

WHAT WE HEARD



Report on the Workshop

PARKER'S BROOK: THEN AND NOW

27 October 2020

Newfoundland and Labrador

Prepared for:

World Wildlife Fund-Canada
St. John's, Newfoundland and Labrador



Parker's Brook Workshop Report

Cover photo: Nick Nelson and Mackenzie Butler of Inter-Fluve conducting a site assessment of Parker's Brook, on the Great Northern Peninsula of Newfoundland. Photo by WWF-Canada.

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The views expressed in this report do not necessarily represent the official views of WWF-Canada, Intervale Associates, or the organizations participating in the workshop.

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Acknowledgements

The *Parker's Brook: Then and Now* workshop was a collaborative effort of organizations and individuals committed to the restoration of the Parker's Brook habitat and the conservation of its anadromous fish populations. Intervale thanks WWF-Canada staff member Chelsea Boaler for her leadership in guiding the workshop from initial conceptualization through planning, implementation, and follow-up. She and Victoria Neville of WWF-Canada believed in the importance of the workshop in building collaborative relations and community engagement in the stewardship of Parker's Brook. Intervale thanks Sheldon Eddison of DFO, Nick Nelson of Inter-Fluve, and visual notes researcher Libby Dean for their dedication and positive spirit, which created a welcoming platform on which the workshop accomplishments were built.

Executive Summary

World Wildlife Fund Canada (WWF-Canada) organized an online workshop, *Parker's Brook: Then and Now*, which was held on October 27, 2020 and hosted in Newfoundland and Labrador. The workshop's purpose was to bring together community members, resource managers, and science and engineering experts to share information on the Parker's Brook aquatic system and its ecologically unique population of Arctic char, *Salvelinus alpinus*, as well as Atlantic salmon, *Salmo salar*, and brook trout, *Salvelinus fontinalis*. The workshop was designed to encourage community engagement in the planning of restoration actions and long-term stewardship of the river and its aquatic resources. This report is a record of what was presented, including questions from participants and live answers from the presenters.

There were four objectives of the workshop:

- Review the recent history of conservation and stewardship work for Parker's Brook;
- Present information on Arctic char and cultivate appreciation for the special population in Parker's Brook;
- Share the results of a geomorphic and habitat assessment conducted by Inter-Fluve for WWF-Canada's Parker's Brook Restoration project; and
- Explore remediation options with community members, resource experts, and engineers.

The workshop was intended for biologists, practitioners, area residents, and anyone with an interest in habitat restoration for the anadromous fish populations of Parker's Brook, locally known as Western Brook, on the Great Northern Peninsula of Newfoundland. Nineteen individuals attended, plus 20 college students remotely from the College of the North Atlantic in Corner Brook. Participants represented nonprofit organizations, federal fisheries management departments, academic and research institutions, regional economic development groups, environmental consulting firms, and local residents and cabin owners. The workshop was recorded and made available to the public.

The workshop was part of a multi-year initiative by WWF-Canada, Newfoundland and Labrador region, to restore in-stream habitat of a unique population of anadromous Arctic char, as well as Atlantic salmon, and brook trout in Parker's Brook. Funding for this initiative is being provided by Environment and Climate Change Canada (ECCC) under the Environmental Damages Fund (EDF). Additional funding and in-kind support are provided by the Save Our Char Committee, WWF-Canada, and Fisheries and Oceans Canada (DFO). Staff members of the DFO regional office in St. Anthony provided conceptual and in-kind support for the planning of the workshop.

The workshop was organized as four 30-minute presentations, each one followed by a half hour question and answer period. The morning presentations addressed the history of conservation efforts for Parker's Brook, the general ecology of Arctic char, and the value of the Parker's Brook population. The afternoon sessions presented the results of an on-site geomorphic and habitat assessment of the river and a description of options for restorative work to the downstream char and salmon habitat. The presenter described the river's fluvial processes in common language and depicted the anticipated on-site construction under various scenarios. The presenters responded to 21 questions posed throughout the day.

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Participants accomplished all workshop objectives and maintained a noticeably positive spirit. Presenters and participants expressed appreciation for the collaborative nature of the workshop and a commitment to work together going forward.

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1.0 Introduction

WWF-Canada organized the online workshop, *Parker's Brook: Then and Now*, which was held on October 27, 2020 via Zoom and hosted in Newfoundland and Labrador. Nineteen people participated directly and an additional 20 students remotely from the College of the North Atlantic in Corner Brook. Participants represented a variety of sectors, including environmental nonprofit organizations, Fisheries and Oceans Canada, academia, and regional economic development. This workshop was part of a multi-year initiative led by WWF-Canada for the conservation of Parker's Brook anadromous fish populations and their in-stream habitat.

This report documents the presentations and exchange of information that occurred during the workshop. Staff of WWF-Canada recorded the workshop in its entirety. The recording may be downloaded from a Google platform accessible at the following link:

<https://drive.google.com/drive/folders/1dJ5vaBgDUFskE8sqSjzMqAtIGeligQAQ>

The presentations are also available separately as PDF documents, accessible at the same address.

Staff of WWF-Canada and leading partners in the project acknowledge the stewardship efforts by the Save Our Char Committee (SOCC) during recent decades and believe strongly that a conservation plan for Parker's Brook needs the continued engagement of local citizens, especially the people who interact directly with the river. Citizens provide the watchful eyes and the immediate actions that help to maintain the health of the ecosystem and sustainability of resources for Parker's Brook and Pistolet Bay.

Funding for the workshop was provided by ECCC under the EDF. Additional support for the initiative is provided by the SOCC, WWF-Canada, and Fisheries and Oceans Canada (DFO). Staff members of the DFO regional office in St. Anthony provided conceptual and in-kind support for the planning phase of the workshop.

1.1 Workshop Objectives

WWF-Canada convened the workshop to bring together community members, resource managers, and science and engineering experts to share information on the Parker's Brook aquatic system and its ecologically unique population of Arctic char, *Salvelinus alpinus*, as well as Atlantic salmon, *Salmo salar*, and brook trout, *Salvelinus fontinalis*. The workshop was designed to encourage community engagement in the planning of restoration actions and long-term stewardship of the river and its aquatic resources.

The specific objectives of the workshop were:

- Review the recent history of conservation and stewardship work for Parker's Brook;
- Present information on Arctic char and cultivate appreciation for the unique population in Parker's Brook;
- Share the results of a geomorphic and habitat assessment conducted for WWF-Canada's Parker's Brook Restoration project; and
- Explore remediation options with community members, resource experts, and engineers.

The workshop was intended to facilitate discussion and information sharing such that community members and key stakeholder groups could cultivate a sense of shared ownership for the sustained

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health of the river and surrounding ecosystem. With a renewed appreciation for the uniqueness of the Parker's Brook ecosystem, interest groups and individuals would be more likely to support and engage in activities to conserve Parker's Brook long-term.

1.2 A Multi-year Initiative

The workshop was part of a multi-year initiative to restore in-stream habitat of a unique population of anadromous Arctic char, as well as Atlantic salmon and brook trout, in Parker's Brook. The initiative seeks to re-engage interest groups in the area, with the hopes of fostering sustained stewardship of the Parker's Brook ecosystem and its anadromous species. The objectives of the multi-year initiative are as follows:

- Analyze the in-stream threats affecting Arctic char and Atlantic salmon in Parker's Brook and the options for immediate remediation and long-term mitigation;
- Restore the critical habitat for anadromous fish (Arctic char, Atlantic salmon) in the tidal portion of Parker's Brook, thereby supporting the recovery of the local char and salmon populations that have experienced severe die-offs in recent years; and
- Engage stakeholders and interest groups in a process leading to sustained stewardship for the char population and the Parker's Brook ecosystem.

During August 2019, WWF-Canada contracted the interdisciplinary restoration-based firm, Inter-Fluve, to conduct a physical assessment of the fluvial habitat, scope of work for habitat restoration, and mitigation requirements to reduce the growing issue of in-stream sedimentation near the mouth of Parker's Brook. The three-person team consisting of a fluvial geomorphologist, a fish biologist, and an environmental engineer presented their results to WWF-Canada in a technical memo during the Fall of 2019 and more broadly to WWF-Canada, DFO, and the workshop planning team during a half-day online meeting that took place on May 26, 2020.

1.3 Background to Parker's Brook

Parker's Brook is located at the northern extreme of the Great Northern Peninsula of Newfoundland (outlet, 51°29'53.8"N, 55°43'57.8"W). It flows into Pistolet Bay, which opens to the Atlantic Ocean at the Strait of Belle Isle. The nearest towns are Cook's Harbour at the northwestern end of the bay and Raleigh on the eastern shore; the nearest major service center is St. Anthony. Pistolet Bay may be accessed via Routes 430, 435, and 437 (Figure 1).

Parker's Brook and Pistolet Bay are home to a localized population of anadromous Arctic char, reported by researchers to be the southernmost confirmed anadromous Arctic char population in Newfoundland and Labrador and the world. The Parker's Brook population (local to Pistolet Bay) is at risk without immediate conservation action, particularly to the in-stream habitat.

Outside of Pistolet Bay, area residents report that migratory stocks of Arctic char also exist in the Canada Bay area and possibly elsewhere on the Great Northern Peninsula. This should be examined further in the future. Anadromy is not known to persist south of this area although land-locked populations of Arctic char are common, occur in many lakes and ponds of insular Newfoundland, and are found as far south as Maine.



Figure 1. Map of Parker's Brook.

In northern communities around the globe, Arctic char are an important source of food for Indigenous and non-indigenous peoples. For example, Inuit communities of the Labrador north coast, Arctic char are more important than Atlantic salmon in providing protein for families. On the Northern Peninsula of Newfoundland, Arctic char in Parker's Brook hold a special importance to the people living in communities of the Pistolet Bay area. It is reported that years ago there were large festivals held

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annually in the local area to celebrate the return of fish. Currently, there is a recreational fishery for both Arctic char and Atlantic salmon along the beach before the mouth of Parker's Brook and further upstream, though the tidal zone of the river to the bridge at Hwy 440 is closed to all fishing.

In 1982, a group of citizens joined forces for the ongoing protection of Parker's Brook. Though the group was dormant for some time, in 2007, a significant decline in the char population was observed, which the group believed to have been caused by by-catch in pelagic fisheries in Pistolet Bay. The group was reinvigorated and officially named the "Save Our Char Committee". Their recognition of the ecological significance of this unique local stock of fish led to several science initiatives and university collaborations. Ultimately, through tagging and a counting fence at the mouth of the river, it was confirmed that the Parker's Brook char stock was anadromous (sea-run) and the southernmost confirmed population that retained that quality.

The most urgent threat facing the Parker's Brook Arctic char presently is a partial obstruction at the mouth of Parker's Brook. During the upstream migration, char move in and out of the intertidal pool to acclimate to the drastic change in hydrologic conditions in the transition from marine to brackish to freshwater environments. The tidal cycles enable movement in and out of the brook, and the location of the pool provides needed shelter during the acclimatization period. In recent years, char migrating upstream to Western Long Pond and Stock Pond became trapped within a now-shallow pool, especially problematic during low tide, resulting in suffocation and die-offs. Provincial wildlife conservation officers and area residents have observed multiple die-offs of a significant proportion of the char population, as well as salmon, at the mouth of Parker's Brook. The die-offs occurred in between 2009 and 2018 and involved a significant proportion of the Parker Brook populations (total of 112 char and 67 salmon).

To investigate the cause of the die-offs, WWF-Canada invested in a geomorphic and habitat assessment of the Parker's Brook system. This assessment included reconnaissance led by Inter-Fluve, with participation from a local resident and representatives from DFO and WWF-Canada. The assessment, which consisted of reconnaissance and data collection, extended from Western Long Pond to the mouth of the Parker's Brook. The objective was to identify and describe aquatic habitat features and conditions, the geomorphology of the river and valley, and any potential areas of instability, such as new or significant inputs of sediment or flow from tributaries.

The assessment team described habitat and geomorphic features such as residual pool depth, overhanging cover, canopy cover, large wood, substrates, channel dimensions, bank substrates, and riffle-pool spacing. To characterize the channel morphology, channel dynamics, and habitat features, they collected high resolution aerial photos of the river and floodplain, using an Unmanned Aerial Vehicle (UAV).

Once data were collected and synthesized, it was determined that changes resulting from unusually strong storm activity in prior years, combined with constriction created by the bridge at the mouth of the river created a partial barrier for the fish. When combined with cumulative pressures such as fishing, poaching, logging, nutrient loading, climate change, and increased water temperatures, these changes have been negatively affecting population numbers for both char and salmon.

2.0 WORKSHOP PLANNING AND PROMOTION

2.1 Planning and Promotion

Workshop planning began with an in-person planning meeting held February 5, 2020 at the DFO regional office in St. Anthony. Approximately eight people attended the meeting, including staff from WWF-Canada, DFO St. Anthony, St. Anthony Basin Resources Inc. (SABRI), and Intervale Associates. At the time, it was hoped that the workshop would take place as an in-person event during the spring of 2020; however, as the year progressed with an intensifying COVID pandemic, the federal and provincial health directives and common-sense safety precautions forced planners to postpone the workshop. On May 26, 2020, a half-day online meeting of the planning team took place, during which Inter-Fluve biologists, fluvial geomorphologists, and engineers shared updated information on proposed restoration activities. As the COVID pandemic persisted throughout summer and into the fall, the planning team decided to move forward with the Parker's Brook workshop as an online event, to be held October 27, 2020.

A poster (Appendix A) announcing the workshop was e-mailed to interested individuals on October 13 and an invitation letter (Appendix B) along with the poster was mailed more broadly on October 19. The poster was also shared on social media platforms and print copies were posted in surrounding communities. The workshop was promoted as a free of charge event and open to the public.

2.2 Registration

The workshop was intended for area residents, biologists, fisheries managers, and anyone with an interest in habitat restoration for the anadromous fish populations of Parker's Brook. Seventeen people registered for the online event. The instructor of the fisheries technology course at the College of the North Atlantic (CNA) in Corner Brook arranged for 20 of his students to participate remotely from class.

Actual participants totaled 19, including the moderator, panel members, and a facilitator for the Question and Answer (Q & A) period. When combined with the 20 students from CNA, there were 39 participants. Participants represented nonprofit organizations, federal fisheries management departments, academic and research institutions, regional economic development groups, environmental consulting firms, and area residents and cabin owners.

3.0 THE WORKSHOP

3.1 Workshop Agenda

The workshop was organized as four 30-minute presentations, each one followed by a half-hour Q & A period. The two morning sessions addressed the history of conservation efforts for Parker's Brook, the general ecology of Arctic char, and the importance of the Parker's Brook char population. Session I was presented by Sheldon Eddison, Fishery Officer-Field Supervisor, DFO (St. Anthony). Session II was presented by Victoria Neville, Senior Specialist, Fisheries and Aquatic Ecosystems, WWF-Canada (St. John's).

The two afternoon sessions presented the results of an on-site geomorphic and habitat assessment and a description of options for restorative work to the downstream char and salmon habitat. The presenter

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described the river's fluvial processes in common language and depicted the anticipated on-site construction under various scenarios. The two afternoon sessions were presented by Nick Nelson, Fluvial Geomorphologist and Regional Director, Inter-Fluve (Cambridge, Massachusetts, USA) (Table 1).

Table 1. Workshop Agenda

Time	Topic	Presenter
Opening of the Workshop	Welcome & Introduction	Chelsea Boaler, WWF-Canada (Western Newfoundland)
10 AM	Session I: Pistolet Bay/Parker's Brook Char: A Brief History	Sheldon Eddison, DFO (St. Anthony)
11 AM	Session II: Ecology of Arctic Char	Victoria Neville, WWF-Canada (St. John's)
1 PM	Session III: Parker's Brook Habitat Assessment	Nick Nelson, Inter-Fluve (Cambridge, Massachusetts, USA)
2 PM	Session IV: Parker's Brook Restoration Design and Review	Nick Nelson, Inter-Fluve (Cambridge, Massachusetts, USA)

An artistic visual record of the workshop was created during the workshop by environmental researcher and storyteller Libby Dean, who worked from her home office on the eastern shore of Nova Scotia. Participants observed the live development of a colourful mural that depicted key concepts from the presentations and discussions as well as the inter-relationships of those concepts (Appendix E).

The workshop speakers, visual note-taker, moderator, and question and answer facilitator formed the workshop panel and were visible to workshop participants throughout the course of the day.

The workshop was recorded in its entirety by WWF-Canada. Immediately following the workshop, WWF-Canada staff announced the creation of a Google Drive site, where the workshop recording and PDF copies of all presentations could be downloaded. Participants may access the recording and documents at: <https://drive.google.com/drive/folders/1dJ5vaBgDUFskE8sqSJzMQAtIGeligQAO>.

3.2 Online Format and Facilitation

The online platform for the workshop was Zoom, a cloud-based video conferencing service.

The workshop moderator-in-chief was Chelsea Boaler, Specialist, Marine Conservation and Fisheries, WWF-Canada (western Newfoundland). She is also a Ph.D. Candidate at Memorial University of Newfoundland, where she conducted her dissertation research on capelin, *Mallotus villosus*. Chelsea headed up the planning that led to the workshop, served as the workshop's overall facilitator, and organized the workshop follow-up. Chelsea warmly welcomed participants to the workshop, announced the schedule of the day, and introduced the speakers and panelists. At the conclusion of each presentation, she introduced the Q & A period.

Kathleen Blanchard, Ph.D., facilitated the Q & A period. She is founder and President of Intervale Associates, an environmental nonprofit organization incorporated in Newfoundland and Labrador with an emphasis on community engagement in fish and wildlife conservation. Workshop participants

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submitted their questions using the Q & A function on the Zoom platform. Kathleen reviewed the questions and pitched them one at a time to the speakers or other appropriate panel members.

3.3 Session I: Pistolet Bay/Parker's Brook Char: A Brief History

Sheldon Eddison, DFO (St. Anthony), gave an overview of the recent history of Parker's Brook from a conservation perspective (Appendix F). His presentation included conservation efforts for the Arctic char population, work conducted under a Five-Year Strategic Recovery Plan by the SOCC, observations by DFO personnel and others about the char population to date, descriptions of three die-off episodes that occurred in the river, and restoration efforts that were conducted.

He began with a description of the SOCC, which was formed in 1982 over concerns by area residents over the worsening status of the migratory char population in Parker's Brook. The work of the SOCC has been a partnership endeavour involving DFO, Nordic Economic Development Corporation, SABRI, the Community-University Recovery Alliance (CURRA) of Memorial University of Newfoundland (MUN), and the provincial Wildlife Division. One of the threats of concern to SOCC in 2009 was interception of char by the commercial capelin fishery operating in Pistolet Bay. According to DFO staff and area residents, this fishery has not been active in the region for five years or more (pers. comm., Sheldon Eddison and Sheila Woodward, DFO St. Anthony and residents) thanks to the findings of a local knowledge study (see Michelle Caputo below) and the advocate work from the SOCC and the St. Anthony regional DFO office (pers. comm. Erin Dunne, DFO Management).

The SOCC produced a Five-Year Recovery Plan for the Arctic char of Parker's Brook. The Plan enjoyed cooperation from residents and businesses. One activity that DFO and the SOCC undertook was to install a counting fence with an underwater camera to enumerate how many fish were seasonally entering and exiting the river. Another major project was a bathymetric survey of Stock Pond, which is at the headwaters of Parker's Brook. Sheldon was pleased to present for the first time the map that DFO personnel had created, which depicts the headwaters and where, according to tagging studies by DFO research Corey Morris (pers. comm.), they believe the char overwinter (Appendix D). Many of the activities that Sheldon described in his presentation were collaborative undertakings involving more than one of the partners listed.

Another activity, which was led by Memorial University (MUN) researcher Michelle Caputo (now Dr. Caputo) collaboration with DFO, was to ask recreational anglers to provide the heads of char they catch and to Memorial University, whereupon researchers removed the otoliths (ear stones) and prepared them for chemical analysis (mass spectrometry). The chemical signatures within the otoliths as relates to freshwater and marine periods revealed that the char were anadromous. The average fish caught was 5–7 years old and went to sea at 3 years of age.

MUN student Michelle Caputo also completed a recreational fishing survey of known fishers in the community. She collected responses from 50 individuals.

Approximately 300 charr, 200 salmon, and 200 brook trout migrated each year in Parker's Brook, according to data collected from the counting fence during spring migration (the last count was in 2011). Counting fence personnel would watch the char return in the spring while a coordinator would use video to identify the species. A count could not be taken in the spring when charr left the river, due to ice and high-water levels. In more recent years, locals report that there are less char and that they are smaller. Many people blame the commercial capelin purse seine fishery for the decline.

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Overall, University researchers, DFO, and other community partners collected important baseline information on the anadromous fish of Parker's Brook. Nordic Economic Development Corporation posted the information on their web site for some time, but the site has since then been made unavailable.

In a study to examine how far the char and salmon migrated at sea, transponders were set up in Pistolet Bay and towards Stock Pond. A total of 25 char and 20 salmon were tagged. Results showed that char would leave around May 15, fatten up on capelin, and return to Parker's Brook from July 15 to early August. They all overwintered in Stock Pond. Last winter, the researchers talked to DFO to see if they could go back in to drill more holes around the shoreline of Stock Pond. This would allow them to compare historic and recent data, and this is what we did.

A couple of years ago, there were beach clean-ups with the Girl Guides. This effort with young encourages the recruitment of a new generation of people interested in char.

Beginning in 2004–2005, Guardians were having a lot of trouble at the mouth of the river because it was open to fishing and the char would come into this narrow channel and people would jig them and exhaust them. They asked the Department to close the area to fishing so that the fish could have easy access for entering the river. It seems to be working. DFO researcher Corey Morris believes it is one of the actions that helped the char keep coming to Parker's Brook. The area remains closed today in 2020, although fishing is allowed further up-stream and along Pistolet Bay beach.

One point about the water depth in Stock Pond is that there is 33m of water in one section. Char require deep overwintering areas. There are not many ponds with such deep-water areas, which is another reason why char are still present in this river system.

There have been some serious die-offs. In 2012 there was a large die-off of char at the mouth of the river. In 2015 there was a salmon die-off. In 2017 there was another die-off of char. Additional die-offs occurred in other years but nothing as large. The implications are significant. There were only 300 char migrating back and forth in 2011; therefore, 100 dead represent 33 percent of the population.

As the fish return to the river, they swim into the brackish water to try and acclimate themselves to the dramatically different conditions they will experience upstream. When they get too warm, they normally go back to the ocean, but in low water conditions the channel is no longer available to them, forcing them to remain in the brackish water, which would get too hot. All die-offs happened in the hottest time of the summer, during low tide, when the fish could not go back out into the ocean. The scientists thought that the reason they died was because they became too hot.

This is where the restoration project came into play to help the char of Pistolet Bay. The restoration would allow the fish to come into the river and be able to move back and forth from river to ocean, and create deeper, cooler and more oxygenated water in the tide-affected channel, preventing such die-offs.

Pistolet Bay overall is an important ecosystem, containing 26 regulated species of fish, the most northerly lobster fishery in North America, a sensitive eel grass area, and areas that are popular for fishing and hunting, especially smelts in the wintertime. People come from surrounding communities to fish.

Table 2. Questions and answers following Session I: History of Parker's Brook and Its Arctic Char

Name	Question/Response
Chris Manuel	What is the level of poaching in the area?
Sheldon Eddison	<p>Well, I would have to classify the level of poaching as low. Because, but every now and then we do get complaints of people who are netting the rivers. And that's a real big concern for me because with a small population of fish and a small population of salmon as well, you can easily wipe out a system or a lot of fish in one instant.</p> <p>But we haven't seen any evidence of netting for a lot of years now. And I think a lot of it has to do with a lot of people that I talked to who are stewards and they're concerned about the char in Pistolet Bay. And they're not gonna accept it. And so I think we've got a lot of people who look after the Pistolet Bay area, just because they don't want anything to happen to the char.</p> <p>And so we're not seeing any poaching. We're not getting a lot of complaints over the last few years, which I like to hear.</p>
Tom Bird	Hi Sheldon, thanks for the presentation, great to get all that perspective from your experience. Have you heard of other landlocked char populations in the area?
Sheldon Eddison	<p>That is a good question. You know, in Newfoundland char is everywhere we have char you know, again, Gander Lake is full of char. And char are all around the province. I think there is like 100 different systems in Newfoundland where char exist, but they're all landlocked. And so the only place that we know for sure right now that there are anadromous char is here in Pistolet Bay. There's some talk that there might be some in Torrent River and as well as over in Roddickton area. But, uh, that's not confirmed right now. But there is talk of it. I know Corey has talked about, there are char that don't go to sea in that system as well. They can't afford the energy. It takes a lot of energy to go to sea, fatten up for two months and come back. And, so you know, I'm sure there's landlocked char in Parker's as well.</p>
Samuel Elliott	How many different species are in the bay?
Sheldon Eddison	<p>From my understanding we have 26 regulated species. The reason I say that is because I went through all the regulations and I clicked off the ones that are regulated as a species. But I'm sure there are more species of fish in the bay, than the 26, but I don't know the answer to how many more.</p>
Brandon Ward	Thanks for the presentation, Sheldon, great information. Has there been any reports of removals/fishing for the Char during the winter months in Stock Pond?
Sheldon Eddison	<p>We do have people that fish Stock Pond and I actually was in there on patrol one time when a guy caught a char. And he gave it to me, as they help out with some of the scientific work. But, where the char are in the deeper waters, and most people are trying to fish in the spring time, you know, in 10 to 12 feet of water to get a few trout, a very slim chance you're going to run into a char cluster.</p>
Lica Christensen	Asking for Vic: Where is the eelgrass located in Pistolet Bay?

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Sheldon Eddison	Eel grass is in Shallow Bay, west of Parker's Brook. Well documented area for eel grass. A very sensitive area for small fish.
Kathleen Blanchard	How wide a geographic area do people come from when they visit, or how far do you think a program should be promoted? Does it include people in St. Anthony or further south? What sorts of people might engage in stewardship?
Sheldon Eddison	I know St. Anthony area itself, there are a lot of people that are firmly engaged with the char. But the entire tip of Northern peninsula has been engaged, you know, from Cook's Harbour to Raleigh, those two communities are, well, they're right here. A lot of the, a lot of the residents, fish char and they're active in the area. The community St. Lunaire, there are a lot of people that talk to me about char. You know, I look at it from a stewardship perspective, you know the entire Pistolet Bay ecosystem, I guess. Not only just the char, but it's such a beautiful area. And it's so unique in the sense in what I described earlier and I think it's something that everybody can get onboard with looking after, either the char or just the entire area itself as an ecosystem. I think they're all connected whether it's the eel grass in Shallow Bay or char in Stock Pond. But certainly, the tip of Northern Peninsula would be the main stewardship area. But, I've had people from Australia talk about the char as well.
Kathleen Blanchard	Can you imagine what benefits might exist for people today? Especially the younger generation. And what sort of benefit might there be to the people for the restoration of Arctic char in Parker's Brook?
Sheldon Eddison	Looking at the Pistolet Bay as a whole, I think it's such a unique area and it's something that from a tourist perspective, you could bring in a lot of tourism to the area. I was just thinking if we add that counting fence back up, what a nice area to the view char, they go through the system and, and to engage people to come in and see a rare species of fish that you don't normally see in Newfoundland. You might see them in Labrador, but you don't see him in Newfoundland. And something that's a leftover from the ice age. Just something that you could promote as a tourism package. I won't steal any of Sam Elliott's thunder, because Sam has got such a vision for economic development in the area. And he touches on a lot of this stuff in my conversations with him, about using the char, Pistolet Bay and the Pistolet Bay area itself as a tourism draw as an economic driver in the area. So, I think that's where I'll leave that to Sam, to have more of a discussion on which is best and possible. And because he's got such a really good vision of where he thinks we can go with all this information that we're gathering on the char and for future generations, I guess.
Victoria Neville	Is there a reason why there is not a counting fence on Parker's Brook? Were there challenges and is it time now to come back and reinvigorate some of that energy? Was it just something that was too difficult to sustain? Why has it been 10 years since there's been a count?
Sheldon Eddison	We tried to keep the funding going, to keep the counting fence up. You know, science, was a great help to us. They came out and they would help us set up the counting fence, but Sam lost his funding for the coordinator and that was a big, big hurt for us was to have somebody to help set up the fence and organize the video information.

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	<p>But, I agree with you. I'd love to see where our char population is today. You know, we're going back 2011 was the last time that we had a count on that fence. And, I would love to see some more work done on that, but at the time, there were a lot of funding challenges. And I know just after we lost our funding to keep the counting fence there, DFO started reducing the number of counting fences they had throughout the province, which I'm sure it was controversial at the time. So, there wasn't that flavor to get the funding to try and keep that counting fence there.</p> <p>It would be nice if we could see how many fish are going through the day. Right. I know in my conversations with Corey, Corey feels that the population is pretty steady at 300. His best guess is they're still around 300 fish, too. But, that's a very small number. I always say, when you can count the number of fish, as your biomass, and not tons, it's a very small group of fish and they can be easily wiped out fairly quickly.</p>
Sarah Salisbury	Thanks for the talk, very interesting! I just want to clarify your earlier point about landlocked char, is there evidence of charr in Parker's Bay Brook that don't run to the sea (i.e. are freshwater residents)?
Sheldon Eddison	I can remember Corey saying that there probably is, but I can't say for sure that there are landlocked char because with the smaller ones that we saw, they don't go to sea till three or four years. So, the only ones I saw that were small, I mean they were just trying to survive in the river system themselves. So, I don't know what they would have done when they got to year four. Would they have left to go out to the ocean, or would they just stay? And if they couldn't afford the energy to go. I can't really answer that question a hundred percent sure. But if I can remember what Corey was telling me before, he figures there are landlocked char in that system.
Brandon Ward	Do sea-run char frequent other rivers in Pistolet Bay?
Sheldon Eddison	Good question, no deep-water ponds in Pistolet Bay other than Stock Pond, so they don't think there will be any char in others.

3.4 Session II: Ecology of Arctic Char

Victoria Neville presented an overview of Arctic char ecology, drawing in part on slides prepared by Brian Dempson, a senior fisheries biologist with DFO (Appendix G). Dr. Dempson was originally scheduled to present at the workshop but due to a conflict, Victoria stepped in. Victoria is a Senior Specialist for Fisheries and Aquatic Ecosystems with WWF-Canada (St. John's). She is also a Ph.D. Candidate at Memorial University in St. John's, where her research is related to Atlantic cod, *Gadus morhua*. She is active in volunteer conservation efforts in the province.

The Arctic char is the northernmost freshwater or sea-run, i.e. anadromous, fish on earth. Its distribution is circumpolar. After the last glaciation, sea-run char retreated to colder arctic and subarctic regions but lake-dwelling relics remain. In North America, the southernmost native populations occur in landlocked woodland lakes in Maine, USA. It is believed that Arctic char in Parker's Brook are the southernmost anadromous char. There are local accounts of char further south, for example, at River of Ponds.

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Arctic char spend their early growth in freshwater. When they reach a certain age, they migrate out to sea to sources of good quality food. Going to sea provides increased feeding and growth opportunities as well as reproductive output.

Arctic char leave rivers after ice break up and move to sea for 50–60 days, where they feed and then move back into freshwater. The distances they travel are quite short. They tend to stay close to the shore and may remain close to the estuaries for the entire duration of the marine phase. Their migrations are quite unlike Atlantic salmon and they do not spend multi-winters at sea.

Arctic char are generally slow growing and late to mature. This can make them vulnerable to over-exploitation. They have the most colour variability of any fish species on earth and they are ecologically and morphologically diverse. They spawn every 1–2 years, with eggs laid in redds in broken substrates or gravel shoals. Lake populations of Arctic char are more sensitive to climate fluctuations. Char further north grow somewhat faster.

What may happen to the char in Parker’s Brook? They may persist as the southernmost population. Or, they may transition to an entirely freshwater population. Or, they could be extirpated as a result of competition from other salmonids or invasive species that are undergoing range expansions, for example, stiped bass.

Victoria concluded her presentation with an eight-minute video produced in 2020 called *Arctic Char—Relics of the Ice Age* (<https://www.youtube.com/watch?v=GUGyi-ShrxY>), which documents habitat restoration efforts in Ennerdale, United Kingdom.

Table 3. Questions and answers following Session II: Ecology of Arctic Char

Name	Question/Response
Kathleen Blanchard	Could you possibly expand a bit on the competition between salmon and char?
Victoria Neville	<p>Specifically, as it is a competition for sites for their redds, habitat competition in other ways. Well, I will say Kathleen that, I'm not one to take a presentation and just do it. Of course, I was up to my eyeballs and papers this weekend, and I did find that it's been studied in other areas that they can be vulnerable to competition and they do seem to have ability to carve out niches.</p> <p>When there are other fish species, they tend to inhabit different layers of the lake system. Locally the idea of them being out-competed by naturally occurring species like the Atlantic salmon is probably not a high risk because they have co-evolved and been established with them for quite a while.</p> <p>So, I'd say that the specific genetic makeup of the Arctic char and their subsequent behaviors are quite resilient to that. But as we see climate change happening, we see more aggressive species moving up that gradient. And when you talk about Pistolet Bay, we're really talking about the sub-Arctic climate there. I mean, we talk about it being the last place that there's a lobster fishery. People have tried to put lobster up in Labrador and hope that they would sort of take, but it's just too cold on the South coast of Labrador for lobsters to reproduce.</p>

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	<p>So, we're really at the edge where the subarctic conditions emerge We need to be prepared that range expansions and invasive species, that this is something that needs to be monitored for Arctic char in this spot. I don't know exactly the different types of competition that would be here, but I would say, yeah, at a reproductive level, space could be an issue. There's a certain limiting factor of gravel, but I think food and habitat and other requirements may be competitive as well.</p>
Kathleen Blanchard	<p>It is my understanding that the colour of the char flesh is a function of the food source. Does your reading lead you to agree with that?</p>
Victoria Neville	<p>Yeah. I saw that evidence of that, like the amount of shellfish which have carotenoids in them can influence the color of the flesh, but it's no real indication of the health of the fish in general.</p> <p>So, a fish that's feeding primarily on capelin, with a less appealing pale flesh, is going to be just as tasty. But then I also find there's contributions just due to habitat. So, there seems to be variability from gene pool to gene pool in the general look and aesthetics of a char. And, I'm assuming that may be reflected in what their skin looks like on the outside. And also of course, seasonal spawning colours. But the diet mostly, I think, influences that colour of the internal flesh.</p>
Brandon Ward	<p>Thank you for the great presentation Victoria. You mentioned the potential for impact of invasive species such as striped bass on char. We recently had a striped bass event in Labrador. Are there any studies on this relationship in more southern areas?</p>
Victoria Neville	<p>Yeah. I drew from the presentation that Dr. Dempson sent to me, and he would be able to insert more, nuance or explanation, but you know, when you're trying to pull from bullet points, what was that person trying to say? He listed invasives as a threat, but at another point he also talks about striped bass.</p> <p>There is, somewhat of a technicality in talking about striped bass as an invasive or a range expansion. But I only use the example of striped bass because it's the one that comes to mind because of that Labrador example. It's one species we know that it is very voracious and happens to move into river systems as well. I don't know if it's been studied in more southern areas. I don't think striped bass have landed in Pistolet Bay or if there's an elevated risk. And I don't want to insert that into the chat. I just listed it as one potential species that we know has moved and changed its range. But, any invasive species has the potential to degrade habitat, to directly predate upon char, or to predate upon their food.</p>
Kathleen Blanchard	<p>I love char. I enjoy seeing char in coastal environments. I go out into Canada Bay, where I see it, and I've seen it on the Labrador coast. Well, we saw your map, but would you say that the distribution is continuous, or would you know if it's interrupted at all? When going from the northern part of the Northern peninsula North to Labrador, is it fairly continuous?</p>
Victoria Neville	<p>Honestly, Kathleen, like I said, it was a research project of the weekend for me to learn some of this. But what I did find was that it was hard to find a consistent range map and there was a lot of dotted lines and guesswork. So, I think really, when people are putting together these range maps, they are looking at where was the southern most spot and everything else is sort of just a filled in shade. I</p>

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	<p>don't know so much about the incidents of char on the South Coast (Labrador) and in NunatuKavut, but I know they are more prevalent in the more Northern areas like Nunatsiavut, but perhaps someone like Chelsea who has more experience with the observers network in Labrador may be able to comment on if there's a continuous distribution of anadromous char.</p>
<p>Chelsea Boaler</p>	<p>Thanks, Victoria. Yeah, I was going to insert a little something. I know that I'm not sure the exact boundary lines of where char is found and not found, but I know it's not as common in southern Labrador. In fact, NunatuKavut and Nunatsiavut often trade cod from southern parts of Labrador with char from northern parts of Labrador for their food fishery distributions that they have within their communities. So again, I'm not sure of the exact lines, but I do know it's less common on the South Coast and then when you get to Rigolet and further North, then it's much more common to have the anadromous char there for the food fishery.</p>
<p>Sarah Salisbury</p>	<p>I am very interested in this question of what drives flesh colouration in charr! Any evidence that this might have a genetic basis as there seems to be for Pacific salmon?</p>
<p>Victoria Neville</p>	<p>I don't know your background, Sarah, but I'm willing to bet simply because you knew about this in Pacific char, or in Pacific salmon, you have more of a background likely on this potential. It was really just a shallow lit review that I did. I know from the work that was done in Nunatsiavut, that local people spoke about dietary influence. I know that they're talked about as the most variable species in the world, and there's been quite a bit of aquaculture related work on char. A lot of the literature, which I ignored almost entirely, was about sort of common garden experiments where you're taking the char and you're checking if it's nature versus nurture sort of a thing. So, I would guess that there are genetic components to it, but I can't speak to it specifically.</p>
<p>Kathleen Blanchard</p>	<p>Can you share with us who some of the other researchers are currently, besides Brian Dempson? We know he's very knowledgeable. Are there current studies being done in the province? Are there others who might be studying char currently that would be worth knowing about?</p>
<p>Victoria Neville</p>	<p>Certainly, Dr. Ian Bradbury has likely been involved in some genetic work. Like I said, I was more looking at the life history of char. You know, there were certainly some names that came across Milton Shears and David Orr, from DFO that gave a lot of history, but what's happening more contemporarily, I would say likely Martha Robertson, Ian Bradbury, and I wouldn't be surprised if Marie Clement has some unpublished research that will come out from Labrador on the species.</p> <p>But, no, I didn't go into enough of a detail to really say who the main movers and shakers are, are outside of that.</p>

3.5 Session III: Parker's Brook Habitat Assessment

Nick Nelson, Fluvial Geomorphologist and Regional Director with the consulting firm, Inter-Fluve, gave the presentation, *Parker's Brook Habitat Assessment* (Appendix H). Inter-Fluve is a highly respected

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interdisciplinary consulting group that has worked with many federal, state, and municipal agencies and private groups on designs for river habitat restoration, including salmon and trout streams in Northern United States. Nick spoke from the Inter-Fluve regional office in Cambridge, Massachusetts, USA. The presentation reported on a site assessment conducted by Nick Nelson, Mike McAllister, and Mackenzie Butler in August 2019.

Nick began his remarks with an acknowledgement and appreciation for other individuals who have personal experience and knowledge of the river and he expressed his appreciation for that knowledge which his team considers valuable.

The length of Parker's Brook is more than four kilometers from Western Long Pond to Pistolet Bay. They began the assessment by walking the entire length of the river, from the mouth of Western Long Pond to Pistolet Bay, in order to get an understanding of the habitat and what is happening on the flood plains. Before beginning, they studied arial photos to get more familiar with landscape. They went into the study thinking that sedimentation might be the issue impacting the fish populations. Nick explained that often when anticipating that sedimentation is a problem, there is an obvious source where the sedimentation is coming from. Knowledge of that source can be useful towards the restoration design.

Initial research by the Inter-Fluve team found little historical data as relate to hydrology, which would have enabled them to see how much water is coming through. However, there were data on Bartletts River near St. Anthony, which showed high flows during spring melt and runoff and during the fall rainy season and in contrast, hardly any flow through the winter.

Working in the field, the Inter-Fluve team divided the river into four distinct reaches. In determining the reaches, the team looked at slope of the channel; the channel forms, for example, whether it was multi-channel; the vegetation pattern; and the infrastructure, which they examined in some detail. The only infrastructure found along the upstream portions was a powerline. As they worked their way from the upstream portion, the team observed some straight channels followed by multiple channels and sedimentation, some abandoned channels, and then some straight sections again.

With assistance from WWF-Canada and local DFO staff, the Inter-Fluve team took several measurements. These included channel bottom from outlet to Pistolet Bay, riffles, pools, and periodically a cross-section to better understand the channel width and depth. The team analyzed gravel bars and the channel itself and measured the size of sediment according to, for instance, cobble or rock.

Nick and his Inter-Fluve associates wanted to better understand the tidal fluctuation. To do this, they installed water level loggers to measure water depth and temperature at different levels of the stream. They placed four at different heights above the channel bed: one at the bottom, which was by the bridge, one at the top, and two in the center. This gave them the water depth through the section of stream being measured and changes in elevation from high tide to low tide. They also placed a water level logger in the riffle at the upstream end of tidal influence and one in the estuary to compare the tidal fluctuation in different areas. In this manner, they studied water level for at least 2.5 days. They also completed some drone work to obtain closer and more detailed imagery to see if there was sediment run-off in a particular area. They acquired drone footage for the entire stretch and the corridor along the river. There was good habitat throughout watershed.

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They inferred that if erosion happened in reach #4, it would deposit sediments downstream, where there is a low gradient with less velocity of water. If water velocity were very high, it could transfer everything to the mouth of the river.

Residents of the local area had described suggested an event, which occurred over 10 years ago, that may have caused the sedimentation issues at the mouth of the river. Ice that backed up at the bridge could have resulted in backwater and may have extended the time period of high tide waters above the bridge. Sediment in that case would have fallen out of suspension and deposited in the area.

Nick explained that the team was aware that fish mortality had occurred when water levels were low and temperatures were high. Low stream flow combined with low tide could cause fish to be trapped in the pool.

Table 4. Questions and answers following Session III: Assessment of Parker’s Brook

Name	Question/Response
Kathleen Blanchard	I heard you say really that the only direct anthropogenic source of impact, if I'm right, is the bridge. But then did you not see other signs of disturbance such as ATV crossings, wood cutting, or other kinds of activity?
Nick Nelson	<p>No, we did see a few instances of that and I think Victoria can probably recall as well. We traveled along some ATV trails. There were not many crossings of the channel, cause it's pretty hard to cross the river with the ATV, but there might have been one location for that.</p> <p>There were instances of clearing, but again, these were pretty limited. It seemed like it was not a case of vast hillslopes that were clear-cut. And then, we did not see obvious sources of runoff with lots of sediment coming in. So, those were exactly the kinds of things that I was looking out for. I was kind of anticipating those roads, dirt roads that could be causing issues, but we didn't see that as a major cause of significant sediment downstream.</p>
Tom Bird	Can you comment on whether/how long-shore transport in very shallow Pistolet Bay might be contributing to the deposition dynamics?
Nick Nelson	<p>That's a great question. And I will just move my Google Earth image over here to kind of see that outlet. You can really see the Delta out here. It's hard to say exactly what those impacts are, but you can see the movement of Parker's Brook, the flow of Parker’s is able to maintain channel out there through that material. There are a lot of boulders, big boulders out here that are well away from the bridge here.</p> <p>So, there is some deposition that occurs through there, I think, through that long-shore movement. We see deposition along this edge as well. Through that movement, you kind of see that that's the direction that the Parker’s River outlet is forming there. So, I'm sure the shallowness of the Bay certainly contributes, the wave action and currents within the Bay as well certainly contribute. But we see, you know, with the boulders out here, with the deposition that we do see, there should be the ability for the flows of the river to maintain at least enough depth for fish to move through there continuously.</p>

<p>Chris Manuel</p>	<p>Would any erosion prevention techniques be worthwhile? I know some conservation groups have spent a lot of money on this in the past, for example, the Margaree River in Cape Breton.</p>
<p>Nick Nelson</p>	<p>Usually when we do these geomorphic assessments, we are looking for areas of excessive erosion that might be because of human impact somewhere. But if we see a river that is moving its banks, but in relative equilibrium, meaning that it might be eroding one outer bank, but it's depositing material on the other side, where the river is still activating its floodplains on a regular basis, where it's not confined to an incised channel and not eroding vertically, the erosion that we saw there is the natural processes of this river. We would typically advocate for erosion control measures along channels where we see really excessive erosion, where we see a lot of material dropping into the river system. You'd have to armour, you'd have to treat the entirety of Reach Two and other sections here, which is in my opinion, not appropriate for this system. I think you still want to encourage or allow the natural processes to happen, as that's important for habitat. It's important for spawning gravels. It's important for substrate throughout the river system. It's sort of the excessive erosion that we try to look for.</p>
<p>Kathleen Blanchard</p>	<p>How do you determine there is equilibrium? Is this a formula you work out involving, you know, metrics or is it an eyeball assessment? Because we see only a moment in time and a river has been around for hundreds of years, then how do you judge whether actions should be taken?</p>
<p>Nick Nelson</p>	<p>It's through seeing, evaluating a lot of these rivers throughout the continent here and seeing really obvious examples of heavy erosion. Usually when we see a river that is out of whack, you know, it's eroding more than we think it should be. That's usually when we see erosion happening on both channel banks for long stretches of the river. If that's happening, that means the river's trying to expand. It might not be able to erode vertically, so it expands laterally and erodes on both banks for large stretches of river.</p> <p>If we see a river that is eroding on one bank but building up on the other, that means it's just moving, it's moving across the valley. If we see a river where we'll be walking along the river and then all of a sudden there's a two, three meter vertical drop or a steep drop over maybe 10 or 20 meters of channel length, that might be indicative of a vertical erosion. What we call incision. That could be a head cut, which could be detrimental because as that head cut migrates upstream, that vertical erosion migrates upstream, then you'll start to see the channel banks collapsing. Then you start to see more flows, focused in the river, not being able to flood outside the banks.</p> <p>So there are certain key things that we'll look out for to better understand where we are in the evolution of the channel process. I guess, you know, geologically, you know, these rivers are always adjusting over the thousands of years. So, it's not an equilibrium in the geologic scale, but more of what we're seeing right now. Is it moving the material being brought into that reach? Are we having a kind of erosion on a large, large scale?</p>
<p>Kathleen Blanchard</p>	<p>Do you think that it might be helpful if you had other information about the river as you started, and would there be a role for citizens in the area to help</p>

	you create a baseline of data of any type? Let me throw out the question of a photographic record. Would that be helpful to you, or anything else?
Nick Nelson	<p>That sort of long-term monitoring is always really helpful. It may not be in time for our action here, but it might help inform future actions as well. And, you know, we'll get into the design elements in this next section here. Once this is implemented, we want to know how it's evolving over time. Does the pool fill back in and how quickly? How are the riverbanks evolving over time?</p> <p>Do we see evidence of clearing of trees along there? So, yeah. Repeat photographs is super helpful. Long-term, water level monitoring, getting one of those water level loggers out there that can track tidal fluctuations and the stream flow, and water temperatures, they can be super helpful as well.</p> <p>And it’s relatively inexpensive. You do have to be careful of people sabotaging the equipment out there, especially right under a bridge, but there are ways to camouflage that. Those couple of items are very helpful to have over time.</p>
Brandon Ward	Suggestion: Crown Lands Division of Government of Newfoundland and Labrador has some aerial photography of the province from the 1950s and perhaps other years that may be useful to your work, Nick.
Nick Nelson	Yeah, that would be great. I have recorded that comment and I'll look into it. I'd be really interested to know how we can acquire those photographs. I don't know if those are digitally available somewhere, or if that's a sort of hard copy, a rifling through some file cabinets, or what that would entail, but that imagery is usually very helpful.

3.6 Session IV: Parker’s Brook Restoration Design and Review

For the fourth and final session, Nick Nelson presented the design options for the restoration work that could be undertaken for Parker’s Brook (Appendix I).

Scenario 1: Dredging sediment to deepen the pools. This scenario would include strategically placing woody debris, embedded in the riverbanks, to create shaded cover for resting char and salmon. These logs and other debris would be placed in the ground a few feet to ensure they do not move. This would create a pool for the fish that could not get out of the river when the tide falls. It will also create shade and cooler temperatures for the char. The build-up at the mouth would be dredged and logs placed in the ground, helping char enter and leave the stream during tides and able to access shade (Appendix I, page 57).

Scenario 2: Extending the bridge abutments further back from the river channel. Extending the bridge would help create room for the ice and heavy waters to flow through the bridge area better and will create more space for the char and salmon to rest.

Nick concluded that combining the two action scenarios would work best.

He explained that coffer dams would be installed around the working area to prevent water from entering and exiting the area (Appendix I, page 57). It would be a difficult scene to look at while the construction is underway, due to the operation of equipment in the stream. He cautioned that people

may wonder whether the work is doing more harm than good, but that they would need to see the end results, and he gave assurance that the results would improve the situation for the char.

Table 5. Questions and answers following Session IV: Parker’s Brook Restoration Design and Review

Name	Question/Response
Kathleen Blanchard	Can you outline the timeframe for this kind of work, Nick?
Nick Nelson	<p>When I think about timeline, COVID certainly has challenged things. But, we are going to be proceeding with designs right now. In past conversations, we've understood that permitting generally is not as onerous as I'm used to here in Massachusetts and in United States, where we have potentially nine to 18 months of permitting that can sometimes take place. So, it sounds like because the resource agencies know about this project and are involved already, that should be relatively quick. We typically like to do this work during the low flow periods of summer, and we want to make sure we get it in, prior to any fish spawning windows.</p> <p>So, I think what is the critical element, is working with the fisheries biologists, with DFO and Sheldon, and others to make sure we get the window correct, before fish start to migrate.</p>
Kathleen Blanchard	Nick, would this be, potentially the site that has experienced the most ice impact of any of your studies across North America?
Nick Nelson	<p>Yeah. We do have instances in Toronto and portions of Maine as well, where we have to take ice into consideration. One thing that comes into the design element is that there are a couple of aspects to working with ice. There's both the impact of the ice moving downstream, and there's also the impact of the ice just breaking up. So, if we install large wood, or if we install some plantings along the edge and you have high flows where it's freezing along that edge, that itself can just pluck up a lot of the plantings. We have had some design elements elsewhere where we've critically thought about where do we put these plantings and engineering in terms of the large wood. How do we install this large wood so it can withstand those forces of both ice impact, but also ice uplift that might occur?</p> <p>On a similar vein for this particular site, you also have the tidal influence. So, you have a lot going on. You've got a stream flow, moving down river, you've got the tidal movement back and forth, which is not a large tidal fluctuation, but it is some, and then the ice as well. So there are a number of different elements that we typically put on Mike to figure out on the engineering side of things.</p>
Tom Bird	How have you seen salmon populations in other places responding to interventions like this?
Nick Nelson	<p>In general, we can look kind of holistically across the US, when we create or enhance or restore sections of rivers with these types of modifications, where we're kind of restoring the form of the river, bringing the pools back in, or the riffles back in, or providing more large wood habitat. We really see fish take to those right away. This particular case is a little bit different than our others in</p>

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	<p>that it's sort of obstruction at the mouth of the river that we're trying to open up a little bit.</p> <p>But when we create these habitat elements, they become kind of nursery areas for fish. They become the areas where the fish congregate, as holding patterns to be able to move upstream. They might be holding areas for young as well, because it's good, quiet water and cover habitat. We usually find a number of fish at different life stages in these pools and riffle habitats afterwards.</p> <p>I also want to be clear that, you know, there are a lot of other things at play here, including climate change, sea level rise, and warming temperatures. Recognizing that we are at the southern limit of the char population. We're at the boundary here. So, I think it's clear to us, I think it's clear to most of you that this is an intervention to help a population for as long as we can help it. But there's only so much that you can do before you run into sea level rises and climate change and temperature that are beyond what we're all capable of affecting there.</p>
<p>Kathleen Blanchard</p>	<p>Nick you've done many projects across North America, so are there lessons you've learned from them, particularly about communications in dealing with the public during a project? I imagine that pool will be attractive to local residents and campers who might see it as a swimming pool.</p>
	<p>I think most people, well, their first impression when they're seeing construction happening on a river and flood plain is kind of shock that there's all this impact happening out there. We are accustomed to seeing that sort of impact in upland areas for housing development or roads, but we're not accustomed to seeing that in the river itself, especially for a restoration project. They might be thinking, how are you restoring this when you're having such a large impact?</p> <p>So, in thinking of those expectations, this is going to look heavy handed. It's going to have a lot of big machinery out there. It's going to be dirty. It's going to be messy. It's going to be sloppy. It's not going to look good during construction. And to not sort of overreact, I guess. Often what we see, even with some project partners, is that we have, or they see, something happening and they want to go right in and change that, but we really need be able to be adaptable to conditions. But also remember the larger time period that we're thinking about here. So, recognizing that this site will evolve over time, and that we want to be able to consider site conditions and adjust designs if we think it's necessary. But we also need to be able to trust the designs and engineering and science that went into it all and to not have that sort of knee-jerk reaction of "we gotta make all these changes because it looks scary right now."</p> <p>That's sort of the immediate impact, and we've seen that in a lot of cases where, right after construction, the site just looks like a bomb went off because there's just a floodplain, construction, there's wood all over the place. But then once it greens up at first growing season everybody's on board and they're saying this is amazing. The fish are coming back in and the birds are all over the place. So, it really changes opinions.</p> <p>In terms of recreation, I think that's a really good point about thinking about potential use of that area and wanting to keep people out. So, we do want to</p>

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	<p>keep people out of there at least initially until those riverbanks have a chance to recover and stabilize with vegetation. You're not going to be able to keep people out of there continuously, but I think there could be permanent signs that go up that, during migratory periods, we want to keep people and dogs out of there. It's not a long migratory period, so it shouldn't be too onerous for people to help you out there. But we've definitely had signs up on other projects to keep people out during certain periods of time.</p>
<p>Chelsea Boaler</p>	<p>One of the points that came up through some of my discussions with community members and some local partners was to have an interpretation area near the mouth of the river. So not entirely sure exactly where that's going to be just yet, but that would be a good example of, to be able to have a space, to allow folks to come and see the char when they're able to, when they're migrating in and out. There are also quite a few people who look from the bridge, so that might be something to consider as well. Maybe there's a spot on the bridge where we would be able to have a little lookout area that would deter folks from going down on the actual banks to look at the char or when they're coming in and out, especially during that revegetation time. I've been part of some bridge installations, not necessarily in a restoration type of project, but it is true that it does look really, really messy at first until you start to see that regrowth. So that's something to keep in mind. And I think that with our amazing local partners and stewards in the area as well, having them engaged throughout this entire process, as they have been from the very beginning, even just having them reiterate this verbally to folks that are passing by in the area as well, is very helpful.</p>
<p>Richard Van Ingen</p>	<p>Great presentations. In respect to use of the area by swimmers etc., would a bit more large woody debris maybe discourage the area for that type of recreation without detracting?</p>
<p>Nick Nelson</p>	<p>Great question and comment. I think you can see on my screen here. For that big pool, we currently just have the wood in the area where the access would be coming in there. To put wood in along this whole bend, that would be a bigger impact to the bank, certainly. It would provide a lot of additional cover and habitat, but it'd be a much larger effort to do that construction, and fiscally as well. To some extent, there've been lots of discussions, especially in the Pacific Northwest, where putting large wood back into rivers has been the design element for a while now for restoration projects. There are a lot of concerns about liability and risks to swimmers and boaters. You know, you put more wood in there. It's probably not as attractive, but then do we also create a potential hazard for people if they are going to go in there, anyway. Maybe we consider, continue to evaluate as we move into this next phase of design. I want to be clear. These are concepts that you're looking at here and that as we get into this next phase, we'll really be diving into that, those kinds of discussions and those details.</p>

3.7 Additional Discussion and Wrap Up

Parker's Brook Workshop Report

Workshop participant Ward Sampson experienced a technical problem and was unable to use the Q & A function. He phoned the moderator after the event to voice a concern over angling pressure on "West Brook" (Parker's Brook). With low water levels and increased temperatures, Ward believes the whole river system should be closed to angling, both retention and catch and release, and that temperature monitoring should be conducted regularly. He asked about numbers of fish in the system, which bodes well for the support of a counting fence on this river.

4.0 WORKSHOP SUMMARY AND PARTICIPANT REFLECTIONS

The workshop, *Parker's Brook: Then and Now*, accomplished each of its four objectives for information sharing, cultivating appreciation, presenting options for future remediation work, and to some extent encouraging community engagement.

The organizers suspect that the online format may have discouraged a few residents from the local area from participating. Online workshops, while convenient, carry a variety of risks and require that participants have internet access and adequate speed and that the cloud-based platform be functional at the time. It is also recognized that some participants prefer meeting in person and asking questions face-to-face.

Nonetheless, the workshop made significant progress toward the overall objectives for the restoration of Parker's Brook with regards to analysis of in-stream threats to Arctic char and Atlantic salmon, options for immediate remediation, and engagement of stakeholder groups. It successfully documented and made available a host of important historic and current information about the ecology and fluvial geomorphology of the Parker's Brook system. The workshop acknowledged the beneficial stewardship work by area residents in recent years and acknowledged the important role that stewardship will need to play going forward. The workshop presented complex concepts of fluvial geomorphology in common language with photos and graphics. The artistic visual notes by Libby Dean (Appendix E) present a creative and attractive alternative to PowerPoint slides and technical analysis. Overall, the presentation of information in a variety of formats will facilitate future access to information and engagement by the public.

Several positive comments from panel members were submitted immediately following the workshop. Here below are some of those comments:

.....this group never ceases to put a smile on my face. You are the most positive team of project partners I think I've ever encountered. --Nick Nelson

While I'm sure we all would have preferred to be in St. Anthony addressing community members directly, I don't think the virtual workshop could have gone any better! --Victoria Neville

I also really love the interpersonal skills and positive engagement that Chelsea brought to this workshop. It was a major project milestone. --Victoria Neville

Thanks for all of your hard work on this workshop and the important work each of you do to give this planet — and therefore every char — a better chance at a healthy future. --Libby Dean

Parker's Brook Workshop Report

Sheldon, your kick off presentation was such an splendid combination of science, history and personal connection to the char. Thank you for making that presentation and delivering the science. Thanks for pushing to get that depth survey included! --Victoria Neville

Nick, MacKenzie and Mike! I was so proud of the presentation that was delivered today. Having gotten to participate in your survey, I really appreciated seeing the data we collected. I think everyone who participated was fascinated by the work that you do! --Victoria Neville

Truly a pleasure, and an honour, to work with you all! The event was informative, fun, uplifting, and positive. Excellent presentations, well delivered! --Kathleen Blanchard

I wanted to take one last moment to extend my gratitude to our wonderful panelists (Sheldon Eddison, DFO; Victoria Neville, WWF-Canada; Nick Nelson, Inter-Fluve Inc.) for their contribution, to Kathleen and Libby for their help in preparing for and documenting our event, and to all the incredible partners working on this project, including the Save Our Char Committee; without whom this would not be possible! --Chelsea Boaler

Appendix A. Workshop Announcement.



You are invited to join an online information and discussion session on the health and future of Parker's Brook (also locally known as Western Brook).



RSVP

Please contact **Chelsea Boaler**,
Marine Ecosystems and Fisheries
Specialist at WWF-Canada,
to register.

cboaler@wwfcanada.org

This event will showcase past community led work and research in the area, welcome and address ongoing concerns from community members about the area, and present ongoing monitoring and planned restoration of this key ecosystem, home to the southern-most migrating population of Arctic char.

Sessions:

All sessions will be broadcast online and will feature a 30 min presentation followed by 30 min of discussions and Q&A. You are invited to tune in for any or all sessions, all of which will be recorded and viewable later.

Please register in advance to receive a link to participate.

- 10 am NST: Previous work on Parker's Brook
- 11 am NST: Parker's Brook and Arctic char
- 1 pm NST: Parker's Brook habitat assessment
- 2 pm NST: Parker's Brook restoration design and review

We would like to thank Save Our Char Committee, WWF-Canada, DFO, and Environment and Climate Change Canada for generously supporting this work.

Parker's Brook Workshop Report

Appendix B. Workshop Invitation Letter.

Hello,

We would like to invite you to our Parker's Brook (Western Brook): Then and Now information session. This session will discuss past salmon and char monitoring works, current concerns around species in the brook, and a new restoration project to prevent further fish die-offs near the mouth of the river.

Attached to this e-mail is an invitation with more information and details on how to register. If you would like to attend, you can simply reply to this e-mail, at which point you will receive a link to attend the webinar.

This webinar is open to the public, and we encourage you to share this poster with your networks. If you have any questions, please do not hesitate to reach.

On behalf of all our partners, thank you for your interest in this incredible ecosystem!

--

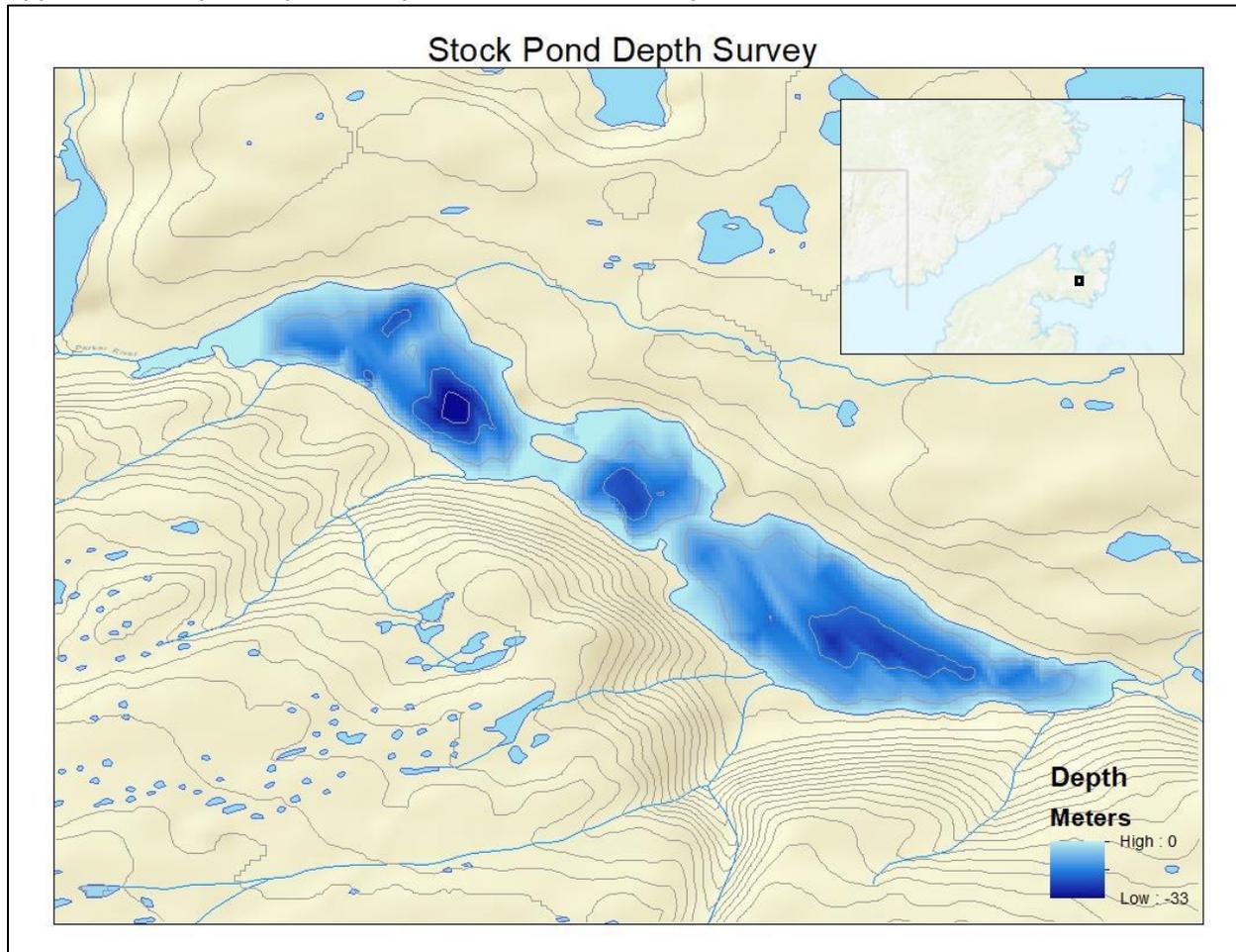
Chelsea Boaler, PhD Candidate (she/her)
Specialist, Marine Ecosystems and Fisheries | WWF-Canada
phone: 709-701-0310 | WWF.ca

Parker's Brook Workshop Report

Appendix C. Workshop Participants.

Name	Organization
Sarah Salisbury	Ph.D. Candidate, Dalhousie University
Brandon Ward	Fisheries and Oceans Canada
Don Ivany	Atlantic Salmon Federation
Ralph Hedderson	Resident and cabin owner, Regional development association
Lica Christensen	Fisheries and Oceans Canada
Tom Bird	Fisheries and Oceans Canada
Kristin Loughlin	Fisheries and Oceans Canada
Sarafina Henderson	Masters Student, Memorial University
Ward Samson	Resident of Middle Brook
Chris Manuel	Salmon Preservation Association for the Waters of Newfoundland
Damian Baldwin (+20 students)	College of the North Atlantic
Erin Herder	Fisheries and Oceans Canada
Russell Wall	Intervale Associates Inc.
Sigrid Kuehnemund	World Wildlife Fund Canada
Richard Van Ingen	Fisheries and Oceans Canada
Megan Lynch	Fisheries and Oceans Canada
Samuel Elliott	St. Anthony Basin Resources Incorporated
Eric Bennett	Intervale Associates Inc.
Kathleen Blanchard	Intervale Associates Inc.
Chelsea Boaler	World Wildlife Fund Canada
Victoria Neville	World Wildlife Fund Canada
Sheldon Eddison	Fisheries and Oceans Canada
Nick Nelson	Inter-Fluve

Appendix D. Map of Depth Survey of Stock Pond, courtesy DFO.



Appendix E. Visuals Created by Libby Dean.

PARKER'S BROOK
then and NOW

Arctic Char
(*Salvelinus alpinus*)

Southernmost* Sea-run char population
* CURRENTLY CONFIRMED

Northernmost Anadromous fish species

LOCAL KNOWLEDGE

LOCAL Cooperation Consultation Collaboration Conservation BENEFITS

DNA STUDY

COUNTING FENCE
200 ↓ 300

CIRCUMPOLAR SPECIES under threat

RESTORATION

STOCK POND 3-D MAPPING

REGENERATION

REMEDICATION

Did You Know?

Each of our interactions with fish and their habitats can affect them

Many other indirect processes also have an impact on fish

Pollution and litter

obstruction of waterways

vehicles crossing in streams

flooding

climate change

heat

fishing

storms

run-off

changes in nutrients

sewage

removal of beaver dams

changes to stream beds

changes to pools

sediment disturbance

dogs splashing in streams

water crossings

erosion

wood cutting

people swimming

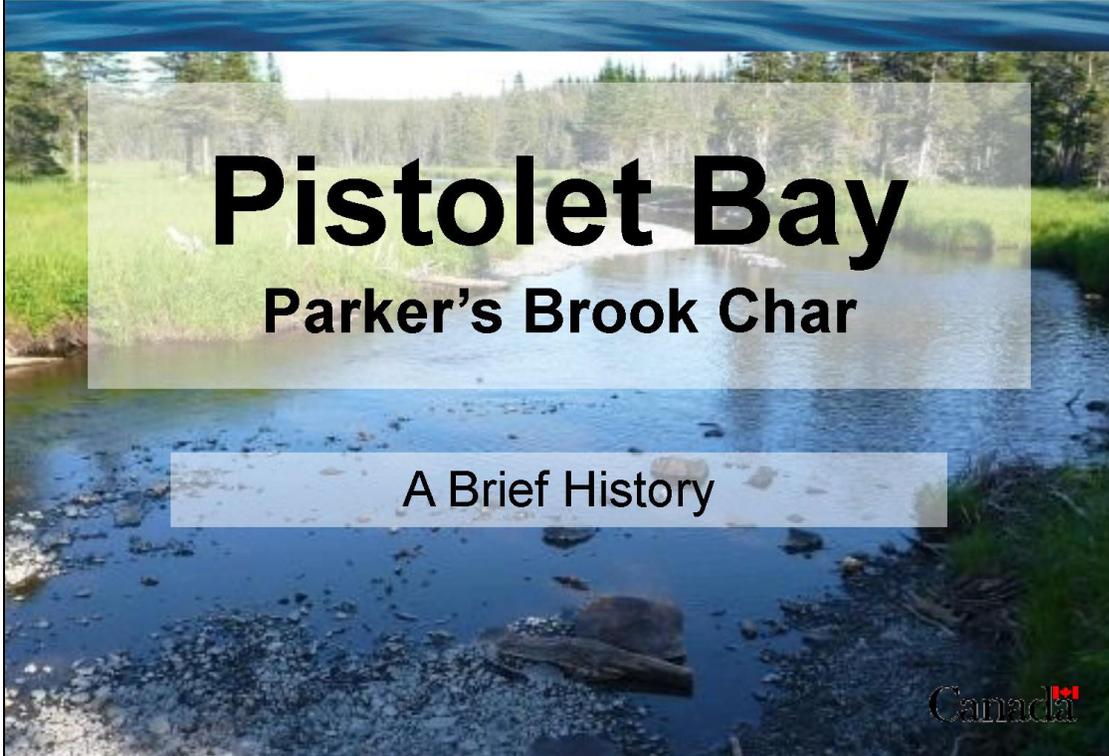
tides

These have a combined impact on fish!



Appendix F. Presentation: Pistolet Bay/Parker's Brook Char: A Brief History.

 Fisheries and Oceans Canada Pêches et Océans Canada



Pistolet Bay

Parker's Brook Char

A Brief History



OUTLINE

- ✓ SOCC
- ✓ 5 Year Strategic Recovery Plan
- ✓ What we Observed to Date
- ✓ Three Great Dyings
- ✓ Parkers Brook Restoration
- ✓ Questions/Comments???



SAVE OUR CHAR COMMITTEE

- ✓ Formed in 1982
- ✓ Concern for char conservation
- ✓ Recognized how special Pistolet Bay Char were!
- ✓ 2007: Saw significant decline
- ✓ Partnered with DFO, Nordic, SABRI, CURRA, MUN and Provincial Wildlife to address concerns

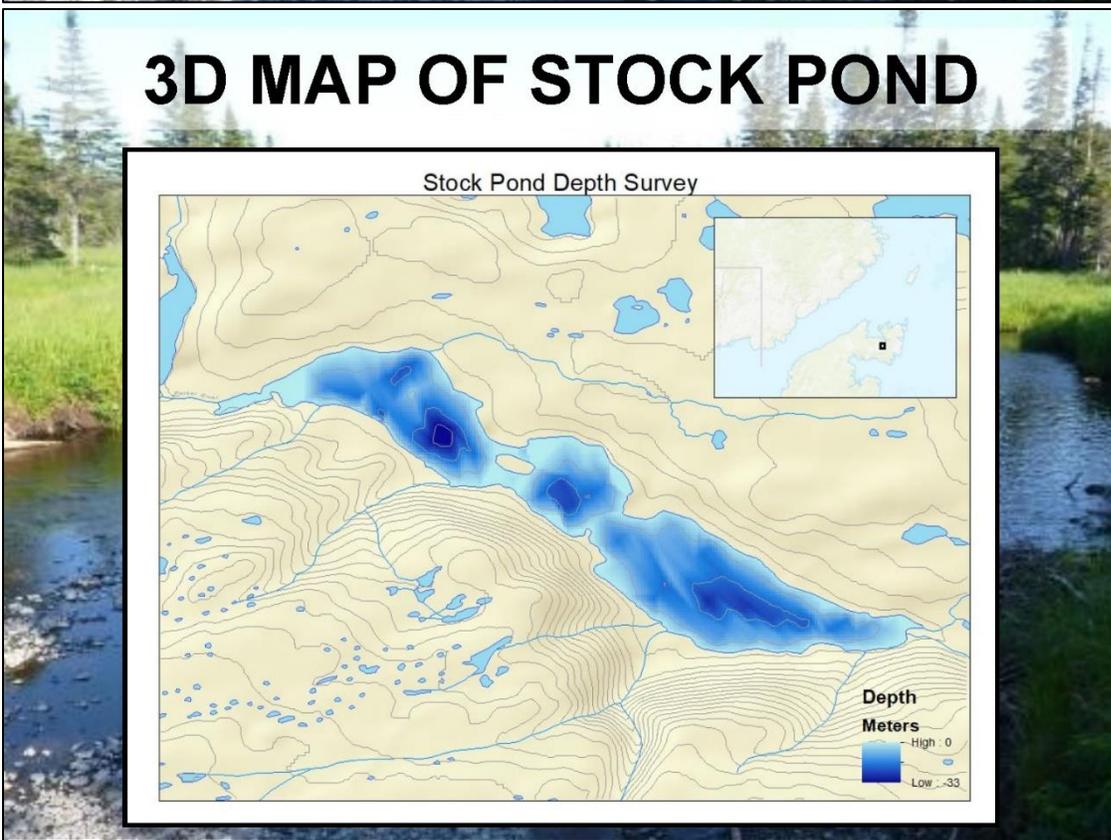
5 YEAR STRATEGIC RECOVERY PLAN

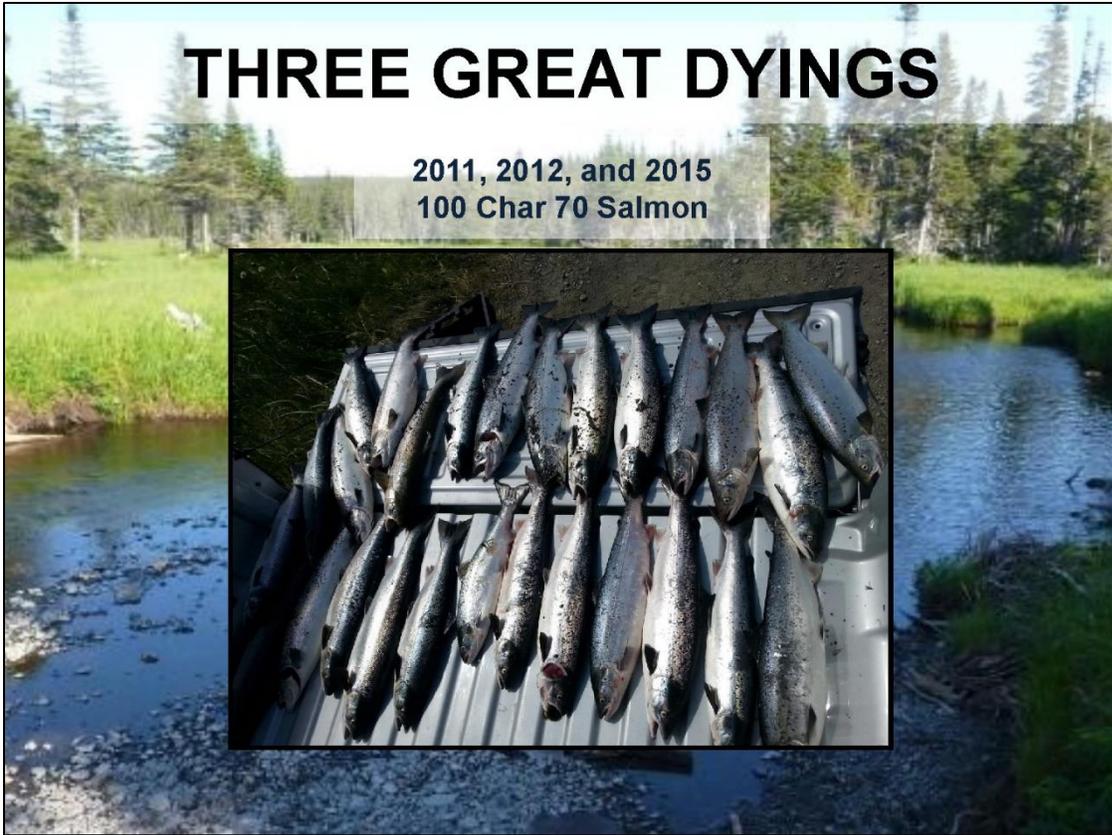
- ✓ Promote conservation, cooperation, and consultation
- ✓ Counting fence and underwater camera
- ✓ Depth survey
- ✓ Heads collection program



WHAT WE OBSERVED TO DATE

- ✓ Counting fence set up
- ✓ Coordination hired by SABRI
- ✓ Fish head campaign (MUN, CURRA)
- ✓ Website development (NORDIC)
- ✓ DFO Science tagging project
- ✓ Mouth of river closed
- ✓ 3D Map of Stock Pond
- ✓ Beach Clean-up (Girl Guides)
- ✓ Heads collection program





**Thank You 😊
Questions?**



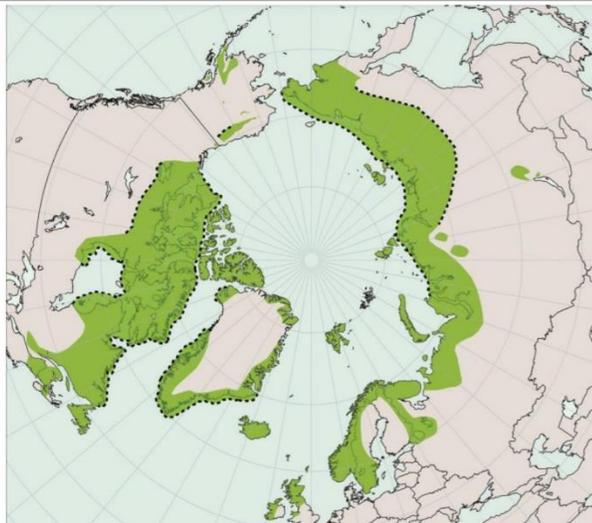
Appendix G. Presentation: Ecology of Arctic Char.



Distribution



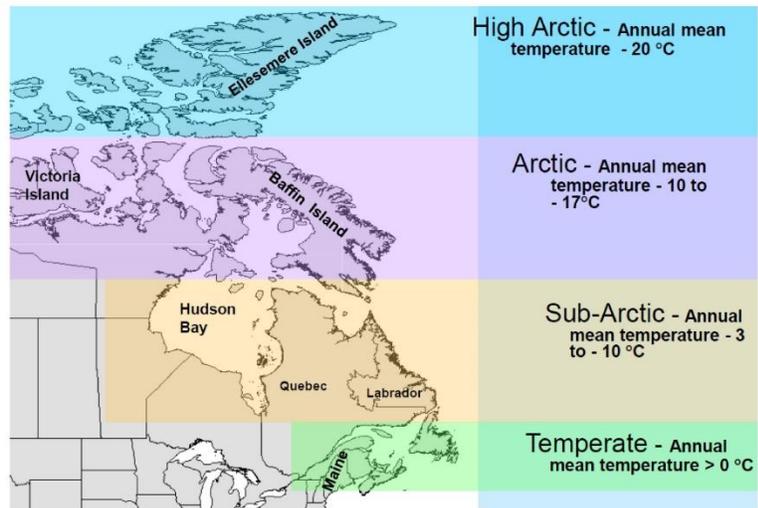
- The Arctic char is the northernmost freshwater or sea-run (anadromous) fish on earth, with a circumpolar distribution.
- After the last glaciation sea-run char retreated to colder arctic and sub-arctic regions but lake-dwelling relics remain.



Distribution



- They are adapted to cold water and are found in arctic, subarctic, boreal and temperate climate regions.
- Southerly limits in freshwater are extended by cold waters (deep and alpine lakes).
- In North America, the southernmost native populations occur in landlocked woodland lakes in Maine, USA.



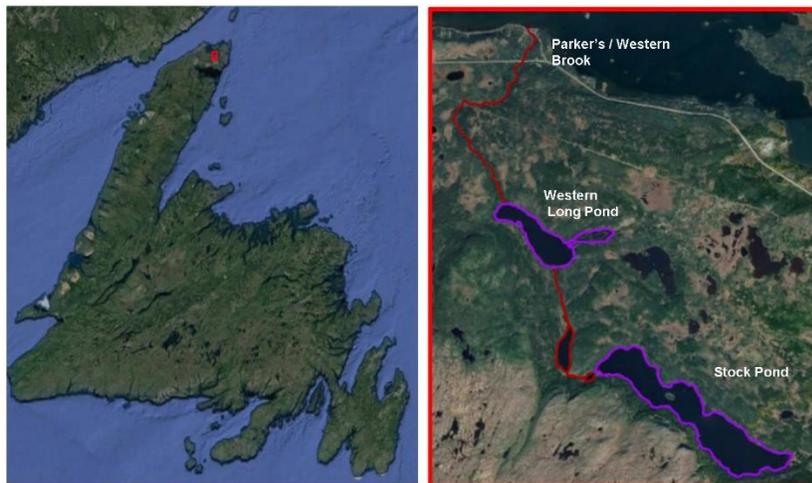
Ecology of Arctic Char (*Salvelinus alpinus*)

3

Distribution



- It is believed that Arctic char in **Parker's Brook/Western Brook** are the southernmost anadromous char.
- Reports further south in River of Ponds.



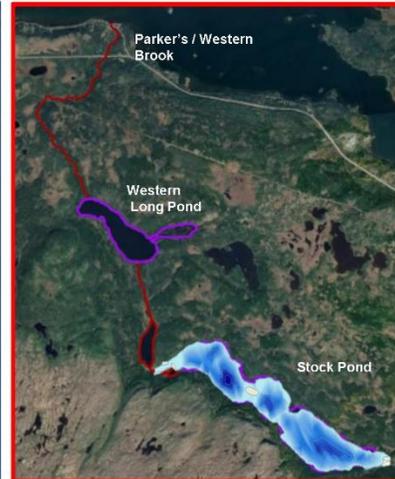
Ecology of Arctic Char (*Salvelinus alpinus*)

4

Distribution



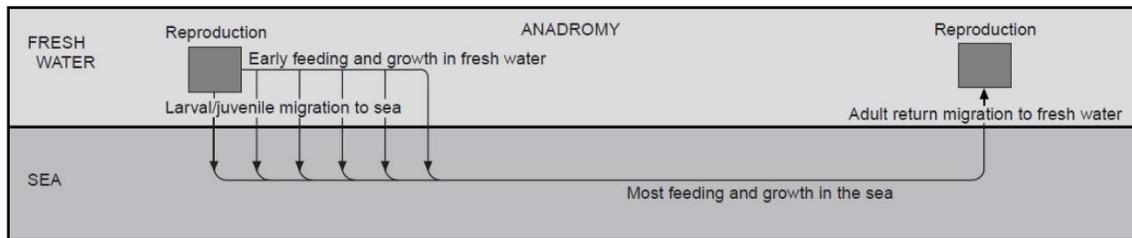
- It is believed that Arctic char in **Parker's Brook/Western Brook** are the southernmost anadromous char.
- Reports further south in River of Ponds.



Ecology of Arctic Char (*Salvelinus alpinus*)

5

Why is anadromy special/important?



- Lake-dwelling char are more common and more southernly distributed than anadromous char.
- Going to sea provides increased feeding and growth opportunities and reproductive output.
- Arctic char can reach large sizes as a result of repeated summer marine feeding forays.



Ecology of Arctic Char (*Salvelinus alpinus*)

6

More about migration...



- Migratory individuals leave the fresh water after ice-breakup and spend a short time (~50 days) in the marine environment where they feed until they migrate back to fresh water.
- Mark–recapture studies suggest that distances travelled by Arctic char at sea are typically short.
- Telemetry data also suggest a preference for nearshore habitats.
- Arctic char may reside close to estuaries for the entire duration of the summer marine phase.

- Very different from the migrations of Atlantic salmon!

Ecology of Arctic Char (*Salvelinus alpinus*)

7

Spawning



Slow growing

Late Maturity

Breeding season: Usually spawn in the fall, between September and December.

Male dominance – females build nests

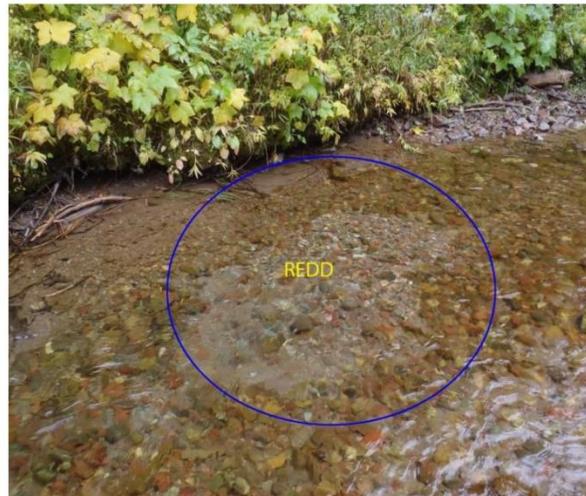
Frequency: Spawn once every other year, while some individuals only spawn every 3-4 years.

Average time to hatching: 6 months

No parental care

Fry emerge 25 mm long

Young char feed on benthic invertebrates



WWF PowerPoint_content_example

8

Arctic char (*Salvelinus alpinus*)



- Closely related to both salmon and lake trout.
- Has many characteristics of both.
- Highly variable in colour and size.

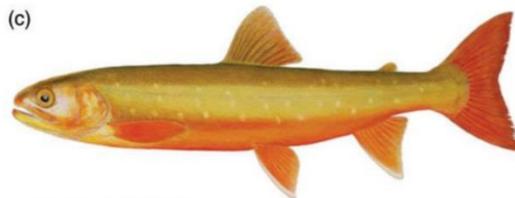
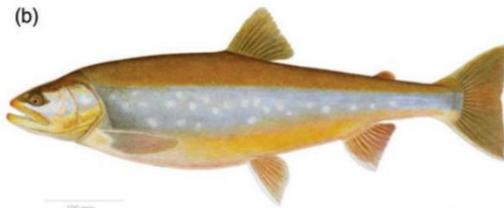
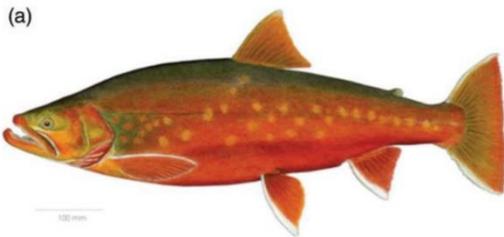


What have you seen Parker's/Western Brook char to look like?

Ecology of Arctic Char (*Salvelinus alpinus*)

9

Arctic char (*Salvelinus alpinus*)



Ecology of Arctic Char (*Salvelinus alpinus*)

10

“The most variable vertebrate on Earth”



- Ecologically & morphologically diverse
- Sea-run & freshwater forms
- Normal and dwarf forms
- Diet variability
- Spawning variability



Ecology of Arctic Char (*Salvelinus alpinus*)

11

Fast Facts



Size: Highly variable depending upon lake environment, up to 38 inches and 15 lbs.

Diet: Zooplankton, insects, other fish (including younger char).

Predators: Other fish, birds, humans.

Reproduction: Spawn every 1-2 yrs, eggs laid in redds in broken substrates or gravel shoals.



Ecology of Arctic Char (*Salvelinus alpinus*)

12

Did you know?



- The famous Swedish naturalist, Linnaeus was the first to describe arctic char from an alpine lake in northern Swedish Lapland in 1758. He named the fish *Salvelinus alpinus*, or “alpine char”.
- In many northern areas, Arctic char can be the single fish species in the ecosystem.
- Because Arctic char are generally slow- growing and have a late age of maturity, they can be vulnerable to overexploitation.



Ecology of Arctic Char (*Salvelinus alpinus*)

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Climate variability & change effects on char



- Seasonal variations impact size either directly through physiological responses to temperature or indirectly through impacts on local food webs.
- Lake populations are more sensitive to climate fluctuations than sea run populations.
- Growth rate increases marginally across latitudes with char in the north growing somewhat faster than char in the south.
- Egg production varies among populations and is responsive to local environmental conditions.
- Cumulative temperature experiences explained much of the variation in length or weight of char sampled at Nain.



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14

Predicting the future for Northern char



Before/Current

Predominately anadromous (sea run)

Long Lived

Useful as a food fishery



After (what's happened in southern areas)

Lake dwelling (usually in deeper water)

Often short lived

Marginal species with limited fishery potential



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15

What is the future of Parker's Brook char?



- Persist as one of the southernmost populations of anadromous Arctic char?
- Transition to entirely freshwater resident population similar to those in Maine, southern Quebec, and much of insular Newfoundland.
- Extirpated as a result of competition by other salmonids (salmon, trout etc.) or invasives.



WWF PowerPoint_content_example

16

Clip (Arctic char – Relics of the Ice Age)



<https://youtu.be/GUGyi-ShrxY>

Flow devices: a fish passage tool in Newfoundland and Labrador

17



Questions/ Comments?

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Flow devices: a fish passage tool in Newfoundland and Labrador

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Appendix H. Presentation: Parker's Brook Habitat Assessment.



Parker's River: Habitat Survey and Geomorphic Assessment

October 27, 2020

Nick Nelson
Mike McAllister
Mackenzie Butler



inter-fluve
Inter-fluve.com



Table of contents:

- Area of study
- Methods
- Results
- Conclusion/Discussion

2

Area of Study

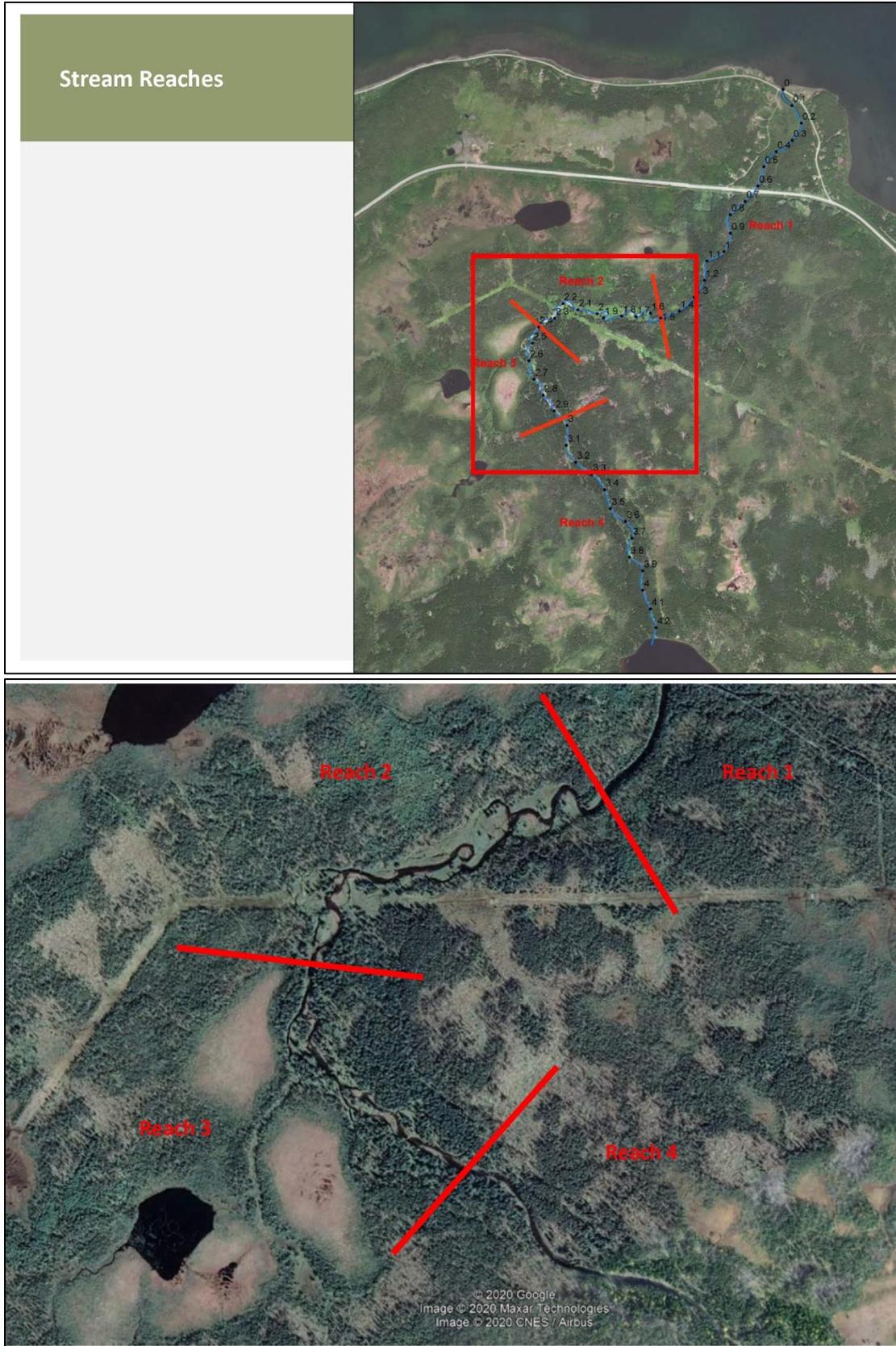
- 'West' or 'Western Brook'
- Headwaters in Eastern Long Pond
- >4 kilometers from Western Long Pond to Pistolet Bay
- Important for Arctic char and Atlantic salmon
- Sedimentation at mouth of river contributing to fish mortality

3

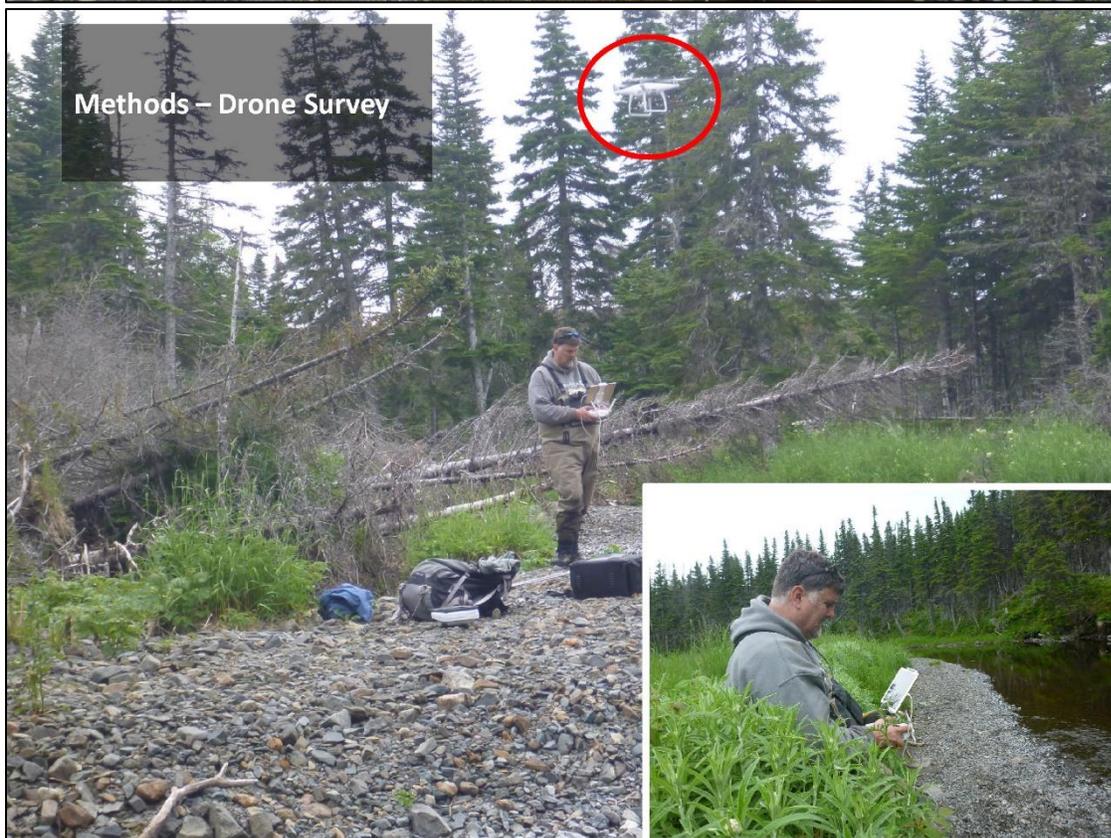
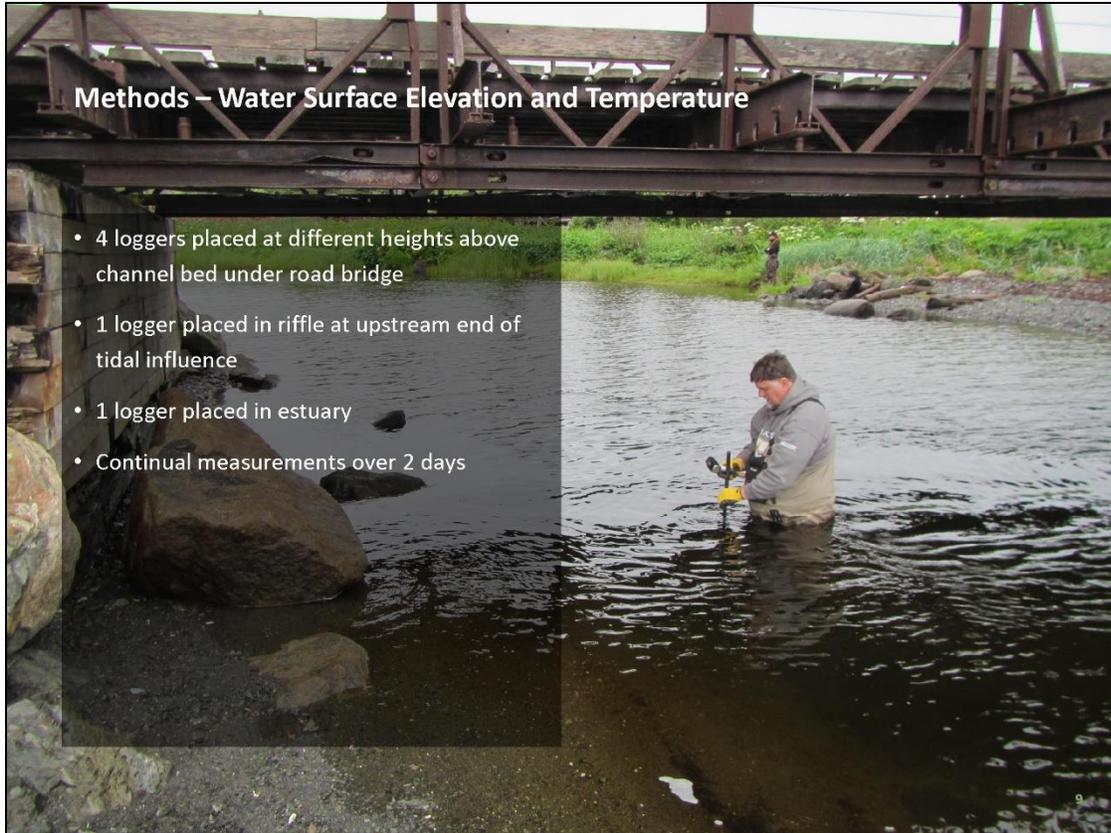
Hydrology

- Little available data for nearby streams - data below from Bartlett's River near St. Anthony
- High flows during spring melt/runoff as well as fall rainy season

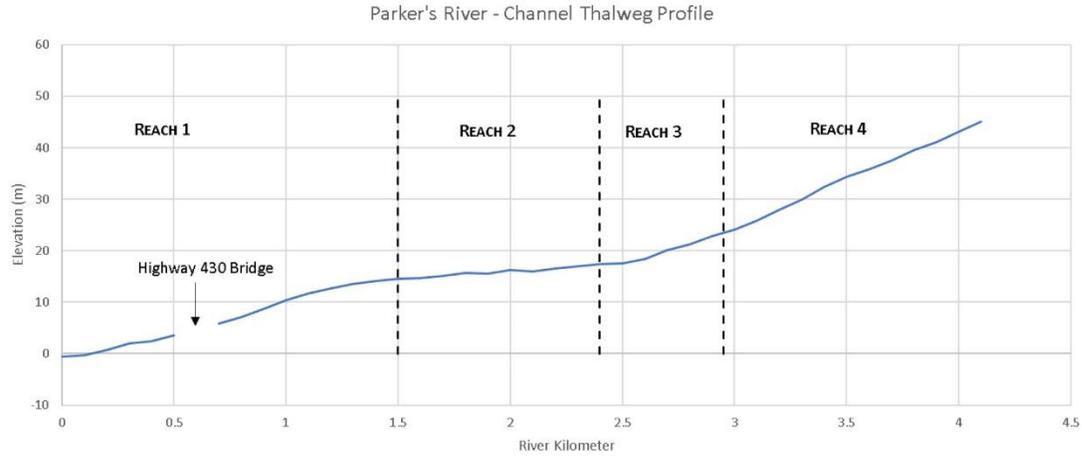
Month-Year	Average Flow (m ³ /s)
Sep-18	1.5
Oct-18	2.5
Nov-18	5.2
Dec-18	3.0
Jan-19	1.5
Feb-19	0.5
Mar-19	4.5
Apr-19	4.2
May-19	4.8
Jun-19	2.5
Jul-19	1.0
Aug-19	0.5
Sep-19	1.0
Oct-19	3.0
Nov-19	1.5
Dec-19	1.0



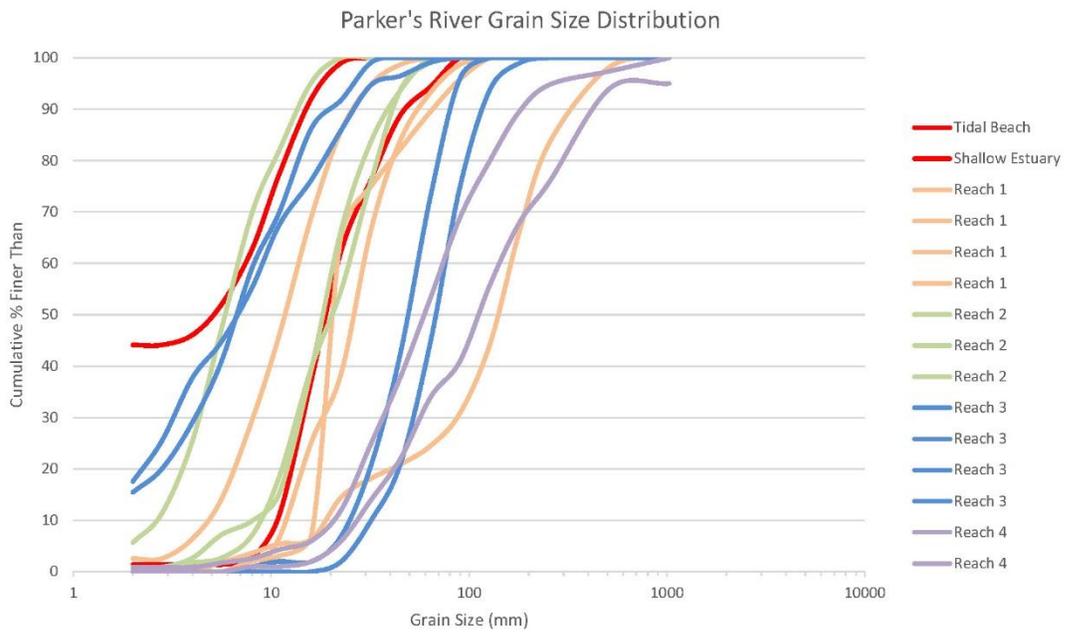




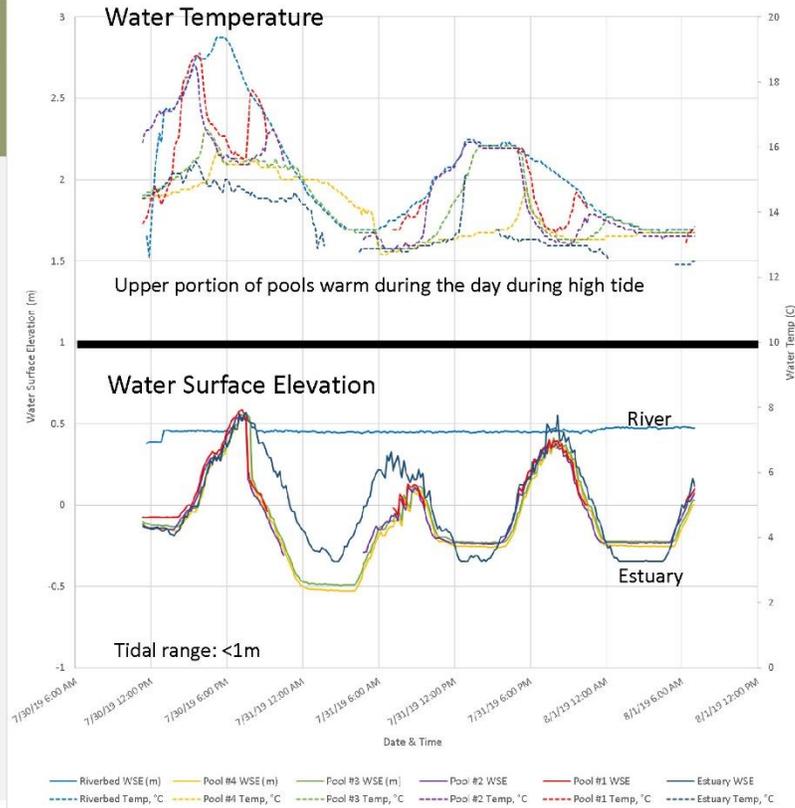
Results - Longitudinal Profile



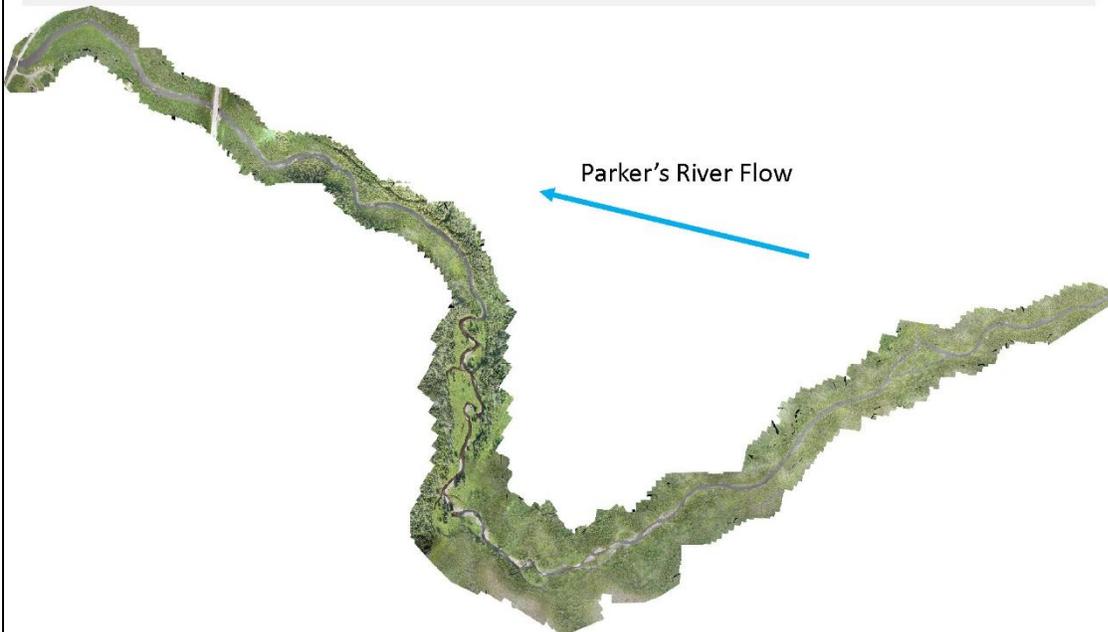
Results - Grain Size Distribution



Results - Water Level Loggers



Results - Drone Survey



Parker's Brook Workshop Report



Summary

- Good habitat throughout the watershed
- Though the channel is mobile, no major sources of sediment
- Precipitation records and conversations with local landowners suggest an event over 10 years ago may have caused the sedimentation issues at the mouth of the river:
 - Early rain on snow/ice resulted in large floods and movement of ice from the upper reaches
 - We observed evidence of possible channel re-working in Reach 2 that could be explained by such an event
 - Ice may have gotten stuck at the bridge at the outlet resulting in a backwater that may have extended longer than a high tide – sediment fell out of suspension and deposited in the area around the bridge
 - Partially fill deeper pools
 - Obscure outlet
 - May take years to mobilize

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Summary, continued

- Fish mortality has occurred when the stream water levels are low and water temperatures high
- Low stream flow combined with low tide could trap fish in the pool
- Hot air temperatures could increase temperatures in the water
- Real or perceived danger from people and dogs may result in increased stress of the fish, further harming them in an already stressed situation
- Fish may use up much of the oxygen in the pool while water levels are still too low to escape

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- Die-offs don't happen every year
- Erosion and sedimentation is a natural process, but the following factors may lead to increased frequency:
 - Climate change
 - Increased weather/precipitation variability
 - Constriction at the bridge



Options Analysis

Options	Habitat Impact	Feasibility Considerations	Relative Cost
A. No Action	- Depending on environmental conditions, may still experience years with die-off events (may become more frequent under climate change scenarios)	- Low initial cost, may be greater overall cost if wait too long/until after next extreme event - Channel conditions may improve naturally over time; if so and how long is uncertain	\$
A. Dredge channel	- Immediate charr migration improvement; habitat open from bridge out to deeper part of Pistolet Bay during entire tidal cycle -	- Depending on environmental conditions, extreme weather events in future may cause dredged channel to fill in again due to hydraulic impacts of bridge	\$\$
A. Replace bridge	- In near term, may still experience die-off events depending on environmental conditions - Over long term, expect a deeper channel to reform, improving habitat conditions	- Uncertain how long it will take to improve habitat/reform deeper channel	\$\$\$
A. Replace bridge and dredge channel	- Immediate charr migration improvement in near term; habitat open from bridge out to deeper part of Pistolet Bay during entire tidal cycle - Over long term, expect a deeper channel to remain, improving habitat conditions, due to improved hydraulics near mouth of channel	- Most expensive	\$\$\$\$

Parker's Brook Workshop Report



Nick Nelson

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Cambridge, MA 02138

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Inter-fluve.com

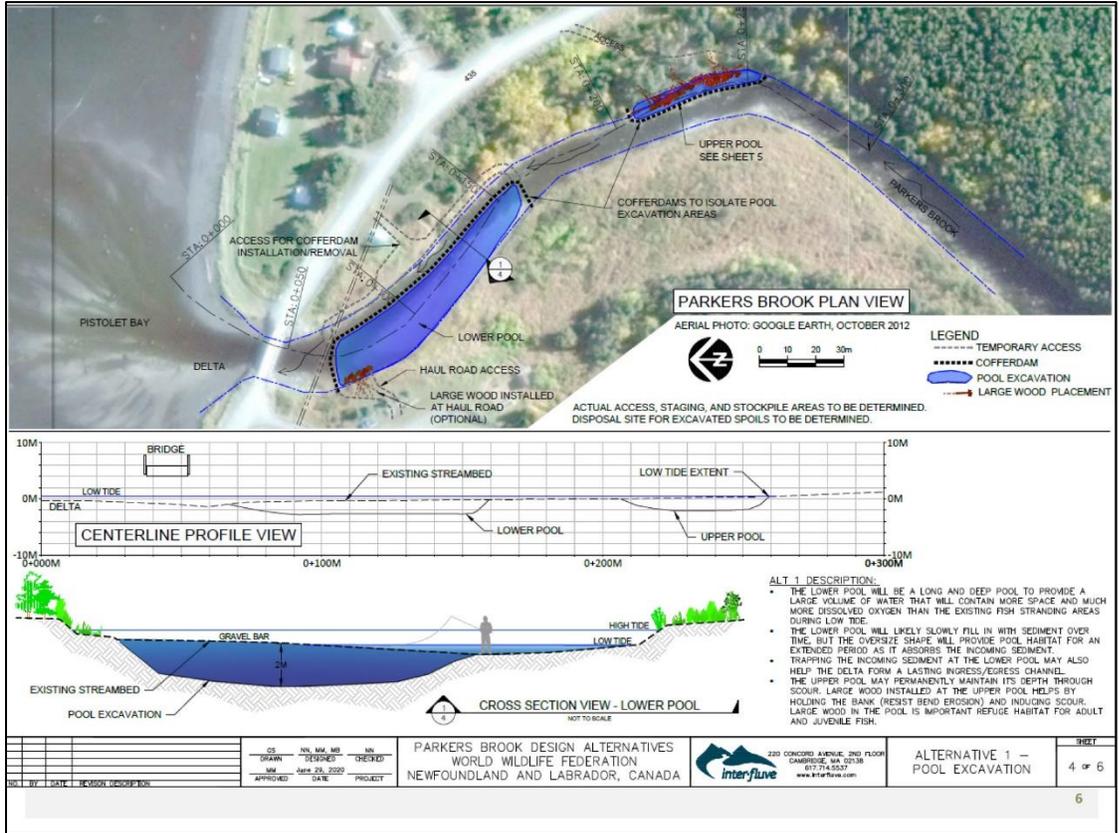
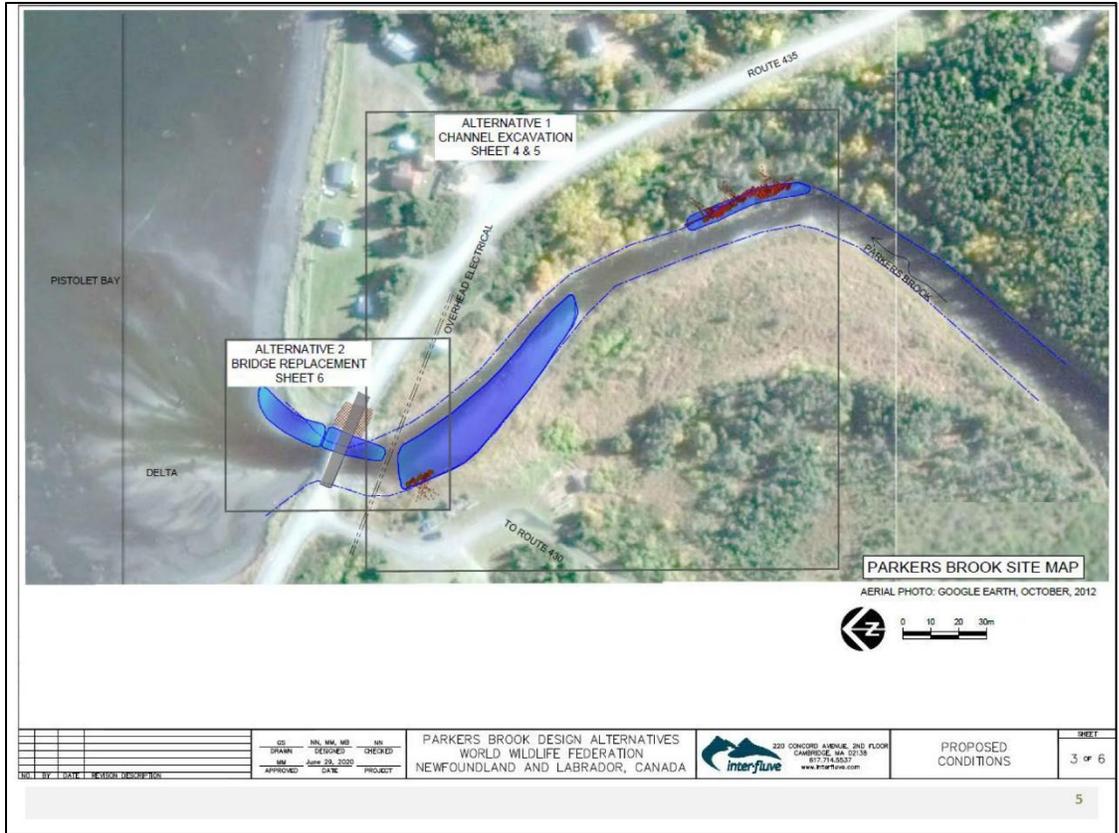
Appendix I. Presentation: Parker's Brook Restoration Design and Review.



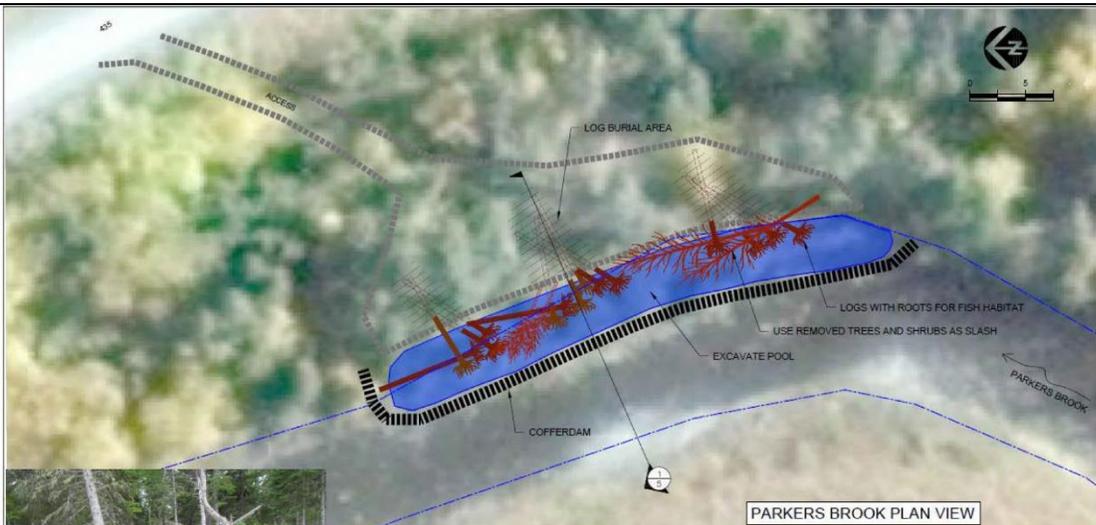
Concept Designs

- Alternative 1 – removal of sand and gravel; large wood installation
- Alternative 2 – replacement of the bridge with a larger span combined with sand and gravel removal just downstream
- Both alternatives are moving forward with designs

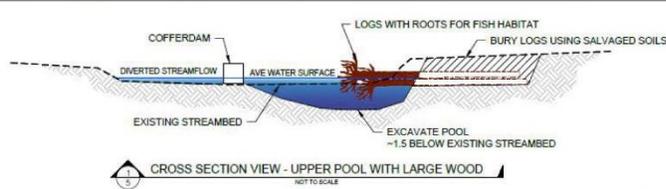
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Example of coffer dam construction

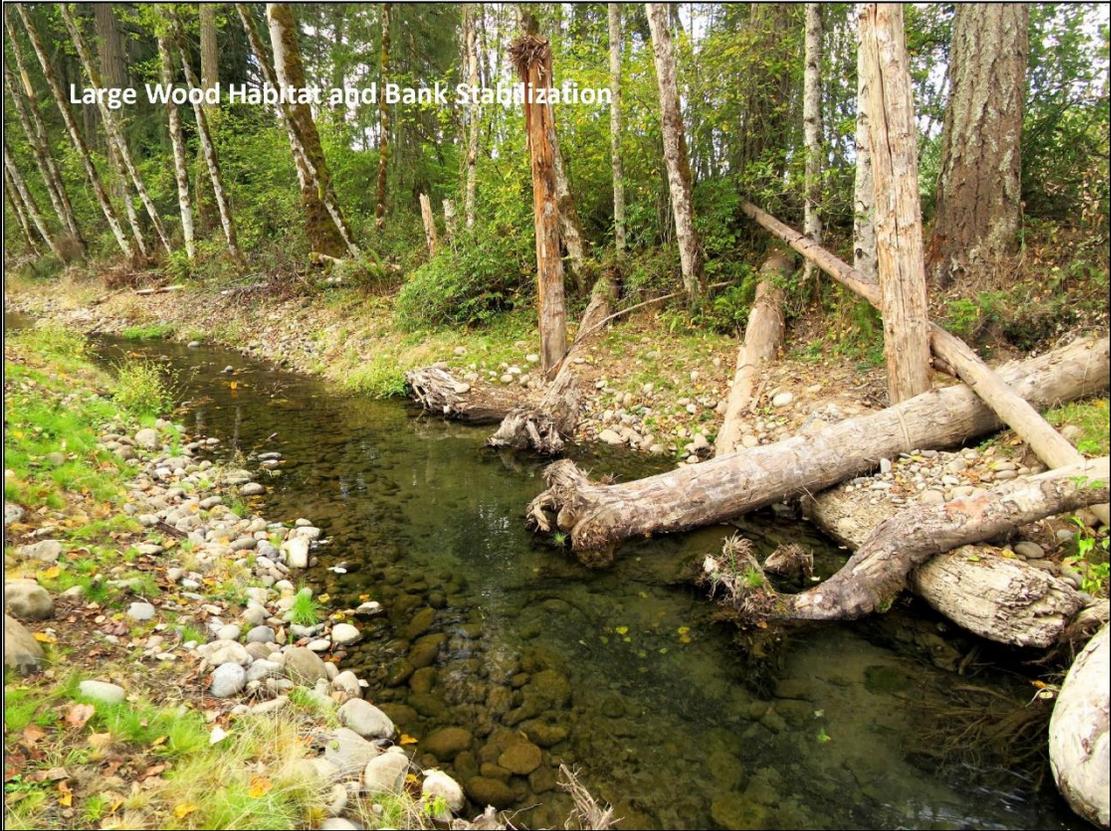


POOL WITH LARGE WOOD HABITAT

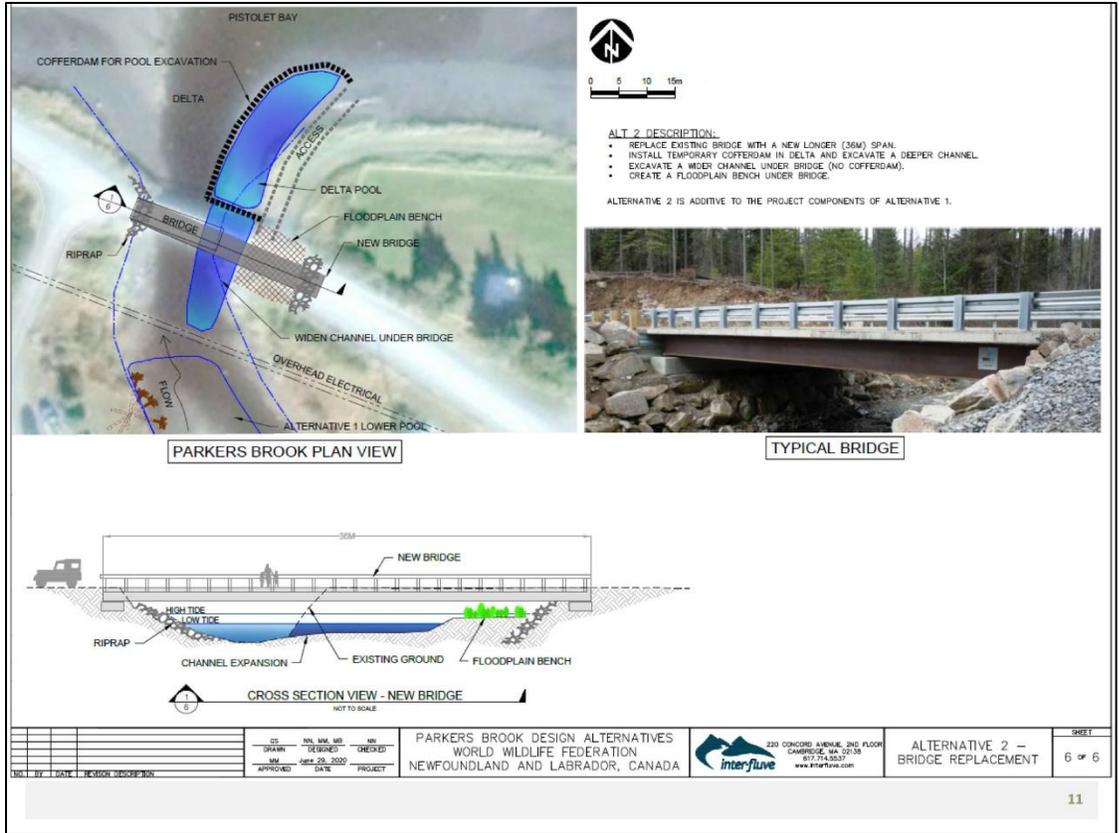


CROSS SECTION VIEW - UPPER POOL WITH LARGE WOOD
NOT TO SCALE

DESIGNED BY: [blank] DRAWN BY: [blank]		DESIGNED: [blank] CHECKED: [blank]	DATE: June 29, 2020 PROJECT: [blank]	PARKERS BROOK DESIGN ALTERNATIVES WORLD WILDLIFE FEDERATION NEWFOUNDLAND AND LABRADOR, CANADA	230 CONCORD AVENUE, 2ND FLOOR CHARLOTTE, MA 03738 617.774.9037 www.interfluvio.com	ALTERNATIVE 1 - UPPER POOL DETAILS	SHEET 5 OF 6
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