INTRODUCTION

Pursuant to Articles 5(1) and 14 of the North American Agreement on Environmental Cooperation ("NAAEC"), the Center for Biological Diversity, Pacific Coast Wild Salmon Society, Kwikwasu'tinuxw Haxwa'mis First Nation and Pacific Coast Federation of Fishermen's Associations (petitioners) submit the following petition to the Secretariat of the Commission for Environmental Cooperation, asserting that Canada is violating and failing to effectively enforce the Canadian Fisheries Act (R.S.C. 1985 c. F-14), contrary to its obligations under the NAAEC. The petitioners seek a finding that Canada is violating and failing to effectively enforce the Fisheries Act by allowing salmon feedlots to degrade wild salmon habitat and erode the capacity of the British Columbia ecosystem to support wild 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. Despite mounting evidence of harm to British Columbia's wild salmon runs and severe threats to wild salmon in Canada and the United States, Canada has permitted more than 100 commercial salmon feedlots 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 waste. The potential for British Columbia salmon feedlots to introduce, amplify and spread pathogens 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.

This petition details the best scientific knowledge about the threats and impacts of parasites and disease from salmon feedlots. It also chronicles public reaction to the crisis and failed attempts to address the problem. The petition provides background on the impacts of fish feedlots in British Columbia on wild salmon and the intensifying threats of disease and parasites caused by inappropriately sited aquaculture. Finally, it outlines the failure of Canada's Department of Fisheries and Oceans and the provincial British Columbia government to act in accordance with Canadian law to protect wild salmon populations, and details how these government entities are actually promoting expansion of harmful salmon feedlots. The need for immediate action is even more urgent with the recent discovery of the deadly salmon virus, Infectious Salmon Anemia, in wild Pacific salmon for the first time.

When a country that is a party to the North American Trade Agreement fails to enforce one of its own environmental laws, a party may petition the NAAEC Secretariat to develop a factual record on the matter. Canada's Fisheries Act prohibits the harmful alteration, disruption or destruction of fish habitat (Section 35) and the addition of deleterious substances to fish habitat (Section 36). The Canadian government has failed to enforce these sections of the Fisheries Act by allowing salmon feedlots to plague wild salmon habitat with amplified levels of parasites, potentially devastating diseases and harmful toxins. The petitioners request the preparation of a factual record due to ongoing harm to wild salmon and their interests in healthy wild salmon runs, and to advance the goals of the North American Agreement on Environmental Cooperation.

STATEMENT OF FACTS AND LAW

A. Commercial Salmon Aquaculture in British Columbia

Salmon "farming" began in British Columbia ("B.C.") in the early 1970s, though large-scale commercial aquaculture took hold in the late 1980s. B.C. 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 the most common commercially produced aquaculture species in B.C., 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 B.C. salmon feedlots.

B.C. salmon feedlots 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. Aquaculture pens of 1,000 square meters can house 35,000 to 90,000 mature fish, depending on fish size and species (Keller and Leslie 1996; WWSS 2004). Stocking densities at fish feedlots typically range from 8 to 18 kg per cubic meter for Atlantic salmon and 5 to 10 kg per cubic meter for chinook salmon (EAO 1997). DFO states that a typical salmon feedlot in B.C. operates 6 to 24 net cages that contain between 35,000 and 50,000 fish per cage; thus holding from 210,000 to 1.2 million fish (DFO 2012).

Confined salmon are fed concentrated fish feed, commonly soaked in chemical treatments and antibiotics designed to remedy parasite infestations (such as sea lice) and bacterial infections. Any unconsumed feed, excrement, pesticides and antibiotics pass through the pens and enter the surrounding environment. Decapod crustaceans such as crabs, lobsters, prawns and shrimp, which are important scavengers in wild salmon habitat, tend to be drawn to accumulated discharge on the seabed beneath finfish aquaculture operations (Bright and Dionne 2005).

Salmon "farms" are essentially concentrated animal feedlots that are offshore, releasing all wastes into the ocean. In B.C., salmon feedlots are universally located in calm waters of protected channels and bays on salmon and herring migration routes traveled by wild salmon during their breeding season and by juvenile salmon making their journey from spawning streams to the sea. Thus, almost all south coast B.C. salmon are exposed to salmon feedlot effluent twice in their life cycle. In addition, many species of salmon smolts will spend their first winter in the protected inlets and bays used by salmon feedlots, subjected to the salmon feedlot pollution, disease and parasitic infestation when they are most vulnerable. Because of the presence of fish feedlots, waters that were once both a nursery and sanctuary to juvenile wild salmon are now riddled with pollution, chemicals, disease and parasites.

B.C. salmon feedlots 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 B.C. in 2009 were Atlantic salmon. The remainder are chinook or coho (BCSFA 2003; WWSS 2004). Fisheries and Oceans Canada ("DFO") began permitting importation of Atlantic salmon eggs into B.C. 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. In 2004, the Canadian Fish Health Protection Regulations were waived to allow eggs from Iceland that did not meet these regulations.

As of 2009, salmon feedlots were operating at more than 130 sites (tenures) in B.C., with over 85 feedlots active at any given time. Most (92%) of the B.C. salmon aquaculture industry is controlled by three Norwegian corporations. In 2009 these fish feedlots occupied a combined total of 4,575 hectares (OMFB 2009). More than half (61%) of the tenures (84) are on eastern Vancouver Island and the mainland coast, 35% (48 tenures) are on western Vancouver Island, and 4% (6 tenures) are on the central coast. The Canadian federal government, B.C. provincial government and the aquaculture industry have indicated they would like to double feedlot salmon production in B.C. over the next decade, with attendant environmental hazards spreading far beyond the surface area of the feedlots.

B. Fish Feedlot Transmission of Disease

Salmon feedlots pose the serious threats of introducing, amplifying and transferring diseases from feedlot fish to wild fish. As long as open-net pens are used which allow constant exchange of water to the marine environment and salmon are crowded into confined areas, diseases will likely be exchanged between feedlot and wild salmon. Four major infectious diseases commonly infect salmon in industrial aquaculture 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 feedlots worldwide.

BKD is a chronic systemic bacterial condition of salmon caused by *Renibacterium salmoninarum.* Infection can result in significant mortalities in both wild and feedlot salmon, and BKD affects fish in freshwater and seawater environments. Nearly all age groups of fish can be affected, although the disease is rare in very young fish. Losses are generally chronic, occurring over an extended period. BKD is a leading cause of death to feedlot chinook and coho, and a serious danger to wild pink, sockeye, and chum salmon (Keller and Leslie 1996). The first BKD outbreak in feedlot salmon in Scotland was recorded in 1976. It has since been found in salmon feedlots around the world. BKD is frequently reported by BCMAL in B.C. salmon feedlots.

IHN is a virus that affects both wild and feedlot salmon. The virus carried is by adult wild salmon without visible symptoms, but is particularly dangerous to juvenile wild sockeye (Traxler et al. 1998). Chinook, coho and rainbow trout can also contract the virus, and Atlantic salmon, which have little natural resistance, are particularly susceptible (Gardner and Peterson 2003). IHN has caused two extensive disease epidemics in B.C. on the largest wild salmon migration route (StHilaire et al. 2001; Saksida 2006).

Furunculosis is a highly infectious disease caused by the bacterium *Aeromonas salmonicida*, Both Atlantic and Pacific salmon are susceptible to this disease at all stages of their lifecycle. It causes large boils to appear on the surface of the skin. In 2005 furunculosis killed 1.8 million Atlantic salmon smolts at a single commercial salmon hatchery on Vancouver Island. The disease occurs in salmon feedlots throughout Scotland, Norway, Canada, the Broughton Archipelago in B.C., and Washington State.

Many have long feared that B.C.'s salmon aquaculture industry poses the possibility of an outbreak of the highly contagious ISAv, a marine influenza virus. This deadly disease has appeared in many places where salmon are raised in open net-cage aquaculture. ISAv was first detected in Norway in 1984. Since then, it has spread to the Faroe Islands, Scotland, eastern Canada and the United States.

In 2007 an ISAv outbreak among Chilean salmon feedlots became an epidemic leading to the death or destruction of 70% of the country's feedlot salmon. The Chilean ISAv outbreak was from a virus strain from Norway (Vike et al. 2009). Norway exports large amounts of Atlantic salmon embryos every year to Chile, and there is no wild counterpart of this ISAv strain in the Americas. A 1996 outbreak of ISAv in eastern Canada required killing 9.6 million feedlot salmon in New Brunswick. There is no cure for ISAv. Once it strikes, a feedlot's entire stock usually must be destroyed since the virus has never been successfully eliminated from infected populations.

The B.C. aquaculture industry has stated that they have never found one case of ISAv in B.C. salmon feedlots among the mere 600 to 800 fish they claim to test each year. However, aquaculture industry documents entered into evidence in 2011 during the Cohen Commission Inquiry (a recently completed Canadian government inquiry into the causes of the Fraser sockeye salmon declines) revealed that symptoms of ISA were detected in feedlot fish over one thousand times since 2006 (Morton 2011). In Canada, ISAv only became a "federally reportable disease" in 2011, meaning that now all suspected or confirmed cases must be immediately reported to the Canadian Food Inspection Agency (CFIA). Yet over 1,100 reports by a B.C. aquaculture veterinarian of "classic lesions" associated with ISAv were never reported to the CFIA (Morton 2011). Evidence presented at the Cohen Commission in 2010 revealed that DFO scientists and the Atlantic Veterinary College in Prince Edward Island detected signs of ISAv as long ago as 2002 in 117 wild salmon from the Bering Sea in Alaska to Vancouver Island in Canada, but the Canadian government neither fully investigated nor allowed a draft research paper on the findings by a DFO researcher be published. There is no evidence Canada informed the U.S. that salmon caught in Alaska tested ISAv positive even though it is an internationally reportable disease per the World Animal Health Organization, of which Canada is a signatory nation.

In 2011, ISAv was detected in four species of wild Pacific salmon from two different salmon generations, 600 km apart in B.C. At the Cohen hearings, testimony was provided on ISAv in feedlot chinook salmon and in 2007 out-migrating juvenile Fraser River sockeye, the age class that crashed in 2009. If this disease is exotic and spreads throughout wild salmon populations, the consequences could be devastating to all wild salmon runs, not just in B.C., but throughout the Pacific Coast. Sockeye salmon smolts were collected in B.C. in early 2011 as part of a long-term study on the collapse of Rivers Inlet sockeye populations. The study was led by Simon Fraser University. Forty-eight sockeye smolts collected were noted to be noticeably thin and samples were sent for analysis to the world-accredited World Animal Health ISAv reference laboratory at the University of Prince Edward Island. Two of the 48 smolts tested positive for the European strain of ISAv. The CFIA and DFO also tested the same 48 sockeye samples, but had only gill tissue, while the lab that found the virus had heart tissue.

CFIA and DFO announced in November 2011 they found no sign of ISAv in the samples, publicly proclaiming that fears of the deadly disease spreading are unfounded. Yet the CFIA acknowledged the samples had been captured and stored for other purposes and were in such poor condition and degraded over time such that no definite conclusions could be drawn. At the Cohen Inquiry, the DFO researcher who did the testing corrected these public statements, testifying there was one weak positive, but that the samples were so degraded results could not confirm presence or absence of the virus (See Cohen Inquiry Final Arguments by lawyer Greg McDade). DFO and CFIA acknowledged that more testing is needed before any conclusions are drawn, yet made unfounded public statements concluding the virus is not in B.C. DFO and CFIA have so far not gone back to the places where the positive tested fish came from to take further and better quality samples. The fact that further testing of the degraded samples could not confirm the initial results showing presence of ISAv does not

negate the positive results. Furthermore, independent testing of the samples by a Norwegian laboratory found one weak positive result among multiple tests of the sockeye, despite poor sample quality. Fresh samples of adult coho, chinook and chum salmon from a tributary of the Fraser River subsequently sent to the World Animal Health Lab produced three more positive results, suggesting ISAv is indeed present in wild populations of Pacific salmon. Particularly disturbing is that researchers examining only 60 fish found ISAv in two different fish generations, 600 kilometers apart, in four different salmon species.

Viruses such as ISAv are known to mutate in the culture environment and the presence of this pathogen could potentially harm wild salmon runs in B.C. and beyond, since most runs and species of Pacific salmon co-mingle in the ocean as adults. The mother strain of ISAv, known as HPR0, can be detected but cannot be cultured. The legal definition of ISAv in Canada includes culture and so by definition this strain of ISAv is not recognized. Scientists reports HPR0 mutates and becomes virulent in response to a high density captive environment, such as in the fish feedlots. Failure by the government of Canada to act on the ISAv threat without delay potentially jeopardizes the health of every other wild salmon run along the Pacific Coast, as well as the entire West Coast fishing industry.

The only rational response to the likely discovery of this deadly virus in B.C. waters is to immediately initiate comprehensive, independently-audited testing of wild salmon, feedlot salmon, hatchery and other fish that could be infected (such as herring and pilchard) to determine the extent of the virus; conduct the testing necessary to track the source of the disease; immediately cull all fish in any feedlot site where fish test positive for ISAv; remove salmon feedlots from the narrow passages used by the Fraser River and other salmon; fast-track the development of closed containment systems for salmon aquaculture; and present a firm, expedited timeline for phasing out all open net-cage operations. Unfortunately, this has not been the response of the Canadian government, DFO or the provincial B.C. government. The Aquaculture Coalition submitted evidence before the Cohen Commission that ISAv is present in B.C. and that the federal government does not take a precautionary or responsible approach to the risk and presence of disease in salmon in B.C. This evidence is attached as Exhibit A.

Meanwhile, U.S. Senators from Washington, Oregon and Alaska, recognizing the severe threat to U.S. salmon runs, have taken the right step with a legislative amendment calling for study of the possible impacts the infection might have on the Northwest Pacific's fishing industry. U.S. agencies, including the Department of Agriculture, along with Canadian and American Indian tribes, are developing plans to conduct more tests, trace the origin of the disease and find ways to combat it.

C. Fish Feedlot Amplification of Sea Lice

Natural populations of sea lice seldom harm wild salmon; however, salmon feedlots 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 to millions of fish in small pens in confined waters makes fish feedlots ideal breeding grounds for parasites such as sea lice, and drastically increases the number of lice in surrounding waters. B.C.'s salmon feedlots are universally located in coastal waters within only a few kilometers from the mouths of salmon rivers, allowing lice to easily travel from adult feedlot salmon to susceptible wild fry and smolts. Salmon feedlots anchor anomalously large and stationary populations of adult salmon, which are collectively infested with extraordinary numbers of sea lice, directly in the migratory corridors of juvenile wild salmon. Even low numbers of lice per fish add up to considerable numbers of lice per feedlot, with up to a

million salmon hosts. Numerous researchers have demonstrated that salmon feedlots in B.C. dramatically increase the infestation rates of parasitic sea lice in wild salmon (Morton et al. 2004; Krkosek et al. 2005; Krkosek et al. 2007; Mages and Dill 2008; Morton et al. 2008; Krkosek et al. 2009; Connors et al. 2010a, 2010b; Krkosek et al. 2010; Price et al. 2010; Krkosek et al. 2011; Price et al. 2011).

Additional information on salmon feedlot amplification of sea lice is attached as Exhibit B.

D. Fish Feedlot Impacts from Toxic Chemicals, Pollution and Escaped Invasive Fish

Fish feedlot salmon are held in flow-through nets and cages that allow fish waste and added chemicals used in industrial salmon feedlot operations to freely pass into marine waters. Salmon feedlots add drugs such as antibiotics and therapeutants to salmon feed, and chemicals such as antifoulants, pesticides and disinfectants are also released into the environment by feedlots in an attempt to control unwanted organisms and diseases. Salon feedlots in B.C. use the neurotoxic chemical emamectin benzoate, trade named SLICE, to treat infestations of sea lice, despite evidence it is deleterious to natural fish habitat. Salmon feedlots also pose the risk of escape of non-native fish from pens, with impacts 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 food and habitat. Additional information on toxic chemicals, pollution and escaped invasive fish from salmon feedlots is attached as Exhibit C.

E. Fish Feedlot Links to Declining Salmon Populations

Like all natural fish populations, wild salmon are subject to some fluctuation. However, salmon runs in B.C. have not historically suffered the same declines as many runs in the United States. Severe declines of B.C. wild salmon returns began in the early 1990s, leading to an outright moratorium on new salmon feedlot licenses in 1995. In 1997 the Canadian government commenced a Salmon Aquaculture Review, which erroneously concluded that the risks salmon feedlots pose to the environment are low (EAO 1997). This review preceded the major outbreaks of sea lice in B.C. salmon feedlots, did not fully investigate the impacts feedlots have upon wild stocks, and overlooked the fact that wild salmon are in decline wherever salmon aquaculture is conducted in marine net pens (Ford and Myers 2008). 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 feedlots.

Numerous studies show that lice infestations associated with salmon feedlots may have depressed wild salmon populations and placed them on a trajectory toward rapid local extinction and that salmon feedlots can cause parasite outbreaks that erode the capacity of a coastal ecosystem to support wild salmon populations. Studies in Europe concluded that "reduction of wild salmonid abundance is also linked to other factors but there is more and more scientific evidence establishing a direct link between the number of lice-infested wild fish and the presence of cages in the same estuary" (European Commission 2002).

For years, the Canadian aquaculture industry and government have insisted that sea lice in salmon feedlots are not a threat to wild salmon, yet an overwhelming body of scientific studies suggests the opposite: sea lice are dangerous and harmful to wild salmon. DFO has dismissed studies linking sea lice and salmon feedlots to wild salmon declines, noting the many potential sources of at-sea mortality for salmon (DFO 2009a). Such explanations for salmon declines offered by DFO include

climate change, ocean pollution, over-fishing and habitat destruction. However, pointing out these global problems does not negate established links between sea lice, disease and fish feedlots and wild salmon population declines.

Broughton Archipelago

In the Broughton Archipelago, a group of islands north of Johnstone Strait off the northeast coast of Vancouver Island, sea lice from salmon feedlots are implicated in the collapse of the 2002 pink salmon run (PFRCC 2002). More than 3.6 million pink salmon returned to spawn in 2000 and similar numbers were expected in 2002, yet only 147,000 salmon returned. Though wide fluctuations in pink salmon populations are natural, analyses conducted by both DFO and the PFRCC showed that the Broughton collapse was not "natural" (PFRCC 2002). There was evidence the Broughton's population of juvenile wild salmon was infested with sea lice, a condition essentially unreported previously for juvenile wild salmon in the natural environment elsewhere in B.C. (PFRCC 2002). There is increasing evidence the 2002 pink salmon collapse likely stemmed from a massive kill of outward migrating juvenile pink salmon in 2001 caused by sea lice originating in local salmon feedlots. Broughton has B.C.'s densest concentration of fish feedlots, with 29 feedlot tenures; 17 of them were active in 2003 (MAFF 2003). Most of the feedlots are located directly on salmon migration routes (LOS 2003). Evidence suggests juvenile pink salmon were infested with sea lice during their outward migration, when the threat from sea lice is normally low, because adult salmon are normally scarce at that time of year. Salmon feedlots made sea lice available precisely when juvenile pink salmon were most vulnerable (PFRCC 2002). Other populations of pink salmon in waters near Broughton did not plummet in 2002 and generally increased in abundance, which suggests that the cause of the decline originated in the waters of the Broughton (PFRCC 2002).

Juvenile pink salmon emerge from stream gravels in late winter and early spring, and almost immediately start making their way to the ocean. They are only 3.5 cm long when they reach salt water and weigh only 0.3 grams (Heard 1991; Morton et al. 2004). They live in the shallow, productive waters of estuaries and coastlines, where plentiful food allows them to grow rapidly before migrating farther out to sea (Scott and Crossman 1973). During their initial stages in the sea, juvenile pink salmon rely heavily on shallow, food-rich, coastal saltwater zones. Brackish estuaries are especially important as they provide ideal conditions for adapting to salt water. Shallow coastal waters also offer protection from predators and strong ocean currents. After several weeks feeding on plankton, juvenile pink salmon migrate to sea, where they stay for 12–16 months (Scott and Crossman 1974; Healy 1980; Godin 1981) Of the Broughton's 27 feedlot tenures, 16 were located directly in the path of migrating juvenile pink salmon (LOS 2003).

Though juvenile pink and chum salmon are most susceptible to sea lice, coho and chinook salmon as well as sea-run cutthroat and steelhead trout in Broughton are also at risk of lice infestations, especially out-migrating juveniles (Johnson and Albright 1992; Nagasawa et al. 1993; Johnson 1998; Fast et al. 2002). A study found that 90% of juvenile pink and chum salmon near Broughton salmon feedlots were infected at or above lice loads considered to be lethal (Morton et al. 2004). Other Broughton research found 28% of juvenile pink and chum salmon infected with lice (Jones and Hargreaves 2007). Krkosek et al. (2011) analyzed recently available sea lice data on feedlots and spawner–recruit data for pink and coho salmon populations in Broughton and nearby regions where feedlots are not present; sea lice abundance on feedlots is negatively associated with productivity of Broughton's pink and coho salmon.

Fraser River

The Fraser sockeye fishery is Canada's most valuable, accounting for nearly half the economic value of all salmon caught in B.C. Most Fraser sockeye runs immediately went into steep decline in 1992 when salmon feedlots were placed on the sockeye migration route. Sockeye runs from the Fraser River watershed plummeted throughout the 1990s and 2000s, and some runs are now on the brink of extinction. However, only the sockeye runs that migrate through water used by salmon feedlots have experienced a decline in productivity. In contrast, the Harrison sockeye run, which migrates out to sea via the Strait of Juan de Fuca around the Southern tip of Vancouver Island - avoiding all the fish feedlots - is the one Fraser run with above average returns the past two decades, while productivity of all other stocks plummeted.

Dr. Alexandra Morton of the Pacific Coast Wild Salmon Society summarized the current scientific knowledge regarding causes of the escalating pre-spawn mortality of Fraser River sockeye salmon in an August 2011 publication for the Aquaculture Coalition, titled *What Is Happening to the Fraser Sockeye?* The report, which relies on documents submitted to the Cohen Commission, notes that only sockeye which migrate through salmon feedlots on the narrowest portion of the Fraser sockeye migration route off eastern Vancouver Island are fluctuating unpredictably. In contrast, there are healthy sockeye runs in the Columbia River, western Vancouver Island (which migrate through Port Alberni Inlet where there are no salmon feedlots), and even in Harrison River sockeye (which originate from the Fraser River but avoid the clusters of salmon feedlots by migrating to sea around southern Vancouver Island). Fraser sockeye appeared to be dying of pathogens that originated in salmon feedlots on the Fraser sockeye migration route, and the geography, pathology, fluctuations and timing all fit perfectly. This report is attached as Exhibit D.

F. 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 often used 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.

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 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 introduction of particular harmful substances into fish habitat, and has exercised that authority more than once. For example, the Cabinet enacted regulations authorizing introduction of harmful substances from pulp and paper effluents, metal mines, petroleum refineries, and meat, poultry and potato processing plants. Conspicuously absent is any regulation authorizing introduction of emamectin benzoate, or SLICE.

ARGUMENT

A. The Canadian Government Has Failed to Enforce the Fisheries Act

The Canadian Government is failing to effectively enforce the Fisheries Act by failing to conserve and protect wild salmon. Specifically, the Canadian government is failing to enforce sections 35 and 36 of the Fisheries Act.

1. Violations of Section 35

DFO is failing to enforce § 35 of the Fisheries Act by not ensuring that salmon aquaculture does not harmfully alter, disrupt, or destroy fish habitat. Fish habitat includes components of the environment upon which fish directly or indirectly depend in order to carry out their life processes. Juvenile wild salmon depend on the safety and habitability of the B.C. coastlines to gain size and strength enough to contend with the currents and predators of the open ocean. Thus, the B.C. coastline is fish habitat that should be protected by the DFO. However, DFO has allowed over 100 salmon feedlots to

operate in this same habitat, despite the fact that salmon feedlots 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 millions of sea lice infested salmon in pens along wild salmon migratory corridors, salmon feedlots 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 feedlot 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 feedlot is responsible for creating harmful alteration, disruption, or destruction of fish habitat, each feedlot in operation must be authorized by DFO. In 2009, there were more than 130 salmon feedlot sites in operation B.C. The productive capacity of fish habitat is suffering great losses as evidenced by the millions of missing wild salmon from B.C. 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 aquaculture or closed-containment tanks. Closed containment uses barrier technologies that ensure no contact between wild and aquaculture 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 aquaculture 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 feedlot 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 feedlots 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 B.C. wild salmon. By failing to authorize harmful alteration, disruption, or destruction of fish habitat for each individual salmon feedlot 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 feedlots, 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 feedlot 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 feedlot 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. Wild salmon get their pink color from carotenoids in decapods such as krill. A negative impact on these species can harm wild 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 feedlots 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 feedlot 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.

B. Previous Attempts to Address the Problems Associated with Fish Feedlots Domestically Have Failed

Wild salmon have long been at the heart of both the history and culture of Canadian coastal dwellers. First Nations, local communities, fishermen and environmentalists in Canada have long attempted to get the federal and provincial governments to address the impacts of salmon feedlots in B.C., due to concern about impacts to wild salmon. Extensive, ongoing scientific evidence about the threats feedlot salmon pose to wild salmon and DFO's failure to protect wild salmon populations has drawn extensive public notice and alarm in Canada. Public concern over the impact of B.C.'s salmon feedlot disaster is not confined to B.C.

The protection of wild salmon is primarily the responsibility of Fisheries and Oceans Canada ("DFO"). DFO's mandate to manage and protect fisheries resources includes responsibility for marine and freshwater environments. Yet DFO has also been mandated to promote aquaculture in Canada, which undermines its ability to protect wild salmon. DFO appears to be unwilling and unable to enforce the Fisheries Act (See Morton v. Marine Harvest Canada Inc., 2009 BCCA 481 (CanLII); BC Aquaculture Regulation 78/2002; Fisheries Act, RSBC 1996, c 149).

At present, Canada's federal government and the B.C. provincial government both support, promote and favor the continuation and expansion of the open net-cage salmon aquaculture industry. Despite abundant scientific evidence that use of this technology is unsustainable and is implicated in the decline of wild salmon stocks and other environmental hazards not just in B.C., but worldwide, both governments continue to advocate for and support the continuation and expansion of open net-cages. Published, peer-reviewed research on the impacts of net-pen aquaculture on ecosystems is debated and dismissed by DFO while scientists, businesses and management regions around the world increase their acceptance of the scientific weight of evidence and are taking steps to address these same impacts.

The regulatory regime governing aquaculture in Canadian coastal waters has failed to address some of the most fundamental aspects of the industry's impacts on the marine environment and on coastal communities for over 25 years. Public confidence in the ability of the Canadian government to protect wild fish and the marine ecosystems upon which many sectors depend has been substantially eroded by continued reliance on scientifically weak regulatory measures, failure to objectively investigate knowledge gaps and the absence of a process for resolving conflicts among resource users affected by net-pen aquaculture. Basic requirements for sound management, such as science-based regulations, are largely absent for Canadian net-pen aquaculture. While the industry is dominated by global companies, global best practices are not implemented in Canada. The B.C. provincial government, Canadian government and DFO have made a huge mistake by allowing industrial feedlots onto the path of every significant wild salmon migration of southern B.C., in contravention of international warnings, their own studies and recommendations going back 20 years. A detailed account of previous failed attempts to address fish feedlot impacts on wild salmon is attached as Exhibit E.

C. The CSEM Procedure is Needed to Address Violations

The Citizen Submission on Enforcement Matters ("CSEM") process under Articles 14 and 15 of the North American Agreement on Environmental Cooperation (NAAEC) is the primary tool by which citizens may file a submission for environmental enforcement matters under NAFTA (CEC 2007). The CSEM process allows any "non-governmental organization or person…residing or established in the territory of a Party" (Mexico, U.S. or Canada) to make submissions to the NAAEC Secretariat asserting "that a Party is failing to effectively enforce its environmental law." The CSEM submission process can lead to the development of a factual record. A factual record seeks to provide detailed factual information allowing interested persons to assess whether a Party is failing to effectively enforce its environmental law in connection with the matter raised in the submission.

The petitioners formally request that the NAAEC Secretariat create a factual record pertaining to Canada's failure to enforce its environmental laws in connection with salmon feedlots, parasites, disease and wild salmon declines. This petition and supporting documents provide sufficient information and evidence, not drawn exclusively from mass media reports, to allow the Secretariat to determine whether a factual record should be developed. Evidence is drawn primarily from Canadian government documents and published scientific studies. The CSEM procedure requested is

appropriate and necessary because it is both objective and comprehensive; the two characteristics absent from other ongoing legal and inquiry actions. The CSEM procedure is indispensable for proper resolution of the matter and protection of wild salmon.

PETITIONERS SATISFY THE REQUIREMENTS OF ARTICLE 14

This submission is made pursuant to the CSEM process by the Center for Biological Diversity, Pacific Coast Wild Salmon Society, Kwikwasu'tinuxw Haxwa'mis First Nation and Pacific Coast Federation of Fishermen's Associations.

The Center for Biological Diversity is a non-profit, public-interest conservation organization dedicated to the protection of endangered species and wild places. The Center is a U.S. non-profit corporation incorporated under the laws of the State of New Mexico. The Center "resides" in the State of Arizona. The Center has offices across the U.S., including in Tucson, San Francisco, Anchorage, Portland, and Seattle.

The Pacific Coast Wild Salmon Society is a non-profit society engaged in raising public awareness of impacts of salmon feedlots. PCWSS was a participant in the Cohen Commission on the decline of the Fraser sockeye and reviewed thousands of internal government documents on salmon feedlots. PCWSS was also involved in the successful jurisdictional challenge against Canada and the Province of BC that removed provincial management of salmon feedlots as farms and returned them to federal jurisdiction as a fishery.

The Kwikwasu'tinuxw Haxwa'mis First Nation is an indigenous Canadian tribe whose territory is within the Broughton Archipelago, a formerly salmon-rich area of mainland coast, islands and bays east of the northern tip of Vancouver Island. The Kwikwasu'tinuxw Haxwa'mis have long advocated for aquaculture industry reforms to protect wild salmon, since numerous fish farms are authorized by the B.C. Government to operate in their traditional territories.

The Pacific Coast Federation of Fishermen's Associations is the largest trade association of commercial fishermen on the west coast. PCFFA works to assure the rights of individual fishermen and fights for the long-term survival of commercial fishing as a productive livelihood and way of life.

The University of Denver's Environmental Law Clinic is representing the Center for Biological Diversity in this submission. The Environmental Law Clinic provides a real world experience for students interested in environmental law who wish to develop practical legal skills.

The petitioners and their members are suffering harm from Canada's failure to effectively enforce the Fisheries Act with regard to salmon feedlot impacts on wild salmon habitat and populations. The petitioners and their members have commercial, conservation, educational and scientific interests in protecting and restoring wild salmon runs in British Columbia and the United States that are jeopardized by Canada's failure to properly protect wild salmon.

This matter is appropriate for the NAAEC to consider because it meets the CSEM criteria:

- It is in written in English and provides notification to the Secretariat;

- It clearly identifies the petitioners, Center for Biological Diversity, Pacific Coast Wild Salmon Society, Kwikwasu'tinuxw Haxwa'mis First Nation and Pacific Coast Federation of Fishermen's Associations, which are making the submission;
- It provides sufficient information to allow the Secretariat to review the submission;
- It is aimed at promoting enforcement rather than at harassing industry;
- It indicates that the matter has been communicated in writing to the relevant authorities of the Party (Minister of Fisheries and Oceans) by letter and e-mail dated December 29, 2011, in which petitioners explained how Canada is failing to effectively enforce the Fisheries Act by allowing salmon feedlots to harm and jeopardize wild salmon runs (see Exhibit F); and indicates the Party's response (see Exhibit G);
- It is filed by organizations which are established in the United States and in Canada;
- The Secretariat may consider a submission from any non-governmental organization or person asserting that a Party is failing to effectively enforce its environmental law.

CONCLUSION

Salmon feedlots are dangerous to wild salmon because they create a place where viruses, bacteria and parasites can be introduced and 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 B.C. have been linked to diseases and parasites amplified and spread by the salmon feedlots. The findings and recommendations of dozens of government and non-governmental processes and inquiries into poor aquaculture practices and threats from salmon feedlots over the past quarter century have largely been ignored by the Canadian government. As a result, the Canadian government has failed to adequately evaluate, monitor or address the problems and threats caused by B.C.'s salmon aquaculture practices or to enforce the Fisheries Act. For the reasons set forth above, petitioners respectfully request the NAAEC Secretariat to find that this submission satisfies the requirements of Article 14(1) of the NAAEC, merits requesting a response from Canada under Article 14(3), and to develop a factual record on the matter. Please contact us if any additional argument, evidence or documentation would assist the Secretariat in evaluating this submission.

Sincerely,

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The normal distribution is a probability distribution. It is also called Gaussian distribution because it was first discovered by Carl Friedrich Gauss. The normal distribution is a continuous probability distribution that is very important in many fields of science. Normal distributions are a family of distributions of the same general form. These distributions differ in their location and scale parameters: the mean ("average") of the distribution defines its location, and the standard deviation... General Distribution Original: English. Application of safeguards in the democratic peopleâ€™s. Republic of korea. Report by the Director General. * The document has been re-posted on GovAtom and on IAEA.org with the addition of this cover page. Atoms for Peace and Development. Board of Governors General Conference. GOV. 2020/42 The generalized normal distribution or generalized Gaussian distribution (GGD) is either of two families of parametric continuous probability distributions on the real line. Both families add a shape parameter to the normal distribution. To distinguish the two families, they are referred to below as "version 1" and "version 2". However this is not a standard nomenclature.