

# Help for Salmon in Nova Scotia

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Historically, the Atlantic salmon has been an important element in the social, economic and cultural heritage of Nova Scotians. It has been, in fact, the economic mainstay of many coastal communities and, in some cases, communities were founded in their present locations because of the abundance and value of the salmon.

The Atlantic salmon is still important to Nova Scotia today, but unfortunately, it has fallen on difficult times: Nova Scotia salmon stocks have declined dramatically over the last four to five decades. In the early to mid-1930's, commercial catches were about 850,000 pounds annually, and from this level they declined to less than 135,000 pounds annually in the 1970's. A variety of causes influenced stock declines in the province, and these include:

- environmental deterioration caused by conflicting and sometimes short-sighted strategies for land and water use;
- acid rain;
- over-exploitation;
- other negative impacts brought on by man's difficulty in co-existing with nature.

Catch reductions in the mid-to-late 1930's appear to correspond to increased hydroelectric power development in the province during that period. Later, in the mid-1960's to early 1970's, the decline appeared to be related to the compounding effects of acid rain and increased fisheries on the high seas.

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**Results from Atlantic salmon enhancement projects now underway in Nova Scotia are encouraging, and a more extensive program may be anticipated if new proposals are implemented.**

These are but a few of the man-made problems imposed on the Atlantic salmon in its fight for survival. In some respects, however, man is slowly coming to the salmon's assistance; Nova Scotia is pursuing a number of programs with this end in view.

Nova Scotia has roughly 164 known salmon-producing streams which vary in size and quality of salmon habitat. Each of these streams has one or more genetic stocks which differ from each other in their racial characteristics. This genetic diversity has helped protect the species against many adversities, and salmon enhancement programs in the province have taken these stock differences into account.

The Nova Scotia enhancement program has several objectives: to expand the salmon's range by providing a fish passage at known obstructions; to improve the physical and chemical characteristics of salmon spawning and rearing habitats; and to rebuild wild stocks and restore salmon to barren streams by utilizing proven enhancement technology that produces salmon which are adapted to recipient stream conditions. As an integral part of the overall management plan for Atlantic salmon, salmon enhancement has provided an opportunity to strengthen the genetic diversity of salmon in several streams, thereby broadening the resource base in the province.

*An early start on the Gold River. Nova Scotia is working hard to permit its children to participate in scenes like this. (Dan Callis photo)*



Smolt tagging, harvest statistics and adult returns to fishway trapping sites are normally used as performance indicators in these projects.

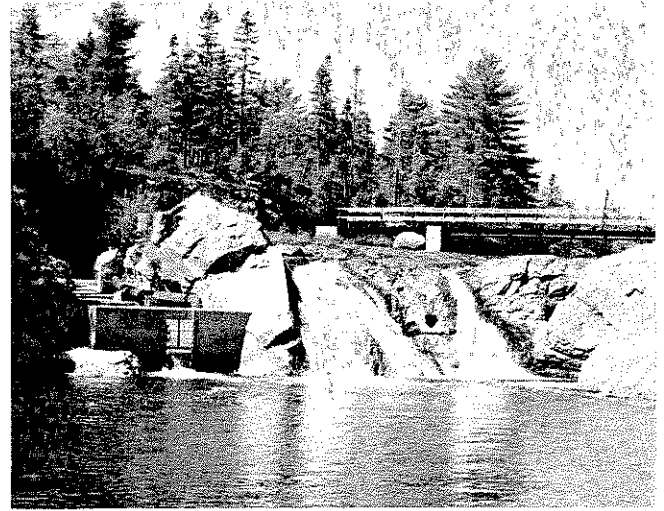
Development of new or improved salmon enhancement techniques, and of suitable genetic hybrid stocks through selective breeding, are integral parts of the Nova Scotia salmon enhancement program. Experimental projects on streamside incubation, kelt reconditioning to improve broodstock utilization, stream acidity control, habitat improvement and adult transplantation have been carried out at several locations. Broodstock selection, selective breeding of several salmon strains and evaluation of stock performance through tagging studies are continuing activities. For example, a salmon hybrid, developed over a period of eight years in the LaHave River, will probably be used as the foundation broodstock in certain major sea-ranching projects if the proposed Atlantic Salmon Enhancement Plan for Nova Scotia is implemented.

Several major Atlantic salmon enhancement projects are currently underway in Nova Scotia. These include projects on the Margaree, St. Mary's, Liscomb, LaHave, Medway and Tuskent rivers. Through application of specific enhancement techniques, self-sustained populations are usually established within eight to ten years of

Liscomb Falls fishway.



Indian Falls fishway on the LaHave River.



start-up. Atlantic salmon produced from these enhancement projects are harvested in commercial fisheries at Greenland, Newfoundland and in homewaters. They also contribute to sport fisheries and the spawning escapements in the respective rivers.

### Margaree River

In 1979, the federal Department of Fisheries and Oceans (DFO) initiated a program to rebuild declining early-run, two-sea-winter salmon stocks of the Margaree River. Acting on the advice of biologist Dr. L. Marshall, DFO instituted sport fishery regulations that reduced the season and established spawning sanctuaries for the protection of these early-run salmon. In 1978, DFO had also initiated a smolt-stocking program for the Margaree that was based initially on 15,000 smolts of early-run Rocky Brook, Miramichi parentage reared at the Cobequid Fish Culture Station (Margaree broodstock was banned from mainland hatcheries because of the risk of transmitting Margaree-endemic bacterial kidney disease).

More than 8 per cent of the smolts were estimated to have contributed to escapement and sports fisheries. As most fish returned after one winter at sea (grilse), and Margaree sport reg-

ulations were designed both to protect two-sea-winter fish and to encourage the harvest of grilse, the total 1979 sport catch of 685 (including 545 hatchery grilse) was the highest since 1948. Smolts of late-run Miramichi parentage stocked in 1979 contributed an estimated 170 grilse to the total sport catch of 328 fish in 1980. Final landings in 1981, resulting from another 15,000 smolts of Rocky Brook parentage released in 1980, are expected to exceed 1,000 fish (a 75-year high). Recent tests allaying fears of the transfer of bacterial kidney disease to mainland hatcheries will permit the release of smolts of early-run Margaree two-sea-winter parentage by 1983.

Morgan Falls fishway and trapping facilities on the LaHave River, installed in 1979.

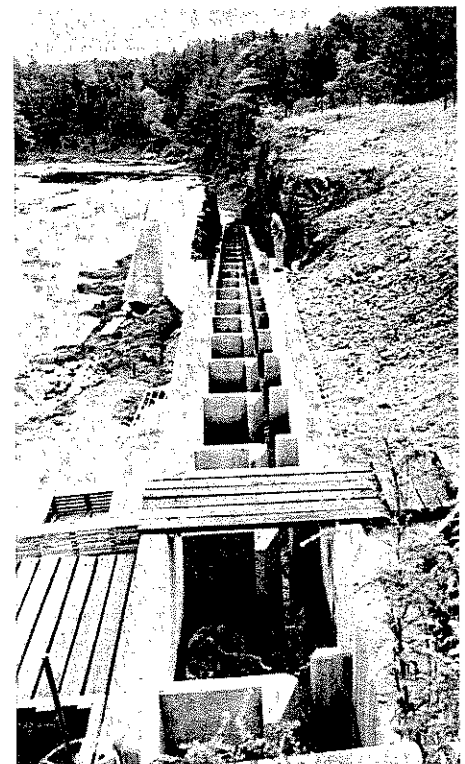


TABLE 1 Summary of Atlantic salmon returns to the Liscomb Falls fishway, 1979-81

Year	Number of Atlantic Salmon returns				
	Wild		Hatchery		Total
	1 Sea-winter	Multi-sea-winter	1 Sea-winter	Multi-sea-winter	
1979	58	2	487	2	549
80	111	0	931	51	1093
81 <sup>1</sup>	74	5	238	47	364

<sup>1</sup>Adult returns to September 25, 1981

A similar stocking program, although of a smaller scale, has been initiated on the Middle River, Victoria County, to bolster early-run native stock.

### St. Mary's River

Since 1975, the early run, multi-sea-winter salmon stock of the East St. Mary's River has been protected by restrictive angling regulations. While this project has resulted in improved juvenile salmon densities, presumably bolstered by increased numbers of multi-sea-winter spawners escaping the sport fishery, salmon stocks in the West St. Mary's tributary unaffected by these conservation measures have not shown similar trends.

Consequently in 1981, in cooperation with the Canada Employment and Immigration Commission and the St. Mary's River Association, DFO initiated a river protection and surveillance project and a streamside incubation project aimed at producing 70,000-100,000 unfed fry for release beginning in 1982. Collectively, these two projects should ensure better protection of wild broodstock for natural spawning and provide large numbers of fry of early-run, multi-sea-winter parentage for release in the West St. Mary's River and hence strengthen this stock.

### Liscomb River

On completion of a new fishway at Liscomb Falls in 1977 which provided access to  $1.7 \times 10^6 \text{m}^2$  of salmon nursery area, DFO initiated a salmon enhancement program aimed at establishing a self-sustained population at its expected optimum yield of 3,000-4,000 salmon annually.

Essential to the success of this program will be the development of a genetic hybrid adapted to environmental conditions in the Liscomb River and also amelioration of borderline pH conditions, both of which will contribute significantly to homewater commercial and sports fisheries. While

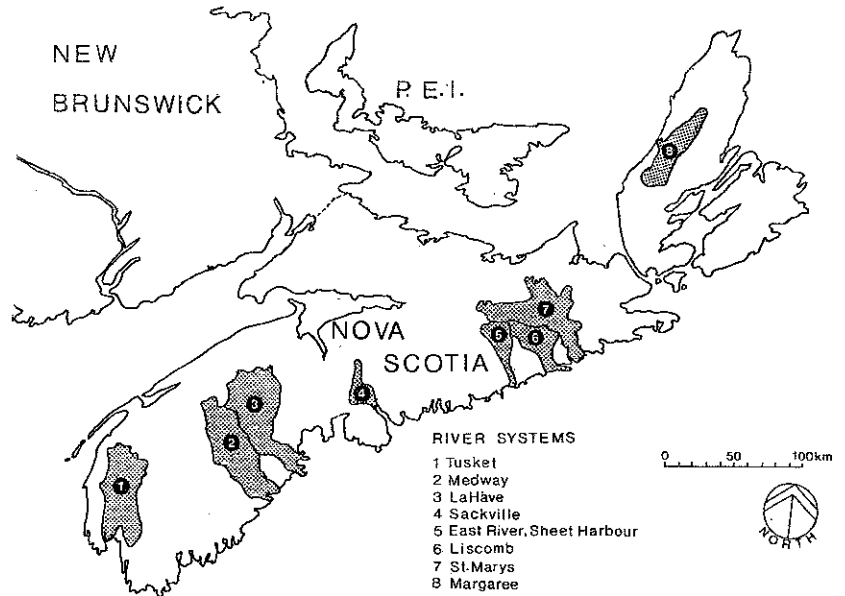
development of a suitable genetic hybrid continues by utilizing predominately native Liscomb salmon and selective crosses with other suitable multi-sea-winter salmon strains, efforts are also underway to improve natural production by increasing the river pH through the introduction of limestone gravel in the headwaters.

Adult returns from the stocking program have been encouraging, and juvenile studies indicate that wild fingerlings (0+ parr) and yearling parr resulting from natural spawning are being produced. At the current modest level of enhancement, it is expected that DFO will reach its objective of establishing a self-sustained run in the Liscomb River by the late 1980's.

### LaHave River

A vertical slot fishway was completed at Morgan Falls in 1969 which provided salmon with access to the excellent headwater spawning and nursery areas of the LaHave River. Since 1971, DFO has implemented an aggressive stocking program above Morgan Falls, utilizing mainly one-year old smolts reared at the Mersey Fish Culture Station. These smolts have

Location map for the major Atlantic salmon enhancement projects in Nova Scotia.



exhibited excellent survival at sea and have made a significant contribution to fisheries. Much of the success from this enhancement initiative has resulted from the development of a genetic hybrid suitable to river conditions. Selected crosses of broodstock from the original Medway strain, wild LaHave stock and adult returns from hatchery stocking has produced a hybrid which has spawned naturally and which has been adapted to environmental conditions in the LaHave River.

Improved adult returns to the Morgan Falls fishway have resulted from the natural spawning of predominantly hatchery return adults. The stock has increased steadily upstream of Morgan Falls, as have river sport catches which reached record highs in 1980 and 1981. Commercial landings at Greenland, Newfoundland and along the Atlantic coast of Nova Scotia have also benefited from the LaHave program.

While the stocking program is scheduled to terminate in 1981, other aspects will continue, including acidity control, lamprey control, broodstock sanctuary, and the regulatory and biological assessment components of the enhancement program. Beginning at least by 1983, controls will be needed

Victor Crowell (DFO) demonstrates unfed fry stocking technique on the St. Mary's River project.



Liscomb Falls fishway and trapping facilities.

for both the sport and homewater commercial fisheries, bolstered in the past by stocking hatchery-reared smolts, so that overharvesting of the wild stock does not occur.

### Medway River

Phase One of the Medway River enhancement project was initiated in 1980 and progress is being achieved in improving upstream and downstream fish passage at the Harmony Mills hydroelectric installation. Adult returns from the first major smolt planting in 1980 appeared this year and to September 25, 1981, a total of 103 Atlantic salmon has been counted at the Harmony Mills fishway. A modest annual hatchery stocking effort from the Mersey Fish Culture Station of roughly 25,000 one-year smolts of Medway parentage is scheduled to continue until a self-sustained population is established in the late 1980's. Other on-going studies on the Medway include a comprehensive study of the effects of acid rain on the river and its fauna being carried out by the Fisheries Environmental Research Section of the Resource Branch.

### Tusket River

On completion of a new vertical slot fishway in 1977, which replaced the old "power house" fishway at the Tusket hydroelectric station, DFO initiated a hatchery stocking program utilizing



TABLE 2 Summary of Atlantic salmon returns to the Morgan Falls fishway in the LaHave River, 1970-81

Year	Number of Atlantic Salmon returns				Total
	Wild		Hatchery		
	1 Sea-winter	Multi-sea-winter	1 Sea-winter	Multi-sea-winter	
1970	2	4			6
71	3	0			3
72	10	2	12	0	24
73	11	7	147	11	176
74	40	2	314	25	381
75	39	5	503	71	618
76	199	24	523	104	850
77	289	72	974	36	1371
78	285	66	553	208	1112
79	857	67	1079	99	2102
80 <sup>1</sup>	1618	287	335	515	2755
81 <sup>2</sup>	1713	336	1080	209	3338

<sup>1</sup>Increased returns resulted from stocking of unmarked 0+ parr in 1973

<sup>2</sup>Adults returns to September 25, 1981

**TABLE 3 Summary of angling catch statistics on the LaHave River, 1965-1981**

Year	Number of Atlantic Salmon angled		Total
	1 Sea-winter (Grilse)	Multi-sea-winter (Large salmon)	
<b>BEFORE ENHANCEMENT</b>			
1962 <sup>1</sup>			546
63 <sup>1</sup>			200
64 <sup>1</sup>			589
65	64	18	82
66	216	187	403
67	267	150	417
68	133	74	207
69	95	50	145
70	557	93	650
71	411	119	530
Mean			377
<b>AFTER ENHANCEMENT</b>			
72	306	93	399
73	604	107	711
74	850	92	942
75	581	224	805
76	1012	110	1122
77	1468	232	1700
78	175	167	342
79	1365	107	1472
80	1273	520	1793
81	1637	442	2079
Mean			1136

<sup>1</sup>Separation of grilse and large salmon not available prior to 1965

**TABLE 4 Summary of Atlantic salmon returns to the Tuskat Falls fishway, 1980-81**

Year	Number of Atlantic Salmon returns				Total
	Wild		Hatchery		
	1 Sea-winter	Multi-sea-winter	1 Sea-winter	Multi-sea-winter	
1980	74	10	127	55	266
81	47	12	110	25	194

one-year smolts of LaHave hybrid parentage reared at the Yarmouth Fish Culture Station. Since water quality investigations suggested that the East Tuskat River was too acidic to enable Atlantic salmon fry to survive at an acceptable level, enhancement efforts were concentrated on the Carleton River tributary where pH was above the critical level. As in other enhancement projects, broodstock were selected from the native Carleton and hatchery return components of the run and selectively crossed to produce a hybrid more suitably adapted to local conditions. From a modest stocking program, 10,000-15,000 one-year smolts released annually, results are encouraging.

This program is scheduled to continue into the mid-1980's until a solu-

tion to the stream acidity problem is found; should stream acidity control be uneconomical, DFO may implement a major sea-ranching project, depending on resources, on the main and east branches of the Tuskat River where low pH's preclude the development of a self-sustained salmon population.

#### Acknowledgements

Many people have contributed to the breadth and effectiveness of enhancement initiatives and experiments in Nova Scotia, but meriting special mention are: J.D. Cameron, biological technician with the Department of Fisheries and Oceans; and hatchery managers Len Forsythe, Trevor Goff, Murray Hill, Len MacIntosh and Ernie Robinson.

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