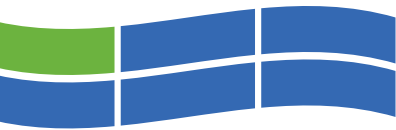


Aquaculture in Canada 2012

A Report on Aquaculture Sustainability





Aquaculture in Canada 2012

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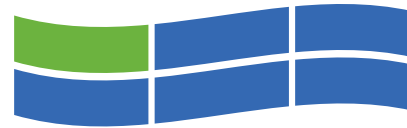
Cover Photo Credits:

Front cover: Linda Duncan, Winter mussel harvesting in Prince Edward Island
Agriculture and Agri-Food Canada, Salmon pieces

Back cover : Agriculture and Agri-Food Canada, Mussels and Oysters
British Columbia Salmon Farmers Association, Salmon farm

Aquaculture in Canada 2012

A Note from the Minister



I am pleased to present *Aquaculture in Canada 2012*: A Report on Aquaculture Sustainability. This project is the result of an important engagement of governments under the National Aquaculture Strategic Action Plan Initiative. Led by the Canadian Council of Fisheries and Aquaculture Ministers, the Initiative includes several Action Plans designed to advance sustainable aquaculture development in Canada.

Aquaculture is increasingly important to Canada's economy. Since 1996, aquaculture production in Canada has more than doubled and its value has nearly tripled, to close to \$1 billion a year. It generates about 14,500 jobs in Canada.

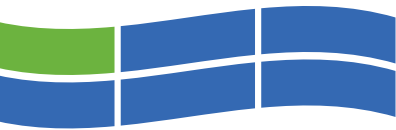
Canada is a world leader in sustainable fish and seafood products, and aquaculture plays an important role in the seafood industry. Fisheries and Oceans Canada, in collaboration with provincial and territorial governments, is providing and applying world-class scientific aquaculture research, enforcing regulations and monitoring results to ensure the aquaculture sector continues to grow responsibly, bringing increased value to Canadians. Both at home and around the globe, consumers are demanding fish and seafood products that are not only safe and healthy but also fished and farmed in ways that do not deplete wild stocks or harm the environment.

Fisheries and Oceans Canada developed this report in collaboration with other federal departments, and the provinces and territories. First Nations, industry representatives, and other stakeholders also contributed to the final result. This report is the first of a regular series of information products from the National Aquaculture Strategic Action Plan Initiative.

Canada's aquaculture industry has great potential to increase its share of the global market. I am confident that together we will continue to build a sustainable industry, one that will thrive for generations to come.

Keith Ashfield
Minister of Fisheries and Oceans
and Minister for the Atlantic Gateway.





Aquaculture in Canada 2012

About this Report

This first report of the Aquaculture Sustainability Reporting Initiative, Aquaculture in Canada 2012, documents the current information on the sustainability of aquaculture in Canada. Key sustainability issues for Canada's aquaculture sector are reflected and organized into six themes: Ecosystem Health, Animal Health and Welfare, Safe and Healthy Products, Resource Use, Social Responsibility, and Economic Viability. This report builds on previous efforts outlined in the Report to Launch the Aquaculture Sustainability Reporting Initiative (http://www.dfo-mpo.gc.ca/aquaculture/lib-bib/sri-ird/pdf/SRI2011_Jan%2009-12%20_English_.pdf), which set out the overall direction and engagement process (Figure 1).

Figure 1 - The Aquaculture Sustainability Reporting Process



The Aquaculture Sustainability Reporting Initiative : A Collaborative Effort

This report outlines the general operating context of the industry and the key issues of aquaculture sustainability in Canada today. The report also summarizes key management practices that are in place to demonstrate how industry and government work together to address sustainability. Where available, key indicators aligned with the six themes have been included to further demonstrate performance.

This reporting initiative is made possible with the cooperation of a number of organizations and individuals. It reflects the work of representatives from across the aquaculture sector, including federal and provincial governments, aboriginal organizations, industry associations and companies, subject-matter experts, non-government organizations, academics, and market representatives.

To advance the Aquaculture Sustainability Reporting Initiative, six theme-based Technical Working Groups were established. Each included a broad range of stakeholders (Table 1 lists working group members as well as other participants in the Aquaculture Sustainability Reporting process). Participants were asked to identify and rank potential indicators for each theme based on their scientific relationship to impact, practicality, availability, measurability, accuracy, and coverage. Information in this first report is largely qualitative in nature. Efforts will be made in future reports to harmonize data methodologies across jurisdictions so that more results can be compiled nationally in a meaningful manner. In preparation for the next reporting cycle we will seek stakeholder feedback regarding this report and the issues covered.

National Aquaculture Strategic Action Plan Initiative

Aquaculture sustainability reporting is a central element of the National Aquaculture Strategic Action Plan Initiative. The Strategic Action Plans developed through this Initiative and endorsed by federal and provincial governments, include a suite of actions to be undertaken by the aquaculture sector with the broader goal of advancing the environmentally, socially and economically sustainable development of aquaculture in Canada. Projects are being undertaken within a five-year timeframe and are based on the priorities and available resources within each of the partners' jurisdictions. For more information on the National Aquaculture Strategic Action Plan Initiative and to access the five Action Plans visit: <http://www.dfo-mpo.gc.ca/aquaculture/lib-bib/nasapi-inpasa/index-eng.htm>.

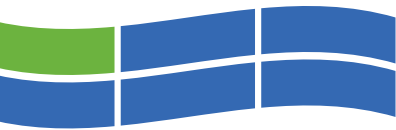
Aquaculture in Canada 2012

About this Report



Table 1: Participants in the Aquaculture Sustainability Reporting Initiative

Aboriginal Aquaculture Association of Canada	EWOS Canada Ltd.
Aquaculture Association of Nova Scotia	Fisheries and Oceans Canada
Archipelago Marine Resources	Aquaculture Management Directorate
Assembly of First Nations	Aquaculture Operational
Atlantic Fish Farmers Association	Economic Analysis and Statistics
Atlantic Policy Congress	Freshwater Institute
Atlantic Veterinary College	Regional Aquaculture Coordinators Office (RACO's) – all regions
British Columbia Salmon Farmers Association	Regulatory Strategic Operations
Canadian Aquaculture Industry Alliance	Strategic and Regulatory Science Directorate, Aquaculture Science Branch
Canadian Council of Fisheries and Aquaculture Ministers Strategic Management Committee Ad Hoc Working Group	Loblaw Companies Limited
Newfoundland and Labrador Department of Fisheries and Aquaculture	Marine Harvest
Prince Edward Island Department of Fisheries, Aquaculture and Rural Development	Memorial University
New Brunswick Department of Aquaculture & Agriculture	Metro
Nova Scotia Department of Fisheries and Aquaculture, Aquaculture Policy & Licensing	NorthEast Nutrition
Ontario Ministry of Natural Resources, Aquaculture Policy and Planning	Northern Ontario Aquaculture Association
Ontario Ministry of Agriculture, Food and Rural Affairs	Skretting North America
Québec Ministry of Agriculture, Fisheries and Food (MAPAQ)	Sobey's
Manitoba Ministry of Agriculture, Food and Rural Initiative	Statistics Canada
British Columbia Ministry of Agriculture	Taplow Feeds
Canadian Food Inspection Agency	University of Guelph
Cooke Aquaculture	University of New Brunswick
Dalhousie University	Vancouver Aquarium
	World Wildlife Fund Canada



Aquaculture in Canada 2012

About this Report

Through discussions with officials from other countries with similar aquaculture sectors, we have become aware that Canada is not alone in its efforts and approaches to reporting on aquaculture sustainability. Norway for example, has developed a “Strategy for an Environmentally Sustainable Norwegian Aquaculture Industry” through a multi-stakeholder process that addresses aquaculture sustainability under five themes. Similarly, the Scottish government has set out aquaculture policy in “A Fresh Start – Renewed Strategic Framework for Scottish Aquaculture,” also developed through wide stakeholder involvement and organized into six key sustainability themes. Both the Norwegian and Scottish strategies include efforts to develop reporting, including indicators. In addition, the Food and Agriculture Organization is exploring reporting and evaluation methodologies for the global aquaculture sector. The Organization is currently developing a “Handbook for Aquaculture Statistics” to streamline definitions, standards and methodologies, and align indicator development among countries. A paper on assessing and monitoring global aquaculture sector performance has also been released. Fisheries and Oceans Canada will continue international collaborative efforts and will strive to align our reporting with that of others.

Report Scope

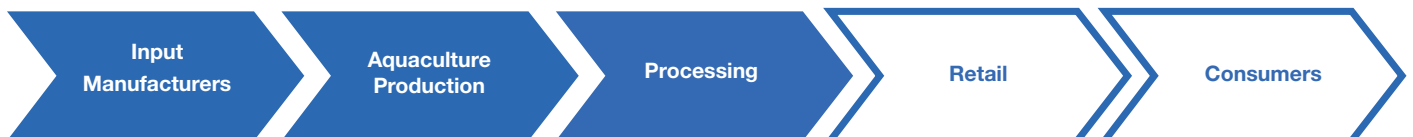
In defining the scope of this report, consideration was given to the broader aquaculture value chain. The aquaculture value chain stretches from input manufacturers, such as feed producers, through to consumers who purchase seafood and related products (Figure 2). The information included in this first report is focused on input manufacturers, aquaculture producers and processors (highlighted in blue). Effort was made to ensure coverage of different regions and a variety of product characteristics and types, reflective of the sector’s diversity.

Next Steps

Effort has been made to align this report with the best practices in sustainability reporting as outlined by the Global Reporting Initiative. The Global Reporting Initiative is a non-profit organization that has developed a reporting methodology and framework used by many organizations around the world to understand and communicate sustainability performance. The Global Reporting Initiative has strategic partnerships with the United Nations Environment Programme, the UN Global Compact, the Organisation for Economic Co-operation and Development, International Organization for Standardization and many others.

The Management and Performance section of this report contains an appraisal of the sector in six thematic areas, as well as actions that are being taken through the National Aquaculture Strategic Action Plans to address sustainability issues. Consistent with Global Reporting Initiative principles, this report establishes a baseline of performance. The process has reinforced the need for nationally consistent statistics. As these are developed, additional quantitative indicators will be included to compliment the qualitative reporting, as verifiable evidence of sustainability. The technical working groups will remain in place to provide continuing assistance in further indicator development.

Figure 2 - The Aquaculture Value Chain



Aquaculture in Canada 2012

Perspectives Across Canada



Aquaculture regulation and management is a shared responsibility among governments and industry. There are many federal, provincial and territorial government departments and agencies involved in the sector. Industry itself plays a hands-on and essential role in ensuring sustainability. Industry and government work together to ensure that management of the sector meets the high standards expected by Canadians and by markets for aquaculture products.

With untapped marine and freshwater resources, world-class scientists and a skilled workforce, Canada has the potential to become a major player in global aquaculture. Governments are working together, in consultation with the Canadian aquaculture

industry and other stakeholders, to harmonize legislation and regulations to facilitate sustainable development, improve financial viability, and encourage investment so that the full potential of the sector can be achieved.

The increased demands for assurances of environmental sustainability, enhanced food safety standards and traceability are realities of modern aquaculture that businesses of all sizes are facing. The Canadian aquaculture sector is reaching out to a wide range of consumer and environmental stakeholders to better understand their perspectives, and is putting in place measures of quality, safety and sustainability to address these issues.

“As a leader in the Canadian food industry, Metro contributes to establishing best practices that will pave the way for commercial activities that are in line with current issues. We have implemented a continuous improvement process not only for the public’s benefit but also to strengthen the trust relationship that we build with our customers every day. In addition to quality, freshness and product price, corporate responsibility is a criterion that more and more people are considering when choosing a brand. Our customers trust us to offer them sustainable products and make choices that reflect ethical values.” - *Metro*

“Access to good quality, accurate information on the Canadian aquaculture industry is vital to helping stakeholders like SFP better engage, inform, educate, and empower the supply chain to work together to solve collective regional farming environmental issues.”

- *Sustainable Fisheries Partnership*

“The guiding set of Aboriginal Principles for Sustainable Aquaculture (APSA) provides a standard for the structural and operational framework under which First Nations can be assured that their values, expectations and interests are included in the sustainable management of aquaculture operations.”

- *Aboriginal Aquaculture Association*

“Sustainability communications should take place globally, involve multiple stakeholders and promote open and honest dialogue ...(to) reach a common understanding of environmentally and socially responsible practices, motivate change and improvements.”

- *Marine Harvest*

“Atlantic Aqua Farms Partnership takes great pride in being a leader in rope cultured mussel farming, one of the most sustainable and environmentally friendly forms of aquaculture. Although rope-grown mussels are ranked very favourably in the ‘green’ and ‘best choice’ categories of all NGO sustainability rankings, our industry cannot take its favourable position for granted. Maintaining that global recognition and ranking is critical to the future of the Canadian mussel industry.” - *Atlantic Aqua Farms Partnership*





Aquaculture in Canada 2012

Aquaculture Sector Snapshot

Global Aquaculture

In 2010, total worldwide aquaculture production amounted to approximately 77 million tonnes valued at \$125 billion US (FAO 2012). This volume was roughly 50 percent of the total world fish and seafood production for human consumption compared to about 25 percent a little over a decade earlier. Global aquaculture production is growing rapidly. In the 1970s, production grew by 73 percent, followed by another 90 percent increase in the 1980s and 40 percent in the 1990s. The United Nations Food and Agricultural Organization projects current global production will double by 2025.

Almost every country has some form of aquaculture. Southeast Asia accounts for 80 percent of global production with China, India, Japan, Korea, Philippines, Indonesia and Thailand being leading aquaculture producers in this region. Despite its extensive marine and freshwater resources, Canada is a relatively small producer, ranking 22nd and accounting for less than 0.3 percent of global aquaculture production. However, Canada accounts for 8 percent of global farmed-salmon production and ranks fourth behind Norway, the United Kingdom and Chile (FAO 2009, *The State of World Fisheries and Aquaculture 2008*).

Aquaculture in Canada

Aquaculture occurs in all provinces and in the Yukon Territory. It now generates about \$2 billion in total economic activity, over \$1 billion in GDP and about half a billion in labour income. Aquaculture operations for several marine finfish and shellfish species are well established on the east and west coasts, while freshwater trout operations can be found in almost every province. In addition, Canadian finfish aquaculture also includes a small number of active tilapia, sturgeon, Atlantic halibut and other operations. The scope of aquaculture operations varies across the country depending upon the species being farmed, the environment (marine, freshwater), and the culture technologies used (Figure 3).

Figure 3: Types of Aquaculture

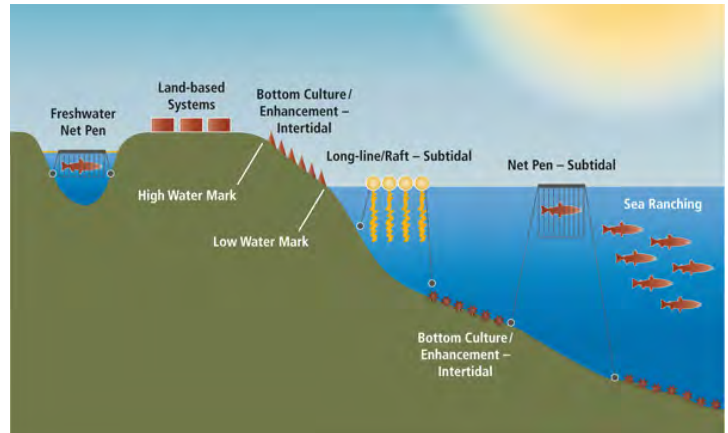
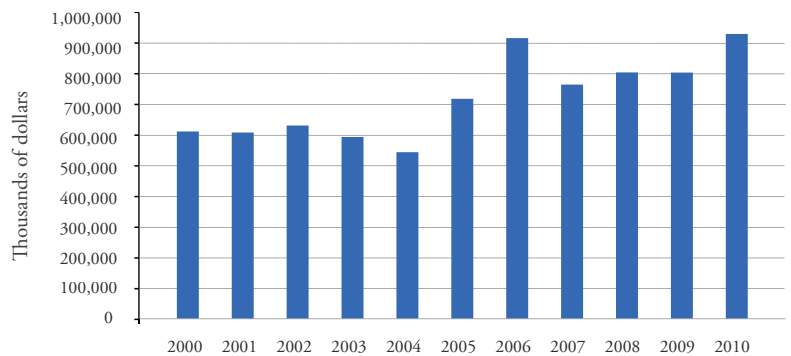
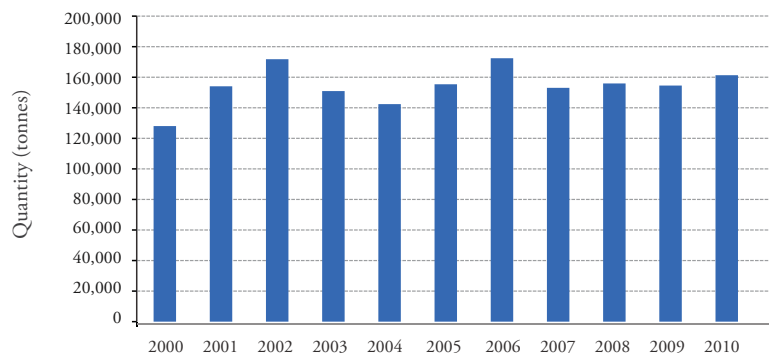


Figure 4: Aquaculture Production Value in Canada, 2000-2010



Source : Statistics Canada

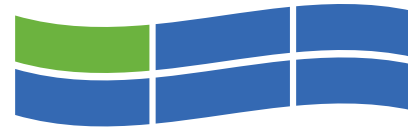
Figure 5: Aquaculture Production Volume in Canada, 2000-2010



Source : Statistics Canada

Aquaculture in Canada 2012

Aquaculture Sector Snapshot

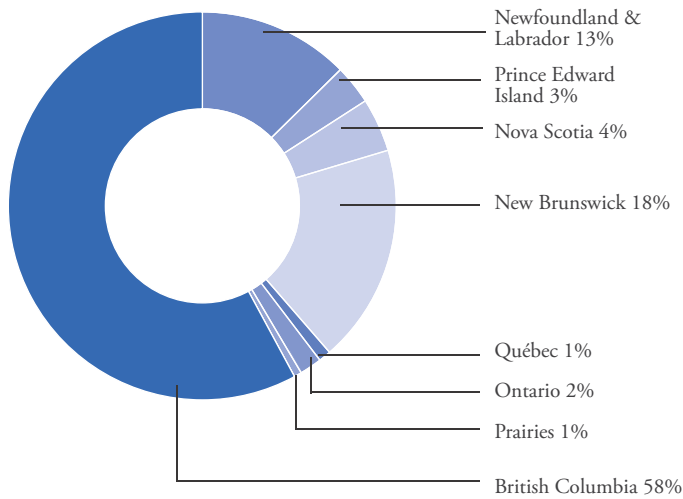


The value of aquaculture production in Canada has remained relatively stable since 2005 with an increase of about 4.5 percent in 2010. This increase in 2010 output value of \$926,504 surpassed the output value of \$912,983 from 2006 (Figure 4). In terms of harvested tonnage, Canada's production has not shown any significant growth over the last decade (Figure 5).

In 2010, British Columbia accounted for about 58 percent of total production value, followed by New Brunswick (18 percent), and Newfoundland and Labrador (13 percent) (Figure 6).

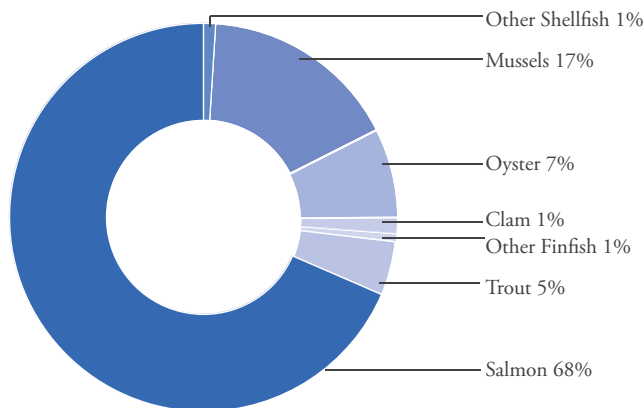
Salmon represented the greatest production volume, at 68 percent in 2010, followed by mussels (17 percent), oysters (7 percent), and trout (5 percent) (Figure 7).

Figure 6: Production Value by province - 2010
Total \$927 million



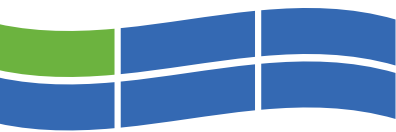
Source : Statistics Canada & DFO

Figure 7: Production by species - 2010
161,000 tonnes



Source : Statistics Canada & DFO





Aquaculture in Canada 2012

Aquaculture Sector Snapshot

Regional Highlights

British Columbia

Presently there are salmon, trout, Pacific oyster, clam, mussel, and scallop farming operations in northern and eastern Vancouver Island (Port Hardy, Port McNeil, Campbell River, Tofino, Baynes Sound) — key centres of activity in British Columbia. The total value of cultured finfish produced in 2010 was \$512 million, of which 98 percent was salmon. BC exports 70 percent of its aquaculture production, mainly to the United States.

Atlantic Provinces

In Atlantic Canada, net-pen culture of Atlantic salmon is well established in New Brunswick, Nova Scotia, and Newfoundland and Labrador. Production of Atlantic salmon in Atlantic Canada rose from 78 tonnes in 1981 to 297 tonnes in 1986 and to 32,000 tonnes (\$192 million) in 2010.

The culture of blue mussels, primarily in Prince Edward Island, has also grown over the past 30 years. In 1981 there was virtually no culture of mussels. By 1986, production rose to 1,800 tonnes valued at over \$2.7 million and by 2010 it had reached 24,000 tonnes valued at over \$33 million. Newfoundland and Labrador

has also become an important region for mussel and salmon production. The province of Newfoundland and Labrador has experienced a significant growth in salmon farming over the past five years (i.e., 2.5-fold increase in landed mass and 3.5-fold increase in landed value).

Sixty percent of all Atlantic province aquaculture production is exported, of which 90 percent goes to the United States

Northern Ontario

Production in inland waters in Canada accounts for approximately 4 percent of the total national volume of aquaculture, with a total value of \$32.6 million. The first private freshwater net-pen aquaculture operation in Canada began in Georgian Bay (Parry Sound) in 1982 and continues today. Close to 60 percent of all rainbow trout production comes from Ontario in the waters of Georgian Bay off Manitoulin Island.

Other Regions

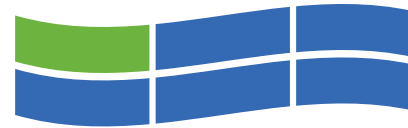
A diversity of aquaculture operations exist throughout other regions of Canada. Freshwater aquaculture is part of the rural fabric of all provinces including Prairie Provinces (Manitoba, Saskatchewan and Alberta) and Québec as well as those noted above. Aquaculture also takes place in the Yukon.

Table 2 Aquaculture Production in Canada by Sector

	Freshwater Finfish	Marine Finfish	Marine Shellfish
British Columbia	✓	✓	✓
Alberta	✓	~	~
Saskatchewan	✓	~	~
Manitoba	✓	~	~
Ontario	✓	~	~
Québec	✓	~	✓
New Brunswick	✓	✓	✓
Nova Scotia	✓	✓	✓
Prince Edward Island	✓	✓	✓
Newfoundland & Labrador	✓	✓	✓
Yukon	✓	~	~

Aquaculture in Canada 2012

Management & Performance



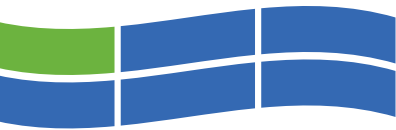
Aquaculture Sector Summary

Through the Aquaculture Sustainability Reporting Initiative, six key themes were identified to demonstrate the sustainability of Canadian aquaculture. This section of the report discusses the management actions and sustainability performance related to each theme. In October 2011, Technical Working Groups

identified theme-specific indicators to provide additional context around sector management and performance of sustainability issues. In this 2012 report, indicators have been included where data availability and comparability is possible, and work is underway to collect additional data for inclusion in future sustainability reports.

The aquaculture sector refers broadly to the science, management and business of cultivating fish, shellfish and aquatic plants.

<p>Maintaining Health & Productive Ecosystems 2012 Indicator ~ Indicators Under Development ✓</p>	<p>Because healthy and productive ecosystems are vital to the sustainability of aquaculture in Canada, the sector must operate in a manner that minimizes environmental interactions. Informed by science, industry and government work together to ensure protection of fish and fish habitat through measures such as siting, management of organic waste, control of introductions and transfers of fish, and escapes prevention measures.</p>
<p>Maintaining Animal Health & Welfare 2012 Indicator ~ Indicators Under Development ✓</p>	<p>It is in every farmer's best interests to provide the best care for the animals. This means adopting science-based practices that minimize stress, maintain a healthy aquatic environment, reduce disease risks, and take steps to prevent the spread of diseases when they do occur. In Canada, these practices are supported by national regulations and international requirements.</p>
<p>Ensuring Safe & Healthy Products 2012 Indicator ~ Indicators Under Development ✓</p>	<p>Seafood is an important part of a healthy and balanced diet, so ensuring that the products of aquaculture are wholesome and safe to eat is essential. Seafood contains nutrients that play a well-established role in normal growth and development, energy metabolism, building and repairing body tissues, formation and maintenance of bones and teeth, formation of red blood cells, immune system health, and the prevention of heart disease. Value-chain traceability is a mechanism by which safety, nutrition, and other attributes can be monitored and maintained.</p>
<p>Using Resources Efficiently 2012 Indicator ✓ Indicators Under Development ✓</p>	<p>Efficient use of resources required to conduct operations is fundamental to aquaculture sustainability. Feed management, water and energy consumption, and production-area optimization are all important components of sustainable resource use. In a highly competitive environment, the ability to find operational efficiencies is a significant contributor to economic success.</p>
<p>Encouraging Social Responsibility 2012 Indicator ✓ Indicators Under Development ✓</p>	<p>The federal government supports social responsibility through laws that preserve labour rights and protect Charter freedoms for all Canadians. Through regulations, monitoring and enforcement, governments can build consumer and public trust in the aquaculture industry. The sector itself is also committed to earning and upholding public confidence. This means operating in a manner that respects local communities as well as aboriginal and labour rights, maintains safe workplaces, and demonstrates that all these systems are in place and functioning.</p>
<p>Ensuring an Economically Viable & Successful Sector 2012 Indicator ✓ Indicators Under Development ✓</p>	<p>The sustainability of the aquaculture sector is directly linked to its economic viability and success in delivering economic growth in rural development, job creation, and domestic and international trade. These objectives apply to the many activities of the sector, including those associated with hatcheries, grow-out, feed production and processing operations, as well as the supply of goods and services.</p>



Aquaculture in Canada 2012

Management & Performance

Maintaining Healthy Productive Ecosystems

Because healthy and productive ecosystems are vital to the sustainability of aquaculture in Canada, the sector must operate in a manner that minimizes environmental interactions. Informed by science, industry and government work together to ensure protection of fish, and finfish habitat through measures such as siting, management of organic waste, control of introductions and transfers of fish, and escape prevention measures.

How the sector works to promote ecosystem health

Siting

Siting is important to help ensure that the aquatic ecosystems in which aquaculture is undertaken remain productive, not just for the cultured species but also for other aquatic species that use those areas.

Sound environmental management of aquaculture is achieved in part by siting processes and the analysis of potential environmental outcomes. This work can involve as many as 17 federal agencies and a range of provincial and territorial governments.

Farm siting is an important element of minimizing impact of excess feed on the ecosystem. Marine and freshwater environments have varied capacity to absorb or assimilate organic materials. Locating marine farms strategically in areas of deeper water and strong currents, combined with mitigation measures such as site fallowing, and Integrated Multi-Trophic Aquaculture helps to minimize environmental effects. Under federal and provincial regulations finfish farms are monitored for changes to the seabed.

Managing Organic Waste

Over the past 15 years, aquaculture management practices and technologies have improved to reduce excess release of feed. Today, federal and provincial regulations are designed to minimize the impact that excess feed from fish farms may have by limiting it to a specified area of the farm and immediately surrounding waters. For net-pen operations, the practice of fallowing allows the seabed time to revert between production cycles.

Control of Introductions & Transfers

Transferring fish and shellfish into and between sites is important for commercial production, enhancement and population restoration projects, and for research endeavours in support of aquaculture. Comprehensive regulatory measures, employing the precautionary approach, are in place to protect local fish stocks and the environment from potential negative interactions.

Fisheries and Oceans Canada requires a review of the risks and consequent mitigative steps before a licence can be issued under the Fisheries Act to introduce or transfer fish. Federal-provincial Introduction and Transfers Committees review applications to move fish and assess the associated risks using the tools laid out in the National Code on Introductions and Transfers of Aquatic Organisms. With the exception of enhancement facilities, all salmonid transfers between provinces require a Fish Health Certificate as proof that the facility was inspected in a prescribed manner.

Fisheries and Oceans Canada also works with the Canadian Food Inspection Agency to deliver the National Aquatic Animal Health Program. The program consists of measures to prevent, control and/or eradicate aquatic animal diseases of concern. The National Aquatic Animal Health Program improves protection of Canadian aquaculture and wild fisheries from diseases to maintain the country's competitive access to seafood trade markets. The National Aquatic Animal Health Program complements measures already in place - on the farm and through provincial aquatic animal health management programs.





Case Study: Reducing Net-Pen Escapes Through Technology, Training & Management Plans

Escapes have a variety of causes. The Canadian aquaculture industry is committed to reducing escapes to zero, and has responded with multifaceted mitigation strategies including implementing appropriate and evolving technical standards for equipment and management.

Failure may result from a variety of causes, including storm damage, abrasion, boat operation, predators, or as a result of vandalism. To address this, minimum net-pen design and breaking strength standards for net mesh have been established, and testing is required following industry Codes of Containment and Best Management Practices. Furthermore, site-specific engineering specifications on net-pen design, installation and anchoring must meet regulatory approval in some jurisdictions.

Techniques are constantly evolving to prevent net failure caused by predators. Net-pen design for example, generally requires predator blinds on the bottom of the net and double net-pen enclosures. Blinds prevent predators from observing and attacking fish.

Double net pen enclosures consist of an inside culture net that holds the fish being grown while a second external predator net distances predators and also serves as an additional barrier to escapes.

Inspection audits and regular maintenance plans are also key to preventing escapes. Divers make regular underwater inspections and farming companies and net-auditing agencies use underwater camera technologies to ensure the integrity of net systems. Records are inspected and audited by regulatory enforcement staff. Regulators in some jurisdictions will also undertake periodic dive and net-shed audits.

Companies have established well documented systems and best management practices for training and education of employees on escape prevention and response plans. Collaborative research is ongoing to improve net technology and reduce escapes. A project to commercialize software to improve mooring and site engineering in the aquaculture industry has recently received funding from the Aquaculture Innovation and Market Access Program. This software will enable farmers to identify equipment (i.e. nets, ropes, buoys, etc) that can withstand wind, waves and currents, preventing fish escapes and costly maintenance. Another example is a west coast project that tested different net types side-by-side to measure durability in high- energy sites.

Escape Prevention

Preventing the escape of farmed fish is a priority for the aquaculture industry, federal, provincial and territorial governments, commercial and recreational fishers, and environmental advocacy groups. Governments and industry collaborate to put regulatory and operational measures in place to manage the incidents of escapes through more robust nets and containment structures as well as improved inspection, training, maintenance and husbandry procedures, and reporting. The implementation of these escape prevention initiatives has allowed finfish production to increase while reducing the number of annual escape events.

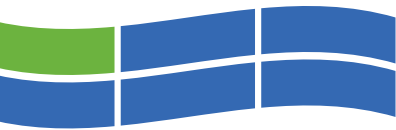
Reporting on Escapes

Across the country, reporting practices for escapes from aquaculture cages are being developed alongside codes of containment and associated regulatory measures. Fisheries and Oceans Canada is also working with other countries, such as

Norway and Scotland, which report nationally on fish escapes. Reporting may include not only the magnitude of an escape event, but also the likely causes, mitigation measures to be applied, and results of recapture efforts. Together, this body of information will help the sector further refine measures to minimize or eliminate escape events.

The regulatory environment concerning escape and recovery events varies according to region. Industry codes of practice for containment exist in most provinces and include guidelines for notification, reporting and recovery. While data on escapes exist, the information is not always comparable as it is compiled in different forms across provincial jurisdictions. Efforts are presently underway to harmonize this information so that results can be compiled and reported nationally.

An example of the type of information on escapes as reported in British Columbia can be found at: <http://www.pac.dfo-mpo.gc.ca/aquaculture/reporting-rapports/docs/escape-evasion/2011-eng.htm>



Aquaculture in Canada 2012

Management & Performance

Actions Moving Forward

The National Aquaculture Strategic Action Plan Initiative has identified a number of priority activities to address issues related to maintaining ecosystem health. Progress on the implementation of National Aquaculture Strategic Action Plan Initiative actions will be presented in future reports.

National Aquaculture Strategic Action Plan Initiative Actions

- Environmental Management (EM-3) - Support research and development pertaining to environmental effects and management
- Introductions and Transfers (IT-1) - Review and update the Introductions and Transfers management framework as appropriate
- Access to Wild Resources (AWR-1) - Conduct the mandated review of the *Access to Wild Aquatic Resources for Aquaculture Purposes Policy*
- Fish Health (FH-3) - Propose regulations under the *Fisheries Act* to enable the administration of drugs and pest control products for fish pathogen and pest treatment within the conservation and protection mandate of the Act

In addition to these activities, the following aspects of aquaculture sustainability related to maintaining healthy and productive ecosystems have been identified in this reporting process and could be addressed in future reports:

- Identifying cumulative effects and establishing thresholds: Scientific understanding is advancing with work on Aquaculture Pathways of Effect (http://www.dfo-mpo.gc.ca/CSAS/Csas/Publications/SAR-AS/2009/2009_071_e.pdf). This work will facilitate understanding of the inter-relationships and cumulative effects to enable development of important thresholds for enhanced environmental management.
- Addressing climate change: Being able to identify future implications of climate change, including determining the effects of ocean acidification on the shellfish sector, is important for the long term viability of aquaculture in Canada.

Future Reporting & Further Reading

As indicated, reporting capacity on escapes is being developed to support national reporting. Similarly, standardized indicators of water quality and benthic monitoring have been developed or are being developed in a number of jurisdictions in Canada. Future Sustainability Reports will include measurable data as the comparability of data between provinces and territories improves.

For more details on how the Canadian aquaculture industry is managed to promote healthy and productive ecosystems, please consult the Fisheries and Oceans Canada Sustainable Seafood website at: <http://www.sustainable-seafood.ca>





Maintaining Animal Health & Welfare

It is in every farmer's best interests to provide the best care for the animals. This means adopting science-based practices that minimize stress, maintain a healthy aquatic environment, reduce disease risks, and take steps to prevent the spread of diseases when they do occur. In Canada, these practices are supported by national regulations and international requirements.

How the sector keeps farmed fish & shellfish healthy

Minimizing Animal Stress

There is a relationship between animal stress and product quality. Fish that are less stressed are less susceptible to disease, grow better, and have higher quality flesh. Stress can cause quality issues such as gaping in the flesh after harvest. Fish farmers want to deliver a quality product to market that returns the maximum value.

There are many factors which can influence animal stress and the sector has developed best management practices to minimize the effects of these stressors to maintain a healthy growing environment. Monitoring the density of fish held in net-pens is one factor which contributes to healthy fish. Some jurisdictions in Canada have established standards and regulations for finfish stocking densities to prevent crowding and many farmers stock below these thresholds.

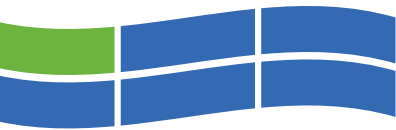
Measures to Reduce Disease Risks

In a shared aquatic environment, strong protocols must be in place to minimize the risk of introducing pathogens.

All aquaculture stock must be certified disease free before it enters the marine farming environment. Controlling the spread of disease, disease agents, parasites, toxins or contaminants, within the site or from one site to another is achieved through strict bio-security measures. These include controlled harvesting methods, and developing bay-management systems requiring rotation of sites to allow for fallowing and year-class separation. These measures are applied mainly through provincial veterinary and regulatory programs, as well as associated industry Standard Operational Procedures.

The National Aquatic Animal Health Program, co-delivered by the Canadian Food Inspection Agency and Fisheries and Oceans Canada, establishes and enforces protocols for control and management of fish health. The National Aquatic Animal Health Program is underpinned by an internationally recognized national laboratory system that delivers accurate, reliable and consistent test results for disease detection. This capability, strengthened by technology development, targeted research, and access to effective treatment options in the event disease or pest outbreaks occur, provides Canada with a sound scientific foundation to protect its wild and farmed animal populations from disease. This program also supports the certification of exported animals and products.





Aquaculture in Canada 2012

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Managing Diseases & Pests

Providing optimal care for their animals is a priority for fish and shellfish farmers. This means taking steps to prevent disease through providing a healthy rearing environment that meets all the life needs of the fish and reduces susceptibility to pathogens and pests; using vaccines to prevent disease; and treating diseases that might occur quickly and efficiently. Treatment products must be authorized for sale by Health Canada and prescribed by a licensed veterinarian. Farmers work to minimize their use.

Health Canada has strict rules governing the use of treatment products on animals grown for food. Health Canada sets maximum residue limits in harvested fish, and there must be appropriate time after the treatment before the fish can be harvested. The Canadian Food Inspection Agency monitors fish at federally registered processing plants and tests for the presence of therapeutants in fish to ensure they do not exceed the levels set by Health Canada.

Sea lice are small parasites that occur naturally in the ocean environment and can be transferred from wild to farmed fish and vice versa. Sea lice feed on the skin and flesh of their hosts. These parasites have existed on wild salmon for thousands of years, long before the first salmon farm was established in Canada. They may transfer from wild fish or attach directly to fish at farmed sites. If left untreated, sea lice can affect the health of farmed salmon, and may be transferred back to wild fish.

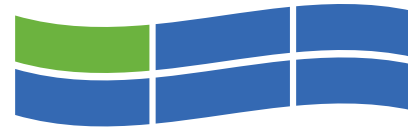
Ensuring a sustainable industry requires an ongoing commitment to high-quality scientific research. Fisheries and Oceans Canada works closely with the provinces and industry to find solutions. Fisheries and Oceans Canada researchers work diligently to develop the knowledge required to provide sound scientific advice on sea-lice dynamics, transmission routes between wild and farmed fish, impacts, monitoring programs, action thresholds, and other related management measures. This research increases the understanding of potential impacts of sea-lice control methods on the reduction of parasites through careful use of approved treatment products and the investigation of non-chemical sea-lice control methods.

Strong regulatory measures, set by Fisheries and Oceans Canada in British Columbia and by provincial governments elsewhere, are aimed at reducing sea-lice interactions on farms.

Farmers manage sea lice by :

- Regular monitoring and reporting
- Choosing sites with appropriate water currents through environmental surveys
- Site fallowing (rotating periods of inactivity)
- Using biological, non-chemical means of control
- Using veterinarian-directed therapeutants and pesticides to treat infested fish
- Other husbandry approaches





A Case Study: Collaborative Approaches to Management of Sea Lice

In the summer of 2008, representatives from the Atlantic provinces, Fisheries and Oceans Canada and Health Canada met to discuss fish-health management. The need for a full suite of tools for an integrated pest management approach to sea lice management was identified as a priority. This led to the creation of the National Working Group on Fish-Health Management Tools for Aquaculture composed of representatives from both the federal and provincial governments and industry.

Since 2009, the New Brunswick salmon farming industry, working with the federal and provincial governments has led in the identification of research needs in the Bay of Fundy. These were then considered in work planning and priority setting for research programs.

The New Brunswick government and Fisheries and Oceans Canada developed an Integrated Pest Management Plan for Sea Lice in collaboration with the aquaculture industry and other federal and provincial departments and stakeholders. As well, the province of New Brunswick and Fisheries and Oceans Canada developed the Sea Lice Monitoring Program for Marine Salmon Aquaculture Sites in New Brunswick, with input from industry and other stakeholders. The plan can be adapted by other aquaculture jurisdictions in Canada. Fisheries and Oceans Canada is also developing a release of aquaculture substances regulatory regime that will support improved fish-health management for sea lice and address other possible fish-health concerns.

Fisheries and Oceans Canada science has conducted several Canadian Science Advisory Secretariat workshops to develop key science advice on therapeutants and the effective control of sea lice. In 2011, a Canadian Science Advisory Process was held to assess the impact of the active ingredient in SLICE™ near aquaculture facilities in British Columbia and its effect on a native prawn.

Another Canadian Science Advisory Secretariat workshop in 2011, focused on defining potential exposure and associated biological effects of aquaculture pest and pathogen treatments with the focus on bath treatments to control sea lice in the Bay of Fundy, New Brunswick.

Industry is making significant investment in the development of alternative, green technology to reduce reliance on chemical products. These include the use of “cleaner fish” (usually a member of the wrasse family), lice traps, the development of an eco-bath closed delivery system, and the use of full tarps for all net-pen therapeutant applications. With support from federal agencies, industry has invested in well boats to deliver treatments, supporting the use of hydrogen peroxide and reducing the quantities of all medicines required for treatments.

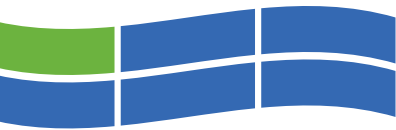
On the west coast, the Broughton Area Monitoring Plan illustrates collaborative research taking place in the area of sea lice monitoring. Through unprecedented data sharing, collaborative field monitoring and research, salmon producers, conservationists, Fisheries and Oceans Canada, and academic researchers are working together to assess sea-lice levels on juvenile wild salmon in the Broughton Archipelago at the northeastern tip of Vancouver Island.

Reporting on Sea Lice

Reporting practices around sea lice are developing as integrated pest management plans and associated regulatory measures are created and implemented in consultation with the sector. Fisheries and Oceans Canada is also working with officials from other countries to align reporting on animal-health matters including sea lice. This reporting may include not only the scale of sea-lice present in the environment, but also the extent of sampling that has taken place. Together, this body of information will help the sector further refine measures to minimize farm salmon interaction with sea lice.

As management plans and new or amended regulations are implemented, reporting capacity on sea lice will improve, allowing for greater analysis. The Aquaculture Sustainability Reporting Initiative Technical Working Groups will be working to develop a relevant indicator and supporting data on sea-lice interaction with farmed fish.

An example of the type of information on sea lice as reported in British Columbia can be found at: <http://www.pac.dfo-mpo.gc.ca/aquaculture/reporting-rapports/docs/lice-pou/2011-Q2-T2-eng.htm>



Aquaculture in Canada 2012 Management & Performance

Actions Moving Forward

The National Aquaculture Strategic Action Plan Initiative has identified a number of priority activities to address fish-health issues. Following is an example of an item currently being worked on in some provinces and/or regions. Progress on the implementation of National Aquaculture Strategic Action Plan Initiative fish-health actions will be presented in future reports.

National Aquaculture Strategic Action Plan Initiative Actions

- Fish Health (FH-2) - Prepare a regional or provincial/territorial fish-health management strategy to coordinate fish health management procedures throughout the sector and provide a living compendium of the principal fish-health issues in the sector



In addition to National Aquaculture Strategic Action Plan Initiative actions, many jurisdictions are undertaking work specifically aimed at maintaining animal health and welfare. For example, an Integrated Pest Management Program (IPMP) for Sea Lice has been developed for New Brunswick in collaboration with the federal government, provincial governments, industry, fish-health experts and stakeholders. To complement the IPMP, a Sea-Lice Monitoring Program for Marine Salmon Aquaculture Sites in New Brunswick and an annual performance measures document have also been developed. For further information, please consult the following link: <http://www.dfo-mpo.gc.ca/aquaculture/consultations/2012/RASRR-NB-eng.htm>.

Further to this, the following issues have been identified in this reporting process and could be addressed in future reports:

- Fish health can be affected by many factors including environmental changes resulting from off-farm activities. There is a need for baseline data related to wild fish and fish habitat.
- Bay Area Management can play a critical role in aquatic animal health. While these systems have been developed and are in practice in many jurisdictions, challenges are presented if not all farmers fully comply. Non-farming operations located in the vicinity can also have a negative impact on aquatic ecosystems and animal health..
- Access to therapeutants to treat fish pathogens and pests continues to be a challenge for the aquaculture sector. Aquatic farmers have fewer options compared to terrestrial farmers.

Future Reporting & Further Reading

Capacity for reporting on disease incidence is currently being developed in a number of jurisdictions in Canada and future reporting through the Aquaculture Sustainability Reporting Initiative will be able to draw on this work.

For more details on how the Canadian aquaculture industry is managed to promote the health and welfare of aquatic animals, please consult the Fisheries and Oceans Canada Sustainable Seafood website at: <http://www.sustainable-seafood.ca>



Ensuring Safe & Healthy Products of Aquaculture

Seafood is an important part of a healthy and balanced diet so ensuring that the products of aquaculture are wholesome and safe to eat is essential. Seafood contains nutrients that play a well-established role in normal growth and development, energy metabolism, building and repairing body tissues, formation and maintenance of bones and teeth, formation of red blood cells, immune system health, and the prevention of heart disease. Value-chain traceability is a mechanism by which safety, nutrition, and other attributes can be monitored and maintained.



Photos: Agriculture and Agri-Food Canada

How the sector ensures safe & healthy products

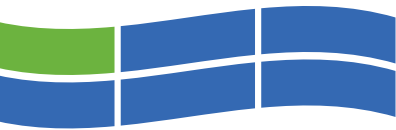
Programs and Standards for Seafood Safety

Canada's food safety system is recognized as one of the best in the world. The Canadian Food Inspection Agency partners with Health Canada to not only set standards for food safety but to make sure these standards are met.

All establishments processing fish and seafood for export or inter-provincial trade must be federally registered and must develop and implement a Hazard Analysis Critical Control Point-based Quality Management Program. A processing establishment's Quality Management Program outlines the controls implemented by the processor to ensure that all seafood products are processed under sanitary conditions, and that the resulting products are safe and meet all regulatory requirements. Canada's fish-inspection and quality management systems contribute to our worldwide reputation for safe, healthy fish and seafood products.

For shellfish, the protocols established through the Canadian Shellfish Sanitation Program are essential to ensuring that only safe product makes it to the marketplace. Extensive water quality and shellstock sampling are part of this program. The Canadian Food Inspection Agency, Environment Canada and Fisheries and Oceans Canada work together to regulate harvesting and restrict it, if necessary, to avoid any risks to public health.





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Seafood Nutrition

Canada's Food Guide defines and promotes healthy eating for Canadians. By eating the recommended amounts and types of food, Canadians can meet their nutritional needs and reduce their risk of nutrition-related chronic diseases. Canada's Food Guide directs Canadians to eat at least 150 grams (cooked weight) of fish each week. The Food Guide emphasizes fatty types of fish, such as farmed salmon, which are high in long-chain omega-3 fats.

Considerable volumes of research have demonstrated that seafood, and especially the long-chain omega-3 fats (eicosapentaenoic acid and docosahexaenoic acid), in seafood can deliver an array of potential health benefits. There is consistent evidence suggesting that eating seafood supports heart health in adults and normal growth and development in infants and young children.

Research is also ongoing in a number of other areas, particularly on the relationship between seafood consumption and improved blood pressure, stroke, cancer, asthma, type 2 diabetes, Alzheimer's disease and depression in adults, and attention deficit hyperactivity disorder in children. While this research is preliminary, it points to the fact that the benefits of eating seafood are very positive.

Scientific reviews or human health risk assessments conducted by Health Canada have shown that the levels of contaminants in Canadian seafood are considered safe to human health. Moreover, the levels are the same for farmed and wild species. For more information on seafood nutrition please visit the following website: <http://www.ats.agr.gc.ca/sea-mer/hs-mq-eng.htm>.

Tracing Products through the Value Chain

A functioning traceability system that can identify where a product is at any given time, where it has been prior to its current location, and what was done to it along the way can help preserve all the positive attributes of aquaculture products. A sophisticated traceability system can track finfish from egg to juvenile to adult fish (and feed), through to the marketplace, and shellfish from larvae to seed to final sale. This maintains confidence in Canada's farmed seafood.

Traceability is a way of demonstrating and verifying product attributes, but traceability is also an important mechanism for ensuring product safety. For example, the Canadian Food Inspection Agency mandates that every bag of oysters, clams or mussels taken from Canadian waters be tagged with the location, time and date of harvest so that if there is a health concern linked to shellfish, there is a way to trace back to the specific harvest location and recall other products from that same location. This is an international protocol to which Canada is a signatory and represents another facet of the Canadian Shellfish Sanitation Program.

A 2010 study commissioned by Fisheries and Oceans Canada to evaluate traceability systems for Canadian farmed finfish and shellfish gave a high rating overall to Canada's aquaculture industry for traceability readiness



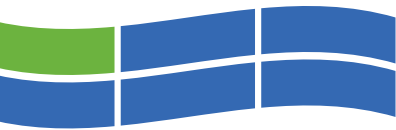


A Case Study: Tracing Salmon from Egg to Plate

Traceability is an important tool for demonstrating value-chain transparency as well as meeting increasing regulatory, food safety and consumer requirements. Cooke Aquaculture is developing an “Offspring Traceability” program that will lead the way in genetic tracking of salmon from egg to plate.

The Offspring Traceability program’s database uses a new DNA-based tracking system that will follow each fish through the value chain. Years of research, development, analysis and refinement have made Offspring a successful program for using genetics as a main marking tool for traceability, product quality and food safety. The full implementation of this program will still take some time, but the end result will be a sophisticated network that gives consumers the ability to use an in-store scanner or home computer to enter a code and see instantly at which hatchery their fish was spawned, in which ocean pen it was raised, at which plant it was processed, what it was fed, and whether it was given any medical treatments during its life cycle.

Phase one of the project – from egg (broodstock) to transfer to saltwater (smolt) – has been completed. Phase two will link saltwater (the sea site) to processing, while phase three will make the connection from processing to market delivery. Phase four will link consumers into the system. Completion of the project is an estimated three years away.



Aquaculture in Canada 2012

Management & Performance

Actions Moving Forward

The National Aquaculture Strategic Action Plan Initiative has identified a number of priority activities to address the safety and nutritional value of products of aquaculture. Progress on the implementation of National Aquaculture Strategic Action Plan Initiative actions will be presented in future reports.

National Aquaculture Strategic Action Plan Initiative Actions

- Canadian Shellfish Sanitation Program- (CSSP-1) Modernize the Program to make it more responsive to the needs of markets and producers (improve communications and information sharing related to the Program management process, especially with respect to restricted areas).



In addition to these activities of the National Aquaculture Strategic Action Plan, the following aspects of aquaculture sustainability related to ensuring safe and healthy seafood products have been identified in this reporting process and could be addressed in future reports:

- Best Management Practices and third-party certification for safe products (therapeutants, contaminants, pathogens) continue to be developed by the sector.
- Managing production according to science-based decisions and analyzing potential environmental outcomes to maintain high nutritional value is important to producers and consumers.
- Quality Management Programs continue to be developed by the sector to deliver safe and healthy seafood products.
- Aquatic farmers require access to supporting programming similar to that in other food-producing industries including on-farm food safety programs.

Future Reporting & Further Reading

The feasibility of developing indicators related to voluntary certification of the aquaculture sector and tracking of aquaculture-related recalls is being assessed for inclusion in future reports.

For more details on how Canada ensures the health and safety of its aquaculture products, please consult the Fisheries and Oceans Canada Sustainable Seafood website at: <http://www.sustainable-seafood.ca>



Using Resources Efficiently

Efficient use of resources required to conduct operations is fundamental to aquaculture sustainability. Feed management, water and energy consumption, and production-area optimization are all important components of sustainable resource use. In a highly competitive environment, the ability to find operational efficiencies is a significant contributor to economic success.

“Skretting will only source fish meal and fish oil from fisheries that are regulated and monitored as being sustainable. Skretting is however mindful that the definition of sustainability used by individuals, markets and consumers can vary significantly across the world and the measurement for sustainability may be different. We understand, and have seen at first hand, excellent fishery monitoring and control systems operated by governments but also recognise that for others, independent certification of sources is preferred.”

Skretting Sustainability Statement

How the sector is working to maximize resources

Feeding Fish Efficiently

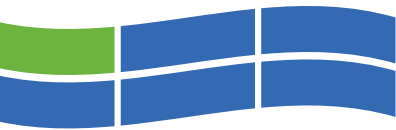
The continued sustainable development of the finfish aquaculture sector in Canada depends in part on the ability of the aquafeed industry to supply innovative, cost-effective and sustainably sourced feed products.

Approximately 40 to 60 percent of a salmon farm's operating cost is feed; therefore, avoiding excess feed is important for both economic and environmental reasons. Farmed fish are excellent protein converters – over the full production cycle, an average of 1.2 kg of feed produces 1 kg of farmed salmon, and many producers have a ratio of 1:1 or lower. The Canadian aquafeed sector is a global leader in replacement of fishmeal and fish oil with alternative feed sources, and the sector is researching the further development of alternative feeds from animal, vegetable, microbial and algal sources.

Seven companies, operating nine aquaculture feed mills, currently produce aquaculture feeds in Canada. Mills in British Columbia, Ontario, New Brunswick and Nova Scotia annually produce an estimated total of 150,000 to 200,000 tonnes of feed. By comparison, Norway recently passed the one million tonnes threshold.

The Canadian Food Inspection Agency regulates the feed industry in Canada at the federal level. Strict raw-material selection criteria are used to ensure a high-quality feed. Under the authority of the federal Feeds Act, the Canadian Food Inspection Agency verifies that livestock feeds, including fish feeds, manufactured and sold in Canada or imported into Canada are safe, effective and labelled appropriately.

Canadian aquaculture feed producers purchase fish meal and fish oil in the international market. Purchasing decisions are based on the best available information and a variety of criteria that may include such factors as a supplier's adherence to the Food and Agriculture Organization Code of Conduct for Responsible Fisheries, availability of local sources of trimmings, the International Fish Meal and Fish Oil Organization Responsible Supply Certification, and other certifications for food safety and traceability. Raw materials are traceable to source.



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Developing Integrated Systems

In nature, there is always a species that finds a feeding niche in another species' outputs. Farming complementary species together offers a scientifically sustainable way to optimize production areas.

Integrated Multi-Trophic Aquaculture (IMTA) is a customized farm-based ecosystem that utilizes farmed fish, such as salmon, together with natural biofilters like mussels and seaweeds on a single farm site, so that more of the nutrients originating from the high-energy fish feed are utilized. The seaweed takes nitrogen out of the water, and the mussels thrive in an enriched environment. At the same time, the seaweed, which is used for human food and in health and beauty products, grows some fifty per cent faster as a result of the nitrogen-rich IMTA waters. Mussels in this environment have similar accelerated growth.

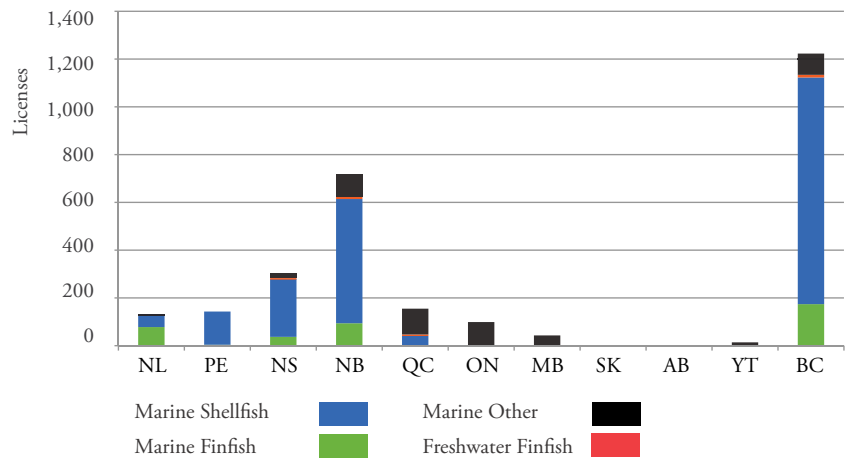
Research is ongoing to determine how best to develop this concept. For further information consult the following website: <http://www.cimtan.ca/>.

Production-Area Optimization

As a food-production sector, aquaculture should be able to produce as much as possible with the resources available while maintaining other attributes of sustainability. One way of looking at this is through the use of the physical space that the sector occupies (see Figure 9).

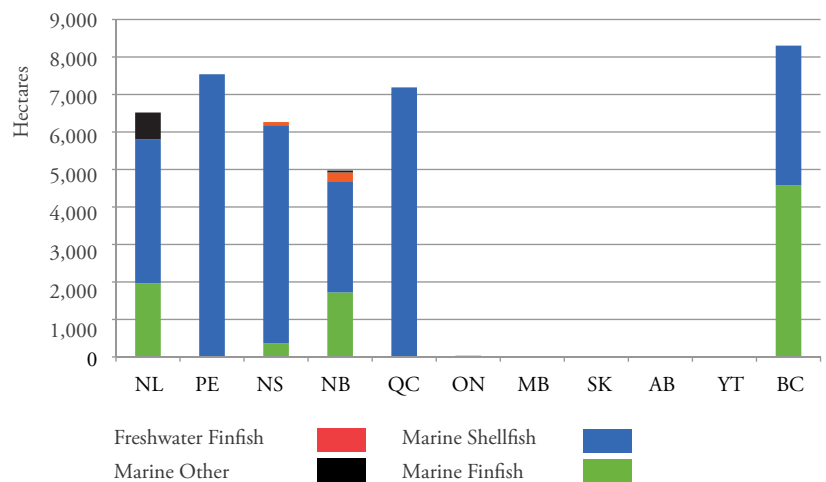
Through the Aquaculture Sustainability Reporting Initiative process, Fisheries and Oceans Canada is working with provincial governments and the industry to determine the best way to indicate how the sector utilizes space. This will be a function of numbers and types of operations (see Figure 8), species, environment, farming cycles, production levels, area and volume, and other factors. The diversity of the sector across Canada presents many challenges to assessing these variables. While we continue this process, we have compiled statistics on the number of aquaculture facilities and the amount of public land under lease to aquaculture, by province, environment, and species group. Together with the production information given in the Aquaculture Sector Snapshot section of this report, these statistics give some indication of the scale and extent of the sector.

Figure 8 Number of Aquaculture Licences, by Province and Species

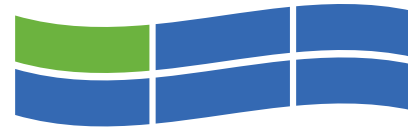


Source: DFO (Data provided by provincial and territorial governments)
 Note: Sites may be licensed for more than one species resulting in multiple counting.
 Note: Marine Other may include marine plants and species such as sea cucumber and sea urchins.

Figure 9 Hectares Under Lease, by Province and Species



Source: DFO (Data provided by provincial and territorial governments)
 Note: Sites may be licensed for more than one species resulting in multiple counting.
 Note: Marine Other may include marine plants and species such as sea cucumber and sea urchins.

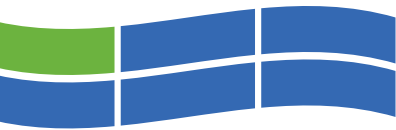


A Case Study: Leading the Way in Feed Research & Development

Feed is an important aspect of finfish aquaculture sustainability, in terms of cost, environmental impacts, and the use of wild-harvest species in meal and oil. These issues have created a strong incentive to reduce the reliance on marine-derived resources for aquaculture feed manufacturing and utilize alternative sources to replace protein and oil from marine resources. Canadian producers are leading the effort to reduce reliance on fish-based ingredients. In the early 1990s, fishmeal and fish oil comprised 50 to 60 per cent of feed; now it is well under 30 per cent.

Farmed salmon utilize feed more efficiently than terrestrial or land-based farmed animals. Salmon are cold-blooded so do not expend energy maintaining a constant body temperature. They do not have to swim against strong water currents or devote biomass to reproduction unlike wild salmon. Farmed salmon are the most efficient of all the commercially raised farm-fed animals, able to convert one kilogram of feed into one kilogram of flesh. In contrast, the feed conversion of poultry is between three and five to one and pork is eight to one.

Canada benefits from a large and dynamic agricultural and agri-food sector, which includes aquaculture, and has a strong tradition of research in the field of fish nutrition and feed technology. Canada's aquafeed sector is a leader in terms of fishmeal and fish oil replacement by alternative sources. These attributes make Canadian aquaculture producers well positioned to improve their environmental and economic sustainability performance through the use of alternative feeds.



Aquaculture in Canada 2012

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Actions Moving Forward

The National Aquaculture Strategic Action Plan Initiative has identified a number of priority activities to address issues related to efficient use of resources. The implementation of National Aquaculture Strategic Action Plan Initiative actions will be presented in future reports.

National Aquaculture Strategic Action Plan Initiative Actions

- Emerging Technologies (ET-3) - Invest in research and development to advance commercial closed-containment aquaculture systems and recirculating aquaculture systems
- Emerging Technologies (ET-6) - Advance development and implementation of Integrated Multi-Trophic Aquaculture
- Aquafeed (AF-1) - Support research and development to improve the quality and availability of aquafeeds in Canada
- Aquafeed (AF-1.1)- Continue to evaluate the availability of alternative feed ingredients sourced from the wild fishery and aquaculture (e.g., processing by-product, by-catch, etc.) to enhance the value of these resources, improve utilization, and foster a more sustainable aquafeed sector.

In addition to these activities of the National Aquaculture Strategic Action Plan, the following aspects of aquaculture sustainability related to using resources efficiently have been identified in this reporting process and could be addressed in future reports:

- Lifecycle analysis – standardizing processes and units so that they are meaningful, comparable among regions, provinces, countries and sectors, as well as being understandable for all stakeholders. Such analysis would include energy, water and other resource use at various stages of production
- Bay Management and integrated marine spatial planning
- Maximizing feed conversion ratios and developing standardized measurements to calculate Fish In Fish Out ratios
- Identifying and assessing optimal (environmental, social and economic) marine

Future Indicators & Further Reading

Members of the Canadian Aquafeed Working Group, formed under National Aquaculture Strategic Action Plan Initiative, worked together with Fisheries and Oceans Canada to determine potential sustainability indicators for the Aquaculture in Canada 2012: A Report on Sustainability. Two indicators related to aquaculture feed were selected:

- Responsible sourcing of marine raw materials;
- Marine ingredients in aquaculture feed.

Through the Aquaculture Sustainability Reporting Initiative, work will continue on the establishment of the collection and management system that will meet the industry and government requirements and enable national reporting on feed-related indicators, as well as energy and water use.

For more details on how Canadian aquaculture operators work to improve their use of important resources, please consult the Fisheries and Oceans Canada Sustainable Seafood website at: <http://www.sustainable-seafood.ca>



Encouraging Social Responsibility

The federal government supports social responsibility through laws that preserve labour rights and protect Charter freedoms for all Canadians. Through regulations, monitoring and enforcement, governments can build consumer and public trust in the aquaculture industry. The sector itself is also committed to earning and upholding public confidence. This means operating in a manner that respects local communities as well as aboriginal and labour rights, maintains safe workplaces, and demonstrates that all these systems are in place and functioning.

Developing a socially responsible aquaculture sector

Demonstrating Sustainability Attributes

The aquaculture industry operates under federal and provincial government regulatory and management programs in addition to undergoing voluntary audits to demonstrate compliance to a range of certification standards. For the aquaculture sector, part of being socially responsible is demonstrating sustainability - through work with non-governmental organizations and third-party certification programs that evaluate the extent to which an operation meets an auditable standard.

There are a number of certification standards applicable to the aquaculture sector. The Aboriginal Aquaculture Association has developed an integrated, aboriginal management and certification program for aquaculture in Canada. This auditable program includes acknowledging the values and interests of aboriginal communities in the management of aquaculture operations, and

applicants who attain this certification qualify to use the “AAA Certified Sustainable” logo. The Canadian Aquaculture Industry Alliance is working with Global Trust to develop a certification model based on the standards and guidelines created by the Food and Agriculture Organization. The Best Aquaculture Practices of the Global Aquaculture Alliance have been adopted by some, while others are working with the Sustainable Seafood Partnership to establish improvement plans. These and other programs offer the aquaculture sector the opportunity of attaining third-party certification of their operations.

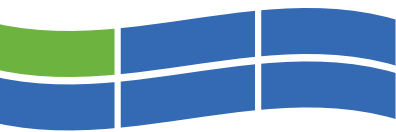
Building a Skilled Workforce and Giving Back to Communities

The Canadian aquaculture industry provides an estimated 14,500 full time equivalent jobs, many of which are in the rural and coastal communities where farms are located. Many of these workers are under the age of 35.

Communities have seen how aquaculture can revitalize their economies, especially in light of declines in other natural resource sectors. In turn, the industry has benefited from a skilled and stable workforce. Providing good jobs in a safe working environment with the possibility of advancement through appropriate training is a responsibility that aquaculture operators take seriously.

Furthermore, communities across the country have seen how aquaculture companies and their employees make a positive impact locally through their active involvement in volunteerism where they live and work. By supporting local events and investing in communities through corporate giving, volunteering, jobs and infrastructure, the aquaculture industry improves the quality of life for all residents.

The aquaculture industry supports wild-salmon conservation projects, beach cleanup activities and other community events. Many operators directly support and lead wild-fishery enhancement projects working in cooperation with local fish and game clubs, and in conjunction with regulatory authorities. Financial donations to high school, trade and university scholarships, school projects and community organizations, as well as product donations to fundraisers, food banks and many more initiatives show the industry's commitment to their communities.



Aquaculture in Canada 2012

Management & Performance

Indicator: Employment

In 2010, Fisheries and Oceans Canada, in conjunction with provincial governments, commissioned a study assessing the socio-economic impacts of aquaculture in Canada. This work (which can be found at <http://www.dfo-mpo.gc.ca/aquaculture/ref/stats/aqua-ff-fc-2009-eng.htm>), based largely on Statistics Canada data and models, determined the number of direct, indirect, and induced jobs generated by the sector across the country. These results are presented in the table below. Looking across Canada, the aquaculture sector directly employs 4,900 individuals in full-time equivalent positions (FTE). Another 6,400 individuals are employed indirectly in fish feed manufacturing, transportation and other secondary industries. Finally, the spending of incomes earned by those directly and indirectly employed generates 3,200 FTE jobs elsewhere in the economy. Another way to look at this information is in terms of employment generated. For every direct job in aquaculture, two spin-off jobs are created elsewhere in the economy.

The way aquaculture data are collected presents challenges for national reporting. Owing to data available at the time of this report, these results are considered accurate as of 2007 levels of activity. Data reported through Statistics Canada captures aquaculture activities defined as those related to hatchery, grow-out and processing. It is recognized that this does not capture all aquaculture activity. As well, a uniform approach to compiling data is not in place. A province-by-province review of data was conducted for the *2010 Socio-Economic Impact of Aquaculture in Canada* report, and adjustments were made to best reflect the full picture of aquaculture employment in Canada. However, it is recognized that differences still remain between provincial-level reporting and this national study.

Fisheries and Oceans Canada also acknowledges that significant changes have occurred in the sector since 2007 and efforts are underway through the Aquaculture Sustainability Reporting Initiative to update the information. For example, employment increases have occurred in Newfoundland and Labrador and Nova Scotia, and in various sub-sectors across the country.

Table 3 - Canadian Aquaculture Sector Employment, 2007

	NL	NS	PE	NB	QC	ON	MB/SK/ AB	BC	Other	Canada
Employment (FTE)										
Direct	215	380	790	1,100	80	110	~	2,220		4,895
Indirect	120	170	125	790	35	55	~	2,330	2,775	6,400
Induced	70	120	250	530	45	51	~	1,410	724	3,200
Total	405	670	1,165	2,420	160	216	~	5,960	3,449	14,495

Source: *Socio-Economic Impact of Aquaculture in Canada*, DFO 2010

~ - Data suppressed to meet confidentiality requirements of the Statistics Act

~ data suppressed to meet the confidentiality requirements of the Statistics Act

*Provincial data in Québec for 2007 reported 302 FTEs. Different from national reporting, Québec includes activity related to re-stocking in total employment figures. Re-stocking refers to sales to outfitters, operations offering lodging, and services for hunting, fishing and trapping.

** The "other" column refers to indirect and induced employment that is not accounted for under each province. The impacts of aquaculture are national in scope. For example, aquaculture companies may procure goods and services from outside their provincial borders. This generates economic impact and employment beyond their home province.

Aquaculture in Canada 2012

Management & Performance



Marine Harvest Canada

A Case Study: Kitasoo Aqua Farms

With the downturn of the wild-salmon fishery in the mid-1980s, the Kitasoo/Xai'xais First Nation, located in the community of Klemtu on the central coast of British Columbia, decided to diversify its economy by pursuing salmon farming and operated an independent salmon farm from 1988 - 1994. Kitasoo Aqua Farms entered into a joint venture with Nutreco Canada (now Marine Harvest Canada) to farm and process salmon. The resulting fish farms and processing activity have been an economic boon to the community. Today, salmon aquaculture operations contribute about \$1.5 million in local annual wages, and more salmon is harvested and processed each week than was produced in an entire year at the pre-partnership farm.

In 1999, the partnership delivered a customized and accredited six-month aquaculture training program through North Island College. Twelve Kitasoo community members graduated from the program and many still work in the business. Band members are also given opportunities and training to enable them to rise to management positions at the farms.

The Kitasoo/Xai'xais joint venture is a success story in partnership and economic diversification. The Kitasoo/Xai'xais owned processing plant is capable of handling a variety of seafood products and the venture made a strategic investment in intensive training and upgrading to bring its crew and processing facilities up to competitive efficiencies of operation. The Kitasoo/Xai'xais people were able to acquire the necessary investment capital to keep their processing operations, while maintaining local control, jobs, training and other benefits from the salmon farms. To protect traditional food harvesting, the partnership also consulted intensively in the community on siting the farms, and the Kitasoo/Xai'xais launched their own program of environment monitoring to ensure the long term sustainability of their operations.



Aquaculture in Canada 2012

Management & Performance

Actions Moving Forward

The National Aquaculture Strategic Action Plan Initiative has identified a number of priority activities to address issues related to social responsibility. Progress on the implementation of National Aquaculture Strategic Action Plan Initiative actions will be presented in future reports.

National Aquaculture Strategic Action Plan Initiative Actions

- Social Licence (SL-1) - Establish a transparent information sharing system to facilitate aquaculture reporting
- Aboriginal Engagement in Aquaculture (AEA-1) - Explore mechanisms and strategies for engaging aboriginal peoples in the implementation of the National Aquaculture Strategic Action Plan Initiative and generate awareness of opportunities for expanded engagement in aquaculture development among First Nations and other aboriginal groups
- Marketing and Certification (MC-1) - Prepare industry to adopt international aquaculture certification programs

In addition to these activities of the National Aquaculture Strategic Action Plan, the following aspects of aquaculture sustainability related to social responsibility have been identified in this reporting process and could be addressed in future reports:

- Improving public confidence in the sector
- Developing labour force skills
- Addressing aboriginal groups' needs and increasing inclusion in industry benefits
- Supporting the development and existence of producer groups, industry associations and co-operatives that will provide leadership, facilitate marketing efforts, drive industry expansion, and provide extension services and training opportunities
- Enhancing workplace safety and wellness

Future Indicators & Further Reading

Tracking the number of jobs created through aquaculture development is an issue of interest identified by the Technical Working Groups and future reports will include indicators related to this.

For more details on how Canadian aquaculture operators work to encourage social responsibility, please consult the Fisheries and Oceans Canada Sustainable Seafood website at <http://www.sustainable-seafood.ca>





Encouraging an Economically Viable & Successful Sector

The sustainability of the aquaculture sector is directly linked to its economic viability and success in delivering economic growth in rural development, job creation, and domestic and international trade. These objectives apply to the many activities of the sector, including those associated with hatcheries, grow out, feed production, and processing operations, as well as the supply of goods and services.

“Sustainable aquaculture can sustain coastal First Nation communities and allow people to continue to live in and depend upon their tribal territories for culture and economic prosperity. For many First Nation communities, aquaculture presents an opportunity to pursue spiritual, cultural, political and economic development in support of a sustainable economy and community self-determination.”

Aboriginal Aquaculture Association

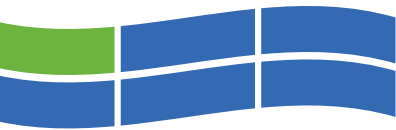
How the sector demonstrates the importance of aquaculture

Calculating the Economic Impact of Aquaculture in Canada

As noted earlier, aquaculture in Canada generates about \$2 billion in total economic activity, over \$1 billion in GDP and about half a billion in labour income. It provides thousands of direct jobs, and many more indirect jobs in industries with strong ties to the aquaculture industry. Production occurs across Canada, with activity concentrated in British Columbia and the Atlantic Provinces.

Demonstrating Aquaculture’s Importance to Coastal and Rural Communities

The aquaculture industry makes a substantial economic and socio-economic contribution to coastal and rural communities where aquaculture takes place. In these communities, aquaculture generates thousands of jobs and millions of dollars in income. It does so through direct activity at the farm sites, and also in indirect ways through links to suppliers of equipment, feed and services, as well as links to processors and marketers. In many cases, these communities are located in isolated areas where economic opportunity tends to be limited. The *2010 Socio-Economic Impact of Aquaculture in Canada* provides case studies from British Columbia, Ontario, Prince Edward Island and New Brunswick that illustrate the social and economic impacts of aquaculture at the community level.



Aquaculture in Canada 2012

Management & Performance

Aquaculture in World Markets

Canadian aquaculture products are sold to more than 60 countries around the world, with the majority of exports going to the United States. Farmed salmon is the largest aquaculture export, both by volume and by value, earning \$539 million in 2010. In fact, farmed Atlantic salmon is Canada's third largest seafood export by value, worth more than all other seafood products except lobster and snow crab. Mussels are the second most significant export item for aquaculture, contributing \$34 million to the Canadian economy in 2010.

Indicator: Labour Income Generated

The aquaculture industry delivers significant economic opportunity to Canadians. In 2007, the industry was responsible for over \$505.9 million dollars (Table 4) in labour income generated by 14,500 full-time equivalent (FTE) employees. More specifically, total direct¹ income was \$156.8 million while those working in support industries generated \$242.2 million in indirect² income. The last \$107.9 million of induced³ income was generated by individuals employed in the broader economy, supporting direct and indirect workers.

As discussed in the previous section, there are also challenges with national reporting on income statistics for the aquaculture sector. The 2010 study entitled *Socio-Economic Impact of Aquaculture in Canada*, based largely on Statistics Canada data and models, determined the direct, indirect, and induced income generated by the sector across the country. These results are presented in Table 4. Limitations to the data have been recognized and efforts are underway to improve the consistency in which income information is collected across the country.



¹ Direct Income refers to income generated from the expenditures made by aquaculture firms on the goods and services needed to produce industry outputs. (e.g hatchery and grow-out facilities, processing and corporate administration).

² Indirect Income refers to income generated from purchased inputs triggered by the direct demand. (Eg: aquaculture companies buy feed, transportation and cages from manufacturers, who in turn buy their inputs from other companies, and so on).

³ Induced Income refers to the employment and subsequent income generated in the broader economy through consumer spending of incomes earned by those employed in direct and indirect activities. (e.g. chefs, corner-store employees)

Aquaculture in Canada 2012

Management & Performance



Table 4 - Canadian Aquaculture Sector Income Generated, 2007

	NL	NS	PE	NB	QC	ON	MB/SK/ AB	BC	Other**	Canada
Labour Income (\$000's)										
Direct	6,200	12,200	22,200	32,700	2,600	2,720	~	78,400		156,820
Indirect	4,900	6,400	2,900	28,300	1,200	2,040	~	95,100		241,200
Induced	2,200	4,800	6,400	16,800	1,230	1,530	~	50,400		107,900
Total	13,300	23,400	31,300	77,800	5,030	6,290	~	223,900		505,920

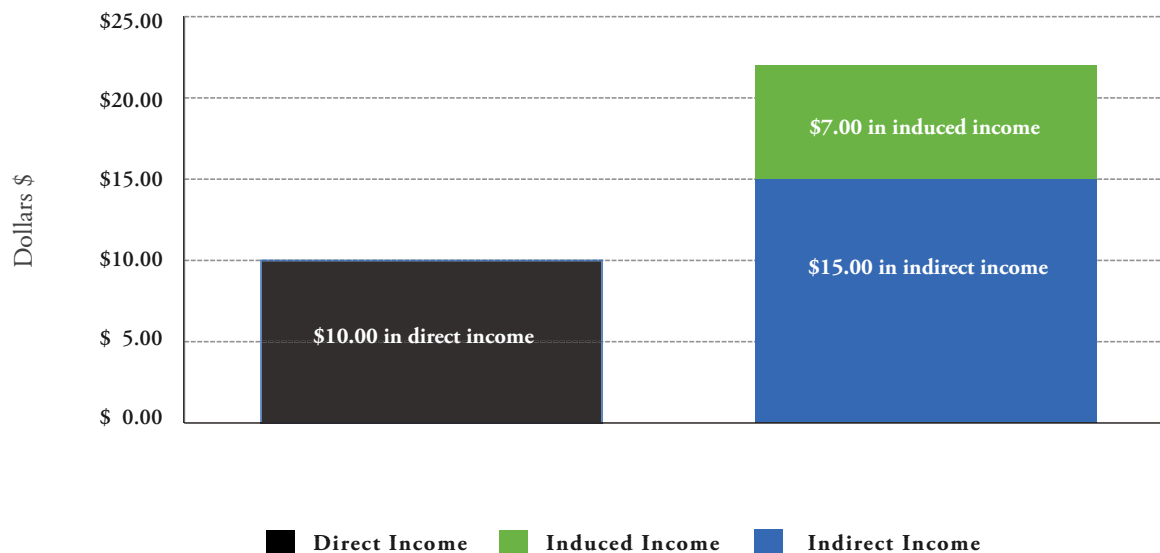
~ - Data suppressed to meet the confidentiality requirements of the Statistics Act

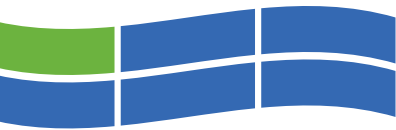
**Provincial data in Québec for 2007 reported \$13.3 million total income. Different from national reporting, Québec includes activity related to re-stocking in total income figures.

** The "other" column refers to indirect and induced labour income that is not accounted for under each province. The impacts of aquaculture are national in scope. For example, an aquaculture company may procure goods and services from outside their provincial borders. This generates economic impact and labour income beyond their home province.

Another way to interpret this indicator is in terms of economic impact at the community level. For example, for every \$10 of direct income realized, an additional \$22 is generated in spin-off income, \$15 in indirect income and \$7 in induced income, resulting in a spin-off ratio of approximately 1:2 (Figure 10). Particularly in rural communities where income potential may be limited, the benefits generated by the aquaculture industry play an important role by providing viable income opportunities.

Figure 10 : Spin-off Income Generated for the Canadian Aquaculture Sector, 2007





Aquaculture in Canada 2012 Management & Performance

A Case Study: The Coast of Bays Region, Newfoundland

The Coast of Bays Region is located on the south coast of Newfoundland. Interest in developing the aquaculture industry in the Coast of Bays began in the mid-1980s and large-scale production in the region successfully took off in the early 2000s. The marine environment of the Coast of Bays presents ideal conditions for farming finfish and shellfish. For example, sheltered bays and inlets offer protected areas for finfish net-pens and suspended shellfish gear culture. That said, the region can also experience hurricane-level events each fall. Therefore significant technological innovations have been made to improve and strengthen net-pen design, anchorage and nets to prevent equipment damage and loss of fish. Since 2008, Fisheries and Oceans Canada's Aquaculture Innovation and Market Access Program has contributed toward the development of innovative technologies and management techniques in the Coast of Bays Region.

The Province of Newfoundland and Labrador has made significant investments to upgrade infrastructure to support a vibrant aquaculture industry in the Coast of Bays Region, such as the construction of new wharves to improve bio-security measures, a salmon hatchery to produce smolt (juvenile salmon) from local broodstock (adult fish used for breeding), as well as a new Centre for Aquaculture Health and Development. Skilled, trained and knowledgeable workers as well as supplies and services are locally and readily available. Industries that support aquaculture, such as secondary processing, net-cleaning, diving, waste management, composting and feed production, also encourage the potential growth of the aquaculture industry in this region. Today, the region is alive with energy and activity – the sense of pride and confidence is clear.

Fisheries and Oceans Canada and the Atlantic Canada Opportunities Agency have together invested approximately \$24 million into the aquaculture industry in the Coast of Bays region over the last five years. This investment from the Government of Canada has boosted employment and economic opportunities, product diversification and strengthened business growth in secondary industries.

An Economic Snapshot

- Aquaculture production in the Coast of Bays Region has more than tripled since 2003.
- The region produced 13,625t of farmed fish and shellfish at a landed value of over \$55 million.
- There are ~80 finfish sites and 4 shellfish sites licensed in the Coast of Bays Region.
- The industry has contributed to 655 direct, full-time jobs.
- Additional employment has been created in the supply & service sectors.





Actions Moving Forward

The National Aquaculture Strategic Action Plan Initiative has identified a number of priority activities to address issues related to the economic viability of the sector. Progress on the implementation of National Aquaculture Strategic Action Plan Initiative actions will be presented in future reports.

National Aquaculture Strategic Action Plan Initiative Actions

- Alternative Species (AS-1-11) - Foster the development of commercially viable alternate- species aquaculture (cod, halibut, Arctic char, sturgeon, bay scallop, giant scallop, soft-shelled clam, walleye, geoduck*). These actions aim to prepare a comprehensive business case and developmental plan for alternate species aquaculture that includes a review of the following factors:
 - market opportunities
 - investment opportunities and challenges
 - technological needs/obstacles/critical constraints
 - realistic five - and 10-year projections for sector development

*There is also interest in sablefish (black cod) and sea cucumber as species for commercial development. Future reporting could include progress on these and other species as interest in their development is explored.

In addition to these activities of the National Aquaculture Strategic Action Plan, the following aspects of aquaculture sustainability related to ensuring an economically viable and successful aquaculture sector have been identified moving forward:

- Current economic climate
- Barriers for business – reporting burden
- Need for appropriate legislation
- Development of business risk management programs that place the aquaculture sector on a level playing field with other Canadian food production sectors

Future Indicators & Further Reading

Return on investment is an issue of interest related to the economic viability of the aquaculture sector that was identified by the Technical Working Groups and future reports will look to include related indicators.

For more details on the economic viability of the aquaculture sector in Canada, please consult the Fisheries and Oceans Canada Sustainable Seafood website at: <http://www.sustainable-seafood.ca>

Feedback on this Report

Fisheries and Oceans Canada is interested in your feedback on this report and the issues covered. We would like to know what was done well and what can be improved. You can offer your comments by sending an email to ASRI-IRDA@df-mpo.gc.ca.





Published by:
Fisheries and Oceans Canada
Ottawa, Ontario
K1A 0E6

DFO/2012-1803
Cat. No. Fs 45-1/2012E
ISBN 978-1-100-10131-3



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