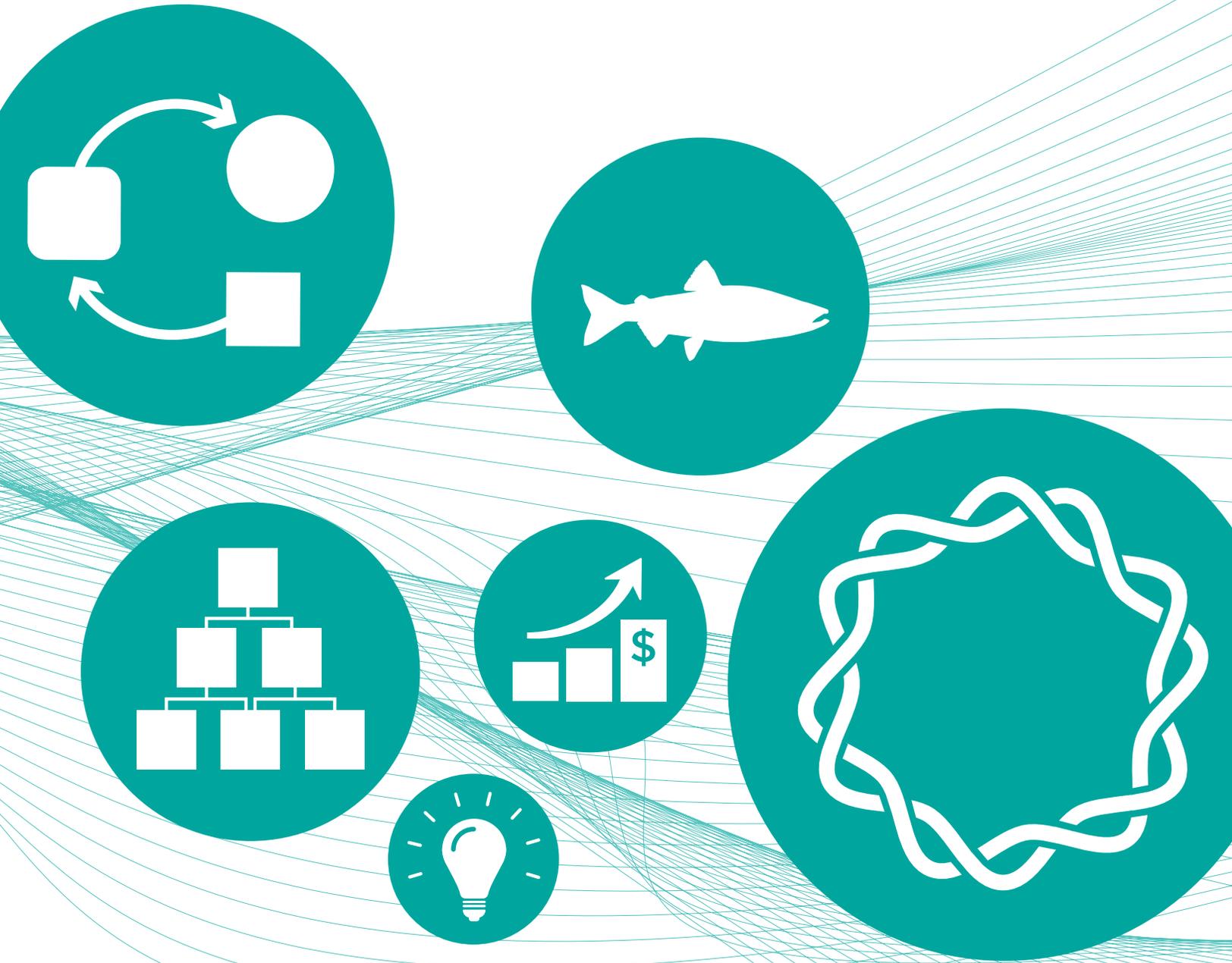


# Open-net pen transition plan in British Columbia: initial engagement process

As-was-heard report  
December 14, 2020 – April 13, 2021



# Letter from the Parliamentary Secretary

With warming waters and declining biodiversity in our oceans, action to support the health of our marine ecosystem is needed now more than ever. This means developing sustainable approaches to the use of ocean resources and spaces that prioritizes conservation and protection while also supporting the many coastal communities that depend on them. In British Columbia (BC), we have clearly heard the need for a more sustainable approach to aquaculture, and the imperative to protect and restore wild Pacific salmon.

The Minister of Fisheries, Oceans and the Canadian Coast Guard was mandated by the Prime Minister to:

“Work with the province of British Columbia and Indigenous communities to create a responsible plan to transition from open net-pen salmon farming in coastal British Columbia waters by 2025...”

The Minister asked that I engage with affected First Nations, communities, aquaculture industry leaders and stakeholders, interested environmental organizations, and parliamentarians to inform our approach in British Columbia moving forward. In addition, we invited academics, industry workers and suppliers, and members of the international community to participate as well. We made sure that every person who wanted to present to the panel had an opportunity to do so. Over the course of the last number of months we spoke to 114 participants and received over 5,400 written submissions. I offer my sincerest thanks to all who participated and hope that you will find your views well represented in this report. I would also like to acknowledge the Province of BC who joined the roundtables as an observer and Fin Donnelly, BC’s Parliamentary Secretary for Fisheries and Aquaculture, who participated in every session.

This interim report covers what we heard over the course of the engagements. These are provided on a non-attributed basis to protect the participants and allow everyone to speak freely. We felt it was important that any readers of this interim report see the full range of views that were presented. As this is a “what we heard report,” a full analysis of viewpoints raised during the engagements was not undertaken. All notes and submissions will be made available on an attributable basis to help inform the next stage of consultations, which has received \$20 million in funding through Budget 2021.

When I was first appointed as Parliamentary Secretary to the Minister of Fisheries and Oceans in 2017, the first two documents I read were the 2005 Wild Salmon Policy and the 2012 Cohen Commission Report. Each of these documents significantly engaged British Columbians and examined key issues with regard to wild salmon and finfish aquaculture. Each of these documents is still extremely relevant today.

The Wild Salmon Policy was developed over a period of five years and has four guiding principles that are still in place today:

1. That the conservation of wild Pacific salmon and their habitats is the highest priority in resource management decision-making;
2. That resource management processes and decisions will honour Canada’s obligations to First Nations;
3. That resource management decisions will consider biological, social, and economic consequences, reflect best science including Aboriginal Traditional Knowledge, and maintain the potential for future generations to meet their needs and aspirations; and
4. That resource management decisions will be made in an open, transparent, and inclusive manner.

There was unanimity in our consultations that the government must do everything in its power to protect and restore wild salmon populations in British Columbia. The government's historic \$647 million investment in wild Pacific salmon in Budget 2021 should go a long way in ensuring that we can deliver on the promise of the Wild Salmon Policy.

Further, the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) has already been passed into law, both federally and provincially in BC. Our government is committed to a nation-to-nation relationship with the Indigenous peoples of Canada, and there is no path forward for aquaculture without meaningful involvement of BC First Nations.

Following its establishment in 2009, the Cohen Commission extensively examined salmon farming in British Columbia. In fact, one of the report's key deadlines under recommendation 19 with regard to the Discovery Islands passed during our engagement period. On December 17th, 2020, Minister Jordan announced her intention to phase out existing salmon farms in the Discovery Islands by June 30, 2022. This announcement certainly affected the content of submissions during the engagement on the broader finfish transition plan.

The announcement also highlighted that any responsible transition strategy must position the sector for growth and job creation, with particular attention to rural and coastal economies. Farmed salmon aquaculture biomass has been plateauing over the past ten years and adopting more sustainable finfish aquaculture approaches and supporting diversification will help provide more growth and opportunities to this sector. Significant reductions in biomass in the Broughton Archipelago and the Discovery Islands gives us an opportunity to measure the economic impact of these decisions on local economies as well as the environmental impacts on local marine ecosystems. In my view, a significant impact study of these decisions should be thoroughly resourced to inform the broader strategy with regard to a responsible transition.

It is going to be essential for all levels of government and Indigenous representatives to work extremely closely and with urgency during the next stage of this transition. A large percentage of tenure decisions will need to be made by June 2022—an important milestone for this transition. The decisions made during this transition will have a significant impact on the livelihoods of British Columbians, and it will be important for us to work together to build a shared vision for a responsible path forward. Done correctly, I believe this can be part of a larger, multi-pronged approach to recover Pacific salmon stocks to traditional levels of abundance while growing a globally competitive and sustainable aquaculture industry in British Columbia.

Shared information gathering, leadership, and decision-making would also present an additional opportunity for the future management of aquaculture and wild salmon in British Columbia. Justice Cohen identified many stressors to wild salmon in his report beyond salmon farming which included: predation, infectious diseases, contaminants, and climate change, alongside further stressors in the freshwater environment including logging, agriculture, gravel removal, pulp and paper mills, mining, municipal wastewater, and other development-related impacts on fish habitat. This was in addition to algal blooms, sea lice, variations in marine productivity, and competition with other hatchery fish and non-salmon species. Many of these stressors cross multiple jurisdictions. A coordinated, multi-government approach with the goal of increasing the future abundance of wild salmon stocks and the future growth of a sustainable aquaculture industry would be an ideal alignment of interests for all parties involved. I think this approach aligns well with the vision set forward in Budget 2021 with regard to creating a Pacific Salmon Secretariat and a Restoration Centre of Expertise.

While there is still much work to be done, I am happy to present this interim report to lay the foundation for the transformation of the aquaculture sector in BC. Once again, thank you to all involved in this report, and I eagerly await the next steps in this historic process.

**Terry Beech**

*MP - Burnaby North - Seymour*

*Parliamentary Secretary for the Department of Fisheries and Oceans*

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# Executive summary

In December 2019, the Prime Minister's mandate letter to Minister of Fisheries, Oceans and the Canadian Coast Guard Bernadette Jordan included a commitment to work with the Province of British Columbia and Indigenous communities to create a responsible plan to transition from open-net pen farming in coastal British Columbia (BC). From December 14, 2020, to April 13, 2021, Parliamentary Secretary Terry Beech, appointed by Minister Jordan, led an initial engagement process to gather input and perspectives on the development of a responsible plan for this transition.

This initial engagement process involved two days of pre-engagement sessions in December 2020 and seven days of virtual roundtable sessions with small groups and individuals. Participants included First Nations representatives, provincial and municipal governments, international experts and government personnel, fish health experts, veterinarians and pathologists, academics, environmental groups, investors, foreign aquaculture operators, local industry, and ancillary industry operators. Fin Donnelly, MLA for Coquitlam Burke Mountain and BC's Parliamentary Secretary for Fisheries and Aquaculture, attended as an observer representing the provincial government. Over 900 pages in written submissions were also gathered through an online survey and by email, both of which were open to the public. Over 5000 form emails linked to a David Suzuki Foundation campaign concerning the transition from open-net pen aquaculture were also received.

The engagement sessions addressed six key themes:



## Definition and development of a responsible plan to transition

The following draft vision statement was presented for discussion: *To position BC as a global leader in innovative and sustainable aquaculture production, while protecting and rebuilding wild fish stocks as we transition from open-net pen salmon farming on the West Coast.*

Participants generally supported the vision of BC as a global leader in innovative and sustainable aquaculture production, but had a range of views on what it would entail. There was alignment in acknowledging the importance of protecting and rebuilding wild Pacific salmon stocks; however, when discussing how to transition from open-net pen salmon farming in BC, participants expressed a diverse range of views.

Participants shared ideas for the key components of a plan for a responsible transition from open-net pen salmon farming on the West Coast, and made suggestions for an appropriate process of engagement for providing input into the transition plan. Some of the key themes were openness and transparency, inclusivity, employing the best available science in decision-making, reflecting work already done on aquaculture, and aligning with the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP).



### Advancing reconciliation<sup>1</sup>

Participants discussed the need to follow government-to-government protocols for engagement and

decision-making and allow sufficient time for the process. A key concern was that many First Nations do not have the capacity or resources to fully participate in an engagement process. Views were shared on the significance of wild salmon for First Nations—culturally, economically, and as a food source. Participants discussed the role of traditional knowledge and local stewardship, as well as governance considerations. First Nations took a variety of positions on open-net pen salmon farms, with some communities opposed to having open-net pen farms in nearby waters and others actively involved in such operations. Alternate forms of aquaculture were also discussed.



### Pacific salmon

Participants generally aligned in their recognition of the cultural and economic importance of

wild Pacific salmon to BC communities, and the environmental, economic, and social impacts of the reduction in wild salmon populations. There was a significant diversity of views on the relationship between open-net pen salmon farming and wild Pacific salmon. While the many threats to wild Pacific salmon (including fishing, climate change, habitat loss, forestry and urbanization) were widely acknowledged, some people expressed the view that open-net pen farms are a source of additional harm to wild salmon, while others expressed the view that these farms do not pose significant risk.



### Encouraging investment in BC aquaculture

Participants discussed BC's current and potential competitive

advantage in the aquaculture sector and shared views on how to encourage investment and innovation in BC. A key theme was the importance of improving certainty for communities and industry regarding the federal policy and vision for aquaculture in BC. Participants shared views on how to optimize the regulatory environment, tailor government incentives and catalysts, and foster local infrastructure, knowledge, and research capacity.

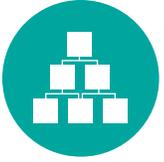


### Technology and innovation

Numerous forms of aquaculture were explored as potential alternatives to open-net pen farming. Information was shared

on both land-based and marine-based systems, the latter including offshore aquaculture, semi-closed containment systems, and marine closed-containment systems. Hybrid systems, which use land and marine facilities at different stages of the life cycle, were also discussed. The discussions touched on a number of innovative technologies that can support these systems, as well as innovations in open-net pen technologies. There were a range of views on the environmental, economic, and logistical considerations for each type of aquaculture. Other ideas for innovation included circular economy models and whole-systems thinking, scaling aquaculture operations to sustainably meet the needs of communities, and growing other food like seaweed and shellfish.

<sup>1</sup> The UN Declaration on the Rights of Indigenous Peoples (UNDRIP) provided important context for conversations about transitioning from open-net pen salmon farming in a way that advances reconciliation with Indigenous Peoples. At the time of the engagement process, a federal bill had been introduced to bring Canadian law into alignment with UNDRIP, and the Province of British Columbia had passed legislation (which came into force in 2019) to ensure that BC laws are consistent with UNDRIP.



## Governance considerations

Participants shared ideas regarding the legislative and regulatory environment

for open-net pen farms currently in place, international models for regulating aquaculture, licencing and resource fees, and governance models. Area-based management was a governance option of interest to many.

Participants praised the model for putting the focus on people and ecosystems and enabling local decision-making based on local knowledge; but a key concern was the fact that local decisions could impact far-away areas, given the scope of salmon migratory runs.

# Introduction

The Government of Canada recognizes the important role that aquaculture plays in Canada's coastal communities, for the economy, and for food security. The Government of Canada is committed to managing aquaculture responsibly, and to ensuring that Canada is a global leader in sustainable aquaculture. Aquaculture is generally recognized as one of the most efficient animal protein production methods in terms of greenhouse gas emissions and feed conversion rates. The Food and Agriculture Organization of the United Nations report, *The State of World Fisheries and Aquaculture 2020*, recognizes that aquaculture has a key role to play in feeding a growing world population with food that is nutritious and has a low carbon footprint. In BC, marine finfish aquaculture supports thousands of jobs in coastal communities and contributes significantly to the provincial economy. Sustainable aquaculture management is key to supporting a thriving aquaculture industry in BC.

The December 2019 mandate letter from the Prime Minister to Bernadette Jordan, Minister of Fisheries, Oceans and the Canadian Coast Guard, included a commitment to work with the Province of British Columbia and Indigenous communities to create a responsible plan to transition from open-net pen farming in coastal BC. On November 12, 2020, Minister Jordan announced that Parliamentary Secretary Terry Beech would be tasked with leading an initial engagement process on the development of a responsible plan to transition from open-net pens in coastal BC waters.

On December 14 and 16, 2020, Parliamentary Secretary Beech held two days of pre-engagement meetings, with Fin Donnelly, MLA for Coquitlam Burke Mountain and BC's Parliamentary Secretary for Fisheries and Aquaculture, attending as an observer. The purpose of these meetings was to prepare for the roundtable sessions and gather preliminary advice regarding how the engagement should occur and what the range of viewpoints could be.

They then held seven days of roundtable sessions between February 22 and April 13, 2021.

In total, there were 114 accepted invitations to participate. Participants that attended included First Nations representatives, provincial and municipal governments, international experts and government personnel, fish health experts, veterinarians and pathologists, academics, environmental groups, investors, foreign aquaculture operators, local industry, and ancillary industry operators. Each day featured a series of 45-minute video meetings with different groups. In the first part of each meeting, people introduced themselves and stated their primary concerns. That was followed by a discussion. Meeting attendees and any other interested parties, including the general public, were invited to submit comments and additional information through an online web survey and an email inbox as well through an open process that ended on March 26, 2021. In response to the online survey, 476 submissions were received; 23 submissions unrelated to the questionnaire were received by email. Over 5000 form emails linked to a David Suzuki Foundation campaign concerning the transition from open-net pen aquaculture were also received.

This report is a non-exhaustive, as-was-heard summary of the opinions expressed and input gathered through the seven days of roundtable sessions and the pre-engagement meetings, supplemented by views shared through the online survey and email submissions.<sup>2</sup>

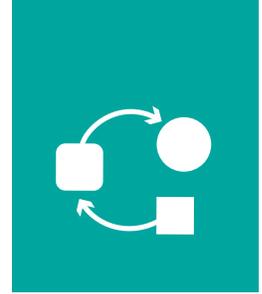
This was an initial engagement process. Phase 1 of a formal engagement process is planned to begin in the fall of 2021, and more information will be shared in the months leading up to that process. That formal engagement and other work toward the development of a transition plan will be informed by a detailed record of this initial engagement process, the extensive written submissions received, and the many suggestions for further research and resources to be consulted.

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<sup>2</sup> For the production of this report, DFO contracted with a professional note-taker and a separate report writer to attend all video meetings and take detailed notes. The writer organized those detailed notes under the six key themes, expressing ideas in the words of participants as much as possible while summarizing the content. The report does not attempt to quantify or give weight to any of the views expressed. DFO staff reviewed the written submissions received to identify material that was not covered during the video sessions, and the writer incorporated additional points and detail into the final report. The report was prepared and finalized in consultation with DFO.

## SECTION 1

# Definition and development of a responsible plan to transition



### COMMENTS ON CURRENT VISION STATEMENT FOR THE TRANSITION PLAN

Engagement participants commented on the following Fisheries and Oceans Canada (DFO) vision statement:

**VISION:** To position British Columbia as a global leader in innovative and sustainable aquaculture production, while protecting and rebuilding wild fish stocks as we transition from open-net pen salmon farming on the West Coast.

Participants expressed a range of views on the vision as a whole and made comments on individual portions of the vision. Most expressed support for protecting and rebuilding wild fish stocks, but they did not agree on whether BC should make the transition from open-net pen salmon farming. The specific areas of disagreement on this point are discussed further under “Relationship between open-net pen salmon farming and wild Pacific salmon.”

The following comments were made on the vision statement as a whole:

- The vision is “backwards” in the sense that the significance of wild Pacific salmon should appear at the very beginning, positioning it as the top priority.
- Rebuilding wild fish stocks should not be tied to the evolution of the aquaculture industry—it should be a separate initiative.
- Without sacrificing the health of wild Pacific salmon, the next priority in the vision should be to build strong economic opportunities for communities.
- The vision implies that there is a connection between rebuilding wild fish stocks and transitioning from open-net pen aquaculture. Some participants agreed that there is a connection, while some did not agree.
- BC should aim to be a global leader in sustainable wild fish stock resource management, rather than in aquaculture production of foreign fish species.
- While the vision statement outlines a necessary change, it is a huge endeavour and there will be many challenges—industry cannot do this all by itself.

- The vision should be to protect wild salmon through more innovative and sustainable aquaculture practices.
- The vision should also include language stating that First Nations have authority over their water and land.

Regarding the phrase, “...as we transition from open-net pen salmon farming on the West Coast,” the following comments were made:

- The vision should focus on what BC is moving toward in terms of outcomes and standards, rather than what it is “transitioning from.” It should not dictate which technology and methods are to be used in achieving the outcomes and standards.
- This phrasing is problematic because it does not say what the transition will lead to, and industry needs to know where the sector is going.
- It should be clear that “transition” means “change” and stated clearly that the change will be to land-based aquaculture.

There were requests for greater clarity on several aspects of the vision statement and the December 2019 mandate letter for the Minister of Fisheries, Oceans and the Canadian Coast Guard:

- If the direction taken is to transition from open-net pen farming, the industry needs clarity and specificity on which environmental impacts and risks need to be addressed, to help in planning which alternative technologies to adopt.
- It’s not clear whether “wild fish stocks” is meant to refer solely to salmon, or includes all wild fish.
- More information is needed on how this transition plan relates to other federal initiatives, and how plans for the Pacific region align with the vision in other regions of Canada.

- Referring to the mandate letter, some called for a clear definition of a “responsible transition” and a better understanding of what “transition” really means, and for greater clarity on the commitment in the mandate letter and the intended outcome of this transition process.
- Is open-net pen farming of Pacific salmon also a concern that will be addressed, in addition to the farming of Atlantic salmon?
- Is it assumed that the transition will be to some other form of salmon farming? Other, more regenerative forms of aquaculture could include growing things like shellfish or seaweed, which could help to improve fish habitat.
- How would the aquaculture industry prove that it is “sustainable”? It should be rebuilding the wild fish stocks.

Several suggestions were made for improving the vision statement:

- Define “responsible” as set out in the mandate letter.
- State that the transition should be sustainable, and define what that means.
- Focus on sustainable activity and protection of the environment.
- Focus on the end state that changes are meant to achieve, rather than on specific technological solutions.
- Include a “human” aspect to the vision, such as having healthy communities.
- Include words on rights for title holders.

## DEFINITION AND KEY COMPONENTS OF A RESPONSIBLE PLAN TO TRANSITION

Many participants agreed that there needs to be a plan if BC is going to transition from open-net pen salmon farming, although there was not agreement on whether that transition should take place or what it should look like.

## Participants identified multiple components of a responsible transition plan:

- Transparency and open communication
- Protection of the First Nations rights-holder status and compliance with UNDRIP
- Consideration of the priorities of the Fisheries Act, which were said to be confirmed by the Supreme Court: the conservation and protection of fish, the protection of Indigenous fisheries, and the protection of commercial fisheries and aquaculture
- Inclusion of current transition activities such as the Broughton agreement and the Discovery Islands changes
- Science-based decision-making guided by the precautionary approach and referencing international models
- Informed by a comprehensive understanding of the salmon farming industry and how all impacted parties are affected
- Measurable goals and targets to monitor short- and long-term success, for both aquaculture production and wild salmon returns
- Clear objectives, timeline, and accountabilities, with interim steps and annual public reporting
- Fostering of innovation, including exploration of emerging technologies (such as containment technologies) and their feasibility and suitability to the region
- A plan for the fish currently in open-net pen farms, and for the smolts in hatcheries
  - A plan to transition and possibly retrain workers, to prevent net job loss
  - Remediation of the areas used by fish farms
  - Increased licence fees for open-net pen fish farms prior to the transition
  - Prioritization of the preservation of wild salmon—rebuilding and enhancement of habitat
- Monitoring of environmental factors, marine health and fish populations, with data shared in a timely way on a public website to ensure transparency and accountability
- A means to resolve the continuous and divisive debating that has reduced public understanding and trust (e.g. by moving to area-based management)

Some participants stipulated that the only responsible transition would be to land-based aquaculture. Others disagreed and had various suggestions for marine-based options that would address any concerns related to open-net pen farming (as discussed further under “Technology and innovation”).

## TIMELINE FOR THE TRANSITION PLAN

Regarding the 2025 timeline for a plan to transition from open-net pen salmon farming, some participants said they felt strongly that the process is happening too fast, while others said it must happen as soon as possible. One participant asked whether 2025 was the date targeted for having a plan in place or the date for having open-net pens completely out of the water.

Some participants said that three to five years was an appropriate timeline for transitioning out of open-net pen farming.

Those who felt the transition is happening too fast said that a common vision should be developed first, before steps are taken to plan and make the transition. It was noted that the industry would need time to transition as they had to plan for a biological cycle of four to seven years. Shutting down in the midst of that cycle is very disruptive, it was suggested, and some companies may have to cull fish. The timeline for switching from open-net pen operations by 2025 may be too short for some First Nations and remote communities that are currently running those operations, if they do not

have sufficient infrastructure in place (e.g. power or water supplies to operate land-based facilities).

Those who felt the transition must happen as soon as possible emphasized that in their view the issue is urgent and it is important to make the transition by 2025. Removing open-net pens from the water as soon as possible would address their harm to wild salmon stocks, they said. Some participants added that the transition from open-net pen salmon farms has been recommended for about 20 years, with several processes recommending that open-net pen farms be removed from the water, starting with the 2001 Legate Inquiry and more recently discussed in the report of the Cohen Commission of Inquiry into the Decline of Sockeye Salmon in the Fraser River. (“Cohen Commission report”). One person suggested that the government should simply pass a law to get the open-net pen farms out of the water.

#### Several suggestions were made for compromising on the timeline:

- If there is a strong plan with measurable goals and targets that are monitored, having a transition that is a bit late is okay, as long as it is occurring.
- The transition plan could focus on removing sites in areas of higher harm first (such as those closest to migratory pathways).
- Short-term changes in procedures could address the most urgent issues, while allowing time for a more fulsome process of discussion.

## PROCESS OF ENGAGEMENT FOR PROVIDING INPUT INTO A TRANSITION PLAN

### Open, transparent, and inclusive

Participants called for an open, transparent, inclusive process of engagement where everyone affected by the decisions feels involved and can

contribute. Some said that they had expected a formal consultation process with a secretariat, website, and email. It was also suggested that the process should lead to a shared vision, rather than being built around a pre-established vision. Suggestions for improving openness and transparency included making meeting summaries public, providing progress reports on the transition plan, providing sufficient time for meaningful engagement, ensuring that decisions are guided by science, raising local awareness and prioritizing local voices, and holding consultations in the communities directly affected. Some participants expressed the view that the situation is past the point of an open and transparent process, given the Discovery Islands announcement.

#### Suggestions were made for who to include in the engagement process:<sup>3</sup>

- Local First Nations
- First Nations rights and title holders by region
- People with Indigenous traditional knowledge and community knowledge
- People who live and work in the remote communities most affected
- Companies in the aquaculture industry
- Workers in the aquaculture industry with on-the-ground knowledge
- Businesses that provide services ancillary to the aquaculture industry
- Municipal governments
- The Province of BC and all orders of government
- Wildlife tourism sectors
- Small land-based farm operators
- Researchers and experts
- All relevant interest and stakeholder groups
- Everyone who wants a voice in this process

<sup>3</sup> Participants were not explicitly asked to provide a full list of list groups that they would like to see included in the engagement process, but were asked for suggestions to ensure that the process would be open and transparent.

Several participants said that the consultation should be made public (factoring in privacy considerations) and that public input should be sought as well. This could include a website to ensure transparency and accountability.

## **Models and suggestions for an appropriate process**

Participants shared a few examples of other processes that could serve as models:

- The Broughton process
- The Killer Whale symposiums
- The species at risk model
- Metro Vancouver’s Liquid Waste Management plan

Several participants advocated for a participatory process, which they said would give all stakeholders, as well as the general public, an opportunity to review the information and learn about the shades of grey in assessing the pros and cons of aquaculture.

One suggestion was an expanded version of the Broughton process, either breaking the province into regions or designing a tiered consultation with one large table and several focus groups that feed into it. Many said that the Broughton process was a good model for an overarching provincial approach and an example of shared decision-making, and that it was a fair process. Another perspective was that the Broughton process was limited in its application, and was possible because there were no pre-existing protocol agreements in the Broughton area. It was noted that the open-net pen aquaculture discussion would be more complicated as it involves different jurisdictions, potential technological changes, a labour disruption, and possible investment in innovation by companies.

Others suggested a problem-solving approach where companies, First Nations, and others would be invited to come together and identify a practical path forward that would meet pre-defined criteria for success (such as regulatory requirements and objectives).

In general, participants recommended that the process should start with the development of a common vision, and then work backwards to develop the regulations and standards needed to support that vision. The process should begin with a clear articulation of the foundations of decision-making.

## **Who should lead the process**

Several participants suggested that there was some distrust of DFO as the organizer of an engagement process for providing input into a transition plan. To increase transparency and trust, a number of people suggested bringing in a neutral, non-governmental third party to lead the formal engagement process. While many saw a supporting role for DFO in the process, one suggestion was to limit the participation of the Aquaculture Management Branch, to avoid any potential or perceived conflict of interest.

## **Alignment of the engagement process with previous work and role of governments**

Clarity was sought on how this process would build on past work related to new aquaculture technology, as well as on the role of the Province of BC in this process. A number of participants said that the role of governments should be to ensure that the process is fair and open, with some emphasizing that local governments and First Nations should have primary roles.

## Alignment with UNDRIP and principles of reconciliation

It was noted that the process must be consistent with UNDRIP, incorporate and recognize First Nations titles and concerns, and make decisions based on principles of reconciliation. Specific suggestions on how this could be ensured are summarized in the “Advancing reconciliation” section below.

## INFORMATION AND RESEARCH FOR DEVELOPING A RESPONSIBLE TRANSITION PLAN

### Employing the best available science in decision-making

There was considerable discussion of the science around both open-net pen aquaculture and wild Pacific salmon, and how to incorporate the best of that science into decision-making.

While science can provide a basis for making sound decisions, this is complicated by the fact that aquaculture science has areas of grey, said several participants. One person acknowledged that it is difficult to parse the science when different experts have different views, and suggested that DFO scientists who oversee fish health in the region and gather data on the ground could contribute useful knowledge.

Participants suggested that when incorporating science into the decision-making process, decision-makers should consider the full range of DFO and independent peer-reviewed science, as recommended by the Cohen Commission report. Some cautioned against placing trust in scientific advice from groups with a vested interest, while others commented that biases should be accepted as unavoidable and declared upfront.

Several people urged that if there was doubt or confusion regarding the scientific basis for the plan to transition from open-net pen farming, then it would be worthwhile to take the time for a discussion of the science. Some people said that it was important to clarify what the questions and issues are—what the transition plan is meant to address.

### Participants made a number of recommendations for incorporating science into the decision-making process:

- Trust existing scientific bodies.
- Listen to impartial scientists and peer-reviewed science.
- Do literature reviews and refer to existing reports on aquaculture.
- Provide sufficient funding to investigate any open questions.
- Fund an independent advisory committee to review evidence, answer questions, and provide advice.
- Gather information on international best practices, and deepen collaboration with leading salmon-producing nations.
- Consult local people with on-the-ground experience, and incorporate traditional ecological knowledge.

One point made was that while decisions should be informed by a scientific risk assessment, they are ultimately made based on a multiplicity of factors. In addition to environmental and economic considerations, decision-makers may also consider community and Indigenous knowledge and socioeconomic considerations. One intangible factor mentioned was social licence, with some people commenting that there is strong support for open-net pen farming in parts of BC, and others saying that on this issue, multiple factions have aligned to oppose open-net pens.

## Additional information and research

While some participants stated that sufficient research exists to proceed with a plan regarding open-net pen salmon farming, others made suggestions for further research that would be useful in developing a responsible transition plan. A number of sources of information and suggestions for further research were also submitted via the web and email during the engagement period. See the appendix at the end of this report for more information.

## ECONOMIC CONSIDERATIONS FOR A PLAN TO TRANSITION FROM OPEN-NET PEN AQUACULTURE

Many participants stressed the economic importance of the salmon farming sector for communities and First Nations, sharing details about the many businesses and local jobs in the sector, both directly in fish farming and through the chain of suppliers and services. Another consideration was that through this employment, money then flows to the local community, other businesses in the local community, and not-for-profit organizations.

### Planning and government support for the sector during the open-net pen transition plan

Several participants said that the broader plan to transition from open-net pen salmon farming by 2025 would need to be done carefully; otherwise, businesses would be hurt and the seafood industry in Canada would be damaged. While Canada is a net exporter of salmon to other markets, it also imports salmon, and a concern raised was that if production stops, product will come in from other countries to fill the gap, with people in BC losing their livelihoods. It was also noted that the trained labour, expertise, suppliers, and services that support the industry are a key part of BC's competitive advantage and would be negatively affected by a transition that is not well-planned.

Participants made several suggestions for actions the government could take during the transition from open-net pen aquaculture to help local communities adapt. The following ideas were shared by one or more participants:

- Make the transition slowly and incrementally.
- Focus on another method of growing fish that would make the same economic and social contribution to the rural fabric and economy.
- Support infrastructure development in coastal communities, including power, water and sewage systems, road access, green energy, product storage, and infrastructure that would enable the development and improvement of alternative aquaculture technologies.
- Allow aquaculture farms to engage in a short-term program of ocean ranching to provide fish to the coastal industry for harvest while natural habitats are being rebuilt.
- Speed up DFO research on mark-selective fishery management and using mass marking to learn more about stocks. This would provide information on where different species spend time and how much they travel. Through mark-selective fisheries, species that do not travel much could provide benefit to communities once they reach minimum legal size.

## VIEWS ON THE DISCOVERY ISLANDS DECISION

Participants provided feedback on the federal government's December 17, 2020, announcement that salmon farming licences would be phased out in the Discovery Islands by June 30, 2022. This announcement was separate from the federal mandate to develop a responsible plan to transition from open-net pen salmon farming in coastal BC waters by 2025.

Some participants stressed that it was urgent to close down open-net pen salmon farming as soon as possible to protect wild salmon stock and

praised the Discovery Islands decision, while others were strongly opposed—particularly to the short timeline for the closing of the Discovery Islands farms.

### **Environmental considerations**

Some participants in support of the Discovery Islands decision shared their view that it would be environmentally beneficial, making the following statements:

- Given the many threats wild salmon are facing in their own environment despite massive declines in fishing activities, salmon aquaculture has to take its share of the dislocation, and closing down the Discovery Islands open-net pen farms is the right decision.
- The Cohen Commission report recommended taking action on this by 2020.
- The Discovery Islands decision should be applauded because wild salmon and Atlantic farmed salmon have difficulty coexisting, and from this perspective open-net pen farms are not advisable in the Discovery Islands or Broughton Archipelago areas.
- The Discovery Islands decision was a difficult but important decision that is supported by science.
- Mouth rot is much higher in areas around farms than elsewhere and is being passed on to wild salmon in the Discovery Islands. This is just one of 39 pathogens identified.

### **Impacts on employment and local economies**

There was considerable discussion of the economic impacts of this announcement on communities.

Many participants said that local businesses in aquaculture are now laying off employees, some of whom had been trained and hired with government financial support. In general, the view was that

local businesses connected to open-net pen farming now had to stop investing, lighten their workforce, and rethink how to use current assets. Some predicted collateral damage to the supply chain by June 2022, with the potential for larger companies to move their investments elsewhere if policy decisions are not supportive of the industry.

Participants noted that many of the small BC communities impacted by the decision have already been affected by changes in commercial fisheries, logging, and mining. They warned about the socioeconomic impacts of this latest change, with one person raising concerns about issues like outmigration and homelessness. Some asked what the federal government would be doing to support these communities.

One participant local to the area offered a different perspective on the impact of the Discovery Islands decision, stating that only a few workers on the area's fish farms are locals, and suggesting that these individuals could easily be employed elsewhere. They mentioned opportunities in other aquaculture enterprises, such as scallop or kelp farms, and specific job openings listed in a number of other sectors. They also called for government investment in local businesses and conservation efforts that could provide further employment.

Another participant observed that every aspect of the economy is being impacted by environmentally mandated changes, and said that just as the commercial fishing sector has been impacted by mandates to protect wild salmon, the aquaculture sector will also inevitably be affected and will have to adapt.

### **Impacts on industry and innovation**

Several participants said that larger companies were freezing investment in BC aquaculture and may consider refocusing on other jurisdictions due to a lack of certainty and a lack of clarity regarding the regulatory and policy vision for BC aquaculture.

If a large percentage of production can be shut down overnight, they argued, then companies cannot feel comfortable investing in BC.

One point made was that some companies had planned to use the income from existing open-net pen farms to finance experiments with closed-containment or land-based operations, and they were now unable to move forward with these plans.

### **First Nations views on the decision**

First Nations views on the Discovery Islands announcement varied: one stated that they had already been negotiating to have industry vacate the area by 2022, so the Minister's announcement was aligned with those plans. Others said that they were not satisfied with the announcement because it did not involve consultation and did not allow for a transition period. One participant expressed frustration that First Nations were being blamed for the announcement, saying they had wanted to do the right thing in a planned way, and not to affect people's work and livelihoods.

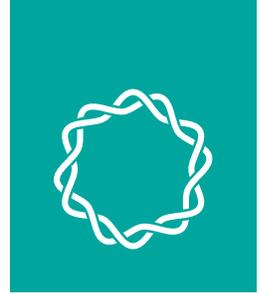
### **Comments on the decision-making process**

Participants made the following comments on the process around the Discovery Islands announcement and next steps:

- Local aquaculture interests and larger companies feel blindsided and disenfranchised.
- The socioeconomic impact does not seem to have been taken into account, and mitigating strategies for locals are not sufficient.
- Relations with the federal government have been negatively affected.
- Companies thought that by addressing the Cohen Commission recommendations they would be allowed to continue operating, at least until 2025.
- There is a contradiction between providing federal funding to improve open-net pen systems, which occurred recently, and then eliminating those operations.
- There is no clear indication of what the transition might look like. The effects in the area should be monitored after removal of open-net pen farms. Economically, communities need support to make the transition.
- Some participants said that the decision was rushed and done without consultation and that people are feeling disenfranchised, while others said the need for this change had been discussed over many years and it had happened too slowly.

## SECTION 2

# Advancing reconciliation



### UNDRIP AND GOVERNMENT-TO-GOVERNMENT RELATIONS

The UN Declaration on the Rights of Indigenous Peoples (UNDRIP) provided important context for the discussions. At the time of the engagement process, a federal bill had been introduced to bring Canadian law into alignment with UNDRIP, and the Province of British Columbia had passed legislation (which came into force in 2019) to ensure that BC laws are consistent with UNDRIP.

**The BC act stipulates:** *“In consultation and cooperation with the Indigenous peoples in BC, the government must take all measures necessary to ensure the laws of BC are consistent with the Declaration.”*

### Decision-making regarding aquaculture and fisheries

Several issues were raised regarding an ongoing lack of proper engagement with First Nations on fisheries and aquaculture, and the general principles that should be observed instead. Participants shared some experiences with DFO that illustrated these concerns:

- Some said they had received form letters either informing them on short notice of an aquaculture development, or responding to First Nations concerns communicated to DFO about an aquaculture issue.

- One nation discussed seeing industry get better access to the Minister and having more resources to spend time in Ottawa lobbying.
- Another nation said they had been trying to work with DFO to conduct their own habitat studies and set up hatcheries within territories.
- “We have a strained relationship with DFO,” said another participant, explaining that they had taken DFO to court over a decision that had gone against an agreement they had in place.
- “We the chiefs gave the authority to DFO to manage the resources and we’ve come to the state where we’re at the last buffalo, only instead it’s the last wild salmon and the last herring,” said one participant.

Several participants said that in their view DFO had been working in the interest of industry rather than salmon for decades and cited the Cohen Commission report as stating that this duality needs to be eliminated. Indigenous law must be incorporated into aquaculture management, many said, and it was noted that some nations are considering doing their own monitoring and enforcement of farms in their territory.

### Engagement on the mandate to create a responsible plan to transition from open-net pen salmon farming

Participants said that the federal government should clarify how UNDRIP will be implemented in this process, and should employ a nation-to-nation, government-to-government model of shared decision-making. A key point was that there

are different protocols for different First Nations. While organizations can play a role as convenors or in identifying common areas of concern and joint interests, they do not speak for all of the nations. One nation discussed being a “modern treaty nation,” noting that this is not the case for all nations. To respect treaties, the federal government must be familiar with what it has agreed to in each treaty and proceed accordingly, they said.

## Engagement process

Participants made several specific recommendations on an engagement process that would appropriately involve First Nations:

- Respect the sovereignty of First Nations, acknowledge their territories, and do not bundle them in with industry or communities. Provide opportunities for First Nations leadership and relationship-building with federal and provincial governments. Use a tri-partite government-to-government process.
- Make the role of the BC government in this process clear, and clarify how the BC government’s commitment to consent-based tenure licencing by 2022 will affect the development of the transition plan.
- Involve First Nations in designing the process. Support an Indigenous leader to co-lead on this process, and have a process where the First Nations can self-organize.
- Ensure that people have communication materials to bring back to their communities.
- Provide sufficient time. The cultural way of determining the best solution is that everyone has a voice and is heard. This requires more than a few minutes of engagement.
- Recognize that the one-on-one format works better for some than being combined with a huge group of nations with varying perspectives and having to share floor time.
- “Consultation” is not an appropriate term—rather, this should be a government-to-government consent process.
- Consider the incorporation of Indigenous knowledge within the process.
- Explore the Broughton process and its implementation of UNDRIP as an example of shared, consent-based decision-making. In that process, the federal government met with hereditary and elected political leaders.

Many participants called for an independent third party to manage the engagement process, rather than DFO, citing a lack of transparency and perceived conflicts of interest, as DFO also oversees aquaculture. It was also noted that this third party could be made up of (or include) First Nations.

### First Nations capacity to engage

Another issue was First Nations capacity and resources to fully participate in an engagement process. The federal government was urged to build resourcing and capacity support into the process to ensure strong participation from First Nations communities. Some participants shared examples of this capacity issue, such as not having the time or resources to learn about the issue on which they were being consulted, having too heavy a workload to focus on an external matter (as well as local crises to deal with), and now, having to deal with Covid-19.

### Ensuring inclusiveness

The following comments were made on who should be included in engagement processes:

- Involve each of the nations.
- Include hereditary chiefs.
- Engage the Union of BC Indian Chiefs and the BC Assembly of First Nations in this process.
- Have an “opt-in” approach for First Nations engagement, with a specific structure and process.
- Fully engage the rights-holders and engage with title-holders that have working relationships with industry.
- Include experts on the issue and on the legalities of First Nations consent.

## SIGNIFICANCE OF WILD SALMON FOR FIRST NATIONS

Participants discussed the significance of wild salmon to First Nations—culturally, as a food source, and economically—and the impact of declining wild salmon populations.

### Cultural significance

Some First Nations participants said that salmon “has been part of us since time immemorial; that is why we have a chapter in our treaty on fish.” Wild salmon are integral to First Nations traditions, their traditional diet, and a vital basis of their livelihoods and communities. Salmon fishing kept the youth occupied with healthy activity. If there is no salmon to catch, they added, traditional knowledge will be lost.

### Food security and traditional diet

Participants noted that wild salmon are integral to the traditional diet of BC First Nations. Where they have an abundance of wild salmon, communities are able to achieve their food requirement. Where this is not the case, people must rely on grocery stores as a food source. One First Nation described wild sockeye as “our medicine, our food” and said in the past three years they had not had any. BC First Nations rely on salmon and other marine resources as food sources, they said.

### Economic significance

Many First Nations participants discussed the historic importance of the commercial salmon fishing industry, with some saying people still rely on commercial fishing for income, but catching salmon is “always touch and go” and it is difficult to compete with other fishers. The economic impact of losing wild salmon populations has been huge, said First Nations participants—and many other problems followed that loss. Fishing that was plentiful in the coastal territories has been reduced to nothing. One nation whose people had lived off the sockeye run “since forever” now counts every fish that returns and has seen a consistent decline in salmon numbers over the years.

## TRADITIONAL KNOWLEDGE AND LOCAL STEWARDSHIP

### First Nations traditional knowledge

Several First Nations discussed their efforts toward protecting and rebuilding wild Pacific salmon stocks and habitat, and the role of traditional knowledge in understanding the ecosystems of their territories.

Some First Nations commented on the changes they had observed in the ecosystems that support wild salmon. They spoke of elders who remember the salmon populations that used to exist in the area, and who could attest to changes in the ecosystem such as invasions of jellyfish and squid, blooms of different kinds of plankton, drought, flash floods, and rivers that are no longer being cooled by glaciers. One view was that, in light of all these changes, wild salmon would not recover to its former abundance, and it was suggested that they were now “fighting over the last fish.”

The role of elders as keepers of traditional knowledge was discussed in relation to local governance efforts, and it was suggested that elders have a lot to offer toward finding solutions to the many pressures on wild salmon, including changes to forests and watersheds.

### Local stewardship and enhancement

It was noted that a one-size-fits-all set of regulations for aquaculture will not work for a number of reasons, including variations in local geography. For example, the steepness of a river bank impacts the optimal buffer zone for salmon spawning areas, so a local buffer zone may need to be adjusted.

**Local monitoring and conservation were seen as the main tools for properly managing ecosystems, and some examples were given of First Nations efforts currently underway to protect and rebuild wild salmon stocks:**

- Fertilizing a lake to bring back a sockeye run that is currently extinct: The challenge is that when the fry hit the ocean, if there is a sea lice

issue, it counteracts all the careful work to start them in the lake. Juveniles are a critical part of any salmon run and are subject to the highest mortality, facing challenges at every stage.

- Setting up open-net pens to hold chinook salmon fry that emerge from the river until they mature to a point where they are less vulnerable to predators.
- Doing research on estuaries and different salmon species.
- Raising funds for enhancement efforts through a conservation fee for tourist participation in local bear tours.

Participants made the following suggestions for supporting and increasing First Nations stewardship and enhancement efforts:

- Co-management of the resources in First Nations territory. When nations are able to get accurate information, they can work with others to mitigate any issues.
- A guardian program with cabins for the guardians.
- Capacity building to enable data collection, oversight (including the guardians) and traditional knowledge.
- Monitoring species with a wider lens, to better predict and address pressures on salmon (e.g. monitoring herring).
- Funding to restock rivers with sockeye (although this will be challenging, considering the impacts of forestry).
- An application process for activities that impact First Nations lands and water, requiring the applicant to demonstrate how they will mitigate environmental impacts.
- Core funding for First Nations to hire full-time fisheries managers or coordinators.

It was noted that increased enhancement efforts could create employment for many people.

## FIRST NATIONS POSITIONS ON OPEN-NET PEN SALMON FARMING

First Nations positions on open-net pen salmon farming were wide-ranging, with some saying the farms should be removed from the water as soon as possible and others saying that they intended to continue open-net pen farming on their territory. Some First Nations said that while they did not support open-net pen salmon farming in their territory, they recognized the benefits it had brought to other First Nations and wanted to ensure that a plan to transition to something else would not impact those communities negatively.

First Nations participants who **did** want to see a transition from open-net pen farms expressed the following views:

- If fish farms are going to be allowed to stay, we have to be at the table. Those fish travel. We have to think about our neighbours and the animals that depend on wild salmon.
- We do not support any further water-based salmon farming. We support the transition to land-based salmon farms by 2025.
- Our common objective is the protection of wild stocks. We need joint operations by Canada, BC and First Nations to do this. We need our wild salmon stocks for jobs, food and economic fishing rights.
- Until aquaculture was introduced to our waters, we had no worries about sea lice.
- The best solution is land-based aquaculture, and there's proven technology to do this.
- We can no longer have profitability at any cost. We need to save the wild salmon. There is other work to do but we can take this step quickly and watch for immediate relief.
- Having fish farms in any area on the coast is an infringement of Indigenous rights and title to the salmon fishery. All Indigenous people along the Fraser River need to have a say in this decision.

First Nations participants who **did not** want to see a transition from open-net pen farms, or who were open to changes that would allow open-net pen farms to remain, expressed the following views:

- We are not opposed to open-net pens in the ocean, or to closed containment, but they should not be in the inlet where all the fish grow.
- We're only asking that it be managed better. Clams, herring and prawns are impacted. We respect those who have agreements, and they respect us.
- It is up to each nation to decide what is right for them, as long as it doesn't impact the fish in our waters.
- A cookie-cutter approach won't work because what's sustainable in one area might not be somewhere else.

## FIRST NATIONS INVOLVEMENT WITH SALMON AQUACULTURE

### First Nations partnerships with industry

A number of First Nations participants discussed the economic importance of open-net pen salmon farming to their communities, as well as the history of how they became involved in the sector. They shared a range of experiences with the aquaculture industry.

Several nations said that they had resisted entering into impact-benefit agreements with companies to have open-net pen aquaculture on their territory, but had ultimately made the agreements because they saw the development as inevitable and felt it was better to receive some benefit. They mentioned several factors that led to this decision:

- A past BC government call-out for aquaculture made the open-net pen presence in the area inevitable.
- Nations lacked funding or capacity to pursue litigation to keep open-net pen farms out of their territory, so they chose to sign on instead.
- Nations were under economic duress, partly

due to the loss of the commercial fishing and processing sectors.

- Agreements in overlapping territories mean that the salmon farming was going forward anyway, so nations that would not have supported it signed on in order to have some benefit.
- One nation that was salmon farming on its own since the 1980s found that it could not compete when the multinationals arrived, so entered into a partnership.

It was also suggested that members of some nations may not always uniformly support leadership decisions to sign agreements with aquaculture companies.

Discussing their impact-benefit agreements with aquaculture companies, some First Nations participants had concerns and negative experiences to report:

- One concern expressed was that nations and employees are not allowed to share information about their experiences, and in some cases had signed non-disclosure agreements that prevented them from discussing issues of concern. One of the problems discussed around this practice was that when one nation is having problems, they cannot discuss those problems with another nation before that other nation signs its own agreement.
- Some said they were not able to monitor the fish farms in their area and were not informed when problems occurred.
- Another issue discussed was that the financial benefits can be limited—for example, the cost of training community members may be subtracted from payments made to the nation, and more benefits may flow to the location of the head office or out of the country than to the First Nation.
- One nation reported that many of the jobs originally gained through an agreement with industry had been automated, and now only two people from the nation were employed with the company.

Other nations said that their relationships with aquaculture companies had been positive and beneficial—in some cases providing the funds for wild salmon restoration efforts. Several described their positive experiences in depth:

- One nation said that their industry partnership in salmon farming provides 50 percent of their jobs, and the farming is all done on the nation's terms. They have operated at the same scale for 15–20 years and they deny industry requests to expand the operation.
- Another nation described their industry partnership as a positive relationship that involves a strong protocol agreement that addresses all environmental concerns. At the company, 30–40 percent of the staff are members of the First Nation, and up to half of the community is employed in fish farming. They said that this was a better option than commercial fishing for wild stock, which in their view could wipe out wild salmon populations.
- Another nation described a “cutting-edge” monitoring agreement with its industry partner, which is one of the biggest employers in the region and a key source of jobs for the nation. The nation has two independent biologists doing research and monitoring.

Among First Nations involved in open-net pen salmon farming, responses to a potential transition from this method varied, from a commitment to defending the right to continue open-net pen aquaculture on First Nations territory, to a willingness to work with an industry partner who was open to moving to a land-based operation.

### **Economic impacts of closing open-net pen salmon farms**

First Nations involved in open-net pen salmon farming echoed many of the concerns expressed by other communities regarding a transition from this form of aquaculture, making the following comments:

- The cost of transitioning from open-net pens would be millions of dollars over the next five years.
- Thousands of jobs would be lost. Many jobs are being created in open-net pen salmon farming while layoffs are occurring in other industries in the community.
- Other First Nations businesses that support open-net pen salmon farming would not survive.
- Some First Nations would be left in debt after significant capital investments in vessels and infrastructure.
- Industry partners that have good working relationships with First Nations may leave the communities, resulting in “a devastating crisis.”

### **Economic options for First Nations communities that rely on aquaculture**

Among those First Nations who wanted or were willing to transition from open-net pen farming, views varied on which alternatives would be acceptable. Some said that the only way to protect wild stock was to fully transition to land-based aquaculture. Others said they were open to exploring various technologies and would decide for themselves which options would address their concerns.

Some nations said they are not ruling anything out and are open to learning about the options, but generally stipulated that any form of aquaculture adopted would have to pass environmental and business assessments.

Some industry participants discussed challenges with regard to developing alternative aquaculture technologies with First Nations partners:

- Capacity issues: Some nations are overwhelmed with incoming requests from resource sectors in BC and this presents a challenge to building relationships with industry partners.
- Lack of reliable utility services (water, power, etc.)

- Isolation/remoteness (plane and boat access only) presenting logistical challenges
- Overlapping territories

### *Land-based aquaculture*

Some First Nations suggested that land-based aquaculture was an economic development opportunity for First Nations that would allow them to retain aquaculture jobs while transitioning from net pen aquaculture. It was suggested that government incentives could help to develop land-based aquaculture. One First Nation suggested that in their area the rivers could provide abundant hydro power, and land use would be more affordable than in the Vancouver area. It was also noted that for those nations in the process of treaty negotiations, interim measures are available to set aside lands for this type of activity.

One point made was that while larger companies may not see land-based aquaculture as profitable enough for shareholders, First Nations could run successful aquaculture businesses on their own, in a different corporate model that would simply focus on building sustainable businesses.

An opposing view was that in some communities land-based aquaculture would be too expensive and impractical.

### *Alternatives to salmon aquaculture*

Several First Nations expressed interest in kelp and seaweed farming, shellfish aquaculture, and mariculture as emerging opportunities that could also be environmentally beneficial alongside watershed restoration efforts. It was noted that kelp farms could provide habitat and shelter for fry as they emerge from the river on their way out to sea, and be a source of income or blue credits.

One First Nation currently involved in open-net pen salmon farming said that switching to other aquaculture species would require significant investment and would not be an option for them.

In a brief discussion of ocean ranching, some participants expressed interest but it was suggested that pilot programs had not led to this sector taking off.

Excess-to-surplus fisheries were also mentioned as one option for helping salmon and also providing revenue. If enhancement efforts are successful, a nation could take some of that excess.

## **CONSIDERATIONS FOR A TRANSITION PLAN THAT ADVANCES RECONCILIATION**

Various First Nations listed some principles and ideas for the transition plan that they said would be important to honour in their territories:

- When the pens are moved, do environmental assessments to learn what has been happening beneath them.
- Allocate funds toward rehabilitation and enhancement programs and implement them.
- Oversee the decommissioning of the sites to ensure that there is no net loss of habitat.
- Turn tenure over to First Nations—transfer licences to them.
- Strive for local management, local decisions and local benefits.
- Support the rights and title of First Nations to the wild salmon fishery.
- Ensure First Nations collaboration in the economic opportunity of aquaculture development and the development of the Blue Economy in BC.
- Protect First Nations culture.

## SECTION 3

# Pacific salmon



### RELATIONSHIP BETWEEN OPEN-NET PEN SALMON FARMING AND WILD PACIFIC SALMON

Participants agreed that conserving and protecting wild Pacific salmon is a top priority. There were a variety of views on the relationship between this goal and the mandate to create a responsible plan to transition from open-net pen salmon farming in BC. Some participants expressed the view that this transition is an urgent step required to protect wild Pacific salmon, stating that Pacific salmon are affected by many stressors and the precautionary principle should apply in this situation. Others said open-net pen farms do not present a significant risk to wild salmon and pointed out the impacts of numerous other stressors on wild salmon, such as overfishing, illegal and unregulated fishing on the high seas, commercial and recreational fishing, climate change, ocean conditions, habitat loss, new pollutants, forestry and urbanization, as well as ocean ranching in Alaska and Russia.

Some said that the primary concern for wild salmon is not the existence of open-net pen fish farms, but rather certain practices. For example, some salmon farms are located on migratory routes of salmon smolts, and keep their lights on at night, which some asserted attracts young salmon. Another issue is that juvenile salmon tend to stay closer to shallow waters while the adults move to deeper water, thus the contact between juveniles and farmed fish is higher. However, the view was also expressed that sufficient work has not been done to calculate the real damage to juveniles from fish farms, including sea lice impacts.

Some participants expressed the view that open-net pen farms can have a harmful impact on wild salmon, but said that there is room for compromise

on how the issue is addressed. One suggestion was that if open-net pen farms cannot all be removed in the short term, the highest-priority areas would be the ones near migratory paths. However, another view was that there is nowhere on the BC coast to locate farms away from migratory routes, and closing only some sites would simply mean choosing some stocks to put at risk over others.

One concern raised was the belief that DFO has “no teeth” to enforce proper sea lice management. Stronger regulatory enforcement, it was suggested, could allow open-net pen farming to continue.

**Those who said that open-net pen farms do significantly harm wild salmon offered the following opinions:**

- Many stocks are still listed under the Species at Risk Act as “Of Concern,” despite a massive reduction in commercial fishing.
- Given the other environmental threats to wild salmon (in both freshwater and saltwater environments), salmon aquaculture must take its share of the dislocation.
- Farming can impact the environment and, through those impacts, can have a secondary impact on wild fish populations.
- The salmon aquaculture sector has not been able to demonstrate that open-net pen farming poses little to no risk to wild salmon.
- Salmon farms located in the migratory pathway of wild salmon are a “smoking gun” in relation to the dramatic decline in stocks in nearby areas.
- While climate change is a serious issue for wild fish, not all west coast salmon populations are failing. Some populations that are away from fish farms, such as Alberni Inlet and Campbell River pink salmon, are thriving. Hydro-acoustics show

that fish are being lost somewhere around the east coast of Vancouver Island. This points to the fish farms as a stressor, and removing one or two stressors will help wild fish fare better against other stressors like climate change.

- BC must move toward a regime where Atlantic salmon do not have the ability to interact with wild Pacific salmon through escapes, and where farms do not impact wild salmon through fecal waste, antibiotics, pesticides, and other factors. All these problems must be contained within the farmed salmon habitat. Open-net pen salmon farming is currently polluting the ecosystem.
- At least 13 studies have been published in peer-reviewed journals showing the increase in sea lice from farmed salmon driving pink, coho, and sockeye toward extinction. Sea lice in southern BC open-net pens are a huge problem.
- The biggest mortality for smolts is the early marine phase. Most juveniles use the same areas year after year. The impact of hundreds of thousands of fish in these areas is extreme.
- The precautionary approach is the only approach for BC.
- Mouth rot is another threat to wild salmon. New information shows that it causes considerable risk to coho, chinook, and sockeye.

Those who said that open-net pen farms **do not** pose a risk of significant harm to wild salmon offered the following opinions:

- There is no solid scientific information linking open-net pens directly to any negative impacts on stocks of wild salmon—including sea lice and piscine orthoreovirus (PRV).
- It does not make sense to link the rebuilding of fish stocks with transitioning from open-net pen farming. Other environmental and human stressors would need to be addressed if wild salmon populations are going to recover.
- Interactions between wild and farmed salmon are not significant.

- Disease transfer between aquaculture and wild fish in BC is not significant enough to warrant closing down open-net pen farms.
- While BC and Alaska have seen wild salmon catches reduced catastrophically, other locations in the world, like Russia, are seeing historically high commercial catches. One hypothesis is that a climate-related ocean effect has led to a regional decline in the carrying capacity of the coastal BC waters.
- There is enough area along BC's coastline to support the continuance of marine net-pen salmon farming.
- Salmon runs were already decreasing before fish farms were set up along the coast.
- The west coast cannot be compared with other regions in relation to some issues. Issues with diseases in other regions are not mirrored in BC. For example, Norway's issues are mostly viral and production-related, while BC's issues are mostly bacterial.
- DFO data from 2018 on the monthly mortality attributed to infectious disease showed that the risk of pathogens potentially spilling over to the wild is less than 2.5 percent per month.
- Sea lice have been monitored for two decades in the Broughton Archipelago, and during most years the majority of pink and wild salmon migrating through the archipelago have no sea lice on them, or just one.
- Science proves that with measures in place—such as noise limits in water, surveillance for pathogens and monitoring of the environment—the residual risk is acceptable.
- Climate change, industrialization, and carbon emissions are key factors in the decline in salmon.
- More studies are needed on the effects of light on salmon (wavelengths affecting wild fish).

## SIGNIFICANCE OF WILD PACIFIC SALMON TO COMMUNITIES AND FOR RECONCILIATION

Regardless of their position on open-net pen salmon farming, participants agreed on the importance of rebuilding wild Pacific salmon stocks. A number of comments were made on the significance of wild Pacific salmon to communities:

- Wild salmon are an iconic BC species and are important to the social, environmental, and economic fabric of BC coastal communities.
- Wild salmon are essential to the spiritual, cultural, and economic well-being of BC First Nations and are part of their traditional diet.
- Pacific salmon are a “keystone species.”
- Fishing communities such as Port Hardy and Prince Rupert used to be vibrant, active communities, but are now a shadow of what they were, due to the decline in abundance of wild salmon stocks.
- A rebound in the health of wild Pacific salmon would rejuvenate the vitality of commercial and recreational fishing and of First Nations communities that use wild salmon for food.
- Salmon farmers are passionate about protecting and preserving wild salmon stocks and stand behind initiatives to support these efforts.
- Wild salmon have a large significance, but so does salmon aquaculture. Farmed fish are an important food. One should not eat or fish wild Pacific salmon because they are endangered animals.

## ECONOMIC SIGNIFICANCE OF WILD PACIFIC SALMON

Wild Pacific salmon were discussed as a resource for the commercial fishing sector, First Nations fishing and food, and sport fishing tourism. In all these areas the decline in abundance of salmon stocks has had a significant impact.

### Commercial fishing

Participants discussed the importance of the commercial fishery in BC, the decline in salmon populations, and the sacrifices that had been made to protect remaining stocks. Some participants said that in its current state, the wild salmon population can no longer support a commercial fishing industry.

In spite of the challenges the commercial fishery has faced, its economic importance along the BC coast was still emphasized. With the potential added value of processing within Canada rather than in other countries, as is currently the practice, the potential economic value could be increased exponentially. It was suggested that the BC competitive advantage in the global salmon industry could best be supported through a federal commitment to rebuilding wild Pacific salmon and sustaining the local ecology, which would rejuvenate the wild salmon fishery as well as the tourism industry—particularly sport fishing.

Conversely, several participants said that wild salmon fishing is currently being managed too conservatively and there is no opportunity for in-season management decisions that would allow for larger catches when there is a surplus in the stock. When runs exceed native spawning requirements for one species, the fish may go unharvested due to federal policies related to other species of salmon. This limit is unwarranted, it was suggested, and commercial fishers are being unfairly impacted. A “made in BC” solution would allow for better regulation of wild salmon harvesting.

One suggestion was that DFO speed up research on mark-selective fishery management and use mass marking to learn more about stocks. This would provide information on where different species spend time and how much they travel. Through mark-selective fisheries, species that do not travel much could provide benefit to communities once they reach minimum legal size.

### Recreational/sport fishing

One participant reflected on the enormous success of the recreational fishing sector in decades past, recalling that in the 1980s, Campbell River was the sport fishing capital of the world. But after more than 20 years of not catching Coho, the salmon population has not come back. Although the participant expressed hope that removing open-net pen farming would help, they noted that with many factors at play there is no certainty that the Strait of Georgia Coho population will improve.

Another participant expressed optimism that the wild salmon economy could return, and said that the tourism industry focused on recreational and sport fishing could be rejuvenated and become an important sector in BC if wild salmon stocks are rebuilt.

## FACTORS TO CONSIDER IN PROTECTING AND REBUILDING WILD FISH STOCKS

### Restoration of wild salmon

Many participants shared their views that wild salmon are in a disastrous state and said that habitat restoration efforts and enhancements need to address broad areas ranging from climate change to habitat restoration. Some participants suggested that all wild salmon fishing should cease until wild stocks improve.

### Participants made the following recommendations regarding restoration of wild salmon and their habitat:

- Involve multiple orders of government.
- Focus on rehabilitation of estuaries, rivers, and streams. Protect and restore habitat and spawning grounds.
- Renew wildlife management programs that employ scientists and others to count fish and monitor natural areas.
- Revamp forestry practices to protect spawning habitat.
- Limit commercial and recreational fishing, and stop ocean ranching in Alaska.
- Ensure there is no illegal or unregulated fishing of wild stocks, including internationally.
- Create a generational plan for wild Pacific salmon, and a generational investment, as a shared responsibility among all governments and partners in the process. Hire people to implement the policies.
- Address pollution sources in BC's rivers.

## Financial support for rehabilitation

It was suggested that the government should invest more heavily in rehabilitating wild salmon stocks. Several participants advocated for grants to support enhancement work and wild salmon restoration. While the BC Salmon Restoration and Innovation Fund (BCSRIF, a \$100 million federal–provincial grants and contributions program) was mentioned as a good start, participants said that investment must be increased exponentially to support wild salmon restoration, and made several suggestions:

- Provide continued support through mechanisms such as grants and enhancement work.
- Use revenues from carbon credits for rebuilding wild salmon stock.
- Require forestry companies and others who use local resources to contribute to salmon restoration.
- Invest in research on migration routes and timing.

- Provide funding for small-scale enhancement efforts and watershed monitoring activities.
- Support initiatives for marine debris cleanups in salmon corridors.

## Policy, regulatory requirements, monitoring and enforcement

Some participants called for policy and planning that would support the restoration of wild Pacific salmon, including a “generational plan” for wild Pacific salmon and better implementation of existing policy such as *Canada’s Policy for Conservation of Wild Pacific Salmon* and the *BC Water Sustainability Act*.

Discussion of additional regulatory aspects to consider for protecting and rebuilding wild fish stocks is summarized in the “Governance considerations” section of this report.

## SECTION 4



# Encouraging investment in BC aquaculture

Discussing BC's competitive advantage and how to improve upon it, participants spoke of the network of businesses and expertise that supports the industry, the technologies and practices developed in BC waters and exported around the world, and the pristine environmental conditions. There were different views on whether BC would continue to have a competitive advantage in farmed salmon production if communities transition from open-net pen farming. Some participants expressed the view that BC's competitive advantage had already been lost with recent policy decisions that have cooled industry interest. Others had suggestions for how to encourage investment in the sector.

### IMPROVING CERTAINTY FOR COMMUNITIES AND INDUSTRY

Uncertainty—specifically regarding the regulatory environment—was cited as a key factor that is stalling plans for business activities and new projects, including plans for collaborative research and foreign private investment. In particular because of the growth cycle of salmon, it was emphasized that companies need certainty over a period of years so that investments can come to fruition.

One question put forward was when the federal government would create a more comprehensive aquaculture policy to serve the sector. Participants said that unless industry could see a clear path forward for growth in BC, it would be difficult to make investments. One broad policy recommendation was for Canada to create a federal Aquaculture Act that provides clear and consistent policies, procedures, and operating models for the salmon farming industry. This would foster confidence and drive innovation. It was suggested that financial incentives are less important than security of tenure, certainty in regulation, and a vision for aquaculture in Canada. Another

complementary suggestion was to make a federal commitment to the Blue Economy platform signed by the Prime Minister in 2020.

Participants also suggested identifying a conclusive decision-making process with a clear path forward and a recognized place for everyone. The federal government should clearly define sustainability in relation to aquaculture and articulate its priorities in relation to fish welfare.

### REGULATORY STRUCTURES AND RISK TOLERANCE

#### Optimizing the regulatory environment

Regulatory challenges were cited by some as a barrier to innovation. Several participants emphasized that industry needs clarity from government on which specific environmental issues need to be addressed, so that they would know what type of solutions to invest in.

Participants also called for a clear regulatory structure and reporting framework, ideally with a single point of access that would eliminate fragmentation among multiple regulatory agencies.

They also said that there should be long-term alignment of all orders of government (federal, provincial and local).

Some international examples were shared for how to make regulatory processes more efficient to reduce timelines from application to operation. One participant explained that Mexico allows companies to obtain a start-up permit enabling a short-term pilot project that serves as proof of concept. Once the project is shown to do no harm, one can apply for a larger commercialization permit. Norway was offered as an example of a country with an efficient permitting process where the time between applying for a licence and putting fish in the water is just four months. Six months was mentioned as a benchmark for a timeline that would be globally competitive.

#### Participants made several recommendations for optimizing the regulatory environment for investment in BC aquaculture:

- Identify a government champion to help with fast-tracking the regulatory process, getting clear policy support, and developing a framework to encourage participation.
- Streamline, clarify, and expedite the permitting process, and shorten the timeline. Having knowledge of all the technicalities up front can reduce the time to cash flow for a new site developer.
- Expedite environmental assessments.
- Take care to resolve regulatory issues without compromising the environment.

#### Risk tolerance

Risk tolerance was cited as an important consideration for innovation. The level of risk tolerance—for companies and regulators—can block or support innovation. Some innovations will fail, and there needs to be flexibility in the system to allow for failure. If a company tries something new and it fails, causing it to violate regulations, that failure should be a practical issue and not a legal issue, said a participant.

## LOCAL CONDITIONS, INFRASTRUCTURE AND WORKFORCE

Participants from companies listed some of the key considerations when evaluating whether a local area is attractive for aquaculture investment:

- Access to clean water appropriate for the technology (e.g. high-salinity seawater)
- Sufficient and reliable power
- Bricks and mortar infrastructure
- Supply chain infrastructure
- Proximity to markets
- A specialized workforce (the level of training sought varied—some companies had their own training programs)
- Social licence for the presence of the business or technology

For land-based operations, companies said they would need sufficient land area and would prefer to build on Agricultural Land Reserve (ALR) lands. One participant said that if the land was available at no cost (such as through a partnership with a First Nation) that would be attractive, and added that their company would like to set up a division of its land-based business with First Nations.

It was noted that several post-secondary schools already have programs to train an aquaculture workforce, including marine veterinarians—giving BC an advantage in providing qualified personnel.

## LOCAL KNOWLEDGE AND RESEARCH CAPACITY

To leverage BC's existing knowledge base, it was suggested that the government provide long-term funding for research toward the development of new aquaculture technologies as well as monitoring and restoration of wild fish stocks. Other suggestions included creating a technical working group to advise the sector, and creating an institute dedicated to fish health (wild and farmed) and environmental stewardship.

It was suggested that UBC and SFU researchers could help with literature reviews and studies; however some participants observed that some of the scientists who had been working in BC to help the industry improve aquaculture have been lost—a situation exacerbated by the freeze on investment by many companies after the recent Discovery Islands decision. Another suggestion was to offer R&D funding to aquaculture businesses to develop new aquaculture methods and technologies in partnership with academic institutions.

## GOVERNMENT INCENTIVES AND CATALYSTS

Several participants emphasized that although incentives are useful, at the end of the day any new technology must be viable in business terms—companies must be able to make a profit and be globally competitive. As well, one participant cautioned that there may be socioeconomic issues associated with offering government support for one production system over another. It was also noted that incentives should not be offered at the expense of the environment. However, there was general support for the concept of government incentives, which could facilitate the transition to more sustainable technologies, build trust with industry, and offset the challenges of transitioning from open-net pen aquaculture.

### Participants made the following suggestions regarding government incentives and catalysts:

- Support small businesses, joint ventures, and cooperatives. Cooperatives allow for local ownership while also organizing for volume and scale. Support structures where local communities prosper not just through employment but through ownership, joint ventures, or profit-sharing.
- Increase fees or taxes for open-net pen farming and use the funds to subsidize more sustainable technology.

- Provide funding or support to help the industry, including Canadian companies, transition to alternative technologies for land-based or offshore salmon farming. Incentivize the first 5,000 to 15,000 tonnes of land-based production—for example, through loan guarantees or tax credits to improve the risk-return ratio. This incentive can be limited and defined, to kickstart the industry.
- To keep jobs along the coastline, fund the development of technologies for marine-based production or fund rural land-based farming.
- Make it easy for the industry to dissolve current agreements with local First Nations and move to land-based sites.
- Provide funding for innovation in alternative energy sources for farms, as well as feed alternatives.
- Provide direct funding for demonstration and pilot projects, for five to ten years. Support small-scale prototypes in collaboration with communities.
- Offer tax incentives, training incentives, labour rebates, and capital incentives early on, recognizing that aquaculture is a capital-intensive business.
- Provide long-term loan guarantees.
- Indicate clearly what types of technology will be supported, to help guide investment decisions.
- Favour technologies that are environmentally friendly and friendly to fish welfare, while enabling farmers to increase production.
- Champion access to global genetics for Atlantic salmon raised in land-based farms, to help in producing higher-performing fish.
- Support the BC aquaculture industry in becoming a major supplier of cultured seafood around the world. Promote sustainable BC salmon and seafood both domestically and internationally as a quality product.

## **INTERNATIONAL MODELS: INCENTIVIZING INNOVATION AND LEVERAGING KNOWLEDGE**

There was some discussion of various international models for incentivizing innovation in aquaculture. One participant described an EU program that provides financial support to cover a portion of the capital costs for the construction of land-based facilities. Other international models for incenting innovation in aquaculture were shared by individuals from Norway and Scotland.

### **Norway**

Several people described the Norwegian system, where the government prices licences lower for those who are testing out new methods of fish production and rewards companies with licences to increase production if they have an innovative idea that could have a positive environmental impact. If the idea does not work, the company is still allowed to keep the licence as a reward for investing in innovation.

It was also suggested that Norway has a good model for using research to inform policy and regulations, funding that research with taxes from the industry. The country's traffic light system was mentioned as an innovative way of managing the growth of aquaculture.

CtrlAQUA, a Norwegian centre for research and innovation, explained that their recommended strategy is to prioritize long-term innovation R&D, collaborate closely with industry, and collaborate with end users and groups that have concerns. It was suggested that Canada could connect with Nofima, a Norwegian research institute, to explore options for joint research projects focused on advancing closed containment technology in BC.

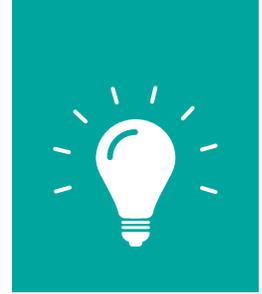
### **Scotland**

The Scottish government explained that the Sustainable Aquaculture Innovation Centre (formerly the Scottish Aquaculture Innovation Centre) supports the drive to enhance aquaculture sustainability. It helps to bring different groups together and apply the latest science to drive sustainable growth through innovation. The sector leads the way in identifying and developing technological innovation that will enable future sustainable growth, with government, academia, and other agencies supporting those endeavours through appropriate incentives.

Scotland indicated that it already enjoys good collaboration with Canada through the Quadrilateral agreement of 2015 and plans to continue this relationship.

## SECTION 5

# Technology and Innovation



### EXISTING AND NEW TECHNOLOGIES OF INTEREST

Participants discussed a variety of technologies and alternative methods of farming salmon—both land-based and marine-based. Several cited the 2019 report prepared by Gardner Pinfold Consultants Inc., *State of Salmon Aquaculture Technologies*, as well as the 2020 report and recommendations prepared by the Indigenous and Multi-stakeholder Advisory Body’s Salmonid Alternative Production Technical Working Group, as useful resources. Views varied on the viability and sustainability of the various technologies. Some groups said that closed containment would be the only acceptable technology. Others favoured a combination of approaches that involves land-based and in-water farming. Some supported semi-closed containment, and some said that semi-closed containment could be a short-term solution during the transition, but with a clear stop date.

One recommendation was not to look to a single farming method as the solution, because a technology’s appropriateness will depend on where and how it is implemented. The participant also advised against referring to specific technology in government regulations, since technology is evolving faster than the regulatory process. Several people said that policies should prioritize results over the method by which they are achieved.

### International knowledge and experience

The Scottish government shared its observations regarding innovation in Scottish aquaculture, commenting that further investment is expected in a number of areas: reducing sea lice loads, trialling snorkel nets, waste capture systems, sustainable cleaner fish, offshore technology for higher energy sites further from the coast, producing super smolts to reduce interaction time at sea with wild salmon, and combatting disease on farms.

The Scottish government commented that closed containment technologies (land or marine) may solve certain challenges but can introduce their own unique set of potential issues, particularly with regard to energy requirements, water quality, water chemistry and dissolved gas management. A great deal of R&D investment is required, and the larger Norwegian-owned companies are working on proof of concept in Norway.

CtrlAQUA, a Norwegian centre for research and innovation, commented that in Norway the idea of growing salmon to market size in land-based closed containment is quite new, with only one such facility in operation (i.e. Fredrikstad Seafood). They indicated that many projects are at different stages in the pipeline, but the technology will need to be proven successful before others jump in.

## Land-based closed containment systems<sup>4</sup>

Some participants expressed the view that land-based aquaculture, featuring the recirculating aquaculture system (RAS), was a good alternative to open-net pen farming, while others expressed doubt that it was economically or environmentally sustainable. It was noted that there is an upsurge of investment interest in land-based aquaculture, with the technologies moving from the vision/model stage to the operation of scaled production systems (e.g. in locations like Florida and Maine). Some mentioned that land-based operations currently exist in BC, are showing promise and can be profitable, but it was also suggested that Canada was “missing the boat” by not moving fast enough to foster this form of aquaculture as industry is currently ready to invest.

Others expressed the opinion that, to date, this technology is either still at the planning stage or, if in operation, not yet proven. Some expressed concerns about environmental impacts, and doubts about the economic viability of this type of system, particularly in the small communities of Vancouver Island. It was noted that the viability of land-based aquaculture depends on available land area. The operations will require land and will be visible, and this may be in conflict with other interests, such as tourism and recreation. The time required to implement land-based aquaculture was another issue, with lengthy steps needed including finding sites, designing and building facilities, and getting them up and running.

## Marine-based systems

Participants discussed several forms of marine-based aquaculture: **offshore aquaculture**, **semi-closed-containment systems**; and **marine closed containment systems**.<sup>5</sup>

Many emphasized the importance of ensuring that any new technology would mitigate interactions between farmed and wild salmon.

### *Offshore aquaculture*

Some participants remarked on a lack of clarity about what is defined as “offshore” (i.e. how far an operation would have to be from shore to fit into this category). While the technology is developing fast, some said it was not clear whether it was logistically feasible or had been commercially successful, and cited the need for significant infrastructure to support operations at sea. Others said that offshore farming options would be more likely than land-based aquaculture to benefit local communities that currently use open-net pen farming and were “more realistic” than land-based options at this point.

One participant described an open-ocean aquaculture system featuring submerged pens spaced apart and located 12–15 km offshore. This system uses real-time automation to monitor the pens from a distance, including biological factors, at a six-kilometre radius around the area. The company’s monitoring of the area around the pens has shown no negative impacts from the farm. It was described as a financially sustainable model. This technology is currently being used for warm-water species, and has not been tested in cold waters.

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<sup>4</sup> **Land-based recirculating aquaculture systems (RAS)** involve growing salmon in recirculating tanks in closed-production facilities on land. ([Salmonid alternative production technologies technical working group report and recommendations](#), 2020)

<sup>5</sup> **Floating semi-closed containment systems** are marine-based, feature a walled-barrier, pump water from depths, and do not capture all waste. There are various designs. **Offshore production** “is defined differently across the globe; however, it is primarily defined by a high level of exposure and lack of protection from land masses, rather than a predetermined distance from shore. The variety of designs include open and semi-closed systems, floating and submersible options, as well as fixed and mobile systems.” ([Salmonid alternative production technologies technical working group report and recommendations](#), 2020)

### *Semi-closed containment*

Some participants suggested that these floating technologies are in the early stages of development, and some suggested the upfront capital costs for building these systems are higher than with fully contained marine facilities. While proponents said that semi-closed containment operations were a good alternative to open-net pen farming, others maintained that they could not promise to contain parasites and diseases.

Participants discussed the development of semi-closed containment systems in Norway and Australia, where they said the technology has become more viable and commonplace and the cost is significantly lower compared to the land-based RAS system. One suggestion was that semi-closed containment could be used to open the northern coast of BC to salmon farming, as water temperatures rise along the west coast of Vancouver Island, making those waters inhospitable to salmon.

One company described an example of a semi-closed containment system that features buoyant, durable pens lined with ultra-strong polymer. Viral risk is greatly reduced by collecting the saltwater for the pens at significant ocean depth, maintaining oxygen and temperature levels, using healthy stock, and vaccinating. The system also avoids lice. The pens have a sediment trap at the bottom that captures 90 percent of sediment, and then the effluent is pumped for water treatment.

### *Closed containment (marine)*

One suggestion was that in-water closed containment technology could be used as part of a responsible plan to transition, providing there are standards for no interaction with wild salmon and zero effluent mixing. This would have to be monitored in a quantitative way.

One new technology described by a participant involves a closed-containment eggshell barrier that would separate wild and farmed fish. Cold water is pumped into the closed-containment shell, with water exiting through the bottom of the eggshell barrier. The effluent is intended to sink into the deep-water column.

### **Hybrid systems<sup>6</sup>**

Some participants expressed positive views on hybrid systems as a way to create a more sustainable industry that still has a place for open-net pens:

- The risks associated with open-net pen farms could be reduced through a “big smolt system” where smolt are grown in land-based facilities or floating semi-closed containment systems until they are bigger (e.g. 800 grams) and then transferred to the open-net pen farm.
- RAS technology makes it possible to produce big smolts and ultimately increase the biomass produced without changing the licence size, by reducing the amount of time fish spend in the water.
- Producing big smolts requires a combination of land-based and in-water farming. Government can bring value to the industry by facilitating communication within the industry to share knowledge.

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<sup>6</sup> In a **hybrid system**, post-smolts are produced “in land-based RAS or floating semi-closed containment systems before the salmon are transferred to traditional marine-based net-pens for grow-out to market-size.” ([Salmonid alternative production technologies technical working group report and recommendations](#), 2020)

## Other technologies

Other technologies and features of interest included: zero-effluent designs and aquifer-only water intake; enhanced growth; disease resistance; plant/insect-based feeds; remote feeding and monitoring systems; low-carbon technologies for moving water efficiently; feed and vaccines to reduce antibiotic use and impacts on wild fish; wind and solar power; hydro turbines; genomic technologies for fish health, sea lice resistance and adaptation to changing conditions; and waste capture and recycling.

## Innovation in open-net pen technologies

It was suggested that the BC aquaculture industry has made significant improvements in addressing risks to wild salmon, and has designed solutions that have been exported to other countries. Several technologies and practices were discussed that could better protect wild salmon from the impacts associated with open-net pens, such as using an artificial protection barrier and better maintaining oxygen levels in pens.

## ENVIRONMENTAL CONSIDERATIONS FOR ALTERNATIVE TECHNOLOGIES

### General concerns—environmental impacts and mitigation strategies of alternative technologies

Participants discussed the fact that removing open-net pens would mean developing new aquaculture systems, which could involve new pathogens and parasites, new physiological issues of interest in the farmed fish, and new potential impacts on the environment. Research would be needed and new tests would need to be developed. This is a long-term process, some said.

A key concern was effluent. Some participants stated that no aquaculture system (land-based or marine-based) currently treats its effluent, resulting in waste, pathogens, and diseases still being transmitted to the wild—but others mentioned systems in use now that are treating effluent before discharging it. Participants called

for research and risk assessments on ocean discharge of effluent, saying this must be done before the permitting process begins so that the industry can grow confidently.

Some people had suggestions for dealing with effluent from various types of aquaculture operations, such as monitoring, filtering, and treating it.

## Land-based closed containment systems

Some participants expressed strong views that land-based aquaculture is not advisable from an environmental point of view and may have unintended consequences on land ecosystems.

### Several concerns were raised:

- Land-based aquaculture has a large footprint. It would result in massive land clearing and would use a large portion of Agricultural Land Reserve (ALR) land.
- Most land-based facilities use freshwater rather than saltwater—a limited resource. Alternatively, using saltwater and discharging the effluent on land leads to other problems.
- Land-based facilities need considerable power, at a time when communities need to reduce their carbon footprints.
- Land-based aquaculture would shift the industry toward a feed lot model when other agricultural sectors are moving away from it.
- Atlantic salmon are living sentient beings and should be raised in their natural environment.
- Large land-based aquaculture systems will lead to biological and water issues, such as waste stream problems.
- If an environmental issue is discovered and a land-based facility needs to be decommissioned, restoration of habitat will take much longer than when an open-net pen fish farm is removed.
- Importing eggs from other countries risks bringing in viruses and pathogens. This risk can be partially mitigated by starting the eggs in an intermediary, closed site away from the

main site, to ensure that no disease is spread. The Canadian Food Inspection Agency, as the gatekeeper for imports, should be involved in consultations.

Several participants commented that salmon farmers who work outdoors have the opportunity to stay connected to the local ecosystem and act as stewards for their regions. Moving salmon farming to land-based facilities would change the nature of the experience for the farmers and for the salmon. Salmon farmers would lose their connection to nature and would become system operation managers in a facility where everything is automated. This is a totally different kind of aquaculture, they said.

**Others said that land-based aquaculture is the best alternative to open-net pen farming, and made the following points:**

- Land-based systems would have more options for effluent treatment and would avoid polluting the environment with pathogens and disease.
- Initial studies on land-based farms assumed they would be powered by coal, not hydro power, and did not consider the total amount of fuel used by open-net pen farms nor the methane emissions from unprocessed fish feces. These studies miscalculated the carbon impact comparison between the two production methods.
- Researchers are working to develop ways of collecting and processing effluent, prevent sludge production and improve water treatment methods.

**Some initial suggestions were made for mitigating the environmental impact of land-based aquaculture:**

- Governments should build upon existing provincial regulations, like those protecting migratory bird nests and raptor nests, to protect terrestrial ecology.
- Agriculture and aquaculture should be separated with regard to ALR land use.

- Regulations can be implemented to require the implementation of technological solutions to reduce power consumption. These solutions exist but currently cost more.

## **Marine-based systems**

### *Sustainability of marine aquaculture as a food source*

Several participants remarked that marine aquaculture is the least carbon-intensive source of animal protein and an important part of meeting the protein requirements of a growing world population.

Others said that farmed fish are not a sustainable food source. One view was that while the industry does produce a lot of food, it also consumes food in order to feed the fish, and any assessment of its benefit needs to take into account all the supply chain impacts. As an alternative, it was suggested that aquaculture could be used to grow other types of food, such as kelp, seaweed and shellfish.

### *Environmental impacts and mitigation strategies*

Comments on the environmental impacts of various marine-based aquaculture systems focused on the different technologies and methods used, and factors associated with their location (such as depth of water and type of ocean current). The following comments were made:

- Closed-containment operations that pump effluent into the deep ocean cannot be placed in areas of high current where diseases and lice will circulate back up to the surface.
- Some semi-closed containment systems reduce the risk of disease spread by using separate units for different groups of fish (compared to the shared habitat of an open-net pen system).
- In some semi-closed containment pens, waste is trapped in a filter at the bottom of the pen and piped back to the top to be collected and dried. It can then be used as fertilizer, to make bio-gas, or even as a source for extracting protein. Treated wastewater is discharged at optimal depth.

- In semi-closed and closed containment systems, it is possible to control temperature, oxygen levels, and feed to reduce the likelihood of disease.
- One new technology disperses effluent into a deep water column, which should sink toward the bottom. However, more research may be needed to determine whether this effluent water would well up in some geographic areas.
- Offshore technologies could still carry many environmental risks, like fish escapes, disease, pollution, and noise pollution, and these risks should not be overlooked just because the operations are further out at sea.

## ECONOMIC CONSIDERATIONS FOR ALTERNATIVE TECHNOLOGIES

It was noted that any new direction the sector takes would have to be a sustainable business model. Whatever options are implemented in place of open-net pen farming would have to be cost-competitive and profitable at scale. If local communities and First Nations are to benefit, the technologies would have to work well in those places. Meeting these requirements would make a technology a “real, not theoretical” alternative.

A key economic challenge mentioned was how to maintain production and economic benefits while directing significant capital investment toward a transition from open-net pen farming.

Participants discussed economic considerations for land-based closed containment, marine-based aquaculture (offshore, semi-closed and closed containment), and hybrid systems.

### Global marketplace and industry direction

As salmon is a global commodity, one concern was that if cheaper forms of production exist, then the more expensive forms of aquaculture will be less viable. For example, some expressed the concern that with some countries still allowing open-net pen farming, it could be more difficult to compete using different aquaculture technologies in Canada.

It was suggested that Canada should move in the same direction as other countries, otherwise the transition plan may not be sustainable.

### Participants raised some questions:

- Is there global leadership—for example, in land-based technology? Are there companies or countries that the BC industry could look to, that are setting the global direction for the sector?
- Should Canada pivot from being a global leader, and instead strategically target specialized markets?

### Land-based closed containment systems

There was much discussion of the economics of land-based aquaculture, and a number of themes emerged:

- **Impacts on small/remote communities:** Many participants noted that, for logistical reasons, companies would build land-based aquaculture facilities close to major markets. In this situation, coastal communities and First Nations in BC would no longer be at the centre of things.
- **New risks to farmed fish:** Potential technological failures would be a new risk factor that could cause large fish mortality events. There are biological issues that may emerge that are unique to these facilities.
- **Electricity requirements:** For many, the cost (and environmental impacts) of electricity consumption was a concern. One point made was that land-based fish farming could only thrive in areas with low-cost electricity (in contrast to open-net pen farming). Others, however, said that there was an abundance of low-cost hydro power available.
- **Profitability:** Many stated that land-based aquaculture is not proven as a profitable model, or at least is a more expensive mode of production that is not globally competitive. Others said that some companies are investing heavily in land-based production and have had success. One participant said that capital

costs for open-net pen farms are spread out over time as the pens must be replaced, while land-based aquaculture requires large upfront capital investment but facilities last longer and conditions are easier to control.

- **Economic models:** One person outlined two economic models for land-based aquaculture: large-scale operations that produce about 10,000 tonnes annually, and small-scale operations that produce 100–1,000 tonnes annually. The latter can be coupled with aquaponic greenhouses for vegetable production. A BC operation producing about 1500 tonnes reported that they were getting a comfortable return on investment by starting at a manageable size and building a strong foundation focused on raising fish.

Some participants said that a key aspect of BC's competitive advantage—its coastal waters at the right temperature for salmon—would be lost if the industry transitions to land-based aquaculture. An alternate view was that the existing network of expertise and services in BC could easily be adapted to land-based aquaculture.

### **Marine-based systems (offshore, closed containment, and semi-closed containment) and hybrid systems**

Discussions of marine-based systems focused on comparative costs of operating the different systems. Citing the 2019 Gardner Pinfold report, *State of Salmon Aquaculture Technologies*, one participant said that hybrid and marine closed containment systems are the most economically feasible alternatives to open-net pen aquaculture, stating that marine-based closed containment systems are one-tenth the cost of land-based aquaculture.

Some participants said that semi-closed containment pens are cost-competitive with open-net pen aquaculture, noting that although there are extra costs, these systems save money by avoiding lice problems, reducing fish mortality, and achieving a higher feed conversion ratio.

One person described an offshore system that was still being tested at beta sites, but showed promise to be a financially sustainable model. The company is creating the needed technologies as it goes along, and partnering with other innovative companies. He suggested that the land-based approach was “uninformed” and said taking a fish farm out of the water does not solve all the problems.

Other participants suggested that marine-based systems would be more appealing to consumers who are willing to pay more for a product that is more environmentally friendly.

### **Economic alternatives to salmon farming**

Noting that aquaculture is not limited to salmon farming, several participants discussed successful operations growing other food and suggested that this sector could be expanded in BC. It was noted that the plan to transition from open-net pen salmon farming does not need to focus on salmon—other forms of aquaculture could be an alternate income stream. Several examples were given of food that can be grown in aquaculture environments, including trout, sable fish, scallops, mussels, sea urchins, seaweed and kelp, and water lentils. This could be a way of repurposing open-net pen operations, and in some cases could even contribute to carbon sequestration, said participants.

Others, while supporting the idea of other aquaculture enterprises, emphasized that this may help but will not replace the economic contribution of salmon farming in BC.

### **PARTNERSHIPS, CIRCULAR ECONOMY MODELS, AND WHOLE-SYSTEMS THINKING**

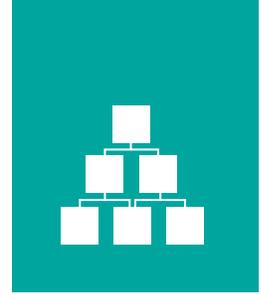
One participant noted that an important global trend is the development of partnerships and joint ventures among different companies. Individual farmers cannot do everything by themselves, and partnerships enable the sharing of knowledge and expertise.

The “circular industry” model is becoming a global trend and is a key to sustainability, said another participant. This model focuses on making the whole value chain sustainable—not just the fish farming component. An example of a circular model would be a sustainable green industry aquapark that grows and processes the salmon as well as handling the feed production and processing the wastewater. This approach presents an opportunity for partnerships to leverage knowledge and maximize potential.

Environmental, Social and Governance (ESG) systems, or “whole-systems thinking,” was also mentioned as an important global trend. This concept recognizes that humans are not separate from the rest of the environment and companies are not separate from the places and communities in which they operate. A whole-systems approach is an underlying set of principles for investment that honours the fish, the ocean and the local communities.

## SECTION 6

# Governance considerations



### LEGISLATIVE/REGULATORY ENVIRONMENT

#### Regulatory requirements, monitoring, and enforcement

Participants discussed some specific ideas for regulations, monitoring, and enforcement, particularly for the open-net pen salmon farms currently in place.

Predator populations and sea lice were both discussed as important challenges to wild salmon. It was suggested that enhanced regulatory mechanisms for marine-based aquaculture—and effective enforcement—are key to limiting the sea lice population in specific environments.

One opinion expressed was the view that DFO uses siting criteria for open-net pen farms as a surrogate for risk assessments. The participant said that while open-net pen farms are in use (active), DFO should be employing risk assessment strategies such as particle flow models (with a vector added to the model) to learn about the local area, rather than just applying siting criteria. According to the participant, risk assessment means knowing where the wild salmon are, where the juveniles are, and where the effluent water flows, then identifying the stressors for stock and monitoring those stressors. Siting criteria, said the participant, are not sufficient to address the threat to juvenile salmon by parasites and disease.

#### International regulatory standards

Representatives of the Scottish government shared insights on how they approach the regulation of

offshore aquaculture. In 2018, Scotland launched the Salmon Interactions Working Group (SIWG), which included members from the aquaculture and wild fisheries sectors, local government, Scottish government, and other agencies. This group made more than 40 recommendations on matters such as regulation and licensing of fish farms and collection of data. The Regulators Technical Working Group (TWG), made up of experts and local authority representatives, developed an evidence-based practical framework tool for a regulator to use to assess risk posed by sea lice to wild salmon and sea trout. Scotland's Farmed Fish Health Framework (FFHF) focuses on three priority areas: the cause of fish mortality, the impact of climate change, and the development of treatments.

Scotland is working on a “modernized” approach to fish farming development within key regulators—SEPA (the Scottish Environmental Protection Agency) and Marine Scotland. The aim is a quicker, surer, and fairer regulatory regime, balancing the legitimate commercial needs of the sector with the health and welfare of farmed fish, the interaction with wild fish, and protection of the seabed and wider water environment.

SEPA will assess the environmental impacts of any finfish technologies proposed for use in the Scottish context within its current overarching regulatory framework. SEPA has also launched a new regulatory framework and sector plan for finfish aquaculture, including measures to improve environmental compliance so that the size of fish farms is better matched to environmental capacity. SEPA is developing its revised framework further,

particularly with regard to how organic waste discharges from farms are regulated—which is a key issue for stakeholders.

### **Requirements for commercial fishing vs. finfish aquaculture**

Several participants said that there should be a level playing field for commercial fishers and fish farms, with fish farms held to equivalent standards as those who catch wild fish. One concern was that fisheries harvesting wild salmon must account for every fish caught, while salmon farms are not held to a comparable standard when gauging their impact on wild fish. Another concern was that while salmon farms produce fish at lower cost than commercial fisheries, this does not factor in the real cost of the fish in terms of the impact on the environment. From this point of view, the perspective was that salmon farmers had an unfair advantage compared to commercial fishers.

### **GOVERNANCE MODELS AND MECHANISMS**

The discussions touched on governance models and mechanisms in relation to fish farming. Participants discussed the appropriate federal, provincial and local roles, the diversity across different areas of BC, and the migratory nature of salmon across larger regions. One key consideration was the fact that BC is entering a new governance relationship with First Nations governments as it implements new legislation to align with UNDRIP.

**The following general suggestions were made:**

- Improve licencing regimes to protect wild salmon instead of industry.
- Include the Sparrow priorities within decisions surrounding Section 56(a) for transfer licences.
- Consult on a co-decision model with a tri-partite government-to-government process, including informed reputable advisors.

- Create a single agency (i.e. integrate the policies of the different orders of government).
- Involve First Nations from the beginning in creating and leading the governance structure. Refer to co-governance models such as the Marine Plan Partnership for the North Pacific Coast (MaPP).
- Adopt recommendations from the Salmonid Alternative Production Technologies Working Group May 21, 2020, report.
- Develop regulations in an unbiased way using science and broad consultation to increase social licence for technologies and help improve trust in DFO.
- Set up an independent science advisory group on ocean health, watersheds, salmon habitat, and other matters. Include Indigenous traditional knowledge. Have members write statements of bias upfront, and try to achieve a balance.

### **DFO, PROVINCIAL, LOCAL AND FIRST NATIONS ROLES IN GOVERNANCE**

Participants discussed the many potential roles of different governments in overseeing aquaculture and wild salmon. There was support for relationship-building and collaboration between the federal and provincial governments and with local governments and First Nations.

One point made was that while DFO is responsible for Canadian oceans, if the aquaculture industry is licenced as both land-based and marine-based then the land-based portion of the industry would be regulated by the province. Proponents of land-based aquaculture suggested that it would be better handled as “agriculture” than as “fisheries.” It currently faces regulatory requirements that are irrelevant to the land-based industry, and can’t access relevant funding because it is not classified as agriculture.

Another issue discussed was the importance of clarifying and following protocols for engaging

with First Nations on a government-to-government basis, which may vary for different nations. This is discussed in more detail under “*Advancing Reconciliation*”.

A variety of suggestions were made regarding the roles of DFO, the province, First Nations and communities:

- DFO should not have the dual responsibilities of protecting ocean resources and overseeing the aquaculture industry. DFO’s primary mandate should be to protect wild stocks. As suggested by Justice Cohen, DFO should serve as a regulator of aquaculture, not as a promoter of the industry.
- DFO should have a director of wild salmon who would play a leadership role in focusing on the health of wild fish.
- DFO should continue to have regulatory oversight over the use of oceans, but licencing should devolve to the province.
  - There could be community and First Nations involvement in licencing and decision-making.
  - Scientific information could be shared with the public before licencing decisions are made.
- Monitoring of aquaculture activities should be handled by the province or locally.
- An overarching provincial approach could be implemented on a regional basis.

## LICENCING FEES AND OTHER RESOURCE FEE STRUCTURES

Norway’s approach to licences and licence fees was discussed (where the Norwegian government auctions licences for considerable sums of money), with participants noting some factors that make it difficult to compare with Canada’s current regulatory regime:

- This practice can result in multiple companies operating in the same areas, which could become complicated in BC because of relationships with First Nations. From this point of view, the Norway model would not work in BC.
- There are differences in the Canadian value chain compared to Norway, which account for the lower licence fees.
- In BC, community involvement is a major aspect of the sector. Large licence fees would not align with the vision of having First Nations involved in the sector, and could become an issue.

One suggestion was to examine the Alaskan fisheries system for fee structures. Other participants suggested that those benefiting from the natural resources should be asked to reinvest something into rebuilding habitat. This policy could extend beyond aquaculture to include ocean ranching, resorts, logging, commercial fishing, and sport fishing. It was also suggested that any funds raised through licences for aquaculture activities on First Nations territory should go back to those territories and not be directed toward outside organizations. One idea was that the federal government work with First Nations to determine a fair fee structure for industry use of land and oceans. Another suggestion was to “charge what is reasonable” for the impacts on the natural resource.

One observation was that the taxes paid by people working in the industry, and corporate taxes collected through the companies, represented value for government revenues as well.

## AREA-BASED MANAGEMENT

There was considerable discussion of area-based management as a governance option for BC, with some participants saying that this approach suits BC because it allows aquaculture to grow differently in different places, minimizing conflict, and supporting diversification. The approach was praised for putting the focus on people and ecosystems rather than technology.

One point made was that area-based management should use Indigenous knowledge to inform decisions. Many First Nations emphasized the need for local management making local decisions for local benefits, and some said they wanted to do their own monitoring of farms located in their territories. It was noted that local decisions should reflect the idea that the ocean is not a dumping ground—care must be taken with what is put in and what is taken out.

Norway's local ecosystem approach to licencing salmon farming was mentioned as a good model. Building on that, one person suggested a structure for moving some of the responsibilities currently held federally to a local ecosystem structure where First Nations, communities, and the province would make decisions within defined ecosystems that are directly impacted. These responsibilities would range from consultation through site licencing

and routine environmental monitoring. The federal government would issue leases and have broad oversight of the environmental monitoring. A body of scientists could provide information to communities to aid in decision-making.

Some participants cautioned that there were challenges with area-based management for aquaculture in BC, noting that with salmon migratory runs of thousands of kilometres, local decision-making could have an impact on other areas. Some said that the region should not move forward with area-based management if there was any chance of open-net pens remaining in the water. It was suggested that if area-based management is put in place, the federal government must still have jurisdiction over certain standards and regulations. From an industry point of view, one challenge with area-based management is that a company can find itself confined to specific areas.

Other suggested models for area-based management included Ireland's CLAMS (Co-ordinated Local Aquaculture Management Systems), the Cowichan Round Table, and the Somass Salmon Harvesting Round Table.

# Suggested further research

Many participants cited existing resources like the Cohen Commission report, the Gardner Pinfold report, the report and recommendations by the Indigenous and Multi-stakeholder Advisory Body's Salmonid Alternative Production Technical Working Group, and the extensive work done by DFO scientists as important resources. Some people also suggested that more information is needed, and many of these suggestions are summarized here. A more extensive list of resources was collected through web-based and email submissions and all the material will be taken into account to inform further engagement and preliminary analysis in the development of a responsible plan to transition.

### **Relationship between open-net pen salmon farming and wild Pacific salmon**

**A number of recommendations were made about ways to gather additional information and make determinations on the relationship between open-net pen farming and wild salmon:**

- Identify the specific risks to wild salmon that would be addressed by removing open-net pen farms.
- Obtain baseline data and do appropriate testing and follow-up to determine the actual impacts on both wild and farmed fish, once open-net pen farms are removed from an area. Assess the outcomes of various measures and publish the results.
- Gather data from the Broughton Archipelago and Discovery Islands now and annually, to measure the return of salmon stock in the rivers (particularly juvenile salmon going up-river) and evaluate the impact of removing open-net pen farms.
- Do further research on the effects of fisheries on wild stocks, to investigate declines in fish stocks that do not pass by fish farms.
- Learn from researchers who are looking at wild salmon migration routes to understand whether

outmigration routes can be varied, and how to minimize interactions.

- Review the CSAS risk assessments, which some feel were not done objectively and could be improved upon. These were focused on a specific pathogen in a specific region for a specific population, using existing data. Current impacts on salmon may be the result of several factors combined.
- Listen to the full range of views held by all DFO scientists, and not just the “squeaky wheels.”
- Create a three-person advisory council in which all the members must be approved by both sides of the debate (rather than having one member endorsed by one side of the debate, one endorsed by the other side, and a third member “in the middle”).

### **Developing a responsible transition plan**

**The following suggestions were made for further research that would be useful in developing a responsible transition plan:**

- Review the benefits, impacts, and costs of various finfish aquaculture technologies with a critical lens.
- Assess the cumulative impact of sea lice and pathogens/disease on wild salmon.

- Do “whole life cycle” studies of Pacific salmon to determine the impacts of open-net pen farming on wild salmon in the ocean, and where in their life cycle the impacts are occurring.
- Do more research on the local coastal carrying capacity.
- Use the regional expertise from the Broughton area to support the removal of open-net pens.
- Improve trust by conducting PRV challenge studies on all five species of wild salmon.
- Research best practices in other jurisdictions.

### **New production systems**

Suggestions were made for useful research on innovation and alternate salmon farming technologies:

- Research all the costs of different modes of salmon farming.
- Explore animal health and welfare issues associated with new technologies and environments, including recirculating aquaculture systems.
- Look into alternative feed sources.
- Be aware of potential future innovations in the sector.
- Explore potential sites for land-based and offshore aquaculture operations.
- Identify priorities for future research based on information gaps identified during this engagement and transition plan process.

Some participants discussed the research and training that would be needed to adopt new production systems, adding that significant funding would be needed for these aspects of the transition plan:

- Training in sample and data collection.
- Identification of new data sets for monitoring conditions and fish health (e.g. to monitor specific diseases and parasites of concern in new growing environments).
- Development of new tests and analysis for the new data sets, and conversion from research-level tests to diagnostic-level tests so that they can be widely adopted.

### **Resources for research**

Participants also discussed the resources needed to support this research, making some specific recommendations:

- Provide funding for “whole life cycle” studies.
- Fund a large-scale closed-containment farm to test the feasibility of the technology.
- Have a funding mechanism that supports fruitful research collaborations between academics and companies to optimize fish health and production.
- Create platforms in BC where industry members can meet and learn. Government can bring value to the industry by being a host and facilitator, and as a participating partner that is also learning.
- Provide support for pilots of area-based management to develop nation-led and community-supported decision-making, with strong local relationships between operators, nations and communities.