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Information: X **Decision:**

Issue: Department of Fisheries and Oceans Canada – Update on Cambridge Bay Arctic Char Research

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Updates:

Project Title: Cambridge Bay Arctic Char Research: Fishery Independent Biological Sampling of Cambridge Bay Arctic Char (Salvelinus alpinus) Stocks: Completion of the Jayko and Halokvik Rivers

Summary

Arctic char in the Cambridge Bay region of Nunavut have long provided an important subsistence resource for the community and have also been commercially harvested since the 1960s from several local systems under a variety of quotas. Since commercial fishing for Arctic char first commenced nearly fifty years ago, six main stock complexes in the vicinity of Cambridge Bay have primarily been targeted (Ekalluk, Ellice, Halokvik, Lauchlan, Jayko and Paliryuak Rivers) and since the inception of the first commercial fishery over 2,000,000 kgs of this species have been commercially harvested. The management of Arctic char from these fisheries, including assessments on the health or status of harvested stocks, has relied on the analysis of trends in biological characteristic focusing on age, weight and, to a lesser degree, fork length. The majority of biological information on which these assessments rely has typically only considered biological/catch information of commercially harvested fish (i.e., information collected as part of the plant sampling program). The limitation of using these data is that older and larger individuals are usually over-represented resulting in a lack of biological information that accurately represents the population as a whole. Additionally, catch and effort data (CPUE) that are vital for quantitative stock assessment models and that are used as a proxy of abundance to truly monitor changes in stock health are rarely collected.

To this end, this project involved the continuation of fishery independent sampling of Arctic Char from the Jayko and Halokvik rivers (the final year for both systems), NU, using multi-mesh research gill-nets and providing an updated mark-recapture estimate of abundance potentially using the recaptures form the ~1000 tagged Arctic char from 2014.. Arctic Char from these systems were sampled for a suite of biological characteristics and these data will be compared to those collected as part of the commercial plant sampling program. All told, these data will be important for resolving sustainable harvest levels for Arctic char following an assessment of stock health for these fisheries as part of a Regional Advisory Process (RAP) planned for 2016-2017.

Materials and Methods

Primarily, work to date has focused on the biological sampling of Arctic char during upstream migrations, typically when this species is commercially harvested. The study was designed and carried out in cooperation with the Ekaluktutiak HTO (EHTO) and two local field technicians chosen by the EHTO assisted with the field component of the work. Briefly, the collection of biological data from Cambridge Bay Arctic char was conducted as part of fishery-independent surveys at the Halovik (30 Mile) and Jayko rivers. Fish were captured using multi-mesh gillnets permitting the capture of Arctic char of all sizes and ages. The aim was to biologically sample two-hundred Arctic char from each location. Location and general environmental data such as position (determined by GPS), time of year, time of day, net depth, water temperature, weather and other environmental conditions were recorded for each net set. To estimate catch-per-unit-effort, the net type and soak time were recorded. The fork length, round weight, gonad weight, sex and maturity stage were recorded for each fish. Ages of sampled fish will be determined by embedding, sectioning and reading the aging structures (pelvic fins and otoliths) when money becomes available to do so.

Additionally, in 2013 and 2014 a weir was operated at the Halovik River with the intent of enumerating the upstream migration of Arctic char in this system. During this time, more than 2000 Arctic char were tagged with T-bar anchor tags and rewards were offered for the return of any tags from fish captured in 2014. Tag recaptures in 2015 allow us to provide an updated mark-recapture estimate of population size for the Halokvik River system.

Preliminary results/discussion:

Fishery Independent Biological Sampling

The Halokvik River was sampled using multi-mesh gill nets from August 21-25 and during that time 212 Arctic Char were captured. Of these, 112 were males and 100 were females. The majority were in “resting” condition (74%) meaning they were not going to spawn the year that they were sampled. The remaining fish that were sampled were all immature (26%), which indicates migration to freshwater for overwintering purposes instead of spawning. Individual fork lengths for males ranged from 256 mm to 790 mm, with an average fork length of 594 mm. Fork lengths for females ranged from 250 mm to 838 mm, with an average fork length of 556 mm. Individual weights ranged from 100 g to 5750 g with an average weight of 2550 g for males. Females ranged from 100 g to 7100 g with an average of 2175 g. The Jayko River was sampled from September 1-5 and 210 Arctic char were captured using multi-mesh gill nets. Of these, 107 were male and 103 were female. The majority of these fish were immature (55%) and all others were in “resting” condition (45%). At the Jayko River, individual fork lengths ranged from 175 mm to 840 mm, with an average fork length of 521 mm. Males fork length ranged between 190 mm and 835 mm (average = 537 mm) whereas fork lengths for females ranged from 184 mm to 725mm (average = 560 mm). Round weight ranged from 59 g to 6150 g with females being slightly smaller (average of 502 g versus an average weight 534 g).

Halokvik Weir Enumeration and Mark-Recapture Estimate

Population abundance estimates were completed by capturing and tagging a sample of Arctic Char using the weir in the fall (2013 and 2014) during the upstream migration and sampling again one year later (2014 and 2015) in order to determine the number of marked

and unmarked fish. Population size were determined for each year (2014 and 2015) using the single-year Peterson model.

The Peterson model is used for closed population; therefore six assumptions must be made (Seber 1982):

1) No immigration or emigration.

2) All fish susceptible to the sampling gear have the same probability of being captured in the first sample.

3) The T-bar tag does not affect catchability.

4) The recapture sample is random.

5) No tag loss.

6) All recaptures are reported

The Chapman modification of the Petersen equation was used to estimate population size (N):

$$N=(M+1)(C+1)(R+1)-1$$

where M= number of individuals marked, C= total number of individuals captured while trying to collect marked fish, and R= number of individuals marked that were recaptured. The uncertainty of N is determined by calculating the variance (Var):

$$Var= (M+1)(C+1)(M-R)(C-R)(R+1)2(R+2)-1$$

Overall, preliminary results found the Petersen method estimated the Halokvik River population of Arctic Char ≥ 500 mm in length to be 38,961 in 2014 and 43,625 in 2015.

Analyses of the fishery independent data collected from the Halovik River and Jayko rivers, including the enumeration and mark recapture estimate of population size at the Halokvik River, are currently underway. These data have been added to the time series collected for these systems and a full assessment of stock health will be performed in 2017. At that time a Regional Advisory Process (RAP) will take place to make recommendations with respect to the sustainability of current commercial quotas for these waterbodies.

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