December 29, 2011

Via Regular and E-Mail

The Honorable Keith Ashfield
Minister of Fisheries and Oceans
200 Kent Street
13th Floor, Station 13E228
Ottawa, Ontario K1A OE6
Canada

Re: Impacts of Salmon Farming on Wild Salmon Populations in BC

Dear Minister Ashfield:

The Environmental Law Clinic at the University of Denver Sturm College of Law ("DU ELC") is writing on behalf of the Center for Biological Diversity to request that the Canadian Department of Fisheries and Oceans ("DFO") immediately implement applicable legal requirements to address the impacts of salmon aquaculture on wild salmon populations in British Columbia. We are concerned that you are violating and failing to effectively enforce the Canadian Fisheries Act (R.S.C. 1985 c. F-14). Despite mounting evidence of harm to British Columbia's wild salmon runs and severe threats to wild salmon in Canada and the United States, you have permitted hundreds of commercial salmon farms to operate in the narrow migration routes used by wild salmon of British Columbia and the United States, including the Fraser River, exposing wild salmon to amplified levels of parasites such as sea lice, viral and bacterial diseases, toxic chemicals and concentrated farm waste. These violations of the Fisheries Act are allowing commercial aquaculture to erode the capacity of the British Columbia ecosystem to support wild salmon. The potential for British Columbia salmon farms to amplify and spread epidemic diseases also jeopardizes the health of every other wild salmon run along the Pacific Coast, as well as the entire West Coast salmon fishing industry, because these stocks co-mingle. Therefore, we request that you immediately take steps to address this issue by enforcing the Fisheries Act.

I. BACKGROUND

A. British Columbia Salmon

Pacific salmon have been a cornerstone of Western Canada's natural ecology, cultural history and economy for thousands of years. Salmon play a large role in the development and maintenance of British Columbia's coastal forest and marine ecosystems.

Every fall, wild Pacific salmon swim upstream into the rivers and streams in which they were born. The salmon fight their way against the current, until they reach shallow gravels bars where they deposit and fertilize their eggs. Once the reproductive process is over, most species of salmon die in the rivers and streams, leaving their carcasses to provide nourishment for the entire ecosystem. Predators such as bears, eagles, osprey and humans prey upon the running salmon, often in an effort to build food supplies for the coming winter. Scavengers such as raccoons and crawfish dine on the remnants. Whatever remains break down into nutrients and enriches the rivers and forests themselves.

When fertilized salmon eggs hatch, the salmon fry, depending on the species, either remain in the fresh water for a year or more, or immediately make their way downstream to the ocean. Upon reaching the ocean, the young salmon, now called smolts, tend to stay close to the coastline during their first winter. Because of their size, these young salmon are vulnerable to predation, strong ocean current, competition for food resources, pollution and parasites. After spending their first winter near the coast, the young salmon move out into the open ocean. Pacific salmon generally spend from one to four years eating and growing in the nutrient rich Pacific Ocean. When their biological clocks indicate that it is time to reproduce, salmon complete the cycle by returning to the rivers or streams in which they were born, where they spawn and die. There are five species of native Pacific salmon that occur in British Columbia waters (chinook, chum, coho, pink and sockeye salmon) as well as steelhead trout and cutthroat trout.

Chinook salmon (*Oncorhynchus tshawytscha*), the largest of the Pacific salmon, spawn in a relatively small number of streams in British Columbia. Chinook production is mainly in major river systems, most importantly the Fraser River. After hatching, most chinook in British Columbia remain in fresh water for at least a year. Adult chinook return from the ocean to spawn after two to seven years. River systems can have more than one stock of chinook, with timing of spawning runs encompassing spring, fall and winter runs.

Chum salmon (*Oncorhynchus keta*) spawn in medium-sized streams and rivers. In short coastal streams, chum fry emerge from gravel beds in spring and move directly to the sea in a day or two. Chum fry remain in larger river systems for up to several months before reaching the ocean. Most chum spend two or three summers at sea before returning to home streams to spawn.

Coho salmon (*Oncorhynchus kisutch*) are found in most British Columbia coastal streams. Young coho generally spend one year in freshwater before migrating as smolts to the ocean, where they spend up to 18 months, tending to remain in nearshore coastal waters. Most coho return to spawn at three years of age, but some mature earlier and return as ‘jacks’ at only two years.

Pink salmon (*Oncorhynchus gorbuscha*) are the most abundant salmon in British Columbia waters. Pink salmon have a short, two-year lifespan. Adults migrate to their home stream from July to October and the majority spawn in waters close to the sea. Young fry enter the ocean immediately after emerging from the gravel in the spring and after a few days to several months in the estuary and nearshore zone, move out into the open ocean.

Sockeye salmon (*Oncorhynchus nerka*) spawn in late summer or fall in lake-fed systems; at lake outlets, in lakes, or in streams flowing into lakes. Major spawning runs in British Columbia are in the Fraser, Skeena, Nass, Stikine, Taku and Alsek rivers. Young sockeye may remain in their freshwater nursery lakes for a year or more, with some waiting until the second or third year to make their seaward journey. In many of the lakes of the Fraser River system in particular, sockeye are abundant in one of every four years. Sockeye can mature at ages between two and six years old but in most systems, one age group (usually four-year-old fish) dominates, meaning most of the offspring produced in any one brood-year return to spawn four years later.

B. Commercial Salmon Aquaculture in British Columbia

Salmon farming began in British Columbia in the early 1970s, though large-scale commercial aquaculture took hold in the late 1980s. British Columbia is now a distant fourth of the largest producers of farmed salmon in the world, after Norway, Chile and the United Kingdom (OMFB 2009). Salmon are by far the most common commercially farmed aquaculture species in British Columbia, accounting for nearly 89% of all aquaculture products by weight from 2007-2009 (OMFB 2009). Nearly 80,000 metric tons of salmon are produced annually in British Columbia salmon farms.

British Columbia salmon farms import salmon eggs, which are then fertilized and incubated. Young salmon are raised in hatcheries until they are able to live in saltwater pens, where they remain until they are harvested. Mature salmon are kept in open-net floating pens, which consist of open net cages or mesh nets, placed in sheltered bays and fjords along a coast.

Salmon farms are essentially concentrated animal feed lots that are offshore. In British Columbia salmon farms are universally located in the calm waters of protected channels and bays, in wild salmon and herring migration routes. These channels are traveled by wild salmon during their breeding season and by newly hatched salmon fry making their journey from spawning streams to the sea. Thus, almost all south coast British Columbia salmon are inoculated with salmon farm effluent passing over their gills twice in their life cycle. In addition, many species of salmon fry will spend their first winter in the protected inlets and bays used by salmon farms, subjected to the salmon farm pollution, disease and parasitic infestation when they are most vulnerable. Because of the presence of fish farms, waters that were once both a nursery and sanctuary to juvenile wild salmon are now riddled with pollution, chemicals, disease and parasites.

British Columbia salmon farms primarily use Atlantic salmon (*Salmo salar*), a species markedly more susceptible to sea lice than Pacific salmon species (Johnson and Albright 1992; Fast et al. 2002). The vast majority (94%) of farmed salmon in British Columbia in 2009 were Atlantic salmon. The remainder are chinook or coho salmon (BCSFA 2003; WWSS 2004). DFO began permitting Atlantic salmon eggs to be imported into British Columbia in 1985, despite the government's own concern about their impact on native salmon and warnings about the potential for transmission of disease and possible displacement of native wild salmon.

C. Fish Farm Impacts on Natural Ecosystems

1. Amplification of Sea Lice

Sea lice are small marine copepods that occur naturally in the Northern Hemisphere. Sea lice are ectoparasites that attach to the outside of fish, either on skin, fins, or gills, and feed off of their blood, tissue and mucus. The term 'sea lice' refers to several small crustacean species of the family Caligidae that live and feed on fish. At least thirteen different species of sea lice live in British Columbia waters. Only *Caligus clemensi*, *Lepeophtheirus cuneifer* and *Lepeophtheirus salmonis* have been reported on farmed and wild salmon in British Columbia. *L. salmonis* is almost always found only on salmon. In British Columbia waters, *C. clemensi* and *L. salmonis* may damage both farmed and wild salmon, and are a major concern both for the fish farming industry and for wild salmon conservation. While *L. salmonis* is often more prevalent and more damaging than *C. clemensi* (Kabata 1988; Morton et al. 2004), studies in the Broughton Archipelago in 2003 indicated that 20% of chum salmon were infected with *C. clemensi* and only 7% with *L. salmonis* (Gallaugher et al. 2004). *C. clemensi* are host generalists and therefore jump more frequently between hosts, increasing their ability to transfer pathogens fish to fish.

Natural populations of sea lice seldom harm wild salmon; however, salmon farms alter natural sea lice transmission dynamics and amplify sea lice populations (Kabata 1970; MacKinnon 1997; Bakke and Harris 1998; Krkosek et al. 2005). Stocking hundreds of thousands of fish in small pens in confined waters makes fish farms ideal breeding grounds for parasites such as sea lice, and drastically increases the number of lice in surrounding waters. Stress levels associated with crowding make farmed salmon more susceptible to lice infestation and most of British Columbia's farmed salmon are Atlantic salmon, which are inherently more susceptible to sea lice than many other salmon species (Johnson and Albright 1992; MacKinnon 1997; Bakke and Harris 1998; Fast et al. 2002).

There have been a few studies purporting to counter the overwhelming scientific evidence that sea lice are magnified and then transmitted from farm to wild salmon and the strong associations between salmon farming and recurrent infestations of wild juvenile salmon in British Columbia. For example, the contention of Brooks (2005) that ocean temperatures and salinities prevent transmission of lice from farm salmon to sympatric wild juvenile pink and chum salmon was based on flawed interpretations, misleading analysis and incomplete evaluation of scientific literature (Krkosek et al. 2005). A DFO lab study testing salmon lice resistance (Jones et al. 2008) claimed that Pacific salmon are resistant to damage from sea lice except in their extreme infancy when first leaving their natal rivers. However, this limited study exposed juvenile pink salmon to infective stages of lice for only a few hours, resulting in artificially low mortality rates. Migrating wild juvenile salmon, like those in the Broughton Archipelago, are exposed to lice for weeks or months. An independent scientific study (Krkosek et al. 2009) that examined the process of sea louse transfer to wild juvenile salmon in the field where salmon are exposed to sea lice over a longer period of time reached entirely different conclusions. Particularly telling is a study of aquaculture facilities in a primary salmon migratory corridor in British Columbia which removed their stock of farm-raised salmon in 2003, resulting in both a decline in sea lice populations and an increase in wild salmon survival rates (Morton et al. 2005; Beamish et al. 2006). A recent study responding to and evaluating previous claims of no impacts to wild salmon from sea lice on salmon farms showed that that sea lice abundance on farms is negatively correlated with productivity of both pink and coho salmon in the Broughton Archipelago (Krkosek et al. 2011). This study analyzed fish farm data and pink salmon and coho salmon data from 1970 to 2009 over a wide geographic area in the Broughton Archipelago, and found up to 80% higher mortality for juvenile wild salmon that swam near fish farms when sea lice populations were high among farmed fish compared to those that did not swim near fish farms.

British Columbia salmon farming companies report their sea lice and disease information to a central database overseen by their industry association, the British Columbia Salmon Farmers Association (BCSFA). This association provides monthly reports summarizing sea lice abundance by region to the British Columbia Ministry of Agriculture and Lands (BCMAL). The public only sees summarized data reported online by BCMAL. This coarse information has little value for researchers or concerned citizens, nor has the BCMAL data been properly evaluated. Every year scientists report elevated levels of lice on wild juvenile salmon near fully-stocked salmon farms. Current monitoring, managing, and auditing are clearly not effectively protecting wild salmon. The salmon farming industry's primary concern is the impact of sea lice on the health of farmed fish, and the reduction in the number of lesions caused by sea lice infection. Protection of wild fish, which requires a much more precautionary approach, is not the industry's concern or responsibility.

2. Fish Farm Transmission of Disease

Salmon farms pose the serious threats of introducing, amplifying and transferring diseases from farmed fish to wild fish. As long as open-net pens are used which allow constant exchange of water to the marine environment and farmed salmon are crowded into confined areas, diseases will likely be exchanged between farmed and wild salmon. As researcher Alexandra Morton has stated, "if you move diseases across the world and brew them among local pathogens, in an environment where predators are not allowed to remove the sick, you get pestilence."

There are four major infectious diseases that infect salmon in industrial farming operations: Bacterial Kidney Disease (BKD), Infectious Hematopoietic Necrosis (IHN), Infectious Salmon Anemia virus (ISAv), and Furunculosis (Ferguson 1989; McDaniel et al. 1994; Traxler and Richard 1996; Kent and Poppe 1998; Kent et al. 1998; EC 1999; St-Hilaire et al. 2001; WOAH 2001; Kurath et al. 2003; Werring 2003; Saksida 2004). BKD and IHN are common throughout salmon farms worldwide.

3. Fish Farm Toxic Chemicals and Pollution

Farmed salmon are held in flow-through nets and cages, essentially flow-through feedlots which allow fish waste and added chemicals such as antibiotics and pesticides used in industrial salmon farming operations to freely pass into marine waters. A typical British Columbia salmon farm can hold from a half million to one million adult fish. Fish wastes can accumulate under and around salmon farms and degrade habitat surrounding the farm, smothering portions of the ocean bottom, contaminating the marine ecosystem and depriving species of oxygen (Findlay and Watling 1997; Pohle et al. 2001; Lampadariou et al. 2005). Even if the bulk of the waste is carried away from the farm site by ocean currents, it can cause localized pollution in other areas.

Salmon farms add drugs - such as antibiotics and therapeutants - to salmon feed, and chemicals - such as antifoulants and disinfectants - are also released into the environment by farms in an attempt to control unwanted organisms and diseases. Vaccines and antibiotics are used in salmon aquaculture to control infections. Vaccines are given by inoculation but antibiotic treatments are typically done through medicated feed, which increases the chance that antibiotics will pass into the environment, affecting wildlife and other organisms and remaining for long periods of time. Little is known about how these chemicals affect the marine ecosystems, however, studies investigating contaminants near British Columbia salmon farms found that rockfish near salmon farms had elevated levels of mercury compared with rockfish found elsewhere; parasites, tumors and lesions have been found on ground fish harvested near salmon farms; and clam beaches used by First Nations in the Broughton Archipelago have been destroyed by the accumulation of black muck and sludge that has been attributed to salmon farm waste (BCAFC 2004; DeBruyn et al. 2006).

The primary treatment for sea lice infestations in British Columbia salmon farms is a reactive treatment of a chemotherapeutant given to farm fish in food after a sea lice infestation has occurred. Although diluted by surrounding water, the chemicals entering the marine environment via feces may affect non-target wild crustaceans and may remain in the environment from ten days to six months (Horsberg et al. 1987; Costello 1993; Roth and Richards 1993; Fraser 1995; Roth et al. 1996; Erdal et al. 1997; Hart et al. 1997; Ritchie et al. 1997; Treasurer and Grant 1997; Valles and Koehler 1997; Roth 2000). The ability of sea lice to develop resistances to chemical treatments is also a major issue (Hammell 2002).

The chemical treatments for sea lice infestations of salmon farms have potential consequences as ecologically drastic as the sea lice themselves. The primary chemical weapon used on sea lice in British Columbia salmon farms is emamectin benzoate, sold under the trade name SLICE. Emamectin benzoate is in a class of chemicals called avermectins, axonic poisons which act by lethally interrupting the neurological processes sea lice feeding on the salmon’s treated tissue (Schulman et al. 1985; Valles and Koehler 1997). SLICE is added as a coating on commercial fish feed and is absorbed into the tissue of salmon, where it takes about a week to be eliminated (SPAHC 2002).

There is emerging evidence that SLICE is becoming ineffective in treating sea lice in some salmon farming operations (DFO 2009b). There are reports from Chile, Norway and Canada’s east coast indicating that sea lice are showing signs of resistance to emamectin benzoate treatments, likely due to frequent and heavy applications (Lees et al. 2008). Since sea lice may have begun evolving a resistance, some fish farms outside of British Columbia are considering replacing SLICE with deltamethrin, another neurotoxin marketed as Alphamax, for the treatment of sea lice. Alphamax is known to be relatively toxic to fish and invertebrates and acutely toxic to crustaceans (Bellona Foundation 2009). Alphamax is administered via a chemical bath: the net-cages are surrounded by tarps, farmed fish soak in pesticide solution and then the tarps are opened and the chemical is released into the ecosystem. DFO has acknowledged concerns regarding Alphamax’s “effect on other marine species and the eco-system in the vicinity of aquaculture cage sites” (DFO 2009b).

4. Escaped Invasive Fish from Fish Farms

One of the risks of salmon farming is escape of non-native farmed fish from pens. Farmed salmon can and do escape into the natural environment, but the complete extent of the problem is not researched and unknown. Storms, equipment failure, attacks by predators such as seals and sea lions, or human error can all result in significant release of farmed salmon into the surrounding water. Over time, even more salmon can escape due to smaller accidental releases or escapes referred to as "leakage."

All aspects of the issue are debated—from the numbers of fish that escape to the impact that farmed fish have on the genetic, biological and ecological status of wild salmon. Escaped fish have the potential to spread disease and parasites, as well as compete with wild salmon for both food and habitat. Although the majority of farmed salmon in British Columbia are Atlantic salmon, coho and Chinook salmon are also farmed, which poses the added risk of interbreeding with wild salmon and genetically affecting indigenous stocks, potentially decreasing wild salmon biodiversity.

5. Fish Farm Links to Declining Salmon Populations

Like all natural fish populations, wild salmon are subject to some fluctuation. However, salmon runs in British Columbia have not historically suffered the same declines as many of the runs in the United States. Severe declines of wild salmon returns in British Columbia began in the early 1990s and resulted in an outright moratorium on new salmon farm licenses in 1995. In 1997 the Canadian government commenced a Salmon Aquaculture Review, which erroneously concluded that the risks salmon aquaculture posed to the environment were low. This review preceded the major outbreaks of lice in British Columbia salmon farms, did not fully investigate the impact that fish farms have upon wild stocks, and overlooked the fact that wild salmon are in decline wherever salmon aquaculture is conducted in marine net pens. Despite lingering skepticism, the government lifted the moratorium in 2002, and the commercial aquaculture industry immediately began investing hundreds of millions of dollars in new farms.

II. CANADA'S FISHERIES ACT

The Canadian Constitution gives the federal parliament exclusive authority to make laws concerning "sea coast and inland fisheries" (Constitution Act, 1982, § 91(12), being Schedule B to the Canada Act 1982 (U.K.), 1982, c. 11). This authority is exercised principally through the Fisheries Act and its regulations. The Fisheries Act requires "the proper management and control of sea coast and inland fisheries" and "the conservation and protection of fish" (*Fisheries Act*, §§ 43(a), 43(b)). The two most relevant sections of the Fisheries Act are section 35, which prohibits the harmful alteration of fish habitat, and section 36, which makes it illegal to introduce a "deleterious substance" into fish-bearing waters. These sections are critical to preserving the ecological integrity of wild fish habitat and are described in detail below.

A. Applicable Legal Requirements

1. Section 35

Under section 35 of the Fisheries Act, DFO is responsible for ensuring that no projects undertaken in aquatic environments result in the harmful alteration, disruption, or destruction of fish habitat without authorization. Section 35 therefore prohibits any unauthorized change in fish habitat that would reduce its capacity to support one or more life processes of fish (Fisheries and Oceans Canada, 1998a).

Fish habitat encompasses components of the environment on which the survival of fish directly or indirectly depends. It includes spawning grounds, nursery and rearing areas, food supply, and migration areas on which fish depend directly or indirectly in order to carry out their life processes (*Fisheries Act*, 34(1)). Fish habitat possesses physical, chemical and biological attributes that are essential to the life processes of fish. Any water body or watercourse, permanent or intermittent, including stream banks as well as any area located in a flood zone, is considered a fish habitat (*Fisheries Act*, § 2).

The Policy for the Management of Fish Habitat adopted in 1986 defines the terms of reference for the consistent administration of DFO's fish habitat management program. The policy explains the guiding principle of "no net loss" of habitat productive capacity in order to achieve the habitat conservation goal. When a project is expected to cause harmful alteration, disruption, or destruction of fish habitat, the policy encourages an examination of alternative solutions and changes to the proposed project (construction methods, location of work, schedules, etc.) to avoid adverse effects on fish habitat, or if this is not possible, to reduce them.

As a last resort, if residual impacts cause harmful alteration, disruption, or destruction of fish habitat, an authorization to modify fish habitat under Subsection 35(2) of the Fisheries Act may be issued. This authorization allows the harmful alteration, disruption, or destruction of fish habitat by the means or under the circumstances authorized by DFO. One of the principal conditions of authorization is implementation by the project proponent of a habitat compensation program which complies with the principle of no net loss of fish habitat productive capacity. It is important to note that DFO may refuse to issue an authorization when it deems that harmful effects on fish habitat are unacceptable. Any harmful alteration, disruption, or destruction of fish habitat that is not authorized by DFO constitutes an offense under the *Fisheries Act*.

2. Section 36

Subsection 36(3) of the Fisheries Act prohibits the deposit of deleterious substances into Canadian waters. Unlike Subsection 35(2), there is no provision to authorize the deposit of deleterious substances except by Regulation or an Order in Council. A deleterious substance is defined by the Fisheries Act as "any substance that, if added to water, makes the water deleterious to fish or fish habitat or any water containing a substance in such quantity or concentration . . . that if added to water makes that water deleterious to fish or fish habitat."

The Federal Cabinet can pass regulations allowing the introduction of particularly harmful substances into fish habitat, and has exercised that authority on more than one occasion. For example, the Cabinet enacted regulations authorizing introduction of harmful substances for effluents from pulp and paper, metal mines, petroleum refineries, meat and poultry plants, and potato processing plants. Conspicuously absent, however, is any regulation authorizing the introduction of the neurotoxin emamectin benzoate, or SLICE.

B. You Have Failed to Enforce the Fisheries Act

1. Violations of Section 35

The DFO is failing to enforce § 35 of the Fisheries Act because it is failing to ensure that salmon aquaculture does not harmfully alter, disrupt, or destroy fish habitat.

Fish habitat includes components of the environment upon which a fish directly or indirectly depend in order to carry out their life processes. Juvenile wild salmon depend on the safety and habitability of the British Columbia coastlines to gain size and strength enough to contend with the currents and predators of the open ocean. Thus, the British Columbia coastline is fish habitat that should be protected by the DFO.

However, DFO has allowed over a hundred salmon farms to operate in this same habitat, despite the fact that salmon farms harmfully alter and degrade this environment.

Harmful alteration, disruption, or destruction of fish habitat is defined as any unauthorized change in fish habitat that would reduce the habitat's capacity to support one or more life processes of fish. By anchoring hundreds of thousands of sea lice infested salmon in pens along wild salmon migratory corridors, salmon farms reduce the habitat's capacity to provide young salmon with safety and respite. Instead, susceptible young salmon are subjected to sea lice infection rates at approximately seventy times greater than natural levels. Thus, each salmon farm is responsible for creating a harmful alteration, disruption, or destruction of fish habitat.

Despite § 35(1)'s prohibition on harmful alteration, disruption, or destruction of fish habitat, the DFO may issue a § 35(2) authorization for harmful alteration, disruption, or destruction of fish habitat. Authorizations are available if the residual impacts of a project cause, or result in harmful alteration, disruption, or destruction of fish habitat. Because each salmon farm is responsible for creating harmful alteration, disruption, or destruction of fish habitat, each farm in operation must be authorized by DFO. In 2009, there were more than 130 aquaculture sites in operation in British Colombia. The productive capacity of fish habitat is suffering great losses as evidenced by the millions of missing wild salmon from British Columbia rivers.

One of the principal conditions of authorization is the implementation of a habitat compensation program, which complies with the principle of "no net loss" of fish habitat productive capacity. "No net loss" encourages an examination of alternative solutions and changes to the proposed project to avoid adverse effects on fish habitat.

One way DFO could enforce this requirement is by mandating the use of land-based salmon farming or closed-containment tanks. Closed containment uses barrier technologies that ensure no contact between wild and farmed fish, thus eliminating the most harmful impacts of net-cage operations and significantly reducing others. Options for closed-containment systems include Recirculation Aquaculture Systems, where fish are grown in tanks, primarily on land, with up to 98% of the water being filtered, cleaned and reused; and Flow-Through Ocean Based Systems, where fish are grown in large floating tanks and ocean water is drawn from a depth determined to eliminate disease and pathogen transfer, oxygenated, then pumped into the tank where it can be treated and filtered to ensure high quality rearing water and that discharge water is returned to the ocean clean. The solid waste (fish feces and uneaten feed) is collected, treated and available for use as compost. The benefits of closed containment salmon farming systems include: eliminating or greatly reducing the risk of disease and parasite transfer to wild salmon; eliminating solid waste dispersal and resulting contamination of the marine environment; eliminating escapes; eliminating deaths of sea lions, dolphins and other marine mammals entangled in fish farm nets; and significantly reducing water column pollution, feed use and the need for antibiotics and chemical treatments to raise fish.

In 2007 and 2011, CAAR submitted full budget briefings and encouraged the Ministry of Agriculture and Lands and the Provincial government to establish the Closed System Aquaculture Innovation and Development Fund. This $10 million fund would provide investment to entrepreneurs who demonstrate the ability to build and operate closed system salmon aquaculture projects. Government support would enable private operators to prove systems without carrying the full costs and without forcing existing businesses into an immediate, capital-intensive transition to technology with which they are not familiar. Yet the 2008, 2009, 2010 and 2011 Provincial budgets did not contain any funding commitments for closed containment.

In sum, § 35 of the Fisheries Act prohibits harmful alteration, disruption, or destruction of fish habitat. The location of the salmon farms reduces the coastlines' ability to support the natural life cycle of wild salmons by introducing unnaturally high levels of disease and sea lice, to which young wild salmon are particularly vulnerable. The result is the rapid decline and predicted local extinction of British Columbia wild salmon. By failing to authorize harmful alteration, disruption, or destruction of fish habitat for each individual salmon farm and enforce the "no net loss" of fish habitat principle, the Canadian government is failing to enforce § 35 of the Fisheries Act.

2. Violations of Section 36

In addition to the link between sea lice, salmon farms, and the wild salmon, the Canadian government is failing to enforce section 36 of the Fisheries Act. This failure to enforce the Fisheries Act stems from the government's failure to prohibit the use of the neurotoxic chemical emamectin benzoate, used to treat infestations of sea lice, despite evidence that this substance is deleterious to natural fish habitat.

A deleterious substance is defined as "any substance that, if added to water, makes the water deleterious to fish or fish habitat or any water containing a substance in such quantity or concentration . . . that if added to water makes that water deleterious to fish or fish habitat." SLICE, the neurotoxic chemical treatment applied to fish feed used to fatten farm raised salmon in their pens, fits the statutory definition of a substance which is added to the waters that affects the environment.

There is a lack of conclusive evidence that SLICE does not harm or kill crustaceans other than sea lice, which may come in contact with the excess treated fish feed, excrement or the remains of deceased, farm raised salmon with SLICE residue still in their tissue. Decapod crustacean such as crabs, lobsters, and shrimp are important scavengers that tend to be drawn to the sea bed beneath finfish aquaculture operations, where the tainted refuse collects. These species perform an important role of breaking down biomass and releasing nutrients, and therefore comprise the "fish habitat" as the term is defined by § 34 of the Fisheries Act. In fact, wild salmon get their pink color from the carotenoids in decapods such as krill. A negative impact on these species can harm wild populations of salmon as well.

DFO indicates that SLICE may soon be replaced by Alphamax, triggered by the growing resistance sea lice are exhibiting towards SLICE in commercial fisheries around the world. Alphamax is described as being acutely toxic to all crustaceans. If DFO allows salmon farms to add Alphamax to the water it will again be failing to enforce the Fisheries Act.

Because there is no evidence provided that SLICE is not deleterious to the wild salmon's "fish habitat," and there is evidence that SLICE can accumulate in the sediments beneath the farm raised salmon pens, it follows that SLICE should be classified as a deleterious substance. Therefore, the Canadian government should prohibit the use of SLICE in the wild salmon's habitat, pursuant to section 36 of the Fisheries Act.

III. CONCLUSION

Salmon farms are dangerous to wild salmon because they create a place where viruses, bacteria and parasites breed and mutate. Locating them near the mouths of rivers in open pens on migration routes of wild salmon is the height of irresponsibility. Severe collapses in the numbers of wild Pacific salmon in British Columbia have been definitively linked to diseases and parasites amplified and spread by the salmon farms. We therefore request that you immediately take action to enforce the Fisheries Act and to protect wild salmon runs from the threats created by salmon aquaculture that you have failed to regulate properly. By taking immediate action to enforce Sections 35 and 36 of the Fisheries Act, you will protect wild salmon populations and their ecosystems. Thank you for your attention to this urgent matter.

Dated: December 28, 2011

Sincerely,

Kevin Lynch
Professor Michael Harris
Environmental Law Clinic
University of Denver Sturm College of Law
2255 E. Evans Avenue
Denver, Colorado 80208
303-871-6140 (Office)
klynch@law.du.edu
mharris@law.du.edu

cc: Paul Sprout, Pacific Regional Director
Associate Deputy Minister, Ecosystems and Fisheries Management
Éric Gilbert, National Regional Aquaculture Coordinator
Andrew Thompson, Pacific Regional Aquaculture Coordinator

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Minister of
Fisheries and Oceans

Ministre des
Pêches et des Océans

Ottawa, Canada K1A 0E6

FEB 03 2012

Mr. Kevin Lynch
Mr. Michael Harris
Environmental Law Clinic
University of Denver Sturm College of Law
< klynch@law.du.edu >

Dear Mr. Lynch and Mr. Harris:

Thank you for your correspondence of December 29, 2011, regarding aquaculture in British Columbia.

I understand your concerns and assure you that Fisheries and Oceans Canada (DFO) takes its responsibility to safeguard the health of British Columbia's wild salmon very seriously. DFO is committed to the sustainability, conservation and protection of marine ecosystems and the aquatic species they support in British Columbia.

Since assuming responsibility for the licensing and regulation of finfish, shellfish and freshwater aquaculture operations, the Department has developed new *Fisheries Act* regulations for aquaculture in British Columbia. The *Pacific Aquaculture Regulations* provide a legal framework consistent with DFO's mandate to manage fisheries and protect wild fish and fish habitat. The Regulations set the foundation for explicit environmental management requirements, tailored to the specific characteristics of each proposed aquaculture site through licence conditions. These requirements include fish health management plans, escape prevention requirements, sea lice management, and mitigation of habitat impacts and environmental effects. More information, including reporting on the environmental and operational performance of the aquaculture industry in British Columbia, is available on the Department's website at < www.pac.dfo-mpo.gc.ca/aquaculture/index-eng.htm >.

DFO has built on the experiences of the past and has carefully examined regulatory regimes for aquaculture management in other countries to identify best practices and lessons learned that are relevant to the situation in British Columbia. The Regulations are available online at < http://canadagazette.gc.ca/rp-pr/p2/2010/2010-12-08/html/sor-dors270-eng.html >.

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You raise a number of specific concerns regarding the impacts of aquaculture on wild salmon stocks, including sea lice, disease transmission, pollution, escapes, *Fisheries Act* enforcement, and the use of SLICE®. Since each of these topics is complex, I have attached related appendices to address your concerns.

Regarding your comments about the applicability of habitat protection provisions of the *Fisheries Act* to aquaculture, the Marine Finfish Conditions of Licence for aquaculture operators under the *Pacific Aquaculture Regulations* have specific provisions to regulate the impacts to fish habitat, and require the development of compensatory habitat.

To discuss aquaculture matters in further detail, you may wish to contact Mr. Andrew Thomson, Director, Aquaculture Management Division, Pacific Region, by telephone at 604-666-3152, or by email at < andrew.thomson@dfo-mpo.gc.ca >.

The Government of Canada recognizes the cultural, ecological and economic importance of salmon in British Columbia. The Department will continue to work to conserve and protect salmon stocks for current and future generations.

Thank you for taking the time to share your concerns.

Yours sincerely,

Keith Ashfield

Attachments (4)

SEA LICE

Management strategies

- Fish farms are required to create fish health management plans that include monitoring and managing the level of sea lice.
- The regulations allow Fisheries and Oceans Canada (DFO) to mandate fish farm operators to monitor the health of wild salmon near their aquaculture sites.
- Current sea lice management strategies include fallowing (modifying production cycles to minimize farmed fish presence during key periods), harvesting and preventative treatment of farms with emamectin benzoate (SLICE®).
- The current aquaculture management strategies were developed based on an extensive body of peer-reviewed science related to both local and international experience with sea lice, and are based on a sea lice trigger level of three motile lice per fish. These are similar to the previous provincial requirements; however, the Department's conditions of licence include more prescriptive actions should the trigger level be exceeded.

Research

- DFO prides itself on maintaining an objective science research program, focused on the Department's priority issues. Results of this research are peer-reviewed and published in international scientific journals. DFO scientists take into account all peer-reviewed science of which they are aware.
- DFO collaborated on the development of peer-reviewed literature on sea lice. A summary of this research is available at < www.llbc.leg.bc.ca/public/pubdocs/bcdocs/457386/sealouseupdate2009.pdf >.
- DFO has also conducted scientific studies on sea lice. DFO monitoring of wild juvenile pink and chum salmon in the Broughton area has found non-lethal sea lice levels on the juveniles in the last several years, particularly upon the most critical stage of ocean entry. Historic sea lice infection rates on juvenile pink and chum salmon in the Broughton Archipelago can be found at < www.pac.dfo-mpo.gc.ca/science/aquaculture/pinksalmon-saumonrose/results-resultats/index-eng.htm >.
- DFO has initiated a research program that will provide new data on sea lice levels on wild juvenile salmon in the Discovery Islands. The Department is also involved in collaborative programs to assess sea lice on wild juvenile salmon in the Broughton Archipelago and Nootka Sound. In addition, DFO is studying how sea lice may disperse along migration routes, and is conducting laboratory studies on the susceptibility of wild Pacific salmon to sea lice.

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SLICE®

- The veterinary drug emamectin benzoate, commonly known as SLICE®, is administered in farmed fish feed to reduce the numbers of sea lice on farmed fish.
- SLICE® is administered under veterinary prescription and is approved by Health Canada for use in sea lice control in Canada.
- The Canadian Food Inspection Agency tests domestically produced and imported aquaculture products for a variety of drug residues, including SLICE®, to verify that these products do not exceed the residue limits set by Health Canada.
- Research conducted on the effects of SLICE® on prawn and crab species native to British Columbia shows no increased mortality of those non-target species. Published studies have demonstrated no evidence for toxicity in zooplankton and bivalve molluscs when exposed to levels of SLICE® that these animals encounter.
- DFO is conducting further studies on the effects of SLICE® in the marine environment. For more information about the use and safety of SLICE® in Canada, you may wish to write directly to Health Canada.
- The British Columbia Centre for Aquatic Health Sciences has begun to research how sea lice respond to SLICE® in a laboratory environment, which may assist in future studies of potential SLICE® resistance.

Drug resistance

- In other countries, and in eastern Canada, there have been cases of potential resistance to SLICE® in sea lice populations on farmed stock that may be a result of multiple treatments with the drug, many farms in an area, and limited numbers of wild sea lice (lack of new influx of wild lice gene flow).
- In British Columbia, SLICE® is used infrequently as compared to other salmon farming areas, usually less than twice per grow-out cycle, and there has been an overall decline in the use of this drug in British Columbia since 2005.
- To date, the British Columbia provincial government, which was the aquaculture management authority, has indicated that there is no evidence to suggest sea lice in Nootka Sound, or elsewhere in British Columbia, are resistant to SLICE®.
- If potential evidence of resistance occurs, alternative sea lice management strategies will be explored.

- For more information about sea lice management and monitoring, please visit < www.dfo-mpo.gc.ca/aquaculture/lice-pou-eng.htm >, or contact Mr. Mark Sheppard, DFO Aquaculture Management, by email at < Mark.Sheppard@dfo-mpo.gc.ca >, or by telephone at 250-703-0901.
- For more information regarding DFO's sea lice research, you may wish to contact Mr. Mark Saunders in DFO's Science Branch, by email at < Mark.Saunders@dfo-mpo.gc.ca >, or by telephone at 250-756-7145.
- For more information about sea lice biology, please visit < www.dfo-mpo.gc.ca/media/infocus-alaune/2005/20051011b/info-eng.htm >.

PREVENTING THE SPREAD OF FISH PATHOGENS

Strict measures are in place to prevent the spread of both identified and unidentified fish pathogens from other countries and other parts of Canada to British Columbia's fish farms. For aquaculture purposes, British Columbia has a strict importation policy of fertilized eggs only for all salmonid species.

Under DFO's *Policy for the Importation of Atlantic Salmon into British Columbia,* only surface-disinfected, fertilized Atlantic salmon eggs from sources certified by a local fish health officer (LFHO) are permitted for import into British Columbia. No live Atlantic salmon or unfertilized eggs are eligible for import.

Any facility serving as a source of eggs for import into British Columbia must undergo rigorous health testing under the *Fish Health Protection Regulations* before eggs can be provided to British Columbia culture operations.

This applies to facilities within Canada or abroad. To export to British Columbia, a facility must be compliant with Canadian laws and regulations.

Since the last import of eggs from Washington State in 2001, the only eggs that have been imported into British Columbia have come from a pathogen-free source in Iceland. This source is a dry-land, closed-containment facility.

Imports of fertilized eggs from qualifying facilities are held in strict quarantine and isolation for up to one year, and the resulting progeny undergo rigorous health testing before introduction to ocean farms. A condition of the import agreement is that results of the fish health testing must be reported to the LFHO on a monthly basis, while fish are in quarantine.

As well, the importing company must immediately contact and advise a LFHO if any of the diseases or disease agents of concern are discovered in the eggs or resulting progeny at any time. Fish are only released from quarantine if all screening reports are satisfactory.

Upon completion of the quarantine and isolation period, the Minister of Fisheries and Oceans issues licences for all introduction and transfers of fish pursuant to Section 56 of the *Fishery (General) Regulations* (FGR), and only issues licences to transfer fish in the absence of disease agents of concern that may be harmful to the protection and conservation of fish. Fish may only be transferred to sea cage pens with either a valid Section 56 FGR or Pacific Aquaculture licence.

Site, vessel and visitor-related fish health protocols (including the use of foot baths and disinfection of any equipment used with fish or sediment monitoring) are in place in accordance with the industry-wide Fish Health Management Plans in British Columbia.

HABITAT IMPACT MITIGATION

Monitoring and analysis of the benthic zone (seabed) have been requirements for aquaculture for many years and continue to be required under the *Pacific Aquaculture Regulations*. For new sites, monitoring of the seabed occurs before farms are operational, and siting criteria is in place to protect sensitive and critical species and habitats. Benthic monitoring also occurs during facility operations to ensure that environmental thresholds are not exceeded.

The waste that is likely to occur from aquaculture is organic waste made up of excess feed and fecal material that deposit on the seabed. The seabed is monitored to ensure the predicted waste footprint is within the area expected. This modelled information is used to site new aquaculture facilities in areas to avoid sensitive and critical fish habitat.

The issue of waste beneath pens is also being addressed by improving feed conversion ratios as a result of nutrition research, monitoring the feeding behaviour of the cultured salmon so that excess feed is not introduced into the pens, and fallowing for sea floor recovery should it be required.

The Department also conducts ongoing research into aquaculture environmental interactions for continued understanding of the potential effects as a basis for adaptive management.

ESCAPE PREVENTION

Aquaculture operators make escape prevention a priority, as escaped farm fish can be a significant economic loss to the individual fish farm operator. The *Pacific Aquaculture Regulations* licence conditions outline the measures that aquaculture operations must take to minimize the escape of fish from the aquaculture facility and to catch the fish that escape from an aquaculture facility.

Fisheries and Oceans Canada has been monitoring the impact of farmed Atlantic salmon on native stocks since 1991. Our research shows that farm-raised Atlantic salmon adapt poorly to feeding in the natural environment and have shown no detrimental effects on Pacific salmon. In addition, worldwide, Atlantic salmon have not been shown to be successful at establishing populations outside their endemic range even when purposely transplanted.