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**WILDLIFE  
PLANTS &  
FISHERIES**  
SECRETARIAT

**Arctic Charr (*Salvelinus alpinus* L.) Creel Survey Methodology:  
Investigating the winter and spring domestic harvest in Nain, Labrador**

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2010

**Torngat Joint Fisheries Board**  
**Torngat Wildlife, Plants & Fisheries Secretariat Series 2010/01**



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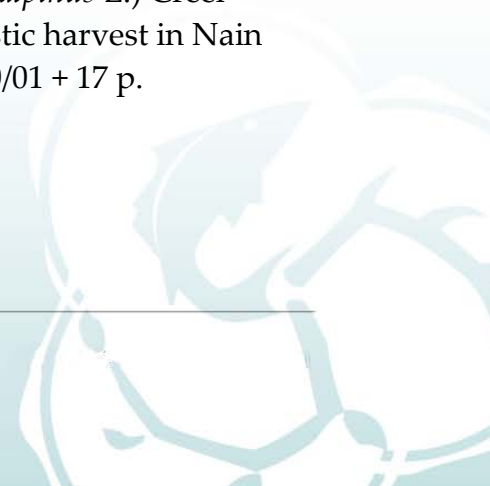


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## Table of Contents

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Executive Summary .....	1
AngajuKkaunet Naillitisimajanga .....	1
1.0 Introduction .....	2
2.0 The Arctic Char of Northern Labrador .....	3
Appearance .....	3
Freshwater reproduction .....	3
Migration to Sea .....	3
3.0 Consultation.....	4
4.0 Creel Survey.....	4
4.1 Survey locations .....	4
4.2 Survey technicians .....	5
4.3 Survey frequency .....	6
4.4 Survey information.....	6
Collecting Biological Data.....	7
Length.....	7
Weight.....	7
Length-mass regression .....	8
Sexing the fish.....	8
Aging – otolith removal .....	8
Genetic analysis – tissue samples .....	8
Feeding interactions - stomach content analysis .....	9
4.5 Data collection and analysis .....	9
4.6 Creel Survey Data Collection Form.....	10
Arctic Charr Local Knowledge Survey .....	13
Nain Area Map.....	14
Closing Statement .....	15
References .....	16



## List of Figures

---

Figure 1. Lateral view of an Arctic charr (IPY, 2006) .....	3
Figure 2: North Labrador map illustrating the location of the anadromous Arctic Char stock complex areas. (Dempson et al., 2004) .....	5

## List of Tables

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Table 1: The Following are length-weight regression coefficients, from $\log W = \log a + b(\log L)$ , for Arctic charr sampled from Nain area .....	8
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## Executive Summary

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This report outlines the project plans to investigate the current state of arctic charr and creel populations in Nain, Labrador. This study will include research, information and biological data. The creel survey data forms are provided for the initial winter and spring season surveys. To develop the surveys consultations were held including relevant knowledge holders to determine the type of information needed to create the survey design. For this survey 4 technicians will be hired for data collection and analysis to be conducted in Nain. Data collection will include weight, length, length-mass regression, sex, age and feeding interactions. It is also proposed that tissues be taken for genetic analysis.

## AngajuKkaunet Naillitisimajanga

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Una Kaujitsiutik takutitsivuk suliaKagiamut pannaigutunik Kaujisagiamut iKalunik ammalu ijiliganik Nain, Labradorimi. Tâna Kaujisannik Kaujisagiamut, Kaujigatsanik ammalu inigiKattajanginnik Kaujisallutik. Ijiliganik Kaujisannik ilingattitaujuk ukiumi upingasâmilu Kaujisagamik. ÂkKisuigiamut Kaujisannimut Kaujimajunik ilingavut Kaujimausitigut Kaujimajunik tamanna KaujisattaugiaKammangât âkKisimausitsanga. Tagvani Kaujisannimi sitamanik tigulalâttut uKumainningit, takiningit anginingillu, sunaummangâta angutik ubvalu annak, jâringit ammalu niginasupvingit. Ammalu tigulagumajut aminginnik nani piguKattamangâta.

## 1.0 Introduction

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The Arctic charr (Ikaluk), *Salvelinus alpinus*, populations of northern Labrador are an important Domestic Harvest for the Labrador Inuit (Brice-Bennett, 1977; Williamson, 1997). In Nain, Labrador, Arctic charr (charr) comprise 90% of the Domestic Fishery and with approximately 8,000 charr harvested annually (L. Felt, personal communication, 18 Jan 2010). To this date, little to no research exists for the Domestic Harvest of charr in northern Labrador (DFO, 2001; Power, 2000; Dempson *et al.*, 2004). This lack of data interferes with the accurate measurements of stock size and health. In contrast, since 1974 there has been an extensive collection of data for the productive commercial fisheries of the north Labrador charr. This research includes information on the catch and biological characteristics of the species stocks from the Nain Fishing Region (Dempson *et al.*, 2004). The Domestic Harvest of charr in the Nain area may create localized pressure that affects commercial and recreational stocks. Comprehensive data on the charr is imperative to the proper management of commercial and domestic fisheries, as well as to studies on the effects of climate change and anthropogenic impacts (Power, 2000).

Currently, no Inuit Domestic Harvest Level is established for the Arctic charr of northern Labrador, and therefore Inuit have the right to harvest, without a quota, to their full level of needs for food, social and ceremonial purposes (D. Blake, NG, personal communication, 25 Jan 2010; Land Claims Agreement (LCA), 2004). The Torngat Joint Fisheries Board is responsible for making recommendations to the Minister regarding the conservation of Arctic Charr stocks. This responsibility includes the establishment of catch controls, such as the placement of quotas and licences to fish (LCA, 2004). In order to provide informed recommendations concerning the Arctic charr, the Torngat Fisheries Board proposes to collect data on the charr caught in the Nain area Domestic Harvest. Further information and research recommendations regarding the Arctic charr of northern Labrador can be found in the Torngat Wildlife, Plants and Fisheries Secretariat report, 'Current Knowledge and Future Research Needs of Atlantic Salmon and Arctic Charr in Northern Labrador' (Andrews & Coffey, 2009).

In order to accurately assess the state of the Arctic charr populations, the initial seasonal, site-specific creel survey aims to quantify the catch of Arctic charr in the Domestic Harvest, as well as collect basic biological data on the Arctic charr stocks of the Nain area. This creel survey focuses on ice fishing in the area of Nain, Labrador during the winter and spring season. Information obtained by this survey is vital in ensuring that the traditional fishery remains healthy and is essential in deriving an effective Inuit Domestic Harvest Level. Furthermore, the data collected in the creel survey will fill in the research gap that is frequently noted by fisheries researchers, providing the missing information that will allow for the best management of the commercial and recreational Arctic charr fishery.

The Nain area creel survey is the initial step in collecting data on the following recommended areas of research as outlined in the Andrews & Coffey (2009) report:

- Annual numbers of charr harvested in the Domestic Harvest by specific area;
- Abundance data for the specific stocks of Arctic charr;
- Document traditional and local ecological knowledge of charr



The creel survey will become more involved in the subsequent years of surveying, and will build on collecting more specific data on the biological characteristics of the charr. Lastly, in order for this project to be successful, it is essential that its purpose be effectively communicated to the community of Nain and to all of the affiliated Ministries and various stakeholders.

## 2.0 The Arctic Char of Northern Labrador

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### *Appearance*

- Charr are distinguishable from Atlantic salmon by a series of large, round, pinkish lateral spots and white margins on the leading edges of the anal, pelvic and pectoral fins (Figure 1; Andrews & Coffey, 2009).
- Spawning fish turn from a silvery colouring to an orange or red, leading edges of the lower fins turn white and males develop a protruding hook called a 'kype' on their lower jaw (DFO, 1999).



**Figure 1. Lateral view of an Arctic charr (IPY, 2006)**

### *Freshwater reproduction*

- Female charr spawn around the age of 6 (DFO, 2001).
- Eggs are laid on gravel bottoms (redds) of lakes or in stream pools during late September to October at depths of 1.0 to 4.5 meters, and will incubate until the hatching and emergence of fry in May (Andrews & Coffey, 2009).
- The mean age at maturity for the Arctic charr of the Fraser River is 6.9 years on average and those in Tikkoatokak Bay is 7.9 years (Dempson & Green, 1985).

### *Migration to Sea*

- Charr exist as both anadromous (sea run) and resident freshwater populations in Northern Labrador (DFO, 2001).

- After two to seven years (10-20 cm) in freshwater the charr will migrate to sea during the spring ice break-up (Bernatchez, Dempson & Martin, 1998; Radtke et al., 1998; DFO, 2001).
- Migration periods last between 30 to 70 days during the summer (Andrews & Coffey, 2009).
- During the migration, charr remain in coastal areas where they feed heavily on primarily capelin, as well as sandlance, sculpins and crustaceans (Dempson, Shears, & Bloom, 2002; Dempson et al., 2008)
- In the mid-summer to early autumn migrating charr return to natal streams to spawn and over-winter. The larger mature fish enter freshwater first, followed by non-mature adults and then lastly the juveniles (Bernatchez et al., 2000; DFO, 2001)

### 3.0 Consultation

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Relevant knowledge holders were consulted in order to ensure a comprehensive creel survey design. Information pertaining to appropriate survey areas, as well as direction on relevant and comparable data collection was obtained. The following personnel were included in the consultation:

- Juliana Coffey and Jamie Snook, Torngat Secretariat
- Larry Felt, Memorial University of NL
- Brian Dempson, DFO, St. John's, NL
- Doug Blake and Rebecca Wilcott, Nunatsiavut Government
- Simon Kohlmeister, Nain Conservation Officer
- Sarah Erickson, Mayor of Nain

### 4.0 Creel Survey

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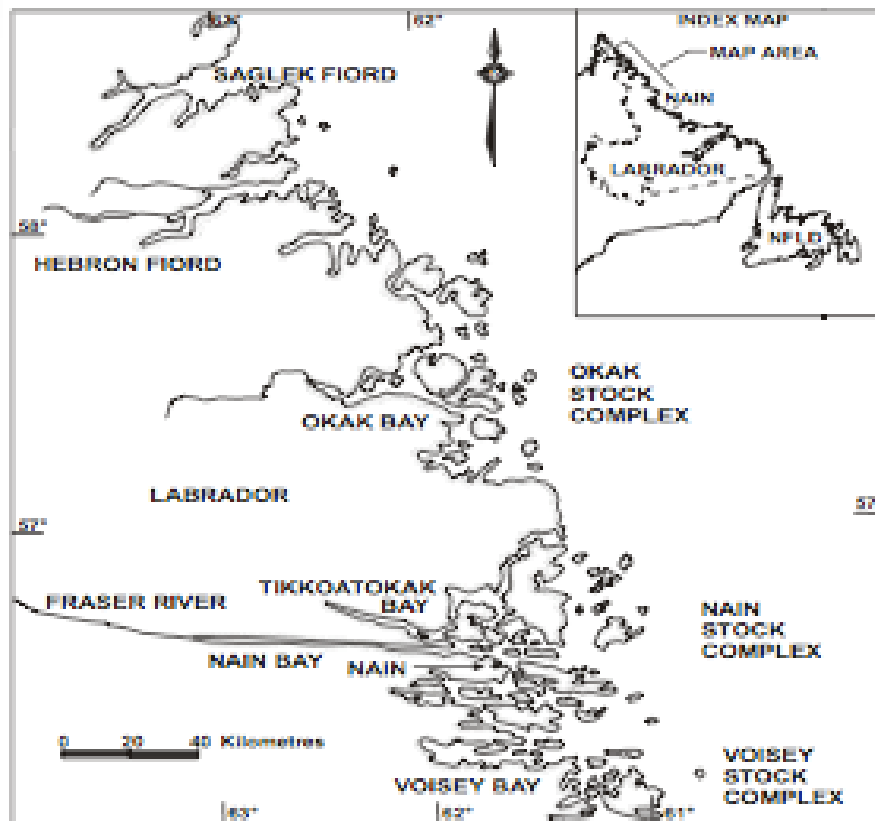
#### 4.1 Survey locations

The Nain fishing region spans from the Voisey's Bay area (56°14'50"N 61°56'17"W) to Okak Bay (57°27'22" N 62°17'32" W; Figure 2; Dempson *et al.*, 2004). The initial creel survey will be conducted in fishing locations directly around Nain, Labrador (56°32'32"N 61°41'34"W). The potential fishing locations in the Nain area include the following water bodies, and are marked on the Creel Survey Form: Nain Area Map (See section 4.6; NRC, 2010; DFO, 2001; S. Kohlmeister, personal communication, 26 Jan 2010):

- **Tasiuyak Brook** (57° 27' 22" N 62° 17' 32" W) in the Okak Bay area.
- East portion of the **Kingurutik River** (56° 56' 44" N 62° 43' 24" W to 56° 49' 39" N 62° 34' 0" W) and along the north shore of **Kinguritik Lake** (56° 48' 39" N 62° 22' 6" W).
- **Webb Brook** (56° 48' 39" N 61° 55' 52" W).
- East portion of **Tasisuak Lake** (56° 38' 42" N 62° 48' 56" W) and **Fraser River** (56° 36' 39" N 62° 13' 26" W).
- **Saltwater Pond** (56° 30' 59" N 61° 58' 29" W) just southwest of Nain.
- East portion of **Anaktalik Brook** (56° 29' 12" N 62° 5' 13" W) and **Pond** (56° 28' 34" N 62° 16' 22" W) just south of the river.

- East portion of **Frank's Brook** (also known as Kogaluk River; 56° 10' 48" N 61° 43' 25" W) in Voisey's Bay.

The above list of locations serves as a guide to the known Arctic charr stock complex areas (Dempson *et al.*, 2004). During the first year of creel surveys in the Nain area, GPS and mapped/named points of fishing locations will be recorded, and will be utilized for designing future location-specific winter and spring creel surveys. Two weekend over-flights in both winter and spring is recommended to ensure that all locations are included in the list of active traditional fishing sites. After these initial efforts an updated map of the Nain area fishing sites should be created for use in future creel surveys.



**Figure 2: North Labrador map illustrating the location of the anadromous Arctic Char stock complex areas. (Dempson et al., 2004)**

#### **4.2 Survey technicians**

Four community survey technicians (surveyor) will be hired to conduct the creel surveys. The surveyor should be approachable, organized, interested in fisheries and able to converse well in both English and Inuktitut. In order to ensure accurate and reliable data, several quality assurance checks will be made in the first season of surveying, and will continue as part of the survey design. Once hired, a four-day training session for surveyors will be conducted in Nain. During the training research delegates will accompany the surveyor for three days of trial creel surveys and an additional day of data recording and excel database tutorials. The research

delegates will also spend time in speaking with community leaders and households in order to ensure that there is knowledge on why the creel surveys are being conducted. Additional duties for the surveyors may include developing information kits and hosting public meetings and workshops in order to provide information on Arctic charr and the importance of conducting the creel surveys. In the future, the surveyor will require training in the collection of supplementary information associated with the biological characteristics of the harvested Arctic charr.

This community-based approach of involving local people in the creel survey will decrease language barriers, aid in the gathering of traditional knowledge, ensure knowledge of the country and enhance local support for Arctic charr management and conservation.

### *4.3 Survey frequency*

This creel survey is designed for use during the winter and spring ice-fishing harvest. The appropriate stratifying techniques are used in order to ensure an appropriate amount of data is collected while taking into account labour and time efficiency. After the initial year of creel surveys a more site-specific methodology should be formed in order to reduce travel distance between sites, as well as determine further spatial and temporal stratification.

In Nain, a harvest survey done by Larry Felt and Dave Natcher (2009) enumerated the households that participated in the Arctic char traditional fishery (approximately 120 households) (L. Felt, personal communication, 18 Jan 2010). These 120 households will each be assigned a number and 30 households will be randomly selected for the creel survey. The four community-based creel surveyors will survey members of the selected households that independently fish for Arctic charr (now to be referred to as the 'fisher') during the winter and spring season. The winter season (mid-January to mid- February) and spring season (April to May) will be stratified into weekend and weekday types and surveying of fishers will be randomly selected for each day type (S. Kohlmeister, personal communication, 26 Jan 2010). Each surveyor will follow the fisher's Arctic charr catches by collecting at least two weekday and two weekend observations for each season. For each seasonal period, there will be approximately 30 days of fieldwork for each surveyor. Each year of surveying, the subsample of fishers (30 households) will be randomly selected and the four surveying days for each fisher will also be randomly selected. In the future, the creel survey should expand to include all four seasons and will be conducted annually or biannually.

### *4.4 Survey information*

The questions included in the creel survey will be the same for the winter and spring season, and will include the following information:

- date and time fishing started and ended;
- surveyors name;
- fishers name;
- location (GPS, map points and names);

- catch (number of charr caught and kept, number of other fish species caught and kept); and,
- effort (total time line was down).

To supplement this information, biological data will be collected, and will include fork length, weight and, when possible, sex. For future surveys, the collection of otoliths, tissue samples and stomach contents should be considered. The additional survey questions regarding the traditional knowledge of the Arctic charr will include the following:

- Locations Arctic charr is fished:
  - o Number of days fished per season
  - o Number of years fished
  - o Year last fished
  - o Average number of fish caught per day
- Changes in Arctic charr:
  - o Location of changes
  - o Changes in number of fish
  - o Changes in size of fish
  - o Year that changes occurred
- Fishing more/less/same in the survey season as they have in recent years
- If any other changes in the Arctic charr populations have been noticed

The most important information that must initially be collected is the catch data. This catch information is imperative in understanding the abundance of the Arctic charr stocks, and will be analysed according to fisher, specific location and general area. Once data is entered into the excel creel survey form, effort information will be summed in order to find a total number of hours fished in the day. The catch information will then be counted to determine the number of fish caught in a day. With this information, the total catch/per total days effort will be calculated.

## **Collecting Biological Data**

### ***Length***

Length will be collected by measuring the fork length of the Arctic charr. The fork length is measured by placing the fish laterally on a measuring board and measuring in cm from the anterior part of the head to the median caudal fin rays.

### ***Weight***

For collecting weight, a spring balance will be the most effective scale to bring in to the field. Two spring scales should be brought into the field, one for small fish (<20 cm) and one for large fish (>20cm). The fish should be weighed for its whole wet weight in grams (before it is gutted). The scale must be kept clean and dry to prevent it from freezing and producing inaccurate readings. Each day, the spring should be calibrated against a known weight standard.

### *Length-mass regression*

For fish that have both the length and weight measurements recorded, these results will be plugged into a length-mass regression in order to find a regression equation for each fishing area (stock complex). This equation can then be used to figure out the weight of the fish that did not have a weight recorded in the field. Dempson's report on northern Labrador Arctic charr (1978) provides length-mass regression formulas that can be used if no current formulas are developed, or if a comparison between length-mass regressions is desired (Table 1).

**Table 1: The Following are length-weight regression coefficients, from  $\log W = \log a + b(\log L)$ , for Arctic charr sampled from Nain area**

<b>Area</b>	<b>log a</b>	<b>b</b>	<b>S.D. of b</b>
Voisey	-4.90	2.96	0.14
Anaktalik	-4.68	2.83	0.13
Tikkoatokak	-5.25	3.15	0.19
Okak	-4.04	2.47	0.11

### *Sexing the fish*

Sexing a fish is easier for large fish (>30cm). For females there should be developed ovaries and small eggs may be visible. For males the testes will typically be smooth, whitish organs along the dorsal surface of the body cavity. Immature fish will have less obvious organs along the dorsal surface of the body cavity, and the female sex organs will appear pink in colour while males will be translucent to white (BC MoE, 1999). Spawning male Arctic charr will also develop a protruding hook on the lower jaw (a 'kype') and will have less girth than the females (DFO, 2001). Spawning fish will expel eggs or milt when the body cavity is lightly squeezed.

### *Aging – otolith removal*

In future creel surveys technicians may be trained to remove and store otoliths. These otoliths should then be sent to be aged by George Furey at DFO in St. John's (B. Dempson, personal communication, 15 Jan 2010).

### *Genetic analysis – tissue samples*

In future creel surveys technicians may be trained to collect tissue samples. The area of the fish that the tissue is collected from and the storing of the tissue are dependent on the type of analysis being done.

## *Feeding interactions - stomach content analysis*

In future creel surveys stomach content analysis may require the complete removal of the stomach and intestine, the dissection and collection of the stomach and intestine ingested matter or stomach flushing. The tissue and/or matter must be stored in an alcohol solution and sent to DFO for analysis.

### *4.5 Data collection and analysis*

The surveyor will be required to bring the following five pieces of survey equipment into the field:

1. Creel survey form (three pages printed on waterproof paper) and pencil
2. Wrist watch
3. GPS
4. Spring scale (x2: one small and one large)
5. Measuring board

The creel survey data and local knowledge information will be documented on a three-page creel survey form during the time of each fisher's survey. Within 48 hours of the creel survey, the form information must be transferred to an electronic excel creel survey form. This information must then be emailed to an individual in charge of overseeing data collection. The hard copy creel survey forms will be saved in a binder organized by date. Assistance from the project supervisors will be available throughout the week and an email update will be sent with the excel spreadsheet for each creel survey. Once a month a quality check will be done on the accuracy of excel data entry.

The catch information, biological data and traditional knowledge survey answers will be entered into a form for each fisher's creel survey. Provided on the 'Creel Survey' CD is the excel version of this creel survey form (when opening in excel, please set the toolbar to: 'View' → 'Normal' and 'File' → 'Page Setup' → select 'Landscape'). In the excel survey form the time data must be entered in the 24-hour notation (e.g. 1:30 pm should be written as 13:30), and the Arctic charr must be written as AC under fish species. This excel form is complete with formulas and will automatically calculate the following;

- Time spent with line in the water
- Total effort hours: total hours line was in the water
- Average length
- Average weight
- Percent of Arctic charr that were male
- Total catch
- Catch per unit effort (Number of fish caught/number of hours fishing)

In the blank excel form, the formulas appear as bolded '0:00', '0' and '#DIV/0!'. Please take care to not delete these cells, for formulas will be erased. Further information on how to operate the excel form can be obtained by contacting the consultant.

The data collected throughout the season for each surveyor will be pooled in order to analyse the variables according to season and fishing location. The initial year of data collection will better determine the boundaries of different fishing locations. A map will be created that marks the fishing sites surveyed based on GPS and place name information. The known fishing locations will be targeted for at least 30 randomly selected creel surveys to be conducted at each site. The catch results of the initial year will be presented as the results from the 'Nain area' and in future years will be done by specific fishing site.

Some examples of potential analyses on the Arctic charr information may include the following:

- Average calculations for: catch, catch per unit effort, length, weight,
- Catch-frequency distributions
- Size composition histograms for each area
- Abundance estimates based on catch per unit of effort data
- Catch/length/weight/sex-frequency distributions
- Length- mass regressions (please refer to the above section)
- Body mass correlated with fork length in order to evaluate the body condition
- Length-age regressions
- Age-frequency distributions
- Compare yearly data: t-test for catch, abundance and biological characteristics
- Feeding link investigations based on gut content analysis and/or Stable Isotope Analysis

The analysis of the data collected from the creel survey should be performed annually.

#### ***4.6 Creel Survey Data Collection Form***

The following three pages display the creel survey form to be printed for the surveyors (these forms are provided in a separate document entitled 'Creel Survey Data Collection Form'). Before these forms are utilized, they require Inuktitut translation. Future surveys should be edited to include the following biological data under 'catch information': otolith sample #, tissue sample # and stomach contents sample #.







## Arctic Charr Local Knowledge Survey

1. Where do you fish for Arctic charr?

Fishing location*	Number of days fished per season (circle: Winter/ Spring)	Number of years fished	Year last fished	Average number of fish caught per day
(1)				
(2)				
(3)				
(4)				
(5)				

*\*Please place the above 'fishing location' numbers on the Nain area map (see page 3).*

2. Have you noticed any changes in the Arctic charr ?

Fishing location	Number of fish (more/less/same)	Size of fish (larger/smaller/same)	Year that changes occurred

3. Do you fish more/less/same this season as you have in recent years?

4. Have you noticed any other changes in the Arctic charr populations?

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## Nain Area Map

*Please mark the map with 'fishing location numbers' from page two of the survey.*

The following fishing sites are marked on the map (NRC, 2010): Tasiuyak Brook (TB), Webb Brook (WB), Kingurutik River (KR), Kingurutik Lake (KL), Fraser River (FR), Tasiuak Lake (TL), Saltwater Pond (SP), Anaktalik Brook (AB), Anaktalik Brook Area Pond (ABP) and Frank's Brook (FB).



## **Closing Statement**

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This Report presents the overview and project plan for the Nain area Arctic charr creel surveys. The creel survey data forms are provided for the initial winter and spring season surveys. Further updates to the form will be required as more information on fishing sites and survey resources is determined.

This Report was prepared by Haley Cohen, MSc. Please be in contact if any questions with respect to the creel survey arise.

Yours truly,

Haley Cohen

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MSc Freshwater and Coastal Sciences

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