

**REPLY SUBMISSIONS OF THE AQUACULTURE COALITION  
NOVEMBER 3<sup>rd</sup>, 2011**

**Marine conditions, disease and fish farms**

The Aquaculture Coalition agrees that changes in broad oceanic conditions likely affect the health of Fraser stocks and other wild salmon and contribute to declining productivity. However, the evidence before the Commission in no way establishes that large-scale biophysical changes are the sole cause of the decline in Fraser sockeye. We reply below to several specific points in this regard.

First, marine events or conditions shared across stocks may present challenges to wild salmon survival; however, the *variability* within survival of Fraser stocks (particularly Harrison versus others) and between Fraser and stocks from Washington or the West Coast of Vancouver Island suggest that there are nonetheless variables that are *not* shared by all the migrating wild salmon. The evidence shows that while Columbia and WCVI stocks declined in the early 1990s, their numbers returned by the late 1990s<sup>1</sup>, whereas the majority of Fraser stocks continued to decline. As set out in our main submissions, this variability means that the Commission must take seriously conditions specific to Fraser stocks, including the introduction of fish farms onto the main migration route and the evidence of disease. If poor marine conditions make the salmon more susceptible to disease, but, the fish nonetheless die of disease, then disease is a, or the cause, of death and decline.<sup>2</sup>

Secondly, the Aquaculture Coalition takes issue with Canada, BC and the BCSFA's assertions that broad biophysical changes related to oceanographic conditions caused the decline in Fraser stocks, as though there is hard, definitive evidence to substantiate this hypothesis and their purported contrast of the soundness of that evidentiary basis with what they characterize as speculation or lack of evidence regarding the impact of disease and fish farms.<sup>3</sup> At this point, the impact of broad oceanographic events on Fraser stocks is largely unproven and lacks hard data. It is an assertion made by various scientists based largely on logical assumptions.<sup>4</sup> Nonetheless, there was broad agreement amongst witnesses that knowledge of what Fraser sockeye encounter at sea is extremely limited.<sup>5</sup>

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<sup>1</sup> Ex. 1291, Technical Report 4, p. 143

<sup>2</sup> In this regard, it is significant that the cumulative change in the temperature of the Fraser River, attributable to climate change, since 1950 is 2 degrees. This change is posited to negatively impact sockeye survival. However, the early-entry behavior that began in the mid-1990s puts "late entry" salmon in the river up to 6 weeks earlier when river temperatures are at their summer peak, *at least* 2 degrees warmer than their customary behavior/entry time. The impact (measured by posited effects of warmer temperatures, including heightened stress, energy expenditure and pathogen levels) of this non-adaptive early entry behavior, potentially explained by Miller's MRS research, may be at least as great as the cumulative effect of climate change. Ex. 553, Technical Report 9, p. 39-42, 46, 84, 90-92 and August 24, 2011 Transcript (Miller), p. 97-8

<sup>3</sup> Government of Canada's ("Canada") Final Submissions, paras. 313-316; Province of British Columbia's ("Province") Final Submissions, pp. 115-124; BC Salmon Farmers Association's ("BCSFA") Final Submissions, p. 120

<sup>4</sup> Ex. 1291, Technical Report 4, p. 139-40

<sup>5</sup> Ex. 1291, Technical Report 4, p. 4

The evidence supporting the theory of marine conditions is more tenuous than that suggesting that disease is impacting the health of Fraser sockeye, and, that fish farms pose a significant disease risk. The research into unnatural early-entry behaviour and pre-spawn mortality (PSM) identified in Fraser stocks beginning in the mid-1990s has been going on for over a decade and the effects have been quantified.<sup>6</sup> As well, Dr. Miller's research has identified a genomic signature and posits symptoms consistent with early entry behavior and potentially attributable to a virus – this research may be 'novel', but it is more developed and substantiated than the evidence supporting any other theory. It has been identified in 2009, 2010 and 2011 as a very likely or likely cause of the decline.<sup>7</sup>

Thus Canada's attempt to contrast the 'highly speculative' nature of the Miller virus with the 'consensus' regarding oceanographic conditions<sup>8</sup>; and, BC's assertion that Marmorek's opinion ought to be accepted, otherwise we are left with pure speculation, are suspect.<sup>9</sup> Of course, with regards to the latter, Marmorek was contracted to synthesize evidence and hypotheses. The reliability of his synthesis can be no greater than the evidence, or speculation, on which it is based.

Canada, BC and the BCSFA rely on Dr. Peterman's assessment of declining productivity to substantiate the marine conditions theory. While important, Dr. Peterman's report studied the decline in productivity, measured as recruits per spawners, which, by the definition used, does not account for en route or pre-spawn mortality. Dr. Peterman nonetheless agreed that pre-spawn or en route mortality is having a significant effect on the amount of spawners, in some years reaching 95% mortality. He described it as "an important phenomenon that will affect the total abundance of recruits over the long term".<sup>10</sup> Similarly, as noted in our main submissions, Dr. Miller's research suggests there is an MRS identified with the early entry and PSM phenomenon, which she describes as potentially the "smoking gun" to explain the decline; and, Dr. Hinch also recognized the significance of PSM in the decline of the Fraser sockeye (with Dr. Hinch calling it a "critical contributing factor to decreasing trends in abundance"<sup>11</sup>).

The evidence before the Commission does not show that the unprecedented, unnaturally high levels of PSM identified in Fraser stocks is affecting other stocks along the coast in the same way. The PSM phenomenon and cause of decreased returns appear to be unique to the Fraser system. Thus, while there may be declines in productivity beyond the Fraser and potentially attributable to broader ocean conditions, there is nonetheless compelling evidence of conditions specific to the Fraser stocks associated with the decline starting in 1992.

As set out in our main submissions, the Aquaculture Coalition maintains that the correlation in timing between the drastic decline of the Fraser stocks, the onset of early entry and very high PSM, and Dr. Miller's research relating the MRS/possible virus with early entry and PSM is the

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<sup>6</sup> Ex. 553, Technical Report 9, pp. 38-39, 42

<sup>7</sup> Ex. 614 (Update on Science Review 2009 Fraser Sockeye); Ex. 73 (PSC- Synthesis of Evidence from a Workshop on the Decline of Fraser River sockeye, June 2010), Ex. 1364 (Draft Summary Report- DFO Synthesis Workshop, April, 2011)

<sup>8</sup> Canada's Final Submissions, paras. 305-316

<sup>9</sup> Province's Final Submissions, p. 37

<sup>10</sup> April 20, 2011 Transcript (Peterman), p. 16:4-37, 36:2-30

<sup>11</sup> Ex. 553, Technical Report 9, p. 50

hardest evidence of a specific cause before the Commission and must be given serious consideration. The correlation between these phenomena and the expansion of fish farms on the migration route in the early 1990s must similarly be given significant weight when identifying potential causes and recommending management actions for the future sustainability of the Fraser stocks.

Finally, unless broad biophysical changes in oceanographic conditions are the sole cause of the decline of Fraser sockeye, which the evidence is very far from establishing, then the Commission must consider other hypotheses and risks, particularly those over which DFO Science and management may exercise some control. In this regard, disease remains a leading hypothesis amongst DFO and other scientists; and, the potential link to fish farms is sufficiently established that it demands investigation and management action.

### **Other Diseases**

With respect to diseases (other than Miller virus) and fish farms, Canada emphasizes that pathogens found in fish farms in BC are endemic and found in wild salmon too.<sup>12</sup> As stated in our main submissions, this assertion ignores the imbalance that fish farms create in pathogen dynamics; and, in particular, the role farms can play in amplifying and harboring pathogens such that wild salmon are at a greater risk of exposure.

Moreover, it is difficult to sustain the assertion that all diseases are endemic when research into wild salmon disease is so minimal and reporting and research for disease in fish farms generally does not probe the cause of unidentified symptoms (the “open diagnosis” in the fish health audits being an example of the latter).

To refute the possibility that plasmacytoid leukemia could be an issue, or traceable to fish farms, the Province asserts that even if fish in farms had plasmacytoid leukemia, it would not be reported or addressed under the fish health management regime because “there is no treatment for plasmacytoid leukemia.”<sup>13</sup> Such reasoning belies the inadequacy of the fish health reporting system both as a reliable indicator of disease and a management tool.

With respect to Infectious Salmon Anemia, or ISA, Canada, BC and BCSFA variously deny that ISA is present in BC, rely on the egg/smolt testing regime to assure the Commission that it will not be introduced here, and posit that, even if the disease is here, it is not associated with fish farms and does not affect sockeye salmon.<sup>14</sup> In our main submissions, we identified inadequacies in the policy and practice of testing eggs and fish. Here, we note in reply to the assertion that the 4,726 PCR tests done over 8 years is a sound basis to conclude that there is no ISA in fish farms<sup>15</sup>, that this number represents just a fraction of a percent of the upwards of 30,000,000 fish raised in fish farms in BC each year. It is not adequate and provides no assurance that there is no

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<sup>12</sup> Canada’s Final Submissions, paras. 313-316, 674; BCSFA (p. 9 and with respect to specific diseases) and the Province (with respect to specific diseases) also note the endemic nature of diseases found in fish farms.

<sup>13</sup> Province’s Final Submissions, page 131

<sup>14</sup> Canada’s Final Submissions, para. 668; Province’s Final Submissions, pp. 104-112; BCSFA’s Final Submissions, pp. 127-132

<sup>15</sup> Province’s Final Submissions, pages 104-112.

ISA. With respect to the assertion that ISA does not cause disease in sockeye, the research into ISA in sockeye salmon is so scant, that it is no basis for such assurances or for risk assessment. ISA has been found to infect sockeye and has infected Pacific coho in Chile.<sup>16</sup>

Recent testing suggests that ISA is found in multiple species of Pacific salmon, including sockeye, in British Columbia waters. At present the extent of ISA in BC is not known. The Aquaculture Coalition urges the federal government to prioritize investigating the extent of ISA in wild and farmed salmon and putting in place an immediate, large-scale precautionary response.

ISA is not endemic to BC; and, if here, was introduced by human activities- i.e. egg imports/aquaculture.<sup>17</sup> The Aquaculture Coalition reiterates that the risk associated with egg imports is too great to be acceptable in light of the placement of fish farms on salmon migration routes.

### **Precautionary principle**

Both BC and the BCSFA assert that the evidence is that fallowing has had no demonstrated effect on health of wild salmon.<sup>18</sup> They refer to studies regarding fallowing in relation to sea lice in the Broughton Archipelago. However, there is further relevant context to the fallowing in the Broughton. Prior to the widespread use of SLICE to minimize sea lice levels in farms (post-2002), fallowing did have a positive effect on sea lice levels and wild (pink and chum) populations in the Broughton. Once SLICE was widely used, lice levels were controlled in farms such that the consequent impacts of stocked or fallowed farms on wild fish would be negligible in this respect. Of course, for other pathogens for which there is no effective treatment, including plasmacytoid leukemia and ISA, pharmaceuticals cannot be relied on to control impacts; and, we submit fallowing would indeed have a positive impact, though not as certain as permanent removal of farms from the wild salmon habitat. Siting of farms remains the most powerful tool at the disposal of the government to manage impacts to wild stocks.<sup>19</sup>

Contrary to BCSFA's assertion, fish farms do not relieve pressure on wild salmon.<sup>20</sup> It is conjecture that the availability of farmed fish means less wild salmon are harvested. There is no evidence that (market) demand for wild salmon factors into DFO management decisions regarding harvesting at all. If anything, relatively inexpensive farmed salmon puts downward pressure on the price of wild salmon, meaning that commercial fishermen need to harvest more wild salmon to make a living than they otherwise might. The evidence before this Commission

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<sup>16</sup> Ex. 1502, Vike, Nylund, "ISA Virus in Chile: Evidence of Vertical Transmission"

<sup>17</sup> The statement by Dr. Sheppard in his 2007 Briefing Note that ISA would come from migrating Pacific salmon as there are no egg imports is clearly wrong. This memo cannot be re-written to change the erroneous factual assertions on which Dr. Sheppard's statement are based; and, BCSFA's proposal to do so ought to be rejected. (see BCSFA's Final Submissions, p. 131)

<sup>18</sup> Province's Final Submissions, pp. 90-93; BCSFA's Final Submissions, pp. 60-61

<sup>19</sup> BCSFA's submission (at p. 93) that the evidence does not support the moratorium on fish farms on the North Coast and that moratorium should be abandoned is unsustainable; and, any recommendation in this regard is beyond the mandate of this Commission, which is to focus on the Fraser stocks.

<sup>20</sup> BCSFA's Final Submissions, p. 52

supports the conclusion that aquaculture increases pressure on wild stocks by taking up, altering, and adding significant risk to fish habitat. Any assertion to the contrary ought to be rejected.

The evidence before the Commission is that: where there are fish farms (worldwide), there are pathogen issues for wild stocks<sup>21</sup>; there are at least 30 reported events of diseases of high-risk to wild salmon in BC fish farms each year; and Fraser sockeye demonstrating non-adaptive early entry behaviour show signs of abnormal genomic conditions and potentially disease. It is also a fact that early entry, high levels of PSM, the decline of Fraser sockeye, and the expansion of fish farms all coincide in time. Further, it has become clear that there are significant knowledge gaps regarding disease levels in wild and farmed fish; and, in the interplay between these two. The Aquaculture Coalition reiterates that, in light of the current state of knowledge, and federal regulatory and management practices<sup>22</sup>, aquaculture poses too great a risk to declining Fraser sockeye. The presence of over 100 fish farms on the Fraser sockeye migration route is contrary to the precautionary principle, is the cause of great concern to the Canadian public, and is unacceptable.

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<sup>21</sup> We refer to our main submissions for a review of the evidence in this regard. On a related note, Canada's assertion that Dr. Morton holds a contrary view with respect to the potential negative effect of sea lice to experts misconstrues Dr. Morton's research and evidence, which fairly assesses differing risks dependent on life stage, farm conditions and other factors. This is consistent with experts, DFO scientists (even Dr. Jones agrees that lice can negatively affect salmon- see Ex. 1770), and international observation and opinion. Also see Ex. 1476 (Price) re: sockeye. Canada's assertion, at para. 677, that Dr. Morton's report contains many factual errors is unsubstantiated. Canada's Final Submissions.

<sup>22</sup> Though in their submissions, Canada asserts that the new federal regulatory scheme for aquaculture will be based on environmental assessments and will ensure against negative impacts from fish farms, past (grandfathered) siting decisions were made on DFO's assessment that there was no or low pathogen risk from farms. DFO has not demonstrated a shift in that risk assessment going forward nor a change in how their evaluations will occur (other than removing the possibility of s. 35 HADD reviews). See Canada's Final Submissions, paras. 663-675. Canada's submission, at para. 681, that there has been no disease outbreak since 2002 may be true if an "outbreak" is defined as the death of 12 million fish (as was the case with the IHN outbreak in 2002). However, there are many documented fish health events and unknown frequency of unreported and/or undiagnosed disease and mortalities every year. Disease in farms, and impacts to wild salmon, cannot be prevented by the fish health management regime. Siting of farms and review for impacts to wild salmon are discussed in more detail in our main submissions.