

# Traditional knowledge of fish migration and spawning patterns in Tsiigehnjik (Arctic Red River) and Nagwichoonyjik (Mackenzie River), Northwest Territories



*Confluence of Tsiigehnjik and Nagwichoonyjik from Church Hill, Tsiigehtchic*

**Gwich'in Renewable Resource Board Report 07-01**  
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December 2007



## SUMMARY

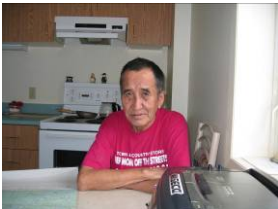
The Arctic Red River (Tsiigehnjik) and the lower Mackenzie River (Nagwichoonyik), Northwest Territories are two very important fishing rivers for the Gwich'in people. In this study, we documented Gwich'in traditional knowledge of fish species in these two rivers. We asked knowledgeable fishermen to identify upstream and downstream migration patterns and spawning periods of important fish species. We recorded text, geographic (spatial), and audio information. We summarized these data into monthly graphs and maps. We conclude that traditional knowledge is a very valuable source of information about migration patterns and spawning seasons of fish in these rivers. This is the first study to document the extensive traditional knowledge of fisheries in this location.



*Mouth of the Arctic Red River from Church Hill, Tsiigehchic.*

## ACKNOWLEDGEMENTS

First and foremost, we would like to thank all the interview participants for sharing their time and knowledge with us. We would also like to thank Frederick “Sonny” Blake Jr. of Tsiigehtchic for coordinating the interviews. We extend a big thank you to Tracy Creighton, Gwich’in Integrated GIS Project, for her valuable assistance with ArcView. We would like to thank the Gwich’in Social and Cultural Institute (GSCI) and Kristi Benson, in particular, for all her help along the way and for reviewing the document. We would also like to thank Dan Topolniski for reviewing the document. Thanks to Bobbie Jo Greenland for volunteering to help with a Tsiigehtchic interview. Vicky Chan took the photo on the cover page. Thanks to those harvesters that participated in the community workshop in May 2007 (Cecil Andre, Gabe Andre, Louis Cardinal, Doug Kendo, Sonny Blake, and one participant who wished to remain anonymous). Also, thanks to Brian Dokum for his help. This study was funded by the Northwest Territories Cumulative Impact Monitoring Program, an Indian and Northern Affairs Canada program.



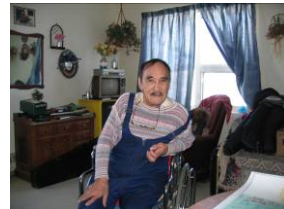
Cecil Andre



Noel Andre



Frederick Blake Sr.



Victor Modeste



Dale Clark



Gabe Andre



George Niditchie



Doug Kendo



Frederick “Sonny”  
Blake Jr.



Herbert Firth



Caroline Andre



Alestine Andre



Pierre Benoit

And 5 other interview participants that indicated that they do not want their picture and/or name displayed in the report.

## INTRODUCTION

The Arctic Red River and the lower Mackenzie River have always been important subsistence fishing areas for the Gwich'in especially for the residents of Tsiigehtchic (formerly Arctic Red River), Northwest Territories. The Gwich'in of Tsiigehtchic call themselves Gwichya Gwich'in, which translates as "flat country people". They know the Arctic Red River as "Tsiigehnjik" or "river of iron" and the lower Mackenzie River as "Nagwichoonjik" or "big country river" (Gwich'in Social and Cultural Institute, personal communication). Fishing is an everyday part of the Gwich'in traditional life. Fish are used for personal consumption and dog food. According to interviewees and the Gwich'in Tribal Council camp database, Gwich'in have camped along these rivers for centuries and there are still many active fishers with camps today. As a result of their extensive experience on the land and rivers, the Gwich'in hold valuable traditional knowledge (TK) about the land and its resources.

Traditional knowledge (alternatively referred to as indigenous knowledge, traditional ecological knowledge, traditional environmental knowledge, or local knowledge) can be broadly defined as cultural and historical connections and relationships with the land. More narrowly, traditional knowledge can be defined as the knowledge acquired or passed down about the surrounding environment.

There have been several research projects on the fisheries resources of Tsiigehnjik and Nagwichoonjik from which baseline information on species distribution, biological characteristics, and habitat use (spawning, rearing, and overwintering areas) has been obtained<sup>1</sup>. A study on the fish resources of Tsiigehnjik (Arctic Red River) was conducted by the Department of Fisheries and Oceans and the Gwich'in Renewable Resource Board off and on during the last five years (Harris 2004). However, for a variety of reasons, these netting studies have never provided sufficient quality samples to draw strong conclusions.

Despite the substantial resources invested in scientific studies, relatively little work has been carried out on the traditional knowledge of these fisheries. A study on community concerns and knowledge about whitefish in the Gwich'in Settlement Area was conducted to incorporate TK into the integrated management plan for broad whitefish (Greenland and Walker-Larson 2001). Local knowledge was documented to provide baseline information about fish distribution, movement and habitat use, as well as ecological characteristics of lakes and streams in the Travaillant Lake system (Winbourne 2004). Another study focused on fish movements around the ferry landing near Tsiigehtchic NT (GeoNorth-Ross-AMEC 2002). Two books were published that document Gwich'in traditional knowledge about all the important species in the Gwich'in Settlement Area including fish (Gwich'in Elders and Raygorodetsky 1997, Gwich'in Elders and Greenland 2001). Finally, several unpublished workshops were also held by

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<sup>1</sup> Hatfield *et al.* 1972a, Hatfield *et al.* 1972b, Stein *et al.* 1973a, Stein *et al.* 1973b, Babaluk *et al.* 2001, Dillinger *et al.* 1992, Howland 1997, Howland 2000, Loewen *et al.* 2006, Reist and Bond 1988, Stewart 1996, Tallman *et al.* 2002, VanGerwen-Toyne 2006.

government organizations that discussed (amongst other things) fisheries related TK (Kristi Benson, GSCI, personal communication).

This study was designed to document traditional knowledge of Tsiigehnjik and Nagwichoonyik on specific fisheries trends including presence/absence of species, migration, and spawning patterns. This information will widen our current knowledge of fisheries in this area.

## METHODS

### Study Area

The areas of focus for this study are Tsiigehnjik (Arctic Red River) and Nagwichoonyik (Mackenzie River), Northwest Territories. Both study areas are in the Gwich'in Settlement Area (GSA) (Figure 1). The GSA was established under the *Gwich'in Comprehensive Land Claim Agreement* (Bill C-94) which was negotiated between the Gwich'in and the Government of Canada in 1992. The GSA is 56,935 km<sup>2</sup> and includes the communities of Inuvik, Aklavik, Tsiigehchic and Fort McPherson. Tsiigehchic and Fort McPherson are predominantly Gwich'in communities while Inuvik and Aklavik are composed of mixed backgrounds (Gwich'in, Inuvialuit, and non-aboriginal). Inuvik means "town of man" and is the main administrative centre of the Western Arctic.

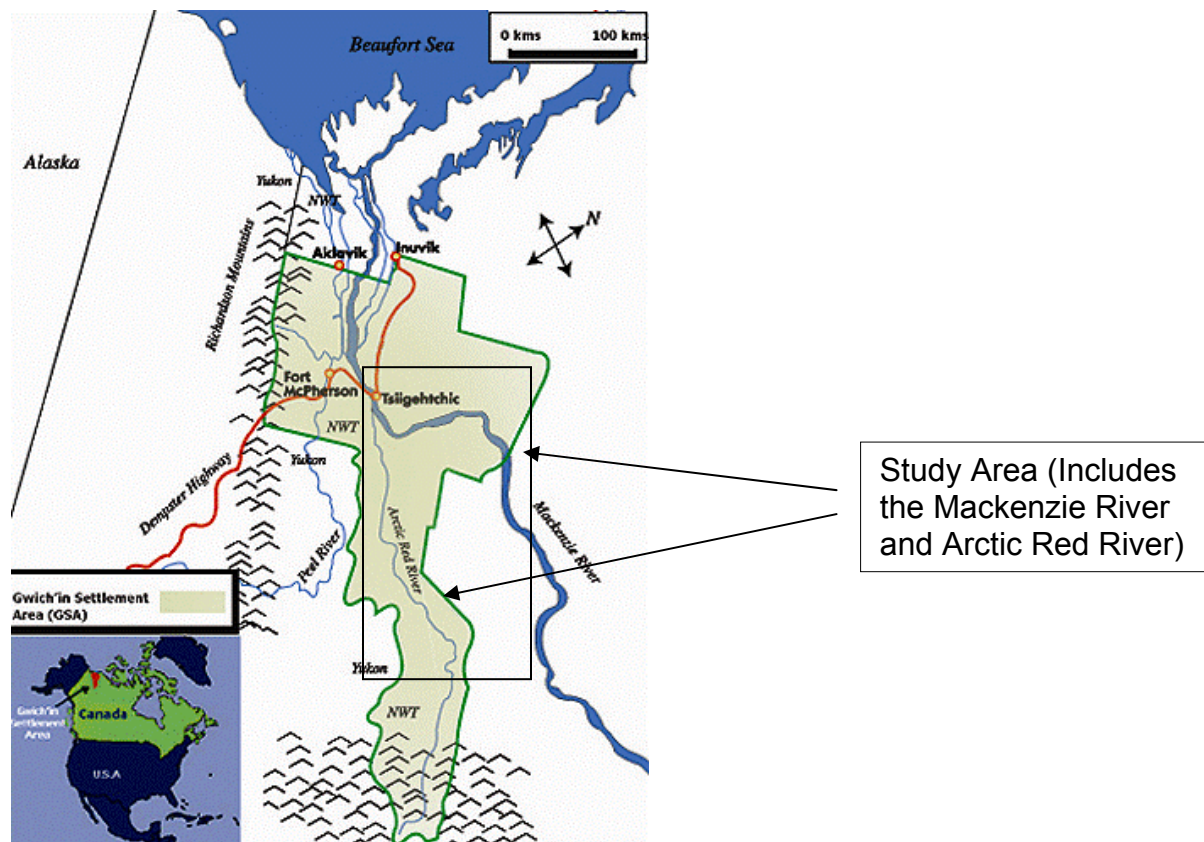


Figure 1: Map showing the Gwich'in Settlement Area (GSA) and the study area.

Nagwichoonyik (the lower Mackenzie River) is a national historic site. It is just a small portion of the great Mackenzie River system which extends from 54° to 69° latitude and is a total of 4,321 km in length (Howland *et al.* 2000). The system is the second longest river in North America and it flows north from its headwaters in northern British Columbia, Alberta, and Saskatchewan into the Beaufort Sea (Hatfield *et al.* 1972a, Hatfield *et al.* 1972b). In this study, Nagwichoonyik is defined by the local areas known as 8 Mile and Thunder River (approximately 67° 30' N latitude and from 131° and 134° W longitude). This study area contains many creeks and rivers that are extensively used primarily by the residents of Tsiigehtchic but also by those of Inuvik and Fort McPherson.

Tsiigehtchic (the Arctic Red River) is one of the largest tributaries of Nagwichoonyik. It is a designated Canadian heritage river. Tsiigehtchic enters the Mackenzie River at the Hamlet of Tsiigehtchic (formerly known as Arctic Red River) which is approximately 25 km south of the Mackenzie River Delta. Tsiigehtchic flows north-northwest from the glaciers in the North Mackenzie Mountains (Canadian Heritage rivers systems, brochure). The total length of Tsiigehtchic is 357 km and its total drainage area is 31,707 km<sup>2</sup> (Hatfield *et al.* 1972a, Hatfield *et al.* 1972b). The river is characterized by a heavy silt load. Coarse gravel bars are prevalent above Jackfish Creek (Hatfield *et al.* 1972a). Similar to Nagwichoonyik, Tsiigehtchic has several creeks and rivers that attract fishers from Tsiigehtchic and surrounding areas.

### *Study design*

Traditional knowledge of Tsiigehtchic and Nagwichoonyik fish stocks was gathered using 1) a literature and database search, 2) interviews with fishermen, and 3) a community workshop.

### *Literature and database search*

We collected information from several database and search engines: Department of Fisheries and Oceans WAVES database, Aquatic Science Fisheries Abstracts (ASFA), NWT libraries including Aurora Research Institute (ARI), Gwich'in Renewable Resource Board (GRRB) library and Google scholar. We used combinations of the following keywords to search: "Arctic Red River", "fish", "fish stocks", "Mackenzie River, Tsiigehtchic", "traditional knowledge", and "local knowledge". We then summarized the relevant literature. This information was used to improve interview questions and to develop a summary of what is known about fish stocks in the area for comparison to our interview results.

### *Community interviews*

To set up interviews with the most knowledgeable fishermen, we hired a community coordinator. The goal was to interview enough people to get a good representation of the fisheries knowledge. The coordinator arranged interviews with the elders and harvesters that fish, or use to fish, extensively in Tsiigehtchic (Arctic Red River) and Nagwichoonyik (Mackenzie River). There were two interviewers (one to conduct interview and one to record information), with the exception of a few days where only one interviewer was available. Interviews took between 45 and 90 minutes. We

conducted interviews at the participant's home or at the local Renewable Resource Council (RRC) office. All participants (interviewees) were paid an honorarium.

Before each interview, we gave the interviewee an introduction and an explanation of the project objectives. Once the interviewee had given informed consent (Appendix 1), we began the semi-directed interview using the interview guide we had prepared (Appendix 2). When we were permitted to do so, we recorded the interviews with an Olympus DS-2200 digital voice recorder. We began the interview by asking the participant to mark their fishing locations on a map we provided. We asked them to break this information down month by month. We then asked a series of questions about particular fish species. Our questioning followed the interview questionnaire (Appendix 3). The audio files were not transcribed. The files are stored at the Gwich'in Renewable Resource Board and at the Gwich'in Social and Cultural Institute (GSCI).

### *Community workshop*

On June 11<sup>th</sup>, 2007, we hosted a community workshop in Tsiigehtchic with a subset of the harvester that we had previously interviewed. The objectives of this workshop were to confirm that our interpretation of the results was accurate and to help us fill information gaps that we identified while analysing the data. We contacted each harvester that was interviewed and invited them to the workshop. At the workshop, each participant was provided with hand-outs and we gave a power point presentation to go over the results of the study.

### *Analyses*

We entered the interview responses into a spreadsheet from which we produced graphs and tables to summarize migration and spawning months. Maps from the interview information were created in ArcView 3.1. Anytime an individual answered that they fished during the spring, we entered May to June. If they answered summer months, we entered June to August. For fall months we entered September to October and for winter months we entered November to December. To identify species importance, we used an average rank for each species with three or more ranks. Gwichya Gwich'in Place Names from the GSCI were added to the maps (Table 1 and Figure 2). There were many place names identified near Tsiigehtchic (Figure 3). To verify the correct placement of the names, we checked with a knowledgeable elder from Tsiigehtchic that was previously interviewed (Noel Andre).

## **RESULTS**

### *General results*

Tsiigehtchic harvesters reported a combined mean annual harvest of 14,000 fish (1995 – 2004; GRRB 2006). When asked about fishing locations, more harvesters reported fishing in Nagwichoonyjik. The popular fishing locations in Nagwichoonyjik were Chii t'iet, Pierre's Creek, Tree River, Gabe's cabin, Travillant River and Thunder River (Table 1 and Figure 2). The popular fishing locations in Tsiigehtchic are at the mouth of

Tsiigehnjik, Jackfish Creek, Bluefish Creek, Weldon Creek, Bernard Creek, and the Forks (Table 1 and Figure 2).

Scientific studies identified twenty-two different species of fish in Tsiigehnjik (Table 2, Stein *et al.* 1973b, Stewart 1996). Eleven of these fish species are harvested by Gwich'in for consumption and/or use (whitefish, crookedback, coney, herring, loche, grayling, char, jackfish, suckers and salmon – see Table 2). A scientific study conducted by Stein *et al.* (1973b) observed two additional species in Nagwichoonyik (Brook stickleback and lake cisco – see Table 2). Both of these rivers were identified through a traditional knowledge study as one of the main habitat areas for whitefish and other fish species (Greenland and Walker-Larsen 2001). Both scientific and traditional knowledge studies state that Tsiigehnjik and Nagwichoonyik contain suspected spawning ground for whitefish (Tallman *et al.* 2002, Reist and Bond 1988, Stein *et al.* 1963, VanGerwen-Toyne and Tallman 2006, Greenland and Walker-Larsen 2001). Scientific studies state that Tsiigehnjik is a suspected spawning ground for crookedback (Reist and Bond 1988), Arctic cisco (Loewen *et al.* unpublished, Dillinger *et al.* 1992, Reist and Bond 1988), and coney (Howland 1997, Reist and Bond 1988). Whitefish that were tagged and released in Aklavik and Inuvik were recaptured in Tsiigehnjik (Babaluk *et al.* 2001) indicating whitefish are migrating towards Tsiigehchic and therefore it could be a potential spawning ground. Scientific studies also state there may be spawning grounds in Nagwichoonyik for crookedback (Reist and Bond 1988, VanGerwen-Toyne and Tallman 2006) and coney (Reist and Bond 1988).

Participants agreed that the most important fish for human consumption is whitefish. It is traditionally used to make dry fish - one of the preferred ways to eat fish (Gabe Andre and Noel Andre, interview; Greenland and Walker-Larsen, 2001; Northern Affairs Program, 1990). The participants ranked whitefish as the most important species followed by coney. Crookedback and loche were tied for third most important species and herring was identified as the fourth most important species. Most interviewees indicated that herring was important in the past to feed dogs but not many people fish for them anymore.

#### *Community interviews*

We interviewed eighteen individuals. Thirteen were residents of Tsiigehchic, three of Fort McPherson and two of Inuvik (who were originally from Tsiigehchic). Of these, fifteen were men and three were women, and nine were elders and nine were adults. All interviewees had extensive experience fishing in Tsiigehnjik and/or Nagwichoonyik. In what follows, our interview results are presented broken down by species and by river. We begin each section by summarizing the traditional knowledge as revealed by the interviews and then present information from the scientific literature. We summarize the timing of migration and spawning based on interview results in Figure 19.

#### *Community workshop*

Seven harvesters participated in the community workshop. There were four elders and three adults (six males and one female). All were current or former long term residents of Tsiigehchic.



Table 1: Gwichya Gwich'in place names from the Gwich'in Social & Cultural Institute (GSCI). The map codes refer to figures 2 and 3.

Map ID	Gwich'in Name	Other Name	Map ID	Gwich'in Name	Other Name
400	Hehnyuu deet'yah tshik	Sainville River or Bernard Creek	511	Ramii tsal vakaiik'yit	None
417	Eltyin choo chihvyàh k'yit	Jackfish Creek	588	Chidaltajj	Tsital Trein
419	Ts'òh tshik	Tso Creek	591	Chii chyah tshik	Pierre's Creek
424	Daghal tyè tshik	None	593	Chii t'iet	None
426	Łèth jithakaii	None	598	Dachan choo gèhnjik	Tree River
430	Daazrajj van k'adh tshik OR Srijjaa tshik	Swan Creek, Bluefish Creek	600	Diighe'tr'aajil	Alestine's camp
433	Teetshik gwichoo	Weldon Creek	605	Dzandiee tshik	None
435	Łiidlajj	The Forks	609	Echoo dadhe'èjj	None
456	Thidyee choo	None	617	Goonèlkak	Cecil's Cabin
461	Jim Nagle viteetshik	Nagle Creek	649	Nuudlajj gugwidiit'it	A bend in Travailant River
463	Guk'an hidh chuudlajj	None	666	Thad's Cabin	None
475	Gwaatr'ii	Adam's Cabin, Adam Cabin Creek	674	Tr'ineht'ieet'iee	Gabe's Cabin
476	Gisheih jiikaii	None	677	Tsiigehnjik	Arctic Red River
479	Łajj van tshik	None	688	Vihtr'ii tshik	Thunder River
509	Teetshik goghaa OR Zeh gwishik	Old Arctic Red River site			

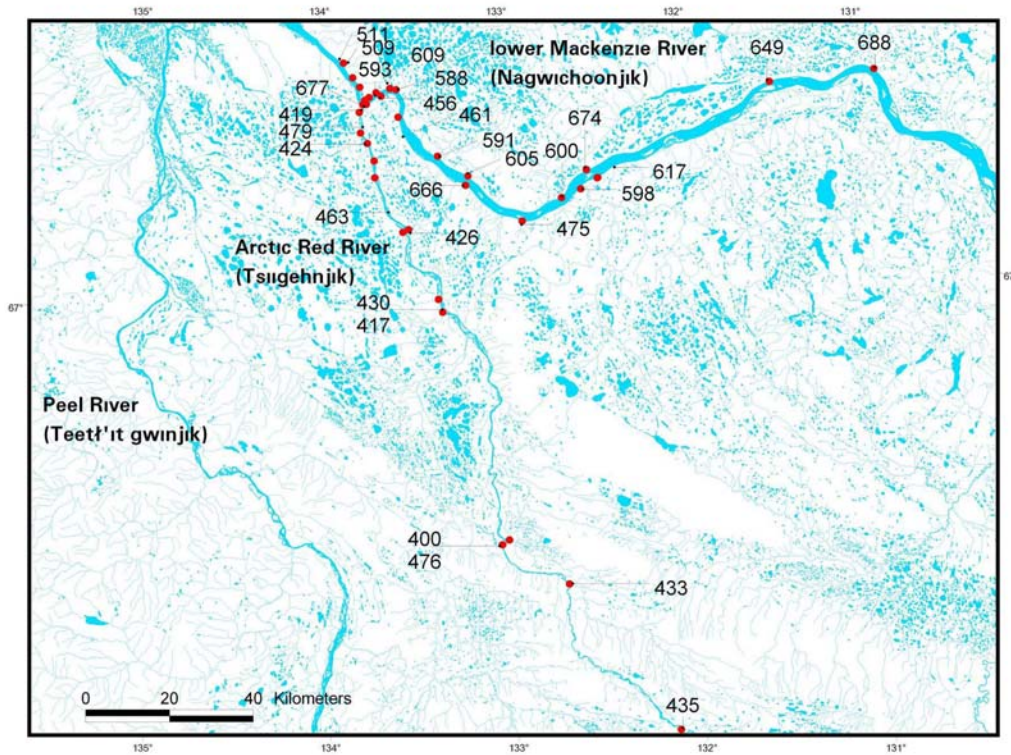


Figure 2: Study Area with Gwichya Gwich'in Place Name codes (see Table 1 for names)

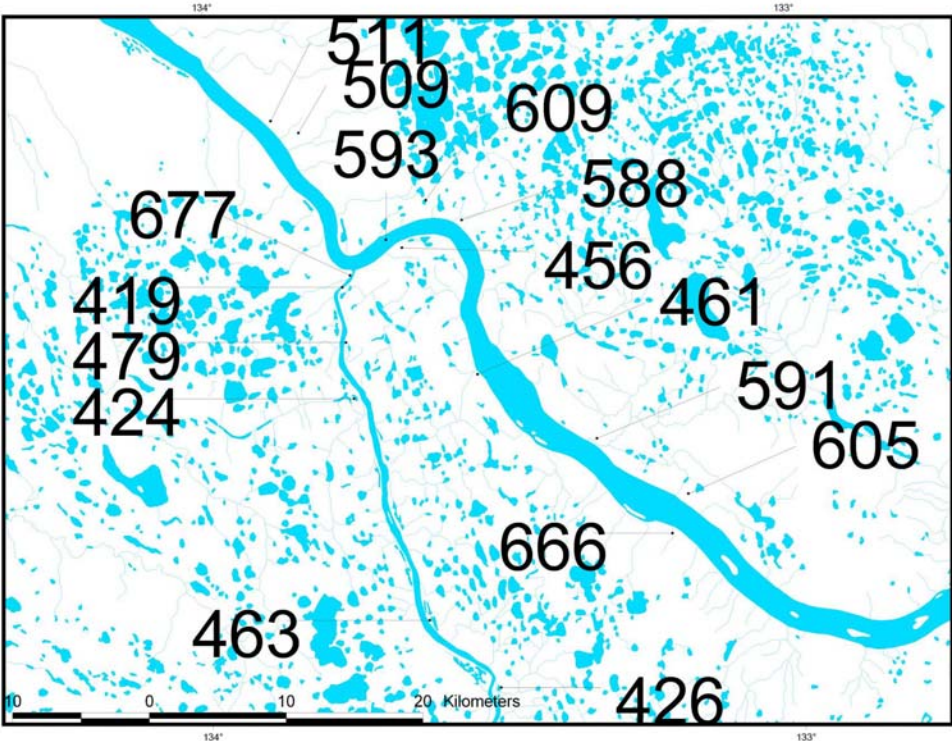


Figure 3: Close up of study area near Tsiigehnjik with Gwich'in place name codes

Table 2: Names of fish species that were identified in interviews. Information was gathered from Tetl'it Gwich'in Language Dictionary (2005). Rivers refer to Tsiigejnjik (ARR) and Nagwichoonjik (MR).

Gwichya Gwich'in	Tetl'it Gwich'in	Local Name	Common Name	River	Scientific
Łuk zheii (Łuk dagajj)	Łuk zheii (Łuk dagajj)	Whitefish	Broad whitefish	Both	<i>Coregonus nasus</i>
Dalts'in	Dalts'an	Crookedback	Lake whitefish	Both	<i>Coregonus clupeaformis</i>
Sruh	Sruh	Coney	Inconnu	Both	<i>Stenodus leucichthys</i>
Treeluk	Treeluk	Herring	Arctic cisco	Both	<i>Coregonus autumnalis</i>
Treeluk	Treeluk	Herring	Least cisco	Both	<i>Coregonus sardinella</i>
Chehluk	Chehluk	Loche	Burbot	Both	<i>Lota lota</i>
Sriijaa	Sriijaa	Grayling	Arctic grayling	Both	<i>Thymallus arcticus</i>
Dhik'ii	Dhik'ii	Char	Dolly varden char	Both	<i>Salvelinus malma</i>
Eltyin	Eltin	Jackfish	Northern pike	Both	<i>Esox lucius</i>
daats'at	daats'at	Sucker	Longnose sucker	Both	<i>Catostomus catostomus</i>
Shii	Shii	Dog salmon	Chum salmon	Both	<i>Oncorhynchus keta</i>
		Pickrel	Walleye	Both	<i>Stizodeum vitreum</i>
			Ninespine stickleback	Both	<i>Pungitius pungitius</i>
			Flathead chub	Both	<i>Platygobio gracilis</i>
			Lake chub	Both	<i>Couesius plumbeus</i>
			Longnose dace	Both	<i>Rhinichthys cataractae</i>
			Northern redbelly dace	Both	<i>Phoxinus eos</i>
			Arctic lamprey	Both	<i>Lampetra japonica</i>
			Slimy sculpin	Both	<i>Cottus cognatus</i>
			Spoonhead sculpin	Both	<i>Cottus ricei</i>
			Trout perch	Both	<i>Percopsis omiscomaycus</i>
			Round whitefish	Both	<i>Prosopium cylindraceum</i>
			Brook stickleback	MR	<i>Culaea inconstans</i>
			Lake cisco	MR	<i>Coregonus artedi</i>

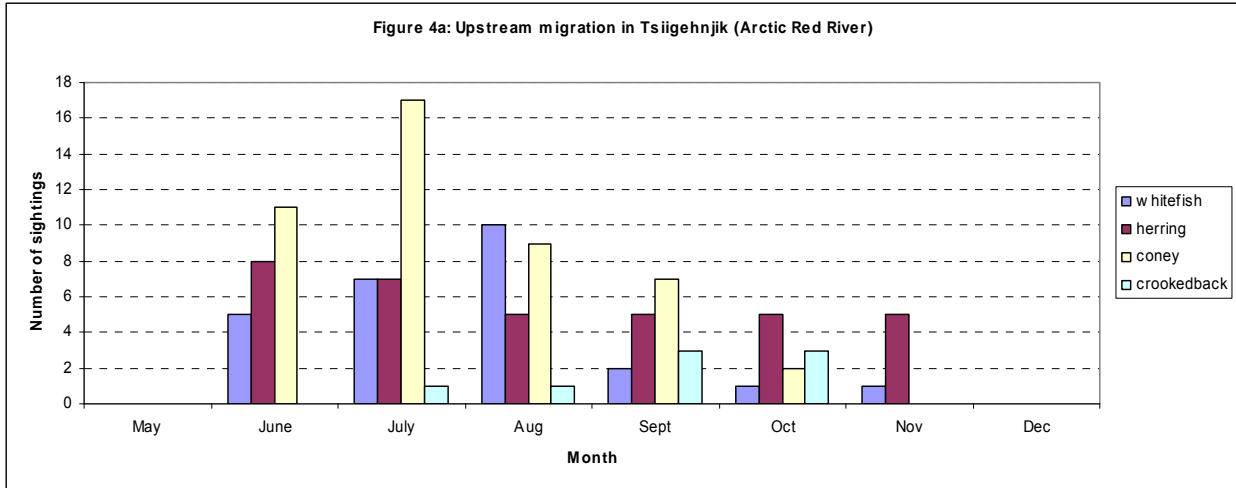


Figure 4a: Upstream migration of fish species in Tsiigejnijk based on interviews.

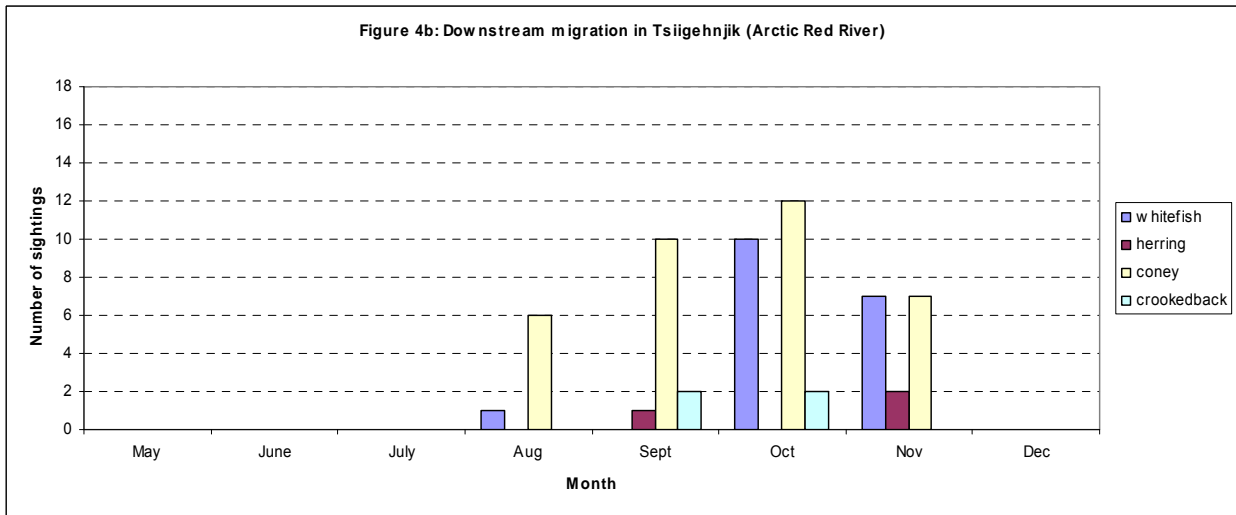


Figure 4b: Downstream migration of fish species in Tsiigejnijk based on interviews.

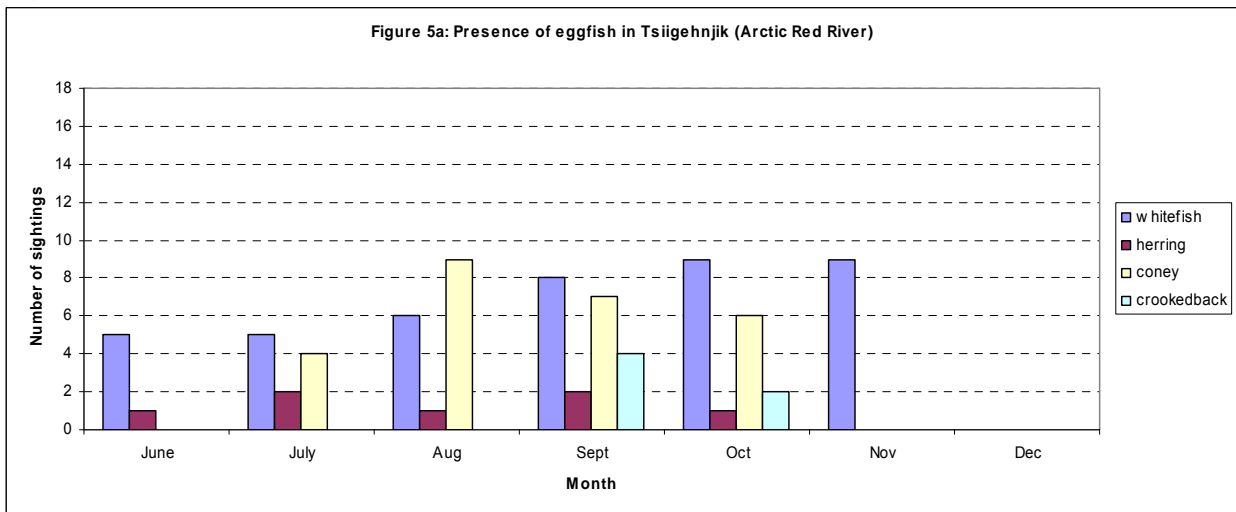


Figure 5a: Presence of eggfish in Tsiigejnijk based on interviews.

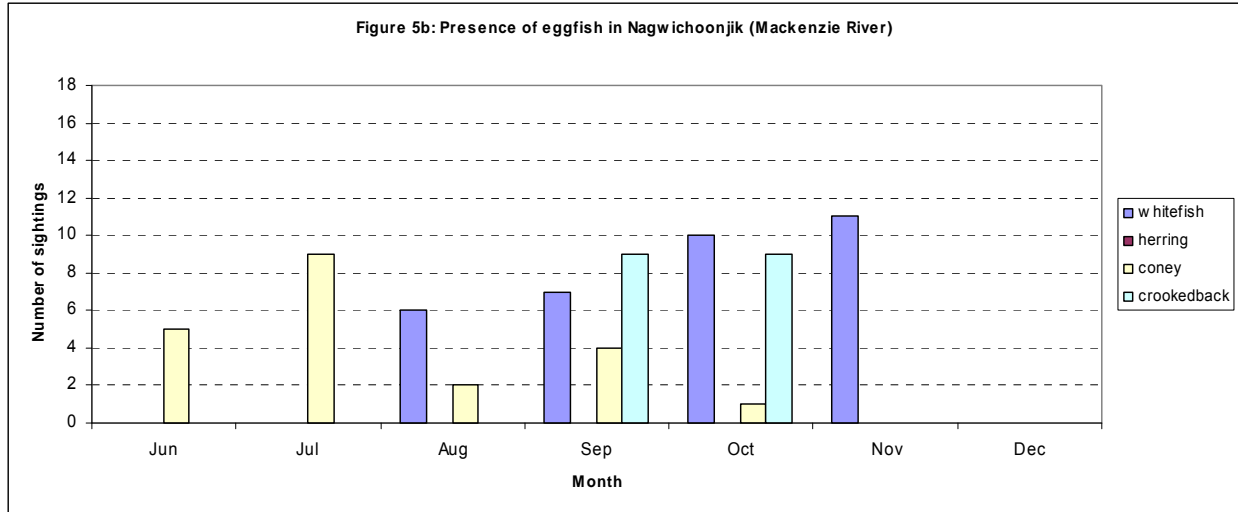


Figure 5b: Presence of eggfish in Nagwichoonyjik based on interviews.

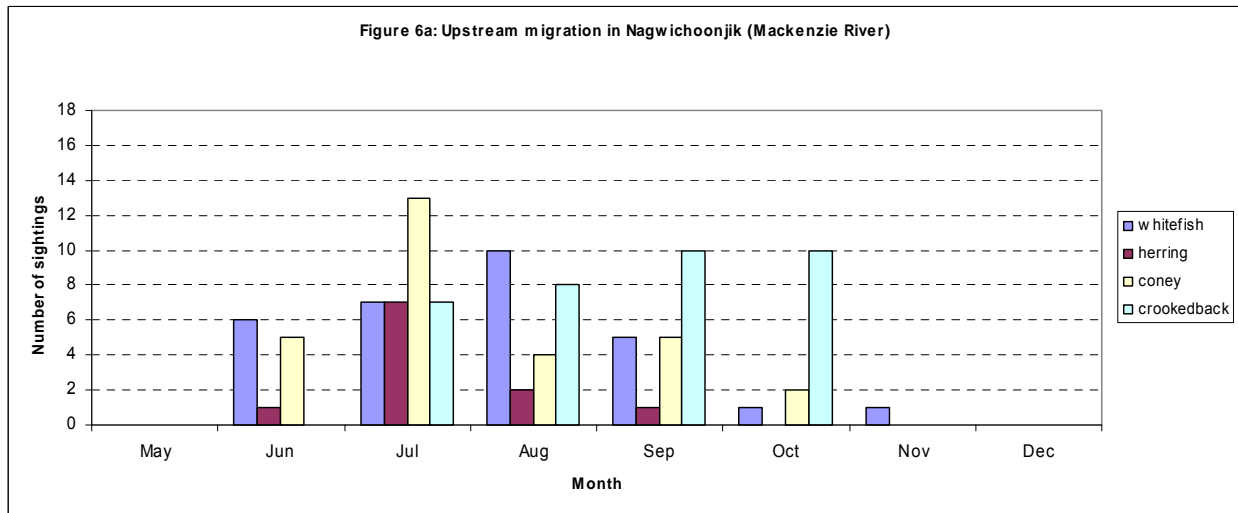


Figure 6a: Upstream migration of fish species in Nagwichoonyjik based on interviews.

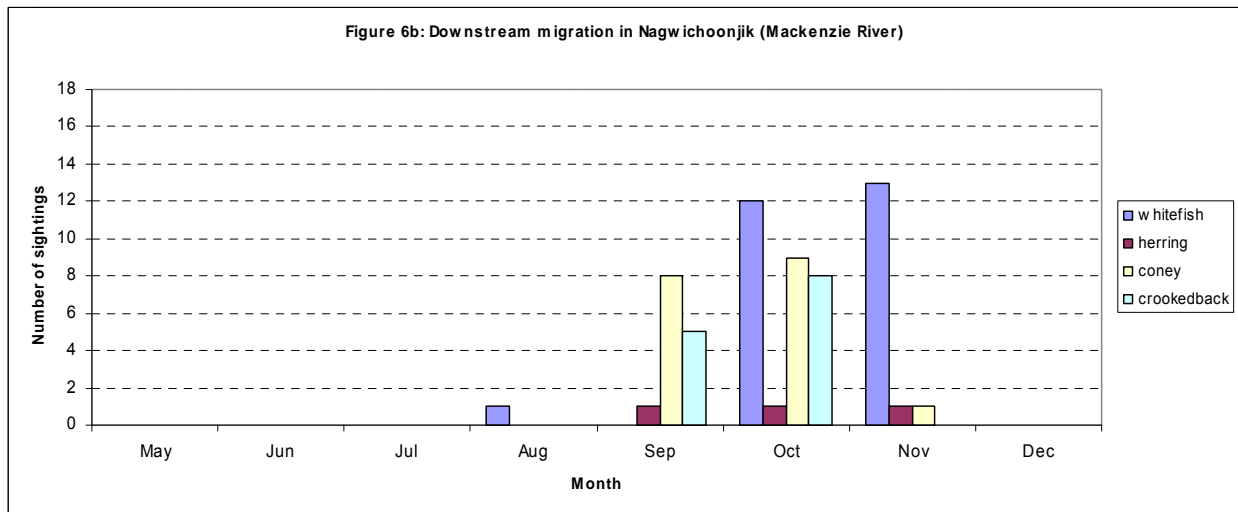


Figure 6b: Downstream migration of fish species in Nagwichoonyjik based on interviews.

## **Łuk zheii (Whitefish)**



### ***Tsiigehnjik (Arctic Red River)***

Our traditional knowledge (TK) interviews revealed that most łuk zheii (whitefish) migrate up Tsiigehnjik from June to September, peaking in June to August (Figure 4a) and come back down in October and November (Figure 4b). Interviewees reported that łuk zheii went as far as the Forks of the Cranswick River and Tsiigehnjik (“the forks”, *Łiidlajj*, Table 1 and Figure 2). These results complement a previous scientific study that found that łuk zheii traveled upstream from late August to October and spawned out fish returned downstream in November (Stein *et al.* 1973b). Participants revealed that people catch females carrying eggs (not necessarily ripe – see Discussion), which are commonly referred to as “egg fish” from June to November (Figure 5a). Previous scientific studies reported that łuk zheii spawn from mid-October to early November (Reist and Bond, 1988). Most fishermen could not identify specific spawning locations. However, many indicated that łuk zheii travel far up Tsiigehnjik (probably to spawn). Sonny Blake stated that “...whitefish spawn in creeks. They like the area below Bernard Creek in the Arctic Red River”. Caroline Andre stated fish usually go up river to spawn then immediately come back. She also remarked that whitefish go as far as Weldon Creek (Table 1 and Figure 2) in the Tsiigehnjik then come back. This site was also reported as a potential spawning site in the scientific literature (Tallman *et al.* 2002).

### ***Nagwichoonyik (lower Mackenzie River)***

In Nagwichoonyik, our interviews revealed that łuk zheii migrate upstream from June to November, peaking from June to September (Figure 6a). They travel at least as far as Thunder River (*Vihtr’ii tshik*, Figure 7 and Table 1) and some interviewees indicated they go as far as Fort Good Hope (Gabe Andre, Frederick Blake Sr., and one anonymous interviewee). Łuk zheii return downstream in October and November (Figure 6b). Other TK states that people start catching łuk zheii at 6 Mile Camp on the Mackenzie River, below Tsiigehnjik, around August 10. The fish then migrate upstream to Ramparts and come back down in October (Gwich’in Elders and Raygorodetsky 1997). Similar results were found by scientific studies. Pre-spawning łuk zheii move upstream in September and October past Fort Good Hope and post-spawning fish return downstream in November to travel to overwintering sites (Reist and Bond 1988, Van Gerwen-Toyne and Tallman 2006). Our participants revealed that eggfish are caught from August to November but most are caught during October and November in Nagwichoonyik (Figure 5b). This fits well with results of the scientific study by Reist and

Bond (1988) who found that łuk zheii spawn in Nagwichoonyik between mid-October and early November.

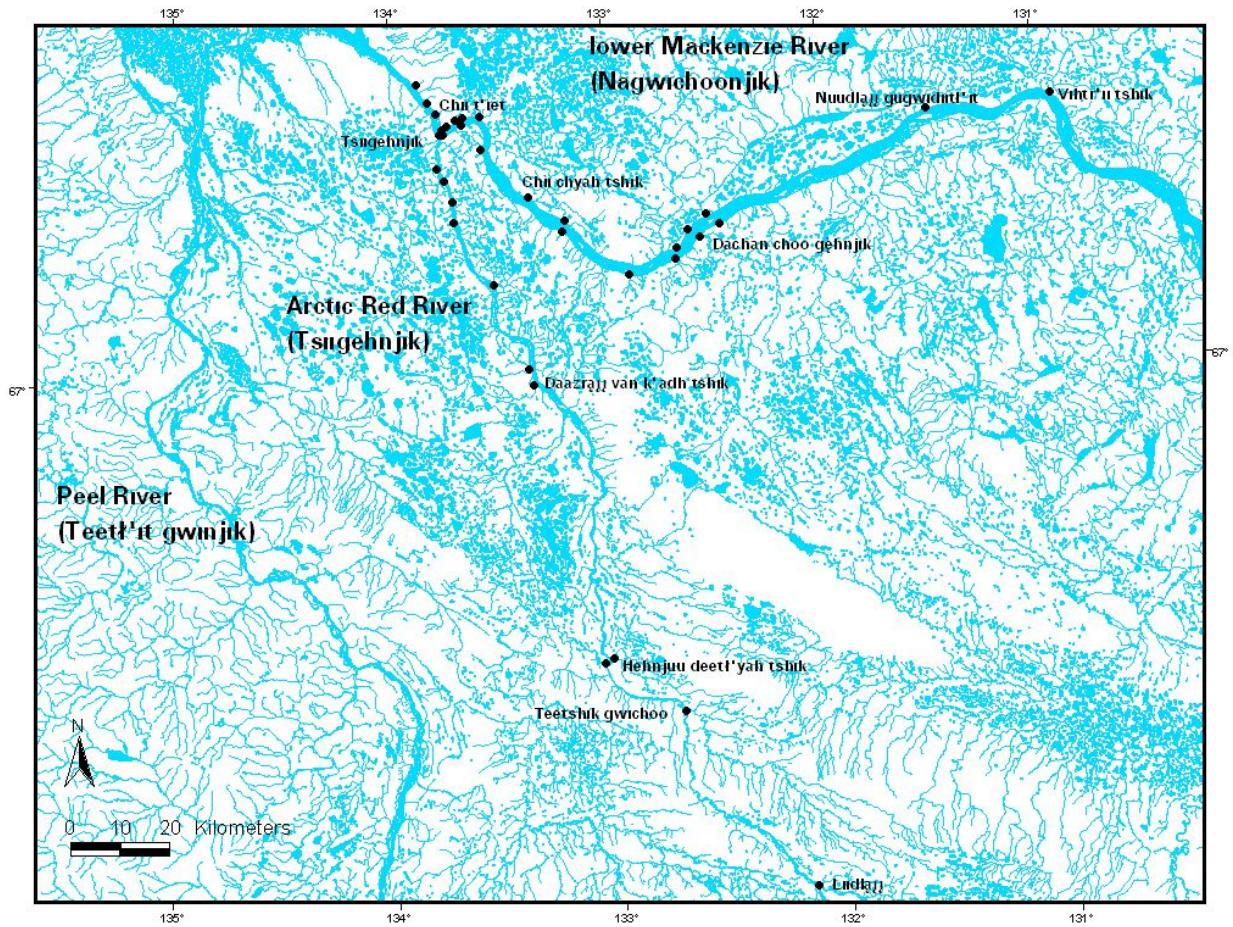


Figure 7: Fishing locations for łuk zheii (whitefish).

## Sruh (Coney)



### ***Tsiagehnjik***

Participants revealed that sruh (coney) migrate up Tsiagehnjik from June to October, with the run peaking in July (Figure 4a). Sruh go as far as the Forks of the Cranswick

River and Tsiigehnjik (Łiidlajj, Figure 8 and Table 1). They come back down between August and November (peaking in October; Figure 4b). Eggfish are caught in Tsiigehnjik between August and October (Figure 5a). Similarly, scientific studies found that sruh run upstream in Tsiigehnjik during July and August and run downstream during September and October (Howland 1997). Howland (1997) also provided good evidence that sruh spawn five to ten kilometres downstream from Cranswick River (the forks) in Tsiigehnjik. She located radio-tagged sruh, observed large numbers of ripe sruh and directly observed sruh jumping out of the water on several occasions. Our traditional knowledge interviews support these observations: Frederick Blake Sr., George Niditchie, Gabe Andre and Sonny Blake all identified the area between Weldon Creek and the forks as a potential spawning ground for many species of fish.

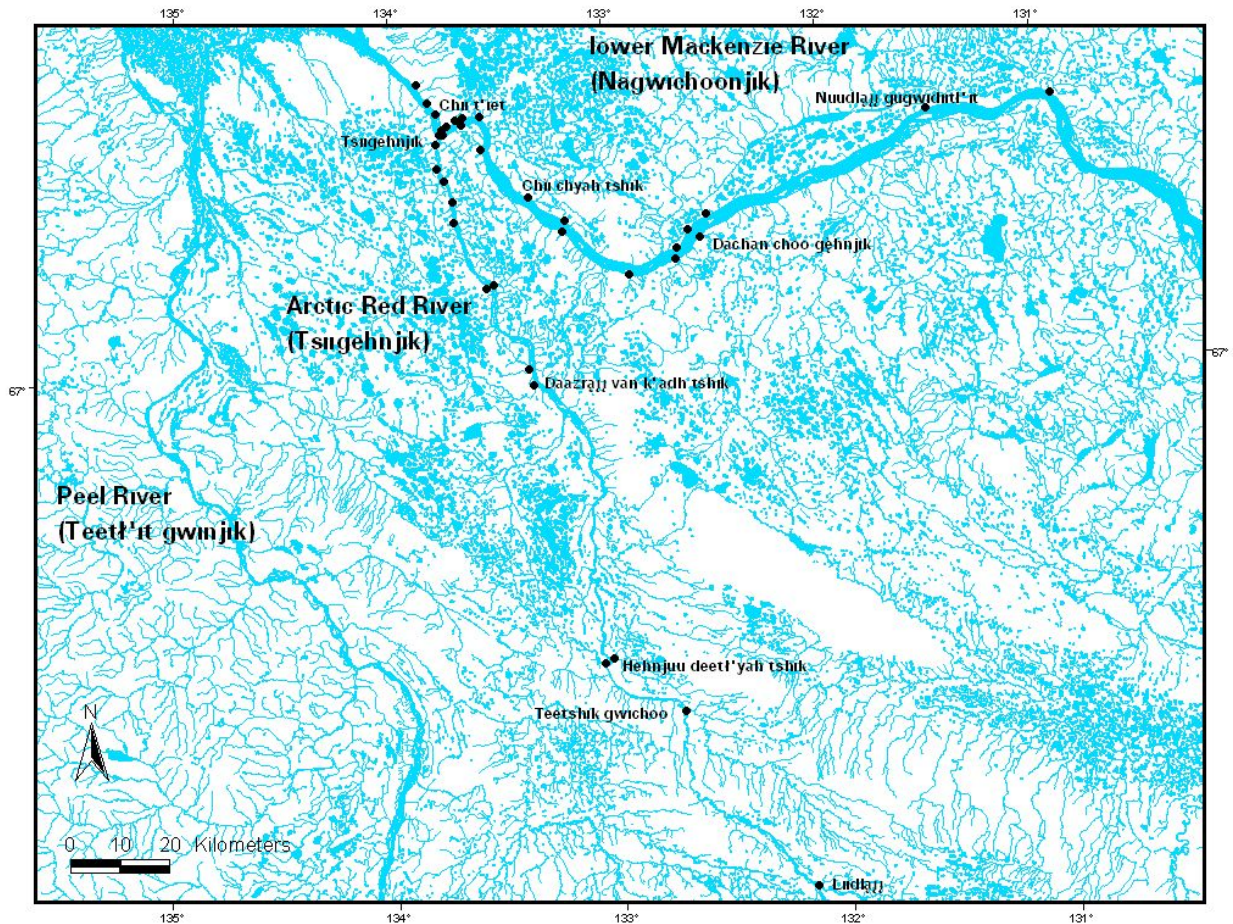


Figure 8: Fishing locations for sruh (coney).

### **Nagwichoonyjik**

Participants identified that sruh move up the Nagwichoonyjik from June to October (peaking in July; Figure 6a). Most people reported that sruh return downstream in September and October. However, one individual claimed they move downstream in November (Figure 6b). Most fishers recall seeing sruh as far as Thunder River (Figure 8 and Table 1), however, Gabe Andre and Frederick Blake Sr. confirmed that sruh travel further, going at least to Fort Good Hope. Most people said they see eggfish in July but



indicated that eggfish are around from June to October (figure 5b). Our interviews gave similar migration results to a scientific study conducted by Reist and Bond (1988) that found that pre-spawning sruh move upstream throughout the summer, spawn in September and early October, and then move downstream in October. Another scientific study conducted by VanGerwen-Toyne and Tallman (2006) also found that sruh moved upstream from July to September and returned downstream in October.

### **Dalts'in (Crookedback)**



#### ***Tsiigehnjik***

The migration timing of dalts'in (crookedback) was not clearly identified in Tsiigehnjik. The few people that did respond said that dalts'in move upstream between June and October, come back downstream September and October, and carry eggs between September and October (Figures 4a and 5a). A previous scientific study documented dalts'in in Tsiigehnjik moving upstream in mid September, presence of ripe eggfish (close to spawning) during the first week of October, and spent fish moving downstream in late October and early November (Stein *et al.* 1973b).

#### ***Nagwichoonjik***

Interviews revealed that dalts'in move up Nagwichoonjik from July to October (Figure 6a) and return downstream in September and October (Figure 6b). Most interviewees indicated that dalts'in only migrate about five to twenty miles upstream past Tsiigechtchic. However, there were a few people that caught them at Travailant River and Thunder River (Figure 9 and Table 1). This observation along with the fact that eggfish are caught during September and October (Figure 5b) suggests that there may be a spawning ground upstream from Tsiigechtchic. This traditional knowledge complements a previous scientific study where pre-spawning dalts'in were caught in mid to late August, spawning occurred in late September and early October, and post-spawning fish were caught moving downstream in November (Reist and Bond, 1988).

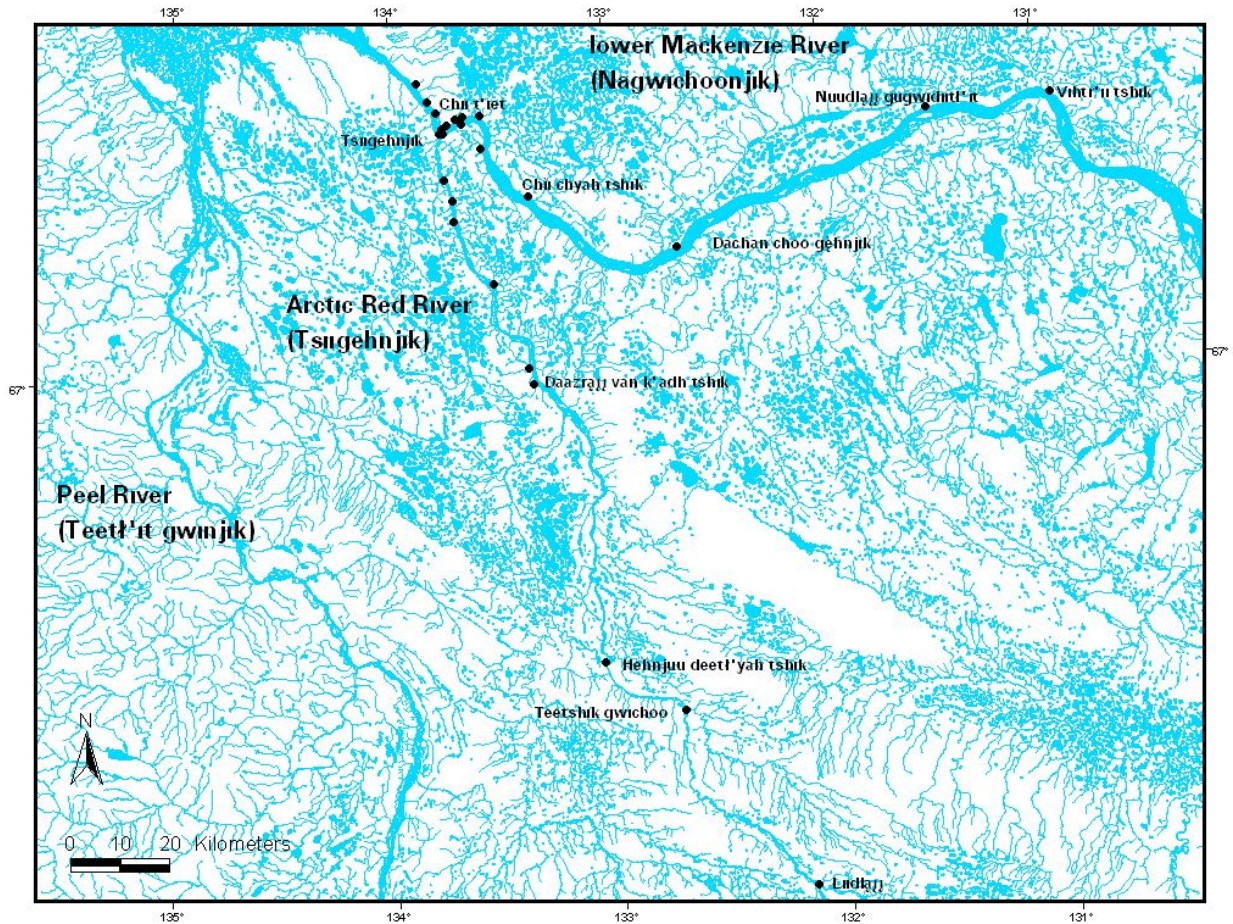


Figure 9: Fishing locations for dalts'in (crookedback).

### Treeluk (Herring)



Fishers do not distinguish between arctic cisco and least cisco so the interview results refer to cisco species collectively. These fish and are called treeluk in Gwich'in.

### ***Tsiigehnjik***

Participants identified that treeluk (cisco) move up Tsiigehnjik between June and October (Figure 4a). Most are caught near the mouth of the river but some were caught at Bernard Creek and the Forks of the Cranswick River and Tsiigehnjik (Łiidlajj) (Figure

10 and Table 1). Treeluk move down Tsiigehnjik from September to November (Figure 4b). People remember catching ripe females mostly near the mouth of Tsiigehnjik between June and October (Figure 5a). The number of respondents for the downstream migration and presence of egg fish was low. A scientific study conducted by Stein *et al.* (1973b) found that arctic cisco migrate up Tsiigehnjik during the summer months and that post-spawning arctic cisco return downstream in October. They found that least cisco move up Tsiigehnjik in late August to October, but did not document their downstream movements. Also, their study did not identify any spawning areas for either species.

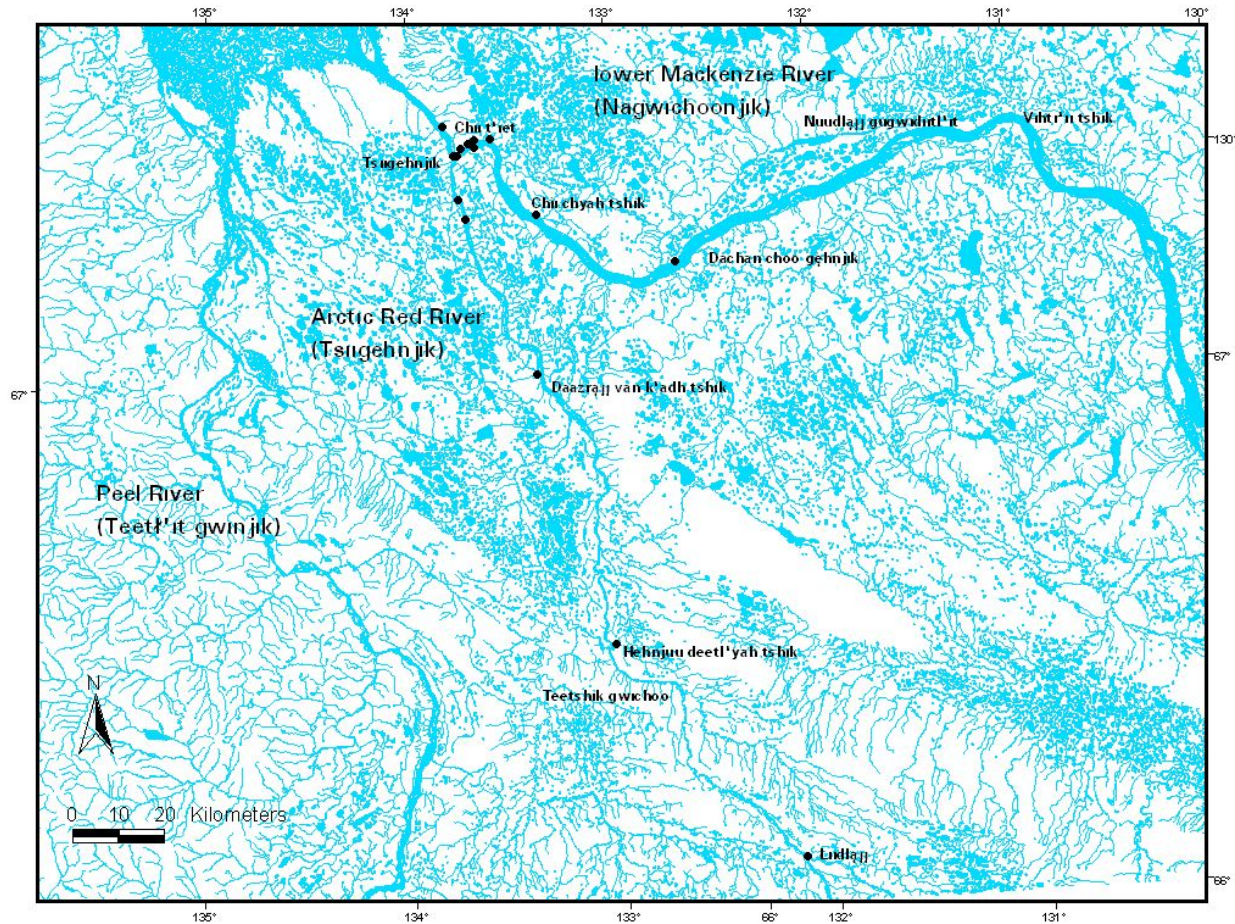


Figure 10: Fishing locations for treeluk (herring).

### **Nagwichoonyik**

Interviews revealed that treeluk move up the Nagwichoonyik between June and September, with the run peaking in July (Figures 6a). Although the response was low, people indicated they return downstream between September and November (Figure 6b). Interview participants did not recall catching eggfish in the Nagwichoonyik (Figure 5b). Migration timing as reported by interviewees was corroborated by a scientific study conducted by Reist and Bond (1988) who found pre-spawning arctic cisco moving up Nagwichoonyik during the summer starting in May and post-spawning cisco returning to the delta in early October. This scientific study also found that least cisco migrate

upstream in late August to September. However, post-spawning least cisco were not documented

### **Chehluk (Loche)**



Interviews revealed that people know when chehluk are around but are uncertain of the direction they are heading. Some people indicated that chehluk do not migrate (Dale Clark and George Niditchie).

### ***Tsiigehnjik***

They appear in Tsiigehnjik throughout the fishing season (Figure 11). Their presence seems to increase in the fall when most people are jigging (fishing with line and hook through the ice). Females with eggs in Tsiigehnjik are always around but are mostly caught during the fall. In previous scientific studies, movements have been recorded to coincide with Arctic grayling, a fish on which chehluk feed (Stein *et al*, 1973b).

### ***Nagwichoonjik***

In Nagwichoonjik, chehluk are always around but are seen more in the spring and fall months (Figure 12). Females with eggs were caught in the Nagwichoonjik during all seasons but seem to increase in prevalence in the fall (Figure 5b).

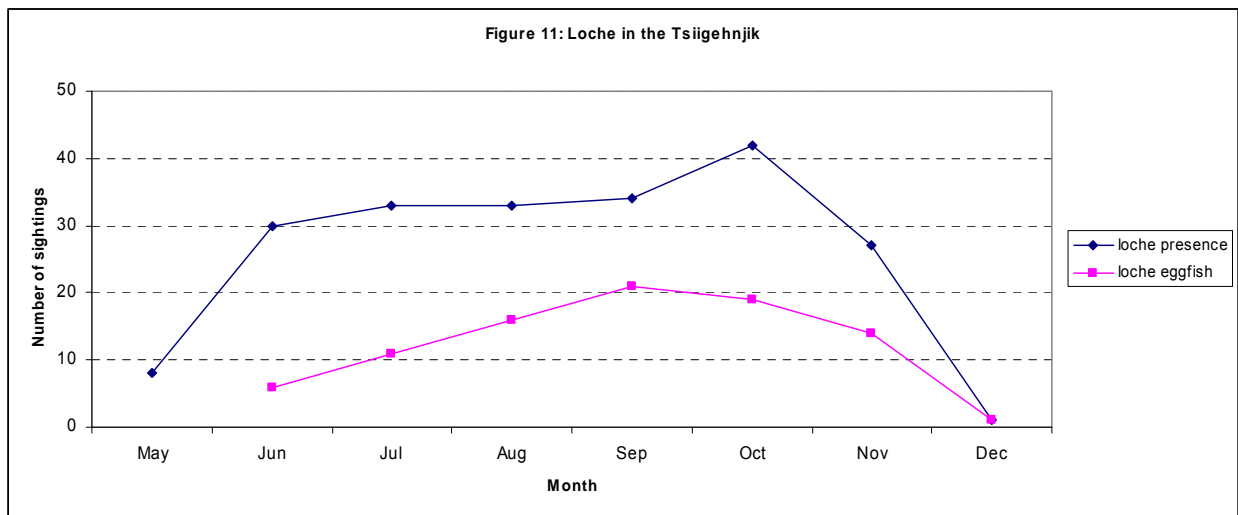


Figure 11: Chehluk presence in Tsiigehnjik. Blue line represents times when people see chehluk and the pink line is when people see chehluk eggfish.

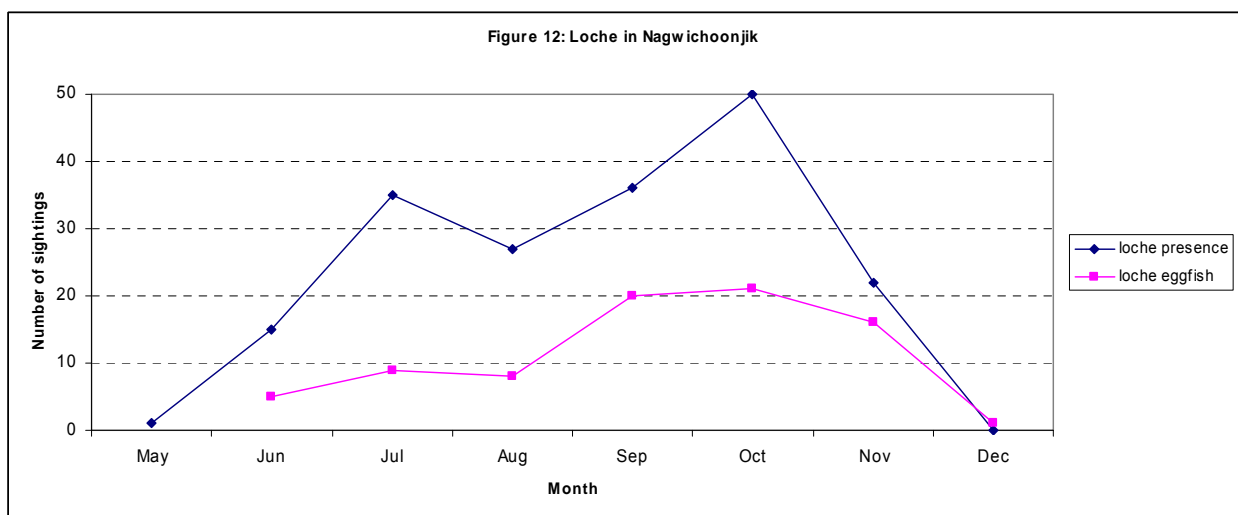


Figure 12: Chehluk presence in Nagwichoonyjik. Blue line represents times when people see chehluk and the pink line is when people see chehluk eggfish.

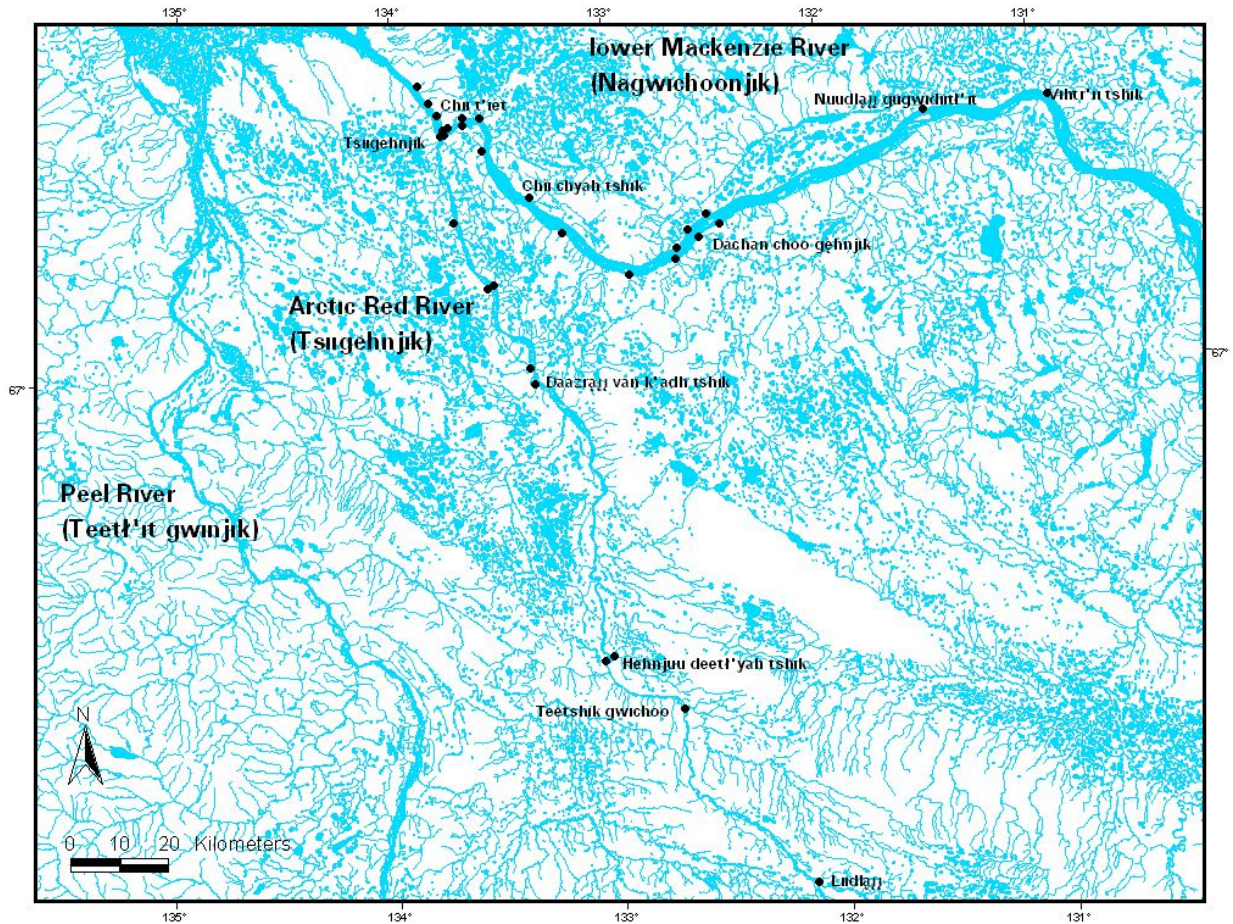


Figure 13: Fishing locations for chehluk (loche).

### Miscellaneous species

There were many species that were caught by fishers in such small numbers that no trends were evident. Shii (salmon) were caught exclusively in Nagwichoonyik (Figure 14). Eltin (jackfish) were observed in many places as well but seem to concentrate near the mouth of Tsiigehnjik (Figure 15). Srijaa (bluefish) were observed up Tsiigehnjik, mostly at Bluefish Creek but some were also caught in Nagwichoonyik. Pickerel (walleye) were caught in both rivers (Figure 17). Daats'at (suckers) were seen up Tsiigehnjik and Nagwichoonyik, however, they were slightly concentrated near mouth of Tsiigehnjik (Figure 18). Fishermen caught ninespine stickleback in Nagwichoonyik near Tsiigehntchic. Dhik'ii (char) were only observed near the mouth of Tsiigehnjik.

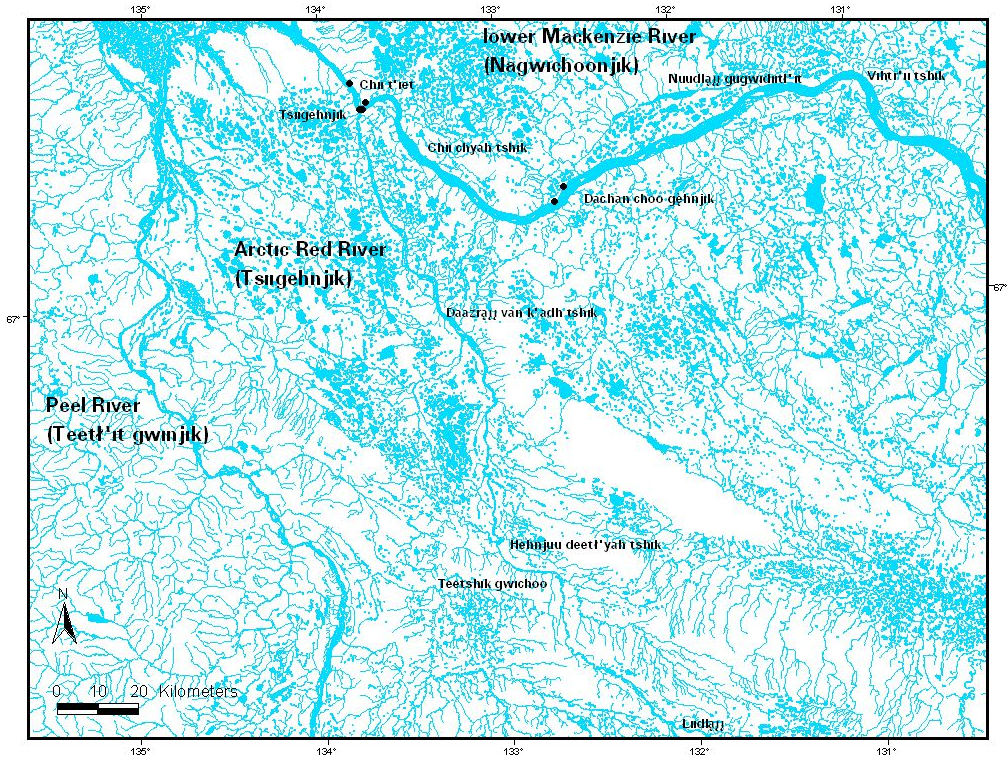


Figure 14: Fishing locations for shii (salmon).

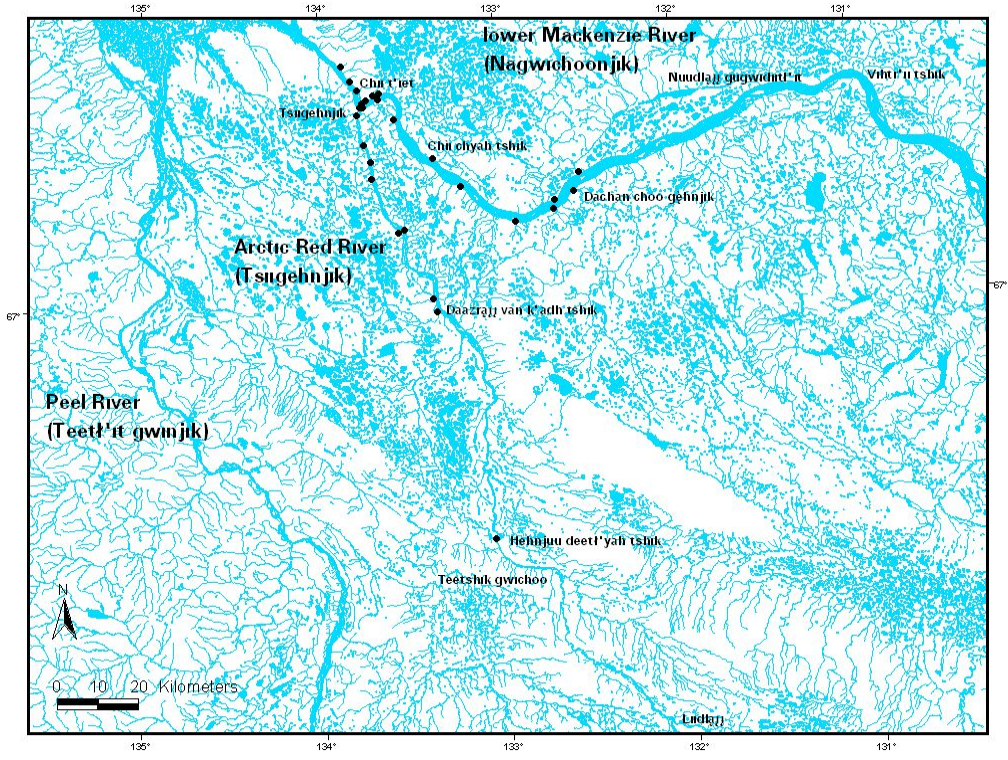


Figure 15: Fishing locations for eltin (jackfish).

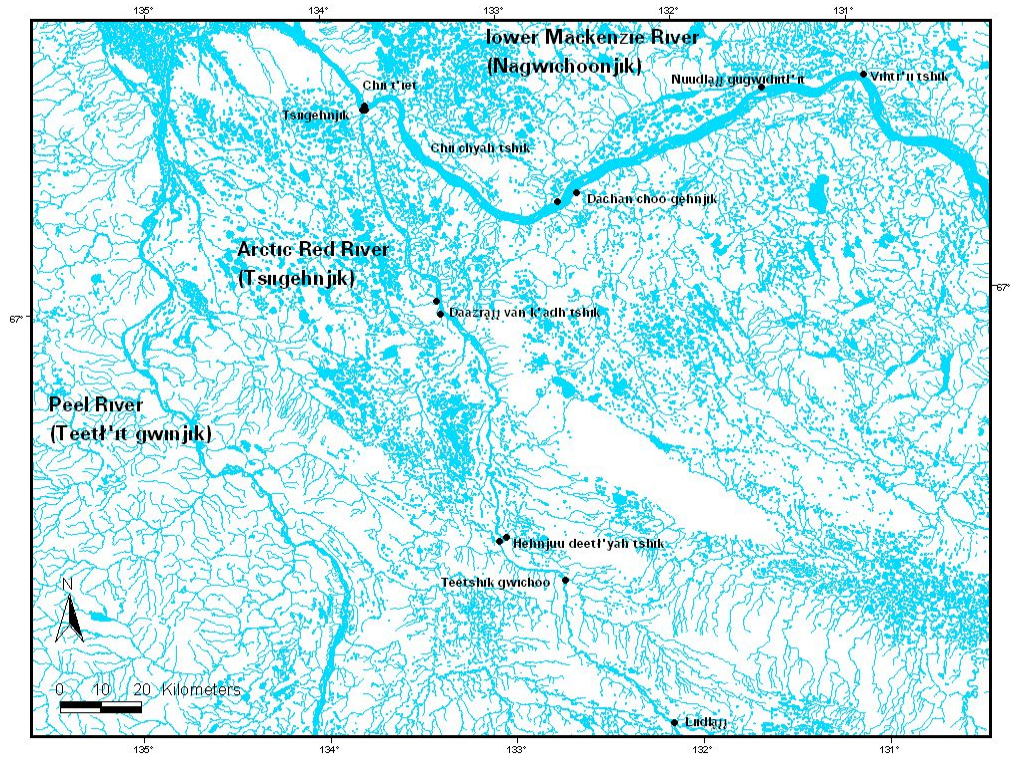


Figure 16: Fishing locations for sriijaa (bluefish).

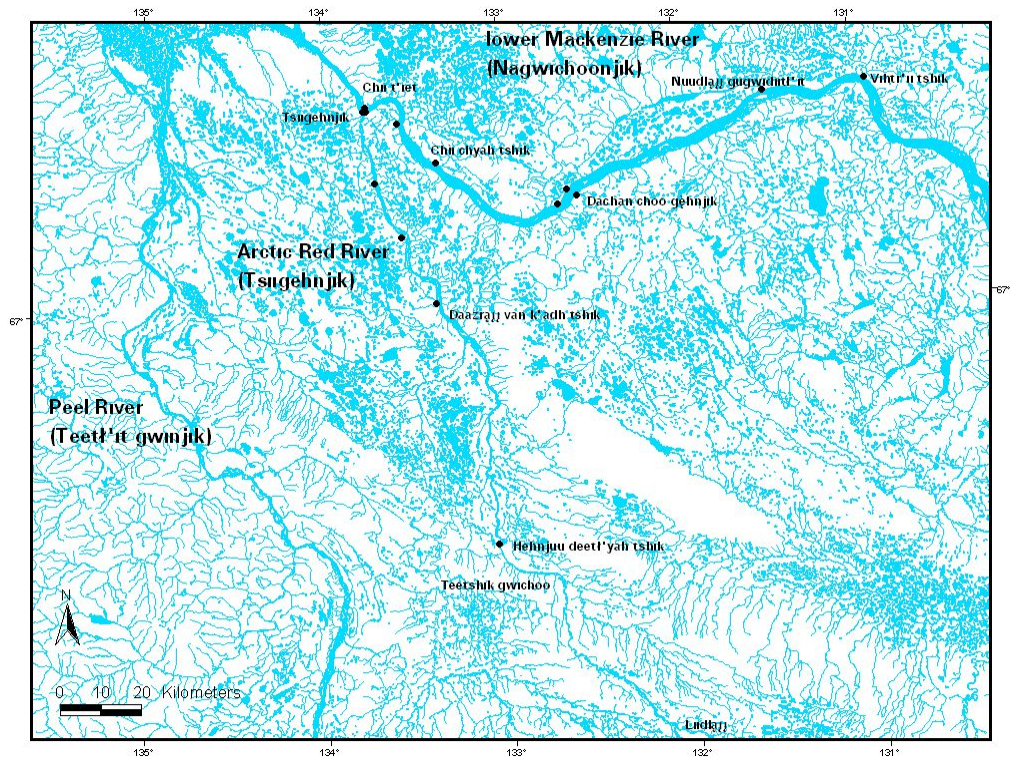


Figure 17: Fishing locations for pickerel (walleye).



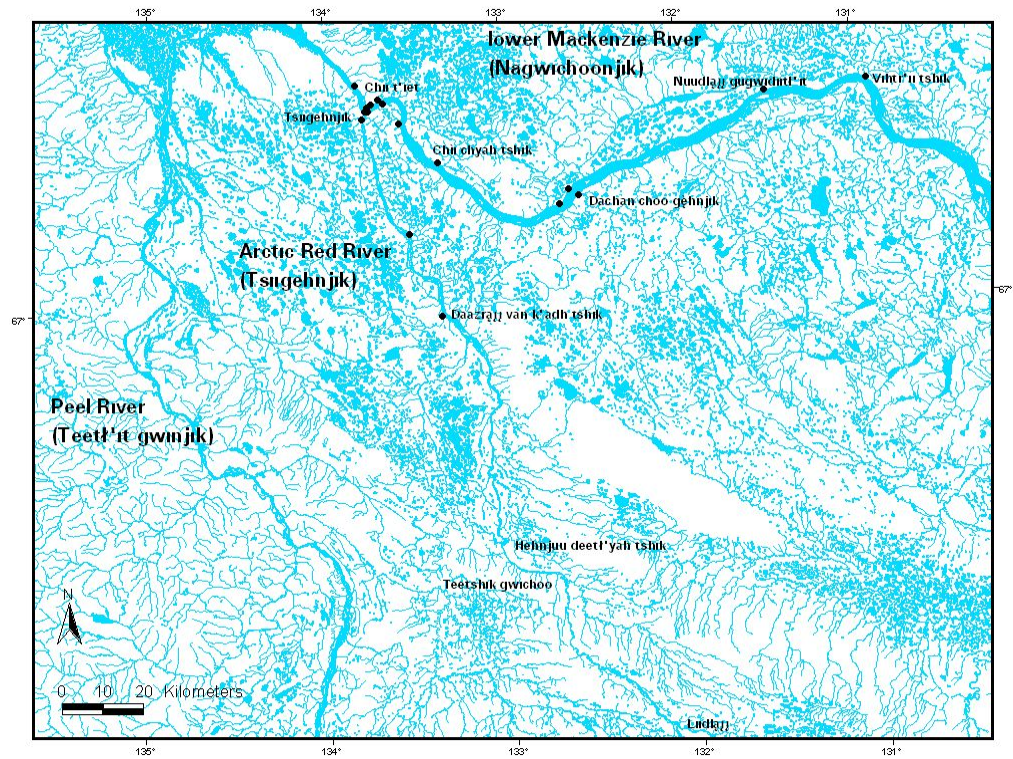


Figure 18: Fishing locations for daats'at (sucker).

Migration and spawning patterns in Nagwichoonyjik (MR) and Tsiigehnjik (ARR)

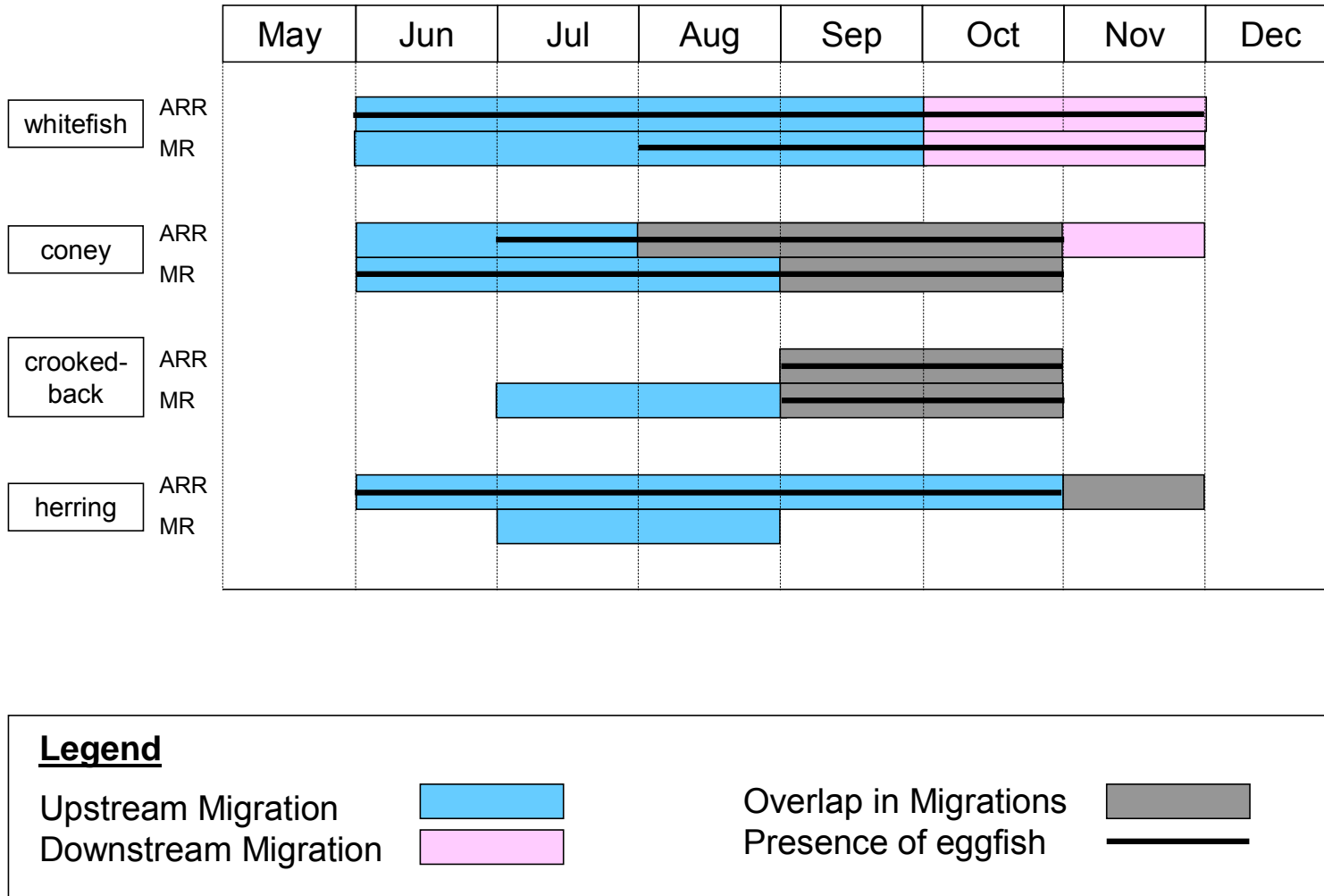


Figure 19: Summary of migration patterns and presence of eggfish for important fish species in Nagwichoonyjik and Tsiigehnjik based on interviews.

## DISCUSSION

### *Workshop information*

During the workshop, we asked participants to clarify certain questions that came up during interviews. The first question that arose during our analysis of the data was how fishers know which direction (upstream vs. downstream) fish are travelling. According to workshop participants, there are three ways of knowing:

1 – the direction the fish are caught in the net. This is a good indicator unless the net is set in an eddy (where the water is circulating)

2 – when fish are caught along the river relative to other fishing camps. For example, people catch crookedback at Tsiigehtchic before people catch them at Tree River.

3 – traditional and scientific knowledge. People know that fish migrate from the ocean and know that they are suppose to come at a certain time and return at a certain time so when they see them they can assume they are moving upstream or coming back downstream.

Our next question to participants was how they know when fish are spawning (in our interviews we asked when do fish spawn). Participants responded that you can identify a spawning fish when a fish that you are handling has eggs or sperm that flows out. When you catch fish of this same species later in the year and nothing comes out then you know they are not spawning anymore. Similarly, we asked participants to tell us what eggfish are. In our analysis, we often found that interviewees reported seeing eggfish for many months (for a period of time far greater than the spawning period). To clarify whether eggfish are spawning fish, we asked for an explanation in the group workshop. Participants told us that an eggfish is any female fish carrying eggs. This is an inclusive definition for an egg-bearing fish at any stage of egg development and does not necessarily indicate that the fish is ready to spawn or is spawning. The final issue that came to our attention during our analysis of the interviews was how interviewees were able to determine whether a fish that was caught near the confluence of Tsiigehtchic and Nagwicheonjik was from one but not the other of these rivers. Specifically, we asked how far away from the Tsiigehtchic must you go before you know you are catching only fish from Nagwicheonjik. Participants responded that fish caught on the Inuvik side of Nagwicheonjik were heading up (or down) Nagwicheonjik, but fish caught on the Tsiigehtchic side of the river could be heading up Nagwicheonjik or Tsiigehtchic.

### *Differences / Commonalities between the Tsiigehtchic and Nagwicheonjik*

Sonny Blake and Herbert Firth indicated that people fish for łuk zheii (whitefish) in Tsiigehtchic first, and when it slows they start to fish Nagwicheonjik. This observation indicates a possible difference in the timing of migration between these two rivers. This corresponds to the overall interview results for upstream migration timing. Łuk zheii start migrating in Tsiigehtchic in June (Figure 6a) and they start in July in Nagwicheonjik (Figure 9a). Dalts'in (crookedback) are caught more in Nagwicheonjik than Tsiigehtchic. In Nagwicheonjik, the migration of dalts'in stops about 5-20 miles past Tsiigehtchic. In Tsiigehtchic, the TK revealed a large overlap amongst dalts'in upstream and downstream migration timings. This could be due to many fish coming and going around

this time. Not clear when they are coming or going. The migration timing between the two rivers is similar suggesting they may have two separate populations moving up these rivers or that the upstream and downstream occur during the same months.

#### *Stock differences*

Some łuk zheii from Nagwichoonjik are larger than the ones caught in Tsiigehnjik (Doug Kendo and George Blake, Victor Modest, interview). People refer to these large łuk zheii as jumbo whitefish. The differences in size suggest two separate populations of łuk zheii. This is an excellent example of information that is readily identifiable from traditional knowledge.

Sruh (coney) migration in Tsiigehnjik and Nagwichoonjik occurs simultaneously. This suggests that there are probably two separate populations moving upstream (one in Tsiigehnjik and one in Nagwichoonjik).

#### *Historical differences*

There never use to be a lot of sruh (coney) in Tsiigehnjik (Herbert Firth and James Nerysoo) until 1950s or 1960s (Dale Clark). Nowadays, sruh are caught more often in Tsiigehnjik than Nagwichoonjik (Sonny Blake, Frederick Black Sr., James Nerysoo, Herbert Firth, Dale Clark). In the last two years, sruh are being caught near the ferry landing more often (Cecil Andre).

Dalts'in (crookedback) were not present in Tsiigehnjik (George Niditchie, James Nerysoo, Dale Clark, Sonny Blake, Herbert Firth, George Blake) until 1950-1960 (Dale Clark). Even nowadays, dalts'in are caught less in Tsiigehnjik than in Nagwichoonjik (Cecil Andre, George Niditchie, James Nerysoo, Sonny Blake).

#### *TK vs. Science*

The timing of migration that we recorded during interviews tends to be a wider range than what is reported in the scientific literature. Traditional knowledge is collected throughout an individual's lifetime and is often passed on from generation to generation. Rather than reflecting a snapshot in time (like scientific studies usually do), traditional knowledge incorporates the natural variation that occurs from year to year and decade to decade.

The traditional knowledge documented in this study was very useful for determining the timing of seasonal increases in abundance such as when important subsistence fish are carrying eggs (whitefish in particular). We documented TK of spatial variation in abundance because harvesters travel great distances during fishing seasons and know when and where fish are abundant. We also documented TK of the distribution of species. For example, harvesters explained that dalts'in are present in greater abundance in Nagwichoonjik than Tsiigehnjik. We also documented TK of spawning locations for the more important subsistence species (łuk zheii, sruh, and dalts'in).

On the other hand, there were some gaps in the TK regarding the direction of migration, especially for less important species. Most fishers knew when fish are abundant but

found it hard to remember which direction they were moving. However, one could assume direction by comparing sighting times to literature. We also found some gaps in the TK of the specific details for less important subsistence species. For example, spawning locations were only identified for the top three subsistence species.

## **CONCLUSION**

It is clear that local fishers have extensive traditional knowledge of the fish species in Tsiigehtjik and in Nagwichoonjik. They provided information that would be difficult to derive from scientific studies. For example, pinpointing where crookedback end their upstream migration would take intense tagging surveys to collect the same information. Overall, traditional knowledge corresponded very closely to findings from previous research studies. This corroboration suggests that fishers have a very clear understanding of when fish are migrating upstream and downstream and that they understand when fish are spawning. Traditional knowledge improves our current understanding of fisheries in this area and can be combined with other fisheries research to give a more complete and balanced understanding. Future studies should strive to include traditional knowledge into their research. Similar projects could be conducted in other important subsistence fishing rivers.

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## APPENDIX 1: INFORMED CONSENT FORM

For generations, the Arctic Red and Mackenzie rivers have been fished by Gwich'in. Knowledge of the fisheries resources of these rivers has been passed down to harvesters and elders. The objectives of this study are to collect community knowledge about:

1. Past and present fish harvesting within the Arctic Red River and the Mackenzie River near Tsiigehtchic;
2. The timing of fish migration and spawning in these rivers;
3. The use of habitat by fish (including spawning and rearing areas);
4. Identification of any critical or sensitive areas, or observations of ecological change.

Staff from the Gwich'in Renewable Resource Board will conduct interviews in Tsiigehtchic with the assistance of a local facilitator. This interview recording, whether it is audio, written, or photographic, and the resulting translations, and/or transcriptions, and/or images will be used to aid the community and others in making renewable resource management decisions.

**Your participation in this interview is completely voluntary. You have the right to refuse to answer questions you are not comfortable with. You also have the right to stop the interview at any time and withdraw your participation from the study.**

Original materials will be kept at the Gwich'in Renewable Resource Board office in Inuvik. A copy of the final report will be distributed to each organizations identified for consultation (Gwichya Gwich'in Renewable Resource Council, Tsiigehtchic Charter Community Council, Tsiigehtchic Metis Local # 63, Tsiigehtchic Charter Community Gwichya Gwich'in Band Council, Gwich'in Social and Cultural Institute and the Gwich'in Land Use Planning Board). According to the Gwich'in Traditional Knowledge Policy (GTC 2004), we will also supply copies of the Gwich'in community interviews to the GSCI for it's archives, as well as any reports, maps, posters, etc. that comes out of this research. Access to the original materials will be restricted according to your wishes and the wishes of the RRC. Your name will remain confidential unless your permission has been obtained in writing (see below).

**A. I agree to the use of the information I provide according to the conditions stated above.**

\_\_\_\_\_  
Participant Signature

\_\_\_\_\_  
Date

**B. I agree to use the information according to the terms outlined above.**

\_\_\_\_\_  
Interviewer Signature

\_\_\_\_\_  
Date

**C. I would like my name to be associated with the information I give and used in the transcripts, reports and products of this study.**

\_\_\_\_\_  
Participant Signature

\_\_\_\_\_  
Date

**D. I agree to have my picture taken and used in the report.**

\_\_\_\_\_  
Participant Signature

\_\_\_\_\_  
Date



## APPENDIX 2: INTERVIEW GUIDE

### Before Interview

- Reserve truck and camera
- Maps (large and small scale)
- Contact list (participants phone numbers and addresses)
- Audio recorder, adapter and microphone (if applicable) – Test it
- Pens and/or pencils
- Interview guide (1 copy per interviewer)
- Consent form (1 copy per participant)
- Questionnaire (1 double-sided word doc, 1 double-sided excel file)
- GSA fish species binder
- Invoice for each participant

### At Interview

1. Fill out interview start time (page 1) – other information can wait until later
2. Turn on recorder
3. Greeting and introductions
4. Drinks, snacks and calendar
5. Explanation of project – Read or explain the following paragraph.

We are here today to document your knowledge of fish in the area. We hope to record information about your experience fishing in the Mackenzie River, in the Arctic Red River, and near Tsiigehtchic (where these two rivers meet). First, we would like to know where you have fished and during which seasons. At each location, we would then like to record which fish you have caught or seen. We also hope to record when you think each species is migrating (up and down the river), when they spawn, and where they spawn. This information, when combined with our netting index study this summer, will allow us to establish baseline information about fish stocks in these locations. Currently there is no baseline information about fish stocks in these areas, so this study is essential for good fisheries management. At the end of the interview, we would like to know if you have any concerns about fish in the area or would like to know something particular about the fish resources in the area.

6. Consent Form – only continue if signed!
7. Interview
  - a. Show me where you fish – mark spots on **map** with an “F” in black marker.  
When? (time of year) – mark dates on **map** beside each fishing site with a black marker.
  - b. Which species are the most important to you – rank them on common species **page**!
  - c. For each common species:
    - One color for each species (on the **map**)!
    - Show me on the **map** where and when you see this species the most.
    - Does it migrate?
      1. If no, indicate no migration – mark on **map** and **page**.  
Ask them where they see it – mark on **map**  
Write down any other comments in comment section of **page**.
      2. If yes, show me on the map where it migrates - draw arrow on **map**!  
When does it migrate upstream and downstream? - mark on **map** and **page**!
  - d. Fill out other concerns **page**.
    - Uncommon species – show photos and ask questions.
    - Ask other questions (salmon, herring, fisheries priorities and other concerns).
8. Thank them and make payment arrangements, sign invoice and turn off recorder.

### APPENDIX 3: INTERVIEW QUESTIONNAIRE

Interview #:		Date:	
Participant:		Interviewer:	
Other attendants: _____			
Interview Start Time:		End Time:	
Consent form signed?	YES NO	Gender:	M F
Age Group:		Years fished:	
<u>Notes/ Comments:</u>			

**OTHER CONCERNS**

1. Have you seen any of these uncommon species? (see binder)

Char/Dolly Varden	Where (location & habitat): _____ When (time of year): _____ Number: _____ Comments: _____
Lake Trout	Where (location & habitat): _____ When (time of year): _____ Number: _____ Comments: _____
Jackfish	Where (location & habitat): _____ When (time of year): _____ Number: _____ Comments: _____
Walleye	Where (location & habitat): _____ When (time of year): _____ Number: _____ Comments: _____
Longnose sucker	Where (location & habitat): _____ When (time of year): _____ Number: _____ Comments: _____
Chum Salmon	Where (location & habitat): _____ When (time of year): _____ Number: _____ Comments: _____
Stickleback	Where (location & habitat): _____ When (time of year): _____ Number: _____ Comments: _____

2. Did you catch any Salmon when you were a kid (~what year)?

Do you still catch Salmon now?

a. How many did you catch (is it more/less than in the past)?

b. Where did you catch them?

c. When did you catch them?

d. What species did you catch (i.e. silver or colored)?

e. Did you see them spawning (where and when)?

f. Have you seen dead carcasses (where and when)?

3. Did you fish for herring in the past (~ when)?

What sized net did you use in the past?

Did you used to catch herring in large nets? Give net size.

Do you still fish for herring?

Do you catch herring today in large nets?

Do you think there are as many herring as there used to be? Explain.

4. Do you find differences between fishing in the Arctic Red River & Mackenzie River (if you fish both)? (i.e. Do you notice a difference in the size of Mackenzie whitefish in comparison with the ARR?)

5. Do you have any priorities for fisheries in the GSA?

6. Is there anything else you would like to say?

Species	Rank	Question	Migration			Spawning (does it correspond with migration?)	Habitat (Circle)		
			Upstream peak	Downstream peak			Lake	Stream	
Broad whitefish (Jumbo in MR?)		When?			When?		Lake	Stream	
		Comments							Shallow
Crookedback (stop after Tsig? few keep going?)		When?			When?		Lake	Stream	
		Comments							Shallow
Coney (2 stocks?)		When?			When?		Lake	Stream	
		Comments							Shallow
Bluefish/Grayling		When?			When?		Lake	Stream	
		Comments							Shallow
Herring		When?			When?		Lake	Stream	
		Comments							Shallow
Loche		When?			When?		Lake	Stream	
		Comments							Shallow
		When?			When?		Lake	Stream	
		Comments							Shallow
		When?			When?		Lake	Stream	
		Comments							Shallow

Species	Comments
Broad whitefish	
Crookedback	
Coney	
Bluefish/Grayling	
Herring	
Loche	