known how changing sea-ice cover will affect narwhal abundance. One respondent speculated that less ice will mean fewer ice entrapments, and a growth in population:

> with less ice there will be more narwhal growing, because in the past, when there was a lot of ice, they used to get stranded, or there were a lot of narwhals that got iced, and they sort of got froze over, but now we're starting to see less ice so I think the narwhal will grow in population (Oliyuk Naqatarvik, Pers. Comm., 2007).

Changing weather patterns are creating risks for Inuit hunters, who say that weather can change quickly now, and is less dependable and predictable than it used to be. In the early spring and late summer, when the annual sea-ice is deteriorating, Inuit hunt narwhal from the floe-edge at the mouth of Admiralty Inlet. Admiralty Inlet runs north-south – northerly winds keep the ice in the inlet, but southerly winds can blow the ice out to sea and may strand hunters on ice pans. The unpredictability of winds therefore poses a considerable risk for Inuit hunters at this time of year. As a behavioural adaptation to these risks Inuit hunters are now bringing extra supplies, small boats, and satellite phones (see Ford et al., 2006).

5.3.2 Technology

Technology is a driver of change. Technology is changing how narwhal are harvested, where they are harvested, and how knowledge is communicated. According to participants, technology is increasing safety and productivity and improving communication. It is also increasing the capital investment required to harvest, as technology, such as rifles and outboard motors, cost money.

5.3.2.1 Safety

Hunting narwhal, whether in open-water or from the sea-ice, can involve risk of personal injury. Weather patterns have become less predictable and in some cases hunters are less experienced, as a consequence of the time demands of wage-based employment or Western-style education. To a certain extent, technology has mitigated these risks. For example, global positioning systems are now being used for navigation. Also, many hunters now carry satellite phones, in case of emergency. Should an accident occur, hunters with access to these technologies will not only be able to call for help, but also to relay their exact position to rescuers:

> I don't know that – snow drifts, how they are south, north. I don't know traditional navigation, so I use a gps [global positioning system] to get around (Naisanna Eecheack, Pers. Comm., 2007).

5.3.2.2 Productivity

In the 1950's and 1960's, as a result of several government initiatives, Inuit began to settle in the community of Arctic Bay. Snowmobiles and outboard motors can be considered an adaptation to settlement, as they allowed hunters access to now-far-away hunting areas. Snowmobiles and outboard motors enabled fast access to and between

hunting areas, and thereby increased productivity. Also, snowmobiles largely replaced dogs as the primary means of winter transportation, and as a consequence the widespread adoption of snowmobiles coincided with a dramatic drop in the number of dogs and a dramatic drop in demand for dog food. Thus snowmobiles not only increased productivity, they also decreased demand. Narwhal meat was sometimes consumed by humans, but it was used:

> for dog food especially, the meat of the narwhals was used to feed dog teams (Koonoo Oyukaluk, Pers. Comm., 2007).

Firearms also increased productivity, and together with snowmobiles and outboard motors, have been used as a justification for the implementation of hunting restrictions. In this case, management restrictions can be considered an adaptation to changes in hunting technology:

> I guess before western technology was introduced a hunter and wildlife were pretty much equal. Technology is now far more superior...today's technology makes the hunter far more superior than wildlife, in terms of who will survive when they come head to head with each other (Joe Tigullaraq, Pers. Comm., 2007);
>
> you have to realize that the means to harvest is completely different too. We have more powerful weapons, quicker means of transportation, so it's much easier today to harvest animals. So as managers, you have to look at that too. You have to look at how much easier it is to harvest – at the same time you have to take into account that there are still people out there that know the methods of traditional harvesting. How do you come up with a management system that's ideal for both – mainly, pleasing the needs of Fisheries and Oceans, in terms of conservation, and at the same time pleasing the needs of the community, and the users (Paul Irngaut, Pers. Comm., 2007);
>
> technology contributes to the abuse of the traditional way...they can go very fast and reach their destination in a shorter time...they can get any type of animal they want, without thinking of the consequences, like whether they're scattering the animals or not...there's more chances of abusing that privilege of hunting (Ipeelie Koonoo, Pers. Comm., 2007).

5.3.2.3 Communication

Technology has changed how people communicate. Radios, for example, are used to share knowledge about weather and animals and to link people together. In the following example, a 'non-traditional' technology (radio) facilitates 'traditional' management:

> all animals have leaders that go to places first. The others wait for those groups of leaders to go there, and if they stay, then others follow behind. It's still being practiced today. When the elders are on the floe-edge, they can advise everyone by radio to tell them – 'the first pod is coming by, don't bother with them, don't hassle them'. They don't really scold, but its strong advice (Leah Klluk, Pers. Comm., 2007).

Radio is also linking people together:

> I hear about young people on the radio saying they want to go hunting – they ask to be invited to go on a trip (Naisanna Eecheack, Pers. Comm., 2007)

5.3.2.4 Cost

Technology may increase productivity, increase safety, and facilitate communication, but it is expensive. Reliance on expensive technology such as outboard motors and skidoos means that hunting requires a substantial capital investment (initially, for purchase of equipment, and later for fuel and maintenance). This being the case, everybody does not have an equal opportunity to participate – people active in the wage-based economy may be more able than others to purchase the equipment necessary for hunting. Alternatively, income can come from harvesting, either through commodities like the narwhal tusk, which sells for approximately CAD 100-300 per foot, or through food procurement – food, in this case, is considered 'cash-in-kind'. A community actor discussed the cost of hunting with reference to intergenerational knowledge sharing:

> especially with the parents that are hunting parents, the children are learning the skills when they go out hunting. It's the ones without hunting equipment...those young guys, although they are envious of people who go out hunting, they don't

> have the means to go, so they're kind of missing out on that knowledge. What prevents the knowledge from being shared, especially hunting knowledge, is the lack of equipment - because they don't have any income, they can't buy any equipment to go hunting, so they're not passing that knowledge to their children (David Klluk, Pers. Comm., 2007).

In other words, employment enables hunting, which enables intergenerational knowledge-sharing. On the other hand, wage-based employment decreases the amount of time available for hunting. Paradoxically, with respect to hunting, wage-based employment is both enabling and disabling – it is an asset and a liability.

5.3.3 Hunting and Use

Today, there are four general methods of hunting narwhal: (1) at the floe-edge, from the sea-ice, in the spring; (2) in leads (cracks) in the sea-ice, from the sea-ice, in the late spring; (3) in near-shore waters, from the land, in summer and early fall, and (4) in open-water, from small boats, in the summer and early fall. There are variations within each of these categories and several participants stressed that specific methods vary from community to community, and between individuals, according to the situation. Since the creation of the Narwhal Protection Regulations in 1977, the Arctic Bay narwhal hunt has been conducted under a quota system. The system was first established with the "goal of preventing overexploitation ...because of the interest in the tusk ivory" (Smith and Taylor, 1977). The quota was first set at 100/year and was later adjusted upwards to 130 in 2001. The number of narwhal harvested in any given year can vary according to ecological conditions (e.g. presence or absence of killer whales) and environmental conditions (e.g., weather or sea-ice conditions). In general, Arctic Bay hunters have met the quota – notice, however, that in some years the total catch was considerably less than the allowable limit, and that three of these years immediately followed the

implementation of the quota system in 1977 (see Table 6). This does not necessarily corroborate the concerns reported by Richard and Pike (1993) – that a quota becomes a target – but neither are the data reliable to the point that they should be used to establish trends. Moreover, the numbers tell part of a story – the reasons for the numbers recorded have been lost. Why were there only 25 narwhal landed in 1987 – it is too easy and inaccurate to infer that there were fewer narwhal in that year. *Inuit Qaujimajatuqangit* is often presented in a similar format – the informational knowledge has been preserved, but the contextual information that allows for meaningful interpretation has not been.

Table 6.0 Landed Narwhal in Arctic Bay and Canada

Year	Arctic Bay	Canada	Year	Arctic Bay	Canada
1958	50	Incomplete	1988	86	234
1959-1972	No Data	Incomplete	1989	99	326
1973	101	373	1990	67	258
1974	52	152	1991	114	355
1975	167	271	1992	102	305
1976	115	305	1993	85	318
1977	42	245	1994	99	344
1978	65	261	1995	46	237
1979	33	309	1996	99	267
1980	100	324	1997	66	236
1981	100	366	1998	103	357
1982	90	382	1999	101	378
1983	100	333	2000	101	547
1984	93	258	2001	134	415
1985	100	298	2002	77	
1986	100	247	2003	129	
1987	25	145			

(Source: COSEWIC, 2004; Ditz, 2004; Strong, 1989)

Several of the commodities derived from narwhal hunting have declined in importance in recent years. For example, the meat is seldom used, largely because there are so few dogs. Similarly, there is very little demand for oil, for bones, or for sinew. Today, narwhal are harvested for *maqtak*, and for their tusk:

> starting around the 1980's I saw a very big change in the way the narwhal were being used. There were no more lamps to fill, no more dogs to feed. Only the *maqtak* was being used. I'm not against the hunt, I'm not with Greenpeace or anything like that, but I saw the carcass of a whale on top of the ice, and it looked like it was naked. They just took the *maqtak* off, they didn't take anything else. Today it's a lot different from how it was before. Today they only bring back *maqtak*. The women are crying out for thread, to make the thread out of the narwhal meat, but even that they're not bringing back – only the *maqtak*.... They only try for the *maqtak* and the tusk, even though some people still want some of the meat of the narwhal (Leah Oqallak, Pers. Comm., 2007);
>
> in the past they would hunt animals for food – dog food especially. But now there's more wastage of meat, because they're not trying to feed dogs. Only some of the hunters bring back some of the meat (Leah Klluk, Pers. Comm., 2007);
>
> now they're only hunting narwhals to get the *maqtak* and tusks, that's it, they're not trying to get anymore, but the Inuit way was to cache meat too, the meat of the narwhal, because there's still some people who crave that (Koonoo Oyukaluk, Pers. Comm., 2007).

Tusks are regarded as "by-products of the 'aboriginal subsistence hunt', which is seen to be oriented primarily toward food acquisition" (Reeves, 1993: 89):

> it's a by-product. Sure, there's an economic aspect to it, but I think the majority of them [hunters] want food, and whatever comes out of it is a bonus, like the tusk is a bonus, the skin is a bonus for seals, or polar bear – we eat the meat. There's no way of getting around that. People will always eat meat up here (Paul Irngaut, Pers. Comm., 2007).

That said, catches of narwhal in Arctic Bay have been strongly biased towards adult males – i.e., tusk-bearers (DFO, 1998; Reeves, 1993; Roberge and Dunn, 1990). The tusk is a motivator, but that is not to say it is the sole, or even primary motivator.

Maqtak can also be considered as an economic return. As *maqtak* reduces the demand for store-bought food, it has an associated replacement value. Food that is procured through hunting may therefore be considered 'cash-in-kind' (Wenzel, 1991). *Maqtak* also has been sold directly to the *Ikajutit* HTO, for resale to stores in Iqaluit. In 1990-91, for example, the *Ikajutit* HTO purchased 3,065 kilograms of *maqtak* at a price of $4.40 per kilogram (Reeves, 1993). Markets for tusks and for *maqtak* have been volatile: "market interventions and price instability have had serious ramifications for Inuit communities in the past and are likely to affect the cost and rewards of narwhal hunting in the future as well" (COSEWIC, 2004).

5.3.4 Management

Prior to the 1970's there was little, if any, government intervention in Arctic wildlife management – even trapping and commercial whaling operated with government support, but little government supervision. One respondent reflected on issues related to sustainability and wastage that arose in the late 1960's and early 1970's:

> at that time I counted dead narwhal and it came up to 400 - there were more than that, but I stopped counting at 400. I think at that time they were only going after the tusk, to sell the tusk.... They still sell tusks, but they'll never go up to 400 now. It's different now, in that more hunters are trying to bring back all of the *maqtak* now, rather than just taking the tusk (Lisha Levi, Pers. Comm., 2007).

In 1971 narwhal quotas were established, and assigned to individual hunters. In 1977 community quotas were established:

> the government unilaterally used to make those decisions [wildlife management], without input from the users whatsoever. In the early 1970's narwhal quotas were introduced to the communities by the Department of Fisheries and Oceans, Canada, and Inuit again didn't have any say whatsoever as to what goes into the narwhal management system – Inuit simply received instructions that these were the new rules: they had no say in them. We've seen these kinds of wildlife management decisions by two levels of government – territorial and federal

> – where Inuit didn't have any say whatsoever as to what goes into the management system (Joe Tigullaraq, Pers. Comm., 2007).

In 1993, the Nunavut Final Agreement provided Inuit with decision-making powers and a voice in wildlife management. Everyone interviewed agreed that, since 1993, Inuit and *Inuit Qaujimajatuqangit* have been included in wildlife management more than ever before:

> to compare with the past, they used to shove the documents to the people, saying 'look, do you agree with this or not'. They already wrote it down, and they'd just give it to the people, saying 'look, you sign this'. And now they're including the Inuit, they're asking before they draft it, their asking 'what do you feel about this'. So they're including *Inuit Qaujimajatuqangit* into these agreements now. They're starting to realize that Inuit have some value that they can contribute to the process of drafting agreements. They're slowly starting to include the Inuit style of making agreements. With the creation of the Nunavut Land Claims, Inuit are now being involved more – the *Inuit Qaujimajatuqangit* is being shared with more of these different agencies/organizations (Leah Klluk, Pers. Comm., 2007).

5.3.5 Concerns of/about Management

Participants were asked to reflect on the purpose of narwhal management. All responses related to struck-and-lost rates, wastage, and sustainability. These were listed as concerns of management, but many participants also commented on concerns about management – concerns that the quota system that has been in place since 1977 is making narwhal hunting more competitive, less safe, and less sustainable.

5.3.5.1 Struck and lost rates

Territorial and State managers cited struck and lost rates as the primary concern of narwhal management, while community managers more often cited wastage and sustainability. In 1990, Roberge and Dunn reported on struck and lost rates of narwhal in Admiralty Inlet: 31.7% at the floe-edge, 23.8% in leads, and 7.4% in open water. A 2006 report by the North American Marine Mammal Commission (NAMMCO) cites five

causes of variability in struck-and-lost rates: (1) type of hunt (as above), (2) hunters (judgement and experience), (3) equipment, (4) weather conditions, and (5) time of year. Respondents in the present study elaborated on two of these – equipment (referring in this case to the type of ammunition stipulated in the Marine Mammal Regulations), and hunters (referring here to demographics and experience). Each of these is further discussed below.

The Marine Mammal Regulations (SOR/2003-103, s. 4.) stipulate that ammunition fired at cetaceans must not be full metal-jacketed. This regulation may be contributing to high struck and lost rates:

> the Marine Mammal Regulations say that you cannot shoot a marine mammal with a non-expanding bullet. Well that's asinine. That's written by an idiot who doesn't know anything about the methods that you use for shooting marine mammals. It's an importation of a restriction for shooting terrestrial animals. There are two methods of death for an animal who is shot: 1) circulatory disruption (bleeding, drop of blood pressure, unconsciousness, death), or 2) neural disruption, which is either a brain shot or a shot in the base of the spine. When you are hunting whales you want to immobilize them on the surface – you do that with neural disruption. The wound type that you want for neural disruption is not a cavity wound, you want a channel wound, and a channel wound is created by a non-expanding bullet (Glenn Williams, Pers. Comm., 2007).

A wound from a non-expanding bullet is also less likely to be fatal if it does not hit the brain or the spine. The NAMMCO (2006) recognize that suitable ammunition is not readily available in Nunavut. Still, the fact that this regulation has not been changed, and suitable ammunition not made available, may speak to adaptive capacity (or lack thereof), or the capacity of actors to actualize learning.

Other explanations for high struck and lost rates relate to experience – some hunters may be less experienced because of the time demands of employment and some because they are young. The Inuit population of Nunavut is younger and is growing

faster than any aboriginal population in Canada (Statistic Canada, 2001). The population of Arctic Bay grew from 543 in 1991 to 690 in 2006; the median age in 2006 was 20.8 and 34.8% of the population was under the age of 15. Compare this with Kitchener, where in 2006 the median age was 36.6 and only 19.5% of the population was under the age of 15 (Statistics Canada, 2006). Younger people are now hunting narwhals, and this is a change:

> really young people are starting to hunt narwhal, even though they don't really know where the kill zone is, or how to keep it afloat. Only the elders and adults would know when to shoot at it to tell its going to float. When I was a young guy I wasn't allowed to hold a rifle, or to shoot at animals. Very young boys are now being allowed to shoot, even though they don't know where the kill zone is (Muctah Accumalik, Pers. Comm., 2007);
>
> but today it seems that any young person, even a very young man, young child, can start shooting without being advised how to shoot it properly (Tommy Tatatuapik, Pers. Comm., 2007);
>
> these 16 year olds, they have no experience in hunting at all...some of these young people have never held a rifle or a gun before, but still they go out to the floe-edge to hunt narwhals...that's the only change that seems to be happening...young people being out with no experience or knowledge about hunting (Moses Koonoo, Pers. Comm., 2007).

To a certain extent, struck and lost rates are expected – narwhal will dive and escape, or sink, if they are not shot in exactly the right place at exactly the right time. The right place is the brain or the spine, and the right time is immediately after an inhale, after the blowhole has been closed. Hunting narwhal successfully takes split-second timing and extreme accuracy – it takes practice, and it takes experience. The fact that there are more young hunters, a function of demographics, will understandably raise struck and lost rates. Struck and lost rates are a concern, within the community and without, but they are also somewhat inherent, given the precision necessary for narwhal hunting and the changing demographic profile of the hunters. But inherent or not, the

skills of young hunters can be improved through training. In 2006 (61) the NAMMCO suggested that "training is paramount", it should be "community-based and species specific", and "local experienced hunters who are familiar with local environment should be employed to train". The NWMB had begun to take interest in an education program in 1996 when they recognized a need to "document traditional hunting and handling methodologies (e.g. for narwhal) in order to provide the background material needed to develop a course or other training aids to help reduce or eliminate wastage" (NWMB, 1996a). In response to concerns about struck and lost rates, and consistent with the recommendations of the NAMMCO and the NWMB (1996b), the *Ikajutit* HTO has begun a young-hunter education program. The program includes target practice, lectures/discussions, and a video:

> at least now it's being taught by the HTO. This was the first year that they had a demonstration, they showed a video – they had a kind of workshop with the young hunters, so it's at least being taught now (Tommy Tatatuapik, Pers. Comm., 2007);

> when they were first starting off they had a meeting with the young people – they announced it on the radio to invite them over – and in that meeting they showed the young people the video – how to shoot and kill narwhals - and a few days later they went past the point there and did a demonstration and practiced target shooting, and they had a plywood cutout to show where they should be shooting the narwhal. It wasn't just young people there – there were also adults, who wanted to help out, so they were part of the discussion. When the spring narwhal hunts were over they tallied up the tags that were issued, because they also recorded the wounded and struck and lost, and there were a lot less, compared with last year's struck and lost. And they also go on the radio to advise the young people who are listening how to properly hunt narwhals. There's a clause in the narwhal management agreement to have the training workshops with the young people – that's how they came about teaching the young people, because there's a clause in the agreement that they should do that (Qaumayuk Oyukaluk, Pers. Comm., 2007).

5.3.5.2 Wastage

Several community actors perceived reduction of wastage as a major objective of community-based narwhal management. The *Ikajutit* HTO by-laws (and the Marine Mammal Regulations) forbid the wastage of edible parts. But who decides which parts qualify as edible? For the most part, narwhal meat is not consumed by humans, and most community actors stated that it had always been used, primarily, for dog food. In fact, some community actors stated that, even for dogs, narwhal meat was not a very good source of food. Regardless, wastage, and underutilization of meat has been a source of some conflict (Diduck et al., 2005).

5.3.5.3 *Sustainability*

In the context of narwhal management, the word sustainability is used in two slightly different contexts. On one hand, scientists use the word sustainability with reference to harvest pressure and population growth rates – trends in abundance. On the other, at least some Inuit used the concept of sustainability with reference to narwhal distribution and a desire to ensure narwhal keep returning to Admiralty Inlet and do not divert elsewhere. The former has resulted in a quota system, which may be indirectly compromising the latter. According to some respondents, the quota system has added a competitive element to narwhal hunting, is contributing to high struck and lost rates, and is compromising personal safety.

Although powers and responsibilities related to quota allocation have been devolved to community HTOs, the quota itself is set by the NWMB and the DFO:

> at present the community-based aspect of it is control of how you hunt and what you hunt, and how you allocate, to your community, access to that resource. But the ultimate amount – how much you harvest – is still dictated, primarily by DFO. At present, the quotas for narwhals that exist are based on the best available scientific information that we have from the Department of Fisheries and Oceans, and those are based primarily on aerial surveys. They get an

> estimate, a range, if they're lucky, within a 95% confidence interval where there is 10,000-15,000 animals [illustrative of the point and not a representation of narwhal populations]. That's the information that we're using now to recommend a particular quota (Joe Justus, Pers. Comm., 2007).

Quotas may be based on the best available scientific knowledge, but they are comparable to earlier quotas which were set somewhat arbitrarily:

> quotas are meted out begrudgingly. In the 70's and in the 80's, when these limitations were brought in, that was the approach – 'we'll see how many you used to take, and you can continue to take that many, but don't ask to take any more' (Glenn Williams, Pers. Comm., 2007).

In the case of Arctic Bay, quotas have changed once since 1977 – from 100/yr to 130/yr in 2001. The increase in quota coincided with Arctic Bay's admittance into the CBNM experiment, and reflects a trade-off – a quota increase in exchange for better self-reporting of struck and lost rates, the creation and enforcement of management regulations, and the development/implementation of a young-hunter education program. Despite all of the time, money, and energy spent researching narwhal, "the ability to detect a trend, if there is one, is low" (COSEWIC, 2004) and quotas appear to be in a state of dynamic equilibrium – they change infrequently, in response to a disturbance.

Furthermore, the quota system, intended to increase sustainability by restricting access, may be decreasing sustainability in the sense that it encourages competition, which, in turn, may be diverting narwhal away from Admiralty Inlet:

> if we compare today with the past. Today there are a lot of people in the community, and they all have the same goal to go hunting. They are in more of a hurry now, because there are a lot of hunters, so they say 'let's go before the other guys get those', so they all want to be the first to go there before the other hunters get them. (Lish Levi, Pers. Comm., 2007);

> before the quota system they didn't have to rush to kill narwhals, because they knew that in the summer time they would have the opportunity to get more narwhals, so they waited along the leads more because they were not in a hurry to finish the quota before somebody else takes it. As soon as the quota is

> announced, right away the hunters start going out to the floe-edge because they know there's only a limited number of narwhals that they can go after (Tommy Tatatuapik, Pers. Comm., 2007).

Many community actors expressed concern that hunting at the floe-edge prevents narwhal from entering Admiralty Inlet, and diverts them elsewhere:

> the hunters are preventing the narwhals to come in to admiralty inlet (Oliyuk Naqatarvik, Pers. Comm., 2007).

It is also likely that struck and lost rates are higher at the floe-edge than in leads (leads are narrow, which precludes the possibility that narwhal will be out of range of a retrieval hook, and ensures all shots taken are at very close range):

> there's less wastage of meat when you are hunting on the leads, and there is a better opportunity to retrieve your kill (Tommy Tatatuapik, Pers. Comm., 2007).

5.3.5.4 Safety

Several community actors stated concerns that hunting at the floe-edge is more dangerous than hunting on leads. The ice closest to the floe-edge is the most vulnerable to breaking free and drifting into Lancaster Sound – which it does every year during break-up. For safety reasons, Inuit did not hunt at the floe-edge in the past:

> we were strongly advised to stay away from the floe-edge in my time (Koonoo Oyukaluk, Pers. Comm., 2007).

Some community actors stated that the main purpose of the narwhal management agreement was to ensure that the community did not exceed ('overshoot') the quota. To safeguard against an overshoot the *Ikajutit* HTO restricts common access to narwhal when the quota is being approached and distributes the remaining tags through a lottery system. Under the lottery system names are drawn every three days – winners have three days to catch a narwhal before their right to do so expires, at which time their name is entered in the next draw. The lottery system may be causing unnecessary hardship by

encouraging people to hunt when weather or sea conditions are marginal, or by increasing travel to and from hunting grounds:

> the only problem is when they start drawing names, because they're trying to keep it at a very controlled level, that's the only problem is when your name has to be drawn to hunt. When you have bad weather and you're only given a certain amount of time to hunt it, even people who are out in the area where they are seeing narwhals, they're not allowed to hunt them because their names were not drawn. (Oliyuk Naqatarvik, Pers. Comm., 2007).

5.4 Temporal Scale: Prospects for the Future

Inuit actors at all levels placed community-based narwhal management within its broader temporal context. For example, the NWMB conducted a review of community-based narwhal management in 2002, after the three years allotted to the experiment had expired. After consulting with the participating communities, the authors of the report concluded that:

> the three-year time line for implementation put pressure on everyone to move quickly and did not allow sufficient time to work through the inevitable problems associated with implementing a new management system (NWMB, 2003).

Although the report (NWMB, 2003: 4) notes that "there were problems in all communities at the beginning" it also notes that "the situation improved over time, and communities that had been on the system longer had developed their own solutions to many of the problems". Still, there was "little buy-in by hunters" and "three years was not long enough to properly allow people to get used to the new system" (NWMB, 2003: 4). Based largely on the findings of this review the NWMB decided to extend the community-based narwhal management experiment for an additional trial period of five years.

Three and five year reviews represent an attempt to monitor the efficacy of experimental programs while fostering adaptive capacity. That said, short-term reviews

may fail to place experimental management initiatives within temporal context. The creation of Nunavut as an independent territory, for instance, was proposed in 1976, but was not realized until 1999. Western wildlife management of any type has only been active in the area since the early 1970's. The first school was established in Arctic Bay in 1958, and it was only then that Inuit began to settle in the community. Placed in context, all of the changes affecting Arctic Bay are recent, and the effects of these changes are still emerging. Negotiating the Nunavut Final Agreement took 20 years – implementing it effectively may take that long again:

> it will take a long time, because we're kind of playing around with things right now, and we'll be doing that possibly for the next 50 years. Things will definitely be better 50 years from now, but there's no magic wand available to make things right right now, we just have to fiddle around with both sides to see what's working, what's not working. I guess what we're doing right now is that we're somewhere in the centre here, Inuit on one side of the system, kadlunat on the other, and those of us who are working are trying to pick out a little bit from each side to come up with something that we think will work, and sometimes were not even right, because like I said, we're playing around with things to see if they will work – it's a learning process and it will take a long time (Joe Tigullaraq, Pers. Comm., 2007).

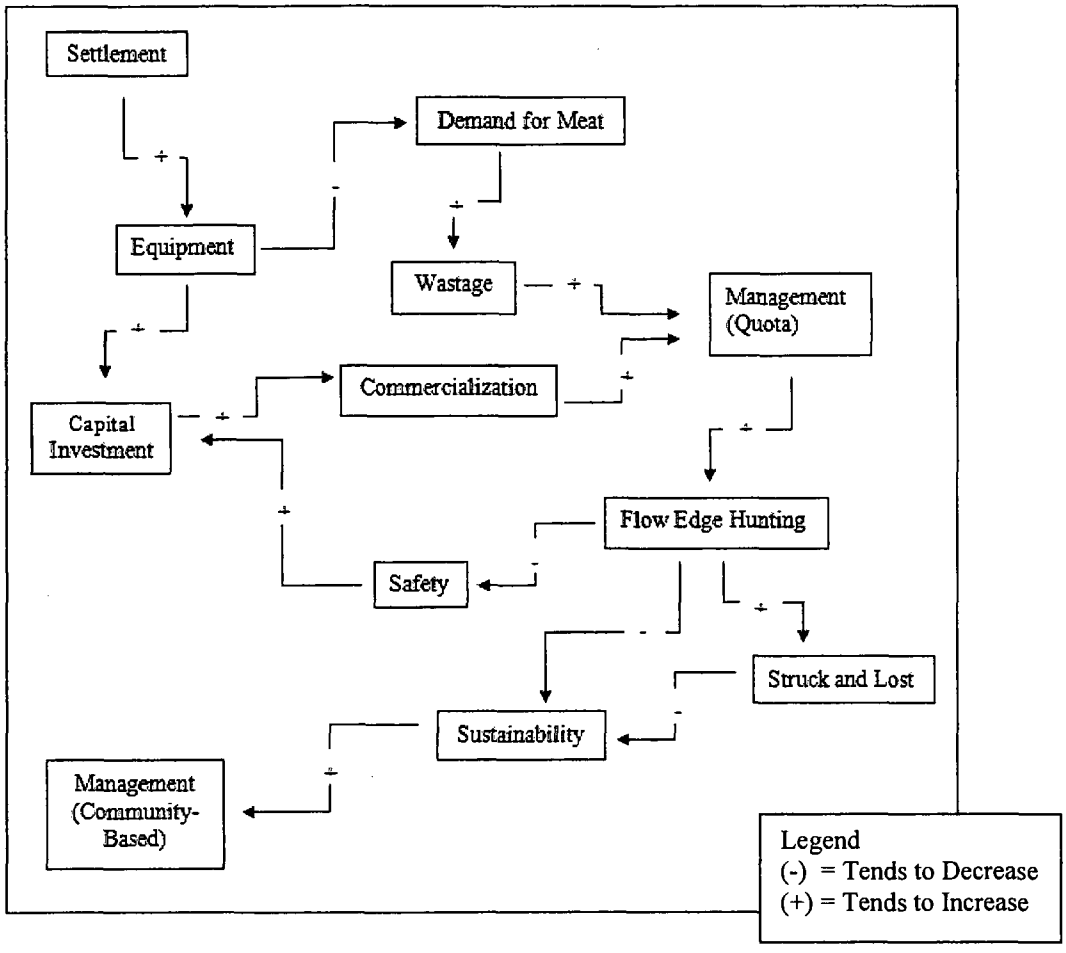
This statement, more than any other, summarizes the mood of all the participants who contributed to this research – that things are getting better, and will continue to get better, but it's going to take a long time before the goals set out in the Nunavut Final Agreement are fully realized.

5.5 Summary

Pathways of cause and effect can be non-linear and drivers of change may be political, social, ecological, cultural, and/or economic. It is important to understand phenomena (in this case, community-based narwhal management) in context. Figure 8 is an influence diagram showing interactions between system-components. The changes

and effects of change included in Figure 8 were reported by actors at all levels and are presented here as the context within which adaptive capacity can be explored.. Adaptive capacity can be understood simply as the capacity of a system to change in response to a change, or in anticipation of a change, and Figure 8 reflects this understanding.

Figure 8.0 Influence Diagram of Narwhal Hunting and Management



Settlement in permanent communities is taken here as a starting point because settlement so clearly demarcates Inuit history into two categories – pre and post. Permanent settlement in Arctic Bay began with the establishment of a Hudson's Bay Post in 1926, but large-scale settlement did not occur until the 1950's and 1960's – the result of a number of federal initiatives to provide Inuit with services such as Western education and health care.

As an adaptation to settlement, Inuit invested in equipment (e.g., snowmobiles, outboard motors, and rifles), which increased access to hunting areas, and increased productivity once there. The reliance on equipment (i.e., snowmobiles) decreased the need for dogs, and decreased the demand for narwhal meat. In turn, this raised concerns about wastage, which served as a rationale for Western quota-based management in the 1970's. The reliance on expensive equipment also increased the capital investment required to participate in the resource economy, which lead to concerns about commercialization of tusk ivory, which served as a second justification for Western-led management.

The quota system has led to hunting at the floe-edge. Every spring narwhal arrive first at the floe-edge and then advance through open-water leads into Admiralty Inlet as the sea-ice recedes. Formerly, narwhal were not hunted at the floe-edge - it was considered too dangerous, and there were (are) concerns that hunting at the floe-edge might deter narwhal from entering the inlet. The quota system has added an air of competition to narwhal hunting as there is pressure to harvest narwhal before the quota is filled. Floe-edge hunting has also decreased personal safety – the ice closest to the floe-edge is the first to break-up, and a south wind (which might be stronger, more frequent, or less predictable as a result of climate change) can blow it out to sea. These hazards have increased capital investment in global positioning systems (an early warning system if the ice should begin to shift), satellite phones (to guide rescuers if stranded), and radios (to communicate with each other about weather forecasts and sea-ice conditions). Ford et al. (2007; 2006) assess vulnerability to climate change in Arctic Bay, and they conclude that access to global positioning systems, satellite phones, and radios may be increasing

exposure and sensitivity to environmental hazards by fostering overconfidence in the safety net they provide. They also note several behavioural adaptations that have reduced exposure and sensitivity (for example, Inuit are packing extra supplies, avoiding dangerous areas at dangerous times, bringing small boats, and traveling in groups).

Hunting at the floe-edge might be directly and indirectly affecting the sustainability of the Admiralty Inlet sub-stock of the Baffin Bay narwhal population, and the social-economic systems based on narwhal hunting. As mentioned above, floe-edge hunting may be deterring narwhal away from Admiralty Inlet, and thus decreasing the sustainability of narwhal hunting in the area. Also, struck and lost rates are highest at the floe-edge, which means actual harvest mortality is higher here than anywhere else, which may be decreasing sustainability. High struck and lost rates also add uncertainty as to total removal, and have been used as a justification for a management system that accurately records the number of narwhal landed, and struck and lost. Concerns about sustainability have led to the current community-based narwhal management system. As a cautionary note, I include this diagram in the hope that it will guide future discussions. It is not the last word on contextual interactions, their causes, or their effects – it is a tool that can enable or facilitate joint discussions of a complex social-ecological system.

6. ADAPTIVE CO-MANAGEMENT AND *INUIT QAUJIMAJATUQANGIT*

6.1 Introduction

Chapter Four of this thesis records comments and provides key insights into collaboration and the process of accessing, interpreting, and incorporating *Inuit Qaujimajatuqangit* into wildlife management. Chapter Five is an assessment of change and adaptation in the context of community-based narwhal management. Chapter Six links the two. The focus here is on establishing a relationship between co-management and adaptive management and assessing whether, or to what extent, community-based narwhal management is consistent with the practice of adaptive co-management (ACM). With an understanding of the challenges and risks impeding narwhal co-management, and of social-ecological dynamics in the broader system, this chapter draws on a framework intended to identify some of the key characteristics of CBNM and help to chart its evolution. Adaptive co-management of narwhal in Arctic Bay is assessed relative to a framework developed by Berkes et al. (2007) - an analytical tool that allows for an understanding of contextual phenomena in temporal context. Issues of scale are critically important in the context of co-management (which tends to focus on jurisdictional and spatial scale) and adaptive management (which tends to focus on temporal scale). This analytical framework links the two.

The framework will assess the community-based narwhal management system relative to nine core components of an ACM approach: reason for being, degree of power sharing, worldview and sense-making, rules and norms, trust and respect, linkages and networks, use of knowledge, capacity to experiment, and learning (see Table 7). These

components are assessed relative to three stages of maturation (early, middle, mature). This framework is a synthesis of co-management and adaptive co-management advanced by Berkes et al. (2007) to reconcile the two into a single approach (ACM). Berkes et al. (2007) recognize that many of the criteria they consider fundamental to ACM are not easily measurable. They further recognize a lack of measures and criteria of success as major challenges. The guiding questions tabled below will allow for a qualitative assessment of the maturation of the nine core components of ACM. Results from Chapters Four and Five will be reexamined through this analytical lens. A designation of 'early' indicates that there is no significant deviation from the narwhal management system supplanted by CBNM; 'middle' indicates greater flexibility and experimentation, but also a resistance to change, and a reluctance to experiment; 'mature' indicates a highly flexible learning institution, with actors at all levels organizing and coming together to address issues as they arise. The criteria for these designations, as identified by Berkes et al. (2007), are tabled below.

Table 7.0 Analytical Framework of Adaptive Co-Management Maturation

Criterion	Guiding Questions	Stage		
		Early	Middle	Mature
Reason for being	Where did the idea of CBNM originate? What is the purpose of CBNM?	Initiated from top down	Successful self-organization to management challenges	ACM to address multiple challenges
Degree of power sharing	How is power shared across levels and between actors?	Little or none, or only as formally mandated	Moving from information exchange to partnership	Partnership of equals identifying problems and testing solutions
Worldview and sense-making	Is there a shared vision of the future?	Reacting to past crises	Making sense of new realities and looking forward	Developing a shared vision of the future

Rules and norms	What rules and norms govern narwhal hunting and where did they originate?	Externally imposed; disconnect between formal and informal	Developing own rules and norms	Formal and informal rules complement each other; rules and norms developed as needed
Trust and respect	Is CBNM facilitating trust-building?	Relationships built on formal arrangements	Mutual trust through high and low points	Mutual trust and respect involving multiple actors
Linkages and networks	How are actors linked across vertical and horizontal space?	Few or only as formally mandated	Increasing number of linkages; identification of roles	Many linkages; partners with diverse functions;
Use of Knowledge	Are all knowledge sources being fully exploited?	Exclusively scientific or local	More attention to integration	Co-production of knowledge
Capacity to experiment	Is CBNM encouraging experimentation?	Little or no capacity or willingness	Willingness to experiment; developing capacity	Cyclic experimentation, adaptation and innovation
Learning	Is CBNM facilitating learning, and is learning being translated into action?	Instrumental	Developing flexibility; recognizing uncertainty	Double-loop transformative learning

6.2 Adaptive Co-Management Maturation

6.2.1 Reason for Being

Community-based narwhal management does not originate in the community. The process was not initiated by the community, and the goals, objectives, and premises of CBNM appear to be extra-local – at least, they are perceived as extra-local by community actors. It is curious that narwhal management in Nunavut should be saddled with the misnomer 'community-based'. Narwhal management in Nunavut is better described as co-management, or perhaps as adaptive co-management.

So what is the 'reason for being' – why the shift to CBNM? The rationale for CBNM is somewhat unclear. In part, decision-making power has been shifted to the community level because actors at the community level have demanded it. Inuit are participants in wildlife management because they have demanded the right to participate in wildlife management – the Nunavut Final Agreement bears the legislative fruits of those demands. Or, as the DFO has retained the power to set, vary, and remove quotas, shifting some powers and responsibilities to community actors may simply be a means of cutting costs without jeopardizing their primary interest – conservation. There is no evidence to suggest this is the case, but the shift to 'community-based' management did coincide with a reduction in the operating budget of the Fisheries Management Directorate and Arctic Science Program of the DFO's Central and Arctic Division (NWMB, 1996c). Officially, the DFO was transitioning from a 'doing' agency to an 'enabling' agency, but the NWMB expressed grave concerns regarding DFO's plans to downsize and still meet their obligations under the NFA (NWMB, 1996c). That said, the devolution of power that has occurred is consistent with what many in the field of resource management would consider 'best practice' (Berkes and Kristofferson, 2005; Carlsson and Berkes, 2004). For example, the subsidiarity principle (Spicker, 1991) states that territorial and state management should be subordinate to that of lower levels. Certainly, some devolution is consistent with many resource management applications in Nunavut and around the world (Natcher et al., 2005; Reeves, 2002; Richard and Pike, 1991).

More specifically, CBNM is a response to several issues: (1) sustainability, (2) struck and lost rates (and uncertainty related to the reporting of struck and lost rates), (3)

wastage, and (4) commercialization. Participants at all levels considered these to be the main impetus for CBNM. The CBNM system was intended to address these concerns, and to improve record keeping, training, and safety.

The shift to CBNM is consistent with the Nunavut Final Agreement and with dominant theories of wildlife management. Devolution, especially in a cross-cultural context, is both moral, and practical: CBNM is a reflection of this morality and practicality. The NFA (NFA 5.3.3), for example, only empowers the NWMB to limit Inuit harvesting for the purposes of conservation, public health, or public safety. It is likely that CBNM, through knowledge sharing and cross-scale collaboration, will result in better decisions, which will result in better decision-making processes, which will result is better decisions. That, at least, is the hope – a self-reinforcing feedback loop that improves decisions, improves decision-making institutions, and builds trust and capacity at all levels.

6.2.2 Power Sharing

In this context, power sharing refers to the extent to which powers previously held by the territory and state have been devolved to the community. As per Arnstein's (1969) eight point categorization of citizen participation, CBNM corresponds best with level 6 (partnership) or level 7 (delegated power). Still, there is a legacy of manipulation, therapy, informing, consultation, and placation (levels 1 through 5). Community-based narwhal management is not consistent with level 8 (community control). Decision-making powers related to quota allocation (i.e., how the established quota is distributed amongst community members) have been devolved to participating Hunters' and Trappers' Organizations, but the quota itself, and the objectives that steer management,

are dictated by extra-local institutions (traditional power-holders). Power sharing is formally mandated by the Nunavut Final Agreement (1993), and there is a move towards shared decision-making. The Nunavut Wildlife Management Board, for example, is comprised of six Inuit members, two non-Inuit members, and an Inuit chairperson. This fact alone, however, does not ensure the inclusion of Inuit knowledge, values, and principles as the system itself is Western. This is consistent with the findings of White (2006), who concluded that northern land-claims boards adhere to Euro-Canadian governance models and are not necessarily equipped to incorporate traditional knowledge, despite the meaningful participation of traditional knowledge-holders.

6.2.3 Worldview and Sense-Making

The terms 'worldview' and 'sense-making' are used here with reference to visioning, a core component of adaptive co-management (Olsson, 2007; Peterson, 2007). Are actors basing decisions on events that have taken place, or are they building towards a shared vision of the future? Community-based narwhal management is not entirely reactionary; at the same time, there does not appear to be a shared vision of the future. Rather, actors at all levels are making sense of new realities. Most commonly, the new realities mentioned by participants related to changing technology, demographics, patterns of settlement and accompanying lifestyles, legislative powers and responsibilities, and environmental attributes related to climate, weather, sea-ice, or narwhal abundance, behaviour, and health. At this point, there does not appear to be a shared vision of the past, let alone a shared vision of the future. Understandings of the past are probably shared within each organizational level, but there is no indication that these understandings transcend levels, or transcend culture.

It is appropriate to here mention continuity and temporal scale. In a system where Western actors, and scientific understandings, change frequently, Inuit actors provide continuity and constancy. The users, more than any other group, are capable of understanding policies, and their effects, in context. Moreover, an acknowledged strength of Inuit knowledge relates to the fact that it is relevant to a long time scale, while scientific knowledge is typically much more short term. Again, Inuit knowledge is critical for understanding phenomena in context (e.g., is an apparent decline in narwhal abundance simply part of a multi-decadal cycle, or is it an immediate effect of some recent cause?). The history of the eastern Canadian Arctic, as it is understood by non-Inuit, is a story that has been told by non-Inuit. Inuit are now in the process of documenting, interpreting, and sharing their own version of the past. Doing so will presumably facilitate future-based visioning.

6.2.4 Rules and Norms

Community actors, by-and-large, perceived formal rules and norms governing narwhal hunting/management to be externally imposed. The *Ikajutit* HTO by-laws, in theory, were developed by the community, but they were required to conform with existing legislation (i.e., the Fisheries Act and the Marine Mammal Regulations). The NWMB decided quite early in the planning process (which was initiated by the NWMB) that it would be necessary to provide HTOs with 'guidelines' for making and enforcing by-laws (NWMB, 1998). They later reiterated that "the NWMB will need to be satisfied that its criteria are met before it will be able to agree to actually implement the new narwhal management system for any particular HTO" (NWMB, 1999b). The community by-laws do not differ substantially from the Marine Mammal Regulations (although they

do contextualize them and add detail). Five Marine Mammal Regulations appearing in the Fisheries Act are reproduced in part, or in whole, in the *Ikajutit* HTO by-laws. Moreover, the NFA did not provide the 'fresh start' it might have – any harvesting restriction or quota/non-quota limitation in effect prior to the ratification of the NFA was deemed to have been established by the NWMB (NFA 5.6.4; NFA 5.6.51). There are, in effect, two management systems: the HTO is empowered to govern harvesting (NFA 5.7.3); while the NWMB is empowered to govern wildlife (NFA 5.2.33; NFA 5.2.34). The former is subservient to the latter. A possible third management system governing narwhal hunting is the Convention on International Trade in Endangered Species (CITES), which monitors and governs trade in narwhal products, amongst many others (WDCS, 2004). Economic returns for narwhal products (i.e., the tusk) fluctuate dramatically in response to market conditions and trade restrictions.

There is also an apparent disconnect between formal and informal rules. None of the nine 'traditional' rules mentioned by community members have found their way into any form of legislation. Furthermore, there is some concern that formal rules are undermining informal ones:

> a government guy showed up, making sure that everybody has tags, and everybody follows the rules, and that all the whales are counted, and that kind of stuff. It started to take the onus away from self-regulation by the community. It was self regulated - people would shut it down, or people would do different things. The government basically took that away – took away that responsibility. knows what you're supposed to do, like not shooting the first whales in, those things are like a line, and everybody stays back behind that line. Then what happens is the government comes in, and what happens is one of the hunters will step over the line. The community looks at Fisheries, and Fisheries says, 'well, you know, that's not against the law', and then everybody steps over that line (Glenn Williams, Pers. Comm., 2007).

Many traditional rules and norms are still being practiced (e.g., not hunting the first pod of whales; not using outboard motors or making noise at the floe-edge), but they have not been formalized at any level. That is not to say that they are not enforced, but the means of enforcement can be subtle, especially to an outsider - enforcement may be as simple as a reprimand from an elder. Other traditional rules and norms – not hunting at the floe-edge, not hunting on Sundays, women and youth not hunting – have not made their way into formal legislation and are no longer practiced.

6.2.5 Trust and Respect

Trust and respect have been undermined by a legacy of exclusionary governance, where Inuit systems were managed unilaterally by the Canadian state and the international community. For example, in 1983 the European Economic Community imposed restrictions on the import of several marine mammal products, and thus removed the cornerstone of the Inuit economy (Wenzel, 1999: WDCS, 2004). Mounting anti-whaling rhetoric has led some to fear further action (Tom Naqatarvik, Pers. Comm., 2007). Within the community there are concerns that the quota will be reduced or removed. Prior to the NFA, outside management intervention, from the territory or the state, had invariably led to further restrictions and enforcement within the community. That said, the NFA has redefined the role of the territory and the state, and management is more inclusive/participatory than it has ever been. In this respect, the new relationships legislated by the NFA are fostering trust and respect.

Still, with regard to knowledge and reporting, there is continued mistrust between Western and Inuit epistemologies:

> the scientific community doesn't understand or know the Inuit way of doing things, and it doesn't trust it, because it views it as being anecdotal – just a story.

> On the other hand, Inuit see scientific information as being not trustable either, because scientific information has been wrong in the past, many times, in terms of wildlife management (Joe Tigullaraq, Pers. Comm., 2007);
>
> I think there's a kind of skepticism on both sides (Michael D'Eca, Pers. Comm., 2007).

Respect for knowledge of different types is improving, but trust in different types of knowledge may not be. But respect must precede trust, and all participants were respectful of each other, and of all types of knowledge.

Berkes et al. (2007) point out that early positive measures of the resource being managed will build trust – for example, if efforts to educate and train young hunters were found to reduce struck and lost rates, and if the narwhal population was found to be increasing, confidence/trust in the co-management process would likely increase in proportion, especially if these findings were then translated into action, such as a quota increase. The capacity to monitor change is a central component of adaptive management and adaptive co-management. An inability to effectively monitor environmental changes (e.g., narwhal abundance), and social changes related to narwhal harvesting (e.g., struck and lost rates) may be compromising adaptive capacity and trust-building. Even shared understandings of environmental and social phenomena (e.g., narwhal abundance) may be attributed to different causes: would an apparent population decline represent a change in abundance or distribution?

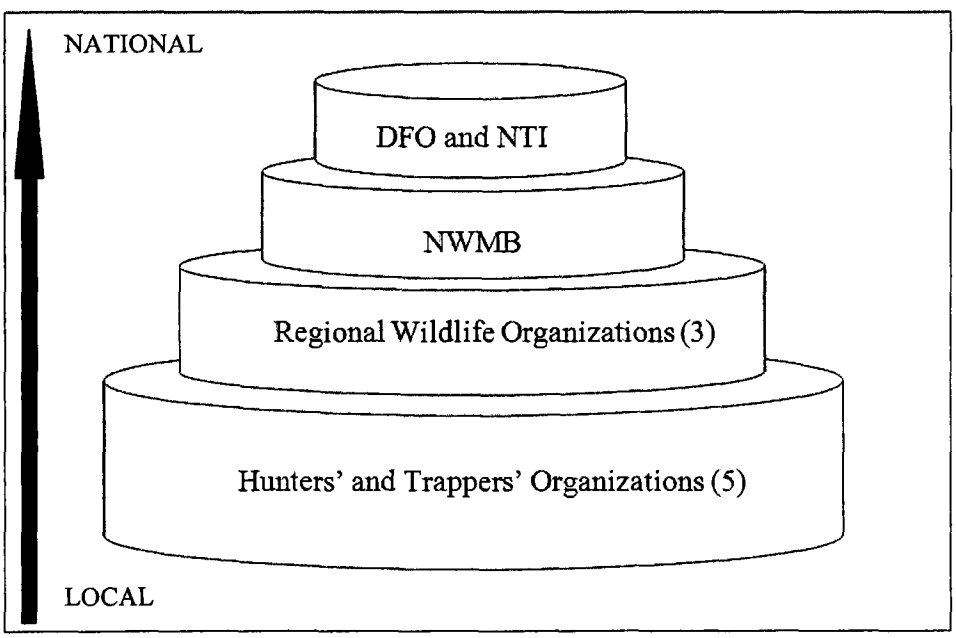
Trust can be compromised unintentionally. In 1996 the NWMB expressed dissatisfaction and concern about the DFO policy requiring Fishery Officers to wear sidearms (NWMB, 1996a). At the 12th quarterly meeting of the NWMB a member (Malachi Arreak) noted that "when a citizen sees a gun on a person in authority he adopts

an entirely different attitude to that person: an attitude which tends to be inconsistent with the precepts of wildlife co-management" (NWMB, 1996a).

6.2.6 Linkages and Networks

Horizontal and vertical linkages are both relative to a jurisdictional scale. The jurisdictional scale is hierarchical, and in this case includes, from the bottom to the top, community Hunters' and Trappers' Organizations (HTOs), Regional Wildlife Organizations (RWOs), the Nunavut Wildlife Management Board (NWMB), Nunavut Tungavik Inc. (NTI), and the Department of Fisheries and Oceans (DFO) (see Figure 9). Horizontal linkages refer to interaction within a level (e.g., between HTOs) and vertical linkages refer to cross-level interactions (e.g., between HTOs and RWOs).

Figure 9.0 Jurisdictional Scale of Community-Based Narwhal Management



Horizontal linkages at the community level are primarily informal, and are somewhat intangible. Suffice to say, informal horizontal linkages seem robust, but likely decrease with distance – socially, culturally, and historically Arctic Bay appears to be most closely linked with the communities of Igloolik and Pond Inlet. Formal horizontal

linkages are present at several levels. Community HTOs are connected to each other, informally, and through RWOs, which serve as boundary or bridging institutions linking HTOs vertically with the NWMB. Arctic Bay is in the Qikiqtaaluk (Baffin) Region – one of three administrative regions in Nunavut – with 11 other hamlets: Cape Dorset, Clyde River, Grise Fiord, Hall Beach, Igloolik, Kimmirut, Pangnirtung, Pond Inlet, Qikiqtarjuaq, Resolute, and Sanikiluaq. Of these, Qikiqtarjuak, Pond Inlet, and Arctic Bay are participants in CBNM. Repulse Bay and Kugaaruk, located in the Kivalliq Region and the Kitikmeot Region, respectively, are also participants in CBNM. Participants in this study stressed that each community in Nunavut exists within its own distinct social-ecological context, and that generalizations from one community to another, with regards to management, should be avoided: "hunting procedures are highly variable among communities, depending on local circumstances. Rules that might be appropriate for open-water hunting might not be appropriate in ice cracks or at the floe edge" (NWMB, 1999a). The second horizontal linkage of interest in this context links the NTI with the DFO. The relationship between the NTI and the DFO can be adversarial, and both sides have resorted to litigation to resolve disputes regarding harvest levels and quota allocation (Bell, 2005; NWMB, 2000b; NWMB, 1999a; Bourgeois, 1997).

Vertical (cross-level) interplay occurs predominantly, but not exclusively, between actors in adjacent levels in the jurisdictional hierarchy (Cash et al., 2006). Boundary institutions, like the RWOs, link actors in adjacent levels. Institutionally, Nunavut's multi-level government is consistent with theoretical prescriptions – there are

"redundant and layered institutions, and a variety of institutional types" (Berkes et al., 2007).

6.2.7 Use of Knowledge

Knowledge itself can be considered as a scale, with IQ on one side and WSK on the other. Some of the criteria that establish the opposite extremes of this scale were noted by participants: IQ tends to be oral, holistic, innumerate, moral, and long-term, while WSK tends to be documented, compartmentalized, numerate, value-free, and short-term. Participants noted challenges and risks associated with five stages of knowledge management; these may stem from what Cash et al. (2006; 8) consider a "lack of cross-level interaction in the knowledge system" – i.e., a failure to accommodate differences between IQ and WSK.

Challenges and risks notwithstanding, participants noted general agreement between informational IQ and WSK – disagreements in interpretation of that knowledge may be a function of the different worldviews that underpin the two ways of knowing, they may reflect pre-existing power dynamics, or they may be an example of bureaucratic inertia. The community-based narwhal management system privileges WSK, but all participants noted more attention to different kinds of knowledge and more discussion of ways to integrate them since the ratification of the NFA in 1993.

6.2.8 Capacity to Experiment

The existence of CBNM, to a certain extent, demonstrates a willingness and capacity to experiment. Community-based narwhal management is novel. For example, there is some flexibility built into the quota system - with approval communities may transfer up to 50% of the quota to future years, or borrow up to 15%. A flexible quota

was first proposed in 1994 (NWMB, 1994) as a solution to repeated community requests for increased quotas. After several years of requests this proposal began to emerge into the foundation of CBNM (NWMB, 2007: Resolution 98-041). Initially, CBNM was characterized by the formal removal of quotas, in favour of community-based non-quota limitations - the term 'non-quota' was being used generally to describe the system (NWMB, 1999a). Nunavut Wildlife Management Board meeting minutes (1999a) describe the CBNM process:

> Communities qualify for the removal of any existing narwhal quota restrictions if they establish local rules that address three basic concerns. These rules are subject to review and approval of the NWMB, and must demonstrate that the community has in place:
>
> > An effective and credible system for reporting all narwhal that are struck and landed or lost;
> >
> > A realistic system for administering the narwhal hunt through a process involving use of individual tags; and
> >
> > A system of local rules designed to ensure conservation, promote humane harvesting, maximize hunter safety, prevent wastage, and foster relevant training and education in respect to hunting.

Resolution 2000-014 (NWMB, 1999a) approves the management proposal of the *Ikajutit* HTO and specifically removes quotas for the community of Arctic Bay. But quotas do not appear to have been removed, although the term itself has been replaced with 'limit'. The removal of quotas would be a serious deviation from the status quo, and it would demonstrate a willingness to experiment. As it is, CBNM is not as novel as it was initially intended to be. Under CBNM, some decision-making powers related to quota allocation have been devolved to community HTOs (e.g., how tags are distributed amongst community members). That said, many participants did not perceive a great

deal of difference between CBNM and the narwhal management system that it supplanted – there are still community quotas and the hunt itself is still subject to the same legislation as it was prior to CBNM (although community HTOs have been empowered to contextualize that legislation).

The capacity to experiment may have been compromised by a desire to retain flexibility. The CBNM system was introduced on a trial basis, first for three years, and then for an additional five years, when the trial was extended. This terminology is certainly consistent with experimentation, but devolution on a 'trial' basis may have increased the perceived risk involved with true experimentation. In other words, the fact that CBNM was introduced on a 'trial' basis, with devolved powers and responsibilities subject to re-evaluation after a prescribed period of time, may have guaranteed the preservation of the status quo. Experimentation at broader scales of management does not necessarily translate into the conditions for experimentation at lower scales

6.2.9 Learning

Learning is central to ACM – the premise is that management decisions should be treated as experiments, results should be monitored, and subsequent management decisions should be modified accordingly. Armitage et al. (2009) distinguish between several types of learning, but two are of particular significance in the context of this research – single-loop learning, and double-loop learning. Double-loop learning focuses on assessing/revising premises, assumptions, and worldviews; single-loop learning is more pragmatic, and is practice-oriented. Single-loop learning focuses on specific decisions, and is highly applied (e.g., what is the maximum sustainable yield for Baffin Bay narwhal; how can struck and lost rates be reduced?). Double-loop learning is

process-oriented, and focuses on the context that guides specific decisions (e.g., how can scientific knowledge and IQ be combined without compromising either?). A management system that focuses exclusively on single-loop or double-loop learning will not be capable of managing wildlife resources in a cross-cultural context. Traditionally, single-loop learning has received preferential treatment, because it lends itself well to technocratic, expert-driven management (Diduck et al., 2005). In Nunavut, the NFA has precipitated a slight refocusing on double-loop learning, but single-loop still predominates. The considerable investment of time, energy, and money into designing and implementing a CBNM system, however effective it has been, indicates a refocus on double-loop learning. The NWMB, established by the NFA in 1993, is a product of double-loop learning but it is primarily tasked with making single-loop decisions.

Whether single-loop or double-loop, adaptive co-management is premised on iterative learning (learning that involves multiple rounds of monitoring and evaluation). The capacity to learn iteratively, and to devise management scenarios that encourage iterative learning, is an attempt to promote flexibility. In recognizing complexity and change as inherent attributes of social-ecological systems, ACM is a response to the failures of rigid, control-focused management regimes. The narwhal management process might be considered to be oriented towards learning and adaptation.

> we're rather pragmatic about our decisions. As soon as there's new information that sheds a different light on a previous decision that was made, we'll revise it, and change the decision if we need to. With anything as dynamic and heterogeneous and stochastic as the environment, you have to roll with the punches. And are all the decisions ultimately the best decisions? No, they can't be, we don't have perfect vision. That's why you have to be willing to go back and revisit any decision that you make (Joe Justus, Pers. Comm., 2007).

Iterative learning, however, does not necessarily translate into iterative decision-making. The case of the bowhead whale is illustrative of this point. Due to methodological shortcomings, early surveys of bowhead whales vastly underestimated their numbers (Johannes et al., 2000). Inuit knowledge-holders challenged these findings and a more appropriate methodology was devised – the revised-methodology study determined that the bowhead whale population was considerably larger than was previously thought to be the case, but quotas for bowheads have not been revised accordingly (NWMB, 1999b). Thus, despite collaboration and iterative instrumental learning, conventional management can prove resilient:

> it's a good example [of collaboration], except that if you look right through it, the information is not coming forward, or it isn't being applied. They haven't upped the quota yet and they've had this information for five years (Glenn Williams, Pers. Comm., 2007).

Narwhal population estimates have also been revised upwards. Failure to act on knowledge that has been iteratively and jointly learned may be undermining trust and, therefore, co-management. Polar bear management provides an example:

> they're saying now that this population [polar bear], they estimated that it was around 1400 or whatever, and they're now saying that it's probably closer to 2500 or 2600, but nobody's rushing to increase the quota. If it was the other way...they'd swoop in with wrath of God (Glenn Williams, Pers. Comm., 2007).

With narwhal populations, the implicit incentive to reduce struck and lost rates is that such a reduction will translate into a quota increase. Logically, it should, but is there any reason to believe it will?

6.3 Summary

Community-based narwhal management is consistent with the practice of ACM, but it is not a mature process linking actors in robust networks of learning and action. Of the nine core components of ACM, none have matured beyond the early or middle stages of evolution (see Table 8). Community-based narwhal management is not as novel as it was originally intended to have been. Although some flexibility has been built into the quota, there is still a quota. Although communities have been empowered to create management regulations, existing legislation still applies. Although there is a greater commitment to learning, learning is not being translated into action. Although there is greater recognition of the potential contribution of *Inuit Qaujimajatuqangit*, it is not readily incorporated into what is still predominantly a science-based management institution. But ACM is a process without an end-goal, and this analysis indicates progress. Each of the nine core components of ACM, despite not having advanced beyond the early or middle stages of evolution, have advanced (see Table 8).

Table 8.0 Maturation of Adaptive Narwhal Co-Management in Arctic Bay, Nunavut

Criterion	Stage	Rationale
Reason for being	**Early**	'Community-based' is a misnomer. The CBNM system was not initiated within communities.
Degree of power sharing	**Early-to-Middle**	More equitable power sharing guarantees Inuit inclusion, but a legacy of exclusionary governance, and a system that is still predominantly Western, limits IQ inclusion.
Worldview and sense-making	**Early-to-Middle**	Making sense of new realities and starting to create shared understandings of the past. No shared visions of the future that transcend culture.
Rules and norms	**Early-to-Middle**	There is a disconnect between formal and informal rules, and concern that the former are undermining the latter.
Trust and respect	**Early-to-Middle**	Respect of different knowledge types does not equal trust. An inability to effectively monitor social and environmental phenomena is likely hindering trust-building.
Horizontal and vertical linkages and networks	**Middle**	Increased information sharing across horizontal levels. Institutional arrangement is as prescribed and there is more attention to informational flows across levels since the ratification of the NFA.
Use of knowledge	**Early-to-Middle**	Increased attention to IQ/WSK integration, but differences in interpretation persist. Little attention to the challenges and risks associated with knowledge management.
Capacity to experiment	**Early-to-Middle**	Casting CBNM as 'experimental' may have compromised experimental capacity. Failure to address the inherent resilience of pre-existing legislation and historical power dynamics.

Learning	**Early-to-Middle**	NFA has shifted some attention to double-loop learning, but pragmatic, single-loop learning dominates management. Iterative learning does not necessarily translate into iterative decisions.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

Consistent with the Issues Framework of the Adaptive Methodology for Ecosystem Sustainability and Health, Chapter Four of this thesis has identified issues related to knowledge management. Consistent with the System Definition component of the AMESH, Chapter Five builds an understanding of the community-based narwhal management system by assessing change and adaptation. Chapter Six links the two and is consistent with the Canon Identification component of the AMESH; it charts the evolution of the CBNM system relative to nine core components of adaptive co-management identified by Berkes et al. (2007) and thereby identifies the system's trajectory. The purpose of this chapter is to summarize the key findings of Chapters Four through Six and translate these into a set of policy recommendations/options.

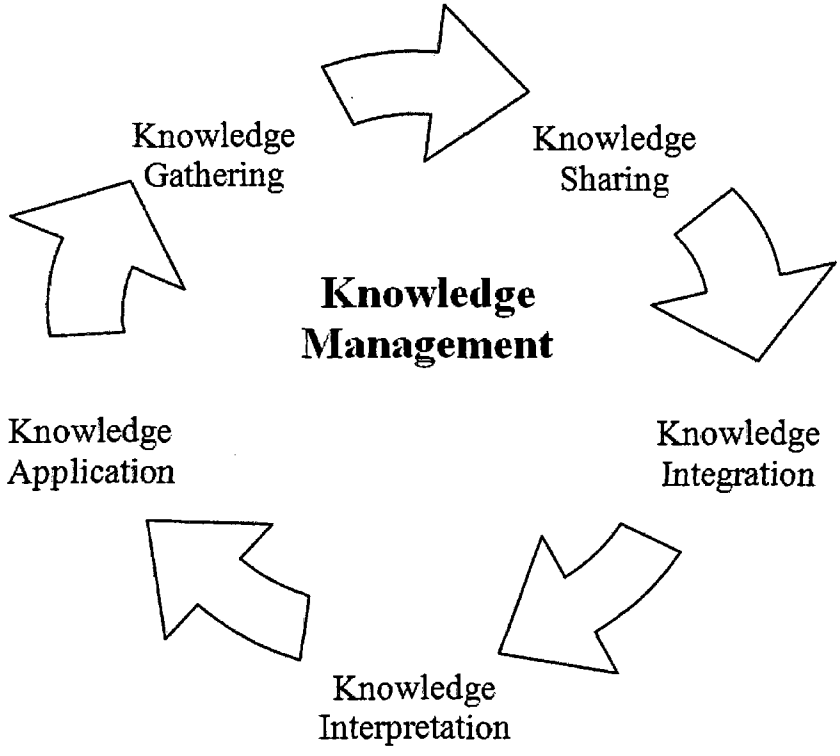
There is an apparent disconnect between the role of IQ as it is prescribed by the NFA and as it is perceived by actors at different levels. This disconnect is evidenced by the numerous challenges and risks complicating the knowledge management system. Challenges (e.g., language) can be overcome, but this is not necessarily true of risks inherent in cross-cultural co-management. For example, the Inuit belief that harvest mortality increases population health and abundance can not be accommodated by the CBNM management institution, as it is at odds with dominant Western paradigms of wildlife management. Right now, the utility of *Inuit Qaujimajatuqangit* is restricted to its

ability to inform conventional scientific inquiries. *Inuit Qaujimajatuqangit* can play an important role in creating spaces for adaptive, collaborative management, but the management institution tends to focus on single-loop learning at the expense of double-loop-loop learning – a more balanced approach in this regard would likely increase the quality of the decision-making institution, and of the specific decisions it makes.

7.1.1 Knowledge Management (Collaboration)

Since Westerners first took an interest in Arctic wildlife - for commercial whaling, then the fur trade - the Inuit of what is now Nunavut have had little control of formal management. Now, more than ever before, Inuit are being heard and their knowledge (*Inuit Qaujimajatuqangit*) is influencing decisions. Under the NFA, decision-making is more participatory and equitable than it has ever been, but the theoretical benefits of knowledge integration (the process of combining and comparing knowledge sets) have not been fully realized. Impeding this realization are significant challenges and risks. Challenges and risks associated with co-management (understood here as a system of knowledge management – see Figure 10) can be assessed relative to five knowledge management activities: Knowledge Gathering; Knowledge Sharing; Knowledge Integration; Knowledge Interpretation, and Knowledge Application/Decision-Making.

Figure 10.0 Knowledge Management System



This model builds on conceptualizations of adaptive management, which typically involve a closed system where an activity (e.g., narwhal hunting), feeds into monitoring (e.g., of narwhal abundance), which feeds into learning and the evaluation/modification of plans, policies and procedures, which guide new activities Adaptive co-management is essentially the same except it incorporates the linkage dimension of collaborative management. Thus ACM advocates cross-level monitoring and evaluation, learning through stakeholder negotiations, and shared decision-making. The knowledge management system conceptualized above builds on these understandings, and focuses them on knowledge. Knowledge Gathering can be any activity that generates knowledge, from hunting, to directed scientific research. Knowledge Sharing refers to the process of sharing knowledge between actors at all levels – thus bringing in the core teachings of

collaborative management. Knowledge Integration refers to the process of creating shared understandings of complex social-ecological realities. Knowledge Interpretation evaluates these understandings and assigns meaning. Knowledge Application uses understandings to modify existing plans, policies and procedures, and guide a new round of Knowledge Gathering.

Challenges and risks associated with knowledge management can be understood relative to specific activities (see Table 9).

Table 9.0 Summary of Challenges and Risks

Knowledge Management Activity	**Challenges**	**Risks**
Knowledge Gathering	• Lack of required skills • Participation ≠ Inclusion	• Disrespectful of animals • Burn-out/Response burden
Knowledge Sharing	• Documentation • Language	• Intellectual property rights

Knowledge Integration	• Accommodating epistemological differences:
	  • Holistic Vs Compartmentalized
	  • Innumerate Vs. Numerate
	  • Long time scales Vs. Short time scales
	  • Moral Vs. Value-free
		• One epistemology taking precedence (knowledge distillation)

Knowledge Interpretation	• Accommodating different worldviews	• One worldview taking precedence (a form of knowledge distillation)
Knowledge Application	• Time-frames • Knowing (deciding) what information/knowledge to apply	• Conflict may directly impact wildlife • Conflict-avoidance • Coercion

7.1.2 Change and Adaptation

Actors at all levels noted technological, social, ecological, and economic changes affecting narwhal hunting and narwhal management. The effects of these changes, and the capacity of the system to adapt or cope, are all highly uncertain and in many cases contentious. Some of the changes affecting narwhal co-management are increasing safety and sustainability, while others are not. Unfortunately, it is often difficult to distinguish the one from the other. For example, the shift from dog teams to snowmobiles as the primary means of transportation has decreased demand for narwhal meat, but it has also increased the funds or resources necessary to participate in hunting (and has presumably increased the motivation for economic returns). Similarly, the quota system, implemented in the 1970's, limits catches but encourages hunting at the floe-edge, which decreases sustainability and safety. *Inuit Qaujimajatuqangit* values and beliefs will have to identify the complex relationships between social-ecological causes and effects – it will have to determine which changes are desirable and should be encouraged, and which are undesirable and should be discouraged. These are normative concepts, and therefore outside the purview of science, but that does not mean they should be outside the purview of wildlife management.

7.1.3 Adaptive Co-management

If CBNM is considered as an ongoing process of adaptive co-management, then the process is in the early stages. The analytical framework developed in Chapter Six was used to assess the maturation of the adaptive narwhal co-management process relative to nine criteria identified by Berkes et al. (2007): reason for being, degree of power sharing, worldview and sense-making, rules and norms, trust and respect, linkages and networks, use of knowledge, capacity to experiment, and learning.

The core lesson from this assessment is that adaptive narwhal co-management is still in an early stage, which should help to set a realistic timetable for advancing the process. Its reason for being was established by the DFO, not community HTOs, and the term 'community-based' is inappropriate. Some powers have been devolved to HTOs, while others have not. In effect, there are three management institutions governing narwhal: the HTO governs hunting and their main tool is non-quota limitations; the NWMB and the DFO manage narwhal abundance and their main tool is quota-limitations, and the Government of Canada, through the convention on international trade in endangered species, manages trade, and their main tool is market restrictions. Inuit worldviews, of the past and the future, are different from those of non-Inuit; rules and norms, formal and informal, reflect these differences. Trust and respect are different things. Actors may respect other knowledge sets, but that does not mean they trust them. And respect may lead to conflict-avoidance, which can be unproductive. Linkages and networks, horizontal and vertical, are generally as prescribed. Use of knowledge is certainly greatly improved since the NFA but technocratic wildlife management is not designed to accommodate non-scientific knowledge, and it has proven resilient. The CBNM system demonstrates a willingness to experiment, although not as much as it might have. Initially, the system was conceived of as a trade-off whereby the state would remove the quota, and the HTO would report struck and lost rates, train young hunters, and draft regulations to encourage conservation. In the end, however, quotas were not removed, self-reported struck and lost data were not valued or used, and by-laws were required to satisfy territorial/state objectives and more or less mirror territorial/state legislation. Finally, there is evidence of single-loop and double-loop learning, but the

emphasis has been on the former (e.g., making short term, immediate management decisions) rather than the latter (e.g., discussing sources of conflict, and sources of conflict-avoidance).

7.2 Recommendations

7.2.1 Experimentation

Co-managers in Nunavut have demonstrated a willingness to experiment. Experimentation and learning are at the core of adaptive co-management, but in the case of CBNM, the process is not working as well as it might. First, there is the question of whether CBNM represents a significant deviation from the management system it supplanted. Second, 'community-based' management does not appear to be 'community-based', as community regulations were required to conform with territorial and state legislation. Finally, experimental capacity may have been compromised by labeling the program 'experimental' and making it subject to a three year review, and then a five year review.

Although adaptive co-management is premised on iterative learning and the periodic review of policies, plans and procedures, it does not specify a time frame. In this case there does not seem to be a pressing management concern: reviews should be less frequent – perhaps every ten years. This will help to build trust and encourage true experimentation. True experimentation should be further encouraged by removing community concerns that the quota might be removed or reduced on short notice – I recommend a ten year moratorium on quota adjustment. A quota review should coincide with the CBNM review. The quota has changed once since it was implemented over 30 years ago. If the quota is static, then managers should be cautious of the threat that it

might be reduced, and the incentive that it might be raised. The 'quota as bargaining chip' scenario should be removed from all subsequent negotiations.

Alternatively, the quota should be removed. This was the initial premise behind the CBNM system, but the DFO balked when harvests exceeded historical quotas and expectations. Experimentation requires commitment and patience. When people are granted a freedom they have previously been denied, they might be expected to be anxious to exercise that freedom. The NWMB (2003) report that when the quota was removed it was "like a leash let go". Managers did not allow sufficient time for the novelty to wear off the 'non-quota' system. If it is true that a quota becomes a target, harvest levels might have even balanced out below where they were under the quota system. It would have been nice to find out for sure.

7.2.2 Research

All future research should be guided by Inuit. Inuit should identify research priorities and develop, or solicit and approve, methodologies. For example, research methodologies that require tagging are a point of contention between Inuit and non-Inuit actors – they are not necessarily compatible with Inuit worldviews of appropriate ways to interact with wildlife. Are these studies necessary? Do they provide information that managers need to know, or information they would simply like to know? There does not appear to be any pressing need for research of this nature, as the implications for management are so few (for all intents and purposes, the quota is fixed – it would likely be extremely politically unpopular to either decrease it or increase it, and it is unlikely that we will soon have the scientific confidence to do either).

One other example is worthy of note: an Inuit hunter noted that he has observed more double-tusk narwhals in recent years, and he therefore concluded that the population is increasing (Anonymous, Pers. Comm., 2007). A small percentage of narwhals have two tusks, and as this proportion is likely constant, it may be a good indicator of relative abundance. Inuit tests of Inuit hypotheses should be encouraged. Inuit studies of narwhal to date have documented informational knowledge, but they have not done a very good job of preserving Inuit logic. Future research in this vein should make a concerted effort to document Inuit logic – a strength of *Inuit Qaujimajatuqangit* lies not in its ability to contribute informational knowledge (which it does as well), but in its ability to present alternate hypothesis and explanations of social-ecological phenomena. For example, climate changes are affecting the duration and spatial extent of sea ice cover. Will these changes reduce narwhal abundance by decreasing habitat, or increase abundance by reducing the likelihood of ice-entrapments? Science has not been refined to the point that it can answer these questions with any confidence, and alternate hypothesis and interpretations therefore provide opportunities for discussion and learning.

7.2.3 Reward Successes

The *Ikajutit* HTO has taken steps towards realizing the goals and objectives of CBNM. They have adhered to the reporting system and are providing reports of struck and lost rates; they have developed community by-laws to reduce wastage and increase public safety; they have developed and implemented a training program for young hunters. These successes should be rewarded. If these initiatives are reducing struck and lost rates, for example, the quota should be raised, as this was the implicit incentive. But

if there is not enough available information on past and present struck and lost rates to warrant an increase (and there may not be), then this incentive should be removed.

7.2.4 Language and Terminology

Mere translation, from Inuktitut to English or vice versa, is insufficient. Time should be put aside to operationally define and discuss the meaning of terms. Two examples from this research are immediately apparent. First, does 'sustainabilty' refer to distribution or abundance? Inuit actors tended to use the term with reference to the former, while non-Inuit actors tended to reference the latter. Second, does the term '*Inuit Qaujimajatuqangit*' refer to contemporary or historic knowledge, values, practices, and beliefs?

7.2.5 Temporal context

Understanding narwhal hunting and narwhal management in temporal context should be a primary goal. What use is 'knowing' there are five substocks when less than ten years ago we knew there were seven; when some stocks were shared with Greenland, but now they are not? Are there really five substocks or will the next study report that there are three, or none, or seven again? The point is that scientific knowledge has been shown to be at best incomplete, and at worst incorrect, many times in the past. Given the short residence time of Western actors, Inuit and *Inuit Qaujimajatuqangit* should play a central role in providing continuity and sharing understandings of context. Also, *Inuit Qaujimajatuqangit* should play a more significant role in detecting trends – scientific estimates of abundance, for example, only go back to the 1980s – Inuit estimates go back much further.

7.2.6 Social-Cultural-Economic-Ecological Context

Inuit Qaujimajatuqangit tends to be holistic, while Western scientific knowledge tends to be compartmentalized. There should be a greater effort to accommodate holism. In the field of wildlife management, this will require hiring and/or building relationships with researchers and managers in areas not conventionally associated with the biological sciences – anthropologists, social scientists, economists, philoshophers, ecologists, historians, cultural geographers, theologians, et cetera. Hunting narwhal is not just an ecological act – it is a cultural act, an economic act, a social act, a spiritual act, et cetera. At the very least, when discussing marine mammals the marine environment should be an admissible topic – it does not currently fall under the mandate of the NWMB. And since Inuit and non-Inuit connect narwhal hunting with social-economic need (as evidenced by Inuit terms for abundance – 'enough', 'not-enough', 'too many' – and the NFA's recognition of Inuit rights to harvest to the full extent of their economic, social, and cultural needs), economic and social implications of narwhal management decisions should be discussed. It is difficult for wildlife managers to incorporate economic and social criteria, as evidenced by the extreme difficulty the NWMB has had in determining basic needs levels for narwhal.

7.2.7 Conflict and Conflict Avoidance

There are social and cultural pressures for Inuit and non-Inuit actors to avoid conflict. Inuit actors may also perceive ecological pressures if they believe conflict can impact animals directly. But a willingness to engage conflict has been identified as a core component of effective co-management. Even so, one can hardly recommend co-managers engage conflict if it is socially, culturally, and/or ecologically inappropriate to

do so. I recommend instead that co-managers discuss sources of conflict, and take that as a starting point. In which situations would it be alright to engage conflict, and in which situations would it be inappropriate?

7.2.8 Morals and Values

Inuit Qaujimajatuqangit tends to be moral (perhaps a function of holism), while science professes to be value-free. Widdowson and Howard (2006) recommend that values be stripped from traditional knowledge to make it compatible with science. I recommend instead that values be added to science (made transparent) to make it compatible with traditional knowledge. The science behind narwhal management is highly uncertain. In some cases 'scientific' positions have been little more than value judgements – the quota for instance is somewhat arbitrary (Armitage, 2005a). Values, not ecological science, formed the basis for the European Economic Community ban on marine mammal products. Values, not ecological science, are the foundation of the Fisheries Act and the Marine Mammal Regulations. Values, not ecological science, have governed and will likely continue to govern how narwhal are managed.

The case of narwhal management demonstrates that the most basic assumptions of Western wildlife management (for example, that hunting decreases abundance) can be contested. Points of contention provide opportunities for learning if actors are able to engage conflict constructively.

7.3 Closing

The Nunavut Final Agreement recognizes a need for effective inclusion of Inuit in all aspects of wildlife management, but to date, the inclusion of *Inuit Qaujimajatuqangit* has not kept pace with the inclusion of Inuit. In practice, the value of *Inuit*

Qaujimajatuqangit is measured by its ability to inform conventional scientific management – it is a source of information, not an integrated system of knowledge, values, and beliefs. Challenges and risks associated with knowledge management can only be overcome and mitigated through collaboration. Managers and resource-users must discuss these challenges and risks and they must engage conflicts that arise therefrom in a manner that is consistent with the values and beliefs of *Inuit Qaujimajatuqangit*.

Social, cultural, technological, ecological, economic, and legislative changes are affecting the CBNM system – the relationship between these changes, and the nature of their effects, are highly complex and uncertain. Managers at all levels are coping with these changes, as best they can, but they are not building towards a shared vision of the future as it 'ought' to be. The institutional processes mandated by the NFA are building capacity to experiment, learn and adapt in the face of change, complexity, and uncertainty. Still, elemental differences between Inuit and Western knowledge and worldviews are impeding the adaptive co-management of narwhal in Arctic Bay, Nunavut.

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9. APPENDICES

Appendix 1. Interview Participants

Actor	Level	Relevant Affiliation/Position
Qaapik Attagutsiak	Local	Member/Elders' Council
Kigutikajuk Shappe	Local	Cultural Instructor/Nunavut School Board
Anna Qaunaq	Local	Community Economic Development Officer/Hamlet of Arctic Bay
Clare Kines	Local	Assistant Manager/Kiggavik Bed and Breakfast
Teema Palluq	Local	Conservation Officer II/Nunavut Department of Environment
Ipeelie Koonoo	Local	Elder; Experienced Hunter; Outfitter
David Klluk	Local	Chairmen/Economic Development Committee; Member/Elders' Council: Experienced Hunter
Leah Klluk	Local	Member/Women's Auxiliary Group
Tommy Killabuk	Local	Chairperson/*Ikajutit* HTO; Active Hunter
Don Oliver	Local	Manager/Arctic Bay Coop
Lisha Levi	Local	Elder; Experienced Hunter
Tommy Tatatuapik	Local	Chairperson/Elders' Council
Dorothy Oyukaluk	Local	Secretary Manager/*Ikajutit* HTO
Leah Oqallak	Local	Member/Women's Auxiliary Group
Naisanna Eecheack	Local	Young Hunter; Guide
Koonoo Oyukaluk	Local	Elder/Experienced Hunter
Moses Koonoo	Local	Active Hunter: Former Member/NWMB
Danny Taqtu	Local	Young Hunter
Tim Hoyt	Local	Principal/Nunavut School Board
Qaumayuk Oyukaluk	Local	Board Member/*Ikajutit* HTO; Former Chairperson/*Ikajutit* HTO
Andrew Taqtu	Local	Active Hunter; Outfitter
Mishak Allurut	Local	Interpreter; Researcher
Oliyuk Naqatarvik	Local	Experienced Hunter; Member/Elders' Council
Tom Naqatarvik	Local	Young Hunter
Levi Barnabas	Local	MLA/Government of Nunavut
Mary Ellen Thomas	Territorial	Manager and Research Liaison/Nunavut Research Institute
Joe Tigullaraq	Territorial	Chairperson/NWMB
Kevin McCormick	Territorial	Member/NWMB
Willie Nakoolak	Territorial	Member/NWMB
Michael D'Eca	Territorial	Legal Council/NWMB

Robert Moshenko	Territorial	Member/NWMB
Paul Frame	Territorial	Wildlife Administrative Biologist/NWMB
Erin Calder	Territorial	Wildlife Management Biologist/NWMB
Dr. Joseph Justus	Territorial	Director of Wildlife Management/NWMB
Paul Irngaut	Territorial	Wildlife Advisor/Nunavut Tunngavik Inc.
Glenn Williams	Territorial	Wildlife Advisor/Nunavut Tunngavik Inc.
Keith Pelley	Federal	Area Chief Conservation and Protection/Fisheries and Oceans Canada
Holly Cleator	Federal	Biologist, Marine Mammal Species at Risk/Fisheries and Oceans Canada
Stefan Romberg	Federal	Fisheries Management Biologist/Fisheries and Oceans Canada

Appendix 2. Interview Guide

General/Experience

1. Can you tell me about yourself?
2. Where/when were you born?
3. Can you tell me about your experience with narwhal hunting?
4. Can you tell me about your experience with narwhal management?

Change

1. What changes have you seen affecting the narwhal hunt?
2. How did narwhal used to be hunted? How has this changed?
    a. Where they are hunted?
    a. Methods used?
    b. Who is hunting? Access?
3. How did narwhal used to be used? How has this changed?
4. How did the hunt used to be managed (rules, norms, code of conduct)? How has this changed?
5. What other changes are affecting how narwhal are hunted or managed?
    a. Environmental?
    b. Technological?
    c. Social?
    d. Cultural?
    e. Economic?

Knowledge Sharing and Knowledge Utilization

1. How is IQ shared with co-management partners? Has this changed?
2. How is IQ shared with researchers?
3. What are the challenges in communicating IQ to co-management partners? Researchers?
    a. Opportunities for improvement?
    b. Change?
4. Are there any risks in sharing IQ with co-management partners? Researchers?
5. Do management decisions (by-laws, regulations) reflect your knowledge?
    a. Example?
    b. Change?
6. How is IQ used by co-management partners? Researchers?
7. Is IQ and scientific knowledge of narwhal being combined?
    a. Should it be?
    b. Can it be?
    c. What are the challenges in doing so?
    d. What can be done if IQ and scientific knowledge disagree?
8. How is IQ and scientific knowledge combined?
    a. Where?

b. When?
c. By who?

General Closing

1. Is there anything else you would like to tell me about any of the topics we have discussed?
2. Are there any topics or questions which were not discussed, but should have been?

Appendix 3. Informed Consent Statement/Information Letter

Project Title: *INUIT QAUJIMAJATUQANGIT* AND ADAPTIVE CO-MANAGEMENT: A CASE STUDY OF NARWHAL CO-MANAGEMENT IN ARCTIC BAY, NUNAVUT

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To Whom It May Concern:

I am a graduate student in the Department of Geography and Environmental Studies at Wilfrid Laurier University. During the summer of 2007 I will be conducting interviews with 20-30 narwhal harvesters in the community of Arctic Bay, Nunavut, and with representatives of co-management organizations – including the Arctic Bay Hunters' and Trappers' Organization, the Regional Wildlife Organization, the Nunavut Wildlife Management Board, Nunavut Tunngavik Incorporated, and the Department of Fisheries and Oceans.

The current narwhal co-management process (implemented in 1999 and scheduled for reevaluation in 2008) was designed to better include knowledge from all available sources. The purpose of this research is to explore the role of *Inuit Quajimajatuqangit* (IQ) in the context of narwhal co-management, and to assess how knowledge (IQ and science-based) is being shared and combined. This research will also explore the role of IQ in encouraging collaboration/participation and the capacity to adapt to environmental, social, and economic change.

The questions I will ask focus on: (a) your experience with narwhal co-management; (b) types of change affecting narwhal and narwhal co-management, and; (c) knowledge sharing. This discussion is expected to take approximately 1-2 hours. You may choose to not answer any questions you do not wish to answer, and you may withdraw from this

study at any time. You are encouraged to comment broadly on any topics which you consider important and to ask any questions you may have.

This information will be held in strict confidence. Interview recordings and transcripts will only be made available to the community-based researcher and Derek Armitage, and will otherwise remain in my sole possession. Mishak Allurut is the community-based researcher in this study, and he will interpret and translate all interviews, in addition to other duties. This research will result in a master's thesis and possibly a journal article publication. Results will be shared through brochures, posters, and written reports. Reporting will begin in 2007 and I hope to be able to share results with the community in person by May of 2008. To receive feedback at any time, please contact Aaron Dale at any of the addresses provided above. Please indicate whether your comments may be quoted for these purposes, and whether you wish to be acknowledged for these quotations.

Given the small number of harvesters being interviewed, there is a risk that you will be identified by readers, even if you do not wish to be. Still, every effort will be made to keep interview results confidential, if you so wish. This project has been reviewed and approved by the Wilfrid Laurier University Research Ethics Board. If you feel you have not been treated according to the descriptions in this form, or that your rights as a participant have been violated during the course of this project, please feel free to contact Dr. Bill Marr, Chair, University Research Ethics Board, Wilfrid Laurier University, (519) 884-0710, extension 2468.

You are invited to participate in this research and will be financially compensated for your time and input. As this study progresses, you may be contacted by the researcher to follow up on the points you have made. Participation in any further discussions will also be voluntary, and you may choose to decline any further contact if you so wish. Participating in this interview implies that you consent to being involved in this study. I look forward to further discussing these important themes.

Yours truly,

Aaron Dale