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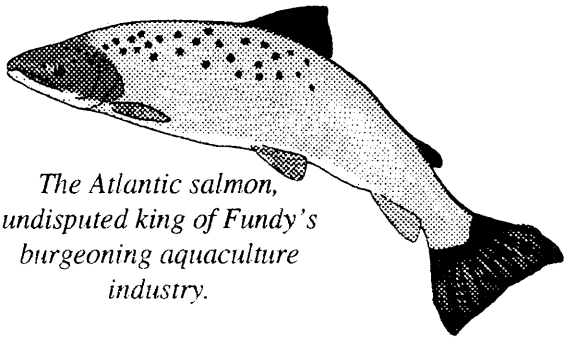
FUNDY ISSUES

FARMING FUNDY'S FISHES

Aquaculture in the Bay of Fundy

Hunters or Herders?

In less than two decades a major part of the fishery in the Bay of Fundy has dramatically transformed from a wide-ranging chase after elusive wild prey to a rather more sedate herding of "flocks" of domesticated fish in large floating corrals. The first such experimental fish farm sprang up in Lord"s Cove in southeastern New Brunswick in 1978. After a slow, tentative start, their number multiplied nearly 14 times between 1984 and 1988. By 1990 there were 54 farms producing more than 8,000 tonnes of fish a year and in 1994, 66 farms produced almost 15,000 tonnes. In recent years it has become a $100 million industry, whose total landed value exceeds that of all the other traditional fisheries in the Bay combined. Rob Stephenson, a fisheries scientist at the Department of Fisheries and Ocean's (DFO) St. Andrews Biological Station acknowledges that "the aquaculture industry in the southwestern Bay of Fundy has grown more rapidly than anticipated". More recently the industry has also begun to develop in southwestern Nova Scotia.



The Atlantic salmon, undisputed king of Fundy's burgeoning aquaculture industry.

There are several reasons for this unexpected growth. The Bay provides almost ideal conditions for intensive fish farming. The coastline of the outer bay is roughly sculpted into many sheltered embayments, where floating cages are well protected from rough seas. As well, Fundy's famous high tides and strong, turbulent currents ensure that cages are continually flushed with clean, well oxygenated seawater. Also, in the last few years there has been a steadily rising international demand for seafood, especially quality products from unpolluted waters. In addition, provincial and federal governments have actively fostered the growth, because aquaculture offered promising alternative employment opportunities in many coastal communities whose economies had been devastated by the collapse of east coast groundfish stocks. Bernard Valcourt, former Federal Minister of Fisheries, clearly echoed the sentiments of both federal and provincial fisheries departments when he proclaimed his intention "to make Canadian aquaculture a world class industry" and that his department was "committed to delivering initiatives that support the industry's growth". The remarkable growth was also helped by the presence in the Maritimes of many well established research centres with considerable expertise in marine sciences. In particular, DFO's St. Andrews Biological Station launched many innovative projects in support of the fledgling aquaculture industry. Also, in 1985 the Atlantic Salmon Technology Centre, sponsored jointly by government and industry, opened in southwestern New Brunswick as an aquaculture demonstration and research facility.

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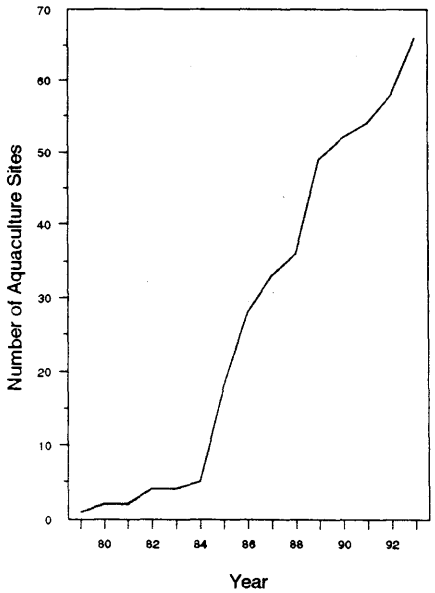
Although most of the fish farms presently concentrate on Atlantic salmon, other species such as sea trout (generally marketed as steelhead salmon) and scallops are being raised in increasing numbers. Scientists at St. Andrews are also experimenting with several other marine species that might be suitable candidates for aquaculture. Haddock, for example, grows well in captivity. Researcher Ken Waiwood has successfully reared juveniles from eggs and is trying to determine the most favourable conditions for growing them to a size suitable for transfer to sea cages. Prospects for the culture of halibut are also excellent, as it too, readily tolerates captivity and crowding In fact, halibut confined in sea cages grow two to three times faster than those in the wild. However, the fragile larvae are proving difficult to rear in the laboratory and many of them die. DFO scientists are working hard to resolve this problem, which must be overcome if the species is to be economically farmed on a large scale. DFO is also confident that "striped bass culture is on the horizon". Several pilot-scale culture studies have been carried out, and it is likely that commercial operations won't be far behind. The bass grow faster at warmer temperatures than are usually found in Fundy's coastal waters, so it may prove more economical to raise them in artificial brackish ponds on land. As an added benefit, some of the hatchery raised fish may eventually be used to restock Maritime rivers, in which natural bass populations have been severely depleted.

"aquaculture here is competing for space in a relatively small coastal area that is already heavily used by many traditional fisheries."

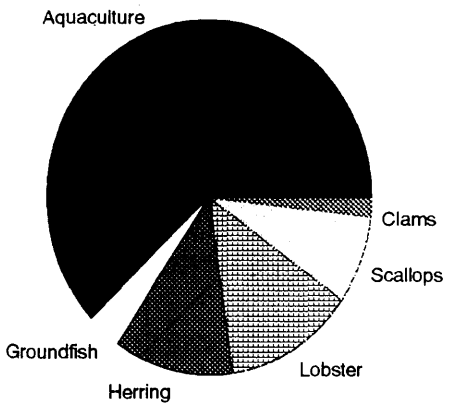
Damper on Development?

Since its inception, Fundy's aquaculture industry has made remarkable progress and governments are clearly intent on encouraging further growth and "realizing the industry's vast potential". However, its continued expansion in the Bay of Fundy may be hampered by several problems. DFO scientist Richard Saunders suggests that low winter water temperature is "the single most serious obstruction in the way of further development of salmonid mariculture in Atlantic Canada". Atlantic salmon cannot tolerate temperatures lower than -0.7°C. The temperature occasionally dips below this in coastal embayments, such as Passamaquoddy Bay, where the shallower water near shore tends to get colder than deeper areas offshore. Thus, in 1983, 1987, 1989 and 1993 large numbers of caged fish were killed during cold snaps. Fish farmers have responded by developing contingency plans to harvest and market the fish early when dangerously low temperatures threaten. DFO scientists are trying to develop reliable methods for predicting the occurrence of such "critical temperatures" well in advance. There is also growing interest in placing larger fish farms further offshore, where low temperature would be less of a problem.

Another possible threat to aquaculture is the presence in Fundy's waters of phytoplankton (microscopic, single celled floating plants) species that release potent poisons. These deadly organisms are always present in low numbers, but when conditions are favourable for growth their numbers can skyrocket (a "bloom"), and cause a problem. Their toxic secretions may be absorbed by shellfish, making them dangerous for human consumption. They may also poison and kill large numbers of caged and wild fish. Although there have been no reports of this occurring in Fundy waters so far, DFO scientist Jennifer Martin emphasizes that "it is critical that the processes which control the formation of a toxic bloom are understood so that..... an early warning can be provided to fishers". Both water temperatures and phytoplankton populations are now regularly monitored in an effort to head off any problems. Aquaculturalists also have to cope with periodic outbreaks of diseases (such as furunculosis) and parasites (such as sea-lice) among the caged fish. This is an almost inevitable consequence of keeping large numbers of animals crowded together. A va-



Growth in the number of aquaculture sites in southeastern New Brunswick between 1979 and 1993.



Relative value of different marine fisheries in Bay of Fundy in 1988

riety of "medicines" (termed "chemotherapeutants") have been used to try to control these outbreaks, with varying degrees of success. The release of these toxic chemicals into coastal waters has aroused considerable scientific and public concern. There are worries about their persistence in the flesh of the farmed fish as well as in other species that may be harvested nearby for human consumption. Sea-lice are crustaceans, so it is not surprising that chemicals used to kill them will also kill other crustaceans, such as lobsters and crabs. The death of 60,000 lobsters, being held in a pound in southeastern New Brunswick this past July, has been blamed on the use of *cypermethrin*, an agricultural pesticide not approved for marine use, to control sea lice in nearby salmon farms. Concentrations in the lobsters reportedly exceeded the lethal level by 10-20 times. Understandably, there is great concern over the use of such illegal chemicals, as well as over the fact that chemotherapeutants, in general, do not seem to be effectively regulated or monitored at present. Furthermore, there is virtually nothing known about the effects of such chemicals on natural populations in the surrounding area, or about the human health implications of their use. However, some progress is being made in convincing responsible salmon farmers that reducing the density of fish in cages, and improving their culture conditions, may lessen the need for toxic chemotherapeutants.

Coastal Conflicts

Perhaps the most serious problem facing the Fundy aquaculture industry, however, has been the conflict between aquaculturalists and the many other users of the Bay's coastal waters. The rapid spread of cage sites has aroused fierce opposition in many quarters, particularly from those still engaged in traditional fisheries. DFO's Rob Stephenson senses that this conflict is "unusual in its intensity and scope", compared to what has taken place in other areas where aquaculture has been introduced. This is largely because aquaculture here competes for prime space in a small coastal area that is already heavily used by traditional fisheries. These include long established and lucrative fisheries for herring, cod, pollock, haddock, lobster, scallop, clams and seaweeds. The conflict is heightened by the fact that the best areas for aquaculture are in sheltered bays, where wild stocks are often abundant or more readily accessible to fishermen. Fish farms have also encroached on sites that have long been licensed for herring weirs. These fish traps depend for their operation on the regular movements of schools of fish along the coast. There is concern that the fish cages may disrupt normal migration patterns and reduce weir catches. Stephenson claims that "we have yet to see a weir perform well in close proximity to a major cage site". A few fishermen have simply converted their weir sites into more lucrative salmon farms. Stephenson also feels that the aquaculture - fisheries conflict has been aggravated by a "lack of a rational and comprehensive management strategy which would maintain capacity in the traditional fisheries, allow growth of aquaculture, and minimize conflict between the two industries". DFO succinctly concludes that "The industries success depends in part [on] how well its practitioners coexist with other resource users."

Harming Habitat?

In addition to worrying that private fish farms will exclude other legitimate users from productive coastal areas, fishers, as well as a growing number of environmentalists, are also fearful that organic wastes and toxic chemicals released by the farms will degrade coastal habitats and adversely effect other marine life. Fish urine and feces are natural products that under normal circumstances disperse and decay rapidly in seawater. However, problems can arise when very large numbers of fish are concentrated for lengthy periods in small pens at one location. The wastes that are soluble in water are usually flushed away from the cages by the strong tidal currents and in most areas are not a problem. However, in sheltered bays, where currents are weak, the wastes could accumulate. As these materials are fertilizers for marine plants, some scientists worry that they might trigger "blooms" of toxic

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algae. The other major waste product from the cages, the particulate fish feces, can also cause environmental problems. These, together with fragments of uneaten food, settle and accumulate on the sea floor under the cages. This decaying mass of organic waste has been appropriately termed "mariculture sludge". At some sites a thick layer of this sludge may build up and smother the bottom. As this material decays, by bacterial action, it uses up oxygen in the surrounding water and releases toxic gases such as hydrogen sulphide and methane. In extreme cases, the resulting smothering, reduction in oxygen and presence of toxic gases kills all of the "normal" bottom dwelling animals, such as mussels, starfish and anemones. Their place is soon taken by a few species of marine worms that thrive in such putrid conditions, and, in fact, are often used as an "indicator" of pollution. Many field studies support the conclusion of marine scientist Bob Rangeley that such "heavy organic loading at most cage sites had a detrimental effect on the benthic community". A 1993 survey of the seafloor in the vicinity of all the active aquaculture sites in New Brunswick revealed that 15% of them had high levels of benthic degradation, while the remaining 85% were low to moderately degraded. The severity of the effect was directly related to the degree of flushing of the site. Changes in management practices in recent years has resulted in some improvement in conditions of the bottom communities at many sites. However, there are lingering concerns that "mariculture sludge"may be carried by currents and deposited in nearby productive habitats (e.g. clam flats) and eventually degrade them.

Aquaculture is now firmly entrenched in the Bay of Fundy and will likely form an important part of the coastal economy for generations. As the industry matures it appears that some of the more irresponsible, environmentally damaging activities are gradually being curtailed as more effective regulatory procedures evolve. However, only time will tell whether we have the wisdom, and collective will, to successfully integrate aquaculture into a healthy and productive natural Bay of Fundy ecosystem that is sustainable and suited to many diverse uses and users.

Further Reading

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The Fundy Issues Series is an initiative of the Bay of Fundy Ecosystem Project. These publications describe our present scientific understanding of some of the environmental issues confronting the Bay. We hope that they will enhance your understanding of the biological richness and complexity of this unique marine area. Such awareness may encourage you to help in protecting it for the use and enjoyment of all, particularly future generations who may also come to rely on its bounty and rare beauty. The origin, evolution and aims of the Bay of Fundy Ecosystem Project are described in the first issue of this series.

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