

CCE AWARD SUBMISSION

LINKING SCIENCE AND COMMUNITY IN A CHANGING NORTH





HISTORY

Arctic char (*Salvelinus alpinus*) is a unique, domestically and commercially important species inhabiting waters farther north than any other freshwater fish. The Hingittok Lake-Nulahugyuk Creek system at Nulahugyuk (Bernard Harbour), Nunavut, has supported a domestic Arctic char fishery for hundreds, perhaps thousands, of years.

Use of the Bernard Harbour Arctic char (char) run as a local food source was first documented by the Canadian Arctic Expedition from 1913 to 1916. Traditional rock weirs used to direct and capture char as they return upstream from the ocean remain visible today. However, according to residents of the nearby Hamlet of Kugluktuk, the number of char migrating at Bernard Harbour has declined markedly since the 1980's. The decline has been particularly evident in recent years and is thought to be the result of several related factors including climate change, flow regime, and in-turn, the presence of fish movement barriers in the channel.

In response to community concerns about the decline in char numbers, members of the Kugluktuk Hunters and Trappers Organization (HTO) and Golder Associates Ltd. (Golder) carried out a preliminary engineering, fish, and fish habitat assessment of char and char habitat in Nulahugyuk Creek in 2004 and 2005. Preliminary findings indicated that movement barriers in the creek were widespread and recommendations were made for additional investigations of potential solutions to improve passage. Subsequently, the HTO and Golder cooperatively developed a number of objectives which resulted in recent Project works presented herein.

The partnership with the HTO began in 2002 and the long-term commitments and relationship with the community has been critical to the successes of this Project.



Logo of the Kugluktuk Angoniatit Kugluktuk Angoniatit Association Hunters and Trappers Organization (top).

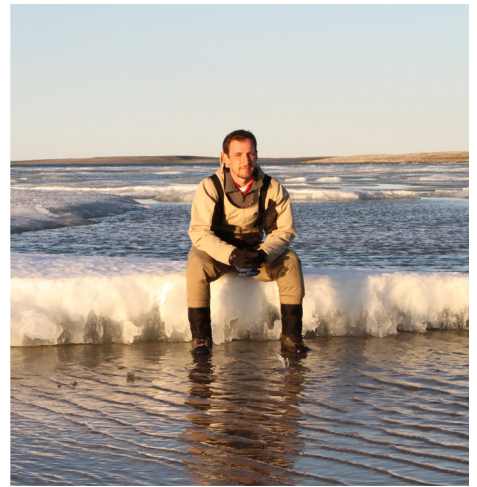
Char struggling to swim upstream (middle).

Inuit fish harvest using traditional rock weir. Photo by D. Jenness, CMC Photo No. 37078 in *The Arctic Odyssey, Diary of a man named Diamond Jenness* (above).

A COLLABORATIVE EFFORT

From 2010 to 2013, Golder designed, coordinated and led a study (the Project) to address community concerns and collect novel scientific information on char at Bernard Harbour. Community involvement was a crucial component of the Project and was accomplished through the incorporation of traditional knowledge and local expertise, and the engagement of HTO summer students and residents of Kugluktuk to facilitate youth education and encourage community stewardship.

There was, and continues to be, a tremendous level of interest and support for the Project, both by the local community and researchers across multiple agencies and jurisdictions. To date, funding and logistic support for this Project has included the local HTO, Environment Canada, the Nunavut Department of Environment (DOE), MMG Resources Inc., Natural Science and Engineering Research Council (NSERC), and the University of Alberta (U of A). In-kind support, in the form of technical equipment and volunteer time has been provided by Golder throughout the Project.



“The fact that Nunavut residents would profit from it by education is a strong ideal which we strive to continue to promote.”

— David Nivingalok, Chairperson, Angoniatit Niovikvia Limited, Kugluktuk Community Member



Students, community members, and Golder staff working together in Nulahugyuk creek



“This project addresses critical questions related to Nunavut char distributions. It does so employing approaches that are at the forefront of working with Nunavut communities.”

– Natalie Griller, Kugluktuk Community Member

THE PROJECT

Planning for the Project began in fall 2010 with field studies completed in 2012 and 2013. Substantial planning was required to overcome the logistical constraints associated with the remote field work in the Canadian Arctic and the timing of the short window of char migration in early summer. Furthermore, identifying objectives and a work plan that could be realistically addressed under these conditions was a challenge. Bernard Harbour is located approximately 250 km inside the Arctic Circle, and access to the Project area requires a five hour boat journey from the community of Kugluktuk. Ice flows and unpredictable weather conditions are common and pose significant logistical constraints and safety risks if not adequately addressed during the planning stages. Indeed, the successful delivery of our Project was due, in part, to local support and knowledge of travel in the area.

Despite the logistical challenges of the Project, our primary goal has remained the same from the onset: to build capacity and improve the stability of the domestic fishery in Kugluktuk by providing scientific data, training, and support which will allow the community to carry the Project forward in perpetuity.



Char swimming in Nulahugyuk Creek (top and top middle)

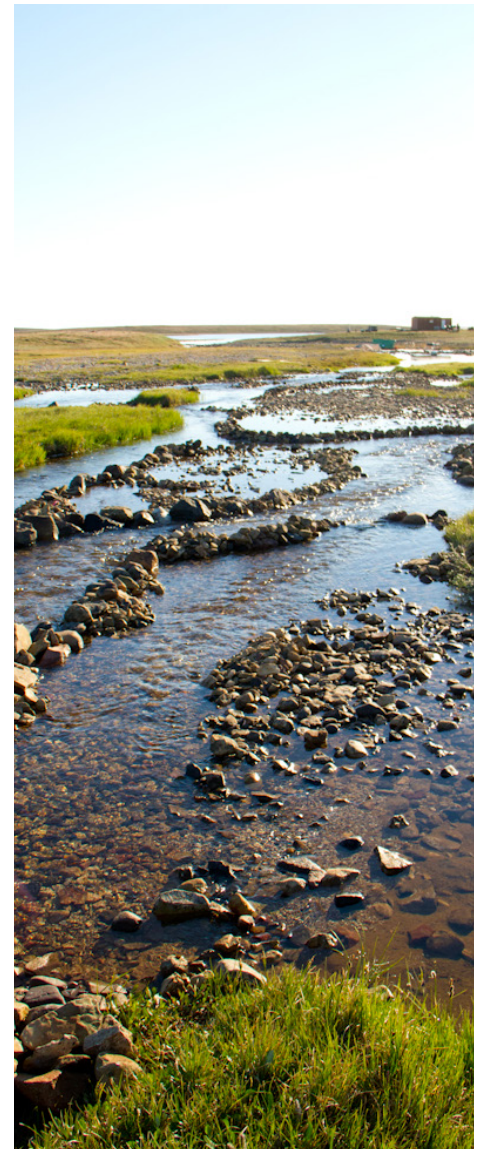
Community member constructing a low-flow channel. (top right).

Fish biologists capturing and tagging char at Nulahugyuk Creek (above).

Project components

The project comprised of four major components:

- **Education and Outreach:** to provide traditional and science-based educational opportunities for Kugluktuk youth through integration in field experiments, mentoring sessions with elders and Golder staff, and knowledge exchange during various community events.
- **Channel Manipulations:** to survey, design, and construct experimental low-flow channels with the goal to restore creek connectivity and increase the passability for char, and expand the timing window for upstream migration.
- **Movement Assessments:** to determine the number and timing of char moving upstream through the creek at Bernard Harbour and to assess char movements in the creek using surgically implanted tags and data logging antennae arrays.
- **Graduate Research:** to support graduate research at the U of A focused on the topic of Arctic char physiology and swimming performance under various flow and temperature regime scenarios using a creek-side swim performance chamber.



Char struggles upstream before low-flow channel construction

Low-flow channel from above (top right).

HTO students constructing low-flow channels (above)

LOCAL SOLUTIONS

The environment is changing in the Canadian Arctic where climate trends and human developments pose new challenges for the management and conservation of natural resources that traditional users rely upon for both subsistence and commercial livelihoods. The underlying approach to the ecological problem at Bernard Harbour was novel in that it applied relatively simple engineering methods combined with community involvement.

The most important role of the community members was in the construction of the experimental low-flow channels. A low-flow channel is defined as a narrow channel that directs flows within a larger channel of low flows. First, locations on the creek were selected by the team based on the preliminary 2004 investigation of creek geomorphology, hydrology and flows. Sections described as being difficult for char passage in 2012 corresponded closely with those identified eight years prior. Once selected, low-flow channels were constructed by manipulating creek substrates, primarily cobble and boulders, by hand. Use of mechanized equipment was not practical due to logistical constraints and to avoid damage to the fragile tundra. Everyone pitched in and got their hands wet, including researchers, students, and elders. The team goal per location was to remove all noticeable obstructions, such as boulders, and then strategically reposition material to redirect flows through the experimental sections thereby increasing the water depth for char passage. Watercourse engineering principles were followed, and in some cases the traditional rock weir methods were adapted and applied. For example, rock weirs assisted with directing migrating fish that would otherwise miss the entrance to the low-flow channels and end up stranded in shallow areas of the creek.

In addition to the restoration efforts, the Project included several unique opportunities to advance the scientific community's understanding of char biology and the environmental conditions this unique and complex species faces in a changing north. Data generated during the char capture and tagging portion of the Project provided a comprehensive survey of the char run at Bernard Harbour, one of very few surveys completed in such systems in the central Canadian Arctic. A life history database that can be used to assist with the management of local fish stocks is now available for approximately 7,000 char. Migration rates, determined by implanting tags in char tracked with remote antenna arrays, will be essential to providing a baseline for monitoring the success of restoration efforts. Another important finding was the exposure of char to water temperatures approaching their physiological limit. This finding was not anticipated and is helping to guide experiments currently underway at the U of A. The new baseline data and local knowledge of Arctic char ecology will drive restoration, planning and new initiatives in the region.



Fish evaluation (top).

Fish biologists implanting tag (middle).

Community member constructing a low-flow channel.

COMMUNITY OUTREACH

The Project team lived and worked together on the tundra at Bernard Harbour sharing knowledge and personal stories. Golder and U of A representatives demonstrated scientific techniques during various field outings and engaged students in conversations regarding conservation issues. In turn, community members shared traditional ecological knowledge regarding the history of the char run at Bernard Harbour and their experiences on the land.

In February 2013, a Golder representative presented the char study at Bernard Harbour to residents of Kugluktuk, including the HTO, during a conservation event, and again to students at the local high school. Over 50 people in the community attended the presentations and feedback was very positive. Individuals communicated a genuine concern for char in a changing north and a desire for the continuation of char conservation work in the region.

As a local partner, the HTO helped to promote the Project and encourage community involvement in nearly all aspects of the work. Equipment, services, and field personnel were contracted locally by the HTO whenever possible. In addition, local Nunavut DOE employees were engaged in the study by participating in various capacities and were instrumental in providing field support and local knowledge, as well as logistics coordination.

Golder and the HTO have also pursued several opportunities to present the Project at various scientific and professional conferences including the Yellowknife Geoscience Forum, the meeting of the American Fisheries Society, Twin Cities, Minnesota, and the Great Plains Fishery Workers Association Annual Meeting, Winnipeg, Manitoba.



Community members constructing low-flow channels.

“The work proposed by Golder Associates will not only assist in re-establishing a viable run of char, but also revitalize a community of people and provide a template for future stream enhancement projects.”

- Keith Tierney, Ph.D. Assistant Professor, University of Alberta



Low-flow channel.

PROJECT UPDATES....AND THE FUTURE

Traditional users of char, as a subsistence and commercial resource, have the most to lose without the continued exploration of novel solutions and collaborative actions, elements that define the Project. All of the work to date has focused on assisting the community with the long-term goal of improving the stability of the domestic fishery in Kugluktuk. In the short term, recent observations are encouraging in that the structural integrity of the low-flow channels created in 2012 has been maintained. Collaboration with local partners has led to successful Project execution by incorporating local knowledge and resources. More importantly, new scientific data, combined with training and educational support, will allow the community to continue the Project in perpetuity. Educational and employment benefits in the community will continue far beyond the longevity of the low-flow channel study.

Recently, the Project has gained substantial exposure through presentations to the scientific community and communications within consulting, industry, and regulatory circles. Our Project design is strongly aligned with the recently revised Fisheries Act regarding new developments in the Canadian Arctic, and Fisheries and Oceans Canada is a staunch supporter of our Project and general approach. The nature of our community-based effort is attractive to potential industry partners because it provides value to all project stakeholders, especially traditional users of a fishery. In brief, the Project can be adapted and applied as an offsetting option to counterbalance the impacts of habitat loss resulting from proposed developments. Candidate watersheds for new offsetting options are being explored and Golder is excited to establish new community relationships as we carry our initiative into the future. Commitments to, and relationships with local communities remain a critical component of how Golder is implementing these projects in the north.



ACKNOWLEDGMENTS

Golder would like to thank and acknowledge the community of Kugluktuk and the HTO, especially Barb Adjun (Manager) and the Board of Directors, for their continued support of the Project. This Project would not be possible without the efforts and enthusiasm of the Kugluktuk youth, the staff and students at the Kugluktuk High School, and the knowledge of the elders. We would also like to acknowledge Matt Gilbert and Dr. Keith Tierney from the University of Alberta for their hard work and research contributions, especially regarding the char physiology experiments. Financial support was provided primarily by Environment Canada through the Environmental Damages Fund, as well as by the Nunavut DOE through the Fisheries and Development and Diversification Policy, the Natural Sciences and Engineering Research Council of Canada, and by MMG Resources Inc.



Before (top) and after (bottom) views of an area where a low-flow channel was constructed.

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