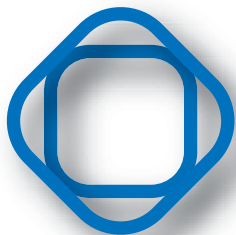


# Achieving the Vision

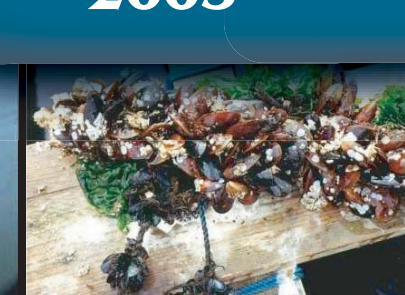
*"Aquaculture, not the Internet, represents the most promising investment opportunity of the 21st Century"*

*Peter Drucker,  
Economist and Nobel Laureate*



## Report of the Commissioner for Aquaculture Development

2003



Fisheries and Oceans  
Canada

Pêches et Océans  
Canada

Canada

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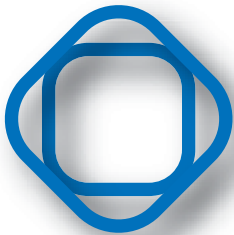
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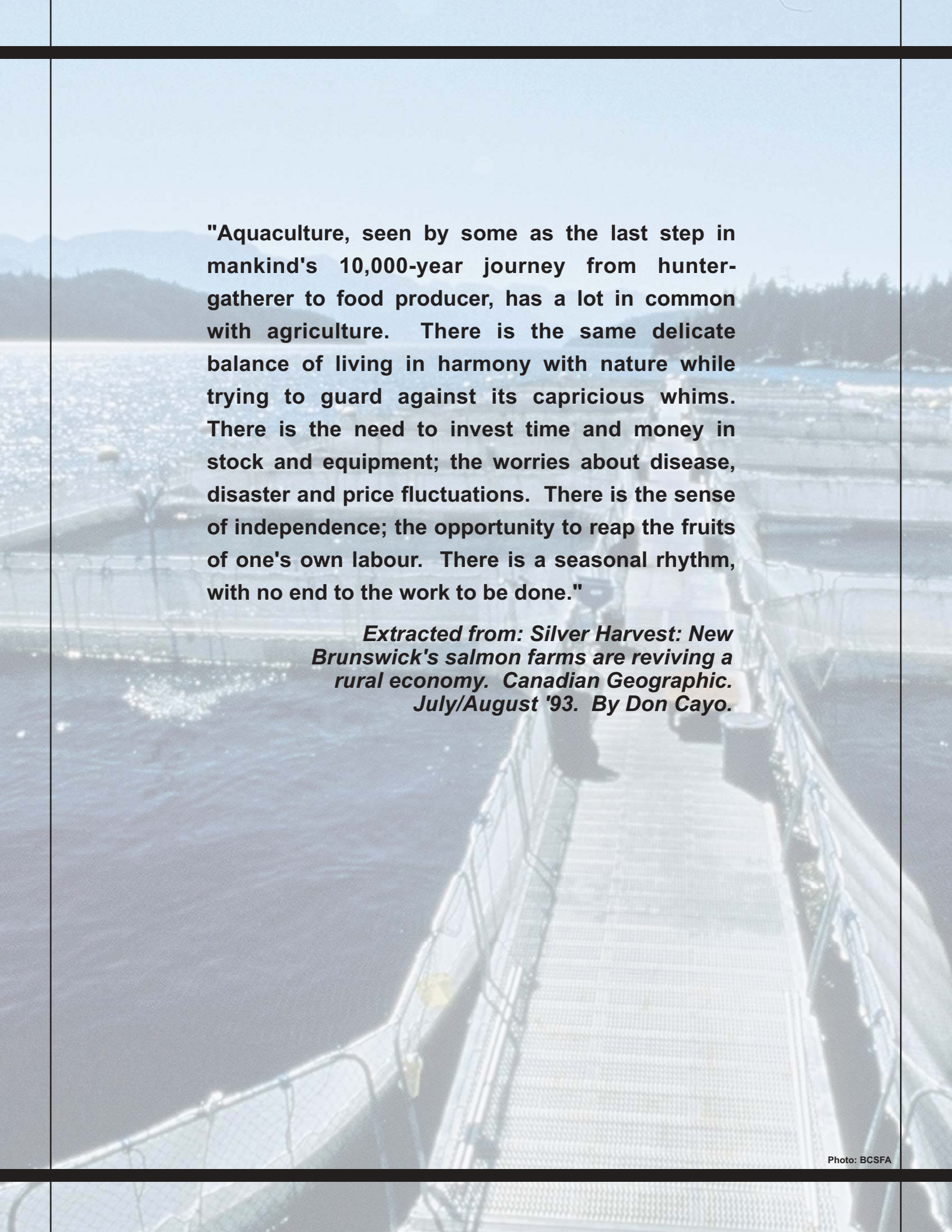
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# Achieving the Vision



**Report of the Commissioner  
for Aquaculture Development**

**2003**



**"Aquaculture, seen by some as the last step in mankind's 10,000-year journey from hunter-gatherer to food producer, has a lot in common with agriculture. There is the same delicate balance of living in harmony with nature while trying to guard against its capricious whims. There is the need to invest time and money in stock and equipment; the worries about disease, disaster and price fluctuations. There is the sense of independence; the opportunity to reap the fruits of one's own labour. There is a seasonal rhythm, with no end to the work to be done."**

***Extracted from: Silver Harvest: New Brunswick's salmon farms are reviving a rural economy. Canadian Geographic. July/August '93. By Don Cayo.***



# Table of Contents

<b>Glossary of Acronyms and Definitions</b> . . . . .	<b>v</b>
<b>Preface</b> . . . . .	<b>1</b>
<b>Making a Case for Aquaculture Development in Canada</b> . . . . .	<b>3</b>
<b>Aquaculture and the Transformation of the Fish and Seafood Sector</b> . . .	<b>6</b>
<b>Importance of Aquaculture in Canada</b> . . . . .	<b>9</b>
Current Status of Aquaculture in Canada	
Aquaculture Supplies, Services and Technologies	
Continued Sustainable Aquaculture Development Represents a Major Economic Opportunity for Canada	
Employment Potential and Coastal and Rural Revitalization	
Aboriginal Opportunities in Aquaculture	
<b>Building on Canada's Capacities and Capabilities</b> . . . . .	<b>21</b>
Aquaculture and Biotechnology	
<b>Aquaculture and the Environment</b> . . . . .	<b>25</b>
Environmental Implications of Aquaculture in a More Global Context	
Facts and Myths about Environmental Impacts from Shellfish Aquaculture	
Facts and Myths about Environmental Impacts from Finfish Aquaculture	
How Industry and Government Policies and Regulations Address Environmental Concerns	
<b>Toward an Appropriate Federal Role in Aquaculture</b> . . . . .	<b>31</b>
<b>A Vision for Sustainable Aquaculture Development in Canada</b> . . . . .	<b>33</b>
Environmental Sustainability	
Integrated Management	
Policy, Legislation and Regulation	
Aboriginal Peoples and Aquaculture Development	
Research and Technology Exploitation	
Finance, Industry Development & Infrastructure	
Marketing and Trade	
Food Safety	
Aquatic Animal Health	
Training and Education	
Communications	

**Conclusion . . . . . 41**

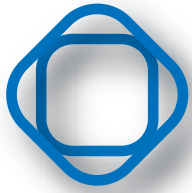
**Bibliography . . . . . 44**

**Appendix I - Summary of Environmental Risks of Salmon Farming . . . 46**

**Appendix II - Environmental Sustainability Measures taken by  
Industry and Government . . . . . 47**

**Appendix III - Summaries of OCAD's Background Studies . . . . . 52**

**Appendix IV - OCAD's Visioning Process . . . . . 60**



# Glossary of Acronyms and Definitions

## Acronyms:

<b>AAFC</b>	Agriculture and Agri-Food Canada
<b>AANS</b>	Aquaculture Association of Nova Scotia
<b>ACOA</b>	Atlantic Canada Opportunities Agency
<b>ACRDP</b>	Aquaculture Collaborative Research and Development Program
<b>BCSFA</b>	British Columbia Salmon Farmers Association
<b>BMP</b>	Best Management Practices
<b>CAIA</b>	Canadian Aquaculture Industry Alliance
<b>CCFAM</b>	Canadian Council of Fisheries and Aquaculture Ministers
<b>CEAA</b>	<i>Canadian Environmental Assessment Act</i> or Canadian Environmental Assessment Agency
<b>COP</b>	Codes of Practice
<b>DFO</b>	Department of Fisheries and Oceans
<b>EMG</b>	Environmental Management Guidelines
<b>ENGO</b>	Environmental Non-Governmental Organization
<b>EU</b>	European Union
<b>FADS</b>	Federal Aquaculture Development Strategy
<b>FAO</b>	Food and Agriculture Organization of the United Nations
<b>GDP</b>	Gross Domestic Product
<b>GM</b>	Genetically Modified
<b>HACCP</b>	Hazard Analysis and Critical Control Points
<b>IHN</b>	Infectious Haematopoeitic Necrosis Virus
<b>MAPAQ</b>	Quebec Ministry of Agriculture, Food and Fisheries
<b>MAFF</b>	British Columbia Ministry of Agriculture, Food and Fisheries
<b>MENVIQ</b>	Quebec Ministry of the Environment
<b>MSX</b>	Haplosporidium nelsoni (virus)
<b>MWLAP</b>	British Columbia Ministry of Water, Land and Air Protection
<b>NAAHP</b>	National Aquatic Animal Health Program
<b>NBDELG</b>	New Brunswick Department of the Environment and Local Government
<b>NBSGA</b>	New Brunswick Salmon Growers Association
<b>NGO</b>	Non-Governmental Organization

<b>NLDFA</b>	Newfoundland and Labrador Department of Fisheries and Aquaculture
<b>NOAA</b>	United States National Oceanic and Atmospheric Administration
<b>NSGA</b>	Newfoundland Salmonid Growers Association
<b>OCAD</b>	Office of the Commissioner for Aquaculture Development
<b>OSAWG</b>	Ontario Sustainable Aquaculture Working Group
<b>PEIAA</b>	Prince Edward Island Aquaculture Association
<b>PFRCC</b>	Pacific Fisheries Resource Conservation Council
<b>R&amp;D</b>	Research and Development
<b>SAR</b>	Salmon Aquaculture Review
<b>SOPs</b>	Standard Operating Practices
<b>SPAAQ</b>	Syndicat professionnel de l'Association des aquaculteurs du Québec Inc.
<b>UN</b>	United Nations
<b>US</b>	United States
<b>WMC</b>	New Brunswick Waste Management Committee

## Definitions:

**Broodstock:** Population of mature and breeding animals. Individuals selected for breeding.

**Carrying capacity:** The capacity of an ecosystem to support healthy organisms while maintaining its productivity, adaptability and capability for renewal.

**Crustaceans:** Members of the class Crustacea, a large class of arthropods with hard shells, mainly aquatic, e.g. crab, lobster and shrimp.

**Enhancement:** Actions taken by a public authority to restock fish or to improve the productivity of a pond by modifying its environment.

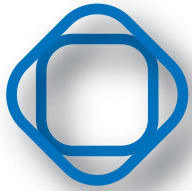
**Molluscs:** Invertebrates of the phylum Mollusca, soft-bodied and usually hard-shelled invertebrates such as limpets, snails, cuttlefish, oysters, mussels, etc.

**Nutraceuticals:** A term applied to dietary supplements and functional foods. Dietary supplements are syrups, tablets, and capsules such as vitamins. Functional foods are staples that have had their nutritional value enhanced with benefit-rich natural extracts.

**Phytotoxin:** A toxin produced by a microalga consumed by filter feeders and their predators that can be extremely dangerous to humans eating the shellfish.

**Sea ranching:** An extensive culture system of marine animals, in which hatchery systems are used to rear young individuals which are then released to forage and grow in their natural environment until they are harvested.





## Preface

The Office of the Commissioner for Aquaculture Development was established by the Minister of Fisheries and Oceans in December of 1998 to provide advice to the Minister on matters pertaining to aquaculture in Canada. The Commissioner was asked to be the champion for aquaculture within the federal government and to accelerate the implementation of the Federal Aquaculture Development Strategy (FADS), launched in 1995 by the Department of Fisheries and Oceans (DFO).

After a first three-year mandate, during which he released a report entitled "Legislative and Regulatory Review of Aquaculture in Canada", the Commissioner was given an extended two-year mandate (until March 2004) to prepare a long-term vision for aquaculture in Canada and to provide the Minister with specific recommendations on the appropriate federal role to help achieve this vision and fully implement the FADS.

This report outlines the rationale for further investment in the development of a sustainable aquaculture industry in Canada, discusses environmental criticisms and


presents a 15-year vision. It concludes with observations on what needs to be done to overcome short and long-term constraints and impediments that keep Canada from achieving its full potential in aquaculture.

During the process of producing this report, we met with many Canadians in all regions of the country. We asked for their input into the formulation of a vision for aquaculture and we were pleased and impressed with their contribution. We also conducted numerous studies, which can be found on our web site:

<http://ocad-bcda.gc.ca/emandate.html#Background%20Studies>

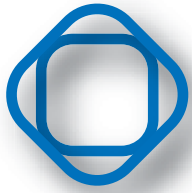
We encourage readers to consult these studies to learn more about the aquaculture industry in Canada and internationally. A summary of these studies can be found in Appendix III of this report.

The opinions expressed in this report are solely those of the Commissioner for Aquaculture Development. The Government of Canada does not necessarily support or endorse these opinions.

A woman wearing a black cap and a blue jacket is seen from the side, working with a large, dark fishing net on a boat. The net is spread out on the deck, and she appears to be handling it. In the background, there is a body of water and a forested hillside. A boat with the word "TAIR" is visible in the distance.

**"Aquaculture is where future growth will come from, aquaculture is the focus of pivotal policy decisions regarding ownership and management in aquatic environments, aquaculture will have an increasing influence on wild fish stocks and the aquatic environment, aquaculture will dominate the international trade and marketing of many species (especially high-valued species), and competition from aquaculture is an increasingly important catalyst for change in fisheries management."**

***Anderson, J.L. 2002. Aquaculture and the Future: Why Fisheries Economists Should Care? Marine Resource Economics 17:133-151***



# Making a Case for Aquaculture Development in Canada



Photos: OCAD

**A**quaculture, the farming of aquatic organisms including fish, molluscs, crustaceans and aquatic plants, is the fastest growing food production sector in the world. The stocks raised in aquaculture operations are the private property of the aquaculturists, who care for the crop throughout its rearing period by administering basic animal husbandry (e.g. providing housing and feed, protection from predators, veterinary practices, etc.). Upon reaching the preferred market size, the livestock are harvested for processing, sale and consumption. This is the agri-food business model of aquaculture—producers invest in production systems, manage livestock to optimize productivity and coordinate sales to earn a return on investment.

In 1986, Canadian aquaculture production amounted to only 10,488 tonnes, valued at \$35 million<sup>1</sup>. Growing at an average annual rate in excess of 19 percent, in 2001, Canadian aquaculture output reached 152,523 tonnes, valued at \$597 million. This



Photo: Gilles Daigle

figure represents 13 percent of total fisheries production in Canada and 24 percent of its value. This extraordinary growth, however, has not kept pace with other leading fish-farming nations. In fact, today, Canada ranks

twenty-second among aquaculture producing nations and accounts for less than one-third of 1 percent of global farmed fish and seafood production. This level of production falls far below Canada's capacity and capability. Canada has the natural resource base that can enable it to be in the top three global competitors in aquaculture production.

With a bountiful biophysical resource base and proximity to two of the world's largest, growing seafood markets (the US and Pacific Rim), Canada is well-positioned to be a more significant producer of aquaculture products. However, in Canada's drive to become a leading supplier of fish and seafood, we are also aware of the broader objectives of Canadian society—to bring economic development to our coastal and rural regions in harmony with the social fabric of these communities, while preserving environmental integrity and the culture and traditions of Canada's Aboriginal Peoples. Building upon a solid foundation established by individual entrepreneurs, small and medium-sized businesses and multi-national organizations, the sector has a tremendous capacity to expand and diversify.

Within the next 15 years, it is projected that the Canadian aquaculture sector, growing at 10 to 15 percent annually, could generate in excess of \$2.8 billion annually in

<sup>1</sup> Unless otherwise indicated, all dollar amounts are in Canadian dollars

farm-gate revenues and provide sustainable, year-round employment to more than 47,000 people living in coastal, rural and Aboriginal communities. Value-added processing and revenues generated in the related supplies and services sector could push the total economic value of the Canadian aquaculture sector beyond \$6.6 billion.

The simple existence of this potential, however, will not bring it to fruition. Success, and the realization of our objectives, will require a new era of co-operation and collaboration among all stakeholders and a determination to address and resolve challenges pertaining to both industry and governments. For its part, the federal government can catalyze sustainable development in the sector by providing a cohesive, integrated and co-ordinated federal response to aquaculture. We have seen the positive benefits attained in countries such as Norway, when government guides the sustainable development of aquaculture.

This proposal for a renewed federal policy and regulatory framework supported by strategic program elements lays the foundation for a more appropriate federal response for the support and development of this dynamic industry. A more effective and efficient public service for the regulation and development of aquaculture will enable the industry to realize its potential as a sustainable supplier of farm-raised fish, shellfish and aquatic plants. The resulting benefits to Canadians would include:

- economic and social revitalization in coastal and rural communities in which opportunities for sustainable development can be elusive;
- enhanced participation in the aquaculture sector by Aboriginal Peoples in a manner consistent with native culture, values and traditions;
- increased public confidence in the environmental sustainability of aquaculture and in the Government's ability and intent to manage the sector on a sustainable basis;
- increased industry and investor confidence in the sector, allowing for enhanced private sector financing of industry expansion;
- practical and equitable solutions for the resolution of user-group conflict among stakeholders in Canada's coastal regions;
- enhanced consumer confidence in the safety, health benefits and wholesomeness of high quality Canadian seafood products; and



Photos: OCAD

- broad-based public acceptance of aquaculture, and confidence that aquaculture development is being managed in a manner that is congruent with the values of Canadians.

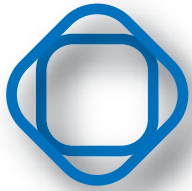
In its 2002 review of global aquaculture practices, the United Nations Food and Agriculture Organization (FAO) concluded that "public management of aquaculture is not dissimilar to public management of agriculture" and, "in developed economies, management and enforcement costs as a share of the value of the produce are lower for aquaculture than for capture fisheries." Not surprisingly, therefore, the FAO predicts that "public policy support for aquaculture

is likely to grow worldwide" as nations, communities and individuals increasingly pursue business opportunities in aquaculture. Furthermore, the FAO notes that aquaculture development "has been of the win-win type, as both producers and consumers have gained when prices for cultured species have fallen as a result of increased production."

In Canada, a nation blessed with an enormous wealth of aquatic resources, the reality of sustainable aquaculture development and the inherent benefits that it offers to all Canadians is within our grasp. Only the strength of our resolve to seize this opportunity limits our potential.

**"...aquaculture is here to stay; the challenge is to ensure the young and growing industry develops in a sustainable manner and does not cause serious ecological damage."**

Rebecca J. Goldberg and others, 2001  
Marine Aquaculture in the United States: Environmental Impacts and Policy Options



# Aquaculture and the Transformation of the Fish and Seafood Sector



Photo: BCSFA

"Consider a meeting of fisheries experts. They debate fisheries management and innovative solutions to the great open-access problems. When they break to eat dinner, it is likely to consist of salmon and/or shrimp. Yet they seem oblivious to the fact that the seafood they are consuming is farmed. They eat the future of fisheries, but continue to discuss its past."<sup>2</sup>

Aquaculture is not a recent undertaking. Historical accounts tell of fish-farming activity in China dating back 4,000 years. In Egypt, ancient tomb friezes depict fish-farming activities over 3,500 years ago. In Canada, proto-aquaculture activities are believed to have been practised by Aboriginal Peoples, while concrete evidence of aquaculture practices trace back to the 1850s when governments engaged in the incubation and hatching of different species of finfish and shellfish. The global (and Canadian) surge in modern aquaculture, however, is quite recent, dating back to the late 1970s.

According to the FAO, two global trends are expected to have a significant impact on fish and seafood consumption—and on aquaculture. First, the global population continues to grow and is expected to increase some 36 percent from approximately 6.1 billion people in 2000 to

8.3 billion people in 2030. Second, global economic growth is enhancing the affluence of many people. Since fish and seafood consumption is proportionate to a population's personal income level, and since the global population is projected to become more numerous and more affluent, the demand for fish and seafood is expected to increase significantly.

If population expansion, income growth and dietary changes were the only considerations, the FAO projects total seafood demand would reach 183 million tonnes by 2030. Due to supply constraints, however, it is more likely that consumption will increase to only approximately 150 to 160 million tonnes. However, given that only 25 percent of major commercial fisheries are under-exploited or moderately exploited, almost two-thirds are fully-exploited (47 percent) or over-exploited (18 percent), and 10 percent are significantly depleted or recovering from depletion, most fisheries experts agree that global capture fisheries can only provide 80–100 million tonnes of fish per year on a sustainable basis. Therefore, a global shortfall of approximately 50–80 million tonnes of fish and seafood is projected. Aquaculture output will increase to fill this gap, and Canada should be part of this output.

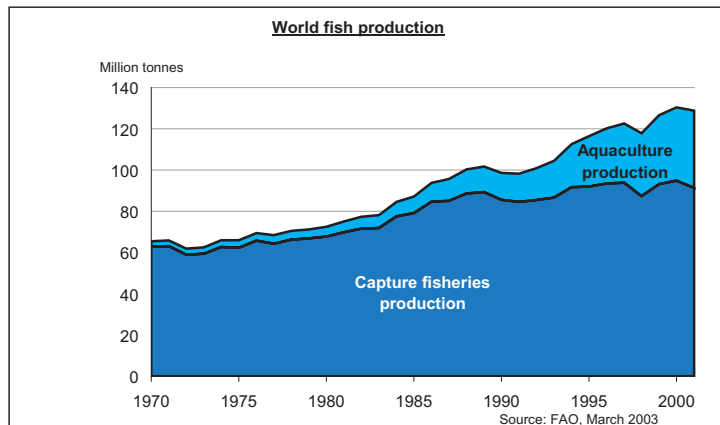
Over the last 15 years, aquaculture has

<sup>2</sup> Anderson, J.L. 2002. *Aquaculture and the Future: Why Fisheries Economists Should Care*. *Marine Resource Economics* 17:133-151.

emerged as an increasingly important contributor helping to supply the global demand for fish and seafood. FAO statistics demonstrate that aquaculture now represents 29 percent of the volume and 38 percent of the value of global fish landings (Figure 1). Moreover, the FAO states that at its present rate of growth, by 2010 aquaculture output will surpass beef production. By 2030, aquaculture is expected to be the dominant source of fish

By producing a consistent, high-quality product on a year-round basis, the aquaculture sector has been able to provide consumers with a superior level of convenience and value. Today, nine out of ten salmon and tilapia, four out of five mussels, three out of four scallops and two out of four shrimp consumed in the world are products of aquaculture. Not only will this trend continue, but it will also extend to other high-value species.

**Figure 1: World Fisheries Production from 1970-2001**



and seafood; and less than one-half of all fish and seafood products consumed will originate from traditional capture fisheries.

Aquaculture is not only transforming the supply of fish and seafood, it is also having a significant impact on consumption. For example, in the US (Canada's largest export market for fish and seafood), farm-raised species now account for about 30 percent of total per capita seafood consumption, equalling more than 50 percent of all non-canned product. Among the top 10 seafood items consumed in the US, four leading aquaculture products (shrimp, salmon, catfish and tilapia) continue to command an increasing share of consumer choice (Table 1).

Hoping to gain on the success of salmon aquaculture, the retail and foodservice sectors are demanding a farm-raised "whitefish" that has the same supply and quality advantages as farmed salmon. Cod is emerging as the likely candidate. In addition, the enhancement of tuna fisheries through aquaculture technologies is developing in Australia and in the Mediterranean region, and it is expected that

similar initiatives will develop in the Gulf of Mexico.

**Table 1: Per Capita Consumption of Seafood in the US (lbs) Top 10 Species 1990 and 2001**

	<u>2001</u>	<u>1990</u>	<u>Change</u>
Shrimp	3.40	2.20	55%
Tuna	2.90	3.20	-9%
Salmon	2.02	0.73	177%
Pollock	1.21	1.27	-5%
Catfish	1.15	0.70	64%
Cod	0.56	1.38	-59%
Clams	0.47	0.61	-23%
Crabs	0.44	0.29	52%
Flatfish	0.39	0.57	-32%
Tilapia	0.35	-	2000%
Scallops	0.27	0.30	-10%
Other Species	1.64	3.75	-56%
<b>TOTAL</b>	<b>14.80</b>	<b>15.00</b>	<b>-1%</b>

Source: HM Johnson & Associates (1997; 2002)

At a time when Canadian fisheries have suffered from the reduction of the Pacific salmon and Atlantic groundfish stocks, the enhanced commercial harvest of shellfish has emerged to augment the production and value of the fishery. Today, however, the fishery is largely dependent on three species—crab (especially snow crab), shrimp and lobsters—and the decline in any one of these stocks would have significant consequences for the sector. Moreover, uncertainty surrounds the status of the shellfish stocks and future harvest tonnages cannot be considered secure. In the absence of growth through aquaculture, many of Canada's coastal and rural communities face an uncertain future.

The global boom in aquaculture output has already had a negative influence on Canada's position in the global seafood trade. In the mid-1980s, Canada led the

world in seafood export trade. In 1988, Canada fell to second place behind the US; by 1991, Canada fell to fifth place. This drop is significant for Canada, as our share of the world seafood trade has fallen from 7.0 percent in 1988 to only 4.2 percent of a US \$ 51.5 billion industry. Among those countries showing gains in the world seafood trade are Thailand, Norway, China and Chile. Economic gains in these countries have come largely through extraordinary growth in the output of farmed fish and shellfish.

Through the managed production of fish, shellfish and aquatic plants, aquaculture presents a sustainable means to enhance the productivity of Canada's fish and seafood sector and provide social and economic stability in our coastal and rural communities. It will also provide an opportunity to regain our former lead position in the international seafood trade.





# Importance of Aquaculture in Canada



Photo: BCSFA

## Current Status of Aquaculture in Canada

In 2001, the Canadian aquaculture industry produced 152,523 tonnes of fish and seafood valued at \$597 million representing roughly 24 percent of the value of total fish landings (Figure 2). Production is dominated by five main categories: salmon 69.0 percent, blue mussels 14.2 percent, oysters 7.0 percent, trout 4.3 percent and steelhead 3.1 percent.

Finfish represents 77 percent of the tonnage and 90 percent of the value of Canadian aquaculture production. From 2000 to 2001, farmed salmon production increased 21 percent to almost 95,000 tonnes. In 2001, shellfish production in Canada surpassed 34,000 tonnes, worth more than \$58 million. Blue mussel is the

most important shellfish species grown in Canada, followed by oysters and clams.

Today, a total of 72 cold-water species are licensed for rearing in the country. They include 50 species of finfish, 18 species of marine shellfish, two species of amphibians and two species of marine plants. Aquaculture is carried out in all provinces and in one territory.

Aquaculture production is mainly for food but, increasingly, for nutraceutical and medicinal applications. In some First Nations communities, species that were once part of traditional diets but are no longer available in the wild are now being farmed.

Figure 2: Aquaculture production and value for the period 1986–2001

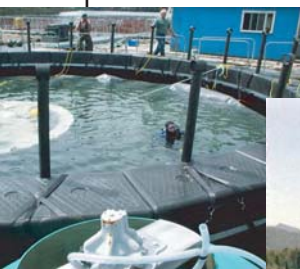
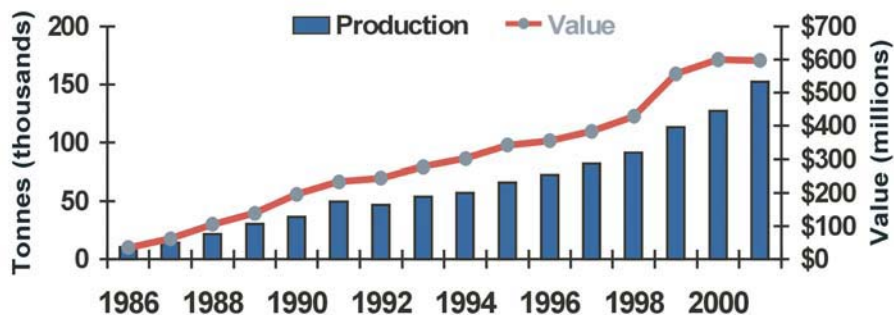


Photo: OCAD



Photo: DFO

## ***Aquaculture Supplies, Services and Technologies***

When one thinks about aquaculture, the managed production of fish and shellfish comes to mind. However, a wide range of speciality companies has emerged to fulfil the supplies and services needs of the sector, some of which are identified in the

lists below. Moreover, for every person employed in the production of fish and shellfish, approximately one additional person is employed in the related supplies and services sector.

### **Supplies**

- Cage Systems/Fittings/Moorings
- Nets/Netting/Rope
- Aeration/Oxygenation Equipment
- Alarms/Monitoring Equipment
- Veterinary Supplies/Vaccines
- Software Systems
- Feeds and Feeding Equipment
- Filtration Systems
- Grading/Counting Equipment
- Hatchery Equipment
- Fish Processing Equipment
- Packaging Equipment
- Pumps and Motors

### **Services**

- Environmental Monitoring
- SCUBA Diving
- Design and Construction
- Equipment Repair
- Fish Health
- Insurance
- Laboratory Services
- Research and Development
- Product Development
- Genetics
- Training and Skills Development
- Transportation
- Management Consulting

## ***Continued Sustainable Aquaculture Development Represents A Major Economic Opportunity for Canada***

During a 2001 strategic planning workshop for aquaculture, a group of industry and government experts were asked to forecast production levels for Canadian aquaculture over the coming 10 to 15 years. It was agreed that the Canadian aquaculture industry could expand to generate approximately \$2.8 billion in farm-gate revenue within this time frame. Incorporating gains from value-addition (20 percent of production) and growth in the related supplies and services sector could more than double this value to approximately \$6.6 billion in economic

activity (Table 2). Moreover, there was consensus among these experts that these projections were not only achievable, but that they were conservative. The key assumptions that were applied in making these projections were that:

- federal and provincial governments establish an appropriate policy and regulatory framework that enables industry to enhance its ability to be internationally competitive;
- the environmental sustainability of the

sector is widely accepted;

- consumer confidence in the quality and wholesomeness of Canadian fish and seafood products is upheld and reinforced;
- industry has secure access to development sites of an appropriate scale to foster international competitiveness;
- US imports of farmed-raised fish and seafood expand at 15 percent annually, as projected; and
- Canada maintains its current 45 percent market share in the US.

include further penetration of new markets, such as the rapidly expanding opportunities in China. It was assumed that this growth would rely predominantly on continuing to service the Canadian and US markets at a level of effort that was no greater than it is today.

While salmonids are anticipated to remain dominant, alternative species including cod, halibut, sablefish and wolffish are also expected to emerge in commercial quantities. Similarly, in the shellfish sector, today's output of mussels, oysters, clams and scallops will be supplemented by an expanded output of farm-raised geoducks, sea urchins and abalone. In the freshwater

sector, where Canada has a vast, untapped potential, the farming of cool water and other "specialty" species will emerge to augment the production of trout and Arctic charr.

However, salmon will continue to dominate Canadian aquaculture production. In fact, global estimates project that salmon farming will continue to increase until about 2015, after which production should stabilize.

**Table 2: Production Potential of Canadian Aquaculture**

Culture Species	2000		2010–2015	
	Tonnage (1000 mt)	Value (\$ millions)	Tonnage (1000 mt)	Value (\$ millions)
Salmonids	84.9	\$511	350	\$2,100
Cod*	0	\$0	128	\$545
Other Finfish	0.5	\$5	5	\$30
Mussels	17.3	\$23	52	\$69
Oysters	9.3	\$14	36	\$57
Clams	0.9	\$4	4	\$16
Other Shellfish	0.1	\$0	2	\$4
Subtotal	113	\$557	577	\$2,821
Value-Addition				\$500
Supplies & Service				\$3,321
<b>TOTAL</b>				<b>\$6,642</b>

\* Data for cod were modified in 2003

To attain this level of output, the sector would have to grow at a rate of 11 percent to 17 percent annually; a rate that is below the 19.8 percent average annual growth rate experienced between 1986 and 2001. Furthermore, the projections did not

Achieving the projected increased output of farmed salmon in Canada (i.e. 350,000 tonnes) would require the allocation of only 66 new salmon sites of 12 hectares each. In this area of 792 hectares, equivalent to approximately twice the size of Stanley

Park in downtown Vancouver (Figure 3), substantial employment and economic benefits would be delivered to coastal and rural communities on both coasts in dire need of permanent jobs.

The industry is also preparing to diversify its species mix over the next decade. Cod farming is particularly attractive for development in Atlantic Canada, where the cod fishery has been reduced to a shadow of its once dominant stature. The technological capabilities are now in place to farm the species and Canada has excellent rearing conditions for cod. With a growing interest in cod farming coming

from both new firms and major salmon farming companies, the industry is poised for development. A recent evaluation of the potential for cod farming in Canada concluded that, within the coming decade, the sector could grow to produce 128,000 tonnes annually, valued at \$545 million (Rogers Consulting Inc., 2002). In comparison, Norway is projecting that by 2007 it will produce 190,000 tonnes annually. In British Columbia, sablefish (black cod) farming holds a similar potential to that of Atlantic cod. Through aquaculture, it is quite possible that in the foreseeable future, Canada could surpass its 1982 highest landings of 510,723 tonnes of cod.

**Figure 3: Map of Vancouver, British Columbia, showing Stanley Park.**



Similarly, a recent study on the economic potential of sea ranching and enhancement projected that, based solely on biophysical capacity, Canada has the potential to generate a landed product value of \$1,255 million, producing 15,000 jobs and contributing more than \$900 million toward the GDP. This potential exists for nine principal species, including the sea scallop, soft-shell clam, green sea urchin, American oyster, northern quahaug, geoduck, Manila clam, northern abalone and Japanese scallop<sup>3</sup>.

The richness and diversity of Canada's coastal and inland aquatic resources

provides considerable potential for the cultivation of a variety of species. Consequently, Canada is better positioned than are many Nordic countries to produce a range of species on a significant commercial scale. As the FAO notes, globally, 78 percent of aquaculture production is derived from only 29 species; however, as technologies improve, the number of species commercially cultured will continue to expand to include many more of the commercially valuable species. Canada's natural resource base provides diverse opportunities for production of an expanded range of aquaculture products.

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<sup>3</sup> Gardner Pinfold and IEC International. *Economic Potential of Sea Ranching and Enhancement of Selected Shellfish Species in Canada*. Report prepared for OCAD. Ottawa, Ontario: 2001.

## Employment Potential and Coastal and Rural Revitalization

While the gross revenue and employment numbers in aquaculture are attractive, the location of the employment opportunities is even more significant. By its very nature, aquaculture exists principally in remote coastal communities, many of which have suffered due to the demise of traditional fisheries and now have few opportunities for sustainable economic development. Aquaculture occurs in those very areas most in need—areas where other industries have difficulty taking root and remaining competitive. Aquaculture has already had a considerable positive impact, leading to the revitalization of many such communities and providing hope where there was despair.

Across Canada, aquaculture has stimulated the economies of many communities, including:

### Newfoundland:

Bay d'Espoir	Salmon, Steelhead, Cod
Notre Dame Bay	Mussels, Salmon, Cod
Trinity Bay	Mussels

### Nova Scotia:

Bras d'Or Lake	Salmon, Steelhead
Mahone Bay	Mussels

### New Brunswick:

Bay of Fundy	Salmon
Northumberland Strait	Oysters, Mussels
Acadian Peninsula	Oysters, Mussels

### Prince Edward Island:

Murray River	Mussels
New London Bay	Mussels
Malpeque Bay	Oysters, Mussels

### Québec:

Îles-de-la-Madeleine	Mussels, Scallops
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### Ontario:

Manitoulin Island	Rainbow Trout
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### Saskatchewan:

Lake Diefenbaker	Rainbow Trout
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### British Columbia:

Campbell River	Salmon
Clayoquot Sound	Salmon
Quatsino Sound	Oysters, Clams
Fanny Bay	Oysters
Baynes Sound	Oysters, Clams
Queen Charlotte Strait	Salmon

### Yukon:

Whitehorse	Arctic Charr
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Photo: DFO



Photo: BCSFA

In 2001, the Canadian aquaculture sector employed some 12,390 people (Table 3). According to the Canadian Aquaculture Industry Alliance, approximately 90 percent of these jobs are located in rural and coastal communities, and two-thirds of all workers are under the age of 35. Aquaculture development has proved to be a revitalizing social and economic force in rural Canada. As part of the new economy, the sector offers real opportunities for well-paying jobs, providing meaningful year-round employment and a reason for youth to remain in these communities.

If the projections for Canadian aquaculture output are reached and allowance is made for a 25 percent increase in labour force productivity, within the coming 10 to 15 years, total employment in the sector will approximate 47,000 individuals. Moreover, the vast majority of these 47,000 jobs would be created in coastal and rural communities, where they are most needed. At present, and for the foreseeable future, there will be a chronic shortage of qualified workers to fill the growing number of job vacancies in the sector.

**Table 3: Direct and Indirect Employment in Canadian Aquaculture (2001)**

<b>Operations</b>	<b>Direct</b>	<b>Indirect</b>	<b>Total</b>
Marine Finfish <sup>4</sup>	4,110	2,942	7,052
Shellfish <sup>4</sup>	3,374	534	3,908
Aquatic Plants <sup>4</sup>	170	n/a	170
Freshwater <sup>5</sup>	893	367	1,260
<b>TOTAL</b>	<b>8,547</b>	<b>3,843</b>	<b>12,390</b>

<sup>4</sup> Chopin, T. and S. Bastarache. *Finfish, Shellfish and Seaweed Mariculture in Canada*. Bull. Aquacult. Assoc. Canada, 2002. 102-3:119-123.

<sup>5</sup> Doyon, M., I. Charron, S. Julien and É. Gilbert. *Value and Economic Impact of Freshwater Aquaculture in Canada: Current State (1999) and Potential for Development*. Report prepared for the Office of the Commissioner for Aquaculture Development (OCAD). Ottawa, Ontario: 2001.

## Charlotte County, New Brunswick - An Aquaculture Success Story

Over the last decade, Charlotte County, in southwest New Brunswick, has experienced significant economic growth due to aquaculture—specifically salmon farming. While this rural area was previously faced with high levels of unemployment, the county is now a significant hub for Canadian aquaculture production. In fact, its economic growth is so significant that it has become necessary to recruit workers from outside the region.

Today, several of Charlotte County's largest



Photo: OCAD

employers are involved either directly or indirectly in the aquaculture sector<sup>6</sup>. Aquaculture now accounts for more than 3,000 full-time jobs in the local area, representing 25 percent of the entire workforce<sup>7,8</sup>. In 2000, the salmon farming industry generated direct employment equivalent to 1,683 person-years (PY's) consisting of: 19 hatcheries: 157 PY's; 41 farming companies operating 96 marine cage sites: 624 PY's; 10 processing plants: 537 PY's; direct services: 240 PY's; and selling, administration and other: 125 PY's. Direct employment wages, salaries and benefits expenditures were estimated at \$47 million<sup>9</sup>.

In the related supplies and services industries such as boat building, net and cage manufacturing, machine shops, etc., it is estimated that an additional 2,962 jobs have been created. Assuming the indirect wages are based on the mean income from the census data, these positions would add close to \$46 million to regional payrolls.

<sup>6</sup> Fundy Region Development Commission Inc. On line: [http://www.frdc.ca/our\\_economy.htm](http://www.frdc.ca/our_economy.htm) . April 24, 2002.

<sup>7</sup> Cooke, G. and L. Stewart. Presentation to the Standing Committee on Fisheries and Oceans. Ottawa, Ontario: House of Commons. December 6, 2001. Online: <http://www.parl.gc.ca/InfoComDoc/37/1/FOPO/Meetings/Minutes/FOPOmn34%281413%29-E.htm>

<sup>8</sup> Atlantic Canada Opportunities Agency (ACOA). News Releases, September 17, 1998. On line: <http://www.acoa.ca/e/media/press/press.shtml?958>

<sup>9</sup> Stewart, L. *Salmon Aquaculture in New Brunswick. Natural Development of Our Marine Heritage*. Aquaculture Strategies Inc. 2001.



## Aboriginal Opportunities in Aquaculture

A significant challenge facing both the Canadian government and First Nations leadership is the creation of a sustainable economic base for First Nations communities. While the modern, global economy is having considerable success with providing employment and generating wealth, this success is limited to those countries which can offer the advanced education, training and mobility needed to participate in this increasingly knowledge- and urban-based economy. Those in rural areas are not able to fully participate. This is particularly true for First Nations communities.

Moreover, there is an inherent lack of mobility among First Nations people and the survival of unique First Nations cultures is linked intrinsically to the resource base of their traditional territories.

To help rectify this situation, long-term, sustainable employment opportunities are required—not short term, make-work projects.

Among some First Nation communities, there is considerable discontent regarding aquaculture, particularly with respect to finfish farming and especially in British Columbia. In other First Nation

communities, however, aquaculture has proved to present a powerful opportunity for the development of a sustainable economic base. In many regions of Canada, First Nations have unique access to aquaculture development sites, when the primary constraint on industry growth in the area is, in fact, site availability. Aquaculture also fits well with the skills held by much of the potential work force in these communities. Recognising this opportunity, those First Nations that have established aquaculture operations have found that the industry can provide stable

**Table 4: First Nations Involved in Aquaculture in Canada, 2003**

<b>First Nation</b>	<b>Location</b>	<b>Culture Species</b>
Miawpukek	Conne River, NL	Salmon, Steelhead, Oyster
Eskasoni	Cape Breton, NS	Salmon, Trout, Striped Bass
Oujébourgoumou	Chibougamau, QC	Brook Trout, Arctic Charr
Cape Croker	Warton, ON	Rainbow Trout
Wikwemikong	South Baymouth, ON	Rainbow Trout
Aundeck Omni Kaning	Little Current, ON	Rainbow Trout
Rainy River	Emo, ON	Sturgeon
Akwesasne	Cornwall, ON	Perch
Tla-o-quiaht	Tofino, BC	Shellfish
Klahoose	Campbell River, BC	Clams, Oysters, Scallops
Sliammon	Powell River, BC	Clams
Quatsino	NW Vancouver Island, BC	Shellfish
Snuneymuxw	Nanaimo, BC	Clams, Oysters
Ahousaht	Tofino, BC	Clams, Oysters, Salmon
Kitasoo/Xaixais	Klemtu, BC	Salmon
Kyuquot	NW Vancouver Island, BC	Salmon
Huu-ay-aht	NW Vancouver Island, BC	Abalone

employment and wealth for the community, thereby producing resources that can be channelled into areas of need.

Today, aquaculture ventures exist in at least 17 First Nation communities across Canada (Table 4). However, the present level of aquaculture development amongst First

Nations is not reflective of the potential that exists. A preliminary analysis <sup>10</sup> conducted for the Department of Indian and Northern Affairs in 2001 by a team of aquaculture experts and First Nations business development specialists suggested that:

- approximately 130 First Nations may have the potential to develop trout farms;

- approximately 61 coastal First Nations have access to sites which could support salmon farms; and
- approximately 123 First Nations have access to sites with the potential for clam, mussel, and/or oyster farming.



Photos: DFO

<sup>10</sup> Canadian Aquaculture Systems, Inc. (2001). *Opportunities in Aquaculture for First Nation Communities*. Dept. of Indian and Northern Affairs. Ottawa, Ontario.

## Kitasoo/Xaixais First Nation Salmon Farming Success Story

Located in Klemtu, some 480 kilometres north of Vancouver on the BC central coast, the Kitasoo/Xaixais First Nation is a relatively small (718 hectares) and isolated community with no year-round road access. The on-reserve population of 460 people is predominantly young and growing, having doubled over the last 20 years. Moreover, this growth rate is expected to continue.

For generations, the economy of the community was sustained by the commercial and food fisheries. Since the 1950s, however, the returns of wild salmon have fallen dramatically, resulting in a severe loss of employment and leaving the community without a sustainable economic base (Figure 4).

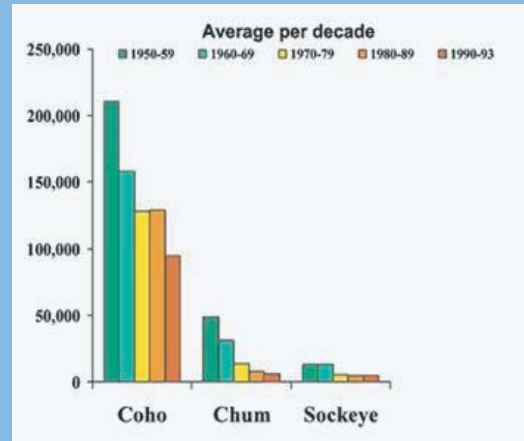
In response to this situation, the Kitasoo/Xaixais people chose to diversify their economy. They developed an economic revitalisation plan that focused upon sustainable opportunities in tourism, forestry and aquaculture. The community decision to develop these sectors was contingent upon maintaining the environmental, cultural and ecological values of their territory and protecting fish and wildlife habitats. Maintaining a balance between these traditional values and the needs of their community for economic prosperity and sustainable employment is critical to success.

In partnership with Marine Harvest Canada, a commercial salmon farm was developed in the Kitasoo/Xaixais territory. In addition, through distance education, North Island College delivered practical aquaculture training to provide community members with the requisite skills.



Photo: Kim Stallknecht - Courtesy of NUTRECO

Figure 4: Wild Salmon Returns 1950 - 1993



Source: www.kitasoo.com

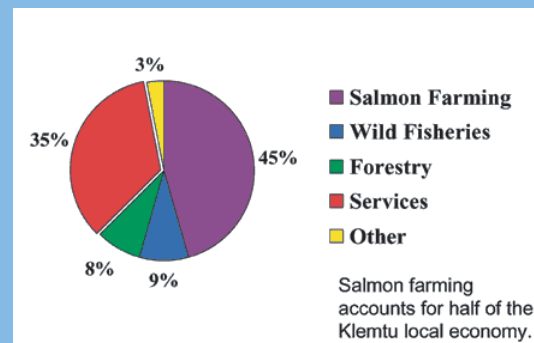
Today, salmon farming accounts for one-half of the local economy of the Kitasoo/Xaixais people (Figure 5) and is a source of community pride.

In deciding to pursue aquaculture via a joint-venture agreement with Marine Harvest Canada, the Kitasoo/Xaixais First Nation was adamant that the environmental

integrity of their traditional territory not be compromised. They were particularly concerned that Marine Harvest's fish-farming activities might reduce the fisheries harvests for other community members. Consequently, the Kitasoo/Xaixais community retained final decision-making powers in all matters pertaining to environmental impacts and decisions, making it clear to Marine Harvest Canada that if the farm was found to be the cause of environmental degradation, it would be shut down without hesitation.

Today, the Kitasoo/Xaixais First Nation and Marine Harvest Canada operate three salmon farms that are certified under an ISO 14001 environmental program and are subject to extensive independent monitoring. After four years of operations, fisheries harvests have not declined and the environmental integrity of the region remains intact. Chief Councillor and Band Manager Percy Starr of the Kitasoo/Xaixais First Nation proudly claims that "no one should be fooled into thinking that BC's Kitasoo First Nation had sold out and sacrificed any part of its environmental heritage in order to become part of the salmon-farming industry."

Figure 5: Employment by Sector, Klemtu 2001





## Building on Canada's Capacities and Capabilities

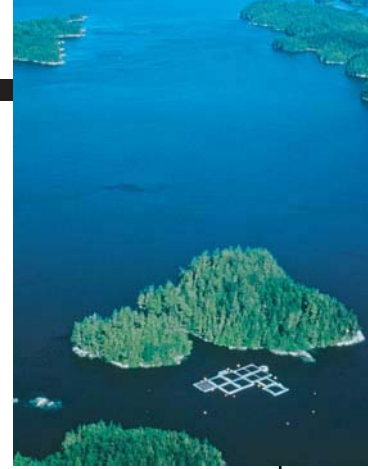


Photo: BCSFA

**A**t 243,792 kilometres, Canada's coastline represents 25 percent of all coastlines in the world. Canada also possesses 16 percent of the world's fresh water in the form of more than 3 million lakes and rivers covering more than 755,000 square kilometres. With an abundance of suitable sites for raising aquatic animals, the biophysical potential for aquaculture in Canada is tremendous. Moreover, the Canadian government, both at the national and provincial levels, encourages aquaculture as a sustainable means of economic development.

Canada's fisheries history dates back more than four centuries, over which time Canada has developed a respected international reputation for providing high-quality, high-value seafood from cold, clean waters. This history has also positioned our nation as a global leader in the processing, marketing and distribution of seafood, with a well-established physical, technological and managerial infrastructure.

Demand for seafood in Canada's major export markets is growing at a faster pace than the traditional fishery can service. This is particularly true in the US, our largest export market for fish and seafood, where the strong demand for high-quality fresh seafood will continue to fuel growth in Canada's aquaculture production.

Canada's salmon farming sector is the

world's fourth largest, following Norway, Chile and the United Kingdom. Several of the leading, multi-national aquaculture corporations are ready to expand their Canadian operations, if an enabling policy and regulatory environment is created. Expanding the sector through this proven industry base will minimize developmental risks and will help to establish larger regional clusters in which ventures of all scales can prosper.

Twenty-plus years of experience in commercial aquaculture has allowed Canada to develop a skilled and experienced workforce in the sector, from basic technical labour through to managerial expertise. The training and education infrastructure established to support the sector is also first rate, providing knowledge services in Canada and abroad. This infrastructure also provides an excellent opportunity for exploratory and development research that will enhance productivity and sustainability.

All told, Canada has considerable potential to be a significant global player in commercial aquaculture and a leading contributor to the development and promotion of sustainable aquaculture technologies. With a vast biophysical resource base, experience and expertise in the production, processing, distribution and marketing of fish and seafood, coastal

infrastructure to expand upon and Aboriginal opportunities and interest, Canada is well positioned to be a leading,

internationally competitive producer of farm-raised fish and seafood.

## A Future for Cod

In 1497, while searching for a sea route to China, John Cabot discovered a "new found land" that was teeming with fish. News of this discovery soon brought scores of fishing boats from Europe to the eastern shore of North America to harvest the riches of the sea. And for nearly 400 years, the seemingly inexhaustible stocks of the Grand Banks were a source of industry, international trade, prosperity, employment and pride.



Photo: NOAA

Over the Grand Banks, a large and relatively shallow coastal region, a mixture of cold arctic currents and warm tropical currents create a nutrient-rich

habitat capable of supporting fish by the billions. In the twentieth century, however, technology had advanced to the point where fishermen were able to hunt down stocks with increasing precision and collect them from the sea with an unprecedented efficiency. Technologies had advanced to the point where fish could be harvested faster than scientists and regulators could collect the data and information required to impose the quotas and fisheries restrictions needed to protect the stocks. In 1992, the unthinkable happened—the mighty Northern cod stocks of Atlantic Canada were severely threatened and the fishery was closed. Today, after more than a decade of intensive conservation measures, cod

stocks remain at less than 2 percent of their historical levels and show little sign of recovery. This situation necessitated the closing of the remaining Gulf of St. Lawrence cod fisheries by the Minister of Fisheries and Oceans in May 2003. As a result, fishing boats that had plied the seas for nearly four centuries are tied up, processing plants have been shut down, thousands of people are unemployed and entire communities have been left without an economic base.



Photo: <http://www.stemnet.nf.ca/cod/627no16.jpg>

As we embark upon the twenty-first century, however, aquaculture technology may come to the rescue of cod. By adopting technologies developed for other marine species such as turbot, halibut and sea bass, it is now possible to breed cod in hatcheries by the millions for commercial production in sea cages. Already, Norway has issued no less than 280 cod-farming licenses, and this year, three million hatchery-reared juveniles have been stocked into cages. It is projected that more than 64 million juveniles will be produced by 2005, which, in theory, should

yield more than 190,000 tonnes of cod by 2007. By 2015, estimates suggest that Norway could be producing more than 400,000 tonnes of cod.

It is projected that Canada has the capability to produce 128,000 tonnes of cod, valued at more than \$545 million, by 2015. This level of production will require development of four to six commercial cod hatcheries capable of producing about 40 to 45 million juveniles annually. Grow-out (including sites for year-class separation and fallowing) will require approximately 120 marine sites of 20 hectares each, or 2,400 hectares. In fact, today more than 160,000 cod are already in cages in Newfoundland, broodstock have been developed, more than a dozen marine grow-out sites have been approved and, in the autumn of 2003, Canada's first commercial cod hatchery will commence production.

Through aquaculture there is an exciting and prosperous future for cod, which is destined to re-emerge as a favourite entrée on dinner tables around the world.



Photo: Dan Stechey

## ***Aquaculture and Biotechnology***

Aquaculture is a knowledge- and technology-intensive sector. The pursuit of increasingly productive and sustainable practices drives an environment of continuous learning and advancement. As significant new technologies, processes and products emerge, the competitiveness of Canadian companies is enhanced. Moreover, Canada has earned an international reputation in the aquaculture sector as a sustainable supplier of high quality and safe fish and seafood. As a result, many Canadian knowledge-based companies are at the forefront of the aquaculture supplies and services sector. Therefore, continued aquaculture development also presents an opportunity for Canadians to export equipment, knowledge and services to a global market.

Other industrial opportunities exist in aquaculture that have yet to be fully explored, including marine plant production for food and nutraceuticals, advanced processing of value-added products and by-products and the development of pharmaceuticals and other biotechnologies. Today, the potential impact of such developments on the scope and nature of aquaculture can only be imagined.

For example, the production and marketing of marine-based nutraceuticals such as

omega-3 fatty acids and chitosan is already an expanding sub-sector, contributing to a nutraceutical and functional foods market that some analysts estimate may exceed US\$ 250 billion within 5 to 10 years. Furthermore, clinical trials have shown that some marine bioactive compounds have anti-cancer, anti-viral and anti-inflammatory properties. Undoubtedly, organisms can be produced, using aquaculture technologies, to specifically generate and harvest such products.

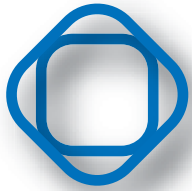
Today, research is also being conducted in order to acquire a better understanding of the potential benefits of genetically modified fish. Conducted in secure, fully contained land-based research facilities, this research is showing potential for reducing the costs of production in some fish species and for the production of human insulin by other fish species.

Thus, looking beyond the conventional production of food, it appears inevitable that aquatic biotechnology will also be harnessed to improve the growth, disease resistance and performance of a number of fish and shellfish species and for the manufacture of functional foods and medicines.



Photo: BCSFA





# Aquaculture and the Environment

"Today, fishing is the largest extractive use of wildlife in the world."<sup>11</sup>

It is clear that aquaculture is sustainable from both a seafood business point of view and a socio-economic perspective. What is less clear to some Canadians, however, is that aquaculture is also environmentally sustainable.

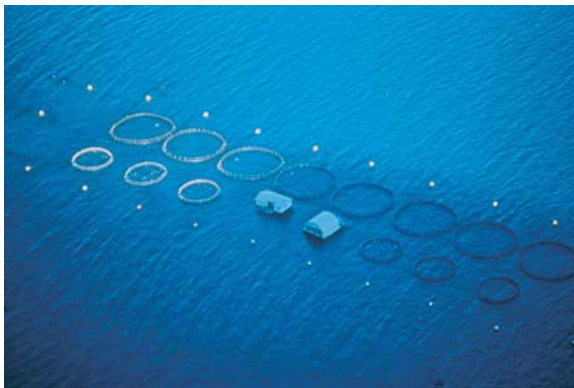


Photo: BCSFA

Whether through farming, fishing or aquaculture, all human activities of a scale significant enough to produce food also have an environmental cost.

In agriculture, for example, the creation of a farm field requires cutting down the existing forest and removing most of the plant and animal life. This usually means the disappearance of the original ecosystem and food web. Furthermore, agriculture practices continue to have other direct and indirect consequences to the surrounding

**"There is growing awareness that aquaculture can be the most ecological way to increase the global food supply in the next 20 years".**

K. Dun Gifford, President and founder of the Oldways Preservation and Exchange Trust

environment on an ongoing basis. Despite these environmental implications, the agriculture sector in Canada enjoys large support from Canadians.

Obviously, Canadians do not expect to feed their families by gathering wild fruit or hunting deer and moose. This practice would not be environmentally sustainable. Canadians accept farming as a necessary activity and expect their governments to ensure that it is practised in the most sustainable way possible. Moreover, despite its environmental impacts, most Canadians are proud of their agriculture sector and fully support government policies to assist the sector.



Photo: 2000-2001 Aerial Farm Statistics Inc.

The reality is that the Canadian agriculture sector is an innovative and competitive industry. It continues to improve its environmental performance and provide high quality, safe food for domestic and



Photo: NOAA

<sup>11</sup> World Fish Center. 2002. Fish for All: An Issue for Everyone. A Concept Paper

foreign markets while creating jobs and economic activity in our rural communities and maintaining the social fabric of Canada.

Being nothing else than farming in the water, aquaculture should enjoy the same kind of support from Canadians. Up to now, this has been the case, as evidenced by several opinion surveys that have demonstrated a consistently large support from Canadians for aquaculture.

Unfortunately, this support is currently eroding due to a growing public perception that aquaculture is a polluting industry that puts our ocean environment and wild stocks at risk and markets fish that are unsafe for human consumption. The reality

is that the aquaculture industry in Canada is an environmentally sustainable industry that meets the highest standards of quality and food safety.

In order to really understand how aquaculture is environmentally sustainable, it is important to:

- reflect upon its environmental implications in a more global context;
- separate myths from facts with regard to environmental impacts; and
- analyse the measures put in place in recent years to ensure adequate environmental protection.

### ***Environmental Implications of Aquaculture in a More Global Context***

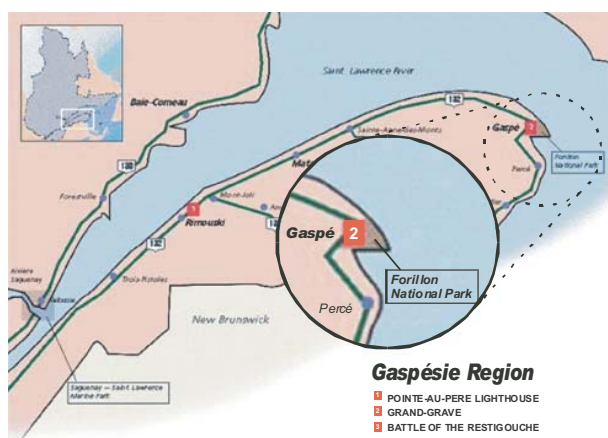
In 2002, the total area occupied by aquaculture operations in Canada was 30,971 hectares (OCAD, 2002), which is slightly larger than the area occupied by Forillon National Park (See Figure 6). It is equivalent to an area measuring 17.6 km long by 17.6 km wide, which is roughly the size of the core area of almost any one of Canada's provincial capital cities.

On this tiny area of our Canadian aquatic resource base, the aquaculture industry produced approximately 24 percent of the value of all Canadian fish landings (fisheries and aquaculture combined).

There is no doubt that aquaculture activities practised on this minuscule portion of our aquatic ecosystem produce

a certain level of environmental impacts. But an objective and strategic assessment of these environmental impacts cannot be done without taking into account the fact that the approach used to produce the other 75 percent of the value of Canadian fish and seafood landings—the commercial fisheries—also has an environmental cost.

**Figure 6: Map Showing Forillon National Park**



The reality is that aquaculture produces a new fish biomass with a certain level of impact on a small, localized portion of our aquatic ecosystem, while commercial fisheries remove large amounts of wild biomass from the ecosystem with a certain level of impact on a large portion of the

same ecosystem.

In fact, aquaculture should be viewed as a good candidate to become a model of sustainable development, contributing towards the long-term protection of Canadian aquatic ecosystems.

### ***Facts and Myths about Environmental Impacts from Shellfish Aquaculture***

The culture of mussels, oysters and clams in Canada is generally considered to pose a low environmental risk. Molluscs are filter feeders, and their presence in an environment is often used as an indicator of the quality of the environment. By removing suspended particles, molluscs can contribute towards improving the quality of the environment in areas or bays.

Due to the fact that they extract their food from the surrounding environment, it is important to consider the carrying capacity of a specific area when siting mollusc culture operations. If not properly sited and monitored, large-scale operations could have consequences on water circulation, sedimentation regime and accumulation of organic material on the bottom of the ocean. Most shellfish operations are well sited, adequately regulated and of a small

enough production to avoid such problems.

Most of the opposition to mollusc aquaculture is based more on conflicts with other users than on environmental considerations. The leasing of private mollusc culture tenures is often viewed by other users as an infringement on their rights, e.g. public access to water for land owners, general access to beaches for citizens, the right to navigation for all types of boaters, access to the resource for fishers, pristine views for cottage owners, etc. This not-in-my-back-yard syndrome can be overcome through pro-active planning of aquaculture sites, and comprehensive and transparent consultation processes and conflict resolution mechanisms.



Photo: PEI Dept. of Fisheries, Aquaculture and Environment.

## ***Facts and Myths about Environmental Impacts from Finfish Aquaculture***

Salmon farming has been the object of criticism in Canada over the last two years. Many of these criticisms are unfounded and are not based on recent data on the environmental performance of the salmon farming industry while other criticisms are valid.

The Salmon Aquaculture Review, published in 1997, was a comprehensive and independent review of all of the environmental risks that are due to salmon farming. It concluded that salmon farming, as currently practised in BC and at current levels, presents a low overall risk to the environment. Since the publication of the Review, many other reports, analysing the same basic environmental risks, have been done on the same subject.

Table 1 in Appendix I summarizes the results of two credible, comprehensive and recent papers on the magnitude of the environmental risks involved with the practice of salmon farming, and compares these with the results of the Salmon Aquaculture Review.

In summary, Table 1 shows that many environmental concerns are based on outdated information or old practices and technologies, or have been exaggerated. At the same time, the table highlights other environmental concerns that are legitimate and require immediate attention by government and industry.

Some critics have raised the issue of the large amount of fish meal and fish oil being

used in the composition of fish feed and consequently contributing to further depletion of the oceans and removal of valuable fish resources for human consumption. The reality is that the fisheries responsible for the production of fish oil and fish meal are stable and sustainable, and are based on fish that were never used for direct human consumption. Aquaculture uses only about one third of available fish meal and fish oil; the rest is used for other livestock production, such as poultry and pork, as well as for pet food.

Concerns have also been expressed about genetically modified (GM) fish being raised in Canadian waters. The reality is that there are no GM fish in commercial production in Canada. Moreover, the Canadian Aquaculture Industry Alliance has a clear policy against the use of GM fish in commercial production until it has been scientifically demonstrated that they are fully safe for consumers and the environment. The only GM fish raised in Canada are in completely contained, land-based research facilities and are used for a variety of research projects, including the possible use of these fish for the production of insulin for humans.

Overall, sustainability resides in developing best management practices and government policies and regulations to reduce to an acceptable level all potential environmental impacts resulting from open net cage finfish culture operations, and to carefully locate these activities in well planned and well managed aquaculture areas or zones.

## ***How Industry and Government Policies and Regulations Address Environmental Concerns***

Regulating a private activity in public waters is a highly complex challenge, and requires new approaches. A number of measures have either been implemented or are in the process of implementation, the goal being to improve the environmental performance of the aquaculture industry in Canada. (See Tables 1, 2 and 3 in Appendix II.) The implementation of these measures within a short timeframe is a clear reflection of the commitment of the aquaculture sector to address environmental concerns. It also illustrates the importance attached by both levels of government to environmental concerns.

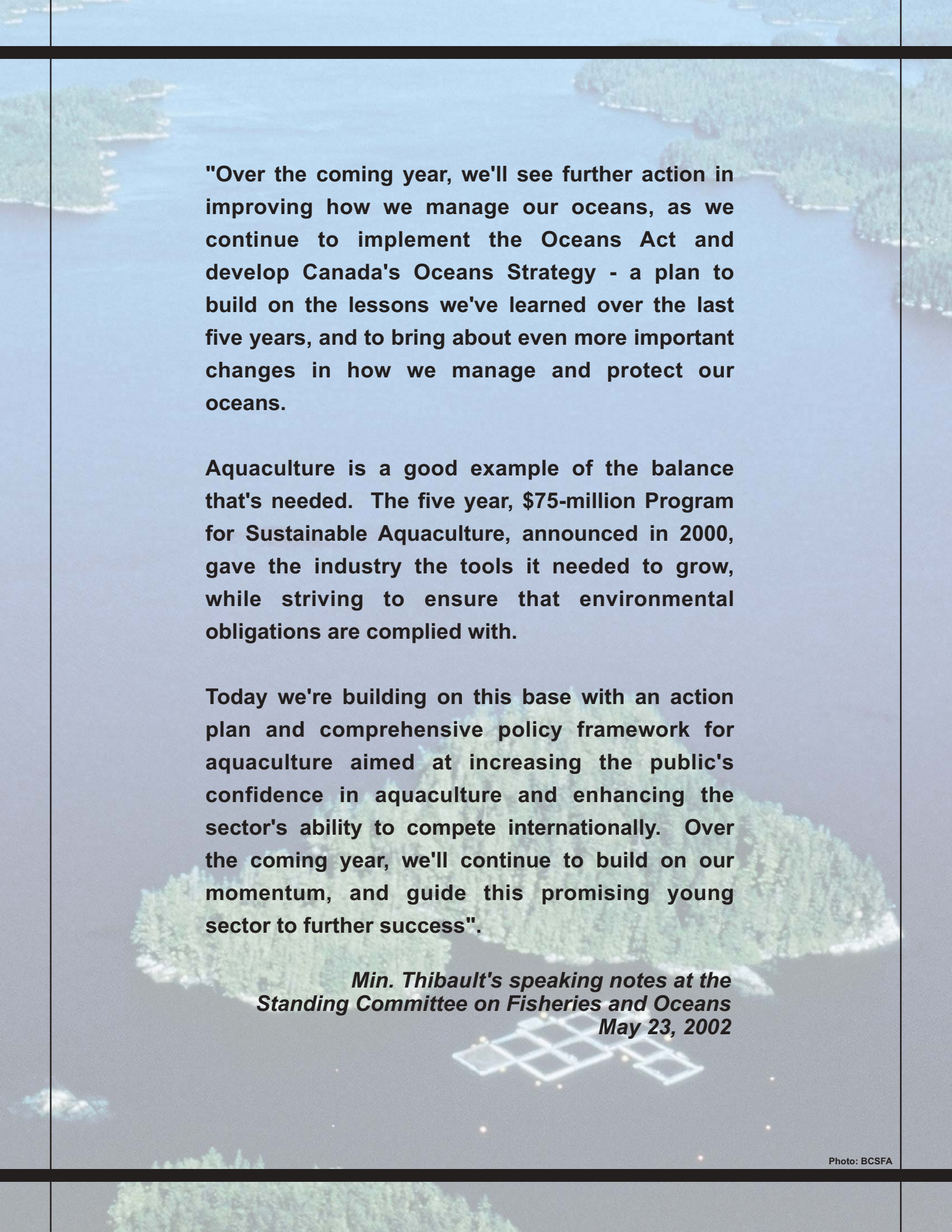
Furthermore, the specific recommendations issuing from our report to the Minister will complete the overall set of federal, provincial, and industry measures already established to protect the environment. New measures may be required to set the (federal) rules for conducting aquaculture in Canada when it comes to environmental sustainability. These rules should be consistent with recommendations submitted in June 2000 in the report of the Commissioner for Aquaculture Development, entitled "Legislative and Regulatory Review of Aquaculture in Canada".

The government's framework for managing environmental risk needs to be flexible enough to take into consideration the realities of scarce enforcement resources, a rapidly evolving sector and constantly changing technologies and practices. Many

existing and proposed measures have been designed in the context of risk management, smart regulation and adaptive management approaches. We must consider new approaches that involve the industry, while ensuring that adequate government monitoring, regulation and enforcement continues to exist to ensure full compliance and that sanctions are imposed when necessary.

It is essential to highlight the fact that each aquaculture operation in Canada (except shellfish bottom-seeding where there is no physical change to the seabed) must undergo an environmental assessment under the *Canadian Environmental Assessment Act* before being granted federal approval. In combination with ongoing federal and provincial environmental monitoring programs, aquaculture projects being subjected to environmental assessments ensure that no unforeseen, significant negative consequences on the environment arise from aquaculture operations.

In summary, although this industry is young (30 years old or less), it has already demonstrated a high level of environmental stewardship and has significantly improved its environmental performance in recent years. Although ongoing improvement is still needed in some areas, this sector has become a model of sustainable development that meets the highest environmental standards.

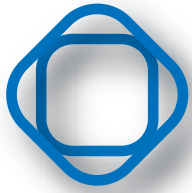


**"Over the coming year, we'll see further action in improving how we manage our oceans, as we continue to implement the Oceans Act and develop Canada's Oceans Strategy - a plan to build on the lessons we've learned over the last five years, and to bring about even more important changes in how we manage and protect our oceans.**

**Aquaculture is a good example of the balance that's needed. The five year, \$75-million Program for Sustainable Aquaculture, announced in 2000, gave the industry the tools it needed to grow, while striving to ensure that environmental obligations are complied with.**

**Today we're building on this base with an action plan and comprehensive policy framework for aquaculture aimed at increasing the public's confidence in aquaculture and enhancing the sector's ability to compete internationally. Over the coming year, we'll continue to build on our momentum, and guide this promising young sector to further success".**

***Min. Thibault's speaking notes at the  
Standing Committee on Fisheries and Oceans  
May 23, 2002***



## Toward an Appropriate Federal Role in Aquaculture

**A**s private enterprise, it is industry's role to develop internationally competitive and commercially successful aquaculture ventures. However, government policies and programs shape the environment in which industry operates and thus can significantly influence the scope and pace of industry growth and competitiveness. With a view to generating wealth and employment opportunities for Canadians, governments act as a catalyst to create a business environment in which aquaculture can flourish while simultaneously upholding mandated responsibilities to safeguard public health and navigational safety and to protect the environment. Such a role is consistent with current federal policy as outlined in the Federal Aquaculture Development Strategy, the 2002 Speech from the Throne and other policies pertaining to the development of an innovative and sustainable Canadian economy.

As a newer agri-food sector, sustainable

aquaculture development is constrained by policies, regulations and legislation that were developed largely for common property fisheries management and which cannot effectively accommodate the nuances of aquaculture. Consequently, delineation of a more appropriate federal role in aquaculture is required.

For all economic sectors, the "enabling" role of government necessitates striking an effective balance between regulation and development. From a regulatory perspective, the federal government is mandated to uphold human health and safety and environmental integrity. The Canadian Food Inspection Agency, for example, must continue to provide assurances to consumers in domestic and export markets that Canadian fish and seafood is safe and wholesome. Similarly, Environment Canada and the Department of Fisheries and Oceans must maintain public confidence in our capacity to assure that activities are conducted in a manner



Photo: BCSFA



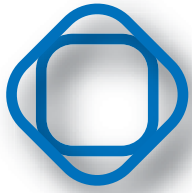
Photos: OCAD

that will not compromise the integrity of coastal and freshwater resources while the Canadian Coast Guard maintains public safety on our waterways. Should public confidence in the government's ability to effectively provide such safeguards erode, sustainable development will be compromised.

Moreover, the aquaculture sector itself is dependent upon these very safeguards. In

the absence of healthy and productive aquatic ecosystems, aquaculture productivity and competitiveness are compromised. Without safe, navigable waterways, the security of aquaculture stocks is compromised. If consumers cannot be assured that products are safe and wholesome, markets are compromised. Hence, governments and aquaculturists are natural allies in the effort to develop and implement measures that enhance sustainability.





# A Vision for Sustainable Aquaculture Development in Canada



Photo: OCAD

**D**uring the summer of 2002, OCAD organized eleven regional workshops with industry, government and other stakeholders to solicit the perspective of those groups most directly involved with aquaculture development in Canada. These collective views were compiled into a cohesive *Vision for Sustainable Aquaculture Development in Canada*. This exercise also clarified those elements deemed to be fundamental to successful development of the aquaculture sector in Canada. Each element represents a high-level component of the vision that, ultimately, will require strategic focus for further implementation.

A number of elements require government intervention. Most notable among these is the need for the creation of an enabling policy and regulatory framework, and investment in a more strategic approach to research and development (R&D). In fact, among eleven strategic areas requiring attention, the policy and regulatory framework and R&D were consistently identified as the primary drivers of sustainable development, providing leveraged benefits to all other areas. Furthermore, environmental sustainability

and market access were determined to be highly dependent upon enhanced efforts in both of these areas. Therefore, it is evident that the federal roles in regulatory and developmental aspects of aquaculture are not mutually exclusive. In fact, they are highly interrelated and complementary.

The responsibility for realising the considerable potential in aquaculture lies with industry; the government is responsible for providing industry with an enabling policy and regulatory framework, supported by a modern administrative system in which expertise and capacity are adapted to the needs of the sector. By providing a balanced federal response to aquaculture, Canada benefits from having a more effective and efficient public service for the regulation and development of the sector, enabling it to realize its potential as a sustainable supplier of farm-raised fish, shellfish and aquatic plants and as a revitalising force for coastal and rural economies. Effective and efficient delivery of these complementary roles across a multitude of federal departments and agencies requires a co-ordinated and integrated federal response — a response that has been absent for the past 20 years.

Following the eleven workshops and after reviewing numerous studies, the following vision statement was developed. It

describes what Canadian aquaculture can become.

*Aquaculture is an environmentally sustainable food production sector that enhances the value and productivity of Canada's fish and seafood sector. By producing wholesome products that exceed consumer expectations for taste, quality and convenience in domestic and international markets and by applying prudent production practices, Canada's aquaculture industry continues to attract investment to sustain growth and diversification. Operating in an enabling policy and regulatory environment, the sector brings sustainable economic and social revitalization to coastal and rural communities in a manner that is respectful of Aboriginal rights and traditional ways of life. Recognizing the significant societal benefits of aquaculture development, the Government of Canada has made it a key federal priority. Canada will fulfill its potential as a competitive force in sustainable aquaculture development.*

For a description of the process taken to arrive at this vision, please refer to Appendix IV, "OCAD's Visioning Process."

A vision without action is merely wishful thinking. The visioning process identified eleven strategic elements which, if acted upon, will allow the vision to be achieved.

## **1. Environmental Sustainability**

The viability of aquaculture is directly dependent upon a healthy and productive aquatic environment. Therefore, the interaction between aquaculture and the environment is twofold: while aquaculture development must advance in a sustainable manner that protects the quality of the environment for other users, it is equally important for society to protect the quality of the environment for aquaculture. Adherence to both aspects requires governments to establish sound,

scientifically based compliance standards or thresholds for water quality and environmental health that will be monitored and upheld by all stakeholders.

Despite clear evidence of considerable new financial resources and activities directed toward environmental management in aquaculture, legitimate environmental problems still challenge this industry. The sector, therefore, is not yet seen to be as sustainable as it could be—and should be.



Photos: BCSFA



These challenges fall into four general categories:

- direct environmental effects from aquaculture (e.g. escaped fish, deposition of organic waste below cages, residual effects of therapeutic agents, disease and pests)
- environmental effects of other industries on aquaculture (e.g. impaired water quality from municipal and industrial effluents and/or from agricultural run-off)
- biological effects on other species (e.g. migratory birds, marine mammals, species at risk)
- human health effects (food safety implications)

To address these challenges, industry and governments must engage in "smarter" environmental management, providing incentives to develop improved technologies to enhance productivity, mitigate against deleterious environmental impacts and monitor results. As well, existing environmental standards for non-aquaculture industries need to be enforced.

To this end, standard operating practices (SOP's) tied to regulatory and non-regulatory enforcement measures have already been developed and implemented in British Columbia, Quebec, New Brunswick, Prince Edward Island and Newfoundland. Similar measures are under development in Ontario and Nova Scotia and a National Code of Conduct for

Aquaculture is also under development by the Canadian Aquaculture Industry Alliance. Industry has been proactive in developing these codes and governments have given them legitimacy by making many of them mandatory for licence renewal.

To a degree, the present environmental challenges in aquaculture are due to an environmental management approach that, ironically, has impaired the sustainability of the sector, particularly salmon farming. This is not the result of a lack of focus or concern with environmental sustainability or an unwillingness to impose environmental regulations. It is largely unintentional and principally due to the absence of compliance standards and the implementation of environmental management strategies that are not well attuned to aquaculture.

For instance, federal environmental management decisions continue to limit access to new development sites for finfish culture. Yet this "environmental" decision is limiting industry's ability to improve overall sustainability by adopting more environmentally sound practices, such as site fallowing and year-class separation<sup>12</sup>. Consequently, the regulatory and management approach of government toward aquaculture is, in effect, compromising the economic and

<sup>12</sup> The practice of holding fish that are all from the same year-class at any given site is a validated means to enhance fish health and productivity.

environmental integrity of the sector by forcing industry to engage in sub-optimal animal husbandry practices and causing the sector to be less environmentally sustainable than it is currently capable of being.

"Smarter" environmental management is required to approve more sites, thereby enabling site following, rotation and year-class separation. This entails the adoption of detailed farm-management plans that incorporate environmental management systems audited by governments or by accredited third parties and which serve as a condition of federal approvals. "Smarter" environmental management should also incorporate integrated coastal zone planning and bay (watershed) management approaches to address multi-stakeholder issues.

It is evident that enhanced sustainability in aquaculture is not just about "doing more" and "spending more." Fundamentally, it is about doing things more effectively. The following features are essential to the development of an effective environmental management regime:

- **Streamlined:** creating an efficient and timely regime through greater co-ordination
- **Predictable and Transparent:** providing greater clarity and certainty for all participants in the process
- **Anticipatory:** placing emphasis on early planning and co-ordination to prevent or mitigate problems before they occur
- **Integrated and Complementary:** ensuring that the environmental management and decision-making responsibilities of federal and provincial departments with respect to aquaculture operations are consistent and mutually reinforcing
- **Science-based:** using the best science available and promoting scientific research and innovation

## ***2. Integrated Management***

Aquaculture has proved to be a revitalising economic force in rural and coastal communities—areas where sustainable economic development is often difficult. In some communities, however, the introduction of aquaculture into areas traditionally used largely for commercial fisheries and/or various recreational activities has coincided with impassioned user-group conflict. This is the dichotomy of aquaculture: a proven mechanism for economic and social revitalisation, yet in apparent conflict with historic users of the resource base. In such an environment, the aquaculture sector can seldom secure adequate long-term legal access to development sites and to aquatic biological resources—both of which are essential to sustainable development. To overcome this imbalance for the benefit of all Canadians, a planned and inclusive community approach to resource management and coastal planning is required, including effective mechanisms for conflict resolution. Development must strike a balance between social and economic

sustainability, ecosystem integrity and human values. Mechanisms for achieving this objective include the development and implementation of effective models for Integrated Coastal Zone Management, targeted zones for aquaculture (and other) development, and the establishment of Marine (aquatic) Protected Areas.

### ***3. Policy, Legislation and Regulation***

As it incorporates aspects of both fisheries and farming, aquaculture is mired in a complex jurisdictional framework that involves federal, provincial and municipal agencies. Moreover, existing policies, regulations and legislation were developed largely for fisheries management and are not attuned to the needs of aquaculture, an aquatic agri-food industry. Aquaculture requires a modern legal and policy framework that is in concordance with the agri-food aspects of this aquatic farming sector.

Sustainable use of Canada's aquatic resource base also requires clear delineation of federal and provincial roles and responsibilities so that they are

effective, efficient and complementary, thereby eliminating unnecessary duplication and overlap. Moreover, fulfilment of the government's role to create an enabling regulatory framework necessitates striking an effective balance among social, economic and environmental sustainability. Achieving this balance will require effective direction and co-ordination of efforts by a proactive lead agency. Implementation should fall largely to regional teams that are fully resourced with professional technicians and managers who are knowledgeable regarding aquaculture. Service standards and a transparent accountability accord are necessary components of this framework. Central themes must include site access, property rights, food safety, productivity, competitiveness, environmental sustainability and a defined government audit function. Such a framework would be conducive to the development of a more balanced and objective public service culture with respect to aquaculture and other users of the aquatic resource base and would enhance productivity in the aquaculture and commercial and recreational fisheries sectors.

#### **4. Aboriginal Peoples and Aquaculture Development**

Through open and consultative processes, Aboriginal concerns regarding aquaculture will be addressed (including related treaty rights and land claims issues), thus facilitating enhanced development of sustainable aquaculture. Nevertheless, Aboriginal Peoples shall retain the latitude to decide upon the scope of development within First Nation territories. For those Aboriginal communities that choose to invest in

aquaculture, specific developmental needs will be accommodated, such as training initiatives, capacity building and partnerships.

#### **5. Research and Technology Exploitation**

Scientific research is the foundation of knowledge, competitiveness, sustainability and progress in the rapidly evolving aquaculture sector. Consequently, a nationally co-ordinated framework to provide emphasis on R&D priorities in support of continuous improvement in present and future productivity and environmental sustainability within the aquaculture sector is vital. The R&D framework must be collaborative, including federal and provincial government research groups, academe and industry. Such a strategic approach should focus on the development and acquisition of innovative solutions in a manner that reflects and

respects local and regional diversity and priorities for sustainable development. Moreover, mechanisms to disseminate knowledge to a practical level, where it can be transformed into real gains in productivity and sustainability and have a positive influence on government decision-making processes, are essential to an effective R&D initiative.

#### **6. Finance, Industry Development and Infrastructure**

A mix of small and medium-size businesses and multi-national organizations reflects the entrepreneurial spirit of the Canadian aquaculture sector. Developing a more attractive investment climate for all scales of producers is imperative, and thus both industry and governments must define measures to quantify and reduce the risks inherent to aquaculture. The creation of an appropriate regulatory and economic framework, appropriate program and service support, tax incentives, enhanced access to investment and working capital funds and programs to provide for disaster relief, when necessary, are effective means to reduce risk. Developmental initiatives targeting enhanced productivity, competitiveness and profitability through measures that stimulate innovation and diversification are also necessary. In addition, investment into a core infrastructure such as wharves, roads, laboratories, utilities, etc. is essential to growth and, therefore, must keep pace with industry development. Finally, an often overlooked but essential factor in "development" is the necessity for investment into effective and financially



Photo: Nutreco

stable industry associations that have full representation of producers and suppliers within the sector.

## **7. Marketing and Trade**

Canada is well positioned to supply increased volumes of fish and seafood to address the growing global demand. Whether from fisheries or aquaculture, Canadian seafood from pure, pristine waters is recognized internationally for its quality and safety. In addition, Canada exports other aquaculture-related products and services including feed, specialized equipment and world-class expertise. Through co-operative initiatives in product and market development, enhanced market penetration would accrue to Canada's fisheries and aquaculture sectors. Initiatives aimed at promoting the consumption of fish and seafood generically, and aquaculture products specifically, in domestic and international markets, are essential to increase market share. Built largely around an enhanced capacity to meet consumer expectations regarding product quality and safety, such a market-driven approach will necessitate the development of improved systems for securing market information and intelligence data. As well, industry can also profit from improved utilization of processing by-products to generate alternative consumer products and, in the process, higher yields and less waste from every kilogram of harvested product. To support this export-oriented industry in the face of increasing pressures from a global seafood network, Canada must maintain security of access to international trade routes and take proactive measures to

mitigate tariff and non-tariff trade restrictions.

## **8. Food Safety**

In today's globally competitive markets, it is essential to provide assurances that will enhance consumer confidence in Canada as a dependable source of safe, healthy and wholesome fish and seafood products. National food-safety standards that meet international protocols developed for our predominant markets must be developed or improved by means of a harmonized approach with provincial, territorial and appropriate international jurisdictions. For aquaculture, such standards must surpass current practices and extend back to include on-farm food safety and farm-based Hazard Analysis and Critical Control Points (HACCP). Additional measures to enable product traceability from farm to market are also required. With respect to shellfish, the Canadian Shellfish Sanitation Program is vital to enable the effective management of growing waters and phytotoxin monitoring in compliance with international standards. When fully implemented, and supported by a "Canada Brand," Canada's food-safety program will provide consumers with necessary assurances regarding the quality and safety of Canadian fish and seafood products.



Photo: BCSFA

## **9. Aquatic Animal Health**

Healthy aquatic animals are the backbone of commercial, recreational and Aboriginal fisheries, aquaculture and the overall environmental sustainability of our aquatic resources. An effective National Aquatic Animal Health Program (NAAHP) is a necessary instrument for reducing the frequency and severity of disease outbreaks in fish and shellfish. Providing the necessary consumer and public assurances with respect to aquatic animal health will require increased collaborative monitoring programs, enhanced laboratory support services, development and maintenance of disease response plans, support for industry good management practices, and increased research to ensure that Canada's disease control protocols are efficient and effective. Moreover, such monitoring and control programs will provide the essential information required to enable Canada to respond effectively to international non-tariff trade (import/export) challenges and restrictions pertaining to fish health.

## **10. Training and Education**

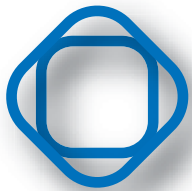
The technological, ecological and animal husbandry aspects of aquaculture call for an educated and well-trained workforce and knowledgeable government and service industry employees. An industry-led and federally-supported comprehensive human resources strategy for aquaculture that specifies training initiatives will present benefits on two fronts. First, it will serve to continually upgrade the skills and knowledge of those who are employed directly within the sector. Second, specific

training modules will improve the skills and knowledge base of academia, suppliers and public service employees whose work involves aquaculture. The human resource strategy also deals with education and the issue of career awareness. It highlights a paradox that sees, on the one hand, chronic shortages of new, highly skilled entrants into this innovative sector and, on the other hand, a high demand by industry for these graduates.

## **11. Communications**

Communications initiatives are essential in three principal areas: 1) Internal communications to promote co-ordination and co-operation among all players within the sector; 2) external initiatives to enhance consumer and public awareness of aquaculture by providing information regarding environmental sustainability, food safety, product quality and regulatory compliance; and 3) communications targeted to groups having specific interests in aquaculture (e.g. lenders, governments, etc.). By applying a co-ordinated, partnership approach to communications, all levels of government and industry could effectively establish a knowledge database regarding common production practices in the sector that would provide a consistent and objective source of information about aquaculture in Canada and around the world.





## Conclusion



Photo: DFO

**A**quaculture is a rural-based business that provides needed employment and allows people to remain in their communities. It is a science-based business, always exploring new ideas and creating new knowledge. It is also a market-based business, providing a growing number of consumers with products they desire. Aquaculture provides Canada with an opportunity to develop

wealth from its oceans and fresh water.

Since 1983, through a variety of initiatives, the federal government has invested resources into aquaculture. Throughout this period, successive Ministers of Fisheries and Oceans have reinforced the federal government's commitment to sustainable aquaculture development:

"Aquaculture is a bright light on the Canadian economic horizon, and the federal government would like to see that light flourish and be sustained."

Brian Tobin

"I certainly don't need to tell anybody here about the high priority I put on the development of a sustainable aquaculture industry in Canada. We can all take a lot of pride in the stellar growth of this industry in recent years. Thanks to the unanimous support shown around this table, our governments are finding the best ways to give this bright young industry the tools it needs to flourish in the years ahead."

"It will take the co-operation of all partners and stakeholders to make sure that the industry of tomorrow is stronger than the industry of today. My department, with the full support of the Government of Canada, is committed to seeing this co-operative partnership flourish, in order for industry to meet these challenges, and to continue to find the success it has earned – and it deserves."

Herb Dhaliwal

"...Canada's wild fishery is now being joined by the aquaculture industry as an important economic engine. My department is working to give this industry the tools it needs to be successful, while ensuring that our regulatory obligations are being met."

"In fact, aquaculture is a good example of how we can find room for innovative economic opportunities for our aquatic spaces."

Robert Thibault

The era of modern aquaculture has just begun. The FAO predicts that by the year 2030, aquaculture will dominate fish and seafood supplies and less than half of the

fish consumed will originate from traditional fisheries. Water farming will be a major revolution for many decades to come. Canada's history, capacity and

biophysical potential is such that it should be a much stronger player in sustainable aquaculture.

Just as we cannot feed the world only by hunting wild animals, we also cannot satisfy the global demand for fish and seafood using only conventional fisheries. The emergence of commercial aquaculture presents an opportunity to re-evaluate Canada's strategy for the sustainable production of fish and seafood. Through the complementary development of both fisheries and aquaculture, Canada will enhance its capacity to produce fish and seafood while protecting more wild stocks and parts of the marine environment. Water farming provides a sustainable means for increasing the production of protein for a hungry world.

With its expertise, know-how and reputation, Canada is perfectly positioned to reap the benefits attained not only by the development of an aquaculture industry but, at the same time, the development of a supply and service industry that will export environmentally sustainable technologies, equipment and expertise throughout the world.

Such positive images, however, must be tempered by the realisation that to achieve this potential, the Canadian aquaculture industry must have the trust of Canadians. Trust is something that is difficult to obtain but easy to lose. Canadian aquaculture is at a crossroads. Public trust is wavering at a time when the industry is poised to expand in new directions. Governments have a

strong role to play in ensuring that industry growth will not happen at the expense of the aquatic environment or the commercial fishery.

In striving to achieve its potential, an unfortunate scenario plays on repeatedly in that the fundamental requirements for the sustainable development of aquaculture are often pushed aside by more pressing fisheries initiatives. If aquaculture continues to be regarded as a secondary component of the capture fishery, its potential will never be realized.

Interestingly, in his keynote speech to delegates at the National Aquaculture Conference in 1983, Kenneth C. Lucas stated the following:

"In closing, let me address the most basic need of the Canadian industry. In a professional study of the problems of fisheries management made a few years ago, it was noted that a lack of co-ordinating and focussing institutions can be a disabling condition for an industry."<sup>13</sup>

The Commissioner for Aquaculture Development has identified a new direction and approach for the federal government to take which has formed the basis for specific recommendations to the Minister of Fisheries and Oceans. There is much work to be done, but we are confident that the means can be found to respond to the needs of the industry *and* to the needs of the public.

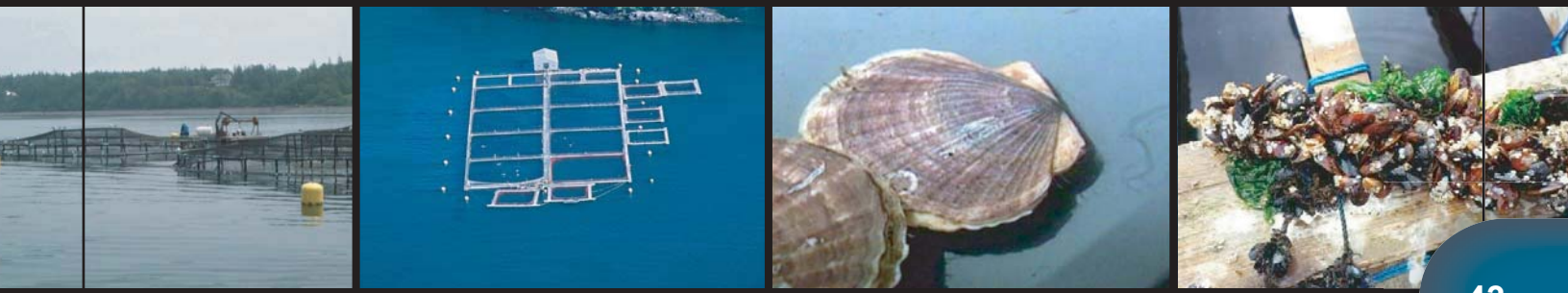
By implementing the vision and by

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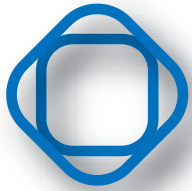
<sup>13</sup> Pritchard, G.I. (1984). Proceedings of the National Aquaculture Conference: Strategies for Aquaculture Development in Canada. Can. Spec. Publ. Fish. & Aquat. Sci. 1-5.

confirming aquaculture as a national priority, the federal government will put in place the cornerstones that will contribute

to making the Canadian aquaculture industry a model for sustainable development.



Photos (left to right): OCAD, BCSFA, DFO, DFO



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# Appendix I:

**TABLE 1 - Summary of Environmental Risks of Salmon Farming**

Main conclusions regarding risk		
Salmon Aquaculture Review British Columbia Environmental Assessment Office (1997)	The Net-pen Salmon Farming Industry in the Pacific Northwest NOAA Technical Memorandum (2001)	Making Sense of the Salmon Aquaculture Debate Pacific Fisheries Resource Conservation Council (2003)
<ul style="list-style-type: none"> <li>• Salmon Farming in BC, as presently practised and at current levels, presents a low overall risk to the environment.</li> <li>• However, concerns need to be addressed by more research and monitoring about:               <ul style="list-style-type: none"> <li>✓ localized impacts on benthic organism, shellfish populations and marine mammals;</li> <li>✓ significant gaps in the scientific knowledge in areas such as the potential impacts of interactions of escaped farmed salmon with wild population, identification and control of disease and disease pathogens, potential for disease transfer and impacts from antibiotic residues, and effects of waste discharge on water quality and seabed life.</li> </ul> </li> <li>• Adaptive management approach should be taken to the sustainable development of the salmon aquaculture industry.</li> </ul>	<ul style="list-style-type: none"> <li>• Aquaculture is not a unique industry with unique hazards i.e. its systems and practices, and its products parallel those of many others industries and human activities.</li> <li>• Based on the evidence available in the existing literature and in ongoing research, degrees of risk vary considerably from issue to issue.</li> <li>• <b>Issues which carry the most risk in the Pacific Northwest Industry (localized):</b> <ol style="list-style-type: none"> <li>1. Impact of bio-deposits beneath net-pens</li> <li>2. Impacts on benthic communities by the accumulation of heavy metals in the sediments below net-pens</li> <li>3. Impact on non-target organisms by the use of therapeutic compounds at net-pen farms</li> </ol> </li> <li>• <b>Issues which carry a low risk:</b> <ol style="list-style-type: none"> <li>4. Physiological effect of low dissolved-oxygen levels on other biota in the water column</li> <li>5. Toxic effect of hydrogen sulphide and ammonia from the bio-deposits below a net-pen farm on other biota in the water column</li> <li>6. Toxic effect of algal blooms enhanced by the dissolved inorganic wastes in the water column around net-pen farms</li> <li>7. Changes in epifaunal community caused by the accumulation of organic wastes sediments below net-pen farms</li> <li>8. Proliferation of human pathogens in the aquatic environment</li> <li>9. Proliferation of fish and shellfish pathogens in the aquatic environment</li> <li>10. Increased incidences of disease among wild fish</li> <li>11. Displacement of wild salmon in the marketplace by farmed salmonids</li> </ol> </li> <li>• <b>Issues which carry very little or no risk:</b> <ol style="list-style-type: none"> <li>12. Escape of Atlantic salmon—a non-native species</li> <li>13. Impact of antibiotic resistant bacteria on native salmonids</li> <li>14. Impacts on human health and safety</li> </ol> </li> </ul>	<ul style="list-style-type: none"> <li>• Report's three main areas of investigation are disease and fish health and escapes and habitat impact.</li> <li><b>1. Risks posed by disease issues:</b> <ul style="list-style-type: none"> <li>• Sea lice are the most serious, immediate risk out of the three fish health issues considered in this report (parasites, bacteria and viruses).</li> <li>• Antibiotic resistance caused by the use of antibiotics on salmon farms does not appear to create risks to wild salmon.</li> <li>• Bacteria pose the lowest risk to wild salmon, among the three fish health issues considered i.e. level of risk posed to wild salmon by viruses of farm origin is intermediate to the higher risk from sea lice and the lower risk from bacteria.</li> </ul> </li> <li><b>2. Risks posed by escapes:</b> <ul style="list-style-type: none"> <li>• Observations to date show that colonization by Atlantic salmon in BC waters is unlikely, though not impossible.</li> <li>• Generally, farmed Atlantic salmon survive poorly in the wild.</li> <li>• Escaped Atlantic salmon have reached BC rivers and spawned there.</li> <li>• The small presence of juvenile feral Atlantic salmon in BC streams does not prove that colonization is taking place. However, this data, combined with the observations of spawning Atlantic salmon, does suggest that colonization may occur.</li> <li>• The greatest risk of long-term effects of escapes would be Pacific farmed salmon escapes affecting wild Pacific species via genetic, ecological and disease impacts. At present, such a risk for Atlantic and Pacific salmon exists in theory but there is little evidence of its occurrence.</li> <li>• There are some occurrences of disease transfer, although infrequent, and given the ratio of escaped to wild fish, the long-term risk is low.</li> <li>• Long-term genetic risks to wild Pacific salmon due to escaped Atlantic salmon are virtually zero.</li> </ul> </li> <li><b>3. Risks posed by habitat impacts:</b> <ul style="list-style-type: none"> <li>• Habitat impacts, whether related to the seabed or to water quality, pose the lowest risk to wild salmon relative to escape-related or disease impacts.</li> </ul> </li> </ul>

# Appendix II:

**TABLE 1 - Measures Already Taken by Industry with Respect to Environmental Sustainability**

FRESHWATER AQUACULTURE
<p><i>Ontario Sustainable Aquaculture Working Group</i>                      Multipartite working group (Industry, Governments) established to supervise R&amp;D projects that foster sustainable aquaculture development.</p> <p><i>Table filière de l'aquaculture en eau douce</i>                      Multipartite working group (Industry, Governments) established to supervise R&amp;D projects that foster sustainable aquaculture development.</p>
BRITISH COLUMBIA
<p><b>Shellfish</b>                      Developed and adopted a Code of Practice outlining preferred standards and methods of practice for reducing environmental impacts.</p> <p><b>Finfish</b></p> <ul style="list-style-type: none"> <li>• Industry has developed and adopted a Code of Practice setting standards in the key areas of waste, escape prevention, environmental protection and animal husbandry.</li> <li>• Two of the largest finfish aquaculture companies are now ISO 14001 certified.</li> </ul> <p><b>Research and Development</b></p> <ul style="list-style-type: none"> <li>• Ongoing participation in workshops and subsequent initiatives related to IHN (contributed to publication of white paper) and sea lice (provided resources for ongoing R&amp;D activities).</li> <li>• Ongoing involvement on BC Aquaculture Research Development Committee.</li> </ul> <p><b>Ongoing work with community stakeholders</b>                      Includes the Aquaculture and Environment Summit held in conjunction with the BC Aboriginal Fisheries Commission in 2002.</p>
NEW BRUNSWICK
<p><b>New Brunswick Salmon Growers Association (NBSGA)</b></p> <p><i>Bay Management Area Agreements</i>                      The NBSGA is responsible for the preparation of bay management agreements. These industry-generated agreements between owners of salmon sites operating in defined bay management areas will greatly assist in the coordination of site activities, including environmental and fish health issues for the benefit of all signing parties.</p> <p><i>Fish Health Surveillance Program</i>                      In 2000, the industry and provincial government implemented the NBSGA Fish Health Surveillance Program. Its primary goal is to provide surveillance of fish health and help strengthen the current knowledge base relating to fish health protection, prevention and control. Moreover, it will deal with any fish health issues or concerns. Under this program, the responsibility for regular testing and reporting of fish health data has moved from government to the individual sea cage operator. The provincial government veterinarian will be tasked with the auditing of the program. Compliance by growers with the Code of Practice is tied to the licensing of salmon farming sites by the province.</p> <p><i>Waste Management Plan</i>                      The NBSGA participates in a Waste Management Committee (WMC) composed of industry and government representatives. This committee was created to deal with issues related to waste management, including harvesting protocols, handling and disposal of bloodwater and the use and disposal of disinfectants. The WMC's main task is to develop an industry wide waste management plan for incorporation into bay management area agreements, regulation and/or approvals to operate.</p>
NEWFOUNDLAND AND LABRADOR
<p><i>Newfoundland Salmonid Growers Association (NSGA)</i></p> <p><b>Code of containment for the Use of Non-Local Strains in Sea Cage Aquaculture in Bay d'Espoir</b></p> <p>The NSGA was the first in Canada to develop a code of containment to prevent escapement. It allowed the import of female diploids. All growers follow the strict rules of the Code of Containment.</p>

**TABLE 1 Cont'd - Measures Already Taken by Industry with Respect to Environmental Sustainability**

PRINCE EDWARD ISLAND
<p><i>Prince Edward Island Aquaculture Alliance (PEIAA)</i></p> <p><i>Environmental Policy</i> The PEIAA has developed an environmental policy regarding their position on issues such as sustainable management, water quality, natural processes and ecosystems, pollution, waste management, product quality, regulatory compliance and environmental stewardship.</p> <p><i>Shellfish Aquaculture Environmental Code of Practice</i> The PEIAA has developed a Shellfish Aquaculture Environmental Code of Practice, which will be revised every five years. The Code provides environmental management guidelines for all aspects of off-bottom and water column shellfish aquaculture operations, from site installation and operation to decommissioning, including vehicle/vessel maintenance, biofouling and predator control, wildlife encounters and contingency plans for chemical spills. Adoption of the Code is voluntary. However, the Code becomes mandatory when a grower signs on, as a mitigative measure for an environmental assessment under the Canadian Environmental Assessment Act. Currently, the Code is mandatory for 246 shellfish growers.</p>

**TABLE 2 - Measures in Progress by Industry with Respect to Environmental Sustainability**

NATIONAL
<p><i>National Code of Sustainable Aquaculture</i></p> <ul style="list-style-type: none"> <li>•The Canadian Aquaculture Industry Alliance (CAIA) has undertaken a national and international review of codes of conduct. Particular attention is being paid to the initiatives resulting from FAO work on codes for aquaculture and also to work undertaken by the NASCO-NASFI Liaison Group regarding development of international guidelines for a code of containment.</li> <li>•Developing comprehensive definitions, including "sustainable aquaculture," which are focused on the Canadian experience.</li> <li>•Developing an initial draft of the Code that can be circulated to industry for review.</li> </ul>
FRESHWATER AQUACULTURE
<p>Some R&amp;D projects receive funding under ACRDP i.e. development of new diets for fish in DFO's Quebec region.</p> <p><i>Ontario Sustainable Aquaculture Working Group</i> Currently developing a sub-Best Management Practices (BMP) of the national one to deal with Ontarian specificity (cage culture and land based facilities).</p> <p><i>Table filière de l'aquaculture en eau douce</i> The Table filière developed a provincial position for Quebec regarding sustainable aquaculture development. This is the basis for the current negotiation process between MAPAQ, MENVIQ and the Industry for an official agreement to be signed by the three parties.</p> <p><i>Syndicat Professionnel de l'Association des Aquaculteurs du Québec inc. (SPAAQ)</i> SPAAQ is considering a project entitled "An Aqua-environmental Portrait" aimed at developing environmental sustainability indicators, which are based on environment performance objectives to be achieved by industry.</p> <p><i>Implementation of the National Management Practices for Sustainable Aquaculture in Freshwater</i> Developed by industry following a broad consultation process all over Canada; led by the Ontario and Quebec aquaculture associations.</p>



**TABLE 2 Cont'd - Measures in Progress by Industry with Respect to Environmental Sustainability**

British Columbia
<p><b>Finfish</b></p> <ul style="list-style-type: none"> <li>• Other companies, in addition to the two already certified, are working towards ISO 14001 certification.</li> <li>• Research underway includes: <ul style="list-style-type: none"> <li>▪ Reducing the impact of <i>Kudoa thyrsites</i> in farmed Atlantic salmon</li> <li>▪ Otolith analysis for the determination of feral versus escapee Atlantic salmon</li> <li>▪ Flesh-quality evaluation of market-size wild and farmed Canadian salmon</li> <li>▪ Efficacy of drug candidates against <i>Kudoa thyrsites</i> in Atlantic salmon post-smolts</li> <li>▪ Genetic variation at microsatellite DNA loci in cultured Chinook salmon strains</li> <li>▪ Sea Lion Method validation study</li> <li>▪ Origin of sea lice on juvenile pink salmon in the Broughton Archipelago</li> </ul> </li> </ul>
NEW BRUNSWICK
<p><b>New Brunswick Salmon Growers Association (NBSGA)</b></p> <p><i>Guidelines for Containment for Salmon Cage Culture in the Bay of Fundy</i>  In 2001, the NBSGA drafted preliminary guidelines for containment for salmon cage culture in the Bay of Fundy. The industry is currently working on finalizing the guidelines aimed at improving fish containment practices.</p> <p><i>Code of Practice</i>  Members of the NBSGA have endorsed a draft Code of Practice that will be tied to the licensing of salmon farming sites by the province. The Code will set standards for husbandry practices and fish health management and will divide New Brunswick's salmon farms into a number of bay management areas. The industry is currently working on finalizing the Code of Practice and ensuring it is consistent with the requirements set out under the <i>Canadian Environmental Assessment Act</i>.</p>
NOVA SCOTIA
<p><i>Aquaculture Association of Nova Scotia (AANS)</i></p> <p><b>Aquaculture Environmental Management Guidelines (EMG)</b></p> <ul style="list-style-type: none"> <li>• In 2000, the AANS prepared a set of draft aquaculture EMGs. Adoption of the guidelines is voluntary. The EMGs cover both shellfish and finfish farm practices and aquaculture operations from the hatchery/nursery stage to the harvesting and processing of products. The AANS has sent the draft EMG to the province of Nova Scotia for comments. The Province is currently reviewing the draft document. Their review was delayed because of the MSX crisis. Once this review is completed, the AANS intends to circulate the approved EMG among its members for implementation.</li> <li>• The AANS is considering converting the EMG into a Code of Practice. This Code would reflect the national Code of Practice that the CAIA is currently developing.</li> </ul> <p><i>Environmental Monitoring Program</i>  The AANS has developed an environmental monitoring program for its members and they are currently in negotiation with the province regarding the Environmental Monitoring Program.</p>
PRINCE EDWARD ISLAND
<p><i>Prince Edward Island Aquaculture Industry Alliance</i></p> <p><b>Shellfish Aquaculture Environmental Code of Practice</b></p> <p>The PEIAA is in the process of hiring an environmental management coordinator. This person will be responsible for developing a monitoring plan to evaluate the level of compliance of shellfish growers with the Environmental Code of Practice.</p>

**TABLE 3 - Measures Already Taken by Governments with Respect to Environmental Sustainability**

FRESHWATER
<p><i>Table filière</i></p> <ul style="list-style-type: none"> <li>▪ The Table filière developed a provincial position for Quebec regarding sustainable aquaculture development. This is the basis for the current negotiation process between MAPAQ, MENVIQ and the industry for an official agreement to be signed by the three parties.</li> </ul>
BRITISH COLUMBIA
<p><b>Shellfish</b></p> <ul style="list-style-type: none"> <li>▪ Comprehensive modeling has been completed for several areas to determine the carrying capacity for shellfish aquaculture.</li> <li>▪ The Province leads various coastal planning efforts, both in the form of broad integrated land use planning and in specific studies that focus exclusively on aquaculture. Coastal planning takes into consideration the social and environmental factors constraining or supporting shellfish development.</li> <li>▪ BC is adapting the industry's Code of Practice into enforceable standards of operation (legislation).</li> </ul> <p><b>Finfish</b></p> <p><i>Escapes</i></p> <ul style="list-style-type: none"> <li>▪ In April 2002 BC introduced new escape prevention legislation.</li> <li>▪ The Province supports the Atlantic Salmon Watch Program (jointly funded with DFO), which studies the abundance, distribution and biology of Atlantic salmon in BC and adjacent waters.</li> </ul> <p><i>Fish health</i></p> <p>The Provincial Disease Surveillance and Auditing Program has improved government's information on the health of farmed stocks. Components of the program include mandatory fish health management plans, a fish health database (industry initiative and industry managed-quarterly reports provided to MAFF) and an inter-agency Fish Health Working Committee. MAFF staff performs a fish-health auditing program, with 25 percent of the sites being audited each quarter.</p> <p><i>Sea lice</i></p> <p>The Province has increased measures to prevent sea lice on farms by following some farms during the 2003 wild salmon migration enhancing sea lice treatment, monitoring, auditing and sampling activities and supporting federal research programs on fish health.</p> <p><i>New Technologies</i></p> <p>The Province supports a number of companies that are working to develop "green" rearing technologies through a provincial pilot program. These technologies include land-based and marine closed containment, vegetable-based feeds, waste recovery and organic feeds.</p> <p><i>Farm Siting and Relocation</i></p> <p>The BC government has identified 30 salmon farms to be relocated to more socially and environmentally suitable sites. The new sites will meet new siting and environmental standards.</p> <p><i>Pollution Prevention</i></p> <ul style="list-style-type: none"> <li>▪ In September 2002, new waste standards were introduced in legislation. The Ministry of Water, Land and Air Protection conducts environmental monitoring and auditing to assess compliance with legislated standards and to assess effects on the marine ecosystem.</li> <li>▪ Specific monitoring/remediation activities must be carried out by operators if a site exceeds legislated chemical or biological indicator levels.</li> </ul> <p><i>Research and Development</i></p> <p>The provincial government has committed \$3.75 million in funding to independent research to address existing and emerging issues of concern to British Columbians. Funding was provided to the University of British Columbia to endow a Chair in sustainable aquaculture. The Province initiated development of the BC Aquaculture R&amp;D Committee, which has First Nations and ENGO representation in addition to that of industry and Government</p> <p><i>Best Management Practices</i></p> <p>The new regulations for wastes and escapes require farmers to develop and follow "best management practices plans." These plans must describe how specific operational activities on the farm will be conducted in order to prevent and mitigate negative environmental impacts.</p>

**TABLE 3 Cont'd - Measures Already Taken by Governments with Respect to Environmental Sustainability**

**NEW BRUNSWICK**

**New Brunswick Department of Agriculture, Fisheries and Aquaculture (NBDAFA)**

***Bay of Fundy Marine Aquaculture Site Allocation Policy***

- Establishes a new system for the allocation and administration of marine aquaculture sites that will foster harmonious co-existence with other marine resources.
- Developed after intensive consultation with all industry stakeholders, the policy is founded on the basic principle of ensuring sustainable aquaculture development based on consideration of all applicable economic, environmental and social factors.
- Government and industry have identified the following management tools as priorities to address fish health management and improve environmental stewardship:
  1. Single-year class management system (restructuring)
  2. Bay Management Area Framework, including Bay Management Areas, Exclusion Areas and Controlled Growth Areas
- The aquaculture industry has developed voluntary agreements, known as Bay Management Agreements, in order to establish operating standards for the respective aquaculture bay management area. These agreements include government and industry standards, plus any applicable local management practices.
- The policy makes reference to site production level and baseline site assessment requirements.

**New Brunswick Department of the Environment and Local Government (NBDELG)**

***Environmental Management Guidelines for the Marine Finfish Cage Aquaculture Industry in New Brunswick***

- In 2000, with the last reorganization of government in New Brunswick, the responsibility for environmental regulation of the marine finfish aquaculture industry was moved from the New Brunswick Department of Agriculture, Fisheries and Aquaculture to the NBDELG.
- This was accompanied by an alteration to the NBDELG's previous interpretation of the Clean Environment Act, and an acceptance that marine finfish aquaculture is subject to the Water Quality Regulation under the Act.
- Before issuing approvals, standards applicable to the industry were developed after review of the current practices, and an external consultation. The policy is now known as the Environment Management Guidelines (EMG) for the Marine Finfish Aquaculture Industry in New Brunswick.
- The first edition of the EMG was applied to the industry in March 2001. All marine cage culture operations are now required to obtain an approval to operate from the Minister of the NBDELG.
- The EMG set environmental quality limits for the benthic environment below cage sites, outlines a monitoring program in relation to those limits and establishes a procedure for addressing non-compliance: the Remediation Process. Moreover, cage sites are scheduled for periodic review.
- As of 2002, all occupied sites (93) have received approvals. All finfish salmon farms submitted waste management plans in the fall of 2002. The NBDELG has responded to all of them. Ten or eleven of them have received approval by the department. The remaining ones are all subject to revisions. Second drafts have been submitted and are still under review. Discussions are ongoing as to final wording and site-specific details.

**NEWFOUNDLAND & LABRADOR**

**Newfoundland and Labrador Department of Fisheries and Aquaculture (NLDFA)**

***Code of Containment Implementation Plan: An Implementation Plan for the Code of Containment For Use of Non-Local Salmonids Strains in Sea Cage Aquaculture in Bay d'Espoir***

- In 1999, the NLDFA developed an implementation plan for the code of containment for use of non-local salmonids strains in sea cage aquaculture in Bay d'Espoir.
- All growers in the Bay d'Espoir salmonid aquaculture industry have developed and adopted practices to minimize fish escapement through the NBSGA Code of Practice. The Code of Practice is in strict compliance with the DFA/DFO Code of Containment Implementation Plan. The Newfoundland Code of Containment is being fully implemented.
- The issuance of the provincial aquaculture licenses is tied to adherence to the Code of Containment Implementation Plan.

# Appendix III:

## **SUMMARIES OF OCAD'S BACKGROUND STUDIES**

### **Study 1 - Current Status and Potential of the Canadian Aquaculture Industry** **Stephen Lanteigne (Office of the Commissioner for Aquaculture Development)**

Aquaculture in Canada is undergoing continuous change. It has to compete in a global world market. The Canadian aquaculture industry is facing the same driving forces that have propelled the industry to the forefront of the seafood sector in several countries around the world, notably, in Norway, Chile, Spain, and New Zealand. Worldwide, there has been a significant increase in aquaculture production while most capture fisheries have reached a plateau or are fully exploited. The demand for seafood products is growing, international competition is strong and consumer needs and expectations are constantly changing. Public scrutiny is on the rise and environmental and social concerns continue to influence the cultivation of seafood in Canada. As a result, both the provincial and federal governments have increased their emphasis on environmental sustainability, food safety and industry competitiveness, while the priorities of the aquaculture sector have been on access to sites, economic viability and improved governance of aquaculture through enabling policy, social and regulatory frameworks.

The purpose of this study is to provide an overview of the present and future status of aquaculture in Canada. The first part of the study presents the current status of the domestic aquaculture industry through the examination of its economic benefits. National trends in aquaculture production value and tonnage and recent production figures by environment type, species and province are reviewed. Employment and economic benefits, contribution of the sector to the Gross Domestic Product (GDP) and Canada's fish and seafood trade are also covered. It also provides a description of the industry: number and distribution of farms, business size and ownership, species raised, enterprise types and industry organization. Current issues such as food safety, environmental sustainability, access to sites, and industry competitiveness are identified and briefly described.

The second part of the study provides an analysis of the potential for aquaculture in Canada, starting with an assessment of the biophysical potential and followed by a discussion of Canadian know-how and expertise in international markets. The information includes a review of the seafood processing sector and distribution chain. The benefits of Canada's proximity to US and Asian markets for export of aquaculture products are also discussed. Lastly, the emerging opportunity to create an environmental aquaculture sub-sector by building on Canada's expertise and reputation in environmentally sustainable technologies and practices is examined.

Despite its relatively small size, the aquaculture industry is subject to a good deal of criticism by the public. This criticism relates to concerns about environmental impacts from aquaculture operations, food safety, escapements, visual or aesthetic pollution, animal welfare, navigation, price destabilization of fish and seafood markets, and so on. Yet, at the same time, aquaculture is a significant source of employment and economic wealth, particularly in rural, coastal and Aboriginal communities in Canada. It is a food production sector and it constitutes a valuable tool for promoting rural economic development. Aquaculture represents an important means of reducing pressure on wild fish stocks as well as contributing to enjoyment of sport fishing through fish stocking activities. Moreover, it is an earner of foreign exchange through export trade in addition to being a user and developer of technology. It is important to put the positive and the negative attributes about aquaculture in perspective so that real and perceived concerns may be adequately addressed. The present study reviews a few key statistics about aquaculture that make it clear that the sector represents the future of the domestic fish and seafood industry. Between 1997 and 2001, Canadian aquaculture production grew, on average, at a rate of 17 percent; in 2001, production reached 152,523 tonnes, valued at \$597 million. Using very conservative forecast assumptions it is estimated that the Canadian aquaculture industry will likely grow from its current revenue level to at least \$3.1 billion in 2010, provided that an enabling policy and regulatory environment exists. Combined with the supply and services industry, the aquaculture sector could generate total revenues in excess of \$6 billion.

However, as mentioned before, it is clear that as aquaculture grows, opposition emerges to some of its practices. Environmental non-government organizations (ENGOS), recreational property owners, representatives of commercial fishers and some Aboriginal leaders have played an important role in identifying concerns, bringing these to the attention of governments and contributing to solutions.

Canadian aquaculture needs to have a framework in place to meet the challenge of achieving its potential. Such a

framework must satisfy not only traditional investment criteria but also public expectations for sustainable development. If this can be achieved, Canada will be unique in having an aquaculture industry that has earned its social licence by respecting environmental, social, and cultural concerns of its neighbours.

## **Study 2 - Market Outlook in the International Fish and Seafood Sector: Canadian Perspective**

**H.M. Johnson and Associates**

This study offers a review of general trends in international fisheries products markets (commercial fisheries and aquaculture) in light of major markets targeted by Canadian aquaculture products.

Japan and the US dominate international seafood trade, while China is the fastest-growing international seafood trading country. Japan is the world's leading seafood importer with frozen tuna as its main import in terms of volume, and shrimp in terms of value. Japan is also the world's largest single market for salmon, with Chile as its leading salmon supplier followed by Russia, the US and Norway. The US is also a top seafood importer but, unlike Japan, it is also a major exporter. The most important seafood imports into the US are shrimp, tuna and salmon, with shrimp being by far the most important: the US is the world's largest market for this crustacean. The US main shrimp supplier is Thailand, followed by Vietnam, India, Mexico and China. Tuna is imported in fresh and frozen varieties and is mainly processed in the US territories of Puerto Rico and American Samoa. Salmon imports, the third most important in terms of seafood, are dominated by Chile and Canada with a market share of 49 percent and 42 percent respectively.

China's improving living standards and its population's appetite for seafood have led to a sharp increase in imports. China is also the second seafood exporter, only after Thailand, and it has become a leading exporter of higher-value aquaculture products such as shrimp, tilapia, sea bream and flatfish. The competitive advantage of China's aquaculture industry and the marked effort made by the government to encourage its development will lead to continued strong growth of this industry.

Canada's importance as a wild fisheries producer has eroded significantly over the past decade. Since the early 1990s its landings have declined from more than 1.6 million metric tonnes to the current level of about 1 million metric tonnes. Although Canadian fishery production is no longer declining, it is unlikely that it will increase significantly in the near future. Therefore, any future growth in the Canadian seafood supply will have to come from imports and/or aquaculture. Globally the scenario seems to be the same: FAO has pointed out that no increases in capture fisheries can be expected and that aquaculture will have to fill any growth in demand.

Canada's aquaculture industry has significant opportunity for growth both in terms of currently cultured species, and in new finfish species such as sablefish, halibut and wolffish, and shellfish species such as geoduck, Manila clams and Mediterranean mussels. Demand from the US for high-quality fresh seafood will continue to fuel growth in Canada's aquaculture production.

Study 2 also presents some examples of potential trade barriers for Canadian seafood exports into the US, the EU, Japan and China. With respect to the US market, the study advises Canadian producers to be prepared for potential trade arguments, such as the ones made against PEI mussels. The US has raised trade arguments against Vietnamese, Chilean and Norwegian seafood products which, in some cases, have resulted in tariff increases. Regarding the EU market, it is expected that Canada will keep pushing for additional reductions in tariffs and other obstacles that reduce seafood trade and, although further reductions are likely, these will probably be only incremental. Japan's policy on tariff and non-tariff barriers will also likely stay the same.

## **Study 3 - Market Outlook in the International Fish and Seafood Sector: Alternative Products/Uses and Food Safety Issues**

**H.M. Johnson and Associates**

This study presents the general trends affecting the value-added of fisheries products, new uses for products derived from aquaculture and commercial fisheries (pharmaceutical products, nutraceuticals, etc.), and issues affecting food safety, especially in terms of consumer behaviour and regulatory changes affecting international trade.

With many fish species yielding edible weight of 40 percent or less, the maximization of profit from both the edible and inedible portions can often mean the difference between profit and loss. Optimization of market value through further processing (value addition) and the identification of by-products from fish and shellfish "waste" are critical to the economics of efficient seafood operations. In addition, disposal of processing waste has become a high cost of business and, in some cases, a source of pollution and health risk.

The best known "value added" for seafood has been the filleting of fish at point of origin. Value added in this case is really a labour reduction which in turn lowers the overall product cost. A reduction of the weight shipped also means a reduction in the overall cost.

The wastes generated by commercial fish and shellfish production and processing represent both a problem and an opportunity. Technical advances and market developments now make it possible to not only process waste into useful and marketable products, but also make contribution to the bottom line. These alternative markets are as diverse as cosmetics and fertilizer but all result from the efficient recovery of proteins and biological constituents from fish and shellfish waste.

There are a number of processing technologies in use for converting fish and shellfish waste into marketable products. Some of these processes involve the grinding and cooking of raw fish and offal, the drying of raw material or the hydrolysis of fish protein through some form of enzymatic action. Output from these processes fall into a number of market categories including pharmaceuticals and nutraceuticals, industrial compounds, food products (oils, gelatins, flavours and extracts), feeds and fertilizers.

Regarding food safety, the study shows that this theme is an overriding concern for all companies in the seafood value chain. Over the past decade there have been numerous initiatives, some regulatory, some technical, to improve food safety and communicate with consumers that the products they purchase are safe. Issues related to seafood safety include various product labeling schemes to assure consumers of the content and/or origin of products, traceability programs to track seafood through the value chain, technical advances in processing (e.g. depuration, irradiation, carbon monoxide treatment) and packaging (e.g. modified atmosphere) and international standards in seafood quality and safety (e.g. International Organization for Standardization, Hazard Analysis and Critical Control Points, EU Standards).

#### **Study 4 - Review of Provincial and Territorial Program and Services in the Aquaculture Sector**

**Hewat Consulting**

Study 4 presents a review and analysis of programs and services provided to the Canadian aquaculture sector by provincial government departments and agencies.

It is noteworthy that Atlantic Canada is reliant on the federal-provincial agreements to initiate support to this sector. The extent to which the types of programs offered in each of the Atlantic provinces is a function of their provincial policy process or a hybrid of federal-provincial negotiations is not evident. However, there is a similar look to the range of initiatives in those provinces. In addition to Atlantic Canada, Quebec and British Columbia demonstrate an impressive array of support. The inland provinces and the territories do not evidence much direct support to the sector.

The information in this report was grouped according to specific types of programs and services, as follows:

##### Support for Production

Support for production activities extends across all provinces with the exception of Alberta, which has indicated an intention to develop a capability in this area.

- In inland provinces, (Ontario, Manitoba and Saskatchewan) there is a reliance on generic agricultural/economic development programs, which must be accessed by the aquaculture sector in order to receive financial assistance.
- Programs and services to support production activities within aquaculture specifically have an emphasis on financial loans and loan guarantees.
- Newfoundland and PEI appear focused on a diversification strategy, which includes specific species support.
- It may be that Quebec offers the broadest range of financial support mechanisms to support production.
- British Columbia has a broad range of initiatives, which, with the exception of the Shellfish Aquaculture Working Capital Fund, is characterized by not being focused on direct financial support to entrepreneurs.

### Support for Processing

Newfoundland, Nova Scotia and PEI have programs that specifically include support for improvements in the processing of product. Support for processing is relatively recent, in comparison to other aspects of industry support. Given that these programs are in Atlantic Canada, this may reflect a regional need. The processing industry may also be outside the parameters of a traditional definition of the aquaculture industry.

British Columbia does not offer specific support for the processing of aquaculture products.

### Support for Technology

Technology development at aquaculture operations may be occurring as a consequence of the various forms of financial support programs. However, the number of programs directed explicitly at new technology development is quite limited.

Support for technology has two broad targets. First, there is support to establish new technologies to mitigate the environmental impacts of the industry. British Columbia is quite focused on this aspect. Second, there is an interest in the development of new technologies to increase the effectiveness and efficiency of production.

### Support for Market Development

Newfoundland and Quebec are demonstrating leadership in their support for marketing initiatives. Each province has dedicated programs to the support of the marketing function of aquaculture entrepreneurs. This extends to financial support for international trade promotion.

It is noteworthy that marketing, along with processing, is a type of support for which British Columbia does not provide explicit assistance. This may reflect a policy perspective.

### Support for the Environment

British Columbia has an aggressive series of programs in place to respond directly to environmental considerations. The degree of pro-activeness of British Columbia is reflected specifically in the farm relocation initiative. In addition, there are dedicated programs related to planning, siting, and piloting and escape prevention.

### Technical Support

All provinces provide some level of technical support, including information services. The nature and extent of technical services, however, differs across the country.

Atlantic Canada is operating with a community-based economic development model which includes having knowledgeable staff available to assist applicants for financial assistance. Staff is also working with industry participants on collaborative research projects at the community level. It would appear that a significant limiting factor in the depth of the extension services is the number of staff attached to each aquaculture department.

British Columbia's technical service seems to be driven in large part by the environmental agenda it must manage.

### Support for Training

Training is occurring at advanced levels. The University of Guelph is but one example of an institution where post-graduate education is available.

Practical industry training is available in selected areas. Most noteworthy is the Nova Scotia Mentorship Program. There are numerous opportunities for participating in short programs in basic aquaculture training. Ontario and Alberta offer day programs.

### Support for Research

This review of provincial programs does not reflect the full extent of the research being undertaken at provincial institutions. The funding programs, which have been documented, reflect several trends. Ontario and Quebec have programs that support basic research. British Columbia and Quebec have made significant investments in support of applied research. The research agenda in Atlantic Canada, which is financed by aquaculture programs, appears to be project-driven.

### Support for Veterinary Services

In Atlantic Canada, veterinary services are available in connection with existing provincial laboratories, where diagnostics and field trials are conducted. Veterinary services to individual operators, however, are constrained by the lack of dedicated field staff.

Quebec has a unique veterinary service, which is available to operators in the industry throughout the province. The program includes mechanisms for local veterinarians to provide services on a subsidized, fee-for-service basis.

### Support for Advisory Committees

The use of formal advisory committees may be more extensive than has been reported. Nova Scotia, New Brunswick and British Columbia have explicitly highlighted the role of advisory committees.

## **Study 5 - Review of Federal Programs and Services In Support of Aquaculture Development Office of Sustainable Aquaculture (Fisheries and Oceans Canada)**

The federal government and its provincial and territorial counterparts share jurisdiction over aquaculture. In the federal government alone, several departments and agencies have an influence on aquaculture development. As the primary organization responsible for this sector, DFO prepared a list of federal government programs and services relating to aquaculture in the summer of 2002 by means of a consultation with representatives of the Interdepartmental Committee on Aquaculture. The Committee brings together more than 20 federal government departments and agencies responsible for aquaculture development in Canada.

This report presents the results of this exercise and sets out the aquaculture programs and services that are currently available within federal government departments and agencies. The purpose of the report was to compile information from federal departments and agencies about existing aquaculture programs.

## **Study 6 - Federal Programs and Services for Five Resource-Based Industries Paul MacNeil Consulting**

The study presents a comparative analysis of how the aquaculture sector is treated by the Canadian government, in comparison with four other primary sectors: agriculture, forestry, commercial fisheries and biotechnology.

The primary responsibility for industrial development, expansion and profitability rests with the industry in question. Governments should only have a supportive role (e.g. ensuring that a suitable business environment exists, providing selected assistance that addresses public policy objectives). The aquaculture industry has its own unique relationships with governments—much different, for example, than those of the softwood lumber, steel, culture, high tech and retail industries. For the Canadian aquaculture industry, some of the key determinants of the nature of its industry-government relationships are:

- aquaculture as a "new, emerging industry" (e.g. unlike agriculture, forestry)
- the shared jurisdiction for aquaculture in Canada (e.g. with the provinces taking the lead on site approvals and leasing/licensing)
- the competing demands for aquatic space (e.g. from boaters, cottagers, shipping)
- the industry's major interface with environmental issues and concerns



- the export orientation of much of the aquaculture industry
- the industry's heavy reliance on R&D and new technology
- aquaculture as part of the overall "food sector," where issues of safety and quality are of paramount concern

In terms of federal programs and services, the aquaculture industry benefits from the three types of programs/services discussed in this report:

(1) Industry-specific programs/services: DFO's Science Program and its Aquaculture Collaborative Research and Development Program, the Canadian Food Inspection Agency's Inspection Program (which provides assurances to the consumer of food safety) and Farm Credit Canada loans.

When the aquaculture industry is compared to the agriculture/livestock industries in terms of eligibility under Government of Canada industry-specific programs, a few observations stand out. First, there are far fewer programs of this nature that apply to the Canadian aquaculture industry. Second, unlike the agriculture/livestock industries, the aquaculture industry is not eligible for assistance under federal programs that deal with matters such as: investment financing; debt management; income support and stabilization; crop insurance; farm management; compensation for the ordered eradication of stocks; price pooling; markets information; marketing loans; etc. Third, AAFC, as the lead federal department for the agriculture/livestock industries, is heavily supportive of "industry development and competitiveness," whereas DFO, as the lead federal department for the aquaculture industry, is not.

(2) Industry-wide programs/services: The Canadian aquaculture industry benefits from a number of federal programs that apply to many industries. Some of the key programs in this regard are: the Export Development Corporation's financing and insurance programs; loans from the Business Development Bank of Canada; market assistance under the Program for Market Export Development; R&D by the National Research Council and the National Sciences and Engineering Council of Canada; and training by Human Resources Development Canada.

(3) Regional development programs/services: The Canadian aquaculture industry has also benefitted from targeted assistance from three of the federal government's regional development agencies: the Atlantic Canada Opportunities Agency, Western Diversification and the Canada Economic Development for Quebec Regions. While some of that assistance has been very significant, this study/report did not investigate that topic. However, based on our knowledge of these programs, it appears that there is scope for further matching the interests of the aquaculture industry with those of the regional development agencies, particularly with respect to new and emerging areas of "regional development" attention, such as innovation, productivity, small and medium enterprises, etc.

### **Study 7 - The International Context for Aquaculture Development: Growth in Production and Demand, Case Studies and Long-term Outlook** Eric Gilbert (Office of the Commissioner for Aquaculture Development)

The central purpose of this study is to profile the growth of global production and demand for aquaculture products and identify the factors that will determine aquaculture performance in the coming years, specifically noting government intervention elsewhere in the world. The ultimate goal is to assess more effectively the future context in which Canadian aquaculture will operate, to the best of our knowledge and based on data currently available, and to adapt Canadian government activities accordingly.

Over the past 30 years, global aquaculture production has grown from 3.5 million tonnes in 1970 to more than 45 million tonnes in 2000, an average annual growth rate of about 8.9 percent. Based on FAO forecasts and our assumptions, it appears that global aquaculture production could reach some 118 million tonnes in 2030 to meet demand, a level three times the output for 2000, or an average annual growth rate of about 4 percent. In 2030, aquaculture will be the main source of supply of fish, as less than half of the seafood consumed will come from fishing catches. However, production-related constraints could cut into market supply.

The status of the aquaculture sector in eight countries was analysed in terms of production trends, industry organization, governance structures, recent developments and current issues. A description of the main programs and services provided by the national government was provided. The countries analyzed were Australia, Chile, Spain, the US, France, Norway, New Zealand and the United Kingdom.

Of all the countries studied, Chile posted the strongest average annual growth between 1995 and 2000, at 15.6 percent, and France posted the worst performance, with an average decline in production of 1 percent a year. Australia, Norway and the United Kingdom achieved an annual growth rate of 12.3 percent, 11.9 percent and 10.2 percent, respectively. In every case, this resulted in a sizeable increase in production, by a factor of 1.8 in Australia and Norway, and 1.6 in the United Kingdom. Spain posted a rate of 6.9 percent. Aquaculture production in the EU rose from 1 to 1.3 million tonnes, with average annual growth of 3.5 percent. The US achieved modest annual growth of 0.7 percent.

The main findings of the case studies are as follows:

- All countries studied support sustainable development of aquaculture. This support varies from country to country, however, and is justified, in the opinion of national governments, by a combination of advantages and benefits that also vary from one country to another.
- The obstacles to aquaculture development fall under two major constraints: the environmental impact of farming in a receptive natural environment (impact that is real or incorrectly attributed); and current policies and a legal and regulatory framework unsuited to the sector's needs. Major progress has been achieved in the environmental performance of aquaculture businesses and in terms of national public opinion regarding the sector's image.
- In most of the countries studied, the national government, in conjunction with the industry, has established or is about to introduce a clear policy to promote sustainable development of aquaculture. This policy is often accompanied by production targets for the medium and long term. In these countries, production value is expected to increase by a factor ranging from 1.4 over the next five years, to 8.4 over the next 20 years.
- In most cases, national production is not very diversified. The list of species produced in significant volumes is quite short. This is even more striking in terms of tonnage: the vast majority of national production often consists of just one or two species.
- Countries that have posted strong growth in production, such as Chile, Norway and Spain, have legislation specific to aquaculture. New Zealand will pass such legislation in 2003. Others such as Australia and Scotland are planning to implement legislation over the short term. One objective of such legislation is legal recognition of this new major economic sector and thus, clarification of current issues such as ownership of farmed animals and exclusive access to and use of a public resource.
- All countries still have room for expansion in the operation of existing sites. In some cases, new sites are readily available near the coast. Finally, several countries are considering the development of technology for culture offshore. Sea ranching is also seen as an activity with good growth potential and an excellent way to promote involvement by the fisheries sector in aquaculture.
- By transferring more decision-making power to local authorities in order to solve the problem of conflicts among users of the aquatic environment, three countries apply integrated resource management concepts (Australia, Chile and Norway) and two others plan to start using these concepts in 2003 (New Zealand and Scotland). The EU issued a new directive to this effect in 2002, urging member countries to introduce such practices.
- Integration of aquaculture activities into those of related sectors such as agriculture and fisheries is seen by several countries as a tool to foster development and a way to create synergy for optimizing benefits for the producer and the national economy. Australia favours integration of freshwater aquaculture (land-based) into agricultural activities. Chile has adopted new regulations favouring the granting of marine concessions to communities of fishers for development of sea ranching activities. Norway increasingly refers to a halieutic sector encompassing traditional fisheries activities as well as aquaculture. In its new aquaculture development strategy, the EU openly advocates shifting the fisheries workforce to aquaculture in areas affected by sharply declining catches.
- In most countries, national industry organizations have adopted a code of good conduct or codes of good practice.
- Most countries provide direct financial support for business development, to expand production capacity and/or enhance the competitiveness of existing production units. Chile, the US and New Zealand are the only exceptions. The

EU, with its *Fisheries Guidance Financial Instrument*, is showing strong leadership for member countries and its joint intervention with these countries covers all segments of the industry, from production to the organization of marketing, as well as processing and improvement on quality products.

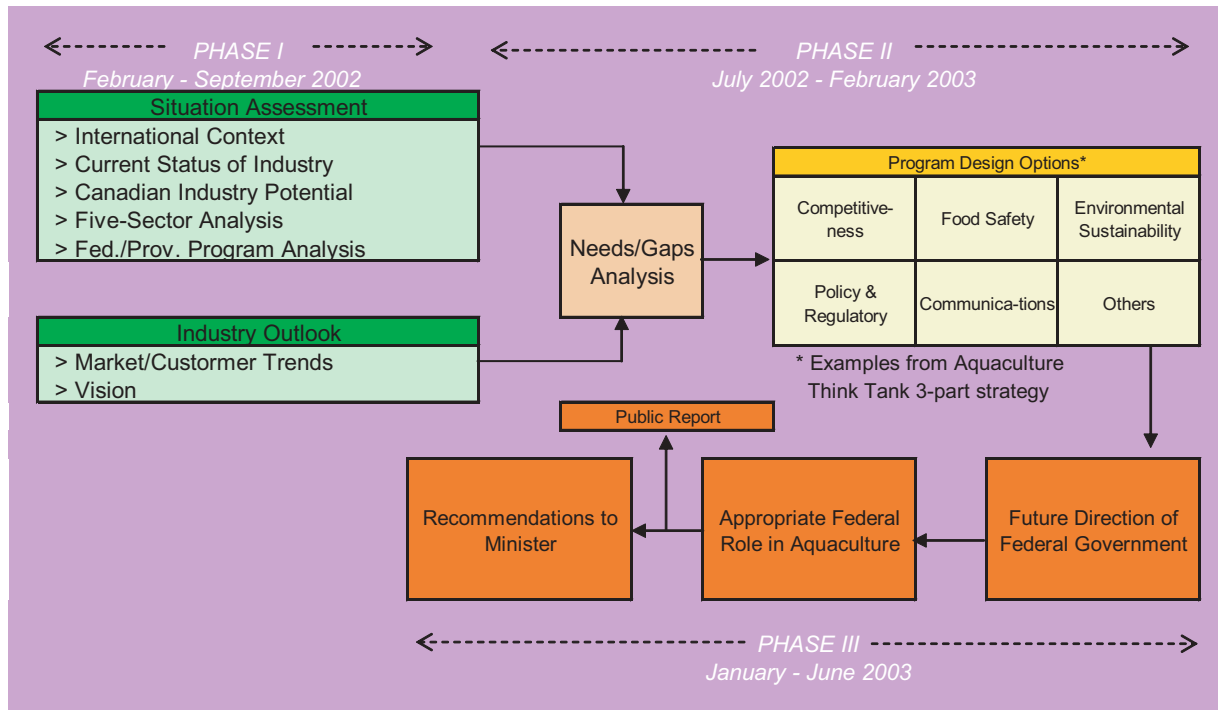
- Only the US and Spain currently have harvest insurance programs established specifically for aquaculture, covering, respectively, the farming of quahogs in the US and gillthead bream, sea bass, turbot, mussel and trout in Spain.
- All governments of the countries studied, without exception, allocate significant resources to research and development, most of them through a National R&D Institute for Aquaculture.
- Norway is the only country that has established a fisheries and aquaculture research fund that is the responsibility of the Ministry of Fisheries, with 100 percent of funding being provided by fisheries and aquaculture businesses through mandatory deductions from their export income.
- All governments also allocate resources to technology transfer activities in cases where these are a key component of the innovation process, fostering adaptation and use by the industry of new technology and other results from R&D.
- Few countries, such as Australia, the US and France, are actively promoting the development of offshore farming technology. These government initiatives are justified for various reasons, ranging from a lack of adequate inshore sites for desired expansion of the sector, to resolving conflicts between users of the aquatic environment by moving aquaculture installations away from the coast.
- Most countries have introduced a national aquatic animal health program that takes an integrated approach to this important aspect of aquaculture and delivers traditional services to the industry for health monitoring, as well as monitoring and rapid response measures for any emergency that might result from an epidemic.
- The wholesomeness and safety of aquaculture products are considered to be major and vital components of government intervention in all the countries studied.
- A strengthening of standards can currently be observed in most countries, which provides one more argument in support of export sales from a given country, but an additional barrier to seafood imports into the same country.
- All national governments directly support development of foreign markets and exports of aquaculture products. This is done through programs introduced specifically for aquaculture (Australia, EU member countries) or through more generic programs (Norway).
- Norway and Scotland have national organizations dedicated to promoting exports of their aquaculture products.

Analysis of supply and demand for fisheries products reveals a solid potential for growth of aquaculture in the coming years. However, a comprehensive strategy for achieving this potential must include two components: 1. a significant increase in production to ensure that there continues to be an increasing effect on global food security, the economic benefits, a rise in household wealth and, thus, enhanced social equity; 2. development that reflects the environment's capacity to support operations that are based on the dictates of sustainable development.

# Appendix IV:

## OCAD's Visioning Process

The Office of the Commissioner's Core Mandate Process can be schematically represented as follows:



### Phase I - Situation Assessment and Industry Outlook (February to September 2002)

OCAD has undertaken a number of background studies to support the core mandate project by providing the necessary context on the current situation and future outlook of the aquaculture and seafood industries. These studies are:

- Study 1: Current Status and Potential of the Canadian Aquaculture Industry.
- Study 2: International Fish and Seafood Markets: a Canadian Perspective.
- Study 3: Market Outlook in the International Fish and Seafood Sector: Alternative Products/Uses and Food Safety Issues.
- Study 4: Review of Provincial and Territorial Programs and Services in the Aquaculture Sector.
- Study 5: Review of Federal Programs/Initiatives in support of Aquaculture
- Study 6: Federal Programs and Services for Five Resource-Based Industries.
- Study 7: The International Context for Aquaculture Development: Growth in Production and Demand and Long-Term Outlook.

The full report for each study is available on the OCAD web site, while an executive summary for each report can be found in appendix III.

During the summer/fall of 2002, a series of 11 regional workshops and one National workshop in Charlottetown, PEI were organized to develop a 15-year vision for a sustainable aquaculture industry in Canada. The format of the workshops included having separate sessions for government and non-government stakeholders around a common vision question. The vision question was:

***It is 2017 and Canada has grown to realize its potential in aquaculture, a locus of investment that is well-regarded as an environmentally sustainable source of wholesome seafood that provides employment for coastal and rural communities and economic benefits to the Canadian economy in a business climate that is free of public criticism. How did we get to this point?***

The workshops were structured in a way to encourage participants to work collaboratively to respond to this question and identify critical issues or gaps, and then come up with ideas for resolving them. The workshops also permitted participants to prioritize the initiatives they had identified and to identify who should be responsible for undertaking each one. The results of each regional workshop have been compiled and are available on the OCAD web site.

The national workshop, held on September 17 2002, had two specific objectives:

1. Present the results of the seven background studies.
2. Discuss the results of the regional workshops and seek a consensus on a national vision statement.

The 15-year vision statement was built from an amalgamation of the results of each regional workshop and was improved through discussion at the National workshop and feedback gathered through OCAD's web site within one month of the national workshop. The Vision is based on the following 11 strategic elements that obtained the highest prioritizations scores during the visioning exercise:

- Environmental sustainability
- Integrated management
- Policy, legislation and regulations
- Aboriginal and aquaculture development
- Research and technology transfer
- Finance, industry development and infrastructure
- Marketing, trade
- Food safety
- Aquatic animal health
- Communications
- Training and education

The results of the visioning exercise were combined with the situation analysis done through the background studies to extract key Canadian gaps and to identify an appropriate federal role in aquaculture. In doing so, several other existing policy documents or recent federal orientations were taken into account in identifying the different components of a federal action plan in aquaculture. Among others, the following received careful consideration:

### **1. Federal Aquaculture Development Strategy**

- More specifically, the description of the dual role of the Lead Federal Agency (Department of Fisheries and Oceans) in aquaculture e.g. regulatory and advocacy.

### **2. DFO's Aquaculture Policy Framework**

- More specifically, the implications of this new policy on operations in all DFO regions.

### **3. Agriculture and Agrifood Canada's Agriculture Policy Framework**

- More specifically, the new orientations with regard to safety net programs, food safety and branding of Canadian quality.

#### **4. September 2002 Throne speech**

- More specifically, its impact on First Nations and the protection of the environment.

#### **5. Canadian Innovation Agenda**

- More specifically, for aquaculture as a recognized priority for Canadian R&D and innovation.

#### **6. Canadian Rural Strategy**

- More specifically, for aquaculture as a recognized source of employment and opportunity for economic diversification in rural and coastal communities.

#### **7. Canadian Council of Fisheries and Aquaculture Ministers**

- More specifically, its 2002 action plan on aquaculture and the shared nature of aquaculture jurisdiction in Canada.

#### **8. Smart Regulation Strategy**

- As announced in the 2002 Throne speech, the government's smart regulation strategy seeks to accelerate reforms in key areas to promote health and sustainability, to contribute to innovation and economic growth, and to reduce the administrative burden of business.

### **Phase II - Needs/Gap Analysis (July 2002 to February 2003)**

With results from the visioning exercise, information from the background studies, and the expertise of the Commissioner's team, an analysis has been made on the needs and gaps of the aquaculture sector to fulfill the 15-year vision. This analysis provided information on, among other things, what needs to be done, whose job it is to do it (role), and how can it be better accomplished.

### **Phase III - Recommendations to the Minister**

The Commissioner will provide the Minister of Fisheries and Oceans with a series of recommendations on programs and initiatives required to fulfill the identified role of the federal government in aquaculture.

**Notes:**

