Agenda Item 5.2
For Information

Council

CNL(15)57

Efforts to Improve River Connectivity in Canadian Waters

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1. Introduction

Atlantic salmon are broadly distributed along Canada's east coast and historically occurred in hundreds of rivers including a population in Lake Ontario. The current number of Atlantic salmon rivers is approximately 937 although a component of these have "unknown" status (http://www.nasco.int/RiversDatabase.aspx). In Canada salmon populations have been in decline, the most severe of which have occurred in the 32 rivers of the inner Bay of Fundy, where Atlantic salmon have been designated as "endangered" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and listed under Canada's Species at Risk Act (http://www.registrelep-sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=672). Numerous rivers in the Southern Upland of the Atlantic coast of Nova Scotia are either threatened with extirpation or already have been extirpated (DFO, 2009).

Aquatic habitats and their adjacent terrestrial areas are valued for a wide range of human uses. The integrity of salmon habitat is challenged by human demand for accessible land and fresh water, for ocean spaces, and for the interconnecting estuarine and coastal areas. In both freshwater and estuaries and near-shore marine areas, human activities can affect the biological, physical, and chemical components of salmon habitat resulting in adverse impacts during critical spawning, rearing, and migration periods. In the open ocean, activities such as commercial fishing, shipping, and waste disposal among others can potentially affect the marine habitat of salmon (DFO, 2009).

This paper supports a presentation made by Canada during the theme-based session on "Maintaining and improving river connectivity with particular focus on the impacts of hydropower", at the North Atlantic Salmon Conservation Organization 2015 annual meeting in Happy Valley-Goose Bay, Newfoundland and Labrador, Canada. The presentation discusses impacts and mitigation techniques for hydro developments and looks at the issue of barriers in general, including smaller projects such as culvert installations.

Figure 1 – Historical distribution of Atlantic salmon (source: Behnke and Tomelleri, 2002).

2. Legislative and Policy Context

The federal Fisheries Act and the Species at Risk Act are the two key pieces of legislation that dictate how Atlantic salmon are managed in Canada. These Acts are supported by Canada's Policy for the Conservation of Wild Atlantic Salmon. It is important to note that there are a number of other federal, provincial and aboriginal Acts, agreements and policies that contribute to the management of salmon throughout Canada.

Federal Fisheries Act (FA)

Of importance to the management of Atlantic salmon and barrier mitigation, the FA manages threats to the sustainability and ongoing productivity of Canada's commercial, recreational and Aboriginal fisheries. The FA provides Canada's Minister of Fisheries and Oceans with the ability to develop regulations in order to enter into agreements with other federal departments, provinces and others for the effective management of fisheries resources, including wild Atlantic salmon habitat.

The two key sections of the FA, relevant to this topic are:

Section 20.(2) If the Minister considers that doing so is necessary to insure the free passage of fish, the owner or person who has the charge, management or control of an obstruction shall

(a) remove the obstruction
(b) construct a fishway
(c) implement a system of catching fish before the obstruction, transporting them beyond it and releasing them back into the water;

and,

35.(1) No person shall carry on any work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fisheries, or to fish that support such a fishery.

Federal Species at Risk Act (SARA)

In Canada, species at risk are identified through processes put in place under the federal SARA and similar provincial laws. COSEWIC, which operates at arm's-length from government, assesses candidate species using established criteria to assign a designation. COSEWIC assessed that there were 16 Designatable Units (DUs) of Atlantic salmon in eastern Canada. Of these, one was assessed extirpated (Lake Ontario DU), five were assessed as endangered, one was assessed as threatened, with the remainder either as special concern, or not at risk. For the most northern DU, Ungava Bay, there was insufficient information to assess status.

Canada's Policy for the Conservation of Wild Atlantic Salmon

(http://www.dfo-mpo.gc.ca/fm-gp/policies-politiques/wasp-pss/wasp-psas-2009-eng.htm)

The Policy for the Conservation of Wild Atlantic Salmon was developed as part of the response to address the decline in salmon populations. Strategies and action plans are developed under the Policy to address: the need for monitoring and assessment of population status; the conservation and protection of Atlantic salmon habitat; the integrated fisheries management planning process; a collaborative approach to conservation; and, a post-season review process.

The Policy is intended to transform the approach to conserving Atlantic salmon, their habitat, and dependent ecosystems. Key elements of the policy recognize that protection of the genetic and geographic diversity of salmon is essential, that shared stewardship and partnerships will help to achieve conservation objectives, that success in salmon conservation relies on addressing factors in their freshwater, estuarine and marine habitats, that ecosystems must be considered when making management decisions, and importantly that management decisions must be based on good scientific information and consider biological, social, and economic consequences.

3. Federal Programs

Atlantic Salmon Endowment Fund (ASEF)

The ASEF was a one-time $30 million conditional grant to invest in the conservation and enhancement of wild Atlantic salmon and its habitat. The income earned from ASEF is used to fund projects that contribute to salmon restoration and conservation mainly in the freshwater environment, although marine environment projects are also considered for funding in some cases.

The purpose of ASEF is to achieve healthy and sustainable wild Atlantic salmon stocks in Atlantic Canada and Quebec. The types of projects that are eligible for funding through ASEF include those that maintain, protect and enhance Atlantic salmon and their habitat, rebuild stocks and restore salmon populations, and are related to watershed planning.

Habitat Stewardship Program for Species At Risk (HSP)

The overall goal of the HSP is to provide financial support for stewardship activities that contribute to the survival and the recovery of designated flora and fauna and their habitats. Eligible recipients of HSP funding include not-for-profit organizations, Aboriginal organizations, educational institutions, community associations and local groups, private individuals and companies, and provincial, municipal and local governments.

Aboriginal Funds for Species at Risk (AFSAR)

The AFSAR Program helps achieve the goals of the Species at Risk Program in Fisheries and Oceans Canada (DFO), as well as the broader Government of Canada three part strategy for the protection of wildlife species at risk that includes SARA, the Accord for the Protection of Species at Risk and activities under the HSP.

The objectives of the AFSAR Program are to have stable or increasing populations of species at risk. To attain this goal, the AFSAR Program assists Aboriginal communities and organizations to build capacity for their participation in SARA implementation and to undertake activities that protect the habitats of species at risk.

Recreational Fisheries Conservation Partnerships Program (RFCPP)

(http://www.dfo-mpo.gc.ca/pnw-ppe/rfcpp-ppcpr/index-eng.html)

Canada is well known for its recreational fisheries. Over the years, recreational fisheries have consistently faced multiple threats, including pollution, invasive species and habitat loss. Reasons for habitat loss include habitat degradation and erosion, barriers to fish migration and water flow alterations.

There is, however, potential to address these historical impacts through restorative action and partnerships. To this end, legislative amendments to the FA were recently put in place to strengthen cooperation with third parties in areas of common interest. These changes now allow the Minister of Fisheries and Oceans to enter into agreements with third parties to undertake activities to restore fisheries habitat.

The program aims to bring like-minded partners and their resources together with the common long-term goal of enhancing the sustainability and ongoing productivity of Canada's recreational fisheries.

The RFCPP funds many different types of restoration projects. Examples of commonly-funded projects include stream, lake and floodplain habitat restoration, fish access improvements, stream channel and bank erosion control and stabilization, ocean habitat restoration and enhancement and chemical manipulations to improve water quality (e.g. aeration and liming).

(Note: Specifics related to funds administered through these programs can be found in Canada's NASCO annual progress reports.
(http://www.nasco.int/implementation_plans.html)

4. Aboriginal Traditional Knowledge (ATK)

The southern Inuit of Labrador and other aboriginal groups have a strong spiritual connection to the land and animals, including Atlantic salmon, found in the region. The land and ocean is

a resource from which Inuit, First Nations and Metis draw the necessities of life. Aboriginal groups in Labrador harvest Atlantic salmon for cultural and ceremonial purposes, as a healthy food source and to maintain strong links to the land and ocean.

Aboriginal groups in Labrador have traditional knowledge and understanding of the resources and land around them which has been gained through years of living from the land. It is for this reason that land use and projects can benefit from early input from these groups as development occurs. Aboriginal traditional knowledge is a means to protect, preserve and sustain future development of the land's vast natural resources for generations to come.

New economic ventures such as mining and forestry operations, highways and hydroelectric plants all bring certain challenges that can negatively impact land, water and animals including the migratory Atlantic salmon.

Inuit, First Nations, Metis have extensive knowledge regarding Atlantic salmon and river systems and the gathering and documentation of traditional knowledge will assist governments in better land use planning and project development, specifically as it relates to Atlantic salmon.

All levels of government, federal, provincial and aboriginal need to work together to ensure projects and land use plans are in the best interest of the people and the resources on which they depend. Consultation and involvement by aboriginal groups in all stages of a development are key to the successful and sustainable approaches we will need into the future.

5. Approaches to Improve River Connectivity

The impacts of barriers to migratory species are well known and include the blocking of migratory routes both upstream and downstream, alteration of bed loads and spawning substrates, water temperature changes and alteration of flows at significant periods in fish development.

Barriers can take many different forms such as hydro developments, mill ponds, stream alterations such as straightening of river channels and poor bridge or culvert installations. While the cumulative impacts from these projects have been great and continue to impact fish recruitment, there is a strong history of trying to address these issues and in particular, recent efforts to mitigate and implement corrective measures are gaining momentum.

The following case studies are used to illustrate the issues, mitigation techniques and challenges associated with barrier remediation in eastern Canada.

6. Case Studies

Case Study #1 - Moisie River

Location:

Located on the Moisie River (tributary to the Gulf of St. Lawrence) in Quebec.

Partnerships:

Protection Association of the River Moisie Inc. (APRM), Quebec Ministry of Forests, Wildlife and Parks, DFO

Project Description and Mitigation Efforts:

The fishway was commissioned in the 1970s. The fishway is as an essential component of salmon management allowing salmon access to spawning grounds that are upstream of a natural barrier.

Since 2000, APRM has been responsible for the operation and maintenance of this fishway.

In 2014, the APRM obtained financial support from various partners for the project to improve the fishway. Recently works were undertaken on the fishway to lower the intake threshold of 45 cm in order to allow the operation of the fishway under flow conditions ranging from 210 m^3/s to 350 m^3/s.

Figure 2 - Improving the Katchapahun fishway on the Moisie River (Source: Daniel Girard, Project Coordinator).

Case Study # 2 - Mactaquac Dam

Location:

Located on the Saint John River (tributary to the Bay of Fundy) in New Brunswick.

Partnerships:

NB Power, DFO

Project Description and Mitigation Efforts:

The dam was commissioned in 1968 and represents 20 percent of New Brunswick's power demand. A small fishway is leading fish to a collection gallery where they are captured, sorted by species, measured, counted, and sometimes tagged for various studies. Subsequently, fish are trucked and released at various locations upstream of the dam. Some salmon from the Tobique River (a tributary to the Saint John River) are brought to the hatchery for reproduction. During subsequent years, hatchery returns captured at Mactaquac are sorted and trucked to the Tobique River.

Although the structures are owned by NB Power, DFO manages fish passage activities. Also, co-operation with NB Power is required to operate generation unit #1 at certain levels (40-60MW) to maximize the attraction flow and reduce turbulences at the entrance of the fishway. In addition to Atlantic salmon, more than 300 tons of alewives and blue back herring are transported above the dam each year.

At this time, there is no protocol for downstream migration. However, the facility is under review for a partial removal, a full removal, or a major refurbishment. All three options include consideration for both upstream and downstream migration. A decision on the dam will be taken by 2016. As a conservation measure, there is a closure on any type of salmon fishery on the Saint John River system.

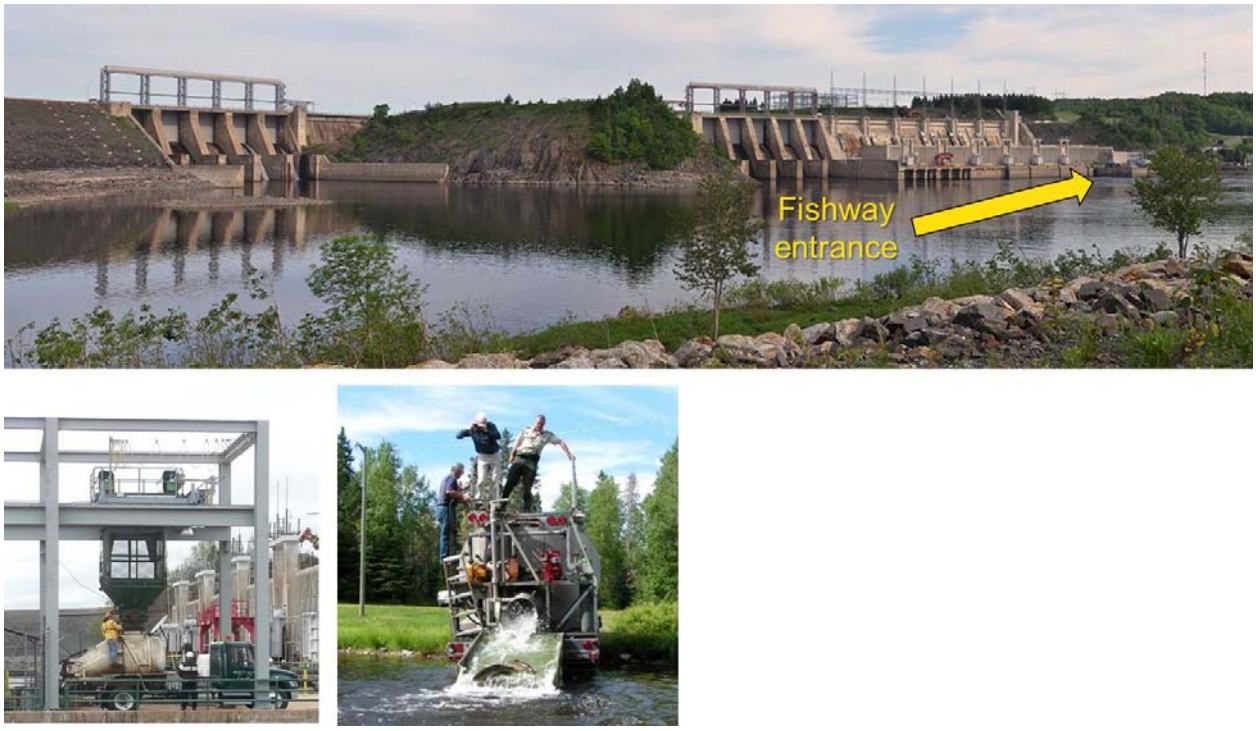

Figure 3 - Mactacquac dam and associated operations for fish passage (Sources: upper picture: NB Power; lower pictures: DFO).

Case Study #3 - Tobique Narrows Dam

Location:

Located on the Tobique River (tributary to the Saint John River) in New Brunswick.

Partnerships:

NB Power, DFO

Project Description and Mitigation Efforts:

The dam was commissioned in 1953. The power house has a capacity of 20 MW. The upstream fish passage is provided through a 350 meter long pool and weir fishway. NB Power is responsible for the maintenance of the fishway and performs annual inspections to ensure the fishway is in good working condition. During migration periods, the structure is operated by DFO. Attraction pumps were added in 1999 to increase the attraction flows from 0.6 m^3/s to 1.8 m^3/s.

For the downstream migration, a controlled spilling procedure is implemented in an effort to reduce pre-smolt passage through the turbines. The theoretical turbine mortality estimate is 6% (Lindroth, 1967). A radio tagging study in 2006 determined turbine mortality to be between 10-30% (Jones et. al 2007). NB Power was spilling water from the small regulation gate during the peak migration period. However, a study evaluating the effectiveness of the control spill indicated that there was no difference between spill and turbine mortality. As a result, the spilling program was stopped in 2012. A new structure to insure a safe downstream migration is actually under review and should be constructed shortly.

A second initiative is to capture young salmon with smolt wheels installed in the Tobique River upstream of the dam. These smolts are transported to a hatchery managed by DFO and raised to the adult stage. Once ready for reproduction, they are released in the river upstream of the dam. Later, when returning adults are captured at other facilities they are trucked upstream of all obstructions and released in the upper Tobique River watershed. In addition, as a conservation measure, there is a closure on any type of salmon fisheries on the Tobique River watershed.

Figure 4 - Left, controlled spilling at Tobique Narrows dam; right, smolt wheels installed in the Tobique River (Source: DFO)

(Note: Additional case studies are contained in the presentation.)

7. Conclusions

Significant challenges remain to remediate the numerous barriers existing in eastern Canada that present a problem to the natural migration of Atlantic salmon. Efforts have been made in recent years to address these challenges through partnerships, research and funding efforts. The work of governments, aboriginal organizations, non-governmental organizations/ recreational fishing groups and the public in general, are slowly improving the ability of fish to migrate and access habitat. Despite this, new challenges present themselves in the form of changing climate and additional land-use pressures that will need to be addressed through a combination of integrated planning, research, ATK and furthering partnerships with concerned groups and individuals.

Partnerships will be key to addressing barriers to migration going forward. One example of this collaboration occurs between DFO and Provincial departments to improve fish passage at existing structures. As old structures are being replaced, as in the case of culverts, they are being upgraded to the most recent specifications for fish passage. Additionally, agreements with partners for construction of fishways through and around existing dams and for dam removal are being developed and/or considered. Continuous efforts are undertaken through those partnerships to address fish passage issues. Where mandatory offsetting plans are deemed necessary to compensate for habitat loss, proponents are strongly encouraged to reopen watershed by removing old structures (e.g. abandoned dams) or improving obstruction to fish passage (e.g. hung culverts). Even though an exact number is hard to define, many thousands of square kilometers have been reopened to fish migration in eastern Canada over the last few years.

Notwithstanding the fact that fish passage is a legal requirement under the FA, impediments to fish passage dealt with through partnerships and agreements raise a greater level awareness and open the doors to voluntary compliance for a brighter future for Atlantic salmon.

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