Agenda item 6.2
For information

**Council**

**CNL(16)43**

***Progress and challenges in achieving NASCO's international goals for aquaculture in the United States***

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## *Progress and challenges in achieving NASCO's international goals for aquaculture in the United States*

### Background

The United States has strong laws, regulations, and policies governing the conservation and management of fisheries resources and their habitat, the protection of the environment, and the protection of endangered species, among others. Recovering Atlantic salmon stocks of U.S. origin (that only persist in the state of Maine) is a very high priority for the United States. These populations are critically endangered and are listed on the U.S. Endangered Species Act. Such listing ensures they have the highest legal protection the United States can offer. Eastern Maine is home to many of these salmon populations as well as all the commercial aquaculture facilities that raise Atlantic salmon (Figure 1). Given the strict requirements of U.S. environmental laws, the proximity of marine net pens to Atlantic salmon rivers, and the precarious state of the salmon populations, the United States takes a careful and considered approach to managing salmon aquaculture operations, an approach that advances the achievement of NASCO's international goals for aquaculture.

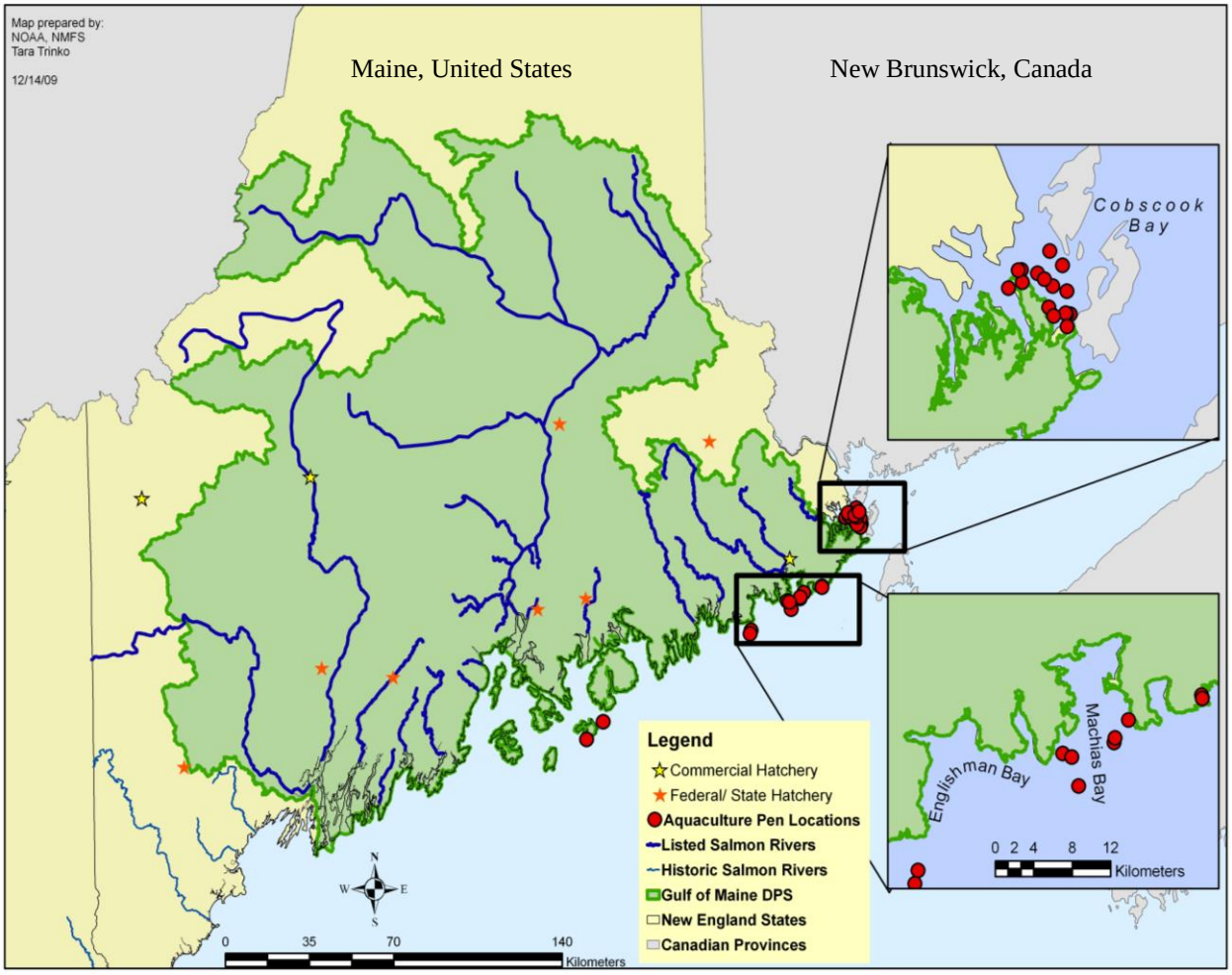


Figure 1. Location of salmon aquaculture facilities in relation the freshwater range of endangered Atlantic salmon populations (Gulf of Maine Distinct Population Segment or "DPS") in the United States.

Since 2002, the Maine salmon farming industry has significantly changed due to both state and federal regulatory requirements, bay management areas, fish health protocols, and change of lease ownerships. In 2003, the implementation of a suite of rigorous management measures began in earnest in collaboration with private industry, the Maine Aquaculture Association and multiple federal and state agencies. The suite of measures implemented pursuant to this process substantially reduced the environmental effect of aquaculture and the risk to endangered salmon populations in Maine and nearby jurisdiction, New Brunswick. Subsequent sections of this report will describe progress in reducing salmon aquaculture impacts in the United States, following the guidance given by the Steering Committee. This report focuses on traditional practices involving grow out from the smolt stage in the marine environment in net pens. We do not address land-based, closed-containment facilities given the limited production levels currently.

**Quantitative information to demonstrate whether or not there has been progress towards NASCO's international goals for sea lice and escaped farmed salmon**

Since 2003, the United States has had excellent containment in place with only two potential escape events. Using a number of reporting mechanisms, the United States provides as much information to NASCO as possible on its progress in meeting NASCO's international goals for sea lice and escaped farmed salmon. NASCO's required annual progress reports are perhaps the most important reporting mechanism. In the U.S annual report to NASCO, three of the four actions described in the aquaculture section directly or indirectly address the potential effects of sea lice or escaped farmed salmon. We also share any available information on salmonid disease incidences, breaches of containment of salmonids from net cages, salmonid introductions from outside the North American Commission (NAC) Area, and summaries of any transgenic activities. These important communication tools, often referred to as "NAC Reports," are all available on the NASCO website (http://www.nasco.int/reports_annual.html). Only two potential breaches of containment in the United States have been reported since 2003. Another important metric we track on an annual basis is the number of escaped farmed salmon captured in salmon rivers in the United States. Since the implementation of the suite of management measures beginning in 2003, the number of suspected aquaculture escapees captured in salmon rivers in the United States has declined substantially and has become a very rare event (Figure 2).

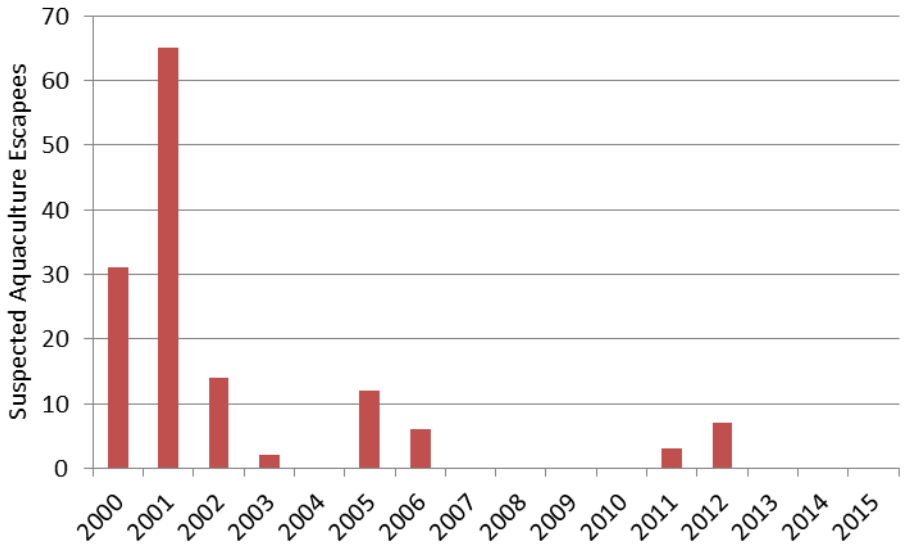


Figure 2. Number of suspected aquaculture-origin escapees captured in Maine rivers from 2000 to 2015.

**Particular challenges in achieving NASCO's international goals for sea lice and escaped farmed salmon**

One of the particular challenges we face in terms of managing the impact to salmon in the wild relates to the international border between the United States and Canada. To a large degree, this challenge has been overcome by extensive collaboration and coordination among all interested parties on both sides of the U.S.-Canada border, including the regulated industry, industry trade groups (primarily the Maine Aquaculture Association) and multiple state, provincial, and federal government authorities. Perhaps the best example of this collaboration is the Finfish Bay Management Agreement, which was formalized through permit requirements and regulations governing the U.S. salmon farming industry in Maine. This agreement is available on the internet at:

http://www.greateratlantic.fisheries.noaa.gov/sed/aquaculture/ne/maine_aquaculture_assoc_finfish_bay_management_plan.pdf

The foundation for this agreement was mutual recognition of the need for coordinated management of common bay areas. Under the agreement, the State of Maine and the Canadian province of New Brunswick manage the Cobscook, Campobello, and Deer Island marine sites as one management area. There are several benefits to this approach: 1) better coordination of site fallows; 2) fewer overlapping year classes in production; and 3) reduced disease transmission between year classes. This approach is critical to effective disease management and addresses several key factors in minimizing outbreaks of Infectious Salmon Anemia (ISA) and sea lice. This agreement and the associated guidelines also seek to control movements of fish and vessels within the bay to minimize disease transfer between the U.S. and Canadian marine sites. Further clarification regarding the bay-wide fallowing protocols (initially set forth in the Finfish Bay Management Agreement) has recently been provided by the U.S Department of Agriculture's ISA surveillance program (described in more detail below).

Further collaboration with Canada has also recently begun at a broader level. The National Marine Fisheries Service and the Department of Fisheries and Ocean (Canada) have recently begun work on a new initiative (referred to as the Regulatory Cooperation Council) to advance regulatory cooperation in the environmental management of the marine aquaculture sector under three specific work streams: 1) comparing regulatory objectives and outcomes of net pen aquaculture; 2) cooperating on farmed to wild fish interactions; and 3) cooperating on regulatory oversight and management of offshore aquaculture. The work of the Regulatory Cooperation Council is ongoing; no reports from this work stream are yet available. Progress and timelines can be found at the following website:

http://www.nmfs.noaa.gov/aquaculture/homepage_stories/08_noaa_dfo.html

In providing data to NASCO and other international organizations, the United States must ensure it abides by its legal requirements concerning confidentiality, which are enshrined in statute. These confidentiality requirements can, in some cases, limit the data that we can make publicly available, which can create a challenge in demonstrating U.S. progress toward achieving NASCO's goals regarding sea lice and escaped farm salmon. To explain, we are required to apply the "Rule of Three," when considering the release of data. This rule requires that any data presented to the public must have been reported by at least three distinct entities, such as fishermen or companies, and be appropriately aggregated before distribution to protect confidential business information. Those data that can only be attributed to two or fewer entities may be shared only if it can be aggregated to a higher level in a way that appropriately protects the confidentiality. Since 2011, only one salmon aquaculture company has been operating in the United States. Therefore, the data cannot be reported directly.

**The approach to verifying compliance with regulations and codes of practice in relation to sea lice and escaped farmed salmon**

The Atlantic salmon farming industry in Maine is required to employ a containment management system (CMS) at all production facilities supporting commercial salmon aquaculture; this includes both freshwater hatcheries and marine sites. The generic CMS template and framework was developed through collaboration between private industry, public interest groups, environmental NGOs, and state and federal agencies. The Maine Aquaculture Association led the effort. These generic plans were used by the hatchery and marine site managers to develop site-specific actions and response plans based on the specific needs of each site. A hazard analysis was conducted to identify critical control points and appropriate equipment modifications needed to eliminate losses from each facility. The site-specific plans were refined during a one-year trial period, at which time state and federal agencies provided oversight to site managers to implement CMS plans at each site. The Maine Aquaculture Association, in cooperation with the salmon farming industry, developed equipment standards (referred to as a Code of Containment), which formed the basis of each plan. The Code of Containment was established using industry expertise and data collected through analyses of load exerted on cages during extreme weather and tide conditions and is available on the internet at:

http://www.greateratlantic.fisheries.noaa.gov/sed/aquaculture/ne/me_salmon_code_of_containment_final.pdf

The major components of the CMS plans include standard operating procedures specific to fish husbandry, stocking, harvesting, predator control, vessel operation, fish transfers, net changes and managing unique events such as storms and winter icing. Reporting of escapes, record keeping (e.g., cage and net numbers), corrective actions, and annual training of employees and managers to explain how to implement CMS plans are mandatory components of each plan.

Specific and stringent containment requirements are in place for freshwater and marine facilities alike pursuant to the CMS plan. Commercial freshwater hatchery facilities located on rivers with endangered salmon populations are required to eliminate losses of juvenile salmon by screening discharges from the hatchery. For example, a three barrier system is required to be installed on the outflow from each facility to prevent salmon from escaping into streams and rivers. For each marine grow-out site, CMS protocols are in place to prevent losses during all activities including stocking and harvesting. Seals and avian predators are controlled using predator nets. Farmed salmon are contained within their rearing areas (e.g., floating net pens) by jump barriers and containment nets that meet gear requirements specific to moorings, nets, and cage design found in the Code of Containment. Each aquaculture company maintains records of all gear deployed. These records are audited annually by a third party, and the results of these audits are reviewed by the permitting agencies for compliance. Non-compliant facilities are required to initiate corrective measures before smolts can be transferred. Any deficiencies found during the routine annual audits are addressed through a corrective action plan and, if major deficiencies are found, a follow up audit to monitor the progress of implementing corrective actions is conducted. Mandatory audits and escape notification are required for losses greater than 25% of cage biomass (as indicated by appetite loss) or 50 fish greater than 2 kg in size. As is illustrated in Figure 2, documented farm-origin salmon entering U.S. salmon rivers have decreased substantially since the implementation of these measures.

Finally, the U.S. Department of Agriculture's (USDA) Animal and Plant Health Inspection Service implemented an ISA indemnity, surveillance, biosecurity, and epidemiological research program for farm-raised fish in the United States, and more recently (2010), they have revised these guidelines that are currently in place. The current guidelines are available on the internet at:

http://www.aphis.usda.gov/animal_health/animal_dis_spec/aquaculture/downloads/isa_standards.pdf

Participation in this program is mandatory for all salmon growers and covers all salmon finfish farms in the State of Maine. USDA's goal is to control and contain the disease through rapid detection and depopulation of salmon that have been infected with or exposed to ISA. The program is being interfaced with the State of Maine's husbandry and bay management program (described above) that is being implemented via the Maine Department of Marine Resources' authority.

**Methods used to support innovation to develop alternative production techniques to promote sustainable salmon farming**

There are a variety of directives and initiatives with associated research programs and facilities in the United States that support innovation and promote sustainable salmon farming, including the Department of Commerce Aquaculture Policy, the National Cold

Water Marine Aquaculture Center, the Aquaculture Research Institute at the University of Maine, and the Maine Aquaculture Innovation Center.

*Department of Commerce (DOC) Aquaculture Policy* – Under the DOC, the National Oceanic and Atmospheric Administration's (NOAA) policy reflects its broad oceans mandate by "reaffirming that aquaculture is an important component of NOAA's efforts to maintain healthy and productive marine and coastal ecosystems, protect special marine areas, rebuild wild stocks, restore endangered species, support marine and coastal habitat, create employment in coastal communities, and enable the production of safe and sustainable seafood." An important component of the policy is technology transfer that seeks to move NOAA-supported innovative technologies and practices that improve the economic and environmental performance of aquaculture to the private sector and others. NOAA research has helped to develop several modeling tools to assist planners and businesses in siting aquaculture in locations which will result in maximizing returns economically and improve environmental performance. NOAA research has (along with the U.S. Department of Agriculture) made several open-formula diets available to researchers worldwide as reference diets.

*National Cold Water Marine Aquaculture Center* -- The mission of the National Cold Water Marine Aquaculture Center is to conduct research that will solve problems limiting production efficiency of coldwater marine aquaculture. The primary research focus is genetic improvement using an applied selective breeding program to increase efficiency and sustainability of Atlantic salmon culture.

*Aquaculture Research Institute (University of Maine)* -- The Aquaculture Research Institute involves researchers and faculty from multiple disciplines at the University of Maine and a variety of industry partners. Some important components of the Aquaculture Research Institute include recirculating or flowing fresh water or artificial seawater in a versatile laboratory. In addition to supporting faculty research and graduate thesis projects, this laboratory is also used for undergraduate training and public outreach. The Aquaculture Research Institute also partners with the Center for Cooperative Aquaculture Research (CCAR), a unique University of Maine aquaculture research and development facility with large-scale systems for the development of sustainable solutions to land-based aquaculture, alternative marine species technology and ornamental aquatics production. The Aquaculture Research Institute and the University of Maine's Animal Health Lab address urgent aquatic animal health issues through industry contracted services and strategic industry partnerships as well has hypothesis-driven sponsored research. Finally, the recent $20 million (USD), 5-year grant (from the National Science Foundation) to establish a Sustainable Ecological Aquaculture Research Network (SEANET) program in Maine further builds research and education capacity in aquaculture. It involves professional staff and faculty across multiple Colleges at the University of Maine, and with multiple partners from other research and education institutions across Maine. SEANET is coordinated by the Aquaculture Research Institute and the Experimental Program to Stimulate Competitive Research (referred to as the Maine EPSCoR Office). Specific research objectives include environmental modelling to inform site location decisions in the future and non-chemical treatments for sea lice outbreaks.

*Maine Aquaculture Innovation Center* – The Maine Aquaculture Innovation Center was established in 1988 by the Maine Legislature with a mission to assist in developing economically and environmentally sustainable aquaculture opportunities in Maine. The Maine Aquaculture Innovation Center sponsors and facilitates innovative research and

development projects involving food, pharmaceuticals, and other products from sustainable aquatic systems; invests in the enhancement of aquaculture capacity in Maine; serves as a source of educational information to enhance public visibility and acceptance of aquaculture; and encourages strategic alliances tasked with promoting research, technology transfer, and the commercialization of aquaculture research.