Canada's arctic marine fish catches[1]

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Abstract

Canada's arctic marine fisheries occur within FAO statistical areas 18 and 21. Although many of the communities in these areas rely on the sea, only commercial data have been part of the formal reporting procedure. Small-scale fisheries data, including subsistence fisheries, have not been formerly assessed, nor do they form part of the national and global reports. Here, we present reported and estimated catch data for the period 1950 to 2001 for the commercial and small-scale sectors, including catches that were formerly used for feeding sled-dog teams. During this period, it is estimated that small-scale marine fisheries were 27 times larger than the reported commercial catches suggest, and small-scale catches declined by 56 % overall. Excluding the sled-dog food component, the small-scale catches destined for human consumption increased from approximately 523 tonnes in 1950 to an average of nearly 1,200 tonnes in the 1970s, but declined to approximately 900 tonnes by the early 2000s. Arctic marine fisheries catches for the small-scale sector in terms of population ($kg \cdot person^{-1} \cdot year^{-1}$) reached an estimated peak of 268 kg in 1960 and were found to be 20.5 kg at the end of the study period.

Introduction

Canada's arctic fisheries occur within FAO statistical areas 18 and 21 (Figure 1). Fisheries and Oceans Canada (DFO) is Canada's federal agency responsible for fishery statistics, and it reports catch data for Canada, including the Central and Arctic region. The Central and Arctic region includes the coastal waters of the Yukon, the marine and inland waters of Nunavut, the Northwest Territories, Ontario and the prairie provinces of Alberta, Saskatchewan, Manitoba, while Quebec is its own separate region (DFO, 2006). However, existing reports allow for the estimation of the marine fish component of catches from arctic waters to be separated from the inland freshwater catches. The present study reports on marine fish catches taken by communities that fish the arctic waters of Canada (commercial and small-scale) for the period 1950-2001. One purpose of the study is to provide an estimate of marine fish catches to serve as a scientific baseline in the face of global warming, while both data and trends may also be of assistance in community and intercommunity development strategies. Although several studies and reports have been published previously, there has been no comprehensive review of potential historical catches, combining both small-scale catches with reported commercial catches, and there has been no expansion to cover the entire Canadian arctic.

Productivity in the marine waters of northern Canada is limited by low nutrient availability in the upper water layer caused by vertical stability, a lack of upwelling and the freeze/thaw cycle which dilutes available nutrients. In Hudson Bay, vertical stability is amplified by the large amount of freshwater inputs from various river sources. It is for these reasons that the commercial fishery potential has traditionally been considered to be low (Dunbar, 1970).

The Arctic Ocean region of Canada is characterized by small coastal communities with an extremely limited tax base and a high degree of dependence upon marine resources including mammals, as well as fish. The population is spread over a vast, often frozen coastline based in communities that are generally less developed than most others in Canada. Although the significance of subsistence fisheries has been recognized (Berkes 1990), this area has previously received little attention as a fishing culture, due in part to the small population and limited government services. The present study focuses on the marine fish catches of 56 northern communities (Appendix Table A1), which are thought to account for nearly the

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entire human population in coastal arctic Canada. These communities are largely populated by Inuit, although some located on Hudson's Bay coast have large numbers of Algonkian, Athapaskan and Métis, as well as non-indigenous peoples. Most of these communities fall within FAO statistical area 18, but some on the east side of Baffin Island fall within FAO area 21 (Figure 1). The communities are linked by factors that include: cultural heritage, transportation routes, jurisdiction as well as ecological parameters thus providing opportunities for intercommunity coastal resource management, research and development. However, the distances involved and the cultural and jurisdictional diversity make strategic planning difficult.

Over the time period considered here, there has been a large change in the economics and infrastructure of these communities. Before the early 1950s, most Inuit were not living as much in fixed communities, but during the mid-1950s government based communities were established and the people adopted a less nomadic lifestyle. Dog-sled teams, the traditional mode of transportation, were replaced by the snowmobile starting in the early 1960s (Usher, 1972; 2002) and the subsistence economy, although still important, has become blended with a government, and market-based infrastructure. During the 1970s and 1980s there was an increasing tendency towards southern foods (Collings *et al.*, 1998) in part based upon the perception that many of the traditional foods were contaminated with toxins (Jensen *et al.*, 1997). There has also been a larger than 5-fold increase in the indigenous population of these communities, with an estimated growth from about 8,000 in 1950 to almost 44,000 in 2001.

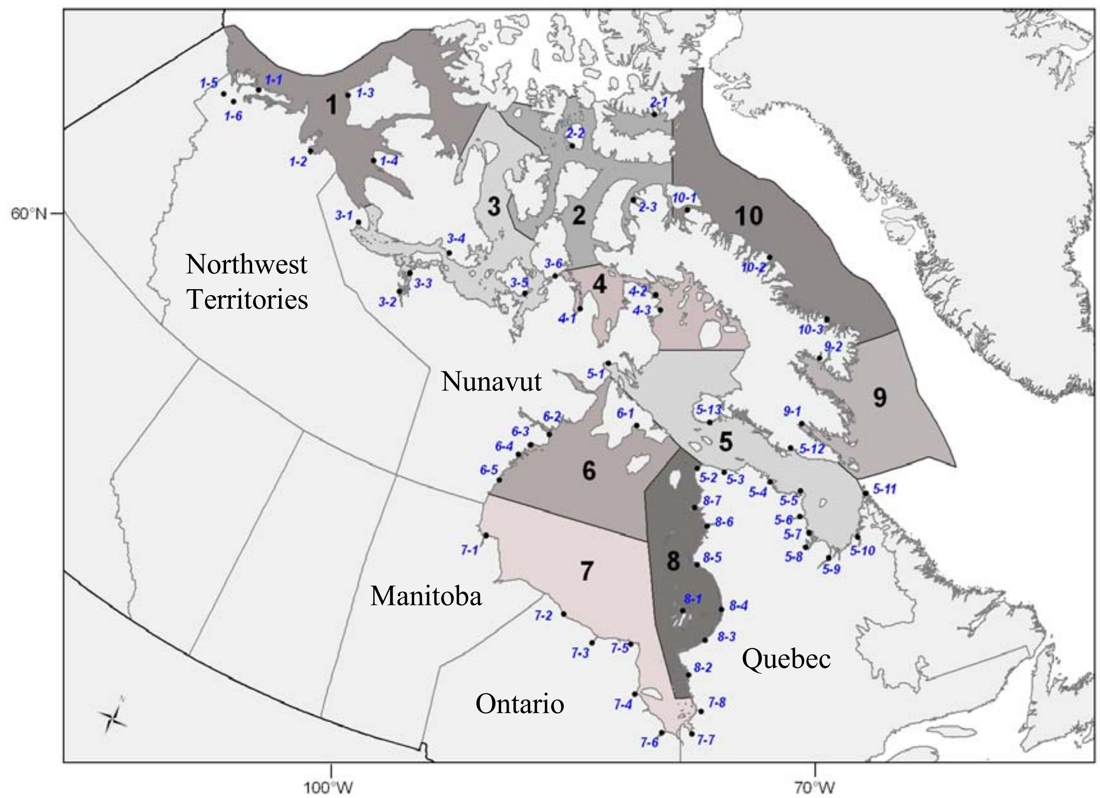

Figure 1: Map of Canada's arctic regions showing the territories and provinces as well as communities by regions (numbered; see Appendix Table A1 for community names).

Materials and Methods

Estimates of commercial marine fish catches in round weight were taken from reports prepared by DFO, while small-scale catches were based on several reports detailing, by species, the number of fish taken. Numbers by taxon were converted to round weight as described below (see 'Small-scale fisheries data'). Since the small-scale reports did not cover the entire time period under consideration, catch data were transformed into per capita catch rates (by community) and combined with human population data to form the basis of the estimates for years when 'hard' data were not available. This method of interpolation between anchor points of hard data to estimate fishery catches has also been used elsewhere (Zeller *et al.*, 2006; Zeller *et al.*, 2007a).

Human population data

Population statistics for the 56 communities were taken from the Canada census undertaken every five years, and were adjusted to only represent the aboriginal population (Anonymous, 1954, 1963, 1973, 1977, 1978, 1983a, 1983b, 1996, 2001). Both the 1996 and 2001 census provide estimates of indigenous people's population by community, with most communities having greater than 90% of the population being self-identified as indigenous. Therefore, for communities that had this profile, this percentage was assumed to stay constant in time back to 1950, and is likely an underestimate for earlier periods. For communities in 1996 and 2001 that had less than 90% of the respondents identifying themselves as indigenous, the indigenous people's population was assumed to be 90% in 1950 and was then scaled linearly to the percentage presented in the 1996 census. Since the census data only provided 5-year snapshots of population numbers, a linear interpolation was done between census years. However, due to apparent erratic reporting during the early census years, the derived population numbers for each community were interpolated between the 1951 and 1971 estimates (Figure 2).

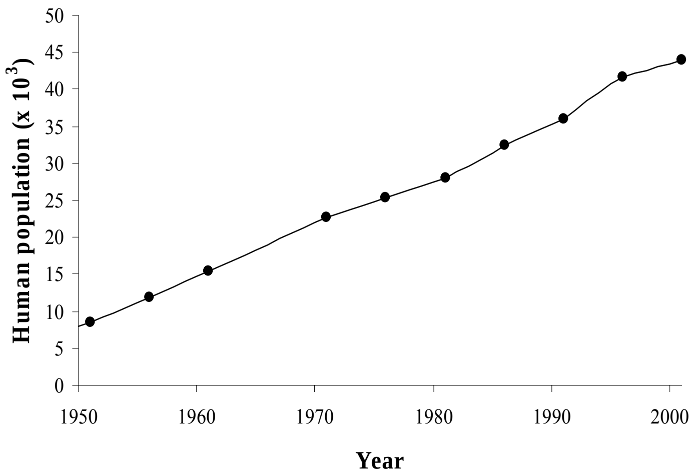

Figure 2: Estimated indigenous people's population (1950-2001) for the 56 coastal communities in Canada's arctic region

Commercial fisheries data

Studies reporting on the commercial catches of marine fishes taken in the Central and Arctic region have been reviewed by Crawford (1989) and Yaremchuk *et al.* (1989), as well as in a series of publications by Fisheries and Oceans Canada (DFO, 1991, 1992a, 1992b, 1993, 1994, 1995, 1996, 1997, 1999). Both Crawford (1989) and Yaremchuk *et al.* (1989) report on commercial catches taken from both marine and freshwater areas in the Northwest Territories and the two studies overlap in area and time. Crawford (1989) reports commercial data from the coastal arctic area including data from Rankin Inlet, Cambridge Bay, Pelly Bay (Kugaaruk), Iqaluit, Mackenzie Delta and other places combined, whereas Yaremchuk *et al.* (1989) describe commercial and test fisheries catches by community and location. Due to the greater detail given, only the work by Yaremchuk *et al.* (1989) was considered here. The data supplied in Yaremchuk *et al.* (1989) and the publications by Fisheries and Oceans Canada were geo-referenced using Google Earth, and capture locations were considered to be marine if they were located in ocean or estuarine areas.

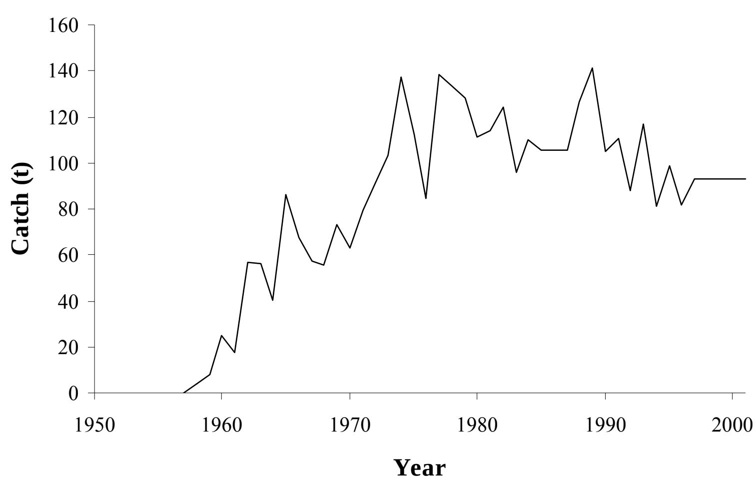

Figure 3: Commercial catches of marine fishes taken from marine waters in the Central and Arctic region from 1950-2001, as determined from national reports published by DFO.

Commercial fisheries in arctic marine waters started in the late 1950s, with the first commercial catches reported from Iqaluit in 1958, while commercial operations in Cambridge Bay, Killiniq and Whale Cove began in 1960 (Yaremchuk *et al.*, 1989). Between 1960 and 1996, 26 communities were determined to have commercial marine fisheries. For the period after 1996, the commercial data (Figure 3) represent a five-year average from the 1992-1996 Fisheries and Oceans Canada reports. Commercial fisheries in Canada's arctic tend to be distributed in space and time, following traditional practices, although some communities, e.g., Cambridge Bay, support yearly, seasonal fisheries (Kristofferson and Berkes, 2005).

Commercial data for the coastal communities located in Quebec and Ontario have not been estimated as it is assumed that the majority of commercial fisheries based in these provinces would be freshwater (Kierans, 2001). Test fisheries in FAO statistical area 21, primarily targeting turbot (*Reinhardtius hippoglossoides*) by large offshore trawlers (Anonymous, 2005), were not considered in this report.

Small-scale fisheries data

Although there are numerous definitions of small-scale fisheries, here we use the interpretation of the basic needs level as defined in the Nunavut Wildlife Harvest Study (NWHS; Priest and Usher, 2004). Although no explicit definition was given, it was acknowledged that it was the end use of fish that mattered. Thus, fish were considered to be part of the small-scale fishery if the fish were used in the fisher's community or entered into inter-settlement trade, but fish were not considered part of the small-scale fishery if the fish was for commercial sale. Therefore, we consider small-scale catches to be primarily subsistence in nature, including inter-community trading, but not those sold in the commercial market.

Small-scale catch data come from four studies. The earliest reported small-scale study used here was undertaken as a provision of the James Bay and Northern Quebec land claims agreement, and was meant to serve as a means to quantify guaranteed harvest levels to the indigenous inhabitants of the area (Anonymous, 1979), and it also estimated the caloric content of their diet. Data collected to estimate marine fish use were from the period 1974-1976.

Gamble (1988) reported on small-scale fisheries undertaken in the Keewatin region, for what was then the Northwest Territories (now part of Nunavut), for a four year period 1981-1986. However, only the data for the period 1982-1985 were used here, since data for other years were incomplete. Gamble (1988) reported on six coastal communities that were also a part of the NWHS (Priest and Usher, 2004). However, the data for Chesterfield Inlet, Coral Harbour and Whale Cove were not used, as their catches were judged to be exceedingly low, especially in comparison to the data reported in the NWHS. Data reported for Arviat, Rankin Inlet, and Repulse Bay were retained.

Two later studies, the ten year (1988-1997) Inuvialuit Harvest Study (IHS; Fabijian and Usher, 2003) and the five year (1996-2001) NWHS (Priest and Usher, 2004) also examined the basic needs level of the Inuit in the Inuvialuit Settlement region and in Nunavut as part of land claims agreements. Data collected in these reports were based on hunters' accounts of their monthly catch, with the term 'hunter' referring to hunters, fishers and collectors; for the remainder of the report we refer to 'fishers'. The data reported by fishers were converted into round weights using reported average weights and edible weight to round weight conversion factors (Appendix Table A2). Once converted into round weight, the data were transformed into per capita rates (kg·person^{-1}·year^{-1}) by taking the estimated total community harvest of that year and dividing it by the estimated human population for the community of that year. Thus, for each year and community represented in one of the four studies, a *per capita fish use rate* was determined, forming the best 'hard' data anchor points available.

The small-scale data collected in the original studies did not give locations of capture, and therefore the proportional commercial catch breakdown (marine vs. freshwater) was used to estimate the portion of reported small-scale catches taken in marine waters.

Human versus sled-dog use of fish resources

To account for changes in the life-style of the Inuit communities from the 1950s to the present, an additional anchor point was derived to account for the amount of fishery resources that were formerly used for feeding sled-dog teams. Sled-dogs formed the primary mode of transportation for Inuit into the late 1960s, early 1970s. However, the introduction of the snow-mobile in the 1960s led to a rapid decline in sled-dog teams, with their virtual disappearance as working dog-teams by the mid-1970s. Usher (2002) states that for 6 communities (Aklavik, Holman, Inuvik, Paulatuk, Sachs Harbour and Tuktoyaktuk) in the Inuvialuit Settlement Region the catch of marine and anadromous fish was approximately 4.3 times higher in the 1960s than compared to the annual mean harvest during the Inuvialuit study period (1988-1997), with the decline being largely due to the demise of the sled-dog teams. Therefore, the annual mean catch estimated during the Inuvialuit Harvest Study for the four coastal communities (Holman, Paulatuk, Sachs

Harbour and Tuktoyaktuk) were multiplied by 4.3 to derive estimated total catches for the year 1960. These 1960 catch estimates were converted into per capita use rates (kg·person^{-1}·year^{-1}) by dividing the catch estimates for each coastal community by the community's population for 1960. This allowed an average per capita use rate to be determined for 1960 which was, on average, 15.5 times higher compared to the average per capita use rate reported during the IHS (1988-1997).

Jessop (1974 in Usher, 2002) reported that in the 1960s, 75% of fish catches in the Mackenzie Delta were fed to sled-dog teams. Thus, the average per capita fish use determined for 1960 was split into a sled-dog feed component and a human consumption component using a 3:1 ratio. This resulted in the human component of per capita use rates to be approximately 3.9 times larger in 1960 than the rates estimated during the IHS period (1988-1997).

<u>Human use component</u>

For communities that were part of the IHS, the 1988-1997 estimated average per capita use rates for each community were multiplied by 3.9 to derive the human use component for the year 1960. The 1960 rates were linearly interpolated to the 1988 value (based on the 1988-1997 average), but were carried back unaltered from 1960 to 1950 (Figure 4). For communities that were not part of the IHS, the same method was used.

An average rate for the study period of the NWHS (1996-2001) was also determined for each community and the per capita use rates for 1960 were set at 3.9 times the 1996-2001 average, and linearly interpolated to the 1996 data point. The three communities of Arviat, Rankin Inlet and Repulse Bay, which form part of the NWHS (1996-2001) and Gamble's (1988) study (1981-1984) had their per capita use rates interpolated between two anchor points. For these three communities, the NWHS estimated mean per capita use rate for each community was multiplied by 3.9 to derive the human use component for the year 1960. The derived 1960 per capita use rates were linearly interpolated to the value estimated from Gamble (1988) for 1981. In turn, the value estimated for 1984 from Gamble (1988), was linearly interpolated to the estimated average value from the NWHS (e.g., Arviat, Figure 4).

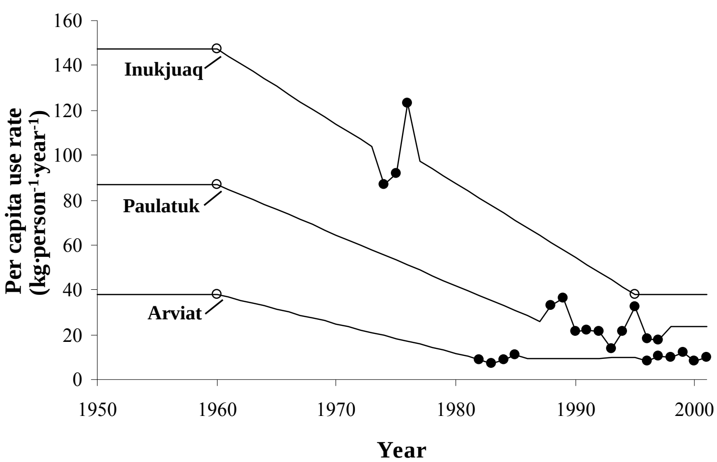

Figure 4: Representative examples of hard data anchor points (solid circles) for communities from small-scale studies, and the 1960 and 1995 (Inukjuaq, Quebec only) derived anchor points (open circles) for Inukjuaq (Anonymous, 1979); Paulatuk (Fabijian and Usher, 2003); and Arviat (Gamble, 1988; Priest and Usher, 2004).

Quebec communities had their per capita use rates scaled from the average estimated from 1974-1976 (Anonymous, 1979) to the per capita use rate determined for 1995, the median year reported from both the IHS and NWHS studies. The 1995 per capita use rate was considered to be 37.9 % of the 1974-1976 average (i.e., if the 1960 rates are 3.9 times the 1995 rate, then the 1995 value is 37.9% of the average estimated for 1974-1976). The 1960 rate was set to 3.9 times the 1995 per capita use rate. Since no other data were available for these communities, the estimated 1995 rate was carried forward to 2001 (e.g., Inukjuaq, Figure 4).

Twelve communities were not represented in any of the four previous studies (Appendix Table A1) and were thus entirely lacking data. For the nine mixed communities located around the southern portion of Hudson and James Bay a conservative estimate was used based on 10% of the average per capita use rate from Inukjuaq and Kuujarapik, the two nearest communities for which data were available. This very conservative assumption reflects the observation from a spatial land use study of these largely Cree communities, that suggested the majority of fishing occurred in freshwater (Berkes *et al.*, 1995). For the three other communities which are largely Inuit (Ivujivik, Puvirnituq and Umiujaq; Appendix Table A1, Figure 1), the average from Inukjuaq and Kuujarapik was applied unaltered.

Sled-dog feed component

The sled-dog feed component of per capita use rates were set at 3 times the derived 1960 human component of the per capita use rates (based on the reported 3:1 ratio; Usher, 2002), and were carried back unaltered to 1950. Going forward in time, the 1960 rate was scaled linearly to zero in 1975 for communities that are largely Inuit. Thus, we assume that 1974 was the last year that marine fish made up a significant part of sled-dog feed, since Usher (1972) states that by 1972 the transition from sled-dog teams to snowmobiles was virtually complete. For the mixed communities, along the southern portion of Hudson and James Bay, no sled-dog feed component was estimated.

RESULTS

Over the time period considered here, our estimated small-scale catches are approximately 27 times larger than reported commercial catches (Figure 5). Given that only commercial catches are reported by Canada to FAO, the global representation of Canada's arctic fisheries catches are substantially underestimated. Total catches may have doubled from 1950 to a peak in 1960 of approximately 4,000 tonnes before declining to catches of approximately 1,000 tonnes in the late 1990s. This overall decline is largely accounted for by the small-scale sector, and particularly by the sled-dog feed component. Although there has been a large human population increase, this has not translated into increased catches in the small-scale sector after 1960 due to the apparent changes in per capita fish use. Since 1975, catches have declined by approximately 21% in the small-scale sector and by approximately 17% in the commercial sector (Figure 5).

In the present study, small-scale per capita use rates were held constant for all communities from 1950 to 1960, and the overall average for all communities during this time period (1950-1960) was approximately 466 kg·person^{-1}·year^{-1}, or, with sled-dog feed component removed, 101

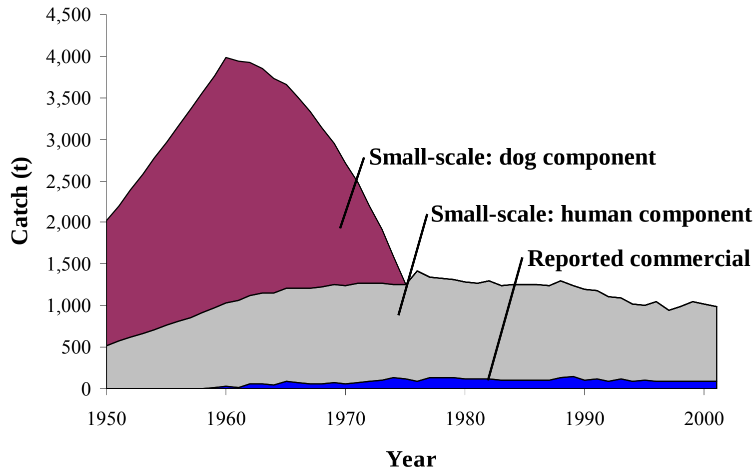

Figure 5: Canada's commercial and small-scale fishery catches in arctic marine waters, with catches for human and sled-dog use separated.

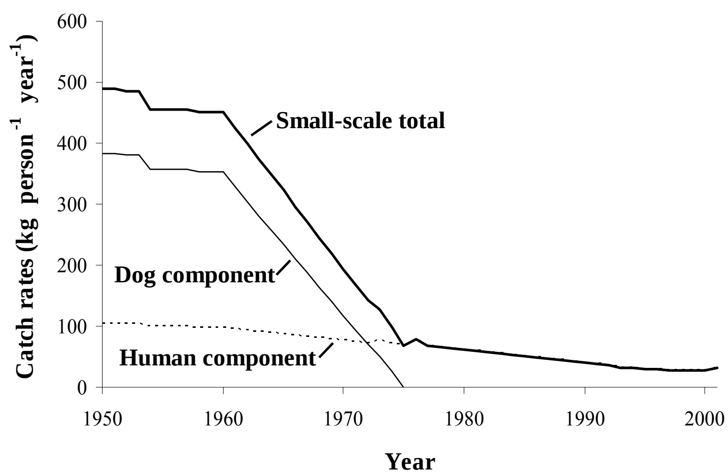

Figure 6: Per capita use rates of marine fish, averaged for all communities over the time period 1950-2001.

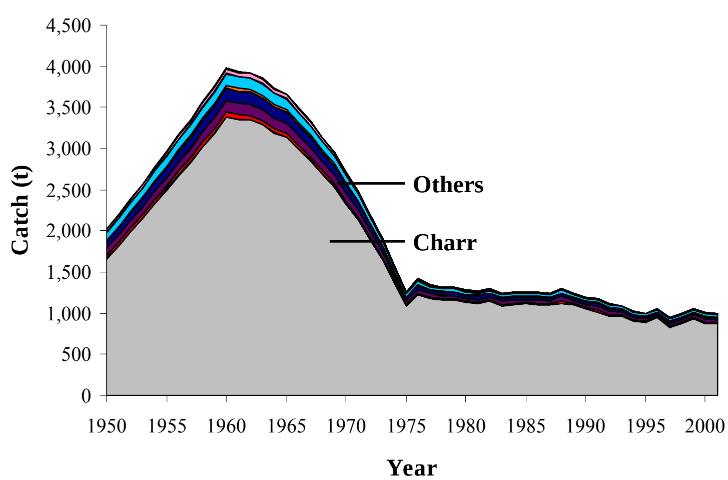

Figure 7: Estimated catches of marine fish in Arctic waters by common names (for species composition of 'others' and scientific names see Appendix Table A3).

kg·person^{-1}·year^{-1} as human use component. Thus, the increase noted from 1950 to 1960 only reflects the human population increase (and assumed concomitant increase in sled-dog teams). In 1975, the first year without the sled-dog feed component, the use rate fell to 68.1 kg·person^{-1}·year^{-1}, and has declined to 32.7 kg·person^{-1}·year^{-1} by 2001 (Figure 6; see Appendix Table A4 for data by region).

Taxonomic Breakdown

FAO, on behalf of Canada, only reports one taxonomic entity, charr (*Salvelinus alpinus*), over the entire time period, whereas here we report on catches of 17 taxonomic entities. Charr is clearly the dominant species accounting for an average of 86 % of total catches, whereas all other species combined account for 14% (Figure 7). However, of the 16 taxonomic entities reported, only 6 are reported for FAO area 21 (Appendix Table A3). It should also be noted that the family Gadidae comprises different species in different regions.

FAO Areas

Catches in FAO area 18 summed over the entire time period have been approximately 5 times larger than the Canadian catches in the arctic part of FAO area 21 (excluding Labrador; Figure 8). In 1950, the aboriginal population of the arctic communities in FAO area 21 made up approximately 5 per cent of the total arctic population, and catches within area 21 made up approximately 4.8% of total catches. By 2001 the aboriginal population accounted for approximately 14% of the arctic total, and catches matched to approximately 13.9 % of the total (Figure 8).

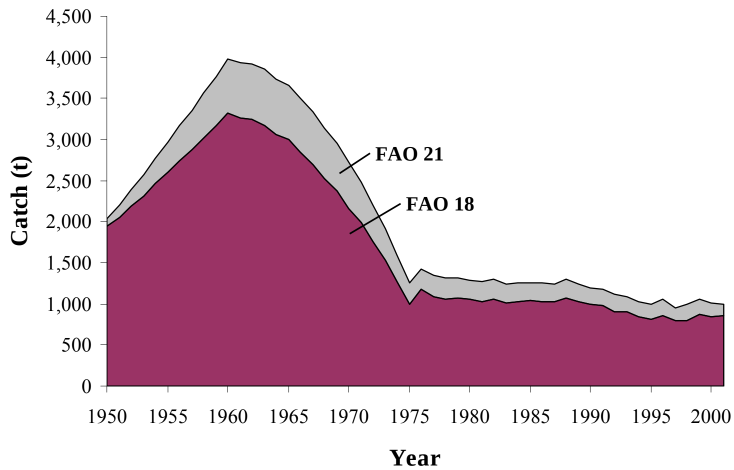

Figure 8: Total reconstructed catches taken in FAO statistical areas 18 and 21.

DISCUSSION

Here we present the first study to estimate the full extent of Canada's past marine fish catches in the Arctic. Although commercial catches are fairly well documented, there has been no such effort undertaken for the small-scale component, with previous studies documenting subsistence fisheries in Canada over relatively short time-spans (e.g., Gamble, 1988; Fabijian and Usher, 2003), and no expansion to consider the entire arctic has been done. The approach taken here provides estimates for years when there are no 'hard' data available. The development of community level fisheries self management systems (Berkes 1990) could potentially include periodic data collection with interpolations employed between survey periods, as suggested elsewhere (Zeller *et al.*, 2007a), thereby improving the inputs into public policy and decision making. The current work in terms of per capita use rates (kg·person^{-1}·year^{-1}) compares well with the study of Berkes (1990), who found an average use of 60 kg·person^{-1}·year^{-1} in his survey of subsistence fisheries in indigenous communities.

The small-scale component estimated here is 27 times larger than commercial catches and underlines the importance of the non-market economy. Changing the collected data from catch·fisher^{-1} to per capita marine fish use also reflects the importance of the non-market economy, since there are extended food sharing networks within and between communities (Collings *et al.*, 1998). Not formally considering estimates of small-scale catches can also lead to bias in national economic indicators (Zeller *et al.*, 2007b).

Global warming has already brought about some noticeable changes to the arctic environment, with the most prominent being the change in the extent and thickness of sea ice (Anonymous, 2003). Global warming will have direct effects on the biological productivity of the arctic and can also affect the livelihoods of the people, who often hunt for marine mammals at the ice edge. Strategies to adapt to this changing environment need to be considered both at the jurisdictional and local level. The change in sea ice conditions has also resulted in a shift of fauna associated with sea ice, with both the number of species and abundance of species being lower now than the 1970s (Melnikov *et al.*, 2002). Shifts in community structure have also been noticed in the northern Hudson Bay area, where the diet of nestling thick-billed murres (*Uria lomvia*) has changed as sea ice has decreased. Their diet has changed with a decrease in the amount of arctic cod (*Boreogadus saida*), sculpins (Cottidae) and eelpouts (Zoarcidae), and an increase in capelin (*Mallotus villosus*) and sandlance (*Ammodyte*s spp.) which are thought to be more typical of sub-arctic waters (Gaston *et al.*, 2003). There are also signs of other species appearing in the arctic, with Pacific salmon (*Oncorhynchus* spp.) showing up in the western arctic (Stephenson, 2006) and increased sightings of Killer whales (*Orcinus orca*) in Hudson Bay (Higdon *et al.*, 2006). The loss of sea ice has the potential to introduce new species into arctic areas, possibly creating a shift in community and ecosystem structure (e.g., Welch *et al.*, 1992; Mohammed, 2001).

The questions regarding how this changing ecosystem will affect the resource dependence and health of the peo0ple of the north will demand both local and jurisdictional attention and is exemplified by the region of Hudson Bay. Hudson Bay represents a major challenge in terms of global warming and related management systems since three provinces, a territory and the federal government have jurisdictional responsibility over these waters. The Bay also contains the only site in Canada where Algonkian, Athapaskan and Inuit people used the same area since pre-European contact, representing a unique cross cultural challenge.

The changes in the arctic ecosystem will affect the population living in the area, and it remains to be seen whether the anticipated and required changes will improve livelihoods. New ice conditions and new species may cause a challenge to these peoples in terms of meeting their basic need levels and ensuring food security. However, there have already been substantial changes in the diets of the people brought about by the introduction of foods imported from further south. Although country foods such as caribou and charr still play an important role in the mixed economy, the amount of country food on a per capita basis has declined, with the largest declines seen in the youngest generations (Blanchet *et al.*, 2000; Boult, 2004). The increased importance of southern foods, including foods rich in carbohydrates and sugars, has led to higher rates of obesity and obesity related diseases, such as type 2 diabetes (Young *et al.*, 2000). These changes in diet have largely occurred since the 1980s (Collings *et al.*, 1998).

The climate and the distances between arctic communities, together with underdeveloped infrastructure and economy, represent challenges. Mitigation of warming trends by the people living in this environment need to be considered in terms of resource management as a function of health, social accountability and cultural survival. Regardless of the roles adopted for local and jurisdictional organizations, the collection and use of fisheries and ecosystem data appears to be a growing priority.

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APPENDIX

Table A1: Coastal communities in Canada's arctic, their region and their associated community number used in Figure 1, separated by FAO statistical area; communities marked with an asterisk were missing fisheries data. Bathurst Inlet and Umingmaktok are reported as one community.

Community Name	Region	Community No.	Community Name	Region	Community No.
FAO statistical area 18			Kimmirut	5	12
Aklavik	1	5	Kugaruuk	4	1
Akulivik	8	7	Kugluktuk	3	1
Arctic Bay	2	3	Kuujuaq	5	9
Arviat	6	5	Kuujjuarapik	8	3
Attawapiskat*	7	4	Moosonee*	7	6
Aupaluk	5	7	Paulatuk	1	2
Bathurst Inlet	3	2	Peawanuck*	7	3
Cambridge Bay	3	4	Puvirnituq*	8	6
Cape Dorset	5	13	Quaqtaq	5	5
Chesterfield Inlet	6	2	Rankin Inlet	6	3
Chisasibi*	8	2	Repulse Bay	5	1
Churchill*	7	1	Resolute	2	2
Coral Harbour	6	1	Sachs Harbour	1	3
Eastmain*	7	8	Salluit	5	3
Fort Albany*	7	5	Sanikiluaq	8	1
Fort Severn*	7	2	Taloyoak	3	6
Gjoa Haven	3	5	Tasiujaq	5	8
Grise Fiord	2	1	Tuktoyaktuk	1	1
Hall Beach	4	3	Umiujaq*	8	4
Holman	1	4	Umingmaktok	3	3
Igloolik	4	2	Waskaganish*	7	7
Inukjuaq	8	5	Whale Cove	6	4
Inuvik	1	6	**FAO statistical area 21**		
Ivujivik*	5	2	Clyde River	10	2
Kangiqsualujjuaq	5	10	Iqaluit	9	1
Kangiqsujuaq	5	4	Pangnirtung	9	2
Kangirsuk	5	6	Pond Inlet	10	1
Killiniq	5	11	Qikiqtarjuaq	10	3

Table A2: Edible weights (kg) and edible to round weight conversion factors used to transform reported numbers of fish to round weight (kg). For scientific names see Appendix Table A3.

Common Name	Edible Weight (kg)	Source	Conversion Factor	Source
		Keewatin (Gamble, 1988)		
Arctic cod	0.225	Froese and Pauly (2007)	1.0000	n/a
Charr	2.500	Gamble (1988)	1.4375	Usher (2000)
Sculpins	0.175	Froese and Pauly (2007)	1.0000	n/a
		Inuvialuit (Fabijian and Usher, 2003)		
Arctic cisco	0.450		1.4444	Usher (2000)
Arctic cod	0.225	Froese and Pauly (2007)	1.0000	n/a
Broad whitefish	1.650	Usher (2000)	1.2121	Usher (2000)
Charr (Aklavik)	0.900	Usher (2000)	1.3846	Usher (2000)
Charr (Holman)	2.200	Usher (2000)	1.4194	Usher (2000)
Charr (Paulatuk)	2.300	Usher (2000)	1.4375	Usher (2000)
Charr (Sachs Harbour)	1.000	Usher (2000)	1.4286	Usher (2000)
Dolly varden	0.650	Usher (2000)	1.3846	Usher (2000)
Flounder	0.500	M. Treble, pers. comm.[a]	1.0000	n/a
Fourhorn sculpin	0.175	Froese and Pauly (2007)	1.0000	n/a
Inconnu	2.550	Usher (2000)	1.3333	Usher (2000)
Pacific herring	0.200	Usher (2000)	1.5000	Usher (2000)
Saffron cod	0.364	Fishbase	1.0000	n/a
		Nunavut (Priest and Usher, 2003)		
Charr	2.500	Gamble (1988)	1.4375	Usher (2000)
Arctic cisco	0.450	Usher (2000)	1.4444	Usher (2000)
Cod	0.872	Froese and Pauly (2007)	1.0000	n/a
Inconnu	2.550	Usher (2000)	1.3333	Usher (2000)
Least cisco	0.200	Froese and Pauly (2007)	1.0000	n/a
Sculpin	0.175	Froese and Pauly (,007)	1.0000	n/a
Turbot	1.400	Froese and Pauly (2007)	1.0000	n/a
		James Bay and Northern Quebec (Anonymous, 1979)		
Charr	4.500	Anon. (1979)	1.4375	Usher (2000)
Cod	2.500	Anon. (1979)	1.4375	Usher (2000)[b]
Salmon	8.500	Anon. (1979)	1.4375	Usher (2000)[b]
Sculpin	0.500	Anon. (1979)	1.2000	Usher (2000)[b]

[a] M. Treble, Fisheries and Oceans Canada, Winnipeg, MB, R3T 2N6, Canada. [b] Specific conversion factors were not available and the closest conversion factor in Usher (2000) was used.

Table A3: Common and scientific names for species reported in this study; common names marked with an asterisk are reported for FAO areas 18 and 21, all others are reported for FAO area 18.

Common Name	Taxonomic Name	Source
Arctic cod	*Boreogadus saida*	Gamble (1988)
Charr	*Salvelinus alpinus*	Gamble (1988)
Sculpins	Cottidae	Gamble (1988)
Arctic cisco	*Coregonus autumnalis*	Usher (2003)
Arctic cod	*Boreogadus saida*	Usher (2003)
Broad whitefish	*Coregonus nasus*	Usher (2003)
Dolly varden	*Salvelinus malma malma*	Usher (2003)
Charr	*Salvelinus alpinus*	Usher (2003)
Flounder	*Platichthys stellatus*	Usher (2003)
Fourhorn sculpin	*Triglopsis quadricornis*	Usher (2003)
Inconnu	*Stenodus leucichthys*	Usher (2003)
Pacific herring	*Clupea pallasi pallasi*	Usher (2003)
Saffron cod	*Eleginus gracilis*	Usher (2003)
Arctic cisco*	*Coregonus autumnalis*	Priest and Usher (2003)
Charr*	*Salvelinus alpinus*	Priest and Usher (2003)
Cod*	*Boreogadus saida* + *Gadus morhua* + *G. ogac*	Priest and Usher (2003)
Inconnu	*Stenodus leucichthys*	Priest and Usher (2003)
Least cisco*	*Coregonus sardinella*	Priest and Usher (2003)
Sculpin*	Cottidae	Priest and Usher (2003)
Turbot*	*Reinhardtius hippoglossoides*	Priest and Usher (2003)
Arctic charr	*Salvelinus alpinus*	Anonymous (1979)
Cod	*Boreogadus saida* + *Gadus morhua* + *Microgadus tomcod*	Anonymous (1979)
Salmon	*Salmo salar*	Anonymous (1979)
Sculpin	*Triglopsis quadricornis*	Anonymous (1979)

Table A4: Small-scale per capita use rates of marine fish determined for the 10 regions, divided into the amount used for sled-dog teams and for human use.

Region	Dog Component			Human Component			
	Min (Year)	Max (Year)	Mean (1950-1974)	Min (Year)	Max (Year)	2001	Mean (1950-2001)
1	10.4 (1974)	177.8 (1953)	115.5	15.0 (1997)	59.3 (1953)	19.0	35.8
2	7.3 (1974)	250.9 (1953)	101.5	8.1 (1998)	83.6 (1953)	9.4	27.9
3	32.6 (1974)	489.6 (1960)	352.5	32.7 (1998)	163.2 (1960)	106.6	109.8
4	23.9 (1974)	357.9 (1960)	257.7	15.7 (2000)	119.3 (1960)	27.3	79.3
5	31.5 (1974)	473.1 (1960)	340.7	40.5 (2000)	157.7 (1960)	40.6	102.9
6	17.2 (1974)	278.4 (1951)	192.1	13.6 (1997)	92.8 (1951)	17.0	54.6
7	n/a	n/a	n/a	2.1 (1995)	8.2 (1960)	2.1	5.4
8	43.1 (1974)	354.6 (1960)	257.6	41.7 (2000)	140.1 (1974)	44.0	83.4
9	32.5 (1974)	487.3 (1960)	350.9	33.5 (2001)	162.4 (1960)	33.5	108.1
10	22.3 (1974)	334.6 (1960)	240.9	17.9 (2000)	111.5 (1960)	18.1	74.2