IP(10)16

Aquaculture, Introductions and Transfers and Transgenics Focus Area Report

Canada

Fisheries and Oceans Canada | Pêches et Océans Canada

Focus Area Report on Aquaculture, Introductions and Transfers, and Transgenics

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Ottawa
January 2010

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Acronyms and Abbreviations

AANS	Aquaculture Association of Nova Scotia
AORA	Aquatic Organism Risk Assessment
ASEF	Atlantic Salmon Endowment Fund
ASF	Atlantic Salmon Federation
BMA	Bay Management Area
CAA	Controlled Aquaculture Area
CAIA	Canadian Aquaculture Industry Alliance
CEAA	Canadian Environmental Assessment Act
CEPA	Canadian Environmental Protection Act
CFIA	Canadian Food Inspection Agency
DFO	Fisheries and Oceans Canada
EDR	Emergency Drug Release
FHPR	Fish Health Protection Regulations
HADD	Harmful alteration, disruption or destruction
I&T	Introductions and Transfers
ISFA	International Salmon Farmers Association
MAPAQ	Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec
NAAHP	National Aquatic Animal Health Program
NAC	North American Commission
NAIA	Newfoundland Aquaculture Industry Association
NB-DAA	New Brunswick Department of Agriculture and Aquaculture
NB-DENV	New Brunswick Department of Environment
NBSGA	New Brunswick Salmon Growers Association
NL-DFA	Newfoundland and Labrador Department of Fisheries and Aquaculture
NS-DFA	Nova Scotia Department of Fisheries and Aquaculture
NSNR	New Substances Notification Regulation (Organisms)
NWPA	Navigable Waters Protection Act
OIE	World Organisation for Animal Health
PEI	Prince Edward Island
PEIAIA	Prince Edward Island Aquaculture Industry Alliance
PEI-DFRD	Prince Edward Island Dept of Fisheries, Aquaculture and Rural Development
PMRA	Pest Management Regulatory Agency
SAP	Sustainable Aquaculture Program
SARA	Species at Risk Act
SMA	Salmon Management Area

PREAMBLE

This Focus Area Report (FAR) on Aquaculture, Introductions and Transfers, and Transgenics in Canada provides a summary of the regulatory and management processes of Canadian aquaculture, introductions and transfers (I&T), and transgenics, and of the measures taken to minimize their impacts on wild salmon stocks. This FAR provides information relative to the geographic area of Canada within the corresponding area of the North Atlantic Salmon Conservation Organization (NASCO). This encompasses the Atlantic Provinces (Newfoundland and Labrador (NL), Nova Scotia (NS), Prince Edward Island (PEI), New Brunswick (NB)), and areas of the Province of Quebec (QC) with watersheds draining to the Atlantic Ocean.

This report has been completed by Fisheries and Oceans Canada (DFO) as the lead federal department for the Government of Canada as a signatory to NASCO. The report is structured according to the template (CNL40.970) provided by NASCO based on the Williamsburg Resolution (CNL(06)48), and incorporating the elements from the Guidance on Best Management Practices (SLG(09)5).

The preparation of this report followed an extensive consultative process. A working group was formed with representatives from provincial departments, aquaculture industry associations, and DFO. This group brought together information as it pertained to each provincial jurisdiction and prepared a working draft report. A meeting was then held with this working group, as well as the Atlantic Salmon Federation (ASF) to discuss the draft, make revisions, and make suggestions for further work. Follow-up meetings were then arranged with each of the provincial level groups to address these matters and complete the report.

The information in this report clearly demonstrates a strong legislative, regulatory, and policy environment, as well as effective collaboration between government, industry, and non-governmental groups, for conservation and management of wild Atlantic salmon. This environment provides a solid basis for minimizing adverse impacts of aquaculture, introductions and transfers, and transgenic salmonids on the ecosystem and wild stocks. Aquaculture matters are being addressed through risk assessments, environmental assessment, siting, and improved farm and health management programs. Canada addresses introductions and transfers issues following an established code designed to avoid the risk of genetic, ecological, and disease impacts through a standardized risk assessment process. To date, Canada has not approved any applications for transgenic fish for use in commercial aquaculture or for any introduction or transfer, and has a regulatory and policy program in place to consider such applications.

Readers of this report should note the following that describes how information has been assembled, as much as possible, into the broad topics of aquaculture, I&T, and transgenics:

- Information has been summarized to give a combined overview as it relates to the geographic area of the Atlantic Provinces and the Province of Quebec corresponding to the NASCO area. Provincial-specific information is given only to provide clarity or to give a specific example.

- Aquaculture information relates mainly to the provinces of New Brunswick, Nova Scotia, and Newfoundland and Labrador to reflect the relative concentration of the sector in these areas. Information provided specifically for Prince Edward Island and Quebec is given only as required.
- Aquaculture information is mainly provided as it relates to marine-based activity, as it is widely accepted that this component of salmon farming comprises the primary risks to wild salmon. Information on freshwater aquaculture is provided for clarity.

In many places this report makes reference to relevant federal and provincial legislation, regulations, and policies. A listing of these is found in Annex 1.

While this report is structured according to the template provided by NASCO, readers should note that this template was somewhat repetitive and this is reflected in the report content. We have endeavoured to not repeat information between sections, and to refer readers between sections, although in some cases this was not possible. In some cases, we have provided further elaborations on similar topics between sections.

1.0 INTRODUCTION

1.1 Overview of Activities

Aquaculture

The salmon aquaculture industry in Atlantic Canada is concentrated in the province of New Brunswick, with significant activities also in Nova Scotia and Newfoundland and Labrador. According to the estimate provided by the industry, together the three provinces produced 35 thousand tonnes of salmon or 32% of total Canadian farmed salmon production in 2008.[1] The industry provided more than 1,200 direct and 5,600 indirect jobs in Atlantic Canada.

In New Brunswick, the marine farms are located in the Bay of Fundy, in Nova Scotia in the Bay of Fundy as well as along the Atlantic coast, and in Newfoundland and Labrador in the areas of the Bay D'Espoir and Fortune Bay. Some of the companies are vertically integrated, while others rely on external service and supply industries. Prince Edward Island (PEI) and Quebec do not have marine salmon grow-outs, but PEI has hatcheries that support the industry in New Brunswick, Nova Scotia, and Newfoundland. All marine farms are operated for commercial production.

Both commercial and recreational freshwater salmonid aquaculture facilities are located throughout the Atlantic Provinces and Quebec.

The industry in these provinces predominantly participates in the following associations: New Brunswick Salmon Growers Association (NBSGA), Aquaculture Association of Nova Scotia

[1] These figures are slightly higher than those reported in the annual aquaculture survey report 2008 by Statistics Canada. The difference is due to the manner in which Statistics Canada combines data.

(AANS), Newfoundland Aquaculture Industry Association (NAIA), and the Prince Edward Island Aquaculture Industry Alliance (PEIAIA). Many companies are also members of the Canadian Aquaculture Industry Alliance (CAIA).

Introductions and Transfers

The majority of introductions and transfers (I&T) in salmon aquaculture in the subject area can be categorized as either freshwater to freshwater movements of eggs or fish between hatcheries, or freshwater to saltwater movements of smolt from hatcheries to marine cage sites. These transfers occur within or between the Atlantic Provinces and Quebec, or within the North American Commission of NASCO. They are all governed by a national I&T code (the *National Code on Introductions and Transfers of Aquatic Organisms*), and related regulatory procedures.

There is also a significant amount of I&T that occurs for non-aquaculture purposes, such as for stock enhancement programs.

Transgenics

No transgenic salmonids have been approved for commercial aquaculture, release, or consumption in Canada. Government approval for transgenic salmon in Canada is limited to research in contained facilities to help assess environmental and human health risks, and performance characteristics of transgenic fish. CAIA does not support transgenic salmon aquaculture and adheres to the following policy of the International Salmon Farmers Association (ISFA): "In accordance with sound environmental practice, the ISFA firmly rejects transgenic salmon production."

1.2 Policy and Management Structure

Aquaculture

Aquaculture and I&T regulation and management in Atlantic Canada and Quebec are shared responsibilities according to the federal and provincial legislation, regulations, and policies.

There are 17 federal departments and agencies which have a direct influence on aquaculture development. DFO is the lead federal department. The *Aquaculture Policy Framework*, introduced by DFO in 2002, guides responsible aquaculture growth in Canada.

All freshwater aquaculture operations in the Atlantic Provinces and Quebec are licensed to operate according to provincial legislation, regulation, and policy.

All marine salmon aquaculture operations must obtain an underwater land lease and an operational licence to carry out their activities. The provinces, except PEI, administer these leasing and licensing processes for all near shore activities under Memoranda of Understanding (MOUs) with DFO. In PEI, DFO provides the leasing and licensing authority (however, it should be noted that there are no marine salmon farms in PEI).

In relation to marine aquaculture, federal authorities including DFO are required to:

- conduct environmental assessments and cumulative environmental effects assessments under the Canadian Environmental Assessment Act (CEAA);
- review all proposals for potential impacts on fish, fisheries, or fish habitat and issue an authorization for any harmful alteration, disruption or destruction (HADD) of fish habitat under the Fisheries Act;
- issue navigable waters approvals under the Navigable Waters Protection Act (NWPA); and
- minimize and mitigate risk or issue a permit pursuant to the Species at Risk Act (SARA).

All project proposals are subject to public advertisement to notify the public about the application and to give an opportunity to comment. There is also a public consultation process during any environmental assessment under CEAA or any environmental assessment triggered under provincial legislation.

At the provincial level, the aquaculture management structure consists of three broad groups of activities: (i) licensing and leasing, (ii) regulating farm activities including containment and waste management, and (iii) aquatic animal health. The following departments coordinate with DFO and other provincial and federal departments to accomplish these activities:

- New Brunswick Department of Agriculture and Aquaculture (NB-DAA)
- Nova Scotia Department of Fisheries and Aquaculture (NS-DFA)
- Newfoundland and Labrador Department of Fisheries and Aquaculture (NL-DFA)
- PEI Department of Fisheries, Aquaculture and Rural Development (PEI-DFRD)
- Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec (MAPAQ)

These provincial departments act as the distribution centre to ensure all applications and supporting documents are circulated to the required federal and provincial departments for review and approval. They are responsible for issuing a commercial aquaculture licence and aquaculture lease or aquaculture occupation permit. New Brunswick Department of Environment (NB-DENV) and Newfoundland Department of Environment (NL-DENV) also issue an Approval to Operate under their respective provincial acts.

An example of the aquaculture application review process in Canada can be found in Annex 2.

Licence terms and conditions stipulate that the proponent follow all the required federal and provincial legislation with regard to the operation of the marine aquaculture facility. To facilitate these stipulations, industry associations have developed policies and codes of practice in consultation with the various federal and provincial departments. Non-compliance with any piece of federal or provincial legislation or regulation is subject to the respective penalties. For example, under the federal *Fisheries Act*, contraventions are subject to prosecution under the *Act* and may result in significant fines and/or defined actions. Contravention of aquaculture licences may result in non-renewal or revocation of that privilege.

In 2008, the federal government launched a five-year Sustainable Aquaculture Program (SAP) with a budget of $70 million. The mission of SAP is to set the conditions for the success of a

more vibrant and innovative Canadian aquaculture sector that is environmentally and socially sustainable and internationally competitive for the benefit of all Canadians. SAP now largely guides DFO's aquaculture programming articulated in the following four inter-related program components: (1) Governance and Regulatory Reform; (2) Innovation; (3) Certification and Market Access; and (4) Regulatory Science. The Governance and Regulatory Reform component is focused on environmental management, whereas Regulatory Science pursues research to support the activities of the Governance component as well as to generate knowledge on various aspects of aquaculture. The other two components of SAP support the development of more sustainable aquaculture technology and management and market competitiveness of the industry.

Introductions and Transfers

All introductions and transfers are evaluated under the auspices of the national I&T Code. The code was developed by DFO and the provinces and territories and endorsed by the Canadian Council of Fisheries and Aquaculture Ministers in 2002 to protect aquatic ecosystems while encouraging responsible use of aquatic resources. Federal-provincial I&T committees are established in each province to manage implementation of the code. This includes an application-based process for approvals, and a standardized risk assessment process. The risk assessment process provides for evaluating the risk of genetic, ecological, and disease impacts as well as the potential for introducing and spreading of pathogens and parasites that might accompany aquatic organisms being moved. The objective of the risk assessment is to identify whether the proposed introduction or transfer presents a *low*, *medium* or *high* risk for the receiving environment. The risk assessment is an adaptation of internationally acknowledged models and processes. The I&T committees screen all applications as being either a routine or non-routine movement. Routine movements may be handled by the Chair of the Committee. If the Committee determines that the movement is non-routine, then it will decide whether or not the application would require further review in the form of an Aquatic Organism Risk Assessment (AORA). The flowchart in Annex 3 illustrates the I&T approval process.

All I&Ts in Atlantic Canada and Quebec are licensed according to the *Fishery (General) Regulations* (s.56) under the federal *Fisheries Act* and under provincial legislation, where applicable. Federal-provincial I&T committees are the focal point of contact for all applications to transfer salmonids within and from outside the provinces. In exceptional circumstances, the Minister of Fisheries and Oceans may authorize importation directly under the federal *Fisheries Act* (s.4).

The imports of salmonid fish into Canada or transfers between provinces also require an import permit under the *Fish Health Protection Regulations* (FHPR) of the federal *Fisheries Act* (s.43). The FPHR requires pathogen testing to certify the fish health status of a fish rearing facility pursuant to a prescribed list of pathogens or to any disease agent causing cytopathic effects. The FPHR are administered by DFO and by fish health officers in each province. Provincial veterinary authorities usually also require further fish health surveillance, disease diagnostics, cleaning and disinfection protocols, and other bio-security provisions.

Transgenics

As mentioned above, currently there is no use of transgenic fish in commercial salmonid aquaculture in Canada. DFO and other federal departments have jointly developed a *Federal Biotechnology Regulatory Framework* to provide guidance on regulating animate products of biotechnology. The *New Substances Notification Regulation (Organisms)* (NSNR) under the *Canadian Environmental Protection Act* (CEPA) applies to new living organisms that are animate products of biotechnology, including aquatic organisms. DFO signed an MOU in 2004 with Environment Canada and Health Canada respecting the implementation of the regulation for certain aquatic living organisms. In the event of an application being made for transgenic aquaculture, DFO will be able to use the NSNR in addition to other regulatory tools to assess the application.

2.0 IMPLEMENTATION OF THE WILLIAMSBURG RESOLUTION

2.1 Minimizing Adverse Effects to Wild Salmon Stocks

The previous section (1.2) provides information to describe the legislative, regulatory, and policy framework for aquaculture, I&T, and the use of transgenic fish that serve to minimize potential adverse effects of these activities on wild salmon stocks. The following paragraphs provide more specific information related to sea lice management and containment in aquaculture.

All salmon farms are subject to the fish health management and containment provisions of the operational licences. Consistent with this, all salmon farms operate according to knowledge-based operational practices for fish health management and containment.

Both government and industry work together so that all salmon farms have effective sea lice management. Sea lice numbers are monitored on all marine sites as part of routine fish health monitoring. The frequency depends on water temperature and typically occurs once a week during the spring, summer and fall. Sea lice management is accomplished through a variety of management practices such as single year class farming, site fallowing and rotation, optimizing stock density, and area-wide bio-security. In addition, theraputant-based control is also used. The first sea lice treatment is typically completed in early summer after stocking. Management approaches along with new treatment planning is being developed to address this issue (see section 2.2)

Government and industry also work together with the goal that 100% of all farmed fish are retained on site. Provincial licences require aquaculture operations to submit escape prevention and recapture plans as well as record and report any breaches of containment. The salmon industries in New Brunswick and Nova Scotia have adopted the *Code of Containment for the Culture of Atlantic Salmon in Marine Net Pens in New Brunswick* developed in 2008 by NBSGA

in collaboration with the NB-DAA and DFO. In Newfoundland the *Code of Containment for the Culture of Salmonids in Newfoundland and Labrador* has been in operation since 1999. Both of these codes detail the procedures and practices to be used by operators in order to contain farmed fish in net pens, equipment standards, handling practices, reporting and documentation requirements, inspection and audit protocols, and escape mitigation responsibilities (see Section 2.4 for further information). Compliance with the Newfoundland Code of Containment is a requirement of provincial and federal licences. NB-DAA and DFO have approved the NB Code of Containment and have jointly developed a governance framework. The governance framework will be supported by changes to current regulations under the provincial *Aquaculture Act*. When the changes occur (expected in 2010) the NB-DAA will be able to take actions to deal with non-compliance including imposing fines and suspending or revoking an aquaculture licence.

2.2 Information to Demonstrate That Proposed Activities Will Not Have Significant Adverse Impacts

An aquaculture application in Canada undergoes a comprehensive review involving as many as 17 federal departments and a range of provincial departments. The extent and depth of the information provided in the application may be judged from the fact that the application process, from data gathering through review to approval, often takes as long as two years to complete. Section 1.2 and section 2.3 provide details of the nature and type of the reviews. The list below provides the most common and broad types of information collected from a proponent for the reviews:

- The site operational activities, including those that may occur beyond lease boundaries;
- The location, layout and proposed production levels of the facility;
- The site proximity to other marine and upland resources, including wild salmon;
- The oceanographic, biological and physical conditions experienced at the site;
- Benthic sampling to determine baseline environmental conditions at the site; and
- The mitigation measures to be implemented to protect the environment.

DFO applies an *Interim Guide to Information Requirements for Environmental Assessment of Marine Finfish Aquaculture Projects* that dictates specific information requirements. DFO in collaboration with NB-DAA and NS-DFA is developing a *Harmonized Guide to Information Requirements for Marine Finfish Site Aquaculture Applications*. This guide will describe the minimum information requirements of both the provincial and federal governments in order to review an application.

A proponent of an introduction or transfer of aquatic organisms must provide information to enable evaluation of genetic, ecological, and disease risks associated with the proposed introduction or transfer. Information requirements for the assessment of non-routine transfers include:

- Rationale and geographic area of the proposed introduction;
- Life history of the proposed species;

- Interaction with native species;
- Receiving environment and contiguous watershed;
- Precautions and management plan; and
- Scientific references to support the proposal.

For all salmonid transfers, the proponent must also submit a Fish Health Certificate for the supplying facility under the FHPR as proof that the facility was inspected in a prescribed manner, indicating which, if any, diseases listed in the regulations are present (see section 2.4). An import permit pursuant to FHPR may be issued only if the supplying facility is certified as disease-free or has the same pathogen profile as the proposed receiving facility or watershed.

Regulation and policy requirements for transgenic fish are described in section 1.2. While these requirements all have in-depth information needs, they are not provided here as no transgenic fish has been or is being considered for commercial aquaculture or stocking.

2.3 Risk Assessment Methodologies

All new site developments for marine and freshwater salmon aquaculture sites undergo a risk assessment under the habitat provisions of the *Fisheries Act*, while all marine sites also undergo a comprehensive environmental assessment under the *Canadian Environmental Assessment Act*. Provincial siting criteria are also used for screening and assessing the potential environmental impacts of a proposed aquaculture project.

Federal environmental assessments under CEAA aim to ensure that:

- the environmental effects of projects receive careful consideration before responsible authorities take actions in connection with them; and,
- projects that are to be carried out in Canada or on federal lands do not cause significant adverse environmental effects outside of the jurisdictions in which the projects are carried out.

The majority of marine aquaculture projects requiring an environmental assessment will undergo a screening, which is a systematic approach to documenting the environmental effects of a proposed project and determining the need to minimize or mitigate these effects, to modify the project plan, or to recommend further assessments.

Subsection 16(1) of CEAA identifies the factors that must be considered in the screening of a project:

> "Every screening or comprehensive study of a project and every mediation or assessment by a review panel shall include a consideration of the following factors:
>
> a) the environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project and any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out;
>
> b) the significance of the effects referred to in paragraph (a);

c) comments from the public that are received in accordance with this Act and the regulations;
d) measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project; and
e) any other matter relevant to the screening, comprehensive study, mediation or assessment by a review panel, such as the need for the project and alternatives to the project, that the responsible authority or, except in the case of a screening, the Minister after consulting with the responsible authority, may require to be considered."

Virtually all marine aquaculture sites in Atlantic Canada (with some exceptions in NS) are single year-class sites and each production period is followed by a mandatory fallow period. In NB this mandatory period is 4 months per site and 2 months for an entire Bay Management Area (BMA), although in practice is often up to or greater than 1 year. Minimum site separation distances range from 300 metres to 1000 metres. Any undertaking within 200 metres of a scheduled salmon river must also be registered and assessed under the Newfoundland and Labrador *Environmental Assessment Regulations 2003* under the *Environmental Protection Act*.

When reviewing project proposals, regional Habitat Management staff of DFO determines the effects the project may have on fish habitat. This is undertaken in accordance with the *Policy for the Management of Fish Habitat* and with s.35(1) of the *Fisheries Act* which states that "no person shall carry on any work or undertaking that results in the harmful alteration, disruption or destruction (HADD) of fish habitat" except when authorized by the Minister, DFO, as contemplated in s.35(2) or through regulations under the *Fisheries Act*.

The initial step in the habitat review process is to determine the pre-development benthic baseline site conditions, using a variety of physical or chemical proxies that rank the quality of fish habitat in an area.

Risk assessment integrates the results of the baseline conditions with the information on the project and its operation. This information is obtained from the proponent through DFO's *Interim Guide to Information Requirements for Environmental Assessment of Marine Finfish Aquaculture Projects*, which the proponent will complete. DFO Habitat Management Branch has also developed a Risk Management Framework, outlined in the *Practitioners Guide to the Risk Management Framework for DFO Habitat Management Staff*, to provide broad guidance to Habitat Management staff on applying a risk management approach.

Risk assessment decisions are guided by the hierarchy of conservation and protection preferences of project relocation, redesign, mitigation, and compensation as outlined in the *Habitat Conservation and Protection Guidelines*. Based on the analysis, DFO concludes whether or not a HADD is anticipated, there is uncertainty with respect to the effectiveness of measures to prevent a HADD, or a HADD will result from the proposed project. In the case of salmonid aquaculture, this initial risk assessment then determines the appropriate instrument to ensure that required mitigation and monitoring requirements are respected.

In the case of salmonid aquaculture, where a HADD of fish habitat is not anticipated to result from organic enrichment, the application is approved on condition that the work will be carried out in a manner that will not result in HADD. This initial risk assessment then determines the appropriate instrument to ensure that required mitigation and monitoring requirements are respected.

Risk assessment methodologies for I&T are conducted according to the national code, described in sections 1.2 and 2.2. Processes related to transgenics are stated in section 1.2.

2.4 Information Related to the Williamsburg Resolution Annexes 2, 3, and 4

2.4.1 Containment

As noted previously in this report, the governments and industry have collaborated to put regulatory and operational measures in place to reduce the incidence and number of escapes. It is acknowledged that the goal must be as close as practicable to zero breaches of containment. Government and industry driven guidelines and codes of containment have been developed and implemented on salmon farms that are consistent with the Guidelines on Containment of Farm Salmon (NASCO document CNL(01)53). Some information on this is provided in section 2.1. Further details are provided below.

The New Brunswick Code of Containment includes a set of Standard Operating Practices (SOPs) and provisions specific to the marine site location and infrastructure. The Bay of Fundy is a unique environment, and depending on the location, sites can experience an extreme variation in waves, storms, and current. For this reason it is difficult to set specific technical standards for site moorings and equipment. Site operators are responsible for ensuring that the equipment chosen for use is appropriate for the geographic location, and that it is installed correctly by experienced personnel. Specifications have been established for the main nets used within the cages based on the size of the cage net, the results from breaking strength testing and the energy classification of the site. There are also established net mesh size standards that are to be used for the specific size of salmon to be stocked into the cages.

The Newfoundland Code of Containment requires that all nets and cages in use in Bay D'Espoir and Fortune Bay must be manufactured by suppliers whose design meets or exceeds industry standards. The nets must be designed to perform in the condition in which they are used, e.g., heavier mesh for sites of stronger current. All nets over three years old must undergo an annual 4-point stress test. The design of cages used in Newfoundland is based on the plastic circle design that is widely used in New Brunswick. The code also provides mooring standards. The majority of mooring designs in Newfoundland and Labrador are consistent with mooring designs found in Norway. The Code is reviewed annually.

Provincial operating licences, and related policies, dictate technical requirements for containment at freshwater facilities. For example, in PEI, all hatcheries have double screening in place on effluent pipes to reduce the risk of escapes. Pond cages and outdoor tanks are also screened to prevent escapes and predation by birds.

The New Brunswick Code of Containment outlines the maintenance, inspection, and auditing processes to be followed by site operators. Inspections and audits are carried out by company staff or contractors. Others within the industry such as insurance companies and third party certification auditors also review the documentation, establishing industry standards.

In Newfoundland, NL-DFA ensures that all farms are routinely inspected by both farm staff and provincial officials and that standards are adhered. NL-DFA performs on-site, random audits to verify net testing and the age of nets. The audit results are compared with the net inventory and testing provided by the farm. Each farm is inspected by NL-DFA for compliance to the Code twice a year.

In most farming areas, immediately upon discovery of a breach of containment incident, the site operator must verbally report the incident to the provincial departments or DFO Regional Offices and file a written report of the incident within a maximum of 72 hours. In Nova Scotia, this immediate reporting is not a requirement of licence, although it is the practice of industry. A significant breach is defined as the loss, or suspected loss of 100 or more fish. Non-reporting is considered as non-compliance with the conditions of federal or provincial licences. After the initial reporting and approval from DFO to implement a site-specific recapture plan, an investigation must take place to determine the cause and to establish corrective measures. While the effectiveness of recapture plans is highly uncertain and largely unproven, compliance reporting and recapture provisions has been high. DFO does not approve any recapturing methods that can cause harm to wild stocks.

The incidence and number of escapes are declining in all provinces as a result of the measures described above, even though the salmon farming industry grows in size. However, the records are not yet maintained by the provinces in a format that allows easy analysis. The data are available to the public upon request.

2.4.2 Impacts of Ranching

Sea ranching is not licensed or practiced in any Canadian waters.

2.4.3 Minimize Adverse Genetic and Other Interactions from I&T

Canada's wildlife and wild Atlantic salmon conservation policies as well as the national I&T Code provide effective means to minimize adverse genetic and other biological interactions from enhancement activities. Provincial policies are also harmonized with federal policies.

The national I&T Code states: "Use of suitable indigenous species for intentional release to unconfined waters from within the aquatic zone or watershed is preferable to the introduction of an exotic species or transfer of indigenous species from other distinct stocks (within and outside Canada)."

The I&T process is supported by the Fisheries (General) Regulations (s.56), that states:

" The Minister may issue a licence if
(a) the release or transfer of the fish would be in keeping with the proper management and control of fisheries;
(b) the fish do not have any disease or disease agent that may be harmful to the protection and conservation of fish; and
(c) the release or transfer of the fish will not have an adverse effect on the stock size of fish or the genetic characteristics of fish or fish stocks".

The *Fish Stocking Policy* of the New Brunswick Department of Environment maintains that wild strains of fish native to New Brunswick be stocked in provincial waters where justified on the basis of ecological, economic and social costs. In Nova Scotia, DFO and the Province have programs to maintain the genetic integrity of salmon stocks. First generation wild caught salmon are used for enhancement purposes. To maintain the genetic integrity, salmon are solely released to their native watershed. A gene-banking program was started in 1998 and a gene-pedigree program has been developed to maximize populations' genetic diversity. Several key populations are being harboured and protected in DFO Biodiversity Centres in New Brunswick and Nova Scotia.

In Quebec, the Department of Natural Resources and Wildlife has issued fish stocking guidelines (www.mrnf.gouv.qc.ca/publications/faune/lignes-directrices-ensemencements.pdf) under the Act respecting the conservation and development of wildlife. This document describes stocking policies and goals. For Atlantic salmon, a handbook containing rules, standards and procedures guides fish production at the Tadoussac government fish farm. A production plan is produced and reviewed every five years. Recently, an expert opinion was requested to analyze practices and the Atlantic salmon breeding plan. The purpose of the mandate is to review breeding patterns, spawner replacement rates and the representativeness of genetic and phenotypic variability within captive adult spawners in order to minimize the negative genetic impacts on natural populations. The conclusions and recommendations of the report will guide government authorities in developing the next production plan.

2.4.4 Minimize Disease and Parasite Transmission

DFO and the provinces together have implemented environmental and health management programs to minimize the risk of disease and parasite transmission. The Atlantic Provinces through the 2008 MOU with DFO, work together on issues dealing with aquatic animal health surveillance, management, and disease control.

In order to achieve single-year class farming, New Brunswick established, six major aquaculture BMAs in the Bay of Fundy in 2006. The boundaries of each BMA are based on a combination of oceanographic, fish health, and business consideration. This new 3-year site rotational system is legislated under the New Brunswick *Aquaculture Act* and adheres to high standards of environmental quality and fish health and welfare. Each year, one-third of all sites are left fallow while another third is receiving smolt and the remaining third is harvesting product. The fallowing practice is designed to break the cycle of sea lice before an outbreak can occur. The sites are organized into geographically-based BMAs that facilitate communication and coordination within the industry and other marine resource users.

Within each area, salmon farmers coordinate health management activities of all farms. For example, only farmed salmon born in the same year may be raised within the same management area; this prevents parasites or pathogens from being transmitted to disease-free incoming smolts. In addition, fish health programs are coordinated within an entire management area, thereby decreasing the likelihood of a re-occurrence. As a result of these coordinated preventative efforts, the use of therapeutic compounds on salmon farms is decreasing.

The Nova Scotia Aquatic Animal Health management group has a comprehensive aquatic animal health program. This program consists of veterinary led prevention, detection and control of potential disease threats. Under this program, provincial government staff aims to visit all marine salmon sites on a monthly basis with a minimum of three visits to each facility a year. Moribund fish collected are necropsied and examined for potential disease agents. Diagnostic tests are conducted, as required, for early detection of potential infectious organisms. The routine includes surveillance for infectious salmon anaemia and enumeration of sea lice. In the past five years, only one farm was treated for sea lice. Salmon hatcheries are also part of this program. The program provides emergency service for quick response to emerging problems. Under provincial regulation, the provincial aquaculture veterinarian can order isolation, quarantine, treatment or destruction of stocks if the there is a significant threat to cultured or wild stock.

The NL-DFAA Aquaculture Health Unit (AHU) conducts sea lice counts during regular diagnostic and surveillance site visits. The aquaculture farms conduct weekly sea lice counts. If sea lice numbers rise above the Newfoundland and Labrador trigger point, treatment will be sought by its licensed aquaculture veterinarian. In marine areas with low salinity (Bay D'Espoir), the freshwater influence acts to mitigate sea lice infection and therefore some aquaculture farms on the south coast of Newfoundland are not affected by sea lice. The following strategies are also in place to militate against sea lice infestation: a 1-year fallow after a 2-year production cycle, single year class sites, and over-wintering strategies.

The availability of theraputants for treating sea lice is limited in Canada. Emamectin benzoate (SLICE), which was available under Emergency Drug Release (EDR) to control sea lice numbers on Atlantic salmon farms, has recently been approved for use and sale in Canada. It is orally administered and delivered to salmon through fish feed. SLICE targets developing, immature, and adult stages of sea lice, eliminating them from the fish. Other options, including an integrated pest management system, are being explored by the governments and industry.

The National Aquatic Animal Health Program (NAAHP) is a science-based regulatory and management program for aquatic animal diseases which have been designated reportable or modifiable in Canada. The program consists of measures needed to prevent, control and eradicate aquatic animal diseases of concern and is delivered under the *Health of Animals Act*. NAAHP is modeled after Canada's internationally recognized terrestrial animal health program, and respects the health measures of the Aquatic Animal Health Code of the World Organisation for Animal Health (OIE). This new program is designed to meet international aquatic animal health management standards to protect Canadian aquatic resources (wild and farmed) from serious infectious diseases.

Two key components of NAAHP are: (1) emergency response plans that clearly delineate respective roles and responsibilities should a regulated pathogen of concern be detected or a disease outbreak occur; (2) domestic disease control measures to prevent spread of disease within Canada and support export attestations and import controls. The Canadian Food Inspection Agency (CFIA) is the lead federal agency to deliver NAAHP and DFO is responsible for providing the scientific expertise to support the program. DFO's national reference laboratories provide quality diagnostic testing for reportable diseases and provide confirmatory diagnostic testing.

Canada is in the process of amending regulations under the *Health of Animals Act* to provide protection for wild and farmed aquatic animals against serious infectious diseases. The regulations used to deliver NAAHP under the *Health of Animals Act* have more direct relevance to terrestrial animals than to aquatic animals. Regulatory amendments are underway to address some inadequacies of the regulations and to support the delivery of NAAHP. Until these regulatory amendments are completed, regulations under the *Fisheries Act* remain in effect. A Domestic Disease Control (DDC) framework is also being developed to control disease spread of listed diseases within Canada and to create an emergency response infrastructure.

The *Fish Health Protection Regulations* (FHPR) are specific to the salmonidae family and are administered under the *Fisheries Act*. The regulations are designed to minimize the risk of the spread of infectious diseases through inspection of wild and culture fish stocks and control of the movements of infected fish into Canada and between provinces. They apply to live and uneviscerated dead cultured fish, eggs (including fertilized eggs or gametes) of cultured and wild fish and products of dead uneviscerated cultured fish destined to move into Canada or across provincial boundaries within Canada. In the event of violation of these Regulations, seizure and other powers of the *Fisheries Act* apply.

A permit for movements of salmonidae may be issued only to producers who have an FHPR certificate that shows their facility has been inspected by a certified provincial Fish Health Officer indicating the pathogen profile of the facility. When the regulatory amendments under the *Health of Animal Acts* are completed, the FHPR will be repealed.

NB-DAA has recently introduced the *New Brunswick Marine Aquaculture Finfish Health Policy*, which will become incorporated into the *Aquaculture Act*. It provides detailed guidelines on all aspects from prevention to health maintenance to minimizing pathogen loading and inter-generational transfer. Fish health surveillance includes regular veterinary visits to marine sites. NB-DAA fish health staff complements these veterinary visits through routine checks of the marine sites in which they audit disinfection protocols, assess overall fish health, and collect samples for disease testing. Upon the detection or suspicion of a disease of concern, NB-DAA may immediately designate an area as a Controlled Aquaculture Area (CAA) under the authority of the *Aquaculture Act*. In addition to this, the NBSGA has developed a Harvesting Code of Practice, which applies to all vessels and individuals on an aquaculture site.

The Nova Scotia health management program has been described earlier. In the event of a significant threat to aquaculture or wild stock, the provincial veterinarian can order isolation, quarantine, treatment or destruction of stocks.

2.5 Movement of Reproductively Viable Atlantic Salmon from Outside a Commission Area

As noted earlier, any movements of aquatic organisms in Canada are governed by the national I&T Code and the associated regulatory framework, which sets in place a mechanism for assessing proposals to move aquatic organisms and a risk assessment procedure for assessing the potential impacts of intentional introductions and transfers. As such, there is no general prohibition of movements.

In practice, the salmon farming industry in Atlantic Canada predominantly uses strains from within the Commission Area (Gaspé and St. John River strains). In PEI, DFO once permitted the importation of the European strain of Atlantic salmon for research purposes following the I&T risk assessment process.

2.6 Introductions of Non-Indigenous Salmonids into a Commission Area

Canada's salmon conservation and wildlife policies and regulations restrict introductions of reproductively viable non-indigenous salmon into the subject area. Similar policies are also administered by the provinces.

Movements of reproductively viable non-indigenous anadromous salmonids or their gametes from outside the Commission Area are regulated by the federal *Fishery (General) Regulations*, introduction and transfer provisions.

Non-native rainbow trout and brown trout were introduced in the North American Commission (NAC) area subject area more than a century ago and now should be considered indigenous to Atlantic Canada. According to the Williamsburg Resolution, these fish should be "treated as indigenous if a population has been established for 10 or more years" (p.16). Current rainbow trout policies authorize use of the fish only within the historical range of introductions. A similar situation exists for brown trout, though the geographic range of introduction and establishment is much less.

2.7 Non-indigenous Fish Introduced Into Rivers Containing Atlantic Salmon

Since the introduction of the I&T Code in 2002, Canada has not approved any new introductions or transfers of non-indigenous fish into the rivers in Atlantic Canada or Quebec containing Atlantic salmon. As described above, if such an intentional introduction were to be proposed, it would go through the I&T risk assessment process to evaluate the ecological and other impacts of introductions and transfers.

Under the *Fishery (General) Regulations* (s. 55(1)), it is illegal for anyone to introduce live fish into fish habitat unless authorized under a licence. The regulations state that "… no person shall, unless authorized to do so under a licence,

(*a*) release live fish into any fish habitat; or

(b) transfer any live fish to any fish rearing facility."

Nonetheless, unlawful introductions have occurred. Non-native smallmouth bass and largemouth bass have recently established in some areas such as the Miramichi River, St. John River, and the Magaguadavic River in New Brunswick. Smallmouth bass are presently known to be in 188 lakes or rivers in Nova Scotia and 69 lakes and 34 rivers in New Brunswick. Similarly unlawful introductions of chain pickerel in Nova Scotia and brown bullhead in Newfoundland and Labrador have also occurred. It is thought that these illegal introductions have negatively impacted a number of freshwater ecosystems in the region.

It is difficult for federal or provincial officials to track unlawful introductions due to the remoteness of much of the subject area, and therefore DFO relies to a large degree on information from the public to enforce the *Fisheries Act* and supporting regulations. According to DFO's records on the Departmental Violation System, 32 actions have been taken throughout Canada as they relate to violations under section 55 of the *Fishery (General) Regulations*. Of them, 23 actions were in New Brunswick and Nova Scotia.

2.8 Application of the Guidelines for Action on Transgenics

Since there are no transgenic fish farmed in Canada, the Guidelines for Action on Transgenic Salmon (Annex 5 of the Williamsburg Resolution—CNL(04)41) currently has no direct relevance to aquaculture management in Canada.

It should be noted, in PEI, there are currently transgenics in land-based closed containment systems for research purposes.

2. 9 River Classification and Zoning

Canada has 34 Atlantic Salmon Management Areas (SMA) which group neighbouring rivers for wild stock management purposes. Marine cage salmonid aquaculture occurs only in six SMAs (SMA 23 in New Brunswick, SMA 11 in Newfoundland and Labrador, and SMA 19, 20, 21, and 22 in Nova Scotia). Inland and tidal waters with wild Atlantic salmon populations are also scheduled for protection under the federal *Fisheries Act* in all Atlantic Provinces and Quebec under the Maritime Provinces Fishery Regulations, the Newfoundland and Labrador Fishery Regulations, and Quebec Fishery Regulations, respectively.

Quebec has adopted a zoning system to protect the integrity of the wild stock and DFO in Newfoundland and Labrador has adopted an individual river classification system. There are regulations and management measures in place that govern conservation and zoning practices and individual river classifications.

2.10 Initiation of Corrective Measures

The potential interactions between aquaculture and wild stocks have been well documented in comprehensive literature reviews. Research and monitoring in individual rivers systems have been undertaken by the ASF in New Brunswick and by DFO in Newfoundland and Labrador (see Annex 4). The management and regulatory measures described throughout this document are intended to minimize these risks, and to establish corrective measures as may be necessary.

DFO has established the Atlantic Salmon Endowment Fund (ASEF), providing $30 million to local conservation organizations. The Fund has been helping Atlantic salmon in Atlantic Canada and Quebec through the funding of projects for the conservation and enhancement of wild stocks and their habitat.

DFO has reinforced its commitment to the conservation of wild stocks by introducing the *Wild Atlantic Salmon Conservation Policy*, which aims to transform the approach to conserving Atlantic salmon, its habitat and dependent ecosystems. The policy has now been finalized and approved by the Minister of Fisheries and Oceans.

Atlantic salmon of the Inner Bay of Fundy was listed as endangered under the SARA in 2003. DFO has been supporting the live gene banking facilities for a number of years. The new Atlantic Salmon Recovery Strategy for the Inner Bay of Fundy population indicates that these facilities will help maintain the genetic diversity required for the long-term survival and recovery of the species.

The aquaculture industry in New Brunswick supports projects aimed at restoring the wild salmon populations in rivers. For example, progeny from the Magaguadavic River wild salmon population have been reared in salmon farming hatcheries and cage sites in the Bay of Fundy. The NBSGA acts as a liaison between the Magaguadavic River Recovery Group and the salmon farming industry. Many of the NBSGA members, including feed companies and suppliers, have provided financial resources, materials and expertise to this and other wild salmon conservation projects.

Nova Scotia administers a Sportfish Habitat Fund which funds programs such as *Adopt a Stream*. This program works with volunteer groups to enhance freshwater habitat. In 2008, the *Adopt A Stream* program worked on 45 watercourses and enhanced 85,000 square meters of in-stream habitat. PEI Department of Environment, Energy and Forestry, in collaboration with DFO, is involved in assessing the state of the wild salmon resource on an annual basis with juvenile population and spawning assessments. In 2008, a study was commissioned to assess the state of the resource. This assessment provided insights into factors contributing to the loss of salmon stocks, which were concluded to be primarily habitat related. The recommendations in the resulting report serve as the basis for community watershed action to restore habitat and enhance wild populations.

Through participation in a variety of international forums, the aquaculture industry is aware of recent scientific work, and ways and means to minimize potential impacts on wild salmon. These include the International Salmon Farmers Association and the NASCO Industry Liaison

Group, the World Wildlife Fund Salmon Aquaculture Dialogues, and various scientific conferences.

2.11 Research and Data Collection

The federal and provincial governments of the subject area, the aquaculture industry, and the conservation and protection community all strongly support, encourage, and participate in research and data collection regarding the potential for impacts to occur, the extent to which they may be occurring, and ways and means that the corrective and mitigation activities related to aquaculture, I&T, and transgenics can minimize or eliminate potential or real impacts on wild Atlantic salmon. Indeed, a significant body of science does exist that demonstrates, at a minimum, that the potential for these impacts is significant (a selected bibliography of relevant references is provided in Annex 4). The results of this research and data collection continue to guide governments and industry in the development of legislation, regulation, policy, and practices.

DFO has two programs dedicated to aquaculture research: Aquaculture Collaborative Research and Development Program (ACRDP) and Program for Aquaculture Regulatory Research (PARR). ACRDP is an industry-driven program and has an annual budget of $4.5 million to fund research in the areas of best performance in fish production, optimal fish health, and industry environmental performance. PARR on the other hand sets its research agenda based on the recommendation from DFO's Canadian Science Advisory Secretariat (CSAS) and has funded research in the areas of aquaculture effects on habitat, mitigation of the effects of escapes, fish health management, and siting requirements. In addition, DFO also implements the Aquaculture Innovation and Market Access Program (AIMAP) to encourage research in sustainable production, diversification, and green technology.

While details on sea lice and containment monitoring and management have been furnished throughout this report, the following text provides further information on recent developments in these areas.

The aquaculture industry in Atlantic Canada, in collaboration with the federal and provincial governments, is in the process of developing an Integrated Pest Management Program for sea lice (IPMP). This group is working toward a draft document to be ready by April of 2010. The program will include: (1) Monitoring of sea lice through detailed counts and standardized sampling protocols; (2) Decision Support System (DSS) which will take all collected information and look at sea lice trends and dynamics, treatment efficacy and early warnings of potential resistance; (3) Non-chemotherapeutant and chemotherapeutant control strategies (4) Monitoring of treatment efficacy; and (5) Environmental impacts, food safety and animal welfare of both cultured and wild stocks.

This new IPMP will build upon the existing programs in the subject area, and will take into account research and practical experience in this and other jurisdictions. In addition, it will support concise data collections, analyses, and evaluations as provided in the NASCO guidance on best management practices (SLG(09)5).

Recent application of codes of containment and revised regulatory requirements will support a similar process relative to breaches of containment and mitigating potential or real impacts on wild stocks. The open dialogue that exists between government, industry, science, and the conservation community will facilitate this process, and will ensure that the practices are optimal.

2.12 Educational Materials

Information on various aspects of aquaculture and its perceived and potential impacts based on research has been made available for the public on the DFO website. Provincial departments responsible for aquaculture also host similar pages on their websites. CAIA, the national industry alliance, also has developed materials for educating the public.

The provinces run several programs which educate anglers on the dangers of illegally introducing non-native aquatic plants and animals. They have published handbooks, which are distributed to every licensed angler. The provinces also distribute brochures and other educational materials. There are several websites which provide information on illegal introductions. They include: www.invadingspecies.com and www.projectufo.ca. All aquaculturists are provided with detailed requirements related to introductions and transfers. Annual outreach programs sponsored by industry and government are used to provide information to aquaculturists and the public on good aquaculture practices including the risks associated with the introductions and transfers of aquatic organisms.

The industry has worked with DFO to produce and distribute public materials identifying aquatic invasive species and warning of the threat which they pose to native habitats and species.

In September 2004, the federal government and its provincial and territorial counterparts introduced *An Invasive Alien Species Strategy for Canada* to reduce the risk of invasive alien species and conserve ecosystems. This strategy helps prevent new invasions, detect and respond rapidly to new invasive alien species, and manage established invasive alien species through eradication, containment, and control. The strategy also includes measures to help prevent introductions of invasive alien species from other countries, or from species which have moved from one ecosystem to another within Canada. The Invasive Alien Species Partnership Program (IASPP) is an integral part of *An Invasive Alien Species Strategy for Canada.* This initiative is administered by Environment Canada, and managed cooperatively with CFIA and DFO. The IASPP provides funding to provinces, municipalities, educational institutions and non-government organizations, as well as to other groups who are working in support of the goals of the National Strategy. There is an Aquatic Invasive Species Committee hosted by Acadia University to heighten research and public awareness of this problem. The topic is also on the curriculum of the Nova Scotia Agriculture College.

NL-DFA is involved with Aquatic Invasive Species work and has funded literature that is distributed to make people aware of aquatic invasive species. Some of these species may or may not have an impact on wild salmon. The NAIA and DFO in Newfoundland and Labrador

currently co-chair a provincial committee related to Aquatic Invasive Species in Newfoundland and Labrador. Regular meetings and workshops are organized with all stakeholders including academia, DFA, ENGO's, etc., with information posters and brochures distributed widely. Signage for wharf areas, harbour fronts, etc., has also been developed and distributed. NAIA maintains a website (www.naia.ca) which includes relevant information to aquatic invasive species initiatives in the province.

3.0 SOCIO-ECONOMIC FACTORS

It is recognized that efforts to minimize impacts on important natural resources, such as wild Atlantic salmon, require consideration of socio-economic factors as well as those related to regulatory, management, scientific, technical, and operations. Wild salmon are an integral part of our history and culture, and the aquaculture and recreational fishing sectors provide significant employment and economic benefits to rural and coastal communities.

DFO's vision for aquaculture development, as stated in the *Aquaculture Policy Framework*, is to benefit Canadians through the culture of aquatic organisms while upholding the ecological and socio-economic values associated with Canada's oceans and inland waters. The Framework further stipulates the following policy principles that are relevant to achieving socio-economic objectives with respect to aquaculture development:

- DFO will support aquaculture development in a manner consistent with its commitments to ecosystem-based and integrated management, as set out in departmental legislation, regulations and policies.
- DFO will address issues of public concern in a fair and transparent manner, based on science and risk-management approaches endorsed by the Government of Canada.
- DFO will communicate with Canadians and be informed by their views on issues pertaining to aquaculture development.
- DFO will respect constitutionally protected Aboriginal and treaty rights and will work with interested and affected Aboriginal communities to facilitate their participation in aquaculture development.

The purpose of the National Code on Introductions and Transfers of Aquatic Organisms is to establish an objective decision-making framework regarding intentional introductions and transfers of live aquatic organisms that is designed to protect aquatic ecosystems while encouraging responsible use of aquatic resources for the benefit of Canadians. This can only be accomplished by developing sound and consistent scientific criteria to evaluate and facilitate the safe movement of live aquatic organisms into and within Canada in an environmentally sustainable and responsible manner. Federal, provincial and territorial governments agree to work cooperatively in applying this Code to national and regional regulations and policies that govern intentional introductions and transfers.

Currently, there is no use of transgenic fish in commercial salmonid aquaculture in Canada. DFO and other federal departments have jointly developed a *Federal Biotechnology Regulatory Framework* to provide guidance on regulating animate products of biotechnology. The *New Substances Notification Regulation (Organisms)* under the *Canadian Environmental Protection Act* (CEPA) applies to new living organisms that are animate products of biotechnology, including aquatic organisms. DFO signed an MOU in 2004 with Environment Canada and Health Canada respecting the implementation of the regulation for certain aquatic living organisms. In the event of an application being made for transgenic aquaculture, DFO will be able to use the NSNR in addition to other regulatory tools to assess the application.

4.0 CONCLUSION

The information in this report clearly demonstrates a strong legislative, regulatory, and policy environment, as well as effective collaboration between government, industry, and non-governmental groups, for conservation and management of wild Atlantic salmon. This environment provides a solid basis for minimizing adverse impacts of aquaculture, introductions and transfers, and transgenic salmonids on the ecosystem and wild stocks. Aquaculture matters are being addressed through risk assessments, environmental assessment, siting, and improved farm and health management programs. Canada addresses introductions and transfers issues following an established code designed to avoid the risk of genetic, ecological, and disease impacts through a standardized risk assessment process. To date, Canada has not approved any applications for transgenic fish for use in commercial aquaculture or for any introduction or transfer, and has a regulatory and policy program in place to consider such application.

Canada is embarking on an aquaculture sustainability reporting initiative that will provide a mechanism to assess the transparency of management and the effectiveness of the regulatory and policy frameworks. The sustainability report will be published to report annual progress on a range of environmental indicators covering existing and emerging concerns regarding farm management, fish health, and potential aquaculture impacts on wild stocks and the ecosystem. It also covers economic and social sustainability indicators. The indicators are being tested and refined in collaboration with Statistics Canada, Canada's national statistical agency, and through consultations with stakeholders. The annual sustainability report, expected to take shape in 2011, will establish a more effective means for the governments and industry to communicate regular updates on the state of the Canadian aquaculture industry with both internal and external audiences.

Annex 1: Legislation, Regulations, and Policies Cited

Federal

An Invasive Alien Species Strategy for Canada, http://www.ec.gc.ca/eee-ias/98DB3ACF-94FE-4573-AE0F-95133A03C5E9/Final_IAS_Strategic_Plan_smaller_e.pdf

Aquaculture Policy Framework, http://www.dfo-mpo.gc.ca/aquaculture/ref/APF-PAM-eng.htm

Canadian Environmental Assessment Act (CEEA), http://laws.justice.gc.ca/en/c-15.2/text.html

Canadian Environmental Protection Act (CEPA), 1999, http://laws.justice.gc.ca/en/C-15.31/

Federal Biotechnology Regulatory Framework 1993, http://www.dfo-mpo.gc.ca/Science/biotech/reg/index-eng.htm

Fish Health Protection Regulations, http://laws.justice.gc.ca/en/F-14/C.R.C.-c.812/index.html

Fisheries Act, http://laws.justice.gc.ca/en/F-14/

Fishery (General) Regulations, http://laws.justice.gc.ca/en/F-14/SOR-93-53/index.html

Habitat Conservation and Protection Guidelines, http://www.dfo-mpo.gc.ca/Library/240756.htm

Health of Animals Act, http://laws.justice.gc.ca/en/H-3.3/index.html

Health of Animals Regulations, http://laws.justice.gc.ca/en/H-3.3/C.R.C.-c.296/index.html

Interim Guide to Information Requirements for Environmental Assessment of Marine Finfish Aquaculture Projects, http://www.dfo-mpo.gc.ca/aquaculture/ref/AAPceaafin-eng.htm

National Aquatic Animal Health Program (NAAHP), http://www.inspection.gc.ca/english/anima/aqua/aquaproge.shtml

National Code on Introductions and Transfers of Aquatic Organisms, http://www.dfo-mpo.gc.ca/Science/enviro/ais-eae/code-eng.htm

Navigable Waters Protection Act (NWPA), http://www.tc.gc.ca/marinesafety/debs/arctic/acts-regulations/nwpa.htm

New Substances Notification Regulation (Organisms), http://www.ec.gc.ca/Substances/nsb/eng/home_e.shtml

Policy for the Management of Fish Habitat, http://www.dfo-mpo.gc.ca/oceans-habitat/habitat/policies-politique/management-gestion_e.asp

Practitioners Guide to the Risk Management Framework for DFO Habitat Management Staff, http://www.dfo-mpo.gc.ca/oceans-habitat/habitat/policies-politique/operating-operation/risk-risques/index_e.asp

The Wild Atlantic Salmon Conservation Policy, 2009, http://www.dfo-mpo.gc.ca/fm-gp/policies-politiques/wasp-pss/wasp-psas-2009-eng.htm#toc-wascp

New Brunswick

Aquaculture Act, http://www.gnb.ca/0062/acts/acts/a-09-2.htm

Aquaculture Regulations http://www.gnb.ca/0062/PDF-regs/91-158.pdf

Bay of Fundy Aquaculture Site Allocation Policy, http://www.gnb.ca/0177/e-fundy.asp

Clean Environment Act, http://www.gnb.ca/0062/Acts/acts/c-06.htm

Cleaning and Disinfection Guidelines for the Control of Infectious Salmon Anemia

Code of Practice to Support Environmental Performance Based Management and Regulation of

Fish Stocking Policy, http://www.gnb.ca/0078/policies/FWB0192006E.pdf

Marine Aquaculture Finfish Health Policy
http://www.gnb.ca/0168/MarineAquacultureFinfishHealthPolicy.pdf

Protocols for Regulating the Introduction and/or Transfer of Salmonids in New Brunswick

The Environmental Management Program for the Marine Finfish Cage Aquaculture Industry in

New Brunswick, http://www.gnb.ca/0009/0369/0017/pdfs/0010-e.pdf

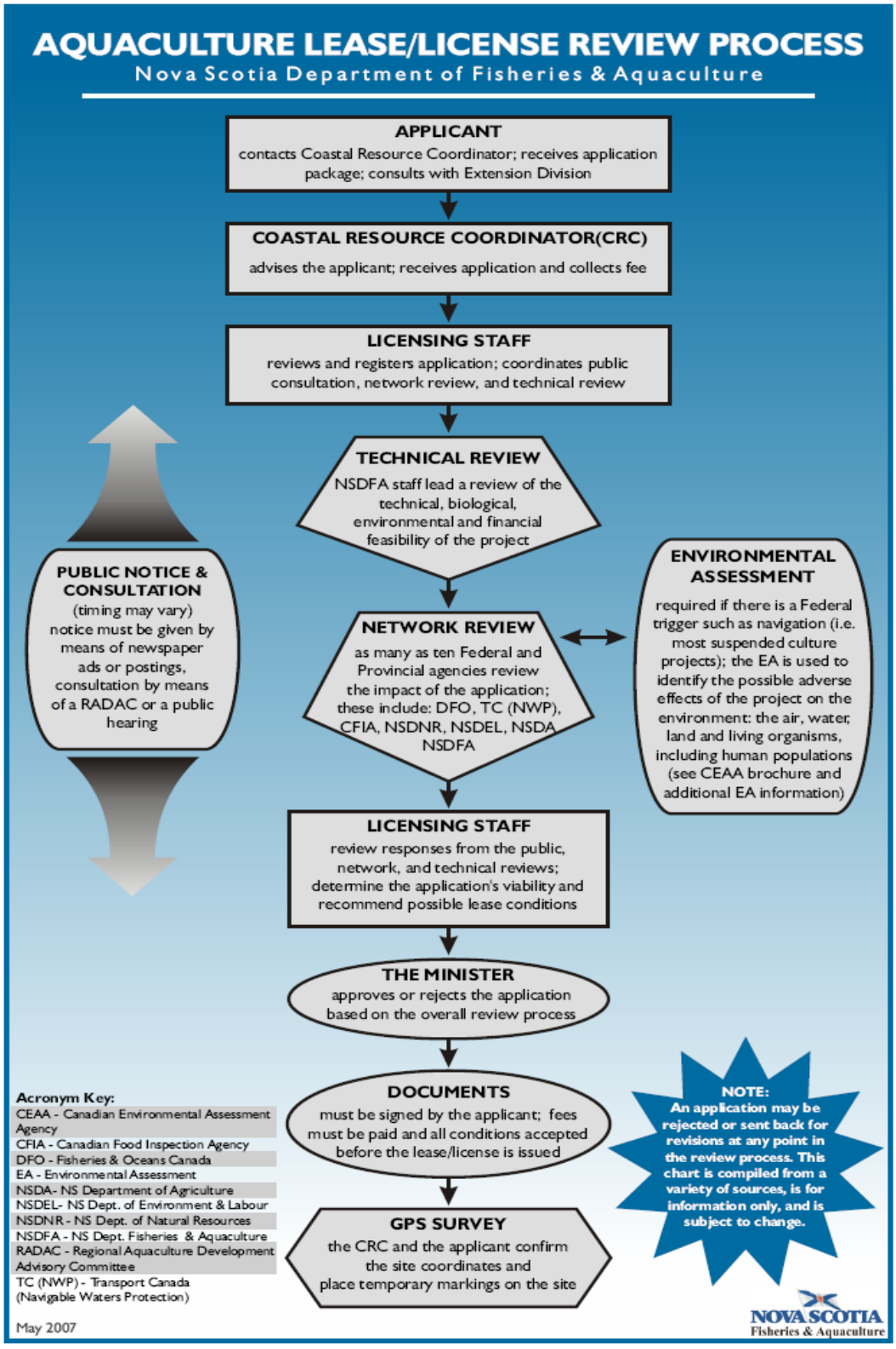
Newfoundland and Labrador

Environmental Assessment Regulations 2003,
http://www.assembly.nl.ca/legislation/sr/annualregs/2003/Nr030054.htm

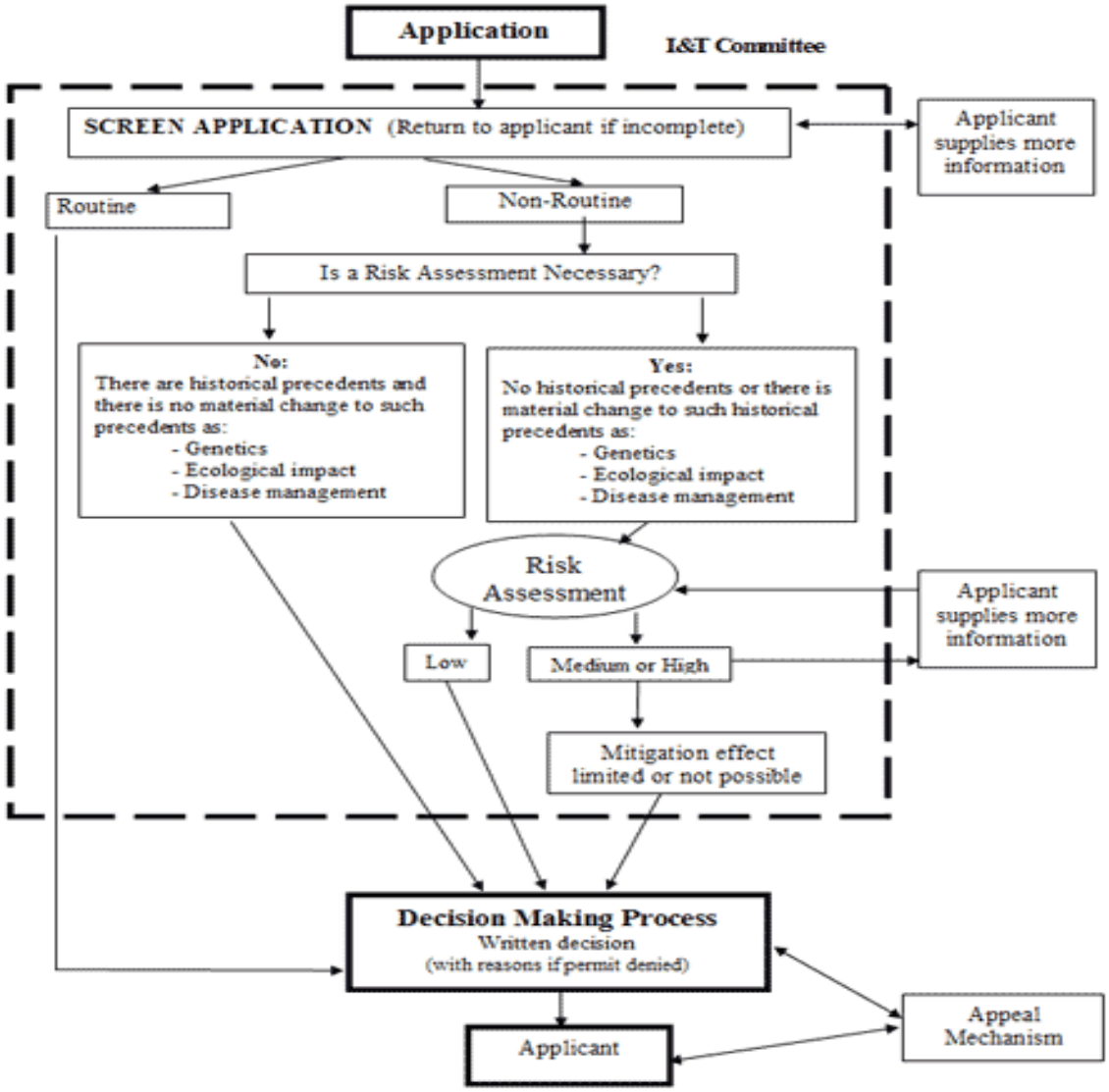
Environmental Protection Act, http://www.canlii.org/en/nl/laws/stat/snl-2002-c-e-14.2/latest/snl-2002-c-e-14.2.html

Code of Containment for the Culture of Salmonids in Newfoundland and Labrador

Annex 2: An Example of Aquaculture Application Review Process in Canada



Annex 3: Approval Process for Introductions or Transfer of Aquatic Organisms



Annex 4: Bibliography of Referencs for Wild-Farmed Salmon Interactions

Carr, J.W. and F.G. Whoriskey. (2006). The escape of juvenile farmed Atlantic salmon from hatcheries into freshwater streams in New Brunswick, Canada. *ICES Journal of Marine Science*, **63**: 1263-1268.

Carr, J.W. et al. (1997). The occurrence and spawning of cultured Atlantic salmon (*Salmo salar*) in a Canadian river. *ICES Journal of Marine Science*, **54**: 1064-1073.

Ford, J.S. and R.A. Myers. (2008). A global assessment of salmon aquaculture impacts on wild salmonids. *PLoS Biol*, **6**(2): e33. doi:10.1371/journal.pbio.0060033.

Gilles, O. (2002). Disease interactions between wild and cultured fish—perspectives from the American Northeast (Atlantic Provinces). *Bull. Eur. Ass. Fish Pathol*., **22**(2): 103-109.

Lacroix, G.L. (2008). Influence of origin on migration and survival of Atlantic salmon (*Salmo salar*) in the Bay of Fundy, Canada. *Can. J. Fish. Aquat. Sci*., **65**(9): 2063-2079.

Lacroix, G.L. and M.J.W. Stokesbury. (2004). Adult return of farmed Atlantic salmon escaped as juvenile into freshwater. *Transactions of the American Fisheries Society*, **133**: 484-490.

Morris, M.R.J. et al. (2008). Prevalence and recurrence of escaped farmed Atlantic salmon (*Salmo salar*) in eastern North American rivers. *Can. J. Fish. Aquat. Sci*., **65**: 2807-2826.

O'Reilly, P.T. et al. (2006). Detection of European ancestry in escaped farmed Atlantic Salmon, *Salmo salar* L., in the Magaguadavic River and Chamcook stream, New Brunswick, Canada. *ICES Journal of Marine Science*, **63**: 1256-1262.

Thorstad, E.B. et al. (2008). Incidence and impacts of escaped farmed Atlantic Salmon, Salmo salar in nature. NINA Special Report 36. WWF.

Weir, K. L. et al. (2004). Dominance relationships and behavioural correlates of individual spawning success in farmed and wild male Atlantic Salmon, *Salmo salar*. *Journal of Animal Ecology*, **73**: 1069-1079.

Whoriskey, F. et al. (1998). A review and update of aquaculture impact studies carried out on the Magaguadavic river, southern Bay of Fundy, New Brunswick. Presented at a Dept. of Fisheries and Oceans Workshop on Interactions of Wild and Farmed Atlantic salmon, Moncton, NB.

Whoriskey, F. G. and J. W. Carr. (2001). Interactions of escaped farmed salmon, and wild salmon, in the Bay of Fundy region. In M.F. Tlusty et al. (eds.), *Marine aquaculture and the environment: A meeting for stakeholders in the northeast* (pp. 141-149). Falmouth, MA: Cape Cod Press.

Whoriskey, F. G. et al. (2006). Movements and survival of sonically tagged farmed Atlantic salmon released in Cobscook Bay, Maine, USA. *ICES Journal of Marine Science*, **63**: 1218-1223.

Whoriskey, F.G. and J.W. Carr. (1999, Sept). Homing of escaped aquaculture Atlantic salmon (*Salmo salar*) to the Magaguadavic River, New Brunswick. Presented at ICES Workshop on Environmental Effects of Mariculture, St Andrews, NB.

Whoriskey, F.G. and J.W. Carr. (2001). Returns of transplanted adult, escaped, cultured Atlantic salmon to the Magaguadavic River, New Brunswick. *ICES Journal of Marine Science*, **58**: 504-509.