MARINE AFFAIRS TECHNICAL REPORT
14

Evolution of subsistence and commercial Inuit fisheries in the Territory of Nunavut, Canada

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TRANSATLANTIC RESEARCH SCHOOL

Evolution of subsistence and commercial Inuit fisheries in the Territory of Nunavut, Canada

Research and summation of landings, quotas, gear type, significance, use and status of hunted marine species

This Report should be cited as:

Hurtubise, J. (2016). Evolution of subsistence and commercial Inuit fisheries in the Territory of Nunavut, Canada: Research and summation of landings, quotas, gear type, significance, use and status of hunted marine species. (Marine Affairs Program Technical Report #14). Available at Marine Affairs Program: http://www.dal.ca/faculty/science/marine-affairs-program/research/research-news/map-technical-series-reports.html

This research was conducted under the supervision of Mirjam Held with the financial support of the Natural Science and Engineering Research Council (NSERC) CREATE Transatlantic Ocean System Science and Technology (TOSST) grant. We also acknowledge the support of the Social Science and Humanities Research Council (SSHRC) Partnership Grant #895-2011-1007.

Source for cover image Erin Keenan.

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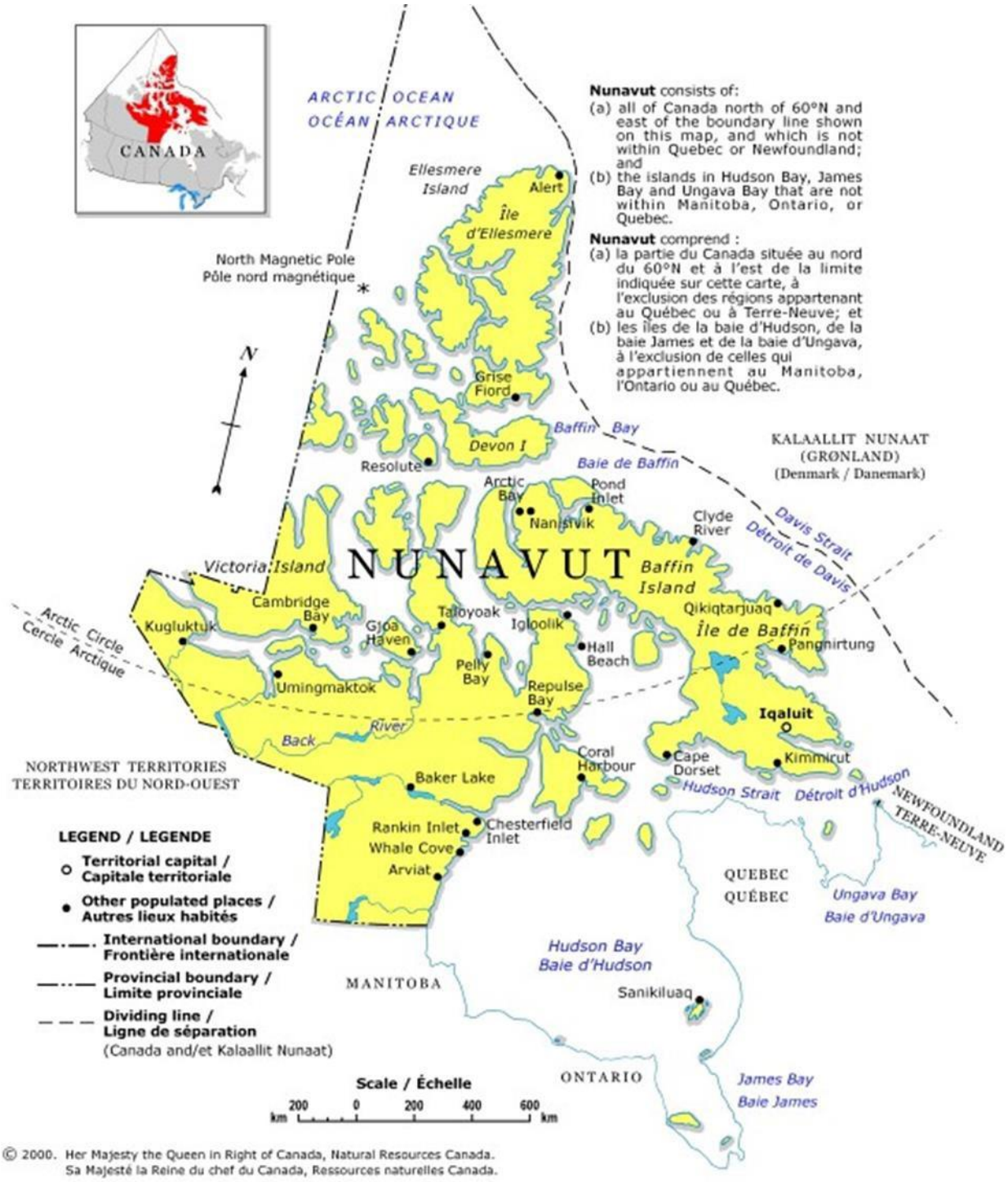

Figure 1. Twenty five hamlets in the Territory of Nunavut, Canada, were the subject of this fisheries research project (for entire list, see the Appendix). Map retrieved from http://www.resolutebay.com/map-of-nunavut.htm

SUMMARY

Eastern Canadian Arctic Inuit have hunted bowhead and beluga whales, seals, and narwhals for subsistence for over 4,000 years. They used tools and weapons made of stone, bone, driftwood, antler and ivory. Historical landing estimates remain incomplete but archaeological sites suggest hunting pressure for some species, such as the bowhead, varied in intensity over time depending on culture and climatic conditions. Today, the same species are hunted including several other fish and invertebrates species. Gear type has greatly changed over time as metal tools, wood, motors and explosives appeared in northern communities. This research aims to investigate the evolution of Nunavut fisheries, both subsistence and commercial, by assessing gear type, landings and quotas, species abundance, use, and conservation status. Gear type was found to be greatly influenced by climatic variations, and exchanging goods with European fur traders and American whalers. Size of harvest increased over time for most species, which could be the result of Inuit population growth or gear technology development. Following the introduction of harvest quotas during the 20th century, Inuit subsistence hunting was restricted in regard to seasonal harvest period, area, and species conservation status. The North Atlantic bowhead whale population was depleted during the whaling period (1860-1915), affecting successful Inuit harvests and leading the Department of Fisheries and Oceans (DFO) to establish strict quotas in an effort to replenish the Atlantic population; hunting only resumed in the mid-1990s. Commercial fisheries have vastly expanded in the last forty years for Greenland halibut, northern shrimp and striped shrimp, and more Inuit are employed each year in commercial fisheries plants. The Inuit show growing interest in participating in the formation of commercial Nunavut fisheries, requesting the development of arctic charr, invertebrates, Greenland halibut, and shrimp fisheries. They also wish to increase bowhead whale, narwhal, and beluga whale quotas in order to continue traditional practices. One challenge faced in managing Nunavut fisheries is combining the very different knowledge systems of Western science and Inuit culture (*Inuit Qaujimajatuqangit)*, which is required for co-management between the Inuit, the Nunavut Wildlife Management Board (NWMB) and DFO in accordance to the Land Claims Agreement signed in 1993. Collaboration between these three parties is necessary in further developing Arctic fisheries knowledge. Commercial fisheries, although typically not involving traditional Inuit hunting practices, can still be an important source for the local economy through employment at fisheries plants or data collection as fisheries observers. Research should continue regarding Arctic subsistence and commercial fisheries in order to better understand Artic species population trends and accurately record yearly harvest totals.

SECTION 1: INTRODUCTION

This project was created as a summer co-op workterm funded by the Transatlantic Ocean System Science and Technology (TOSST) Undergraduate Fellowship. Furthermore, the theme of the research is based on the importance of indigenous knowledge systems, their relationship with western knowledge systems and how the two can be utilized to manage Canadian fisheries; these are the goals of the Fish-WIKS project. This research was conducted as a literature review on subsistence and commercial fisheries in Nunavut to provide background information for my supervisor's, Mirjam Held, doctoral thesis. The report is divided into four other sections. Following this introduction, the second section of this report discusses the species hunted in Nunavut for both subsistence and commercial fisheries, their availability for hunting, use, the timeline in which they were hunted throughout history, their abundance and conservation status. Landings and quotas will then be covered in Section 3, to analyze the trends in fishing pressure and harvesting regulations. The fourth section will focus on the evolution of gear and the importance of culture, trade and technological development on hunting practices. Finally, the fifth section will assess the future of fisheries in the Territory of Nunavut, listing the desires of Inuit communities and the potential effects of climate change.

List of Abbreviations Used

ASTt	Artic Small Tool tradition
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DFO	Department of Fisheries and Oceans Canada
Fish-WIKS	Fisheries - Western and Indigenous Knowledge Systems
GN	Government of Nunavut
HTO	Hunters and Trappers Organization
IQ	*Inuit Qaujimajatuqangit*
IUCN	International Union for Conservation of Nature
IWC	International Whaling Commission
NAFO	Northwest Atlantic Fishing Organization
NLCA	Nunavut Land Claims Agreement
NWMB	Nunavut Wildlife Management Board
SARA	*Species at Risk Act*
SFA	Shrimp Fishing Area
TOSST	Transatlantic Ocean System Science and Technology research school

SECTION 2: SPECIES HUNTED IN NUNAVUT

Subsistence hunting is essential to the Inuit way of life in Nunavut. Historically, these Arctic people managed their hunting practices following the belief animals would present themselves for a successful hunt when the hunter was worthy (Freeman, 2005). Today, the majority of the Inuit fisheries consists of marine mammals, but it also includes fish and invertebrates, as shown in *Figure 2.* Eastern Canadian Arctic people did not always hunt such a wide variety of species, as will be explained in the second part of this section ("Timeline"). Little to none of the animal is wasted, as many of its parts are used for a multitude of functions, ranging from clothing to utensils, tools to modes of transportation, and food to weapons; the use of each animal will be discussed in part three of this section ("Animal use"). Availability is species specific and in some cases controlled by fisheries regulations. In part four, the current availability of each species will be discussed. The ability to hunt or fish a certain species is also dependent on its abundance, and in turn, its conservation status. Both will be presented in the fifth part of this section to recognize at-risk Arctic species and the effect of trade and harvest limitations of these species on the Inuit lifestyle.

Figure 2. Marine mammals, fish and invertebrates most commonly hunted today by the Inuit in Nunavut, Canada. (Picture references can be found in the reference list.)

2.1 Timeline

Eastern Canadian Arctic Inuit have been hunting a variety of marine animals for subsistence for over 4,000 years. Marine mammals have always been of utmost importance to these people, particularly bowhead and beluga whales, seals, and narwhals (Stern, 2010; DFO 2013c). Interestingly, the species hunted by the Arctic peoples varied according to culture, but were not unique to that culture; each culture adopted the previous culture's repertoire, then added new species as more efficient tools and techniques were created (*Fig. 3*). In this section, the species hunted by the Eastern Arctic Canadian people over time will be discussed.

Bowhead whales, walrus and ringed seals were some of the first species hunted by Arctic peoples, beginning during the Arctic Small Tool Tradition (ASTt), between 2200BC-500BC (*Fig. 3*) (Freeman, 1998). Arctic charr, polar bear, and other coastal animals were also hunted during this time (Anderson, 2004). Although remains of polar bears were found in sites linked to the ASTt and the ensuing culture, the Dorset (ca. 500BC-1500AD), the ASTt historically hunted very few polar bears, mainly due to the difficulty and danger in killing them (Anderson, 2004; Waters, Rose & Todd, 2009). The Dorset added beluga whales, narwhals and a variety of seals to their targeted species (Sutherland & McGhee, n.d.; Freeman, 1998).

Researchers and archaeologists have a general consensus that Eastern Arctic people have been hunting bowhead whales for approximately 4,000 years (Freeman, 1998; Stern, 2009). However, the intensity of hunting fluctuated over time: bowhead whale hunting is thought to have decreased, if not ceased altogether, during the Little Ice Age because expansive ice cover prevented the whales from migrating to inner bays (Stern, 2010). Despite the ice cover, the Thule managed to hunt bowhead whales that migrated into Davis Strait and Hudson Bay during this time (circa. 1300AD-1850AD) (Stern, 2010; Freeman, 1998). Bowhead hunting only became prevalent during the Thule period, when appropriate bowhead hunting tools were created (Anderson, 2004). The ASTt had very small tools which likely made bowhead whale hunting difficult and restricted to the floe edge. As the Thule developed more efficient tools (see Section 4, "Evolution of Gear") and the climate warmed, bowhead whale hunting peaked, dating approximately 1,000 years ago (Freeman, 1998). The Thule also caught ringed seals, bearded seals, harbour seals, walruses, belugas, and several species of fish and shellfish (McCartney, 1980; Anderson, 2004).

Today, the same marine mammals are hunted, including several other freshwater and marine fish, and invertebrates like mussels and clams (Priest & Usher, 2004). Certain species can solely be hunted by the Inuit: such is the case with the walrus, which was reserved for Inuit hunting as of

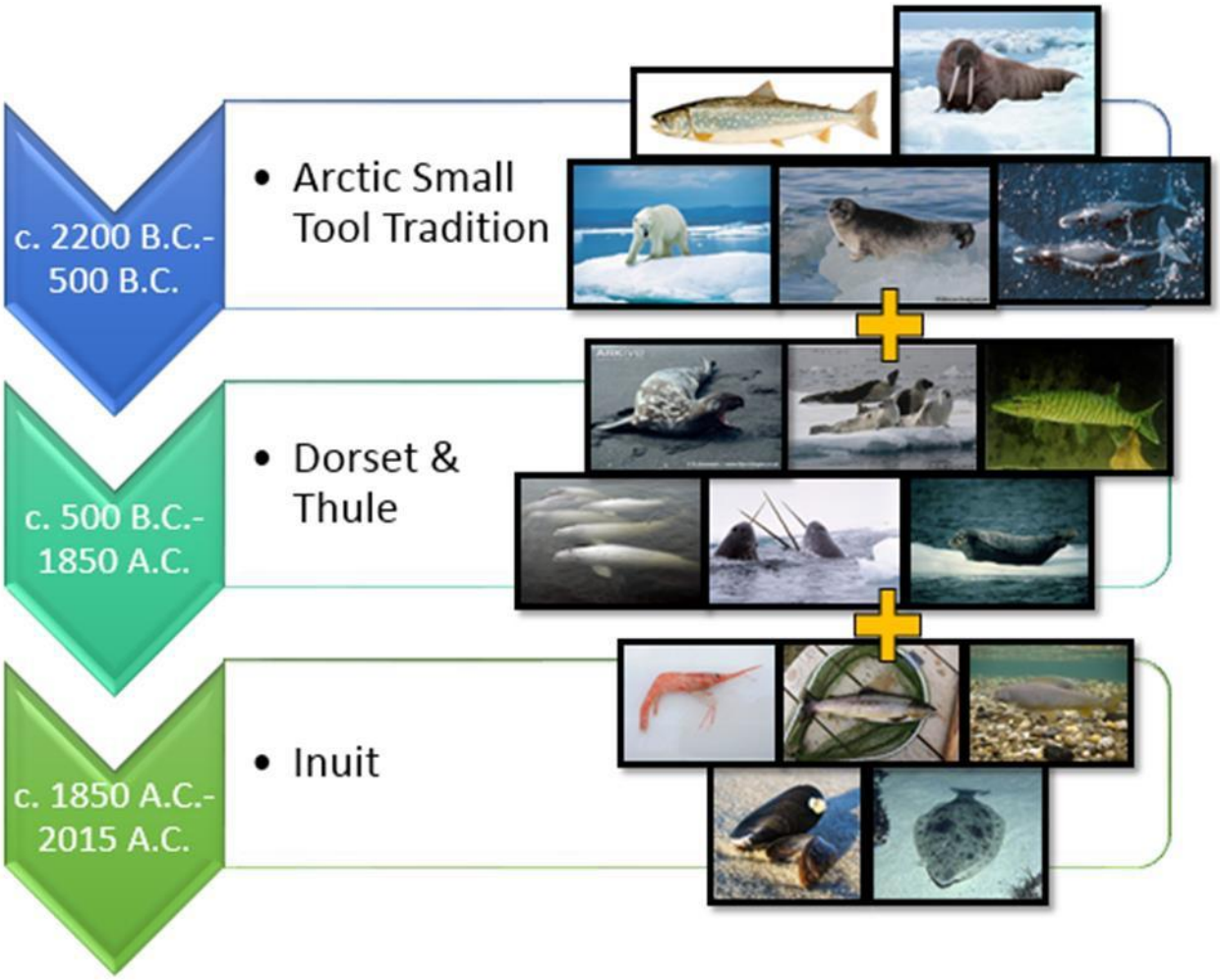

Figure 3. Relative sequence of species hunted in the Territory of Nunavut as subsistence or commercial fishing according to culture. Arctic peoples appear to have adopted the previous culture's hunting techniques and targeted species, adding new species as techniques and tools were improved or created. As of 2015, the Inuit hunt all species pictured, as well as several others such as birds and terrestrial mammals (see References for picture sources).

1928 (Stewart, Hidgon, & Reeves, 2014). Commercial fisheries are newer to emerge; Greenland halibut, Arctic charr, Northern shrimp and Striped shrimp fisheries have been expanding in Nunavut over the last 50-80 years (Stewart, Hidgon, & Reeves, 2014). Originating in the mid-1940s, anadromous Arctic charr fisheries are found in Cumberland Sound and Cambridge Bay (Nunavut's Truly Wild, n.d.). Northern and Striped pink shrimp fisheries began in the late 1970s and Greenland halibut fisheries launched in the 1980s (DFO 2010; Brubacher Development Strategies Inc., 2004; DFO 2008b). The potential expansion of these efforts as well as other future fisheries will be discussed in Section 5.

2.2 Significance and use

With a large repertoire of targeted species, the Eastern Arctic peoples developed ingenious ways to use the harvested animals to successfully survive in the Arctic. Each culture utilized animal parts in differing ways, but certain practices endured the test of time and are still used today. The information in the following paragraphs and in *Table 1* refer primarily to historical uses of the animals, before the development of plastics, mechanical devices and heating instruments.

As bowhead whale hunters and gatherers, the Thule utilized many parts of the whale for various functions. Bowhead whale bones dating back to 1300-1600 were used as sled runners for dogsleds (McCartney, 1980). They are also used for carvings (Hay *et al.* 2000). Around 1880, Boas (1964) observed the Inuit using whale bones as fishing lures during seal hunting and baleen for waterfowl traps. Bowhead whale bones are still desired for sled runners today, as they do not wear out as quickly as plastic (Hay, Aglukark, Igutsaq, Ikkidluak & Mike, 2000). Bowhead whale parts are currently used for many traditional practices, such as eating the meat and *maqtaq*, and using the bones to instruct younger generations by reconstructing the skeleton of the whale (Hay *et al.* 2000).

According to a Hudson Bay ecological review conducted by Stewart and Lockhart in 2005, harp seals, harbour seals and bearded seals were hunted for their meat to feed the communities and their dogs, while the skins were crafted into clothing, handicrafts, rope and boot soles. The hunters either kept the seals for personal use or sold them for profit (Stewart & Lockhart, 2005; Nature's Edge, n.d.). Bearded seal skins are known for making tough, flexible boot soles (Stewart & Lockhart, 2005).

The ringed seal remains an important component of Inuit culture in the twenty-first century. The meat and blubber are food for both humans and dogs (Furgal, Innes, & Kovacks, 2002). The hides are used to make rope, clothing (mitts and boots), handicraft items (rugs, gun cases and toys), transportation related products, and housing structures (Furgal, Innes & Kovacks, 2002). The foreflippers are sometimes used for children's games (Furgal, Innes & Kovacks, 2002). Previously, tent covers, floats, tarps and kayak skins were also made of ringed seal skins (Furgal, Innes & Kovacks, 2002; Boas, 1964). Today, however, they are typically produced using modern equipment because production time is shorter than that of traditional items. As for the walrus, it is harvested mainly for the tusks which are sold or carved as art pieces (DFO, 2005). Like the ringed seal, walrus meat is consumed by the Inuit or their dogs. The molluscs found in the walrus' intestines are considered a delicacy in certain communities (Stewart & Lockhart, 2005). Walrus hunting habits have changed over time, as indicated by Nunavummiut declaring they "knew" the walrus better when they were still using dog teams (Stewart & Lockhart, 2005).

Table 1. Subsistence hunted species by body part and its uses. Uses are mostly historical, but many are still practiced today.

Species	Body part & Use	Reference
Bowhead whale	• Bones: Sled runners (jawbone), ulu handle, scraper, house framework, carvings, harpoon head, lure, waterfowl traps, plates and bowls • Blubber: Food (for Inuit and dogs), oil, bandages, cough medicine • Ties (*qajaq*, dogsled, dog booties)	McCartney, 1980; Hay *et al.* 2000; Boas, 1964
Ringed seal	• Meat: Food (for Inuit and dogs) • Skin: Rope, clothing, rug, gun case, toy, float, tarp, *qajaq* skin, tent • Blubber: Oil, fuel • Bones and foreflipper: Children's toys	Fugal, Innes & Kovacs, 2002; Boas, 1964
Walrus	• Meat: Food (for Inuit and dogs) • Skin: Summer tent • Tusk: Ivory carvings, harpoon heads, toggles, handles, shoe sledges, protective edge on *qajaq* paddles • Intestine contents (i.e. molluscs): Food (considered a delicacy)	COSEWIC, 2006; Stewart & Lockhart, 2005; Boas 1964
Harp seal	• Meat: Food (for Inuit and dogs) • Skin: Clothing, handicrafts	Stewart & Lockhart, 2005
Harbour seal	• Skin: Decorative boots and clothing • Meat, blubber: Food (for Inuit and dogs)	Stewart & Lockhart, 2005
Bearded seal	• Meat: Food (for Inuit and dogs) • Skin: Rope (flexible, tough), boot soles, drinking cups, boat covers	Stewart & Lockhart, 2005; Boas, 1964
Narwhal	• *Maqtaq* (blubber and skin): Food (for Inuit) • Meat: Food (for dogs) • Ivory: Harpoon heads, carvings, lures, snow knives, snow goggles	Dale, 2009; Stewart & Lockhart, 2005; Boas, 1964
Beluga whale	• Blubber: Oil • *Maqtaq*: Food (for Inuit) • Skin: Boots, tents • Meat: Food (for Inuit and dogs)	Stewart & Lockhart, 2005
Polar bear	• Hide: Clothing • Bones: Knife	Hay *et al.*, 2000

Many communities no longer use narwhal parts traditionally (Dale, 2009). In a 2012 documentary titled "Vanishing Point", distant Inuit relatives from southern Baffin Island and northern Greenland discover the difference in each other's use of narwhal meat (Smith & Szucs, 2012). The Baffin Inuit, who abandoned dogsleds for snowmobiles in the 1960s, leave the meat on the ice for other animals to eat; in comparison, the Greenlandic Inuit continue to eat the meat of the narwhal, as marine mammals are often scarce and difficult to hunt in this region on the world, and thus fully consumed (Smith & Szucs, 2012). In the twentieth century, oil lamps were replaced with lanterns and lights, and the use of snowmobiles means Inuit no longer need to feed narwhal meat to their dog teams (Dale, 2009). In Arctic Bay, current uses of the narwhal only involve the consumption of *maqtaq* and the use of the tusk; the rest of the carcass is often left on the ice (Dale, 2009). The polar bear is only hunted for its pelt, because consuming its meat can be lethal for humans (Stewart & Lockhart, 2005). Without proper cooking, the meat can lead to contracting trichinellosis and the liver can be toxic to people (Stewart & Lockhart, 2005). In summary, the use of each species changed over time according to the culture and tools (which will be discussed further in Section 4: Evolution of Gear).

2.3 Abundance and status

Species worldwide are assessed for population trends and conservation status. Multiple organizations such as the International Union for the Conservation of Nature (IUCN) and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) list species that are in some danger of disappearance (COSEWIC, 2009). The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) regulates the trade of endangered animals and plants in such a way that their survival is not threatened (CITES, n.d.). In this section, the most current population abundance (worldwide and in Nunavut) of each species is presented in *Table 2*. In *Table 3*, species listed under the IUCN, COSEWIC and CITES as well as their status are shown. For simplicity, abundance for the fish species were not listed because of the difficulty of estimation.

According to Appendix II of CITES, trade of the animals listed therein is regulated or restricted (CITES, 2013). Polar bear pelts, narwhal tusks, and any beluga parts are all listed under Appendix II which restricts their export from Canada (CITES, 2013; Nunami Stantec, 2012). Management of the polar bear is complicated because management stocks overlap multiple Canadian territories and provinces. This species is listed under Appendix II to restrict trade of pelts. A complete ban on international trade of polar bear pelts and parts was proposed by the US in 2013, which would have significantly affected Nunavut Inuit communities (ITK, 2013). The proposal was rejected and trade continues to be legal but regulated. The bowhead whale, listed under Appendix I, cannot be traded under any circumstances (Stewart & Lockhart, 2005).

Table 2. Species abundance (and year of assessment) for marine animals in the Territory of Nunavut according to location, population or National Atlantic Fisheries Organization (NAFO) fishing zone. Abundance is presented as number of animals, unless specifically listed otherwise as weight.

Species	Location	Abundance	Year	Source
Bearded seal	Worldwide Canada	N/A Minimum 190 000	2008 2008	DFO (2015b); Nunami Stantec (2012)
Beluga whale	Worldwide Western Hudson Bay Eastern High Arctic-Baffin Bay Cumberland Sound Eastern Beaufort Sea Western Greenland	150,000 50,000 21,213 1,527 39,258 7,941	2008 2004 2002 2002 1996 2002	Nunami Stantec (2012); Jefferson *et al.* (2012)
Bowhead whale	Eastern Artic	14,400	2002	DFO (2008a)
Greenland Halibut	NAFO 0A (North of 72°) NAFO 0A (South of 72°) NAFO 0B	86,200 (tonnes) 45,877 (tonnes) 68,917 (tonnes)/85.9million fish	2004 2004 2001	DFO (2008b)
Harbour seal	Worldwide Atlantic Canada	5-6 million 20,000-30,000	2015	DFO (2015b)
Harp seal	Northwest Atlantic	7.4 million (no NU estimate)	2015	DFO (2015b); Nunami Stantec (2012)
Hooded seal	Canada	592,000	2005	DFO (2015b), Kovacs (2008)
Narwhal	Worldwide Canadian Arctic Eastern Baffin Island Northern Hudson Bay	80,000 70,000 1,000 3,500	2008 2012 2005 2004	Nunami Stantec (2012); Jefferson *et al.* (2008)
Polar bear	Worldwide Canada Baffin Bay Davis Straight West Hudson Bay Foxe Basin Gulf of Boothia M'Clintock Channel Lancaster Sound Kane Basin Norwegian Bay Viscount Melville Northern Beaufort Southern Beaufort Sea	20,000-50,000 1,000 1,546 2,251 935 2,300 1,528 284 2,541 164 190 215 1,200 1,526	2008 2014 1997 2007 2004 2009 2000 2000 1998 1997 1998 1992 2006 2008	Schliebe *et al.* (2008); GN (2014); Nunami Stantec (2012)
Ringed seal	Worldwide Canadian Arctic	1.2 million 1 million	2015 2006	DFO (2015b); Nunami Stantec (2012)
Walrus	Atlantic Penny Strait-Lancaster Sound N Foxe Basin and Central Foxe Basin Foxe Basin West Jones Sound Southeastern Baffin Island Western Greenland	18,000-20,000 557 10,379-13,452 8,000 404 1,500 2,978	2008 2009 2011 2012 2008 2008 2008	DFO (2013c); Stewart, Hamilton, & Dunn (2013); DFO (2014e)

Upon researching the statuses of the species listed in *Table 3*, the incomplete state of many species' population trends became apparent, as well as conservation status. For example, in the case of the harbour seal, its global population is estimated at over 5 million individuals (DFO, 2015); however, the Canadian Arctic population size remains unknown. The closest abundance estimate to Nunavut is that of Atlantic Canada (*Table 2*). IUCN states the harbour seal's status as Least Concern as of 2008 (*Table 3*) because the global population was very large at that time and was unchanging or growing. Nevertheless, species should be assessed on a smaller scale because specific areas could be experiencing different trends than observed globally (Thompson & Härkönen, 2008). Harbour seal populations off Nunavut's coasts could be undergoing an isolated population decrease, but without specific assessment the populations' state remains uncertain (Thompson & Härkönen, 2008). Bearded, harp and ringed seals are also listed as Least Concern under IUCN, due to large population sizes, no visible declines in abundance, and wide distribution (Kovacs & Lowry, 2008; Kovacs, 2015; Kovacs, Lowry, & Härkönen, 2008). The walrus is listed as Data Deficient, as little recent data has been collected on any of the populations (*Table 3;* Lowry, Kovacs, & Burkanov, 2008). Having little to no population trend information on this species could be detrimental to its survival in Nunavut and the continued reliance of the Inuit on the walrus. Further research on these species' population trends in Nunavut are essential in properly assessing the impact of subsistence hunting.

2.4 Availability

Successful hunting in Nunavut depends on many factors, most of them related to the seasons. Length of day, weather conditions, temperature, ice cover, and animal migratory patterns are all examples of factors which may influence a prosperous hunt. The hunting period of a Nunavut species is most often correlated to its availability. In the following section, the availability of the primary Arctic species mentioned above will be discussed. This is shown in *Figure 4*, which presents the yearly availability of each species by a line overlapping a month's section.

Some species are mainly hunted during the winter months. This is the case for the polar bear, whose pelt is the thickest during colder months (Stewart & Lockhart, 2005). Polar bear hunting is regulated by populations/management areas such as Foxe Basin, Western Hudson Bay and Southern Hudson Bay. Within Nunavut, there are roughly 10 management boundaries for Canadian polar bear populations and hunting regulations vary by area. Arctic and Greenland cod are also harvested during the winter, the ice cover allowing Inuit hunters to fish it through the ice. Arctic cod is often found at ice cracks or at the edges. Greenland cod moves inshore during the winter, making it available for Inuit fishers.

Table 3. Species conservation status according to the International Union on the Conservation of Nature (IUCN), the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), including the year of assessment.

Species	IUCN	COSEWIC	CITES	Source
Bearded seal	Least Concern (2008)	Data Deficient (2007)	-	DFO, 2015b; Nunami Stantec, 2012; Kovacs & Lowry, 2008
Beluga	Near Threatened (2008)	•West Hudson Bay stock: Special concern (2004) •Cumberland Sound: Special Concern (2002) •Eastern High Arctic/ Baffin Bay: Threatened (2004) •East Beaufort Sea: Endangered (1996)	Appendix II*	Nunami Stantec, 2012; Jefferson *et al.*, 2012; COSEWIC, 2004a; CITES, 2013
Bowhead	Least Concern (2012)	Special Concern (2009)	Appendix I*	Nunami Stantec, 2012; Reilly *et al.*, 2012; COSEWIC, 2009; CITES, 2013
Harbour seal	Least Concern (2008)	Not At Risk (2007)	-	DFO, 2015b; Thompson & Härkönen, 2008
Harp Seal	Least Concern (20)15	On the mid-priority candidate list (2011)	-	Nunami Stantec, 2012; Kovacs, 2015
Hooded seal	Vulnerable (2008)	Not At Risk (1986)	-	DFO, 2015b; Kovacs, 2008
Narwhal	Near Threatened (2008)	Special Concern (2004)	Appendix II (1979)	Nunami Stantec, 2012; COSEWIC, 2004b
Polar bear	Vulnerable (2006)	Special Concern (2008)	Appendix II*	Schliebe, Wiig, Derocher & Lunn, 2008; GN, 2014; Nunami Stantec, 2012
Ringed Seal	Least Concern (2008)	Not At Risk (1989)	-	DFO, 2015b; Nunami Stantec, 2012; Kovacs, Lowry, & Härkönen, 2008
Walrus	Data Deficient (2008)	Special Concern (2006)	Appendix III*	DFO, 2013; Lowry, Kovacs, & Burkanov, 2008; CITES, 2013

*Year of status declaration is unclear

Other species are hunted during the summer, when they migrate into Arctic waters. In the case of the harp and hooded seal, who migrate into Arctic waters during the summer after spending the winter in the Grand Banks area, they are available from late spring to early fall (Templeman, 2010; Nature's edge, n.d.). The narwhal and the bowhead whale are harvested in July and August, when the animals are available in open water or from the floe edge (Stewart & Lockhart, 2005; DFO, 2008a). Arctic charr is another species harvested during the summer, its availability being year round (Stewart & Lockhart, 2005).

Whereas the above listed species' hunting periods are influenced by seasonal conditions, north- ern shrimp and Greenland halibut harvesting is regulated by the Northwest Atlantic Fishing

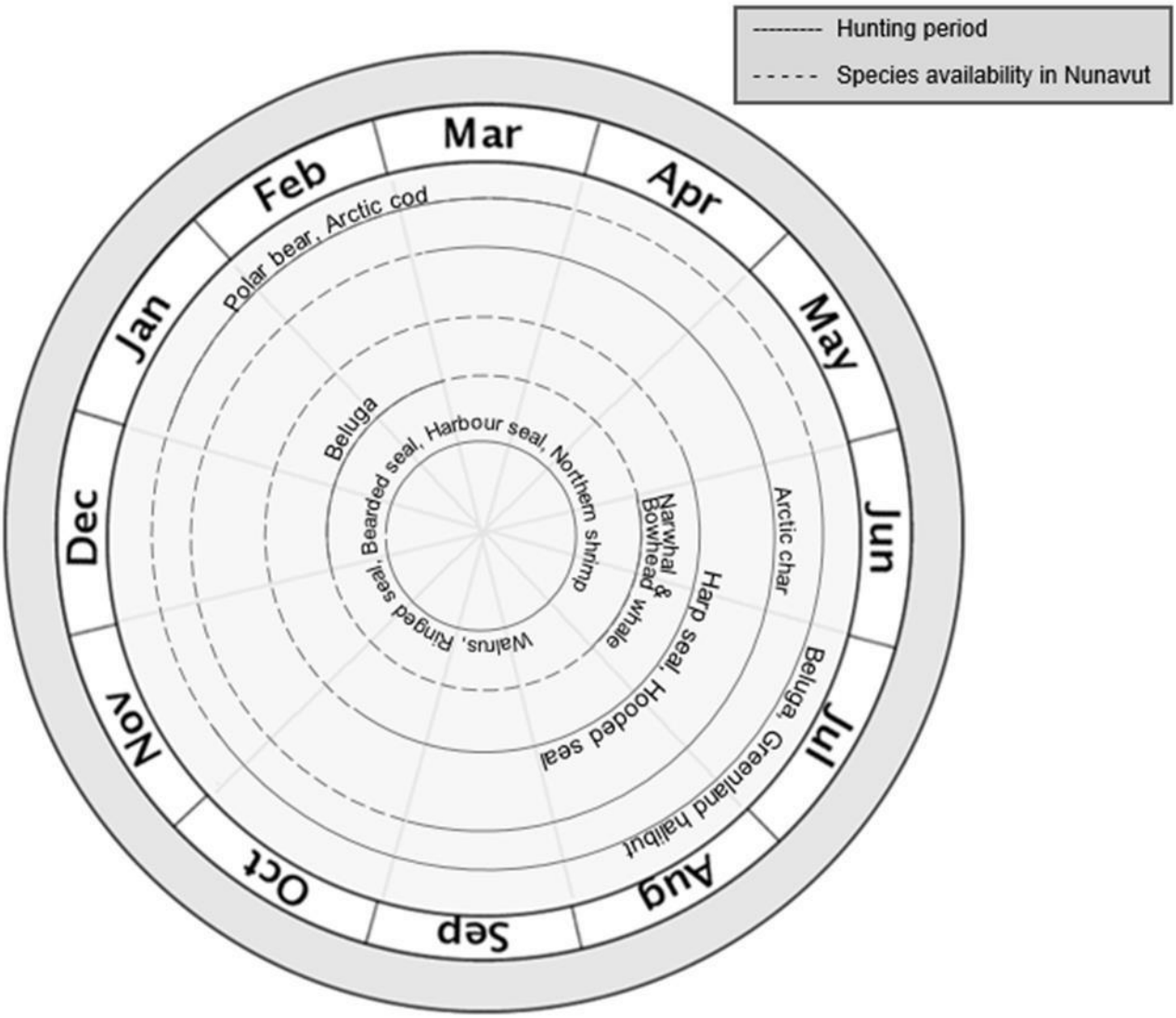

Figure 4. Species availability and hunting period of Nunavut species for Inuit subsistence hunting and commercial harvests.

Organisation (NAFO). This is mainly a result of its commercial founding. Both species are available all year (Fig. 4); however, hunting seasons vary according to Division and Shrimp Fishing Area (SFA) (DFO, 2014c; DFO, 2014c; DFO, 2010). Northern shrimp can be harvested year round in SFA 0 (*Fig. 21*) and 1, and from April 1 to March 31 in SFA 2 and 3 (DFO, 2010). Striped shrimp was not listed in *Figure 4* because it currently remains primarily as an exploratory fishery. The turbot fishery also operates year-round, but ice hunting periods can be cut short due to unsafe ice conditions (DFO, 2014c). The turbot fishing period begins in June and ends in November for NAFO Division 0A, and the offshore fishery in 0B starts in May and also ends in

November.

Most Arctic pinniped species can be hunted year round because they do not migrate out of the area (Ross, 1975). Nevertheless, hunters have determined ideal hunting periods for each species, usually in relation to environmental and climatic conditions. The walrus can be hunted year round in Coral Harbour, but the largest harvests are usually taken when the water is ice-free, allowing for hunting from boats (Stewart & Lockhart, 2005). The open water season for Naujaat is during September and October, and July through September for the Coral Harbour-Coats Island area (Stewart & Lockhart, 2005). The bearded seal is also available year round, but it is not hunted between November and March when the animals haul out in herds (Stewart & Lockhart, 2005). The ringed and harbour seal are predominantly hunted from June through October (Stewart & Lockhart, 2005). Hunting style will change according to the season for most pinniped species, especially the ringed seal: hunters can catch the ringed seal at its breathing hole in the winter, in the dens with a rifle in spring, and by kayak and harpoon in the summer (Ross, 1975). Finally, the beluga whale has a dual hunting period from Dec-Jan and June-Nov (Stewart & Lockhart, 2005). The whales are hunted by boat during the open-water season or at the floe edge (Freeman, 1998). The Marine Mammal Protection Regulations of the *Fisheries Act* prevents hunters from catching calves and female-calf pairs (Stewart & Lockhart, 2005). Belugas also cannot be killed for scientific purposes, but samples can be taken from subsistence kills once a scientific permit is obtained (Stewart & Lockhart, 2005).

SECTION 3: LANDINGS AND QUOTAS

This section compiles all available yearly harvests and quotas for the 20th and 21st centuries for marine mammals, fish and invertebrate species hunted in Nunavut. For most species, harvest levels have been divided by Nunavut's three regions: Qikiqtaaluk, Kitikmeot and Kivalliq (see the Appendices for the list of hamlets in each region). When there is no sufficient data to sort by region, it is presented according to community. Species hunted in commercial fisheries are organized by Northwest Atlantic Fishing Organization (NAFO) Divisions or by Shrimp Fishing Area (SFA). The goal of this section is to analyze trends in landings and quotas and determine a reason for these trends, if possible. Values are based on the database tabulating all harvest and quota values found during the research term.

3.1. Marine Mammals

3.1.1 Beluga whale (*Delphinapterus leucas*)

Landings data for the beluga whale cover the second half of the 20th century for the regions of Qikiqtaaluk and Kivalliq, whereas little data was found for Kitikmeot (*Figure 5*). Kitikmeot landings were much lower than the ones in the other two regions (Strong, 1989; Priest & Usher, 2004; Stewart & Lockhart, 2005; Hoover *et al.*, 2013). A co-management plan was accepted by the Minister of Fisheries in 1994 followed by the NWMB in 1995 for the communities of Iqaluit, Kimmirut and Pangnirtung following disagreement over Southeast Baffin Beluga management with the Government of Canada (Freeman, 1998; Natcher, 2001). Certain events may have affected subsistence harvesting of the Cumberland Sound population in 1996: first, the disappearance of the beluga leader, named "Luuq", and second, a scientific study which illegally netted 120 whales, causing the beluga whales to be more difficult to hunt as they dispersed (Freeman, 1998).

In 1990, DFO set new quotas for the southeastern Baffin region, in the Pangnirtung, Iqaluit and Kimmirut communities (Freeman, 1998). Researchers believed the Inuit were unsustainably hunting beluga whales from the severely depleted local beluga whale population, and worried the population would go extinct in the near future (Freeman, 1998). The original quota was a complete restriction on beluga whale hunting for a period of 10 years; evidently, the communities were highly opposed to this quota, stating the restriction of beluga whale hunting would prevent them from passing on traditional knowledge and was a violation of Inuit rights (Freeman, 1998). The Minister of Fisheries proposed a

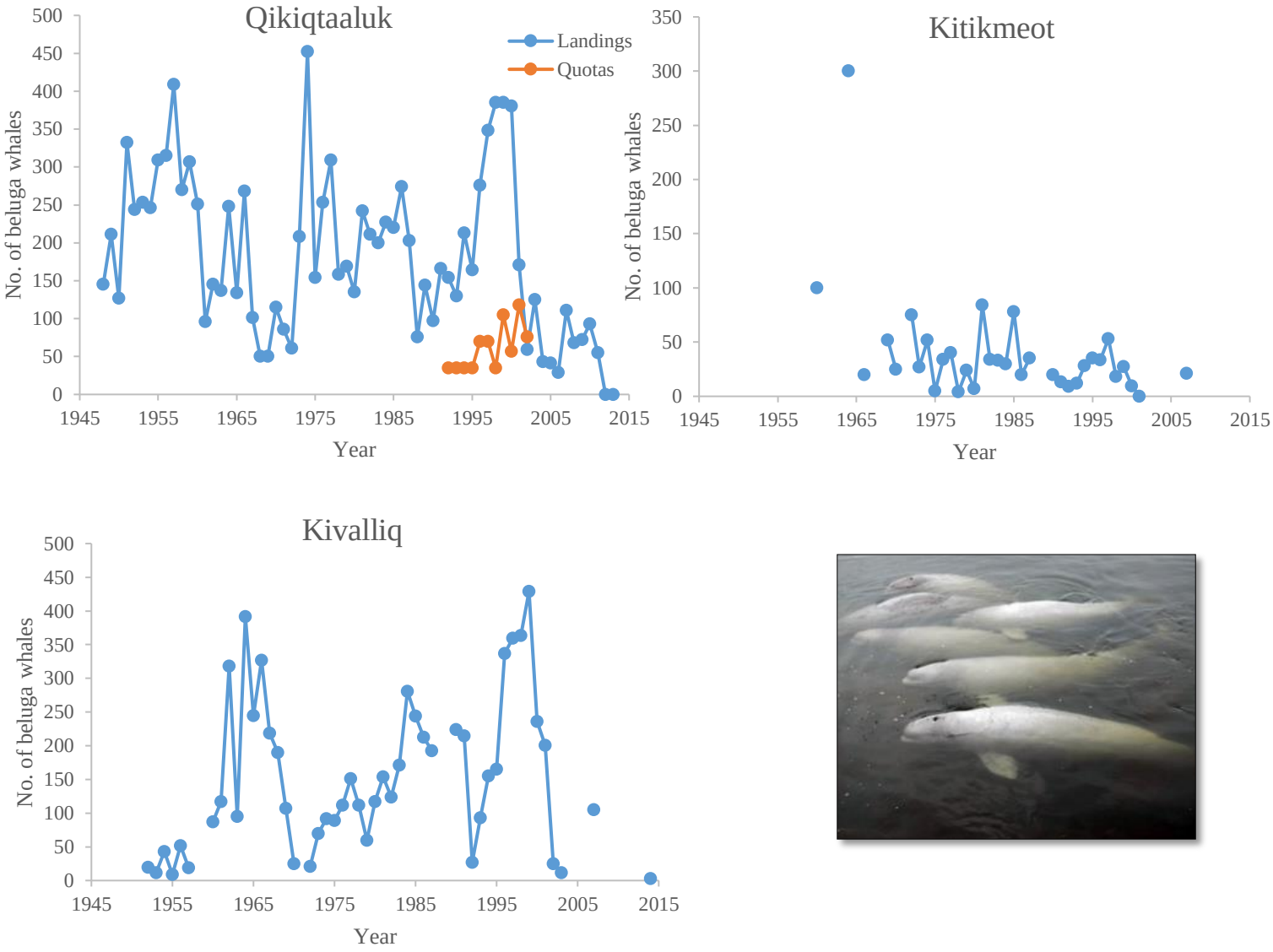

Figure 5. Beluga whale subsistence hunting landings and quotas in the Territory of Nunavut, by region. Landings in Qikiqtaaluk include the communities of AB, CD, CR, Creswell Bay, CS, eastern Hudson Bay, GF, HaB, Ig, Iq, Ki, Pg, PI, Qk, Res, and Sa; Kitikmeot landings are in Kglu, Kga, Na, and Ta; Kivalliq landings are for Ar, BL, CI, CoH, RI and WC (See Appendices for list of community abbreviations).

revised quota of 5 beluga whales per year for each community (Freeman, 1998). The final quota was increased to 35 belugas per year per community, on the condition hunters worked with federal government scientists in conducting surveys and composing a suitable co-management plan. The

quota continued to increase in the following years (Freeman, 1998).

Mean annual harvest of beluga whales from 1996-2001 was estimated ranging between 669 and 1,339 whales (Priest & Usher, 2004; Nunami Stantec, 2012). The dataset for the beluga whale clearly represents the difficulty in accurately reporting landings in Nunavut: in 1997, Priest and Usher (2004) recorded 376 beluga whales were landed in Arviat, according to interviews with hunters in the community; in comparison, Stewart and Lockhart (2005) and DFO recorded 100 whales landed that year. Priest and Usher admit their study is subject to biases, notably when hunters cannot be contacted for several months, causing the accuracy of the recording to decrease. Nevertheless, one has to wonder how these numbers differ almost fourfold.

Furthermore, recording marine mammal landings by geographical and jurisdiction quickly becomes problematic. In the case of a study in the eastern Hudson Bay, landings from Sanikiluaq (formerly known as the Belcher Islands) were added to those in Nunavik, QC, rather than Nunavut (Doniol-Valcroze, Hammill, & Lesage, 2012). This caused the landings for the Qikiqtaaluk region to be higher than expected from 1985-2011 as these values include the harvest for the entire eastern Hudson Bay area (Doniol-Valcroze, Hammill & Lesage, 2012). Sanikiluaq was estimated in having only 12.6% of the total harvest for the 1985-2011 period. To put in perspective, a study done specifically for beluga whale landings in Sanikiluaq for 2008, 2009 and 2010 recorded 15, 34, and 42 landed whales, respectively, whereas the eastern Hudson Bay study recorded 53, 38 and 51 whale landings for those same years (Doniol-Valcroze & Hammill, 2012; Doniol-Valcroze, Hammill, & Lesage, 2012). Now, using the estimated 12.6% of landings accorded to Sanikiluaq in the first study, the total harvest for this community for 2008-2010 would be those shown in *Figure 6*.

$$\text{2008: } 53\ landings \times 0.126 = \sim 7\ beluga\ whales$$
$$\text{2009: } 38\ landings \times 0.126 = \sim 5\ beluga\ whales$$
$$\text{2010: } 51\ landings \times 0.126 = \sim 6\ beluga\ whales$$

Figure 6. Estimated Sanikiluaq landings of the beluga whale from 2008-2010 using a 12.6% harvest rate and total landings estimate of the eastern Hudson Bay stock, as predicted by Doniol-Valcroze & Hammill (2012).

Using Doniol-Valcroze & Hammill's (2012) eastern Hudson Bay harvest allocation of 12.6% for Sanikiluaq results in lower landings than those recorded specifically for Sanikiluaq in the Doniol-Valcroze, Hammill, & Lesage (2012) study. This type of situation is a perfect example

of the obstacles researchers face when studying subsistence hunting of Arctic species: marine organisms do not succumb to borders, crossing back and forth regularly, causing confusion when researchers study a species that migrates between Nunavut, Greenland, northern Quebec, or the Northwest Territories. For the beluga whale, this caused both an overestimation of harvested animals when looking at the wider area that is the eastern Hudson Bay while underestimating the Sanikiluaq landings when producing a harvest percent allocation. This was also a large issue with the polar bears, as discussed later on.

The beluga whale undoubtedly requires further assessment of current landings, notably for the time period of 2003-2015. Of course, there is the possibility these values were published, but are not yet public domain. Nevertheless, the eastern Canadian Arctic beluga whale populations are also affected by the effects of climate change and deserve up-to-date assessment regarding population trends and yearly harvesting rates. In a study done by Hovelsrud, McKenna, & Huntington (2008), the floe edge is melting before breaking up during the spring and the Inuit are not seeing as many beluga whales along the coast of eastern and northwestern Hudson Bay and the Hudson Strait as in previous years. Instead, the whales are following the currents farther offshore, making it more difficult for the Inuit to hunt them (Hovelsrud, McKenna & Huntington, 2008). These results of climate change will continue to affect the Inuit in Nunavut and their subsistence hunting, meaning Arctic research is essential in observing trends and changes in this environment should subsistence hunting endure.

3.1.2 Bowhead whale (*Balaena mysticetus*)

As mentioned previously in Section 2, Eastern Canadian Arctic people have hunted the bowhead whale for thousands of years. The whales were an important food and tool source; bones, for example, were used as sled runners. Although bowhead whale hunting has a long history in the Arctic, accurate historical landing values remain incomplete. Most are based on bowhead whale remains found in Thule campsites, such as the ribs, mandibles, crania, or vertebrae (McCartney, 1980).

Commercial whaling significantly impacted the Inuit. Between 1840 and 1910, American and European whalers overexploited the North Atlantic bowhead whale population in their quest for whale blubber to produce oil (Stern, 2010). Only once the bowhead whale population was depleted and whale oil was replaced with petroleum did whalers leave the Canadian Arctic. However, commercial whaling continued in association with the Hudson's Bay Company and free traders until 1951 (Reeves & Mitchell, 1990). Subsistence harvest rates following this time period

Table 4. Subsistence hunting landings of bowhead whales in the Territory of Nunavut.

Time interval	Location	Total landings	Source
1919-1975	Hudson Bay/Foxe Basin	1	Hay *et al.* (2000)
1922-1975	Baffin Bay/Davis Strait	6	Hay *et al.* (2000)

greatly suffered due to commercial whaling, since the bowhead whale population was so depleted.

Accurate landing reports only began in the late 19th century and through the 20th century, when The Hudson's Bay Company could record landings near their trading posts or when community members would provide accounts from bowhead whale population abundances, as told by their elders (Hay, Aglukark, Igutsaq, Ikkidluak, & Mike, 2000; Priest & Usher, 2004; Reeves & Mitchell, 1990). As shown in *Table 4* and *Figure 7*, bowhead whale landings have remained very low for over one hundred years, averaging at less than one whale harvested per year.

Several factors have limited the Inuit in their subsistence hunting of the bowhead whale, for example: commercial whaling, climatic conditions, and quotas. Commercial whaling in Canada was banned in 1935 and subsistence hunting restrictions were implemented in 1979 (Reeves & Mitchell, 1990). No licensed hunts occurred in the Hudson Bay-Foxe Basin stock from 1979 to 1996 (DFO, 1999). COSEWIC assessed the Eastern Canadian Arctic stock as Endangered in 1980 (see Section 2: "Abundance and Status") (DFO, 2009; Hay *et al.*, 2000). Despite there being no restrictions on bowhead whale hunting from 1950-1995, the Inuit were wary in conducting the hunts due to a combination of factors. First, they believed DFO ceased bowhead whale hunting prior to 1979 and secondly, they encountered so few whales that hunting was almost impossible (Hay *et al.* 2000). The Nunavummiut claim they lost multiple opportunities to hunt bowhead whales between 1950 and 1979 because of the perceived ban; they were not aware the ban was not officially in place until 1979 (Hay *et al.*, 2000). Furthermore, the bowhead whale was protected under the International Convention for the Regulation of Whaling by the International Whaling Committee (IWC), of which Canada was a member until 1982 (Hay *et al.*, 2000). Subsistence hunts finally resumed in 1994, the Inuit landing three whales from 1994-1998 in the communities of Igloolik, Repulse Bay (now Naujaat), and Pangnirtung (*Fig 7*). Since then, quotas were implemented to prevent overhunting the sensitive population. One whale every three years could be hunted from 1995-2005 and after reassessment of the population abundance, the quota was increased to 3 whales per year, one for each region of Nunavut (Nunavut Tuungavik Inc, 2005;

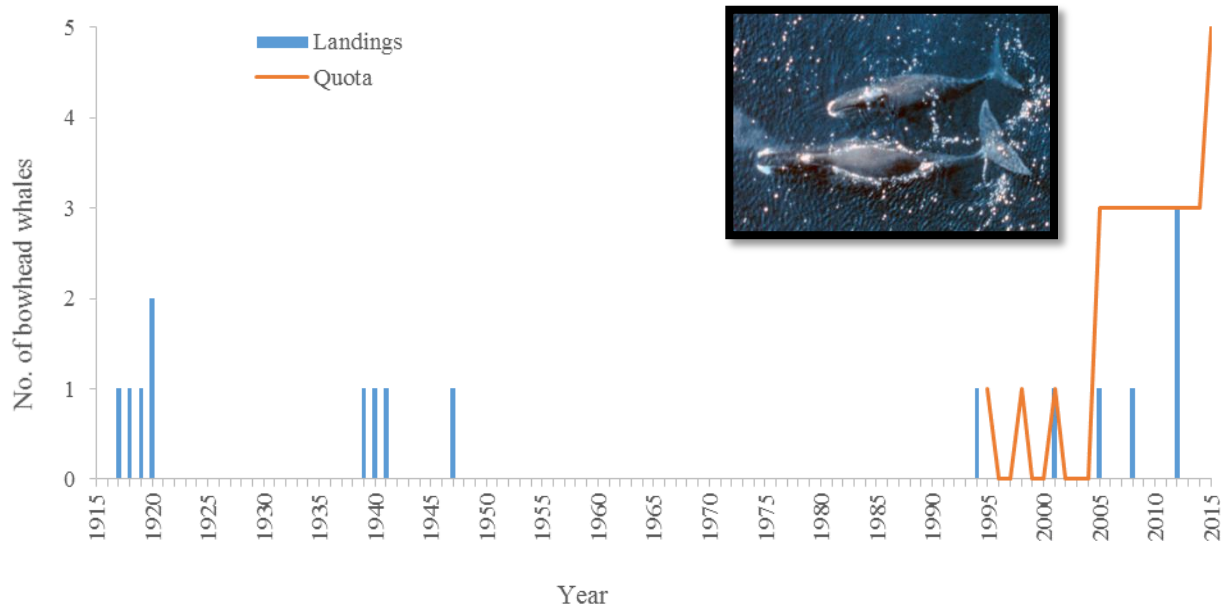

Figure 7. Bowhead whale landings and quotas for subsistence harvest in the area of the Territory of Nunavut over the last century.

DFO, 2009). The quota was changed this year to five bowhead whales per year, two each for Qikiqtaaluk and Kitikmeot, and one for Kivalliq ("Kivalliq hunters", 2015).

As seen in *Figure 7*, most of the quotas were not fulfilled during the last 10 years. Every year, one community per region is allocated the right to hunt a bowhead. However, being granted the right to hunt does not guarantee landing a bowhead whale. In many instances, a community did not complete a successful bowhead hunt due to whale absence or poor weather and ice conditions, as was the case for Kugaaruk in 2009 and 2010 (Ridlington, 2010; Aboriginal Affairs and Northern Development Canada, 2011).

Poor weather conditions are not the only adverse factors facing the Inuit during bowhead hunts. Growing interest in the North negatively impacted the Inuit when the 1996 bowhead whale hunt in Naujaat was filmed by CBC and the Inuit Broadcasting Corporation (Bourgeois, 1998). Inexperience of the hunters and lack of a restrictive perimeter around the hunting area caused uninvited hunters to shoot the whale several times, causing it to sink (Bourgeois, 1998). All was taped for national television, through CBC. The whale only resurfaced two days later, and by that time the *maqtaq* was rotten. Since then, film coverage has been restricted to respect the hunters (Bourgeois, 1998).

The Nunavut Inuit are consistently observing increasing abundance of bowhead whales over time, throughout the territory. In Hay *et al.*'s (2000) study, elders are seeing more whales than

when they were young and many Inuit are declaring higher abundances in Foxe Basin, the Hudson Strait, Naujaat, Chesterfield Inlet, Arctic Bay, Clyde River, Pangnirtung, Pond Inlet, and Qikiqtarjuaq. This increase has occurred over time, anywhere from the early 40s to later in the 80s (Hey *et al.*, 2000). One can only conclude that the Northwest Atlantic bowhead whale population continues to grow since then, increasing the Inuit's odds of larger quotas. Most Inuit simply want to provide *maqtaq* to their elders one last time, as thanks for their teachings and advice (Hay *et al.*, 2000).

3.1.3 Narwhal (*Monodon monoceros*)

Enacted under the *Fisheries Act* through the Marine Mammal Regulations, DFO implements hunting regulations, which make the Inuit the sole hunters of the narwhal (Stewart & Lockhart, 2005). An important reason narwhals are hunted is for the tusk, which is collected from large males. The European Economic Community (EEC), precursor to the European Union (EU), banned the import of narwhal tusks in 1983, causing the market to drop, but a strong demand from Japan allowed it to recover (Stewart & Lockhart, 2005). Narwhal landings are tracked through tags, which are attached to the tusk or carcass of the whale once caught (Stewart & Lockhart, 2005).

Narwhal harvest quotas were first implemented in 1971 (*Fig. 8*) under the Narwhal Protection Regulation for individual hunters, then for communities in 1977 (Dale, 2009). Quotas have remained community-based since then (Dale, 2009; COSEWIC, 2004b; DFO, 2012b; Stewart & Lockhart, 2005; Strong, 1989; Greer, 2007; NWMB, 2015; DFO, 2013b; Richard, 2009). The size of the quotas fluctuated over time and according to community. Quotas in the Qikiqtaaluk region are typically larger than those in the Kitikmeot and the Kivalliq region. Some of the largest quotas are those of Pond Inlet and Arctic Bay, equal to 234 and 221 narwhals, respectively, as of 2014 (NWMB, 2015). In contrast, Whale Cove hunters could only hunt 5 narwhals in 2007 (Greer, 2007).

Overall, landings stayed below the harvest limits for the majority of the period from 1950 to 2015 (*Fig. 8*). However, in certain years landings greatly surpassed quotas: in 1999, the community of Naujaat participated in a community-based management plan that enabled them to modify the total allowable harvest of narwhals for that year (Priest & Usher, 2004; Stewart & Lockhart, 2005). To qualify, local Hunters and Trappers Organizations (HTOs) had to develop

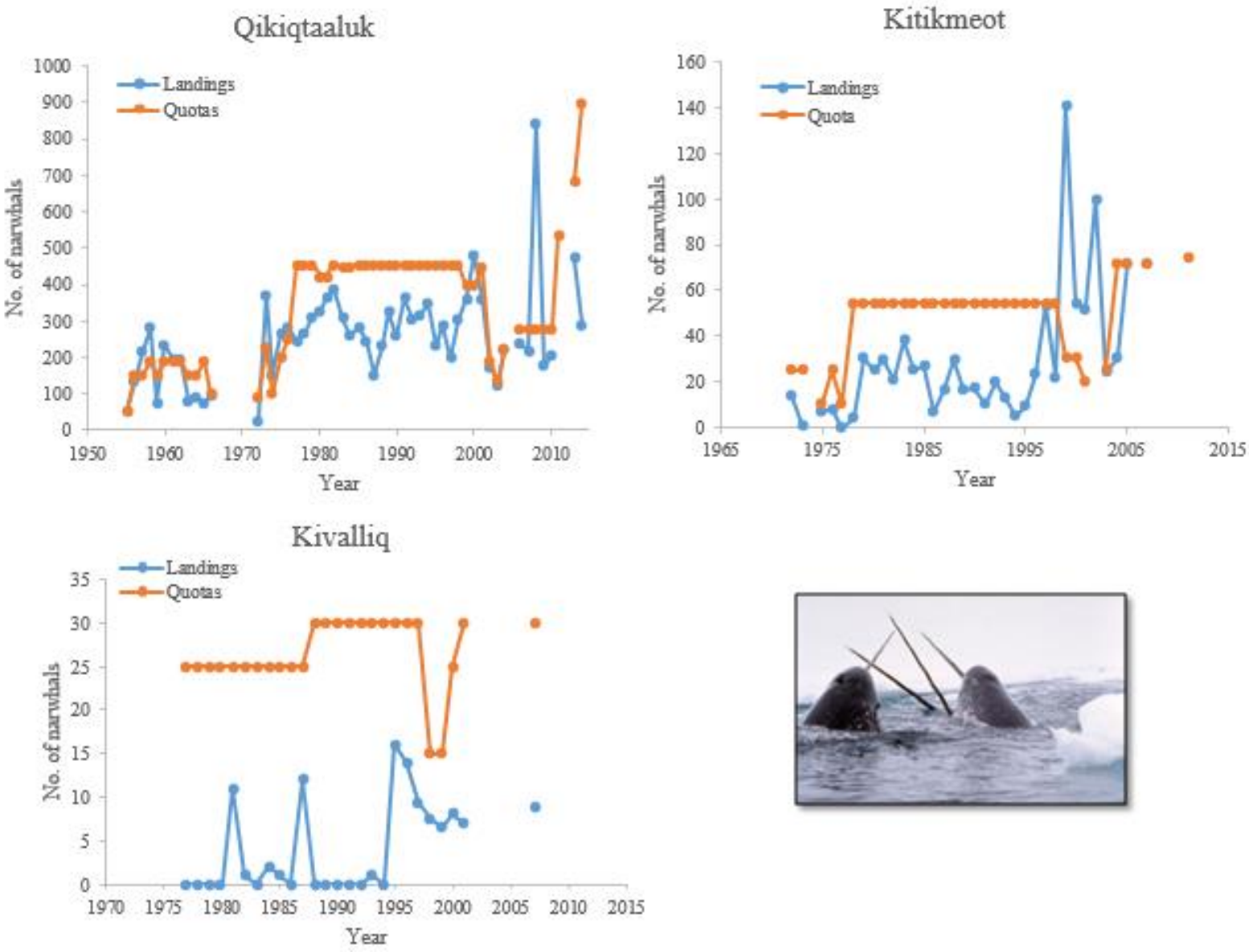

Figure 8. Narwhal landings and quotas in the Territory of Nunavut for Inuit subsistence hunting. All communities within the region of Qikiqtaaluk have landings and quota data; Kitikmeot includes the communities of GH, Kga, Na, and Ta; and Kivalliq includes the communities of CI, CoH, RI and WC.

hunting regulations and agree to record all landed narwhals, as well as those lost or killed without a successful landing. The quota, set at 25 in 1998, was waved during the management plan (Stewart & Lockhart, 2005). 156 narwhals were caught in 1999 under this plan, which continued until 2002 when the quota was re-established. There was concern the Hudson Bay narwhal population could not sustain harvests of over 100 animals a year, therefore the annual harvest limit was reduced to 72 narwhals in 2002.

Another prominent datapoint is in 2008 when 692 narwhals were harvested in Pond Inlet (DFO, 2012b). Seventy narwhals were caught that year under the quota (which was 130), but an ice entrapment occurred, trapping over 600 whales in Eclipse Sound. The community was allowed to harvest the whales, as they would not have been able to free themselves from the ice. Despite the large size of the harvest, DFO stated the hunt was sustainable; however, this size of harvest would not be sustainable should such entrapments become more common (DFO, 2012a).

In 2013, an integrated fisheries management plan was approved. One aspect involved the increase in Grise Fiord's narwhal quota by 2015 (NTI, 2013). An interim narwhal tag carry over policy was created in 2012 by the DFO, the Nunavut Tungaavik Inc. (NTI), the HTOs and the Regional Wildlife Organizations (RWOs) of Kitikmeot, Kivalliq and Qikiqtaaluk (NTI, 2014). This policy allowed hunters to carry over unused tags into the new year. Just like the beluga, narwhal harvest information after 2001 is sparse, making it difficult to assess current quota and landing trends.

3.1.4 Bearded Seal (*Erignatus barbatus*)

As stated by Hay *et al.* (2000), harvesting seals in the Canadian Arctic allows the Inuit to sustain their customs of sharing, continue observing trends in the environment and their natural resources, and transfer important skills required for Arctic living. In other words, preserving the traditional Inuit way of life. In Section 3.1, seal landings will be shown according to region, the first being the bearded seal. Bearded seals are permanent residents of northern Canada, living alone on the pack ice (Hovelsrud, McKenna, & Huntington, 2008). During the ice-covered winter, the Inuit solely hunt ringed seals and bearded seals. The largest harvests are taken from the Hudson Strait, Foxe Basin and the eastern region of the Hudson Bay. A second study states bearded seals are also prevalent in Ungava Bay, Roes Welcome Sound and the northern Hudson Bay (Smith, 1981).

Despite the importance of the bearded seal to the Inuit, very little data can be found regarding yearly landings, as seen in *Figure 9*. There is currently no quota for this seal species in Nunavut (Nunami Stantec, 2012). An estimated 1,476 seals were hunted annually from 1996-2001; however, another study states as many as 2,608 bearded seals were caught in the Qikiqtaaluk region alone during this period (Nunami Stantec, 2012; Priest & Usher, 2004). A study conducted by McLaren (1958) explains the ringed seal and the bearded seal contributed the highest economic revenue out of the five Canadian Arctic seals (ringed, bearded, harp, hooded and harbour).

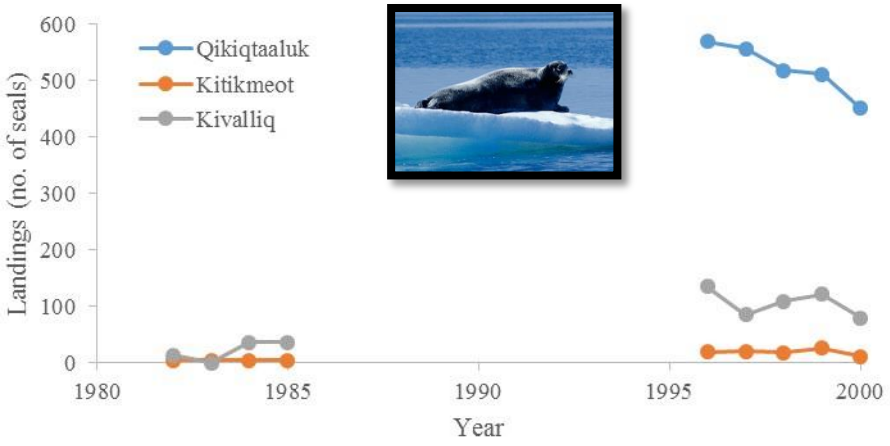

Figure 9. Bearded seal subsistence hunting landings in the Territory of Nunavut, by region. Landings in Qikiqtaaluk include the communities of GF, Res, ABN, PI, Ig, HaB, CR, Qk, Pg, Iq, Ki, CD, and Sa; Kitikmeot landings are in Kglu, Ta GH, and Na; Kivalliq landings are for BL, CoH, RI, CI, and WC (See Appendices for list of community abbreviations).

The lack of landings information is questionable considering the importance of the bearded seal as a source of food and other materials (as shown in Section 2). This remains a reoccurring trend amongst all seal species, as we will see in the following paragraphs.

3.1.5. Harbour seal (*Phoca vitulina*)

The harbour seal is one of five historically hunted seal species in Nunavut, and is still hunted today for subsistence (McLaren, 1958). Sinking quickly after being shot makes them a difficult species to hunt (Stewart and Lockhart, 2005), but hunters target them despite this. Landings have been recorded along the west coast of Hudson Bay, Coral Harbour, the southern coast of Baffin Island, and Kugaaruk (Stewart and Lockhart, 2005; Priest and Usher, 2004). As seen in *Fig. 10*, very little landing data is present in the current literature and there is no quota. Most likely there are no quotas currently implemented. The most abundant landings were recorded in the Qikiqtaaluk region in the late 1990s, mainly from Iqaluit and Kimmirut (Priest and Usher, 2004).

Incorrect reporting possibly skewed this dataset: two seals were reportedly caught in Kugaaruk in 1999, but hunters from the community explained harbour seals are not found in this area (Priest & Usher, 2004). Harbour seal landings were not recorded for the regions of Kitikmeot or Kivalliq any other years between 1980 and 2000 (*Fig. 10*). Regardless of the low landings total

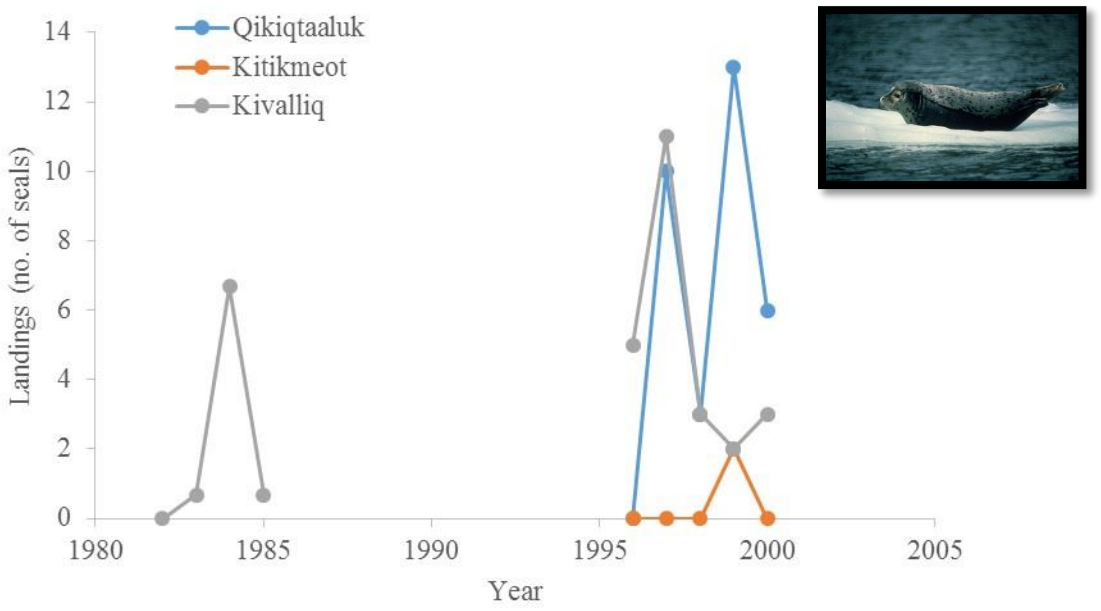

Figure 10. Harbour seal landings according to region for subsistence hunting in the Territory of Nunavut. Landings for the Qikiqtaaluk region are for the communities of CD, Iq, and Ki; Kitikmeot is Kga; and Kivalliq is Ar, BL, CI, CoH.

for subsistence hunting, the harbour seal population in the Arctic could potentially be vulnerable to overfishing due to its localized and predictable distribution (Stewart and Lockhart, 2005). The Inuit are skilled harbour seal hunters, utilizing confined areas of open water, shallow streams, or estuaries to trap the seals and easily haul them out of the water (Steward and Lockhart, 2005).

3.1.6 Harp seal (*Pagophilus groenlandicus*)

Commercial and subsistence hunts account for the majority of harp seal landings in the Northwest Atlantic (Stenson, 2005). An estimated 288,000 seals were caught commercially in Canada from 1952-1971, but less than 5,000 seals are caught annually in the Canadian Arctic (*Figure 11*, left). Quotas were imposed in 1972, but specific values within Nunavut could not be found, only those for the Canadian commercial hunt: from 2003-2005, the total allowable catch for the Canadian commercial harp seal hunt was 975,000 harp seals in three years for a maximum of 350,000 in one year (Stenson, 2005; 2014). The harp seal was harvested commercially and for

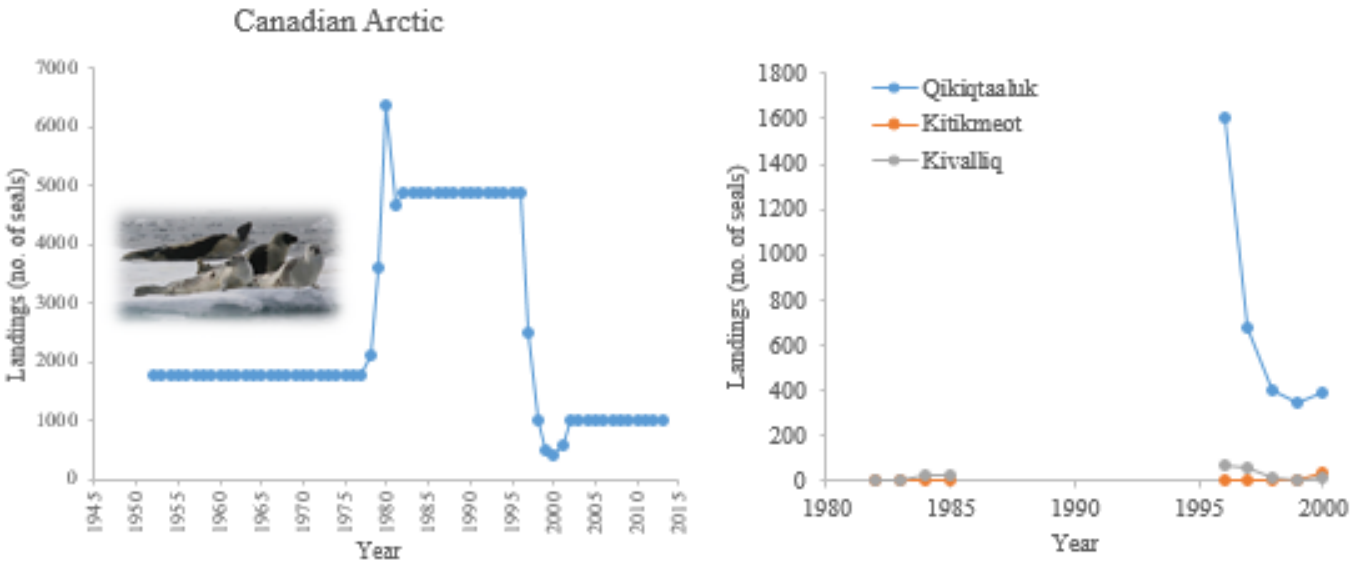

Figure 11. (Left) Landings of harp seals for commercial hunting in the Canadian Arctic. Note: values for 1952-1976, 1983-1996 and 2002-2013 are estimates (data from Stenson, 2014). (Right) Harp seal landings by region for subsistence and commercial hunting in the Territory of Nunavut. Qikiqtaaluk region landings include the following communities: ABN, CD, CR, GF, HaB, Ig, Iq, Ki, Pg, PI, Qk, Res; Kitikmeot: GH, Na; and Kivalliq: Ar, CI, CoH, WC, RI.

subsistence in the past in the Eastern Canadian Arctic, primarily around Baffin Island. As seen in *Fig. 9*, very few harp seals were landed in the early 1980s (Stewart & Lockhart, 2005). A significant drop in landings occurred in 1996, both recorded by Stenson's (2014; *Fig. 11*, left) and Priest & Usher's (2004) research (*Fig. 11*, right). The reason for this drop remains unclear, as most landings data refer to commercial harvests or a combination of commercial and subsistence as opposed to uniquely analyzing subsistence harvests in the Canadian Arctic (Stenson, 2005; Stenson, 2014). Current landings (2000 onwards) in the Canadian Arctic are estimated at roughly 1,000 harp seals per year (Stenson, 2014).

Hunters from Coral Harbour state harp seal hunting occurred every year during the 1996-2001 period, and Whale Cove hunters say they take 1-2 seals per year (Priest & Usher, 2004). Twenty-six seals were reportedly caught in 1996 in Whale Cove; however, hunters believe this value is too high (Priest & Usher, 2004). In Pangnirtung, 1,309 harp seals were recorded as landed during the 1996 harvest, yet Priest and Usher state this number again seems too high, attributing the inaccuracy on difficulty in contacting hunters at the beginning of the Harvest Study. In contrast, landings in Pangnirtung are fewer than 188 harp seals for each of the four other years of the study. Iqaluit is the second highest ranking community for most landings of harp seals, harvesting an

average of 295 harp seals per year from 1996-2000 (Priest and Usher, 2004). Overall, subsistence harp seal landing reports in Nunavut remain incomplete and current data are rather inaccurate.

3.1.7 Hooded seal (*Cystophora cristata*)

The hooded seal is not the most important species in Inuit subsistence hunting, therefore very few are landed in Nunavut each year (Priest & Usher, 2004; DFO 2006). The largest harvests occur instead in Atlantic Canada (DFO, 2006). A single study on hooded seal harvests was found, from Priest and Usher's (2004) Harvest Study between 1996 and 2001. No landings were recorded for the region of Kivalliq. Most catches yielded merely one or two hooded seals; however, 32 and 63 seals were reported in Iqaluit and Pangnirtung respectively for 1997 (*Figure 12*). Local hunters explained that these values are too high for this species in these communities, but no explanation was provided by the researchers as to whether or not these values were the cause of data input error or unexpected species availability (Priest & Usher, 2004; DFO 2006). No further landings information nor quotas could be found for hooded seal subsistence hunting in Nunavut.

Commercial quotas for hooded seals were implemented in 1974 for Canada. Catches in Atlantic Canada varied greatly after this quota, from hundreds to over 25,000 hooded seals (DFO,

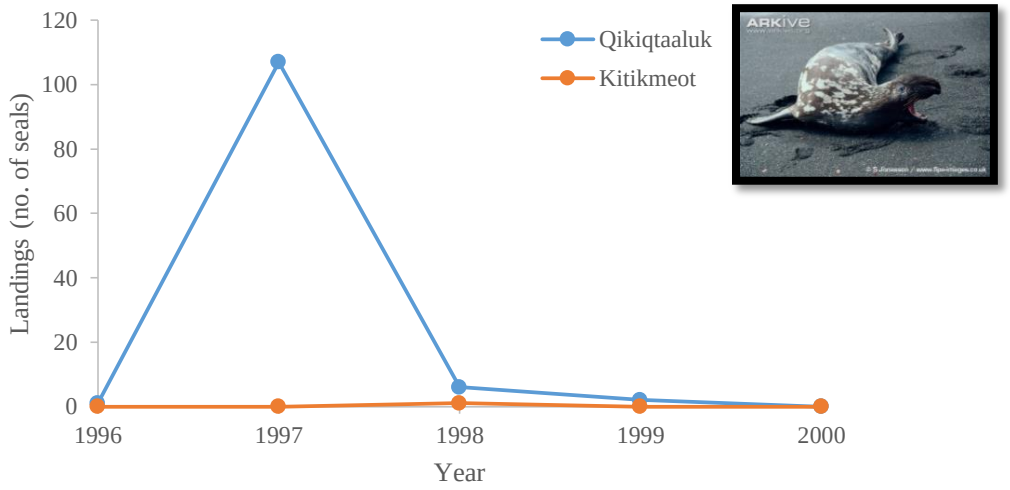

Figure 12. Hooded seal landings for the regions of Qikiqtaaluk and Kitikmeot in the Territory of Nunavut for subsistence hunting. Landings in Qikiqtaaluk are for the communities of CD, CR, Iq, Ki, Pg, and PI; Kitikmeot is for the community of Kglu.

2015a). Despite this large annual hunt, very few hooded seals are harvested for subsistence in the Canadian Arctic (DFO, 2015a). Major commercial hooded seal markets collapsed in 1982, causing commercial landings to drop to a couple hundred through the 1980s to mid-1990s (DFO, 2015a).

3.1.8 Ringed seal (*Pusa hispida*)

The ringed seal is the most important seal species hunted for subsistence by Inuit communities in Nunavut (McLaren, 1958; Ross, 1975). Harvest information comes from an array of sources, such as: RCMP Game reports (Bradley, 1970), a Harvest Study (Priest & Usher, 2004), and skin sales in police reports (Usher, 1975). Highest landings have always been in the Qikiqtaaluk region, as seen in *Figure 13*. There, yearly harvests were in the low 20,000 from 1920 to 1980, whereas ringed seals were hunted in the 3,000 range in Kitikmeot and Kivalliq (Usher, 1975; Reeves, Wenzel, & Kingsley, 1998). Current catch data is incomplete, but values seem to remain much lower than historical harvests (Priest & Usher, 2004). The peaks seen in the 1970s in both Kitikmeot and Kivalliq are caused by a one-time large harvest of ringed seals by hunters from Kugaaruk and Whale Cove, who harvested 500 and 1,500 ringed seals in a year, respectively (Reeves, Wenzel & Kingley, 1998). Ringed seal hunting has also been very prevalent in the Foxe Basin, where over 14,000 seals were harvested in the 1960s (*Table 5;* Reeves, Wenzel & Kingsley, 1998).

Ringed seal landings vary from year to year, based on weather and ice conditions as well as pelt prices (Priest & Usher, 2004). Although data from Priest and Usher (2004) show a decreasing trend of ringed seal harvesting from 1996-2000, they suspect ringed seal hunting has instead increased because pelt prices also increased during this time. In reports by Nunavut's Department of Sustainable Development (DSD), 1,393 pelts were purchased from Pangnirtung in 1999/2000 (the fourth year of the study) and 1,010 pelts were purchased the following year, in 2000/2001 (Priest & Usher, 2004). Although this also seems like a decline, landings from the DSD are recorded for the harvest year from July to the following June whereas Priest and Usher's Harvest Study was from June to May, which does not allow for an accurate comparison of and conclusion on sale trends.

Ringed seal landings in Nunavut were reasonably well documented over the course of the last century; the same cannot be said for the quotas. As shown in *Fig. 13*, there appears to be no

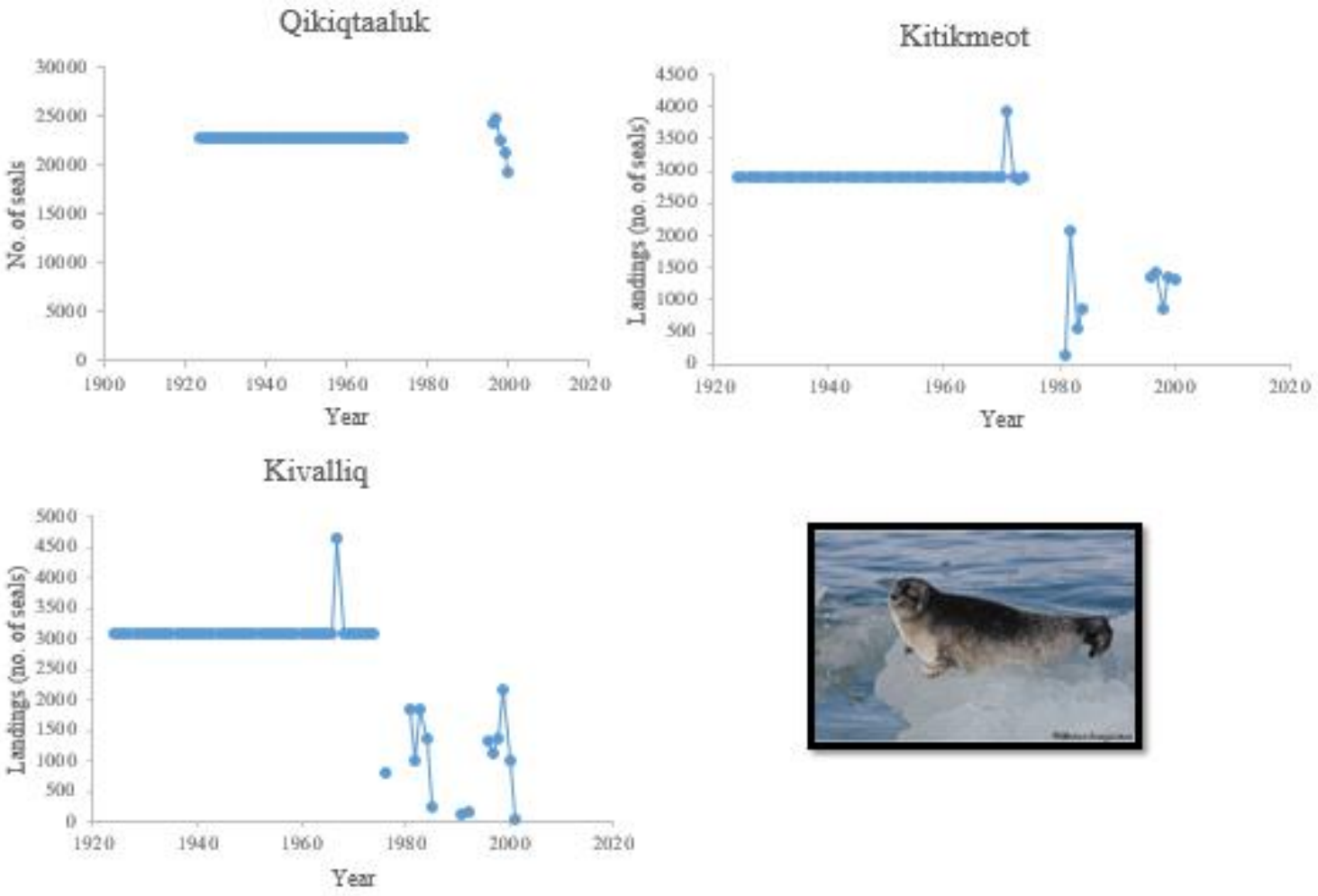

Figure 13. Ringed seal landings in the Territory of Nunavut for Inuit subsistence hunting by region. In each region, all communities have landings data.

quotas for either subsistence or commercial ringed seal hunting. Although the ringed seal population in the Canadian Arctic is estimated at 1 million, as seen in Section 2, the lack of quotas is unexpected, considering the heavily regulated quotas for cetaceans and the importance of the ringed seal in Inuit culture. Over 30,000 seals were caught annually in the Canadian Arctic in the 1980s and 25,000 ringed seals were caught in Nunavut in 1996 alone (*Table 5*; Reeves, Wenzel & Kingley, 1998; Priest & Usher, 2004). With changing sea ice conditions, climate change may be affecting both the ringed seal population and Inuit hunting effectiveness more rapidly than we believe, making research on ringed seal population trends essential (Laidler *et al.*, 2008). The

Table 5. Ringed seal landings by subsistence Inuit hunting in the Territory of Nunavut, Canada. Values were placed in this table if they were not compatible in timeline form (*Fig. 13*).

Year	Location	Landings	Source
1964 1965 1966 1967 1968	Northern Foxe Basin	4,697 2,678 3,814 804 2,198	Bradley (1970)
1973-1982	Gjoa Haven/Taloyoak/Kugaaruk	630/year	Reeves, Wenzel, & Kingsley (1998)
1973-1982 1987-1994	Kitikmeot region	5,000 500-600	Reeves, Wenzel, & Kingsley (1998)
1981-1983	Canadian Arctic	31,500 – 36,500/year	Reeves, Wenzel, & Kingsley (1998)
1996	Nunavut	25,086	Nunami Stantec (2012)

most recent population abundance estimate stated here dates back to 2000 (Priest & Usher, 2004; Ferguson, Stirling & McLoughlin, 2006). The ringed seal is an indispensable species for the Inuit, but there is limited available on its current population state and the numbers caught in the last 15 years (*Fig. 13)*.

3.1.9 Walrus (*Odobenus rosmarus*)

The walrus is the species with the most thorough harvest reports in the 20th century of all 26 species researched in this report. Most of the landings seen in *Figure 14* come from the Hudson's Bay Company (HBC) trade records. Stewart *et al.* (2014) compiled catch data according to community, stock and population from HBC journals and whalers logs. Landings were estimated according to hunt products such as hides, ivory or even Peterhead boatloads ("enough walrus to fill a Peterhead boat"; Stewart *et al.* 2014).

An estimated 41,300 walruses were caught between 1820 and 2010 in the Eastern Canadian Arctic in subsistence and commercial hunting (Stewart *et al.*, 2014). Commercial hunting of the walrus in Atlantic waters extirpated the population from Quebec and the Atlantic Provinces, but the northern stocks were sheltered until approximately 1885 (Stewart *et al.* 2014). Commercial whalers turned to the walrus once the Northwest Atlantic bowhead whale population was decimated. Walrus hunting was finally made exclusive to the Inuit in 1928. A decrease in

landings is observed since 1950 in all three regions of Nunavut, despite the growing Inuit population (*Fig 14*; Stewart *et al.*, 2014; Strong, 1989; DFO, 2013a; Nunami Stantec, 2012). It is unclear whether this is a result of decreased effort or walrus availability. The numbers shown here are most likely an underestimation, considering under-reporting or loss of the animal when hunting. Underestimation could also occur due to an Inuk hunter deciding not to trade a walrus at an HBC trading post, and instead keep it for his family.

Quotas fluctuated over time and according to community and region. In Qikiqtaaluk, all communities except Hall Beach had a quota of seven walruses per person (Inuk) between 1949 and 1979 (Strong, 1989). The quota was then decreased to four walruses per Inuk for Cape Dorset, Grise Fiord, Hall Beach, Igloolik, Iqaluit, Kimmirut, Pangnirtung, Pond Inlet, Qikiqtarjuaq, and Resolute Bay. This quota was maintained until 2004; it is to be noted that occasionally these quotas included sport hunting (Strong, 1989; COSEWIC, 2006). No information regarding these communities' quotas were found for subsequent years. Communities in the Kivalliq and Kitikmeot regions also had quotas beginning at seven walrus per Inuk per year in the 1970s and transitioning to four walrus per Inuk in the 1980s onwards. Naujaat's quotas started even earlier, in 1953 & 1964. The exception is Coral Harbour, having had a quota of 60 walrus for the whole community from 1980-2004. Arctic Bay, Clyde River and Sanikiluaq's quotas were changed in 1980 to 10, 20, and 10 walruses per communities, respectively (COSEWIC, 2006).

Finally, Kivalliq quota data is sparse from 1952-1971. Arviat, Chesterfield Inlet and Whale Cove occasionally had a quota of seven walruses per Inuk; however, the records were incomplete during this time period in these communities (Stewart *et al.*, 2014; Strong, 1989). Arviat, Chesterfield Inlet, Rankin Inlet and Whale Cove had a quota of four walrus per Inuk from 1980-2004, whereas Coral Harbour had a community quota of 60 walruses per year during this time (Strong, 1989; COSEWIC, 2006). DFO (2014e) states the 60 walrus quota was also instated in 2013 for the community of Coral Harbour, but quotas in other Kivalliq communities between 2005 and 2015 remain unknown.

The decrease in total allowable harvest during the 20th and 21^{rst} centuries mirrors the decline in walrus landings in Nunavut, and thus are likely a result of decreased effort. According to Hovelsrud, McKenna, and Huntington (2008), ringed seals, polar bears and walruses are expected to move northward between 2070 and 2090 due to climate change. The Inuit have observed the walruses moving farther away from the Belcher Islands, causing longer travel

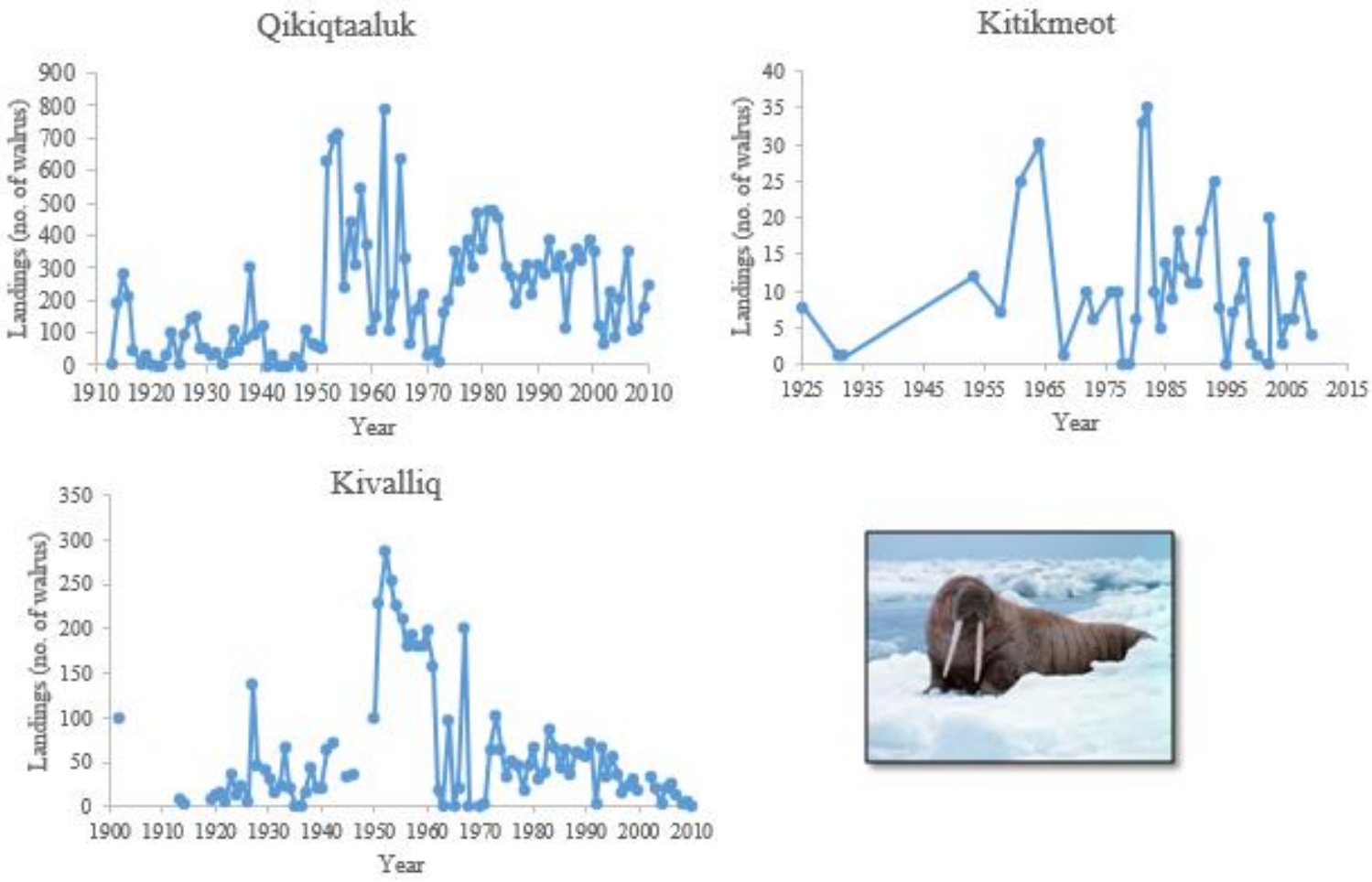

Figure 14. Walrus landings for the Qikiqtaaluk, Kitikmeot and Kivalliq regions of the Territory of Nunavut as subsistence hunting.

distances to hunt the animals (Hovelsrud, McKenna & Huntington, 2008). Hunting the walruses therefore might not be worthwhile economically in the future and in regards to safety with rapidly changing ice conditions.

3.1.10 Polar bear (*Ursus maritimus*)

There are two forms of polar bear hunting in the Eastern Canadian Arctic: subsistence and sport hunting (Holvesrud, McKenna & Huntington, 2008). Subsistence hunting is exclusive to Aboriginal peoples, as stated under the 1973 International Agreement on the Conservation of polar bears, inherited by Nunavut from the Northwest Territories (Inuit Tapiriit Kanatami, Government of Northwest Territories, Government of Nunavut & Environment Canada, n.d.; Government of Nunavut, 2014). In Nunavut, the Inuit are permitted to allocate part of their quota to non-Inuit for

sport hunting (Holvesrud, McKenna & Huntington, 2008). Inuit communities benefit from these regulations by obtaining funds for other subsistence hunts through payments from sport hunters (Inuit Tapiriit Kanatami, Government of Northwest Territories, GN & Environment Canada, n.d.). Harvest management has been in place since the 1970s between Inuit communities and the Government, but the Inuit have the right to regulate their own hunting. Quotas are based on conservation and subsistence needs and are often much higher than the harvest levels. Once quota tags are distributed and used for a catch, hunters record the season or year of the hunt, the community, the type of harvest (subsistence, sport, illegal, problem or miscellaneous), the date of the hunt, and any additional information (Priest & Usher, 2004).

As mentioned in Section 2.1, polar bears did not contribute a large percentage of total historical landings in Inuit hunting, due to the danger of hunting polar bears (Waters, Rose & Todd, 2009). As little as 0.1% of the Paleoeskimo diet consisted of polar bear, based on archaeological sites (Waters, Rose & Todd, 2009). However, polar bear hunting became more prevalent over time. The introduction of guns and an increase in demand for polar bear pelts had a large impact on the Canadian polar bear population in the 20th century (Waters, Rose & Todd, 2009). Bears could more easily be hunted from a safe distance by use of rifle, which lead to increased polar bear harvesting

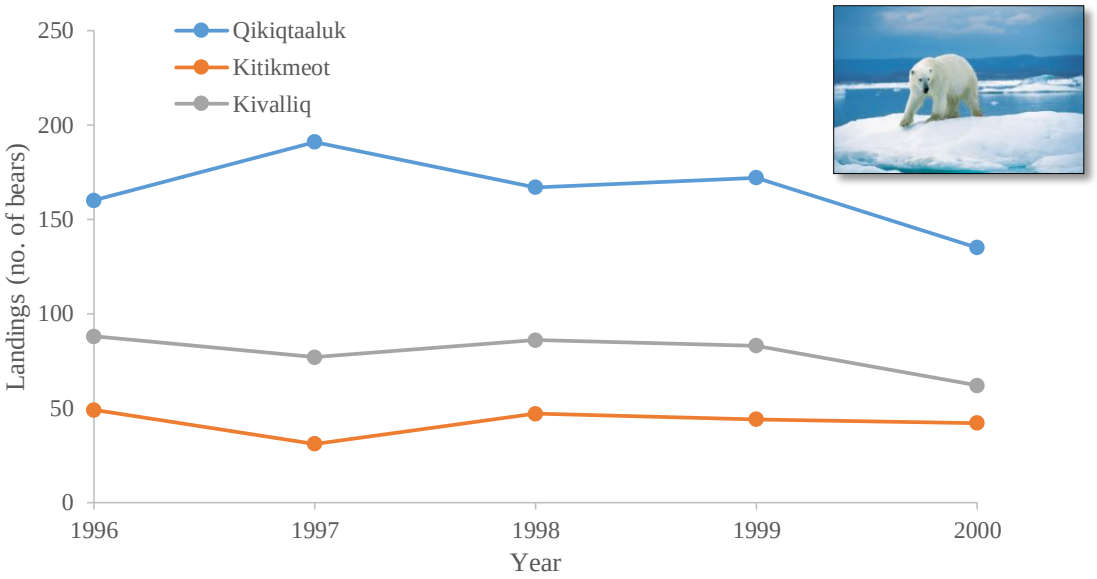

Figure 15. Polar bear landings in the Territory of Nunavut for Inuit subsistence hunting. Landings include all communities listed in *Table 7* except Gjoa Haven.

in the Northwest Territories. Landings peaked in the 1960s, with 726 polar bears being killed in 1966 (Waters, Rose & Todd, 2009). Moreover, this total is most likely vastly underestimated due to the lack of record keeping at the time (Water, Rose & Todd, 2009).

An estimated 705 polar bears are hunted globally each year, out of a total population of 21,000-25,000 bears (Holvesrud, McKenna & Huntington, 2008). As *Figure 15* shows, Inuit subsistence landings of polar bears in Nunavut in the late 1990s remained around 300 bears per year, the largest harvests occurring in Qikiqtaaluk from the communities of Grise Fiord and Sanikiluaq (Priest & Usher, 2004). However, the largest number of landings overall took place in Coral Harbour, where 159 bears were caught between 1996 and 2001 (Priest & Usher, 2004). These values are not estimates, but rather harvest totals provided by the Department of Sustainable Development (DSD), as shown in Priest and Usher's (2004) Harvest Study. Priest and Usher relied on values from the DSD because polar bears are hunted by a very small group of people; recording these values through community interviews would therefore not be as reliable as the DSD records. These landings only reflect subsistence hunting and do not include any sport hunting (Priest & Usher, 2004).

Polar bear populations are expected to move northward sometime during 2070-2090 as the climate changes, which will affect Inuit hunting practices and the interactions between humans and bears (Holvesrud, McKenna & Huntington, 2008). Floe edges are creeping closer to land, decreasing viable polar bear habitat, forcing the bears closer to communities, as well as affecting the bears' health and reproductive success (Holvesrud, McKenna & Huntington, 2008). In some instances, climate change is leading hungry bears to disrupt non-polar bear related hunts: in 2014, a man from Arviat lost a tug-o-war with a polar bear over his catch, a beluga whale (Polar bear wins tug of war with Nunavut man over beluga, 2014). The bear was described as red-eyed and very skinny, bringing the beluga to a nearby island to eat with four other bears. Encounters such as these may continue to increase if polar bears are losing habitat and having more difficulty feeding, thus approaching communities in search of food. The Government of Nunavut has already recorded an increase in defensive kills, which causes a decrease in traditional harvesting because these landings count towards the yearly harvest (GN, 2014). Communities currently have safety concerns in regards to polar bear interactions, considering *IQ* indicates the population has increased since the 1960s and bears are more prevalent in the vicinity of communities (GN, 2014). Polar bears are known to be resourceful and adaptive animals, thus climate change may not play

as large of a role on this species as other Arctic species. Nevertheless, polar bear harvesting will likely change in the future if non-hunting related Inuit-polar bear interactions become more common.

3.2 Freshwater and marine fish

3.2.1 Arctic charr

Arctic charr is very important for the Inuit and many researchers consider it the most desirable fish for this people (Stewart & Lockhart, 2005). Approximately 80% of the Arctic charr fishing immediately returns to the domestic economy (GN & NTI, 2005). The species is primarily hunted by use of gillnet (minimum mesh size 139mm), both in landlocked bodies of water and those connecting to the sea (DFO, 2014a; GN & NTI, 2005, DFO, 2004). Arctic charr subsistence fisheries are not regulated by quotas (Stewart & Lockhart, 2005). Despite the importance of this fish species to the Inuit, very little information on landings could be found, notably from 1985-1996.

Subsistence Arctic charr landings from 1982-1985 remained low in the Kitikmeot and Kivalliq regions (Stewart & Lockhart, 2005). Priest and Usher (2004), looking at the Arctic charr subsistence fishing of both landlocked and sea-run charr in Nunavut, recorded the largest harvest in the Qikiqtaaluk region (*Fig. 16,* top right). In their study, hunters from Grise Fiord explained low harvest totals were sometimes caused by poor weather conditions, preventing the hunters from completing a successful harvest (Priest & Usher, 2004). Also, values could potentially be inaccurate between 1996 and 2001 because some hunters estimated the size of a catch instead of counting the total number of fish (Priest & Usher, 2004). As with all other species presented in this study, these gaps of knowledge prevent proper assessment of the species' population state following fisheries development.

Commercial fishing of Arctic charr in Nunavut is more thoroughly documented. It began in the 1960s and has grown significantly since then, but makes up of only 20% of all Arctic charr fisheries in Nunavut (DFO, 2004; GN & NTI, 2005). Harvesting was mainly located in the following rivers during the second half of the 20th century: Freshwater Creek, Ekalluk River, Paliryuak River, Halovik River, Lauchlan River, Jayco River, Ellice River and Perry River (DFO, 2004). These rivers are all within the Queen Maud Gulf-Cambridge Bay area. Commercial quotas

were initially set for specific areas, then changed to individual rivers as fishing decreased in some rivers, necessitating a redistribution of effort (DFO, 2004).

Historical landings for the commercial fisheries of Arctic charr in the Kitikmeot region are shown in *Figure 16* (top left). Some sources pinpoint the beginning of commercial anadromous Arctic charr fishing to 1931 when a man named Mr. Ingebrigsten sailed up to Kivalliq from Churchill, where he began the charr commercial fishery (Stewart & Lockhard, 2005). It did not become popular until 1960 (Stewart & Lockhart, 2005). That year, the harvest was roughly 16,000kg of fish, all taken from the Ekalluk River (Stewart & Lockhart, 2005; DFO, 2004). Fishing was suspended in 1961 due to fear of overexploitation of this important species, then resumed the following year (DFO, 2004). The quota, then at 14,570kg for the Ekalluk River, was increased to roughly 45,000kg for the Wellington Bay area in an attempt to distribute effort (DFO, 2004). This approach was unsuccessful, as the average charr weight dropped (DFO, 2004). The Ekalluk River fisheries was closed in 1970 (DFO, 2004). This area, as well as the Paliryuak River, were areas of poor fishing, mostly due to reduced fish size but also declining prices (DFO, 2004). Large landings were common through the late 70s and 80s (the reasons remain unclear; *Fig. 16*, top left), but began decreasing in the 1990s and did not return to comparable values even after 10 years (DFO, 2004).

Arctic charr commercial fisheries are set at the mouth of the rivers to catch either the fish running up the river in the fall or swimming down to sea in the spring (DFO, 2004). The main Arctic charr fisheries are currently found in Cumberland Sound and Cambridge Bay (DFO, 2014a).

Four main plants process Arctic charr in Nunavut, one each in Cambridge Bay, Rankin Inlet, Iqaluit and Pangnirtung. These plants each generate 50-70 jobs per year (GN & NTI, 2005; Nunavut's Truly Wild, n.d.). Nunavut Development Corporation owns three of these plants, Iqaluit Enterprise the fourth (GN & NTI, 2005).

Setting quotas for specific rivers, as was done in the 1960s, is not a perfect method for managing Arctic charr populations in Nunavut. Tagging research has shown charr from the Ekalluk River swimming into the Paliryuak River, which means the harvest total could have been much higher had that information been known beforehand (DFO, 2004). Furthermore, a quota for a given area does not imply that those hunters are harvesting a single stock. In the case of the anadromous charr, multiple stocks move up the western coast of the Hudson Bay and experience hunting at the mouth of several rivers and along the coast, which can negatively impact a stock established with sustainable goals (Stewart & Lockhart, 2005). As seen in the bottom graph of

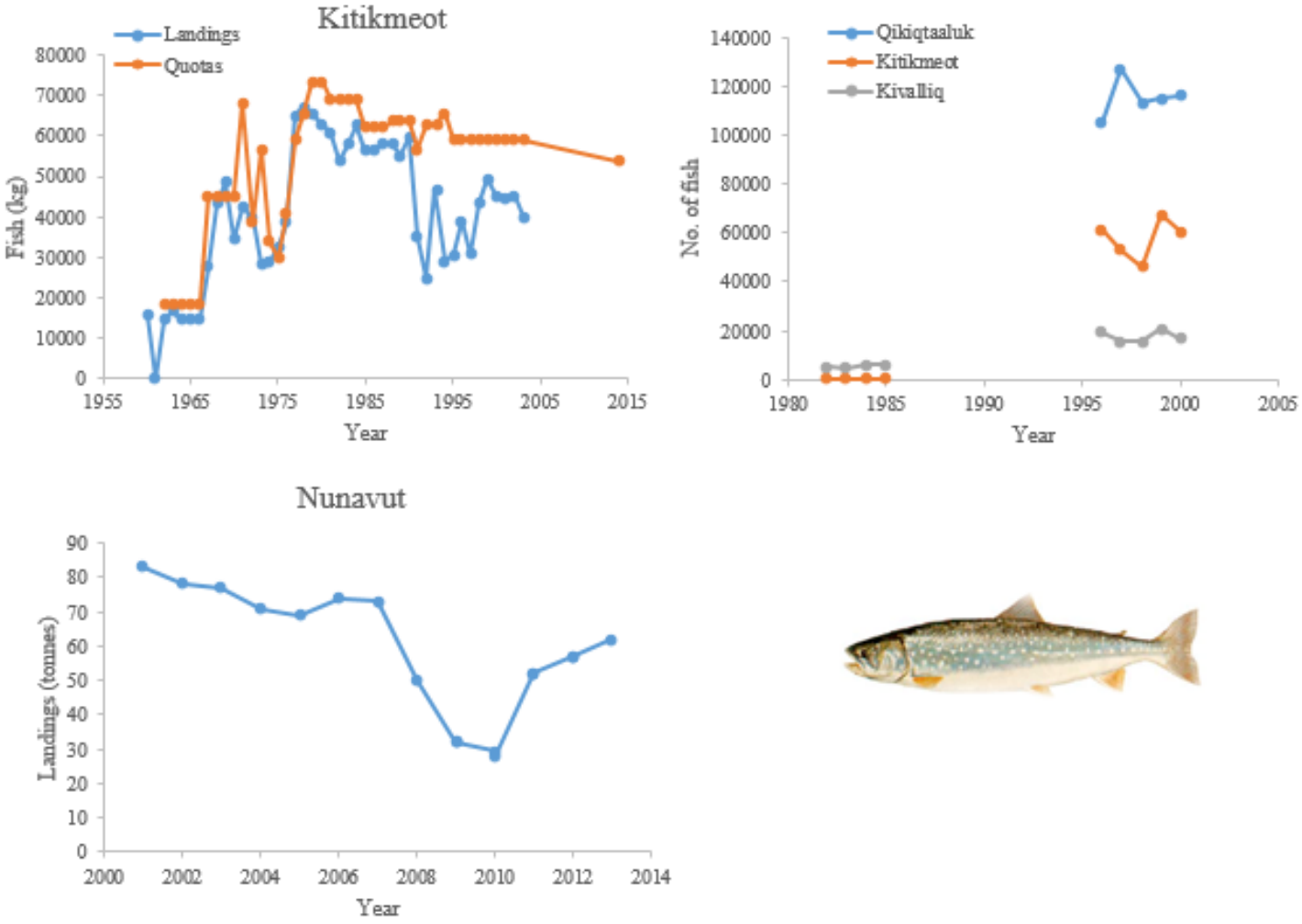

Figure 16. Arctic charr landings in the Territory of Nunavut for: (top left) commercial fishery in the region of Kitikmeot (all communities listed in table 7 except Res & Sa), recorded as tonnes of fish; (top right) subsistence hunting as recorded by number of fish for all three regions; (bottom) commercial fishing for all of Nunavut, in tonnes.

Figure 16, commercial landings of Arctic charr in Nunavut decreased from 2001-2010, but experienced some recovery following this period (Roux, Tallman, & Lewis, 2011; DFO, 2014b). This was most likely caused by the opening of 81 commercial and 18 exploratory fisheries (pending commercial licensing) in Nunavut in 2010-2011 (see *Fig. 1* of Roux, Tallman & Lewis, 2011 for locations of these fisheries), increasing the annual catch total of Arctic charr throughout the territory (Roux, Tallman, & Lewis, 2011).

Small scale commercial fisheries of the anadromous *Salvenius* have been considered since the 1970s for economic profit in small communities (Roux, Tallman & Lewis, 2011). This type of

fishery would allow for continued traditional practices and population growth of Inuit communities. Further research should be conducted on the anadromous charr stocks, for there is evidence that anadromous charr may be mating with non-anadromous charr in some rivers (DFO, 2004). Further information on future Arctic charr fisheries will be discussed in Section 5.

3.2.2 Lake trout (*Salvelinus namaycush*)

Lake trout is abundant in Nunavut, occurring in deep water lakes on Baffin, South Hampton, King Williams, Victoria and Banks islands (Nunami Stantec, 2012). Lake trout is fished most prevalently in Kitikmeot and Kivalliq, where landings are often over 1,000 fish each year between 1996 and 2000 (Priest & Usher, 2004). Hunters from Baker Lake harvest large amounts of lake trout, having collected 5,884 trout in 1997; however, the biggest harvest occurred in Taloyoak. During the harvest study, hunters from this community caught over 45,000 lake trout, the largest harvest being in 2000 at 14,068 fish (Priest & Usher, 2004). The Inuit also fish lake trout in fishing derbies or sometimes catch the trout in nets when fishing for Arctic charr (Priest & Usher, 2004). Weather dictates whether or not a lake trout derby takes place, and since derbies greatly increase the number of landings in a given year, years with low landings (1996 onwards) may not have had a derby.

Lake trout is also heavily fished recreationally: in 2010, lake trout and Arctic charr accounted for 88.5% of the recreational fishery harvest that year (Lynch, 2012). These trout were caught inland, for example in the lakes of Kivalliq as trophy sport fishing (Stewart and Lockhart, 2005). Priest and Usher (2004) state DFO issued commercial quotas for lake trout during their Harvest Study, but it is unlikely any commercial landings were reported. No further information was found in regards to whether or not there were commercial fisheries for lake trout during this time.

3.2.3 Greenland cod, Arctic cod and Atlantic cod (*Gadus ogac, Gadus saida, Gadus morhua*)

Multiple cod species are found in Nunavut, the three species listed in the section title being those studied by Priest and Usher (2004) and Stewart and Lockhart (2005). Of all North Atlantic marine fish species, the Inuit only fish Greenland cod, Arctic cod, and sculpin, which are normally harvested using nets (Stewart & Lockart, 2005; Priest & Usher, 2004). Cod is harvested in small

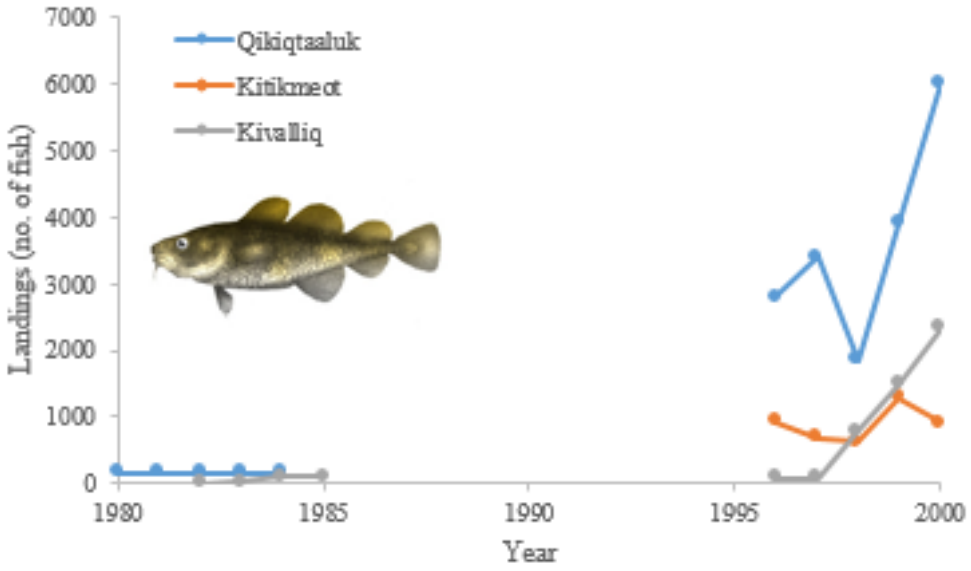

Figure 17. Greenland cod, Arctic cod and Atlantic cod landings for the regions of Qikiqtaaluk (all communities listed in *Table 7* under Qikiqtaaluk), Kitikmeot (CaB, Kglu, Ta) and Kivalliq (all communities except BL) as subsistence hunting in the Territory of Nunavut.

numbers for subsistence in Nunavut, being more often caught incidentally as bycatch (Stewart & Lockhart, 2005). Subsistence fishing of cod is more prevalent in the eastern coast of Hudson Bay than on the western side (Stewart & Lockhart, 2005; Priest & Usher, 2004).

Inuit cod fishing does not appear to be as prevalent as Arctic charr fishing, and perhaps it is partly due to the meat: Dr. Jeff Hutchings of Dalhousie University explains Inuit in communities like Iqaluit or Kimmirut are not known to fish the Atlantic cod in Ogac Lake, perhaps because the fish do not have the best taste (personal communication, July 13, 2015). The cod's poor diet and high water content leads to poorer tasting meat and shorter preservation time (personal communication, July 13, 2015). In contrast, Arctic charr is more readily available, more easily storable, tastes good and has a high nutritive content.

Data from the 1980s show low landings of cod in Nunavut (Stewart & Lockhart, 2005). Qikiqtaaluk landings have an estimated yearly average of 163 fish from 1980-1984 and Kivalliq harvests range between 3 and 105 cod per year from 1982-1985 (Stewart & Lockhart, 2005). For the next ten years, there is no landing data available for cod harvested in Nunavut.

In the second half of the 1990s, Greenland cod, Arctic cod and Atlantic cod are dominantly fished in the region of Qikiqtaaluk (*Fig. 17*), most communities harvesting several thousand each year (Priest & Usher, 2004). In Arviat, the cod is also sometimes caught in fishing derbies, as was

the case in 1996-1997 (Priest & Usher, 2004). In Sanikiluaq, an estimated 4,573 cod were caught in 2000, 79% of the harvest in the month of March (Priest & Usher, 2004). Large catches were also made in Kimmirut and Pangnirtung, each of which harvested over 1,200 cod in at least one year of the five year Harvest Study by Priest and Usher (2004). Other communities such as Kugluktuk (in Kitikmeot) and Arviat (in Kivalliq) also harvested up to 2,000 cod in a year, whereas Whale Cove only landed seven cod in five years (Priest & Usher, 2004).

In an assessment by COSEWIC, Atlantic cod was shown to be harvested by the Inuit both on land and at sea (COSEWIC, 2010); however, the Inuit do not harvest Atlantic cod in large quantities from the three Arctic Lakes of Baffin Island (Ogac Lake, Qasigialiminiq Lake and Tariujarusiq Lake). But since the Atlantic cod is listed as Special Concern under COSEWIC in this area, any regular fishing could negatively impact it (COSEWIC, 2010). Thus, further population monitoring of this species should be required.

3.2.4 Greenland halibut (*Reinhardtius hippoglosoides*)

Greenland halibut, also known as turbot, is not targeted for subsistence. Some subsistence fishing was recorded between 1996 and 2001 for Bathurst Inlet and Clyde River; however, most catches are believed to have been for commercial purposes (Priest & Usher, 2004).

The commercial turbot fishery has, in comparison, become of great importance in Nunavut. It has a recent beginning in the territory, originating in the 1980s (Nunavut's Truly Wild, n.d.). It began as an ice fishery, using longline technology (Nunavut's Truly Wild, n.d.). Now, it is primarily done offshore.

The Northwest Atlantic Fishing Organization (NAFO) regulates turbot fishing through management areas, known as NAFO zones. Turbot is caught in NAFO areas 0A and 0B, both off the eastern and southeastern coasts of Baffin Island (Brubacher Development Strategies Inc., 2004), as seen in *Figure 18*. The Arctic Fishery Alliance, Baffin Fisheries Coalition, Pangnirtung Ltd./Cumberland Sound Fisheries Ltd. partnership, and Qikiqtaaluk Corporation are the primary players in the turbot fisheries (Nunavut's Truly Wild, n.d.).

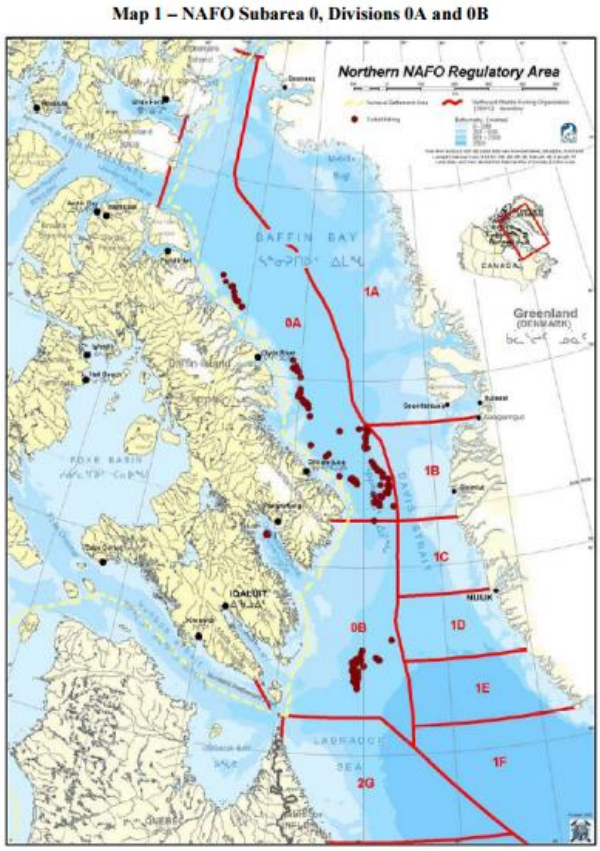

Figure 18. Northwest Atlantic Fishing Organization (NAFO) regulatory areas, including areas 0A and 0B, found along the northern and southern halves of the eastern coast of Baffin Island, respectively (source: Canada-Nunavut Geoscience Office Iqaluit, October 2002, as cited in Standing Senate Committee on Fisheries and Oceans [2009]).

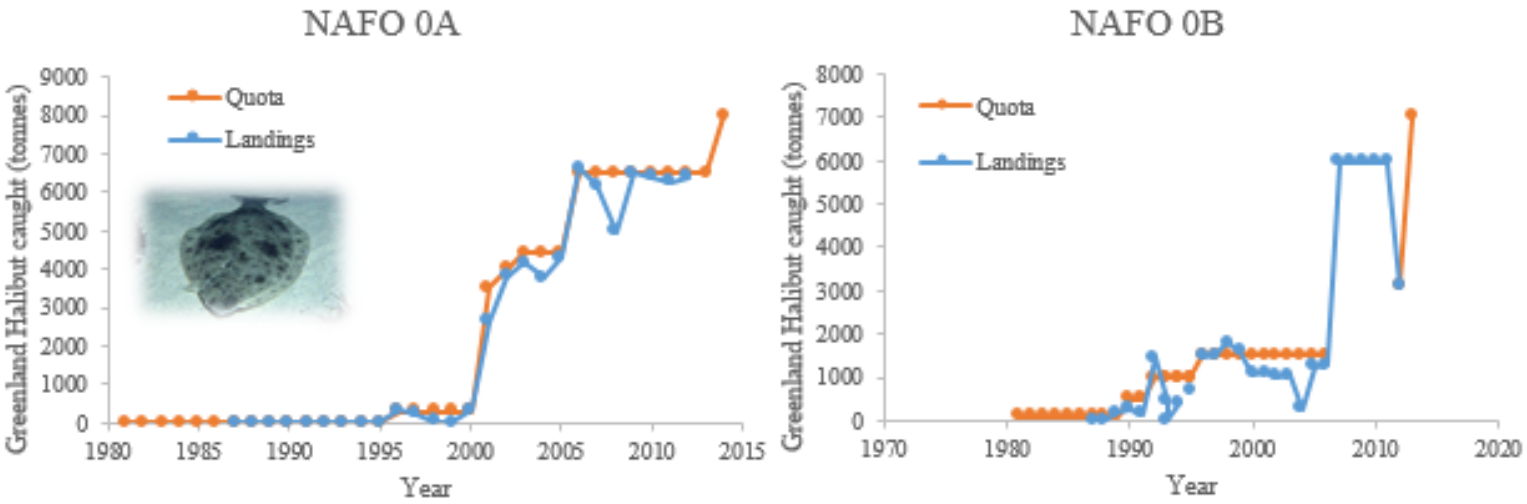

Figure 19. Commercial landings and quotas of the Greenland halibut (also known as turbot) in Nunavut, by Northwest Atlantic Fishing Organisation (NAFO) fishing zones.

Turbot is caught by use of mobile gear, gill nets or longline fishing, the first being the most popular gear type in areas 0A and 0B (DFO, 2010). However, in some areas such as Cumberland Sound, certain gear is prohibited. Only longline can be used in this region, not gillnets (DFO, 2014c). Other restrictions also regulate the turbot fisheries in Division 0A and 0B: trawl type, mesh and hook size, distance from shore, requirement of at-sea observers, seasonal restrictions in narwhal overwintering and cold-water coral zones, and longline soak time (DFO, 2014c; Wells *et al*., 2006). In sum, the commercial turbot fishery in Nunavut is highly regulated.

NAFO 0A's first quota was 300 tonnes in 1996 (Brubacher Development Strategies Inc., 2004). The biggest expansion of quotas and landings in this Division occurred in 2001 (*Fig. 19* left), when quotas were increased by 3,200 tonnes (Standing Senate Committee on Fisheries and Oceans, 2009). A second quota increase to 4,000 tonnes occurred in 2005-2006 due to high turbot sales that year, leading to approximately $35.2 million in revenues for the catch that year (Standing Senate Committee on Fisheries and Oceans, 2009). A separate 500 tonnes inshore quota was established for Cumberland Sound in 2004 (Standing Senate Committee on Fisheries and Oceans, 2009). Today, the quota is set at 8,000 tonnes for NAFO 0A, 1,500 tonnes higher than in 2006 (GN, 2013).

As for NAFO 0B, quotas were established much earlier: 100 tonnes of turbot could be fished as of 1981 (Brubacher Development Strategies Inc., 2004). A larger quota of 1,500 tonnes was eventually established in 2006 (Brubacher Development Strategies Inc., 2004; DFO, 2008b). Now, NAFO 0B's quota is 7,000 tonnes (GN, 2013). The increase in 0A is fully given to Nunavut for its offshore fisheries, whereas Nunavut continues to be a minority shareholder in 0B, holding only 40% of the 7,000 tonnes quota (GN, 2013). Due to the importance of turbot to the territory, the Government of Nunavut pushes each year to increase the hold of 0B closer to 85-90%, which is the national norm (Standing Senate Committee on Fisheries and Oceans, 2009). Quotas are still set according to NAFO divisions, but they are also divided amongst the primary turbot fishery corporations in Nunavut, such as the Qikiqtaaluk Corporation (Qikiqtaaluk Corporation, 2010). Turbot fisheries have greatly expanded since the 1980s and will continue to do so as fisheries infrastructure is developed in Nunavut.

As seen in *Fig. 19*, most yearly harvests between 2000 and 2015 almost fill the allocated quota in order to maximize revenue (DFO 2013a, Qikiqtaaluk Corporation, 2014). Some exceptions are seen: first, the Ministry of Fisheries and Oceans expanded the total allowable catch

following several years of exploratory fishing, and allocated all 0A quotas to Nunavut (Standing Senate Committee on Fisheries and Oceans, 2008). Second, a significant drop in harvest total occurred in 2008, where the harvest was 2,000 tonnes lower than the previous year (DFO, 2013a). Reasons for this drop remain unclear, but bad weather or late ice break-up could have caused the poor harvest season.

3.2.5 Other non-primary targeted fish species

Several additional species of freshwater and marine fish are hunted in low abundances for subsistence in Nunavut. Recording harvests is done irregularly and is unrepresentative (Priest & Usher, 2004). A single study, Priest and Usher's (2004) Harvest Study, was found recording harvest levels from 1996-2001, thus these species will only be discussed briefly. General trends will be discussed first, then individual patterns per species.

Several of the fish species have similar harvest locations and harvest rates. Arctic cisco, least cisco, Northern pike, and burbot are all fished in Qikiqtaaluk; Arctic grayling and lake whitefish are harvested in Kitikmeot; Arctic cisco, Least cisco, and Arctic grayling are all fished in Kivalliq (Priest & Usher, 2004; Nunami Stantec, 2012). For instance, landing records were very low and inconsistent for the Arctic cisco, Least cisco, Burbot, Inconnu, Northern pike and the sculpin (Priest & Usher, 2004). These species are not primarily targeted for subsistence fishing in Nunavut, instead they were most often caught by accident, recreationally, or occasionally used to feed dog teams (Priest & Usher, 2004; Nunami Stantec, 2012). Other species, like the Arctic grayling and the Northern pike, are targeted species, being harvested during derbies or in commercial fisheries (Priest & Usher, 2004; DFO, 2014b).

The Arctic cisco is more heavily fished than the least cisco (Priest and Usher, 2004). Highest landings are in Qikiqtaaluk from 1996 to 1998, where landings averaged under 30 fish per year, but were in excess of 600 in 1997 (Priest & Usher, 2004). Inconsistent recording most likely caused this inconsistency. These species are hunted in nets and often 50 fish could be brought up at once (Priest & Usher, 2004).

The Arctic grayling is hunted by the communities of Cambridge Bay, Kugluktuk, Arviat, Baker Lake and Whale Cove (Priest & Usher, 2004). Approximately 2,500 fish were caught in 1996, but harvests in the following four years remained below 1,200 fish and decreased over time (Priest & Usher, 2004). The larger landing totals in the earlier years may be due to trout derbies:

hunters caught Arctic grayling when fishing for trout (Priest & Usher, 2004). This fish species is also caught when jigging through the ice for other species (Priest & Usher, 2004).

Burbot is absent from the northern areas of Kitikmeot and Kivalliq as well as the Arctic islands (Nunami Stantec, 2012). Landings remain under 25 fish yearly for the region of Kivalliq, whereas both Qikiqtaaluk and Kitikmeot account for only one to five fish per year, probably accidentally (Priest & Usher, 2004).

The Inconnu yielded less than 125 landings for subsistence during 1996-2001 (Priest & Usher, 2004). Highest landings were recorded in the second half of this period (Priest & Usher, 2004). 264 inconnu landings were recorded in Kugluktuk in 1999; however, hunters explained this species is not found in the area and the record was most likely not the inconnu, rather another species not listed on the Harvest Study species list. When ignoring this datapoint, the largest harvest occurred in Resolute Bay in 1996, when 95 inconnu were caught, all in the month of June. Only three hunters contributed to the Inconnu harvest during this study, which demonstrates the low effort of fishing this species in Nunavut (Priest & Usher, 2004).

Between 1996 and 2001, lake whitefish were typically harvested in several hundred each year in Qikiqtaaluk and Kivalliq (Priest & Usher, 2004). In the latter region, estimated average landings were also recorded in the 1980s, when they were less than 100 for each year (Stewart & Lockhart, 2005). In contrast, hunters in Kitikmeot communities fished upwards of 5,000 fish annually between 1996 and 2001 (Priest & Usher, 2004). In 1997, there were over 14,000 fish caught by Kitikmeot hunters; 11,304 of those fish were mainly caught in October and November by Gjoa Haven hunters (Priest & Usher, 2004).

The Northern pike is absent from northern Kivalliq and the Arctic islands (Nunami Stantec, 2012). In the rest of Nunavut, recorded harvests of this species are very low. Stewart and Lockhart's (2005) research recorded one landing of 2 fish in Whale Cove in1982, while Priest and Usher's (2004) Harvest Study only recorded subsistence fishing landings in Arviat (27 fish) and Kugluktuk (3 fish). In other words, the Northern pike does not strongly contribute to yearly subsistence landings in Nunavut. Commercial fishing of the Northern pike has occurred in the Northwest Territories in the 1990s, which would have included Nunavut before its creation (DFO, 2014b). An average of 148 tonnes of Northern pike was harvested there each year from 1990-1999 (DFO, 2014b).

Sculpin is the third marine species hunted by the Inuit, the other two being the Greenland and Arctic cod (Stewart & Lockhart, 2005). Records show some fishing of sculpin in Qikiqtaaluk and Kivalliq in the 1980s, but harvests were only equal to an average of 226 and 5 fish per year, respectively (Stewart & Lockhart, 2005). Landings were generally highest in 1996/97 for all three regions of Nunavut (Priest & Usher, 2004; Stewart & Lockhart, 2005). Qikiqtaaluk hunters harvested the most sculpin, averaging 2,500 fish per year between 1996 and 2011 (Priest & Usher, 2004). Landings were much lower in Kitikmeot and Kivalliq (less than 150 fish per year). The inconsistency of yearly landings may be due to the fact that sculpin is caught when fishing for other species, by children, or in nets along with Arctic charr.

3.3 Invertebrates

3.3.1 Clams (*Mya spp.*) and blue mussels (*Mytulis edulis)*

Subsistence harvesting of invertebrates in Nunavut is often an opportunistic undertaking. In Cape Dorset, people collect clams on the beach, and 15,536 clams were collected this way in 1997 (*Fig. 20,* left; Priest & Usher, 2004). Clam harvesting is weather-dependent, as high winds and large waves can prevent communities from collecting the shells on the beach (Priest & Usher, 2004). Landings were especially high in 1999 because almost 100,000 clams were collected in Qikiqtarjuaq, in what the researchers believe was possibly a commercial harvest (Priest & Usher, 2004). The amount of clams harvested as subsistence versus commercially is unclear. In the case

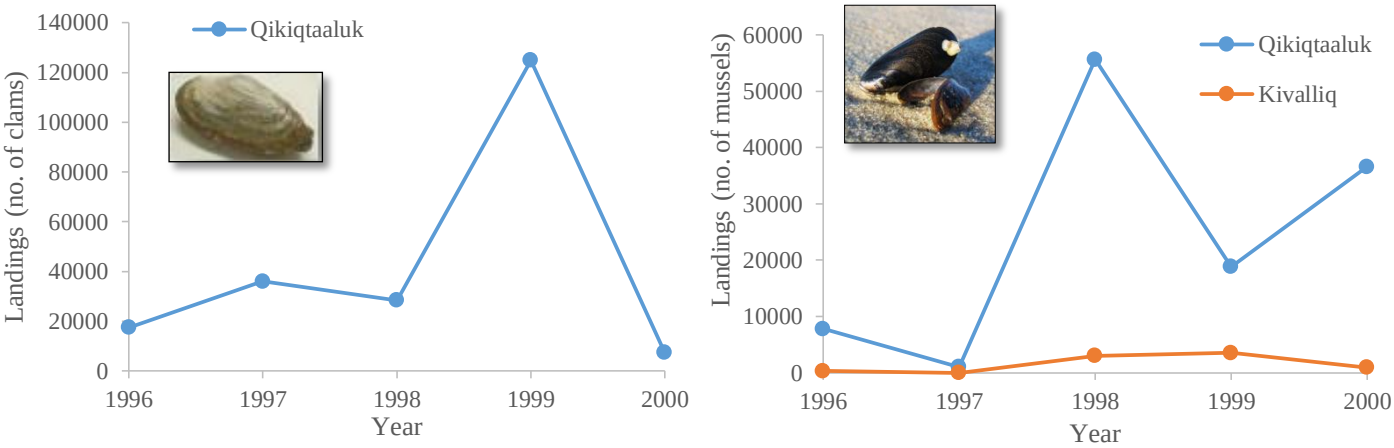

Figure 20. Clam (left) and Blue mussel (right) landings for all communities listed for Qikiqtaaluk (*Table 7*), as well as Coral Harbour and Whale Cove for the region of Kivalliq (mussel) as subsistence hunting in the Territory of Nunavut.

of mussels, these invertebrates are collected by communities annually when they go berry picking (Priest & Usher, 2004). As many as 14,000 mussels were collected in one day in 2002 by the community of Coral Harbour, but similar harvests normally go unreported (*Fig. 20*, right; Priest & Usher, 2004). This could be a significant conservation issue for the invertebrate populations on the coasts of Nunavut, seeing as no strict regulations are in place to manage these types of large harvests occurring in short periods of time.

Invertebrates like clams and blue mussels can be underreported for subsistence harvests for two reasons: hunters are worried of accurately reporting landings should officials decide to lower harvest limits or they were unaware invertebrates were to be reported for the Harvest Study (Priest & Usher, 2004). Harvest levels should be more consistent throughout all years for both clams and mussels, ranging in the five digits (Priest & Usher, 2004). Therefore, low landings do not mean low harvesting rates, but rather a high possibility of infrequent reporting. Priest and Usher (2004) stated clam harvesting has increased between 2000 and 2004 because clams are now also collected by diving.

3.3.2 Northern shrimp (*Pandalus borealis*)

Offshore commercial fisheries for the northern shrimp have existed since the 1980s, primarily in the Hudson Strait and Ungava Bay (Nunavut's Truly Wild, n.d.). The Baffin Fisheries Coalition and the Pangnirtung Fisheries Ltd./Cumberland Sound Fisheries Ltd. partnership hold most of the licences for northern shrimp in Nunavut (Standing Senate Committee on Fisheries and Oceans, 2009; Nunavut's Truly Wild, n.d.). Northern shrimp is harvested in NAFO Shrimp Fishing Areas 0-3 (*Fig. 21*), which are found off the eastern and southeastern coasts of Baffin Island (DFO, 2010). As some of these areas also border Newfoundland and Labrador, Nunavut does not get the full quota set for these areas as determined by DFO and NAFO (NWMB, NTI & GN, 2012). With an allocation of less than a third (31.25%), however, Nunavut got a disproportionately low share of the total quota; the remainder was allocated to other Canadian provinces (Standing Senate Committee on Fisheries and Ocean, 2009). In comparison, the Atlantic provinces each have access to 80-95% of their adjacent fisheries (Standing Senate Committee on Fisheries and Oceans, 2009). Nunavut does hold 68% of the northern shrimp share of Subarea 0, as a result of the Nunavut Land Claims Agreement in 1993 (Standing Senate Committee on Fisheries and Oceans, 2009). The remaining 32% is available to "any Canadian trawler, offshore northern shrimp licence holder or

vessel acquired by Nunavut interests" (DFO, 2010). It remains unclear why Nunavut holds such low harvest ratios, but the Nunavut communities are voicing their desire to retain more shrimp in the territory.

Northern shrimp fisheries are very important for the Nunavut economy, yielding approximately $2.9 million in 2005 (Standing Senate Committee on Fisheries and Oceans, 2009). The shrimp is frozen and processed on the vessel decks. However, fishing northern shrimp in SFA 1 and 2 often requires expensive offshore travelling, causing fisheries to sometimes be described as worthless (Standing Senate Committee on Fisheries and Oceans, 2009). These high costs as well as the low market price of the shrimp has led much of the quota to be left in the water (Standing Senate Committee on Fisheries and Oceans, 2009). Total landings in 2006-2007 declined by 1,351 tonnes compared to the previous year (Standing Senate Committee on Fisheries and Oceans, 2009).

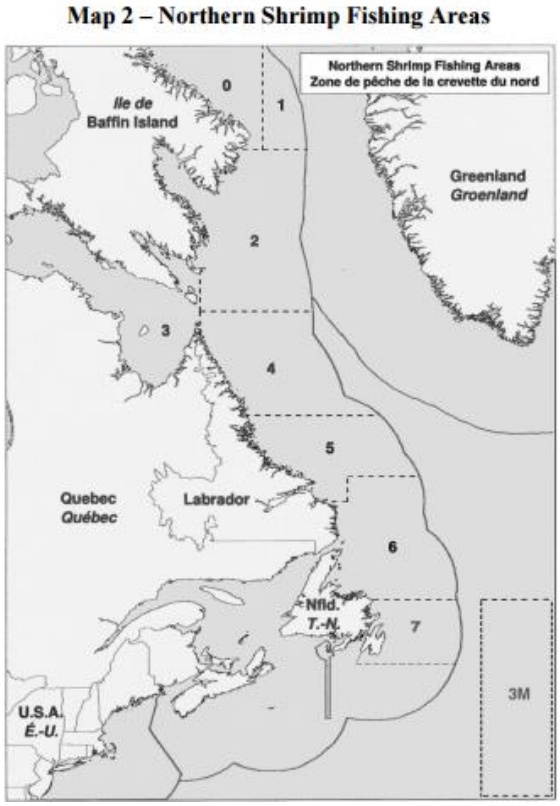

Figure 21. Northern Shrimp Fishing Areas (SFAs) according to the Northwest Atlantic Fishing Organization (NAFO), shown here for the northern and striped shrimp commercial fisheries, SFA 0-3 on the eastern and southern coasts of Baffin Island (source: Department of Fisheries and Oceans, as cited in Standing Senate Committee on Fisheries and Oceans [2009]).

The trends observed in the quotas and landings of the shrimp fisheries in Nunavut greatly varies depending on the NAFO management area. Commercial shrimp fisheries take place in four such management areas: SFA 0, 1, 2 and 3. Each will be discussed in turn.

Exploratory quotas were set for SFA 0 in 1993 at 300 tonnes (*Fig 22*, SFA 0) and increased to 500 tonnes in 1994 (DFO, 2010). This quota remained until 2012 and current quotas were not published (DFO, 2013a). Despite *Figure 22* showing no harvests for northern shrimp in SFA 0 from 2003 to 2012, there is speculation that catches were made but not recorded (DFO, 2010). Fisheries and Oceans Canada state SFA 0 has a competitive quota, but the challenging Arctic weather and ice in this area makes harvesting difficult (DFO, 2010).

Canada and Greenland share the management of Shrimp Fishing Area 1 harvesting, using a bi-lateral management plan with annual assessment by NAFO (DFO, 2010). Average landings were low during the period of 1994 to 2001, yielding only 46% of the quota (DFO, 2010). Harvest effort increased in 2002 in SFA 1, along with the quality of the shrimp caught (DFO, 2010). The SFA 1 quota reached over 18,000 tonnes in the mid-2000s, however, it dropped to 3,722 tonnes as of 2006 (DFO, 2010; DFO, 2013a). Shrimp harvesting in Nunavut can become complicated because of the sharing of quotas: for example, the SFA 1 quota was increased from 12,040 tonnes in 2002 to 14,167 tonnes in 2003, a quota shared by Makivik, Nunavut and Offshore Licences (DFO, 2010). Out of this 2,127 tonnes increase, Nunavut was allocated less than half the increase, 1,000 tonnes. This scenario demonstrates the bias of analysing unilaterally shared fishing areas, where some countries or regions are not proportionally assigned fishing quotas despite their closest proximity to it.

An exploratory quota exist is in place in part of SFA 2, set at 3,500 tonnes in 1989 (DFO, 2010). It was reached for the first time in 1995 (DFO, 2010). The quota fluctuated for the next 20 years, almost reaching 10,000 tonnes; however, harvest limits were decreased to below 2,000 in the early 2010s as landings declined (DFO, 2010; DFO 2013a). One datapoint in 1997 states over 55,000 tonnes of shrimp were caught that year (*Fig. 22*, SFA 2), with a significantly lower quota of 5,250 tonnes (DFO, 2010). The absence of explanation for this large harvest suggests a potential data input error. SFA 2 is one of the main fishing grounds for northern shrimp, the others being SFA 4, 5, and 6 (DFO, 2010).

Figure 22. Northern shrimp commercial landings according to Shrimp Fishing Areas (SFAs) 0-3 of the Northwest Atlantic Fishing Organization (NAFO) in the Territory of Nunavut.

Shrimp Fishing Area 3 also continues to be used as an exploratory fishing ground as the striped shrimp fishery expands in this area, as explained in the next subheading (DFO, 2010). The first quota was set in 2003 at 500 tonnes, then increased to 1,000 tonnes from 2004 onwards (*Fig. 22* SFA 3; DFO, 2010). Landings are below 1,000 tonnes per year (DFO, 2010).

3.3.3 Striped shrimp (*Pandalus montagui*)

As mentioned above, commercial shrimp fisheries are expanding in Nunavut, both for the northern shrimp and the striped shrimp, also known as the pink shrimp. Fisheries for the striped shrimp remain exploratory and are not as important as the northern shrimp fisheries (DFO, 2010; DFO 2013a). Striped shrimp is harvested in SFAs 2 and 3 (*Fig. 21*), off the south and southeastern coasts of Baffin Island (DFO, 2010). The striped shrimp's market price is inferior to northern shrimp, making it less profitable to fish, so it is not targeted. When it is caught, it is primarily as bycatch in the northern shrimp fisheries (GN & NTI, 2005; DFO, 2010).

As seen in SFA 2 of *Figure 23 (left)*, landings remain relatively low for the striped shrimp, especially in relation to the much higher quotas (DFO, 2013a). An exploratory quota was implemented in 2010 at 2,000 tonnes for SFA 2 and 1,000 tonnes for SFA 3 (DFO, 2010). In SFA 3 (*Fig. 23, right*), the quota was originally set at 1,200 tonnes and then gradually raised over the years, namely to 3,800 tonnes in 1996 and 6,300 tonnes in 2002 (DFO, 2010). The current quota remains unknown. Furthermore, northern shrimp quotas were set in the SFA 3 in the directed

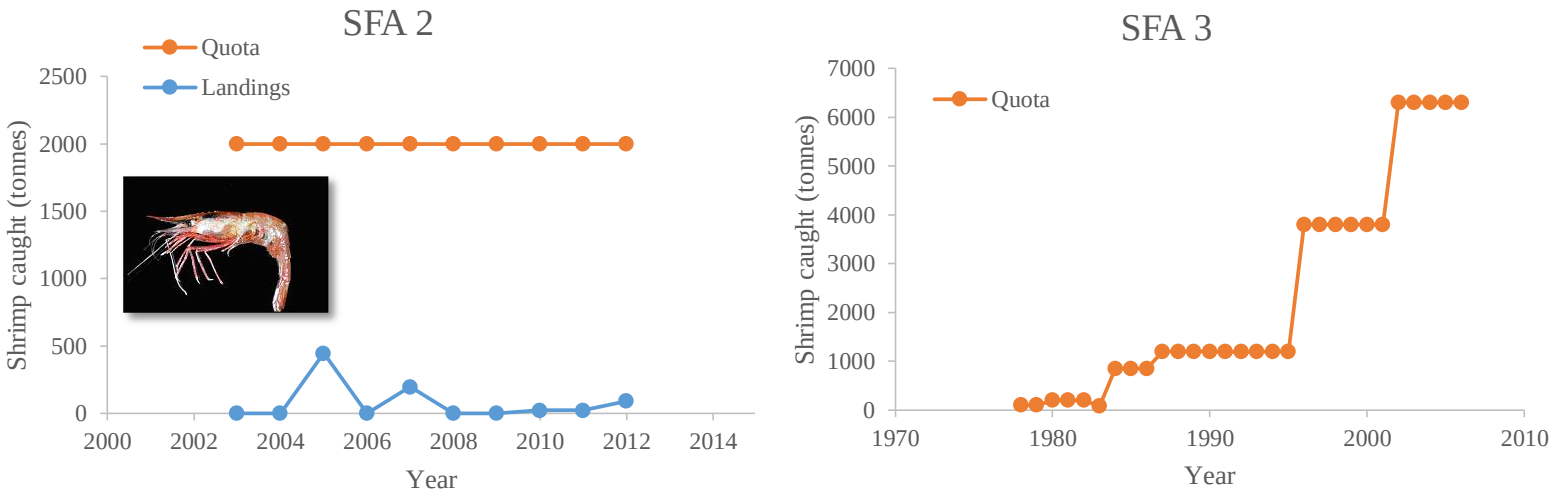

Figure 23. Striped shrimp commercial landings and quotas according to Shrimp Fishing Areas 2 (left) and 3 (right) of the Northwest Atlantic Fishing Organization (NAFO) in the Territory of Nunavut.

striped shrimp fisheries (DFO, 2010). No landings were found for SFA 3, which could be due to the exploratory state of the fishery or landings may not be accurately recorded if the striped shrimp is still being caught primarily as bycatch in the northern shrimp harvests. The striped shrimp fishery will most likely continue to grow, as Nunavummiut become increasingly interested in the commercial shrimp fisheries (Standing Senate Committee on Fisheries and Oceans, 2009). This subject will be discussed further in Section 5.

SECTION 4: EVOLUTION OF GEAR

The people of Arctic Canada have used several dozen types of tools, gear and equipment in the past 4,000 years to hunt and fish. Many tools were invented by these peoples, but some were introduced during exploration periods. This section will discuss the four main Arctic peoples who occupied the Eastern Canadian Arctic, describing the culture, the tools they invented, the tools' role and importance for hunting and fishing, as well as the length of time each tool was used throughout history (*Fig. 24*). A short description of general events which occurred during each culture's period will be provided to highlight their role in gear usage. The presence of mankind in the Canadian Arctic has been divided into four main cultures: the Arctic Small Tool Tradition (ASTt, also known as the Paleoeskimo or Pre-Dorset), the Dorset, the Thule and the current-day Inuit/Eskimo (Stern, 2010).

4.1 The Artic Small Tool tradition (ASTt)

The ASTt, also known as the Paleoeskimo or Tunit, are descendants of those who migrated across the Bering Strait from Russia to Alaska (Stern, 2009). They were in Alaska prior to 2200BC, then travelled throughout the Canadian Arctic and all the way to Greenland (Stern, 2009). They are renowned for their small tools, as the name suggests. Their weapons were made of organic material such as ivory, bone, antler, and wood (Anderson, 2004). They built ivory and stone headed toggling harpoons, small stone oil lamps, composite bows and arrows, and fine bone needles used for fishing (Stern, 2009). Harpoons, bows and arrows were the weapons of choice for the Paleoeskimo, the heads being made of chipped stone. Bone and ivory snowknives indicate the possibility of snowhouse construction (since snowhouses do not leave any remains, the knife's purpose remains uncertain), most likely built for seal hunting (Stern, 2010). Tents were built of animal hides and driftwood poles, supported by a ring of boulders and stones (Sutherland & McGhee, n.d.). These rings can still be found in today's northern landscape, helping archaeologists determine ancient Paleoeskimo sites.

Paleoeskimo tools share similarities to those found in Siberian sites from the same period, suggesting the importance of this type of technology for adaptation to Arctic conditions (Sutherland & McGhee, n.d.). Fine bone needles used for sewing and fishing were also essential for Arctic life, used to sew the skin clothing donning these people (Sutherland & McGhee, n.d.).

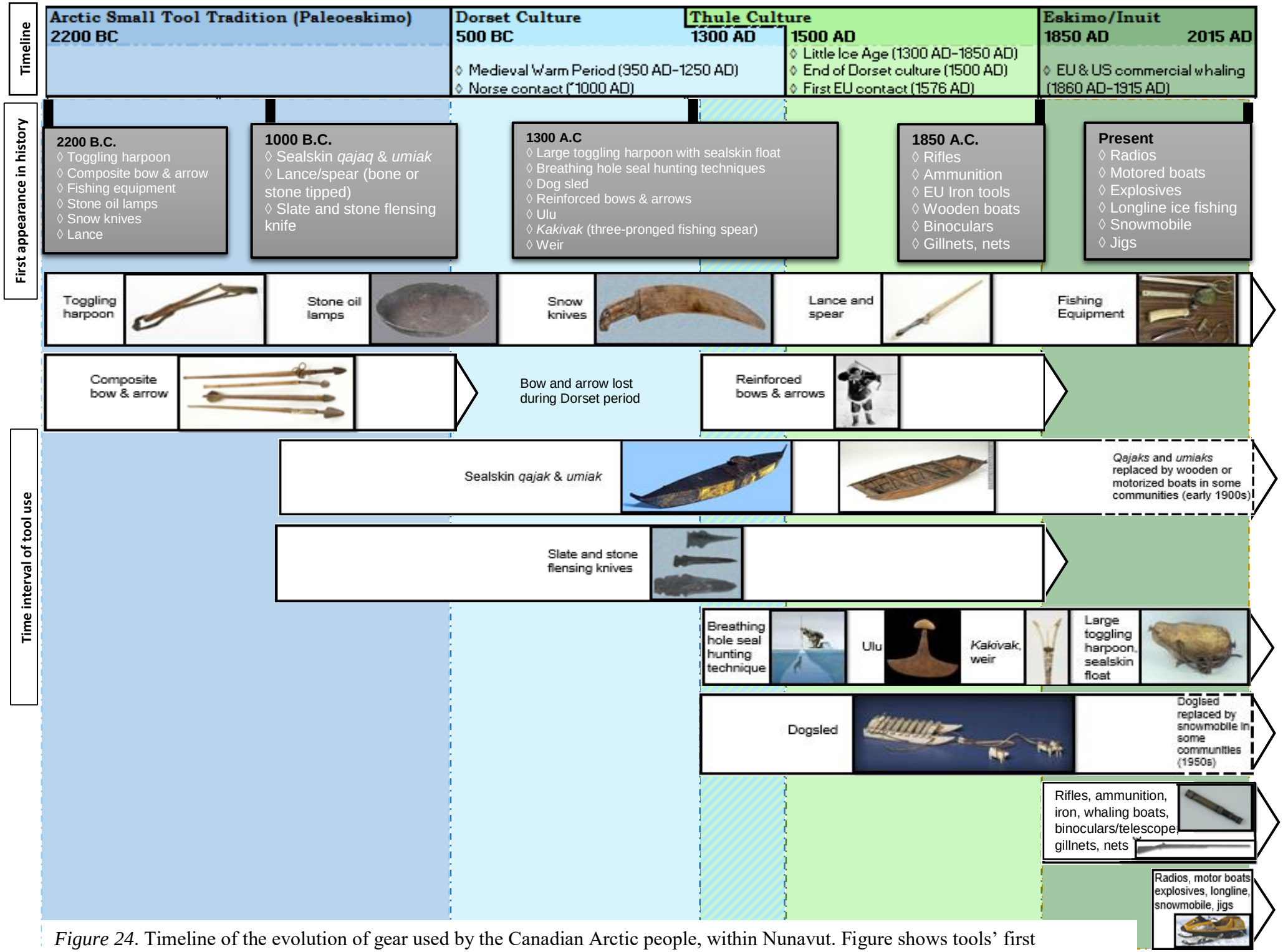

Figure 24. Timeline of the evolution of gear used by the Canadian Arctic people, within Nunavut. Figure shows tools' first appearance in history (invention or introduction), associated culture and length of use through time.

In the first millennium of the ASTt, no evidence was found of dogs nor boats in the ASTt culture, thus these people most likely hunted by foot and at the floe edge (Stern, 2010; Anderson, 2004).

Around 1000BC, the development of new gear such as sealskin-covered *qajaqs* and *umiaks* (multiperson, top open boats), slate and stone flensing knives, lances, and spears, were developed and improved the Paleoeskimo's way of life in the Arctic (Sutherland & McGhee, n.d.). Despite the simplicity of most of the ASTt gear, many of them, such as the lance and spear, are still used today in traditional Inuit fishing and hunting (*Fig. 24;* Sutherland & McGhee, n.d.) as their traditions were passed down through subsequent cultures.

4.2. The Dorset culture

Around 500 BC, the Arctic Small Tool tradition transitioned into the Dorset culture (Sutherland & McGhee, n.d.). As the climate warmed during the Medieval Warm Period (950AD-1250AD), gear started changing to embrace a more coastal way of life. Warmer weather melted the sea ice, giving easier access to the ocean and the animals within (Stern, 2010). As a result, the Dorset hunted a variety of sea mammals such as seals, walrus, belugas and narwhals (Sutherland & McGhee, n.d.). Women would cut up the animals using an *ulu (Fig. 24*), the "woman's knife", a semi-circular stone blade with a bone handle (Stern, 2009). Remains of Dorset habitations are seldom found in interior regions, leading to the conclusion the Dorset relied primarily on sea animals rather than terrestrial ones (Stern, 2009).

Coastal hunting and fishing led to an upgrade in hunting technology. After 1300 AD, larger toggling harpoons with attached sealskin floats were created to hunt large marine mammals and prevent them from sinking or diving once harpooned (Stern, 2010; Freeman, 1998; Stern, 2009). Curiously, the bow and arrow were abandoned during the Dorset period, which may have been caused by preferential seal hunting at breathing holes with harpoon or spear due to a warmer climate during this time (Stern 2009).

Uniformity in Dorset artifacts in the North has led archaeologists to suggest widespread travel of this people (Sutherland and McGhee, n.d.). The Dorset culture disappeared sometime between 1300AD and 1500AD, but the reason still remains unknown (Stern, 2010). Theories have emerged, suggesting either the people died out, were killed by the Thule, or became the Thule culture (Stern, 2010). The latter theory is the most likely, considering evidence was found of Dorset-styled tools in Thule campsites, for example: snowknives and soapstone oil lamps.

4.3 The Thule culture

The Thule period (1300AD-1850AD) coincided with the Little Ice Age. Since seal hunting grounds were covered with ice, the Thule let their posts in the northern parts of the Canadian Arctic and followed the bowhead whales eastward towards one of the remaining open-water areas, the Baffin Strait (Stern, 2010).

Renowned as bowhead hunters, the Thule also caught ringed seals, bearded seals, harbour seals, walruses, belugas, and several species of fish and shellfish (McCartney, 1980). As McCartney explains, researcher Freeman questions whether the Thule were bowhead hunters, suggesting they were instead bowhead gatherers, collecting remains of beached whales. Bowhead crania, vertebrae, jawbones, liver, and baleen have all been found in Thule campsites as sled runners, toys, building materials, platforms and drumheads, as discussed in Section 2 (McCartney, 1980). Several findings in the archeological record dispute Freeman's claim, however, confirming the Thule were more than gatherers: large toggling harpoons, multiple oversized meat caches, drilled holes in the whale craniums, and numerous whale bones used as housing structure (more than what could be collected from beachings) were all found in Nunavut Thule campsites (McCartney, 1980). In order to collect enough bones for all these items, the Thule most likely hunted bowhead whales and used the remains of the washed up specimen (McCartney, 1980).

As mentioned previously, these people did not uniquely hunt bowheads, but also several other marine species, which required specialized tools and gear. Bows and arrows reappeared around 1300AD (*Fig. 24*), now reinforced with bone, antler or wood (Boas, 1964). Three-pronged fish spears, the *kakivaq*, originated during Thule times as well as the *qajaqs* (seal skin covered kayaks), *umiaks* and fish weirs (Kitikmeot Heritage Society and Cultural Centre, 2004; McCartney, 1985; Anderson 2004). The Thule collaboratively hunted by use of boats, harpoons with sealskin floats, stone or bone tipped lance (4m long), detachable toggling harpoon heads, and slate or stone flensing knives (Freeman, 1998). Thule harpoons had distinct holes drilled into one corner to attach the shaft and head together, allowing detachment of the head from the shaft without the loss of the harpoon head (Anderson, 2004). Sealskin floats, attached to the harpoon head, would prevent the whale or walrus from diving deeply, eventually tiring them out (Anderson, 2004). Another important invention of this time was the dogsled, crafted of driftwood or whale bone (Anderson, 2004). All this innovation allowed the Thule to be very effective hunters and travellers.

4.4 The Inuit/Eskimo culture

The Inuit culture arguably experienced the largest change in the 19th and 20th centuries. During this time, the Inuit in Nunavut met European and American whalers, Christian missionaries, and government representatives aiming to relocate entire communities to "southernize" them (Stern, 2009; 2010). Nunavut became its own territory in 1999, following the Land Claims Agreement in 1993 (Stern, 2009). Many adaptations have occurred between the Thule and current day Inuit, including changes in their hunting technology.

The Europeans significantly impacted the Inuit culture. One influence was the introduction of new equipment to the Inuit toolkit through commercial whalers. Inuit were hired by whaling vessels as guides, bowhead hunters, and to also process the animals once killed (Hay, Aglukark, Igutsaq, Ikkidluak & Mike, 2000). In return, whalers would pay them with hunting equipment and commodities: rifles, boats, knives, binoculars, ammunition, telescopes, tobacco, flour, needles, and clothing, to name a few (Hay, Aglukark, Igutsaq, Ikkidluak & Mike, 2000; Freeman, 1998). The Hudson's Bay Company also introduced a wide variety of tools, by trading their hunting goods (Ross, 1975). Communities south of Rankin Inlet, mostly sheltered from whaling vessels, could procure firearms from the Churchill trading post (Ross, 1975). Trading with the Hudson's Bay Company lead communities to relocate closer to trading posts, accept employment as hunters, seamstresses, guides or interpreters, and even form relationships with incoming whalers (Ross, 1975). On the one hand, many Inuit fishing practices improved in efficiency, but there was a visible decline in traditional practices as clothing and domestic functions began to mirror European ones (Ross, 1975). Inuit communities most affected by commercial whaling trade were those between Rankin Inlet and northern Foxe Basin, and from Committee Bay to the Boothia Peninsula (Ross, 1975).

Changes in hunting technology also involved the disappearance of some tools as others replaced them. This was especially prevalent during the commercial whaling period, as American and European whalers imported firearms, metals knives and wooden whaleboats (Ross, 1975). As shown in *Table 6* adapted from Ross (1975), several traditional Inuit tools were replaced by imported equipment. In some instances, the traditional tool was abandoned for the modern equipment, such as slate and stone flensing knives for metal ones (Sutherland and McGhee, n.d.). The pressure stove replaced the stone lamp in the first half of the 20th century, creating waste

Table 6. Traditional tools and material construction in comparison to the introduced European or American material during the whaling period (adapted from Ross, 1975).

Tool	Traditional material	Introduced material
Knives and needles	Bone and ivory	Metal
Sled runners	Bone and driftwood	Wooden planks
Pots and kettles	Stone	Metal
Lamps	Stone	Kerosene (stove)
Lance shaft	Wood	Iron
Projectile points	Stone and ivory	Iron
Projectile weapon	Wood (bows and arrows)	Explosives (firearms)
Boat	Sealskin and driftwood	Wooden planks

during seal hunts because blubber was no longer required for light and heat (McLaren, 1958). Stone lamps now remain mostly for traditional teaching (McLaren, 1958). Other traditional tools were traded for modern equipment, but remain present in select communities: such is the case for the *qajaq*, *umiak* and dogsled (*Fig. 24;* Cartier & Lemay, 2005; Freeman, 1998). Furthermore, once whalers began hunting along the shores of Nunavut in the 19th century, the Inuit realized the ingenuity of the sturdy, wooden whaleboats (Bonesteel, 2006). Whaleboats were less prone to capsizing than *qajaqs* and *umiaks*, allowing for longer and farther hunting trips on open water (Bonesteel, 2006). *Qajaqs* and *umiaks* continued to be used in eastern Arctic well into the 20th century, but by the 1960s they were generally replaced by wooden and motorized boats (Cartier & Lemay, 2005; Freeman, 1998). Ross (1975) even states that the traditional boats were absent in the Hudson Bay as early as the 19th century, or never utilized, as was the case for the communities of Igloolik and Sanikiluaq.

Introduced equipment not only changed the tools the Inuit used, but also their method of hunting. When the Inuit began using riffles, the size of their hunting parties decreased, changing their hunting style from collective to individualized (Freeman, 1998). White screens were also observed being used for hunting seals, acting as camouflage for lone hunters against the snowy landscape as they approach their prey (Boas, 1964; Wilkinson, 1952). This method of seal hunting was observed in both the 19th and 20th century in Nunavut, as described by Boas and Wilkinson, but its origin remains unclear.

Fish weirs originated during the Thule period and have been used since, but only in select locations (Kitikmeot Heritage Society and Cultural Centre, 2004). Boas (1964) did not observe the Inuit using weirs, but other researchers found them being used in the Chesterfield Inlet area during the 19th century (Boas 1964). Nets likely did not appear until the 20th century. A documentary in the 1950s showed Inuit in Chesterfield Inlet catching seals with a net made from purchased rope (Wilkinson, 1952). McLaren (1958) states the invention of nylon greatly increased the efficiency of nets compared to cotton. The Inuit in the Hudson Strait caught over 500 ringed seals as well as belugas and harp seals with this type of net in 1956 (McLaren, 1958). Despite the success of this gear, Inuit have voiced their dislike of nets because they eliminate the pleasure of hunting, when compared to rifle hunting (Freeman, 1998). Nets are currently used in many fisheries, such as: turbot (longline, gillnet and otter trawls), beluga hunting and charr fishing, but their origin remains unclear (DFO, 2014a; Roux *et al.*, 2011; DFO, 2014c; Welks, Treble, Siferd, Brodie, & Richard, 2006; Freeman, 1998). Perhaps nets made prior to the invention of nylon were only made by communities in close proximity to herds of seals, as a sizeable net would require multiple seal skins and long hours of work, making the conception of this tool very time consuming. More research is required to confirm this theory.

Hunting gear in the Eastern Canadian Arctic has vastly changed since the arrival of the first people over 4,000 years ago. The evolution allowed Arctic people to hunt larger animals, increase the size of the harvest, hunt farther offshore and on land, diversify the species hunted and increase the depth of fishing. As Dale (2009) explains, the development of technology made hunting in the Arctic safer, more productive, and decreased demand. For example, the snowmobile increased productivity by allowing the Inuit to drive farther and faster, and decreased the demand to procure sled dogs and to feed them. However, the evolution of gear also conflicts with Inuit beliefs, in some cases making them feel like they are no longer on the same level as the animals they hunt, instead putting them above (Dale, 2009). Gear will continue to evolve with increased technology and it will be up to each hunter to determine how it shapes their traditions.

SECTION 5: FUTURE FISHERIES & CONCLUSION

Fisheries in Nunavut do not remain solely as subsistence. Rather, commercial and recreational fishing are both trending towards expansion for fish and invertebrates. Both researchers and the Inuit community are voicing their opinions in shaping future fisheries in the territory. Some involve expanding current quotas or fishing areas, whereas others present entirely new fishing opportunities.

Arctic charr has remained an important food source for the Inuit over time, as seen in Section 1, but growing interest is seen from Canada's southern inhabitants (Roux, Tallman & Lewis, 2011). There are currently four Arctic charr processing stations in Nunavut in the following hamlets: Cambridge Bay, Rankin Inlet, Iqaluit and Pangnirtung (Nunavut's Truly Wild, n.d.). Three are operated by Nunavut Development Corporation and the fourth by Iqaluit Enterprises (Nunavut's Truly Wild, n.d.). The development of frequent air travel allows such corporations to export their Arctic charr to major southern sites. Roux, Tallman and Lewis (2011) explain that the future of commercial Arctic charr fisheries could require complicated risk assessment tools to evaluate the vulnerability of the charr from harvest, including analysis of life history parameters and utilization of local traditional knowledge. Communities will experience fewer changes (in regards to traditional practices and to the environment) and costs with the creation of smaller fisheries (Roux, Tallman & Lewis, 2011).

The Inuit also show growing interest in participating in the formation of commercial Nunavut fisheries, requesting the development of Arctic charr, clams, flounder, scallops, crab, Greenland halibut, and shrimp fisheries (Standing Senate Committee on Fisheries and Oceans, 2009; Brubacher Development Strategies Inc., 2004). They also wish to increase bowhead whale, narwhal, and beluga whale quotas in order to continue traditional practices (Standing Senate Committee on Fisheries and Oceans, 2009; Brubacher Development Strategies Inc., 2004). The Inuit believe that by expanding the bowhead hunt, there would be physical and mental benefits to consuming its meat more frequently (Hay *et al*., 2000). Should a decision not be made in the near future, bowhead hunting may become obsolete as many young Inuit no longer understand or appreciate the importance of consuming bowhead, having never done so before (Hay *et al.*, 2000).

As mentioned in Section 3, "Landings and Quotas" for the Greenland halibut (p. 44), Nunavut does not hold the common 85-90% of the quota for its surrounding waters (GN, 2013). However, Nunavummiut believe they have the right to a greater share of the allocations in the

waters off Nunavut in order to boost the local economy (Standing Senate Committee on Fisheries and Oceans, 2009). Commercial fishery organizations also have plans for the future: the Qikiqtaaluk Corporation aims to increase the turbot and shrimp quotas through application in order to maximize vessel capacity (Qikiqtaaluk Corporation, 2014). Additionally, they wish to hire more Nunavummiut and increase their retention rate.

Despite this report being primarily focused on subsistence and commercial fisheries, Nunavut also holds an important recreational fishery mainly (62.5%) in the Baffin region (Wayne, 2012). Approximately 76% of freshwater fishing accounts for recreational fishing, when compared to saltwater fishing (Wayne, 2012). Lake trout and Arctic charr are the main species fished, but Arctic grayling, whitefish and Northern pike are also caught (Wayne, 2012). Although this type of fishing remains primarily catch and release (only 25% of catches are kept), over 23,000 fish were caught in 2010 alone (Wayne, 2012). In the same year, recreational fishing generated $1 million to Nunavut's economy (Wayne, 2012). Catches appear to be decreasing since 2005; however, recreational fishing still provides profitable revenue to local communities (Wayne, 2012).

The future of subsistence hunting and fishing will also transform, as climate change alters conditions in the Artic. Hovelsrud, McKenna & Huntington (2008) state climate change will influence primary interactions, such as hunting, and secondary interactions between humans and marine mammals, such as oil rigs. Arctic species, including humans, may not be able to adapt quickly enough to climate change (Hay *et al.*, 2000). Polar bears, bowhead and beluga whales, walruses, ringed and bearded seals are expected to have a decreased range as they move northwards with the warming climate (Hay *et al.*, 2000). Inuit communities could potentially experience increased dangerous interactions with hungry polar bears, their harvest through increased defense kills (Hay *et al.*, 2000). Finally, the melting of the sea ice will allow more vessels to occupy Eastern Canadian Arctic waters, increasing the risk for ship strikes and various kinds of pollution in these prime marine mammal habitats (Hay *et al.*, 2000). Researchers further predict an increase in oil spills, tourism and competition for resources (Hay *et al.*, 2000).

In summary, the future of Nunavut fisheries is bright, for its people show interest in shaping its regulation and creating new fisheries. However, although we may not see any variations in the current population trends of Arctic species, climate change will affect them in unpredictable ways. The Inuit will most likely have to experience increased activity on coastal waters as the ice melts. They will also have to continue to manage the balance between keeping traditional practices and

embracing technological and cultural evolution. As we have seen throughout this document, the Inuit are a resourceful people, able to adapt to changing environments. They are knowledgeable in thousands of years of Arctic living, hunting and survival. As co-management practices continue to be implemented in Nunavut, hopefully *IQ* will be used more frequently in order to preserve both hunters and their prey.

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APPENDICES

Table 7. List of Nunavut communities referenced in this research as well as the relevant abbreviation and region**.**

	Qikiqtaaluk		**Kitikmeot**		**Kivalliq**
ABN	Arctic Bay & Nanisivik	CaB	Cambridge Bay	Ar	Arviat
CD	Cape Dorset	GH	Gjoa Haven	BL	Baker Lake
CR	Clyde River	Kga	Kugaaruk	CI	Chesterfield Inlet
GF	Grise Fiord	Kglu	Kugluktuk	CoH	Coral Harbour
HaB	Hall Beach	Na	Naujaat	RI	Rankin Inlet
Ig	Igloolik	Ta	Taloyoak	WC	Whale Cove
Iq	Iqaluit				
Ki	Kimmirut				
Pg	Pangnirtung				
PI	Pond Inlet				
Qk	Qikiqtarjuak				
Res	Resolute Bay				
Sa	Sanikiluaq				