Photo: Tom Montgomery

The Parr Project

An innovative approach to salmon hatchery and stocking procedures offers the hope of abundant Atlantic salmon runs in Downeast Maine

Photo: Michel Roggo

Atlantic Salmon in Crisis

Atlantic salmon populations in Maine are in crisis. The five year average return to Maine's rivers is about 1,000 fish—less than 1% of the historic run. The restoration effort that began in earnest with the listing of Maine Atlantic salmon under the Endangered Species Act in November of 2000 has produced some results, a reduction in commercial fishing, improved water quality, dam removals and other habitat improvements, but has done very little in the way of improving salmon populations. The federal and state fisheries agencies have kept the population from going extinct, but new approaches are essential if the Maine restoration effort is to achieve meaningful results in terms of salmon recovery.

East Machias River

The East Machias is one of five coastal salmon rivers in Downeast Maine. The river has a drainage area of approximately 160,000 acres that includes 26 lakes and ponds and over 50 coldwater tributaries supporting Atlantic salmon and native brook trout. The abundance of lakes also supports a robust alewife (river herring) run in the river that is critically important to several life stages of salmon. The river flows a distance of 40 miles from its headwaters in Pocomoonshine Lake to its estuary in Machias Bay. The watershed is sparsely settled and forested with a mixed coniferous and deciduous forest.

The East Machias is one of only a few Maine rivers that still have a small run of adult salmon. The river's fairly reliable flows of relatively unpolluted and cool water, the absence of dams and other obstacles restricting access to spawning areas and its remoteness provide good salmon habitat.

Partners

Downeast Salmon Federation (DSF)
DSF is taking the lead in implementing the project. DSF is a regional conservation organization created by members of local sporting groups, anglers and conservation-minded individuals. DSF owns two river-based hatcheries on the Pleasant and East Machias Rivers and is active in the Dennys, East Machias, Machias, Pleasant, and Narraguagus rivers.

North Atlantic Salmon Fund (NASF)
NASF is an international conservation organization headquartered in Reykjavik, Iceland, dedicated to the restoration of Atlantic salmon populations to their historic abundance. Since its founding in 1989, NASF's activities have been primarily focused on protecting Atlantic salmon in the North Atlantic and Europe.

Atlantic Salmon Federation (ASF)
ASF is a non-profit incorporated in the US and Canada dedicated to the conservation, protection and restoration of wild Atlantic salmon and the ecosystems on which their well being and survival depends. Started almost 70 years ago, ASF has seven Regional Councils throughout New England and Eastern Canada.

Before: Previously a Bangor Hydro Electric Company plant (circa 1960).

An Innovative Solution

Producing Promising Results Since 2012

After: Now a state-of-the-art salmon hatchery & outreach and research facility.

The new hatchery is partially powered by solar.

The building also serves as a teaching and research facility.

Craig Brook National Fish Hatchery provides the eggs.

As soon as they hatch, the young alevins are placed into incubator boxes built to mimic a salmon redd (pine boxes adjacent to tanks).

When the alevins have used up their egg sac, they swim into the tanks to be fed.

For the past five years, Downeast Salmon Federation, North Atlantic Salmon Fund, and the Atlantic Salmon Federation have been focused on rebuilding the Atlantic salmon population on the East Machias River. Over two million dollars has already been invested in infrastructure and the stocking of over 700,000 salmon parr. Our results have shown that the Parr Project has boosted the success of stocking to a degree not seen since the early nineties.

DSF has completed the first two phases of renovation of its East Machias facility. DSF's facility is located in the small town of East Machias at the mouth of the East Machias River. It includes a flow-through conservation hatchery and a visitor center. With the completion of phase III construction, it will also include a water quality laboratory to be used for reseach and education. Acquired as a dilapidated hydro-electric plant in 2000, DSF has managed through a monumental volunteer and grassroots effort to restore this facility into a real asset for the river and local community. DSF's Salmon Hatchery and Outreach Facility is located a few miles from the University of Maine at Machias, a school which emphasizes environmental studies and is interested in using the East Machias as a laboratory for its students. DSF's facility is also immediately adjacent to the Washington Academy High School whose students are actively involved on a volunteer basis.

In 2012 and 2013 the hatchery was built out by DSF staff in consultation with Peter Gray. In 2012, a small number of eggs were transferred to the facility and successfully grown out and stocked as parr. In the winter of 2013, DSF received 102,000 eggs from the United States Fish and Wildlife Service (USFWS) at Craig Brook National Fish Hatchery (CBNFH). This number has increased to 345,000 eggs in 2016. The project is in full swing.

A Man on a Mission

How Peter Gray successfully recovered an endangered stock in England

Most people who know about the restoration of the salmon run on the River Tyne in England believe that much of the credit must go to the long-time manager of the Kielder Salmon Hatchery, the late Peter Gray. His contribution in rearing and stocking huge numbers of naturalized, athletic salmon parr was the major factor in achieving the most successful restoration of any European salmon river.

Peter Gray acted as an advisor to the project and, sponsored by NASF, made two visits to the East Machias to oversee the build out of the hatchery. Following his death in 2013, the hatchery was re-named the "Peter Gray Hatchery" in his honor, with his daughter present for the dedication.

Stocking has been used on a major scale in Maine for many years with minimal results, but the focus has been primarily on releasing unfed fry—the tiny fish that first emerge from the salmon egg. "Forget about fry," Peter Gray told a Maine audience, "With fry you lose about 90% of what's raised and released." They have to be stocked exactly when the river is at the right temperature and they only have 10 days to begin feeding naturally before they die. There are too many things that can go wrong and he gave examples of fry being blown out in rain events and the inherent problems associated with stocking fry at river temperatures that are too low or too high.

He believed strongly in releasing parr—the second phase of maturing salmon. Parr are substantially larger than fry and are better able to avoid predators and to catch natural food. The key to a successful stocking strategy, according to Gray, is to condition the parr in the hatchery so that when they are released they closely approximate the fitness of fish hatched naturally in the river.

"You must raise little athletes," Gray said. "They must have the size, muscle texture and survival-of-the-fittest instincts that will enable them to swim to Greenland and Iceland and then come back to reproduce in your river." Gray analyzed the reasons for the Tyne's remarkable recovery and described his techniques in his book, *Swimming Against The Tide* (2011, Medlar Press, Ellesmere, England).

During his visits Peter Gray explained to the people of Maine why we need to help the Atlantic salmon. "The biggest problem salmon have is us, directly or indirectly," he declared. "People are the bloody problem. We did the damage but now we have the facilities and knowledge to repair that damage. So let's get it done."

The Project

The goal of this project is to restore a self-sustaining run of wild Atlantic salmon in the East Machias River modeled on methods used successfully on the River Tyne in England.

Specific objectives include demonstrating that:

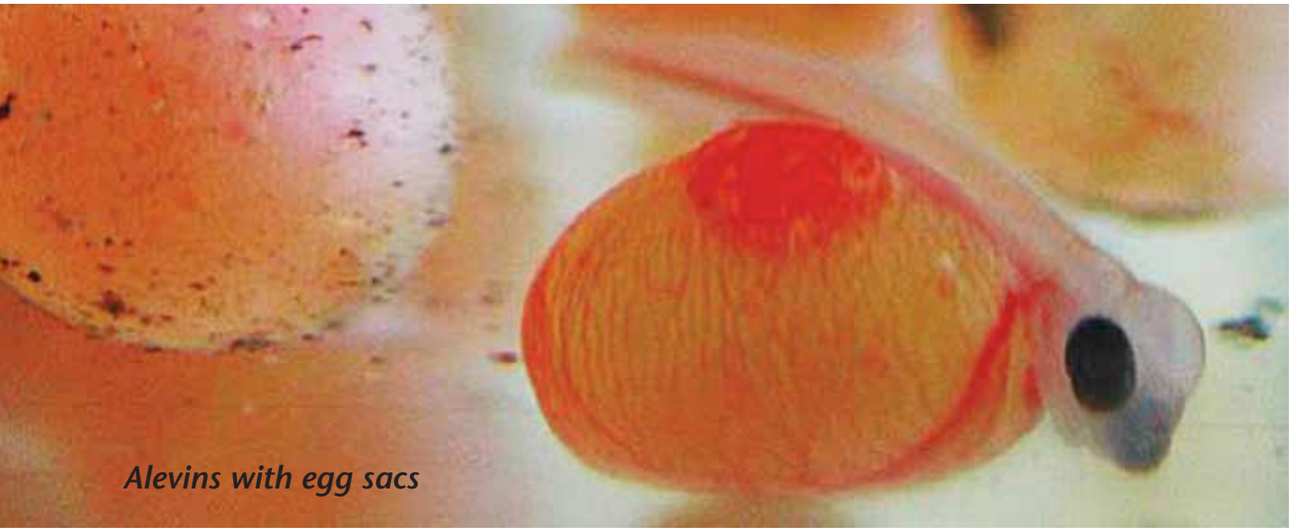
1) Parr stocking is more cost-effective than smolt stocking
2) Parr stocking produces far better adult returns than fry stocking
3) Using a river based hatchery can produce a more 'wild' fish
4) This model can be used elsewhere in Maine and Canada.

The project is modeled on the methods used at the Kielder Hatchery on England's River Tyne. This approach requires a river specific hatchery using water directly out of the river in which the juvenile salmon will be stocked. Each fall, eggs gathered from East Machias salmon broodstock at the Craig Brook National Fish Hatchery are transferred to the Peter Gray Hatchery. Juvenile salmon are raised to the parr stage under conditions designed to produce fish that approximate wild fish in terms of their ability to feed and avoid predators. These parr are then stocked in the fall of their first year once river water temperatures have dropped and the metabolism of the fish requires less feeding. The project hopes to demonstrate that this strategy can produce many more adult returns than fry stocking and achieve return rates equivalent to smolt stocking at a much lower cost. These parr will also spend more time in the river than stocked smolts, which should make for superior survival behavior.

Two of the key strategies are using the fall parr and greatly increasing stocking densities for the next five years to saturate the vacant habitat and make sure there are enough fish to survive expected predation in the river. Over the next several years, the USFWS has committed to increasing the East Machias broodstock numbers at the Craig Brook National Fish Hatchery which will allow DSF to raise up to 400,000 parr. A rigorous adaptive management program will closely monitor the health and abundance of each age class in the river, and stocking densities may be altered based on the data collected.

Parr Project Successes in the First Five Years	
Increased the Juvenile Salmon Population	2012: 5.1 fish/100m^2 2015: 8.7 fish/100m^2
Mimicked Natural Age Distribution of Smolt	Wild populations: ~80% Age 2 smolt Parr Project Origin: ~67% Age 2 smolt
Increased the Number of Eggs Available to East Machias	2012: 81,370 2015: 345,597
Stocked More "Wild" Naturally Colored and Sized Fish	
Increased the Number of Smolt Leaving the East Machias	2013: ~582 2016: ~1,873 (Per unit—more than any other downeast river.)

Atlantic salmon eggs



Alevins with egg sacs

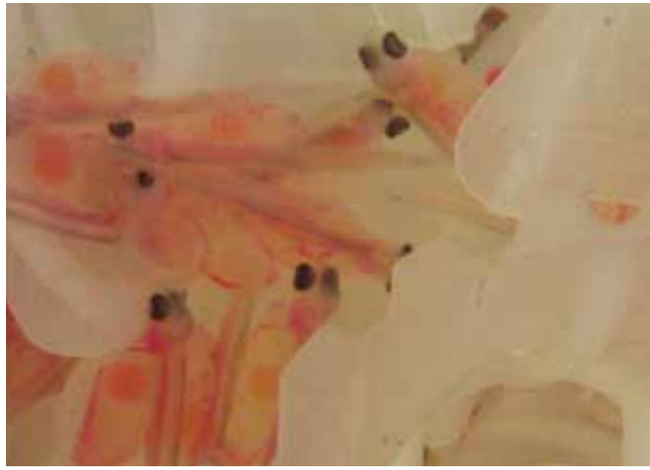
A healthy parr ready for release

The Role of Hatcheries

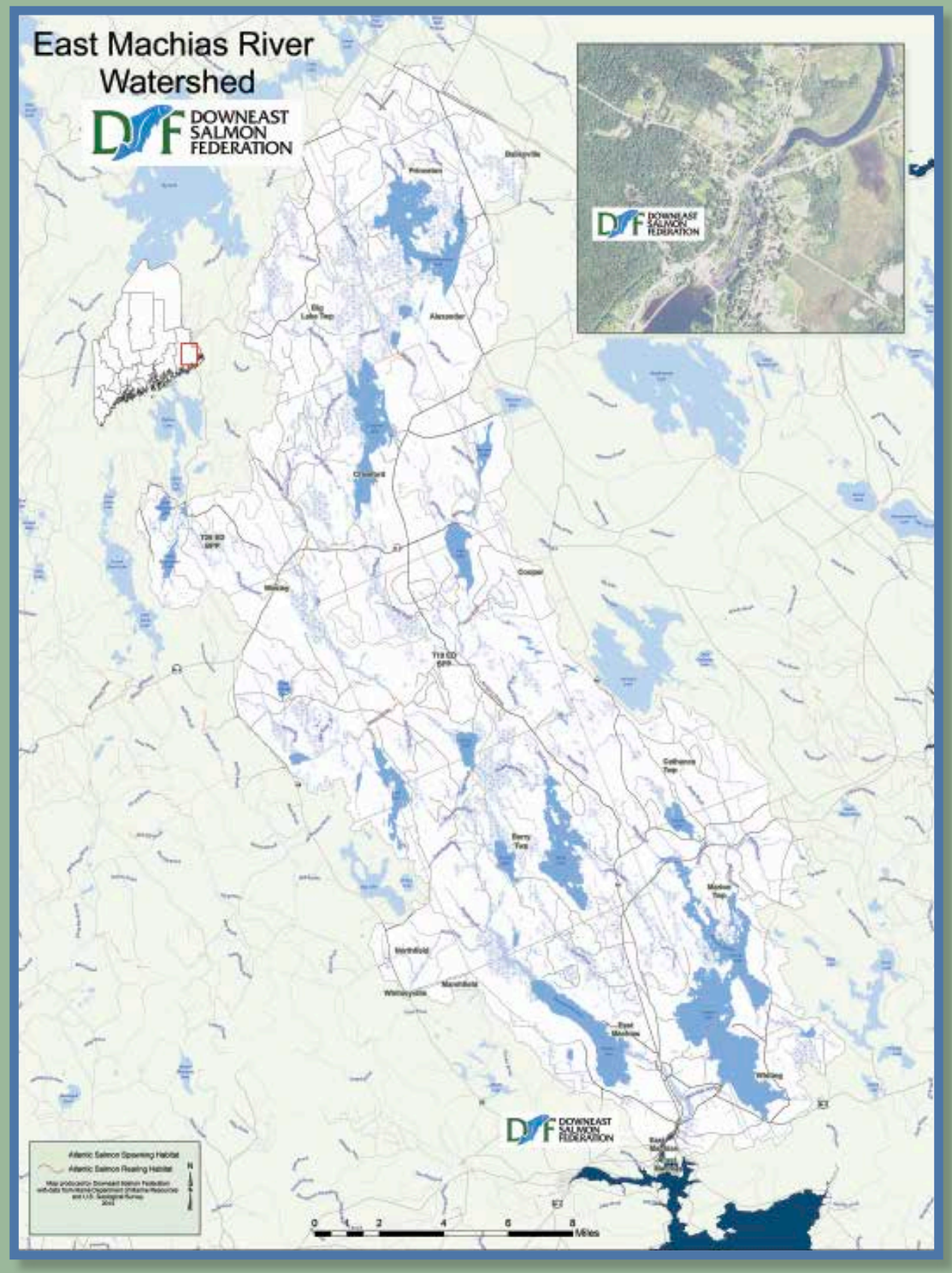
We know that hatcheries have not always had a positive reputation. Generally speaking, there are two types of hatcheries: production hatcheries (catch & kill) and conservation hatcheries. The Peter Gray Hatchery is a conservation hatchery focused on growing parr in the hatchery that closely resemble the wild fish. A visit to the hatchery will make it abundantly clear that these fish are being raised differently than in a traditional hatchery. Local river water is used, temperatures vary just as they would in a wild river, the tanks are sheltered, and the current velocities are increased every three weeks to make the fish stronger. Given the success of this technique in England and the recent studies that have demonstrated that many of the old problems of hatcheries can be successfully mitigated against, we are confident that we have the right system in place for success.

Fish raised at the Peter Gray Hatchery are East Machias origin salmon, genetically distinct from other rivers. Juveniles are captured from the East Machias River and reared in a federal hatchery where they are spawned and resulting eggs delivered to the Peter Gray Hatchery. This project has helped to maintain and even increase genetic diversity in the East Machias broodstock. Ultimately, the hatchery should serve as a temporary tool to restore the salmon population. As adult salmon returns increase, future stocking will be scaled back as called for in the project's monitoring and assessment program.

Downeast Salmon Federation biologists, Kyle Winslow and Zach Sheller, finishing up a day at the Peter Gray Hatchery in East Machias.



As soon as the eggs hatch they are placed into these incubation boxes full of small plastic pieces which simulate interstitial space in the redd. These boxes function like a salmon redd (nest) in the wild. Once the alevins have used up their egg sac and the natural river water running through the hatchery reaches an optimal temperature, they swim to the surface within the box and into the tank where they start feeding.



Habitat Restoration

Pokey Dam fishway before and after. This collaborative project was completed in 2014 by DSF and ASF with the help of others.

This culvert on Beaverdam Stream, an important tributary to the East Machias River, is one of two sets of culverts to be removed from the stream, allowing free access for fish to the upper section for the first time in over a decade.

These remnant log drive dams do not block passage but impound water thus increasing water temperatures.

By New England standards, the East Machias is a relatively pristine watershed characterized by a largely forested landscape, an abundance of small feeder (tributary) streams, ponds, and even large lakes. However, past land use practices have left the landscape in need of repair. These include under-sized road crossing culverts, remnant log drive dams that may not block passage but do continue to impound water thus heating up the stream, and several outlet dams on the lakes in need of improved fish passage.

While not specifically part of this fundraising initiative, the habitat restoration work is important to the long-term success of the Parr Project. Fortunately, groups like Project SHARE, DSF, and ASF are systematically repairing the habitat so salmon and trout will have full access to the more than 50 coldwater tributaries in the watershed. Since 2011, SHARE has replaced 21 road crossings and removed 5 remnant log drive dams. In 2017, with assistance from ASF and local timber owners, a SHARE seasonal crew will begin adding back large wood in tributaries that had lost their natural cover and structure due to past logging practices. On the main stem of the East Machias, DSF, ASF, and other partners have constructed a new fishway below the 5,400 acre Crawford and Pocomoonshine Lake Complex. This fishway was built in the fall of 2013 to allow upstream migration of salmon, trout, river herring, and eels, and completed a culvert/dam removal project as part of a larger restoration project on Beaverdam Stream, an important tributary to the East Machias River.

Let's Make this Possible

Over the past decade the Downeast Salmon Federation has built a private, state-of-the-art, research and hatchery facility on the East Machias through tremendous vision and hard work. The North Atlantic Salmon Fund has provided significant funding and guidance, and the Atlantic Salmon Federation fully supports this innovative approach to salmon restoration. Now we are seeking the funds to fully implement this project over the next five years.

To support the Parr Project, please make checks payable to Downeast Salmon Federation and mention the Parr Project on the check. Every dollar will go to the project and your donation is fully tax deductible! For more information regarding how you can help support these efforts, contact Downeast Salmon Federation's Membership and Development Coordinator by calling (207) 255-0676 or emailing heather@mainesalmonrivers.org. Thank you for your support!

DOWNEAST SALMON FEDERATION

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Project Budget	Total 6 Year Cost*	Description
Capital Infrastructure	$481,910	Stocking vehicle and hatchery expansion to handle over 400K eggs
Staffing	$1,369,200	Includes three full-time hatchery biologists and part-time administrative staff
Operations	$357,557	Fish food, electricity, maintenance, filters, supplies
Total	$2,208,667	*Budeget includes a 10% contingency

To make this project successful, we are seeking 1-6 year pledges from the conservation community.

agency partners

Maine Department of Marine Resources (DMR)
DMR is responsible for Atlantic salmon and fisheries management in coastal rivers such as the East Machias. A key partner with two biologists involved in the fall parr project, other activities include broodstock collection, smolt analysis, juvenile population assessments, habitat surveys, redd counts, assistance with stocking, and adaptive management plans.

United States Fish and Wildlife Service (USFWS)
USFWS is another key partner as they manage the East Machias broodstock line at the Craig Brook National Fish Hatchery in Orland, Maine. Their staff plays a key role in broodstock collection, transfer of eggs to DSF hatchery, hatchery advice to DSF, and use of stocking trucks in the fall.

NOAA's National Marine Fisheries Service (NMFS)
NMFS is a member of the working group for this project. They are providing the use of a jet boat for fall stocking of parr, two 8' smolt wheels for springtime assessment, and assistance with sampling protocols and estimates of out-migrating smolt population each spring.

MAINE DMR MARINE RESOURCES

U.S. FISH & WILDLIFE SERVICE

NOAA

"We owe it to the Atlantic Salmon Federation and our other North American conservation partners who have been supporting our European projects for many years. This is an exciting new project for NASF and we very much hope the outcome will reward our supporters in the USA who give us great financial support. Now we here in Europe can help them with the expertise we have developed. It could make a big difference for Atlantic salmon in the US."

Orri Vigfusson, Chairman, North Atlantic Salmon Fund

"This could well be the type of project needed to help depressed salmon populations on any Atlantic salmon river in North America. It is all about recovering an Atlantic salmon run that can then sustain itself and nothing about continuing to use the same methods that have only succeeded in keeping the population from going extinct."

Andrew Goode, VP US Programs, Atlantic Salmon Federation

"Through sheer determination and with few resources, we managed to build this new riverside hatchery on the East Machias. To now have the involvement of two well respected international salmon groups, and the support of the state and federal fisheries agencies, we have the best opportunity to recover a critical wild run of Atlantic salmon anywhere in Maine."

Dwayne Shaw, Executive Director, Downeast Salmon Federation