Appendix A:
Lake Ontario Atlantic Salmon Restoration Program History and Overview

Prepared by: **The Ontario Federation of Anglers and Hunters (O.F.A.H.), December 2007**

Image Credit: O.M.N.R.

A female Atlantic salmon returning to the Credit River, October 2007, prior to transport upstream

"It is doubtful, indeed, whether in any other part of the world a more wonderful or pleasing exhibition can be enjoyed at one sight, of such numbers of large salmon as were enclosed within this small space. This extraordinary display is not of long duration, lasting only about a fortnight, generally during the last week of October and the first week of November."
- Samuel Wilmot, Canada's pioneering Atlantic salmon conservationist, in 1878

RESTORING A LOST TREASURE

Summary

Lake Ontario was once home to one of the most important and well-known fish in the world – the Atlantic salmon. Wiped out before 1900 by the degradation and damming of their spawning streams and overfishing in both the streams and Lake Ontario, for the last 20 years the Ontario Ministry of Natural Resources (O.M.N.R.) and its research partners have been studying the potential for restoring Atlantic salmon to Lake Ontario. Research and stream rehabilitation efforts have shown it is now time for a serious effort to restore to Lake Ontario a wild, self-sustaining population of this lost natural treasure.

Lake Ontario Atlantic Salmon Restoration Program Background

Atlantic salmon (*Salmo salar*) are a large silvery salmon species with small black spots over most of the body, the colour changes to a deep bronze when spawning. Colour can be highly variable however, with brown, green, or blue shades being possible on the back, and sometimes during spawning reddish spots are seen on the head and body. Average sizes of 18 inches and 2-4 pounds were probably typical in the historical population of Lake Ontario. A 35 inch, 24.3 pound fish caught in 1989 is the Ontario record for the species, and came from New York's put-grow-take program for Atlantic salmon. Old records suggest fish up to almost 45 pounds were occasionally caught.

Around the world, most Atlantic salmon populations are sea-running, spawning in the fall in freshwater rivers. Young Atlantic salmon spend one or more years in the river before migrating to the sea to grow to adulthood. Other populations, including Lake Ontario's former population, are freshwater, and live as adults in lakes and spawn in the lakes' tributaries. Historically, 40 tributaries in Lake Ontario supported runs of Atlantic salmon. Unlike many other salmon species, Atlantic salmon survive spawning and return to the lake/ocean until the next spawning season; however, like other salmon, Atlantic salmon return home to the river where they themselves hatched.

When they existed in Lake Ontario, adult Atlantic salmon were top predators in the lake, along with lake trout. They fed primarily upon lake herring, and probably slimy sculpin; we anticipate they will also feed upon alewife and rainbow smelt in the current Lake Ontario ecosystem. Before reaching maturity, young Atlantic salmon feed upon invertebrates as well as fish.

Sea-running Atlantic salmon are found from the Arctic Circle to Portugal, from northern Quebec and the northeastern coast of North America to Iceland, Greenland, and northern Europe, anywhere there is a tributary leading to the North Atlantic Ocean and Baltic Sea. North American landlocked populations are found in Newfoundland and Labrador, Quebec, Michigan, Vermont and Maine. A stocked population exists in Trout Lake, Ontario. The Atlantic salmon of Lake Ontario were the only native population of the species in Ontario.

This population invaded the lake from the sea during the last post-glacial period and adapted to life in freshwater conditions. To the aboriginal peoples residing near Lake Ontario, the species was an object of worship and an important part of their diet. European settlers arriving in North America were already very familiar with Atlantic salmon. Records of the species in Europe go back to the time of the Gauls and Romans, and it was granted special protection in the Magna Carta of 1215. The first laws in Upper Canada protecting Atlantic salmon were passed in 1807.

Settlers in the Lake Ontario region were able to harvest Atlantic salmon by the barrelful, and it was an important part of their diet. Some have suggested the availability of Atlantic salmon encouraged settlement of the interior of Canada (meaning, at the time, Ontario). Later, commercial and recreational fisheries for Atlantic salmon developed on Lake Ontario, with the commercial fishery supporting thousands of fishermen.

However, it was the pressure of these fisheries plus serious environmental degradation and ecological change that initially led to noticeable and serious declines of Atlantic salmon in Lake Ontario. In the late 1700s and onwards large areas of land were cleared for agriculture, resulting in a lack of cover for the tributaries of the lake, which were the spawning and nursery sites for the species. Deforestation also created massive erosion problems which, when combined with changes in flow rates produced by dams, mills, and channelization, resulted in the silting over of the rock substrate Atlantic salmon deposited eggs upon. Dams and mills were also barriers even the "leaping" salmon couldn't pass during their annual migrations. Meanwhile, in Lake Ontario the fish community was changing. The traditional prey of Atlantic salmon, lake herring, was being replaced by alewife and rainbow smelt.

When the decline of the Lake Ontario Atlantic salmon was observed in the latter half of the 19th century, efforts were made to restore or at least maintain the population. The first efforts were made by Samuel Wilmot in 1866, when he established the first government-sponsored fish hatchery in North America in Newcastle, Ontario. His efforts seem to have initially paid off, and population increases were observed in many streams. However, the number of returning fish had fallen again by 1881. The species was declared extirpated in 1896, and the last reliable report of a harvested Atlantic salmon was in 1898. Atlantic salmon were one of the first species in Canada to be decimated by human activities:

> "*The Atlantic salmon was one of the first Canadian fishes in the Great Lakes region to disappear as a result of man's careless use of natural resources. It was to be the first of many. In Lake Ontario the erection of mill dams on streams denied it access to spawning grounds. It was also the first to suffer from DDT sprays (in New Brunswick), hydro-electric dam construction, domestic pollution, and a thousand and one other indignities thrust upon the environment by man."* Scott and Crossman, *Freshwater Fishes of Canada*, 1973.

Prior to extirpation, the popularity and success of Lake Ontario Atlantic salmon led to the stocking of it in two rivers in Maine to produce fisheries there. The Sheepscot River population still exists, albeit in very low numbers, and we hope to someday examine the genetics of this population to determine its relatedness to the historic Lake Ontario strain. The Cobscook River population is believed to be extinct or nearly extinct. Between 1877 and 1899 Lake Ontario

Atlantic salmon were shipped to England, but no evidence exists that populations of the strain remain anywhere. New Zealand also received shipments of Lake Ontario Atlantic salmon stock.

Additionally, the now-extirpated Sebago Lake, ME Atlantic salmon population was either the result of a direct stocking of fish from Lake Ontario, or derived subsequently from Lake Ontario stocks planted elsewhere. Interestingly, fish from eggs from Sebago Lake were successfully stocked in lakes in Argentina over the period 1904-1910, and at one time it was hoped the last remnant of Lake Ontario's population existed in South America.

After Samuel Wilmot, the next significant effort to restore Atlantic salmon in Ontario was undertaken by the Department of Lands and Forests (O.M.N.R.'s predecessor) in the 1940's using Miramichi, NB, stock. After five years of stocking, mortalities were still significant from high summer stream temperatures and predation upon juvenile Atlantic salmon, and the attempt was stopped. Sporadic stocking occurred up until 1964 without success, and efforts were halted as the entire ecosystem was considered too degraded to make restoration likely.

However, in the latter half of the 20th century stream stewardship and environmental awareness gained momentum, and many tributaries of Lake Ontario have recovered thanks to the efforts of local landowners and conservationists. The physical recovery of Lake Ontario's tributaries prompted both New York and Ontario to reconsider the potential return of Atlantic salmon in the 1980's.

The New York State Department of Environmental Conservation began a small Atlantic salmon recovery program in 1983 to restore a self-sustaining population in Lake Ontario. The specific goals were modest, and while growth rates were excellent and a small recreational fishery developed, by 1990 the course of the program changed from a small recovery program to a larger scale put-grow-take trophy sport fishery. However, increased effort did not produce increased recreational catch returns, and the program has since been scaled back.

In 1987, the O.M.N.R. began its own stocking program to establish a self-sustaining population in at least one tributary of Lake Ontario and provide a sport fishery based on stocking and a naturally reproducing population. When initial returns were lower than expected, O.M.N.R. developed the first formal Recovery Strategy in 1995 to research the apparent problems in successfully stocking Atlantic salmon in Lake Ontario. The research program used experimental stockings of approximately 150,000 to 300,000 fry (free-swimming, newly hatched fish) per year to study the factors believed to be most important for developing self-sustaining populations. Research subjects included embryo survival and rearing success, juvenile survival, and adult salmon habitat selection and movement behaviour. Benchmarks were set for a 5-20 year timeline, and a review in 2003 concluded the initial research phase had successfully met the short-term benchmarks. The remaining benchmarks could only be tested with full-scale restoration efforts. With this knowledge in hand, it is now time to begin full-scale recovery efforts, more than a century since the last wild Atlantic salmon was caught in Lake Ontario.

Program Plan

The initial five-year program is focusing on three tributaries of Lake Ontario. There are four components that are critical to the long-term goal of establishing self-sustaining populations: fish production/stocking; habitat enhancement/water quality; research/assessment; and education/outreach. Once substantial migrations of adult salmon are established in the three initial tributaries (Credit River, Duffins Creek, Cobourg Brook), the program will be expanded to additional streams and rivers. The project will follow a Recovery Strategy currently being written by a multi-agency Recovery Team, following federal species-at-risk guidelines.

Fish Production and Stocking

In order to reestablish self-sustaining populations of Atlantic salmon in Lake Ontario and its tributaries, a large number of Atlantic salmon must be stocked into the selected streams to form the basis of the recovering population, therefore, fish production will be increased significantly. Currently, the O.M.N.R. has one breeding stock originally from the LaHave River, Nova Scotia. All North American Atlantic salmon strains have a high degree relatedness, but we will be developing and maintaining two new broodstock populations of contrasting characteristics to maximize genetic diversity and the potential of program success. We will also evaluate the relative success of various life stages of fish from the three strains.

As the size of broodstock populations expand, it reduces the capacity of O.M.N.R. facilities to produce fingerlings and yearling fish. To meet this challenge, some funding is being allocated to upgrade O.M.N.R. facilities, while some of the funding is developing capacity within O.F.A.H. community clubs to raise fish. Workshops will be conducted to educate community conservation clubs on fish culture practices based on government expertise and the experience of our other member clubs. O.M.N.R. is responsible for all broodstock to ensure that optimal genetic diversity is maintained and fish health protocols followed.

In addition to O.M.N.R. and club hatcheries' production, we will use in-stream and streamside incubators to raise eggs entirely in the stream, and thereby imprint the fish to prime local spawning and nursery habitat sites. This type of system provides an excellent opportunity to engage the community in habitat and water quality rehabilitation, followed by local, hands-on incubation of fish and volunteer monitoring for returns.

We have also partnered with Fleming College, Ontario's premier fish and wildlife technical institution, on a cooperative education program utilizing the college's hatchery facility to rear fish. Students at the college participate in all aspects of the Atlantic salmon restoration program, from raising fish in the hatchery, to stream and water quality rehabilitation, to stocking and monitoring fish. Fleming College has spent over $140,000 to renovate their teaching hatchery for Atlantic salmon.

Habitat Restoration and Protection

Ongoing habitat restoration and water quality protection will be essential to the return of Atlantic salmon. This component of the program identifies critical habitat areas that can be targeted for

restoration or protection within each of the streams, and then acquire the resources and partners to achieve the result. The O.F.A.H. already has in place a program, the award-winning Community Stream Steward Program (C.S.S.P.), designed to engage local landowners and provide them with techniques and support to conduct habitat restoration on their lands. These "stream stewards" evolve into community leaders, encouraging their neighbors to become involved and ultimately leading to coordinated, large-scale habitat restoration. The program engages each of the relevant municipal, provincial and federal government agencies to pool resources and streamline the permitting process for the landowners. Through 2006, the C.S.S.P. had completed 182 habitat projects utilizing 964 volunteers planting over 25,000 trees and enhancing 7,055m of streams. These projects enhance not only fish communities, but also the quality and quantity of water, and they create an awareness and appreciation for ecosystem health within the community that lasts long after the completion of the project. These stream stewards form the community groups that will conserve and sustain tributary environments.

An Atlantic salmon habitat coordinator works with local agencies to raise funds to conduct large projects such as fish passage construction, but the LCBO and lead sponsor also provides "seed" funding for habitat projects on each stream that can be used to lever additional funding from the public and private sectors on a project-specific basis. Volunteers such as conservation clubs, school groups, and community groups deliver the on-the-ground projects. The following are the types of projects that will be completed during the course of the five-year project:

- Tree planting on stream and river banks to decrease erosion and lower water temperatures;
- Removal of online ponds to reestablish natural channels;
- Debris removal to restore natural flows and expose suitable salmon and trout habitat (gravel and rock cobble);
- Bank stabilization projects to minimize erosion and resulting sedimentation of spawning and nursery areas;
- Wetland protection to ensure high quality and quantity of water; and
- Cattle fencing and alternate watering systems to prevent grazing on stream and river banks and in-stream habitat destruction.

Research and Assessment

Applied research/assessment and monitoring are integral aspects of the program which will allow the program to adapt and respond to successes and failure as we move forward. Since Atlantic salmon have been extinct for over 100 years in Lake Ontario, some elements of their biology local to Ontario will need to be learned, such as the specifics of their life cycle in Lake Ontario.

The program works as a partnership of O.M.N.R., conservation authorities, stakeholders, and academia to collect detailed background information on critical habitats and fish communities in each of the three streams. We will also engage anglers to help us to monitor salmon in the lake and tributaries through a web-based volunteer reporting network. This will provide critical information on juvenile and adult distribution in the lake, as well as data on survival of fish to the lake. We will also train volunteers to monitor fishways for returning adults.

Education and Outreach

Perhaps the most critical component of the overall program will be informing the public about the history of Atlantic salmon in Ontario, the significance of their return, the role of Atlantic salmon as indicators of watershed health, and how the actions of all residents of the Lake Ontario basin will determine the future of our collective restoration efforts. To this end, we are holding frequent public and media events around the release of fish and habitat restoration projects. More information about the program is also available at the program's website: www.bringbackthesalmon.ca.

The program is also expanding an existing classroom hatchery program to more schools and outdoor education centers throughout the Greater Golden Horseshoe (currently Trenton to Hamilton). The classroom program combines education modules about Atlantic salmon and the importance of healthy streams with the students actually raising approximately 40-100 fish for release. We hope to partner with another organization that has developed a program (Stream of Dreams) for younger students which will be an ideal lead-in to hosting their own hatchery.

Image Credit: O.F.A.H.

Image Credit: Lori DeGiusti

Image Credit: O.M.N.R.

Lake Ontario Atlantic Salmon Restoration Program Partner List

Sponsors/Lead Partners:

- Banrock Station Wetlands Foundation Canada/ Banrock Station Wines
- LCBO Natural Heritage Fund
- Ontario Federation of Anglers and Hunters
- Ontario Ministry of Natural Resources

Partners:

- Canadian Sportfishing Industry Association
- Fleming College
- Fishing Forever Foundation
- Department of Fisheries and Oceans

Contributing Partners:

- Ganaraska Region Conservation Authority
- Let's Talk Science
- Toronto and Region Conservaton Authority
- Ontario Streams
- Credit Valley Conservation
- Belfountain Community Hatchery
- Conservation Halton
- Metro East Anglers
- Trout Unlimited Canada
- Greg Clark Chapter of Trout Unlimited Canada
- Toronto Zoo
- Ted Knott Chapter of Trout Unlimited Canada
- South Central Ontario Big Game Association

Supporters:

- Trees Ontario Foundation
- Ontario Wildlife Foundation
- World Fishing Network
- Canadian Wildlife Federation
- Species-at-Risk Stewardship Fund

Contributing Supporters:

- O.F.A.H. Zones (3)
- Link Line Contractors Ltd.
- Dufferin-Northern Peel Anglers and Hunters
- Dufferin Aggregates
- Islington Sportsmen's Club
- Harrington and Hoyle Landscape Architects
- Quinte Wildlife Conservation Dinner
- Pine Valley Springs Hatchery
- Ontario Trillium Foundation
- HRSD Canada

Friends of the Program:

- Atlantic Salmon Federation
- Royal Ashburn Golf Club
- JJ Stewart Motors
- Cobourg Creek Golf Course
- Scotty Plastics
- Rehill Building Supplies
- Terra Cotta Inn
- Belfountain Inn

Provincial and Federal Strategies, Objectives, and Policies Guiding Lake Ontario Atlantic Salmon Restoration

- Lake Ontario Fish Community Objectives
- Lake Ontario Lakewide Management Plan (LaMP)
- Credit River Fisheries Management Plan
- Duffins and Carruthers Creeks Fisheries Management Plans
- Humber River Fisheries Management Plan
- A Joint Strategic Plan for Management of Great Lakes Fisheries
- Strategic Plan for Ontario Fisheries (SPOF)
- Ontario's Biodiversity Strategy 2005
- Our Sustainable Future
- Greenbelt Plan
- Endangered Species Act
- Canadian Biodiversity Strategy