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**National Oceanic and
Atmospheric Administration**
U.S. Department of Commerce

A Joint-Report:

Regulatory Regimes for Environmental Management of Marine Net Pen Aquaculture in Canada and the United States

April 2018

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Foreword

The Prime Minister of Canada and the President of the United States announced the Canada-United States Regulatory Cooperation Council (RCC) in February 2011 to better align regulatory environments in both countries through tools such as enhanced technical collaboration, mutual recognition of standards, and joint work sharing. The objective of the RCC is to increase regulatory coordination and transparency while promoting economic growth and job creation for the benefit of consumers, businesses, and governments in both the Canada and the United States.

Phase II of the RCC, the *Joint Forward Plan*, was launched in August 2014. It includes a commitment by the Department of Fisheries and Oceans Canada (DFO) and the National Oceanic and Atmospheric Administration (NOAA) to undertake greater regulatory cooperation in environmental management of the aquaculture sector and identify potential areas for further regulatory coordination.

Work streams for the NOAA-DFO aquaculture regulatory cooperation include:

1. Comparison of regulatory environmental management objectives and outcomes for net pen aquaculture;
2. Cooperation on farmed and wild fish interactions;
3. Cooperation on regulatory development initiatives for offshore aquaculture; and
4. Evaluation of the feasibility, as well as costs and benefits, of a joint statement on the equivalence of Canada and U.S. regulatory programs.

DFO and NOAA hereby acknowledge completion of work streams 1 and 2 through production of this joint study report comparing the regulatory regimes for net pen aquaculture in Canada and the United States. The report indicates that the regulatory regimes for net pen aquaculture in Canada and the United States are similar in design. Both lead to the similar outcome of ensuring production of healthy and sustainable farmed fish while protecting wild fisheries and the aquatic environment.

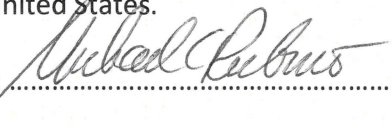
Canada and the United States share similar goals to avoid and minimize negative impacts of net pen aquaculture on fish habitat, water quality, fish health, wild fish populations, marine mammals and endangered species/species at risk. There are some differences in how each country achieves these goals due to variations across multiple provincial, state, and federal administrative structures and procedural requirements.

The regulations summarized in this report were made current to the best of our ability as of April 2018. DFO and NOAA are satisfied with this joint study report and are optimistic that the outcome of work streams 1 and 2 will greatly facilitate the mutual exchange of knowledge and expertise in regulating the aquaculture sectors in Canada and the United States.

Signed:


Jean-François LaRue
Director General, Aquaculture Management
Fisheries and Oceans Canada

Signed:


Michael Rubino, PhD
Director, Office of Aquaculture
National Oceanic and Atmospheric Administration

Executive Summary

Canada-United States Regulatory Cooperation Council

Announced in February 2011, the Canada-United States Regulatory Cooperation Council (RCC) is a binational commitment between the governments of Canada and the United States (U.S.) to increase regulatory cooperation. The objective is to increase regulatory coordination and transparency, as well as promote economic growth and job creation for the benefit of consumers, businesses and governments in both countries.

Phase I of the RCC (i.e., the *Joint Action Plan*) was launched in December 2011. Phase II, known as the *Joint Forward Plan*, was launched in August 2014, and it includes a commitment by Fisheries and Oceans Canada (DFO) and the National Oceanic and Atmospheric Administration (NOAA) to undertake cooperation in environmental management of the marine net pen aquaculture sector and identify potential areas for regulatory coordination.

The Governments of Canada and the United States reaffirmed their commitment to the intent and purpose of the RCC in March 2016, and this commitment was re-echoed by the two governments in February 2017.

Stakeholder engagement is a very important part of the RCC process. The aquaculture industry in both countries, government agencies in the provinces and states with marine waters that border the two countries, as well as other stakeholders have been consulted as part of the RCC initiative.

As an initial step, DFO and NOAA agreed to compile and share information about the current environmental management regimes for marine net pen aquaculture in Canada and the United States. The effort encompasses a review of the main regulatory requirements established by relevant federal and provincial/state authorities in both Canada and the United States to address issues of mutual concern, and a comparative analysis to identify similarities and differences between the regulatory requirements and management approaches in each country. The focus is on jurisdictions in which significant commercial-scale net pen aquaculture farms currently operate – namely, the Canadian provinces of British Columbia, New Brunswick, Newfoundland/Labrador, and Nova Scotia and the U.S. coastal states of Maine and Washington.

The marine net pen aquaculture industries in both Canada and the United States operate under similar environmental conditions and face many of the same technical and environmental challenges. In both countries, the industry is regulated by a suite of both federal and provincial/state laws and regulations. Canada and the United States share similar goals to minimize impacts of net pen aquaculture on fish habitat, water quality, fish health, wild fish populations, marine mammals and endangered species/species at risk. However, as in most regulatory regimes there are differences in how each country achieves these goals. By sharing information about these regulatory requirements and management approaches developed and applied by both countries, DFO and NOAA hope to establish a strong basis for further regulatory cooperation and collaboration to advance the marine net pen aquaculture industry while conserving the marine environment in both countries.

Canadian and U.S. Regulatory Regimes for Marine Net Pen Aquaculture

Currently, commercial-scale marine net pen aquaculture occurs in the Canadian provinces of British Columbia, New Brunswick, Newfoundland and Labrador, and Nova Scotia, as well as in the U.S. states of Maine, Washington, New Hampshire, and Hawaii. Information on the U.S. states for this report is focused

on Maine and Washington, which border Canada and have well-established marine net pen aquaculture industries.

Both Canada and the United States have implemented comprehensive legislative and regulatory measures for the sector, as described below under the following five key themes:

- siting and management of aquaculture operations;
- habitat and water quality;
- fish health and therapeutants;
- genetics and fish escapes; and
- other living marine resource interaction

Siting and Management of Aquaculture Operations

Regulatory requirements and practices for siting and managing aquaculture operations in both Canada and the United States are designed to ensure protection of the marine environment, fish health, human safety and navigable waters. In Canada, the siting decision falls under provincial and federal jurisdiction; however, the provincial regulations work in conjunction with federal regulatory requirements administered by DFO and other federal regulators (with the exception of BC and PEI). A similar situation applies in the United States, where marine net pen aquaculture operations occur in state waters and thus coastal states have jurisdiction over siting (e.g., through state permitting processes) and many areas of conservation and management, while ensuring compliance with applicable federal law.

Habitat and Water Quality

Both Canada and the United States have implemented similar federal and provincial/state statutes and regulations to ensure protection of fish habitat and water quality during routine aquaculture operations. In Canada, marine net pen aquaculture operators are required to comply with federal regulatory requirements with respect to the deposition of deleterious substances into aquatic habitats under the *Aquaculture Activities Regulations*. Other federal statutory provisions for ensuring habitat protection or water quality are contained in the *Species At Risk Act*, the *Fisheries Act*, the *Canada Shipping Act*, the *Canadian Environmental Protection Act* and the underlying *Disposal at Sea Regulations*. In the United States, marine net pen aquaculture operators must obtain certain federal permits even in state waters (e.g., from the Army Corps of Engineers) and must comply with federal regulatory requirements to, among other things, ensure protection of *Essential Fish Habitat* (EFH) under the *Magnuson–Stevens Fishery Conservation and Management Act* (MSA) and critical habitat and listed species under the *Endangered Species Act* (ESA), as well as applicable requirements regulating the discharge of pollutants into waters of the United States under the *Clean Water Act* (CWA).

Fish Health and Therapeutants

Regulatory tools and approaches for regulating fish health and the use of therapeutants in Canada and the United States are similar. The Canadian Food Inspection Agency is responsible for ensuring the health of aquatic animals under the *Health of Animals Act* and underlying regulations, and has implemented in phases, disease management responsibilities under the National Aquatic Animal Health Program, which is co-delivered by DFO. Therapeutants are prescribed by licensed provincial veterinarians, and the sale of veterinary drugs is regulated by Health Canada's Veterinary Drugs Directorate. Canada and the United States communicate regularly on fish health issues. For example, DFO coordinated with NOAA on messaging with respect to the incidence of Piscine Reovirus on the West Coast. In the United States, the Animal and Plant Health Inspection Service (APHIS) coordinates with the U.S. Fish and Wildlife Service (FWS) and NOAA to protect the health of farmed and wild animals under the *Animal Health Protection Act*. The U.S. Food and

Drug Administration's (FDA) Center for Veterinary Medicine (CVM) regulates the manufacture and distribution of food additives and drugs that will be given to animals, and also has a Minor Use and Minor Species designation program that provides incentives for sponsors to seek approval of new animal drugs for fish.

Genetics and Fish Escapes

Federal, provincial and state jurisdictions in both Canada and the United States have implemented net pen containment requirements specified in statutes and regulations to prevent farmed fish escapes and minimize genetic impacts on wild fish.

The aquaculture industry in New Brunswick uses modern damage-resistant net pens such as the Sapphire Ultracore to prevent fish escapes. Nova Scotia requires auditing of a facility if there is a breach in the containment system. The containment practices in Maine align closely with that of New Brunswick with a few differences. For example, Maine requires comprehensive genetic marking, an audit of the responsible farm, and making audit-based changes to escape management to address the cause of the escapes. The remaining Canadian provinces and Washington State require comprehensive monitoring of the net pen containment system. Washington also requires marking of all fish so that escaped fish can be traced back to the producer. Current net pen operations in Washington use otolith marking.

Other Living Marine Resource Interaction

Canada and the United States share similar goals to protect marine mammals during aquaculture operations. Canada's federal *Marine Mammal Regulations* and *Pacific Aquaculture Regulations* have provisions for protecting marine mammals. Moreover, the federal *Species At Risk Act* prohibits the killing, harming, harassing, capturing or taking, possession, collection of, buying, selling or trading individuals of wildlife species listed as extirpated, endangered or threatened, as well as the destruction of any part of the critical habitat of listed endangered or threatened species (or of any listed extirpated species if a recovery strategy has recommended its reintroduction into the wild in Canada). Canada's provincial regulatory regimes require marine net pen operators to implement measures to deter predators and minimize interactions with marine mammals. Licensed aquaculture operators may be authorized to lethally control marine mammals in limited circumstances where marine mammals present imminent danger to the aquaculture facility, or the safety of persons and fish cultivated in the facility. In the United States, the *Marine Mammal Protection Act* (MMPA) prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the United States. The newly-published MMPA Import Provisions Rule in the United States has provisions related to marine mammal protections for countries exporting to the United States. These provisions may have implications for Canadian exporters under current Canadian regulatory practices for managing such interactions within net pen aquaculture operations. Under the ESA, the effects of proposed marine net pen operations on species listed as threatened or endangered under the Act must be considered. At the state level, the Maine Aquaculture Code of Practice includes guidance on predator deterrence and Washington's Department of Fish and Wildlife (WDFW) requires consideration of *Priority Habitats and Species* (PHS) including listed marine mammals.

Opportunities for Engagement

Both Canada and the United States have robust regulatory mechanisms in place to ensure the production of healthy and sustainable aquaculture products. There are some differences in regulatory approaches, but in both countries the ultimate outcome of the regulatory regime is production of healthy and sustainable farmed fish while protecting the aquatic environment.

Regarding farmed fish monitoring and containment system management, Canada and the United States have actively developed regulatory regimes to ensure sound management practices. Nevertheless, variation exists in terms of approaches to farmed fish monitoring and containment system management. In order to further align the existing regulatory regimes in place, there is an excellent opportunity for DFO and NOAA to collaborate on marking/tagging/tracking systems for farmed fish to facilitate escape identification, proactive reporting, facility monitoring, and auditing of containment systems.

Through increased cooperation and collaboration surrounding management approaches and the implementation of regulatory requirements by both countries, DFO and NOAA will continue to strengthen our respective regulatory regimes to help ensure the highest possible standard of environmental sustainability and close alignment of aquaculture regulatory regimes between Canada and the United States.

Comparative Analysis of Regulatory Regimes

Canada

The aquaculture regulatory system in Canada is complex as there are three distinct types of approaches, including: 1) the British Columbia approach under the federal *Pacific Aquaculture Regulations*; 2) the Prince Edward Island approach; and 3) the provincial-lead model, whereby the remaining provinces retain principal regulatory responsibility. Overlaying the three regimes, the federal government plays a substantial cross-cutting role in aquaculture governance, regulating fish habitat protection, pesticide and drug approvals, food safety, navigable waters protection, and feeds activities that are all relevant to aquaculture.

The federal government regulates aquaculture through seven separate federal organizations involving ten different pieces of legislation and their underlying regulations. The federal government, through Fisheries and Oceans Canada (DFO), is the principal regulator for aquaculture in British Columbia. The federal government and the province have established “one stop shopping” for permit applicants and the federal government has assumed responsibilities for most aquaculture activities except leasing the land, which is a provincial responsibility.

Through the 1928 and 1987 Memoranda of Understanding (MOU’s) between the federal and provincial governments, Prince Edward Island effectively delegated administration and control of provincial land as it applies to aquaculture licensing and leasing to the federal government. Through the MOU’s, the federal government is responsible for issuing leases for the culturing of mollusks and for issuing licences and leases for finfish.

The provincial governments in New Brunswick, Newfoundland and Labrador, and Nova Scotia, have developed and implemented aquaculture regulatory regimes under their respective provincial mandates, and their regimes complement the federal regulatory regime. Each province controls the licensing and leasing of net pen aquaculture in their jurisdictions, while DFO acts as an advisor, and also implements federal regulatory requirements under the *Aquaculture Activities Regulations* (AAR) and enforces the federal *Fisheries Act* and underlying regulations.

United States

The U.S. regulatory system for marine net pen aquaculture is equally complex with numerous federal, state, local, and tribal requirements. The regulatory oversight for marine net pen aquaculture involves both state and federal agencies, since the facilities are largely in state waters but require certain federal permits for

operation, notably from the Army Corps of Engineers. Coastal states maintain jurisdiction over marine activities out to three nautical miles from shore, and each state has a system for leasing areas of their coastal zone for marine net pen aquaculture.

Marine net pen aquaculture must obtain a federal permit issued by the Army Corps of Engineers (ACOE) under Section 10 of the *Rivers and Harbors Act*, and a *National Pollutant Discharge Elimination System* (NPDES) permit under the CWA. The U.S. Environmental Protection Agency (EPA) has authorized most coastal states to issue NPDES permits under the provisions of the federal CWA. NOAA's role in state aquaculture operations is to consult with federal agencies that issue permits for such operations to ensure that effects on wild fisheries, marine sanctuaries, marine mammals, endangered or threatened species, and fish habitat are appropriately considered and addressed.

Maine has implemented “one-stop shopping” for license applicants. The state coordinates its own requirements and liaises with the ACOE, which deals with all of the other federal agencies to bring together a federal viewpoint on license applications and requirements. Conditions of license usually include stringent requirements for reporting mechanisms which are largely enforced by the state. Inspections are mostly carried out by the state with two departments involved.

All existing net pen aquaculture in Washington is in state waters with leases of state-owned aquatic lands. In addition to federal and state permitting requirements similar to those in Maine, local authorities in Washington also require permits. The permitting process is subject to public consultations and appeal at both state and local levels. A one-stop permit application, the Joint Aquatic Resources Permit Application (JARPA), is available to applicants and used by most regulatory authorities. Management guidelines developed by the state in the 1980s-90s are being updated and revised through a collaborative effort by three state departments (Ecology, Fish and Wildlife, Agriculture) and NOAA, with advice from tribal interests. The new guidance is expected to inform all aspects of net pen siting and management.

Topic Summaries

Siting and Management of Aquaculture Operations

Siting decisions form the basis for the design, layout, and management of marine net pen aquaculture, and they take into consideration the distance between farms; the oceanographic and bathymetric conditions; the proximity to fish spawning and migration areas, sensitive fish habitats, and marine mammal areas; the proximity to recreational or commercial fisheries sites; and the biosecurity needs.

Canada

- Siting is shared between the provincial/federal jurisdictions. The provincial and federal governments have aquaculture or fisheries related legislation/regulations and policies that guide the siting of marine net pen aquaculture operations.
- During siting application reviews, the provinces consult federal agencies such as Transport Canada (e.g., navigable waters), Environment and Climate Change Canada (ECCC) (e.g., migratory birds), and DFO (e.g., aquatic species at risk, fish habitat protection, fish health).
- DFO provides regulatory and scientific advice to the provinces on site applications. For example, the federal AAR require that siting-related information on proposed new or expanded marine finfish sites be submitted to DFO prior to depositing deleterious substances. This information is used in the preparation of DFO's siting recommendations.
- Detailed plans for aquaculture facilities must accompany the licence application before provincial and federal regulators are able to make a siting decision.

United States

- Coastal states maintain jurisdiction over marine activities out to three nautical miles from shore. Each state has a system for leasing areas of its coastal zone for marine net pen aquaculture, which must comply with local, state and federal laws.
- Many of the key concerns about the potential impacts of marine net pen aquaculture are addressed through proper siting and the inclusion of permit conditions developed in public interest review and notice and comment processes, consultations, *National Environmental Policy Act* (NEPA) analyses, and other state and federal state-level environmental reviews.
- Prior to issuing a *Rivers and Harbors Act* (33 U.S.C. 403) Section 10 permit to site a marine net pen aquaculture operation, the ACOE is required to conduct a public interest review to evaluate how the proposed marine net pen aquaculture facility may affect an extensive range of factors, beyond impacts on navigation. This includes consideration of impacts on conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shore erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, considerations of property ownership, national defense, and the needs and welfare of the people.
- ACOE must also meet requirements under other applicable federal laws. This includes consultations with NOAA's National Marine Fisheries Service (NOAA Fisheries) and the FWS under the *ESA*, consultations with NOAA Fisheries under the EFH provisions of the MSA, consultation with tribes regarding treaty rights, state certifications regarding water quality standards and coastal zone management consistency, and completion of an environmental assessment or environmental impact statement under NEPA.

Table of Comparison: Siting and Management of Aquaculture Operations in State and Provincial Waters

	Canada					United States		
	Fed	BC	NB	NL	NS	Fed	ME	WA
Requirement for lease and/or permit	*X (BC)	X	X	X	X		X	X
Requirement for site marking						X		
Requirement to evaluate site for navigational conflicts	X	X				X		X
Requirement to evaluate use conflicts	X	X				X		X
Requirement to ensure treaty /indigenous people's rights are addressed		X				X		X
Requirement to evaluate site for potential environmental impacts	X	X				X	X	X
Requirement to evaluate site for other natural resource issues /interactions and impacts on wild species	X	X				X	X	X
Requirement for public input in siting review process		X	X	X	X	X	X	X
Requirement to use a Bay			X	X	X		X	

	Canada					United States		
	Fed	BC	NB	NL	NS	Fed	ME	WA
Management Area approach to address aquatic animal health issues								
Requirement to use Fish Health Zones approach to address aquatic animal health issues		X						X
Requirement for site fallowing /rotation to manage benthic impacts			X	X	X		X	

Comparative Analysis

Siting decisions for aquaculture operations is a shared jurisdiction in Canada. The provinces take into consideration federal regulatory requirements administered by DFO and other federal regulators to ensure protection of the marine environment, fish health, human safety and navigable waters.

A similar situation applies in the United States where coastal states maintain jurisdiction over the siting and management of marine net pen aquaculture operations while ensuring compliance with applicable federal regulatory requirements and the federal agencies that administer them. Local governments in Washington also have a significant role in siting and management of net pen operations.

The Province of New Brunswick and the State of Maine collaborate to manage aquaculture in adjacent waters. There has been successful coordination between New Brunswick and Maine with respect to Bay Management Areas (BMA). This has improved fish stock production, environmental health, and coordination among aquaculture operators.

Habitat and Water Quality

Marine net pen aquaculture activities involve the deposit of substances, such as treatment products (i.e., drugs and pest control products) or organic matter (i.e., fish feces and uneaten feed), into waters where they may fall directly under the net pen or out to considerable distances.

Canada

- The federal *Fisheries Act* and the underlying Aquaculture Activity Regulations (AAR) have provisions pertaining to regulating the deposition of deleterious substances. There are requirements to monitor benthic deposits under net pens and for a certain distance beyond, normally out to considerable distances from the net pen.
- Sections 34-36 of the federal *Fisheries Act* contain regulatory provisions on fisheries protection and pollution prevention. In particular, Subsection 36(3) of the Act prohibits the deposit of deleterious substances in water frequented by fish, and the Minister of DFO is responsible for deposits related to aquaculture.
- The federal AAR regulate the deposition of deleterious substances from aquaculture operations into aquatic environments. DFO enforces the AAR in all jurisdictions where aquaculture is operated across Canada. The Minister of DFO is responsible for the regulation of deleterious substances related to the operation of aquaculture facilities, as described in the AAR.

- In addition to federal regulatory requirements under the AAR, the provinces have regulatory requirements under their respective aquaculture related legislation and regulations to ensure protection of aquatic habitats and water quality.
- Although attempts have been made to harmonize federal and provincial regulatory requirements for benthic deposits with the development of the federal AAR, there are differences and overlaps that DFO is attempting to resolve (e.g., harmonization of AAR environmental monitoring standards and provincial requirements).

United States

There are federal requirements to protect critical habitat of species listed under the ESA and to protect EFH under the MSA. NOAA Fisheries coordinates directly with federal agencies to conserve and enhance EFH for managed species. In addition, the federal *Coastal Zone Management Act* gives states a voice in federal agency decision making for activities that may affect a state’s coastal uses or resources.

- For marine net pen facilities, the ACOE Section 10 (siting) permit triggers the need for certain federal consultations, including the need for the ACOE to consult with NOAA Fisheries.
- Compliance with protections for state PHS is also required in Washington.
- The CWA regulates discharges of pollutants to waters of the United States. NPDES permits are required for effluents from aquaculture facilities. The EPA has regulatory authority for NPDES under the CWA, which EPA may delegate to states if certain conditions are met. Both Washington and Maine are authorized to issue NPDES permits in their state waters.
- The EPA has established Effluent Limitation Guidelines and New Source Performance Standards for the Concentrated Aquatic Animal Production Point Source Category. The Effluent Limitation Guidelines apply to net pen systems that directly discharge wastewater and produce at least 100,000 pounds of fish a year.

Table of Comparison: Habitat and Water Quality

	Canada					United States		
	Fed	BC	NB	NL	NS	Fed	ME	WA
Requirements and practices for avoiding, minimizing and mitigating benthic impacts	X		X	X	X	X	X	X
Requirements and practices for avoiding, minimizing and mitigating impacts on water quality	X					X	X	X

Comparative Analysis

Marine net pen aquaculture operators in all Canadian jurisdictions are required to comply with federal regulatory requirements respecting the deposition of deleterious substances into aquatic habitats under the AAR. Other federal regulatory tools for ensuring habitat protection, Fisheries Protection and Pollution Prevention provisions of the *Fisheries Act*, the Pollution Prevention provisions of both the *Canada Shipping Act* and the *Canadian Environmental Protection Act*; the Disposal at Sea Provisions of the *Canadian Environmental Protection Act*, and the underlying *Disposal at Sea Regulations*.

In the United States, marine net pen aquaculture operators must also comply with federal regulatory requirements to ensure habitat protection under the MSA and ESA, as well as the requirements under the

regulation of discharge of pollutants into U.S. waters under the CWA. They must also comply with state and local requirements that may be more stringent than federal requirements, and differ by jurisdiction.

Fish Health and Therapeutants

Canada

- The health of aquatic animals (i.e., finfish, molluscs, crustaceans) falls within the jurisdiction of the Canadian Food Inspection Agency (CFIA), under the *Health of Animals Act*. The CFIA has phased in its disease management responsibilities under the National Aquatic Animal Health Program (NAAHP), which is co-delivered by DFO.
- The goal of the NAAHP is to prevent the introduction and spread of aquatic animal diseases, and the Program operates under a disease risk framework based on internationally accepted principles of the World Organisation for Animal Health (OIE).
- Under the NAAHP, the CFIA utilises a risk-based disease management approach, which includes defined lists of federally reportable diseases, immediately and annually notifiable diseases, and the species of finfish, molluscs, and crustaceans susceptible to these diseases.
- DFO issues licences to intentionally move live fish under the *Fishery (General) Regulations*. These licences are issued following the *National Code on Introductions and Transfers of Aquatic Organisms* to ensure that disease, genetic, and ecological risks are minimized.
- Therapies to treat infections include in-feed and topical medications, as well as administration of vaccines to hatchery fish. Therapeutants are prescribed by licensed veterinarians after diagnosing health problems in aquatic animals. Veterinary drugs are regulated for sale in Canada by Health Canada's Veterinary Drugs Directorate; vaccines for animals are approved for release in Canada by the CFIA; and pest control products are regulated for use by Health Canada's Pest Management Regulatory Agency.
- Conditions of aquaculture licences in the provinces require operators to develop and implement fish health management plans for their aquaculture facilities.

United States

- The *National Aquatic Animal Health Plan* (NAAHP) is a non-regulatory plan that provides recommendations to industry, states, tribes, federal agencies, and stakeholders to facilitate legal movement of aquatic animals, eggs and products in interstate and international commerce.
- Under the *Animal Health Protection Act (2002)*, APHIS coordinates with the FWS and NOAA to protect the health of farmed and wild animals. APHIS has accredited private practice veterinarians who can endorse health certificates for transport of animals as well as accredited laboratories that use diagnostics protocols for testing of the OIE reportable diseases. APHIS coordinates with state agencies to manage the response to a disease outbreak. APHIS works closely with Canada's CFIA, the State of Maine and the Province of New Brunswick with respect to managing Infectious Salmon Anemia (ISA) for cultured Atlantic salmon. APHIS has also been working with the National Aquaculture Association (NAA) to develop *Commercial Aquaculture Health Program Standards* (CAHPS) on fish farms. Veterinary biologics are regulated by APHIS's Center for Veterinary Biologics according to statutory guidelines in the *Virus-Serum-Toxin Act*.
- The FWS regulates imports of live or dead salmonids or their products under the *Injurious Wildlife Regulations of the Lacey Act* (50 CFR 16.13)
- The FDA's CVM regulates the manufacture and distribution of food additives and drugs that will be given to animals, including fish, through the federal *Food, Drug, and Cosmetic Act*. The CVM also has a Minor Use and Minor Species designation program that provides incentives for sponsors to seek approval of new animal drugs for fish.

- The Maine Department of Marine Resources (MDMR) has a finfish aquaculture regulation that relates to pathogens. Maine aquaculture operator permits require that they also follow the APHIS ISA Program Standards.
- Maine’s Net Pen Aquaculture General Permit notes that all drugs used for disease prevention or control must comply with FDA requirements.
- In Washington State, conditions of Aquaculture Finfish Permits issued by WDFW require development of Regulated Finfish Pathogen Reporting Plans. Transport and transfer permits are required to restrict movement and reduce potential transport of pathogens. Additionally, the NPDES permit requires reporting of therapeutant use and allows for monitoring to assess potential impacts. Following done voluntarily by the existing operator contributes to sea lice control.

Table of Comparison: Fish Health and Therapeutants

	Canada					United States		
	Fed	BC	NB	NL	NS	Fed	ME	WA
Requirement for stocking disease-free fish	X	X	X	X	X	X	X	X
Requirement for disease prevention, monitoring and surveillance of fish health	X	X	X	X	X	X	X	X
Requirement for reporting of pathogens and pests that may cause disease	X	X	X			X	X	X
Measures to prevent introduction and transfer of pathogens and pests	X	X	X	X	X	X	X	X
Regulation of the use of therapeutants	X				X	X	X	X

Comparative Analysis

Under the responsibility of the CFIA, Canada has regulatory requirements to ensure the health of aquatic animals under the *Health of Animals Act* and underlying regulations. The CFIA has phased in its disease management responsibilities under the NAAHP, which is co-delivered by DFO. DFO issues licences to intentionally move live fish under the *Fishery (General) Regulations* following the *National Code on Introductions and Transfers of Aquatic Organisms* to ensure that disease, genetic, and ecological risks are minimized. Therapeutants are prescribed by licensed veterinarians after diagnosing health problems in aquatic animals. Veterinary drugs are regulated for sale in Canada by Health Canada’s Veterinary Drugs Directorate. The conditions of aquaculture licences issued by the provinces require operators to develop and implement fish health management plans for their aquaculture facilities.

Similar to Canada, in the United States, APHIS coordinates with the FWS and NOAA to protect the health of farmed and wild animals under the *Animal Health Protection Act*. Under the NAAHP, APHIS provides recommendations to facilitate legal movement of aquatic animals, eggs and products in interstate and international commerce. The FWS regulates imports of live or dead salmonids or their products under the *Injurious Wildlife Regulations of the Lacey Act*. The FDA’s CVM regulates the manufacture and distribution of food additives and drugs that will be given to animals. The CVM also has a Minor Use and Minor Species designation program that provides incentives for sponsors to seek approval of new animal drugs for fish. Marine net pen aquaculture permitting processes in Maine and Washington require operators to comply with federal and state requirements.

Canada and the U.S. use different methods to authorize introductions and transfers. Canada uses the *a licence under the Fishery (General) Regulations* and the U.S. uses state and federal permits. Canada and the U.S. have agreed to report annually to the North Atlantic Salmon Conservation Organization's North American Commission (NAC) on decisions made in one jurisdiction that may impact the other, and especially identify any that are not consistent with NAC Protocols. Also, the two countries will consult with each other if either receives a proposal for an introduction or transfer that might impact the other country or that would be inconsistent with the NAC protocols. Canada and the U.S. have agreed to occasionally convene a NAC Scientific Working Group to review the Williamsburg Resolution with respect to any relevant development relating to introductions and transfers, and make recommendations to the parties of the resolution.

Genetics and Fish Escapes

Canada

- In Atlantic Canada, there is the potential for escaped farmed Atlantic salmon to interbreed with their wild counterparts, resulting in direct genetic interaction and a mix of farmed and wild genomes. Two approaches are employed to mitigate impact from the escape of farmed fish into the wild (i.e., physical containment, biocontainment).
- On the West Coast, Atlantic salmon do not interbreed with any species of Pacific salmon; neither do they create feral populations upon escape.
- Marine mammal interaction management is also an important containment issue since marine mammals can damage net pens as they seek food, which leads to fish escape events.
- In British Columbia, the *Pacific Aquaculture Regulations* (PAR) enable the Minister of DFO to specify conditions in an aquaculture licence related to the escape and recapture of escaped fish.
- Under Section 56 of the federal *Fishery (General) Regulations*, DFO issues introduction and transfer licences in provinces adjacent to tidal waters, whereby live fish are released into fish habitat or transferred to a fish rearing facility. As part of the eligibility requirements under subsection 56(b) the Minister may take into account measures that avoid fish escapes and the recapture of escaped fish. DFO manages the recapture of escaped farmed fish through a separate fishing licence.
- Newer, more damage-resistant net pen materials (e.g., Sapphire Ultracore) are being developed and used in the aquaculture industry.
- Also, the use of sterile triploids fish is being considered to help mitigate potential post-escape interactions with wild fish populations. DFO recently approved the importation of triploid European-origin salmon eggs for aquaculture in Newfoundland and Labrador, subject to completion of the federal and provincial regulatory review processes for aquaculture proposals.
- Provinces have aquaculture-related legislation and regulations governing the prevention and recapture of escaped farmed fish and requirements to recapture escapes as part of the Conditions of Aquaculture Licences. These include requirements for containment array designs and development of escape management plans, monitoring and reporting.

United States

- ACOE Section 10 (siting) permits include conditions relevant to aquaculture containment and cage integrity. In Maine, these permits include Salmon Aquaculture Special Conditions for Protection of Atlantic Salmon. The fish must be sourced from North American stocks; transgenic salmon are prohibited. Fish transferred into net pens must be marked (i.e., genetically characterized) before stocking so that the facility of origin can be identified in case they escape.

- A *Containment Management System (CMS)* must be prepared and submitted to Maine Department of Environmental Protection (MDEP) for approval before fish are introduced to the facility. The CMS must include third party audits of a facility, conducted both annually and within 30 days of a reportable escape. The aquaculture operators must conduct daily monitoring (e.g., of activities, how much feed is used, conditions of net pens, any diving monitoring done, etc.). An audit is required if an escaped fish is found in the wild and no aquaculture operator has reported an escape.
- Salmon aquaculture operators in Washington stock Atlantic salmon. Research indicates that Atlantic salmon escapes are not a threat to native species such as endangered and threatened salmonids (i.e., they cannot interbreed with native salmon species).
- WDFW administers the *Revised Code of Washington (RCW) 77.125* Marine Finfish Aquaculture Programs, which includes requirements: to minimize escapes through statewide prevention measures; and, to develop rules for aquaculture management, including for escape prevention, recapture and management, and a provision to develop an Atlantic salmon watch program and an education plan to promote environmentally sound marine aquaculture operation. *Washington Administrative Code (WAC)* title 220 relates to WDFW (fisheries) and Chapter 76 focuses on Aquaculture. Several WACs regulate escapement from aquaculture operations. Otolith marking is currently done by the existing operator. Some Puget Sound local governments prohibit the use of Atlantic salmon over concerns about escapes and interbreeding. In Washington, NPDES requires reporting of escapes, consistent with WDFW requirements. Transgenic fish are prohibited.

Table of Comparison: Genetics and Fish Escapes

	Canada					United States		
	Fed	BC	NB	NL	NS	Fed	ME	WA
Requirement for broodstock selection for culture	X					X	X	
Requirement for marking or genetic tagging and tracking						X	X	X
Requirement for containment infrastructure		X	X	X	X	X	X	X
Requirement for facility inspection	*X (BC)	X	X	X	X		X	X
Requirement to minimize and monitor escapes	X	X	X	X	X		X	X
Requirement to report and recapture escapes		X	X	X	X		X	X

Comparative Analysis

Under Section 56 of the federal *Fishery (General) Regulations*, DFO issues introduction and transfer licences in all provinces and territories to release live fish into fish habitat or transfer live fish to a fish rearing facility. Newer, more damage-resistant net pen materials (e.g., Sapphire Ultracore) are being developed and used in the aquaculture industry in New Brunswick. Marine net pen aquaculture operators in Atlantic Canada currently use St. John River (i.e., native) sources broodstock of Atlantic salmon. However, in Newfoundland and Labrador, there is a current proposal for use of triploid Norwegian-stock Atlantic salmon. On the West Coast, Atlantic salmon are the main species cultured in marine net pen aquaculture. Although escapes do occur, scientific evidence indicates that escapes do not establish breeding populations and do not cause genetic impacts to wild salmon species.

In the United States, ACOE Section 10 (siting) permits include conditions relevant to aquaculture containment and cage integrity. Maine's aquaculture permits from MDEP and ACOE indicate that reproductively viable Atlantic salmon placed in net pens must all be of North American origin. The regulations in Maine for management of escapes are comprehensive. Maine requires genetic marking, audit of the responsible farm, and making audit-based changes to escape management to address the cause of the escapes. Salmon aquaculture operators in Washington stock Atlantic salmon, and research indicates that Atlantic salmon intentionally and accidentally released on numerous occasions have not resulted in feral breeding populations. Marine Finfish Aquaculture Programs in Washington have requirements: to minimize escapes through statewide prevention measures; and, to develop rules for aquaculture management, including for escape prevention, recapture and management, and a provision to develop an Atlantic salmon watch program and an education plan to promote environmentally sound marine aquaculture operation.

Canada and the United States share similar goals to prevent genetic impacts from farmed fish to wild fish. In some cases, there may be differences in how each country achieves these goals. Maine's containment practices align closely with New Brunswick's. Similar to Maine, Nova Scotia requires auditing of a facility if at least one farmed fish is found in a river that has been identified as potentially being affected by a breach in the facility's containment plan. British Columbia, New Brunswick, Newfoundland and Labrador, and Washington require monitoring but not facility audits. Washington requires otolith marking. Due to comprehensive marking being done in Maine, there is better understanding of where and when escapes occur. On the contrary, there is little or no ability to track an escaped fish back to the net pen it escaped from in Canada. This represents an area where the regulations could be better aligned so that a more proactive reporting, marking and/or facility auditing containment management approach is conducted in the Canadian provinces.

Other Living Marine Resource Interaction

Canada

- The federal *Marine Mammal Regulations* (MMR) apply across all jurisdictions in Canada, and they prohibit fishing, disturbing, or killing of marine mammals unless authorized to do so under specific conditions in the MMR or other federal regulations.
- The federal *Species At Risk Act* prohibits the killing, harming, harassing capturing or taking, possession, collection of, buying, selling or trading individuals of wildlife species listed as extirpated, endangered or threatened. The Act also prohibits destruction of any part of the critical habitat of listed endangered or threatened species (or of any listed extirpated species if a recovery strategy has recommended its reintroduction into the wild in Canada).
- The federal *Pacific Aquaculture Regulations* (PAR) enable the Minister of DFO to specify conditions in an aquaculture licence respecting the catching of nuisance fish, and the records that must be kept in relation to the number and species of nuisance fish that die as a result of the aquaculture facility's operations. Nuisance fish, in the context of the PAR, means fish that represent an imminent danger to the equipment used in the operation of an aquaculture facility, the safety of persons in the facility or the fish cultivated in the facility.
- The Conditions of Licence for aquaculture in British Columbia require facility operators to have a Marine Mammal Interaction Management Plan in place, including measures to deter and minimize marine mammal interactions. Licence holders are required to make all reasonable attempts to free entangled marine mammal without harm and notify DFO of any marine mammal drowning mortality or entanglement (live or dead) no later than 24 hours after discovery. In the event that deterrence efforts fail, licence holders are authorized to dispatch harbour seals and California sea lions which are within 30 meters from the edge of net pen associated with the containment structure array, and are within or

attempting to enter the containment structure array, and represent an imminent danger to aquaculture equipment and infrastructure, the safety of persons in the facility or the fish cultivated in the facility.

- New Brunswick and Newfoundland and Labrador aquaculture regulatory regimes require marine net pen aquaculture operators to have predator control plans (including measures to deter and minimize marine mammal interactions) as part of licence application.
- Nova Scotia *Aquaculture Management Regulations* require that procedures consistent with industry best practices on interactions with wildlife must be included in the Farm Management Plan.
- In limited circumstances, where avoidance or exclusion measures are ineffective, licenced aquaculture operators in Atlantic Canada may be issued Nuisance Seal Permit under specific conditions in the MMR and *Fishery (General) Regulations* to authorize lethal control of nuisance seals.

United States

- The MMPA addresses potential marine mammal interactions with net pen aquaculture facilities. Under the MMPA, NOAA Fisheries must annually categorize commercial fisheries (including aquaculture facilities) based on the relative frequency of incidental mortalities and serious injuries of marine mammals in the fishery:
 - Category I designates fisheries with frequent mortalities and serious injuries incidental to commercial fishing;
 - Category II designates fisheries with occasional mortalities and serious injuries; and,
 - Category III designates fisheries with a remote likelihood or no known mortalities or serious injuries.
- Incidental take under the MMPA is non-intentional, accidental death or injury that occurs when carrying out an otherwise lawful activity, such as permitted fishing.
- For 2016, salmon net pen facilities in Maine and Washington were designated as a Category III fishery and received Incidental Harassment Authorizations.
- Under the MMPA, an interaction resulting in the mortality or injury of a marine mammal in the course of commercial operations must be reported within 48 hours of the occurrence.
- Killing a marine mammal, also known as intentional lethal take, is strictly prohibited, and only allowed if imminently necessary for self-defence or to save a person's life.
- The MMPA allows deterrence of marine mammals from damaging gear or catch as long as the measures do not result in the death or serious injury of the marine mammal.
- NOAA Fisheries has also issued a final rule implementing import provisions of the MMPA.
 - This rule implements aspects of the MMPA that aim to reduce marine mammal bycatch associated with international commercial fishing operations, which includes aquaculture operations, by requiring nations exporting fish and fish products to the United States to be held to the same standards as that of the United States.
 - The rule also establishes criteria for evaluating a harvesting nation's regulatory program for reducing marine mammal bycatch and the procedures required to receive authorization to import fish and fish products into the United States.
 - The rule establishes a five-year exemption period to allow foreign harvesting nations time to develop, as appropriate, regulatory programs comparable in effectiveness to U.S. programs.
- Federal agencies are directed, under the ESA, to use their authorities to conserve threatened and endangered species. Federal agencies must consult with NOAA Fisheries and the FWS on activities that may affect a listed species. The interagency consultations are designed to assist federal agencies in fulfilling their duty to ensure federal actions do not jeopardize the continued existence of a species.
- In Washington, State Environmental Policy Act review results in the consideration of impacts to marine mammals. The state and some local jurisdictions have specifically prohibited use of lethal predator controls.

Table of Comparison: Other Living Marine Resource Interaction

	Canada					United States		
	Fed	BC	NB	NL	NS	Fed	ME	WA
Requirements and practices for managing predation by marine mammals and birds		X	X	X	X	X	X	X
Requirement to prevent incidental marine mammal mortalities	X	X	X			X		
Requirement to minimize negative effects on threatened and endangered species and critical habitats	X	X				X		X
Requirement to prohibit deliberate killing of marine mammals	X	X				X		X
Authorization to kill marine mammals for specific reasons	X	X						

Comparative Analysis

Canada’s federal MMR prohibit the fishing, disturbing, or killing of marine mammals unless authorized to do so under specific conditions in the MMR or other federal regulations. The federal *Species At Risk Act* prohibits the killing, harming, harassing, capturing or taking, possession, collection of, buying, selling or trading individuals of wildlife species listed as extirpated, endangered or threatened, as well as the destruction of any part of the critical habitat of listed endangered or threatened species (or of any listed extirpated species if a recovery strategy has recommended its reintroduction into the wild in Canada). The provincial regulatory regimes in the Atlantic Provinces require marine net pen aquaculture operators to implement measures to deter predators and minimize interactions with marine mammals or wildlife. In limited circumstances, where avoidance or exclusion measures are ineffective, licensed aquaculture operators in Atlantic Canada may be issued Nuisance Seal Permit under specific conditions in the MMR and *Fishery (General) Regulations* (FGR) to authorize lethal control of nuisance seals. In British Columbia, the federal PAR provides the authority for specifying conditions in an aquaculture licence with respect to the catching of nuisance fish, and the records that must be kept in relation to the number and species of nuisance fish that die as a result of the aquaculture facility’s operations. The Conditions of Licence for aquaculture in British Columbia require facility operators to have a Marine Mammal Interaction Management Plan in place, which must include measures to deter and minimize marine mammal interactions. Licence holders are required to make all reasonable attempts to free entangled marine mammal without harm. In the event that deterrence efforts fail, licence holders are authorized to only dispatch harbour seals and California sea lions that are close to the containment structure array, are within or attempting to enter the containment structure array, and represent an imminent danger to aquaculture equipment and infrastructure, the safety of persons in the facility or the fish cultivated in the facility.

In the United States, the MMPA addresses potential marine mammal interactions with net pen aquaculture facilities, and NOAA Fisheries must annually categorize commercial fisheries (including aquaculture facilities) based on the relative frequency of incidental mortalities and serious injuries of marine mammals in the fishery. The MMPA allows deterrence of marine mammals from damaging gear or catch as long as the measures do not result in the death or serious injury of the marine mammal. Killing a marine mammal is strictly prohibited, except if imminently necessary for self-defense or to save a person’s life. The ESA

requires consideration of impacts of proposed marine net pen operations on threatened and endangered species.

An important emerging issue is requirements contained in the new *Import Provisions Regulations* under the MMPA. Nations are required to prohibit the intentional mortality or serious injury of marine mammals in the course of commercial fishing operations unless the intentional mortality or serious injury of a marine mammal is imminently necessary in self-defense or to save the life of a person in immediate danger; or that it has procedures to reliably certify that exports of fish and fish products to the United States are not the product of an intentional killing or serious injury of a marine mammal. These provisions may necessitate changes in Canada's MMR and PAR in order to avert potential import restrictions on farmed salmon products exported to U.S. markets.

List of Acronyms and Abbreviations

Canada

AANS	Aquaculture Association of Nova Scotia
AAR	<i>Aquaculture Activities Regulations</i>
ACFFA	Atlantic Canada Fish Farmers Association
ACRDP	Aquaculture Collaborative Research and Development Program
ASWP	Atlantic Salmon Watch Program
BCARP	British Columbia Aquaculture Regulatory Program
BMA	Bay Management Area
CAIA	Canadian Aquaculture Industry Alliance
CFIA	Canadian Food Inspection Agency
CSAS	Canadian Scientific Advisory Secretariat
DAAF	Department of Agriculture, Aquaculture and Fisheries
DFA	Department of Fisheries and Aquaculture
DFO	Fisheries and Oceans Canada
FHMP	Fish Health Management Plan
IHNV	Infectious Haematopoietic Necrosis Virus
IPNV	Infectious Pancreatic Necrosis Virus
IMTA	Integrated Multi-Trophic Aquaculture
ISA	Infectious Salmon Anemia
ISAV	Infectious Salmon Anemia Virus
MOU	Memorandum of Understanding
NAAHP	National Aquatic Animal Health Program
NASCO	North Atlantic Salmon Conservation Organization
OIE	World Organization for Animal Health
RCC	Regulatory Cooperation Council

United States

ACOE	United States Army Corps of Engineers
APHIS	Animal and Plant Health Inspection Service
BE	Biological Evaluation
CAHPS	Commercial Aquaculture Health Program Standards
CMS	Containment Management System
CVM	Center for Veterinary Medicine
CWA	Clean Water Act
CZMP	Coastal Zone Management Program
Ecology	Washington Department of Ecology
EFH	Essential Fish Habitat
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
FDA	United States Food and Drug Administration
FHMZ	Fish Health Management Zone
FWS	United States Fish and Wildlife Service
JARPA	Joint Aquatic Resources Permit Application
MAA	Maine Aquaculture Association
MDEP	Maine Department of Environmental Protection
MDMR	Maine Department of Marine Resources

MMPA	Marine Mammal Protection Act
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NAA	National Aquaculture Association
NOAA	National Oceanic and Atmospheric Administration
NOAA Fisheries	NOAA National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
PATON	Private Aids to Navigation (U.S. Coast Guard)
PHS	Priority Habitats and Species
SMA	Shoreline Management Act
U.S.	United States
USNAHP	United States National Aquatic Animal Health Plan
VFD	Veterinary Feed Directive
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WDNR	Washington Department of Natural Resources
WSDA	Washington State Department of Agriculture

Introduction

Regulatory Cooperation on Marine Net Pen Aquaculture

The Canada-United States Regulatory Cooperation Council (RCC) initiative was established to enable closer regulatory cooperation between Canada and the United States (U.S.) and improve economic competitiveness while maintaining high standards for health, safety, and the environment. Canada and the United States have released several Regulatory Partnership Statements and annual Work Plans to advance regulatory cooperation between Canadian and U.S. agencies.^{1,2}

As part of the RCC initiative, Fisheries and Oceans Canada (DFO) and the National Oceanic and Atmospheric Administration (NOAA) developed a Regulatory Partnership Statement focusing on the aquaculture sector. DFO and NOAA established a partnership framework, implemented a binational RCC work planning process, and identified opportunities for stakeholder engagement.^{3,4}

Through the RCC's *Joint Forward Plan* (August 2014), the two agencies committed to implement a deeper collaborative relationship and enable closer regulatory cooperation for the aquaculture sector.⁵ DFO and NOAA agreed to focus on the environmental effects of net pen aquaculture and to compare the applicable regulations and management approaches used in each country. This includes the regulatory requirements and management approaches under the jurisdiction of federal agencies other than DFO and NOAA and by the relevant agencies in the Canadian provinces and U.S. coastal states where commercial marine net pen farms currently operate.

DFO and NOAA support sustainable development of the marine net pen aquaculture sector and share similar environmental management objectives for this industry - namely, to ensure that living marine resources and their habitats are protected using approaches that are efficient, effective, and commensurate with the potential risk to the environment.

Organization of Report

This report compares regulatory requirements and management approaches for marine net pen aquaculture in Canada and the United States, with a focus on five major topics of interest to DFO and NOAA:

- Siting and management
- Habitat and water quality
- Fish health and therapeutants
- Genetics and fish escapes
- Other living marine resources

For each of these topics, this report summarizes key requirements in applicable laws, regulations, and guidelines and highlights major similarities and differences between requirements and approaches in Canada, the United States, and the Canadian provinces and U.S. coastal states where commercial-scale marine net pen aquaculture currently operates.

¹ See <http://www.trade.gov/rcc/> (accessed April 5, 2018).

² See <http://www.dfo-mpo.gc.ca/aquaculture/management-gestion/statement-declaration-eng.htm> (accessed April 5, 2018).

³ See <http://www.trade.gov/rcc/documents/l-rps-dfo-noaa-rps.pdf> (accessed April 5, 2018).

⁴ See <http://www.dfo-mpo.gc.ca/aquaculture/management-gestion/reg-coop-eng.htm> (accessed April 5, 2018).

⁵ It is not the intention of the Regulatory Partnership Statement to create binding obligations under domestic or international law. Overall support from the executive branch of government in each country, as well as the availability of appropriations, personnel and other resources, is required to implement the Regulatory Partnership Statement.

Overview of Marine Net Pen Aquaculture Regulatory Regimes

Canada

The Canadian aquaculture regulatory regime has evolved incrementally over time into a multi-faceted arrangement wherein the federal and provincial governments play a variety of roles throughout the country. At the time of Confederation, aquaculture was a minor area of activity, something that likely explains why the term does not appear in the *Constitution Act, 1867*. Since that time, the sector has grown in importance in different regions.

Since aquaculture is not specifically mentioned in the *Constitution Act, 1867*, historically the federal and provincial governments have been unable to agree about which level of government should be primarily responsible for the activity. The federal government has long believed that there are fisheries-related elements associated with aquaculture, while the provinces have historically claimed jurisdiction. Emerging from federal-provincial discussions on this matter in the late 1980s, the governments agreed to disagree on the constitutional question and to cooperate on aquaculture through a series of non-binding Memoranda of Understanding (MOU) without prejudice to their respective positions.

This rough settlement lasted until 2009 with the arrival of the *Morton* decision, a ruling by the British Columbia Supreme Court which, among other things, raised fundamental constitutional issues regarding the nature of aquaculture. Post *Morton*, three distinct types of aquaculture regulatory approaches operate concurrently in Canada: 1) the British Columbia approach under the federal *Pacific Aquaculture Regulations*; 2) the Prince Edward Island approach; and 3) the provincial-lead model, whereby the provinces retain principal regulatory responsibility.

The British Columbia approach emerged from the key finding in *Morton* that finfish aquaculture in British Columbia was a fishery. As such, aquaculture fell under the jurisdiction of the federal Parliament pursuant to s. 91 (12) of the *Constitution Act, 1867* (sea coasts and inland fisheries) and not under the jurisdiction of the province. In response, DFO developed the *Pacific Aquaculture Regulations* (PAR) under the *Fisheries Act* which set out the federal authorities for aquaculture management in British Columbia, and in particular waters off of its coasts. The *Morton* decision applies in British Columbia only. In other provinces, no court decision has declared that aquaculture is a fishery falling within the jurisdiction of the federal Parliament.

In British Columbia, the federal government is responsible for the operational regulation of finfish, shellfish, freshwater and enhancement aquaculture, including licensing, site approvals (province still issues leases), and the establishment of a range of operator requirements, including monitoring, fish health management etc., as set out under conditions of license. The federal government is not responsible for the regulation of plant aquaculture or for the management of land on which, or over which, aquaculture takes place. Land management responsibilities fall under provincial jurisdiction, and thus a provincial approval for access to land remains a requirement.

With respect to aquaculture governance in Prince Edward Island (PEI), through the 1928 and 1987 MOU's between the federal and provincial governments, PEI effectively delegated the administration and control of provincial land for aquaculture purposes to the federal government. Through the MOU's, the federal government is responsible for issuing leases for the culturing of mollusks and for issuing licences and leases for finfish. For shellfish aquaculture, leases assign authority to occupy crown land and to operate an aquaculture venture.

Outside of British Columbia and Prince Edward Island, the provinces are the principal regulators. They have individually developed and put in place aquaculture-related legislation and associated programs, and each is

responsible for aquaculture licensing and a system of tenure management which allocates access to Crown land associated with aquaculture sites.

Overlaying the three regimes, the federal government plays a substantial cross-cutting role in aquaculture governance, regulating fish habitat protection, pesticide and drug approvals, food safety, navigable waters protection, and feeds activities that are all relevant to aquaculture. Specifically, the federal government manages aquaculture activities mainly through 7 separate organizations involving 10 different pieces of legislation and their underlying regulations:

- Fisheries and Oceans Canada (DFO) administers the federal *Fisheries Act* and underlying regulations such as the *Aquaculture Activities Regulations* (AAR), the *Pacific Aquaculture Regulations* (PAR), the *Fishery (General) Regulations* (FGR), the *Management of Contaminated Fisheries Regulations* (MCFR), and the *Marine Mammals Regulations* (MMR). The Act includes provisions for protecting fisheries and preventing pollution in waters frequented by fish, provisions that are broadly relevant to aquaculture throughout the country. Pursuant to the Act, the PAR contains provisions that are relevant only to the management of aquaculture in British Columbia, and in particular waters off its coast. In PEI, a Memorandum of Understanding sets out responsibilities for aquaculture whereby DFO issues leases and licences. The Minister of Fisheries and Oceans is the competent minister for aquatic species in Canada under the federal *Species at Risk Act* (SARA) (other than for individuals in or on federal lands administered by the Parks Canada Agency for which the Minister of the Environment and Climate Change is the competent minister) and there are requirements to protect aquatic species at risk. The Department also has a mandate for supporting the economic prosperity of the aquaculture sector.
- Transport Canada through the *Canada Shipping Act 2001*, addresses vessel-related pollution response measures, vessel requirements and inspections. In addition, through the *Navigation Protection Act*, Transport Canada regulates safety requirements for the protection of the public right of navigation;
- Environment and Climate Change Canada (ECCC) administers the *Canadian Environmental Protection Act* (CEPA) which includes disposal-at-sea provisions that apply to some aspects of aquaculture. In addition, the *New Substances Notification Regulations* under CEPA specify information requirements and the decision/approval times for the manufacture and importation of new chemical products to support aquaculture husbandry activities;
- The Canadian Food Inspection Agency (CFIA) via the *Health of Animals Act* covers the management and control of animal diseases. The *Feeds Act* governs the manufacture, sale and import of livestock feeds.
- Health Canada through the *Food and Drugs Act* provides for the regulation of drugs for sale for the safety for people and animals;
- Also under Health Canada, the *Pest Management Regulatory Agency* through the *Pest Control Products Act* regulates the registration of pesticides for use for the safety of people and animals and protection of the environment, and;
- Under *the Department of Agriculture and Agri-Food Act*, duties and functions of the Minister of Agriculture and Agri-Food extend to matters relating to agriculture products, which includes the marketing of fish and seafood.

From an international perspective, Canada's three-regime model is unusual in that lead regulatory responsibilities are highly variable. For example, even though the federal government leads in Prince Edward Island and British Columbia, the regimes are different in the two provinces. Elsewhere, under provincial leads, the legislative and regulatory arrangements differ in the various provinces.

Marine finfish net pen aquaculture in Canada primarily occurs within the coastal waters of British Columbia (BC), New Brunswick (NB), Newfoundland and Labrador (NL), and Nova Scotia (NS). There is currently no commercial marine finfish net pen aquaculture operation in Prince Edward Island (PEI), and the provinces of Quebec (QC), Ontario (ON), Manitoba (MB), Saskatchewan (SK) and Alberta (AB) primarily operate land-based freshwater aquaculture. Consequently, all the Canadian sections of this report describe the regulatory regimes for marine net pen aquaculture on the basis of the obligations of the federal government of Canada, and the provincial governments of BC, NB, NL, and NS.

United States

Marine net pen aquaculture in the United States currently occurs primarily within the coastal waters of Maine and Washington. Smaller marine net pen operations exist in New Hampshire and Hawaii. These coastal states maintain jurisdiction over marine activities out to three nautical miles from shore, and each state has a system for leasing areas of their coastal zone for marine net pen aquaculture. Marine net pen aquaculture must comply with a suite of state/federal laws and with city and/or county regulations.

The primary federal permit required is issued by the United States Army Corps of Engineers (ACOE) under Section 10 of the *Rivers and Harbors Act*, which authorizes structures and work in navigable waters of the United States. Issuance of a Section 10 permit may also require a Section 401 Water Quality Certification, under the *Clean Water Act* (CWA), if the state determines that there may be an associated discharge from the construction or operation of the facility. The other major federal permit required is a *National Pollutant Discharge Elimination System* (NPDES) permit under the CWA which authorizes discharges into waters of the United States. The United States Environmental Protection Agency (EPA) has authorized most U.S. coastal states, including Maine and Washington, to issue NPDES permits under its CWA authority.

Other federal regulatory requirements address potential effects of marine net pen aquaculture on aquatic animal health, environmental health, and living marine resources. The United States Department of Agriculture (USDA) has regulatory programs that address aquatic animal health matters through its Animal and Plant Health Inspection Service (APHIS), while the U.S. Food and Drug Administration (FDA) addresses aquatic animal health matters through its Center for Veterinary Medicine (CVM).^{6,7}

NOAA's marine aquaculture program supports further development of marine net pen aquaculture and conservation of the marine environment; however, the agency does not authorize marine aquaculture in state waters. NOAA's role (along with that of the U.S. Fish and Wildlife Service) is to consult with federal agencies, in particular the ACOE, that issue permits as part of its stewardship responsibilities for protecting wild fisheries, marine sanctuaries, marine mammals, endangered species, and fish habitat. NOAA and the U.S. Fish and Wildlife Service (FWS) may recommend that the federal agency issuing the permit require the permit holder to adopt certain conservation measures to protect species or habitats.

State, city, and county agency roles and requirements are discussed in subsequent sections of this report.

⁶ See <https://www.ars.usda.gov/IWGA/factsheet.htm> for other fact sheets addressing aquaculture regulations (accessed April 5, 2018)

⁷ The list of acts and authorities is not exhaustive.

Siting and Management of Aquaculture Operations

The Siting and Management topic area is broad in scope and overlaps with issues addressed in the other four sections of the document. The summary table at the end of this section therefore includes regulations that may also be included in other sections.

Siting

Siting decisions form the basis for the design, layout, and management of aquaculture operations. Siting decisions take into consideration the distance between farms; oceanographic and bathymetric conditions; proximity to wild fish spawning and migration areas, sensitive fish habitats, and marine mammal areas; proximity to recreational or commercial fisheries sites; biosecurity needs; marine transportation corridors; and many other factors. Typically, facility owners seek locations to avoid negative environmental effects and optimize fish growth (e.g., adequate tidal flushing, water depths, temperatures, and dissolved oxygen concentrations). Further, facility operators avoid areas that have very low wintertime water temperatures, damaging ice floes or are subject to high wind or seas. Proper site selection for marine net pen aquaculture operation is the initial crucial step in the management of wild and farmed fish interactions. Regulatory decisions and appropriate siting advice are needed to support sustainable development of commercial net pen operations.

Management Areas

Area management approaches take into consideration the potential cumulative impact of all activities, including the aquaculture facility, on the larger local or regional ecosystems, and are essential to the development and maintenance of sustainable aquaculture. The adoption of an aquaculture management area approach, such as the Bay Management Area (BMA) approach, requires farmers in the BMA to coordinate fish health management practices and measures across all farms, preventing or mitigating the spread of disease and parasites and supporting environmental management practices. Site fallowing, year class separation, and designation of separation distances between sites/farms within designated “bay areas” are effective approaches to the management of fish health in aquaculture.

Fallowing and Site Rotation

Fallowing is an important management tool used in terrestrial agriculture. It entails purposeful crop rotation to allow for soil recovery. This approach has also been applied to aquaculture operations. Fallowing of a site can be completed, even where a BMA is not being used. Farms may also rotate the locations of their aquaculture facilities between production runs, allowing recovery of the benthic ecosystem as monitored using geochemical indicators. Fallowing can also be effective in avoiding or managing the spread of pathogens and parasites such as sea lice. This is because when farmed fish is removed, pathogens and pests are unable to propagate without access to their host (i.e., farmed fish). One of the challenges with this approach is that farms require more than one site on which to operate.

Canada

Federal

Siting of Marine Finfish Net Pens

Siting is a federal/provincial/territorial responsibility except in PEI where there is a Management Board involving federal and the provincial authorities that oversee aquaculture regulation in the Province.

All provinces are the land owners and are responsible for leasing aquaculture sites (except PEI) and the day-to-day operation of aquaculture licences (except PEI and BC). During provincial siting application reviews, all provinces consult agencies such as Transport Canada (e.g., navigable waters), Environment and Climate Change Canada (ECCC) (e.g., migratory birds), DFO (e.g., aquatic species at risk, fish habitat protection, fish health). DFO plays an important role by providing regulatory and scientific advice to the provinces on site applications. For example, the federal AAR require that siting-related information on proposed new or expanded marine finfish sites be submitted to DFO prior to depositing deleterious substances. This information is used in the preparation of DFO's siting recommendations.

Regulatory decisions and advice regarding where to site aquaculture operations are essential components of the mitigation actions that regulatory authorities require to offset any potential interaction between wild and farmed fish. Detailed plans for aquaculture facilities must accompany the licence application before provincial and federal regulators are able to make a siting decision.

The federal *Aquaculture Activities Regulations* (AAR) specify conditions for substrate sampling or visual monitoring to determine whether or not restocking a site may take place. These conditions are applicable in tidal waters in or adjacent to QC, NS, NB, BC, PEI, and NL. A site cannot be restocked if it exceeds designated thresholds. The site may resume production once the level of the indicator drops below the thresholds. These thresholds relate to the quality of the benthic environment.

Public Consultation

In all provinces, public consultations are part of the application process for new licences and siting decisions, though the extent and approach to consultation vary depending on the jurisdiction.

Provincial

A. BRITISH COLUMBIA

Siting

In BC, siting of marine net pen aquaculture is the responsibility of the federal/provincial governments—the Province is the landlord and it issues the tenure⁸ for aquaculture under authority of the BC *Lands Act*. However, provincial officials do heed DFO's published Siting Guidelines for Marine Finfish Aquaculture in BC⁹ and consult DFO officials directly on siting, with regard to lease applications. DFO issues the licence for aquaculture operation¹⁰ under the federal *Fisheries Act* and PAR.

The DFO Siting Guidelines for Marine Finfish Aquaculture in BC developed in close consultation with provincial officials in BC is organized into four major themes that help identify key management objectives and potential issues (i.e., risks) regarding the siting of proposed aquaculture facilities. The four themes are as follows:

1. General siting considerations:

Management objective: to ensure that new marine finfish aquaculture facilities have the required permits, tenures and authorizations; and that Indigenous Peoples' rights and title are respected.

⁸ See information on tenure for aquaculture in BC at <http://www.pac.dfo-mpo.gc.ca/aquaculture/licence-permis/index-eng.html#tenures> (accessed April 5, 2018)

⁹ See the DFO Siting Guidelines for Marine Finfish Aquaculture in BC at <http://www.pac.dfo-mpo.gc.ca/aquaculture/licence-permis/docs/site-guide-direct-eng.html> (accessed April 5, 2018)

¹⁰ See the BC Marine Finfish Aquaculture Licence under the *Fisheries Act* at <http://www.pac.dfo-mpo.gc.ca/aquaculture/licence-permis/docs/licence-cond-permis-mar/index-eng.html> (accessed April 5, 2018)

Guidelines:

- Where applicable, Indigenous Peoples Treaty and/or Non-Treaty agreements will be considered.
- Where required, aquaculture facilities will have provincial land tenure and/or navigable waters permit.
- The proposed aquaculture facility should not be sited within a National Marine Protected Area unless identified as an exception within the regulation.

2. Potential fish, fish habitat, and environmental impacts:

Management objective: to minimize potential impacts to the environment (e.g., seabed) that may result in a negative impact on existing commercial, recreational or aboriginal (CRA) fisheries or important/valued ecosystem components.

Guidelines:

- Aquaculture facilities should be capable of meeting performance measures for benthic conditions, as identified in the AAR, to mitigate impact to the ecosystem below the facility.
- The predicted footprint of increased deposition should be located in water depth of greater than 30 meters to mitigate potential impacts to shallow water habitats.
- A minimum distance of 10 meters should be maintained between the bottom of the facility infrastructure (i.e., netting, predator nets) and the seabed to mitigate potential impacts from direct contact.
- Placement and operation of the proposed aquaculture facility should not impact the SARA listed species.

3. Potential impacts to existing fishery activities:

Management objective: to minimize and/or mitigate potential impacts on existing fisheries. Within this objective, Indigenous Peoples' rights to fish for Food, Social and Ceremonial (FSC) purposes have priority, after conservation, over other uses of the aquatic resource.

Guidelines:

- Placement and operation of the proposed facility in relation to Indigenous Peoples' ability to access fish for FSC purposes will be evaluated.
- Placement and operation of the proposed aquaculture facility in relation to existing CRA fisheries will be evaluated.

4. Fish health and wild-farmed interactions:

Management objective: to minimize and/or mitigate potential risks to the health of wild and farmed stocks resulting from interactions between wild and farmed fish.

Guidelines:

- Siting of aquaculture facilities will take into consideration potential impacts to the health of wild migratory salmon and other fish stocks.
- Aquaculture facilities should be located at least three kilometres from an existing marine finfish facility or operate under co-ordinated Fish Health Management Plans (FHMP).

The guidelines are based on current science knowledge and advice regarding aquaculture and potential interactions with the environment. Some of the guidelines do not have a science-based linkage (i.e., they are policy based or legal requirements), whereas others are directly connected to science advice received from DFO's Canadian Science Advisory Secretariat (CSAS)¹¹. The Pathways of Effects for Finfish and Shellfish Aquaculture (CSAS Science Advisory Report 2009/071)¹² formed the scientific basis for the guidelines. Emerging science on risks related to wild-farmed and environmental interactions will be incorporated in the DFO application assessment process as it becomes available.

¹¹ See the CSAS at <http://www.dfo-mpo.gc.ca/csas-sccs/index-eng.htm> (accessed April 5, 2018)

¹² See the Pathways of Effects for Finfish and Shellfish Aquaculture (CSAS Science Advisory Report 2009/071) at http://www.dfo-mpo.gc.ca/csas-sccs/publications/sar-as/2009/2009_071-eng.htm (accessed April 5, 2018)

With regard to the fish health and wild farmed interactions theme, the mandatory FHMP and facility Standard Operating Procedures outline best practices and represent the primary management measures used to mitigate potential risks to all fish stocks. The siting guidelines further reduce the likelihood of disease outbreaks at aquaculture facilities and thereby potential risks to wild and farmed stocks.

The BC Harmonized Aquaculture Application Form is a single window application to meet the needs of the federal and provincial governments. The Province is the landlord and issues the tenure for aquaculture. The lease application is reviewed by DFO, as well as federal and provincial agencies, to make sure it is acceptable. Input is then received from stakeholders through a public consultation process before the tenure is issued. The provincial government has the final say on issuance of the tenure, and the federal government will not issue the licence for net pen aquaculture unless the tenure is in place.

The Government of Canada and BC's Guide to the Pacific Marine Finfish Aquaculture Application (currently under review) describes what information federal and provincial agencies require to review an application for a marine finfish aquaculture facility in BC (i.e., new applications or amendments).

While the tenure does not specifically consider pathogens or pests, siting-related considerations of the BC Ministry of Forests, Lands and Natural Resource Operations (i.e., the provincial Ministry responsible for issuing Crown tenures for aquaculture facilities) that could have relevance to pathogen or pest transfers may include (depending on the type of application):

- The applicant must conduct fish surveying if the aquaculture site is closer than one kilometer from the mouth of an anadromous salmonid-bearing stream determined as significant by the Province. The proponent must contact a provincial fish and wildlife biologist and provide information and a mitigation strategy if anadromous salmonids of provincial interest are found in the stream.
- The Guide notes that local governments exercise authority through zoning bylaws, permits and other instruments. The aquaculture activity should consider these instruments. Local governments review aquaculture applications and comment with respect their Official Community Plans.

Management Areas

The BMA approach is not practised in BC but there are geographically defined fish health zones supporting minimizing transfer of diseased fish from one area to another.

Fallowing

There is no fallowing required specifically to manage disease or sea lice outbreaks in BC. Recently, DFO initiated a study to examine how fallowing could be incorporated as an effective strategy for the management of certain diseases. Regarding sea lice, advice received from the CSAS noted that for fallowing to be fully effective, all susceptible fish need to be removed from the site and surrounding areas, and remain 'host free' for a period longer than the time required for development of sea lice from egg to copepodid stage plus the lifespan of the copepodid, and these time periods are strongly influenced by water temperature. Moreover, fallowing should also consider the presence or absence of wild host species in the area, since the presence of wild fish infected with sea lice near the farm sites will make fallowing less effective. In BC waters, it is not considered possible to completely remove sea lice from an area through fallowing processes due to the number of wild sea lice hosts in the region.

Public Consultation

Applications for aquaculture sites are posted on the harmonized provincial application website and opportunity is provided for public comments. Furthermore, input is sought on regulatory or legislative amendments consistent with other consultation processes.

Figure 2.1: Marine Finfish Aquaculture Sites in BC



B. NEW BRUNSWICK

Siting

Siting is part of the licensing application in NB. The *General Regulation 91-158* of the *NB Aquaculture Act* provides authority to the provincial Minister to refuse an aquaculture lease if the aquaculture site is within 300 meters of another aquaculture site or other marine structure (unless appropriate permission is received). However, there have been no sites approved recently. An application must identify other marine users, migratory birds, and biodiversity (in benthos), and works on a performance-based standards approach. The sites are a certain size and they have to submit a production program to the Department of Agriculture, Aquaculture and Fisheries (DAAF) and the Department of Environment (DOE) to get approved. The company must stay within the environmental parameters based on results of the monitoring programs, not necessarily the density of the fish in the cages. Companies need to have an aquaculture licence from

DAAF and need an approval to operate from DOE before they can put any fish on the farm. DAAF's Marine Aquaculture Site Mapping Program¹³ has a map viewer that identifies finfish and mollusk aquaculture sites.

Management Areas

The BMA approach is comprehensively practised in the Bay of Fundy, NB. The provincial *Aquaculture Act* states that the Minister may designate a water body as a BMA, the year class of the aquaculture production permitted in the area, and the length of a fallow period for the area. There is a mandatory four month fallow period per site, and minimum two month BMA fallow zone. Normally, a Bay Area is fallow for six months to a year before fish are restocked. There is a three-year bay management system in the Bay of Fundy (i.e., for first-year fish, for second-year fish, and to keep fallow). This includes seven BMAs.

The Bay of Fundy Marine Aquaculture Site Allocation Policy¹⁴ encourages the aquaculture industry to establish voluntary BMA among finfish operations located in the same aquaculture BMA. These agreements would be consistent with relevant government and industry standards, and local management practices. They would also be submitted for approval before DAAF approves new sites, adjustments to boundaries, subdivision of sites, sub-leasing of sites or increases to production.

Fallowing

Under the NB *Aquaculture Act*, the Province can enforce the length of time that a site may need to be fallowed. The Registrar can make licence terms and conditions that include the length of the fallow period. There is a mandatory four month fallow period per site, and minimum two month BMA fallow zone. More details on fallowing are provided in the above section on Management Areas.

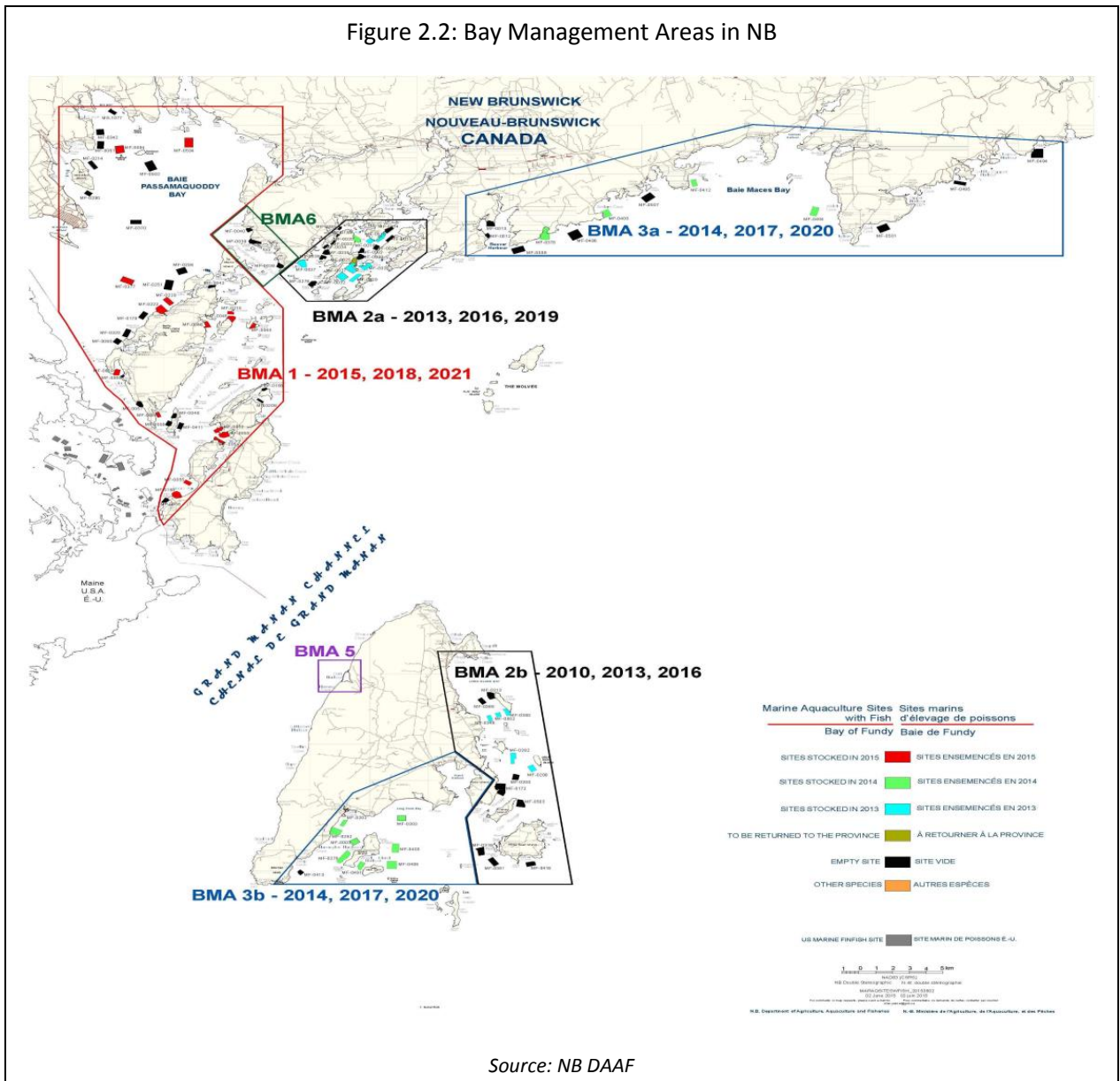
Public Consultation

Sections 33 and 34 of the NB *Aquaculture Act* require an applicant for a lease or occupation permit to provide 'public notice' in accordance with the regulations. The Marine Aquaculture Application Guide states that all applications to lease a marine aquaculture site or amend a site's boundaries and occupation permits are open for public comment. The applicant is responsible to inform members of the public. The Guide further states that landowners within 100 metres of the proposed site are to be informed via a letter from the DAAF. There are no provisions in the Act or regulations that require public engagement in the context of a licence application. However, Section 42 of the NB *Aquaculture Act* gives the Minister complete discretion in determining if, when and how, public consultations will take place.

¹³ See DAAF's Marine Aquaculture Site Mapping Program at <http://www2.gnb.ca/content/gnb/en/departments/10/aquaculture/content/masmp.html> (accessed April 5, 2018)

¹⁴ Bay of Fundy Marine Aquaculture Site Allocation Policy at http://www2.gnb.ca/content/gnb/en/departments/10/aquaculture/content/site_allocation_policy.html (accessed April 5, 2018)

Figure 2.2: Bay Management Areas in NB



C. NEWFOUNDLAND AND LABRADOR

Siting

The NL *Aquaculture Act* regulates the layout, size, and development of aquaculture facilities. Prior to the implementation of the BMA approach, generally, a minimum of one kilometre between sites was required for cumulative environmental, pathogen and health protection. In a BMA, each site belonging to the same company can be one kilometre apart. However, new sites from different companies need to be a minimum of five kilometres apart. The licensing process considers siting and is enforced by the Department of Fisheries and Aquaculture (DFA). The proponent can request a “site hold” to reserve a site while they conduct investigations to determine if they want to use it. DFA does environmental testing and encourages the proponent to site away from scheduled rivers (i.e., with known salmon runs) to reduce the risk pathogen transfers and genetic interactions. Figure 2.3 identifies salmonid/hatchery and shellfish sites in NL.

Management Areas

NL has adopted a BMA approach similar to that used in the Bay of Fundy in NB. There is coordinated stocking in each BMA. Thus, all sites within a BMA would be stocked with the same year class of fish. All would also be fallow at the same time. The NL *Sustainable Aquaculture Strategy 2014*¹⁵ notes that BMA is currently being used to enhance biosecurity and mitigate pathogen presence and spread. There are currently twelve BMAs but this may change. The Province's DFA plans to further delineate and enhance the BMAs. This will require a better understanding of oceanographic influences, and will include collection and analysis of oceanographic and epidemiological data.

Fallowing

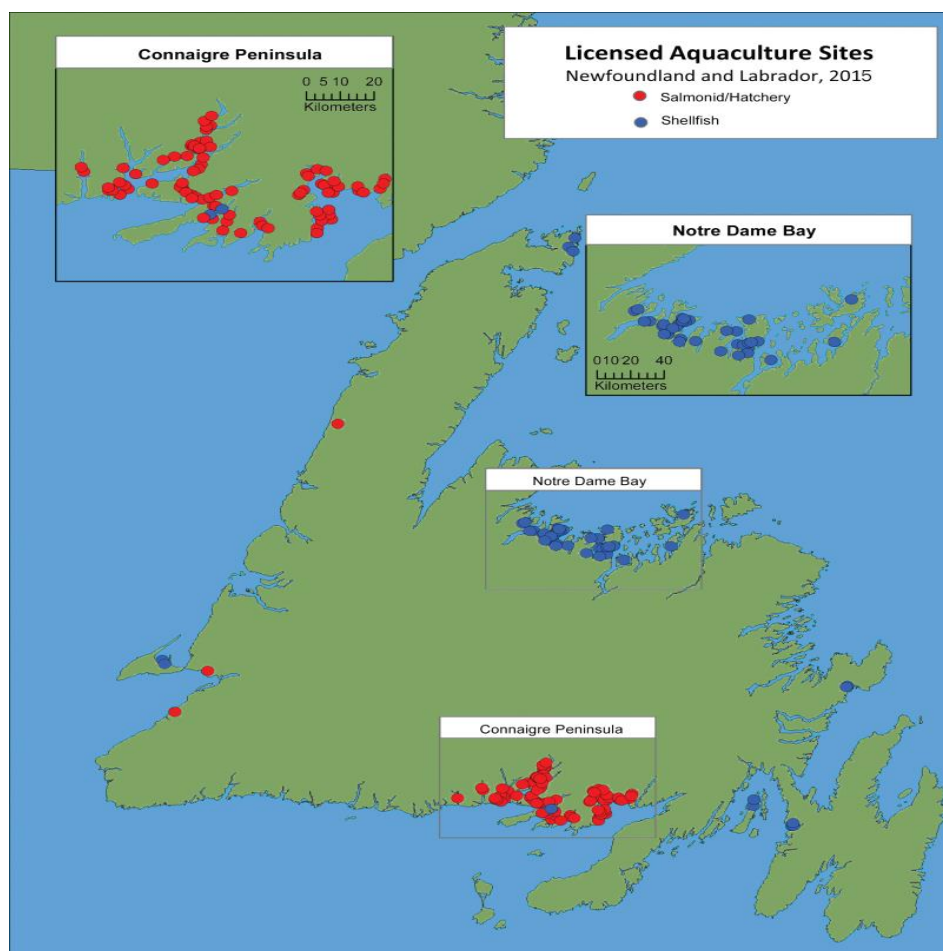
As described in the BMA Agreement, there is a mandatory fallow period of four months for a BMA and a mandatory fallow period of seven months for sites within a BMA.

Public Consultation

In the Province, most proposed aquaculture operations are considered an undertaking that must be registered under the provincial *Environmental Assessment Regulations* and the process includes communications to the public. An environmental preview or environmental impact assessment is at the discretion of the Minister. Opportunities for public input exist for both processes.

¹⁵ See the NL Sustainable Aquaculture Strategy 2014 at http://www.fishaq.gov.nl.ca/publications/pdf/Sustainable_Aquaculture_Strategy_2014.pdf (accessed April 5, 2018)

Figure 2.3: Aquaculture Sites in NL



Source: "Aquaculture Sites," posted on the DFA, http://www.fishaq.gov.nl.ca/pdf/aquaculture_2015_year.pdf (accessed June 5, 2017)

D. NOVA SCOTIA

Siting

The NS *Fisheries and Coastal Resources Act* regulates the layout, size, and development of aquaculture facilities. The new NS *Aquaculture Management Regulations* require that the health of wild Atlantic salmon must be considered when siting a marine net pen facility. Policy regarding these new regulations is still being developed. The provincial Department of Fisheries and Aquaculture (DFA)'s Aquaculture Site Mapping Tool provides an interactive map¹⁶ that identifies marine finfish aquaculture sites.

Management Areas

NS *Aquaculture Management Regulations* authorizes the Minister of Fisheries and Aquaculture to establish an aquaculture management area containing multiple aquaculture sites to manage health of aquatic animals in the area. If there is more than one aquaculture licence holder in such an aquaculture management area established by the Minister, all licence holders must have a written agreement to share

¹⁶ See NS DFA's Aquaculture Site Mapping interactive map at <http://novascotia.ca/fish/aquaculture/site-mapping-tool/> (accessed April 5, 2018)

required procedures under their FHMP, coordinate treatments where appropriate, coordinate fallow periods, and create communication protocols for all fish health issues of common concern.

Fallowing

The Province of NS will be exploring legislation and regulations supporting standard fallowing practises. Currently, NS has few and fairly separated marine net pen aquaculture sites and fallowing is not regulated as part of normal operations. Operators restock after harvest. There may be a short break before a facility is re-stocked (e.g., harvest might take place in March but restocking might not take place until April or May, when the water is warmer).

NS's *Aquaculture Management Regulations* have a provision allowing the Minister of Fisheries and Aquaculture to create an aquaculture management area to manage health of aquatic animals in the area. Coordination of fallow periods is covered in a written agreement among all licence holders (if there is more than one) within an aquaculture management area established by the Minister.

Public Consultation

New provincial regulations were published in 2015. As previously noted, when the provincial Minister receives an application to lease a site, a public notice is issued and hearing(s) held by a review board. Following public consultations, the application is passed on to the Administrator for review and consideration for the lease. When the review is completed, the decision on a lease is made by the Administrator.

United States

Federal

Siting

Section 10 of the *Rivers and Harbors Act* prohibits the unauthorized obstruction or alteration of any navigable water of the United States. The ACOE requires marine net pen farms to obtain a permit under this law (Section 10 permit). For safety purposes, the U.S. Coast Guard requires net pen operations to properly mark the site with navigation lights specified in a Private Aids to Navigation (PATON) permit.

Prior to issuing a Section 10 permit, ACOE is required to conduct a public interest review. The public interest review evaluates how the proposed marine net pen aquaculture facility may affect an extensive range of factors, beyond impacts on navigation. This includes consideration of impacts on conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shore erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, considerations of property ownership, and the needs and welfare of the people.¹⁷ ACOE considers both cumulative and secondary impacts on these public interest factors. ACOE must also meet requirements under all other federal laws that apply to the issuance of a federal permit. This includes consultations with the NOAA National Marine Fisheries Service (NOAA Fisheries) and the FWS under the *Endangered Species Act* (ESA), consultations with NOAA Fisheries under the *Essential Fish Habitat* (EFH) provisions of the *Magnuson-Stevens Fishery Conservation and Management Act* (MSA), consultation with tribes regarding treaty rights, state water quality, coastal zone management consistency certifications under the *Coastal Zone Management Act*, and completion of an environmental assessment or environmental impact statement

¹⁷ See <http://www.lrl.usace.army.mil/Portals/64/docs/regulatory/Permitting/PermittingProcessInformation.pdf> (accessed April 5, 2018)

under the *National Environmental Policy Act* (NEPA).¹⁸ As a result, many of the key concerns about potential impacts of marine net pen aquaculture are addressed through proper siting and the inclusion of permit conditions developed in the public interest review process, consultations, and NEPA analysis. ACOE must also consider Section 106 of the *National Historic Preservation Act*, which requires evaluation of the project's potential impacts to historical properties.

State

A. MAINE

Siting

ACOE has a general permit on aquaculture and has input into siting. It consults with the Maine Department of Marine Resources (MDMR) and both agencies have similar information requirements as part of their permitting processes. The State of Maine consults with the FWS, NOAA Fisheries and MDMR when siting aquaculture facilities.

Management Areas

Maine has a comprehensive BMA Agreement in Cobscook Bay which works in concert with the BMA approach in the Province of New Brunswick. APHIS had some input into the BMA Agreement. The MDEP's discharge (NPDES) permit requires three types of areas in the BMA approach for Cobscook Bay: a fallow area, a first-year fish area and a second-year fish area. Each area rotates on a schedule and the facilities in each area must conform to that area's type. A rotational period for individual sites is used in Jonesport Area and Machias Area, but the BMA approach is used in Cobscook Bay only.

The BMA, which is used both for marine net pen aquaculture companies operating in Cobscook Bay and for companies operating in Canadian waters adjacent to the bay, allows for coordinated management of three bay areas (Cobscook Bay in Maine, and Campobello and Deer Island sites in New Brunswick). This allows for better site fallowing coordination, fewer year class overlaps in fish production, and a reduction of the risk of transmission of disease between year classes. Such coordination is an integral part of effective disease management and reduces outbreaks of Infectious Salmon Anemia (ISA) and sea lice. The agreement also limits and controls fish and vessel movement to reduce disease transfer between Canadian and U.S. sites.¹⁹ A vessel movement permit is required to bring vessels into Maine waters.

There are currently no requirements for density of facilities. Presently, only one company, with multiple facilities, operates in Cobscook Bay. Should more companies begin to operate in Cobscook Bay, a previous 2,000 foot (610 meter) minimum distance between facilities may be re-established.

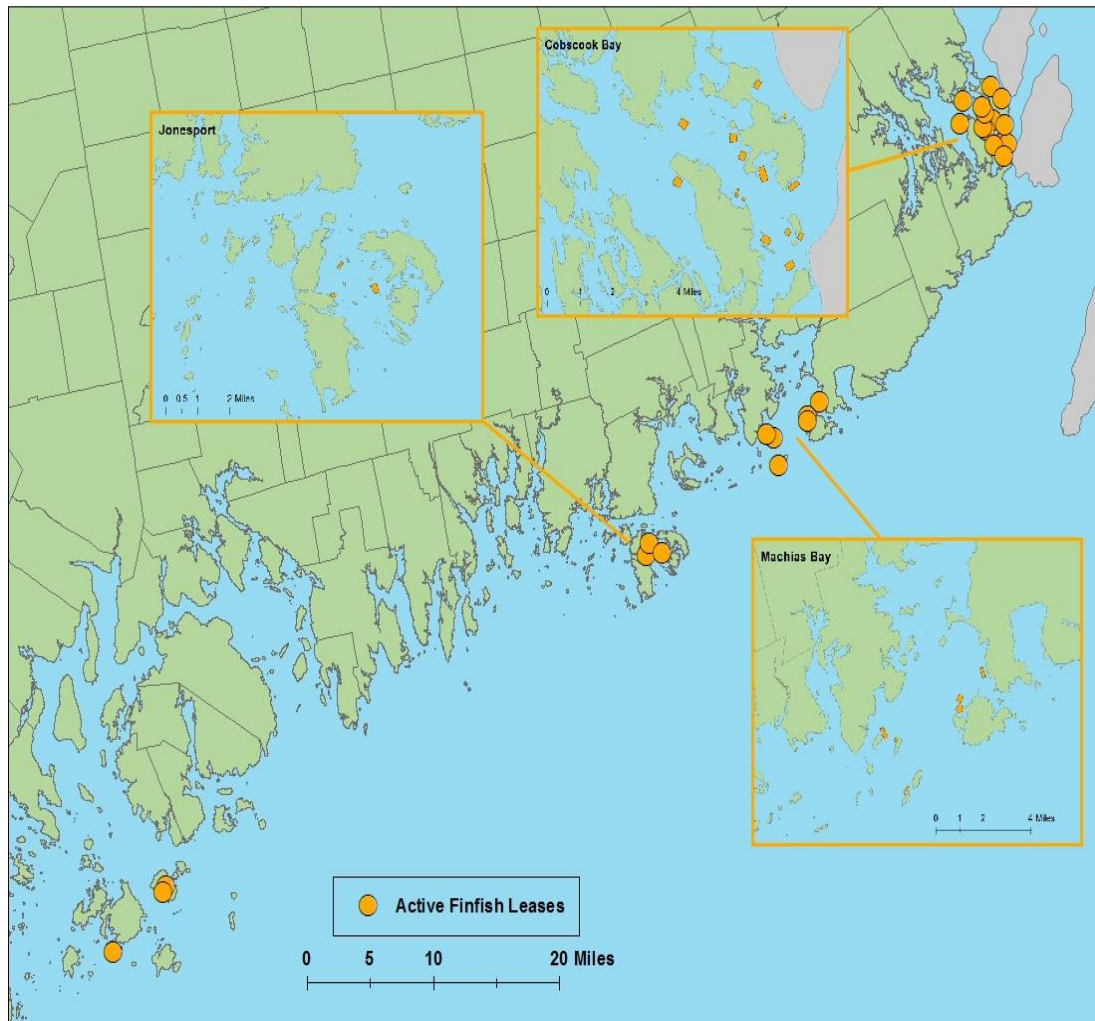
Fallowing

Chapter 2 of the MDMR Aquaculture Lease Regulations indicates that an aquaculture producer may be required to submit an annual fallowing plan and a reassessment schedule. Fallowing is required as part of the BMA Agreement in Cobscook Bay. Rotational periods including fallowing for individual sites are used in Jonesport Area and Machias Area. Maine limits the size of any given aquaculture site to 100 acres. There are fallowing guidelines in the ISA Program Standards developed with Canadian authorities and veterinary authorities and pest control standards as part of the Integrated Pest Management Program for the Control of Sea Lice on salmonids developed with fish experts from APHIS and MDMR.

¹⁸ See more information on Section 7 of the *Endangered Species Act* at NOAA's website http://sero.nmfs.noaa.gov/protected_resources/section_7/ (accessed April 5, 2018)

¹⁹ As noted on page 55 of: NOAA Fisheries' *Endangered Species Act* Biological Opinion (June 2011) for the Proposed Permit for Installation of Net Pens at Black Island South, Frenchboro.

Figure 2.4: Marine Finfish Aquaculture in Maine



Source: Maine Department of Marine Resources as of August 2017

B. WASHINGTON

The Revised Code of Washington (RCW) is the compilation of state laws now in force arranged by topic, with amendments added and repealed laws removed. The legislature passes state laws and assigns state agency responsibility for implementation of the laws. The *Washington Administrative Code* (WAC) codifies agency responsibilities and regulations by agency (or subject).

There are a number of overarching regulations that address issues covered in all five topic sections of this document including Washington's *State Environmental Policy Act* (SEPA), the *Shoreline Management Act* (SMA), local Shoreline Master Programs (SMP), and leases issued by the Washington Department of Natural Resources (WDNR). These regulations will be covered in this section as well as others where applicable.

Siting

All existing commercial Atlantic salmon marine net pen aquaculture facilities are located over leased state-owned aquatic lands administered by the WDNR, where the depth and aquatic flushing are adequate.

General aquatic land lease requirements are described in *Chapter 79.105 RCW*, those specific to aquaculture are described in *Chapter 79.135 RCW*, and aquatic land management is described at *Chapter 332-30 WAC*. WDNR works with the Washington Department of Fish and Wildlife (WDFW) to provide guidance to state and local agencies on how to site farms to avoid negative environmental impacts.²⁰ WDNR must balance criteria that requires protecting the long-term value of the resource with providing for appropriate use.

The Treaty Tribes of Washington are co-managers of the fisheries resource and also provide input on siting as well as many other issues. The ACOE, through coordination with Treaty Tribes, analyzes the project with regard to its effects on the treaty rights of Tribes. Aquatic farm registration and a marine finfish aquaculture permit are also required by the WDFW as described in *Chapter 77.115.040 RCW* and *WAC 220-370-100*, respectively.

The Washington Department of Ecology (Ecology) administers the NPDES permit for net pens in Washington. Siting is a critical factor in net pens being able to meet state water quality and sediment standards. Pens are sometimes relocated in accordance with NPDES permit conditions. Refer to the Habitat/Water Quality section below for more information.

Section 307 of the federal *Coastal Zone Management Act*, called the “federal consistency” provision, gives states a strong voice in federal agency decision making for activities that may affect a state’s coastal uses or resources. Federal consistency requires that federal actions, within and outside the coastal zone, which have reasonably foreseeable effects on any coastal use or natural resource be consistent with the policies of the state’s federally approved coastal management program. The state is able to review, evaluate, and condition projects including new net pen aquaculture facilities.

SMPs are required by the State of Washington’s SMA and cover a wide range of issues including environmental and marine resource effects, use conflicts, views, aesthetics, noise, lighting, and litter. The SMA requires over 260 towns, cities and counties in the state to have shoreline master programs. Some local programs include requirements that partially overlap or conflict with state and federal requirements. Local governments have the authority to implement standards that are more stringent than state and federal standards.

The SMA delegates authority to Ecology to oversee development and implementation of local programs to ensure they comply with the SMA and agency WACs including the SMP Guidelines. Ecology must approve locally adopted programs before they take effect. Ecology is working with local governments to help them understand current net pen operations and federal and state regulations. Ecology has an SMP handbook that provides guidance to local governments on writing and administering shoreline master programs, with one chapter on aquaculture, including net pens. Figure 2.5 identifies the locations of commercial Atlantic salmon net pens in Puget Sound.

Ecology has recently partnered with WDFW, Washington State Department of Agriculture (WSDA) and NOAA scientists to identify current science and management practices that can be used by the state to inform future decisions regarding new and existing facilities. Washington will benefit from guidance that addresses current risks with modern approaches. This project is intended to assist the industry, state and federal agencies, local and tribal governments to ensure Washington’s aquaculture is sustainable and is protecting threatened native salmon, while contributing to state food production and job creation. Results

²⁰ See NOAA Technical Memorandum NMFS-NWFSC-53. , posted at <http://gulfcouncil.org/Beta/GMFCWeb/Aquaculture/atlantic%20salmon%20culture.pdf> (accessed April 5, 2018)

are expected in spring 2019 and will include specific recommendations for the five topic areas addressed in this report.²¹

The Joint Aquatic Resources Permit Application (JARPA) was created to streamline the application for environmental permitting. This form can be used to apply for federal permits required for new, relocated, or modified marine net pen aquaculture operations. The JARPA is also accepted by some state and local agencies, such as WDNR for the Aquatic Lands Lease, Ecology for Section 401 Water Quality Certification, and by some cities and counties for Shoreline Substantial Development or Shoreline Conditional Use permits as required by the SMA. However, state and local agencies often have additional application requirements.

WAC 173-26-241(3)(b) states that aquaculture facilities should not be permitted in areas where it would result in a net loss of ecological functions, adversely impact eelgrass and macroalgae, or significantly conflict with navigation and other water-dependent uses. Aquacultural facilities should be designed and located so as not to spread disease to native aquatic life, establish new nonnative species which cause significant ecological impacts, or significantly impact the aesthetic qualities of the shoreline.

Management Areas

One company owns all the marine net pen sites in Puget Sound and voluntarily implements an area stocking and fallowing plan for these sites. There is no regulation requiring a BMA in Puget Sound or related zones (i.e., for coordinated stocking or fallowing of net pens). The company's facilities are located in four geographically distinct areas (see Figure 2.5) with single generation stocking. The WDFW and the Treaty Tribes of Washington (i.e., co-managers) developed a *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* for the propagation of enhancement fish. The policy requires sanitation of equipment used to move gametes, fish eggs, or fish from one *Fish Health Management Zone (FHMZ)* to another before the equipment is used for a different transport. The policy also recommends that sanitation of all equipment and transport vessels be done after gametes, fish eggs, or fish are moved to a different watershed. The policy requires Treaty Tribes of Washington and others involved in rearing and transfer of salmonids in Washington to manage fish health risks from transfers by restricting movement of fish between watersheds and FHMZs. A FHMZ may contain one or more watersheds. The policy delineates 14 FHMZs in Washington (one in the Columbia River, and 13 in Puget Sound).

Fallowing

As stated above, there is one company presently operating all commercial marine net pens in Puget Sound. This company moved to single-generation stocking of the sites approximately 10 years ago and carries out voluntary fallowing of the facilities after each harvest cycle. Sites are fallowed for several months before restocking pens after harvest.

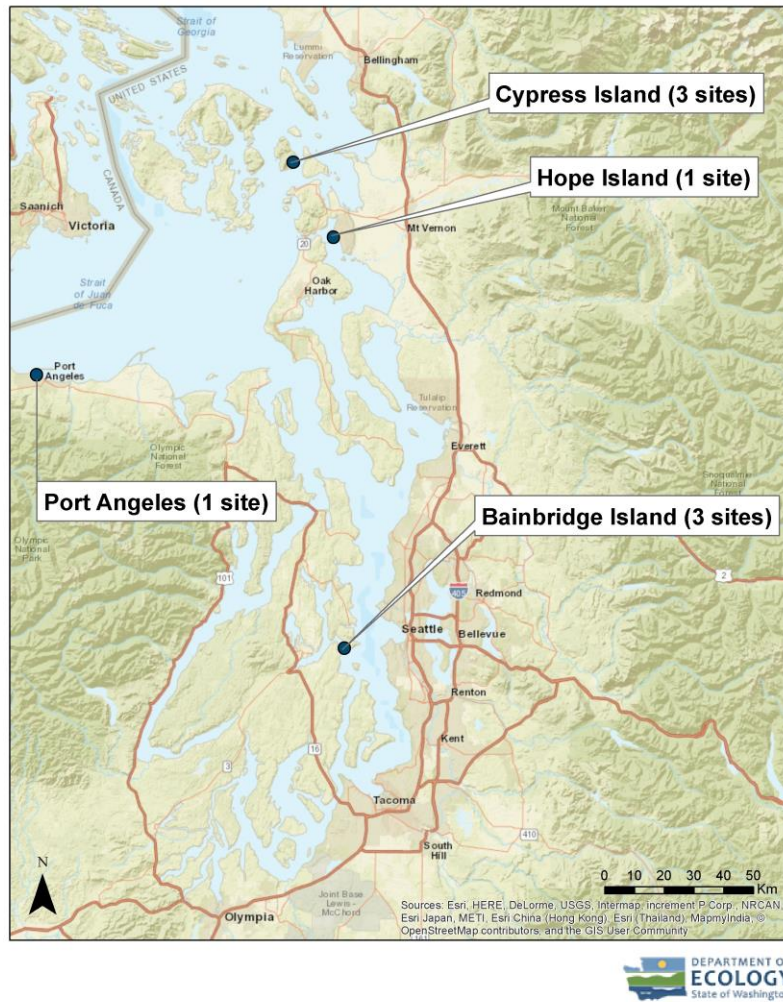
Given the voluntary use of fallowing, there is currently no regulatory requirement for aquaculture facilities to conduct fallowing on a regular basis as part of operations. Regulatory requirements for environmental quality may necessitate fallowing if benthic sediment exceeds thresholds.

Public Consultation

Public consultations are part of the application process for new licenses and siting decisions as well as for many other issues addressed in other topic areas of this document.

²¹ See more information at the State of Washington's Department of Ecology website <https://ecology.wa.gov/Water-Shorelines/Shoreline-coastal-management/Shoreline-coastal-planning/Aquaculture/State-guidance-commercial-pens-of-Atlantic-salmon> (accessed on April 5, 2018)

Figure 2.5: Commercial Net Pens in Puget Sound as of March 2017



List of Regulatory Tools

Siting and Management of Aquaculture Operations	
Canada	United States
Federal	Federal
<p>Transport Canada</p> <ul style="list-style-type: none"> - Navigation Protection Act - An Act respecting the protection of navigable waters. Applicable to aquaculture siting and construction waters; administered by Transport Canada. More information can be found at: http://laws-lois.justice.gc.ca/eng/acts/N-22/index.html - Canada Shipping Act - An Act respecting 	<p>Army Corp of Engineers</p> <ul style="list-style-type: none"> - Rivers and Harbors Act - Section 10 prohibits the unauthorized obstruction or alteration of any navigable water of the United States. A permit is required for structures or work in or affecting navigable waters. More information can be found at: http://www.usace.army.mil/Missions/Civil-Works/Regulatory-Program-and-Permits/Federal-Regulation/

Siting and Management of Aquaculture Operations	
Canada	United States
<p>shipping and navigation; administered by Transport Canada. More information can be found at: http://laws-lois.justice.gc.ca/eng/acts/C-10.15/index.html</p> <p>Fisheries and Oceans Canada</p> <ul style="list-style-type: none"> - Oceans Act - establishes and manages marine protected areas, regulates “marine installations or structures”. More information can be found at: http://laws-lois.justice.gc.ca/eng/acts/O-2.4/index.html - Fisheries Act - An Act respecting fisheries (including aquaculture). The Act enables the Minister of DFO to issue or authorize issuance of leases and licences for fisheries or fishing, wherever situated or carried on. The Act has specific provisions respecting fisheries protection and pollution prevention in Canadian waters. More information can be found at: http://laws-lois.justice.gc.ca/eng/acts/F-14/index.html - Aquaculture Activities Regulations - Designated for regulating deposition of three kinds of deleterious substances associated with aquaculture operations, including: <ul style="list-style-type: none"> (a) drugs whose sale is permitted or otherwise authorized, or whose importation is not prohibited, under the Food and Drugs Act; (b) pest control products that are registered, or whose use is authorized, under the Pest Control Products Act; and, (c) biochemical oxygen demanding matter. More information can be found at: http://laws-lois.justice.gc.ca/eng/regulations/SOR-2015-177/index.html - Fishery (General) Regulations - Regulations respecting fishing and fish habitat in general and the payment of penalty and forfeiture proceeds under the federal Fisheries Act; administered by DFO. More information can be found at: <a href="http://laws- </td> <td> <ul style=" list-style-type:="" none;"=""> - National Environmental Policy Act - An Act that requires federal agencies to evaluate the effect of proposed projects on both the environment and human health and welfare. More information can be found at: http://www.sac.usace.army.mil/Missions/Civil-Works/NEPA-Documents/ - National Historic Preservation Act - Section 106 requires evaluation of impact on historic properties. More information can be found at: http://www.achp.gov/106summary.html <p>U.S. Coast Guard</p> <ul style="list-style-type: none"> - Private Aids to Navigation (PATON) - Installation of navigation lights on floating marine net pen structures to ensure safe navigation are required. New navigational devices will be added to NOAA navigation charts for the area. More information can be found at: http://www.uscg.mil/d11/DP/PatonOne.asp <p>Environmental Protection Agency</p> <ul style="list-style-type: none"> - Clean Water Act - Section 402 establishes the NPDES and authorizes EPA (or states authorized by EPA) to issue permits for point source discharges of pollutants into waters of the United States. <i>Effluent Limitation Guidelines</i> are established for Concentrated Aquatic Animal Production facilities, including marine net pen aquaculture producing 100,000 pounds or more of aquatic animals per year (<i>40 CFR Part 451</i>). More information can be found at: https://www.epa.gov/eg/concentrated-aquatic-animal-production-effluent-guidelines http://www.ecfr.gov/cgi-bin/text-idx?SID=b32f065c3e56d423dbc1858e2a077818&mc=true&node=pt40.32.451&rgn=div5#sp40.32.451.b <p>NOAA Fisheries</p> <ul style="list-style-type: none"> - Magnuson-Stevens Fisheries Conservation and Management Act - Requires federal agencies to consult with NOAA Fisheries regarding effects on EFH for federally managed species. More information can be found at: http://www.habitat.noaa.gov/protection/efh/index.html 	

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Canada	United States
<p>lois.justice.gc.ca/eng/regulations/SOR-93-53/index.html</p> <p>- Marine Mammal Regulations - Regulations Respecting Marine Mammals. -Prohibit the fishing, disturbing, or killing of marine mammals unless authorized to do so under specific conditions in the Regulations or other federal regulations. -Enable the Minister of DFO to issue a nuisance seal licence, pursuant to subsection 4(1) of the regulations, to lethally remove nuisance seal. More information can be found at: http://laws-lois.justice.gc.ca/eng/regulations/SOR-93-56/index.html</p> <p>- Management of Contaminated Fisheries Regulations - Regulations Respecting the Management of Contaminated Fisheries. More information can be found at: http://laws-lois.justice.gc.ca/eng/regulations/SOR-90-351/index.html</p> <p>Environment and Climate Change Canada</p> <p>- Canadian Environmental Protection Act - An Act respecting pollution prevention and the protection of the environment and human health to contribute to sustainable development; administered by ECCC. More information can be found at: http://laws-lois.justice.gc.ca/eng/acts/C-15.31/index.html</p> <p>- Canadian Environmental Assessment Act 2012 - An Act respecting the environmental assessment of certain activities and the prevention of significant adverse environmental effects. In reality, an environmental assessment of a proposed aquaculture site is not automatically required except in cases where there is a need; for example, if a site could come into conflict with regulatory requirements in other acts and regulations such as the Species at Risk Act. More information can be found at: http://laws-lois.justice.gc.ca/eng/acts/C-</p>	<p>http://www.habitat.noaa.gov/pdf/efhconsultationguidancev1_1.pdf http://www.NOAA Fisheries.noaa.gov/pr/consultation/</p> <p>- Endangered Species Act - Section 7 requires federal agency consultations to determine if actions federally authorized, funded, or carried out (e.g., the proposed facility) may affect species listed as threatened or endangered under the ESA or their critical habitat. Section 9 prohibits “take” of listed species. Section 10 provides guidelines under which a permit may be issued to authorize prohibited activities such as take of threatened or endangered species. More information can be found at: http://www.NOAA Fisheries.noaa.gov/pr/laws/esa/ http://www.nmfs.noaa.gov/pr/consultation/ http://www.nws.usace.army.mil/Missions/Civil-Works/Regulatory/Permit-Guidebook/Endangered-Species/</p> <p>- Marine Mammal Protection Act - An Act seeking to conserve, protect and recover species. Marine mammal deterrence is allowed while intentional lethal take is strictly prohibited. More information can be found at: http://www.NOAA Fisheries.noaa.gov/pr/laws/mmpa/ http://www.fisheries.noaa.gov/pr/interactions http://www.fisheries.noaa.gov/ia/slider_stories/2016/08/mmpafinalrule.html</p> <p>- Marine Mammal Authorization Program - Aquaculture facilities must be categorized annually based on the frequency of incidental mortalities and serious injuries. More information can be found at: http://www.NOAA Fisheries.noaa.gov/pr/interactions/mmap/</p> <p>NOAA National Ocean Service</p> <p>- Coastal Zone Management Act - Encourages coastal states to develop and implement <i>Coastal Zone Management Programs</i>, and requires federal agencies to obtain certifications from states that authorized actions are consistent with the state program. More information can be</p>

Siting and Management of Aquaculture Operations	
Canada	United States
<p>15.21/index.html</p> <p>- Species at Risk Act - An Act respecting the protection of wildlife species at risk in Canada More information can be found at: http://laws-lois.justice.gc.ca/eng/acts/S-15.3/index.html</p> <p>- New Substances Notification Regulations (Chemicals and Polymers) - The Regulations, under the Canadian Environmental Protection Act, set out the information that must be provided before manufacturing or importing a chemical or polymer. More information can be found at: http://laws-lois.justice.gc.ca/eng/regulations/SOR-2005-247/index.html</p> <p>Health Canada</p> <p>- Food and Drugs Act & Food and Drug Regulations - Administered by Health Canada and regulate which therapeutants can be licensed for sale in Canada. The Act together with the Fish Inspection Regulations, regulate the permissible residue levels in harvested fish, either at zero level or a maximum residue limit depending on the therapeutant. More information can be found at: http://laws-lois.justice.gc.ca/eng/acts/F-27/index.html</p> <p>- Pest Control Products Act & Pest Control Products Regulations - Administered by Health Canada and regulate the use of pesticides to treat fish for pests such as sea lice. More information can be found at: http://laws-lois.justice.gc.ca/eng/acts/P-9.01/index.html</p> <p>Canadian Food Inspection Agency</p> <p>- Health of Animals Act & Health of Animals Regulations - Administered by the Canadian Food Inspection Agency (CFIA) under the Minister of Agriculture. The Act and Regulations provide for the control of fish disease and related matters, and impose an obligation to notify the nearest veterinary</p>	<p>found at: https://coast.noaa.gov/czm/act/</p> <p>Fish and Wildlife Service</p> <p>- Endangered Species Act - Section 7 requires federal agency consultations to determine if actions federally authorized, funded or carried out may affect threatened or endangered species or their critical habitat. More information can be found at: http://www.nws.usace.army.mil/Missions/Civil-Works/Regulatory/Permit-Guidebook/Endangered-Species/</p> <p>- Injurious Wildlife Regulations of the Lacey Act - An Act seeking to prevent the spread of disease and manage the import of live or dead salmonids or their products. More information can be found at: http://www.ecfr.gov/cgi-bin/text-idx?SID=188104a4a209e9dfaaccb30848f475f4&mc=true&node=se50.1.16_113&rgn=div8</p> <p>Animal and Plant Health Inspection Service General information regarding APHIS's role in managing aquaculture animal disease can be found at: https://www.aphis.usda.gov/aphis/ourfocus/animal-health/animal-disease-information/aquaculture/ct_aquaculture_index</p> <p>- Animal Health Protection Act - An act seeking to prevent, detect, control or eradicate diseases of farmed animals (including aquaculture) and promotes best management practices. More information can be found at: http://uscode.house.gov/view.xhtml?path=/prelim@title7/chapter109&edition=prelim</p> <p>- U.S. National Aquatic Animal Health Plan - A plan providing recommendations to prevent, manage and minimize disease in farmed and wild aquatic animals. More information can be found at: https://www.aphis.usda.gov/animal_health/animal_dis_spec/aquaculture/downloads/naahp.pdf</p> <p>- Infectious Salmon Anemia Program Standards - Standards providing recommended procedures for</p>

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<u>Canada</u>	<u>United States</u>
<p>inspector of the presence of a reportable disease or toxic substance, or any fact indicating its presence, in or around the animal, immediately after the person becomes aware. More information can be found at: http://laws-lois.justice.gc.ca/eng/acts/H-3.3/index.html</p> <p>Agriculture and Agri-Food Canada</p> <p>- Feeds Act & Feeds Regulations - Administered by Agriculture and Agri-Food Canada (AAFC), include medicated feeds for aquaculture. Feed and its constituents used in aquaculture are under the regulatory authority of the CFIA. More information can be found at: http://laws-lois.justice.gc.ca/eng/acts/F-9/index.html</p>	<p>the prevention and containment of ISA from farm raised Atlantic salmon. More information can be found at: https://www.aphis.usda.gov/animal_health/animal_dis_spec/aquaculture/downloads/isa_standards.pdf</p> <p>- Virus-Serum-Toxin Act - An Act seeking to ensure that pure, safe, potent and effective biologic products are available in the United States for use in animals. More information can be found at: https://www.aphis.usda.gov/animal_health/vet_biology/publications/vsta.pdf</p> <p>Food and Drug Administration</p> <p>- Federal Food, Drug, and Cosmetic Act - An Act regulating the manufacture and distribution of food additives and drugs that will be administered to animals. More information can be found at: https://www.fda.gov/regulatoryinformation/lawsenforcedbyfda/federalfooddrugandcosmeticactfdact/default.htm</p> <p>- Minor Use and Minor Species Act - An Act intended to make medications legally available for the treatment of minor animal species. More information can be found at: http://www.fda.gov/AnimalVeterinary/DevelopmentApprovalProcess/MinorUseMinorSpecies/</p> <p>- Animal Drug Availability Act – Facilitates approval of new animal drugs and medicated feeds. The <i>Veterinary Feed Directive</i> is a category within this act that requires use of antimicrobials be supervised by a licensed veterinarian. More information can be found at: https://www.fda.gov/AnimalVeterinary/DevelopmentApprovalProcess/ucm071807.htm</p>
<i>British Columbia</i>	<i>Maine</i>
<p>Fisheries and Oceans Canada</p> <p>- Pacific Aquaculture Regulations - Governs aquaculture operation in British Columbia; it enables the Minister of DFO to issue an aquaculture licence to authorize a person to engage in aquaculture and prescribed activities upon payment of applicable fee, and to specify net pen construction requirements and measures to deal with fish escapes. The</p>	<p>Maine Department of Marine Resources</p> <p>- Department of Marine Resources Regulations - Chapter 2 describes the aquaculture lease requirement. An annual fallowing plan may be required. MDMR has sole authority to issue aquaculture lease sites. More information can be found at: http://www.maine.gov/dmr/laws-regulations/regulations/index.html</p>

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<p>Regulations enable DFO to administer aquaculture in BC as a federal responsibility. More information can be found at: http://laws-lois.justice.gc.ca/eng/regulations/SOR-2010-270/index.html</p> <p>Ministry of Lands, Parks and Housing</p> <p>- Land Act - Provincial Regulation governing the disposition of crown land in BC; administered by BC Ministry of Lands, Parks. http://www.canlii.org/en/bc/laws/stat/rsbc-1996-c-245/latest/rsbc-1996-c-245.html</p>	<p>Maine Department of Environmental Protection</p> <p>- General Permit – Net Pen Aquaculture - The General Permit harmonizes Maine Department of Environmental Protection and ACOE permits and is the state-issued version of the NPDES permit that includes siting, water quality, benthic habitat, monitoring, and reporting requirements. More information can be found at: https://www1.maine.gov/dep/water/wd/atlantic_salmon_aquaculture/index.html http://www.maine.gov/dep/water/wd/atlantic_salmon_aquaculture/MEG130000-2014permit.pdf http://legislature.maine.gov/statutes/38/title38sec413.html http://www.maine.gov/sos/cec/rules/06/096/096c529.doc</p> <p>- Coastal Zone Management Federal Consistency - Consistency determination is required for activities involving federal licenses or permits to ensure the project is consistent with Washington’s <i>Coastal Zone Management Program</i>. More information can be found at: https://coast.noaa.gov/czm/consistency/applying/</p>
<i>New Brunswick</i>	<i>Washington</i>
<p>Department of Agriculture, Aquaculture and Fisheries</p> <p>- Aquaculture Act and General Regulation 91-158 are the regulatory tools used to regulate aquaculture in NB. An application for an aquaculture licence must include a site development plan. All licence applications are reviewed through a federal/provincial review process. Administered by the NB DAAF. More information can be found at: Aquaculture Act: http://laws.gnb.ca/en/showfulldoc/cs/2011-c.112/20160310 General Regulations under Aquaculture Act: http://laws.gnb.ca/en/showfulldoc/cr/91-158/20160310</p>	<p>Joint Aquatic Resources Permit Application (JARPA)</p> <p>- Multiple regulatory agencies cooperated to create this streamlined application that can be used for certain federal, state, and local permits. More information can be found at: http://www.epermitting.wa.gov/site/alias_resourcecenter/jarpa_introduction/10042/introduction.aspx</p> <p>Washington Department of Natural Resources</p> <p>- Chapter 79.105 RCW - General aquatic land lease requirements are described and uses specific to aquaculture are covered in <i>Chapter 79.135 RCW</i>. More information can be found at: http://apps.oria.wa.gov/permithandbook/permitdetail/31 http://app.leg.wa.gov/rcw/default.aspx?cite=79.105 http://app.leg.wa.gov/rcw/default.aspx?cite=79.135 http://apps.leg.wa.gov/wac/default.aspx?cite=332-30</p>
<i>Newfoundland and Labrador</i>	
<p>Department of Fisheries and Land Resources</p> <p>- Aquaculture Act - An Act respecting the encouragement and regulation of an aquaculture industry in NL. The Act prohibits a person from carrying out aquaculture without</p>	<p>Washington Department of Fish and Wildlife</p>

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<u>Canada</u>	<u>United States</u>
<p>a licence for each site. It regulates the issuance of aquaculture licences, which must contain terms and conditions relating to access to a site, optimal resource utilization, health and safety and the environment. The DFA administers the Act. More information can be found at:</p> <p>http://www.assembly.nl.ca/legislation/sr/statutes/a13.htm</p> <p>Department of Municipal Affairs and Environment</p> <p>- Environmental Protection Act - An Act respecting environmental protection in NL. More information can be found at: http://www.canlii.org/en/nl/laws/stat/snl-2002-c-e-14.2/latest/snl-2002-c-e-14.2.html</p> <p>- Environmental Assessment Regulations, 2003 under the Environmental Protection Act. More information can be found at: http://www.canlii.org/en/nl/laws/regu/nlr-54-03/latest/nlr-54-03.html</p>	<p>Separate application forms are used for WDFW permits and the JARPA does not apply.</p> <p>- Chapter 77.115.040 RCW - Registration of aquatic farmers. More information can be found at: http://app.leg.wa.gov/rcw/default.aspx?cite=77.115.040</p> <p>- WAC 220-370-100 - Marine finfish aquaculture permits. Permit may be denied based on the determination by the director of significant genetic, ecological or fish health risks of the proposed fish rearing program on naturally occurring fish and wildlife, their habitat or other existing fish rearing programs. More information can be found at: http://apps.leg.wa.gov/wac/default.aspx?cite=220-370-100</p> <p>Washington Department of Ecology</p> <p>- Section 401 Water Quality Certification - The federal CWA allows states to approve, condition, or deny projects proposed in water of the United States. Issuance of a 401 Certification means that Ecology has reasonable assurance that the project will comply with state water quality standards and other aquatic resources protection requirements. http://www.ecy.wa.gov/programs/sea/fed-permit/</p> <p>- Coastal Zone Management Federal Consistency - Consistency determination is required for activities involving federal licenses or permits to ensure the project is consistent with Washington's <i>Coastal Zone Management Program</i>. More information can be found at: http://www.ecy.wa.gov/programs/sea/fed-permit/index.html#What is a Coastal Zone Consistency Determination</p> <p>- Shoreline Management Act - This policy is designed to ensure shoreline development in a manner which, while allowing for limited reduction of rights of the public in the navigable waters, will promote and enhance the public interest. Aquaculture is identified as a preferred use for state shorelines and waters. Siting of net pen operations must comply with the SMA and implementing WACs. SMPs are locally tailored. More information can be found at:</p>
<u>Nova Scotia</u>	
<p>Department of Fisheries and Aquaculture</p> <p>- Fisheries and Coastal Resources Act - An Act to Revise and Consolidate the Laws of the Province respecting the fishery and to encourage and promote programs to sustain and improve the fishery. Section 52 of the Act requires an aquaculture lease to be subject to specific conditions, including a development plan and environmental baseline/background information. The Act is administered by the provincial Minister of Fisheries and Aquaculture. More information can be found at: http://nslegislature.ca/legc/statutes/fishand.htm</p> <p>- Aquaculture Management Regulations made under Section 64 of the Fisheries and Coastal Resources Act - The Regulation specifies requirements for aquaculture operators to develop and implement Farm Management Plans, Aquaculture Management Areas, Disease Surveillance and Reporting, etc. More information can be found at: https://www.novascotia.ca/just/regulations/regs</p>	

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Canada	United States
<p>/fcraquamgmt.htm</p> <p>- Aquaculture Licence and Lease Regulations made under Section 64 of the Fisheries and Coastal Resources Act - The regulations specifies siting requirements for aquaculture leases, including depth (25 meters) location, and shoreward water depth (2 meters) at low tide. More information can be found at: https://www.novascotia.ca/just/REGULATIONS/regs/fcraqualiclease.htm</p>	<p>http://apps.leg.wa.gov/rcw/default.aspx?cite=90.58 http://apps.leg.wa.gov/WAC/default.aspx?cite=173-26 http://www.ecy.wa.gov/programs/sea/shorelines/smp/handbook/Chapter16.pdf</p> <p>- WAC 173-26-241(3)(b) - Provides guidance on siting of aquaculture facilities in a location where they would not result in a net loss of ecological functions. More information can be found at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-26-241</p> <p>- State Environmental Policy Act - An act similar to the National Environmental Policy Act that requires identification and analysis of environmental impacts of a net pen facility. For new facilities, SEPA review is typically conducted by the local government because local permits are issued first. More information can be found at: http://www.ecy.wa.gov/programs/sea/sepa/e-review.html</p> <p>Local Jurisdictions</p> <p>- Shoreline Management Act and Chapter 173-26, Part III, WAC - Cities and counties administer through local SMPs that have been reviewed and approved by Ecology. If a marine net pen aquaculture facility requires a Shoreline Conditional Use permit (in addition to a Shoreline Substantial Development permit), the local permit decision must be submitted to Ecology for final review, conditioning, and approval or denial. More information can be found at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-27-160</p>

Habitat and Water Quality

Net pen aquaculture may affect water quality and the aquatic environment in the area surrounding the facility. The control of disease, pests, biofouling, and fish feeding are critical animal husbandry activities in aquaculture, as they are in other food production sectors. These activities involve the deposit of substances, such as treatment products (i.e., drugs and pest control products) or organic matter (i.e., fish feces and uneaten feed, occasionally medicated, biofouling organisms), into waters where they may fall directly under the net pen or out to considerable distances. In addition, the installation, operation, maintenance and removal of an aquaculture facility that are not related to the deposit of substances may also result in impacts to fish habitat. Benthic communities and wild fish and fauna in surrounding areas may be affected by changes in water quality or habitat. Proper siting, sustainable management strategies, and regulation of net pen aquaculture activities are required to ensure adverse environmental impacts are avoided or managed within acceptable limits.

Canada

Federal

Canada has stringent federal legislation (i.e., the ***Fisheries Act***) that provides for the conservation and protection of fish and fish habitat. Sections 34-36 of the federal *Fisheries Act* contain regulatory provisions for Fisheries Protection and Pollution Prevention. In particular, Subsection 36(3) of the Act prohibits the deposit of deleterious substances in water frequented by fish except where authorized by regulations. The Minister of DFO is responsible for regulating deposits of deleterious substances related to aquaculture. Subsection 35(1) of the Act prohibits the carrying on of any work, undertaking or activity that may result in serious harm to fish, except where authorized, including by regulations. Serious harm to fish means the death of fish or any permanent alteration to or destruction of fish habitat.

The AAR are made pursuant to the regulations making authorities in sections 35 and 36 of the Act. They regulate the deposit of deleterious substances from aquaculture operations into aquatic environments and any serious harm to fish resulting from the installation, operation, maintenance or removal of an aquaculture facility. In particular, and with respect to deleterious substances, there are requirements in the AAR to monitor benthic deposits underneath net pens and for a certain distance beyond it, normally within considerable distances from the net pen. The basic consideration is the effects on the sea floor organisms within or on the substrate and the development of anaerobic bacteria that produce sulfides deleterious to creatures immediately below and the surrounding area. Testing is done for either a sulfide index for soft bottom environments, or visual proxies over hard or mixed bottom habitats, and remediation takes place depending on test results.

Attempts have been made to harmonize federal and provincial regulations for benthic deposits with the development of the federal AAR. While for the most part successful, there are differences and overlaps that the DFO is trying to resolve, for example, environmental monitoring standards under the AAR and provincial requirements.

Under the AAR the Minister of DFO is responsible for the regulation of deleterious substances related to the operation of aquaculture facilities in all jurisdictions where aquaculture is carried on throughout Canada, including in British Columbia. However, those provisions of the AAR that regulate serious harm to fish do not apply in British Columbia; rather protection of fish habitat in British Columbia is regulated under the *Pacific Aquaculture Regulations* (PAR), also made under the *Fisheries Act*.

Provincial

A. BRITISH COLUMBIA

The provisions of the federal AAR apply where an aquaculture facility's activities have the potential to cause serious harm to fish or fish habitat. Marine Finfish Aquaculture Licence conditions in BC²² require measures to be taken to protect fish habitat. A key component of the federal BCARP is the provision of timely information and data on the environmental and operational performance of the aquaculture industry in the province.

B. NEW BRUNSWICK

Under the NB *Aquaculture Act* and regulations, the provincial Minister of DAAF has the prime regulatory role to manage aquaculture. Aquaculture regulation is guided by two policies: the *Bay of Fundy Marine Aquaculture Site Allocation Policy* and the *Marine Aquaculture Site Allocation Policy for East Coast of NB*. These policies take into account environmental aspects of aquaculture activities. Regarding benthic deposits, provincial inspectors verify records of the companies and check the environmental sampling, sulfide and other items required under the Conditions of Licence. DFO also inspects for adherence to the provisions of the federal *Fisheries Act* and AAR for benthic monitoring.

The NB Department of the Environment has an environmental monitoring program in place for marine sites in the Bay of Fundy.

C. NEWFOUNDLAND AND LABRADOR

In NL, the provincial DFA is responsible for aquaculture licensing, inspections, enforcement, development, and extension services. DFO is responsible for habitat protection. Shared responsibilities between the federal and provincial government on aquaculture include environmental protection, aquaculture science, site inspection and fish health. For benthic monitoring, there are two levels of inspection, including those carried out by the provincial inspectors enforcing the NL *Aquaculture Act* and regulations and conditions of licence, and federal inspectors enforcing the federal *Fisheries Act* and AAR.

Conditions of aquaculture licence require the maintenance of records and inspection of benthic deposits, samples of bottom sediment, etc. One of the issues in the province is that much of the bottom is rocky such that the science that applies to mud bottom deposits is difficult to transpose.

D. NOVA SCOTIA

The provincial Minister of Fisheries and Aquaculture has the primary regulatory authority to manage aquaculture in the Province. In 2003, NS established an Environmental Management Program for marine aquaculture and incorporated a requirement for data collection in the licence conditions for benthic monitoring, surveillance and chemical analysis of deposits. Provincial fish inspectors verify that the Conditions of Licence are being fulfilled. DFO also inspects to ensure that regulatory provisions in the federal *Fisheries Act* and AAR are being complied with.

²² See the BC Marine Finfish Aquaculture Licence under the *Fisheries Act*: PART B. Licence Conditions at <http://www.pac.dfo-mpo.gc.ca/aquaculture/licence-permis/docs/licence-cond-permis-mar/col-cdp-eng.html> (accessed April 5, 2018)

United States

Federal

Habitat

NOAA Fisheries consults directly with federal agencies to conserve and enhance EFH for federally managed species under the MSA and to protect species and designated critical habitat under the ESA.

EFH includes all waters and substrate necessary for wild fish spawning, breeding, feeding, or growth to maturity. A consultation is required by a federal agency when any action or proposed action authorized, funded, or undertaken by that agency may adversely affect EFH. An “adverse effect” is defined as any impact that reduces the quality and/or quantity of EFH. An adverse effect may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat and other ecosystems components, if such modifications reduce the quality and/or quantity of EFH. Adverse effects to EFH may result from action occurring within EFH or outside EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

If a federal agency determines that an action (e.g., issuance of permit by ACOE) may adversely affect EFH, then:

- The action agency provides notification of the action to NOAA Fisheries.
- The action agency submits an EFH Assessment to NOAA Fisheries.
- NOAA Fisheries reviews the EFH Assessment, and, if necessary, provides EFH Conservation Recommendations to the action agency within 30-60 days.

The action agency responds to NOAA Fisheries within 30 days with information on how it will proceed with the action.

Federal agencies are directed, under Section 7(a)(1) of the ESA, to use their authorities to conserve threatened and endangered species. Consultation with NOAA Fisheries and the FWS is required under Section 7(a)(2) of the ESA for federal actions (actions authorized, funded, or carried out, in whole or in part, by a federal agency) that may affect a listed species. These interagency consultations, or Section 7 consultations, are designed to assist federal agencies in fulfilling their duty to ensure federal actions do not jeopardize the continued existence of a species or adversely modify critical habitat. Should an action be determined by NOAA Fisheries to jeopardize a species or adversely modify critical habitat, NOAA Fisheries will suggest “Reasonable and Prudent Alternatives.”

For marine net pen facilities, the ACOE Section 10 (siting) permit triggers the need for the ACOE to consult with NOAA Fisheries because any net pen location could have a potential EFH, ESA, and critical habitat impact on species managed or protected under federal law.

Water Quality

The CWA regulates discharges of pollutants to waters of the United States. NPDES permits are required for effluents from aquaculture facilities.²³ The EPA has regulatory authority for NPDES permits under the CWA and has authorized 47 states to issue NPDES permits under the process defined by the CWA Section 402(b) and 40 CFR Part 123.²⁴ Both states where most marine net pen aquaculture currently takes place (Washington and Maine) are authorized to issue NPDES permits in their state waters. See below for details about requirements in Washington and Maine.

The EPA has established *Effluent Limitation Guidelines* and *New Source Performance Standards* for the Concentrated Aquatic Animal Production Point Source Category. The Effluent Limitation Guidelines apply to net pen systems that directly discharge wastewater to freshwater or marine environments and produce at least 100,000 pounds of fish a year. The guidelines stipulate a series of management practices designed to help reduce discharges of conventional pollutants (primarily total suspended solids), non-conventional pollutants such as nutrients, and drugs and chemicals that are used to manage fish health. These practices are included as provisions of the NPDES permit. The requirements, which are specified in 40 CFR Part 451, are as follows:

- **Feed management.** Employ efficient feed management and feeding strategies that limit feed input to the minimum amount reasonably necessary to achieve production goals and sustain targeted rates of aquatic animal growth. These strategies must minimize the accumulation of uneaten food beneath the pens through the use of active feed monitoring and management practices. These practices may include one or more of the following: use of real-time feed monitoring, including devices such as video cameras, digital scanning sonar, and upweller systems; monitoring of sediment quality beneath the pens; monitoring of benthic community quality beneath the pens; capture of waste feed and feces; or other good husbandry practices approved by the permitting authority.
- **Waste collection and disposal.** Collect, return to shore, and properly dispose of all feed bags, packaging materials, waste rope and netting.
- **Transport or harvest discharge.** Minimize any discharge associated with the transport or harvesting of aquatic animals including blood, viscera, aquatic animal carcasses, or transport water containing blood.
- **Carcass removal.** Remove and dispose aquatic animal mortalities properly on a regular basis to prevent discharge to U.S. waters.
- **Materials storage.** Ensure proper storage of drugs, pesticides, and feed in a manner designed to prevent spills that may result in discharge to U.S. waters. Implement procedures for properly containing, cleaning, and disposing of any spilled material.
- **Maintenance.** Inspect the production system on a routine basis to identify and promptly repair any damage. Conduct regular maintenance of the production system to ensure that it is properly functioning.
- **Recordkeeping.** For calculation of representative feed conversion ratios, maintain records for aquatic animal net pens documenting the feed amounts and estimates of the numbers and weight of aquatic animals. Keep records of the net changes, inspections, and repairs.
- **Training.** To ensure the proper clean-up and disposal of spilled material, adequately train all relevant facility personnel in spill prevention and how to respond in the event of a spill. Train staff on the proper operation and cleaning of production systems including training in feeding procedures and proper use of equipment.

²³ See more information on EPA's NPDES Aquaculture Permitting website <http://www.epa.gov/npdes/npdes-aquaculture-permitting> (accessed April 5, 2018)

²⁴ See more information on EPA's NPDES State Program Information website <http://www.epa.gov/npdes/npdes-state-program-information> (accessed April 5, 2018)

EPA has also prepared a Compliance Guide for the Concentrated Aquatic Animal Production Point Source Category.²⁵

State

A. MAINE

Maine has harmonized aquaculture-related permits that are issued by Maine Department of Environmental Protection (MDEP) and the ACOE. Maine's Net Pen Aquaculture General Permit (i.e., the state-issued version of the NPDES permit, is administered in Maine as the Maine Pollutant Discharge Elimination System²⁶). This permit is required for the direct or indirect discharge of pollutants to waters of the State pursuant to *Water Pollution Control*, 38 M.R.S.A. § 413. The similarity of discharges from net pen aquaculture facilities has prompted the MDEP to issue this General Permit for those facilities located in Class SB or SC waters east of Naskeag Point in Brooklin, except those waters in the area north of a line from Schoodic Point in Winter Harbor to Baker Island in Cranberry Isles, then west to Naskeag Point in Brooklin, Maine.

The term of this General Permit is five years and it applies to not only Atlantic salmon but to all finfish species that may be legally cultivated in net pens located in Maine waters. Siting requirements to address potential water quality and habitat impacts include current velocity of not less than 5 cm per second at a point one half the distance between the bottom of the net pens and the sea floor and locations that do not demonstrate significant, persistent vertical stratification during the summer. Water column and sediment mixing zones are defined as the area 30 m beyond the perimeter of a net pen and within this zone, dissolved oxygen concentration must not be lower than 6 mg/L. Outside the designated Mixing Zones, discharges from the facility must not cause or contribute to conditions that are hazardous or toxic to aquatic life, or that would impair the uses designated by the classification of the receiving waters. Within the designated mixing zone, the discharge must not cause or contribute to conditions that are lethal to passing organisms indigenous to the receiving water.

Facility and management specifications that must be reported include description of the net pens, maximums of rearing density, number/total weight of fish in the facility at one time, and feed rate. Additional requirements include a list of drugs/disinfectants/anti-fouling agents, baseline monitoring data, and a statement that an Operation and Maintenance Plan has been developed.

B. WASHINGTON

In addition to federally issued licenses and permits, net pen aquaculture projects in Washington may require a CWA Section 401 Water Quality Certification, Section 402 NPDES permit, and a *Coastal Zone Management Consistency Certification* under the State's *Coastal Zone Management Program* (CZMP). The Washington State *Water Pollution Control Act (Chapter 90.48 RCW)* is the principal law governing water quality in Washington State and it is pursuant to this law that Ecology issues NPDES permits for state waters.

²⁵ See more information at EPA's website

http://water.epa.gov/scitech/wastetech/guide/aquaculture/upload/2006_05_03_guide_aquaculture_guidance_full-final.pdf (accessed April 5, 2018)

²⁶ See the Maine Pollutant Discharge Elimination System Permit – *Maine Waste Discharge License Fact Sheet* posted at https://www1.maine.gov/dep/water/wd/atlantic_salmon_aquaculture/MEG130000-2014fact-sheet.pdf (accessed April 5, 2018)

The Section 402 NPDES permits managed by Ecology require benthic and water quality monitoring, no intentional/accidental release of Atlantic salmon, reporting of fish escapes, fish escape plans (i.e., Fish Escape Prevention Plans, Fish Escape Reporting Procedures, and Accidental Fish Escape Recovery Plans – all in coordination with WDFW), a Pollution Prevention Plan, and reporting in coordination with WDFW. Sediment monitoring of benthic impacts is carried out around a 100-foot perimeter from the farm sites. Impact limits are set for the organic enrichment of sediments to distinct threshold values. The Section 402 NPDES permit requires that a sampling plan complying with specific permit requirements be developed, including a sediment monitoring cycle to be carried out by a third party consultant. Mandatory mitigation and monitoring is required if sediment standards exceed the limits and closure monitoring is required of any station that exceeds the threshold limits until sediment quality is returned to allowable levels. All sediment monitoring reports are submitted to Ecology and WDNR.

The Section 402 NPDES permit sets limits on the allowable discharges from a finfish aquaculture operation in State waters and prohibits discharge of unauthorized chemicals. Mandatory reporting of approved chemical use, reporting incidence of sea lice infestations, reporting of emergency disease occurrences and the reporting of accidental fish escapes are required. Development and use of Best Management Practices and Best Available Technology is required.

Chapter 173-204 WAC establishes surface sediment contamination standards and applies them as a basis for management in an effort to reduce and ultimately eliminate adverse effects on biological resources and significant health threats to humans. The *WAC 173-204-412* section sets forth the applicability of this chapter specifically to marine finfish rearing facilities. Sediment quality compliance and monitoring requirements shall be addressed through NPDES or other permits for facility operation.

The Section 401 Water Quality Certification provides Ecology reasonable assurance that the applicant's project will comply with state water quality standards and other aquatic resources protection requirements under Ecology's authority. The Section 401 Certification can cover both the construction and operation of a proposed project. Conditions of the Section 401 Certification become conditions of the Federal permit or license.

Activities and developments located within Washington's coastal counties, which involve federal activities, federal licenses or permits, and federal assistance programs, require that a written *Coastal Zone Management Consistency Determination* be sent to Ecology. The Consistency Determination or Certification needs to demonstrate how the proposed project meets the enforceable policies of Washington's CZMP.

The enforceable policies can be found within the five state laws and their implementing regulations. The five state laws of Washington's CZMP are the SMA, SEPA, the state *Water Pollution Control Act* (which includes Ecology's authority under the CWA's 401 Water Quality Certification and NPDES permits), the state *Clean Air Act*, and the *Ocean Resources Management Act*.

Both WDFW and WDNR play a leadership role in habitat. The state has a list of *Priority Habitats and Species* (PHS), marine reserves, and marine protected areas that all must be considered when siting and operating a commercial net pen fish farm. *Chapter 173-26, Part III WAC* requires SMPs consider the PHS list and existing reserves and designate "natural" environments. As co-managers of the fisheries resource, the Tribes play a significant role in designation of reserves and protected areas.

List of Regulatory Tools

Habitat/Water Quality	
Canada	United States

Habitat/Water Quality	
<u>Canada</u>	<u>United States</u>
<i>Federal</i>	<i>Federal</i>
<p>Fisheries and Oceans Canada</p> <ul style="list-style-type: none"> - Fisheries Act - An Act respecting fisheries (including aquaculture). Sections 34-36 of the Act have specific provisions respecting fisheries protection and pollution prevention in Canadian waters. Specifically, Subsection 36(3) of the Act prohibits the deposit of deleterious substances in water frequented by fish except when authorized. More information can be found at: http://laws-lois.justice.gc.ca/eng/acts/F-14/index.html - Aquaculture Activities Regulations - the AAR primarily focus on regulation of authorized deposition of deleterious substances in aquaculture operations, including: <ul style="list-style-type: none"> (a) drugs whose sale is permitted or otherwise authorized, or whose importation is not prohibited, under the Food and Drugs Act; (b) pest control products that are registered, or whose use is authorized, under the Pest Control Products Act; and, (c) biochemical oxygen demanding matter. The AAR also include requirements for sampling or visual monitoring of benthic substrates in aquaculture operations, and, with the exception of British Columbia authorize serious harm to fish resulting from the installation, operation, maintenance or removal of an aquaculture facility. More information can be found at: http://laws-lois.justice.gc.ca/eng/regulations/SOR-2015-177/index.html 	<p>Environmental Protection Agency</p> <ul style="list-style-type: none"> - Clean Water Act - Section 301 prohibits the discharge of pollutants into waters of the United States except in compliance with prescribed provisions of the Act. Section 402 establishes the NPDES and authorizes EPA (or states authorized by EPA) to issue permits for point source discharges of pollutants into U.S. waters. EPA has authorized both states where significant production in marine net pen farming currently exists (Maine and Washington) to issue NPDES permits for projects sited in their state waters. See sections below for additional information on requirements in Maine and Washington. <i>Effluent Limitation Guidelines</i> establish effluent guidelines for Concentrated Aquatic Animal Production facilities, including marine net pen aquaculture producing 100,000 pounds or more of aquatic animals per year (40 CFR Part 451). More information can be found at: https://www.epa.gov/eg/concentrated-aquatic-animal-production-effluent-guidelines http://www.ecfr.gov/cgi-bin/text-id?SID=b32f065c3e56d423dbc1858e2a077818&mc=true&node=pt40.32.451&rgn=div5#sp40.32.451.b NOAA Fisheries <ul style="list-style-type: none"> - Magnuson-Stevens Fisheries Conservation and Management Act - Requires federal agencies to consult with NOAA Fisheries regarding effects on Essential Fish Habitat for federally managed species. More information can be found at: http://www.habitat.noaa.gov/protection/efh/index.html http://www.habitat.noaa.gov/pdf/efhconsultationguidancev1_1.pdf http://www.NOAA.Fisheries.noaa.gov/pr/consultation/ - Endangered Species Act - Section 7 requires federal agencies to consult with NOAA Fisheries to determine if the proposed facility may affect threatened or endangered species or their critical habitat. More information can

Habitat/Water Quality	
<u>Canada</u>	<u>United States</u>
	<p>be found at: http://www.nmfs.noaa.gov/pr/consultation/ http://www.nws.usace.army.mil/Missions/Civil-Works/Regulatory/Permit-Guidebook/Endangered-Species/</p> <p>Fish and Wildlife Service - Endangered Species Act - Section 7 requires federal agency consultation to determine if the proposed facility will affect threatened or endangered species or their critical habitat. More information can be found at: http://www.nws.usace.army.mil/Missions/Civil-Works/Regulatory/Permit-Guidebook/Endangered-Species/</p>
<i>British Columbia</i>	<i>Maine</i>
<p>Fisheries and Oceans Canada - Pacific Aquaculture Regulations - Governs aquaculture operation in British Columbia. For the proper management and control of fisheries and the conservation and protection of fish, the PAR allows specification in Conditions of Aquaculture Licenses respecting measures to be taken to minimize the impact of a facility's operations on fish and fish habitat. There are also requirements to monitor the environmental impact of benthic deposits, and records that must be kept. The method of monitoring benthic deposits is through the use of core samples of the substrate and video monitoring. The samples are then analyzed for various items, including measurements of sulfides. The PAR enables DFO to administer aquaculture in BC as a federal responsibility. More information can be found at: http://laws-lois.justice.gc.ca/eng/regulations/SOR-2010-270/index.html</p> <p>Ministry of Environment - Environmental Management Act - Part 7 Section 78 enables the provincial Minister of Environment to require an environmental impact assessment if the minister considers that: (a) something a person proposes to do will have a detrimental environmental impact, and, (b) the environmental impact cannot be assessed from information available to the Minister. More information can be found at:</p>	<p>Maine Department of Environmental Protection - General Permit – Net Pen Aquaculture - The EPA authorized Maine to issue NPDES permits for operations in state waters. The General Permit harmonizes MDEP and ACOE permits and is the state-issued version of the NPDES permit that includes siting, water quality, benthic habitat, monitoring, and reporting requirements. A permit is required for the direct or indirect discharge of pollutants to waters of the State pursuant to the <i>Federal Water Pollution Control Act</i>. More information can be found at: https://www1.maine.gov/dep/water/wd/atlantic_salmon_aquaculture/index.html http://www.maine.gov/dep/water/wd/atlantic_salmon_aquaculture/MEG130000-2014permit.pdf http://legislature.maine.gov/statutes/38/title38sec413.html http://www.maine.gov/sos/cec/rules/06/096/096c529.doc</p>

Habitat/Water Quality	
Canada	United States
http://www.bclaws.ca/civix/document/id/lc/statreg/03053_00	
<i>New Brunswick</i>	<i>Washington</i>
<p>Department of Agriculture, Aquaculture and Fisheries</p> <ul style="list-style-type: none"> - Aquaculture Act - Section 13 of the Act include measures to be taken to minimize the risk of environmental degradation. Section 14 enables allows the Minister to establish terms and conditions relating to the year class and fallow period for aquaculture. More information can be found at: http://laws.gnb.ca/en/showfulldoc/cs/2011-c.112/20160310 - General Regulations under <i>Aquaculture Act</i> - Section 25 of the Regulations enable the Minister to control matters related to aquaculture lease or occupation permit when there is potential risk to the environment or ecologically and environmentally sensitive areas. More information can be found at: http://laws.gnb.ca/en/showfulldoc/cr/91-158/20160310 <p>Other relevant provincial legislation:</p> <p>Department of Environment and Local Government</p> <ul style="list-style-type: none"> - Clean Environment Act - https://releve.canlii.org/en/nb/laws/stat/rsnb-1973-c-c-6/latest/rsnb-1973-c-c-6.html - Clean Water Act - https://releve.canlii.org/en/nb/laws/stat/snb-1989-c-c-6.1/latest/snb-1989-c-c-6.1.html 	<p>Washington Department of Ecology</p> <ul style="list-style-type: none"> - Water Pollution Control Act - This is the principal law governing water quality in Washington State to maintain the highest possible standards. <i>More information can be found at:</i> http://app.leg.wa.gov/rcw/default.aspx?cite=90.48 https://fortress.wa.gov/ecy/publications/documents/1510015.pdf - NPDES Permit - The EPA authorized Washington to issue NPDES permits for operations in state waters. NPDES permits require benthic and water quality monitoring, no intentional/accidental release of Atlantic salmon, reporting of fish escapes, fish escape plans, a pollution prevention plan, and reporting. More information can be found at: http://www.ecy.wa.gov/programs/wq/permits/index.html - Chapter 173-204 WAC - Provides sediment management standards. More information can be found at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-204 - WAC 173-204-412 - This section identifies marine finfish rearing facility siting, operation, closure and monitoring requirements. More information can be found at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-204-412 - Section 401 Water Quality Certification and Coastal Zone Management Consistency Certification or Determination - A CWA Section 401 Certification is a certification from the state that the project will comply with the state's water quality standards. If the state determines that the water quality standards will not be met, the state can deny certification. A <i>Coastal Zone Management Federal Consistency Certification</i> is an analysis

Habitat/Water Quality	
<u>Canada</u>	<u>United States</u>
	<p>prepared by the applicant asserting that the proposed project will meet the state's CZMP's enforceable policies. The state will issue a "concurrence" if it agrees with the applicant's Certification or Determination for federal agencies. If the state concludes that the project will not meet the enforceable policies, then the state can object to the applicant's federal consistency certification or determination. More information can be found at:</p> <p>http://www.ecy.wa.gov/programs/sea/fed-permit/index.html</p> <p>- Chapter 173-26, Part III WAC – SMPs must consider the PHS list. More information can be found at:</p> <p>http://apps.leg.wa.gov/WAC/default.aspx?cite=173-26</p>
<i>Newfoundland and Labrador</i>	
<p>Department of Fisheries and Land Resources</p> <p>- Aquaculture Act - An Act respecting the encouragement and regulation of an aquaculture industry in NL. Conditions of Licence established under the Act require benthic monitoring of deposits to be conducted through bottom samples and video surveillance. Tests are done to determine the effects of net pen deposits on the floor underneath the pens, and records and reports are required. Inspections of records are done by both provincial and federal inspectors. The DFA administers the Act and associated Conditions of Licence. More information can be found at:</p> <p>http://www.assembly.nl.ca/legislation/sr/statutes/a13.htm</p> <p>Department of Municipal Affairs and Environment</p> <p>- Environmental Protection Act - An Act respecting environmental protection in NL. The Act prohibits unauthorized release of substances that may cause adverse environmental effects. Inspections for water quality and benthic deposits are carried out by both provincial and federal inspectors. More information can be found at:</p> <p>http://www.canlii.org/en/nl/laws/stat/snl-2002-c-e-14.2/latest/snl-2002-c-e-14.2.html</p>	
<i>Nova Scotia</i>	

Habitat/Water Quality	
<u>Canada</u>	<u>United States</u>
<p>Department of Fisheries and Aquaculture</p> <ul style="list-style-type: none"> - <i>Fisheries and Coastal Resources Act</i> - An Act to revise and consolidate the laws of NS respecting the fishery and to encourage and promote programs to sustain and improve the fishery. The provincial Minister issues aquaculture licences with conditions of licence including requirements in regard to water quality. The Act is administered by the provincial Minister of Fisheries and Aquaculture. More information can be found at: http://nslegislature.ca/legc/statutes/fishand.htm - <i>Aquaculture Management Regulations</i> - The Regulation specifies requirements for aquaculture operators to develop and implement Environmental Management Monitoring requirements for aquaculture operations. More information can be found at: https://www.novascotia.ca/just/regulations/regs/fcraquamgmt.htm - <i>Aquaculture Licence and Lease Regulations</i> - The Regulations specifies siting requirements for aquaculture leases, including depth (25 meters) location, and shoreward water depth (2 meters) at low tide. Conditions of licence require aquaculture operators to maintain records including those on environmental degradation and remedies, with benthic surveillance required, and these are inspected by provincial inspectors. More information can be found at: https://www.novascotia.ca/just/REGULATIONS/regs/fcraqualiclease.htm <p>Nova Scotia Environment</p> <ul style="list-style-type: none"> - <i>Environment Act</i> - The Act includes prohibition of unapproved release of any substance into the environment that may cause an adverse effect. Under the Act, the Minister is required to consult with other provincial departments prior to making a decision on a licence. More information can be found at: http://nslegislature.ca/legc/statutes/environment.pdf - <i>Environmental Monitoring Program</i> - Since 2002, the Province established an EMP for marine aquaculture and incorporated a requirement for 	

Habitat/Water Quality	
<u>Canada</u>	<u>United States</u>
data collection in the operating procedures in 2014. This includes, among other items, conditions for benthic monitoring, surveillance and chemical analysis of deposits. More information can be found at: http://novascotia.ca/fish/aquaculture/environmental-monitoring/	

Fish Health and Therapeutants

Management of pathogens and pests is a critical consideration in marine net pen aquaculture. The large numbers and densities of farmed fish in net pens could allow for an infection to spread within a net pen or facility, which could then affect productivity or may act as an additional source of infection to wild populations and/or neighboring farms. Industry best management practices along with federal and provincial/state regulatory frameworks seek to ensure that farmed fish will not introduce new pathogens or disease agents into the marine environment. Stocking of healthy fish, fish health management, proper siting and BMA and fallowing strategies can reduce the risk of pathogen and pest transfer between farmed and wild fish and among farms.

Therapeutants used to treat infections, such as in-feed medications administered on farms and vaccines administered to hatchery fish prior to stocking net pens, are managed primarily by federal regulatory requirements.

Canada

Federal

National Aquatic Animal Health Program²⁷

In Canada, the health of aquatic animals (i.e. finfish, molluscs, and crustaceans) falls within the jurisdiction of the Canadian Food Inspection Agency (CFIA), under the *Health of Animals Act*. The CFIA has phased in its disease management responsibilities under the National Aquatic Animal Health Program (NAAHP), which is co-delivered by DFO. DFO provides diagnostic/laboratory support to the CFIA under the NAAHP through the National Aquatic Animal Health Laboratory System (NAAHLS) and conducts research on fish health and disease interactions.

The goal of the NAAHP is to prevent the introduction and spread of aquatic animal diseases and the Program operates under a disease risk framework based on internationally accepted principles of the World Organisation for Animal Health (OIE).

The *Health of Animals Act* authorizes the CFIA to take actions pertaining to any animal that may be affected by any disease. However, the CFIA has refined its programs through the implementation of the *Health of Animals Regulations*, the *Reportable Disease Regulations*, and published policy documents.

Under the NAAHP, the CFIA utilises a risk-based disease management approach, which includes defined lists of federally reportable diseases, immediately and annually notifiable diseases, and the species of finfish, molluscs, and crustaceans susceptible to these diseases.

The disease lists contained in the *Reportable Disease Regulations* and the susceptible species list contained in the *Health of Animals Regulations* can be amended based on an assessment of emerging risks. Action can be taken at any time, if necessary, for potential diseases not appearing on these lists.

Movement Controls

²⁷ See the Canadian National Aquatic Animal Health Program website at <http://www.inspection.gc.ca/animals/aquatic-animals/eng/1299155892122/1320536294234> (accessed April 5, 2018)

Authorizations to move aquatic animals under the NAAHP are subject to relevant import or domestic program requirements. The import component of the NAAHP has been in effect since December 2012 and domestic movement controls were implemented in December 2015.

A CFIA-issued import permit is required under the NAAHP to import susceptible species of aquatic animals into Canada. For domestic movements, the CFIA has assigned, through ministerial declarations, a specific status to each province or part of a province, as well as the territorial seas, for reportable diseases of susceptible species of aquatic animals. Movements between declared areas of lower to higher health status require a CFIA permit.

In addition, the CFIA will allow facilities whose management and biosecurity practices are amenable to the maintenance of a distinct health status to apply to the CFIA for recognition as a compartment. The CFIA will inspect such facilities and, if they meet the necessary requirements, will issue a permit that recognizes the elevated health status of the compartment; subsequently it will allow domestic movements of susceptible species from the compartment regardless of the health status of the area in which the facility is located.

In some cases, the CFIA does not manage diseases that already exist in Canada and for which the Agency does not consider regulatory control measures are justified (e.g., diseases for which vaccines or treatments are readily available, and/or infection from wild stocks is very likely, etc.). The onus rests with industry to account for these diseases in their sourcing decisions and facility operations (e.g., source product from biosecure facilities). Some industry players have already secured their own third party disease-free certification, which encompasses enzootic diseases of production concern.

The CFIA is also responsible for certifying exports of aquatic animals for animal health and food safety purposes. Export certification is necessary to maintain access to existing aquatic animal and seafood markets and to secure entry to new markets by negotiating science-based, practical, and cost-effective export conditions. The National Animal Health Export Program inspects and certifies programs to meet the requirements of other countries, using science-based principles and OIE standards.

Disease Response

Should a either a listed disease pathogen or significant emerging pathogen be detected or suspected, the CFIA has a range of tools to manage the potential outbreak, including mandatory removal of fish from the site, and will work with relevant authorities to prevent the spread of the pathogen.

Although disease investigation and response situations vary, the steps involved normally include:

- **Initial inspection** by a CFIA veterinarian, who may decide to initiate movement controls by ordering quarantine and/or declaring the premises an infected place.
- **Sample collection and submission** following a rigorous process to ensure that test results are reliable and valid. The CFIA will only accept samples that have been collected by or under the oversight of a CFIA veterinary inspector and submitted to the National Aquatic Animal Health Laboratory System.
- **Investigation** of the health of the animals and the management practices used at the facilities, including movements of the animals.
- **Disease testing** conducted at a national aquatic animal health laboratory belonging to DFO using testing protocols that are validated according to international standards.
- **Destruction and disposal** if necessary following humane, internationally recognized methods.
- **Cleaning and disinfection** of infected facilities and things (e.g. nets, equipment, boats, vehicles, etc.) after all destruction and disposal activities have been completed.
- **Removal of movement controls** once the CFIA evaluates and determines that the quarantine order or infected place declaration may be removed.

Surveillance

The CFIA monitors for aquatic animal diseases and functions as the focal point for the collection, analysis and dissemination of surveillance data. The CFIA gathers the required data by building relationships and fostering existing partnerships with: aquatic animal industries and other private organizations, provincial and territorial governments, aboriginal groups such as First Nations, Métis, Inuit, and researchers in Canada and other countries.

To date, the CFIA conducts, in collaboration with other groups, surveillance for finfish diseases in British Columbia, Alberta, Manitoba, Ontario, Quebec, and Atlantic Canada. The CFIA also conducts collaborative surveillance for molluscan diseases in British Columbia and in the Atlantic area.

Samples collected under the surveillance program are tested by the National Aquatic Animal Health Laboratory System (NAAHLS) by DFO using testing protocols validated using international standards set by the World Organisation for Animal Health (OIE).

Results of surveillance activities are shared through quarterly and annual reports. This information facilitates access to domestic and international markets by providing the basis for health certification and domestic disease control measures. It also provides the necessary information for international reporting purposes, as required by the World Organisation for Animal Health (OIE). The CFIA also updates its website monthly with confirmed cases of Federally Reportable Aquatic Animal Diseases.

Fishery (General) Regulations

In all coastal provinces, DFO issues licences to intentionally release and transfer live fish under the Section 56 of the *Fishery (General) Regulations (FGR)*. These licences are issued following the *National Code on Introductions and Transfers of Aquatic Organisms (Code)* to ensure that disease, genetic, and ecological risks are low. However, DFO is currently proposing amendments to FGR Section 56 to eliminate overlap in fish disease management responsibilities with those contained in the Health of Animals Regulations, as administered by the CFIA under the NAAHP.

Following the Code, and as required under FGR Section 56, DFO is also responsible for assessing potential aquatic invasive species that may accompany the intentional release and transfer of aquatic organisms. Treatments to control pests and aquatic invasive species are authorized by DFO under the *Aquaculture Activities Regulations* and *Aquatic Invasive Species Regulations*, respectively.

Fish Health Treatment

Therapies to treat infections include in-feed and topical medications, as well as administration of vaccines to hatchery fish. In Canada, therapeutants are prescribed by licensed veterinarians after they have diagnosed health problems in aquatic animals. Veterinary drugs are regulated for sale in Canada by Health Canada's Veterinary Drugs Directorate, vaccines for animals are approved for release in Canada by the CFIA, and pest control products are regulated for use by Health Canada's Pest Management Regulatory Agency. Health Canada sets a science-based maximum food residue limit (MRL) for each drug and pest control product, and the Canadian Food Inspection Agency enforces these limits to ensure the food Canadians eat is safe.

CFIA is responsible for the management of animal diseases in finfish, shellfish and fish feed. The Agency sets authorities governing the manufacture and sale of livestock feeds in Canada to ensure they are safe, effective and labeled appropriately (through the federal *Feeds Act*), and ensures that harvested fish are fit for human consumption through the federal *Fish Inspection Act*. The aquaculture operator must follow existing regulations administered by the CFIA and Health Canada.

Approved antibacterial drugs for finfish aquaculture in Canada include: oxytetracycline, florfenicol, trimethoprim in combination with sulfadiazine, or ormetoprim in combination with sulfadimethoxine. Additional approved drug products are available at the discretion of prescribing veterinarians but the use of alternative drugs is uncommon.

The use of drugs to treat finfish is under the purview of provincial governments, as it is the practice of veterinary medicine, and the provinces require involvement of the provincial veterinarian, or a licensed veterinarian, in the prescribed treatment of fish in marine net pens.

Siting of aquaculture facilities can also be used to reduce the risk of pathogen and pest transfer between farmed and wild fish.

In September 2016, the Government of Canada announced over \$3 million investment to support an innovative environmentally friendly and economical approach to remove sea lice from farmed salmon in the Atlantic Provinces²⁸. This approach uses warm water to remove sea lice from farmed salmon, and will achieve a 95% removal rate. It is a 'green alternative' to the costly use of therapeutants, and will significantly reduce the cost of sea lice treatment to the aquaculture industry.

Provincial

A. BRITISH COLUMBIA

Pursuant to the federal PAR, one of the Conditions of Licence for Finfish Aquaculture in BC requires that aquaculture licence holders have a DFO-approved Fish Health Management Plan (FHMP)²⁹ in place. The FHMP includes all the standard operating procedures that the company implements related to such fish health matters as: biosecurity; predator control; feed and nutrition; fish handling; water quality monitoring, biofouling control; fish health and disease monitoring, record-keeping, and reporting; carcass collection and classification; egg and milt collection; etc. The details of each company's FHMP are proprietary to the company.

DFO's PAR Conditions of Licence require that complete records regarding fish health be kept and specific fish health incidents, such as occurrences of disease and elevated sea lice levels, be reported. In addition, DFO conducts inspections and tests for diseases under the Fish Health Audit and Surveillance component of the FHMP. The Province's Animal Health Centre provides animal health laboratory diagnostic support to DFO's Fish Health Audit and Surveillance team. Government and industry have tested over 5,000 samples of Atlantic salmon for ISA in recent years, but there has never been a confirmed case of ISA in BC.

The PAR Conditions of Licence describe the sea lice monitoring program³⁰ that aquaculture operators are required to follow. For farmed Pacific salmon, sea lice monitoring must be done at the facility during routine observations and handlings of live or dead fish or, quarterly (at a minimum) during a harvest of fish sorting event. The licensee must maintain documentation of sea lice abundance for review at DFO's request. DFO must be notified if the average motile *Lepeophtheirus spp.* exceeds three sea lice per farmed Pacific salmon. Industry monitors sea lice not only at marine net pens, but also occasionally at brackish sites containing

²⁸ See the article on "Cooke Aquaculture to Develop New Process to Battle Sea Lice" at <http://www.acoa-apeca.gc.ca/eng/Agency/MediaRoom/NewsReleases/Pages/4935.aspx> (accessed April 5, 2018)

²⁹ See more details at DFO Pacific's Fish Health Management website <http://www.pac.dfo-mpo.gc.ca/aquaculture/reporting-rapports/index-eng.html> (accessed April 5, 2018)

³⁰ See DFO Pacific's website <http://www.dfo-mpo.gc.ca/aquaculture/protect-protege/parasites-eng.html> for more information on sea lice monitoring (accessed April 5, 2018)

hatchery smolts. Licences do not require sea lice monitoring from some facilities with only two stocked pens for the production cycle; however, industry generally reports from these facilities voluntarily.

The BC Salmon Farmers Association has developed a Viral Disease Management Plan. The plan describes the protocol to be followed if there is an outbreak of a viral disease, and recognizes CFIA's lead on findings of reportable disease. It includes minimum standards for biosecurity, and for handling, harvesting, and processing of fish.

DFO provides public reporting of operational and environmental information to aquaculture stakeholders and the general public as part of BCARP. For example, every quarter, DFO reports to the public sea lice counts based on data collected by the industry and/or DFO personnel.

The Province of British Columbia also manages fish health via the *Reportable and Notifiable Disease Regulations* under the provincial *Animal Health Act*. The Regulations list diseases that must be reported to provincial officials if detected; the prescribed diseases in the list relating to marine finfish closely mirror diseases listed under the NAAHP. Further, the provincial *Animal Health Act* contains provisions that relate to disease prevention, duty to keep records and make reports, inspections, and disease control orders.

ATLANTIC CANADA

The Atlantic Canadian provinces (i.e. Newfoundland and Labrador, Nova Scotia, New Brunswick, and Prince Edward Island) are currently developing a Health Policy for the Transfer of Live Cultured Finfish in Atlantic Canada. This policy ensures that cultured finfish from aquaculture facilities transferred between and within the Atlantic Canadian provinces meet the health requirements of the receiving province. The finalization and implementation of this finfish health policy is targeted for spring 2017. A similar health policy for the transfer of shellfish is also being developed, although timelines for implementation remain uncertain.

B. NEW BRUNSWICK

The New Brunswick Department of Agriculture, Aquaculture, and Fisheries (DAAF) is the provincial authority responsible for the management of aquatic animal health within New Brunswick (NB). The Province is responsible for on-farm fish health surveillance and management (i.e., a company-specific fish health program and veterinary oversight), including disease-free certification. The DAAF monitors disease in fish through its Aquatic Animal Health Unit. If a disease is found that is on the World Organization for Animal Health's list (i.e., Immediately Notifiable, Annually Notifiable, Reportable), CFIA would play a lead role in disease management. DAAF would take the lead for non-reportable diseases.

The NB *Aquaculture Act (General Regulation 91-158)* contains restrictions on moving finfish, as well as requirements for fish health diagnostic testing and disease-free results for various diseases, before live fish can be transferred between facilities. NB's licence conditions require that aquaculture operators follow fish health management frameworks included in the *Code of Containment for Culture of Atlantic Salmon in Marine Net Pens in NB*. The Province is considering including this requirement in *General Regulation 91-158*.

The NB *Aquaculture Act* has requirements for a licensee to maintain health and genetic standards for aquaculture fish, as well as immediate reporting of diseases and parasites. The NB *Aquaculture Act* also gives the Minister power to direct a licensee to take measures to prevent the spread of disease, disease agents and parasites (including imposing quarantine or disposal of produce). Also, the Minister can designate an aquaculture site and surrounding area as a controlled area if he or she believes disease, disease agents and parasites are present at the site.

The NB *Marine Aquaculture Finfish Health Policy*³¹ outlines the health management framework for all marine finfish aquaculture stock. Key components of the policy include prevention of pathogen introduction, health maintenance through good farming practices, early disease detection and effective response, minimizing pathogen loading and inter-generational transfer (e.g., by year class separation and fallowing), communicating information to stakeholders, and research and education.

The DAAF has a Fish Health Management Program with staff who visits the aquaculture sites on a monthly basis. The aquaculture companies have veterinarians that visit the sites once per month where they will collect a maximum of five fish. Disease screening is done on these fish mainly for ISA, but also for Bacterial Kidney Disease and others. This monitoring is required by the NB *Aquaculture Act*. The Fish Health staff coordinates with the company veterinarians to proactively, look for pathogens.

The DAAF veterinarian administers and audits provincial programs under the NB *Marine Aquaculture Finfish Health Policy*. The provincial veterinarian investigates situations that he or she considers to present a high risk for potential diseases of concern. The provincial veterinarian is a central source of information relating to the policy and communicates essential information to appropriate stakeholders. The provincial veterinarian both monitors programs operating under the policy and initiates action to ensure compliance with those programs.

The NB *Health Policy for Shellfish Aquaculture*³² provides a framework for health management of all cultured shellfish in New Brunswick. Key components of the policy include prevention of pathogen introductions, health maintenance, early detection and effective disease response, communication, as well as research and education. Appendix B of the shellfish health policy includes the *NB Shellfish Health Surveillance Program for Aquaculture*. The surveillance program aims to provide comprehensive and timely information on *MSX* and *Bonamia* as well as assess other diseases and pests of concern for shellfish aquaculture (i.e. *polydora* spp., dermo, green crab, boring sponge, oyster drill, codium, various invasive tunicates, and skeleton shrimp).

As required by *General Regulation 91-158*, the licensee must perform sea lice counts at each of its sites: seven days before administering treatment, following treatment, and weekly (when water temperatures are at least 5°C) or monthly (when water temperatures are less than 5°C). A sea lice count must be reported within 48 hours after a sea lice count. The licensee must keep records of disease, disease agents and parasites as well as provide a written report upon request for diagnostic work or treatment. All sea lice counters employed by the aquaculture industry are trained and certified by the Atlantic Veterinary Training College. The Department does ten audits a season where its representative will visit a facility and make an independent count at the same time as the industry counter, and will compare how close the counts are.

NB also has an Integrated Pest Management Plan for sea lice specifically for southwest NB where most of the aquaculture farms are sites are located.

³¹ See the NB Marine Finfish Health Policy at <http://www2.gnb.ca/content/dam/gnb/Departments/10/pdf/Aquaculture/MarineAquacultureFinfishHealthPolicy.pdf> (accessed April 5, 2018)

³² See the New Brunswick Health Policy for Shellfish Aquaculture at <http://www2.gnb.ca/content/dam/gnb/Departments/10/pdf/Publications/Aqu/HealthPolicyShellfishAquaculture.pdf> (accessed April 5, 2018)

NB's Integrated Pest Management Program for Sea Lice

- Provides a science based management framework for sea lice
- Considers the environment and impacts on non-target organisms and commercial fisheries and has three components:
 - *Prevention and Control Measures:*
 - Non-chemotherapeutant control strategies (siting/BMAs with year class separation and fallowing, cleaner fish, sea lice traps, and new technologies); and,
 - Chemotherapeutant control strategies (in-feed and topical treatments using treatment thresholds, product rotation, farm-based and area treatments, and seasonal treatments).
 - *Monitoring Conducted:* sea lice at the aquaculture facility; and, monitoring efficacy of, and resistance to, sea lice treatment. Other monitoring includes environmental monitoring to support regulatory approvals; and, research and scientific monitoring.
 - *Data Collection and Analysis:* A database known as the Decision Support System is used to analyze sea lice dynamics and trends, treatment efficacy, regional differences, and treatment options.
- Includes engagement of key stakeholders

Source: NB. 2013. Integrated Pest Management Program for Sea Lice in NB, presentation at World Aquaculture Society

As required by *General Regulation 91-158*, the commercial aquaculture licence requires submission of a yearly sea lice management and treatment plan for each of an applicant's sites. This includes providing information on: location of site (i.e., BMA in which it is located. See section 3.2.3 for more information on BMAs); names of products expected to be used for sea lice treatment; expected timing of treatment; method of treatment administration; weekly notices of whether or not sea lice treatment activities are planned and details describing the treatment and names of persons and regulatory authorities to be sent the weekly notices; and, any revisions to the plan.

C. NEWFOUNDLAND AND LABRADOR

The Department of Fisheries, Forestry and Agrifood (DFFA) provides fish health support to the aquaculture industry in Newfoundland and Labrador (NL) by providing services related to environmental biological monitoring, aquatic invasive species monitoring, fish health sampling, monitoring, diagnostics, treatment and management planning. For example, the provincial animal health surveillance program requires veterinary inspections and diagnostics every 4-6 weeks during the production cycle.

Further, the Province's *Sustainable Aquaculture Strategy 2014*³³ includes an Aquatic Animal Health Management strategic initiative to implement an Aquatic Animal Health Management Plan. The Strategy will guide future aquaculture policy in NL, and will be reviewed annually to consider relevant new science and technology advancements. The Biosecure Infrastructure and Logistics strategic initiative notes that DFFA will assess, identify, prioritize and cost new infrastructure for optimal biosecurity and best practices for disease management.

Under the NL *Sustainable Aquaculture Strategy* the Aquatic Animal Health Management strategic initiatives will:

- continue to conduct surveillance and biosecurity audit programs for the aquaculture industry;
- support research and trials for equipment and strategies supporting fish health (e.g., for sea lice mitigation); and,
- support fish health epidemiological studies (e.g., risk factor studies, clinical field trials, and network and spatial epidemiology).

³³ See the NL Sustainable Aquaculture Strategy 2014 at http://www.fishaq.gov.nl.ca/publications/pdf/Sustainable_Aquaculture_Strategy_2014.pdf (accessed April 5, 2018)

D. NOVA SCOTIA

The provincial Department of Fisheries and Aquaculture is the key provincial authority regulating aquaculture health in Nova Scotia (NS). The *NS Aquaculture Management Regulations* require marine net pen aquaculture licence holders to have a Farm Management Plan, with a section on fish health management (including sea lice management procedures). An updated fish health section must be submitted for approval once per year. The regulated mandate for managing disease outbreaks includes appointing and authorizing a Chief Aquatic Animal Health Veterinarian or Veterinary Administrator to: take samples of fish, other organisms or water; inspect fish transportation vehicles; inspect aquaculture sites where diseased fish originated or to which the disease causing agent could have spread; conduct epidemiological investigation; order treatment or vaccination of fish; restrict movement of fish into or out of the site; and, require that the licence holder to conduct enhanced biosecurity measures.

Sites with a known or suspected disease can be quarantined under these regulations, with required conditions and restrictions (including biosecurity measures). Disease management measures for a quarantined area could include: restricting movement to and from the area; destroying fish; instituting disinfection protocols; eradicating disease or disease causing agents in the area; establishing fallowing; and, stopping the disease or disease-causing agents from spreading into or out of the quarantine area.

A certificate of health for transfer (issued by the NS's Minister of Fisheries and Aquaculture) authorizes an aquaculture licence holder to transfer fish to or from an aquaculture site. The Regulations require a licensee to comply with any conditions set by Minister for issuing the certificate.

The *NS Aquaculture Management Regulations* also have requirements for licence holders to prepare the environmental monitoring section of the Farm Management Plan, which must not discuss monitoring for pathogens. The section must include measuring oxyc conditions, reporting stocking levels associated with monitoring events and providing a mitigation plan. However, this section must also include any information and procedures for effective environmental monitoring of the site required by the Minister. The Farm Management Plan's section on fish health management has a requirement to include disease surveillance practices.

Disease surveillance and reporting requirements for aquaculture licence holders include: health recordkeeping for the stock; any required diagnostic testing to be conducted at an approved laboratory; mandatory reporting of antibiotics and sea lice treatment products. There is also mandatory reporting of disease and mortality, including: suspicion or knowledge of reportable disease in a fish; mass mortality; and a significant mortality even of unknown cause. The licence holder of a quarantined site may be required to conduct testing and sampling of restocked fish.

The *NS Aquaculture Management Regulations* do not prescribe specific sea lice management measures, but rather outline that "procedures for managing sea lice" are required in the Farm Management Plan (which is approved annually). As mentioned previously, the *NS Aquaculture Management Regulations* also require the aquaculture licence holder to report on products to treat sea lice.

E. PRINCE EDWARD ISLAND

Marine net pen aquaculture does not occur in PEI. The Province is currently developing its first aquaculture fish health regulations. Disease risks associated with intentional release and transfer of fish are addressed via the NAAHP and the FGR.

United States

Federal

The *United States National Aquatic Animal Health Plan* (USNAHP) is a non-regulatory plan that provides recommendations to industry, states, tribes, federal agencies, and stakeholders to facilitate legal movement of aquatic animals, eggs and products in interstate and international commerce. The USNAHP makes recommendations to protect wild and farmed animal health, ensures that diagnostic, inspection, and certification services are available, and minimizes disease impacts in farmed or wild animals.³⁴

APHIS is the lead federal agency for disease management under the *Animal Health Protection Act (2002)*. APHIS coordinates with FWS and NOAA pursuant to a memorandum of understanding to protect the health of farmed and wild animals. APHIS has accredited private practice veterinarians who can endorse health certificates for transport of animals as well as accredited laboratories that use diagnostic protocols for testing of the World Organization for Animal Health (OIE) reportable diseases.³⁵ If an OIE-listed pathogen is confirmed in finfish, then operators are obligated to report to the appropriate APHIS office. APHIS coordinates with state agencies to manage the response to a disease outbreak. The specific response varies depending on whether or not the reported pathogen is already widespread and endemic.

APHIS works closely with Canada's CFIA, State of Maine, and Province of New Brunswick to develop ISA Program Standards with recommended procedures to prevent and contain ISA for cultured Atlantic salmon.³⁶ The major components of the standards are:

- Surveillance, including scheduled inspections and fish health assessments to quickly diagnose ISAV infection;
- Testing at APHIS-approved laboratories for a quick and accurate diagnosis;
- Reporting to allow needed control measures to be implemented quickly;
- Disease control, including biosecurity protocols and a site-specific ISA action plan reviewed by the APHIS ISA Program Veterinarian; and,
- Indemnity to provide financial relief and encourage compliance.

Veterinary biologics are regulated by APHIS's Center for Veterinary Biologics according to statutory guidelines in the *Virus-Serum-Toxin Act*.

APHIS has also been working with the National Aquaculture Association (NAA) to develop *Commercial Aquaculture Health Program Standards* (CAHPS) on fish farms, which is a voluntary and non-regulatory framework.³⁷ The CAHPS program was initiated by industry (NAA) with the goal of providing uniform standards for U.S. commercially farmed aquatic animal health and movement, and a template for known national aquatic animal health status. All aquaculture producers (public or private) may participate in the CAHPS program with the potential benefit of improved marketability of animals produced. FWS regulates imports of live or dead salmonids or their products under the *Injurious Wildlife Regulations of the Lacey Act*. All live salmonid fish and their eggs and dead whole, unviscerated salmonids imports into the United States must be inspected by a FWS-certified fish pathologist, fish health inspector, or

³⁴ See NOAA Fisheries National Aquatic Health Plan at <https://www.fisheries.noaa.gov/national-aquatic-animal-health-plan> (accessed April 5, 2018)

³⁵ See the OIE website for more details on the role of the OIE with respect to aquatic animal diseases at <http://www.oie.int/for-the-media/editorials/detail/article/the-role-of-the-oie-in-aquatic-animal-diseases/> (accessed April 5, 2018)

³⁶ ISA has not been found in Washington, the only other state where commercial-scale net pen aquaculture occurs.

³⁷ More details on the CAHPS can be found on APHIS's website https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/animal-disease-information/aquaculture/!ut/p/z1/04_iUIDg4tKPAFJABpSA0fpReYllmemJJZn5eYk5-hHGkVFm8X6Gzu4GFiaGPu6uLoYGjh6Wnt4e5mYGBv7G-I76UfgVFGQHKgIAONF55A!/ (accessed April 5, 2018)

veterinarian, who then certifies the shipment as disease free. This health certificate must accompany any shipment. Only salmonids deemed “healthy” are allowed into the United States by the Director of the FWS or his or her agents, except in certain instances.³⁸ FWS law enforcement authorized field inspectors and agents at 18 designated ports of entry allow only these “healthy” fish into the United States.

The FDA's CVM regulates the manufacture and distribution of food additives and drugs that will be given to animals, including fish, through the *Federal Food, Drug, and Cosmetic Act*. CVM approval is required for all new animal drugs, and CVM authorization is required for investigational new animal drug (INAD) exemptions for use by the aquaculture industry. CVM has a Minor Use and Minor Species designation program that provides incentives for sponsors to seek approval of new animal drugs for fish. CVM's authority includes the regulation of medicated feeds through the *Minor Use and Minor Species Act* of 2004. When therapeutants are used, a farm's permit for discharges under the CWA may require monitoring for the therapeutants and their break-down products (in benthos or water quality sampling), and/or sampling of indicator bacteria to test for resistance to antibiotics. Pollutant discharges allowed from the facility under a CWA permit include fish excrement, ammonia excretions, unconsumed fish food and FDA-approved medications. All FDA-approved veterinary drugs are evaluated for environmental impact (NEPA analysis is required) as part of the approval process.

ACOE's Section 10 (siting) Permit allows application of antibiotic chemicals approved by FDA. Pre-emptive use of antibiotics is not permitted. In an effort to ensure the judicious use of medically-important antimicrobials in feed or water for food-producing animals, the FDA issued a final rule, effective October 1, 2015, revising the *Veterinary Feed Directive* (VFD), which is a category within the *Animal Drug Availability Act*. The VFD now requires that therapeutic use of these drugs in or on animal feed or in water be supervised by a licensed veterinarian and provides veterinarians in all states with a framework for authorizing use for specific animal health purposes.

State

A. MAINE

MDMR has a finfish aquaculture regulation that relates to pathogens: Department of Marine Resources Regulations – *Chapter 24: Importation of Live Marine Organisms*. The salmonid fish health inspection regulations prohibit clinically diseased salmonid fish from being introduced into Maine's coastal waters. Active and passive pathogen surveillance is required for spawning broodstock and production stock (see *Chapter 24.21, Section D* for the testing requirements and *Section F* for the list of pathogens for salmonids). Maine has an Aquatic Animal Health Technical Committee (described in the regulations) that has been established by the Commissioners of the Department of Inland Fisheries, Maine Department of Wildlife, and MDMR. The Committee provides “advice to maintain optimum health among Maine's aquatic resources and to safeguard wild and cultured organisms from the introduction or dissemination of infectious organisms.” Membership includes people from the state departments noted previously plus the Maine Department of Agriculture, Food and Rural Resources, FWS, NOAA Fisheries, APHIS, academia, commercial finfish aquaculture, and commercial shellfish aquaculture. For the ACOE Section 10 permit issued in Maine, ACOE must receive certification from the Committee and MDMR that the stocking is in compliance with disease management standards permitting the culture of alternative salmonid species.

³⁸ See federal regulation at http://www.ecfr.gov/cgi-bin/text-idx?SID=e6a50c9cb330a8cfd097beaff509fda&mc=true&node=se50.1.16_113&rgn=div8 (accessed April 5, 2018)

Maine aquaculture operator permits require that they also follow the APHIS *Infectious Salmon Anemia Program Standards*, which include participation in the Integrated Pest Management Program for the Control of Sea Lice on Salmonids in Maine.

Pathogen Monitoring

Producers in Maine are doing routine monitoring on various pathogens. Follow-up monitoring is required if a pathogen is found. Monitoring and reporting-related requirements in Maine include smolt health inspections before transfer from hatcheries to marine net pens, and broodstock testing at spawning. Companies conduct voluntary additional diagnostic testing to meet management protocols and production requirements.

Producers in Maine are required to have working relationships with licensed and APHIS-accredited veterinarians, who are responsible for implementation of the standards. These veterinarians conduct surveillance and comply with the standards' testing and reporting procedures. Fish inventory information (e.g., age, numbers, origin hatchery, date of saltwater transfer, vaccination status, and therapeutant history) must be submitted to the APHIS ISA Program Veterinarian for every site. Industry must maintain mortality data for each site and net pen, and make this data available to APHIS Veterinary Services.

Chapter 24: Department of Marine Resources Importation of Live Marine Organisms Regulations include salmonid fish health inspection regulations, and controls transfers of fish or gametes. Active and passive pathogen surveillance is required for spawning broodstock and production stock (see Chapter 24.21, Section D for the testing requirements and Section F for the list of pathogens for salmonids). There are also special fish health inspection regulations relating to ISAV, which have mandatory surveillance and reporting requirements. Leaseholders participating in an APHIS ISA control program would be governed by the ISA control program standards or rules if there is a conflict between the two.

Therapeutant Use and Monitoring

Maine's Net Pen Aquaculture General Permit (Section N) notes that all drugs used for disease prevention or control must comply with FDA requirements. MDEP may restrict or limit use of the drug if it determines significant adverse effects are likely to occur. Prior consent by MDEP is required for discharge of drugs authorized by FDA during studies conducted by the Investigational New Animal Drug program.³⁹ The Net Pen Aquaculture General Permit has the following monitoring conditions:

- It may require sediment monitoring for a specific drug or its metabolites if data in literature are not available that sufficiently characterizes environmental fate of the drug or metabolites. When MDEP has required sediment monitoring with use of a drug, the permittee must submit a sediment monitoring plan for approval before it can discharge the drug. Monitoring must be conducted between seven and 30 days following the use of a drug unless otherwise specified by MDEP.
- A permittee must provide an environmental monitoring and evaluation program to MDEP for any approved Investigational New Animal Drug use. The program must consider potential impacts to the water column, benthic conditions and organisms in, or uses of, surrounding waters.
- A monthly drug use report must be submitted describing discharged drugs or other disease control chemicals.
- Sediment monitoring for drugs is also required.

B. WASHINGTON

³⁹ Investigational New Animal Drug files are opened as part of drug approvals process. See more information on FDA's website <http://www.fda.gov/AnimalVeterinary/ResourcesforYou/AnimalHealthLiteracy/ucm219207.htm> (accessed April 5, 2018)

WDFW is the lead state agency on disease relating to net pen aquaculture. Conditions of Aquaculture Finfish Permits (also called operation permits) issued by WDFW require development of Regulated Finfish Pathogen Reporting Plans, as well as other plans relating to fish escapement. Regulated diseases are required to be reported to WDFW.

Chapter 77.115 RCW Aquaculture Disease Control includes requirements for disease inspection and control for aquatic farmers, consulting with relevant agencies and Tribes, and entering into agreements for diagnostic field services. Specific pathogens are regulated through the WAC Aquaculture Chapter (Title 220-370):

- *WAC 220-370-100* indicates a permit is required for marine finfish aquaculture. It also notes that a permit can be denied if there are fish health risks from the aquaculture operation to naturally occurring fish or wildlife, associated habitat or other fish rearing programs.
- *WAC 220-370-120* requires that an escape reporting and recapture plan be included with each application for a marine finfish aquaculture permit. There are reporting requirements for escaped fish being treated with antibiotics or other drugs subject to FDA withdrawal requirements whose withdrawal periods had not expired when the fish escaped. All fish escape reports (including a required annual report) must include disease and medication history of escapes.
- *WAC 220-370-150* enables an educational program with marine farmers (contingent on funding), to inform them of WDFW activities relating to disease prevention in hatcheries.
- *WAC 220-370-190* regulates finfish aquaculture disease control. It states that a permit is required to transport finfish aquaculture products into or within Washington. WDFW can impose conditions on this permit to protect these products and native finfish if a reasonable risk of transmission of disease from such products is determined.

Chapter 77.15.290 RCW establishes that a person is guilty of unlawful transport of finfish in the second degree if they conduct import, export, or intra-state transport of marine finfish without an approved marine finfish aquaculture permit.

The Treaty Tribes of Washington (i.e., co-managers) provide input on disease control regulations. The *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* was developed to protect wild and cultured fish from management activities (e.g., transfer of gametes, fish eggs, dead fish, or water between watersheds) that can adversely affect salmonid health. It includes hatchery sanitation requirements, transfer requirements, and a requirement for a site-specific pathogen containment plan.⁴⁰

Monitoring and management requirements include the following:

- Surveillance for regulated pathogens.
- Regular fish health monitoring by a fish health inspector for cultured fish stocks.
- Preventative and therapeutic procedures will be conducted if possible when an infectious agent is implicated in a fish loss.

The state veterinarian is an employee of the WSDA and works with WDFW on aquaculture disease management and controls.

The Washington NPDES permit addresses sea lice treatment and requires reporting of sea lice infestations. If an operator uses pesticides to treat sea lice, the treatment must be approved by Ecology as required by NPDES permits. NPDES also requires the reporting of emergency regulated disease occurrences. If there is a regulated disease outbreak other than sea lice, WDFW takes the lead on addressing the issue. When

⁴⁰ See the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State*, posted at http://files.nwifc.org/fish-health/FinalDiseasePolicy-July2006_Ver3.pdf (accessed April 6, 2018)

Ecology asks for changes, the only commercial operating company of marine net pens in Puget Sound institutes the changes in all its facilities at once.

In addition, local governments are required to comply with Ecology’s SMP Guidelines, and specifically WAC 173-26-241(3)(b), in developing SMP standards that affect aquaculture siting and operations. Facilities must be designed and located so as not to spread disease to native aquatic life. Ecology approves the standards. A Shoreline Master Programs Handbook was developed to provide direction to shoreline planners working on SMP updates and amendments and includes information relevant to review of aquaculture permit proposals as well as a review of state and national aquaculture policy.

List of Regulatory Tools

Fish Health/Therapeutants	
Canada	United States
Federal	Federal
<p>Health Canada Food and Drugs Act & Food and Drug Regulations - Administered by Health Canada and regulate which therapeutants can be licensed for sale in Canada. The Act together with the Fish Inspection Regulations, regulate the permissible residue levels in harvested fish, either at zero level or a maximum residue limit depending on the therapeutant. More information can be found at: http://laws-lois.justice.gc.ca/eng/acts/F-27/index.html</p> <p>- Pest Control Products Act & Pest Control Products Regulations - Administered by Health Canada and regulate the use of pesticides to treat fish for pests such as sea lice. More information can be found at: http://laws-lois.justice.gc.ca/eng/acts/P-9.01/index.html</p> <p>Canadian Food Inspection Agency Health of Animals Act & Health of Animals Regulations - Administered by the Canadian Food Inspection Agency (CFIA) under the Minister of Agriculture. The Act and Regulations provide for the control of fish disease and related matters, and impose an obligation to notify the nearest veterinary inspector of the presence of a reportable disease or toxic substance, or any fact indicating its presence, in or around the animal, immediately after the person becomes aware. More information can be found at: http://laws-lois.justice.gc.ca/eng/acts/H-</p>	<p>Animal and Plant Health Inspection Service - General information regarding APHIS’s role in managing aquaculture animal disease can be found at: https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/animal-disease-information/aquaculture/ct_aquaculture_index</p> <p>- Animal Health Protection Act - Seeks to prevent, detect, control or eradicate diseases of farmed animals (including aquaculture) and promotes best management practices. More information can be found at: http://uscode.house.gov/view.xhtml?path=/prelim@title7/chapter109&edition=prelim</p> <p>- U.S. National Aquatic Animal Health Plan - Provides recommendations for efficient, safe, and effective national and international commerce of aquatic animals and protection of cultured and wild aquatic animals from foreign pests and diseases. More information can be found at: https://www.aphis.usda.gov/animal_health/animal_dis_spec/aquaculture/downloads/naahp.pdf</p> <p>- Commercial Aquaculture Health Program Standards - Developed with the NAA as a voluntary non-regulatory framework for industry. More information can be found at: https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/animal-disease-information/aquaculture/ct_aquaculture_index https://www.aphis.usda.gov/animal_health/animal_dis_spec/aquaculture/downloads/cahps_concept%20faq.pdf</p>

Fish Health/Therapeutants	
<u>Canada</u>	<u>United States</u>
<p>3.3/index.html</p> <p>- Reportable Disease Regulations - Regulations under the Health of Animals Act that prescribe certain diseases as Reportable Diseases. More information can be found at: http://laws-lois.justice.gc.ca/eng/regulations/SOR-91-2/index.html</p> <p>Agriculture and Agri-Food Canada</p> <p>- Feeds Act & Feeds Regulations - Administered by Agriculture and Agri-Food Canada (AAFC), include medicated feeds for aquaculture. Feed and its constituents used in aquaculture are under the regulatory authority of the CFIA. More information can be found at: http://laws-lois.justice.gc.ca/eng/acts/F-9/index.html</p> <p>Fisheries and Oceans Canada</p> <p>- Fisheries Act and Regulations - Administered by DFO and have provisions related to fish health, fish feed, pesticides, control of pathogens, fish treatments, and record keeping. More information can be found at: http://laws-lois.justice.gc.ca/eng/acts/F-14/index.html</p> <p>- Fish Inspection Regulations - http://laws-lois.justice.gc.ca/eng/regulations/C.R.C.,_c._802/index.html</p> <p>- Aquaculture Activities Regulations - The AAR have specific conditions regarding the deposition of drugs and pesticides used to treat fish, and the requirement to monitor their effects outside a net pen facility if any morbidity/mortality occurs in wild fish. In addition, the AAR require aquaculture operators to submit an annual report to the Minister of DFO on the drugs and pesticides used in respect of the operation of the aquaculture facility. More information can be found at: http://laws-lois.justice.gc.ca/eng/regulations/SOR-2015-177/index.html</p>	<p>- Infectious Salmon Anemia Program Standards - Provide recommended procedures for the prevention and containment of ISA from farm raised Atlantic salmon. More information can be found at: https://www.aphis.usda.gov/animal_health/animal_dis_spec/aquaculture/downloads/isa_standards.pdf</p> <p>- Virus-Serum-Toxin Act - Seeks to ensure that pure, safe, potent and effective biologic products are available in the United States for use in animals. More information can be found at: https://www.aphis.usda.gov/animal_health/vet_biology/publications/vsta.pdf</p> <p>Fish and Wildlife Service</p> <p>- Injurious Wildlife Regulations of the Lacey Act - Seeks to prevent the spread of disease and manage the import of live or dead salmonids or their products. More information can be found at: http://www.ecfr.gov/cgi-bin/text-idx?SID=188104a4a209e9dfaaccb30848f475f4&mc=true&node=se50.1.16_113&rgn=div8</p> <p>Food and Drug Administration</p> <p>- A list of drugs approved for aquaculture use can be found at: https://www.fda.gov/animalveterinary/developmentapprovalprocess/aquaculture/ucm132954.htm</p> <p>- Federal Food, Drug, and Cosmetic Act - Regulates the manufacture and distribution of food additives and drugs that will be given to animals. More information can be found at: https://www.fda.gov/regulatoryinformation/lawenforcedbyfda/federalfooddrugandcosmeticactfdca/default.htm</p> <p>- Minor Use and Minor Species Act - Intended to make medications legally available for the treatment of minor animal species. More information can be found at: http://www.fda.gov/AnimalVeterinary/DevelopmentApprovalProcess/MinorUseMinorSpecies/</p>

Fish Health/Therapeutants	
<u>Canada</u>	<u>United States</u>
	<p>- Animal Drug Availability Act – Facilitates approval of new animal drugs and medicated feeds. The VFD is a category within this act and requires use of antimicrobials be supervised by a licensed veterinarian. More information can be found at: https://www.fda.gov/AnimalVeterinary/DevelopmentApprovalProcess/ucm071807.htm</p>
<i>British Columbia</i>	<i>Maine</i>
<p>Fisheries and Oceans Canada</p> <p>- Pacific Aquaculture Regulations - Under Section 4 of the Regulations, the Minister of DFO may specify conditions in an aquaculture licence respecting the measures that must be taken to control and monitor the presence of pathogens and pests in the aquaculture facility, as well the presence of pathogens and pests in wild fish in the waters that may be affected by the operations of the aquaculture facility. The Minister may also specify the records that must be kept in relation to any diagnosis or treatment of a fish pathogen or pest present in the aquaculture facility, and any substance used to treat fish for pathogens or pests. More information can be found at: http://laws-lois.justice.gc.ca/eng/regulations/SOR-2010-270/index.html</p> <p>- Conditions of Licence for Finfish Aquaculture, subsequent to the Pacific Aquaculture Regulations, require that licence holders must have a FHMP. The Plan requires operators to report on the health of their stocks. DFO conducts inspections and tests for diseases under the Fish Health Audit and Surveillance component of the FHMP. More information can be found at: http://www.pac.dfo-mpo.gc.ca/aquaculture/reporting-rapports/health-sante/index-eng.html</p>	<p>Maine Department of Marine Resources</p> <p>- Department of Marine Resources Regulations - Chapter 24 covers the permit for importation of live marine organisms. More information can be found at: http://www.maine.gov/dmr/laws-regulations/regulations/index.html</p> <p>Maine Department of Environmental Protection</p> <p>- General Permit - Net Pen Aquaculture - Drugs used for disease prevention or control must comply with FDA requirements under Section N. A drug use report must be submitted monthly and monitoring is required. More information can be found at: https://www1.maine.gov/dep/water/wd/atlantic_salmon_aquaculture/MEG130000-2014permit.pdf</p>
<i>New Brunswick</i>	<i>Washington</i>
<p>Department of Agriculture, Aquaculture and Fisheries</p> <p>- Aquaculture Act (General Regulation 91-158) - Contains restrictions on finfish movement, and has requirements for fish health diagnostic testing and disease-free results for various</p>	<p>Washington Department of Fish and Wildlife</p> <p>- Chapter 77.115 RCW - Regulates disease inspection/control and authorization for diagnostic field services. More information can be found at: http://app.leg.wa.gov/RCW/default.aspx?cite=77.</p>

Fish Health/Therapeutants	
<u>Canada</u>	<u>United States</u>
<p>diseases before live fish can be transferred between facilities. Also requires licensee to maintain health and genetic standards for aquaculture fish, as well as reporting of diseases and parasites, including sea lice counts. More information can be found at: http://laws.gnb.ca/en/showfulldoc/cr/91-158/20160310</p> <p>Other regulatory tools include:</p> <ul style="list-style-type: none"> • New Brunswick Marine Aquaculture Finfish Health Policy http://www2.gnb.ca/content/dam/gnb/Departments/10/pdf/Aquaculture/MarineAquacultureFinfishHealthPolicy.pdf • Integrated Pest Management Program for Sea Lice in New Brunswick https://www.was.org/documents/MeetingPresentations/AQ2013/AQ2013_1100.pdf 	<p>115</p> <ul style="list-style-type: none"> - WAC 220-370-100 - Establishes that a marine finfish aquaculture permit may be denied based on the determination by the director of significant genetic, ecological or fish health risks of the proposed fish rearing program on naturally occurring fish and wildlife, their habitat or other existing fish rearing programs. More information on can be found at: http://apps.leg.wa.gov/wac/default.aspx?cite=220-370-100 - WAC 220-370-120 - Establishes reporting requirements for escaped fish being treated with antibiotics or other drugs. More information can be found at: http://apps.leg.wa.gov/wac/default.aspx?cite=220-370-120 - WAC 220-370-150 - Enables an educational program to inform farmers of WDFW disease prevention activities. More information can be found at: http://apps.leg.wa.gov/wac/default.aspx?cite=220-370-150 - WAC 220-370-190 - Regulates disease control. A permit is required for transfer of finfish aquaculture products into or within the state. WDFW must be informed upon initial detection of a regulated pathogen. More information can be found at: http://wdfw.wa.gov/licensing/fish_transport/transport_app.html http://apps.leg.wa.gov/wac/default.aspx?cite=220-370-190 - Chapter 77.15.290 RCW - Establishes the penalty for conducting marine finfish import or intrastate transportation without a permit. More information can be found at: http://app.leg.wa.gov/RCW/default.aspx?cite=77.15.290 <p>Washington Department of Ecology</p> <ul style="list-style-type: none"> - NPDES permit - Requires that an operator report use of pesticides to treat sea lice and emergency

Fish Health/Therapeutants	
<u>Canada</u>	<u>United States</u>
	<p>regulated disease occurrences. More information can be found at: http://www.ecy.wa.gov/programs/wq/permits/index.html</p> <p>- WAC 173-26-241(3)(b) - Contains SMP Guidelines for Aquaculture requiring that local governments develop standards that will ensure facilities are designed and located so as not to spread disease. More information can be found at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-26-241</p> <p>- Shoreline Master Programs Handbook - Provides guidance to local governments on the interpretation and application of federal and state regulations in Shoreline Master Programs, including disease control and response. More information can be found at: http://www.ecy.wa.gov/programs/sea/shorelines/smp/handbook/Chapter16.pdf</p>
<i>Newfoundland and Labrador</i>	
<p>Department of Fisheries and Land Resources</p> <p>- The <i>Sustainable Aquaculture Strategy 2014</i> has an Aquatic Animal Health Management strategic initiative to revise and implement the DFA's Aquatic Animal FHMP. More information can be found at: http://www.fishaq.gov.nl.ca/publications/pdf/Sustainable_Aquaculture_Strategy_2014.pdf</p>	
<i>Nova Scotia</i>	
<p>Department of Fisheries and Aquaculture</p> <p>- Aquaculture Management Regulations - Require marine net pen aquaculture licence holders to have a Farm Management Plan, with a section on fish health management. More information can be found at: http://www.novascotia.ca/just/regulations/regs/fcraquamgmt.htm</p>	

Genetics and Fish Escapes

Fish escape refers to the incidental or accidental release of finfish or spawn into the marine aquatic environment, which may affect wild fish populations through naturalization (establishment of non-native breeding populations), increased competition (for food, reproductive, and habitat resources), predation, and hybridization (interbreeding between native and non-native strains and stocks). The potential for fish to escape occurs during routine aquaculture operations (e.g., transfer to and from culture facilities or during transport), or as a result of damage to infrastructure (e.g., damage to containment nets as a result of storms or marine mammal interactions).

The impact of escaped farmed fish on wild fish populations depends on the health of the ecosystem, the species involved and their life-history stage, the magnitude and frequency of escapes, the ability of escaped fish to thrive in that environment, and the health and size of the recipient wild populations. Potential hazards to wild populations posed by aquaculture escapes have been identified, but the probabilities and magnitudes of effects are not well known and are dependent on whether the escaped fish are native to the area. Further research is required in well-defined ecological systems to examine the extent of ecological and genetic interactions where escapes are known to occur.

Two approaches are employed to mitigate impact from the escape of farmed fish into the wild: physical containment, and biocontainment. Physical containment involves the design and use of physical structures (e.g., farm design, physical structure engineering, nets and design) that are built robust enough to withstand local weather and oceanographic conditions in order to prevent potential escape. Biocontainment embodies measures to mitigate potential post-escape interactions with wild fish populations.⁴¹

Containment consists of two approaches: prevention of large escapes, and best practices to manage small-scale ongoing accidental releases. To prevent the escape of farmed fish into the wild and minimize the potential impacts on the genetics of wild fish, the aquaculture industry uses both physical containment and biocontainment. Systems need to be regularly inspected, tested, and maintained to ensure continued integrity and to control biofouling, ice build-up and other factors that could contribute to containment system failures

Net pen aquaculture farms are required to develop escape management plans to prevent escapes and recovery plans for responding if escapes should occur. Management measures include best practices to prevent escapes, marine mammal interaction management to prevent damage, improved monitoring, marking fish, and reporting any escapes.

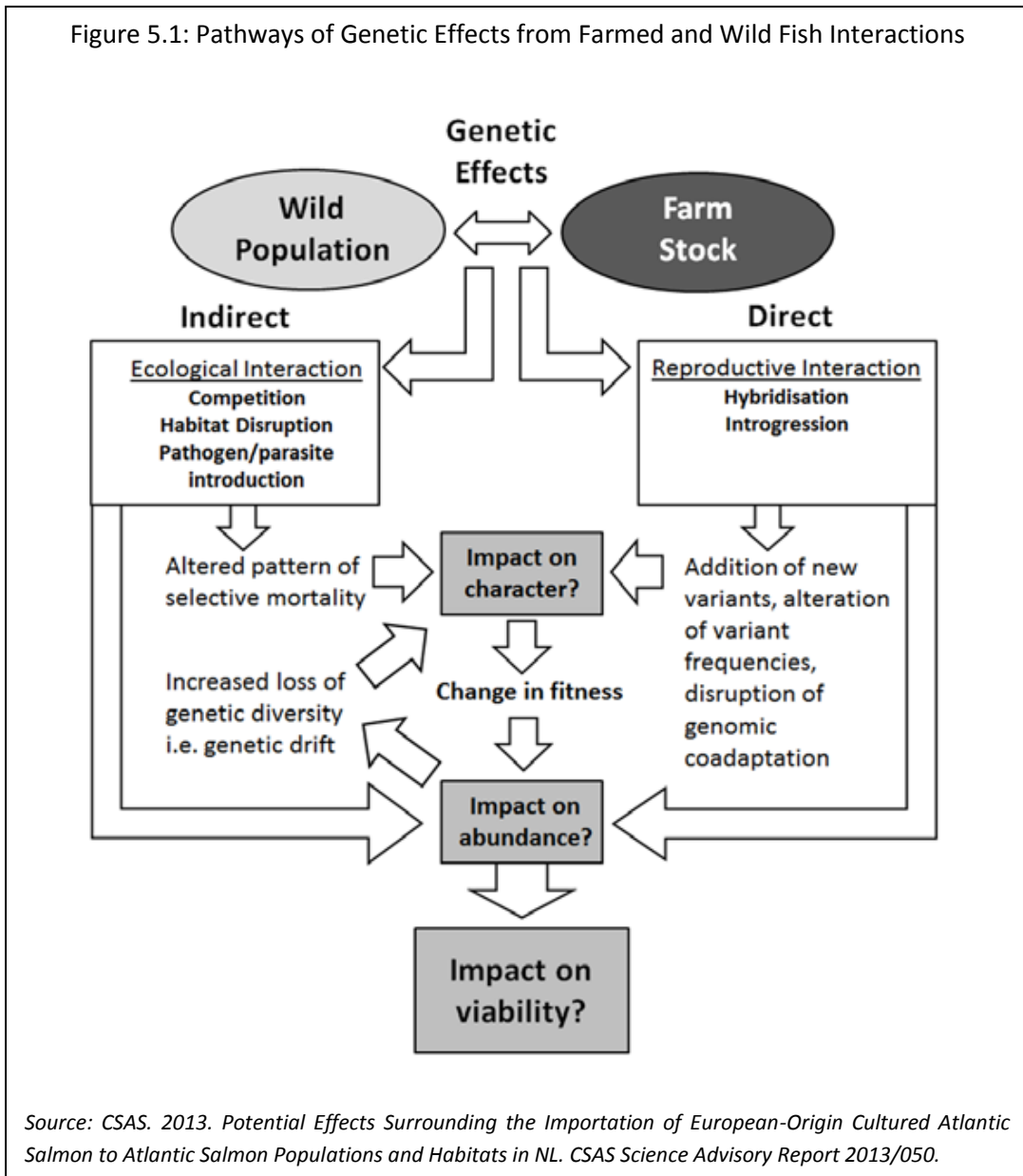
Canada

Fish Escape and Genetic Interactions

Farmed Atlantic salmon in Canada are the product of long-term selective breeding. Although their genetic complement is the same as wild Atlantic salmon, their genes and alleles occur in different frequencies and combinations. This is the result of selection for economically important traits specific to the grow-out environment such as age at sexual maturity, pathogen resistance, flesh colour, fat content, and growth rate.

⁴¹ For more information on triploidy and its use to ensure sterility in Atlantic salmon, see Benfey, T.J. 2015. Biocontainment measures to reduce/mitigate potential post-escape interactions between cultured European-origin and wild native Atlantic salmon in Newfoundland. DFO Can. Sci. Advis. Sec. Res. Doc. 2015/003. v + 28 p., posted at http://publications.gc.ca/collections/collection_2015/mpo-dfo/Fs70-5-2015-003-eng.pdf (accessed April 6, 2018)

In Atlantic Canada, there is the potential for escaped farmed salmon to interbreed with their wild counterparts. This direct genetic interaction results in a mix of farmed and wild genomes. In addition, the movement of genes (or alleles) from farmed to the wild gene pool through the backcrossing of hybrids with wild parental stock results in introgression. Limited research suggests that there could be phenotypic and fitness impacts to wild Atlantic salmon from genetic interactions with escaped farmed Atlantic salmon. There is considerable uncertainty surrounding the assignment of cause and effect regarding impact and consequences of genetic interactions on wild Atlantic salmon populations. Indirect genetic effects have been hypothesized to occur if the presence of farmed salmon affects the environment in which wild salmon occur such that the selective pressures on the wild Atlantic salmon population are modified. See Figure 5.1 for an overview of interactions associated with direct and indirect genetic impacts.



Biocontainment for escape management

To minimize and prevent farmed fish escapes, various codes of containment (e.g., in industry) require finfish containment systems to be designed and built robust enough to withstand local weather and oceanographic conditions.

Marine mammal interaction management is an important biocontainment issue since marine mammals can damage net pens as they seek food, which leads to fish escape events. Notwithstanding the risks posed by marine mammal interaction, the federal *Marine Mammal Regulations* (MMR) prohibit the fishing, disturbing, or killing of marine mammals unless authorized to do so under specific conditions in the MMR or other federal regulations. New, more damage-resistant net pen materials are being developed and used in the aquaculture industry. An example is the Sapphire Ultracore⁴², which contains a stainless steel core woven into it to resist damage from biting.

The second containment approach, biocontainment, embodies measures to mitigate potential post-escape interactions with wild fish populations. The only proven effective method to achieve this goal is to ensure that farms are stocked solely with sterile triploids, preferably all-female. Triploid organisms have three complete sets of chromosomes in their genomes, as opposed to the two sets (i.e., diploid) most vertebrates have in their genome. Triploid fish are sterile, so if any escapes occur, they would not be able to breed with wild fish. Use of these fish effectively removes all direct genetic interactions between farmed and wild fish.⁴¹

Federal

Under Section 56 of the federal *Fishery (General) Regulations*, DFO issues introduction and transfer licences in all provinces and territories adjacent to tidal waters. The licence authorizes the release of live fish into fish habitat or the transfer live fish to a fish rearing facility.⁴³ These regulations enable the Minister of DFO to specify conditions, including escapement/recapture conditions. The Minister will only issue an introduction and transfers licence if the proposed release or transfer is consistent with proper fisheries management and control and is not expected to adversely affect stock size, health, or genetic characteristics of wild fish. The Introductions and Transfer licences are issued based on genetic, disease, and ecological risk assessments conducted by federal-provincial Introductions and Transfer Committee following the *National Code on Introductions and Transfers of Aquatic Organisms*. Under the Code, federal, territorial, and provincial governments co-deliver a consistent codified process to assess these risks from the intentional movement of live aquatic organisms from one water body or facility to another. This enables all jurisdictions to work cooperatively with the aquaculture industry to minimize the risks from the unintentional spreading of diseases or pests, alteration of the genetic makeup of native species, or from negative impacts to surrounding ecosystems as a result of farmed fish escapes.

DFO manages the recapture of escaped farmed fish, but recapture is considered fishing, therefore requires a fishing licence from DFO. When there is evidence that an escape event has occurred, aquaculture licence holders must report the incident to DFO. Where appropriate, DFO will instruct operators, to recapture escaped farmed fish. DFO investigates the causes of escapes and identifies the operational or infrastructural factors that could make facilities vulnerable to escape events.

The provinces also have legislation and regulations relating to the prevention and recapture of escaped farmed fish and require recapture as part of conditions of their aquaculture licences; some provinces further require containment measures and escape plans.

All farmed Atlantic salmon cultured on the East Coast of Canada are derived from St. John River broodstock strain. There were two applications in the past (around 2012 and 2014) from the aquaculture industry in Newfoundland to use a Norwegian-origin diploid strain from an Icelandic facility but they were denied by

⁴² See information on Sapphire Ultracore at <http://www.garwareropes.com/predator-systems.html> (accessed April 5, 2018)

⁴³ See DFO's website for more information on licences for introduction and transfers and a link to the *Fishery (General) Regulations* at <http://www.dfo-mpo.gc.ca/aquaculture/management-gestion/licen-permi-eng.htm> (accessed April 5, 2018)

DFO under the authority of Section 56 of the federal *Fishery (General) Regulations*. DFO recently approved the importation of triploid European-origin salmon eggs for aquaculture in Newfoundland, subject to completion of the federal and provincial regulatory review processes for aquaculture proposals. The current proposal under review covers the construction of a hatchery to grow out the smolt for cage stocking and possible sale to other companies, installation of eleven cage sites, and importation of triploid Atlantic salmon from Iceland. The project was announced in the fall of 2015 but no development has occurred to date.

Monitoring of the facility is conducted to identify potential escapement of fish in all jurisdictions. However, when a facility has a very large population of farmed fish, it may be difficult to know when a small number have escaped. Furthermore, it is often difficult to recapture escapes. There are no federal or provincial regulations requiring industry to conduct programs to monitor escaped farmed fish or hybridization in the wild.

Provincial

A. BRITISH COLUMBIA

On the West Coast, Atlantic salmon are grown in marine net pen aquaculture operations, and they do not interbreed with any species of Pacific salmon, nor do they create feral populations upon escape. Additionally, two species of Pacific salmon, Chinook and Coho, are also farmed.

PAR Marine Finfish Aquaculture Conditions of Licence⁴⁴ specify requirements for containment structure array anchoring (i.e., to withstand oceanographic and meteorological conditions), use of escape prevention measures (i.e., an escape prevention and response plan) and reporting of escapes (and follow-up reporting) to DFO⁴⁵. There are also licence conditions related to net strength. The farm operator is required to inspect the nets (with divers) to make sure the nets have no gaps, and to monitor the inventory of the site to make sure there is no escape event. There are only a few times when the numbers of fish can be reasonably counted (i.e., when operators stock, harvest, or transfer fish). Otherwise, estimations of inventory have large margins of error.

Questions have been raised regarding the ability of escaped Atlantic salmon to potentially establish themselves in non-native waters. As a result, the Atlantic Salmon Watch Program⁴⁶ was initiated to monitor for the establishment of feral populations of escaped Atlantic salmon. It is a research program operated by DFO “to study the abundance, distribution, and biology of Atlantic salmon in BC and its adjacent waters. The Program relies on recreational and commercial fishers, fish processors, government and independent field staff, and hatchery workers to report observations of Atlantic salmon.” To date, there has been no evidence to suggest that escaped Atlantic salmon have been able to establish themselves in non-native waters (i.e., no feral populations)⁴⁷.

B. NEW BRUNSWICK

⁴⁴ See the BC Marine Finfish Aquaculture Licence under the *Fisheries Act*: PART B. Licence Conditions at <http://www.pac.dfo-mpo.gc.ca/aquaculture/licence-permis/docs/licence-cond-permis-mar/col-cdp-eng.html> (accessed April 5, 2018)

⁴⁵ See BC Public Reporting on Aquaculture Escapes at <http://www.dfo-mpo.gc.ca/aquaculture/protect-protege/escape-prevention-evasions-eng.html> (accessed April 5, 2018)

⁴⁶ See the Atlantic Salmon Watch Program at <http://www.pac.dfo-mpo.gc.ca/science/aquaculture/aswp/index-eng.html> (accessed April 5, 2018)

⁴⁷ A survey conducted in 2011 and 2012 found no Atlantic salmon adults or juveniles in BC waters. See Canadian Technical Report at <http://www.dfo-mpo.gc.ca/Library/357053.pdf> (accessed April 5, 2018)

New Brunswick's *Aquaculture Act (General Regulation 91-158)* includes fish escapement provisions and requires reporting of escapes. The Province is also planning to complete a review of their *Aquaculture Act* to harmonize its aquaculture regulations with those of other provinces. The regulatory review and any subsequent changes are expected to be completed by the fall of 2017. Currently, the Regulation requires that aquaculture operators report escapes of 100 or more fish to the Province's DAAF, although it is expected that this will be amended to require the reporting of any escapes. Once a containment breach is confirmed, operators are required to fill out a breach of containment management plan, which must provide details of the escape, cause of the escape, gear and nets inspection history, and mitigation measures put in place. It must also submit a final report after completion of mitigation measures.

The aquaculture industry adopted the Atlantic Canada Fish Farmers Association *Code of Containment for Culture of Atlantic Salmon in Marine Net Pens in New Brunswick*⁴⁸ that was developed in collaboration with the New Brunswick Department of Agriculture and Aquaculture and DFO. The Code of Containment outlines the standards for nets and pens, maintenance requirements, stock loss and recapture contingency planning to reduce fish escapes, but does not specifically discuss genetic interactions.

The *Southwest NB Breach of Containment Governance*⁴⁹ document was developed by DFO and the New Brunswick Department of Agriculture and Aquaculture in 2009 (updated 2016) to complement the Code of Containment. It describes federal and provincial requirements for farmed Atlantic salmon breaches of containment and recapture in the Bay of Fundy, as well as provides guidance for recapture if escapement should occur.

C. NEWFOUNDLAND AND LABRADOR

All marine net pen aquaculture sites are located on the South Coast of Newfoundland, around the Connaigre Peninsula⁵⁰. Genetics and fish health issues are especially considered by the federal-provincial Introductions and Transfer Committee during the risk assessment process associated with the *National Code on Introductions and Transfers of Aquatic Organisms*. Input from numerous federal and provincial departments and agencies are also considered before aquaculture licences are issued.

The NL *Code of Containment for the Culture of Salmonids*⁵¹ is the primary tool used to manage and mitigate escapes and protect wild stocks once the farm has been licensed. The industry conducts regular net pen testing and monitoring to ensure good condition and inspections of moorings to ensure they withstand storm damage, as well as maintaining detailed inventories of stocked fish, with regular reporting to the Province at the end of each calendar year (i.e., how many fish are present, introduced, transferred, died, and present in each cage). Inventory reconciliation is done every year. Discrepancies are an indicator of how many fish have escaped. A reduction in escapes has been realised since the adoption of the Code of Containment.

⁴⁸ See the Code of Containment for Culture of Atlantic Salmon in Marine Net Pens in NB at https://static1.squarespace.com/static/56e827cb22482efe36420c65/t/570ed80db09f950e801cde72/1460590605851/2008_NBSGA_Code_of_Containment_June_2008.pdf (accessed April 5, 2018)

⁴⁹ See the Office of the Auditor General of Canada website on the environmental impact of salmon aquaculture in Passamaquoddy Bay, NB at http://www.oag-bvg.gc.ca/internet/English/pet_300_e_34331.html (accessed April 5, 2018)

⁵⁰ See Verspoor, E., McGinnity, P., Bradbury, I., and Glebe, B. 2015. The potential direct and indirect genetic consequences for native NL Atlantic Salmon from interbreeding with European-origin farm escapes. DFO Can. Sci. Advis. Sec. Res. Doc. 2015/030. viii + 36 p., posted at <http://publications.gc.ca/site/eng/9.803080/publication.html> (accessed April 5, 2018)

⁵¹ See the NL Code of Containment for the Culture of Salmonids at http://www.fishaq.gov.nl.ca/aquaculture/public_reporting/pdf/Salmonid%20Code%20of%20Containment%202014.pdf (accessed April 5, 2018)

The provincial DFA, through the Farmed and Wild Fish Interactions initiatives under the Newfoundland *Sustainable Aquaculture Strategy 2014*, is working with DFO to develop strategies to improve technology for fish recapture so that there will be an enhanced rapid response for escape events. Under the Strategy's Aquaculture Research and Development section, there will be initiatives for the finfish sector, where the DFA will support research into more robust containment technology and will monitor developments in marine and land-based closed containment.

Escape monitoring takes the form of reports from the general public about finding suspected farmed fish in the wild. DFO follows up on these reports to validate any reported siting of farmed fish, as well as reports from Conservation and Protection staff and Indigenous peoples guardians. However, DFO does not undertake any formal escape monitoring programs. On the other hand, DFO has been conducting an ongoing investigation of escaped farmed Atlantic salmon in Newfoundland since October 2013.

D. NOVA SCOTIA

The aquaculture industry in Nova Scotia also adheres to the Atlantic Canada Fish Farmers Association's *Code of Containment for Culture of Atlantic Salmon in Marine Net Pens in New Brunswick*.

Nova Scotia's *Aquaculture Management Regulations* require marine net pen aquaculture licence holders to have a Farm Management Plan, including a section on containment management. The containment management section of a Farm Management Plan must consider operating procedures to mitigate risk of a breach, as well as address emergency responses to breaches. Site management must be considered in cases of unusual events or severe storms.

The containment section of the Farm Management Plan required by the Nova Scotia *Aquaculture Management Regulations* must include schedules for reporting initial farm stocking and production inventory levels. This section of the Plan also requires third-party auditing: before initial stocking; at least once per year of stocked sites; and, 30 days or less after a reported breach of more than 50 fish. Third-party auditing is also required if at least one farmed Atlantic salmon is found in a river for every farm that has identified that river in their containment plan as potentially being affected by a breach. This does not apply to licensees who have approved marking plans that verify the found farmed fish is not from their sites. Also, the whole Farm Management Plan can be audited at any time.

Containment management monitoring requirements include mandatory notification of a breach of containment to the DFA.

The Nova Scotia *Aquaculture Licence and Lease Regulations* (under Section 64 of the *Fisheries and Coastal Resources Act*) require aquaculture licence holders to maintain records of all losses of aquaculture produce and an on-site inventory.

E. PRINCE EDWARD ISLAND

There is no marine net pen aquaculture in PEI. However, the Province's aquaculture sector has six freshwater finfish farms that are involved with hatchery and grow-out operations, which export their products to marine sites in other provinces.⁵² The use of triploid rainbow/steelhead trout imported from the United States is employed to minimize ecological impacts to wild fish in the event of an escape. These triploid trout are raised in PEI and then exported out-of-province for marine aquaculture operations.

⁵² See the websites of PEI Government at <http://www.gov.pe.ca/fard/index.php3?number=77919&lang=E> and the Aquaculture Alliance at http://www.aquaculturepei.com/pei_cultured_fish.php (accessed April 5, 2018)

United States

Federal

ACOE Section 10 (siting) permits include conditions relevant to aquaculture containment and cage integrity. In Maine, these permits include *Special Conditions for Protection of Atlantic Salmon* and are described in the section below.

State

A. MAINE

Maine's Net Pen Aquaculture General Permit includes Special Conditions for Protection of Atlantic Salmon. Fish must be sourced from North American stocks and transgenic salmon are prohibited. "Transgenic salmonids" is defined as species of the genera *Salmo*, *Oncorhynchus* and *Salvelinus* of the family *Salmonidae* and bearing, within their DNA, copies of novel genetic constructs introduced through recombinant DNA technology using genetic material derived from a species different from the recipient, and including descendants of individuals so transfected. Genetic analysis must be submitted to NOAA Fisheries and FWS (collectively known as the Services) annually. MDEP, MDMR, EPA and the Services can inspect an aquaculture facility. Fish transferred into net pens must be marked before stocking to identify the facility of origin in case of escape. The permittee must maintain a copy of its marking plan and evidence that the plan received approval from NOAA Fisheries and the FWS. By December 31 of each stocking year, the permittee must submit a summary of results from a third party QA/QC audit assessing marking effectiveness and demonstrating compliance with the approved marking plan.

A *Containment Management System* (CMS) must be prepared and submitted to MDEP for approval before fish are introduced to the facility. MDEP worked with farms and hatcheries to develop a hazard-based approach to identify critical areas for function of the containment system, including opportunities to establish and monitor control protocols to prevent escape. MDEP worked with the Maine Aquaculture Association (MAA) to define gear requirements at the farm to minimize escapes (e.g., net sizes, anchors, etc.).

The CMS must include third party audits of a facility, conducted both annually and within 30 days of a reportable escape. However, MDEP, in consultation with the ACOE, NOAA Fisheries and the FWS, may exempt a facility from any additional third party audits when the facility from which the fish escaped can be identified or when circumstances preclude the possibility that the facility was the source of the escaped fish. Mandatory report thresholds are known or suspected escapes of 25% of a cage's population or 50 fish with an average weight of two or more kilograms. The aquaculture operators must conduct daily monitoring (e.g., of activities, how much feed is used, conditions of net pens, any diving monitoring done, etc.). Monitoring results may indicate a possible escape – for example, if the amount of feed used has decreased unexpectedly. When a suspected aquaculture fish is captured in the wild, steps are taken to confirm the fish is of aquaculture origin and the fish must be stored for the record. Canadian and U.S. stakeholders are notified that an aquaculture fish escape is found or a report is made. An audit is required if an escaped fish is found in the wild and no aquaculture operator has reported an escape. There is a two-tiered approach taken: identification of who needs immediate notification that a suspect escape was found; and, who needs to know when that determination is confirmed.

Genetic Marking Program

Guidelines for quality assurance and quality control (QA/QC) procedures for a genetic marking program for permits required by MDEP and/or ACOE permits (e.g., the Aquaculture General Permit, Section 10 Permit) include an auditing program. Each aquaculture net pen farm operating in Maine needs to follow the QA/QC procedure to reduce or eliminate data collection bias. The chain of custody database system ensures integrity of the stocking group (i.e., that the group only has the intended families and not others so that it has a unique genetic mark). A fin clip can also be done at the end to distinguish sub-groups of a family group sent to a different pen. Testing at the pen shows 90 to 100% compliance with the genetic marker. If below a 95% threshold, then the aquaculture farm would search for a record-keeping or testing error.

Genetic Marking Lessons Learned

The aquaculture industry in Maine used to use male fish multiple times to fertilize eggs. This resulted in similar genetic markers in offspring that confused testing results. Now it uses a 1:1 male-to-female mating ratio. This has resulted in greater genetic diversity of the farmed fish.

B. WASHINGTON

Salmon culture operators in the State of Washington stock Atlantic salmon. Research indicates that Atlantic salmon escapes are not a threat to native species such as endangered and threatened salmonids (i.e., they cannot interbreed with native salmon species). Over one million Atlantic salmon have been either purposefully or accidentally released into Puget Sound over the last 40 years. There is no evidence of self-sustaining, wild populations of Atlantic salmon in Puget Sound and establishment anywhere outside their home range was concluded as being 'extremely remote' given the substantial and repeated failed efforts over the last 100 years⁵³.

WDFW is the lead on genetic interactions concerns (e.g., what species is allowed with respect to genetics concerns) relating to net pen aquaculture. WDFW administers the Revised Code of Washington (RCW) 77.125 Marine Finfish Aquaculture Programs, which includes requirements: to minimize escapes through statewide prevention measures; and, to develop rules for aquaculture management, including for escape prevention, recapture and management, and a provision to develop an Atlantic salmon watch program and an education plan to promote environmentally sound marine aquaculture operation. WAC Title 220 relates to WDFW (fisheries) and Chapter 370 is the Aquaculture Chapter. Several WACs regulate escapement:

- WAC 220-370-100 notes that a permit is required for marine finfish aquaculture. The use of transgenic fish is prohibited. Permits can be denied if it is determined that there are significant genetic, ecological or fish health risks from the aquaculture operation to naturally occurring fish or wildlife, associated habitat or other fish rearing programs. The permit application must include a method to identify all marine aquaculture finfish. Current net pen facilities use otolith marking.
- WAC 220-370-110 requires that farms have an escape prevention plan. It must include procedures to minimize risk of escapement from net pens during normal daily operations; movement, repair or manipulation of pens; and harvesting operations. There need to be procedures for training of employees and contractors and determining and tracking how many fish are lost (i.e., from predation, mortality, and escapement). Plans and manuals required by Ecology through the NPDES permit process may be substituted to meet requirements.
- WAC 220-370-120 requires that an escape reporting and recapture plan be included with each application for a marine finfish aquaculture permit. Reportable fish escapes must be reported with 24 hours of discovery, and the permittee must have a procedure for attempting to recapture (e.g., skiffs, nets, contracts with tribal or commercial fishers). Emergency procedures to minimize escapes

⁵³ See Waknitz, F.W., T.J. Tynan, C.E. Nash, R.N. Iwamoto, and L.G. Rutter. 2002. Review of potential impacts of Atlantic salmon culture on Puget Sound chinook salmon and Hood Canal summer-run chum salmon evolutionarily significant units. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-53, p. 30.

must be identified in the plan. Plans and manuals required by Ecology through the NPDES permit process may also be substituted to meet these requirements. There are reporting requirements for escaped fish being treated with antibiotics or other drugs subject to FDA withdrawal requirements whose withdrawal periods had not expired when the fish escaped. An annual report must be provided that reports details of the escapes and summarizes actions taken to prevent escapes. All fish escape reports must include location, number, age class, disease and medication history, and cause of escape.

- WAC 220-370-130 provides WDFW authority to inspect (at least on an annual basis) marine finfish aquaculture facilities to determine conformity with the law and WDFW rules with respect to preventing and recapturing escapes.
- WAC 220-370-140 enables the director of WDFW to establish an Atlantic salmon watch program in Washington (subject to funding).
- WAC 220-370-150 enables an educational program with marine farmers (also contingent on funding), which includes informing aquaculture operators of WDFW activities relating to disease prevention in hatcheries; annual workshops hosted by WDFW, industry and others to review new containment technologies or other aquaculture-related environmental issues; and other marine finfish aquaculture information sharing activities attended by WDFW staff.

In addition to WDFW’s authority, local governments are required to comply with Ecology’s SMP Guidelines and specifically WAC 173-26-241(3)(b) Aquaculture, in developing SMP standards that affect aquaculture siting and operations. Facilities must be designed and located so as to not establish new nonnative species which cause significant ecological impacts. Ecology approves the standards.

In addition, the aquatic land lease issued by WDNR includes rules similar to WDFW and Ecology. WDNR issues the lease after all the permits are issued to the aquaculture operator. WDNR could deny the lease despite the other permits.

List of Regulatory Tools

Genetics and Fish Escapes	
Canada	United States
Federal	Federal
<p>Fisheries and Oceans Canada</p> <ul style="list-style-type: none"> - Fishery (General) Regulations - Regulate transfer of live fish to rearing facilities, fish release into fish habitat. More information can be found at: http://laws-lois.justice.gc.ca/eng/regulations/SOR-93-53/index.html - Marine Mammal Regulations - -Prohibit the fishing, disturbing, or killing of marine mammals unless authorized to do so under specific conditions in the Regulations or other federal regulations. -Enable the Minister of DFO to issue a nuisance seal licence, pursuant to subsection 4(1) of the regulations, to lethally remove 	<p>Army Corps of Engineers</p> <ul style="list-style-type: none"> - General Permit - Net Pen Aquaculture - In Maine, consultation is provided to the MDEP (also with NOAA Fisheries and FWS) on whether a facility can be exempted from additional third party audits of the CMS when the facility from which fish escaped can be identified or when the facility can be precluded as the source of the escaped fish. More information can be found at: http://www.maine.gov/dep/water/wd/atlantic_salmon_aquaculture/MEG130000-2014permit.pdf

Genetics and Fish Escapes	
<u>Canada</u>	<u>United States</u>
<p>nuisance seal. More information can be found at: http://laws-lois.justice.gc.ca/eng/regulations/SOR-93-56/index.html</p> <p>- National Code on Introductions and Transfers of Aquatic Organisms under the Fishery (General) Regulations - Regulates introduction and transfers of aquatic animals, risk assessment for genetics and pathogens. More information can be found at: http://www.dfo-mpo.gc.ca/aquaculture/management-gestion/2013-IT-Code-Aug-26-eng.pdf</p>	
<i>British Columbia</i>	<i>Maine</i>
<p>Fisheries and Oceans Canada</p> <p>- Pacific Aquaculture Regulations - Under Section 4 of the Regulations, the Minister of DFO may specify conditions in an aquaculture licence respecting the measures that must be taken to minimize the escape of fish from the aquaculture facility and to catch the fish that escape, as well as the records that must be kept in relation to any major failure of the aquaculture facility's containment structures and the quantity of any fish that escape from the facility. More information can be found at: http://laws-lois.justice.gc.ca/eng/regulations/SOR-2010-270/index.html</p> <p>- Marine Finfish Aquaculture Licence under the federal Fisheries Act: PART B. Licence Conditions. More information can be found at: http://www.pac.dfo-mpo.gc.ca/aquaculture/licence-permis/docs/licence-cond-permis-mar/col-cdp-eng.html</p>	<p>Maine Department of Environmental Protection</p> <p>- General Permit - Net Pen Aquaculture - Special Conditions for the Protection of Atlantic Salmon are included. Fish must be sourced from North American stocks and transgenic fish are prohibited. An approved marking plan to identify farm origin and a CMS are required before fish are stocked. The CMS plan must include inventory control procedures, predator control, escape response, unusual event management and record keeping. More information can be found at: http://www.maine.gov/dep/water/wd/atlantic_salmon_aquaculture/MEG130000-2014permit.pdf</p>
<i>New Brunswick</i>	<i>Washington</i>
<p>Department of Agriculture, Aquaculture and Fisheries</p> <p>- Aquaculture Act, Section 13(1)(f) http://laws.gnb.ca/en/showfulldoc/cs/2011-c.112/20160310</p>	<p>Washington Department of Fish and Wildlife</p> <p>- Chapter 77.125 RCW - Marine Finfish Aquaculture Programs include accidental Atlantic salmon release prevention measures and provisions to monitor and eradicate escapes. More information can be found at:</p>

Genetics and Fish Escapes	
<u>Canada</u>	<u>United States</u>
<ul style="list-style-type: none"> - General Regulation 91-158 under Aquaculture Act, Section 14(1) http://laws.gnb.ca/en/showfulldoc/cr/91-158/20160310 - Code of Containment for Culture of Atlantic Salmon in Marine Net Pens in NB. https://static1.squarespace.com/static/56e827cb22482efe36420c65/t/570ed80db09f950e801cde72/1460590605851/2008_NBSGA_Code_of_Containment_June_2008.pdf 	<p>http://app.leg.wa.gov/RCW/default.aspx?cite=77.125</p> <ul style="list-style-type: none"> - WAC 220-370-100 - States that a marine finfish aquaculture permit may be denied based on the determination by the director of significant genetic, ecological or fish health risks of the proposed fish rearing program on naturally occurring fish and wildlife, their habitat or other existing fish rearing programs. Use of transgenic fish is prohibited and marking of all fish is required (current facilities use otolith marking). - WAC 220-370-110 - Requires escape prevention plan. Plans and manuals required by Ecology through the NPDES permit process may be substituted. - WAC 220-370-120 - Requires escape reporting and a recapture plan. - WAC 220-370-130 - Provides WDFW authority to inspect marine finfish facilities at least annually to determine conformity with the law and the rules of the department relating to preventing escaped finfish and/or the recapture of escaped finfish. - WAC 220-370-140 - Enables establishment of salmon watch program. - WAC 220-370-150 - Enables establishment of farmer educational program on new containment technologies. More information can be found at: http://apps.leg.wa.gov/wac/default.aspx?cite=220-370 - WAC 173-26-241(3)(b) - Contains SMP Guidelines for Aquaculture requiring local governments to develop standards that will ensure facilities are designed and located so as not to establish a non-native species. More information can be found at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-26-241 <p>Washington Department of Natural Resources</p> <ul style="list-style-type: none"> - Chapter 79.105 RCW - Aquatic land leases specify structural development and operational practices. More information can be found at: http://app.leg.wa.gov/rcw/default.aspx?cite=79.105

Genetics and Fish Escapes	
Canada	United States
<i>Newfoundland and Labrador</i>	
<p>Department of Fisheries and Land Resources</p> <ul style="list-style-type: none"> - NL Code of Containment for the Culture of Salmonids - http://www.fishaq.gov.nl.ca/aquaculture/public_reporting/pdf/Salmonid%20Code%20of%20Containment%202014.pdf - NL Sustainable Aquaculture Strategy 2014 - http://www.fishaq.gov.nl.ca/publications/pdf/Sustainable_Aquaculture_Strategy_2014.pdf 	
<i>Nova Scotia</i>	
<p>Department of Fisheries and Aquaculture</p> <ul style="list-style-type: none"> - Aquaculture Management Regulations - Sections 15 and 33(1). More information can be found at: http://www.novascotia.ca/just/regulations/regs/fcraquamgmt.htm - Code of Containment for Culture of Atlantic Salmon in Marine Net Pens in NB - This is the same Code used in NB. 	

Other Living Marine Resource Interaction

Marine mammals attempting to feed on cultured fish may become entangled in net pens, or may even make their way inside net structures. The relative density and abundance of fish found in aquaculture facilities can attract marine mammal predators, such as seals and sea lions, which may identify these facilities as potential sources of food. This may lead to the loss of farmed fish through predation, as well as impact the structural integrity of net pens and increase the risk of farmed fish escapes. Also, marine mammal predation increases stress for farmed fish, and this can lead to the expression of diseases and increased mortality. Persistent interactions may pose a danger to human safety.

Net pen aquaculture equipment may result in damage or mortality to endangered species and marine mammals. Deterrence or intentional action by net pen aquaculture facility staff may also harm marine mammals. Regulation of interactions between living marine resources and net pen facility stocks, equipment, and staff is therefore required.

Canada

Federal

The federal *Marine Mammal Regulations* (MMR) applies across all jurisdictions in Canada, and they prohibit fishing, disturbing, or killing of marine mammals unless authorized to do so under specific conditions in the MMR or other federal regulations. Section 3.1 of the MMR specifies that “these Regulations do not apply to fishing for marine mammals that is authorized by an aquaculture licence issued under the PAR”. Section 5 of the MMR specifies that, subject to Section 6 (i.e., an exception for Indigenous Peoples fishing rights), no person shall fish for marine mammals except under the authority of a licence issued under these Regulations or under the *Aboriginal Communal Fishing Licences Regulations*.

The federal *Species At Risk Act* (SARA) also applies across all jurisdictions in Canada, and it prohibits the killing, harming, harassing capturing or taking, possession, collection of, buying, selling or trading individuals of wildlife species listed as extirpated, endangered or threatened species. SARA also prohibits the destruction of any part of the critical habitat of listed endangered or threatened species, or of any listed extirpated species if a recovery strategy has recommended its reintroduction into the wild in Canada.

Provincial

A. BRITISH COLUMBIA

The federal *Pacific Aquaculture Regulations* (PAR) applies only to the regulation of aquaculture in BC. Section 4 of the PAR enables the Minister of DFO to specify conditions in an aquaculture licence respecting the catching of nuisance fish, and the records that must be kept in relation to the number and species of nuisance fish that die as a result of the aquaculture facility’s operations. Nuisance fish, in the context of the PAR, means fish that represent an imminent danger to the equipment used in the operation of an aquaculture facility, the safety of persons in the facility or the fish cultivated in the facility. The catching of nuisance fish and fish that is incidental to the operation of an aquaculture facility are considered to be “prescribed activities” under the PAR. Section 5 of the PAR specifies that “unless the retention of incidental catch is expressly authorized by an aquaculture licence, every person who catches a fish incidentally must immediately return it, if it is alive, to waters outside the aquaculture facility in a manner that causes it the least harm”.

Marine mammals may be considered to be nuisance fish under the PAR and the associated Conditions of Licence for aquaculture in BC. The PAR does not necessarily classify marine mammals as nuisance fish. Any fish (including marine mammals) is classified as nuisance fish when it represents an imminent danger to the equipment used in the operation of an aquaculture facility, the safety of persons in the facility or the fish cultivated in the facility.

Aquaculture sites and stock management activities have the potential to result in the destruction of non-target wild fish, including marine mammals. Siting to avoid placing aquaculture facilities near major congregations of marine mammal populations is required, especially where a marine mammal population is at risk.

The Conditions of Licence for aquaculture in BC⁵⁴ issued under the PAR require facility operators to have a Marine Mammal Interaction Management Plan in place, including measures to deter and minimize marine mammal interactions. The use of acoustic deterrents is currently prohibited. Licence holders are required to make all reasonable attempts to free entangled marine mammal without harm and notify DFO of any marine mammal drowning mortality or entanglement (live or dead) no later than 24 hours after discovery.

In the event that deterrence efforts fail, licence holders are authorized to dispatch harbour seals and California sea lions which are within 30 meters from the edge of any net pen associated with the containment structure array, and are within or attempting to enter the containment structure array, and represent an imminent danger to aquaculture equipment and infrastructure, the safety of persons in the facility or the fish cultivated in the facility.

Prior to implementation of the PAR in December 2010, licensed aquaculture operators were issued Nuisance Seal Licence to humanely destroy California sea lions and harbour seals that interacted dangerously with aquaculture facilities pursuant to subsection 4(1) of the MMR. However, Nuisance Seal Licenses for the lethal control of California sea lions and harbour seals were discontinued with introduction of the PAR.

B. NEW BRUNSWICK

Predator control plans must be included in the licence applications for finfish aquaculture. These plans include measures to deter and minimize marine mammal interactions at fish farms. In addition to protecting farmed stocks and facility infrastructure, the measures aim to protect marine mammals by reducing the number of accidental drownings that can occur when these animals attempt to feed on the farmed fish and become entangled in lines and nets.

NB's industry Code of Containment has a requirement to have a predator control net outside the fish containment net.

As nylon nets are retired, aquaculture operators in NB are replacing them with nets containing new technologies (e.g., Sapphire Ultracore) that deter predators.

In limited circumstances, where avoidance or exclusion measures are ineffective, licensed aquaculture operators in Eastern Canada may be issued Nuisance Seal Permit under specific conditions in the MMR and *Fishery (General) Regulations* to authorize control of nuisance seals.

⁵⁴ See BC Marine Finfish Aquaculture Licence under the *Fisheries Act*, which requires operators to have Marine Mammal Interaction Management Plan at <http://www.pac.dfo-mpo.gc.ca/aquaculture/licence-permis/docs/licence-cond-permis-mar/licence-cond-permis-mar-eng.pdf> (accessed June 5, 2017)

Nuisance Seal Permits are issued annually upon request by licensed aquaculture operators (as a precautionary measure).

C. NEWFOUNDLAND AND LABRADOR

Predator control plans must also be included in the licence applications for finfish aquaculture.

The NL Code of Containment for the Culture of Salmonids does not directly discuss marine mammal interactions. However, it does discuss breach of containment and how often nets need to be tested.

In limited circumstances, where avoidance or exclusion measures are ineffective, licensed aquaculture operators in Eastern Canada may be issued Nuisance Seal Permit under specific conditions in the MMR and *Fishery (General) Regulations* to authorize control of nuisance seals.

Nuisance Seal Permits are issued annually upon request by licensed aquaculture operators (as a precautionary measure).

D. NOVA SCOTIA

Licence conditions outlined in the NS *Aquaculture Management Regulations* require that procedures consistent with industry best practices on interactions with wildlife must be included in the farm operations section of the Farm Management Plan.

In limited circumstances, where avoidance or exclusion measures are ineffective, licensed aquaculture operators in Eastern Canada may be issued Nuisance Seal Permit under specific conditions in the MMR and *Fishery (General) Regulations* to authorize control of nuisance seals.

Nuisance Seal Permits are issued annually upon request by licensed aquaculture operators (as a precautionary measure).

United States

Federal

NOAA Fisheries administers the *Marine Mammal Protection Act* (MMPA), which addresses potential marine mammal interactions with net pen aquaculture facilities under its Marine Mammal Authorization Program (MMAP). Under the MMAP, NOAA Fisheries must annually categorize commercial fisheries (including aquaculture facilities) based on the relative frequency of incidental mortalities and serious injuries of marine mammals in the fishery:

- Category I designates fisheries with frequent mortalities and serious injuries incidental to commercial fishing;
- Category II designates fisheries with occasional mortalities and serious injuries;
- Category III designates fisheries with a remote likelihood or no known mortalities or serious injuries.

Incidental take under the MMAP is non-intentional, accidental death or injury that occurs when carrying out an otherwise lawful activity, such as permitted fishing. For 2016, salmon net pen facilities in Maine and Washington were designated as a Category III fishery. Any vessel owner or operator, or fisher (in the case of non-vessel fisheries), participating in a Category I, II, or III fishery must report all incidental mortalities or injuries of marine mammals that occur during commercial fishing operations to NOAA Fisheries (50 CFR 229.6).

An interaction resulting in a mortality/injury of a marine mammal incurred during the course of commercial operations must be reported within 48 hours of the occurrence. A marine mammal injury is defined as a wound or other physical harm. Signs of injury may include:

- Bleeding
- Gear ingestion
- Loss of or damage to an appendage or jaw
- Inability to use one or more appendages
- Asymmetry in the shape of the body or body position
- Any swelling or hemorrhage (bruising)
- Laceration (deep cut)
- Puncture or rupture of eyeball
- Listlessness or inability to defend itself
- Inability to swim or dive after release from fishing gear
- Signs of equilibrium imbalance
- Released trailing gear/gear perforating body

Killing a marine mammal, also known as intentional lethal take, is strictly prohibited, and only allowed if imminently necessary for self-defense or to save a person's life. If a marine mammal is killed in self-defense or to save a person's life, a mortality/injury report must be filed with NOAA Fisheries.

The MMPA allows deterrence of marine mammals from damaging gear or catch as long as the measures do not result in the death or serious injury of the marine mammal. NOAA Fisheries is currently developing national guidelines, under Section 101(a) (4) (B), for measures that can be used to safely deter marine mammals.

Federal agencies are directed, under Section 7(a)(1) of the ESA, to utilize their authorities to carry out programs for the conservation of threatened and endangered species. Federal agencies must also consult with NOAA Fisheries and the FWS, under Section 7(a)(2) of the ESA, on activities that may affect a listed species and their designated critical habitat. These interagency consultations, or Section 7 consultations, are designed to assist federal agencies in fulfilling their duty to ensure federal actions do not jeopardize the continued existence of a species. Section 9 of the ESA prohibits "take" of listed species. "Take" includes to hunt, harm, harass, pursue, threaten, kill, etc., listed species. Section 10 lays out the guidelines under which a permit may be issued to authorize prohibited activities, such as take of endangered or threatened species.

- Section 10(a)(1)(A) Portion of section 10 that allows for permits for the taking of threatened or endangered species for scientific purposes or for purposes of enhancement of propagation or survival.
- Section 10(a)(1)(B) Portion of section 10 that allows for permits for incidental taking of threatened or endangered species.

The ACOE Section 10 siting permit is a federal action that must comply with the ESA. The information required for ESA evaluation must be prepared in the form of a Biological Evaluation (BE) which is utilized to assess project impacts. If the ACOE determines that the work proposed in a permit application may affect any threatened or endangered species, informal or formal consultation with NOAA Fisheries and the FWS is required. If the ACOE determines that the proposed facility may affect, but is not likely to adversely affect the species or critical habitat then the BE would be forwarded to NOAA Fisheries and the FWS for informal consultation. If NOAA Fisheries or the FWS finds that the facility will have significant adverse effects and does not concur with a "not likely to adversely affect" determination, then formal consultation commences. The ACOE could include conditions in its Section 10 permit to protect a marine mammal or an endangered

or threatened species if protection is identified a requirement during consultations with NOAA Fisheries and/or the FWS.

FWS consultation is required if there are ESA-listed species managed by the FWS that may be impacted by the proposed net pen facility. For example, in Washington, the marbled murrelet is an ESA-listed species that feeds on small fish in nearshore marine areas and there has been a history of significant bycatch in commercial fisheries. There would be concern that net pens may attract marbled murrelets possibly leading to problematic interactions. The FWS would work with applicants to implement appropriate precautions to prevent such negative interactions from occurring.

NOAA Fisheries has also issued a final rule that will affect Canadian and other net pen farmer who plan to export product to the United States. The rule implements the import provisions of the MMPA that aim to reduce marine mammal bycatch associated with international commercial fishing operations, by requiring nations exporting fish and fish products to the United States to be held to the same standards as United States commercial fishing operations. The rule also establishes criteria for evaluating a harvesting nation’s regulatory program for reducing marine mammal bycatch and the procedures required to receive authorization to import fish and fish products into the United States. To ensure effective implementation, the rule establishes a five-year exemption period to allow foreign harvesting nations time to develop, as appropriate, regulatory programs comparable in effectiveness to U.S. programs.

State

A. MAINE

The ACOE Section 10 Permit issued in Maine requires that an aquaculture operator report any incidental take of marine mammals allowed under the federal MMPA.

The MAA Code of Practice includes guidance for predator deterrence (e.g., using humane and multiple deterrents, information sharing, complying with regulations).

B. WASHINGTON

Washington complies with federal requirements (no lethal deterrence, etc.). No state-level regulations for marine mammal interaction were identified for Washington though WDFW performs best available science to inform state and local agencies on PHS.

List of Regulatory Tools

Other Living Marine Resource Interaction	
<u>Canada</u>	<u>United States</u>
<i>Federal</i>	<i>Federal</i>
Fisheries and Oceans Canada - Marine Mammal Regulations under the <i>Fisheries Act</i> - -Prohibit the fishing, disturbing, or killing of marine mammals unless authorized to do so under specific conditions in the Regulations or other federal regulations. -Enable the Minister of DFO to issue a nuisance	NOAA Fisheries - Marine Mammal Protection Act - Conserves, protects and recovers species. Marine mammal deterrence is allowed while intentional lethal take is strictly prohibited. NOAA Fisheries issued a final rule requiring nations exporting fish and fish products to the United States to be held to the same standards as U.S. commercial fishing

Other Living Marine Resource Interaction	
<u>Canada</u>	<u>United States</u>
<p>seal licence, pursuant to subsection 4(1) of the regulations, to lethally remove nuisance seal. <i>Nuisance seal</i> means a seal that represents a danger:</p> <p>(a) to fishing equipment despite deterrence efforts; or,</p> <p>(b) based on a scientific recommendation, to the conservation of anadromous or catadromous fish stocks because it inflicts great damage to them along estuaries and in rivers and lakes during the migration of those species. More information can be found at: http://laws-lois.justice.gc.ca/eng/regulations/SOR-93-56/index.html</p> <p>Environment and Climate Change Canada, Parks Canada Agency, and Fisheries and Oceans Canada</p> <p>- Species At Risk Act -</p> <p>- prohibits the killing, harming, harassing, capturing or taking, possession, collection of, buying, selling or trading individuals of wildlife species listed as extirpated, endangered or threatened species. The Act also prohibits the destruction of any part of the critical habitat of listed endangered or threatened species, or of any listed extirpated species if a recovery strategy has recommended its reintroduction into the wild in Canada. More information can be found at: http://laws-lois.justice.gc.ca/eng/acts/S-15.3/index.html</p>	<p>operations. More information can be found at: http://www.NOAA Fisheries.noaa.gov/pr/laws/mmpa/http://http://www.fisheries.noaa.gov/pr/interactions http://www.fisheries.noaa.gov/ia/slider_stories/2016/08/mmpafinalrule.html</p> <p>- Reporting requirements for all incidental marine mammal injuries and mortalities are contained in 50 CFR 229.6. More information can be found at: https://www.gpo.gov/fdsys/granule/CFR-2000-title50-vol2/CFR-2000-title50-vol2-sec229-6/content-detail.html</p> <p>- Marine Mammal Authorization Program - Aquaculture facilities must be categorized annually based on the frequency of incidental mortalities and serious injuries. More information can be found at: http://www.NOAA Fisheries.noaa.gov/pr/interactions/mmap/</p> <p>- Endangered Species Act - Informal or formal consultation is required if the ACOE determines that the proposed facility may affect threatened or endangered species. More information can be found at: http://www.NOAA Fisheries.noaa.gov/pr/laws/esa/ http://www.nws.usace.army.mil/Missions/Civil-Works/Regulatory/Permit-Guidebook/Endangered-Species/</p> <p>Fish and Wildlife Service</p> <p>- Endangered Species Act - Informal or formal consultation is required if the ACOE determines that the proposed facility may affect threatened or endangered species. More information can be found at: http://www.nws.usace.army.mil/Missions/Civil-Works/Regulatory/Permit-Guidebook/Endangered-Species/</p>
<i>British Columbia</i>	<i>Maine</i>
<p>Fisheries and Oceans Canada</p> <p>- Pacific Aquaculture Regulations - <i>Nuisance fish</i>, as defined in the Regulations, means fish that represent an imminent danger to the equipment used in the operation of an aquaculture facility, the safety of persons in</p>	<p>Maine Aquaculture Association</p> <p>- Maine Aquaculture Association Code of Practice - Establishes recommended minimum operational standards and includes guidance on predator deterrence. More information can be found at:</p>

Other Living Marine Resource Interaction	
Canada	United States
<p>the facility or the fish cultivated in the facility. Under Section 4(i), the Minister of DFO may specify conditions in an aquaculture licence respecting the catching of nuisance fish. More information can be found at:</p> <p>http://laws-lois.justice.gc.ca/eng/regulations/SOR-2010-270/index.html</p> <p>- Conditions of Aquaculture Licence under the Pacific Aquaculture Regulations require operators to implement a Marine Mammal Interaction Management Plan. Operators must deter nuisance marine mammals and minimize interactions at aquaculture facilities. Operators must also try to free entangled animals without harm and publically report marine mammal deaths or entanglement.</p> <p>http://www.pac.dfo-mpo.gc.ca/aquaculture/licence-permis/docs/licence-cond-permis-mar/col-cdp-eng.html</p>	<p>http://www.maineaquaculture.com/Code_of_Practice_v1.pdf</p>
<i>New Brunswick</i>	<i>Washington</i>
<p>Department of Agriculture, Aquaculture and Fisheries</p> <ul style="list-style-type: none"> - Predator control plans are required in aquaculture licence applications. - The Industry Code of Containment requires operators to have a predator control net outside the fish containment net. <p>https://static1.squarespace.com/static/56e827cb22482efe36420c65/t/570ed80db09f950e801cde72/1460590605851/2008_NBSGA_Code_of_Containment_June_2008.pdf</p>	<p>Washington Department of Fish and Wildlife</p> <ul style="list-style-type: none"> - Functions in performing 'best available science' that informs state and local agencies regarding PHS. More information and priority species lists can be found at: <p>http://wdfw.wa.gov/conservation/phs/</p>
<i>Newfoundland and Labrador</i>	
<p>Department of Fisheries and Land Resources</p> <ul style="list-style-type: none"> - Predator control plans are required in aquaculture licence applications. <p>http://www.fishaq.gov.nl.ca/aquaculture/public-reporting/pdf/Salmonid%20Code%20of%20Containment%202014.pdf</p>	
<i>Nova Scotia</i>	
<p>Department of Fisheries and Aquaculture</p> <ul style="list-style-type: none"> - Aquaculture Management Regulations - Procedures consistent with industry best practices on interactions with wildlife must be included in the farm operations section of the Farm Management Plan. More information can 	

Other Living Marine Resource Interaction	
Canada	United States
be found at: https://www.novascotia.ca/just/regulations/regs/fcraquamgmt.htm	

Conclusion

Both DFO and NOAA consider the regulatory regimes for net pen aquaculture in Canada and the United States to be similar in design, with both regimes leading to the similar outcome of ensuring production of healthy and sustainable farmed salmon while protecting wild fisheries and the aquatic environment.

There are areas of successful collaboration between Canada and the United States to better manage disease and environmental impacts where Canadian and U.S. net pen facilities are located in close proximity. Examples include the collaboration between New Brunswick and Maine on Bay Management Areas and the cooperation of CFIA, APHIS, New Brunswick, and Maine to develop Infectious Salmon Anemia Program Standards. One notable difference in regulatory requirement between the two countries is the genetic marking of farmed salmon that is only required in Maine. Another difference was identified with respect to interactions with marine mammals. Differences in regulations provide opportunity for the countries to learn from one another to administer regulatory frameworks for net pen aquaculture.

The comparability analysis included in this report will provide the basis for completing Workstream D of the DFO-NOAA Technical Work Plan, which includes evaluating development of a joint-statement on Canada and U.S. net pen aquaculture regulatory programs.

The RCC work on aquaculture serves as a vital mechanism for enabling mutual exchange of knowledge and expertise for enhancing sustainable aquaculture in Canada and United States. DFO and NOAA will continue to cooperate on net pen aquaculture regulation to address emerging domestic and global issues related to aquaculture.