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Dear Wild Salmon Advisory Council,

We applaud BC's emerging leadership on Pacific salmon and conservation. We thank Premier Horgan for his leadership on this issue and for the Advisory Council's hard work in putting together the Options paper. We are scientists from Simon Fraser University who study BC's salmon, their ecosystems, and their fisheries. We are also members of the broad community of people that deeply care about salmon populations and their roles in coastal communities, economies, and ecosystems.

The Options Paper accurately outlines some of the challenges facing BC's wild salmon and the diverse people that rely on wild salmon for food, economic livelihood, and culture. For example, the council is rightfully focusing on wild salmon as defined by Canada's Wild Salmon Policy, the most scientifically defensible definition of "wild salmon". It also is our assessment that the three over-arching goals are appropriate. Here we offer our reaction and suggestion in response to the Option Paper. First, we describe the serious scientific inaccuracies regarding the quantification of risks of artificial propagation to wild salmon. Second, we offer a series of specific recommendations for your consideration.

***The Science of Hatchery Impacts on Wild Salmon.*** The Options Paper recommends to "*Increase the production of juvenile salmon under controlled conditions*" (Strategy 1.3) and justifies this recommendation by stating that "*[a]t present, research is inadequate to address the potential competition of salmon on the high seas, including between species and/or between countries of origin.*" This statement is scientifically incorrect. The science is clear—hatcheries have repeatedly show to seriously harm wild populations at both broad and local scales. At broad scales, there now is a convincing body of research demonstrating that large-scale production of hatchery fish has caused fish to exceed the ocean's carrying capacity (there now is higher numerical abundance and biomass of salmon in the North Pacific Ocean than at any time since 1925), which is causing serious competition between species (Ruggerone & Irvine 2018). Specifically, the Alaskan model of mass-producing chum and pink salmon (via ocean ranching) is negatively impacting the age, size, and survival of other species. For example, BC's sockeye salmon and Salish Sea Chinook salmon survive worse in the ocean in years when there are more pink salmon in the ocean (Ruggerone & Nielsen 2004; Ruggerone & Goetz 2004; Ruggerone & Connors 2015). Mass production of enhanced pink salmon in Alaska came at the cost of local wild production of pink salmon (Amoroso et al. 2017). At local scales, there is an enormous weight of evidence indicating that hatcheries can have negative impacts on wild populations, such as by eroding local adaptations (reviewed by Naish et al. 2007). In addition, if the goal of hatchery production is to increase fishing opportunities, then hatchery production will increase the chance of overfishing co-mingling wild populations in mixed-stock ocean fisheries (Walters et al. 2008; Wood 2008). Thus, the scientific evidence overwhelmingly demonstrates that hatcheries can pose substantial risks to wild salmon populations.

Fisheries and Oceans scientists recently completed their Science Advisory Report on hatcheries as related to Chinook Salmon (Withler et al. 2018). They found that higher levels of hatchery production posed greater genetic risks to wild salmon populations and recommended "[*i*]*n establishing goals for each population, document tradeoffs between increased genetic risk to wild populations from hatchery production and increased abundance required to support other objectives*" (Recommendation #4, page 52). We agree with this recommendation—there is a need to articulate and carefully consider the trade-offs with different types of hatchery propagation. For example, hatcheries might provide some additional fishing opportunities in some situations over the short-term, but this comes with serious risks to wild salmon over the long-term. Alternatively, if the foremost goal is to restore diminished wild salmon populations (Goal 1), hatcheries may play a temporary role in recovery of imperiled populations in some circumstances but only if such an approach is paired with harvest reductions (Naish et al. 2007; Waples et al. 2007; Fraser 2008).

- ***Recommendation: Remove Strategy 1.3.*** We agree completely with the Options Paper that BC "*needs to learn from past efforts*" (page 27). Based on the past, Strategy 1.3 would not help achieve Goal 1 of increasing the abundance of wild salmon, but rather would do the opposite – particularly when integrated with co-occurring mixed-stock fishing.

***Strategy 1.1. Protect critical salmonid habitat from loss or degradation.*** We applaud that this is the first strategy listed in the Options paper. Indeed, *"[r]estoring spawning and rearing habitats disturbed by weather events and human activity is often expensive, time consuming and complicated*", and we would add, may not be feasible. Thus, protection of BC's salmon habitat is a top priority. Some of the challenges that salmon are experiencing today are the legacy of historic and on-going human impacts on their spawning and rearing habitat. For example, the negative effects of logging on coho salmon weren't realized until 20 years after logging was abated (Tschaplinkski & Pike 2017). We agree with the committee's suggested approaches to habitat protection, but also suggest stronger measures be undertaken.

- ***Recommendation: Create a strong network of Tribal Parks for Salmon***. These watershed conservation areas would restrict large-scale industrial activities that have repeatedly been shown to damage salmon habitats (e.g., large-scale mining, clear-cut forestry, urban development) but not restrict other uses of the land (e.g., hunting, fishing). We suggest that these protected areas should be co-designed and co-managed by indigenous groups, following the model of other recently developed Tribal Parks.

***Strategy 2. Support and encourage greater community engagement with wild salmon.*** We agree that there is a need to continue to maintain the connections between wild salmon and BC's communities.

- ***Recommendation: Create a BC holiday that is a tribute to salmon***. There are many local celebrations of salmon as they return to spawn (e.g., First Salmon ceremonies) or migrate out to the ocean (e.g., Invisible Migration Ceremonies of the Skeena River). BC could embrace salmon as part of their heritage and future by designating an official BC holiday for wild salmon.

***Strategy 2.*** There is hard work to be done to assess the different values, objectives, and goals associated with wild salmon conservation. While we generally agree that the three over-arching goals may be win-win-wins in many cases, there are other cases where there are trade-offs among objectives.

- ***Recommendation:*** Use stakeholder consultations and meetings to define and operationalize a diverse set of long-term goals and priorities (including treaties and FSC rights) that will help a flexible co-management framework to better navigate and balance potential trade-offs between the diversity of goals and stakeholders that rely on wild salmon.

***Strategy 3. Protect and enhance the economic, social and cultural benefits that accrue to BC communities from wild salmon and other seafood resources.*** We agree that there is a need to protect and enhance the benefits from wild salmon and other resources. However, we believe that there is a need to consider a broader diversity of the economic benefits and opportunities offered by salmon.

- ***Recommendation: Diversify BC's salmon economy.*** Salmon can provide economic benefits to BC that beyond commercial and recreational fishing. For example, salmon tourism (recommendation 3.4) should also include interactive experiences with salmon (e.g., snorkeling with salmon) and for viewing wildlife like eagles and bears that gather to feed on salmon. Thus, there is a need to support community initiatives that diversify BC's salmon economy and to support training and educational opportunities, particularly for the next generation of Indigenous and non-Indigenous youth.

We appreciate the opportunity to engage on such an important issue facing British Columbians, and hope that you carefully consider our recommendations. We recognize the remarkable expertise and experience offered by the Advisory Council in salmon fisheries and management. It would also be worth considering whether independent scientists such as ourselves might also be able to contribute to help making BC's wild salmon strategy be based on the best-available science. We are interested in further engagement in this process.

Thank you for your hard work and dedication towards sustaining BC's wild salmon.

Sincerely,

Dr. Jonathan W. Moore, Associate Professor

Dr. John Reynolds, Professor

Colin Bailey, PhD candidate

Allison Dennert, PhD candidate

Michael Price, PhD candidate

Dr. Kyle Wilson, postdoctoral fellow

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