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Cage Rearing of Salmonids in
Coastal Areas of Nova Scotia

by

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The rapidly declining catches of Atlantic salmon in recent years spurred renewed interest in the possibility of culturing Atlantic salmon as well as other salmonids such as rainbow (Salmo gairdneri) and speckled trout (Salvelinus fontinalis) in enclosures located in saltwater. Observing the interest in saltwater aquaculture by private enterprise, the Resource Development Branch of Environment Canada embarked upon a pilot study to determine the technological and economic feasibility of growing salmonids in floating enclosures or "sea cages" to marketable size. This paper presents preliminary results from pilot studies conducted over the period 1972 to 1974 at Arichat Bay in Cape Breton and Polly Cove near Halifax (Fig. 1). The species cultured were Atlantic salmon and Rainbow trout.

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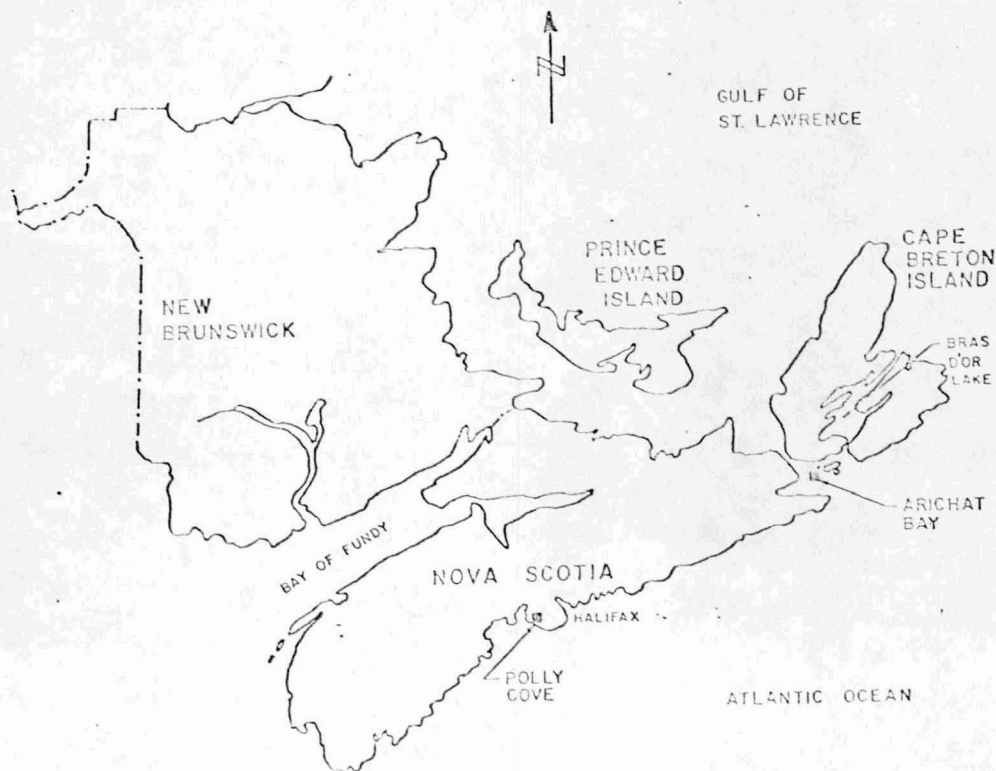


Fig. 1. Map showing location of site at which salmonid rearing studies are being conducted in coastal areas of Nova Scotia.

REVIEW OF SEA CAGE CULTURE TRIALS

Arichat Bay

Arichat Bay in Cape Breton was the site at which the first rearing trials were conducted. These trials, sponsored by the Cape Breton Development Corporation, were initiated in 1972. The general objective was to develop and assess different techniques that could be employed to rear Atlantic salmon and Rainbow trout in saltwater.

The Arichat Bay site had good protection from Atlantic storms, a water depth of 14.5 m (meters) and water quality judged suitable for growth of both species. Rearing facilities consisted of one wire-mesh cage, measuring 2.5 m X 2.5 m X 6.1 m, supported by a hinged floatation platform around the cage.

In late September, 500 Atlantic salmon were acclimated to saltwater and transferred to the Arichat site for rearing. Approximately 4 months later (January 1973) heavy seas accompanied by super-chilled water (-0.8°C) killed all the caged fish.

As a result of the January incident, the Arichat project was reoriented towards determining the feasibility of rearing rainbow trout to marketable size in one growing season (May to December). The objectives of the 1973 project were: (1) to develop and test different types of rearing units; (2) to develop and test a diet for saltwater rearing; (3) to develop a procedure for acclimating salmonids to full seawater; and (4) to establish growth rates of cage-reared salmonids in coastal Nova Scotia.

The rainbow trout were available for transfer to the Arichat site in early August. These fish had been acclimated to full sea water in July (July 2-22). Of the 2,400 rainbow trout available at the beginning of the acclimation period, 2,363 fish (98.5%) were transferred to cages. The rainbow trout were yearlings of a spring-spawning stock. They were obtained from one of the Branch's hatcheries.

The rearing facilities used in 1973, consisted of the same wire-mesh cage (2.5 m X 2.5 m X 6.1 m) used in 1972 and two square box nets (4.9 m square) with knotless nylon mesh. One of the nylon nets was treated to prevent algal fouling. The untreated net proved to be the most practical of the three enclosures.

Fish were fed a diet consisting principally of fresh fish offal (cod and flounder), herring meal, perch oil, whey, wheat germ, wheat middlings and a vitamin fortifier. The cost of the diet ranged from 24 cents to 31 cents per kilogram.

The production statistics for this 1973 experiment can be summarized as follows:

Average wt. of trout at start (August 3, 1973)	48 g
Average wt of trout at end (November 1, 1973)	520 g
Average wt. gain per fish in 3 months	472 g
Total wt. produced at end (1,915 fish)	996 kg

The major proportion of the 20% loss which occurred during the experiment, in both the acclimation and rearing phases was attributable to severe bacterial infection and parasite infestation, carried over from the freshwater stage of the rearing cycle. Only 2% of the available stock were lost after September 1, when the disease problem had been brought under control.

The relative success of the Arichat pilot project stimulated the Cape Breton Development Corporation (DEVCO) toward developing its own production-scale program. In 1974, DEVCO undertook considerable work in site selection along the Bras d'Or Lakes and took over a freshwater hatchery in the area to supply fingerling trout for their cage rearing operation. The 1974 DEVCO operation produced approximately 13,600 kg of dressed rainbow trout and provided information on site suitability. In 1975, DEVCO initiated larger rainbow trout rearing project, involving some 200,000 fish, to test feasibility on a commercial scale.

Polly Cove

As a result of the January 1973 incident in Arichat Bay, where all salmon died from heavy seas and lethal cold water temperatures, the Atlantic salmon cage rearing trials were moved to a more southern site along the Nova Scotia coast (Polly Cove). Available temperature records indicated that temperatures would likely not be in the lethal range.

As at Arichat, water at Polly Cove is relatively unpolluted. The salinity varies infrequently upward from a low of 28.5 ppt. The annual average salinity is 30.5 ppt. Low temperatures, dropping to a minimum of -1.2° C, were subsequently found to occur in late February and early March. The highest summer temperature was 20° C. From late May until early December normal temperatures range from 8° C to 16° C. Natural barrier reefs provide protection from the sea, while good tidal exchange ensured oxygenation of the waters and flushing of waste products.

The objectives of the project at Polly Cove were similar to those stated for the 1973 project at Arichat. The first salmon were transferred to the nets at Polly Cove in the first week of July. These salmon (1,800) had been acclimated to full seawater over an 18-day period starting in early May. At the beginning of acclimation the salmon averaged 74 g. By December 31, 1973, their average weight was 850 g.

Sixteen hundred of the salmon from 1973 group were carried over winter in the same nets and cages used during the summer. By August 7, 1974, the fish averaged 3.2 kg.

Although the growth rate and health of the fish had been good, the program encountered several severe set backs. The first of these occurred on March 4, 1974 when 418 fish were lost due to severe gill damage and suffocation, brought about by a prolific algal bloom that occurred during a winter storm. This is a common

problem in late winter along the Atlantic coast of Nova Scotia. Major loss occurred on December 3, 1974 when a freak storm, that caused extensive damage to fishermen's shore facilities in the area, destroyed the two aluminum-frame wire-mesh cages, and one-half (385) of the remaining salmon escaped.

In April 1974, 1,100 Atlantic salmon smolts (average weight 87 g) were acclimated to salt water. These fish were transferred to Polly Cove in May and placed in the cages. The growth of these fish surpassed the 1973 growth by approximately 20% (Fig. 2). Fish health and progress were monitored regularly throughout the growing season. In the December evaluation, it was determined that 20% of these fish weighed 0.9 kg, 60% weighed 0.9-1.3 kg, 12% weighed 1.3-1.9 kg, and 3% averaged 1.9-2.3 kg. Total mortalities during transfer, acclimation and the summer growing cycle were 5.8%.

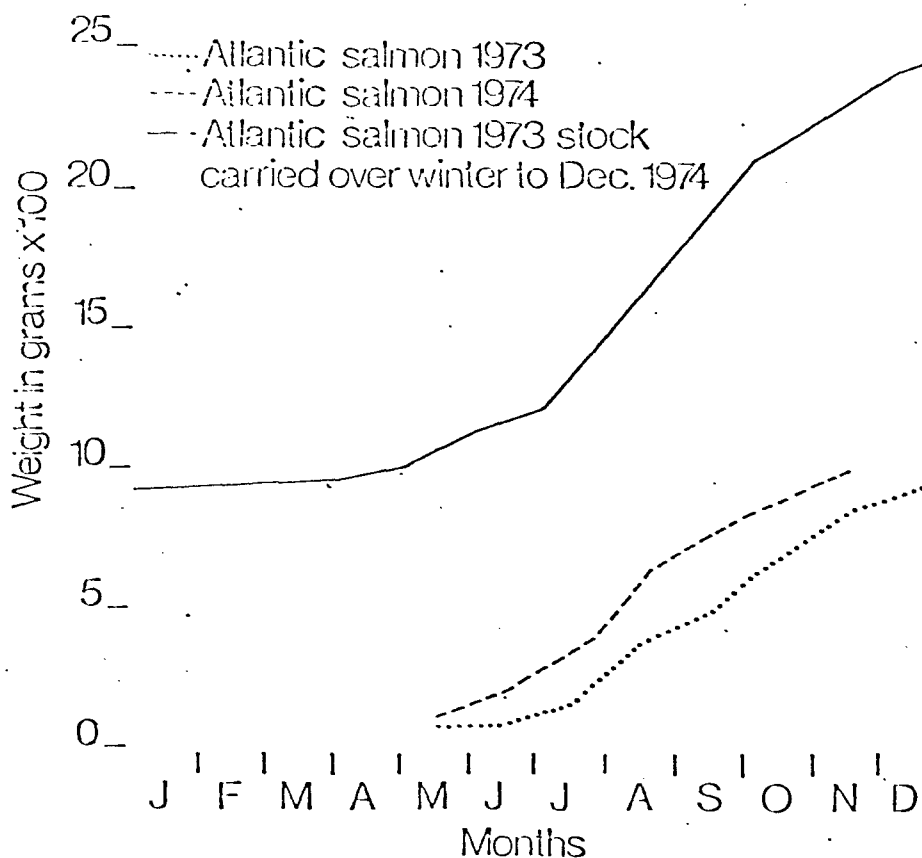


Fig. 2. Incremental growth rate of Atlantic salmon reared at Polly Cove, Halifax County, Nova Scotia.

Note on Facilities

The projects at Arichat and Polly Cove are providing information on the types of rearing facilities that are best suited for cage rearing of salmonids in Nova Scotia coastal waters. A P.V.C. plastic netting cage being tested at Arichat desintegrated during a severe storm. Similarly, aluminum frame and vinyl-coated wire-mesh cages, while excellent units in which to hold fish, were all destroyed by heavy wave action in the second year of use. Although the knotted nylon nets proved to be very good and could be used in place of knotless units, the knotless nets were the best.

SUMMARY

The Arichat and Polly Cove projects have demonstrated that rainbow trout and Atlantic salmon grow well in Nova Scotia coastal waters from May to December. Overwintering of these salmonids in saltwater appears to be both risky and impractical at this time. It may however, be possible to reacclimate these species to freshwater for overwintering.

Since working with such small numbers of fish and high experimental costs, it does not at this time appear economically feasible to commercially grow salmonids in Nova Scotia's coastal waters. A government controlled inproduction study is required to determine the technical and economic feasibility of establishing salmonid aquaculture as a viable commercial industry.

These projects indicate a potential in coastal Nova Scotia waters for rearing salmonids but it remains to be demonstrated whether a commercial industry would be economically viable.