



Background Paper

Aquaculture in Eastern Canada

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Aquaculture in Eastern Canada
(Background Paper)

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CONTENTS

1	INTRODUCTION.....	1
2	BACKGROUND.....	1
2.1	Legislative Framework	2
2.2	Aquaculture Zones.....	2
3	AQUACULTURE PRODUCTION	3
3.1	Overview.....	3
3.2	Provincial Analysis	4
3.2.1	New Brunswick.....	4
3.2.2	Newfoundland and Labrador	4
3.2.3	Nova Scotia	4
3.2.4	Prince Edward Island.....	5
3.2.5	Quebec	5
4	EMPLOYMENT IN AQUACULTURE.....	5
5	CHALLENGES AND OPPORTUNITIES	6
5.1	Challenges	6
5.1.1	The Environment.....	6
5.1.2	Other Challenges	7
5.2	Opportunities	7
6	CONCLUSION.....	8

AQUACULTURE IN EASTERN CANADA

1 INTRODUCTION

There has been a revolution in global aquaculture in recent decades. According to a study by the Food and Agriculture Organization of the United Nations (FAO), global aquaculture production was 28.3 million tonnes, or 23.2% of the world's supply of fish.¹ In 2008, the FAO reported that "[a]fter growing steadily, particularly in the last four decades, aquaculture is for the first time set to contribute half of the fish consumed by the human population worldwide."²

According to the same study, aquaculture production varies widely from region to region around the world. China is by far the leading producer, contributing 67% of the world's supply of cultured aquatic animals in 2006.³ According to a report by the World Bank, Asia accounted for 91% of aquaculture production in 2004, compared with 2% for North America.⁴ The same report quoted a forecast that global aquaculture production would total between 35 million and 40 million tonnes in 2010.⁵ That forecast proved to be far too conservative: According to FAO figures, global aquaculture production was 50.3 million tonnes in 2007 (excluding cultured aquatic plants).⁶

Canada has mirrored the trend by increasing its production nearly exponentially over the last 30 years. Canadian aquaculture started growing at about the same time as cod stocks off the Atlantic provinces collapsed.⁷ Between 1986 and 2008, Canada's aquaculture production increased from 10,488 to 144,684 tonnes, or by about 1,300%. It generated revenue of \$736 million in 2008, down from its peak of \$913 million in 2006. While the aquaculture industry has provided a new source of economic activity on the east and west coasts, it faces many challenges, including a number of environmental difficulties.

The eastern part of Canada, which includes the Atlantic provinces and Quebec, is benefiting from this new contribution to the economy. In this paper, we will provide an overview of aquaculture in eastern Canada. We will begin with some background information, and then we will examine the production and employment situation in the five provinces concerned. We will then provide a brief description of the challenges and opportunities for the industry, and we will conclude with a short analysis of what lies ahead.

2 BACKGROUND

The general context of aquaculture in eastern Canada includes the industry's legislative framework and the region's division into aquaculture zones.

2.1 LEGISLATIVE FRAMEWORK

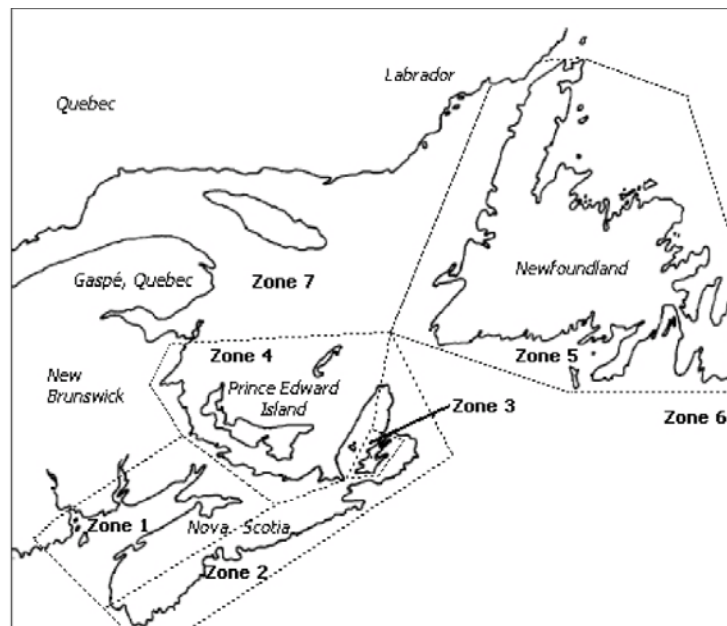
At the federal level, responsibility for the laws and regulations governing aquaculture is split among various departments and agencies, led by Fisheries and Oceans Canada. While there is no federal statute that deals specifically with aquaculture, the industry is covered by several laws, including the *Fisheries Act*, the *Navigable Waters Protection Act* and the *Canadian Environmental Assessment Act*.

In contrast, all of the Atlantic provinces and Quebec have laws or regulations on aquaculture.⁸ In addition, eight of the 13 provinces and territories (including all of the Atlantic provinces and Quebec) have a memorandum of understanding on aquaculture development to clarify roles and responsibilities.⁹ Federal responsibilities include fish health and inspection, habitat protection and scientific research, while the provinces and territories attend to promotion, development and regulation of the industry. They are also responsible for licensing and leasing (except for Prince Edward Island, where the federal government retains that responsibility).

2.2 AQUACULTURE ZONES

Aquaculture must be well suited to the aquatic environment for the industry to prosper. According to Fisheries and Oceans Canada, the Atlantic marine environment can be divided into seven zones for aquaculture (see Figure 1). The zones are defined on the basis of various environmental criteria, such as water temperature, tides and ice. For example, Zone 1 consists of the Bay of Fundy, while Zone 3 is the Bras d'Or Lake region in Cape Breton and zones 5 and 7 encompass the west coast of Newfoundland and the northern Gulf of St. Lawrence, where winter conditions are harsh.

Figure 1 – Aquaculture Zones in Eastern Canada (Atlantic)



Source: Fisheries and Oceans Canada, *By the Sea – A Guide to the Coastal Zone of Atlantic Canada*. (Formerly found on the Fisheries and Oceans Canada website, this map is no longer available there).

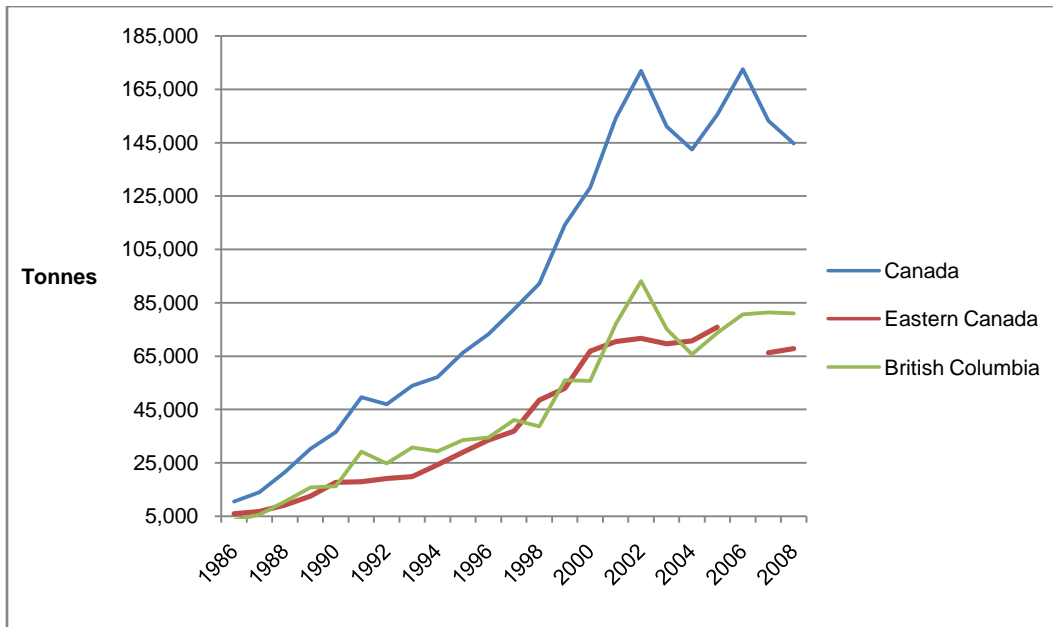
3 AQUACULTURE PRODUCTION

3.1 OVERVIEW

Originally, the First Nations practised a form of aquaculture by transferring fish species from one river or stream to another. Planned aquaculture dates back to 1857, when the first Superintendent of Fisheries in Lower Canada studied the incubation and hatching of Atlantic salmon and brook trout eggs.¹⁰ Oyster production began in Prince Edward Island in 1865. Commercial aquaculture began in earnest in the 1970s, with mussel culture in Prince Edward Island and salmon production in the Bay of Fundy and British Columbia. However, it wasn't until the mid-1980s that commercial aquaculture truly came into its own.

Between 1986 and 2008, aquaculture production in eastern Canada grew from 5,953 to 67,742 tonnes (see Figure 2). As a percentage of Canada's total production, though, it declined from 57% in 1986 to 47%. In 2008, aquaculture production in eastern Canada generated a revenue of \$339 million, compared with \$736 million in Canada as a whole. The main reason for the decrease in eastern Canada's share of total production is the rapid growth of British Columbia's aquaculture industry.

Figure 2 – Aquaculture Production in Eastern Canada, British Columbia and Canada, 1986-2008



Note: The 2006 figure for eastern Canada was unavailable for confidentiality reasons.

Source: Fisheries and Oceans Canada, [Aquaculture Production Quantities and Values](#).

3.2 PROVINCIAL ANALYSIS

3.2.1 NEW BRUNSWICK

New Brunswick had the highest aquaculture production on the east coast, with 27,598 tonnes and \$198.3 million in revenue in 2008. New Brunswick is the second-highest producing province after British Columbia. Its main product is salmon (94%), followed by oysters (2.2%), trout (1.8%) and mussels (1.8%). In fact, New Brunswick is where salmon farming first started in Canada in 1979. Among the other fish species raised in the province are Atlantic halibut, Atlantic cod, Atlantic and shortnose sturgeon, Bay scallops and giant scallops.¹¹

3.2.2 NEWFOUNDLAND AND LABRADOR

Newfoundland and Labrador ranks second among the eastern provinces in aquaculture revenue, at \$63.1 million. In 2008, the province produced a record 11,545 tonnes of aquaculture finfish and shellfish. Its aquaculture production doubled between 2004 and 2006, and revenue climbed from \$22 million to more than \$52 million. That growth was fuelled by large private- and public-sector investments in the province. The provincial government introduced support programs, the largest of which is the Aquaculture Capital Equity Investment Program. Under that program, the government will make financial contributions to finfish and shellfish aquaculture projects as long as the private sector makes the initial investment.¹²

The province's primary aquaculture species are Atlantic salmon, rainbow trout and blue mussels. The government is also making an effort to develop farmed cod. Ninety percent of the province's salmonid aquaculture is concentrated in the Bay d'Espoir and Fortune Bay region, and 85% of shellfish farming is in the area of Notre Dame Bay and Green Bay.¹³

3.2.3 NOVA SCOTIA

Nova Scotia has the third-largest aquaculture industry in eastern Canada, with a revenue of \$35.7 million and production of 7,245 tonnes. It produces less tonnage than Prince Edward Island, but it earns higher revenues because of the principal species farmed (salmon and blue mussels). In addition, although clams are fairly marginal in terms of aquaculture production compared with the other species raised in the province, Nova Scotia is the only province where clams are raised.

Atlantic salmon is grown primarily in the Bras d'Or Lakes area, the Annapolis Basin, Shelburne Harbour and parts of St. Margaret's Bay.¹⁴ Blue mussel and clam production flourishes on the eastern shore of Nova Scotia from the Strait of Canso to Halifax, on the south shore from Halifax to Yarmouth, and in Cape Breton.

3.2.4 PRINCE EDWARD ISLAND

Prince Edward Island stands fourth among the eastern provinces, with an aquaculture revenue of \$29.6 million. In 2008, its production totalled 19,509 tonnes, almost all of it shellfish (99.9%).

The province grows the majority (63.5%) of the shellfish produced in Canada, including 85% of the mussels (specifically, blue mussels). Mussels take 12 to 24 months to grow large enough for harvesting and commercial sale. They are farmed mainly along the island's northern and eastern shores.

Prince Edward Island is also the country's second-largest oyster producer (30% of Canadian production). The predominant species is the American oyster, which takes between five and seven years to reach market size.¹⁵

While the production of cultured finfish is less important economically, Prince Edward Island produces rainbow trout, Atlantic salmon, fish eggs, fry and smolts, and halibut, mainly in the eastern part of the province.

3.2.5 QUEBEC

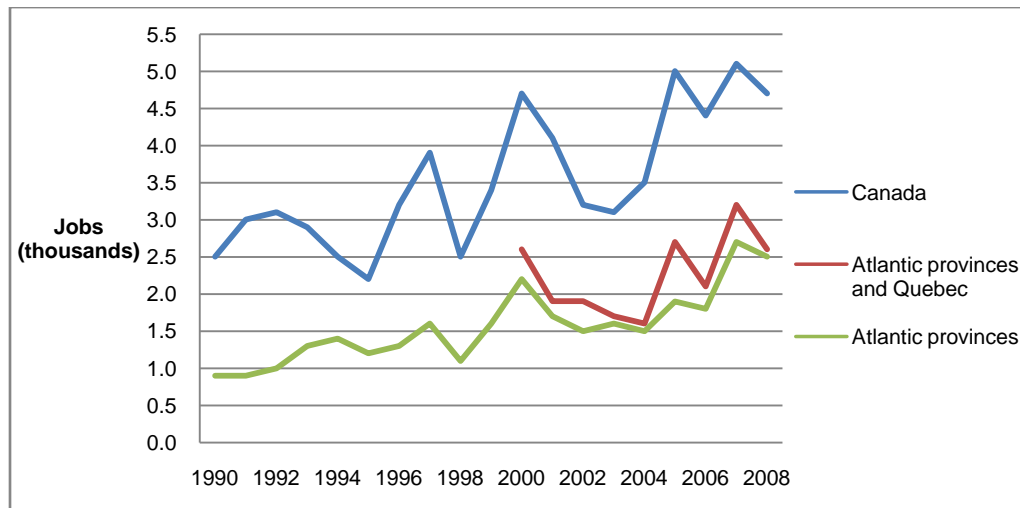
In Quebec, revenue from aquaculture production totals \$12.3 million. The industry began with freshwater aquaculture in 1857¹⁶ and then expanded into marine aquaculture (or mariculture); the two types account for 69% and 31% of production respectively. Freshwater aquaculture consists primarily in farming salmonids such as brook trout and rainbow trout,¹⁷ while the main species in mariculture is blue mussels.

With aquaculture production of 1,845 tonnes, Quebec makes a modest contribution to Canada's total production. However, the aquaculture industry has a significant impact in the Magdalen Islands, the Lower North Shore, Gaspé, the Eastern Townships, the Laurentians, the Outaouais and Central Quebec.

4 EMPLOYMENT IN AQUACULTURE

According to Statistics Canada, in 2008, aquaculture in Canada accounted for 4,700 jobs in establishments primarily engaged in farm-raising aquatic animals and plants. In the eastern provinces, aquaculture provides direct employment for 2,600 workers.¹⁸ Figure 3 shows the history of aquaculture employment in Canada, eastern Canada (Maritime provinces and Quebec) and the Maritime provinces.

Figure 3 – Employment in Aquaculture



Note: For reasons specific to Statistics Canada, pre-2000 data for the category consisting of the Maritime provinces and Quebec were unavailable.

Source: Figure prepared by the author with publicly available Statistics Canada data and with information obtained by special order from Statistics Canada.

It is also interesting to note the conclusions of a study that shows that each person-year of employment in aquaculture creates employment for the equivalent of 0.93 person-years in the rest of the economy.¹⁹

5 CHALLENGES AND OPPORTUNITIES

5.1 CHALLENGES

5.1.1 THE ENVIRONMENT

Even though Fisheries and Oceans Canada established a sustainable aquaculture program in June 2008, aquaculture's impact on the environment remains a concern. A major source of pollution is the organic waste produced by cultured fish (e.g., nitrates and phosphates), which can contaminate receiving bodies of water, cause algal blooms and lower oxygen levels in the water. Another concern is the negative effect that aquaculture can have on aquatic biodiversity when aquaculture organisms foreign to the indigenous wild environment escape and alter the biodiversity of the local environment, in particular by outcompeting indigenous species.

It is highly likely that climate change will affect aquaculture. In its 2007 synthesis report on climate change, the Intergovernmental Panel on Climate Change stated with a high degree of confidence "[...] that observed changes in marine and freshwater biological systems are associated with rising water temperatures, as well as related changes in ice cover, salinity, oxygen levels and circulation. These include: shifts in ranges and changes in algal, plankton and fish abundance in high-latitude oceans [...]"²⁰ The serious consequences that this could have for wild fish species may also affect aquaculture.

Climate change could also have an impact on the shore-based infrastructure associated with fisheries and aquaculture. According to a Natural Resources Canada study, “Atlantic Canada will experience more storm events, increasing storm intensity, rising sea level, storm surges, coastal erosion and flooding.”²¹

5.1.2 OTHER CHALLENGES

Other challenges for aquaculture in eastern Canada include the following:²²

- the high degree of dependence on monoculture salmon farming;
- poor diversification of markets (Canada and the United States);
- the small size of aquaculture operations compared with those in competing countries such as Chile and Norway;
- little influence on world prices (price setter);
- scarcity of suitable aquaculture sites near shore for certain species;
- fish health;
- the negative public perception of aquaculture, though acceptance is higher in Atlantic Canada.

5.2 OPPORTUNITIES

According to some researchers, the prospects for the Atlantic provinces are favourable if they diversify their aquaculture production to include white fish such as Atlantic halibut, cod and haddock.

Atlantic halibut farming has excellent potential since demand currently exceeds supply.²³ In addition, halibut is the largest flatfish in the world, and it can be cut into reasonably priced fillets and steaks. Moreover, researchers estimate Atlantic halibut’s income elasticity²⁴ at 3.92%, which means that for each 1% increase in the consumer’s income, per capita demand for halibut rises by 3.92%.²⁵ In this market, eastern Canada has an advantage over its competitors because of the proximity of New England and the heavy demand in that area; high-quality fish is greatly sought-after in Boston and New York supermarkets and restaurants. The market also appreciates the reliability and consistency of the distribution system from eastern Canada.

Another opportunity lies in the move toward greener aquaculture production practices. Particularly promising in this regard are eco-certification²⁶ and integrated multitrophic aquaculture (IMTA).

In an IMTA farming system, organic waste products from some cultured species are used as food for other species, such as seaweed and shellfish. There is currently an IMTA pilot project in the Bay of Fundy, in which seaweed, mussels and Atlantic salmon are being farmed together. According to a study,²⁷ IMTA would have a favourable effect on the public’s perception of salmon farming: 65% of the people

surveyed believe that IMTA reduces the environmental impact of salmon monoculture, and 100% feel that it improves waste management in aquaculture. The negative effects of more conventional aquaculture can be mitigated with other practices, such as closed or semi-closed aquaculture systems with effluent filtering.

6 CONCLUSION

Over the years, aquaculture has developed in the regional and rural economies of the Atlantic provinces and Quebec as commercial fisheries have declined. According to many analysts, aquaculture will continue to grow. For example, Fisheries and Oceans Canada estimates that by 2020, Canada's aquaculture production may more than double and may even exceed 308,000 tonnes.²⁸

In a context of growing demand, Canada must continue investigating technological advances in offshore production, since suitable coastal sites seem to be increasingly scarce. By remaining at the leading edge of research and innovation, and by favouring environmentally responsible aquaculture, Canada – especially eastern Canada – will be better able to exploit potential new markets.

From an economic perspective, economic partnership with the European Union and increased trade with Asia could create opportunities to reduce Canada's dependence on the United States market.

NOTES

1. Food and Agriculture Organization of the United Nations [FAO], [The State of World Fisheries and Aquaculture 1998](#), 1999.
2. FAO, [The State of World Fisheries and Aquaculture 2008](#), Rome, 2009.
3. Ibid.
4. World Bank, [Changing the Face of the Waters: The Promise and Challenge of Sustainable Aquaculture](#), Washington, DC, 2007, p. 145.
5. FAO (1999), quoted in World Bank (2007), p. 1.
6. FAO, [World aquaculture production of fish, crustaceans, molluscs, etc., by principal species in 2007](#).
7. Statistics Canada, [Human Activity and the Environment: Annual Statistics](#), 2009.
8. House of Commons, Standing Committee on Fisheries and Oceans, [The Federal Role in Aquaculture in Canada](#), April 2003.
9. Ibid., p. 20. The exceptions are Ontario, Alberta, Saskatchewan, Manitoba and Nunavut.
10. House of Commons, Standing Committee on Fisheries and Oceans (2003), p. 5.
11. Government of New Brunswick, [2007 Aquaculture Sector Overview](#). For more information about aquaculture in New Brunswick, see [New Brunswick Aquaculture Summit: Discussion Document](#).
12. Government of Newfoundland and Labrador, Department of Fisheries and Aquaculture, [Aquaculture Capital Equity Program](#).

13. For more information about aquaculture in Newfoundland and Labrador, see Government of Newfoundland and Labrador, Department of Fisheries and Aquaculture, [Seafood Industry Year in Review 2008](#), 2009.
14. Government of Nova Scotia, Department of Fisheries and Aquaculture, [Aquaculture Species Sheets – Atlantic Salmon](#), 1 May 2007.
15. Prince Edward Island Aquaculture Alliance, [PEI Cultured Oysters](#).
16. Aquaculture began in Quebec (Lower Canada) in 1857 with the farming of young salmonids. Fish farms were established in the 1950s to meet sports fishing demand. Salmonid farming for food developed in the 1980s.
17. Government of Quebec, Ministère de l'Agriculture, des Pêcheries et de l'Alimentation, [Aquaculture en eau douce](#) (updated on 17 July 2009). For more information about fisheries and aquaculture in Quebec, see Government of Quebec, Ministère de l'Agriculture, des Pêcheries et de l'Alimentation, [Les pêches et l'aquaculture commerciales – Bilan 2007 et perspectives](#), 2009.
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19. J. Beibei et al., *A Marketing Overview for the Advancement of Atlantic Halibut Cultivation in Atlantic Canada*, 2008.
20. Intergovernmental Panel on Climate Change, [Climate Change 2007: Synthesis Report](#), 2008, p. 33.
21. Natural Resources Canada, [From Impacts to Adaptation: Canada in a Changing Climate 2007](#).
22. From Beibei et al. (2008) and Fisheries and Oceans Canada, [National Aquaculture Strategic Action Plan Initiative: Strengthening Sustainable Aquaculture Development in Canada](#), Discussion Document, March 2009.
23. Beibei et al. (2008).
24. Income elasticity measures the impact that a change in a consumer's income has on his demand for a particular commodity.
25. Beibei et al. (2008).
26. Eco-certification is an approach being developed market-wide to improve commercial fishing practices with a view to ensuring sustainable development of the resource. Eco-labelling helps generate consumer demand for fisheries products.
27. N. Ridler et al., "Integrated Multi-Trophic Aquaculture (IMTA): A Potential Strategic Choice for Farmers," *Aquaculture Economics & Management*, Vol. 11, No. 1, 2007.
28. Fisheries and Oceans Canada (2009).