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Fish and Marine Mammals Harvested near Ulukhaktok, Northwest Territories, with a focus on Anadromous Arctic Char (*Salvelinus alpinus*)

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Canada

Foreword

This series documents the scientific basis for the evaluation of aquatic resources and ecosystems in Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

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ABSTRACT

Fish and marine mammals are an important traditional subsistence and cultural resource for residents of Ulukhaktok, a community within the Inuvialuit Settlement Region, Northwest Territories. Community-based harvest surveys were conducted monthly out of Ulukhaktok, between 2004 and 2015, to enumerate fish and marine mammal subsistence harvest. Anadromous Arctic Char (annual average: 3,464 fish), Lake Trout (annual average: 2,114 fish), and Ringed Seals (annual average: 256 seals) continue to be the most abundantly harvested fish and marine mammal species 2004–2015, with landlocked Arctic Char (annual average: 203 fish), whitefish (annual average: 74 fish), cod (annual average: 136 fish), and Bearded Seals (annual average: 8) also reported. Accessibility to harvesting areas and availability of fish and marine mammals were strongly linked to seasonal cycles. Following concerns regarding the population status of Kuujjua River (i.e., Tatik Lake) Arctic Char, and to support the sustainable management of all Arctic Char subsistence and commercial fisheries in the area, the Ulukhaktok Char Working Group (UCWG) was established in 1996. The UCWG implemented a community fishing plan with voluntary management measures and fishery guidelines supported by harvest data provided by monitoring programs. In response to the observed decline in stock status, the UCWG established a voluntary subsistence harvest level of 1,000 fish from Tatik Lake which has not been surpassed in recent years (2003–2015); however, the total number of Kuujjua River Arctic Char harvested is unknown due to the uncertainty regarding contributions to the coastal mixed-stock harvest. Total annual harvest of anadromous Arctic Char from respective management zones 1988–2015 varied as follows: a) between 486 and 6,297 fish in coastal waters; b) between 0 (voluntary community closure) and 4,386 fish from the Kuujjua River; and c) between 0 and 5,502 fish from rivers in Prince Albert Sound. Co-management partners consider all available information collected through harvest surveys, monitoring programs, Indigenous Knowledge and observations, and scientific research to support the adaptive co-management of these important fish and marine mammal species in a changing climate.

INTRODUCTION

Ulukhaktok (formerly known as Holman Island), Northwest Territories, is a coastal community located on the west side of Victoria Island in the Inuvialuit Settlement Region (ISR; Figure 1). Traditional harvesting of fish, marine mammals, and other wildlife from fresh and coastal waters continues to be important for Inuvialuit subsistence, culture, and well-being. Olokhaktomiut (Inuvialuit from Ulukhaktok) have a continued dependence on and preference for local traditional foods harvested throughout the year (OHTC et al. 2016). Fish and marine mammals have been co-managed by the Olokhaktomiut Hunters and Trappers Committee (OHTC), Fisheries Joint Management Committee (FJMC), and Department of Fisheries and Oceans (DFO), since the Inuvialuit Final Agreement (IFA) was established in 1984 (Canada 2005).

The Inuvialuit Harvest Survey (IHS) was initiated in 1988 to collect long-term harvest data from six communities in the ISR for three main purposes: 1) to support the management and harvest monitoring of fish and wildlife through the co-management structure; 2) to inform the assessment of the potential impact of development on the environment, wildlife, and/or traditional harvesting activities; and 3) to provide a basis for harvester compensation in the event of adverse effects from development activities (Joint Secretariat 2003). The IHS identified Arctic Char (*Salvelinus alpinus*), Ringed Seals (*Pusa hispida*), and Lake Trout (*Salvelinus namaycush)* as the most abundant fish and marine mammal species harvested in the Ulukhaktok area (Joint Secretariat 2003). Following completion of the IHS in 1997, similar programs were developed to address community and co-management priorities and support the implementation of an Arctic Char fisheries management plan for the Ulukhaktok area.

Arctic Char, an important component of traditional diets in Ulukhaktok (Paylor et al. 1998), are co-managed by the UCWG (formerly the Holman Char Working Group, or HCWG). Anadromous (or sea run) Arctic Char are harvested in coastal waters during summer and in freshwater lakes and rivers during fall, while landlocked Arctic Char are harvested from lakes mostly during spring. There are several known anadromous Arctic Char populations in the Ulukhaktok area: the Kuujjua River (Tatik Lake (also known as, Fish Lake)) and Mayoklihok Lake connected to Minto Inlet; and Kagluk, Kagloryuak, Kuuk, and Naloagyok rivers flowing into Prince Albert Sound (Figure 1). Fish from these populations are harvested in a mixed-stock fishery in the coastal areas around Ulukhaktok as they undertake feeding migrations to marine waters during summer. Not only has this mixed-stock been harvested for subsistence purposes, but since 2000 there has also been a small-scale community-based commercial fishery, licensed since 2006 as a Stage I (Feasibility) Exploratory fishery under DFO's New Emerging Fishery Policy (DFO 2008) with an annual quota of 500 Arctic Char. The fishery provides important economic opportunities for Inuvialuit harvesters to sell their catch locally within the Northwest Territories.

To guide the management of Arctic Char stocks in the area and following concerns about the trend and status of Kuujjua River Arctic Char, the UCWG established voluntary subsistence harvest levels for different Arctic Char management zones in the Ulukhaktok Char Fishing Plan (UCFP) (UCWG 2006). The management zones include: 1) the coastal area (mixed-stock); 2) Kuujjua River, including Tatik and Red Belly Lakes, and 3) the Prince Albert Sound area, including the Kagloryuak River (Kingua area), Kuuk River (Tahiryuak Lake), and Kagluk River (Quunnguq Lake) (Figure 1). The UCWG has also supported quotas for small-scale commercial fisheries in coastal waters near the community. The UCWG meets annually to review Arctic Char harvest data, management measures, monitoring programs, and research, all of which support the fishing plan in an adaptive co-management setting (Ayles et al. 2007). The collection of subsistence harvest data has been essential to enable the UCWG to establish effective voluntary harvest levels and monitor harvest. While the focus of harvest data collection in recent years has largely been on Arctic Char, the collection of harvest data for other

subsistence species of fish and marine mammals continues to be important for characterizing, monitoring, and understanding harvest patterns seasonally and over time.

OBJECTIVES

The objectives of this report are to:

- Summarize fish and marine mammal subsistence harvest for the Ulukhaktok area, collected from harvest surveys, 2004–2015;
- Compile anadromous Arctic Char subsistence and commercial harvest by management zone (established in the Ulukhaktok Char Fishing Plan), 1988–2015;
- Describe the seasonality of key harvested fish and marine mammals in the Ulukhaktok area.

METHODS

FISH AND MARINE MAMMAL SUBSISTENCE HARVEST SURVEYS (2004–2015)

Subsistence harvest surveys were conducted between 2004 and 2015 in Ulukhaktok, NT, to collect fish and marine mammal subsistence harvest data. Between 2004 and 2010 these were conducted with support from DFO, Canadian Wildlife Service (CWS), Government of Northwest Territories Resources Wildlife and Economic Development division (RWED; now Environmental and Natural Resources), and OHTC. Beginning in April 2011 the surveys were conducted in partnership between OHTC and DFO.

Following methods used in the Inuvialuit Harvest Study (Joint Secretariat 2003), the OHTC hired a community interviewer to collect fish and marine mammal harvest information from active Inuvialuit harvesters. The OHTC was responsible for managing the list of active harvesters who were each assigned a unique identification number to maintain their anonymity. Participation in the surveys was voluntary but strongly encouraged given the importance of this information for community-based management. Harvesters were interviewed monthly prior to 2012 and since then only during April to December, given limited harvesting for fish and marine mammals between January and March (OHTC et al. 2016). Surveys did not occur between April 2010 and March 2011 and therefore only partial data is available for 2010. The years where harvest surveys were incomplete (2010), or when the community noted lower confidence in the accuracy of the reports (2013 and 2014) were not included in the calculation of average annual harvest.

The interviewer contacted harvesters by phone or in-person, using paper forms to record the species, number, location, and harvest date (Appendix 1). In addition to fields for fish and marine mammal harvest information, there were additional questions to ensure that these monthly harvest reports were not double counted with other catch monitoring efforts (coastal and Tatik Lake fishery monitors or commercial catch reporting). Harvesters were also asked to provide comments on the quality of the fish and catches compared to previous years and any relevant observations. Completed survey forms were sent to DFO Inuvik where the data were tabulated and shared with OHTC, UCWG, and FJMC. In accordance with the IHS, and to respect the interests of harvesters, data were aggregated among regions and months, while detailed harvest records were maintained by the OHTC and DFO. Detailed reports and summaries of harvest by area and month were reviewed and verified annually by the UCWG.

Harvest was tabulated annually by species and an average annual harvest was calculated. To illustrate the seasonality in the harvest of key fish and marine mammal species (anadromous Arctic Char, landlocked Arctic Char, Lake Trout, cod, whitefish, Ringed Seals, Bearded Seals)

monthly harvest was summed by species across all years (2004–2015), and the proportion of the total harvest was calculated. Monthly average air temperatures were calculated and compiled along with seasonal information on environmental conditions in coastal and freshwater habitats, harvesting areas, and key species harvested. Seasons were defined: winter (January-March); spring (April-June); summer (July-September); and fall (October-December), recognizing that transitions between seasons are continuous rather than discrete and show a high degree of variability. Monthly average air temperature records for Ulukhaktok were compiled from Environment Canada records collected from the Ulukhaktok airport weather station (70.763°N, 117.806°W; ECCC 2021; Appendix 2).

ANADROMOUS ARCTIC CHAR SUBSISTENCE AND COMMERCIAL HARVEST, BY MANAGEMENT ZONE (1988–2015)

Previously published and new (data presented in this report from the subsistence harvest surveys described above) records of anadromous Arctic Char harvested in subsistence and commercial fisheries from 1988–2015 were compiled and tabulated by UCFP management zone (data sources: Joint Secretariat 2003, Stephenson 2004, UCWG 2006, Harwood et al. 2013, Gallagher et al. 2021). Harvests from Mayoklihok Lake in 2013 and 2015 have been presented in a separate column. Commercial harvest was summarized from DFO sources based on information provided by harvesters in mandatory logbooks designed to collect catch-effort and/or biological data (Lea et al. 2023).

Given that the harvest monitoring program for Tatik Lake (Harwood et al. 2013, Gallagher et al. 2021) was designed to coincide with the peak fall fishing period, a comparison was made between harvest reported in the community harvest surveys and harvest enumerated by the monitors, to determine the best estimate of anadromous Arctic Char harvested from Tatik Lake. While enumeration of total harvest was not a specific objective of the harvest monitoring program, monitors stationed at Tatik Lake were able to collect harvest data from others fishing in the vicinity. In cases where the harvest enumerated by the monitors was greater than the numbers reported through the community surveys, the monitors record was selected as the most accurate record of harvest from the lake in that year. A similar harvest monitoring program took place during the coastal summer fishery (1993–1997 and 2011–2015), collecting catch-effort and biological data (Lea et al. 2023). Given the number of harvesters fishing in the coastal area, the number of fish caught, and the geographic range of fishing activity along the coast during summer, it was not practical for these monitors to enumerate the total harvest, although, where possible, records from all programs were compared at annual UCWG meetings to determine the most accurate estimate of total harvest.

RESULTS

FISH AND MARINE MAMMAL SUBSISTENCE HARVEST SURVEYS (2004–2015)

Fish and Marine Mammal Harvest

Anadromous Arctic Char (*Salvelinus alpinus)*

Anadromous Arctic Char harvested in subsistence fisheries 2004–2015 ranged between 1,944 and 4,934 fish with an average of 3,464 annually (Table 1, Figure 2). Of all reported records of anadromous Arctic Char harvest 2004–2015, the majority occurred in July (46.2%) and August (27.1%), and to a lesser extent in October (13.5%) and November (6.3%), and were limited (< 5%) for all other months (Table 2, Figure 3).

Landlocked Arctic Char (*Salvelinus alpinus*)

Landlocked Arctic Char harvested in subsistence fisheries during 2004–2015 ranged between 0 and 612 fish, with an average of 203 annually (Table 1, Figure 2). The majority were harvested in May (25.9%) and June (42.2%), with fewer reported in July (9.4%), October (8%), and December (6.6%), and less than 5% during the remaining months combined (Table 2, Figure 3).

Lake Trout (*Salvelinus namaycush*)

Lake Trout harvested in subsistence fisheries during 2004–2015 ranged between 817 and 2,967 fish, with an average of 2,114 annually (Table 1, Figure 2). The majority were harvested in May (32.4%) and June (33.2%), with fewer reported in April (8.7%), July (6.9%), and October (10.3%), and less than 5% during the remaining months combined (Table 2, Figure 3).

Whitefish (*Coregonus* spp.)

Whitefish harvested in subsistence fisheries during 2004–2015 ranged between 0 and 173 fish, with an average of 74 annually (Table 1, Figure 2). The majority were harvested in October (24.6%) and November (61.2%), with fewer reported in January (9.2%) and December (4.5%), and less than 1% during the remaining months combined (Table 2, Figure 3).

Cod (presumably Greenland Cod (*Gadus Ogac),* but may also include Saffron Cod (*Eleginus gracilis*))

Cod harvested in subsistence fisheries during 2004–2015 ranged between 0 and 966 fish, with an average of 136 annually (Table 1, Figure 2). The majority were harvested in June (55.5%), July (24.7%) and August (12.5%) with fewer than 5% during the remaining months combined (Table 2, Figure 3).

Ringed Seals (*Pusa hispida*)

Ringed seals harvested during 2004–2015 ranged between 24 and 518 seals, with an average of 256 annually (Table 1, Figure 2). The majority were harvested in June (19.5%), July (35.8%) and August (22.3%), with fewer reported in May (5.9%) and September (6.9%), and less than 5% during the remaining months combined (Table 2, Figure 3).

Bearded Seals (*Erignathus barbatus*)

Bearded seals harvested during 2004–2015 ranged between 0 and 25 seals, with an average of 8 annually (Table 1, Figure 2).The majority of harvest occurred in July (46.7%) and August (26.7%), with fewer reported in June (5.6%), and less than 5% during the remaining months combined (Table 2, Figure 3).

Other species

Between 2004 and 2015, Beluga Whales (*Delphinapterus leucas*), Walrus (*Odobenus rosmarus*), and Pacific Salmon (*Oncorhynchus* spp.) were harvested in rare instances and low numbers (≤2 in the years when they occurred), except for 2014 when 37 Beluga Whales were harvested (Table 1).

Harvesting Seasons

Winter (January-March)

Monthly average air temperatures in Ulukhaktok during winter, 2004–2015, ranged from -26.5°C to -28°C (Figure 3; Appendix 2). Freshwater and coastal waters are covered completely with thick seasonal sea ice, with the exception of wind- and current-driven leads and cracks. Daylight hours are short or absent altogether during the polar night. These conditions are not ideal for

travel or harvesting, although a small number of seals from coastal waters and fish from lakes are harvested during this season.

Spring (April–June)

Monthly average air temperatures during spring, 2004–2015, transitioned from -16.4°C in April to -5.6°C in May, and then to 5.3°C in June (Figure 3; Appendix 2). With increasing daylight and warming temperatures, the sea ice and land remain frozen enough for travel by snow machine and harvesting can safely occur through the ice, or at exposed leads or cracks in the ice. These conditions are ideal for accessing lakes for harvesting of landlocked Arctic Char and Lake Trout, as well as for harvesting Ringed Seals, Bearded Seals, and Greenland Cod in coastal waters.

Summer (July–September)

Monthly average air temperatures during summer, 2004–2015, reached their peak in July at 9.6°C, and gradually cool to 7.8°C in August, and then to 1.5°C in September (Figure 3; Appendix 2). With these warmer temperatures, lakes become ice-free, and on average, the sea ice breaks-up in early July in East Amundsen Gulf (Harwood et al. 2020). These conditions are ideal for harvesting anadromous Arctic Char while they are feeding in coastal waters, and for harvesting Ringed Seals, Bearded Seals, and other marine species that occur close to shore near the community.

Fall (October-December)

Monthly average air temperatures during fall, 2004–2015, show gradual cooling from -7.1°C in October, to -18.0°C during November, and then to -24.5°C during December (Figure 3; Appendix 2). Lakes start to freeze up in early-fall, while the ice in coastal waters takes longer to develop, first starting in small bays with landfast ice and later as pack ice, becoming a stable platform within East Amundsen Gulf by early-November, on average (Harwood et al. 2020). These conditions are ideal for under-ice fishing for anadromous Arctic Char while in their freshwater overwintering habitats, along with Lake Trout and whitefish. Nets are set under the ice (before it is too thick), either at inland lakes or in coastal areas of Prince Albert Sound.

ANADROMOUS ARCTIC CHAR SUBSISTENCE AND COMMERCIAL HARVEST, OVERALL AND BY MANAGEMENT ZONE (1988–2015)

Estimated harvest from all fisheries

Estimated annual harvest of anadromous Arctic Char from all fisheries between 1988 and 2015 varied from 2,616 (2009) to 11,360 (1995) (Table 3, Figure 4). Harvest was highest from 1988 until the mid-1990s, with an overall declining trend since 1995, and some of the lowest numbers on record reported in the 2010s. In nearly all years the coastal harvest exceeded harvest from the Kuujjua River system, as well as other rivers in Prince Albert Sound. In general, Arctic Char in the Kuujjua River system (including Tatik Lake, or Fish Lake) and Mayoklihok Lake are harvested through an under-ice fishery in the fall (October-November), the Prince Albert Sound area is harvested through an under-ice fishery in early winter (November, December), and the coastal area is harvested during the open-water season in the summer months (late-June to early-September) .

Coastal fishery near Ulukhaktok

The harvest of anadromous Arctic Char from Ulukhaktok coastal waters during 1988–2015 has ranged from 486 (2013) to 6,297 (1994) fish annually (Table 3, Figure 4). When there were concerns about the status and trend of Arctic Char in Tatik Lake in 1996, and recognizing the contributions to the coastal harvest, the UCWG recommended that coastal fishing around the

community during summer be kept to a minimum that year, with plans to organize a community harvest at the Kagloryuak River in the fall instead. In general, the number of Arctic Char harvested in the coastal area has declined over time (Table 3, Figure 4), and has not approached the 4,500 fish (4,000 subsistence, 500 commercial) voluntary harvest level set out in the UCFP since the early 2000s. The commercial fishery commenced in 2000 with a quota of 100 fish, which was then raised to 500 in 2001 and remained at that level through to 2015. However, this quota was not reached every year and commercial fishing did not take place in 2004 and 2005.

Kuujjua River (Tatik Lake)

The number of Kuujjua River (i.e., Tatik Lake) anadromous Arctic Char enumerated by the harvest monitoring program (Harwood et al. 2013, Gallagher et al. 2021) and reported through the community harvest surveys (Joint Secretariat 2003, UCWG 2006, Stephenson 2004, and this report) are presented in Table 4 and Figure 5. The comparison revealed that records compiled through the harvest surveys were greater and considered more representative of the total harvest in most years (Table 4, Figure 5), therefore, the larger of the two values was considered the most accurate estimate for any given year and was used to populate the long-term harvest records presented in Table 3.

Historically the Kuujjua River supported a larger harvest of Arctic Char between 1966 and 1978 (average = 3,390 fish, range = 1,891–4,569 from subsistence harvest and a sport fishing lodge) (Lewis et al. 1989, Appendix 3). Records are not available but subsistence harvest likely occurred during 1978–1987, and a small commercial fishery operated at the Kuujjua River during this period with < 1,400 fish harvested annually in 1980 and 1982–1984 (Yaremchuk et al. 1989, Appendix 3). Between 1988 and 1992 subsistence harvest declined from 4,386 to < 2,500 fish (Table 3). Following community concerns about population declines of Arctic Char from the Kuujjua River, the UCWG implemented a voluntary closure from 1993 to 1995. Fishing did not occur in Tatik Lake in 1993 and the only fishing in 1994 and 1995 was conducted by the monitoring program to obtain biological samples for stock assessment (Harwood et al. 2013). Following the closure, reported subsistence harvest between 1996 and 2002 varied between 1,000 and 1,800 fish; since 2003 harvest has been below the 1,000 fish voluntary harvest level set by the UCWG (Table 3, Figure 4). The community-set guideline for the number of Tatik Lake Arctic Char was initially 25 per household in 1996, but that has changed over time with periodic increases, and since 2016 it has been 70 per household. Although the recommended harvest guideline for each household has been raised over time, this has not resulted in an increase in harvest, as there have been fewer families harvesting from Tatik Lake in recent years (John Alikamik, Community of Ulukhaktok, pers. comm.). Between the 1960s and 1980s approximately 25–30 families from Ulukhaktok fished at Tatik Lake for up to a month, whereas starting in the mid-1990s this declined to only about 10 families who fished on the lake for roughly one week. In addition to establishing a voluntary harvest level, the UCWG suggested a specific period for fishing at Tatik Lake starting in 1996, October 1–November 1, but over time that window expanded, with increased variability and unpredictability in the timing of freeze-up each fall.

Mayoklihok Lake

The first record for Mayoklihok Lake in the harvest surveys was in 2013 when monitors sampled 200 Arctic Char at the request of the community (FJMC and DFO unpublished, Table 3). It is unclear how much this lake has been used for fall fishing in the past but it is reported to be a relatively productive and easily accessible fall fishing location. A voluntary harvest level has not been established for Mayoklihok Lake.

Prince Albert Sound

Harvest from rivers in distant Prince Albert Sound (Kuuk, Kagloryuak, and Kagluk rivers) has traditionally occurred during fall when it is easier to travel far distances over a frozen landscape. Between 1988 and 2015 the annual harvest of anadromous Arctic Char from Prince Albert Sound rivers has ranged from 0 to 5,502 fish. In general harvest of anadromous Arctic Char from river systems in Prince Albert Sound has been lower than the coastal or Tatik Lake fisheries, except for the mid-1990s when there was the voluntary closure at Tatik Lake. Of these rivers, the Kagloryuak River has the highest harvest and appears to be fished more often; however, there are some years where the fishing location in Prince Albert Sound was not specified. It is reported that the number of harvesters fishing in Prince Albert Sound has declined over time, because of the distance from Ulukhaktok and because the ice in this area is freezing up later in the fall and not as reliable as it used to be (David Kuptana, Community of Ulukhaktok, pers. comm.).

Anadromous Arctic Char harvested from the Kagloryuak River, 1988–2015, from an area locally known as Kingua, has ranged between 0 and 5,502 fish annually (Table 3). The harvest was at its highest in the mid-1990s when the UCWG organized fisheries at the Kagloryuak River during the Tatik Lake closure, to provide a source of fish for families in the community. Low catches at the Kagloryuak River in 1997 led to a recommendation to limit fishing in 1998 to only 200 fish. Since 1996 Ulukhaktok has only once approached the voluntary harvest level of 1,500 fish for the Kagloryuak River and that was in 2008 when 1,274 were harvested.

Harvest from the Kuuk River system, including Tahiryuaq Lake, has been low compared to other areas, ranging between 0 and 454 annually, with limited harvest occurring since 2007 (Table 3). The voluntary harvest level of 1,500 anadromous Arctic Char established by the UCFP has never been reached.

The UCFP identified a voluntary harvest level of 500 anadromous Arctic Char for the Naloagyok River; however, harvests from this system have never been reported.

The UCFP identified a voluntary harvest level of 500 anadromous Arctic Char for the Kagluk River. Since the commercial harvests in 1996 (550 fish) and 1997 (227 fish), the only subsistence harvest reported was 191 fish in 2006.

DISCUSSION

The ongoing collection of harvest data is important for assessing stock trends over time, tracking the prevalence of rare species, informing the design of monitoring and research programs, determining management measures, and could be used to support compensation claims for loss of harvesting opportunities due to future resource or infrastructure development. In the Ulukhaktok area harvest data is collected ‘by the community, for the community’ for consideration by the UCWG in their adaptive co-management decisions. Most harvesters participate in the survey and the UCWG has generally high confidence in the estimates of total harvest. These results are reviewed and endorsed annually by the UCWG. Efforts have been made to avoid double counting and to ensure that everyone is interviewed. However, given that these surveys are voluntary, and harvesters spend time out on the land where they may not be consistently accessible to interviewers, the estimates of harvest are not considered an exact count of total harvest.

Biological, environmental, socio-economic, climatic, and other factors drive spatial and temporal patterns in the harvesting of fish and marine mammal harvests. We underscore the importance of traditional and local knowledge in the interpretation of harvest data, through meaningful engagement with, and verification by, local community experts through the UCWG, OHTC, and

other forums. Other complementary approaches can be used to assess some of the factors which could be driving these harvest patterns, including, but not limited to, community household surveys (e.g., Paylor et al. 1998), harvest-monitoring programs that assess key fishery indicators (e.g., Bell and Harwood 2012, Harwood et al. 2020, Gallagher et al. 2021, Lea et al. 2023), assessment of relevant environmental conditions over time (e.g., Melling et al. 2005), modelling and other analytical approaches (e.g., Zhu et al. 2017), and traditional knowledge interviews (e.g., Worden et al. 2020).

The average annual harvest of fish and marine mammals by species 2004–2015 has declined relative to records collected 1988–1997 (Joint Secretariat 2003), although Arctic Char, Lake Trout and Ringed Seals have remained the most common fish and marine mammal species harvested by Ulukhaktok residents. The one exception was cod harvested during spring appears to be increasing, with reports of up to 966 caught in 2015. Beluga harvests continue to be opportunistic and rare, with the exception of 2014 when 37 whales were harvested (see Loseto et al. 2018). While the harvest of Pacific Salmon recorded in 2005 is not a new occurrence with harvests noted back to the 1960s (John Alikamik, Community of Ulukhaktok, pers. comm.), their prevalence in the Canadian Arctic appears to be increasing, although it is still variable from year to year (Dunmall et al. 2013). Ulukhaktok is outside the range of Pacific and Atlantic Walrus, however, one was harvested near Ulukhaktok in 2015, and walrus have previously (1970s) been observed near Banks Island in the Beaufort Sea (Stirling 1974). Not only do harvest records indicate the importance of a species to the community, but they also guide the design of future research and monitoring programs, that might rely on subsistence harvests to obtain samples (e.g., to ensure there would be sufficient sample sizes to address research questions).

Seasonal patterns were observed in fish and marine mammal harvest, likely relating to both travel and accessibility across lands and waters, as well as life histories of harvested species (particularly for anadromous Arctic Char as they undertake their seasonal migrations). Ice cover on lakes and coastal waters continues to be an important seal and fish harvesting platform for Ulukhaktok harvesters. The changing climate and trend toward earlier break-up and later freeze-up in the area (Harwood et al. 2020) could have direct and indirect impacts on fish, marine mammals, and their ecosystems, as well as on the Indigenous communities that rely on these resources as a primary food source.

While harvests from all locations tend to be lower in recent years, anadromous Arctic Char continues to be an important part of the Ulukhaktok diet, underscoring the importance of continued monitoring and management of this resource. The history of the UCWG and the harvest data presented here illustrates the adaptive co-management decisions that were led by the community, on a voluntary basis, and largely in response to concerns surrounding the sustainability of the Kuujjua River Arctic Char population. These management measures included voluntary closures, encouraging harvest from alternate fishing areas, using areas on a rotational basis whenever possible, recommended timing restrictions, and establishing guidelines for harvest levels, all of which were initiated by the community through the UCWG. This illustrates how Inuvialuit harvesters are leaders in conservation and management of fish and wildlife, supported by the adaptive co-management approach defined by the IFA.

CONCLUSIONS

While harvests have declined over time, Arctic Char (anadromous and landlocked), Lake Trout, and Ringed Seals remain staples in the Olokhaktomiut traditional diet. The spring harvest of cod from coastal waters has become increasingly important to the community in recent years.

Beluga harvests remain rare and opportunistic depending on proximity of the whales to the community during spring and summer.

Estimated total harvest of anadromous Arctic Char from all fisheries between 1988 and 2015 varied between 2,616 and 11,360 fish. The coastal subsistence fishery generally harvested the most Arctic Char relative to Kuujjua River or Prince Albert Sound fisheries. The total harvest from coastal waters during 1988–2015 varied between 486 to 6,297 fish annually, including a small commercial harvest of < 500 fish annually beginning in 2000. The subsistence harvest of anadromous Arctic Char from the Kuujjua River has declined over time, varying between 1,986 and 4,000 fish annually during the late 1960s to late 1980s, < 1,800 fish during 1996–2020, and < 1000 fish during 2003–2015. The total number of Arctic Char harvested from the Kuujjua River stock is unknown due to the uncertainty regarding contributions to the mixed-stock coastal harvest. In recent years the community has found that Mayoklihok Lake is a relatively productive fishing site during fall. The annual subsistence harvest of anadromous Arctic Char from Prince Albert Sound rivers 1988–2015 has varied between 0 and 5,502 fish, with the majority from the Kuuk and Kagloryuak rivers.

Fish and marine mammal harvest records are an essential component of stock assessments and a source of information for co-management partners to inform management decisions, research, and monitoring programs. The ongoing collection of harvest data is essential for documenting the importance of these species to the diet, culture, and traditions of the Inuvialuit, particularly given emergent and significant influences of a changing climate. The periodic review of annual harvest data, harvest monitoring programs, research results, Indigenous Knowledge, and observations made by co-management partners established through the IFA, continues to underpin the sustainable management of fish and marine mammals in the Ulukhaktok area.

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TABLES AND FIGURES

Table 1. Subsistence harvest of fish and marine mammal species reported during Ulukhaktok community surveys, 2004–2015.

Year	Fish						Marine mammals				Other/ Not specified
	Arctic Char (anadromous)	Arctic Char (landlocked)[a]	Lake Trout	Whitefish	Cod	Pacific Salmon	Ringed Seal	Bearded Seal	Beluga Whale	Walrus	
2004	3,377	-	2,967	104	6	-	518	14	2	-	-
2005	4,058	-	2,655	145	43	2	354	8	-	-	-
2006	3,393	27	2,476	100	-	-	226	8	-	-	-
2007	3,433	23	2,550	173	3	-	424	10	-	-	62
2008	4,934	199	2,775	111	24	-	426	5	-	1	-
2009	2,616	1	1,421	3	9	-	180	2	-	-	-
2010[b]	-	-	28	-	-	-	35	3	-	-	-
2011	3,631	140	1,147	20	18	-	24	-	-	-	2
2012	3,873	354	1,409	12	216	-	255	1	-	-	1
2013[c]	1,944	339	817	-	21	-	47	2	-	-	2
2014[c]	3,706	136	2,560	-	57	-	150	25	37	-	5
2015	3,465	612	2,481	1	966	-	207	5	1	1	14
Average[d]	3,464	203[e]	2,114	74	136	rare	256	8	rare	rare	-

[a] Landlocked char were sometimes grouped in with anadromous Arctic Char, especially in earlier years; only added to form in 2012 so likely underestimated in earlier years.

[b] Harvest surveys only conducted January–March 2010.

[c] Community noted lower confidence in the data collected these years; did not consider the records to be complete.

[d] Average did not include 2010.

[e] Average calculated using 2011–2015 data only.

Table 2. Proportion of harvest by month (summed by species across all years, 2004–2015) for Arctic Char (anadromous and landlocked), Lake Trout, whitefish, cod, Ringed Seal, and Bearded Seal.

Month	Arctic Char (anadromous)	Arctic Char (landlocked)	Lake Trout	Whitefish	Cod	Ringed Seal	Bearded Seal
January	0.0	0.0	0.1	9.2	0.0	0.8	0.0
February	0.0	0.0	0.2	0.0	0.0	0.7	3.3
March	0.0	0.0	0.5	0.0	0.0	0.8	0.0
April	0.0	4.3	8.7	0.0	0.6	3.8	4.4
May	0.0	25.9	32.4	0.0	3.1	5.9	4.4
June	1.9	42.2	33.2	0.0	55.5	19.5	5.6
July	46.2	9.4	6.9	0.3	24.7	35.8	46.7
August	27.1	0.9	2.7	0.1	12.5	22.3	26.7
September	4.4	1.4	1.2	0.0	3.5	6.9	4.4
October	13.5	8.0	10.3	24.6	0.0	0.8	1.1
November	6.3	1.2	3.6	61.2	0.0	1.1	1.1
December	0.6	6.6	0.2	4.5	0.0	1.6	2.2

Table 3. Subsistence and commercial harvest of anadromous Arctic Char by management area (sources: Joint Secretariat 2003, Stephenson 2004, Harwood et al. 2013, Gallagher et al. 2021, Lea et al. 2023, and this report).

	Coastal			Kuujjua R. (Tatik L.)[e]	Mayoklihok Lake	Prince Albert Sound					Total All Areas
Year	Subsistence	Commercial	Total Coastal			Kuuk R./ Tahiryruak L.	Kagloryuak R./ Kingua	Kagluk River	Unspec.	Total	
1988	4,838	-	4,838	4,386	-	15	0	0	-	15	9,239
1989	2,609	-	2,609	3,218	-	70	0	0	-	70	5,897
1990	4,021	-	4,021	3,160	-	186	0	0	-	186	7,367
1991	1,752	-	1,752	1,465	-	14	0	0	-	14	3,231
1992	4,934	-	4,934	2,485	-	454	399	0	-	853	8,272
1993[a]	4,753	-	4,753	0	-	282	2,800	0	-	3,082	7,835
1994[b]	6,297	-	6,297	269	-	157	3,327	0	-	3,484	10,050
1995[b]	5,631	-	5,631	227	-	0	5,502	0	-	5,502	11,360
1996	5,549	-	5,549	1,000	-	50	1,330	550	-	1,930	8,479
1997	4,365	-	4,365	1,166	-	150	224	227	-	601	6,132
1998	3,714	-	3,714	1,260	-	178	210	0	-	388	5,362
1999	4,449	-	4,449	1,201	-	320	0	0	-	320	5,970
2000	3,928	100	4,028	1,786	-	0	351	0	-	352	6,166
2001	3,469	500	3,969	1,137	-	54	453	0	-	507	5,613
2002	4,061	500	4,561	1,180	-	-	283	0	-	283	6,024
2003	2,263	293	2,556	743	-	29	105	0	-	134	3,433
2004	2,359	0	2,359	530	-	29	-	-	459	488	3,377
2005	2,126	0	2,126	951	-	65	475	191	250	981	4,058
2006	2,163	500	2,663	488	-	22	100	-	120	242	3,393
2007	2,154	500	2,654	491	-	88	200	-	-	288	3,433
2008	2,193	500	2,693	967	-	-	1,274	-	-	1,274	4,934
2009	936	500	1,436	570	-	-	610	-	-	610	2,616
2010[c]	unknown	500	> 500	201	-	-	-	-	-	0	> 701

Year	Coastal			Kuujjua R. (Tatik L.)[e]	Mayoklihok Lake	Prince Albert Sound					Total All Areas
	Subsistence	Commercial	Total Coastal			Kuuk R./ Tahiryruak L.	Kagloryuak R./ Kingua	Kagluk River	Unspec.	Total	
2011	1,325	500	1,825	892	-	-	914	-	-	914	3,631
2012	2,083	286	2,369	819	-	10	675	-	-	685	3,873
2013[d]	132	354	486	518	200	-	740	-	-	740	1,944
2014[d]	2,409	346	2,755	644	-	-	151	-	156	307	3,706
2015	1,953	500	2,453	821	100	11	80	-	-	91	3,465

[a] Voluntary closure at Tatik Lake (no harvest).

[b] Voluntary closure at Tatik Lake (harvest monitoring program only).

[c] Incomplete harvest records; surveys only occurred January-March.

[d] Community noted lower confidence in the accuracy of harvest surveys in these years.

[e] Values represent best estimate determined through a comparison of data from harvest surveys and harvest monitoring program (Table 4).

Table 4. Tatik Lake anadromous Arctic Char harvest, collected by the harvest monitoring program, 1991–2015 (Harwood et al. 2013, Gallagher et al. 2021) and reported to the community harvest survey, 1988–2015 (Joint Secretariat 2003, UCWG 2006, Stephenson 2004, and this report). Surveys were incomplete in 2010 (*) and the community had lower confidence in the accuracy of harvest numbers reported in 2013 and 2014 (‡).

Year	Harvest Monitoring Program	Harvest study
1988	-	4,386
1989	-	3,218
1990	-	3,160
1991	65	1,465
1992	113	2,485
1993	0 (closure)	0
1994	231	269
1995	227	200
1996	625	1,000
1997	209	1,166
1998	231	1,260
1999	1201	1,045
2000	237	1,786
2001	191	1,137
2002	595	1,180
2003	230	743
2004	176	530
2005	951	602
2006	488	62
2007	491	410
2008	796	967
2009	331	570
2010*	201	NA
2011	870	892
2012	459	819
2013‡	518	496
2014‡	644	NA
2015	686	821

Figure 1. Fishing areas adjacent to Ulukhaktok, Northwest Territories: the Kuujjua River (Tatik Lake) and Mayoklihok Lake connected to Minto Inlet, the coastal area near Ulukhaktok (highlighted blue), Prince Albert Sound and the Kuuk, Kagloryuak, Naloagyok, and Kagluk Rivers. A majority of summer fishing for anadromous Arctic Char occurs in the coastal area near Ulukhaktok.

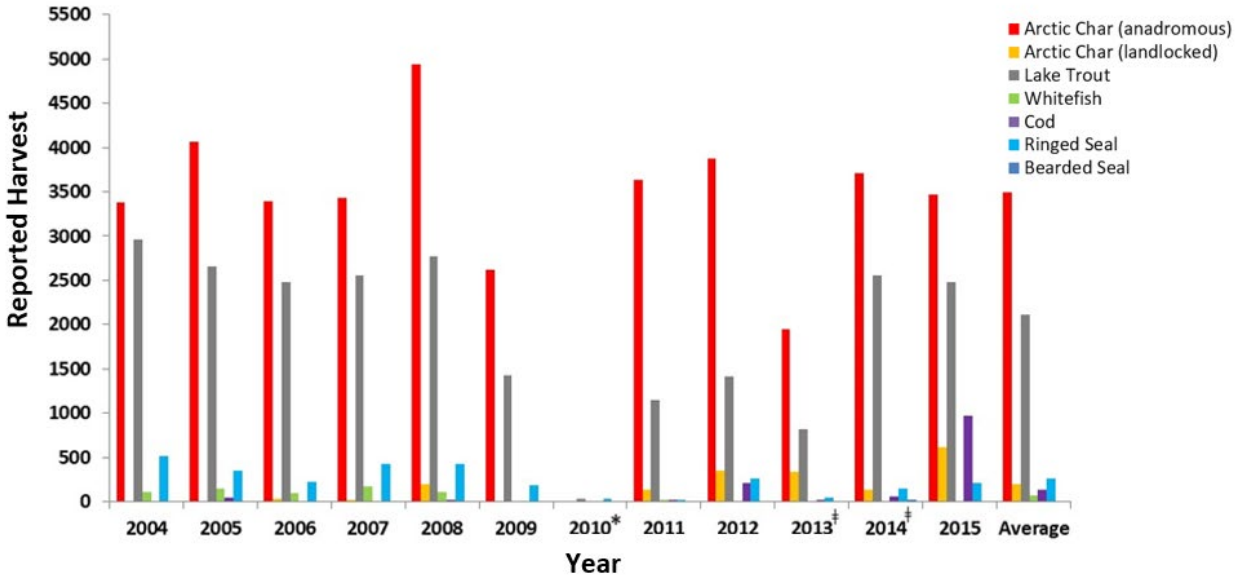
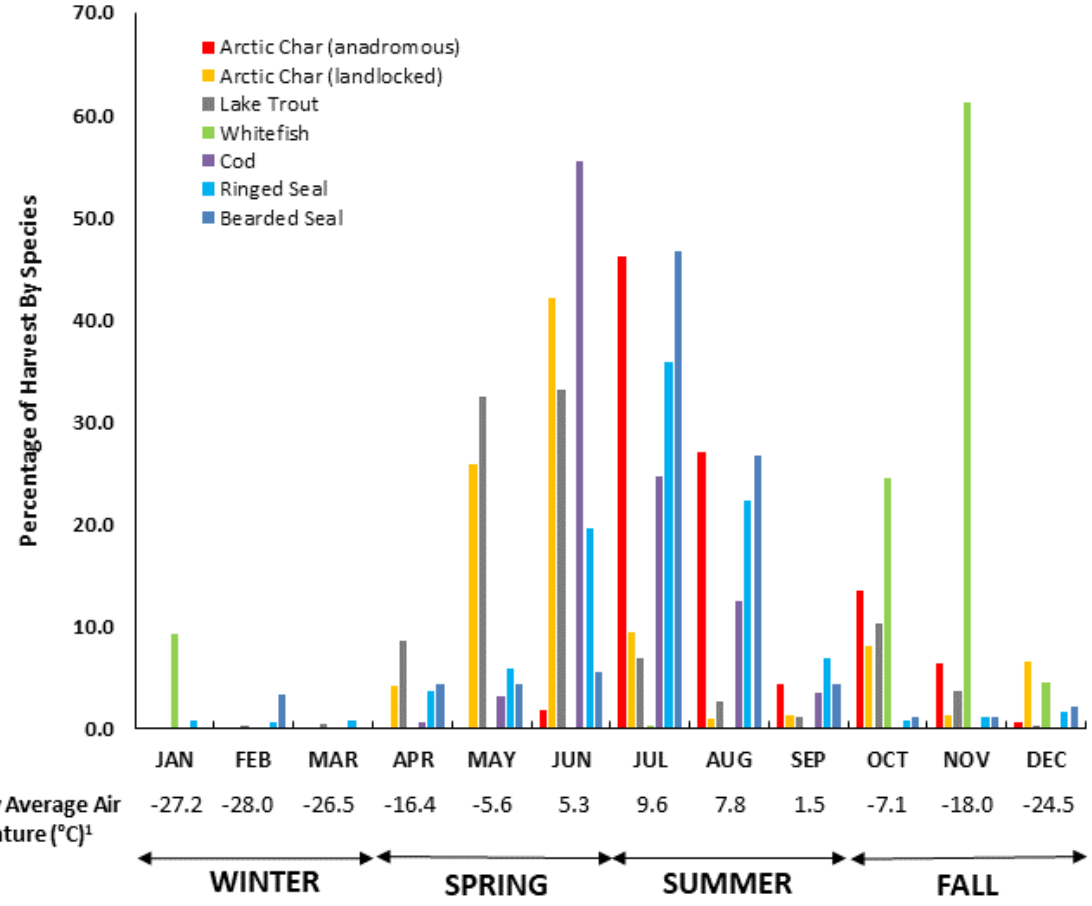


Figure 2. Reported harvest of key species collected through community harvest surveys, 2004–2015. Surveys were incomplete in 2010 (*) and the community noted lower confidence in the accuracy of harvests reported in 2013 and 2014 (‡).



Coastal Waters	Full ice cover	Ice cover with cracks developing in late-spring	Open water; break-up in Eastern Amundsen Gulf in early-July[2].	Open water with developing ice; Eastern Amundsen Gulf freeze-up early in November[2]
Freshwater	Full ice cover	Frozen with cracks in ice developing and lake-shores opening up with stable platform for ice-fishing	Open water, but harder to access with travel over land and having a boat at site	Ice-developing with stable platform for ice-fishing
Key Harvesting Areas	Sea ice and inland lakes	Inland lakes and rivers and sea ice accessible by snowmobile	Mostly coastal waters accessible by boat	Inland lakes and rivers and sea ice accessible by snowmobile
Key Fish and Marine Mammal Species Harvested	Limited harvest records during this time given limited harvest during this time of year[3]; some seals from the ice and fish from inland lakes	Arctic Char (landlocked) Lake Trout Cod Ringed Seals Bearded Seals	Arctic Char (anadromous) Ringed Seals Bearded Seals	Arctic Char (anadromous) Whitefish Lake Trout

[1] Monthly average temperature calculated from 2004-2015 (ECCC 2021).
[2] Harwood et al. 2020.
[3] OHTC et al. (2016) and this study

Figure 3. Proportion of harvest by month, summed across all years, 2004–2015, for key species (Table 2), relative to the four seasons and monthly annual air temperatures. A general description of coastal and freshwater conditions, and key harvesting areas and species are also provided for each season.

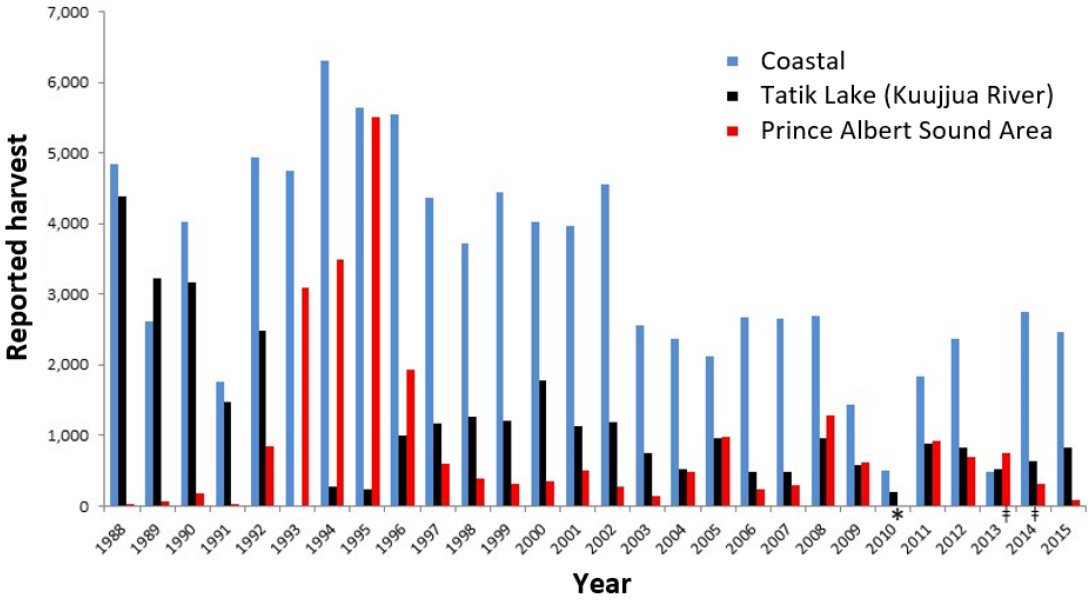


Figure 4. Reported harvest of anadromous Arctic Char, 1988–2015, in management areas established by the Ulukhaktok Char Fishing Plan: Coastal, Tatik Lake (Kuujjua River), and Prince Albert Sound (Kuuk, Kagloryuak and Kagluk Rivers). Surveys were incomplete in 2010 (*) and the community noted lower confidence in the accuracy of harvest numbers reported in 2013 and 2014 (ǂ).

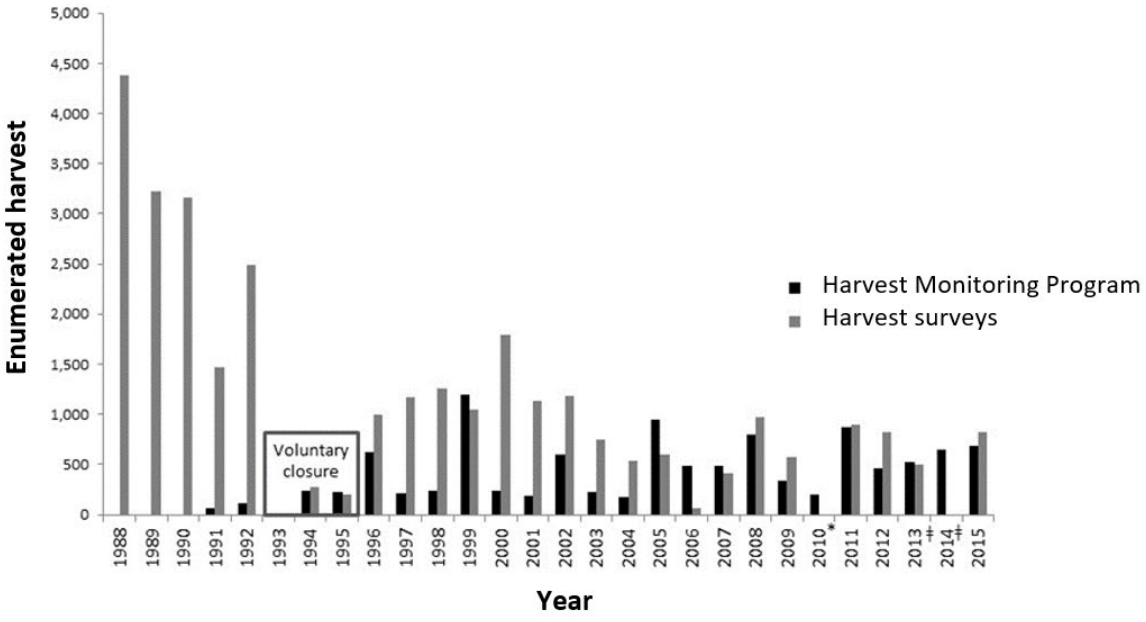


Figure 5. Harvest of anadromous Arctic Char from Tatik (Fish) Lake collected by the harvest monitoring program (Harwood et al. 2013, Gallagher et al. 2021), 1991–2015, and reported during community harvest surveys, 1988–2015 (Joint Secretariat 2003, UCWG 2006, Stephenson 2004, and this report). During the voluntary closure established by the UCWG 1993-1995, harvest monitoring took place in 1994 and 1995 to obtain biological samples to support stock assessment research. Surveys were incomplete in 2010 (*) and the community noted lower confidence in the accuracy of harvest numbers reported in 2013 and 2014 (ǂ).

APPENDIX 1. EXAMPLE OF A BLANK HARVEST SURVEY FORM

Ulukhaktok 2015-16 Harvest Study	Harvester Number	Community Ulukhaktok
	Interview Date	Interviewer
Harvest information from: _____		to _____

Did you fish or hunt whales/seals this month: ☐ YES ☐ NO, if YES then fill in harvest information.

FISH			
Species	**Harvest Date**	**Number**	**Harvest Location**
Arctic Char (sea run)			
Of the Arctic Char harvested: a) Were these already accounted for by the summer coastal or fall Fish Lake char monitors? ☐ YES ☐ NO ☐ PARTIALLY If partially, how many were already accounted for? _____ b) Were these caught for the commercial fishery? ☐ YES ☐ NO ☐ PARTIALLY If partially, how many? _____			
Landlocked Arctic char			
Lake Trout			
Broad Whitefish			
Lake Whitefish			
Cod (oogak)			
Other (specify)			
Other (specify)			

MARINE MAMMALS					
Species	**Harvest Date**	**Number Harvested**	**Struck & Lost**	**Sex**	**Harvest Location**
Beluga					
Ringed Seal					
Bearded Seal					

(Male = M, Female = F, Unknown = UK)

OTHER COMMENTS:

How was fishing/hunting compared to previous seasons?

Did you notice anything unusual (*e.g.*, unusual fish, scars, parasites)? ☐ YES ☐ NO

If YES, please explain

APPENDIX 2. ULUKHAKTOK MONTHLY AVERAGE AIR TEMPERATURES, 2004–2015

Year	January	February	March	April	May	June	July	August	September	October	November	December
2004	-29.1	-32.7	-32.3	-19.5	-10.7	3.3	7.3	5	0	-10.7	-19.6	-29
2005	-26.9	-30.8	-25.2	-14.2	-7.2	4.5	6.3	5.6	0.1	-8.1	-18.8	-21.6
2006	-22.2	-23.7	-21.9	-16.5	-1.8	6.1	8.9	11	3.9	-5.2	-18.4	-21.7
2007	-25.3	-27.4	-28.8	-14.5	-8.4	5.9	13.6	7.2	0.3	-9	-21.8	-24.2
2008	-27.6	-29	-30	-17	-3.8	6	9.7	5.8	0.1	-7.1	-17.8	-23.5
2009	-27	-27.7	-31.3	-17	-8.1	4	5.6	7.2	1.6	-9.1	-15.8	-22.2
2010	-26.1	-24.1	-20	-7.7	-4.2	7	11.2	8.9	1.9	-5.8	-15.9	-24.1
2011	-27.5	-27	-23.4	-20.8	-5.9	3.1	12	11.3	2.7	-6.9	-19.2	-26.5
2012	-26.5	-24.6	-28.3	-15.4	-3.6	7.5	12.3	8.8	3.9	-4.9	-16.9	-26.2
2013	-30.8	-30.9	-25.4	-19.1	-7.3	5.8	7.4	7.7	1.3	-4.6	-17.2	-26.1
2014	-29.7	-27.8	-24.9	-18.2	-6.4	5.2	9.7	6.6	-0.5	-4.3	NA	-23.3
2015	-27.3	-29.8	NA	NA	0	4.6	10.6	8.3	2.4	-9.9	-17	-25.5
Average	-27.2	-28.0	-26.5	-16.4	-5.6	5.3	9.6	7.8	1.5	-7.1	-18.0	-24.5

Source: ECCC (2021)

APPENDIX 3. NUMBER OF ANADROMOUS ARCTIC CHAR HARVESTED FROM THE KUUJJUA RIVER 1966–2015

Year	Subsistence	Commercial	Sport Lodge	Total
1966	3,600*	-	133	3,733
1967	4,000*	-	569	4,569
1968	3,500*	-	400*	3,900
1969	3,500*	-	500*	4,000
1970	3,800*	-	110	3,910
1971	3,994	-	119	4,113
1972	3,063	-	325	3,388
1973	3,367	-	135	3,502
1974	1,704	-	187	1,891
1975	3,782	-	27	3,809
1976	2,222	-	-	2,222
1977	3,046	-	-	3,046
1978	1,986	-	-	1,986
1979	-	-	-	-
1980	-	1,026‡	-	1,026
1981	-	-	-	-
1982	-	1,356‡	-	1,356
1983	-	1,356‡	-	1,356
1984	-	1,356‡	-	1,356
1985	-	-	-	-
1986	-	-	-	-
1987	-	-	-	-
1988	4,386	-	-	4,386
1989	3,218	-	-	3,218
1990	3,160	-	-	3,160
1991	1,465	--	-	1,465
1992	2,485	-	-	2,485
1993	-	-	-	-
1994	269	-	-	269
1995	227	-	-	227
1996	1,000	-	-	1,000
1997	1,166	-	-	1,166
1998	1,260	-	-	1,260
1999	1,201	-	-	1,201
2000	1,786	-	-	1,786
2001	1,137	-	-	1,137
2002	1,180	-	-	1,180
2003	743	-	-	743

Year	Subsistence	Commercial	Sport Lodge	Total
2004	530	-	-	530
2005	951	-	-	951
2006	488	-	-	488
2007	491	-	-	491
2008	967	-	-	967
2009	570	-	-	570
2010	201	-	-	201
2011	892	-	-	892
2012	819	-	-	819
2013	518	-	-	518
2014	644	-	-	644
2015	821	-	-	821

* Estimation (Lewis et al. 1989).

‡ Number of fish estimated using an average weight of 2.3 kg per fish.

Sources: Lewis et al. 1989, Yaremchuk et al. 1989, Joint Secretariat 2003, UCWG 2006, Stephenson 2004, Harwood et al. 2013, Gallagher et al. 2021, and this report.