# ARCTIC CHAR IN A CHANGING CLIMATE:

## Community priorities and recommendations

**Makivik Corporation**

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*Submitted by Mikhaela Neelin*

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# PROJECT APPROACH

## ORIGIN

This project was the result of discussions between McGill University and the Nunavik Climate Change Committee on Adaptation (which includes representatives from the Kativik Regional Government [KRG], Makivik Corporation, the Nunavik Hunting Fishing and Trapping Association [HFTA, also known as Anguvigaq], le Ministère de l'Environnement et de la Lutte contre les changements climatiques [MELCC], and Ouranos). This committee recognized the need for more information regarding **the impacts of climate change on Arctic char**.

Funding for the project was shared between McGill University and the Climate Change Preparedness in the North Program (CCPN). Makivik Corporation took on the supervision of the project, which included providing resources at the Nunavik Research Centre, arranging meetings, and approving the report. Community meetings and the report itself were coordinated by Mikhaela Neelin, a Master's student at McGill University.

## INITIAL PLAN & PROJECT EVOLUTION

Initially, the plan for this project was to visit Kuujjuaq, Tasiujaq, and Kangiqsualujjuaq in October 2018. Neelin would investigate the influence of climate change on stream connectivity and community recommendations to manage these issues. These included dry streams from lack of rain, dams from expanding beaver populations, and eroding banks from melting permafrost, which form barriers that inhibit Arctic char migration to lakes.

This project focused on the involvement of Local Hunting Fishing and Trapping Associations [local HFTAs, otherwise known as Anguvigapiit], fishermen recommended by the local HFTAs, and other community members as time permitted.

The project evolved according to community requests. The number of villages involved grew from 3 to 10 over the course of the project due to expressed interest. In addition, the structure of these meetings was relaxed in order to accommodate all

concerns about Arctic char; discussions often surpassed the topic of stream connectivity.

## RESULTING REPORT

This knowledge gathering project was never intended to cover every topic and community in an all-inclusive manner. It is meant to act as a launch board, not as a final to-do list.

***Overall project goals:***

- *To communicate community concerns and recommendations so that researchers and policy makers may help address these concerns and support local projects.*
- *To communicate management ideas and successes so that other communities can be inspired, get ideas, and collaborate on similar goals.*

***Specific goals for each community report:***

- *To summarize relevant past projects and research on Arctic char.*
- *To identify present concerns regarding Arctic char and climate change impacts.*
- *To summarize recommendations for future management and research to allow continued access to Arctic char as the environment changes.*

***Please keep the following in mind when reading the subsequent pages:***

- Some issues and voices were not included because of logistical limitations. Communities were only visited if interest was expressed and time/money permitted, but this does not reflect their importance/lack thereof.
    - The voice of Elders is underrepresented in a few of the communities. Any further research or management must ensure that their voices are heard, as they are knowledge holders with a wealth of wisdom and experience.
- If an issue, management, or research idea inspires the reader, he/she should do more investigation into the topic by communicating with community leaders.

This information is organized by community, and the layout is as follows:

1. *Arctic char overall trend*
2. *Problems for Arctic char*
    a. *Barriers to Arctic char migration*
    b. *Other problems for the Arctic char fishery*
3. *Recent research and management projects for Arctic char*
4. *Recommended research and management solutions*

# OVERVIEW OF RESULTS

**Table 1** - **Participating communities**: Number of group interviews, individual interviews, and total respondents in each of the communities that participated.

| | NUMBER OF GROUP INTERVIEWS | NUMBER OF INDIVIDUAL INTERVIEWS | TOTAL NUMBER OF RESPONDENTS |
|---|---|---|---|
| Kangiqsualujjuaq | 2 | 3 | 10 |
| Kuujjuaq | 0 | 11 | 11 |
| Tasiujaq | 2 | 7 | 11 |
| Aupaluk | 1 | 10 | 15 |
| Quaqtaq* | 1* | 0 | 1 |
| Ivujivik* | 1* | 0 | 1 |
| Akulivik | 1* | 0 | 1 |
| Inukjuak | 2 | 1 | 6 |
| Umiujaq | 1 | 0 | 5 |
| Kuujjuarapik | 1 | 1 | 5 |

*A group interview was held with HFTA members from Akulivik, Ivujivik, and Quaqtaq (in Akulivik after the 2018 HFTA Annual General Meeting). Ivujivik and Quaqtaq were not visited in person.

## CONCERNS AND RECOMMENDATIONS

**Table 2 - Summary of concerns and recommendations**: Summary of major concerns regarding Arctic char and recommendations from each community.

| | MAJOR CONCERNS | RECOMMENDATIONS |
|---|---|---|
| Kangiqsualujjuaq | -Low water levels<br>-Erosion of banks<br>-Concentration of fishing efforts | -Stream enhancement<br>-More research<br>-Improved research communication |
| Kuujjuaq | -Low water levels<br>-Overharvest<br>-Beavers | -Stream enhancement<br>-Regulations<br>-Beaver trapping |
| Tasiujaq | -Beavers<br>-Low water levels<br>-Garbage in water | -Dam removal<br>-Stream enhancement<br>-Improve dump |
| Aupaluk | -Low water<br>-Water quality<br>-Concentration of fishing efforts | -Stream enhancement<br>-Research<br>-Regulations (from within) |
| Quaqtaq | -Low water levels<br>-Overharvest | -Stream enhancement<br>-Regulations (from within) |
| Ivujivik | -Low water levels<br>-Contaminants | -Stream enhancement |
| Akulivik | -Unpredictable conditions<br>-Permafrost<br>-Contamination | -Hatchery<br>-Research |

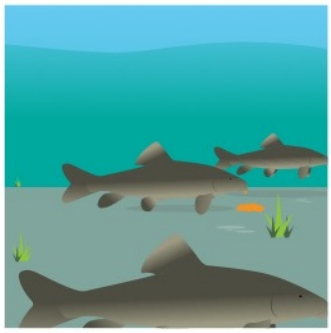
| | | |
|---|---|---|
| Inukjuak | -Sucker fish | -Removal of sucker fish |
| | -Low water levels | -Hatchery |
| | -Hydroelectric dam | -Stream enhancement |
| Umiujaq | -Beavers | -Dam and vegetation removal |
| | -Human impacts | -Removal of abandoned nets |
| Kuujjuarapik | -Vegetation growth | -Hatchery |
| | -Otters | -Increased otter harvest |
| | -Health | -Research |

## SUMMARY

Slipping banks due to permafrost melt blocking Arctic char

Drying Streams blocking Arctic char

Beaver dam blocking Arctic char



New fish species eating or competing with Arctic char

Caleb Trimm

Arctic char migration to overwintering sites is a pivotal time for this species. Nunavimmiut involved in this project explained that if char are unable to access an overwintering site quickly enough, they will migrate to new areas and may not return. This is key to many community members' concerns. Communities have preferences of specific lakes for ice fishing, and if any barrier, such as a dam, soil, or low water flow, delays the passage of the char, it may greatly decrease or even eliminate the availability of char at that site and for the community as a whole.

With climate change, Arctic char habitat and migration routes are constantly changing. A widely recognized barrier to char migration, which was investigated by Power and Barton (1987), is lower water levels in streams. This water level is

thought to be caused by multiple factors, including the rise of the ground in the Arctic due to melting ice from the last glaciation period (known as isostatic rebound), decreased precipitation, and permafrost melt.

Precipitation has become more unpredictable and weather conditions have become more extreme; droughts lower water levels, causing barriers for Arctic char as they return to their overwintering sites. Permafrost melt may also cause the draining of water systems or the erosion of banks. The drainage of water systems lowers water levels, while erosion of banks may cause silt to plug river systems or disturb spawning sites. In addition, the expansion of new species into parts of Nunavik impacts Arctic char in various ways. Beavers introduce dams to river systems which may slow down or block char migration, new species of fish may be competing for resources and space, and longnose suckers are expanding into new areas and consuming char eggs.

These factors are thought to contribute to the redistribution of Arctic char. Some Nunavimmiut have observed a change in the size and taste of Arctic char in certain areas and wonder if it may be linked to the char migrating from other areas.

According to their representatives, all communities recommended continuing stream enhancement projects, although some felt that it was a lower priority or needed to be monitored better. A few communities have expressed a desire for a hatchery or an alternative that would raise spawning success. Many communities wished that the process for funding and permit applications were not so complicated and looked for inspiration from other communities.

In addition to these subjects, many communities expressed a desire for better communication with researchers. They understood that research *could* be helpful in forming management plans, but often recognized a disconnect as has been described in the National Inuit Strategy on Research (ITK 2018). However, research that addresses community priorities and communicates results clearly can be useful to help direct and inform management strategies.

In the face of environmental change, Nunavik communities have been taking initiative and working hard to ensure continued access to Arctic char. Many projects would be improved and made easier if there were better communication and collaboration between policy makers, researchers, and communities. Mitigating and adapting to climate change impacts is facilitated by working together, sharing ideas, and supporting one another. The purpose of this report is to foster such conversations in order to promote collaboration for effective management of the Arctic char fishery in the context of an uncertain and rapidly changing environment.

# 1.
# KANGIQSUALUJJUAQ FULL REPORT

*Participants: Sammy Unatweenuk, Thomas E. Annanack, Willie Annanack, Tommy George Etok, David Annanack, Tommy Unatweenuk, Tommy L. Baron, Elijah Imbeault, Johnny Sam Annanack, Joshua Annanack*

## ARCTIC CHAR POPULATION TREND

Arctic char have been decreasing around Kangiqsualujjuaq, especially in water bodies close to the village. One community member explained that according to the Elders, Arctic char numbers fluctuate year to year because of relocation. However, members of the local HFTA worry that Arctic char may continue to decline if action is not taken.

## BARRIERS TO CHAR MIGRATION

Low water levels

Low water levels have been impacting Arctic char migration near Kangiqsualujjuaq.

***"We have a climate change problem now. Sometimes it's a big river, sometimes it's dry, it's not the same as before." (Sammy Unatweenuk)***

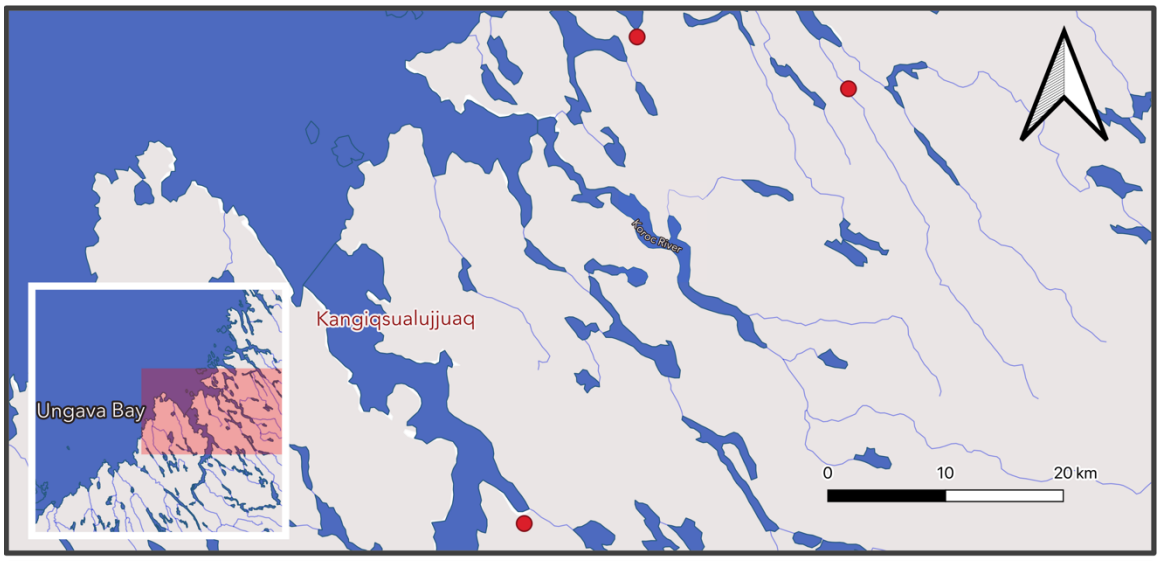
This lack of rain has also made Arctic char more accessible to predators such as polar bears, black bears, and seagulls.

Permafrost melt

***"Our biggest problem right now is climate change. All the Arctic char are going to lay eggs, and spawning areas are destroyed by the climate change because permafrost is melting and the rivers become sand all over the place." (David Annanack)***

David Annanack was describing the erosion of the banks, which causes them to slip and for the debris (sediment such as soil) to enter the water systems. This may impact spawning and/or migration. This process has been observed in three different areas near Kangiqsualujjuaq [Map 1.1].

***"[Sand is] blocking the whole river. And it used to be a big river, but there will be no more river if we don't stop it." (Tommy George Etok)***



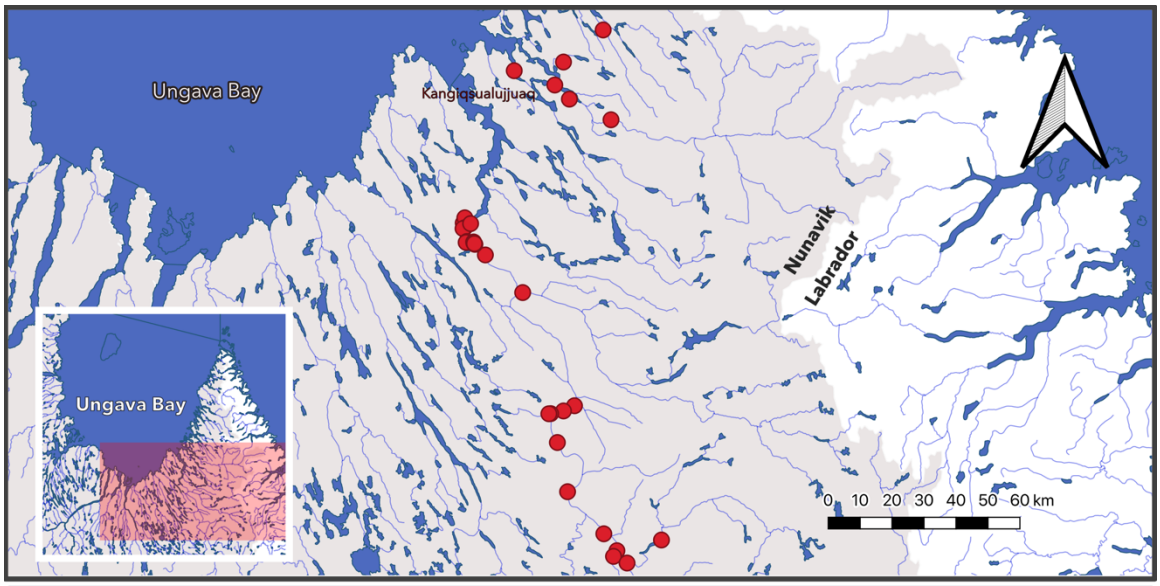

Map 1.1: Map of slipped banks near Kangiqsualujjuaq, where erosion of the riverbanks has caused soil to enter the streams.

## Beavers

***"The more south we go from Weymouth Inlet… we have a beaver problem. Mainly at Koroc River we have dams all over the place where the char used to spawn." (David Annanack)***

The Kangiqsualujjuaq HFTA members were uncertain about the impacts of beavers on Arctic char but brought them up because of the increasing population and stories from Tasiujaq about their negative impacts. Beaver observations are documented in Map 1.2.

***"Beavers are mostly in George River. Not too many in other places […] I haven't really seen this kind of problem, but it's possible the beaver could make problems with the spawning area." (Anonymous)***




Map 1.2: Map of beaver sightings or beaver signs observed near Kangiqsualujjuaq.

## OTHER PROBLEMS FOR THE ARCTIC CHAR FISHERY

### Overharvesting

***"The way the Kangiqsualujjuamiut population has skyrocketed, [...] it's affecting all the char close by. All the char that are going near the community are getting smaller and smaller." (David Annanack)***

Fishing efforts tend to be concentrated on the most accessible lakes:

***"Less people are going out camping when 5 gallons costs over $50. Everybody is going nearer, close to the community." (David Annanack)***

### Egg collection

Several respondents were concerned about possible impacts of the Kuujjuaq hatchery, which has been collecting char eggs from the area near Kangiqsualujjuaq for many years. In general, people wished that there was more of a balance, that the eggs did not come only from their region.

***"I think that Makivik Research should look at other communities besides here and Tasiujaq." (Anonymous)***

Kangiqsualujjuamiut concerns about the health of fish centered around gaps in knowledge and uncertainties regarding sicknesses. The following are a few stories that highlight these concerns:

***"A couple years ago, it was strange to see fish dying in Short Lake** [Map 1.3]. **Maybe five years ago? Makivik Research was there and they didn't ever really find out what the reason was. There was a lot of fish dead in the river. They were cleaning it up, they were picking up all the dead fish from the lake and the river. It almost happened again two years ago. In the same area. I think people didn't really know the reason, even the researchers…" (Tommy Unatweenuk)***

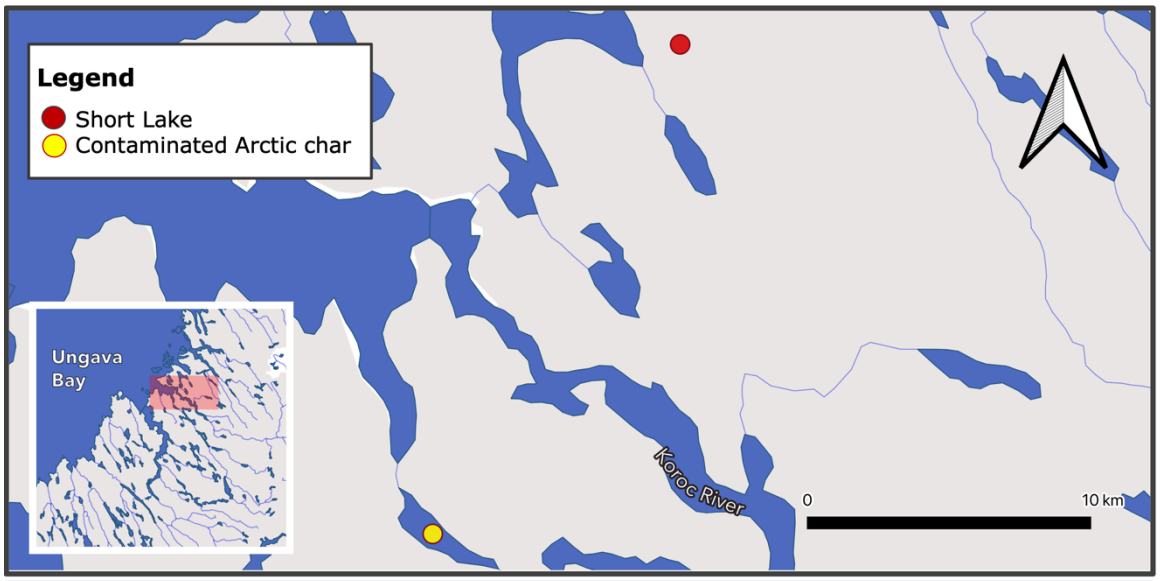
An Elder from the community said that close to 6000 fish had died in the situation that Tommy Unatweenuk described [Map 1.3]. Since then, there has been a decline in fish catches from Short Lake.

Another story, told by Elijah Imbeault, tells of a sick fish that nearly killed him [Map 1.3]:

***"Two years ago, it was in September, there was no snow yet but it was nearly snowy, and at Ujarasujjuliup Lake we went fishing. […] It was the weekend, and I caught a few fish, and when I got back we started having raw fish.***

***Me and my children, we were having raw fish, and I cut up my piece, and while I was chewing it, I felt something soft from the meat. […] The next day I woke up pretty sick, like all my body was swollen. And I was feeling sick, and then I went to the hospital and they told me to have some Tylenol and go back home. A few days later, I was getting worse from the same sickness, so I told my wife that maybe I wasn't going to make it that night while I was sleeping.***

***[…] That night we went to the hospital, and after a few tests they started to say that I got a parasite from the char. The next day they took me to Kuujjuaq hospital, they put IV on me, and from there I started to get better. […] They tested my blood and sent it pretty far away. Like, New Zealand or somewhere there. I never got the results from it." (Elijah Imbeault)***




Map 1.3: Short Lake, where there were many dead fish, and the lake where Elijah Imbeault caught a contaminated Arctic char.

Littering

***"When they're ice fishing, people that smoke just litter their butts in the lake. [...] I heard someone caught a fish that swallowed a cigarette butt." (Thomas E. Annanack)***

The littering of cigarette butts is especially problematic when many people come together for fishing contests. Other types of littering have also been problematic, especially when projects are not cleaned up.

## RECENT RESEARCH & MANAGEMENT PROJECTS

Stream enhancement

All respondents discussed the fact that there have not been stream enhancement projects from approximately a decade ago until 2019.

Fishing restrictions

***"There are three lakes that we banned for fishing with gillnets because we want to grow the fish. They're all too small... when they're too small that means we're overfishing." (Sammy Unatweenuk)***

Unfortunately, HFTA members have observed a few fishermen using gillnets, disregarding the by-law. One fisherman explained that some people, including himself, are not fond of these rules:

***"Some people don't like that new rule. They want to get fish, and some people want to use nets to catch fish. […] Maybe when they're spawning, that's the only time we should not fish there." (Anonymous)***

For the most part, however, there seems to be a positive attitude about this by-law.

***"With the Koroc, we used to use nets before but not anymore. That's a good move; there's more fish…" (Anonymous)***

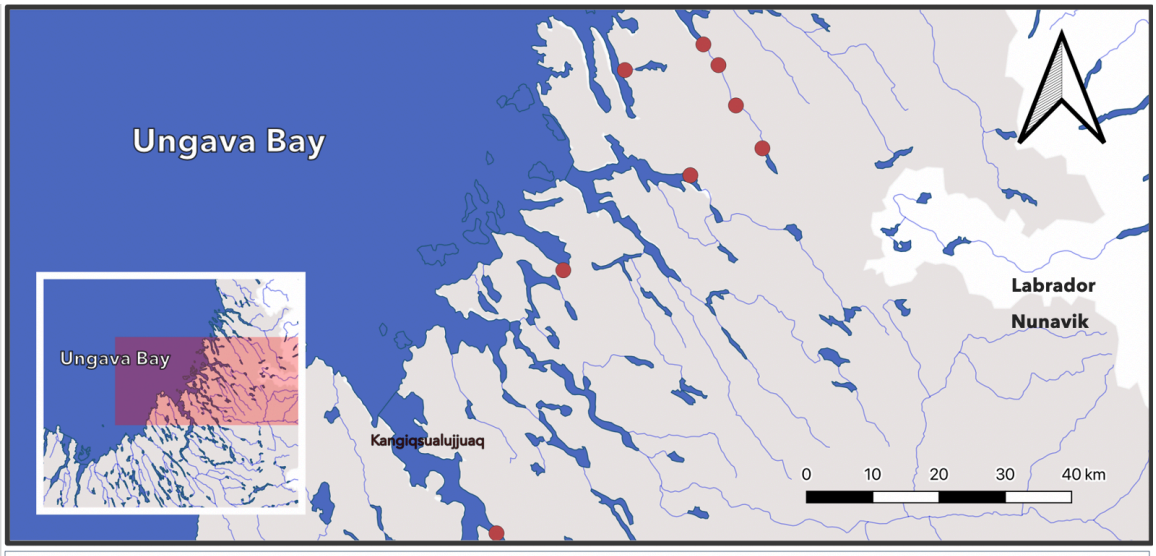
# RECOMMENDED RESEARCH AND MANAGEMENT

## Stream enhancement projects

In Kangiqsualujjuaq, there are a lot of char streams to take care of. HFTA members recognized the necessity of prioritizing projects so that they do not get overwhelmed. They also need to find the funding for the many jobs that need to be done.

***"We have lots of rivers and streams from George River all the way from Tunilik to Killiniq. We cannot take care of all that in one shot so we figured we can do stream enhancement starting from Weymouth Inlet up to George River." (David Annanack)***

HFTA members specifically identified 5 areas that were priorities for enhancement, which they hoped to work on in summer 2019 [Map 1.4]. Helicopter surveys performed on a regular basis across water systems would help to assess which rivers need enhancing.




Map 1.4: 8 sites identified in 2018 as priorities for stream enhancement projects. These were assessed in summer 2019.

## Beavers

***"For beaver dams, we really have to know how to deal with that, […] I don't know if they're blocking the side streams and Arctic char are able to go up to the lake? We need more studies on that…" (Thomas E. Annanack)***

Research was a recurring subject when it came to beavers. Community members have not observed negative interactions with Arctic char firsthand but wonder if they should be concerned.

***"For the beaver problem, we have lots of beaver dams on the side of the lake. I wonder if they affect the char in the lakes. […] We need to study beaver dams in the fishing habitats." (Sammy Unatweenuk)***

When asked what kind of questions they would like researchers to answer regarding beavers, here were some of the suggestions:

***"Are [beavers] affecting our fish? Are they affecting our rivers?" (Sammy Unatweenuk)***

***"Where are they?! Where are the beavers? That's the main thing. We go out sometimes, but we don't see everything." (David Annanack)***

## Overharvesting

***"We have to look at how we can resolve the problem. Maybe fish farming?" (David Annanack)***

Additionally, gillnet regulations are important to the Kangiqsualujjuaq HFTA members. Anything larger or smaller than 4½ inch gillnets are not acceptable. This applies to everyone: researchers as well as fishermen.

***"We have to watch what we're doing with the gillnet; what mesh we use. If we use all different sizes of mesh nets it's going to be like fishing out of the pot." (David Annanack)***

## Health

***"More and more fish have something wrong with them. People just throw them away instead of sending them to the Research Department. If we could collect all of these sick fish then we can find out exactly why they're like that." (David Annanack)***

As the weather has been getting warmer, the fish have been getting sicker. Community members do not want to continue having so many unanswered questions when it comes to the health of fish.

Research

A specific research suggestion was to repeat an experiment from the 1980s, in which Arctic char were tagged to find out where they moved.

***"I was part of Makivik research, back in the 80s when they were tagging fish, when they were going upstream. I would like that tagging program to come back. […] Locate them, tag them, see if they go anywhere besides coming back to the region." (Thomas E. Annanack)***

Another research recommendation was a general one: to study the migration both to and from the ocean, to better understand why, where, and how obstacles are causing fish mortality or inhibiting their movements.

## OBSTACLES & SOLUTIONS FOR EFFECTIVE MANAGEMENT

The main obstacle to effective management was lack of communication, especially with researchers.

***"They never tell us exactly what stage they're in. I'd rather stay with the Kuujjuaq Research Department." (David Annanack)***

A specific case illustrates how this might impact community members:

***"They used to put polar bears to sleep, and we eat polar bear. Recently, we found out that polar bear is not edible within a year or two after it's been put to sleep. That stuff, we just cannot find a book and read, "oh I can't kill this polar bear"; we don't know when it was tranquilized." (David Annanack)***

This dissemination should be done in a way that is accessible. HFTA members discussed the difficulties that they have had with information received in book form alone.

# 2.
# KUUJJUAQ
# FULL REPORT

*Participants: Allen Gordon, Peter May, Jason Aitchison, Steven Kleist, Alix Gordon, Billy May, Johnny May, Vallee Saunders, Anonymous*

*Natalie D'Astoust, a helicopter pilot, described helicopter observations.*

*Michael Barrett, Associate Director of the KRG Renewable Resources, Environment, Lands and Parks Department, described parks and administration.*

## ARCTIC CHAR POPULATION TREND

Arctic char are not very common in Kuujjuaq compared to other fish species. Arctic char populations are much higher in Kangiqsualujjuaq or in Tasiujaq, which is why many Kuujjuamiut travel to go fishing.

***"For char we normally go east or west. East meaning towards George River, and west towards Tasiujaq. […] We've noticed that there's less char than there used to be. […] We used to put out our net and immediately, it was full. Now you have to wait and there's seaweed, it's a lot more work." (Anonymous)***

The Kuujjuaq Landholding Corporation has been working with the Nunavik Research Centre on an Arctic char hatchery, which has been adding Arctic char to the Nepihjee River. This has had a positive impact on the Arctic char availability near Kuujjuaq, but increased pressures due to a rising human population will continue to challenge the growth of the fishery.

***"For the past 30 years or so, caribou took over as the main food source. Now that the population has just dramatically dropped, there will be a lot of pressure on the char resource..." (Allen Gordon)***

## BARRIERS TO CHAR MIGRATION

Multiple factors have been making it difficult for Arctic char to migrate to lakes for overwintering:

***"Beaver dams. I've seen that. I've seen riverbanks that are slipping down. And drying up of streams. […] There's the isostatic rebound, which is lands rising." (Allen Gordon)***

**Isostatic rebound**: The rise of land masses that were depressed by the huge weight of ice sheets during the last ice age. (NSIDC 2020)

### Low water levels

Low water levels are one of the main issues for Arctic char:

***"We've had a lot of low water these past few years. […] And last year or the year before, I was hearing reports that char were staying in the saltwater because the creeks were too low for them to get back up." (Johnny May)***

For the Diana River system in particular, some fishermen have been noticing a decline in Arctic char (especially from 2017-2019).

### Permafrost melt

Permafrost melt, including riverbank erosion, has been frequently observed near Kuujjuaq over the past ten years. Although this may not be the largest barrier to Arctic char migration, it seems to be the most recent.

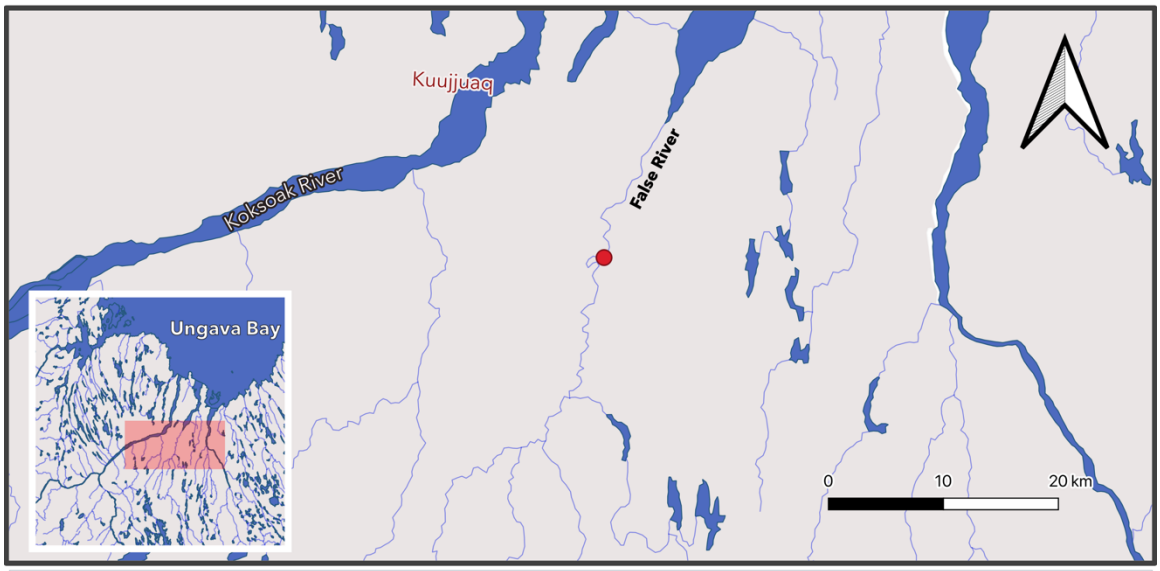
Allen Gordon described two systems that had been impacted by erosion: False River [Map 2.1] and Koksoak River. Although these aren't char systems, it's a reflection of some of the potential impacts of permafrost melt on char rivers.

***"I've seen riverbanks that have slipped further upstream (pretty high riverbanks) so the silt spills down to the river. Some winters you really notice that silt had completely changed the streams and you don't know how many spawning beds have been covered. The other erosion or slip is way up the Koksoak River […] The whole bank had shifted down." (Allen Gordon)***

Johnny May spoke about the erosion that occurred on False River [Map 2.1]:

***"I've seen a lot [of banks slipping]. It's whole banks that are letting go. I suppose that's because permafrost is melting, and permafrost probably held these, usually along the bank of a river. At False River*** *[Map 2.1]****, we can't***

***call it a mountain, but it was about 300 feet high, it went right across the river and plugged it for a few months. […] That wasn't happening 30, 40, 50 years ago. Even around town, we used to hit permafrost when we dug for something. Now I see these excavators, nothing is frozen." (Johnny May)***




Map 2.1: False River, where the bank slipped due to permafrost melt and the sand blocked the river.

Another impact that melting permafrost may have is on the size and depth of lakes:

***"I've noticed a lot of new lakes formed by the ground thawing out. Lakes are getting bigger, more shallow." (Anonymous)***

## Beavers

***"You know when I was young, there were no beavers up here [in Kuujjuaq and Kangiqsualujjuaq]. None. You never heard of a beaver. The first ones I started seeing were at Helen's Falls. That was probably 1958. It was bank beavers that were there. And over the years, they seemed to keep multiplying, and there seemed to be a lot of fresh beaver dams, then they'd kind of disappear. The dams would age and I don't know if the population went down or not, but then fresh dams would increase again. This has been progressive over the past 55 years or more. And now there's beavers above the tree line… so they're really spreading." (Johnny May)***

When asked when he first noticed the population exploding, this was Johnny May's response:

***"Probably when I started to fly, 1963. And probably 70s, between 70s and 80s I would think the most rapid expansion occurred in the small tributaries." (Johnny May)***

Beavers have expanded higher than the tree line. Some people have seen them as high as Aupaluk:

***"I saw dams close to Aupaluk, out in the barrens, where there's willows. […] There were beaver dams even out of the trees eh?" (Anonymous)***

Johnny May has heard that they have expanded into the Kangirsuk region:

***"I've heard people seeing beavers on the Payne River… that's almost 200 miles north. They are that far! They're going north." (Johnny May)***

Allen Gordon shared his mother's theory for why the beavers had suddenly begun expanding north:

***"In the late 1970s, we started to hear of quite a few beavers being noticed here in the river, which is quite unusual. In the early or mid 1970s, we didn't hear of that. Suddenly it was a dramatic increase of sightings of beavers. People said that they were coming through the main river here, heading north along the shoreline. My mum said, although she wasn't a hunter, her theory was that the inland people (Naskapi people) that were trapping these all the time, had been relocated to Schefferville. So there was no more trapping, and the beaver population has exploded cause no one is taking them. Anytime you have a population that's growing, they've got to expand. Being in one area is not productive for them, so they've got to find new areas." (Allen Gordon)***

Another reason that beavers seem to be moving further north is because of food availability, mainly the growth and densification of shrubs:

***"These beavers have been here since I was a kid eh? But where we're seeing more beavers maybe is where there were less willows before, but the willows are spreading. So you see they're moving north, where they can take advantage of food." (Anonymous)***

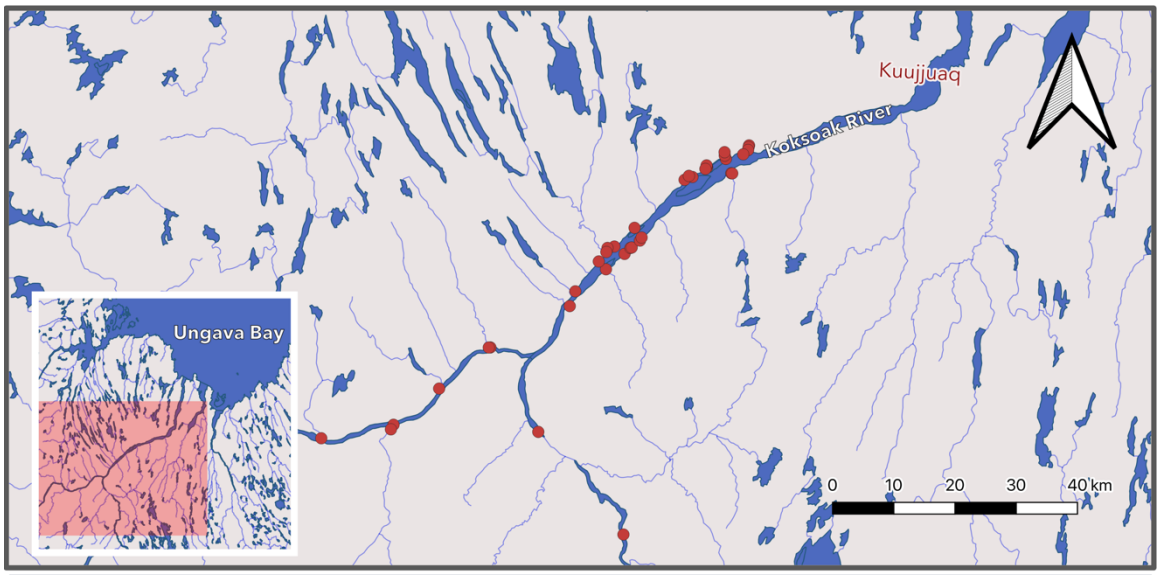
Johnny May explained that beavers will build their dams using a lot of rocks and mud if vegetation is scarce:

***"I see that above the tree or willow line, even willows further north are pretty scarce. So they divert to rock and mud. Pretty smart huh?" (Johnny May)***

Char are not as often impacted by beavers as trout are, especially near Kuujjuaq:

***"[The damming of char streams] happens for sure, but much less frequent I think than the trout streams. There's a little creek going to Stewart Lake, we used to catch all kinds of speckled trout in the fall when the ice was thin, but over the years the beavers have built dams so there is no more fish in the creek. The same thing is happening, maybe not to the same extent, with char." (Johnny May)***

Map 2.2 illustrates where beavers have been sighted recently near Kuujjuaq.




Map 2.2: Map of beavers near Kuujjuaq. Most beavers are found near Koksoak River, which is not a char river.

The size of the dam influences its effect on fish:

***"I guess [the effect on Arctic char] depends on how big the dam is eh? Some dams are only like a foot. But I've seen some dams that are like 4 feet. And those dams, those for sure they can't get up. But the smaller ones, I'm sure they can get up if there's a flow. [...] As long as they're not too high, fish can go over them. Like that place near Tasiujaq, we went that time there were like two or three dams, but we saw char above the dams" (Anonymous)***

The big problem with beavers is that once they're established, they are difficult to remove.

***"I think the biggest, most dangerous threat [to Arctic char] (besides lower water which we can't really control)... as soon as you have a beaver colony moving in you're going to have a hard time, once they're established. Once there's one, there will be quite a few." (Anonymous)***

***"I'm not someone that likes to point/blame wildlife movements. They're wildlife, they're out there... To me honestly, humans are the biggest***

***problems of anything. I don't see [beavers] in a negative way, but if they're having an impact on a char system (which is new for char systems to be inaccessible to the returning fish), in that sense, I see it in a negative way. That it may have an impact on the food fishery." (Allen Gordon)***

Arctic char and other fish species are valued as a source of food. Many Kuujjuamiut do not eat beaver and some explained that they do not like the taste. Of course, exceptions exist:

***"Some people eat beavers… they're good eh? Like I've eaten them before. But a lot of people won't eat them, like bears. A lot of people won't eat bears here. But if you go where the Cree and the Naskapi are, they hunt bears to eat. So it's more of a habit, I think. People don't eat beavers… but in other places they really like them and it's hard to change habits." (Anonymous)***

***"[The meat] is an acquired taste, I find, but some older people really enjoy it. I find younger people don't appreciate it as much. […] I think, more from my perspective, we're not hunting them as much for their meat as for their fur. And in the summer, we're fishing. The fish is more a staple than beaver will ever be. Unless there's a major food shortage… then we might have beaver burgers." (Anonymous)***

## OTHER PROBLEMS FOR THE ARCTIC CHAR FISHERY

### Overharvesting

Although the hatchery has added to the char population near Kuujjuaq, some people worry that netting might be slowing down the process:

***"The management here is going to be a problem, unless people wake up and quit netting. Our char is not going to multiply here. I don't know what their counts were last fall (2017) in Dry Bay. I know it's been going up slowly, it's quite well managed. But if they didn't set nets and catch 200 or 300, that would be more fish that are going to spawn in the system." (Anonymous)***

### Temperature

***"My biggest worry, actually, for the char, other than us (humans) and the communities becoming very populated and wiping out the fishery, is related to climate change. The warming of the streams is an issue. […] When I was going [to Tasiujaq] in the 80s, the juvenile char, the babies, were going up a lot to the little streams of Finger River. Which they still do now I believe. But my wife called me one time, about 10 years ago, and said that they were noticing a lot of little dead char in the streams. […] And when she***

***called me, I told her "go touch those streams where the char are dead". And she called me later and she said "yep… these streams are extremely warm". So the char has adapted so much to extreme temperatures… warm waters is, I think, a very negative impact." (Allen Gordon)***

Research is currently being done to try and better understand changing temperatures and its impact on native fish. This will be important to comprehend as climate change continues to impact the species distribution in Nunavik water bodies.

***"As a scuba diver, the temperature is always recorded in our logbook. And I've seen the curve in the log… it went from the 50s, low 50s, to even upper 60s. That's a big shift in water temperature in the same body of water." (Anonymous)***

## RECENT RESEARCH & MANAGEMENT PROJECTS

### Stream enhancement and hatchery

The Nepihjee River (or Dry Bay) project has been an incredible success for Kuujjuamiut [Map 2.3]. Allen Gordon described what was done:

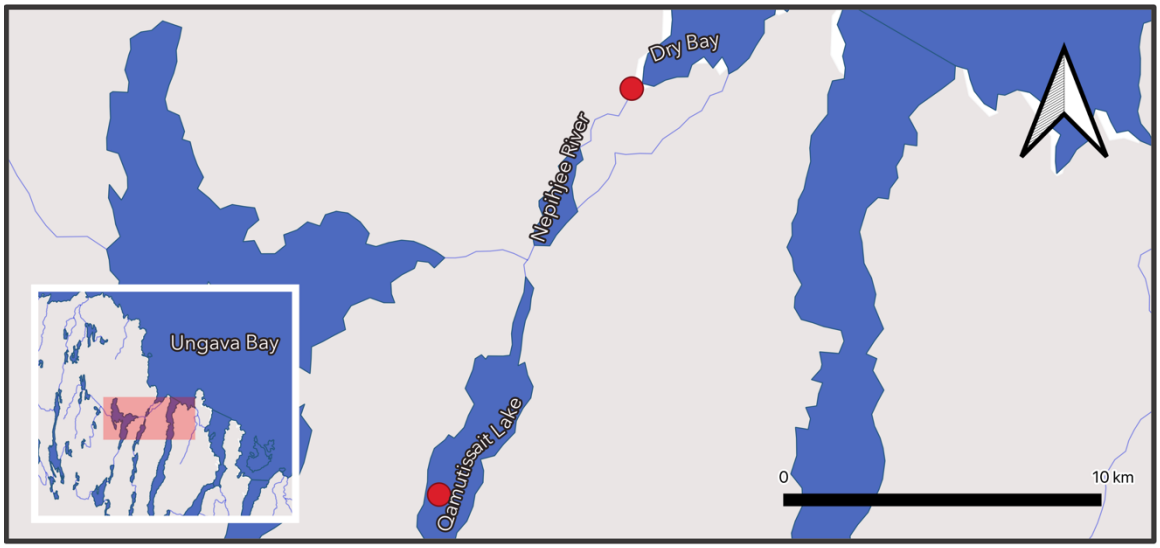
***"We did that experiment in Kuujjuaq, where we basically made a corridor between the fresh and saltwater, where the char were not before. We've made a complete new fishery. It's small, but we were an experiment. […] There were a few skeptics who said "you can't just open up a system. The char were not there before, they're not just going to go up." That was the attitude of some people, and we proved them wrong." (Allen Gordon)***

The success of this project was immediately apparent, as Arctic char wasted no time entering the new habitat…

***"The first year they blew it out, I was there clearing the rocks out, and there were fish in the bottom, waiting to go up. As soon as it was cleared they went up. It was instant. In the past they used to go in the pool below the falls." (Anonymous)***

Immediate results did not necessarily mean that this would be a sustainable fishery. Many people wondered if the Arctic char would continue returning to the Nepihjee River. To measure the long-term trend and investigate climate change factors affecting Arctic char growth and migration patterns, the system has continued to be monitored and maintained by Landholding and the Nunavik Research Centre. The project has had positive results to date: in 2019, the Nunavik Research Centre

counted an average of 17 Arctic char per day, which was an increase from the 8 char per day that they had counted the previous three years.




Map 2.3: The Nepihjee River system, which was enhanced, and Qamutissait, where they release the fish from the hatchery.

## RECOMMENDED RESEARCH AND MANAGEMENT

### Stream enhancement

Kuujjuamiut are encouraged by the success of the Nepihjee project and generally want this work to continue and expand.

***"In my opinion [the river] should be even further enhanced to keep the char population healthy and growing. [We should also] work on new char habitats where the lakes are very suitable for char, for wintering and spawning, but they're not accessible due to natural obstacles." (Allen Gordon)***

Johnny May suggested that systems that go from saltwater to freshwater should be prioritized:

***"Some of the creeks may be not too necessary, where it's a freshwater system going into another freshwater system, but definitely saltwater going into freshwater spawning... I've been told that char are only able to live so long in saltwater before they die." (Johnny May)***

Beavers

A better understanding of trapping techniques amongst Inuit in communities with beavers might ensure that populations do not drastically increase.

***"The people in Tasiujaq have very little experience with beavers. In the past, beaver pelting was pretty lucrative. Canada has been built on beavers. I think hunters should maybe get to know how to harvest beavers better. Maybe not completely eliminate them but at least control the population." (Anonymous)***

Overharvesting

***"If you have a population of fish that are heavily fished, the fish are going to be smaller and are going to mature quicker when they're still fairly small, to try to compensate. So... I mean, if the systems are getting in trouble it's best to monitor them eh? Maybe by getting catches and comparing them year to year to see if they're going down." (Anonymous)***

In addition, many people felt that more by-laws and better enforced by-laws, although uncomfortable in the present, ensure a better future for the Arctic char fishery.

***"For stream enhancement purposes, there could be a moratorium on fishing, to build up the fish stocks. That's really hard to get across to everybody. [...] It's frustrating when you see people fishing at the other end." (Anonymous)***

Research

***"There's research that's really helpful for the north, that's going to benefit the north. But there's also research just for the purpose of science. And we would want to see something that would benefit the populations and to help enhance char populations. The work that we'd want to see is work that'll help the char populations and is not purely for science." (Anonymous)***

## OBSTACLES & SOLUTIONS FOR EFFECTIVE MANAGEMENT

Allen Gordon went through a long and challenging process in order to plan and find funding for the hatchery project in Kuujjuaq. Many other communities look to the Nayumivik Landholding for inspiration, and Allen Gordon shared some of his advice for them:

***"When a community has a project in mind, they have to come through. They can't expect other people to look after it. There has to be further research, yes, further identification of systems. But after that, there has to be follow-up, and the community leaders really have to go forward. […] They kept telling me 'you're lucky that Makivik helped you, you're lucky that KRG…' and I said 'No. It was our community project. We didn't wait for anybody; we just went ahead. We got our authorizations and once we were going through, they came on board to help us. […] There are some communities that are in a stuck mode. They talk a lot, they complain a lot. But they don't go forward a lot. A project needs a good leader every time." (Allen Gordon)***

When communities ask him for help planning a potential hatchery project, one of the first questions that he asks is "where will you get your eggs?".

***"You can't think. You've got to go check now. You have to go see if you're able to catch these char that are about to spawn to strip them of their eggs… and spawn them and bring them to your hatchery. You can build the greatest hatchery building but if you don't have eggs you can't go anywhere. […] That's the first thing before you invest hundreds of thousands of dollars on a fish plant or a hatchery plant." (Allen Gordon)***

Another challenge that communities are faced with are the turnover rates for leadership. One leader may begin a project but if they are voted out, the project will often get neglected. Kuujjuaq Landholding had the advantage of having Allen Gordon re-elected as Nayumivik Landholding Corporation president for many years.

***"With a lot of projects… every two or three years there are elections. And the people that were interested are either gone, or the new ones are kind of interested but not really. […] When you're dealing with that, a lot of projects are in limbo." (Allen Gordon)***

Steven Kleist also had a few thoughts to share about the challenges that have been faced by Kuujjuaq as well as other communities doing large-scale Arctic char projects:

***"Because we are re-introducing char back here, we have to go somewhere else to get char eggs. […] That's a challenge: getting permission from other communities. Funding is also always another challenge. Fortunately, Kuujjuaq has an awesome Landholding with a reasonable budget.***

***What else is a challenge? Getting the right people in the right places. Informing the right people is also a challenge. For example, when they first had issues in Tasiujaq area with the beavers, they had to notify MFFP to inform them of what they were intending to do, but we found out they had rules about how to do things. That was a challenge, to get the right***

***Certificate of Authorizations. Quebec government has rules and regulations about how to perform stuff, especially when it comes to wildlife. That's a challenge, especially since they're mostly French, and most of us in Nunavik are English, that's a barrier.***

***What else is a challenge? Maybe gathering up information from the local hunters. Because they're the ones who are out on the land and are seeing something every day. Sometimes we are only informed after the fact." (Steven Kleist)***

For some issues, it may not be clear who to communicate with about concerns:

***"We know our temperature is going higher and higher, and we're seeing a lot more landslides. It would be nice to pinpoint somebody that we could contact about it. We've been in contact with the Quebec government and DFO, but we're always talking about it. But nobody really knows who's the person that could help you." (Steven Kleist)***

# 3.
# TASIUJAQ
# FULL REPORT

*Participants: Willie Cain Jr., James May, Johnny Cain, Billy Dan May, Billy Cain, Moses Munick, Thomasie Munick, Joseph Kauki, Johnny Munick, Willie Cain Sr., Tommy Cain Sr.*

## ARCTIC CHAR POPULATION TREND

Overall, Tasiujarmiut interviewed (listed above) have observed a decline in Arctic char catch for the Tasiujaq area.

***"From 15 to 20 years ago we used to catch lots. […] In the last 10 years, we seem to find that the char are declining." (Billy Cain)***

Various causes were recognized, but some participants stated that it was likely that Arctic char are declining locally due to relocation to new systems further away.

***"I think they're changing rivers. If they can't go up the river they go to a different river. Then they end up in a different lake." (Billy Cain)***

## BARRIERS TO CHAR MIGRATION

***"I was told before by Elders that during the char migration there should be no obstacles. Once you put obstacles in the water they remember that." (James May)***

In addition, Arctic char may be able to sense when a river is too low to pass.

***"On the small streams they can tell by the rushing of the water…. they can tell if it's low water or high because it's louder when there's more water." (Billy Dan May)***

When asked what barriers are blocking Arctic char migration, all community members involved in this project mentioned the increasing presence of beavers.

***"Beavers and erosion are the biggest impacts that we've seen. Another one is low water, but the biggest I see is the beavers." (James May)***

Willie Cain Sr. explained that beavers started to appear in Tasiujaq during the Hydro-Quebec damming projects. Hydro-Quebec dams reduced river depth, so beavers had to move further north into Nunavik for good habitat. Their population really exploded in the past ten years [Map 3.1]. Increased vegetation near Tasiujaq may be another factor in their expansion.

Billy Dan May, the president of the Tasiujaq HFTA, explained that beavers were not initially impacting char migration when they first appeared in Tasiujaq, but this has changed in the last five to ten years:

***"[Beavers] never really used to have activity in char streams, usually it was smaller ones. But now they're building dams in char streams more." (Billy Dan May)***

He also acknowledged that Arctic char do occasionally pass the dams, although this is rare:

***"It seemed like [Arctic char] were able to get around somehow a bit, even before the [dam removal] project. Maybe some ditches?" (Billy Dan May)***

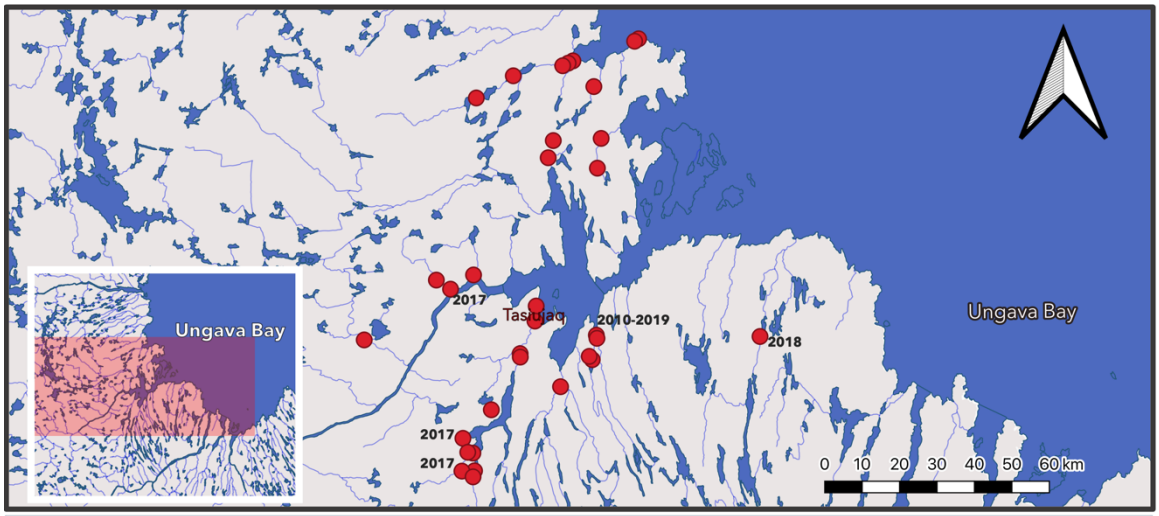
Willie Cain Sr. described that although some species, like lake trout, are able to pass beaver dams, this is not usually the case for Arctic char. Billy Cain explains that even if they do occasionally pass, the problem remains that any barrier will cause the Arctic char to change systems:

***"They have one thing in mind... getting back to the lake. But at times, they divert their migration. That's the problem, 'if I can't get up, I'll go somewhere else'." (Billy Cain)***

The expansion of beavers into Tasiujaq is aggravated by a lack of experience with beaver trapping amongst most Inuit.

***"We don't really hunt beavers. We're not used to this method of hunting beavers. They come from the south, more southerners do beaver trapping. We're not used to beaver trapping. That's why they're starting to increase a lot." (Willie Cain Jr.)***

The two photos above were taken on October 25, 2018 during a helicopter visit to beaver dammed sites near old Tasiujaq (Tasiujatuqaq).
Pilot: Peter Duncan, Guides: Peter May, Billy Dan May, and Willie Cain Jr.




Map 3.1: Map of beaver sightings identified in interviews. Dates are written when provided. The dammed sites marked 2010-2019 have been dismantled in 2015, 2017, and 2019.

## Low water levels

***"There's been no rain at all over the summer [2018] so the water has been very very low." (Moses Munick)***

This is exacerbated by rocks which are moved during the spring flow each year:

***"When the ice goes down, the big chunks of ice gather the rocks and make obstructions for the char to go up the river." (Willie Cain Jr.)***

With lower water, Arctic char are increasingly being found with lesions on their stomachs from rocks. In addition, Billy Dan May explained that in low water, some Arctic char are more vulnerable to being caught by bears and humans.

***"The past two years [2017 and 2018] we've been having a drought, with no rain. […] I think char are changing rivers. If they can't go up the river they go to a different river. Then they end up in a different lake." (Billy Cain)***

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Marina access road

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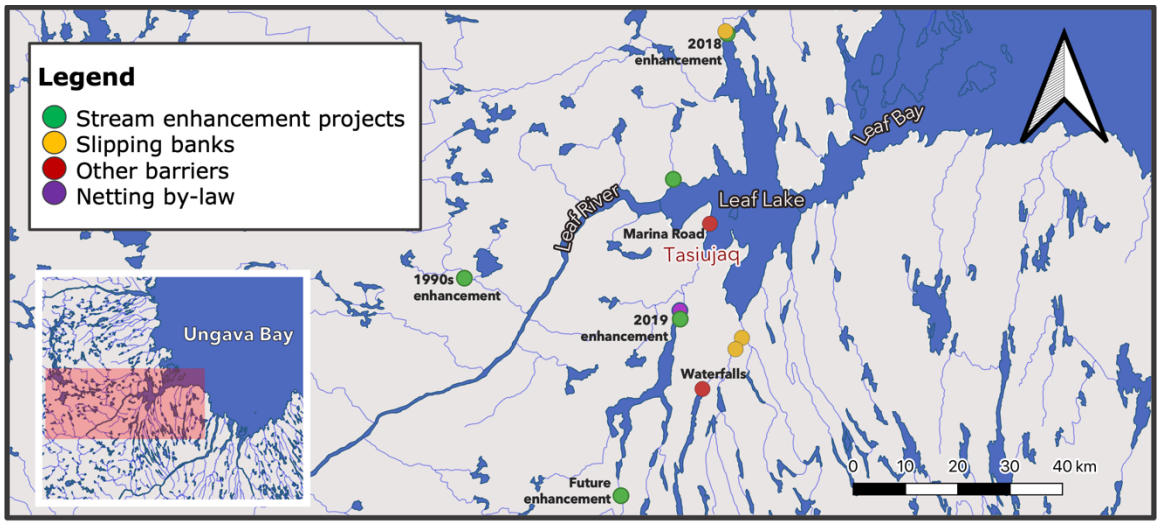
Billy Cain, the mayor of Tasiujaq, identified a very specific factor contributing to Arctic char declines: the access road to the marina, which was built approximately 10 years ago [Map 3.2]. In the first year after it was built, some people started to notice a difference in the char population. Here was his explanation:

***"When they built the road to the island, we noticed that fish started to decline because they had a migration route along the shore that they would use to get to the river, but when that access road was built they had to divert their [movement]. They may go to another river; not necessarily coming here. […] We noticed right away that the fish weren't the same after that access." (Billy Cain)***




Map 3.2: Notes from interviews, including stream enhancement projects, slipping banks due to permafrost, other barriers (waterfalls and road to marina), and one area with a netting by-law (Qamanialuk).

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Permafrost melt

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***"The past two summers [2017 and 2018], […] a natural barrier eroded, so it drained out the stream, making it harder for fish to go up and to spawn." (James May)***

Permafrost is not only draining waterbodies…

***"Permafrost is making outcrops; looks like the land is pushed up from under." (Billy Dan May)***

Slipping riverbanks due to melting permafrost [Map 3.2] can cover spawning sites or block rivers used in Arctic char migration.

## OTHER PROBLEMS FOR THE ARCTIC CHAR FISHERY

### Overharvesting

For a few years, the Kuujjuaq Arctic char hatchery was collecting their char eggs from Tasiujaq. Tommy Cain Sr. was involved in egg collection for the Kuujjuaq hatchery. He said that he felt uneasy with how many eggs were taken and felt that people have been taking better care of the fish in that area, which includes the creation of by-laws for gillnet fishing, since the egg collection has stopped.

***"They were doing that every year for like 5 years in a row. We think that that was affecting the char population. We stopped their fish collection. That could have also caused the char population decline. People in the community were very worried about this, they didn't want them collecting eggs anymore." (Willie Cain Jr.)***

Overfishing by multiple communities can also have an impact on char populations:

***"Overfishing… it's not only the community that fishes here in the summer. It's also people from Kuujjuaq that come here with their speedboats to do some fishing too, with gillnets." (Anonymous)***

Arctic char are especially sensitive to netting during their migration:

***"[Net fishing] is a problem when [Arctic char] are all funneling into one small area. Takes too many and makes a barrier. They have no choice to go that way." (Billy Dan May)***

### Garbage dump

***"The dump is not too far from the ocean, lots of debris is going towards the water. Sometimes along the shore there are metals or a roof that was blown away going to the water. That might have an impact on the fish too." (Billy Cain)***

The garbage dump in Tasiujaq is not well contained. The local HFTA brought up concerns about fish health and said that although this has been brought up with KRG in the past, it is an issue that still remains unresolved.

## RECENT MANAGEMENT PROJECTS

### Stream enhancement

Stream enhancement projects are meant to improve river systems by removing rocks, providing passages around waterfalls, or redirecting the flow.

***"What we were doing was diverting the water that's kind of being wasted in different areas and trying to concentrate it so it's deeper and going in one direction (but not too deep)." (Billy Dan May)***

Recent projects include the enhancement of:

- ***2017:*** *The area between Leaf Lake and Mannic Lake [Map 3.2].*
- ***2018:*** *The Amaluuqtuq River system [Map 3.2].*
    - *This was a joint project with Aupaluk.*
- ***2019:*** *Finger Lake (Aipparusik area) [Map 3.2].*

### Dam dismantling

Recent dam removal projects include:

- ***2015:*** *Project to dismantle beaver dams along significant char rivers.*
- ***2017:*** *Dam removed in the Compeau River, repaired by beavers right away.*
- ***2019:*** *Beaver dam removal in Tasiujatuqaq.*

### Fishing restrictions

The Tasiujaq HFTA has already put into place a small by-law on Qamanialuk Lake that ensures that gillnetting is regulated [Map 3.2].

***"There's more restrictions now with the lake up there... Qamanialuk is what we call it, 6 miles from here. They're not meant to do any netting there anymore. [...] The wildlife committee made [the by-law]. We're trying to get the fish population stable." (Billy Cain)***

# RECOMMENDED RESEARCH AND MANAGEMENT

Beavers

***"Find out how many beavers are there and the best way to remove them. It might even come down to hiring Cree or Naskapi people to come and help with the project. We are not traditionally beaver hunters so it's hard trying to trap something that hasn't been around forever, we don't have knowledge of that." (James May)***

A workshop with Cree or Naskapi trappers was a possible solution that came up in a few discussions. Willie Cain Sr. suggested that the best way to eliminate beavers would be to trap during the winter and disassemble the dams during the summer. Unless beavers are trapped, they continue to come back to rebuild their dams.

Discussions about partnering with Cree went beyond a workshop; Billy Cain and Willie Cain Sr. also recommended sharing the beaver meat:

***"I know people that will eat them, and you can sell the fur. I know mostly native, Cree people are used to it, we don't really eat beaver." (Billy Cain)***

Johnny Munick estimated that only about 10% of the community hunt for beavers. Billy Cain suggested that fur prices, which have already been increased in the past, should be further boosted to encourage Inuit to hunt beaver more.

***"I know some people that already hunt beaver. The price of the fur was brought higher, so that people will get them. [...] It was arranged with Hunters Support. The council can decide to increase the price on that type of thing. Our price is higher than when they sell it to a fur auction. [...] Maybe if we jack up the price even more, then people will go after it even more." (Billy Cain)***

The dams are difficult to take apart, and many people suggested that stronger tools would be necessary to properly remove the dams.

***"Maybe have dynamite, to blow up the hut and the dams, because they're very compacted with mud... it's like cement." (Willie Cain Jr.)***

Beyond the practical approaches to managing the increasing number of beavers around Tasiujaq, some potential research was proposed:

***"Maybe do experiments where the dam is. If the fish are trying to go up but are not getting past the dam." (Billy Cain)***

Willie Cain Sr. suggested that research on the interaction between beaver and Arctic char would be very useful. He wanted to know exactly how beavers are affecting char, because there are a lot of interactions, like caribou and muskox, that might be more complicated than it may seem. But for the most part, Tasiujarmiut involved in these conversations wished to deal with beavers as rapidly as possible and wanted research to make this process more efficient.

## Stream enhancement

Stream enhancements were looked upon favorably by everyone involved in this project. The site on Map 3.2 marked "Future enhancement" will hopefully be done in the coming years.

## Marina access road

Billy Cain had a few ideas of how to resolve the marina access road problem, which he has already been sharing with KRG transport:

***"A person from KRG transport was here last month [September 2018] to assess the marina and the road, so I talked to that guy, and we want them to figure out if they can get funding to have a bridge or a culvert." (Billy Cain)***

He also recommended research be conducted to find out if Arctic char are still trying to use the route that was blocked by the access road.

***"The fish used to go that way, and it's been blocked by the road. It affected the fish. Maybe they could make something so that the fish could cross through." (Moses Munick)***

## Permafrost melt

James May explained that there have not yet been any projects to deal with permafrost melt and soil erosion. Miroslav Chum, a hydrologist with experience working on stream enhancement projects in the north, visited Tasiujaq during the fall of 2018 in order to assess the drained streams. James May suggested that potential management might involve restoring the natural banks to hold water in the beds, but this is a project that is currently being evaluated.

When asked what the biggest priority is, if there were limited funds and he had to choose, this was the answer that James May gave:

***"It's either the river up here where there's erosion, because that's a big spawning area and the future of the char really depends on this river... The second is the area [...] where there's beavers." (James May)***

Overharvesting

In general, overfishing is a sensitive topic. Management of overfishing is best conducted and led by the community. Below is a quote from Willie Cain Jr. on the topic, but this is a concern that the local HFTA is best placed to handle.

***"I think we should make by-laws, like small by-laws to not overharvest or make public notice to hunters to stop overharvesting. I think that would be the key." (Willie Cain Jr.)***

Incubators

One possibility for encouraging Arctic char population growth is a more natural alternative to hatcheries: incubators in natural systems.

***"I brought up an idea to the [local HFTA], with problems with the spawning beds and invasive species, maybe we could help the char out by putting fish eggs in incubators, instead of having them do it in the rocks [...] The birth rate is not very high in char, so we can help them out. I've seen it done before. [...] I proposed it to [Billy Dan] and he proposed it to Miroslav Chum on my behalf [...] but Miroslav pretty much told him that someone had to be dedicated to work on it. Well, it's not as big of a job as having a full hatchery, to take care of it and feed it. It's pretty much almost natural." (James May)***

## OBSTACLES & SOLUTIONS FOR EFFECTIVE MANAGEMENT

Many stream enhancement projects were conducted in Nunavik until approximately 2002 in order to clear char streams and redirect flow in areas where low water levels and rocks were blocking char migration. From 2002 until recent years, these projects decreased despite increasing interest from the community.

***"We wanted to do the projects, but we never had funding to start with... When our local committee, [HFTA], wanted to work on river enhancement, we always tried to ask for money, but they never had funding for that. So I guess [Makivik and KRG] pushed that on the government, and I guess the climate change [funding] started from here." (Willie Cain Jr.)***

Whereas past enhancement required extensive reports throughout and after the process to acquire funding, the Climate Change Preparedness in the North program has simplified the process.

Another challenge for stream enhancement is ensuring that there is the follow-up necessary for long-lasting solutions.

***"There wasn't very much follow-up. I don't think it was done permanently, probably just a quick fix trying to utilize the money allocated. Which was not very much." (James May)***

He suggested that more research should be done before and after the projects in order for future enhancement projects to be more permanent.

***"It's got to be planned better. Find out what's happening on the individual streams, not Nunavik as a whole. The streams individually. Find out what we can do to fix them. And go back the years after to make sure that our work is really making a difference." (James May)***

He clarified that the research need not be as extensive as the research done on the Nepihjee River, for example, but could simply involve checking up on the streams in subsequent years to ensure that fish are continuing to pass through.

More research and better planning need to be done during dam dismantling as well. The 2015 dismantling project was not very successful because there was a lack of knowledge about beaver elimination. Future projects will be more effective with better planning and more manpower.

## PRIORITIES FOR TASIUJAQ

A second trip to Tasiujaq in March 2019 gave the Tasiujaq HFTA the opportunity to review interview notes and summarize three main priorities for management for the Tasiujaq Arctic char fishery.

1. *More funding and research for beaver removal, including…*
    a. *Increasing the price of beaver fur to encourage hunting*
    b. *Funding dam removal*
    c. *Organizing a workshop with Cree trappers to improve beaver trapping methods*
2. *More funding for stream enhancement projects*
    a. *The Climate Change Preparedness in the North program is a great example of accessible funding for this type of project*
3. *Fix dump to stop garbage from entering water systems*
    a. *Build higher fences/make the dump deeper, or…*
    b. *Build better container for garbage*

# 4.
# AUPALUK
# FULL REPORT

*Participants: Eva S. Grey, Tamisa Grey, Charlie Angutinguak, Willie Angutinguak, George Eetook, Lazarussie Angutinguak, David Angutinguak, Edward Saluarsiak, Masha Onningnak, Johnny Akpahatuk, Lizzie Annahatak Gordon, Mary Saluarsiak, and two anonymous participants.*

*Interviews also included Adam Gardner, the Community Climate Change Liaison Advisor, who spoke about the Climate Change Preparedness in the North (CCPN) program.*

## ARCTIC CHAR POPULATION TREND

In general, Aupalummiut have observed a decrease in Arctic char catches in the past few years. Most community members attributed this decline to the relocation of Arctic char to other water systems.

***"This river is known to have big fish. […] Kangirsuk has always had average size. But they've been noticing they're having big fish now. And we lost ours." (HFTA member)***

Members of the Aupaluk HFTA explained that fish have been changing water bodies for a long time…

***"Well, the Elders tell us that fish move. […] The Elders could tell where the fish come from just from looking at them, the color. […] Each river has this kind of fish, this color, even the taste. They taste different." (HFTA member)***

Recent declining trends have been particularly concerning to many Aupalummiut, who feel that they may be more severe than normal movement patterns. A number of community members worry that if the community does not take action, the char may not return.

As a result of this Arctic char movement, Aupalummiut are forced to travel further in order to fish. Tamisa Grey travels long distances to fish and said that Arctic char were plentiful in Anniangulik lake in 2018. Yet he agrees that overall, fish catch has been declining.

## BARRIERS TO CHAR MIGRATION

### Low water levels

Decreased precipitation was discussed at length by Aupalummiut, especially since 2018 was a remarkably dry year (the third dry year in a row). Most community members identified decreased rainfall as the primary reason for decreased catches.

***"The problem we have here, it's when there's not much rain. We don't get fish in lakes. They move to other lakes." (Tamisa Grey)***

***"I used to get 40 [Arctic char] every high tide. This year [2018], nothing. No rain." (Eva Grey)***

Fish that try to access overwintering lakes often get stuck or scratched on the rocks.

***"Sometimes they try to go to the lake. Very dry. They get cuts. We see many damaged fish, but they're alive." (Eva Grey)***

2018 was the first year that Tamisa Grey was able to catch char in Nikuttivik, but other areas, such as Qingaujaq, remained dry.

The waterfalls near Aupaluk are yet another barrier that can be insurmountable for Arctic char during their migration.

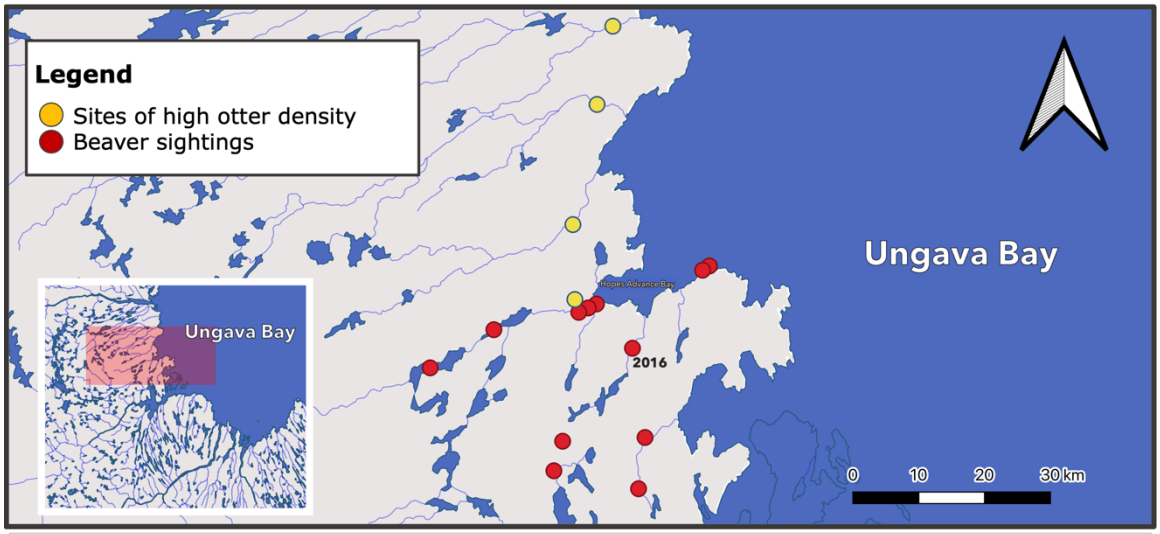
### Permafrost melt

The impact of melting permafrost is impressively displayed in Aupaluk, where a small lake, Lake Nipirqanaq, once teeming with fish, is now shallow and empty. The local HFTA tried to enhance the stream leading to Nipirqanaq, but it has not seemed to improve. This may have been due to a variety of factors, but one reason has been that water has been draining from the lake due to the melting permafrost beneath.

***"Nipirqanak there, which doesn't seem to have char… they tried to open it to make a bigger river. It has less water now. There's no more fish. Maybe since 2 years [2016-2018] there's been no fish? The fish may have died." (Tamisa Grey)***

Beavers were seldom mentioned without prompting and did not seem to concern most respondents. They are being increasingly sighted but have not seemed to impact char enough near Aupaluk to be considered a high priority, as they are in Tasiujaq.

Beavers have been seen along the bay, but few dams have been discovered [Map 4.1]. This may indicate that beavers have begun attempted expansions into Aupaluk but have not been able to establish well.




Map 4.1: Beaver sightings and sites of high otter density. Date of sighting marked when available.

***"So far I've shot two, here in the bay. Not lately, but it's been a while. Over ten years. I thought I saw a seal, finally in the very shallow water. After I shot it I found out it was a beaver." (HFTA member)***

***"There have been sightings of dams on these rivers, nearly clogging up the flow of these rivers. They have been really close to the community." (Johnny Akpahatuk, with translation)***

Johnny Akpahatuk mentioned beavers the most and seemed to be concerned:

***"It's recent that these beavers have come up where there are no trees, so this has to be studied further, how to work on these beavers if they can so the fishing will be better. […] There was a point where the beavers were so noticeable here in this river that the flow in the river was really low and we could see them from here. (Johnny Akpahatuk, with translation)***

A pilot from Kuujjuaq described how the beavers might be moving northwards:

***"Lots of willows, [beavers are] taking over eh? Everywhere. Even out in the barrens. That's a problem right now. There have been beavers there. Probably the same beavers as Tasiujaq… I've seen them in the ocean, eh? Swimming along the shore. They're not scared to move. […] That's probably why they moved up to Aupaluk." (Anonymous)***

## OTHER PROBLEMS FOR THE ARCTIC CHAR FISHERY

### Overharvesting

Some Aupalummiut shared concerns regarding overfishing, especially the use of nets to catch char in sensitive areas. Some wondered if the depletion of fish in Nipirqanak Lake was influenced in part by overfishing and the fishing contests that took place there (in addition to permafrost draining the lake).

The local HFTA explained that part of the problem for Arctic char is the concentration of the community's fishing efforts on accessible areas. They explained that it didn't used to be like this; Elders used to be spread out and fish in different lakes with their families.

There has also been some concern over fishermen from Kuujjuaq netting in areas shared by Tasiujaq and Aupaluk. Pilots were addressed many years ago with concerns about this, and it has decreased since.

These views are not shared by everyone; there were some respondents who did not have any concerns about overfishing.

### Otters

***"When I fished […] in a beautiful pool, we caught a lot of fish. But otters came to the pool, and nobody caught fish. Nobody caught fish, not one! That's what I noticed one time. Fish are afraid of otters." (HFTA member)***

According to a few community members, otters play a part in the decline of char populations but are not often hunted. Map 4.1 shows areas of high otter presence.

***"We make [otters] into mitts and boots, but it's hard to catch them." (Eva Grey)***

### Mining

Although mining has not yet commenced in Aupaluk, Oceanic Iron Ore Corporation has been conducting prefeasibility studies and environmental assessments in

preparation for future work. They plan on building a deep seaport with a pipeline running to the mining site, which might block an Arctic char stream for a year. In addition, many Aupalummiut worry about the impacts of such mining operations on the quality of water and the health of Arctic char. A few people questioned the thoroughness of Oceanic's environmental assessments and want baseline measurements to be measured by a third party.

Some drilling has already occurred in Oceanic's pre-feasibility projects, and one community member said that when spills occurred while drilling, they were not cleaning it up properly (only using straw bales). No one knows if this is creating problems in the streams, but community members are concerned for the health of their water systems.

***"We see the news and it shows that with saltwater in their drilling they shut down the whole operation in Nunavut somewhere because they weren't careful enough. That was just spilling around their drilling, and here we have people saying that they have really bad fuel and salt gunk spilling and going right down into the stream, and no monitoring of that. […] In Nunavik, and in Quebec itself, Quebec seems to have some of the most lax environmental rules around exploration or drilling." (Anonymous)***

Water quality

Aside from mining, some other concerns were brought up about water quality. Johnny Akpahatuk brought up concerns about the development of the village and its closeness to the water. When asked why this was an issue, this was his response:

***"It's not because of the closeness of the people and a lot of fishing, but because this river has been crossed over by so many vehicles… ATVs and so on. And these ATVs have oil leaks and stuff, so it might have some effect on this river." (Johnny Akpahatuk, with translation)***

## RECENT MANAGEMENT PROJECTS

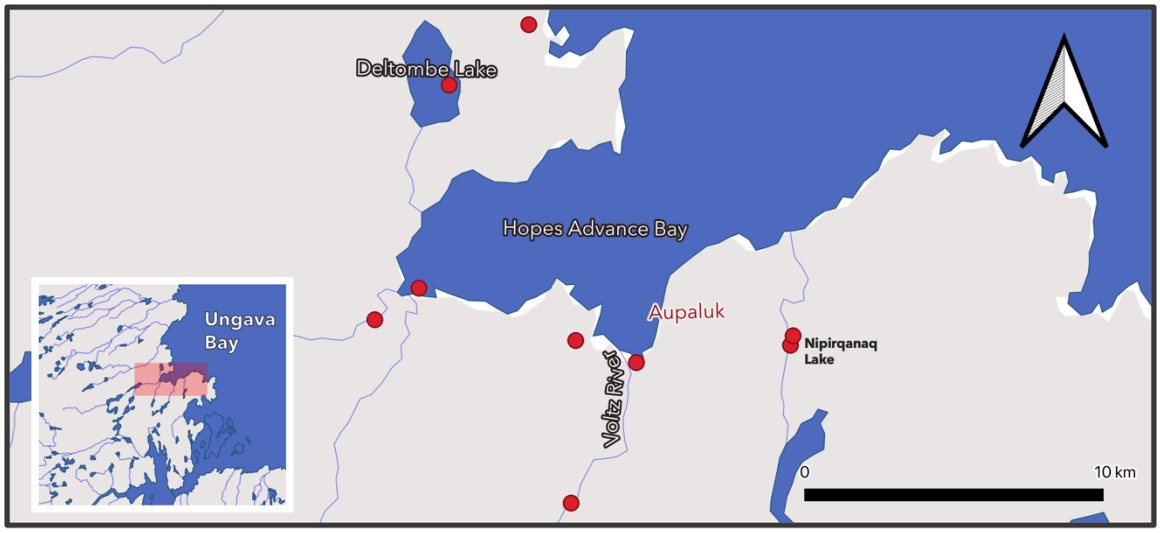
Stream enhancement

Recent stream enhancement projects:

- ***2005:*** *Nipirqanak Lake [Map 4.2].*
    - *Nipirqanak was mainly filled with trout before the enhancement project, but Arctic char began to increasingly enter the water body after its completion. This did not last, however, as permafrost melted*

*and the lake began to drain from between the ice polygons. It is presently too shallow to support fish.*

- ***2017:*** *Deltombe Lake and Nikuttiviup River.*
- ***2018:*** *The Amaluuqtuq River system. This was a joint project with Tasiujaq.*




Map 4.2: Recommended areas for verification and potential future stream enhancement. Nipirqanaq Lake (labelled) is the lake that drained due to permafrost melt.

MFFP research

In 2016, MFFP installed a temporary counting fence and used gillnets to characterize the species in the lakes and measure the fish. In total, seven rivers and streams, four lakes, and Hope Advance Bay were sampled. Their results reported in Mainguy and Beaupre (2019) suggested that the fish were generally healthy with low mercury concentrations. However, the mortality rate was 50% and there were few mature char, which may mean that the population is not very stable.

Johnny Akpahatuk felt encouraged by the report that was presented to the community and hoped that it would be continued locally:

***"If this was done locally, or to find people that would be able to do the counting, that would give the Inuit more scientific facts so that they could know if their numbers are going down, or if they increased, or if they're in a stable condition. […] It gives us lots of knowledge about the fish, that's why I like [the report]." (Johnny Akpahatuk, with translation)***

# RECOMMENDED RESEARCH AND MANAGEMENT

Stream enhancement projects

One of the priorities for stream enhancement is Voltz River [Map 4.2]:

***"People didn't have to go anywhere, just to Voltz River, to get their fish cause it's right there. It was easy to get the fish, […] but not anymore." (HFTA member)***

The Aupaluk HFTA suggested establishing a monitoring system after the stream enhancement projects, to make sure that streams were improving.

***"We have many lakes and rivers where the Arctic char go up. If they could enhance this river, then we could monitor it to see if there's more fish going up. After seeing the results, we could do more rivers. Maybe 3 years [of monitoring]?" (HFTA member)***

If they found that during the monitoring the stream became blocked again, they would focus more of their efforts on maintenance of the streams, rather than starting many new enhancement projects.

An anonymous respondent suggested that monitoring could be done by Inuit fishermen. If someone was hired to check in with them, that would give a good snapshot of whether the situation was improving. The ideal would be to do consistent, rigorous research to see how the population is doing, if there are enough resources and the community agrees.

***"There was some concern that Qingaujaq was very low this year and fish couldn't get up… I'm not sure, maybe it's the next one that should be worked on, but we'll see. We have to have some monitoring and feedback process to find out if things worked and improved the situation or not." (Anonymous)***

Tamisa Grey recommended doing small stream enhancement projects like moving rocks, but he cautioned the importance of being mindful to not over-modify the water system. In fact, his preference would be to leave the streams, and adjust fishing patterns until the char return.

***"Maybe just try to clean up a little bit. [Arctic char] don't need much water to go up. If you touch them too much, they're going to know. They won't go. […] For me, if we don't touch it much, it's better. Leave it. The weather will always change." (Tamisa Grey)***

Johnny Akpahatuk was also worried about messing with the river systems, especially the removal of weirs set up by ancestors to help fish for char:

***"There are some rocks that have been set up a long time ago by the Inuit [...]. This used to be really helpful for the Inuit, but now when we do stream enhancement some of these rocks have been removed. It could have been helpful for the fish and for the lakes, and since then the water level has gone down and we are losing the opening to the river. Even if we receive the river enhancement project, they could be doing it the wrong way. They shouldn't have removed the rocks put there by the Inuit." (Johnny Akpahatuk, with translation)***

He also worried that stream enhancement might destroy a migration route, rather than enhance it. He warned that discussions and research need to happen before these steps are taken.

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Beavers

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***"That's an area where they need to do another study, if they're becoming more and more, the beavers and the otters, they should try to catch them or harvest them so that they can be able to help out the hunters and fishermen to sell their pelts. They need to do a study to see if they can be a sustainable resource." (Johnny Akpahatuk, with translation)***

As was mentioned in Tasiujaq, one of the main recommendations is for the facilitation of collaboration with Cree trappers in order for Inuit to learn and improve beaver trapping techniques.

***"If we want to do something more with the beavers, we'd need the professionalism of the Cree natives since they know about the beavers the most. We'd need their knowledge so that we can catch the beavers." (Johnny Akpahatuk, with translation)***

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Overharvesting

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When asked what should be done to ensure that Arctic char remains available, the Aupaluk HFTA responded with a few possibilities, including net fishing by-laws:

***"Maybe limited time with fishing with nets? Some people set nets all year on the same lakes, and it's not good for the fish. There are less fish after." (HFTA member)***

Another community member suggested netting be kept mostly in the sea.

The HFTA pointed out the dangers of getting your net stuck to the ice, which happens accidentally but could be managed by avoiding leaving nets out for multiple days during certain weather conditions.

***"Once your net touches the ice, there's a problem. It's not meant to touch the ice when it's under. You have to take it in and out. If it touches the ice, then it means it's stuck for the whole winter and that means that you'll catch all the fish." (HFTA member)***

They suggested the possibility of a time limit on net fishing.

Landholding received a complaint from a community member concerned about the sale of fishing permits to out-of-towners, since catch-and-release methods could be harming the fish. A possible solution to this is to insist that recreational out-of-town fishermen use barbless hooks, which would be made available at the local Coop. This would provide an alternative to the three-hooked, barbed hooks presently in use.

## Mining

The community of Aupaluk has already been voicing concerns about the quality of the environmental assessments being performed by WSP (the company hired by Oceanic for this task, which used to be Genivar). The council head requested that a better land-use survey be performed, and Makivik Corporation has already been meeting with the community to respond to this request. MFFP has also been doing baseline studies which is reassuring for some community members. In addition, the Aupaluk NV applied for Plan Nord funding in order to address this issue.

## Other research recommendations

***"For the fish, maybe we need some kind of water sampling on every river or lake. People say there's no more fish, there used to be lots, we need to prove why. Maybe do more research." (HFTA member)***

The Aupaluk HFTA mentioned a tagging project that happened some time ago, to find out the movement pattern of Arctic char:

***"There was a project a long time ago, where they tagged [the fish], and the women caught them, and they could tell us if they moved or not." (HFTA member)***

They suggested that it might be a useful project to perform again, to find out whether fish are moving from Kangirsuk to Aupaluk, but they suggest care be taken to confirm support for such a project with the community.

***"So maybe we need a baseline, right now. Before the mining starts. We should have water sampling, baseline for what kind of fish ... are they healthy or not? [...] Then every two or 3 years, do that project to see if it's getting worse or not." (HFTA member)***

An anonymous respondent felt that the MFFP research was a good start, but to really understand how Arctic char are doing and will do under environmental and human pressures, there needs to be consistent repetitive measuring and collecting of data every year. He suggested that this might mean encouraging people to call the FM every week about their catches… people were eager to share this type of data with MFFP while they were present in the community, but it was not sustained once they left.

Johnny Akpahatuk also recommended learning more about spawning sites:

***"There is lots of information that we do not have. Inuit do not know exactly where the fish are hatching their eggs. Sometimes they know where the fish are but they don't know where they're hatching their eggs. If they know this information then they can help the fish and how we can better their life. So if they have some kind of a base where you can give your information to, if you're not really sure. Those need to be set up." (Johnny Akpahatuk, with translation)***

In research, the focus is often on interviewing men about fishing habits. However, the HFTA points out that women do most of the fishing for the community and cannot be left out of the research/management discussion.

***"But if we talk about fish, we cannot leave out women. Because it's mainly women represented. They're the ones that take maybe 70% of char the whole year." (HFTA member)***

## OBSTACLES & SOLUTIONS FOR EFFECTIVE MANAGEMENT

Access to resources

***"Need lots of equipment. We used our hands; we did not have much choice." (Willie Angutinguak)***

HFTA members recommended using equipment such as a helicopter to access the sites. The HFTA also stated the need for simple equipment, like gloves, boots, and hand tools.

***"It takes time to receive the funding. Easier access first… that would help a lot." (HFTA member)***

The process required to access funding is often long, complicated, and involves a lot of paperwork that can be overwhelming for the community.

In the past, Aupaluk had hired Amélie Collard and Miroslav Chum to assist with most of the application process (for funding and permits), assessment of the area before and after the project, and writing of the report. Hiring professionals to arrange the projects was helpful to navigate the complicated process and deal with technical vocabulary, but unfortunately this meant that the community needed to pay salaries as well as application fees. In recent years, the Climate Change Preparedness in the North Program has allowed another avenue for communities to access funding, which removes a lot of the overhead cost involved in applying to and writing assessments for funding sources. Instead, the money can be used for the direct project costs.

***"Streamlining the process the way that [the Climate Change Preparedness in the North program] seems to be able to would allow a lot more to be done without all the paperwork and the hassle." (Anonymous)***

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Communication

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***"There are a lot of organizations, maybe even government agencies, that are overseeing wildlife issues. […] But they all do not see each other working together so that they can better manage the wildlife. They are not making sure people know what they are there for. […] We do not know who to contact." (Johnny Akpahatuk, with translation)***

It is not just management organizations that may need to work on their communication, but also research that is conducted in the area:

***"There needed to be more consultation about what the important areas are for Aupalummiut, where are the areas that are going to be affected by the mining (if we're talking about mining). […] [Researchers] came at the wrong time of the year to study migratory birds, they came at the wrong time of the year to study caribou migration, so it didn't make any sense. They weren't doing the right thing." (Anonymous)***

# CONCLUSION

***"We are in the middle of asking the same questions that you're asking, because this is new. These questions are new." (HFTA member)***

Climate change has been introducing issues that have never been dealt with previously by Aupalummiut. These can be tricky to navigate and require collaboration, communication, and teamwork. For this reason, the HFTA is sharing their concerns and would like to be supported in their efforts to mitigate and adapt to climate change impacts. It would be helpful for them to have access to researchers willing to follow their lead and to be aided financially by larger organizations. However, their intentions in sharing these details was not for others to impose these management strategies on the village. The two main cautions that they shared with the distribution of this information were the following:

1) *Even though they are the elected representatives for the hunters and fishers of Aupaluk, these management strategies and recommendations still need to be verified with the wider community.*

***"Like we said, we still need to work with our local hunters, before we really decide exactly what we're going to do." (HFTA member)***

2) *Aupaluk is a small village. In the past, quotas have disadvantaged them, and they do not want this to become the case for Arctic char.*

***"When it comes to beluga, it depends on community size. Because one community is bigger, even though they have less beluga, they get a bigger quota. We are always the smallest, if it ever comes with Arctic char to do this, we would get the smallest fishing area." (HFTA member)***

# 5.
# QUAQTAQ
# FULL REPORT

*Participant: Johnny Oovaut*

*This meeting was held after the HFTA Annual General Meeting, along with Quitsaq Tarriasuk (Ivujivik), and Henry Alayco (Akulivik)*

## ARCTIC CHAR POPULATION TREND

Quaqtaq has one predominant Arctic char source, which has been experiencing a decline.

***"We have a char lake. Actually two lakes, but it's the same char that go up the river to one lake and then continue to the next one. This lake is about 30 to 50 kilometers from the community. We made a trail to that place, it's on the Ungava Bay, the name is actually Arctic char place, Iqaluppilik** [Map 5.1]**. We noticed that there seems to be less char in that river and lake." (Johnny Oovaut)***


Map 5.1: Iqaluppilik, the closest Arctic char system to Quaqtaq.

## BARRIERS TO CHAR MIGRATION

Low water levels

Low water levels have been a big issue for the Iqaluppilik char system, and this is due to lack of precipitation.

***"The rainfall has changed in the past few years, we have very little rain in August, usually we have a huge amount of rain just before the fish migrate to the lakes. We don't have that anymore, so the rivers are drying up. The signal for Arctic char to start going upriver is when it starts to get dark, they know it's time to go upriver, but now when it gets dark and they start to try to go upriver they can't. I've actually seen fish stuck on land, because there's no more water. So we need to maybe dig a trench, make it deeper; we need to enhance that river there." (Johnny Oovaut)***

Permafrost melt

Permafrost melt is also a concern, even though Quaqtaq does not have much permafrost (because of the amount of bedrock).

***"There's more of those [mounds] now, I believe it's because it's cold, but not cold enough to completely freeze flowing waters, so it collapses somewhere. We've already seen some mounds that have exploded. And it seems to be happening more and more." (Johnny Oovaut)***

## OTHER PROBLEMS FOR THE ARCTIC CHAR FISHERY

Overharvesting

Changing fishing methods have impacted Arctic char as well. Although the HFTA warns community members not to overfish their small char systems, there are some who do not listen.

***"That's another problem too, we need the support of conservation officers to enforce local by-laws. In the space of only about 20 years I guess, we've almost depleted the stock. Our fishing methods need to change; we're overfishing." (Johnny Oovaut)***

## RECENT RESEARCH & MANAGEMENT PROJECTS

Bridge

Crossing rivers with vehicles can deter Arctic char, so Quaqtaq has taken steps to provide alternative options:

***"We did some work, we put a bridge so we wouldn't be crossing the river with ATVs or trucks, to try and protect the char. We actually installed a bridge in that river." (Johnny Oovaut)***

## RECOMMENDED RESEARCH AND MANAGEMENT

Stream enhancement projects

Johnny Oovaut was passionate about the need for stream enhancement in the small char system that Quaqtaq relies on, and emphasized the need for this to happen immediately:

***"I'd like to see us use machinery… use an excavator to remove boulders rather than blasting. Engineer the river a bit so the fish would have an easier time going upriver. […] It's the only place where we can obtain a larger-sized Arctic char, because Quaqtaq is not close to Arctic char fishing spots. I would like to do that next year [2019]. Right away… might as well start right away next year to try to save the char there. Either they're gone or they move to another place." (Johnny Oovaut)***

The main challenges to these projects are engineering the river and finding funding:

***"Engineering. Stream engineering. That's what we need. Money, we need money to pay laborers and fuel and so on. That's about all we need." (Johnny Oovaut)***

Overharvesting

Overfishing is a sensitive topic. When thinking of management possibilities, one of the most important parts is ensuring that rules are not imposed from the outside.

***"If we had a moratorium for 5 years… that would be the biggest challenge. Telling people not to set up their nets, to fish only by hooks… We have to talk about it. Cause there will be no more fish for my grandchildren, even for me! Maybe set a catch limit? That's one of the biggest challenges: convincing Inuit that there are rules. Cause they consider it non-Inuit who***

***have rules. But it's to protect our food source. It's to convince them about that. Some people don't listen at all." (Johnny Oovaut)***

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Hatchery

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Johnny Oovaut recognized the usefulness of a hatchery, especially since the community only has one Arctic char fishing system, but he worries about the introduction of foreign Arctic char:

***"That's the only concern I would have, is interfering with the natural order. If we were to introduce other species, how would it affect our other species? [...] Cousins of char. Because the char are not all the same." (Johnny Oovaut)***

He wondered if there were alternative approaches to a full hatchery.

***"I wonder if there's other methods, where we don't need a whole facility. Maybe we can use a small fish tank, to make some small fry. We have a lake right in the community with shrimp, it could be a good food source for the fish." (Johnny Oovaut)***

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Health

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***"I want to know if fish are getting sick because of mining activities. Because in Kangirsuk, the community south of us, they have fish, it's a big river with fish. They had this funny taste and we want to know what that was." (Johnny Oovaut)***

## PRIORITIES

According to Johnny Oovaut, stream enhancement is a very high priority for Quaqtaq. If this does not occur soon, the fish will leave the area or die in the rivers. He suggested that enhancement in Quaqtaq is important especially since they are limited to only one char system.

***"It's urgent for me, so I'm going to do that. We will need help, in keeping data and research and so on. [...] I'd also like to see an inspection of some other char places, to inspect the rivers, to make sure there's no barriers." (Johnny Oovaut)***

# 6.
# IVUJIVIK
# FULL REPORT

*Participant: Quitsaq Tarriasuk*

*This meeting was held after the HFTA Annual General Meeting, along with Henry Alayco (Akulivik), and Johnny Oovaut (Quaqtaq)*

## BARRIERS TO CHAR MIGRATION

Low water levels

***"Today the world has changed, it's not the same anymore. The river has receded in the whole lake. Even those places where they used to have lots of fish, the water in those areas have drained. There was the least amount of water in 2018." (Quitsaq Tarriasuk, with translation)***

These draining lakes are due to the melting permafrost:

***"Even those places that aren't very big, near the community, they used to have water all the time. They don't have water anymore. Because of the permafrost melting." (Quitsaq Tarriasuk, with translation)***

In the spring, when the snow melted, it used to be directed towards the river. Now, however, it seeps into the ground.

***"When it melts, it used to melt from anywhere, all over the place to the river, and that water is draining... it's not like that anymore. The water is receding from those areas where it used to be." (Quitsaq Tarriasuk, with translation)***

# OTHER PROBLEMS FOR THE ARCTIC CHAR FISHERY

## Contaminants

Concerns regarding contaminants were only briefly mentioned:

***"We're concerned about contaminants going into the river, such as Kovik River." (Quitsaq Tarriasuk, with translation)***

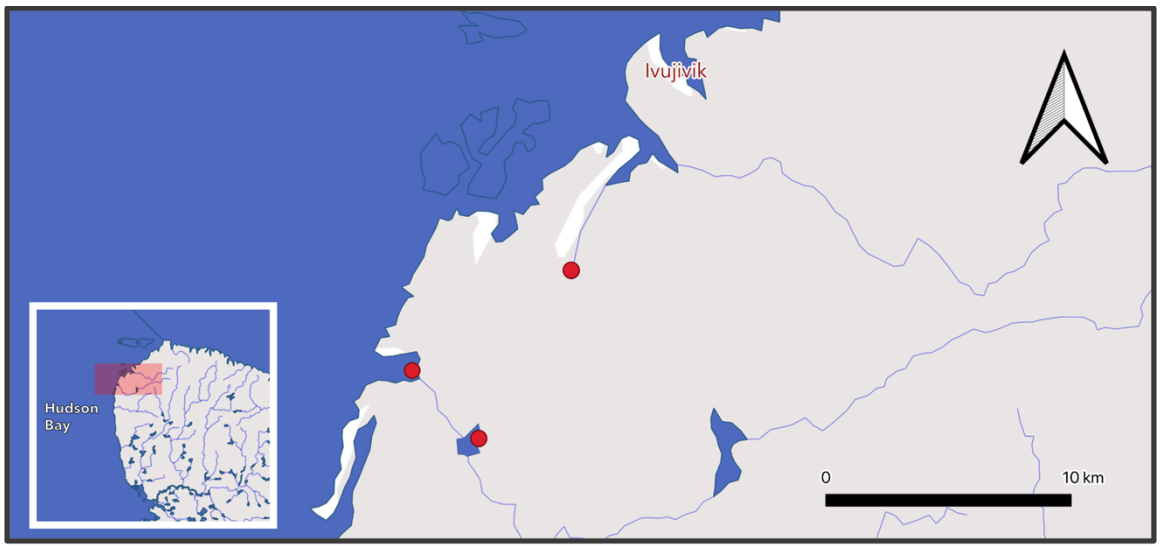
# RECOMMENDED RESEARCH AND MANAGEMENT

## Stream enhancement projects

Quitsaq Tarriasuk recommends continuing stream enhancement projects [Map 6.1]:

***"We really need the stream enhancement projects to keep on going because the fish have to keep going back and forth upriver and downriver. […] You don't just go to a river and start working on it without looking at it first. You have to be well organized." (Quitsaq Tarriasuk, with translation)***

Quitsaq Tarriasuk suggested that projects are much more effective when they are done with Inuit and not only southerners. When there is collaboration, the work is more successful.




Map 6.1: Three recommended systems for enhancement near Ivujivik.

# 7.
# AKULIVIK
# FULL REPORT

*Participant: Henry Alayco*

*This meeting was held after the HFTA Annual General Meeting, along with Quitsaq Tarriasuk (Ivujivik), and Johnny Oovaut (Quaqtaq)*

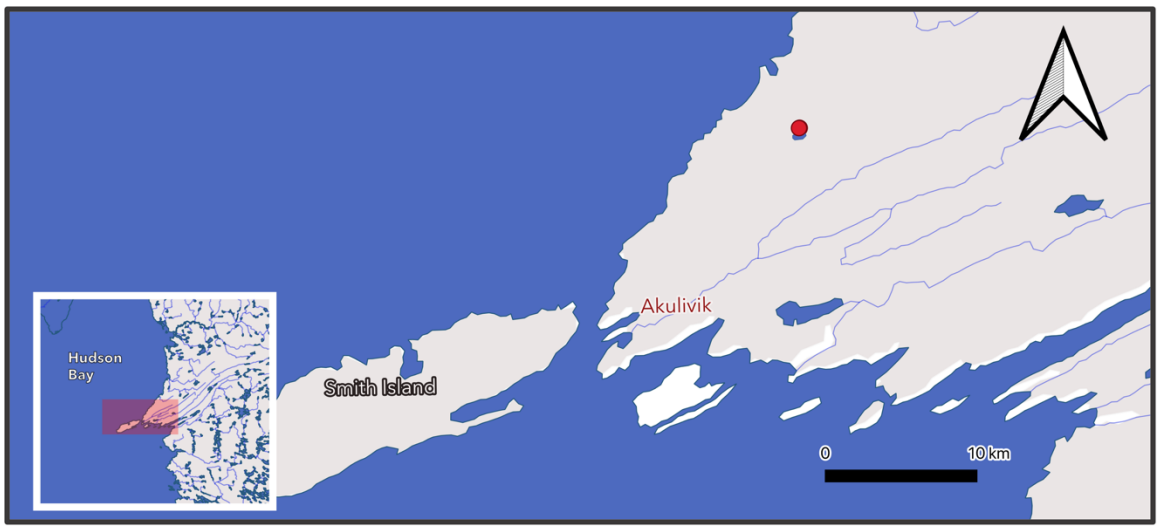
## BARRIERS TO CHAR MIGRATION

Ice

Summer ice in Akulivik has important ramifications for the Arctic char population:

***"If we see ice in the area, like we did this summer [2018], there's no fish. I think from this point on, we will see less Arctic char in our area." (Henry Alayco)***

Permafrost melt




Map 7.1: Lake near Akulivik that is draining due to permafrost melt.

***"I've seen some lakes close by** [Map 7.1] **that have drained from the bottom of the lake; they go underground and come out in some areas […] because of permafrost melting." (Henry Alayco)***

Water passes underground rather than entering the rivers.

## OTHER PROBLEMS FOR THE ARCTIC CHAR FISHERY

### Overharvesting

***"Inuit used to have an understanding that we don't have to overharvest, we just take what we need for a few days or one day. Now the whole world has changed; because of rules and regulations they tend to overfish in some areas. […] Those rules and regulations didn't come from Inuit people; they came from outside. [Inuit] don't like to be controlled by people." (Henry Alayco)***

### Contamination

Henry Alayco brought up concerns about the health of Arctic char and explained that the meat was changing.

***"People have said in the past that one day we will not be able to eat any [char] because it will be too contaminated. We have to have studies done." (Henry Alayco)***

## RECENT RESEARCH & MANAGEMENT PROJECTS

### Stream enhancement

***"We have had a lot of stream enhancement projects around here, in the Cape Smith Islands." (Henry Alayco)***

### Protected areas

Kovik River [Map 7.2] is fished by Akulivik, Ivujivik, Salluit, and Puvirnituq. The four communities identified the area as one that should be protected. It is now a proposed aquatic reserve, and there is no mining exploration in that area.


Map 7.2: Kovik River, which is between Akulivik, Ivujivik, and Salluit, but is also used by Puvirnituq.

Research

A specific research experiment which Henry Alayco brought up was one done a long time ago, in Kovik River [Map 7.2]:

***"40 years ago, we had a person from Makivik who would go to the Kovik River where lots of people go, and they did a study on Arctic char just to see if there are lots of smelts or small fries of fish in that area." (Henry Alayco)***

## RECOMMENDED RESEARCH AND MANAGEMENT

Stream enhancement

***"I know that the stream enhancement projects have been very well organized in the past, there's still those rivers that are open. Whenever local people see something that's not right with the river, they will tell us that. They know who to contact. We haven't had many complaints about this issue, no char going up the river. [...] Stream enhancement is good, if someone wants to do it that's fine, but we need a fish hatchery." (Henry Alayco)***

Hatchery

Akulivik has been inspired by the Arctic char project in Kuujjuaq.

***"They have a program in Kuujjuaq, bringing back Arctic char to their streams and rivers. [...] We have to start looking at that also. This project,***

***people really want to have a hatchery. The older people that have passed away wanted to have a hatchery before, now we really have to have it today." (Henry Alayco)***

## Research recommendations

Henry Alayco suggested redoing the Kovik River study, to see how the Arctic char numbers have changed.

***"People are depleting the stock in Kovik River** [Map 7.2] **because of overuse with gillnets in that area. If we made a study today to see how many fish are still in that river, I'm quite sure that the report that was done in the 70s would be very different." (Henry Alayco)***

He recommended expanding the research to include the health of the fish.

***"Sometimes we send a species of fish that is not good to the research department, but we need to have studies done to see what kind of sickness, or what's happening with the fish. Why are they changing? Why is the meat changing? They used to be healthy. We need more studies done. [...] That's one of our priorities. To check the health of the fish. We've never done that intensely before." (Henry Alayco)***

# 8.
# INUKJUAK
# FULL REPORT

*Participants: Arthur Elijassiapik, Lazarussie Tukai, Charlie Elijassiapik, Tommy Palliser, Samwillie Kutchaka, Simon Ningeok*

## ARCTIC CHAR POPULATION TREND

Arctic char populations have been very low near Inukjuak recently. There was an experimental fishing project done in 2008 for the Innavik hydroelectric dam environment assessment and not a single Arctic char was caught in that river.

***"They did a test, if there's char migrating up the river. They didn't get a single char. Now they're certain that there's no char in this river now. [...] They're going to build a dam upriver so there's probably no more chance in our river for char." (HFTA member)***

Kuuttaaq [Map 8.1] is the area that had the most Arctic char near Inukjuak in 2018.


Map 8.1: The area with the most Arctic char near Inukjuak in 2018. It was closed for fishing for approximately 2 years.

Summer 2018 was an exception to the overall decline that has been observed.

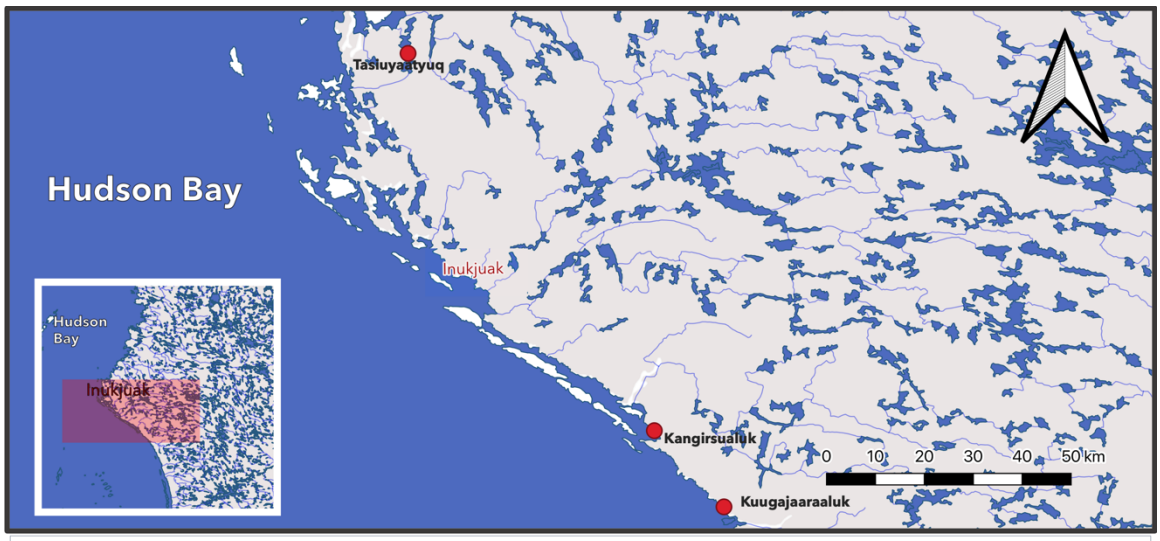
***"This year [2018] we had quite a lot of fish. Was surprising this year. In the past 10 years we had few char, so we haven't seen any growth in the population. The population is big right now; I think it's because of the ice that didn't go away during the summer." (Lazarussie Tukai)***

## BARRIERS TO CHAR MIGRATION

Low water levels

Some rivers have been becoming too shallow for fish migration, and Arctic char can no longer be found in the adjacent lakes.

Near Kuugajaaraaluk [Map 8.2], the rivers are blocked by sand nearly every year during the spring due to the current. This is a barrier that stops Arctic char from returning to the ocean for the summer.



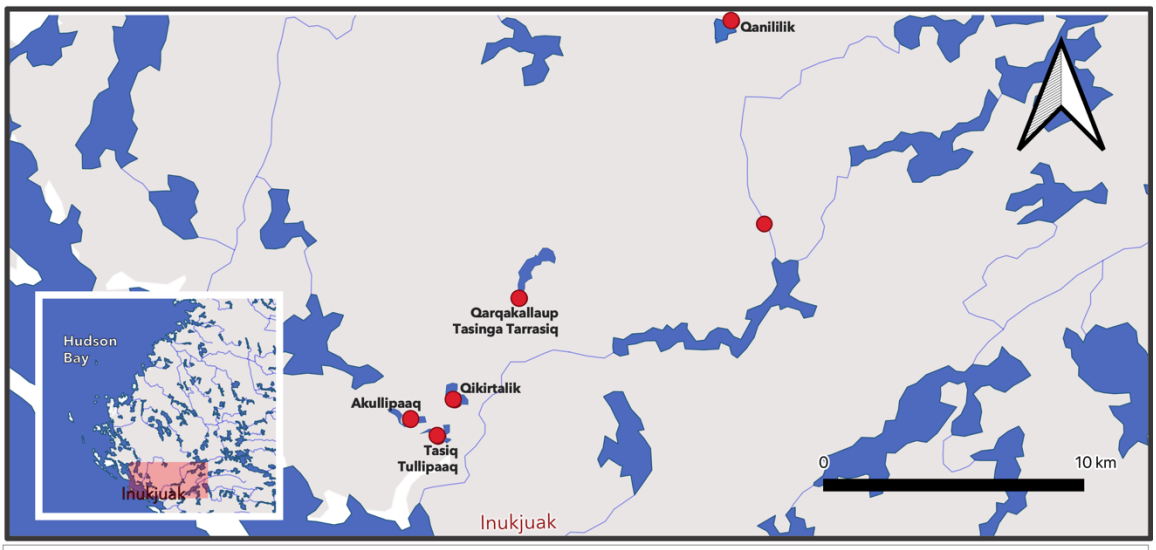

Map 8.2: Recommended future stream enhancement projects.

## OTHER PROBLEMS FOR THE ARCTIC CHAR FISHERY

Longnose suckers

***"We've been having problems with sucker fish in our rivers." (Lazarussie Tukai)***

"Sucker fish" refers to the longnose sucker, which started to become a concern in 2005. Longnose sucker and brook trout were the two most abundant species in Inukjuak River in Innavik's 2008 experimental fishing project. They have taken over almost every fishing lake near Inukjuak [Map 8.3], which is greatly troubling for fishermen.




Map 8.3: Areas with an abundance of longnose suckers near Inukjuak.

### Fishing

Fishing with gillnets in Arctic char lakes is a concern for many community members and Elders in the community. There have already been some actions taken to regulate gillnets in certain char lakes.

***"There's different ideas as to what causes [the decline]. One of them is thought to be over-harvesting with the fishnets." (Anonymous)***

### Innavik hydroelectric project

The Inukjuak HFTA worried that the future Innavik dam would seal the fate of Arctic char in Inukjuak.

The Innavik project is a hydroelectric project done in a collaboration between Pituvik Landholding Corporation and Innergex Renewable Energy (a technical and financial partner that Landholding selected). This project was initiated in order to find a sustainable alternative to the diesel-fired generating station that currently supplies electricity, but many people are concerned about its impacts on fish movement and availability.

## RECENT RESEARCH & MANAGEMENT PROJECTS

### Fishing restrictions

Kuuttaaq was closed for approximately two years for fishing [Map 8.1].

***"It was closed for a while, maybe two years? They needed permission from Landholding to fish there but it was only for community members." (Simon Ningeok)***

New regulations have prohibited gillnet fishing on a few of the other lakes near Inukjuak.

## Stream enhancement

The last stream enhancement projects were done in Inukjuak approximately 25 years ago. Charlie Elijassiapik remembers that Kuugaapik and Tasiujaaluk were both cleared, but none have been done recently.

Most streams were not cleared effectively and continued to have the same problems even after the stream enhancement, according to Arthur Elijassiapik. Saputiapik, on the other hand, may have been more successful.

***"There was one project done in Saputiapik and the numbers are growing. That was more than 25 years ago." (HFTA member)***

## Research

The MFFP visited Inukjuak in the summer of 2018 to put in counting barriers and measure Arctic char populations, just as they did in Tasiujaq and in Aupaluk. According to the HFTA, community members were sometimes uncomfortable with the counting barrier used by the MFFP. Overall, however, people seemed happy with the project because knowledge about char populations is useful in order to preserve them.

***"They were doing good with the community. They mostly donated the fish to the community to share, ones that they did research on." (HFTA member)***

## Innavik environmental impact assessment

Experimental fishing in the fall of 2008 was done in an effort to characterize the fish community in Inukjuak River, to prepare for the Innavik project.

In the Environmental and Social Impact Assessment (Pituvik and Innergex, 2019), it says that "no issues or risks with regard to higher mercury levels in fish are anticipated". Nevertheless, a "fish contamination monitoring program will be implemented for the Project to determine and monitor potential changes in mercury concentrations in fish tissue."

# RECOMMENDED RESEARCH AND MANAGEMENT

Hatchery

***"Up here, we need to help them to reproduce. They're declining. And we're not doing anything." (Simon Ningeok)***

Two possibilities to help Arctic char reproduce is to leave them as they migrate to freshwater (maybe by limiting fishing) or to begin a hatchery.

Tommy Palliser began to think of the possibility of a hatchery while he was working for KRG in the Economic Development Department.

***"Hatcheries I believe are the answer. That will help bring the balance needed, as well as increase the stocks for future consumption following the rise of our populations." (Tommy Palliser)***

He initiated the project, met with the Kuujjuaq hatchery planners (such as Allen Gordon and Gaetan Souzy), started planning the budget, and identified possible locations for egg collections.

***"We located five lakes and rivers, four in the north and one in the south, all within about maximum 40 or 50 kilometers from the community." (Tommy Palliser)***

For the hatchery, the plan was to build it in the south and ship it up.

***"I have all the documents with me; the plan was to build a premade fish hatchery in the south with all the units, the heating unit, the water filtration system, all that stuff on one side, and a hatchery on one side... and the plan was to ship it up here. The cost we were estimating was between $400,000 and $500,000, and the ongoing operational cost which would depend heavily on the harvesting of the char eggs..." (Tommy Palliser)***

He had already done a mini pilot-project, where people stayed at the potential sites and recorded the fish that they caught. They caught about 200 char during their short stay just above Five Mile Inlet, about 15km north of Inukjuak.

The old Jewelry shop and the steel container were both possible locations for the hatchery building. Operational costs were one of the biggest challenges, since funders tend to prefer investing in the start-up cost. Tommy Palliser had estimated about $30,000 a year on the harvesting, $30,000 a year on the general operating cost of the building, and $30,000 on the salary of the assistant or the part-time coordinator.

***"Whenever I start knocking at people's doors... operating costs, operating budget, that's the challenge. You can have all the money in the world, big project money for startup. But operations you'll have to look elsewhere." (Tommy Palliser)***

These plans were going well but were put on hold when he got a job at the Nunavik Marine Region Wildlife board in 2016. Arctic char are not part of their mandate, so Tommy had to put aside the hatchery project to focus his attention on his new position.

***"That was kind of the overall plan, just a matter of getting the start-up funds and running with it. We were there, I just moved to this job. [...] Then I left it with the [HFTA], and I was meeting with them on getting all the budget together, getting all the contacts in place, and all that kind of stuff." (Tommy Palliser)***

The HFTA has taken over the job of starting the hatchery, which will be a huge benefit to the community of Inukjuak.

***"These kinds of projects where we can have hatcheries repopulate these lakes, we're looking at sustainability. We're looking at food security. I think there's so many benefits." (Tommy Palliser)***

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Innavik hydroelectric project

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Landholding has promised to undertake a monitoring program for 10 years after the dam is installed in spawning areas. Despite these measures, there may still be an impact on fish species.

***"We want to see what we can do, even if the dam is built. If we can still put char in there. Their blueprints have a little area where fish might be able to migrate upstream. So they still might have a chance." (HFTA member)***

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Longnose suckers

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***"Nobody's eating them. We don't eat them, only Cree eat them. If they were a commercial fish that would be good. But there's no store that wants sucker fish. [...] We have to find a way to not waste the sucker fish and get rid of them at the same time." (HFTA member)***

One option was to use suckers as dog food, according to Simon Ningeok.

***"[Suckers] are good for dogs, they de-worm." (Simon Ningeok)***

The question is: how would fishermen target sucker fish? The process may be labor-intensive.

***"We are thinking of closing the little rivers that get to the lake, and check the nets every day, two or three times a day, but that would take a lot of work, and there's a lot of sucker fish. We need more than two ATVs just to do the project." (HFTA member)***

They have discussed this with the MFFP, but it is not clear what the next steps should be. How do you get rid of or control a single fish species, when no one likes to eat them? Where would you get the funding? This issue was identified as first priority by the HFTA.

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Stream enhancement projects

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***"Streams are very shallow; we're thinking about removing quite a few rocks to make the stream stronger so that we have more char going upriver to reproduce. We're going to need funding and help to do that project." (HFTA member, with translation)***

Kuugajaaraaluk gets blocked by sand nearly every year as char try to return to the ocean [Map 8.2]. This is one of the few mentions of char having difficulty returning to the sea. In this case, the waves displace the sand which blocks the river. This project would be worth the effort and money because char are abundant in that area. Aside from this area, there are other systems that the HFTA would like to enhance [Map 8.2].

***"There's a lot of streams that we want to enhance, but it takes a lot of time, a lot of funding, a lot of work." (HFTA member)***

# 9.
# UMIUJAQ
# FULL REPORT

*Participants: Three HFTA members and two Elders, all anonymous*

## ARCTIC CHAR POPULATION TREND

Since the 1960s, Arctic char populations near Umiujaq have been declining.

***"That fish is #1 up north. We used to have a lot in 1940s and 1950s, in 1960s… we don't know where they went." (Anonymous)***

Arctic char come to Richmond Gulf during the summer, but do not stay for long.

***"Arctic char are very smart… if they feel threatened they move. They don't come back." (Anonymous)***

The Umiujaq HFTA worries that the shift away from Richmond Gulf may be irreversible, but that does not stop them from trying.

## BARRIERS TO CHAR MIGRATION

Beavers

Beaver dams were identified by the HFTA as a large issue for Arctic char and one of the reasons that the habitat has not been good enough for them. Beavers increased in the area once Cree became concentrated in Whapmagoostui.

***"1954 Kuujjuarapik was developed, Cree and Inuit gathered there. Before that they were expanded throughout Richmond gulf." (Anonymous)***

It is now incredibly difficult for locals to keep up with all of the beaver dams that are appearing.

***"In the past, it was really well taken care of, removing the dams… but now it's hard to keep up with the dams." (Anonymous)***

Low water levels

Low water was briefly mentioned as another issue for Arctic char, often in relation to the impact of beaver dams and growing vegetation. These factors work together to worsen the habitat in Richmond Gulf for Arctic char.

## OTHER PROBLEMS FOR THE ARCTIC CHAR FISHERY

Motorboats & gillnets

***"When the motors came to the north, there were no more Arctic char." (Anonymous)***

A period of changing technologies introduced new challenges that Arctic char had to face. These included motorboats and gillnets.

***"The fish was plentiful before motors started being used: onboard motor for example. […] With motors, there were too many by the mouth of the river, and that's also when gillnets appeared. That's the time when there was a really big decline." (Anonymous)***

There were also southerners who were disrespectful of the area.

***"Back in 1976 they were guiding some white people who were actually shooting at the fish, that had a big effect. They didn't like it, and they couldn't say anything to them." (Anonymous)***

Today, there is concern about abandoned nets and the impact that they can have on fish populations.

## RECOMMENDED RESEARCH AND MANAGEMENT

Beavers

The Umiujaq HFTA recommends three main solutions to beaver presence: dam removal, hunting/trapping of beavers, and management of riparian (near the river) vegetation. Most importantly, however, projects would need to be checked and maintained.

***"It would be better if we check on it every single year, since they have been making dams. Even if they remove the dam, it's always rebuilt by beavers." (HFTA member)***

So far, there has not been a coordinated approach to removing beavers from the area.

***"They keep coming back. We don't usually use a trap for the beavers, we just shoot when we see them. [… We remove the dams] mostly by hand." (HFTA member)***

***"If those dams were removed, and the bottom of the river was excavated… there would be some possibility for Arctic char to come back." (Anonymous)***

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Net removal

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Some nets have been left in the rivers in the past. HFTA members recommended an organized cleanup be done to make sure that they have been effectively removed from the water bodies.

***"[The HFTA manager] wanted a small canoe with a small engine to remove fishing nets that were left years ago. […] He found that it was too expensive to proceed with this idea. […] It would be great if we could check on the river every year. We don't know if anyone is leaving nets behind without anyone knowing. More likely late 70s or early 80s they left the fishing nets, and they're still not found." (HFTA member)***

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Stream enhancement projects

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Stream enhancement projects were recommended but not as a first priority for Arctic char. HFTA members often listed these projects as a follow-up step to dam removal.

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Park regulations

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Tursujuq National Park was created in 2013. The salmon river that that the HFTA wants to enhance is within the park boundaries. The HFTA would like to ensure that they will still be able to enhance this area and that they will be continuously consulted about changes in regulations.

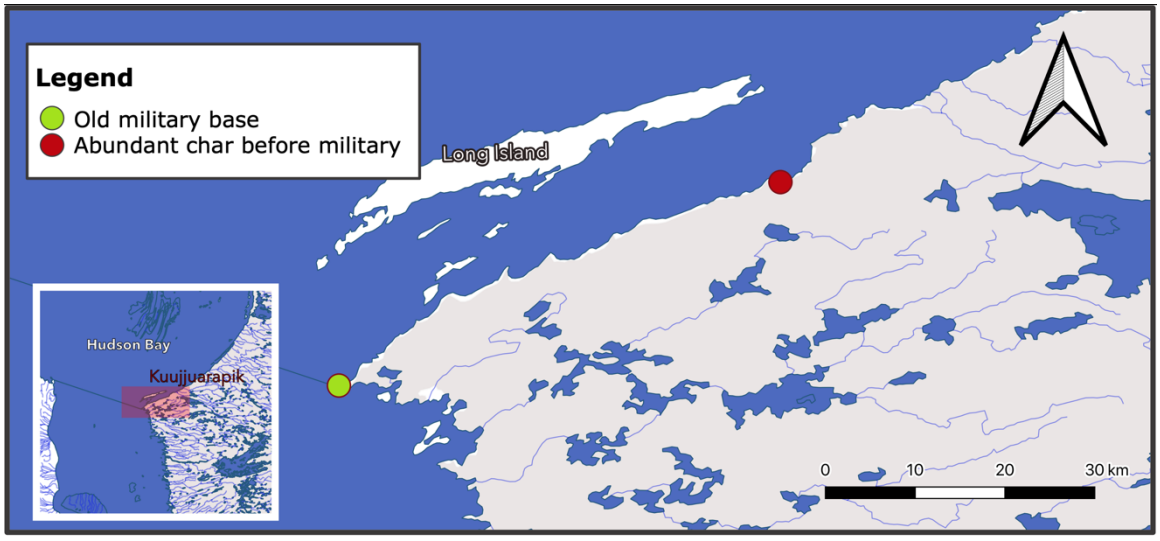
# 10.
# KUUJJUARAPIK
# FULL REPORT

*Participants: Anthony Ittoshat, Willie Novailinga, Joana Fleming, Jimmy Paul Angatookalook, Alec Tuckatuck*

## ARCTIC CHAR POPULATION TREND

***"A long time ago, 1951-1960s, there were many activities [from the army] on the water, in the air, on the land… and most of the fish were gone. Now they're coming back slowly. And every now and then we get Arctic char in this river." (Anonymous)***

The US Air Force military base [Map 10.1] closed in the 1960s. They were described by one HFTA member as "terrorists to the environment" because they left fuel along the coast and contaminated the area.




Map 10.1: Military base and area with Arctic char before the military base.

Anadromous char, which migrate to and from the ocean, have been heavily impacted by these events, and are only now beginning to increase in the area.

***"I would say about 20 years ago we caught [a char] every few years, and everyone would know about it. [...] It's more frequent now. [...] Char tastes good! Although we do have native fish that we've very fond of, it's good to have a variety sometimes." (Anthony Ittoshat)***

Another HFTA member observed that the new char appear different than the ones used to be caught.

***"They seem to be longer, and not so chunky as the Arctic char that we normally see around." (HFTA member)***

According to the Kuujjuarapik HFTA, community members are not generally worried about fish populations. They have many fishing spots, many species, and are excited about Arctic char returning to their area.

***"The proximity of our fishing areas does not give us too many problems. It's our shared resource, too, with the Cree. They're constantly fishing too, and they've never complained about lack of fish or anything, for that matter." (Anthony Ittoshat)***

## BARRIERS TO CHAR MIGRATION

### Low water levels

Low water can often be a barrier for fish accessing spawning sites but was not mentioned frequently during interviews.

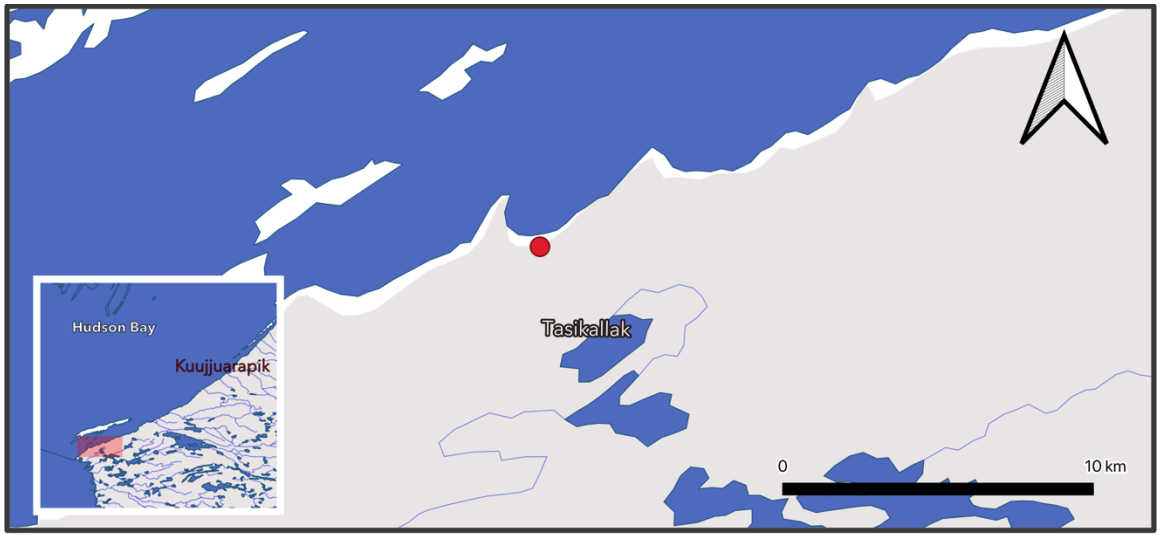
***"The last couple of years it was very dry... ponds were drying up, and I'm sure streams and rivers were too. That's definitely a barrier. That is to say, it was dry for a few years. It may have had an impact, but we don't know for sure. This year [2018] was kind of rainy, snowy, and now there's lots of water in all the ponds. This might give them a chance to recuperate." (Anthony Ittoshat)***

### Vegetation

***"[There are] a lot of bushes! Especially willows. [...] They tend to grow on the side of the creeks, rivers." (HFTA member)***

If there is erosion or the shrubs die, they are carried by the river and block the flow. One HFTA member observed an increase in vegetation growth in one specific area [Map 10.2] shortly after the military base closed in the 1970s. Drying streams and

increased vegetation are thought to be two important factors that contributed to the decline of Arctic char.




Map 10.2: Drying stream and growing vegetation has decreased the number of Arctic char in this area.

### Beavers

When asked about beavers and whether they ever caused issues for fish, an HFTA member replied that they are well controlled compared to otters.

***"Otters are more of a problem than beavers are. […] The dams may be a problem, but when there's a dam we know there's a problem with water flow, so we destroy the dam. And if we see the beaver we shoot it and sell it to the Cree. We don't trap it. About 30 years ago, we did have a big problem with beaver dams. But like I said, we took a few guys to go destroy the beaver dams and opened up the water, and they left the territory. Unless they were all caught." (HFTA member)***

This may be partially due to the Cree of Whapmagoostui:

***"When they see a dam, Cree will trap it." (Anonymous)***

## OTHER PROBLEMS FOR THE ARCTIC CHAR FISHERY

### Overharvesting

The HFTA was unanimous about overfishing not being an issue for the community. In fact, many of the younger generation has not been fishing enough and have been increasingly reliant on technology rather than experiences on the land. Community

members were excited about the increase in Arctic char numbers and would like to encourage the trend without regulating netting.

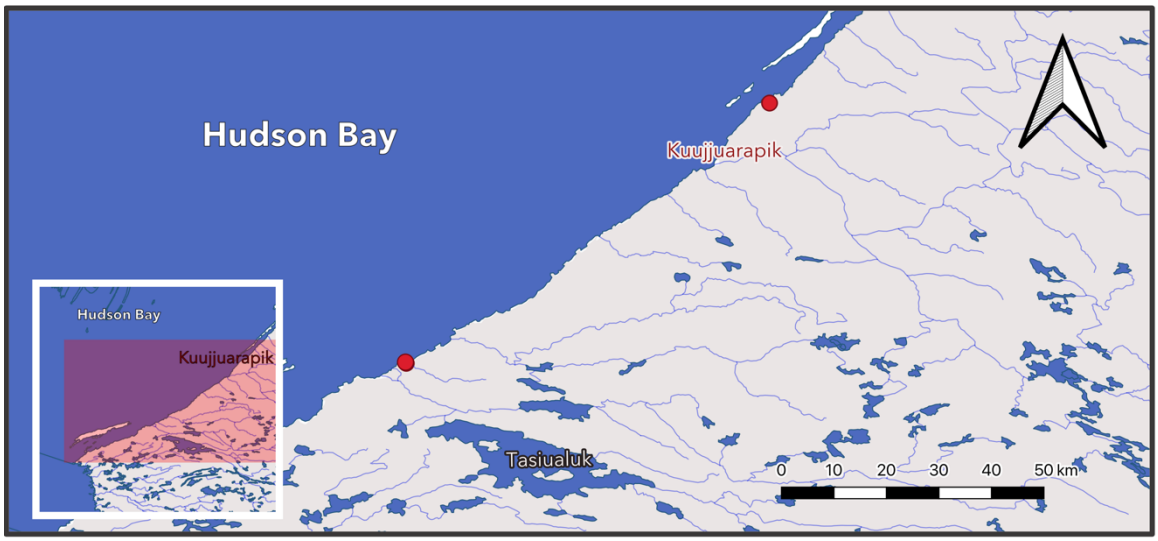
***"And fish netting here... that would probably be a barrier, but what can you do? You can't tell char to go this way, or go this way, to avoid the nets. If they get caught in the net, what can you can do about it? You just have to go home and eat it." (Anthony Ittoshat)***

## Otters

Otters are a larger concern for many community members in Kuujjuarapik.

***"Otters are a real pain in the rump when it comes to harvesting fish. They tend to eat your catch. They can wipe out your whole catch in a couple of days if you don't check your nets regularly." (Anthony Ittoshat)***

Otters have been increasing in numbers due to a release in hunting pressure. This has had a noticeable effect on fish populations in a few areas [Map 10.3].




Map 10.3: Areas where otters are causing problems for fish.

***"They used to be well-controlled before. Maybe there was less population of otters, but they seem to have really exploded now. I'm not blaming the Cree, but the lack of hunting now... people don't hunt them as much as they should because the prices have gone down. It's not worth the energy to set up the otter traps and spend gas on this when you're going to get ten bucks for a pelt, when you used to get a hundred or so. That definitely has an impact, at least where we fish anyways. We've noticed a large drop in the fish population because the otters are just about everywhere on the creeks now. They're not being hunted as often as they used to be... I know that for***

***sure. That's definitely contributing to the number of fish available to us." (Anthony Ittoshat)***

Health

Health and sicknesses in fish will always be a concern, and some worry about the hidden impacts of the Hydro damming projects that company-funded environmental assessments may not reveal.

***"The level of mercury, I think, has risen quite dramatically since the damming 40 years ago. The scientists said that the level of mercury would die off as time went by, but I don't believe they've done any follow up on the level of mercury in the fish that we catch here. [...]***

***One scientist paid for by the environmental company and the other paid for by Hydro-Quebec with millions of dollars, of course they'll make it sound good. That's what they're paid to do. We know for a fact that mercury levels have gone up. Despite what the Hydro-Quebec scientists were saying. People took people's hair samples and there were high levels of mercury in the Cree in Chisasibi, and some of the Cree here in Whapmagoostui..." (Anthony Ittoshat)***

Studies done with Cree populations on mercury levels have been worrying many Inuit, since they live in a similar area and often eat similar traditional foods.

***"I don't know. It's been a bit of a hot topic for a long time now. I know for a fact that Cree were told to not eat fish more than twice a month. If they were lake trout or predatory fish, pregnant women were told not to eat it more than once a month. But for other people, they were given a guideline of how often to eat fish because of the levels of mercury in those fish." (HFTA member)***

## RECOMMENDED RESEARCH AND MANAGEMENT

Hatchery

Community members have been pleased with the increasing presence of Arctic char. Many people hope that a hatchery might encourage this trend and continue to increase populations of Arctic char. Some suggest that this action should be taken immediately. Others caution that further research should be undertaken to investigate how this would impact other species of fish.

***"We should start soon [with the hatchery project]! […] We would do enhancement first along the streams, and make sure they're well organized." (HFTA member)***

The hatchery could begin after stream enhancement, this person explained. The area would remain protected for a few years until the population stabilized. He recommended a few areas near Kuujjuarapik for the hatchery [Map 10.4].


Map 10.4: Ideal water systems for a potential Arctic char hatchery.

A few of the other HFTA members brought up concerns to consider when planning such a project, especially with regards to the different types of Arctic char.

***"My concern is introducing new species (well not necessarily new species), to a given area… How would it affect the native fish around here, and the ecosystem? We all love char, don't get me wrong. I love char too, and I wouldn't mind fishing for char every other day, but Elders have always warned us if you start playing around with nature it has a way of turning around and kicking you in the back. […]***

***My concern is that the white fish that are predominant here are bottom feeders. They help keep the bottom of the sea clean. They have a role to play in our ecosystem. We're expressing a few concerns that if we introduce another species, then all of a sudden we have a dirty bottom of the sea and no one to clean it up. […]***

***We need to know a lot more, because people just say 'let's do it.' We want to know what we're going to get into. What are the impacts, positive or negative? I know that they're doing really well in Kuujjuaq with their hatchery, but we have to know more about introducing different species to***

***the area. That's my main concern. If it's possible, if it's feasible, by all means, let's do it! But be careful about it." (Anthony Ittoshat)***

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Stream enhancement projects

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***"It's true that that's an impediment for fish... debris, branches, dead trees... All you need is one big dead tree to block up the whole entire stream. It has to be enhanced first." (Anthony Ittoshat)***

Stream enhancement was mentioned mainly as a precursor for a hatchery initiative.

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Otters

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The largest recommendation for dealing with otters was to hunt or trap them more.

***"Maybe we can encourage the Cree trappers to trap some more?" (Anthony Ittoshat)***

Another HFTA member suggested that Inuit should also be dealing with this problem, and not only expecting Cree to do the job:

***"We have Cree neighbors that camp a mile south of here, and I told them "you guys are not hunting otters enough". And he said, "you too!!"." (HFTA member, with translation)***

Unfortunately, trapping is tedious work and the price for fur is not worth the effort to many.

***"The practice of hunting on a regular basis, on a yearly basis, has gone down drastically. You practically see no hunters now. We seem to only go camp when it's a good time to do it. Before we'd have people camping year-round. Like today, we're mostly seasonal hunters, so beaver and otter populations seem to grow." (HFTA member)***

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Research recommendations

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***"[Arctic char] are coming back naturally, I guess there's not much we can do. It's true that there's more char on a regular basis here now. We're not sure if they're coming back, or expanding, or just using the territory to lay their eggs. We're not sure. Research has to be done." (Anthony Ittoshat)***

Anthony Ittoshat wants research to be done in order to systematically check if there's more char coming in, every year, on a regular basis.

***"We have hunters here, fishing almost year-round. Maybe we should start documenting every time someone catches a char." (Anthony Ittoshat)***

A genetics project, along the lines of those done by the Jean-Sebastien Moore lab at Laval University, was also brought up as a possibility.

***"A DNA test would also be a very good idea. We want to know where they come from. [...] Are some coming from the north, like Akulivik? Or are some coming from Cape Jones? What species are they? Are they the same group? Are they different groups? Similar studies like they've done with beluga. Where they come from and what their habits are." (Anthony Ittoshat)***

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Youth

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The Kuujjuarapik HFTA expressed concerns about the youth, who are going on the land less often and are instead spending time on technology inside. One possibility is to encourage fishing competitions.

***"We should have a lot more fishing derbies, it would be a lot of fun. [...] Too much time on iPads and TVs, it's a concern for a lot of us. But we'll try to bring it back. We have so many programs available to us... It's flabbergasting that we don't take advantage of the opportunities to take the kids out hunting. [...] Everyone wants to stay home on social media rather than go out fishing. But when they do go out, they do realize how refreshing it is, how good it is!" (Anthony Ittoshat)***

# 11. ENVIRONMENTAL CHANGES

With climate change, many new species, plants, and geological phenomena are occurring in Nunavik communities. Some of these were already mentioned, such as permafrost melting and beaver expansion. Other changes that were discussed did not seem as directly related to Arctic char migration and populations. These are a collection of quotes and observations of additional environmental changes.

## KANGIQSUALUJJUAQ

Animals

Species have been redistributing in Quebec due to climate change and many new species are arriving in Nunavik:

***"We have more black bears, porcupines, and what? Since there's been development, they've started going up north." (Willie Annanack)***

***"It looks like moose are coming up this way too." (Tommy George Etok)***

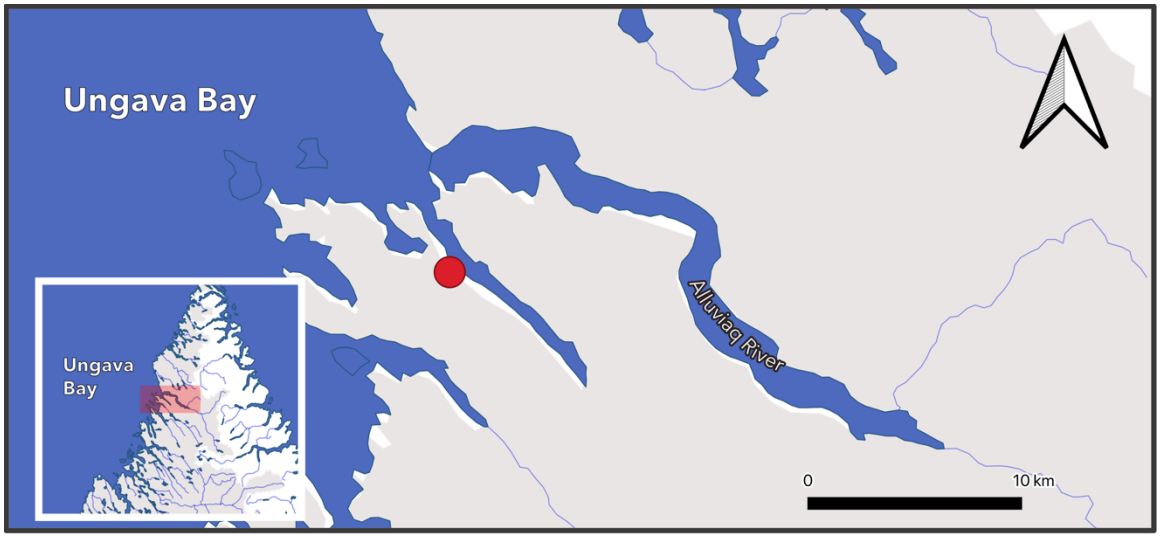
***"There are more and more sea birds that are going inland, like the example of seagulls." (David Annanack)***

Not only is climate change changing animal distributions, but it is also affecting animal interactions.

***"There haven't been very many seals on the shore of Ungava Bay, so polar bears are also fishing for char." (David Annanack)***

***"I've seen black bear feeding polar bear in the fall, the black bear was feeding the polar bear and the polar bear was not too far away. They were sharing the river. That was my first time seeing that." (Tommy George Etok)***

In fact, this story about a black bear and a polar bear fishing together is one that came up in multiple discussions [Map 11.1]. It is a striking example of how the changing climate has impacted species distributions as well as species interactions.




Map 11.1: Site where black bear and polar bear were seen fishing side-by-side for char.

Fish are also impacted by climate change. Whitefish are increasing in the river, sucker fish are more frequent (which worries the HFTA due to stories from Inukjuak about their impact on Arctic char), and trout are appearing in new areas due to the warming of the water.

***"Because of climate change, whitefish are going downstream. Because of climate change, our saltwater is turning into freshwater. That's the thing. It's completely a big difference." (David Annanack)***

***"We never used to have whitefish in the sea, now we've got lots and lots." (Sammy Unatweenuk)***

## Saltwater

Saltwater is becoming diluted in many areas due to the melting sea ice.

***"20 to 30 years ago, George River was very salty. […] With climate change, it's turning into freshwater slowly. That's why lots of freshwater fish are going downstream." (David Annanack)***

***"The freshwater can be on top of the saltwater. If I shoot a seal and it sinks, it's not going to sink to the bottom, it's going to stop at the saltwater. Because on top of the inlet there's 3 feet of freshwater. Our sea is slowly turning into freshwater." (Tommy George Etok)***

***"I think the other problem is that there are so many plants that are growing. Even the bushes; there used to be no bushes and now there are too many bushes growing, blocking the whole [river]." (Tommy George Etok)***

Bushes have been taking over the fishing trails, and now some trails have completely disappeared.

***"The vegetation has changed so much. I have pictures of places near our camp. Like in the 70s, there were no bushes; there were no trees. And it's become like a forest... In the past 25 years it's grown up." (Anonymous)***

Aquatic grasses have also been growing bigger and denser, especially in a specific area of the Koroc River. It was described as nearly being a hot spring, one that never freezes. The grass has grown so high that it blocks the flow. This seems to impact Arctic char, which have been observed less in those areas.

## KUUJJUAQ

Species have been changing their distributions in Nunavik. Here, Allen Gordon gives an overview of a few of the changes that he has observed:

***"There are also black bears that have really expanded north. [...] The black bear was never seen in the Hudson straight until a few years ago. [...] With less ice, the polar bears are starting to be on the shoreline more than ever. That's a big change with climate change and the expansion of species. In the future who knows? There might be hybrid bears. They've seen that out west, with grizzly and polar bears... they may rendez-vous in char streams and make babies... [...]***

***We were down in Sapukkait Steam in 1989 where we'd never seen polar bears. We never even used to carry a rifle! But every time we fly down that way to get char eggs for the hatchery, there are always polar bears. This year there were 3! They know now where the food is. So, it's not strictly seals they're eating. They're also using char, big fat char.***

***Also, eagles and ospreys. They also eat fish. There's starting to be a lot of eagles, both golden, and bald. Ever increasing. And osprey: first time that I saw an osprey was when I was guiding caribou hunters in the mid to late 80s, and I said, "What the hell is that?" And I looked it up and it was an osprey... a fishing bird. Now, we have a lot of them nesting on the river and we see them eating fish all the time.***

***Moose too! They're starting to show up. Things are changing." (Allen Gordon)***

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Vegetation

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***"Tree-wise, I think that it's so slow that in your lifetime you're probably not going to observe the northern advance of the tree line. But willows, willows are growing so fast these days... from nothing they're 6 or 8 feet high! I don't know what kind of willows they are but definitely I see a change in the vegetation, and I believe that the trees are growing a lot more. Not this year, because it was a cool summer I guess, but the last... I don't even know how many years... We've had really long and warm summers." (Johnny May)***

A specific example of this is his old outfitting camp:

***"You go there now, and you won't recognize the place. Because of all the willows that grew since then. It's not where we disturbed the land, it's on undisturbed land that didn't have willows 25 years ago; now it's covered." (Johnny May)***

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Bears

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***"Even black bears... they get them in Salluit now.  That's as far as you can go north in the province of Quebec!" (Johnny May)***

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Fish

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***"New species moving in. There's a lot of pike in the river now. And not only here, in lakes just south of here, there's pike. They were catching pike in lakes that we didn't even know had pike. Everything is moving north. Like black bears and moose. There are a lot more fish upriver than there used to be. Like salmon. After the Caniapiscau dam, the ouananiche [landlocked salmon] came down the Caniapiscau... When I was growing up we didn't have salmon like this. Never caught a salmon in the summer when the Atlantic salmon were not running, now salmon are here 12 months a year." (Anonymous)***

***"Salmon are a more warm water species than char and maybe moving up north. [...] Even here in Kuujjuaq, our brook trout fishery during July has completely changed. [...] It's all related to water temperature changes. Even here, Dry Bay... salmon they're coming up now." (Allen Gordon)***

# TASIUJAQ

Shrubs

***"[Willows] are growing bigger. They're even dwarfing trees and other vegetation in Kuujjuaq, like berry patches being overgrown with willows. It's a problem for the women to pick them." (Billy Dan May)***

Bears

Black bears have been increasing in Tasiujaq. In fact, Moses Munick, an Elder of the community, observed that they were not found in Tasiujaq approximately 20 years ago, but are now present every summer at his camp. They cause problems because they enter camps and destroy cabins, and their intense fishing can affect Arctic char.

Fish

Allen Gordon, who lives in Kuujjuaq, spoke a bit about what he had heard from his brother-in-law, Willie Cain Sr.:

***"My brother-in-law from Tasiujaq [...] said 'we were catching 99% char and 1% salmon occasionally 20 years ago. Today you throw a line... chances are it's about 50% 50% now. There's a lot more salmon in the Leaf River estuary now more than ever were before: they're taking over. Salmon are more warmer water species than char and maybe char are moving up north.'" (Allen Gordon)***

This was verified with Willie Cain Sr., who explained that fishermen who fished near Tasiujaq used to catch Arctic char almost exclusively. Now they have char, salmon, and trout.

Birds

Willie Cain Sr. observed that bird species that he had never seen in the past were starting to be observed in Tasiujaq.

One elder has observed a decline with ptarmigan in the area, although he specified that the change may or may not be due to climate change.

## AUPALUK

With climate change, many transformations are taking place in Aupaluk and across Nunavik.

***"It's not just the fish too, it's something else. Everything together... we miss having fat caribou. They're not fat anymore. And seals are still sinking, over 50% are sinking (right now they are supposed to be floating)." (HFTA member)***

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Travel routes

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***"Climate change: when we travel we follow the small lakes in order to travel faster because there's not enough snow. In order to do that we follow the rivers, which makes us go faster. Today, even if we try to follow this lake, there's rocks all over now. We have to change our routes. [...] It has a big impact too for travelling, our skidoos are wearing skis out faster because of the rocks." (HFTA member)***

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Bears

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Black bears are recognized as a nuisance, as they often are near villages. With an increasing presence in the area, this is a problem that will continue to rise.

***"20 years ago, there were none. Now there's lots. The population's grown. And they're bad too. They destroyed all the cabins. When you left something, they eat it. They destroy the markers to go to other communities." (Tamisa Grey)***

***"Black bears are problems with the camps and the geese. They're messing up the geese nesting, because they don't walk straight... they come and they eat all the geese so there's no more in the area. It's a new problem for us."* (*HFTA* member)**

Polar bears have been seen around Aupaluk for a very long time, but their presence is increasing.

***"Polar bears. They're increasing too. We don't usually kill them here. For me, even if I see them I don't usually kill them. It's too much work to skin them." (Tamisa Grey)***

## Greenland sharks & killer whales

Eva Grey noticed Greenland sharks and killer whales, which she did not see before, coming in (especially during November). Potential impacts of these new marine species are still uncertain:

***"Greenland sharks, yes [we've seen them]. But others we cannot prove, but we think seals are impacted. There are less seals." (HFTA member)***

## Fish

***"[Salmon] are getting more common. [...] There's more now. Depends on the location, not everywhere." (HFTA member)***

## Birds

***"Before we had ptarmigan, goose, white goose, those kinds of birds. Now we have land birds and seabirds. We had a big swan with the babies all over. We don't want to kill them eh? We don't eat them." (Eva Grey)***

Tamisa Grey said that he has also observed robins in the area.

## Mushrooms

***"From the sun, from the snow, more and more mushrooms all over. They grow. There's a lot more mushrooms now. When I was younger they were small, now they're huge. Maybe two years ago they started being big and this year they're huge. They start growing June-July, some are good for eating." (Eva Grey)***

## Vegetation

Changes in vegetation have included grasses, bushes, and water plants. These have been increasing in size and in density.

***"Lakes are dry from growing big grasses. [...] 4 or 5 years now, [the grasses are] much bigger." (Eva Grey)***

***"We noticed that the plants are forming in the middle of the lakes. [...] Even the caribou stands in the middle of the lake. Running away from wolves." (HFTA member)***

***"I think we're getting too many plants. Even our hunting routes, walking in the middle of the bush, there's too many plants to walk through. They are growing." (HFTA member)***

***"50, 60, 70 years ago there were not, now there are willows all over. Even bulldozer marks, there are full-grown willows on top now these days. After 70 years. [...] Every time that we move the earth, they grow faster along the road. Women start to complain, 'Hey, our beautiful berry picking area!'" (HFTA member)***

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Arthropods

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Flies, ladybugs, and butterflies have been changing in the area. Climate change may be causing this, but other factors may also contribute.

***"More flies. Different flies. Lots of flies. [...] We even have ladybugs. They were small before, now they're huge. Kids love it." (Eva Grey)***

***"We used to have butterflies. I don't see them anymore. I don't know why. Used to have colours... yellow... any kind of colours. I think I haven't seen them for maybe 10 years." (Tamisa Grey)***

## QUAQTAQ

In Quaqtaq, many environmental changes have been taking place. In general, the weather and precipitation have become more extreme:

***"The last few years, I've noticed that the rain showers are more intense. They're heavier, and they're eroding the sides of the roads in my community. It's only like that for maybe two days. Whereas some of that water might wash out roads. That's unusual too; we used to not have rain like that before. But it's not enough for the rivers. [...] I remember driving in Montreal one time, and it was raining so hard I couldn't see the road. That kind of rain behavior is coming up north." (Johnny Oovaut)***

Moreover, these changes are impacting traditional activities and the safety of going on the land.

***"We cannot build igloos anymore, because [the snow] is too hard. We get more fog in the wintertime now. [...] The weather is fluctuating so drastically now. There's one year that we had, I think this winter, where it was extremely cold, -50s. [...] We had one winter where we had -60 with windchill. It was really cold. I don't know how we survived. It was a few years ago." (Johnny Oovaut)***

## IVUJIVIK

***"A river used to rise even before the rain started. It doesn't do that anymore. […] When you walked on snow it made a sound, like a crackling sound. It doesn't do that anymore." (Quitsaq Tarriasuk, with translation)***

## AKULIVIK

***"Before [the snow] used to be hard, and now it's […] not hard anymore." (Henry Alayco)***

## INUKJUAK

***"Killer whales. They're coming to our sea now. They usually eat beluga whales." (Simon Ningeok)***

## KUUJJUARAPIK

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Fish

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Observed changes amongst fish have included whitefish becoming larger and mackerel changing distributions:

***"The last 20 years, I've noticed that the whitefish are getting bigger too. That used to be only small ones." (HFTA member)***

***"Over the past few years, I've been seeing mackerel. Migrating too." (HFTA member)***

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Vegetation

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Bushes near Kuujjuarapik have been growing larger and are sometimes encroaching on the streams.

***"Bushes are probably about twelve feet high now, when they used to be two or three feet and I was a kid." (Anthony Ittoshat)***

***"We cannot take shortcuts through those rivers anymore; the branches are growing too big. And we can't go to spots where we used to fish because the branches are growing very fast, and the streams are getting narrower because it's growing on both sides." (Anonymous)***

## Moose

***"We used to have no moose, now there's a lot of moose around." (Anthony Ittoshat)***

When asked if they hunt moose, one of the HFTA members said the following:

***"Yeah. If you ask us 'What do you hunt?', we'll tell you 'Anything that moves!' Except for ravens." (HFTA member)***

## Other species

***"The moose population has really exploded the last few years. But we also have other species, like skunks. They've been around too, but they're starting to be more. Lynx might be moving up too, and we had a resident pigeon here this summer! Everybody knew… we had a pet pigeon for a while. But then it migrated south. We're starting to see birds that are not common in this area." (Anthony Ittoshat)***

Vegetation changes may be one of the reasons that animals are changing their distributions:

***"The vegetation grows because of the nice warm weather and expands… so that could be one reason why we see animals that are not native to this area. Black bears as far as Wakeham Bay or Salluit?? There you go, it's true… animals are migrating north or anywhere that they can. I don't know if climate change is the real reason why, nobody can prove that I guess. They are moving up north." (Anthony Ittoshat)***

## Temperature

Temperatures have been very extreme and unpredictable.

***"In the last twenty years or so this so-called global warming effect has really accelerated, and for some reason the last couple of years, it's kind of been back to normal. This type of winter that we're having now, it used to be normal when I was a kid. But 10 years ago, we would probably still be close to swimming in the river." (Anthony Ittoshat)***

***"Last winter was really cold, super cold. And this winter [winter 2019] is meant to be even colder! It's already -30 with windchill, in the middle of November! I'm scared, what's it going to look like in January?" (HFTA member)***

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