The Pangnirtung Inuit and the Greenland Shark

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Abstract

Inuit are known to be holders of detailed ecological knowledge about their environment and animal resources. However, this is not the case for the Greenland shark (*Somniosus microcephalus*), an animal not considered to be culturally or economically important to the Inuit community of Pangnirtung (Baffin Island, Canadian Eastern Arctic). But there is some knowledge of it. This thesis is about the Pangnirtung Inuit knowledge of the Greenland shark, their perceptions, and the available knowledge and the processes by which this knowledge is produced.

This work draws upon my field experience over two seasons in Pangnirtung (July to September 2007 and April 2008). I developed this research through a micro-ethnographic collaborative approach. That is to say, this thesis represents knowledge about the Greenland shark in the context of the Pangnirtung Inuit worldview. As fieldwork tools, I employed participant observation, joining hunting and fishing trips as well as being part of community activities. I also carried out 16 semi-structured interviews, 15 of them Inuktitut-English interpreted. At the end of the first field season, I conducted a focus group with the hunters who demonstrated interest on the research topic. During the second season, I reviewed the main findings with two English-speaking hunters.

The results from this research are framed into two main sections: the first one (Chapter 4) visits the existing relationships between Pangnirtung Inuit and Greenland shark. This section provides a holistic framework to understand the context where knowledge about sharks is produced. The Greenland shark is a "thief" that steals and destroys caught animals, a nuisance to the commercial fishery on Greenland halibut (*Reinhardtius hippoglossoides*). Rarely seen, and neither hunted nor used, the shark is absent from the Pangnirtung Inuit oral tradition. Sharks do not fit into the Pangnirtung collective mental model of what edible food should look like. They are rubbish-eaters, and their meat is white and

keeps twitching even when dead and cut into pieces. The Greenland shark is neither an object of symbolic thought, nor an object of hunter's everyday discussion.

The second results section (Chapter 5) explores the Pangnirtung Inuit knowledge about the Greenland shark, as well as the processes that inform the emergence of this knowledge. This section is divided into two main bodies of results. The first one reviews what Pangnirtung Inuit consider when looking at sharks, and the second one presents the inference and abstractions from what is observed. That sharks have a unique skeletal structure, the fact that shark's flesh keeps twitching long after death, the particular way sharks bite, stomach contents, and peaks of abundance were topics that the Pangnirtung Inuit considered as part of their observations, and are known to many hunters. On the other hand, explanations about shark abundance and appearance, habitat, and feeding behaviour were themes that allowed discussion, but did not produce a consensus.

The Pangnirtung Inuit do not consider themselves as shark experts. They are not even aware of all the knowledge they do in fact possess about this species because it is not a regular subject of discussion. However, their interest in the present research established a platform to involve the Inuit to talk about, and make sense of, their observations, and to integrate this knowledge of the shark and its habitat. This study is an example of traditional knowledge as an ever-evolving and adaptive entity. By dealing with a topic not commonly discussed, the research turned into a creative process by which scattered pieces of information were gathered, organised, and integrated. The interaction between Inuit and outside scientists allowed both parties to learn from each other, constructing knowledge of a species that does not draw outstanding interest among the Pangnirtung Inuit.

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It would have been impossible to work on this thesis without the help of many people and institutions. I am grateful for the support, patience, teachings, and true friendship I experienced over the course of the last two years.

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Chapter 1: Introduction

Inuit are well known for their profound and holistic understanding of the environment they live in; the Arctic ecosystem (Wenzel 1999). Some scholars even refer to the Inuit as experts on ecological knowledge about the Arctic ecosystem (Laidler 2007). This has been associated with the close relationships to animals and the Arctic ecosystem the Inuit have, their resource management systems and renowned capacity to cope and adapt to an unpredictable environment (Stairs and Wenzel 1992, Wenzel 1999, Berkes and Jolly 2001, Nichols and others 2004, Laidler 2007). In these regards, Inuit ecological knowledge from across the Canadian Arctic has been extensively documented (Nelson 1969, Kilabuk 1998, Hay and others 2000, Jolly and others 2002, Hart and Amos 2004, Noongwook and others 2007, Laidler and Elee 2008, Laidler and Ikummaq 2008). However, Inuit ecological knowledge analyses within worldview perspectives have not been developed extensively (Tyrrell 2007, Bonny and Berkes 2008).

Inuit Knowledge (IK) from the worldview perspective, which is within the cosmology, beliefs and traditions that shape knowledge about the world, has been a matter of larger interest to anthropologists, ethnographers and native studies practitioners. This perspective has allowed perceiving the significance of

animals and their role within Inuit culture and oral tradition (Saladin D'Anglure 1991, Randa 1994, Van Londen 1996, Bennet and Rowley 2004, Oosten and Laugrand 2006, Trott 2006). However, most TEK practitioners have neglected this area, which provides a context to analyse the information coming from animal-related TEK representations (Sang and others 2004). As such, there is a lack of connection between seeing Inuit ecological knowledge as information about the environment and knowledge produced within a non-western worldview that is not susceptible to be verified within the standards of the Western epistemic community (Wenzel 1999). This situation faces its worst-case scenario when Inuit and external resource management agendas collide. The case of the beluga whale (*Delphinapterus leucas*) quota allocation in Northern Quebec is one example. While the Inuit see the animals as sentient beings that present themselves to be taken, natural scientists and external managers conceive Inuit's worldview as a strategy to maximise the harvest of an endangered species (Hammill and others 2007, Tyrrel 2007). These clashing perspectives provide no room for developing common understanding among the different epistemological communities involved in natural resource management. Nonetheless, to take into account the nuances of how knowledge is produced within the Inuit worldview can provide forums where sound resource management practices can emerge. This perspective can be used as a strategy to engage Inuit and other epistemological communities in a coherent dialogue.

To research IK of a particular species with neither local nor external economic interest has been systematically neglected (Bonny and Berkes 2008). However, this kind of research is an opportunity to explore the processes underlying ecological knowledge production away from the prejudices that both indigenous communities and outside resource managers/researchers have towards each other. The study of the Inuit ecological knowledge on the Greenland shark provides that opportunity.

The Greenland shark (*Somniosus microcephalus*), the largest fish and the only shark that routinely inhabits Canadian Eastern Arctic waters, may play an important role in the movement of nutrients and energy in Arctic marine ecosystems. This shark can be found in the Atlantic Ocean from Polar latitudes to at least 32^{o}N, near Portugal. Even though this shark is one of the largest shark species, ranging from ~1 to > 6 metres long, its ecology has been frequently referred to as enigmatic (Bigelow and Schroeder 1948, Yano and others 2007). The limited understanding of this shark is related to its not-easy to access habitat, inconspicuous behaviour and the relative lack of commercial interest in it (Yano and others 2007). Nonetheless, the scientific understanding of this shark has expanded recently (Fisk and others 2002, Skomal and Benz 2004). Originally thought to be a scavenging deep water fish, recent research findings suggest that this fish species can also be an active predator that attacks sea mammals in distress and, specially, ringed seals (*Phoca hispida*) under the land-fast ice (Skomal and Benz 2004).

This updated understanding of the Greenland shark has been possible due to the data available sets through relatively new technology. Stable isotopes analyses allow a general perspective of the shark's main food sources (Fisk and others 2002). In addition, ultrasonic tracking provides more information about the horizontal and vertical movements of this fish species (Skomal and Benz 2004). Without these instruments, knowledge about this shark would be restricted to inferences based on incidental catches and a limited number of sightings.

Undertaken with the elders and active hunters from Pangnirtung and facilitated by the local Hunters and Trappers Association (HTA), this thesis is the Inuit knowledge component of the Government of Canada International Polar Year-funded project: "*Determining the diet of the Greenland Shark in a changing Arctic*". This framing project aims to provide an understanding of the role of the Greenland shark (*Somniosus microcephalus*) in the marine Arctic ecosystem. Its

objective is to compile comprehensive quantitative information on the feeding ecology of the Greenland shark under different ice conditions. The consumption of seals, the influence of ice-cover and open water conditions on the marine food web structures as well as the concentrations of contaminants are being assessed.

This IK component aims at representing the perceptions and understandings the Pangnirtung Inuit have about the Greenland shark and its habitat. This document is a representation of the Pangnirtung Inuit knowledge about the Greenland shark. My reflection is divided into two main thematic areas. The first section deals with the encounters and experiences that the Pangnirtung Inuit have had with the Greenland shark. Describing the way people have interacted with sharks, this section provides a context to analyse the available knowledge. The second section reviews the Pangnirtung Inuit knowledge about the Greenland shark. By examining how the available knowledge is gathered, organised and structured I try to address how this particular body of knowledge is produced within the Pangnirtung Inuit worldview.

Most traditional ecological knowledge related to animals focuses on those of immediate economic use (Hay and others 2000, Hart and Amos 2004). The approach of the not-used Greenland shark provides the opportunity to visit how knowledge is produced outside the context of decision-making or problem solving (Mackinson 2000, Paolisso 2002). This perspective entails different nuances to approach traditional ecological knowledge holistically, from the perspective of an adaptive and heuristic way of understanding the natural world.

In order to develop this indigenous ecological knowledge representation, I employed fuzzy logic, mental models and anthropological structuralism to shape my theoretical approach. While fuzzy logic and collective mental models are approaches that provide frames to comprehend how commonsense knowledge becomes functional through the organisation of reasoning based on approximate

and relative concepts (Zadeh 1973, 1975, 1989; Genter and Stevens 1983), structuralism provides a theoretical framework to analyse how information about the environment is organised within indigenous worldviews and knowledge systems, the Inuit worldview in this case (Baert 1998, Bonnefoy and others 1993).

Understanding the Greenland shark from an Inuit point of view opens unexplored paths that make this project relevant. What is known about the Greenland shark and how this is known are points of encounter between the Inuit, biologists and social scientists. The overall research created settings where perspectives on this not well-known fish species were shared and discussed. Venues like fishing sharks either on the open sea or the land-fast ice were forums in which the multiple epistemic communities exchanged information that not only enriched the knowledge systems involved, but also triggered the formation of the understanding of this shark species.

The importance of this research lies in the fact that ecological knowledge production is a perspective on IK that has not been researched in depth (Wenzel 1999). To follow this path gives insights not only about how Inuit control and validate their own system of knowledge, but it also provides spaces for knowledge systems to interact. In the long run, this co-operative learning can be used in improved and more contextual resource management practices (Wenzel 1999, Davidson-Hunt and O'Flaherty 2007).

1.1. Purpose and Objectives

This thesis is a representation of Pangnirtung Inuit knowledge on the Greenland shark. It identifies and describes the available knowledge about this species and the process in which knowledge about it is produced. Specific objectives are as follows:

1. To describe the encounters and experiences that the Pangnirtung Inuit have had with the Greenland shark over the recent history of the Cumberland Sound.
2. To represent the Pangnirtung Inuit knowledge about the Greenland shark.

1.2. Study Community

Pangnirtung is located on the south-eastern shore of the Pangnirtung Fjord, on the Cumberland Sound's northern shore, south-eastern Baffin Island, Canada (66°08'N; 65°41'W) (Figure 1). The name of this hamlet is the English spelling of the Inuktituk[1] original name *Panniqtuuq:* "*place of the bull caribou*" (Harper 2004).

1.2.1. Recent History of Pangnirtung

Pangnirtung Inuit face several forces that drive them to adopt their lifestyles and economies to the ever-changing environment. The recurrent contacts with *Qallunaat* (white man in Inuktitut) have been a source of drastic changes for Inuit culture and the Arctic social-ecological systems (McElroy 2005). From the first encounters with whalers in the 1840's to the current climate changes presumably caused by the industrial society, these sorts of interactions show the adaptability of the Inuit to a changing world (Berkes and Jolly 2001). In this section I present a brief review of the recent history of Pangnirtung and the Cumberland Sound region.

[1] The language of the Inuit; literally means, "*the way of being an Inuk*"

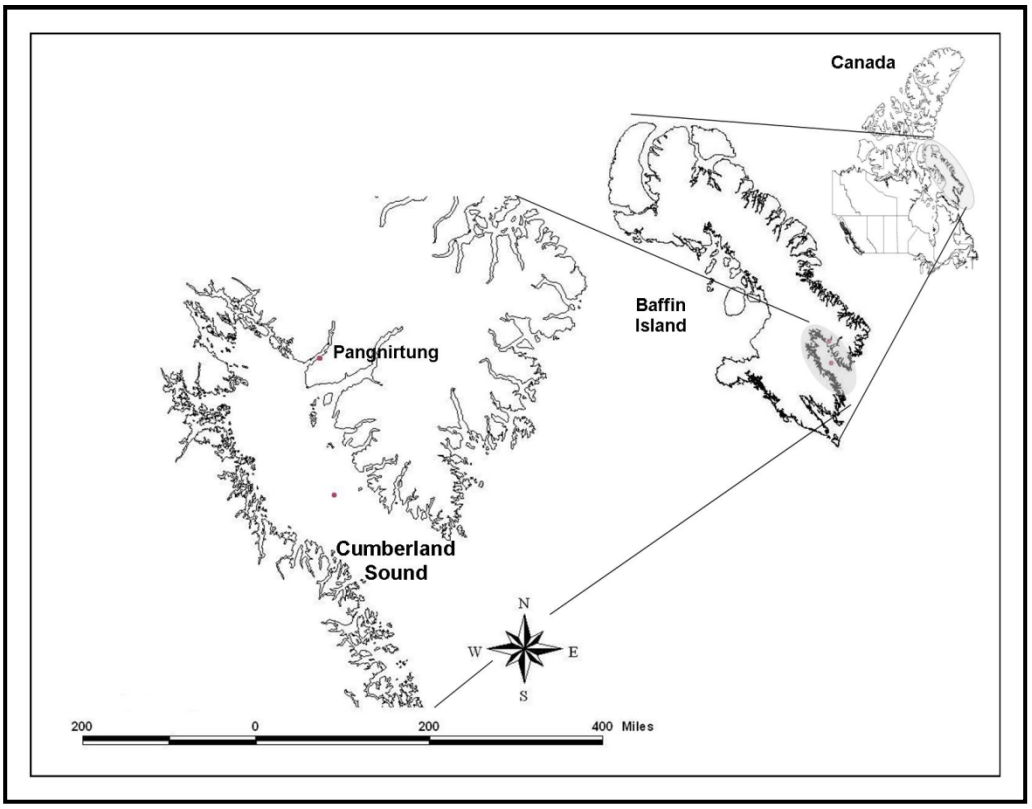

Figure 1. Location of the Pangnirtung Hamlet and the Cumberland Sound

During the first half of the nineteenth century, early contact between Inuit and *Qallunaat* happened in the context of whaling. Through these interactions, whalers from Scotland and the United States of America came to appropriate Inuit knowledge of whale hunting for their own purposes. In 1851-52, one of the first experiments took place when whalers overwintered in the Cumberland Sound in order to hunt at the floe edge in spring. These whalers brought southern food, clothing, tobacco, alcohol, whaleboats and muskets to the Inuit. Cumberland Sound Inuit were employed to work as crew on whaleboats, to flense whales and to provide food and winter clothes for whalers. These interactions with the whalers also brought several consequences for the Cumberland Sound Inuit. The most significant ones were diseases such as tuberculosis and cholera. For the first time local Inuit were susceptible to

Western respiratory and gastrointestinal ailments, circumstances that made survival even more difficult in times of hardship (Stevenson 1997, Matthiasson 1992).

Whaling reached its peak during 1860-70. Within just one decade of intense whaling, bowhead whale populations in the Cumberland Sound were close to depletion. This situation changed relationships among Inuit, *Qallunaat* and the environment. Whale companies that stayed in the Cumberland Sound had to diversify their targets. Even with the price of the baleen still high by 1870, the reduced number of whales and the uncertainty of their hunting forced the companies to consider other products. Seal blubber and skin came within this scope. With this shift in the economy and after living closely with the whalers, the Inuit from the Cumberland Sound returned to their own camps after 1908, participating in whaling sporadically (Stevenson 1997).

In 1921 the Hudson's Bay Company (HBC) established a trading post in the Pangnirtung Fjord. The HBC tried to impose fox trapping instead of sealing or whaling on the Inuit. This created a variety of issues, since these Inuit had no experience as trappers. Fox trapping was contradictory to Inuit lifestyle. After the Cumberland Sound Inuit did not perform this task as expected by *qallunaat*, beluga whaling and sealing were the alternatives to which the HBC resorted (Stevenson 1997, Graburn 2004). At the same time, around 1921, the Canadian Government established a detachment of the Royal Canadian Mounted Police (RMCP) in Pangnirtung to discourage the Inuit from moving into the new settlement and becoming dependent on the traders (Stevenson 1997).

In the early 1960's, the RCMP use a distemper outbreak that killed almost all of the dogs as an excuse to force the relocation of Cumberland Sound Inuit to Pangnirtung with the intention of centralising education and healthcare. This was the start of the Pangnirtung Hamlet as such. Pangnirtung was (and still is) a hunting community, but with the introduction of snow-mobiles, outboard motors and the inherent high costs of oil combined with the drop of sealskin

prices in the late 1970s, the community was left with an unsustainable practice that transformed the Inuit economic base from the sale of native products to wage labour employment by the end of the 1970s (Wenzel 1991, Stevenson 1997, von Finckenstein 2002).

1.2.2. Pangnirtung Today

Currently, Pangnirtung has an approximate population of 1325 inhabitants living in 433 dwellings (Statistics Canada 2007). The main sources of economic income in Pangnirtung are government service economy, the ice dependant Greenland halibut fishery, which is supported by and receives advice from the government of Nunavut (Government of Nunavut and Nunavut Tunngavik Incorporated 2005), the *Uqqurmiut* Inuit Artist Association, and the outfitting for the *Auyuittuq* National Park. Since it depends on ice, the Greenland halibut fishery is dwindling due to the instability brought by climate change. Of the 120 Inuit that used to fish on the Cumberland Sound land-fast ice in the mid 1990s, no more than 10 remain active (Laidler 2007, personal observations). Pangnirtung is also well recognised for its *Uqqurmiut* Inuit Artist Association. This is a weaving, carving and printing centre (Von Finckenstein 2002, Government of Nunavut and Nunavut Tunngavik Incorporated 2005, Laidler 2007). The presence of the *Auyuittuq* National Park also moves the economy of this hamlet by employing local Inuit as outfitters and guides (Figure 2).

Figure 2. Summer view of the Pangnirtung Hamlet (Photo C.J. Idrobo)

Hunting practices of the Cumberland Sound Inuit have depended on several marine mammal species to satisfy nutritional and cultural needs. The animals hunted are the ringed seal (*nattiq*; *Phoca hispida*), the bearded seal (*ugjuk; Erignatus barbatus*), walrus (*aivik*; *Odobenus rosmarus*), beluga whale (*qilalugaq*; *Delphinapterus leucas*), narwhal (*qirniqtuq* or *qilalugaq tuugalik*; *Monodon monoceros*), and polar bear (*nanuq*; *Ursus maritimus*); the last three ones restricted under quotas (Figure 3). Even though Pangnirtung is a community that has been historically dependent on marine resources, caribou (*tuktu; Rangifer tarandus arcticus*) is considered an important animal. Its meat is highly appreciated and its skins are targeted for winter clothing. The Arctic fox (*tiriganiaq*; *Alopex lagopus*) was temporarily included in the Inuit economy because of the fur trade, but this not practiced in the Cumberland Sound anymore (Stevenson 1997).

Figure 3. Alukie Metuq butchering a ringed seal (Photo: C.J. Idrobo)

1.3. General Methods

In this research, I approached IK about the environment from the worldview level (Berkes 2008). I developed a representation of the way the Inuit perceive the Greenland shark within their understanding of the environment. I also look at how knowledge about this species is produced in the context of observations, traditions and legacies. Rather than measuring or describing characteristics of the Greenland shark, I attempted to create dialogue spaces where, together with the research collaborators, I could describe how the Greenland Shark and its ecological relationships are conceived through the lenses provided by local sets of values, beliefs and practices. Within this context, social research methods allow me to engage with and make sense of people's world by participating in their everyday life (Hammersley and Atkinson 2005).

I carried out this research employing a micro-ethnographic approach (Berg 2004). A set of ethnographic tools allowed me to study Inuit relationships with the Greenland shark. Likewise, this perspective served also to represent the understandings of this shark and its feeding ecology. These techniques were participant observation, open-ended, and semi-structured interviews and focus groups. Research participants were knowledgeable elders and hunters I sought out following the advice of academics working within this community, research carried out in Pangnirtung recently and the recommendations from the Inuktituk-English interpreter, Andrew John Dialla (Huntington 2000, Jolly and others 2002, Davis and Wagner 2003, Laidler 2007, Chris Trott – personal communication).

1.4. Thesis Organisation

The remainder of this document is organized as follows: **Chapter 2** provides a context that grounds the theoretical approaches I used to develop this thesis. Firstly, it reviews traditional ecological knowledge according to the agendas of those involved in this research area. Further, it describes some epistemological and theoretical tools useful for accessing Inuit knowledge of the Greenland shark. **Chapter 3** presents in detail the methodological strategy I followed in this study. It is an account from the first and second field seasons in the context of the methodological tools I employed. It further describes how these tools allowed the construction and organization of the results and the conclusions of this research. Chapters 4 and 5 enclose the two main bodies of results of this thesis. **Chapter 4** visits the existing relationships between the Pangnirtung Inuit and the Greenland shark looking for the context where knowledge is produced. **Chapter 5** analyses the processes that guide this ecological knowledge production in regards to the available Pangnirtung Inuit ecological knowledge on the

Greenland shark. Finally, **Chapter 6** summarises and connects the results/discussion/conclusions of each chapter. It highlights the main findings from each objective as well as the overall significance of this thesis.

Chapter 2: Literature Review

"We live" (...) "lives based upon selected fictions. Our view of reality is conditioned by our position in space and time – not by our personalities, as we like to think. Thus, every interpretation of reality is based on a unique position. Two paces east or west and the whole picture is changed"

Balthazar (The Alexandria Quartet)
Lawrence Durrell (1962: 210)

This research looks at the processes of how the Pangnirtung Inuit understand and produce ecological knowledge about the Greenland shark. This chapter develops three subject areas that serve as the theoretical base in which this research is contextualised. The first section (2.1.) provides some definitions and approaches that frame traditional ecological knowledge (TEK). It emphasises how the understandings of nature outside of Western societies are documented. The second section (2.2) presents perspectives and theoretical tools for approaching TEK from the worldview level. I explain how complexity becomes a strategy that perceives reality as a socio-cultural construction. In this section I also describe two epistemological tools: fuzzy logic and mental models. These tools allow understanding how ecological knowledge about the environment is produced. The third and last section (2.3), from the perspective of anthropological structuralism, explores how the knowledge that the Inuit have of the environment is constructed from the worldview level. By conveying these three perspectives, I provide an epistemological and theoretical context to the analysis of the Pangnirtung Inuit knowledge of the Greenland shark.

Hereafter I refer to TEK as a general discipline and to Inuit knowledge (IK) and Pangnirtung Inuit knowledge to the academic production related to this indigenous group and community in particular.

2.1. Traditional Ecological Knowledge and Indigenous Knowledge

2.1.1. Definitions

Traditional ecological knowledge refers to the knowledge related to the environment that local and indigenous peoples possess. These peoples, through their contact with the land, produce and adapt this knowledge over generations (Berkes and others 2003). TEK can be understood as a local, contingent and time-tested tradition; an emergent attribute held by those societies with historical continuity in natural resource use and practices. Indigenous and traditional peoples from all around the world develop their own understanding of the environment where they live, as well as their own strategies for managing their natural resources (Freeman 1992, Berkes and others 2000, Berkes 2008).

Since not all knowledge necessarily reflects an ecological understanding of the world, TEK can be seen as a subset of cultural knowledge held by indigenous or local peoples that explains the ecological understanding of nature through the relationships established with it (Berkes 2008). Nazarea (2006: 323) refers to local knowledge and indigenous knowledge as equivalents to traditional environmental knowledge. These refer to knowledge applied to perspectives and practices related to nature. She describes these bodies of knowledge as "*experiential and embodied in everyday practice, not logically formulated apart from what makes sense from living day to day in one's environment; nor is it* [knowledge] *inscribed as a set of processes and rules*". Berkes (2008: 7) proposes the following as a working definition for TEK as "*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". These definitions have in common that TEK is a place-based knowledge-practice-belief complex that emerges and evolves where knowledge of species, practices related with livelihoods (such as agriculture, hunting and fishing) and western-called beliefs of people's role within the ecosystem interact (Usher 2000, Nazarea 2006, Berkes 2008).

TEK has been approached from different frameworks of analysis. Usher (2000) proposes four categories with the aim of articulating TEK in environmental assessment and management: (1) knowledge about the environment, (2) knowledge about the use of the environment, (3) values about the environment and (4) the knowledge system. In addition, Berkes (2008), proposes an equivalent framework of four interdependent levels for analysing TEK. This framework makes an explicit integration of each level, creating nested and inclusive categories with boundaries that are not easy to define. The first level - local and empirical knowledge of plants and animals - consists of knowledge about species identification, natural history aspects and the ecological processes involved. Closely attached to this knowledge basis emerges a second level, namely land and resource management systems. It includes sets of practices, tools, and techniques developed through the interaction with nature. The third level - social institutions - refers to the set of rules and regulations that emerge for developing control about the use of resources. The fourth level - worldviews - provides the context that shapes the way in which the environment is perceived. Enclosing all other levels, this latter level recognises how religion, ethics and beliefs set the way in which nature is perceived, hence the knowledge about it produced (Berkes 2008).

2.1.2. Researching TEK: From the Extraction of Information to the Co-Production of Knowledge

TEK has been researched from perspectives informed by the agendas of those approaching it. In relation to Berkes' (2008) proposed levels of TEK, the inner ones, i.e. local knowledge of land and animals as well as land and resource management systems, have been mainly approached in a utilitarian and mechanistic manner. On the other hand, when TEK is approached via its outer levels, i.e. social institutions and worldviews, the knowledge systems under the scope can be considered within their own legitimacy. This situation opens or even creates spaces of dialogue where co-production of knowledge for co-operative resource management is possible.

Nazarea (2006) identifies how certain intellectual waves have characterised the way indigenous knowledge is researched. The ethno-scientific approach, shaped by positivist perspectives, conceives indigenous knowledge as a source of data useful to validate Western scientific ideas. Indigenous knowledge is perceived as a supplementary source of information for science and management disciplines. Sometimes ignoring its inherent complexity, indigenous knowledge systems are seen as objects that can be disentangled from its context to fill gaps in scientific understanding and perspectives of the world (Drew 2005, Ramstad and others 2007). This perceives TEK as information in need of legitimisation through the deployment of standards outside its own control; that is, using Western Science, rather than a system on its own (Cruikshank 2005).

Approaching TEK from a mechanistic and utilitarian perspective is a common practice in ethno-biology (Berkes 2008). Cases that illustrate this situation can be found in Mayr (1930, see also Wilson 1999) and Berlin (1973). Mayr (1930) compares the birds that New Guinea people recognise as equivalent

to scientific classifications, using this argument as an alternative to validate the biological species concept. Further, Berlin (1973) describes folk systematics as a primitive form of knowledge, as the principles by which organisms are organised in preliterate and primitive minds. Regarded as inferior, the intention of studying these systems of knowledge is to look for equivalents within scientific systematics to find "natural" or so-called real aspects of nature.

Indigenous knowledge systems are also used as a source of data to be extracted, transformed, and be made functional within natural scientists' agendas. Researching indigenous knowledge represents a strategy to fulfil information gaps needed for the preservation of endangered, endemic or rare species (Ramstad and others 2007). Ramstad and colleagues (2007) present a case in which TEK is considered as a source of biological information. They collect Maori TEK about the distribution of tuatara (*Sphenodon punctatus*) in New Zealand to design conservation strategies for this endangered and endemic reptile species. Looking for "*tangible outcomes*" for Tuatara's conservation, these scholars disentangle biological and ecological information from the cultural values of the Maori, judging what pieces of information are right or wrong in terms of their needs from the perspective of their values and beliefs as conservation biology scientists. In another case, talking about the application of TEK in marine conservation, Drew (2005) argues that indigenous knowledge can be dissected into components in order to be useful for the biological disciplines that comprise conservation biology. Folk systematics becomes useful for systematic phylogenetics and biogeography; population level knowledge can supply behavioural ecology and population genetics; and local knowledge about ecological relationships can be employed to nourish community biology and ecosystem management (Drew 2005).

Recognising the necessity to create dialogue forums between disciplines, some scientific scholars still apply TEK to strengthen research designs. Sometimes these knowledge systems are disaggregated into components in order

to be made useful for certain groups of people (Drew 2005) or to enable knowledge holders to collect information from the environment (Dyck 2007). Within this perspective, TEK is regarded as easy-to-use information prone to be separated into components in order to be extracted and organised to fulfil scientific requirements. The cases presented by Drew (2005) and Ramstad and others (2007) are examples that portray how TEK is understood and approached by positivist science; it is considered data and information that indigenous and traditional people possess about the environment rather than a system of knowledge that has legitimacy on its own.

With the advent of complexity theory and constructivist epistemologies, what Nazarea (2006) refers to as the "*post-modern critical wave*", indigenous knowledge systems started to be considered as a legitimate knowledge in their own right, able to create platforms of dialogue with other epistemic traditions, especially the Western academy (Davidson-Hunt and O'Flaherty 2007, Goldman 2007). When indigenous knowledge is approached from its social institutions and worldviews (Berkes 2008), other approaches are required. In the case of understanding how ecological knowledge fits in with particular worldviews, rather than measuring or describing characteristics of the system of interest, it is required to engage in processes that recognise the extant and under-construction knowledge; that is, the way the environment and the existing relationships with it are conceived through the lenses provided by different sets of values, beliefs, and practices emerging in contingent and unique fashions.

Indigenous knowledge is embedded in the experiences of its holders. These systems of knowledge cannot be understood in isolation from the social-ecological systems in which they emerge. By recognising indigenous knowledge (TEK in this case) as a knowledge system with its own legitimacy, spaces where epistemic communities can create dialogue may be developed collaboratively (Davidson-Hunt and O'Flaherty 2007, Goldman 2007).

There is some correspondence in the way TEK is researched and analysed

in terms of approach and the purposes behind it. As Drew's (2005) case shows, when TEK is approached at the level of knowledge of plants and animals, it becomes prone to be disentangled into specific components to satisfy dominant scientific disciplines (Cruikshank 2005). By doing this, the holistic and complex nature of TEK is neglected and the information obtained is prone to be used (or even misused) out of the context where it emerged. On the other hand, researching indigenous knowledge from the perspective of worldviews represents an opportunity to understand how knowledge about the environment is produced, and what it means to its holders. This approach may generate settings where the inherent legitimacy of indigenous knowledge is not only recognised, but it is also a platform where external researchers and indigenous people engage in the construction of consented strategies for natural resources and environmental management. It is possible to build other conceptions of nature through the articulation of different worldviews (Davidson-Hunt and O'Flaherty 2007).

Since the worldview level is the approach that best fits researching TEK as a legitimate body of knowledge, it is necessary to deal with the whole system knowledge, at least with the way in which nature is understood from local perspectives. In order to do this, it is fundamental to comprehend how reality is perceived and how knowledge is acquired and structured. In the following section, I describe some epistemological scopes useful to pursue this perspective.

2.2. Working with Traditional Ecological Knowledge

2.2.1. Complexity and Worldviews

Conceiving reality as "*self-organising, nonlinear and sensitive to initial conditions, and influenced by a set of rules*" (Kuhn 2007: 163), complexity allows viewing the

world from perspectives relative to the individual and its own contingencies. This perspective challenges positivists' assumptions where there is only one objective, mechanistic and predictable reality (Kuhn 2007).

As humans we are locked into ways of picturing reality. Our biology, the contingencies of our lives and our social context set the boundaries of how we perceive the world we are immersed in. There is more than one option of reality. Indeed, reality is relative to the context where it emerges and to the understanding of those who perceive it (Maturana and Varela 1987). In a similar fashion, as societies evolve they collectively develop specific strategies for understanding the world they are involved in. Structured during the interactions of individuals between each other and with their social-ecological systems, these strategies for perceiving reality are contextual, neither neutral nor independent, to the observer. These emergences can be presumed to be paradigms or worldviews that basically refer to "*a connected set of beliefs or basic assumptions, or dispositional stances about the nature and organisation of the world, together with beliefs about how best to investigate it*" (Kuhn 2007: 156).

Indigenous and traditional people deal with complexity through the understanding of ecological systems based on particular but holistic perspectives of the environment. These understandings emerge from people's interaction with nature in constantly evolving and contingent relationships that are made explicit in learning from practice and mistakes (Berkes 2008, Berkes and Kislalioglu-Berkes 2008**).** Within the context of TEK, these worldviews are represented in the organising concepts underlying knowledge claims that a particular group of people possesses about its particular environment. The lenses provided by particular ways of perceiving the world shape observations about the world itself.

When TEK is approached from these worldviews, complexity becomes a paradigmatic package that helps to understand how these guiding principles emerge and how understandings of nature are produced within them. This

situation provides a holistic perspective of how the world works moving away from the certainty of positive and objective science on which Western society relies to give explanations of reality, complexity allows us to consider explanations of phenomena from different narratives that make sense within specific worldviews, or paradigms (Feyerabend 1992, Kuhn 2007, Berkes 2008). Approaching TEK from the worldviews level and using the complexity paradigm recognises iterative and ever adaptive interactions between knowledge and environment. Rather than conceiving reality and explanations of it as part of a different ontological domain from the one who is documenting it, worldviews work with the underlying assumption that knowledge is socially constructed, that it itself exists not only as knowledge, but also as the process of acquiring and producing it (Descola 1996). TEK is the outcome of the dynamic and adaptive relationship that local and indigenous people establish with their environment (Maturana and Varela 1987, Kuhn 2007).

Embedded and interwoven during these interactions with the environment, underlying assumptions appear and shape the perception and the conceptualisation of the surrounding environment. An example of how TEK makes sense only within the context of those who represent it within place-based non-absolute perspectives of the world can be found in Whiteman's story about porcupines and forest monocultures (2004). She explains how for the Cree people in the James Bay area forest monoculture practices employed by forestry companies can be bad for boreal forest ecosystems. The manner in which the Cree people understand this situation is explained through porcupine's taste (Whiteman 2004: 267):

> *"No, it's true. To illustrate this point, I want to offer a story of my own. Once when I was in James Bay, I was talking with my key informant, a Cree tallyman, who was telling me about his concerns regarding forestry. Freddy had a problem with the way the forestry company was replanting trees. He said to me, "*After clear cutting, when they plant the trees it's the worst way to do it. Because when they plant a tree, I think it's going to taste different. Like

when Porcupine eats it, it's going to be a different taste". *Freddy felt that the porcupines needed greater variety than such replanting programs would allow".*

2.2.2. Approaching Inuit Knowledge at the Worldview Level

The understanding of the processes underlying TEK production in the context of natural resources and environmental management research is considered obscure; the case of IK is not an exception (Wenzel 1999, Tyrrell 2007, Berkes and Kislalioglu Berkes 2008). Knowledge about the environment via IK is produced through iterative processes. Information is gathered in the form of qualitatively assessed propositions and organised following particular modes of relating relative to specific social-ecological context (Paolisso 2004). Understanding how these propositions are approached, assessed and organised to be made functional becomes a way to comprehend how nature works in the commonsense outside scientific perspectives (D'Andrade 1995, Kosko 1999).

Fuzzy logic, collective mental models and anthropological structuralism are theoretical tools that allow navigation of the understanding of nature from the lenses of socially constructed realities. These three approaches complement each other by relating: (1) how individual phenomena are read and analysed (the role of fuzzy logic, Kosko 1999), (2) the way in which information about these phenomena is organised in holistic systems that make knowledge functional (the role of mental models; Genter and Stevens 1983, Abel and others 1998); and, in the context of the Inuit, (3) providing a context to categorise what is considered when nature is observed (the role of anthropological structuralism, Bonnefoy and others 1993, Trott 2006). From this perspective, IK can be approached not only as specific ideas and its variations, but also as an adaptive process in which ideas about the environment interlock and influence each other, establishing particular and contingent structures that cut across environmental complexity (D'Andrade 1995, Grant and Berkes 2007).

2.2.2.1. Fuzzy Logic

Logic, in a general sense, is the study of methods and principles of human reasoning. Classical or Aristotelian logic deals with either true or false propositions. Based on the fact that only one truth-value can be perceived by a logical function, classical logic is also known as two-valued absolute logic. This logic is considered controversial and has been criticised because propositions can be both partially true and partially false (Chen and Pham 2001). To tackle those partial truth-values, other approaches are developed to expand the two-valued logic. Since the 1930's, multi-valued logics have been proposed and developed. Three-valued logics, introducing "*neither*" as an option between "*true*" and "*false*" and n-valued logics are examples of this (Chem and Pham 2001). Within this revolution of a 2000-year-old logic, in 1973, the engineer Lofti A. Zadeh proposes logics able to deal with approximate reasoning using imprecise propositions. He termed this "*fuzzy logic*".

In short, fuzzy logic can be defined as the "*logic of approximate reasoning*" (Zadeh 1975: 407) or the "*reasoning with vague concepts*" (Kosko 1999: 6). Fuzzy logic provides an understanding of how commonsense knowledge becomes functional by means of connecting blurry-bounded variables. The main characteristic of fuzzy logic is the avoidance of absolute statements about whether some proposition is either true or false, whether something belongs to a certain category or not (Zadeh 1973, 1975, 1989). Instead, fuzzy logic relies on explanations of the world within a perspective that sees phenomena within a natural continuum rather than being enclosed in exclusive dichotomies (that is, yes or no; false or true). Thus, fuzzy logic allows moving from absolute and bivalent statements (that is, binary logic) to what is in between them. Rather than assuming that phenomena happen or not, this logic recognises the existence of alternative stages, which classification depends on the language used by who is describing it. Considering that human reasoning and common sense are

approximate rather than exact, using fuzzy logic allows comprehending nature in its own complexities and uncertainties, rather than something that behaves in a linear and predictable manner (Zadeh 1989, Kosko 1993). Following Zadeh (1975: 407), the defining features of fuzzy logic are: (1) fuzzy-truth values expressed in linguistic terms, e.g., *true, very true, more or less true, or somewhat true, false, nor very true and not very false, etc*[2].; (2) imprecise truth tables; and (3) rules of inference whose validity is relative to a context rather than exact.

How TEK is acquired and organised fits in with fuzzy logic's characteristics described above (e.g., Berkes and others 2007, Grant and Berkes 2007). Berkes and Berkes Kislalioglu (2008) reviewed how the Inuit from Hudson Bay use fuzzy logic features to evaluate seal wellness. Variables, such as fatness, bone colour and liver conditions are assessed using qualitative descriptors that rely on the collective expertise of the resource users, which are then expressed in the form of fuzzy-truth values. In this way, a particular variable is evaluated within a spectrum that is relative to the mental model pertinent to the moment of evaluation. In this case, the variable *fatness* is evaluated within the range *thin* to *fat*. The same condition applies to each variable; evaluation is relative to both the context in which it is assessed and who is evaluating it. Decision-making within indigenous ecological knowledge systems occurs through the use of fuzzy cognitive maps, qualitative models of a system consisting of descriptive variables and the causal relationships among them (Berkes and Kislalioglu Berkes 2008).

Rather than following binary logic, where the output depends on the input (but not on its context), imprecise truth tables depend on an evaluation and categorisation relative to each variable. The object or system being evaluated, a seal as in Berkes and others' (2007) case, is assessed under fuzzy conditional statements. For example, "*IF – THEN*" type statements are shaped by the knowledge system's repository used to perform such an evaluation. These ranks are generally qualitative and language-based, created within the worldview

[2] Italics in the original text.

where they are encoded (Berkes and Kislalioglu Berkes 2008). When a seal is evaluated, the result is compared with the idea of what an edible seal should look like. This fuzzy image, far from being precise, is the result of the iterative process of learning from the environment, (both individually and collectively), understanding it from variables categorised within a continuum of possibilities, instead of simply good and bad.

Nazarea (1998) explains how some local farmers employ a form of fuzzy logic as evaluation criterion to select crop varieties and agricultural technologies. Using sweet potatoes as an example, Nazarea shows how peasants' agricultural practices do not respond to a systematic analysis or evaluation of what could be considered the best alternatives for improving crop varieties. Instead, these practices are rather shaped by specific worldviews in the form of beliefs, values and myths. Farmers "*muddle through*" the necessities set by the changing environment they live in. They learn and select from varieties and technologies at hand by trial and error. By using fuzzy logic as the basis of their decision-making processes, farmers conserve crops with higher diversity. This allows farmers to tackle uncertainty in terms of having more options to cope with uncertain weather and even more options to satisfy fussy tastes. As an evaluation criterion, fuzzy logic helps to reinforce the use of local varieties and the wisdom interwoven within them. Borrowed from engineering, fuzzy logic works to understand the way indigenous and traditional people deal with a complex world where the absolute truth and objectivity exists but as an abstraction pursued by science (Kosko 1999, Berkes and Kislalioglu Berkes 2008).

2.2.2.2. Mental Models

Since the 1940s and adopted from psychology and cognitive anthropology, mental model research has implied an examination of how people understand a particular domain of knowledge. A model is a representation of how an

interrelated set of elements works. Thus, the aim of studying mental models is directed at understanding how humans know the world they interact with and how either a single person or a group of people thinks about how the world works (Genter and Stevens 1983, D'Andrade 1995). The more interaction a person has with a particular environment or system, the more accurate his/her mental model is expected to be. This is in this sense that as long as they work, mental models do not necessarily need to be precise (Norman 1983).

Cultural (or collective) mental models, are defined by Quinn and Holland (1987: 4) as: "*presupposed, taken-for-granted models of the world that are widely shared by members of society and that play an enormous role on their understanding of that world and their behaviour in it*". Collective mental models enclose common understandings of nature in which Indigenous knowledge systems express their own rules about the operation of the world. Rather than science's hypothetic-deductive logic that is based on experimentation to falsify hypotheses, these systems work through the individual collection of information and its exchange among community members. Data verification (to use a science-related term) happens as this information is pooled among community members. While what is considered necessary to provide useful indications of environmental phenomena and its components is included in the knowledge repository, what is unimportant is simply discarded. Collective mental models provide ideas of how complex social-ecological systems work, giving an approximation about what things should look like and how ecosystems function (or should function) within certain ranks.

As an example of the structure of a mental model, Grant and Berkes (2007) present an expert knowledge system as a representation of how Grenada people read and understand the environment from the perspective of the long line fishery. This knowledge system has three basic components: (1) a knowledge base repository, (2) an inference engine, and (3) a user interface. The knowledge base repository consists of a series of facts, general cases, exemptions, and

relationships gathered and constructed when the interaction with the environment takes place. The information contained in this system ranges from the biological knowledge of the fisheries (e.g., behaviour and diet of fish species), to meteorological knowledge and even folk oceanography (e.g., relating marine birds with the presence of fish). To make this knowledge functional, Grenada fishermen employ inference engines that allow them to connect facts from the knowledge repository in order to find and catch fish. The knowledge base of this system gives a holistic idea of the sea environment from the perspective of long-line fishing. Considering its heuristic nature, this knowledge has the possibility of being adaptive enough to cope with environmental uncertainty. The user interface of this system relies on the exchanging of information among fishers. The network that emerges from the interaction with other community members in different contexts allows them to constantly learn from the failure and success of each other.

Grant and Berkes' (2007) case shows how collective mental models from the environment emerge during the interaction of people, either as individuals or as social groups, with the marine ecosystem. Collective mental models are useful by providing understandings of nature in terms of specific necessities. In general, collective mental models (or equivalents) operate when experience from the natural environment, developed through interpretations and inference (propositions), is put into action to cope with specific necessities or to understand particular phenomena. Either in the context of decision-making or problem-solving processes collective mental models can be elicited. These explanations are structured as propositions that stand on their own as descriptions for local knowledge system subsets, or that are linked together to structure a holistic depiction how the world works (Quinn and Holland 1987, Paolisso 2002).

Collective models are useful placed-based representations of nature. They bring together information from the environment that is gathered, analysed, and

discussed according to specific spaces and circumstances (Grant and Berkes 2007, Berkes and Kislalioglu Berkes 2008). Indigenous knowledge systems have their own rules of operation. Rather than science's hypothetic-deductive ideas based on experimentation to falsify hypotheses, indigenous knowledge systems work through the individual collection of information on the land and its exchange among community members.

2.2.2.3. Inuit Knowledge: Some Generalities

Inuit ecological knowledge of animals is documented in the available literature following two basic approaches: TEK and anthropological/ethnographic literature (Bonny and Berkes 2008). I used these two perspectives to enlighten my approach to the Pangnirtung Inuit knowledge about the Greenland shark, an animal absent in the literature that deals with the understandings of nature of the Canadian Eastern Arctic Inuit. *Inuit Qaujimajatuqangit* (IQ) is a guiding principle meant to incorporate IK (and its embedded values) into the Nunavut Government in the form of education, services, policies, research and legislation (Wenzel 2004). Considering that this research was originally thought outside the Pangnirtung hamlet's agenda, I cannot deferentially declare I am working with IQ as such. However, as an examination of the processes underlying the ongoing construction of IK, this work contributes to the documentation and promotion of the IQ in Pangnirtung

Knowledge representation of different species and the land is categorised within the inner levels of TEK literature. However, worldviews or cosmologies play an essential role influencing how a knowledge system is constructed (Berkes 2008). In order to develop representations of how a culture understands the environment, it is necessary to approach not only the social and ecological aspects but also its cognitive aspects. By doing this, an understanding of the world-image (or worldview) emerges (Stairs and Wenzel 1992). When research

about Inuit ecological knowledge is undertaken, the approach to follow should include the perspectives that forge this knowledge itself (Stairs and Wenzel 1992, Wenzel 1999). When this approach is not considered, it opens the possibility that information obtained during this practice is understood out of context, turning it into something superficial, worthless and even misleading in terms of the decision-making processes regarding natural resources management (Tyrrell 2007).

Ethnographic and anthropological areas describe cultural production about animals and nature from the Inuit oral tradition, folklore and mythopoetic imagery (Bonnefoy and others 1993). These provide standpoints to observe how Inuit interact with animals further the assumption in which this knowledge is the product of specific interaction within specific environments. In this context, ecological knowledge goes beyond the manifestation of unconscious responses to living (or surviving) in a particular ecosystem. It can be seen as an explicit conceptualisation of religious beliefs and rituals equivalent to TEK's worldview level (Laughlin and Throop 2001, Descola 2005). Examples of these anthropological approaches to Inuit cultural ecology and ecological knowledge of animals can be found in Randa's (1986) monograph about Inuit relationships with the polar bear (1986) and in Oosten and Laugrand's (2006) paper about the place ravens (*Corvus corax*) occupy within the Inuit tradition along the North American Arctic. These two works explore these animals within the Inuit cosmology. Thus, the equivalents of biological and ecological knowledge Inuit hold about these animals are not seen in isolation from the whole knowledge systems and/or cosmological contexts. This knowledge is seamlessly approached within the continuum in which Inuit see themselves fitting within the natural environment.

In the case of the polar bear, Inuit understandings of the ecology of this species are used as stepping-stones towards further symbolical significances. Hunting and denning are seen as primal and defining traits that both Inuit and

bears share. The Inuit perceive land and sea as the primary binary opposition underlying the structure of their world (Bonnefoy and others 1993). Since polar bears inhabit the sea and the land, they are powerful elements in Inuit lore, especially in the mediation between the natural and supernatural world (Randa 1986).

The raven entails a slightly different perspective as a not extensively used animal within Inuit cosmology. In the Eastern Arctic, the raven is generally disliked; it is seen as a scavenger and trickster. However, this bird is also associated with the origins of light and intelligence due to its ability to find meat caches. For the Inuit, the raven is also important in terms of their relationship to caribou. These birds help people to track and find caribou herds (Chris Trott personal communication). In symbolical terms, the marks left by these birds and their representation on women's skins as tattoos represent crucial transitions in natural cycles such as annual renewal cycles and the transition into early adulthood (Oosten and Laugrand 2006).

Both cases, polar bear and raven, provide a perspective often neglected by the Western/science-based worldview. Inuit ecological knowledge does not exist in isolation. Rather, this knowledge subsystem is part of a profound knowledge/cosmological body in which some animals are understood beyond practical necessity. Even though polar bears are high-valued and ravens are not, they are both objects of symbolical thought among Inuit. The fact that these animals are present in the Inuit mythopoetic imagery is more related to the fact that they meet intellectual requirements rather than satisfying needs (Levi-Strauss 1966, Descola 1996, Laughlin and Throop 2001).

Structuralist anthropology provides a holistic theory of significance. This anthropological school argues that the meaning of a symbol is dependent on its difference from other signs in current use, thus taking the form of binary and complementary oppositions (Baert 1998). A binary opposition works by cutting-across phenomena complexity by categorising them within discontinuous-

opposable variables (Lévi-Strauss 1993). From a structuralist perspective, these oppositions are considered the basis for analogical construction of Inuit thought. They are part of a generative logic that categorises, by comparing and contrasting, what is perceived from nature. Even though dark/bright and lower/higher are nonspecific oppositions, they can be seen as angles from where environment features are respectively organised: night/day, cold/hot, man/woman, marine/terrestrial, and so on (Randa 1986, Bonnefoy and others 1993, Trott 2006). This condition favours the formation of heuristic repositories that filter or shape new information and its subsequent integration into the knowledge system (Descola 1996, Berkes and Kislalioglu Berkes 2008).

In the case of my research I employed fuzzy logic as a parameter to analyse the variables that Pangnirtung Inuit look at when they refer to the Greenland shark. Collective mental models become a useful tool to draw a hologram that portrays how the Greenland shark is understood both as a species and as part the marine arctic ecosystem. Anthropological structuralism provided context to analyse how nature is categorised among the Pangnirtung Inuit. Thus, by articulating the aforementioned strands, I could organise a theoretical complex to deal with this knowledge representation.

Chapter 3: Methods

"Truths are illusions of which one has forgotten that they are Illusions"

On Truth and Falsity in Their Extra-moral Sense
Nietzsche (1995 in Kuhn 2002: 39)

This research followed an ethnographic perspective; that is, a social science research methodology that allowed me, as researcher, to make sense of people's worlds by participating in their everyday life (Hammersley and Atkinson 2005). By interacting with the research collaborators on a regular basis, I could represent the interactions between Pangnirtung Inuit and the Greenland shark, and, from this perspective, how this species and its ecological relationships are locally understood.

As an introduction to my research context, I participated in the *Panniqtuuq* Summer School from the Native Studies Department and the Faculty of Environment from the University of Manitoba, and the Hamlet of Pangnirtung (Nunavut). Taught six weeks before the first research season started (from 25 June to 3 August 3, 2008), this course enclosed a wide range of contemporary Inuit social and cultural topics that gave me an idea of the social-ecological context where this research took place. Moreover, during the length of this academic program, I had the opportunity to introduce this project to some Pangnirtung community members who later became research collaborators.

This research took place in two field seasons, July to September 2007 and April 2008. In the first field season (July-September 2007), I participated in field trips with local hunters and the scientific team in charge of shark fishing. I also identified knowledgeable community members and gathered information through participant observation, open ended and semi-structured interviews, and a focus group. In the second field season (April 2008), I participated in the Greenland halibut long-line fishery (in which the Greenland shark is generally involved as a by-catch) and verified results with two English speaking hunters/fishermen.

3.1. A Micro-Ethnographic Approach

As there is no objective and unique reality, many possible versions of it can be represented (Kuhn 2007). An ethnographic approach allows one to not only approach reality as a negotiated construction instead of something that exists naïvely independent to the observer, but also recognises researchers as part of the social world they study[3]. An ethnographer must be aware of this reflexive condition in order to be able to distinguish what she/he is representing (Maturana and Varela 1998, Pink 2001, Hammersley and Atkinson 2005).

Ethnography refers to the process of creating and representing knowledge based on an ethnographer's own experiences (Pink 2001). This methodological approach can be understood as the reflexive production of knowledge where the researcher creates a dialogue with the social-ecological system under inquiry (Hammersley and Atkinson 2005). Ethnography recognises the fact that social researchers are part of the social-ecological systems they are studying (Bernard 1988, Hammersley and Atkinson 2005, Pink 2001) and considers reflexivity as an

[3] Maturana and Varela (1998) and Kuhn (2002) name this condition as second-order cybernetics, recognising that when the researcher interacts with what she/he is researching she/he becomes part of the systems of interest, influencing each other in both ways.

ethnographic trait that recognises the importance of the role played by a researcher's subjectivity in the production and representation of ethnographic knowledge (Pink 2001).

Relative to its scope, ethnography can be classified into two different categories (Berg 2004): macro and micro ethnography. While macro-ethnography focuses on entire representations of worldviews or cosmologies, micro-ethnography focuses attention on specific phenomena or subsets of a social-ecological system. Considering that this research is a representation of the ecological knowledge on the Greenland shark as a particular aspect within the Pangnirtung Inuit culture, micro-ethnography is the scope that best fits with my research purpose, hence the one I chose to employ as guiding methodological approach for this research.

Wolcott (1999) categorises ethnographic methods under three main phases of an ongoing process: experiencing, enquiring and examining. Equivalent to participant observation, experiencing refers to a researcher's perceptions in the context where research takes place. Enquiring embodies the task of giving context to the observations being made. This occurs through the establishment of dialogue with collaborators' understandings of how their observations fit within their worldview. This scope is generally fulfilled with the different kinds of interviews, especially the open-ended and semi-structured interviews that allow people to express their own perceptions of a phenomenon without having to restrict their answers. Finally, examining is the analysis that involves detailed evaluation of the interpretation of the subject.

The bundle of techniques I used to carry out this micro-ethnography enclosed participant observation, open-ended and semi-structured interviews, and a focus group involving the most knowledgeable and interested members of the Pangnirtung community.

3.2. Data Collection

3.2.1. Participant Observation

Participant observation is an approach that, by active involvement, allows a researcher to establish rapport with the social-ecological system under inquiry. This technique provided me a context to examine the general information gathered in the field and that coming from the interview sessions (Bernard 1988). The main strength of participant observation is that it gives the researcher a chance to actively participate with her/his research collaborators, reducing possible biases and providing a deeper meaning to what is being seen, perceived and represented.

To carry out participant observation, Bernard (1988) suggests some basic skills: "*management of language*"; "*explicit awareness*": keeping the details of ordinary life; "*building memory*": training for being able to remember what is seen; "*maintaining naiveté*": conserving the willingness to learn about the research context along the field phase(s); and building writing skills. Further than complementary, participant observation represents a methodological tool that enforces and makes any ethnographic approach viable (Bernard 1988, Creswell 2003).

Participant observation was an essential component of this research, especially shark fishing field trips that were part of the scientific component of this project and the hunting journeys with community members. Shark fishing trips were an opportunity to observe the interactions between fishermen and natural scientists. Since local fishermen/hunters do not fish for sharks (they only get them as by-product in winter/spring season), summer shark fishing was a novelty for Pangnirtung Inuit. These journeys facilitated ongoing exchange of ideas about techniques, bait and place where to carry this activity between the

epistemic communities involved in this research.

Pangnirtung Inuit were hired to fish for sharks during the halibut fishing in spring, when sharks are caught as a by-product. The only strategy fishermen normally use to prevent catching sharks is to set the long lines for no more than two hours. Since in this context the intention was to get as much sharks as possible, during these shark-fishing trips the long lines were left in the water for longer, hence luring more sharks to the area. To participate in the field trips of the natural science component of this research gave me an idea not only about the Greenland shark but also about the perception of some Pangnirtung Inuit fishermen towards this species, as they were actively interacting with this fish (Figure 4, 5).

I also joined several trips over the Cumberland Sound area, basically hunting and forming part of the Arctic char commercial fishery. This participation let me be closer to hunters, engaging some of the activities related to the hunting practice. Participant observation gave me a sense of what it means to be on the land (or in the sea) for the Inuit and the role that the Greenland shark plays within their experiential reality (Figure 6).

Figure 4. Simeonie Kullualik, Rob Currie and Adam Morris fishing for sharks on the Cumberland Sound open waters (Photo: C.J. Idrobo)

Figure 5. Joe Akpalialuk and Aaron Fisk fishing on the land-fast ice

(Photo: C.J. Idrobo)

Figure 6. Hunting caribou with Jaco Ishulutaq

3.2.2. Open Ended and Semi-Structured Interviews and Focus Groups

A researcher who observes events within a particular cultural context will not acquire all of the information she/he may hope to get. Indeed, a researcher is inherently biased by her/his cultural constraints; what she/he "observes" may not necessarily be an accurate representation of what research collaborators observe and think. To complement observation and get more in-depth understanding about a specific subject, it is useful to engage in conversations with research partners. Interviews can be a constructive way of probing into a subject of interest and are a significant tool in the acquisition of ethnographic knowledge (Hammersely and Atkinson 2005).

An ethnographic interview refers to the reflexive interaction between researcher and the collaborator/research partner. Instead of surveys, where

questions are already set up, these ethnographic interviews are conversations in which the researcher has certain issues to be covered and guides the conversation by means of open-ended and leading questions (Bernard 1988, Hammersley and Atkinson 2005).

An open-ended interview is a conversation with general and non-directed questions that allows the researcher to be an active listener. By doing this, the researcher aims to minimise her/his influence on the answers received. On the other hand, semi-structured interviews can be considered conversations that occur when the researcher has achieved a better understanding of the system under inquiry. This condition allows her/him to have a more interactive dialogue with the person acting as interviewee (Bernard 1988, Hammersley and Atkinson 2005).

Since Pangnirtung Inuit did not recognise themselves as "shark experts", I interviewed Inuit elders and active hunter/fishermen identified as knowledgeable in hunting and fishing on the sea. To identify them among the rest of the community members I relied on the local HTA and the interpreter's (Andrew John Dialla, Pangnirtung) advice. Also, an academic actively involved with the Pangnirtung community (Christopher Trott, Native Studies Department, University of Manitoba) along with research undertaken recently in the hamlet (Laidler 2007) gave me insights about knowledgeable people who could be interested in participating in this research.

I carried out 16 interviews, 15 in Inuktituk, with interpreter collaboration, and one in English (Table 1). Of the interviewees, 14 were male and two were female. Since men perform hunting, the main activity done on the land by Inuit, my interviewee's scope was centred on middle age/elder males. The reason for inviting women to participate on the research was related to their well-known knowledge on the local oral tradition. With the exception of the interview to the late Joeelee Papatsie (which I transcribed word per word), the original quotes

were in Inuktituk. The ones I present on the results sections are product of the Inuktituk-English interpretation done by Andrew John Dialla.

There were no fixed questionnaires. Instead, I followed an adaptive interviewing approach (Bernard 1988, Hammersley and Atkinson 2005). The initial interviews were open-ended conversations that allowed me to identify relevant topics related to the overall research. Once I could identify which of these topics could be developed in depth, I moved to semi-structured interviews with the rest of the research collaborators (Table 1, Bernard 1988, Hammersley and Atkinson 2005). The latter interviews were organized into two main sections: conversations about the experiences and encounters the Inuit have had with the sharks and questions about interactions among sharks and sea animals. Shark-related conversations were centred on accounts about personal encounters with this species, stories people have heard and what is normally seen when sharks are caught - mainly in the Greenland halibut fishery long-lines. Each interview lasted from 45 to 70 minutes (averaging an hour) and was recorded on digital media both in MP3 and WMA file format.

Research collaborators wanted their individual knowledge to be explicitly recognised. In this way, every time a direct quotation is used in this thesis, I reference their authorship according to the codes found in Table 1. A copy of this material was deposited in the Angmarlik Centre[4] in DVD format.

Focus groups are a strategy intended to generate discussion and interaction within small groups of people (Huntington 2000, Jolly and others, 2002, Berg 2004). At the end of the first field season (29 September 2007), I carried out one focus group with the three interviewees that proved to be the most knowledgeable and motivated to participate in this phase of the research (Joeelee Papatsie, Manasie Maniapik, and Pauloosie Veevee). This session allowed me to

[4] This is a multipurpose cultural and community centre in Pangnirtung. It houses the community library, the elders' room and a museum about whaling in the Cumberland Sound.

complement, organise and discuss in detail the information obtained during the individual sessions (Figure 7). I used the code "FG" to refer to the discussion undertaken over the focus group session.

Table 1. Research participants in alphabetical order

Code	Name	Type of Interview	Date
DD1	Daisy Dialla	OE	Aug 27/07
EI1	Elisapee Ishulutak	OE	Aug 29/07
EN1	Enoosie Nashalik	OE	Aug 27/07
JA1	Jarloo Akulukjuk	SS	Sep 13/07
JI1	Jaco Ishulutak	SS	Sep 18/07
JM1	Jamesie Mike	OE	Aug 29/07
JP1	Joeelee Papatsie	OE	Aug 31/07
LA1	Leopa Akpalialuk	SS	Sep 12/07
LI1	Lazarosie Ishulutak	SS	Sep 3/07
LN1	Lootie Nowyok	SS	Sep 2/07
MK1	Michael Kisa	SS	Sep 7/07
MM1	Manasie Maniapik	SS	Sep 19/07
MN1	Manasie Noah	SS	Sep 3/07
NK1	Norman Komoartok	OE	Aug 31/07
PQ1	Peterosie Qappik	OE	Aug 21/07
PV1	Pauloosie Veevee	SS	Sep 18/07

*OE: Open Ended; SS: Semi-structured

Figure 7. Focus group with Pangnirtung hunters, from left to right: Joeelee Papatsie, Manasie Maniapik and Pauloosie Veevee (Photo C.J. Idrobo)

3.3. Results Verification

A results verification trip was carried out in April 2008. Looking for approval and feedback for the knowledge representation I was in charge of, the main body of outcomes was checked over. This was done during individual meetings with English speaking active hunters (i.e., the late Joeelee Papatsie and Noah Metuq). The results were not verified extensively because of an unexpected unavailability of an Inuktituk-English interpreter. However, the topics I discussed in the verification trip were coherent with what I had already discussed over both the individual and group sessions.

3.4. Data Analysis

Digital taped interviews were transcribed word per word. Afterwards, content analyses allowed me to identify the recurrent topics that emerged from the respondent accounts. Once I analysed and categorised them, these topics acted as the standpoints where the main bodies of the results from this research were structured (David and Sutton 2004, Charmaz and others 2008). In this way, two main themes emerged: how Pangnirtung Inuit have had encounters with the Greenland shark and the knowledge that local Inuit have on this species.

Chapter 4: Encounters and Experiences with an Unused Species

> "*According to* Plutarch's Face in the Moon*, some people interpreted the face as a visual disturbance while for others the moon was a glare issuing from a single luminous point. Did they perceive the moon in that manner? And is it possible for simple perceptions to vary so drastically? Often when wandering around in the countryside I stared at the silver disk, trying hard to make it appear as a hole or a glare, I didn't succeed*".
>
> Killing Time
> Paul Feyerabend (1995: 141)

Despite being one of the two largest fish that inhabits Arctic waters, little is known about the Greenland shark. Biologists have suggested that this information gap is due to the fact that this shark species normally inhabits not easy to reach areas (that is, cold and deep waters) and there is little commercial interest in it (Skomal and Benz 2004, Yano and others 2007). From an IK perspective, the situation is similar. There are no systematic studies that document the Greenland shark from an Inuit perspective. The few accounts available in the ethnographic literature do not provide insights about the Inuit understanding of this elasmobranch (Randa 1994, Bennet and Rowley 2004). This apparent lack of documentation does not necessarily reflect the absence of a body of knowledge that explains the Greenland shark from Inuit perspectives, it rather suggests that the Greenland shark has not been a priority for Inuit knowledge research.

IK documentation of the Arctic ecosystem has been centred on elements where there are obvious relationships built through direct use between people and the environment. There is a collection of literature referring both to Arctic animals – that is, polar bears (*Ursus maritimus*), seals, waterfowl, and bowhead (*Balaena mysticeus*) and beluga (*Delphinapterus leucas)* whales (Nelson 1969, Kilabuk 1998, Hay and others 2000, Hart and Amos 2004, Noongwook and others 2007) – and biophysical terminology– that is, sea ice, weather and topography (Jolly and others 2002, Aporta 2004, Tyrrell 2006, Laidler and Elee 2008, Laidler and Ikummaq 2008). Nonetheless, there are few studies that represent or document ecosystem components not considered as a resource or as necessary for survival by the Inuit (Wenzel 1999, Bonny and Berkes 2008). In this way, by focusing on what the Inuit know, most traditional ecological knowledge studies have not looked at the processes underlying knowledge production. Western scholars have not addressed Inuit epistemology in depth (Bielawski 2003). This research analyses the processes in which Inuit knowledge about the Greenland shark is produced through the experience with it. As such, in regards to this thesis, this is the first step to visit the origins of the Pangnirtung Inuit knowledge about this shark.

This chapter explores the encounters and experiences that the Pangnirtung Inuit have had with the Greenland shark. I present the traditional stories related to this fish in Pangnirtung, the venues where the Pangnirtung Inuit have been in contact with sharks, and what could be referred to as *incidental uses*. The review of contexts where the Pangnirtung Inuit have been in contact with Greenland sharks becomes a means to understand the available knowledge about this fish species in Pangnirtung.

4.1. The Greenland Shark within Pangnirtung Inuit Cosmology and Oral Tradition

Iqalukjuaq is the name by which Pangnirtung Inuit refer to this species. Even though this name literally means "big fish" it only denotes the Greenland shark (i.e., *Iqaluk*= char; *juaq*= big).

The Pangnirtung Inuit revealed no stories or legends about the Greenland shark. Most of the research participants agreed that either there are no old stories involving sharks or they have faded away. In this way, references about the origins of the shark within the local cosmology are unknown. Daisy Dialla, an Atagoojuk school teacher, mentioned:

> *"I have researched and read all of the Inuit legends on origins of different animals, there is no mention of the origins of the shark though [...] Since I was asked to do this interview, I have been thinking if there are no legends or stories about sharks. Nothing has come to my mind, there is nothing"* (DD1).

There is the possibility for the Inuit to have symbolic interactions with sharks within their cosmology through the use of helping spirits. A helping spirit is an Inuit shaman's key element for establishing communication with the supernatural forces that inhabit the unseen world and control people's lives (Bennet and Rowley 2004). When I asked the Pangnirtung Inuit about having sharks as helping spirits, none of the interviewees even considered this possibility. Research participants mentioned the existence of stories in which polar bears, seals, walruses, and birds were helping spirits. The accounts I received even referred to shamans that had the *pittiulaaq* (black guillemot, *Cepphus grylle*), a small marine bird, acting as spirit helper. Pauloosie Veeve shared his perspective about this idea:

> *"There are no stories of shamans having sharks [as] helpers. We have land animal helpers and marine animal helpers. The major animals*

> *and even really small animals were helpers for shamans, but there are really no stories of shark shaman helpers. Maybe in other Inuit communities, maybe in Greenland, or in the Western Arctic. In Baffin, I don't know of any. We don't have any shark helper stories"* (PV1).

For most hunters, the shark is not considered an interesting enough animal to make stories about, because sharks have not been used among the Cumberland Sound Inuit. It is an opinion shared by Enoosie Nashalik, that "*there are no traditional stories about sharks. It was not one of the animals that I specifically targeted hunting. That is why I do not know a lot about it*" (EN1). The lack of use for sharks was not the only reason the Pangnirtung Inuit mentioned to explain the absence of an oral tradition about this species. Limited contact with this fish was also a reason used to describe why this fish has been neglected in the local lore. These were Peteroosie Qappik's words on this topic:

> "*There probably was not much use to them, because it was so rare to see one. We only saw them [sharks] every once in a long while. So, I cannot see how something like that could be made into a story. They [sharks] were just not used. I don't know any really old stories, where we would use the shark. We would just see them occasionally*" (PQ1).

In spite of the aforementioned situation, some Pangnirtung Inuit referred to a single old story and shared some memories where Greenland sharks were involved. Passed on by older relatives, these micro-narratives both implied an understanding of the shark and illustrated people's attitudes towards this fish species. The old story was about a human leg found inside a shark stomach. Even though this narrative was well known by some Inuit, each Inuk who mentioned it had his/her own interpretation. Each personal version of this anecdote acted as a metaphor that reflected the personal understandings of the shark, which enriched the overall story and expressed personal understandings about and feelings towards the shark. Depending on who was telling this story, sharks were seen as active hunters:

> "*One of the stories my grandmother would say is:* 'there was one instance of a person's leg being severed. The person was waiting close to the water; the shark came along and bit it off. It took off with the leg. More than a year later, someone got a shark and inside it was a leg wearing a *kamik*[5]. That must have been the leg of that person'" (DD1).

Or as scavengers:

> "*My grandfather knew a story of something that happened very long time ago. Someone must have drowned, and one of the sharks they opened up had a whole Inuk's leg in it, almost up to the knee. It doesn't happen every day that an Inuk will fall into the water and drown. So, that person must have had an accident; [he/she] drowned, sank, and got eaten*" (PV1).

Michael Kisa recognised that concerns about a possible shark ambush were known long time ago in Pangnirtung:

> "*The only story [about sharks] my dad always told me was:* 'if you are going to cut up an animal in the water, keep your feet out of the water. You can't see what is in the water when there is blood in the water. If you can't see through it, you don't know what is in the water anymore'" (MK1).

In these examples the Greenland shark was understood from facts passed on to the current Pangnirtung hunters/elders. These old incidents with sharks provided foundations and perspectives on which more understandings about this species accumulated. The available information on the shark's biology, such as poor eyesight, its good sense of smell, and the particular shark bite, exemplifies the way sharks have called the Pangnirtung Inuit's attention.

The Greenland shark is close to being non-existent in the Inuit oral tradition, compared to marine and terrestrial mammals. However, the Pangnirtung Inuit have used their knowledge about the rest of the environment to develop their own understanding of this shark species. *Tulugatitut*, as in "*the*

[5] Inuit boot made out of ringed seal skin.

way ravens behave", was a recurrent metaphor used to refer to sharks' behaviour. This metaphor illustrates how the understanding of sharks is established by means of comparison with other species, which are better understood. The perception of sharks as "*the ravens of the sea*" also explains the interactions of this species with other sea animals, as this following quotation demonstrates:

> *"Ravens go following polar bears. If a polar bear catches a seal, they will leave something behind. The same happens with sharks; they follow some predators that leave something behind. They are ravens of the sea and the killer whales are the wolves of the sea"* (JP1).

The encounters that the Inuit remembered to have had with the shark in the past have been relatively rare. The topics elaborated on in their oral tradition are equivalent to archived information about this species and show early stages of Inuit knowledge about the Greenland shark. Pangnirtung Inuit knowledge on sharks is perhaps shaped through the perspectives found embedded in these narratives.

4.2. Sightings of the Greenland shark

> *In the old days, before halibut fishing, we knew that sharks were around. They would eat seals out of seal nets. That was pretty much the only indication of them swimming around. There is a common saying from many years ago:* Iqalukjuaqtalik imaqtinni. *It means: there are sharks in our waters.*
>
> *Only when people started fishing for halibut, they began to learn about sharks. The [Pangnirtung] Inuit did not know very much about sharks at all before the halibut fishery. As soon as we started fishing for halibut, we started catching sharks right away. Sharks have always been there. They are still there…*
> (JI1)

The starting of the commercial halibut fishery in 1986 was the dividing point of the encounters the Pangnirtung Inuit have had with Greenland sharks. Before the halibut fishery, the Greenland shark was rarely seen. Some of the venues where people recalled to have had contact with sharks were incidents related to harvested animals. After the start-up of the halibut fishery there was a venue for

the Inuit to interact with the Greenland shark on a more regular basis.

4.2.1. The Greenland Shark before the Greenland Halibut Fishery

The Greenland shark is known to be attracted to dead and wounded animals. Most of these ideas are based on animals caught by the Inuit that showed evidence of shark attacks. According to the old bowhead whalers' stories, the Pangnirtung Inuit mentioned that sharks were attracted to animals they harvested. Peterosie Qappik gave an example of this phenomenon: "*My grandfather, Quinainaq, used to be one of the whalers. They used to hunt the big bowhead whale at the floe edge. When they caught a whale the sharks would come*" (PQ1). Jamesie Mike also mentioned the sharks' association to the bowhead whale hunting: "*I also have heard that during the whaling days, when people were hunting bowheads at the floe edge in Kekerton, the sharks would go after the whales after they [hunters] caught them*" (JM1). As can be seen, there was a common thread linking bowhead whale hunting journeys to the Greenland shark; every time this practice took longer than usual, sharks got attracted to the dead or injured animal.

In addition, some sharks have been seen attacking hunted animals while these were being retrieved. Manasie Maniapik narrated one of his encounters with a Greenland shark. The shark was eating a beluga that this hunter had killed and let sink the day before:

> *"... My uncle and I had a little old boat. We were trying to retrieve a beluga that had sunk. We could barely see it. It was way down there at the bottom. After we tried to hook it, something kept going over it. We thought it was kelp waving above the beluga. We realised that a shark was eating it when chunks of blubber started floating up. It was a shark we had seen passing over that beluga"* (MM1).

Hunters mentioned that sometimes they shot at seals and whales letting them sink to the bottom of shallow waters. During the low tide, they return to

retrieve the killed animal. These sunken animals often attract sharks:

> *"I killed a beluga there [inside the Pangnirtung Fjord] and it sank. The day after I went to retrieve it and sharks had already eaten the whole top, just over night. The only part of the beluga left was the one that had been touching the bottom"* (JM1).

Evidence of sharks feeding on the carcasses of other animals was proof of these animals' presence in the Cumberland Sound waters. This is recognised by some hunters, as Veevee explained: "*We knew there were sharks around, because whenever we retrieved a sunken seal, it would have a piece missing. We knew that there are sharks down there, although it is very rare to actually see them*" (PV1).

Another milieu where people in the Cumberland Sounds had encounters with the Greenland shark was onshore where animals were butchered. Blood and fat spread by these carcasses were recognised as good shark attractors. Jamesie Mike explained this situation from the perspective of a beluga-hunting journey:

> *"One time in Ingallik, the first point on the right when you head out the [Pangnirtung] fjord, we caught seven belugas. As we were skinning them, there was a little stream where the blood was flowing into the ocean. Sharks were running aground trying to get the meat. I could see them trying to get meat"* (JM1).

For Pangnirtung Inuit, it was also well known that sharks are attracted to seal and whale intestines: *"We have a cabin, out in the Cumberland Sound. Once we threw seal intestines into the water. A few minutes later we saw this shark fin going around the intestines. It came just a few minutes after we threw the intestines in the water"* (LI1). This was another situation where the Pangnirtung Inuit mentioned to have seen sharks approaching to shallow waters.

The Inuit linked blubber and oil slick floating on the water surface to dead animals being scavenged on the bottom of the sea. It is believed that when

animals are shot and missed during hunting journeys, they sink to the bottom, attracting sharks that rip them apart. From what the Inuit know about the animals that inhabit the Arctic seas, the Greenland shark is the only species able to tear a dead animal apart.

According to the Pangnirtung Inuit, seals trapped in seal nets attract sharks. If these nets are left in the water for a considerable amount of time, it is likely to find them already scavenged by sharks. As Elisapee Ishalutak said, *"It is going to be great to put the nets up, but there will be sharks"* (EI1). One of the most common points made by the Inuit when discussing encounters with sharks before the halibut fishery, was the damage this fish can do to seal nets. This can be considered an indirect way of interaction. Leopa Akulukjuk illustrated how shark-attacks of seal nets have been common for people in Pangnirtung:

> *"Sharks will regularly eat seals out of the seal nets. When we started using seal nets, we found that sharks would go after the caught seals. It was a regular occurrence that sharks ate seals caught in the seal nets"*(LA1).

Leaving the nets soaking in the water for long periods of time was due to bad weather, when hunting was difficult to carry out. In this context, sharks scavenging seals in nets added to general times of hardship: *"I know that in the old days, whenever there was bad weather and we could not check the nets for a couple of days, sharks would get those seals that got caught"* (LA1). Seals, along with the seal nets, were destroyed at times when families and communities relied on this hunting strategy for their livelihoods. As Jamesie Mike expressed, this inflicted damage was one of the reasons for the negative feelings the Pangnirtung Inuit have towards the Greenland shark: *"They [the sharks] cause a lot of damage. They make huge holes in the net. When there is a seal caught in your net the shark will eat it from all over the place, making many holes in your seal nets. I don't want them around"* (JM1).

Seals partially eaten by sharks presented an additional problem to the Pangnirtung Inuit. People from this community said emphatically that they do not eat an animal that has been scavenged by sharks. This is what Daisy Dialla talked about when she remembered her father using seal nets in the Pangnirtung Fjord:

> *"My dad used to have seal nets in the fjord close to the hamlet. Sharks always took a piece of the seal when he was netting there, never the whole thing, sometimes half of it. We wouldn't eat those leftovers. That seal would just end up as dogs' food, not for people. We Inuit are very picky about what we eat. We would not eat a thing like that"* (DD1).

This condition exacerbated the perception of the damages inflicted by sharks, triggering more feelings of resentment towards them. When there is enough food to sustain people in the community, animals attacked by sharks are discarded.

When marine mammals' carcasses wash ashore, they normally show evidence of shark bites. From the observations of these carcasses, the Pangnirtung Inuit have learned about sharks' patterns of predation/scavenging. In the following case it seems that the Inuit have become skilled in telling the particular shark biting marks from the ones of other Arctic marine predators:

> "*I know that orcas, when they kill a beluga, they rip the* maktaak *and eat the meat inside. In my old camp, when the wind was blowing from the southeast and we were living there, carcasses washed ashore. On those carcasses, I know when killer whales had ripped the* maktaak. *However, I could [also] see that sharks had been eating from it as well, because I saw the circular bite marks on the* maktaak"(JM1).

Knowing that the shark is attracted to blood spills in the water, feelings of fear towards the sharks have arisen. As a result, the Inuit stressed that butchering a big animal - such as a beluga or a bearded seal - has to be done as close to shore as possible. While a person is performing this task, he/she has to stand up between the animal being butchered and the land. Otherwise, there is

propensity for a shark's ambush.

4.2.2. The Greenland Shark after the Halibut Fishery

The Greenland halibut fishery started in Pangnirtung in 1986 and redefined the way in which the Inuit were interacting with sharks. Fishermen from Greenland were brought into the community to teach local hunters fishery methods that involved long-lines which are released into the water through holes drilled into the winter/spring land-fast ice (Figure 8). Greenland sharks have been a regular by-catch throughout the history of this fishery, as well as the fishery in East Greenland (Gordon 1999). Thus, these sharks moved from a rarely seen animal that occasionally caused damage to animals harvested by the Inuit, to one commonly encountered. This changed the perception that the Pangnirtung people had about this species. For these hunters, now halibut fishermen, the Greenland shark became a constant nuisance species: "*They keep coming back to the long line when it is underwater. They'll take a piece of one halibut and then take another piece until they get hooked. So, they just keep nibbling, taking bites of the fish until they get caught*" (MN1).

When caught, sharks slow the fishing and damage the long lines. They may even cut the main rope of the long-lines, making it impossible to retrieve the rest of the line along with the catch and increasing the economic losses: "*Sometimes we lost entire [long] lines when shark come by and bit them off*" (Qappik 2007; Figure 9, 10)

Figure 8. Joe Akpalialuk fishing for Greenland halibut on the Cumberland Sound land-fast ice, April 2008 (Photo: C.J. Idrobo)

Figure 9. Greenland shark caught in a long line (Photo: Susan Dennard)

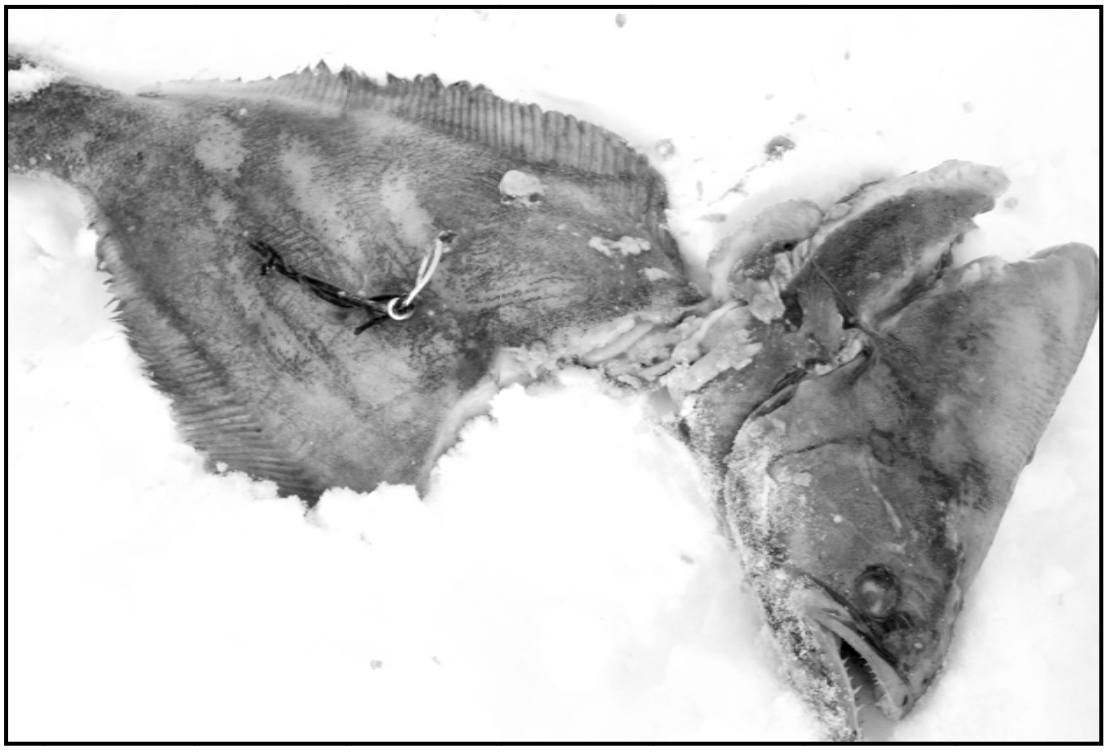

Figure 10. Greenland halibut found in a shark stomach (Photo: C.J. Idrobo)

Although an important factor, having sharks as by-catch was not the only reason why Inuit relationships with the Greenland shark took on a more negative connotation. The halibut fishery enabled the Pangnirtung Inuit to know more about this mysterious fish due to increased contact and opportunities to open the sharks' stomachs to explore their dietary habits. They not only confirmed that sharks were scavengers of the sea bottom, but they also realised that these fish are probably hunters of live baby seals. From these observations, most of the research participants saw sharks as animals that eat *"anything they bump into"* (e.g., PQ1, JP1). What is more, garbage thrown into the sea by the Inuit (such as pop cans, snowmobile parts, or cigarette packages) and almost any kind of living and non-living things of the ocean were found in the sharks' stomachs. This reinforced the negative perception that the Inuit already had of the Greenland shark.

The current treatment given to the sharks in the halibut fishery shows how undesirable this animal is to the Inuit. After the long line fishery had been established for a while and the Inuit curiosity about the sharks' stomach contents was satisfied. Fishermen found it pointless to keep pulling sharks out of the water. Since none of the sharks is used, it is a worthless effort to bring them onto the ice. Instead, to free the long lines easier, the Inuit cut the sharks' caudal fin and let them sink to the bottom where they will likely be eaten by other sharks.

4.3. Possible Uses of the Greenland Shark

There is no memory of sharks considered as a resource among the Pangnirtung Inuit. Yet, there have been some marginal uses for the sharks that were incidentally caught. Before relocation of the Inuit (mid-1960s), the available shark meat was used as dog food and as bait for fox traps; shark livers were used as an

incidental source of oil for *qulliit*[6] (Veeve 2007). Although the qualities of shark's liver oil were not considered as good as beluga or even ringed seal blubber, it was seen as an alternative in times of hardship. This last anecdote was shared only by one old hunter (i.e., PV1) and never mentioned by the only two women I interviewed (who were in charge of manipulating the *qulliit*). This suggests that the use of shark liver oil was not a widespread practice.

In Pangnirtung, it is known that shark meat is good food for sled dogs, especially younger ones. It is known in the community that this meat "*makes them grow healthier*" (EN1). However, contrary to the Greenlanders who are emphatic about the meat treatment in order to make it edible - that is, non poisonous (Bøje 1939)-, the Pangnirtung Inuit neither have memory of any treatment done to shark flesh nor remember sick dogs resulting from the lack of treatment. This inference is made from the few and isolated accounts that give reference to this practice. Jamisie Mike and Enoosie Nashalik provide examples for this:

> "*We fed three young dogs with shark meat and they grew into dogs with beautiful fur*" (JM1).

> "*My dad, Atagoojuk, used to say that shark meat is very good for the dogs. It gives them really nice and shiny fur*" (EN1).

Whereas Greenlandic Inuit catch sharks alive, it is possible that these stories refer to sharks found dead washed ashore. Soaking in salt water may remove the urea and trimethylamine oxide from shark's flesh.

Another alternative for using the sharks can be traced back to the late-1980s. At this time, the Economic Development Minister of the North Western Territories (NWT) tried to find a market for sharks' skins as an alternative to minimise the economic losses caused by sharks when caught in the Greenland halibut fishery. This alternative sought to tan sharks' skins and use them in the "*exotic leather industry*" (The Hub 1989). Manasie Maniapik, as one of the Pangnirtung Inuit that recalled this initiative, said that there was no follow up

[6] Oil lamps made out of soapstone.

for this project, perhaps because of technical difficulties (MM1).

4.3.1. The Greenland Shark as Food?

When I asked, "*why is shark's meat not considered edible*?" I could not find a clear answer. The Pangnirtung Inuit do not explicitly know about the toxicity of shark flesh; at least not as the Greenlanders do (Bøje 1939; Karla Jessen, Nunavut Research Institute, personal communication). The only explicit justification I found was the following response: "*we don't eat shark meat, because it doesn't look like our food*" (FG1).

The Pangnirtung Inuit said they are meticulous with what they eat. The Arctic char is a good example that illustrates this idea. By taking a look at some general traits, in order to choose which specific fish they eat, the Inuit have developed an idea of how a good Arctic char should look to them. A plump, well-proportioned body and bright red meat are enough to consider an Arctic char as edible. On the other hand, there are some Arctic char considered as "*ayaupiaq*"[7]. These fish also have specific traits that are easily recognised by most Inuit. An *ayaupiaq* is a very skinny fish with the head as the biggest and widest part of the body; its skin is thicker than usual; and the meat ranges in colour from whitish to pinkish. When fish that fall into this category are caught, they are thrown back into the water. Nonetheless, in times of hardship, they feed these *ayaupiaq* to the dogs and even eat them boiled (but not raw, as a good Arctic char should be eaten).

Before the Greenland halibut fishery started, some hunters remembered seeing some fish of this species washed onto the ice. At that time, they did not consider halibut as an edible fish. These "*weird looking animals*" (JP1) were either discarded or used as dog food. The reason is that halibut simply does not look like the fish they are used to eat. Even today most middle aged and elderly Inuit

[7]. Literally, tasteless fish in Inuktituk

do not like to eat fish of this species, mainly because of its white meat[8]. Yet, they conceive it as a source of income.

In regards to the sharks, the Pangnirtung Inuit have their own reasons to exclude this fish from their diet. During the conversations about encounters with sharks, three facts explained the Inuit reluctance for eating sharks' flesh: (1) its colour, (2) the amount of time they take to die, and (3) their dietary habits, i.e., they eat carrion and even human rubbish. As in the *ayaupiaq*'s case, the shark meat is white. From an Inuk point of view, this does not look appetising. Likewise, since shark flesh continues flinching long after it dies; the Inuit are not attracted to eat an animal that is "*still alive*". To understand this point, it has to be considered that the Inuit eat raw meat. For them, it is not easy to take to their mouths pieces of an animal that is still moving. Finally, since food cans, metal pieces, and plastic containers are found within sharks' stomachs, it is common to hear among most of the people in Pangnirtung that they have problems with an animal that besides eating "*good Inuit food*" (such as seals and whales), it also eats their rubbish.

The understandings and perceptions that the Pangnirtung Inuit have about the Greenland shark are bounded by the way interaction has happened with this species and they are shaped by the general means in which information about the environment is gathered and conceptualised. The interactions that the Inuit in Pangnirtung have had with this shark are symbolically and experientially limited. This fish has shown that it does not occupy a special place within the local Inuit cosmology. There are neither stories that mention the origin of the shark nor other myth-related encounters. On the experiential side, if compared with the animals being used, there is a peculiar way for the Inuit inhabiting the Pangnirtung hamlet to interact with the Greenland shark. The underlying rationale that shapes these relationships can be explained from the

[8]. Younger generations seemed to have no problem eating white-flesh Greenland halibut. Indeed, it is well known that dietary preferences between young and old people in Nunavut differs, the first ones being keener to prefer how store food looks like (McElroy 2005).

facts that this fish is not perceived as a resource for food or for anything else; it is rarely seen and, being a Greenland halibut fishery by-catch, it is perceived as a nuisance species. This situation provides a special context to approach the Inuit knowledge. I am in charge of representing the knowledge about an animal that is not used and perhaps not thought about in depth. The Greenland shark turns out to be a topic that the Inuit neither recognise themselves as experts nor want to talk about.

4.4. Discussion and Conclusions

For the Inuit, being part of a hunting society that inhabits an always-changing ecosystem (i.e. the Arctic) entails a unique way to relate to and to understand nature. Each Inuk acquires and outlines information and stimuli from the environment by conveying world-views, language, history and life experiences. The constant socialisation of these phenomena leads to ongoing processes that allow the emergence of collective cognitive models of the environment. Animals, mainly but not necessarily the ones under use, are vehicles of thought that facilitate the understandings of nature (Van Londen 1996, Randa 2002, Berkes and others 2007, Kuhn 2007).

The ways by which the Pangnirtung Inuit have come into contact with the Greenland shark have determined how this species is known. By focusing on the Greenland shark I attempted to conceptualise the underlying processes of how a non-desired and rarely seen animal is known beyond the standpoint of a use-based relationship, the case of most Inuit knowledge of animals already documented.

The ways animals are named reflect the spaces they occupy within specific cultures (Levi-Strauss 1966, Berlin and others 1973, Descola 1996). Local taxonomies are organisational manifestations of the non-human world. The

Inuktituk name "*iqalukjuaq*" serves as a means to start analysing the abstractions being made about the Greenland shark in Pangnirtung. As in other areas of the Eastern Arctic, the Pangnirtung Inuit have not given as much attention for naming fish species as other animals like mammals and birds (Randa 2002). "*Iqaluk*" is not only used to name the Arctic char, but also to refer to fish in general: "*Le terme iqaluk est utilisé aujourd'hui à la fois pour désigner les poissons en général et l'omble chevalier (*Salvelinus alpinus *L.) en particulier*"[9] (Randa 2002: 96). Even though the Inuit distinguish three kinds of fish, these names are not commonly used in Pangnirtung (Chris Trott, personal communication). [10]

The case of the Greenland shark's name shows how the generic fish name is used as a referential framework. Naming the shark in this way, *Iqalukjuaq*, shows how the Inuit, not only in Pangnirtung but also all over the Eastern Arctic and Greenland (Rink 1886), have employed what they know as a reference to understand and classify information flowing into the knowledge system. Within an Inuit ethno-linguistic perspective, an *iqalukjuaq* named after *iqaluk* is seen as an example of this, "iqalugjuaq *(*-jjuaq augmentatif*: «grand poisson»): requin dormeur (*Somniosus microcephalus *Black et Schneider). Le requin est donc bien classé terminologiquement parmi les poissons dont il se différencie par sa grande taille*"[11] (Randa 2002: 97).

Local classifications are a dynamic product that reflects how substances and contrastive features of organisms are conveyed through individual and collective mental processes (Descola 1996). Further than taxonomic categories, naming also entails an interlocked set of properties. In the case of the Inuit, they are generally known not to use generics to identify animal species (Randa 2002,

[9] The term "*Iqaluk*" is currently used as a form for naming fish species in general and the Arctic char in particular [The translation is mine].

[10] In Pangnirtung, I frequently heard about: *Nataarnaq*, Greenland halibut, this name was implemented when the commercial fishery started; and (2) *Kanajuq*, sculpin, which people commonly refer to as "*ugly fish*"

[11] *Iqalugjuaq (*-jjuaq augmentative*: «big fish»):* Greenland shark *(Somniosus microcephalus).* The shark is terminologically classified among the fish, from which it is different because of its big size [The translation is mine].

Bennet and Rowley 2004). Seal classification is an example of this. In the Cumberland Sound, seal species (that is, ringed seal, harp seal and bearded seal) do not share a common name. Each name carries either behavioural or morphological characteristics that connect each species to the social-ecological setting where it can be found (Randa 2002). Ringed seals, a staple food for the Inuit, have names that refer to behavioural traits and different age classes. *Nattiq*, for example, refers to the characteristic way these seals breathe through ice holes. *Nattiaq*, *nattiaminiq*, and *piminiq* to "new born", "no more white", and "yearling" seals respectively (Andrew Dialla, personal communication). In regards to the Greenland shark, the Inuit have used *Iqaluk* as a referential framework to identify this species rather than producing a particular one based on an aspect of the species' morphological or behavioural traits. *Iqalukjuaq* as a name to identify sharks does not circumscribe specific traits belonging to the shark; this suggests that there has not been important symbolical interaction between this fish and the Inuit.

The presence of an animal within a cultural symbolic-mythopoetic universe mirrors the experiential interactions that a cultural group has with certain elements of its social-ecological system (Laughlin and Throop 2001). The limited presence of the Greenland shark within the Pangnirtung Inuit lore shows a dual condition. While the absence of a well-constituted oral tradition suggests that sharks are neither object of thought nor collective discussion, the analogies established between this shark and other Arctic animals shows that shark information is analysed within the Inuit logic.

The Greenland shark occupies a minor role within Inuit cosmologies in other areas of the Eastern Arctic and Greenland. For the Igloolik Inuit, this fish lives within Sedna's[12] urine pot (hence the urine-like smell of its flesh) and is conceived as a shaman's helping spirit (Randa 1994, Rasmussen 1929 in Bennet

12. "Mother of the sea beasts" was the name that Franz Boas (1964, in Trott 2006) recorded as Sedna. This deidity is also known as *Uinigumasuittuq*, *Nuliajuq* and *Takannaaluk* (Van Londen 1996, Bennett and Rowley 2004, Trott 2006).

and Rowley 2004). Even Greenlandic Inuit have stories in which the shark interacts with people providing them with food in times of distress (Jørgen og Birgitte Sonne, e-mail communication on 8 August 2008). This is not the case for the Pangnirtung Inuit. Although Sedna is also perceived as creator and protector of the sea animals in the Cumberland Sound (Van Londen 1996), our informants found no connection between this supernatural being and the shark. Sedna is a cornerstone entity that brings sea animals together within their symbolic world: she gave birth to the sea creatures, the source of food and warmth for the Inuit (Van Londen 1996). That the Greenland shark is not an element involved in this mythical universe suggests that it has not played an evident role within the Pangnirtung Inuit cosmology. I find no presence of the Greenland shark within the Pangnirtung versions of the Inuit foundational myth about the origin of the sea creatures, neither in the literature about the Cumberland Sound Inuit (Boas 1901, Van Londen 1996) or in the narratives provided by the Pangnirtung elders I interacted with. Considering this, it is possible to infer that the Greenland shark has not been a vehicle of symbolic thought.

On the other hand, the present versions of the "*old Inuk leg*" micro-narrative enable interpretation of the way shark-experiential information has been processed. Scenarios are developed to explain this timeless short story. Depending on who is referring to the account, the means by which the shark got the leg were varied. The leg could have been severed from either a living person ambushed while he/she was close to the shore or from a dead person scavenged on the bottom of the sea.

Narrators are known to create their own interpretations of stories, allowing adaptations of them in space and time (Vansina 1985). Widespread stories are known to have variations among communities placed in different ecological contexts. Storytellers adapt local elements into a general plot but tend to keep a recurrent frame of relationships (Van Londen 1996, Bennet and Rowley 2004, Oosten and Laugrand 2006). In ecological terms, the variation on the Sedna

myth illustrates this situation. Depending on which region Sedna's story comes from, different animals originated from her finger joints (Van Londen 1996:36)[13]. The Pangnirtung "*old inuk leg*" micro-narrative follows a different pattern. The different versions found were distributed within the same community, among people belonging to similar generations (that is, men and women between 50 and 80 years old). What is more, both shark and human leg as main elements of the story remained constant throughout the accounts received. The variations found were related to the existing relationships between circumstances and means by which the shark took the leg. In this way, the availability of explanations for the same phenomenon suggested that its socialisation has been poor. From these different interpretations, it is possible to argue that the shark is not a collective subject of discussion among the Pangnirtung Inuit.

To approach to the limited experiential contacts that the Pangnirtung Inuit have had with the Greenland shark give grounds to understand why sharks are not an active object of thought in Pangnirtung. There were physical spaces in which hunters mentioned to have had encounters with sharks. However, these interactions were surrounded by negative connotations that probably have influenced the Pangnirtung Inuit to not recreate stories about this species or to exclude it from narratives where it could have been involved. That local narratives neglect the shark is proof of this. Even though sharks were present in the accounts I received from the Pangnirtung Inuit, when reviewing Inuit stories about bowhead whale hunting in Pangnirtung (Pitsualak 1976, Hay and others 2000), I found no mention of sharks going after the caught animals. I did not even find stories telling about incidental sharks lingering around waters where a caught animal is either hauled or kept. However, this was not the case of the Europeans whaling in the Cumberland Sound and Davis Strait waters. They

[13]. For example: in Alaska, Sedna's distal joints became salmon, the middle ones seals, and the proximal ones walrus; the remaining wrist gave origin to whales. Yet whereas, in the Cumberland Sound, the same process gave origin to the bowhead whale and some seals species (Van Londen 1996).

frequently mention encounters with sharks in their diaries, even in contexts where they were not whaling or hunting (Ross 1985). It is possible to infer that asking people specifically about sharks helped them to remember incidents of this scavenger fish's presence during their hunting journeys.

With the halibut fishery, the Pangnirtung Inuit had more contact with sharks. Yet these interactions kept their displeasing connotation. Negative feelings increased when people realised that this animal was a scavenger. Dunbar (1952) suggested that the aversion that the Ungava Bay Inuit have towards Greenland sharks was the reason why this community did not market this species during the 1950s. Sharks are in a similar situation in Pangnirtung.

It is possible that the Pangnirtung Inuit have collected information about sharks from their limited encounters with them. However, it is also possible that because of its status as a nuisance species, these facts have not been encoded within collective cognition of the environment (Laughlin and D'Aquili 1974). The spaces that the present research opened stimulated the Pangnirtung Inuit to think and talk about sharks. Even though it has no direct resource management implications, the process in which the Inuit and researchers engaged as collaborators can be denoted as a co-production of knowledge (Davidson-Hunt and O'Flaherty 2007). In these terms, by asking about a topic that local Inuit not interested in to think about before, I was implicated in bringing it forth the system into focus (Kuhn 2002).

There were instances that provide a context to theorise about how data on the Greenland shark is integrated within the local knowledge system, at least in terms of ecological and food suitability. The way this collection of facts was organised seemed to follow holistic-heuristic analyses (Berkes and Grant 2007). The Pangnirtung Inuit employ analogical thinking as the underlying rationale to conceptualise knowledge about sharks.

Forms of thought look for an order of the universe. The emerging world-views organise abstractions of the social and natural world in relation to a

totality of elements that interact among themselves in a systemic fashion (Descola 1996, Laughlin and Throop 2001). Inuit cosmology establishes an order of nature through a logic based on oppositions: land-sea, winter-summer, day-night, and female-male. Information and stimuli acquired from nature are organised following this heuristic form for establishing how elements from nature interact (Strauss 1966, Saladin D'Anglure 1991, Descola 1996, Van Londen 1996). In the case of the Greenland shark, the Inuit applied this reasoning to try to understand sharks' ecological role within the Arctic ecosystem. Two oppositions were primarily used: land-sea, the primary opposition within Inuit cosmology (Trott 2006), and the predator/opportunistic-scavenger opposition (Table 2). Even though this last opposition does not figure in Inuit thought (Chris Trott, personal communication), it emerged as strategy to discuss available information about sharks. The raven/shark analogy came directly from Inuit accounts; I use it to try to understand the context, which the following account illustrates.

On the land, wolves form packs that hunt for caribou and other animals; ravens follow behind, feeding on the remains and attacking wounded animals they come across (Oosten and Laugrand 2006). In the sea, wolves' and ravens' niches are filled by orcas and Greenland sharks respectively. While orcas form packs that prey on an ample range of sea animals (i.e., seals or bowhead whales), Greenland sharks are found where these predators (and also Inuit hunter/fishermen) leave remains behind and perhaps go after animals in distress.

Table 2. Greenland shark's feeding behaviour based on Inuit logic of opposition

Feeding Behaviour	**Land**	**Sea**
Predator	Wolf	Orca
Opportunistic Scavenger	Raven	Greenland shark

By using what they know as reference to categorise the Greenland shark, the Pangnirtung Inuit employ a logic of relations according to their own ordering of nature. Not only known relationships among land and sea animals, but also the logic that underlies them was used to assign the Greenland shark space in the Pangnirtung Inuit's knowledge of the environment. Even though this way of thinking entails two structural oppositions, it also showed that the way in which the Pangnirtung Inuit organise newly acquired information by integrating it according to holistic and heuristic principles. In this way, a shark as "*the raven of the sea*" represents analogical thinking based on an understanding shaped by Inuit cosmology (Descola 1996). In this section, I have only presented the "*sharks: ravens of the sea*" complex as an example of how the Inuit develop figures of speech about an animal they do not like, think about in depth or interact with. Yet, I also found that more detailed information is processed within a similar framework of thought. Migration patterns and dietary preferences are other examples in which a heuristic reasoning was employed (See Chapter 5).

Asking "*why shark meat is not eaten"* showed me that the Pangnirtung Inuit also make use of holistic-heuristic strategies to evaluate what edible food should look like (Berkes and others 2007). These strategies rely on a knowledge base expressed through rules of thumb that, at the time, are dependent on culturally embedded qualitative statements. That the shark's meat is not red, unlike Arctic char, was the first reason the Inuit gave to explain their reluctance to eat this animal: "*if not red, then it is not appetising*" (JP1).

In Pangnirtung, a community whose members consider them to be fussy in terms of what they eat, this rule comes from extensive use of the Arctic char. Local Inuit prefer red-meat fish. In addition, the fact that shark meat keeps flinching even after the animal is dead and cut into pieces was another reason why this animal is excluded from the model of what edible food should look like. The explanation that underlies such decision-making is related to the fact that

sharks are different from the animals the Pangnirtung Inuit regularly use as food. Berkes and Berkes Kislalioglu (2008) review how the Inuit from Hudson Bay use a similar strategy to evaluate seal wellness. Decision-making among the Inuit seems to occur through the use of fuzzy cognitive maps, which are qualitative models consisting of descriptive variables and the causal relationships among them. Moreover, the feeding habits of the shark are another reason why its meat is not considered as food. Eating scavenging animals, as in the case of ravens, is a cultural taboo for the Inuit (Oosten and Laugrand 2006). The Greenland shark case is similar, as this fish is not liked because it eats "rubbish". Similar decision-making systems used to evaluate food are documented about the Inuit from the Western Arctic (Berkes and others 2007). Although these systems are used more to evaluate the health and condition of what is eaten on a regular basis, such as ringed seals or burbot (*Lota lota*), the Pangnirtung Inuit evaluate the shark's suitability as food under similar parameters of comparison.

The Greenland shark is not an active element of the current Pangnirtung Inuit knowledge system. It does not occupy a space within the local symbolic world and it is not a common object of collective discussion. It is possible that the lack of connection between humans and sharks has not allowed for the emergence of cultural constructions. The Pangnirtung Inuit do not find the shark to be "*an animal interesting enough to make stories about*" (MN1). As such, further than limited knowledge, there has been no interest to recreate analogies of the behaviour and other ecological features of this fish as has happened with other animals. The polar bear for example, an animal frequently seen is a powerful animal within Inuit lore. The seal hunting strategies of polar bears as well as a number of its traits, are either similar in accounts or can be seen to be imitated by the Inuit (Randa 1986, Trott 2006).

In spite of this situation, information on sharks has not been totally neglected. Continued encounters with these fish have allowed for the accumulation of information about some biological features of this species.

However, maybe the sharks' undesirable condition has not motivated people to process experiential information and actually think about this species in depth. In this way, my research may help to stimulate intellectual processes among those hunters who participating in this research, permitting a form of knowledge co-production that facilitated people to think about sharks.

Chapter 5: The Pangnirtung Inuit Knowledge of the Greenland Shark

"What we think and perceive has a certain sense - and even if it is nonsense, it is not non-sense. Making nonsense is also making sense"

Luhmann explained: from Souls to Systems
Moeller (2006)

Traditional and indigenous ecological knowledge can be seen as a complex composed not only by knowledge but also by practices and beliefs (Berkes 2008). The ecological knowledge held by some indigenous groups is the manifestation of adaptive processes built through the interactions people have had historically with their social-ecological environment. Since the relationships the Pangnirtung Inuit have with the Greenland shark (*Somniosus microcephalus*) are based neither on use nor on cultural significance, the available knowledge about this species falls outside the context of current Inuit ecological knowledge research (Kilabuk 1998, Hay and others 2000, Hart and Amos 2004, Noongwook and others 2007). The encounters with sharks are limited. Further, it scavenges caught animals, destroys seals trapped in seal nets, and slows the halibut fishery. For this reason, the Greenland shark is an animal that the Pangnirtung Inuit do not like and are not interested in. The absence of cultural constructions and an oral tradition surrounding this fish proves the aforementioned statement (Chapter 4).

Is there a body of Inuit ecological knowledge on the Greenland shark in Pangnirtung? An initial response would be: there is none as such and if there were any knowledge on this species, it would be limited to scattered information. However, during this research the Inuit proved to be able to explain this species from their own perspective. What is more, through the interaction with researchers, these hunters were able to think about the role that the Greenland shark plays in the Arctic marine ecosystem.

In this chapter I navigate through the knowledge the Pangnirtung Inuit have about the Greenland shark that fits into a biological and ecological perspective. It is organised in two main sections: "*what is commonly known about the Greenland shark*" and "*on the variations of Inuit knowledge about the Greenland shark*". The first section corresponds to a superficial layer of knowledge related to mainly experiential information and the reflections made about sharks. The second one is related to more complex elaborations, a product of heuristic reasoning of the shark-related available information and the efforts to understand the role of this fish in the Arctic ecosystem. I frame this knowledge representation using fuzzy logic thinking (Zadeh 1973) and collective mental models (Quinn and Holland 1987). Even though these approaches have been considered suitable for understanding how traditional ecological knowledge is produced, their use has been restricted to explain decision-making and solving complex problems (Nazarea 1988, Mackinson 2000, Paolisso 2000, Grant and Berkes 2007, Berkes and Berkes Kislalioglu 2008). By representing the available knowledge of an unused species I open the opportunity to review the processes in which general knowledge about the environment, based on limited experience and data, is produced within an indigenous knowledge system.

5.1. On what is Commonly Known about the Greenland Shark

"One time we were fishing Greenland halibut. In between times you put a piece of plywood over the hole, just to keep it from freezing. We noticed that the plywood was coming up a little bit. We were wondering what was going on, when somebody flipped it over. There was a big shark that had been going up and then going down. It must have smelt the fishing hole"
(MN1).

There are some bodies of knowledge about the Greenland shark that the Pangnirtung Inuit I talked to agreed upon. These are mainly related to direct observations made on sharks. Features that have come to the Pangnirtung Inuit attention when observing the Greenland shark are the sharks' skeletal structure, the fact that they do not die easily, the poor eyesight/ strong sense of smell complex, bite strategies, stomach contents, and patterns of abundance during the halibut fishery. Even though some of these emerging topics were not used to infer more ecological knowledge as the statements "*sharks do not have true bones*" and "*sharks do not die easy*" demonstrate, they were used to exclude sharks from the Pangnirtung Inuit diet (Chapter 4). There is agreement over what is known about this set of features; they are taken as starting points from where more knowledge unfolds, which is structured using what some hunters call a "*conscious guesswork practice*" (Figure 11)

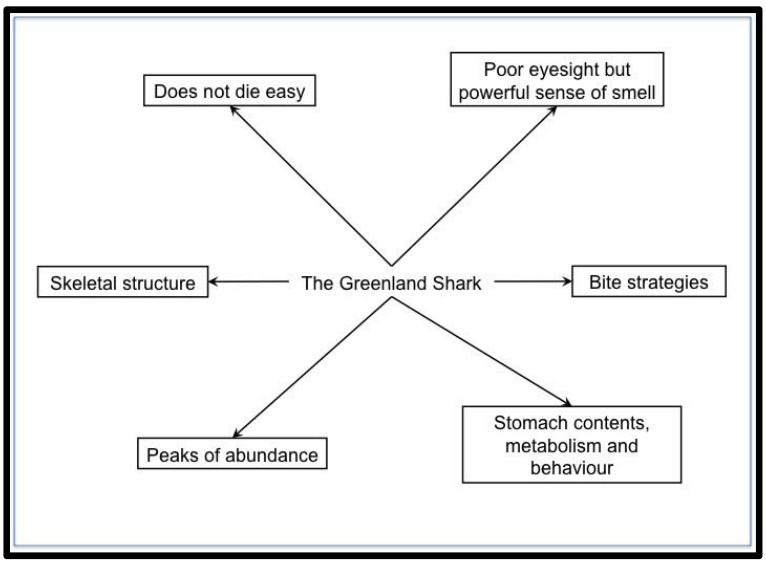

Figure 11. Commonly known topics of Inuit knowledge on the Greenland Shark

5.1. Sharks do not have True Bones

As other Chondrichthyes, the sharks' taxonomic class, the Greenland shark has a flexible cartilaginous skeleton with no true bones (Idyll 1971). This is a remarkable feature that Pangnirtung Inuit recognised about the Greenland shark, i.e. that this species has no bony skeleton, at least not the kind the Pangnirtung Inuit are familiar with. Perhaps this is the only fish species in the Cumberland Sound that comes to people's mind in regards to this trait[14]. Elisapee Ishulutak, a woman story teller in her 80s, and the late Joeelee Papatsie, a hunter and active halibut fisherman in his 50s, both made reference about their impressions of coming across an animal with "*no bones*":

> "*They don't seem to have bones. They have cartilage where bones should be. My father used to just chop the whole animal up. He fed the whole thing to the dogs. Sharks don't have bones at all*" (EI1).

> "*Sharks do not have bones. When I was a child, we found a shark washed ashore. We cut a piece of it and we found that what it had as bones bounced. There are no bones in the whole shark, only the teeth are bony*" (JP1).

5.2. "Sharks do not die easily"

I commonly heard that "*Sharks do not die easily*", "*they are hard to kill*", and similar comments about this animal. As I started looking more profoundly into this topic, these remarks were not directly related to having difficulties killing sharks, generally an animal known to behave lethargically and hence easy to catch once spotted. Rather, what people meant was related to the fact that sharks' flesh keeps moving long after sharks are pulled out of the water and even cut into

[14]. Although there are more fish from this class in the area, such as the thorny skate (*Raja radiata*), hunters did not mention these neither during the participant observation nor the interview phases of the present research (Chambers and Dick 2005 and personal observations).

pieces: "*they are almost impossible to kill. Even after you cut it all up, they keep flinching, they keep moving*" (MK1). Enoosie Nashalik pointed out that his father passed on the awareness of this trait:

> "*Dad used to say to me that sharks' flesh has a hard time dying. The shark can be rotten, even sticky rotten, and when you touch the skin or the meat it still moves. You know, it is still alive but it is rotten*" (EN1).

This flesh-twitching phenomenon has called the Pangnirtung Inuit attention and adds to the features that make the shark a peculiar animal to the members of this community. "*Sharks do not die easily*" became another feature that defines the identity of this species when it is compared to other sea animals:

> "*They [sharks] are different from other animals. Their meat is unique. Even though it [the shark] is dead for a long time, the meat will keep twitching for a very long time. That is very characteristic of a shark*" (JI1).

As presented in Chapter 4, the uniqueness of the shark is used by the Pangnirtung Inuit to assess the edibleness of this animal's meat. The Inuit do not eat the shark's meat because it does not look like "*their food*".

5.3. Poor Eyesight and Strong Sense of Smell

Among the main traits for which the Greenland shark is known is the poor-eyesight/powerful-sense-of-smell complex. Sharks are known to have poor eyesight that is compensated with a strong sense of smell that helps them to find food. People linked these two traits every time they talked about sharks. The notion of poor eyesight is inferred by the findings of parasitic copepods (*Ommatokoita elongata*) attached to sharks' eyes and their always-bloody snouts (Figure 12). Because of these parasites, some Inuit believe that sharks' eyes look like they are hanging and therefore not working properly. Hanging from the

sharks' eyes, these small crustaceans are seen as the indicators of the sharks' blindness. Furthermore, the Pangnirtung Inuit make assumptions about the Greenland sharks' blindness because of their always bleeding snouts[15].

Figure 12. Parasitic copepods attached to the eyes of a Greenland shark (Photos: C.J. Idrobo)

To find sharks' snouts always bruised and covered in blood also makes people assume that these fish are not skilful swimmers. This limitation is linked to poor eyesight. It is common to see sharks bumping into rocks while they are going after animal-remains thrown into the sea. Observations of this kind have reinforced the idea that sharks are almost, if not entirely, blind.

Within this position some people explained why sharks are not active hunters. Enoosie Nashalik's summarised how it is understood that sharks do not rely on their eyesight to locate food: "*They [sharks] are always moving in the water and smell very quickly. If something is smelly, they'll find it very quickly, although they are almost blind*" (EN1). As the Greenland sharks' powerful sense of smell is well

[15] This could be function of being caught on long line (A. Fisk, personal communication).

known among Pangnirtung hunters, they identify blood, fat, and dead/wounded animals as shark attractors. When and where there are animal-remains in the water, sharks will be lingering, looking for something to eat or scavenge. Old hunters, such as Enoosie Nashalik, explained this connection very explicitly:

> "*I know that they [sharks] have a very keen sense of smell. In a camp called Sauniqtuajjuq, where we used to live also, we used to leave pieces of beluga* majja *[subdermal tissue] in the water. When we put that in the water, in no time sharks would be coming, sniffing along, and trying to eat. That's why I say that their sense of smell is very good*" (EN1).

Inferences about powerful sense of smell made from previous encounters have also allowed Pangnirtung Inuit to expand their understanding of the ecology of sharks, as new information is available. At the time sharks became a halibut fishery by-catch, fishermen realised that sharks may go after live baby seals. Explanations given to this phenomenon are related to blood trickling into the water. Mother seals are known to discard their placentas and keep bleeding after giving birth. Attracted by this, sharks may lurk around seal denning areas, waiting to ambush baby seals that are learning to swim.

Because of their powerful sense of smell, sharks are perceived to follow the general principles of environment patterns. A case in which this linkage is made evident is the influence tidal streams have on animals' behaviour. For experienced hunters like Jaco Ishulutak, animals' behaviour changes according to the tides. Again, sharks are not an exception for this:

> "*It is common for all animals in our waters to be more active and travel faster during the highest tide of the month. That is when the currents in the water are the strongest and fastest. I don't see why sharks do not obey to the same.*
>
> *It is not just because of the shark. It is a general thing that happens in the sea. The higher the tide the higher activity animals have*" (JI1).

The idea that the sharks' sense of smell is linked to the tide's influence came from the halibut fishery. It is known that the highest number of sharks is caught in the long-lines during the big *piturngniq*[16], "the biggest/highest tide of the month". *"During the highest tides of the month, there would be much more sharks, many more sharks"* (JI1). Since dead animals' and blood's scent is transported along the tidal currents, sharks use their keen sense of smell to locate it. This is how sharks are known to use tidal streams to find food quicker. Michael Kisa shared his perspective on this topic:

> "*They [sharks] have a very powerful sense of smell. They use the currents the same way we use the wind. The wind carries the smell; the currents carry the smell in the water, just like the wind*" (MK1).

The complex of poor eyesight/strong sense of smell comes forth as knowledge about sharks in which the Pangnirtung Inuit have consensus. This subset works as one of the conceptual keystones from where the understanding of the shark is unfolded. In this way, this trait complex defined the sharks' identity among most of the people I interviewed. For Jaco Ishulutak, these are the characteristics that outline the sharks' essence:

> "*I think that sharks have very poor eyesight, but very strong sense of smell. I know they have a very strong sense of smell. I don't know if their eyesight is good, I think it is not. That's the way they are, it's normal for them*" (JI1).

5.4. From Sharks' Bite to Evidence about Feeding Strategies

The way a shark bites emerged also as a theme the Pangnirtung Inuit were eager to discuss. As mentioned in Chapter 4, the direct contact that Inuit from

[16].As this *piturngniq* concept emerged during the interview settings, I had to ask Andrew Dialla about the overall meaning of it. This was his explanation: "We call *piturngniq* when the tide goes up, it is super high, and when the tide goes down, it is super low (clam digging time). Clam digging time is when the tide is at its lowest. It is like that twice a month. In every two weeks you get like a minor *piturngniq* and then once a month you get your big *piturngniq*. That is when our sea mammals are more active. There is more water and the currents are faster".

Pangnirtung have had with sharks has been limited to specimens both caught in the halibut fishery and those that rarely wash ashore. However, along these encounters, the Inuit have been able to see and infer what sharks can do to their catches and other found dead animals.

From observing sharks' jaws and connecting this to sharks' bites previously seen, evidence has been gathered to make inference on sharks' behaviour, especially in regards to its feeding strategies. The Inuit see in sharks' jaws a very dexterous tool from which their efficiency at ripping seals out of the seal nets and destroying Inuit catches can be deducted. Jaco Ishulutak expressed how shark jaws stand out as defining characteristics in regards to its feeding strategies:

> *"When I'm touching the head, I just can't imagine that this animal can do that kind of damage or be that efficient. But when I look at the teeth, I see that it can be that efficient. They don't just bite and grab; they grind back and forth. They can cut like a saw"* (JI1).

The shark's round-shaped bite emerged as another essential characteristic of this species for the Pangnirtung Inuit. When an animal is found with these kinds of wounds, it is clear that no other animal but a shark can make them. When sharks bite, they leave behind their own signature. Therefore, whenever a dead or wounded animal is found with the very particular round-shaped bite, people guaranteed that a shark had been around.

In this way, the marks left behind by sharks (as in the way they bite) can be considered as a diagnostic characteristic of sharks' presence. For the Pangnirtung Inuit to know these characteristics becomes useful to make sense of new information about the Greenland shark. They are able to integrate information into their own system to understand the shark and its role in the arctic marine ecosystem.

5.5. Stomach Contents, Metabolism and Behaviour

While discussing shark's stomach contents an unexpected topic became explicit[17]. The Pangnirtung Inuit were not only interested in the kind of items found in the stomach contents, but also in their appearance. Through the systematic observation of these items, the Pangnirtung Inuit are able to make assumptions about the sharks' metabolism. This deduction is arrived at by comparison of what is found inside the sharks' stomachs with what is known about other animals during hunting journeys.

Some Inuit analyse the stomach contents of the animals they hunt. Beluga whales, narwhals, and ringed seals are examples of it. From observations and discussions carried out while these sea mammals are flensed and butchered, a collective idea of the understanding of these animals' metabolism has emerged. Since both whales and seals seem to digest very quickly what they eat, making the food look as if it was cooked, they are considered "*warm-blooded*" (JI1, JP1), like humans. When it is possible to contrast this idea of "*warm-blooded*" with what they see coming from sharks' stomachs, deductions about the sharks' metabolism were elicited.

> "*I know that a beluga's digestive system is a lot faster than the sharks'. I wait for the belugas on their way in [to the Cumberland Sound], in springtime. When I hunt them at their arrival, you only see the skins of fish inside their stomach...They are coming with a meal from way out there [Davis Strait] and they digest the food right away*" (JP1).

Elisapee Ishulutak told me her experience about the first time she saw shark stomach contents. Her account embraces a heuristic comparison to previous observations on sea mammal stomach contents. These previous

17. Shark stomach contents used to be checked out on a regular basis when the halibut fishery started. However, fishermen stopped this practice, as they found it pointless to pull sharks out of the water. The uncertainty that came along with the changing in the ice conditions meant a reduction of the number of active fishermen and less spare time available on the Cumberland Sound ice. Since shark stomach content examination was performed out of curiosity rather than necessity, it made sense to stop this practice (further details on Chapter 4).

experiences serve as a standpoint to analyse and give sense to this newly acquired information about the sharks' physiology, especially their particular metabolism:

> "*They must be cold blooded. When my father cut the shark and looked at its stomach content, I could see that it (the food) was not really digested. It didn't look like in mammals, as if it had been cooked. Always like old sculpins, it didn't look like it had come from a kettle*" (EI1).

The way items are digested within a shark's stomach works as a metabolism indicator. Again, a specific relationship emerges: "*old looking stomach content items mean sharks are cold-blooded animals*". The micro-narrative about the Inuk leg found inside a shark's stomach also refers to the digestive system of the shark:

> "*One of the local knowledge is that a shark's stomach takes a long time to digest anything in there. So, that strange kamik from somewhere else may be proof or indication of how slow its digestive system works*" (FG1).

The Pangnirtung Inuit recognised the shark as an animal that digests food slowly. Most of the comments on this specific characteristic lead to more general inferences about the biology of the shark. The agreement found among most of the people I talked to can be seen as an expression of information that has been stored from encounters with sharks.

Linked to cold-blooded metabolism, "*sluggish*" and "*stubborn*" were adjectives commonly used by the Pangnirtung Inuit to describe the behaviour of the shark. Although these two concepts appeared frequently correlated, they refer to different facets of this animal. The description sluggish is used when a shark is pulled in with the halibut fishing long-lines. Sharks are seen as animals that generally do not struggle when pulled onto the ice by fishermen.

Sharks are regularly seen as lethargic animals by most of the hunters. There are isolated records of sharks fighting back after being caught: "*although most of the sharks do not struggle at all when they are either hooked in the long lines or*

harpooned, some can fight back" (MK1). These observations caution Pangnirtung hunters to not generalise this angle of sharks' behaviour. Normally perceived as passive animals, the few available records of sharks struggling when caught seem to be derived from the definition of the local understanding of a shark's behaviour and how this can affect people's lives:

> "*Some of them don't react at all when you catch them. They just stop. It's like they are waiting for you to do something. Others really react and try to get away. They really fight. I think those are the dangerous ones*" (MN1).

In regards to stubbornness, some people commented on having observed sharks becoming "*unstoppable*" when interested in something. Manasie Noah recounted one occasion in which he found himself struggling with a shark interested in a seal he was cleaning onshore. While fighting with it, he found an obstinate animal with "*no feelings*" (MN1). He even tried to poke the shark with a harpoon to scare it away, yet this animal did not seem to get distracted from its aim.

This condition awaked some people's attention towards sharks. Some have even tested to what point a shark would pursue something it is interested in. This is the account of Peterosie Qappik, a retired fisherman, who used the halibut fishery as a setting to scrutinise this component of sharks' knowledge:

> "*Once, we took the back part of a ringed seal, tied it, and put it in the water to see if a shark would get it. When it started moving we pulled it up. There was a shark trying to eat the seal. We tied up a piece of seal and just put it off the water and the shark came up. As the shark was biting it, we brought it up a little higher, pulled it up a little higher. The shark was still chewing, but its head was sticking right out of the ice. And it was still chewing when we put it out onto the ice, the whole shark. It was still chewing on the seal meat. It didn't look around; it didn't notice the people. It was just concentrated on eating"* (PQ1).

Most of the people who have seen a living shark, observe sluggishness and stubbornness in its behaviour.

5.6. Patterns of Abundance

The Greenland shark is a by-catch of the halibut fishery. It is caught in the long-lines of this fishery on a very regular basis; sometimes it succeeds to cut them. While as the ice has permitted to carry on with this fishery[18], the Pangnirtung Inuit have been able to develop an idea about the abundance and possible migration strategies of the Greenland shark in the Cumberland sound.

Fishermen were not keen to talk about the number of sharks caught in the long lines. Instead, they constantly used qualitative adjectives (that is, "*a lot*" and "*a few*") to refer to the amount of sharks trapped during specific periods of the fishing season (LA1). Since a "*norma*l" fishing season spans from late January/early February to late April/early May, fishermen's accounts are limited to this time frame (LI1).

There is almost unanimous agreement between the fishermen's perspectives on this topic. High numbers of sharks are observed at the beginning of the fishing season. Afterwards, there is a no-shark period that lasts until the end of March. After that, there is a sudden shark outbreak that goes until the end of the fishing season in mid-May. Except in Michael Kisa's account (MK1), a hunter but not a fisherman elder, the aforementioned patterns remain constant among the hunter/fishermen with whom I talked. I present and substantiate these versions during the focus groups carried out at the end of the summer field season of this research (FG1). The achieved consensus is that sharks appear in big numbers, as in "*patterns of abundance*", at the beginning and at the end of the fishing season. In the middle, shark numbers decrease substantially, which results in rare catches. At the same time, fishermen also recognise that halibut numbers remain relatively stable throughout the season (Figure 13).

[18]. The later freeze-up and earlier break-up of the Cumberland Sound land-fast ice has shortened the halibut fishing season. Although this situation seems not to affect the Greenland halibut stocks, it does to the means for accessing them (Laidler 2007).

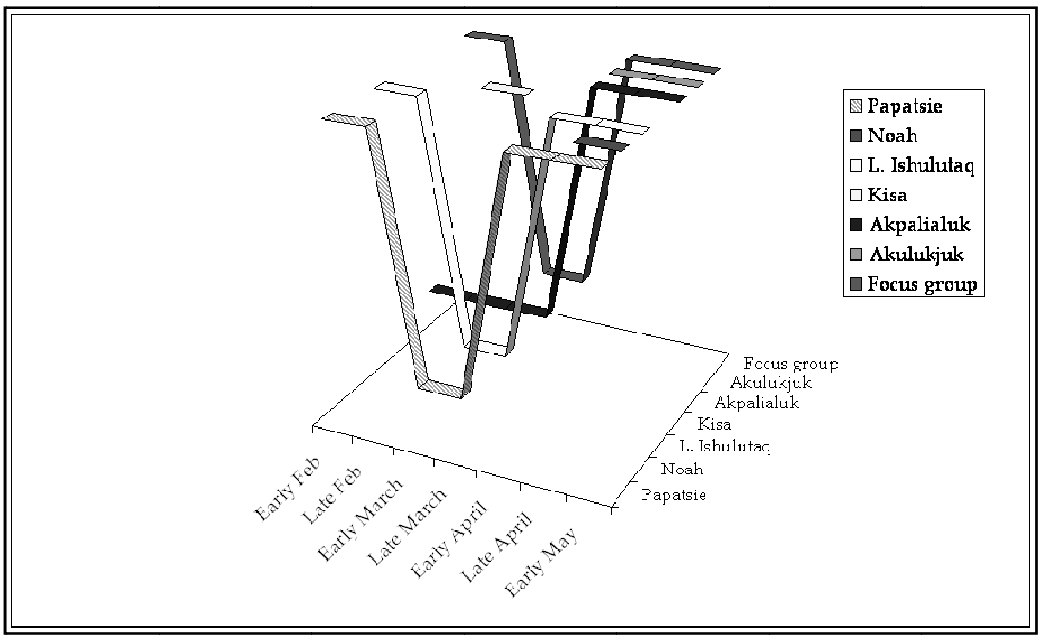

Figure 13. Seasonal abundance of the Greenland shark according to the Greenland halibut fishermen

The aforementioned "*patterns of abundance*" require some explanation about the inferential processes that underlie them. I proceed to open the next section unpacking the existing explanations of finding sharks on a predictable basis. To this point in this chapter, the emerging elements of the biological/ecological understanding of the shark are shared by most of the people to whom I talked. However, from now on, I start showing how some emerging concepts have dissimilar and complex perspectives depending on who is interpreting what is either seen or thought and which variables are put together to do so.

5.2. On the Variations in Inuit Knowledge of the Greenland Shark

To understand an animal not seen on a regular basis is not easy. The Pangnirtung Inuit recognise this limitation. Most of what they are able to talk about the

Greenland shark is a product of conscious guesswork woven into narrated and experiential information about sharks and the general understanding of the sea. The assemblages of the few observations that can be articulated about this species constitute the existing knowledge about sharks. This is done within the common sense that encompasses what it is to be a hunter, an Inuk hunter in this case. From this process ideas about sharks are gathered and organised to finally acquire sense, a sense sometimes relative to the beholder.

In spite of the fact that the Pangnirtung Inuit have known about sharks' existence long before they were a by-catch in the halibut fishery, this fishery allowed fishermen to adjust their existing knowledge to new available information. By discussing this now accessible evidence, different versions about the ecological understanding of the shark can be elicited. From habitat to feeding behaviour, I find no uniform overarching descriptions of the Greenland shark. The following section presents the different variations I found.

5.2.1. Explaining the Sharks' Abundance and Appearance

The Pangnirtung Inuit have an idea about sharks' patterns of abundance because of the halibut fishery (Figure 12). However, hunters/fishermen have come to more than one explanation for this phenomenon. The available accounts involve complex, not exclusive but complementary, ways to understand the Greenland shark's presence in the Cumberland Sound area. While tidal/moon cycles are known to influence the monthly abundance of sharks, possible seasonal rounds, and the halibut fishery's effect are facts that the Inuit consider in longer time lapses (Table 3).

Table 3. Sharks' appearance and available explanations for it

	Commonly Known	**Available Explanation(s)**
Shark Appearance	Monthly appearance	Tidal currents' influence.
	Seasonal patterns of abundance	Natural migration patterns. Permanent dwellers of the sound Lured to the area by fishermen

Referring to the tidal/moon cycles, the amount of sharks caught and seen is linked to the "*piturngniq*" tide timing. The higher the tide of the month, the more sharks will be caught. This is the conclusion that the Pangnirtung fishermen have come to. Although this assumption is deduced from first-hand observations, it also embodies the general understanding of how the moon cycle influences animal behaviour.

With respect to seasonal rounds, migratory patterns are considered as one possible explanation to sharks' appearance patterns:

> "*What I have noticed is that sharks seem to come in cycles or waves. There are long stretches of time where we didn't catch any shark at all. That was good. Then we would start catching one, sometimes even two in the same line*" (JA1).

The Pangnirtung Inuit structure and explain this perspective using the knowledge they already have, in this case the Arctic char (*Salvelinus alpinus*) and the Greenland halibut, fish species harvested on a regular basis. The Arctic char is known to be a migratory species. It winters in the highland fresh water lakes and moves to the open sea in summer. On the other hand, the Greenland halibut is thought to come to the Sound in winter and migrate to the Davis Strait in late spring. This knowledge is widespread among all of the hunters/fishermen I talk to. Some fishermen mobilise their knowledge in order to give sense to sharks' occurrence in the Cumberland Sound. For them, sharks seem to follow a migratory pattern similar to the char and halibut, yet in a different sequence:

> "*I just suspect that in the spring time, when it is lighter, they [Sharks] come to their home sound, their home lake; it is almost a lake. In late summer they leave the sound and go to open depth. This [the Cumberland sound] is shallower than the Atlantic, so this is their shallow home for the early summer*" (LA1).

Nonetheless, observations of sharks in summer have also led to other alternatives to explain their presence. To have a high number of sightings of this species during both ice-covered and open-water seasons provides evidence to suppose that sharks are permanent dwellers of the sound. People recognise their limited knowledge about sharks in open water time because there are no activities linking them to this fish:

> "*Looking at the number of sightings of an animal that doesn't need air to breath, it is easy to think that there must be a lot of them down there [in the sound]. We see so many of them, even though they don't need to breathe air. There is no reason for them to go up, into the air. I think there are a lot of sharks around, all over the place, all year round*" (MN1).

Another possible explanation to sharks' occurrence in the sound is the influence that the halibut fishery, but not necessarily the schools of halibut, may have on their appearance. Fishermen cast bait into the sea bed to fish halibut. This bait, along with the halibut struggling in the long lines, is seen as one of the factors that attract sharks to the area. Fishermen even relate sharks' abundance to the amount of bait left soaking in the water: "*when there is more bait in the water, it can attract more sharks*" (JP1). In this way the Pangnirtung fishermen, by explaining their influence in the numbers of sharks found in the Sound, portray themselves as active agents that shape the sharks' occurrence.

5.2.2. Habitat: Bottom Dwellers or Free Swimmers?

That sharks are bottom dwellers is a conclusion the Pangnirtung Inuit have come to through the examination of the stomach contents of these animals. To find

seabed creatures along with old sunk mammals within shark stomachs means for hunters/fishermen that these fish are benthic zone inhabitants. However, I cannot find agreement whether sharks are restricted to the bottom of the sea or can also move freely along the water column. Some hunters were emphatic that sharks are basically bottom scavengers: "*I have only seen bits of sea creatures from shark stomachs. Pieces of old sunken seals, sunken whales, and weird bottom sea creatures are in their stomachs*" (LA1). Others said that sharks swim both on the bottom sea and along the water column: "*We don't go to the bottom, but we know sharks go there to eat halibut from the long lines. However, it is easy for them [sharks] to come to the surface"* (JP1). Since these kinds of assumptions cannot be verified, the available accounts were product of deductive reasoning where different conceptions about the shark are conveyed.

For those who conceived the bottom-dwellers scenario, sharks go along the seabed looking for food. When they detect something to go after, sharks will chase it. If the item they are interested in is on the surface, sharks will get it by following the seabed: "*They [sharks] stay at the bottom and occasionally will follow the bottom to shallow areas*" (JI1). It is in these situations when people have been able to see them: "*They are following the bottom of the sea when we see them. They follow the bottom of the sea until it gets shallow*" (JA1).

As for the perspective that sharks are free-swimming, some hunters use similar evidence to draw this conclusion, but they put it together in a different fashion. In that case, the local perception of sharks' habitat is that they can move freely along the water column, although they spend most of their time at the bottom of the sea. The Pangnirtung Inuit infer this from the fact that sharks have been seen swimming close to the sea's surface, lingering around where blood has trickled into the water. Another indicator of the sharks' use of the seabed and water column as habitat is the fact, that this elasmobranch apparently does not change body shape under low surface's pressure. This is inferred from observations made of other bottom fish regularly brought to the surface.

Fishermen know that some bentho-bathypelagic fish species, such as the round-nose grenadier (*Coryphaenoides rupestris*), die when pulled up to the surface. The eyes of these fish explode and their body shape changes because of the loss of pressure. Following this, the reasoning of the Pangnirtung Inuit in these regards with sharks in mind, lead them to another set of conclusions. If sharks do not die when brought up to the surface and their bodies do not change with the lack of pressure, then they are able to swim freely along the water column. These were the words from the late Joeelee Papatsie in this regard:

> "*Its [shark's] body doesn't change. Either at the bottom or up here, it is the same. Other fish basically blow up. Because there is so much pressure at the bottom of the sea, when you bring them up here, these fish just burst. But sharks have no problem at all. They are both real deep water and surface animals. They are just fine*" (JP1).

The free-swimming sharks' alternative was taken even further. Jamesie Mike relates the fact of sighting sharks at the surface with his general knowledge of the sea. There seem to be time spans in which sharks are more commonly seen. For Jamesie, these periods are synchronised with the high tide: "*They don't stay in the deep, at the bottom. They go right near the shore; they go on top [surface] when the tide is high*" (JM1).

These perspectives about the Greenland shark's habitat seem to be very similar; they can be considered as interpretations of the same phenomena. Yet the importance of pointing them out lies beneath the fact that these dissimilar ideas work as starting points to document different perspectives on the ecology of the shark. Sharks seen as bottom dwellers are considered scavengers, while the free swimming ones are also considered predators (Figure 14).

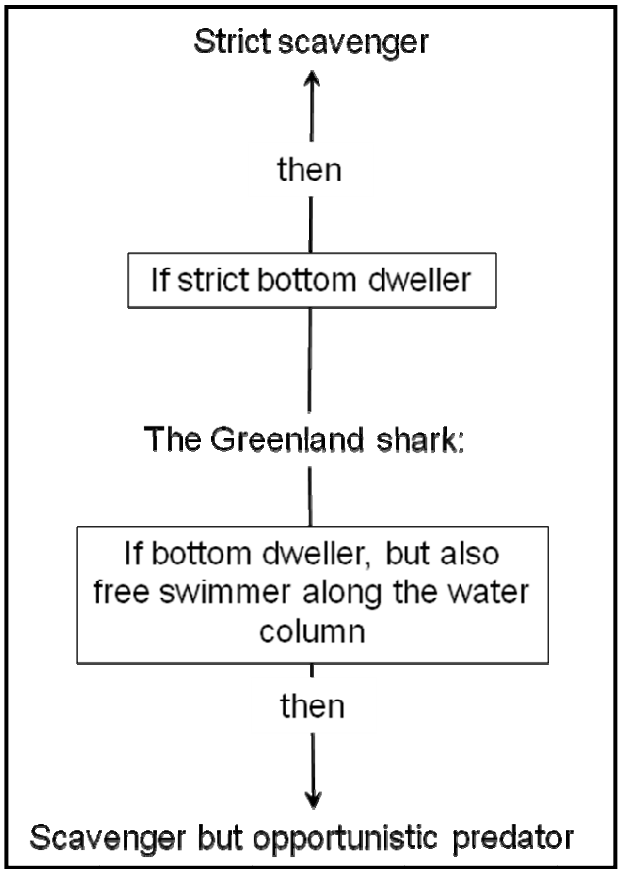

Figure 14. Sharks' feeding behaviour relative to habitat use

5.2.3. Feeding Behaviour

"They [sharks] try to eat anything they smell and touch. Sharks are not selective. Whatever they smell and it is close to their mouths, they'll eat it. You can't really say that they eat something specific, because they don't care"
(PV1)

Sharks are known to "*eat anything they bump into*". Whereas this reference is common among all of the accounts I receive, it acquires a particular connotation each time it is used. Indeed, the aforementioned expression acts as a primer to navigate the local understanding of sharks' feeding behaviour. In general, the Pangnirtung Inuit have taken for granted that the Greenland shark is not very selective in terms of what its diet includes. Depending on specific phenomena the comprehension of the feeding behaviour of this fish species has been structured. Mainly based on what is seen as stomach contents, but also including incidental

observations in other contexts, I find a continuum of explanations that rank the shark from being a strict scavenger to an active predator (Figure 15).

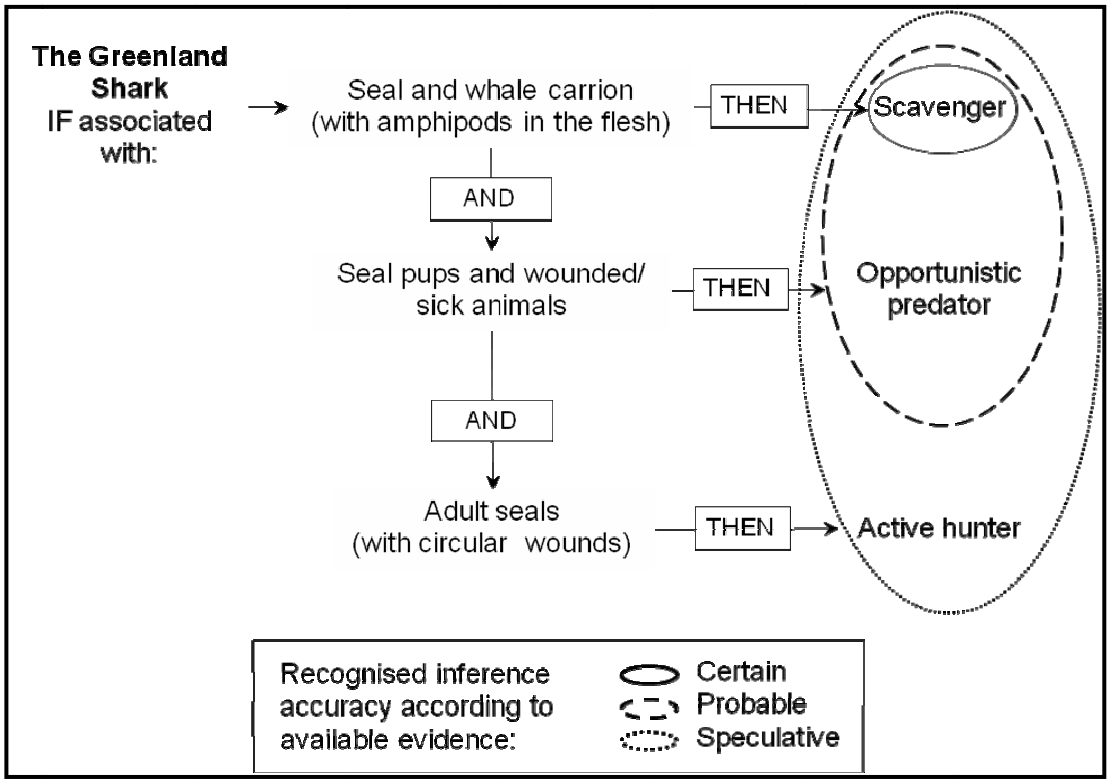

Figure 15. Relative understanding for the feeding behaviour of the Greenland shark

The fact of seeing sharks as strict scavengers is based on the observation of the stomach contents of this species. Old animal remains frequently associated with scavenging amphipods (*Anonyx nugax*), human waste (such as pop cans), and Greenland halibut ripped from the long-lines of this fishery are the items that hunters mentioned most frequently when referring to this topic. By putting these dietary items together it emerges the idea that shark-feeding habits are restricted to dead animals (plus a diverse human waste -item collection).

Leopa Akpalialuk shared his perspective on how sharks interact with the halibut fishery:

> "*They just go after whatever they smell. Any dead animal down there is going to give up a smell. For example, when I leave the halibut lines in the water for too long, the fish will die. The sharks will normally go after those dead fish on the line. Because of that, I think they go after dead things hunters shoot, like beluga that sank. They just go for things like that, dead animals in the water. I have come to the conclusion that sharks will eat absolutely anything, anything dead that touches their mouth they have to eat* " (LA1).

For Leopa, the fact that sharks go after halibut hooked in the long-lines works as an indication to infer that sharks' diet is restricted to carrion lying on the bottom of the sea. In this case, the general expression "*anything*" is expanded to "*anything dead lying at the bottom of the sea*" (LA1).

Knowledge acquired during the hunting practice is also used to give sense to the observations made about sharks. Bearded seals (*Erignathus barbatus*) are known to sink very quickly after being shot by hunters. Very often these seals are lost before retrieved, sinking to the bottom of the sea.

> *"Usually I have found bits of bearded seal in their [sharks'] stomachs. So, I concluded that sharks eat anything that sinks in the water. It's not surprising to see bearded seals in the guts of the shark because bearded seals sink a lot. They are easy to shoot but hard to get. They sink really fast, so it is common to see bearded seal pieces in their stomachs. Sharks eat just about anything dead. I have seen in their stomachs baby seal's skin, adult seal's skin, and beluga skin. Those are the main things I have seen in their stomachs"* (JA1).

On the other hand, sharks, further than being seen as scavengers, are also perceived as facultative predators. Baby ringed seal remains become the evidence that motivates local Inuit to reach this conclusion. A number of explanations for finding baby seals as part of sharks' diet are available. Although some of these explanations still perceive sharks as strict scavengers, some others serve to infer that sharks go after young seals. For those who perceive the first option, baby seals found inside shark stomachs can only be scavenged after being found dead on the seabed. Jaco Ishulutaq gave an example for that:

> "*During baby seal season, I know that baby seals sink. They don't really float, because they don't have much fat on them. When the mother is teaching them how to swim, baby seals follow their mother into the water. Sometimes they drown before finding their way back to the hole. They drown, they sink, and sharks go and get them. I don't think sharks actively hunt baby seals; they feed on sunken baby seals only*" (JI1).

Yet there were other explanations for the baby ringed seal situation. Some other people argued that sharks can perform a more active role while pursuing baby seals. This is the case of Manasie Maniapik (MM1), who considers that baby seals are supposed to be the only living sea mammal that sharks go after. The overall understanding of the Arctic sea seemed to be used to give sense to the baby ringed seal - shark interaction.

From their personal experience, some Pangnirtung Inuit put together series of facts to explain possible contexts in which sharks can take live baby ringed seals. Mother ringed seals are known to keep bleeding after giving birth. That the bloodstained waters attract sharks to the denning areas and that baby seals are not skilful swimmers were key points to explain why healthy looking baby seals have been found within shark stomachs.

> "*Mother seals give birth on the ice, in a den, out of the water. They don't give birth in the water. However, their blood may trickle down there. I see that how that can happen. You also see baby seals [coming from shark stomachs]. Sharks must catch them [baby seals] alive. They are quite capable of getting a live one*" (MN1).

Though mother seal blood leaking into the water is not considered in other scenarios in which sharks were thought to target swimming-by baby seals, the rest of the elements remain constant: "*I think sharks could go after baby seals. As mother seals teach them how to swim, baby seals will stay near the den. That is a good opportunity for the shark to get the youngling*" (MM1).

Discussions on whether sharks actively go after live beluga whale serve both to expand the ecological knowledge on this fish and to prove that hunters'

knowledge is ever adaptive, susceptible to be adjusted as new information is incorporated into their knowledge system. Every time I asked about the possibility of a shark going after a live beluga whale this was discarded. Along the summer field season, as I conducted interviews and interacted with the hunters in individual settings, they did not remember live beluga whales with signs of shark attack. When beluga whale remains are found within sharks stomachs, no matter how they look like, the only available explanation to see them is that these come from scavenged whales: *I can't see a shark attacking and getting a live beluga. If you find a beluga in a shark's stomach, it is probably from carrion dead beluga* (MM1).

However, during the focus group session carried out in summer 2007, I brought a set of photos taken of a pod of beluga whales locked in the Lancaster Sound land fast ice (North of Baffin Island) in April 1998 to the discussion (Malcolm Ramsay, University of Saskatchewan, personal archive). The belugas in these photos had signs of distress, such as polar bear-caused and round-shaped wounds. The last ones resembled the typical bites found in incidents where sharks were known to be involved. These pictures brought new information that was analysed and discussed against an existing knowledge framework, not only related to shark but also general marine ecological knowledge. As this discussion was carried out, the available images allowed revisiting this specific local knowledge subset related to marine ecology, this time with the Greenland shark in mind.

Some beluga and narwhal pods are known to remain locked in the Cumberland Sound land-fast ice. Although these animals have been seen in poor conditions, sometimes even with wounds caused by polar bears, hunters only considered sharks involved in this situation because of the information input brought by these images. As the wounds on the beluga skins were discussed, hunters agreed that these disc-shaped wounds on the whales were undoubtedly caused by sharks (Maniapik 2007, Papatsie 2007, Vevee 2007).

Baby seals and ice-locked beluga whales attacked alive are topics that allow visiting the local knowledge about sharks from other perspectives. Hunters who have observed indications of these phenomena perceive sharks' feeding behaviour within a wider angle. Further than visualising them as strict scavengers, sharks are also seen as facultative predators.

That sharks can hunt live preys actively was a possibility that some Pangnirtung Inuit perceived as remote. Some accounts referred to episodes in which seal adults were found with round-shaped wounds already healed. As in other situations, these wounds were implicitly compared with those observed in situations where sharks are known to be involved: "*I have hunted ringed seals on the ice. A couple of them had horrible wounds, perfectly round wounds on them*" (PV1). Within this context, the strategy that sharks may go after live adult ringed seals is related to the way in which ringed seals breathe through the land-fast ice:

> "*In winter, they [ringed seals] have small breathing holes. So the seal was probably at the breathing hole when the shark bit it. There, they are very vulnerable. Some of the agluit are that high (up to 0.6 metres). I have seen seals with just their snout out of the water. They take a breath and then go back down"* (PV1).

Along the field season carried out in summer 2007 only one hunter came across this sort of observation. Seeing this occurrence just twice in his life and having heard about a similar record just once, sharks behaving as active predators are considered incidental but possible.

Finally, there was another instance in which hunters recalled having seen sharks behaving as active predators. This happened in Ingalik, at the mouth of the Pangnirtung Fjord. In the spring of 2007, the late Joeelee Papatsie saw a shark going after a wooden toy boat that his grandson was playing with along the seashore. Yet this was the first time this behaviour was seen, it was explained within the existing framework in which sharks are understood as part of the Cumberland Sound Ecosystem. Joeelee recalled that, as they were butchering

seals onshore earlier that day, the bloodstained waters might have attracted this shark to swim around. The movement of the little boat could have enticed the shark up to surface and to follow the Inuk child too (JP1).

5.3. On the Pangnirtung Inuit Understandings of the Cumberland Sound Marine Food Web

The understanding of the Cumberland Sound food web also showed variations among the respondents involved in this research. One possible explanation for this situation is that marine food webs have not been conceptualised as such. However, as I asked, "*who eats who and who is not eaten by anybody else*", different relationships among the species of the local ecosystem were elicited. As these associations were navigated along with different hunters, the understanding of the local marine food web was overall similar but shows slight variations. An example that depicts how the interactions among Cumberland Sound species are not evenly understood is shown with the models assembled with two hunters: Lazarosie Ishulutaq and Manasie Maniapik(Figure 16).

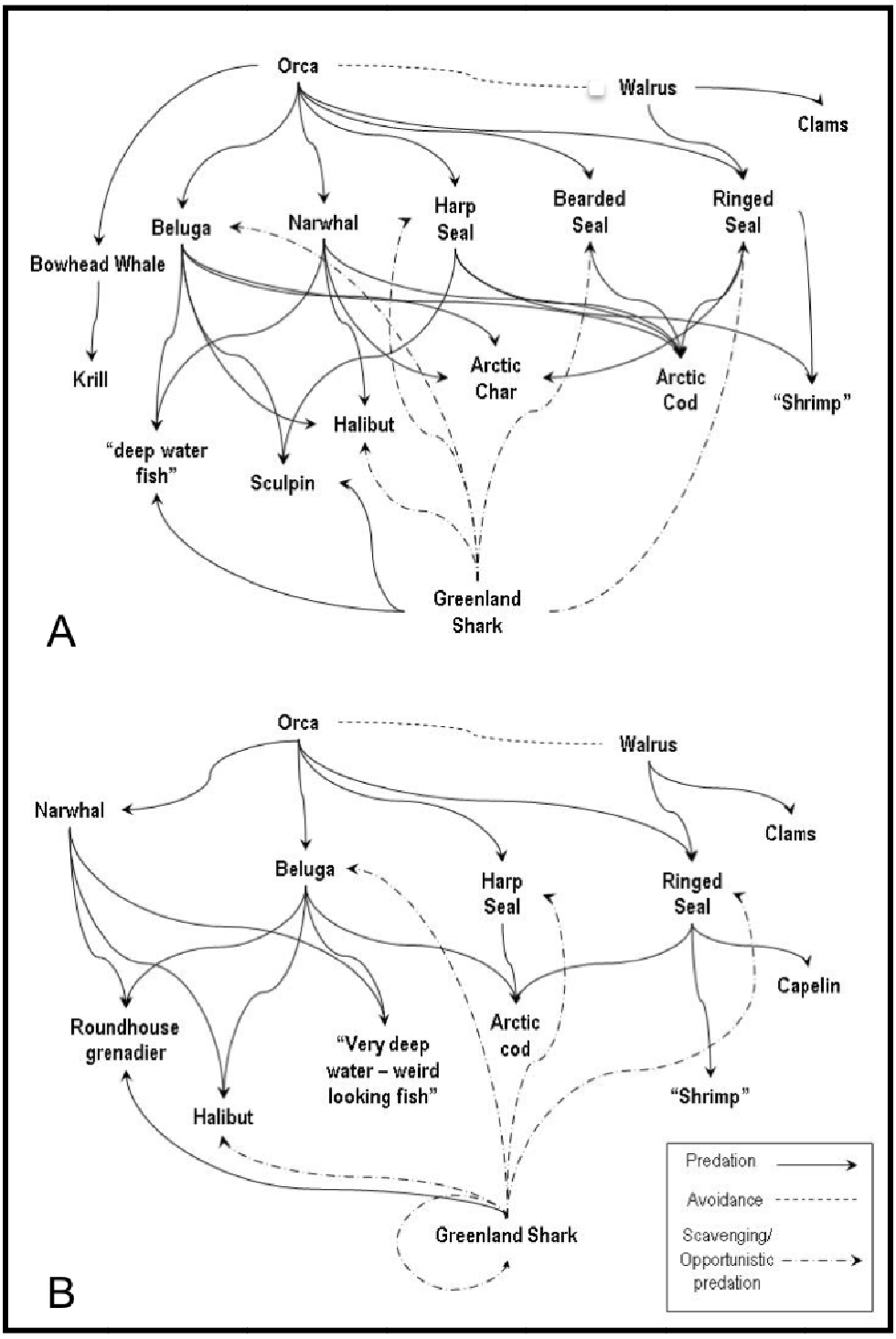

Figure 16. Marine food webs according to two Inuuk hunters

By comparing the presented models, it can be seen that the type of relationships perceived among animals and the levels of the food chain remain constant. On the other hand, the main difference found between each model is limited to the species enclosed by each. The exclusion of bowhead whales and its staple (as in krill) from the second food web is remarkable (Figure 16b). Whereas if the current low numbers of this species and the ban imposed to its hunting in Nunavut ever since 1979 are considered (Hay 2000), it makes sense that this animal is excluded from hunters' minds due to limited interaction. Furthermore, it is also important to put into context the way in which narwhals', belugas' and seals' feeding items are described. The Inuit are known to have non-generic names for animals (Chapter 4). Yet, this is not the case for some feeding items found in the stomachs of these same animals. People refer to groups of fish and crustacean species rather than individual species. In this way, designations such as "*very deep water – weird looking fish*" or "*shrimp-like creatures*"[19] are commonly used. These accounts suggest that there are no elaborated conceptualisations for these groups of species available in Pangnirtung.

In terms of what is found in these food web models, four easily distinguishable trophic levels are common among hunters' accounts. Orcas and walruses are seen as the equivalent to top predators, the rest of the marine mammals are grouped in a specific level that feeds on benthic and pelagic marine fish species plus some crustacean species. The last ones form another cluster of which hunters did not mention further relationships. Either seen as strict scavenger or scavenger and opportunistic predator, the Greenland shark is frequently located in a group that stands alone.

By evaluating different interpretations of the local marine food webs, I realise that this is not a topic explored in depth in Pangnirtung, but by using knowledge from the feeding habits of the animals they hunt and observe,

[19]. Although the Pangnirtung Inuit refer to all small crustaceans as *quinuk*, there are at least four shrimp species (Decapoda), plus amphipods, and copepods inhabiting the Cumberland Sound (Pangnirtung Hunters and Trappers Organization and Walsh 2003).

hunters are able to generate models to represent how energy flows across the ecosystem. Despite the discrepancies, models coming from different hunters can be compared among each other. There is a general idea of the Cumberland Sound food web. Though some components tend to differ, conceptualisations are similar in terms of both trophic level composition and existing relationships among animals.

The Pangnirtung Inuit have had limited contact with sea animals other than the mammals and the few fish species they use on a regular basis. The stomach contents of used marine mammals and fish species, as by-catch in the long-line fishery along with what is washed ashore are the venues where hunters recognised to have had contact with this unusual fauna. Though to encounter these animals is part of the daily life of active Pangnirtung hunters, it is personal preference of each Inuk to pay attention to what he/she encounters. Marine food web knowledge is not part of the knowledge that hunters regularly mobilise to survive on the land or sea. In this way, as I asked about the understanding of marine food webs; the responses I received were relative assumptions. Each food web representation is not only constrained by the inherent access to data sets, but also by the individual interest paid to the information when it is gathered and structured. The differences presented by each model suggest that information from the feeding behaviour of marine species is used to assemble food webs. The overall representations are informed by the personal experience on the land and the interpretation of passed on stories, but not by a collective construction that the Pangnirtung Inuit have access to.

In general, the knowledge the Inuit have about the environment can be seen as an intricate process in which observations and experiences gathered on the land contribute to the formation of a knowledge repository. At the same time, this knowledge repository influences the way in which information and stimuli are acquired from the environment. In regards to a possible collective understanding of the environment, the objects under inquiry are relative means

to understand how knowledge is constructed within the local knowledge system In regards to animals, those that are focus of use or inquiry seem to facilitate a continued information flux. As people interact with these animals, both in experiential and symbolic fashion, new information is being assembled and shared among community members. This process allows the knowledge system to adapt to new situations as novel events are integrated to the existing repositories of knowledge (Berkes 2008). On the other hand, those animals, which are neither active object of use nor of thought, generate a different process. Even though information about them is processed with the already existing body of knowledge, the lack of interaction between people and these animals does not make a constant sharing of information necessary. At the same time, this may inhibit the emergence of a collective understanding of these animals (Figure 17). The Greenland shark is perhaps a case that portrays the latter situation. The following discussion connects each process of thought occurring at each level in which the Pangnirtung Inuit have treated shark-related information. By doing this, sharks become a model useful to visit the processes in which ecological knowledge is produced in the context of what is not used.

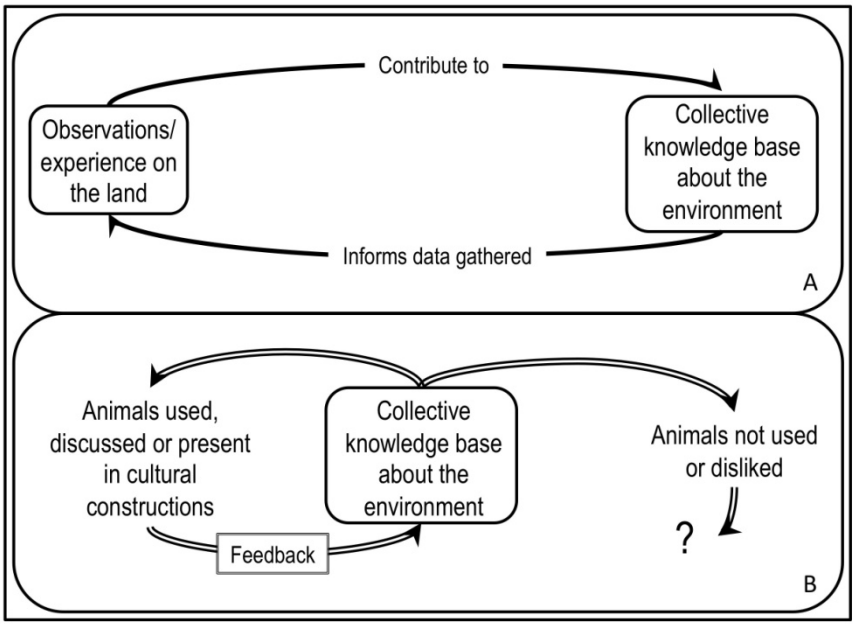

Figure 17. Information flow within the Pangnirtung Inuit Knowledge System

5.4. Discussion and Conclusions

The Pangnirtung Inuit ecological knowledge about the Greenland shark interweaves a complex array of predispositions, stored information and conscious guesswork. That this fish species is rarely seen, not liked and not used limits the access to experiential information and is a barrier to the emergence of cultural constructions about the shark. However, the Pangnirtung Inuit have a body of information about the Greenland shark that allows them to explain the role of this species in the Arctic ecosystem. Studying the Pangnirtung Inuit ecological knowledge of this elasmobranch is an opportunity to explore how new knowledge about particular components of nature is produced from existing scattered pieces of information.

Inuit ecological knowledge about the Greenland shark is based on a continuum of two main processes: observation/interaction and information processing. Information from the first process is the product of direct contact with sharks. The second process is the outcome of inference made when available information is located within the framework of an existing knowledge system, which is embedded within the Inuit worldview.

Approaching the first layer of knowledge provides the context to examine the variables that the Inuit consider when looking at sharks. The type of topics identified - as well as their content – is recurrent and homogenously understood by the research participants. To examine what the Inuit know about the Greenland shark in this context provides a framework to categorise the concepts acting as primers from where more ecological knowledge is produced. Topics like "*sharks do not die easy*" and "*sharks do not have real bones*" do not provide a context for thinking about the ecological understanding of sharks, at least not in terms of habitat and interactions with other species. Instead, these notions work to define the distinctiveness of the shark and the existing relationships between it and people in Pangnirtung. The Pangnirtung Inuit combine the variable "*sharks*

do not die easy" with other general features of "*what is considered edible*" to tacitly exclude this fish from the local diet (Chapter 4). Even though I am unable to develop these two topics in terms of their ecological significance, they allow me to understand the Greenland shark's quintessence for the Pangnirtung Inuit: this animal is strange and different from other animals the Pangnirtung Inuit interact with on a regular basis.

The mental processes related to the processing of variables included within the experiential knowledge layer reflect how particular shark-related traits entail related patterns of the Inuit world-view. This is an indicator of how the Pangnirtung Inuit understanding of sharks seems to obey holistic thinking, and not just correlating ideas following a linear rationale (Berkes and Kislalioglu 2008). Although the belief that sharks have poor eyesight and a strong sense of smell are mentioned, these features are not considered in isolation. Instead, these concepts about sharks' behaviour are complexly influenced by what the Inuit consider general principles that apply to all sea creatures. What is more, when stomach contents are considered, the linkages that emerge took on an unexpected direction. These are mostly centred on the appearance of the items found within stomach contents; this has to do with the stages of digestion observed rather than the species found. These observations enable people to elaborate direct links between stomach contents and sharks' metabolism and behaviour. Reasoning about shark ecology involves the context where sharks are observed plus a heuristic coordination of general information from the environment. Commonsense knowledge is made functional to provide an explanation for specific phenomena or entities related to this species (Berkes and Kislalioglu 2008).

There is a collective understanding among the Pangnirtung Inuit of the first layer of shark knowledge. However, as mental processes that imply bigger sets of variables were required to explain the Greenland shark, the explanations found showed variations among participant responses. These variations suggest

that there are some missing steps in the information flow related to the knowledge repository. These impede the construction of collective models for understanding sharks. An example of this can be seen in the topic: sharks' patterns of abundance. While there was agreement about the times when sharks are caught in the Cumberland Sound, the fact that there is more than one available explanation for why this is so, shows that different options are considered in coming to a common observation. Perhaps none of these are collectively discussed among people in Pangnirtung. Whether sharks have natural migration patterns, are permanent dwellers of the Cumberland Sound, or are lured to the area by fishermen are different explanations that, while not excluding each other, do entail putting across different elements depending on the contingent experience of each respondent.

Habitat use and feeding behaviour are traits not easy to be seen from the Greenland shark. However, by linking the bits and pieces of accessible information, a strategy was employed to bring together coherent ideas of sharks' features. The Pangnirtung Inuit consistently used heuristic rules to frame the inference being made about the ecology of the shark. This type of reasoning utilised the form IF –*observation/appreciation*- THEN – *a possible explanation for what is observed*-. Variables related to feeding behaviour were used to understand the shark's habitat use. Whether sharks are strict scavengers or scavengers and opportunistic predators is not clear. As such, these two ideas were used as relative points of view to make further conjectures about sharks' habitat. While perceiving sharks as strict scavengers allowed people to view the habitat of this species as being restricted to the sea bed, seeing sharks as opportunistic predators let people to deduce that these fish are more active and able to move freely up and down the water column.

Local understandings of the Greenland shark's feeding behaviour involve similar processes as the ones mentioned before. In this case, the available evidence determines the abstractions made about the ecological role of the shark.

The main body of evidence leads the Inuit to have a core idea of sharks' feeding behaviour. This is shared by most of Pangnirtung Inuit I talk to: this fish is a scavenger. However, the availability of other kinds of information allows some of the local hunters to adapt their views of the shark's diet within a wider spectrum. In this way, depending on the available evidence, sharks are seen as a probable opportunistic predator by some and even as an occasional active hunter by a small number of people.

The use of forms of thought fitting into fuzzy logic and heuristic reasoning are documented inside traditional and indigenous knowledge systems (Nazarea 1998, Mackinson 2000). Fuzzy logic thinking is consistent with how indigenous knowledge provides understandings of nature (Berkes and Kislalioglu Berkes 2008). Nonetheless, the pertinence of this approach is assessed only in regards to decision-making systems related to natural resources management such as fishing in the Northern Atlantic and the Caribbean (Mackinson 2000 and Grant and Berkes 2007), the evaluation of animal edibleness by Canadian Inuit (Berkes and others 2007) and the selection of potato varieties to be cropped according to changing environmental conditions in South America (Nazarea 1988). In this research, the Greenland shark becomes a model to evaluate how subsets of ecological knowledge are produced within what can be called an Inuit worldview. How sharks are thought of both as individual species and as part of the environment proves that fuzzy logic thinking, from the perspective of traditional and indigenous knowledge systems, is not only useful for understanding decision-making systems but also ecological knowledge production in abstract. Even though there are not large amounts of information available about the Greenland sharks, the Pangnirtung Inuit explain this animal by mobilising what they understand about the environment, in an ever-adaptive fashion. In general, fuzzy logic helps us to understand how traditional knowledge systems work in regards to ecological knowledge production beyond dealing with what is being used. Indeed, fuzzy logic facilitates understanding the

process in which ecological knowledge acquires its holistic sense providing insights about the organisation of general components of nature, including those by which there are neither experiential nor symbolic interactions.

Contrary to other knowledge subsets in which the Inuit are considered as experts (Laidler and Elee 2008, Laidler and Ikummaq 2008), the Greenland shark is something the Pangnirtung Inuit do not consider them specialists about. Most of what is known about this species can be considered as knowledge in formation, scattered observations that are not thought about in depth. The inquiries brought by the research team, consisting of natural and social scientists, are stimuli that entice the collaborators to think about sharks beyond what they are used to. Hunting and fishing journeys, individual interviews and the focus groups were forums where the existing knowledge about sharks was mobilised to elicit new relationships and more thoughtful reflections about the ecology of this species. These abstractions occurred because of the interactions triggered by scientists in the Inuit research participants, which allowed reorganising already existing information and eliciting new relationships coherent within bigger ecological processes.

Collective mental models are taken-for-granted ideas of the environment shared by members of a society. They provide a perspective for understanding the social-environmental contexts in which these societies (as in aboriginal groups) are embedded (Quinn and Holland 1984). Perceiving this strategy, traditional ecological knowledge TEK is structured by conveying an arrangement of observations and experience that contributes to form a collective knowledge base about the environment. Through the constant collection and verification of information the understanding of the environment adapts to new (or constantly changing) situations (Berkes and others 2007). That this knowledge is necessary for social-ecological continuity and facilitates continued pooling, creating the ever adapting and collective nature of knowledge systems (Van Londen 1996). It is not possible to affirm that there is a collective mental model explaining the

Greenland shark thoroughly in Pangnirtung. However, knowledge about this fish species seemed to be produced in reference to the collective knowledge framework existing in Pangnirtung.

The information treatment by what is neither of use nor of interest seemed to resemble how information is processed within the abovementioned scheme. However, the variety of answers available about the complex ecological relationships I found among respondents suggested that Greenland shark related information is also being unconsciously stored in people's individual memory, yet without incorporating it into the cognitive model (Van Londen 1996). Since the shark is not an object of individual thought, it is not an object of collective discussion either. Though the way of knowing and understanding the environment is collective (as in obeying to similar principles), the inference processes tend to remain individual, leading to personal understandings of complex phenomena which contrast with the interactions among member of a social group. Since pooling Greenland shark-related information is not necessary for the Pangnirtung Inuit, this may prevent the emergence of a collective understanding about it.

Chapter 6: Conclusions

The foregoing thesis has presented an analysis of the Pangnirtung Inuit knowledge about the Greenland shark. At the time I started this research, the broad purpose was to represent the ecological knowledge that Pangnirtung Inuit have about the Greenland shark, including the relationships this species have with Arctic marine mammals. However, as this research unfolded I realised that I had to take a step back and consider the vantage point that is needed to make sense of the body of knowledge I was trying to represent. The interaction of the Pangnirtung Inuit with sharks became a starting point to understand what people know about this fish. The Greenland shark is an animal that has not drawn the Pangnirtung Inuit's attention to a large extend, as it is unused, rarely seen, and not considered interesting by the Pangnirtung Inuit. Hence, there is a noticeable absence of stories as well as other indicators of symbolic interaction with this species. On the other hand, as I analysed what the Pangnirtung Inuit know about the Greenland shark, I found a venue where the processes of the Inuit ecological knowledge production could be explored. Thus, a number of interesting findings can be drawn from this research.

6.1. Key Findings

My first objective was to explore the way the Pangnirtung Inuit have been in contact with the Greenland shark along the Cumberland Sound in recent history.

I categorised these interactions as symbolic and experiential. The Pangnirtung Inuit have meagre symbolic interaction with the Greenland shark. This lack of interaction is reflected in the absence of this fish species' representations in the Pangnirtung Inuit lore and oral tradition. The Inuktituk name for the shark – *Iqalukjuak* is produced in relation to other species' names (as the Arctic char, *Iqaluk*) and exemplifies this situation. This way of naming sharks is different to the one used for naming regularly used and observed animals that depends on exalting unique animals' physical or behavioural characteristics. This naming denotes deep knowledge and extended interaction between people and animals. This has not been the case for sharks, not only in Pangnirtung but also in other places of the Eastern Arctic and Northern Atlantic including Western Greenland (Rink 1886, Randa 2002). On the other hand, the absence of stories or abstractions about sharks I found in Pangnirtung was remarkable. Beyond scattered and varied versions of the "*the old Inuk leg story*" micro-narrative, nobody involved in this study remembered old stories or myths involving sharks. By drawing upon these situations, I can conclude that the Greenland shark is neither a vehicle nor an object for symbolic thought among the Pangnirtung Inuit.

The analysis of the experiential interactions that the Pangnirtung Inuit have had with the Greenland shark provided an idea about the limited symbolic interactions found. Historically, this shark has not been commonly observed in the Cumberland Sound and the limited encounters with this fish have mainly had negative connotations. Sharks are known to scavenge dead animals, including those harvested and left soaking in the sea. Coupled with the fact that there is no apparent active use for sharks, people considered them as undesirable animals not worthy to make stories about.

The research process provided a venue where people could express their thoughts about the sharks. I found that the Pangnirtung Inuit understand sharks according to the logic of structural opposition being documented throughout the Canadian Arctic (Randa 1986, Van Londen 1996, Trott 2006). The use of

metaphors such as, "*sharks are the ravens of the sea*" (JP1) was an indicator of the use of this logic for constructing the understanding of the sharks through the comparison with better-known animals and ecological relationships. Thus, the metaphors "*sharks are ravens of the sea*" and "*orcas are the wolves of the sea*" conveyed the Inuit primary opposition (land/sea, Randa 1986) with the predator/scavenger, an opposition that, even though it has not been reported in the Inuit literature (Chris Trott, personal communication), it emerged over the course of this research. Because of their feeding strategies and behaviour, orcas and wolves were seen as equivalents in the sea and on the land respectively. Ravens and sharks were also brought together through their ecological similarities. In this way, heuristic opposition can be perceived as logic used by the Pangnirtung Inuit to cut across the inherent complexity of the Arctic environment into manageable prescriptions of it.

My second objective was to document and analyse the Pangnirtung Inuit ecological knowledge about the Greenland shark. My findings lead to two main bodies of knowledge: experiential and inferential. The experiential body of knowledge summarised the traits this Inuit community considers when looking at sharks. At the same time research participants showed agreement about this body of knowledge; the singular traits mentioned worked as standpoints to outline more detailed and complex knowledge about sharks, which is produced by means of inference.

The second or inferential body of knowledge about the Greenland shark allowed me to visit elaborated ideas and concepts about the Greenland shark and the processes in which these ideas emerge. At this level, I found how the Pangnirtung Inuit place the shark within their overall understanding of the sea and how the observation of evidence related to sharks is transformed into abstractions about habitat use, metabolism and feeding behaviour. Perhaps because of the restricted possibilities to observe sharks and their condition of unused species, information and reasoning about the ecology of these sharks is

not a matter of extensive collective discussion. Instead, I found that the Pangnirtung Inuit elaborate their own understandings of the shark at an individual level. By doing this, they seemed to use heuristic reasoning in which particular shark-related features are analysed using the general knowledge of the sea as knowledge repository or reference (Berkes and Berkes Kislalioglu 2008). Hence, the explanations I found made sense within the general understanding of the sea, but they were not evenly distributed among hunters.

An explicit collective mental model of the Pangnirtung Inuit knowledge about the Greenland shark was not possible to elucidate. However, schemes of reasoning emerged in which the Pangnirtung Inuit recurrently used their general environmental knowledge to explain particular facets of the shark. The appearance of stomach contents that leaded to inferences about sharks' metabolism and the effects of how surface pressure on the shark's body indicates the habitat use of this species were examples that showed a generative logic connecting ecological facts that goes beyond what is observed among the Pangnirtung Inuit.

I found that there is a collective mental model of the Cumberland Sound marine ecosystem in Pangnirtung, at least in terms of the way energy flows. This conclusion emerged from comparing the individual models of the marine food web made with each hunter. The models produced showed that, even though there was no agreement in terms of the species each contained, the relations existing among species and the levels found remained constant. By putting together the results coming from the knowledge production of sharks with the collective mental model of the food webs, it can be said that the Pangnirtung Inuit are holders not only of knowledge drawn upon their experience on the land, but also of a generative logic that allows them to explain what they do not know from thinking about what they understand in depth (Paolisso 2002, Berkes and Grant 2007).

6.2. General findings

This thesis is a small contribution to linking Inuit epistemology to the field of natural resource management. The initial purpose of this thesis moved away from documenting the local knowledge of the Greenland shark to visiting the processes and contexts in which knowledge about the environment is produced. This is the first time that a monograph about the Greenland shark has been written from Inuit perspectives. However, I do not consider that as the most outstanding feature of this document. From a personal perspective, this thesis comprises my first experience as social researcher working in a cross-cultural context. This document means for me the beginning of my journey as an academic in the field of ecological anthropology. But obtaining a master's degree through this research is not the only reason that makes researching the Inuit knowledge about the Greenland shark important. Approaching to the Inuit knowledge about the Greenland shark, an animal with neither cultural nor economic relevance, became a venue to explore the nuances by which knowledge is constructed and produced. This perspective moves away from perceiving knowledge as information to assume it as an ever-evolving construction. In the following paragraphs I expand on some of the major implications drawn upon this research.

An important angle to highlight this research is the fact that it is based on an animal with neither cultural relevance nor immediate economic interest to the Inuit. The shark is an animal that is considered a nuisance. As the fieldwork phase of this research unfolded, I realised that in order to represent what the Pangnirtung Inuit know about the Greenland shark, I had to go beyond the available information. Feelings, side thoughts, silences, and even participation reluctance in this research process became integral parts of my knowledge representation. I had to revise my research strategy to be able to carry out social research on a species unused and disliked by the Inuit, an atypical topic within

this Inuit knowledge research. The Greenland shark's condition of being disliked was a force that guided the paths this research undertook.

What are the implications of researching people's knowledge of a disliked animal? On one side it allowed people to think about what is beyond immediate economic importance. Even though sharks are not considered interesting in Pangnirtung, I was able to engage in conversations about these fish. This knowledge representation created a forum to talk, discuss and think about sharks. This process provided an opportunity to approach the knowledge that indigenous communities have as a dynamic entity; rather than something fixed in time. Although sharks are not part of people's everyday lives, discussions about this animal let memories of encounters and experiences surface, allowing us, as a team, to draw a representation of the Pangnirtung Inuit understanding of the Greenland shark.

To develop a sound knowledge representation about the Pangnirtung Inuit knowledge about the Greenland shark, I had to revise what I was initially aiming for. Since the original objectives of this research were centred on studying the understanding of the relationships among the Greenland shark and sea mammals, they both neglected the local perceptions of the shark itself. Moreover, among my original objectives, I assumed that the Pangnirtung Inuit will be able to link climate change, sharks and sea mammals. This objective had two factors that hindered its development. First, the main venue where the Pangnirtung Inuit interact with sharks has been the halibut fishery active in the season when land-fast ice is available, i.e. winter and spring. Members of the community were not able to contrast information with shark-related experiences during the open water season. Further, sharks were considered as habitat generalists, therefore climate change is not thought to influence them.

The Inuit are considered experts in regards to their knowledge about the Arctic environment. Their resource management systems and adaptive strategies to an unpredictable environment are examples in which this expertise has been

addressed (Berkes and Jolly 2001, Laidler 2007). However, by following the path of describing what is not used, this thesis showed that the Pangnirtung Inuit have the capability to produce coherent knowledge coming from isolated and scattered information. The case of the Pangnirtung Inuit knowledge about the Greenland shark depicts a situation in which Inuit wisdom is not restricted to what they use and need for survival; it goes beyond the objects that this indigenous community has symbolic interactions with, which are manifested in the local oral tradition. The members of this community proved to be able to integrate a limited data set with their known environment (namely their realm of expertise) to provide a holistic understanding of this shark.

To carry out ethnographic research about an animal neither used nor considered a vehicle of thought provided the opportunity to experience a case of knowledge co-production (Davidson-Hunt and O'Flaherty 2007). This research project facilitated intellectual processes among research participants and myself, as researcher, that collaboratively organised a body of knowledge that represents the understandings of a species not previously described and perhaps not even thought about in depth before. I consider this a valuable outcome from this research because it frames an approach that helps to develop knowledge representations considering the nuances and contexts where knowledge emerges. Knowledge co-production approaches can be seen as bridges for conveying the knowledge and ideas that different epistemic communities have about the environment in common arenas. This strategy moves from the notion of imposing realities that have validity only within particular epistemic communities (e.g., scientist and the Inuit) to negotiating validity through open discussion (Purdon 2003, Tyrrell 2007).

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Appendix 1. Research Licence

Nunavummi Qaujisaqtulirijikkut /Nunavut Research Institute
Box 1720, Iqaluit, NU XOA OHO phone: (867) 979-7279 fax: (867) 979-7109 email: jwilman@nac.nu.ca

Reviewer Recommendation Form: Social Science & Traditional Knowledge Research

Applicant Name:	**Carlos Julian Idrobo**
Project Name:	**Greenland Shark, marine ecosystems and Inuit Knowledge in Pangnirtung**

Review Panel Name:	**Nunavut Tunngavik Incorporated**		
Community:	**Pangnirtung**	**Region:**	South Baffin

Research Discipline: **Traditional Environmental Knowledge**

Panel Comments:

- We appreciate the participatory approach and the variety of research methods for this project
- We would encourage you to offer co-authorship to participants who offer their knowledge to the project and that co-ownership of the data is ensured by both the researcher and the research participants.
- Could you please explain what the "Inuit mental model" is, mentioned on page one of the summary?
- The research objectives should be flexible in order to reflect what Inuit would like to find out about Greenlandic sharks and marine ecosystems
- The application mentions that there is a risk of misrepresentation and misinterpretation of data. How will this risk be mitigated?
- It would be a nice gesture to Inuit and an acknowledgement of Inuit knowledge if the Inuktitut name for the Greenlandic shark (*iqalujuaq*) was used where ever possible in your writing. For example, it could be added in the parentheses along with the Latin species name when that is used.
- We recommend looking at Greenlandic uses of the Greenlandic shark (called *eqalussuaq*). Greenlanders have been involved in commercial fishing much longer than Canadian Inuit and have therefore had much more contact with the fish. In Greenlandic dog teaming communities, *eqalussuaq* is used as dog fodder. The meat is fermented in order to be edible.
- You mention community outcomes in the data section. Could you please clarify what these are? We hope this would mean that the results/conclusions will first be returned and proofed at the community level before the publications and conferences start rolling out.
- We encourage you to link up early on with the scientific component of the study, so that the knowledge coming out of the community could help inform and guide the overall work (and not just be a stand-alone social/anthropological project that gets added to the final product).
- Laakkuluk Williamson did receive notification about the project via email from Aaron Fisk concerning the project on May 14, 2007 (not 2004 as written in the application). The contact made was much appreciated and we hope that there will be further communication between NTI and the research team.

Requested Terms or Conditions:

- Please address the above comments and recommendations.

Recommend Approve ☒ Recommend Reject ☐	Signature Laakkuluk Williamson	Title: Senior Advisor of Social and Cultural Affairs	Date August 2, 2007

Appendix 2. Consent Forms

UNIVERSITY OF MANITOBA

303 – 70A Dysart Road
Winnipeg, Manitoba
Canada R3T 2N2
NRI General Office 204 474-9373
Centre for CBRM 204 474-9050
Fax: 204 261 0038

Research Project Title: Greenland Shark, Marine Ecosystems and Inuit Knowledge in Pangnirtung, Baffin Island (Canada)

Researcher(s): Carlos Julian Idrobo

Sponsor (if applicable): International Polar Year Program

This consent form, a copy of which will be left with you for your records and reference, is only part of the process of informed consent. It should give you the basic idea of what the research is about and what your participation will involve. If you would like more detail about something mentioned here, or information not included here, you should feel free to ask. Please take the time to read this carefully and to understand any accompanying information.

This project is the traditional knowledge component of the IPY project "Determining the diet of the Greenland shark in a changing Arctic" (Aaron Fisk, PI). The objectives of the main project are to determine the feeding ecology of the Greenland shark (*Somniosus microcephalus*), to assess and describe the changes in the role of this shark in arctic ecosystems, and to propose this species as a sentinel of ecosystem change.

This traditional knowledge component of the project aims to incorporate the experiences of elders and fishers/hunters related to the local ecosystem, to represent Inuit understandings of the relationships among Greenland sharks, marine mammals (in particular, ringed seals), and sea ice.

Data collection (interviews and participant observation) will be carried out during August and September 2007 and one month in early spring 2008 (March or April).

As participant, you will be in individual semi-structured and focus groups interviews. These are expected to take between 50 minutes to 1.5 hours.

All data and interpretation of results will be made available to the Nunavut Research Institute and the community of Pangnitrung via reports and posters in English and Inuktitut that will be available in the HTA once this research is finished.

In accordance with the IPY Data Policy, all data generated by this project will be made available to

the science community and interested parties once it has been verified and quality assurances have been met.

Financial compensation for your time is available in order to facilitate your participation in this study. As a participant you will get $100/interview as set by Pangnirtung Hamlet HTA.

Your signature on this form indicates that you have understood to your satisfaction the information regarding participation in the research project and agree to participate as a subject. In no way does this waive your legal rights nor release the researchers, sponsors, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time, and /or refrain from answering any questions you prefer to omit, without prejudice or consequence. Your continued participation should be as informed as your initial consent, so you should feel free to ask for clarification or new information throughout your participation.

Carlos Julian Idrobo, Graduate Student Researcher
1 (204) 474 9902
umidrobo@cc.umanitoba.ca

Fikret Berkes, Academic Advisor of Carlos Julian Idrobo
1 (204) 474 9050
berkes@cc.umanitoba.ca

Aaron Fisk, The Principal Investigator of the project
1 (519) 253 3000 X 4740
afisk@uwindsor.ca

This research has been approved by University of Manitoba Human Ethics Review Committee. If you have any concerns or complaints about this project you may contact any of the above-named persons or the Human Ethics Secretariat at 474-7122, or e-mail margaret_bowman@umanitoba.ca. A copy of this consent form has been given to you to keep for your records and reference.

_____

Participant's Signature Date

_____

Researcher and/or Delegate's Signature Date

Consent form

Greenland Shark, Marine Ecosystems and Inuit Knowledge in Pangnirtung

Description of project

This project is the traditional knowledge component of the IPY project "Feeding ecology of the Greenland shark under different ice conditions" (Aaron Fisk, PI).

The objectives of the main project are to determine the feeding ecology of the Greenland shark (*Somniosus microcephalus*), to assess and describe the changes in the role of this shark in Arctic ecosystems, and to propose this species as a sentinel of ecosystem change.

This traditional knowledge component of the project aims to incorporate the experiences of elders and fishers/hunters related to the local ecosystem, to represent Inuit understandings of the relationships among Greenland sharks, marine mammals (in particular, ringed seals), and sea ice.

"I have been fully informed of the objectives of the project being conducted. I understand these objectives and consent to being interviewed for the project. I understand that steps will be undertaken to ensure that this interview will remain confidential unless I consent to being identified. I also understand that, if I wish to withdraw from the study, I may do so without any repercussions."

Medium of Interview:

Face to face	☐
Audio taped	☐
Photograph	☐

Conditions for release of recorded information:

Printed name of participant:	Signature of participant
Witness signature	**Date of consent**