Aquaculture Policy and Past Inquiry Recommendations on BC First Nations Title and Rights

Report To:

First Nations Fisheries Council

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Executive Summary

The federal government was directed by the BC Supreme Court to regulate and manage aquaculture in BC. To this end, Fisheries and Oceans Canada (DFO) is undertaking consultations to develop a Federal BC Aquaculture Regulation while concurrently consulting on a National Aquaculture Strategic Action Plan Initiative (NASAPI). In order to support BC First Nations in these consultations, the First Nations Fisheries Council (FNFC) has commissioned this evaluation of relevant policies, legislation and reviews of the aquaculture industry. The goal of this policy review is to provide specific advice to First Nations, federal and provincial governments on which areas of current policies require consideration for potential reform.

The objectives are to identify themes of interest to First Nations emerging from the documents, including areas of existing policies which may result in infringement of First Nations jurisdiction, title and rights. A second objective is to compile recurring recommendations to create a toolkit of best practices which can be used to enlighten the drafting of new regulations.

The policies and legislation reviewed included the DFO *Aquaculture Policy Framework* (2003), the *Wild Salmon Policy* (2005), BC Aquaculture Regulation (2002), BC Aquaculture Waste Control Regulation (2002), and the DFO *Federal BC Aquaculture Regulation and Strategic Action Plan Initiative* Discussion Document (November 2009). Inquiry reports included the *Pacific Salmon Forum Final Report* (2009); Special Legislative Committee on Sustainable Aquaculture Final Report (2007); Assembly of First Nations report, *Aquaculture Discussion Paper: An Overview of Concepts and Terms Associated with Aquaculture, Sustainable Aquaculture in Canada, and Impacts Aquaculture has on First Nation Peoples* (2006); First Nation Panel on Fisheries report, *Our Place at the Table* (2004); and Standing Committee of Fisheries and Oceans report (2003). Most of the documents reviewed were concerned with finfish aquaculture, however, much of what is said concerning decision making, management, research, and monitoring of finfish aquaculture, could also apply to shellfish aquaculture. For additional guidance, various documents obtained through the FNFC were reviewed. Comments from representatives from BC First Nations and the Aboriginal Aquaculture Association were sought through the FNFC.

The common themes that emerged from the reports and policies were: 1) review and revise regulations and policies; 2) prioritizing wild salmon and the environment; 3) applying an ecosystem approach to managing the industry; 4) creating an inclusive process (including a co-management role for First Nations) in management and decision-making; 5) revising or creating policies and regulations that include best practices for dealing with environmental issues such as disease and parasite transfer, waste discharge and contaminants, escapes; 6) using science to guide decision-making and taking an adaptive management approach to day-to-day management; and 7) developing a commercially viable technology for closed containment finfish aquaculture. There was a high degree of convergence in the recommendations that came out of the reports. This made it possible to organize them into areas for the development of best practices.

The review identified 37 areas where best practices could be developed. Identifying these best practices is only a first step. Further work needs to be done to prioritize these and to expand their content. The list of best practices offers a starting point for consultations with DFO and the province on aquaculture regulation reform and strategic direction of the industry in BC.

As participants in the drafting of a new federal regulatory regime, First Nations have an opportunity to significantly change the way aquaculture is managed. Based on two premises, that First Nations have rights and title that must be considered and accommodated, and that the wild species and their aquatic environments are a defining characteristic of BC, First Nations can articulate their vision of a future for aquaculture in BC.

1. Introduction

1.1 Background

Aquaculture in BC is an industry whose potential to provide jobs and wealth, and grow significantly, is stalled by a lack of public consensus on its viability. Questions of the industry's compatibility with values such as a clean environment, coastal way of life, and health of wild salmon populations go unresolved[1]. Certainly within First Nations' communities, the choice between economic growth and ensuring environmental health creates tension. Although some First Nations embrace aquaculture for the potential it has to revitalize their communities, they are concerned about environmental effects of aquaculture and its potential to infringe upon their jurisdiction, title and rights. Much of the problem centres around how these issues are regulated.

Fisheries and Oceans Canada (DFO) is the lead agency for aquaculture since 1985. As such, it bears ultimate authority for managing aquaculture according to the provisions and prohibitions of the *Fisheries Act*, *Navigable Waters Protection Act*[2] and *Oceans Act*. In a 1988 memorandum of understanding (MOU), DFO and BC agreed that the province would manage and develop the aquaculture industry in consultation with DFO, with DFO retaining responsibility for the Fisheries Act. The BC Ministry of Agriculture and Lands (MAL) has since developed regulations on licensing and escapes (Aquaculture Regulation) and waste management (Finfish Aquaculture Waste Control Regulation).

DFO has led a number of initiatives around aquaculture but these have been mainly focused on strategies for developing the industry[3]. Where they do discuss governance and regulation, the goal seems to be streamlining and harmonization of the regulatory regime. DFO still plays an active role in decision-making around siting, fish health, research and other areas, but the principal regulator has been the province. This arrangement has not been fully satisfactory as has been noted by various inquiries.

Inquiry reports such as the Pacific Salmon Forum report (2009); Special Legislative Committee on Sustainable Aquaculture report (2007); First Nation Panel on Fisheries report (2004); and Standing Committee of Fisheries and Oceans report (2003) have raised questions about DFO's involvement, or lack of, in protecting wild fish, or even conflict of interest between protecting wild fish and fostering aquaculture development[4]. These reports have unanimously called for greater emphasis on protecting wild salmon and their habitat. The Standing Committee report (2003) even recommended a reclamation of DFO responsibilities through the enactment of a federal Aquaculture Act, regulations, and standards with a clearly defined priority of protecting fish and fish habitat.

In 2009 the BC Supreme Court ruled that aquaculture was a fishery and that as such, it falls under the

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1 See the Pacific Salmon Forum Final Report. 2009.

2 The NWPA is presently within the jurisdiction of the federal Ministry of Transportation.

3 A history of DFO initiatives for developing aquaculture is summarized in the Assembly of First Nations report "Aquaculture Discussion Paper: An Overview of Concepts and Terms Associated with Aquaculture, Sustainable Aquaculture in Canada, and Impacts Aquaculture has on First Nation Peoples". 2006. Available on the AFN website: http://www.afn.ca/article.asp?id=2773

4 Three major inquiries on aquaculture are reviewed here, but others include the BC Salmon Aquaculture Review, 1997 and federal Auditor-General's report, *The Effects of Salmon Farming in British Columbia on the Management of Wild Salmon Stocks*, 2000.

jurisdiction of the federal government. In the judge's decision, the federal government was directed to regulate and manage aquaculture in BC (see Ratcliff & Co. memo to FNFC, January 2010[5]). To this end, DFO is undertaking consultations to develop a Federal BC Aquaculture Regulation while concurrently consulting on a National Aquaculture Strategic Action Plan Initiative (NASAPI).

1.2 Goals and Objectives

The First Nations Fisheries Council (FNFC) is mandated to provide support to BC First Nations on fisheries issues. It has commissioned a series of reports on aquaculture that will be used to assist First Nations in consultations or information meetings that may be held with DFO on the aquaculture regulation and strategic initiative (NASAPI). This report is one in this series. It is a review of relevant policies, legislation and reviews of the aquaculture industry. The goal of this policy review is to provide specific advice to First Nations, federal and provincial governments on which areas of current policies require consideration for potential reform.

The first objective is to identify themes of interest to First Nations emerging from the documents, including areas of existing policies which may result in infringement of First Nations jurisdiction, title and rights. Recurring recommendations relevant to protecting First Nations jurisdiction, title and rights will be noted. A second objective is to compile recurring best practices or recommendations to create a toolkit of best practices which can be used to enlighten the drafting of new regulations.

2. Methodology

The policies and legislation reviewed included the DFO *Aquaculture Policy Framework (2003)*, the *Wild Salmon Policy (2005)*, BC Aquaculture Regulation (2002), BC Aquaculture Waste Control Regulation (2002), and the DFO *Federal BC Aquaculture Regulation and Strategic Action Plan Initiative* Discussion Document (November 2009). Inquiry reports included the *Pacific Salmon Forum Final Report* (2009); Special Legislative Committee on Sustainable Aquaculture Final Report (2007); Assembly of First Nations (AFN) report, *Aquaculture Discussion Paper: An Overview of Concepts and Terms Associated with Aquaculture, Sustainable Aquaculture in Canada, and Impacts Aquaculture has on First Nation Peoples* (2006); First Nation Panel on Fisheries report, *Our Place at the Table* (2004); and Standing Committee of Fisheries and Oceans Report on Aquaculture (2003). Most of the documents reviewed were concerned with finfish aquaculture, however, much of what is said concerning decision making, management, research, and monitoring of finfish aquaculture, could also apply to shellfish aquaculture. For additional guidance, various documents written by First Nations organizations were obtained through the First Nations Fisheries Council and reviewed.

2.1 Topics of Interest to First Nations

This report organizes the themes identified in the reports and policies into four topics and sub-topics[6]: siting, day-to-day management, science and monitoring, and compliance. There are no distinct boundaries between these topics; any of sub-topics could fit in more than one topic area.

1. Siting

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[5] Memorandum to the First Nations Fisheries Council. *Legal Opinion for FNFC re: Consultation and the Federal Aquaculture Initiative*. January 2010.

[6] First Nations have voiced an interest in actively participating in aquaculture through these four topic areas in a Statement of Solidarity resolution issued by the Union of BC Indian Chiefs, September 16-18, 2009.

- Resource and land-use decision making
- Sustainability of in the marine ecosystem

2. Day-to-Day Management of the Aquaculture Industry
   - Governance and First Nations
   - Interference of aquaculture with fisheries
   - Economic benefits (e.g., jobs, business opportunities, training, resource sharing)
3. Science Guiding Decision-Making for the Industry
   - Environmental impacts (fish farm effluent and associated contaminant issues; transfer of disease and parasites and associated issues; escaped farmed fish; species attraction to farm sites; wild fish use in farm fish feed)
   - First Nations participation in scientific research
4. Monitoring and Compliance of the Industry

Guidance was sought from representatives of BC First Nations to confirm that their interests were covered by these topics.

The intention of this policy review report is to use these topic areas to explore how existing policies meet expectations of First Nations and to illuminate where there is room for improvement. First Nations expect (from the Union of BC Indian Chiefs *Statement of Solidarity* Resolution No. 2009-35):

- their title and rights are paramount in any legislation, policy or decision-making process regarding changes to the aquaculture industry
- there is a fully supported process for meaningful involvement of First Nations on the development of policy and regulations, as well as on four topic areas (above)
- opportunities for participation in aquaculture (training, resources, funding)

The remainder of this paper offers a synthesis of policies and approaches that have been put forward in the past six or seven years in an effort to better manage salmon aquaculture. The key questions asked were:

- What do the policies say about each of the topic areas and the role of First Nations?
- What are the deficiencies in the policies, i.e., what is not being addressed?
- What do the reports offer to guide a new regulation, e.g., best practices or recommendations?

The result of this review is a compilation of best practices or recommendations that could be considered in a federal Aquaculture Regulation to reduce risks and provide maximum benefits for First Nations.

3. Synthesis of Policies, Legislation and Legislative Inquiries

Although there was a divergence in the tone and focus of each policy and report, there was agreement that the marine environment, wild salmon and their habitats are a priority for British Columbians and that current aquaculture governance and management practices fail to fully protect these values. (See Appendix 1 for a summary of each policy and report.)

The most prevalent themes emerging among the reports include:

- over-hauling the regulatory environment so that DFO has greater authority and visibility as the upholder of the *Fisheries Act*,
- applying an ecosystem approach to managing the industry,
- creating an inclusive process (including a co-management role for First Nations) in management and decision-making,

- revising or creating policies and regulations that include best practices for dealing with environmental issues, e.g., disease and parasite transfer, waste discharge and contaminants, escapes
- using science to guide decision-making and taking an adaptive management approach to day-to-day management, and
- developing a commercially viable technology for closed containment finfish aquaculture.

These will be explored in the following four topic areas.

3.1 Siting

3.1.1 Resource and Land-Use Decision-Making

First Nations maintain that protection, maintenance and rehabilitation of aquatic resources, habitats and systems take precedence when making land-use decisions about aquaculture (First Nations Panel report). Principles outlined in the Wild Salmon Policy (WSP), the Pacific Salmon Forum (PSF) report, Special Committee and Standing Committee reports agree that the health of wild salmon stocks are a priority for British Columbians. It is also clear that a wild salmon perspective for evaluating aquaculture's impacts has not been adequately applied to aquaculture siting and land-use decisions. It should be noted that while some of the reports were mandated to consider only salmon, other wild fish species should equally be protected within new regulations, policies or best practices.

An ecosystem or integrated area-based management approach would allow for site assessment of aquaculture development and its impacts on all marine resources at an ecosystem level rather than at the site level as is currently the practice. All resource users in such a defined area would also be included in the assessment to further increase the understanding of potential impacts.

What follows is a synthesis of what such an approach might look like. First a thorough understanding of the characteristics and functions within an ecosystem would be necessary. Area-specific indicators and their thresholds would be identified. It would also mean creating a collaborative structure for planning and making decisions, developing risk-management tools (such as oceans models or sea lice dispersal models), collecting baseline data, ongoing monitoring against area-specific indicators and thresholds, integrating data from various sources, and continual communications and information sharing with other governments, First Nations, stewardship groups, and industries. For First Nations this level of inclusion would require a bilateral management structure with the federal and provincial governments.

If implemented and supported fully, this kind of inclusive and comprehensive vision for aquaculture management would give First Nations greater input into siting decisions. Its weakness is that protection of wild salmon and habitat is dependent upon setting up complex, time-consuming and expensive management structures. A more reactive approach such as restricting all future finfish aquaculture development or expansion to ocean-based closed containment technologies (e.g., Special Committee report) would immediately reduce many of the environmental risks associated with siting but could carry significant economic risk. The Special Committee report also recommended that no new fish farms be sited within the central or north coast as a measure to reduce the risk of impacts to wild fish stocks. This restriction includes prohibiting expansions of current farms and new aquaculture species.

<u>Areas for Developing Best Practices</u>:

1. Bilateral co-management structure with First Nations, federal, provincial and local governments
    - Capacity for First Nations and First Nations organizations

2. Environmental assessment of aquaculture on an area and ecosystem scale
   - Involve all First Nations with territories in the defined area, in marine or land use planning
3. Siting decisions
   - Reviewing and updating siting criteria
   - Integrating data from other user groups, agencies and sources, and continuous information sharing
   - Characterizing an ecosystem: defining the baseline data necessary for an environmental review
   - Identification of local indicators and thresholds;
   - Risk-management tools
4. Independent regulatory oversight authority to audit land-use decisions
5. Restrictions. Province-wide planning to determine if, when or where restrictions are needed (e.g., species, farm expansions, or regional restrictions)

3.1.2 Sustainability of the Aquaculture Industry

Questions of sustainability are often at the heart of First Nations concerns about the aquaculture industry in BC. Finfish aquaculture, in particular, is viewed as requiring enormous inputs to keep it going; it has negative impacts - the severity of which are not conclusively known; and though the positive benefits of jobs and income to coastal communities are recognized, many wonder whether aquaculture is compatible with long-term coastal marine environment sustainability. Sustainability issues for First Nations can be encapsulated into three areas: 1) healthy ecosystems, 2) First Nations health concerns, 3) poverty and economics in First Nations communities (AFN report).

To be sure, agreement with principles of sustainability and precaution are fundamental to the policies and reports reviewed. Yet these principles seem to be challenging to put into practice. As a start, sustainability definition consistent with the *Oceans Act* should articulated in a federal Aquaculture Regulation. From there, goals need to be defined. Direction to design and test ocean-based closed containment systems at a commercial scale is one such goal (PSF report and Special Committee report), a shift regarded by many as sustainable[7].

Regardless of which finfish technologies are eventually adopted in BC, the best chance of meeting sustainability goals are by managing aquaculture through an area management and ecosystem-based approach. Not only siting, but continued operations would be looked at from an ecosystems approach. Effects on area-based indicators would be monitored over time and tested against the benchmarks for that area. Risk management tools would be applied using fully integrated data and operations adapted according to results as appropriate. Underlying all these is a need for increases in monitoring of estuaries and watersheds, wild fish habitat and status, and stock assessments. Such a management approach would involve full and meaningful participation by First Nations in framing policy and subsequent implementation, planning, and development of best practices.

Along with these reforms, decisions on land-use should also be made taking into account the value of ecological good and services within an ecosystem.

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[7] For a discussion of environmental costs of closed containment systems, see: Ayer, N. and P. Tyedmers, Assessing alternative aquaculture technologies: life cycle assessment of salmonid culture systems in Canada, J Clean Prod (2008), doi:10.1016/j.jclepro.2008.08.002

Areas for Developing Best Practices:

1. Research, design and test commercial-scale, marine-based closed containment systems
2. Formulate a definition of sustainability within an area, based on area management and ecosystems-based research and management of aquaculture operations.
3. Monitoring area-based sustainability indicators and thresholds over time (including estuaries, watersheds, wild fish habitat and status, and stock assessments)
4. Models and risk management tools

3.2 Management of the Aquaculture Industry

3.2.1 First Nations Governance

Throughout the last 40 years, BC First Nations have not been participants in decision-making in regards to siting of fish farms or granting of licenses within their territories. At present they are invited to respond to referrals during the application process and the government is obligated to respond to their concerns. But the current situation does not grant the authority due them through their Aboriginal rights and title (see Ratcliff & Co. memo to FNFC, January 2010 for a full discussion).

First Nations expect to be fully engaged partners in decision-making and managing fish and fish habitat along with federal, provincial and local governments, whether they are participants in aquaculture or not. It is an aspiration that is consistent with the scope of bilateral consultation envisioned in the PSF report and WSP. Inclusive activities such as planning, research, data collection, monitoring, and evaluating would enable First Nations to participate meaningfully in decision-making. With a structure like this, amendments to management plans would require First Nations consultation[8]. This degree of involvement would entail a revision of the governance relationship between First Nations and governments.

Unfortunately this level of commitment to First Nations is not as forthcoming in the DFO's APF, or in DFO's 2009 Discussion Document. The language is somewhat non-committal about involving First Nations directly in decision-making. For example the APF states "the priorities of Aboriginal users of aquatic resources will be taken into consideration when making decisions about aquaculture". To be fair, the APF is a document that preceded recent legal decisions regarding recognition and accommodation of rights and title, but the thinking inherent in the Discussion Document of 2009 and any new federal regulatory work should be consistent with the latest understanding of case law (discussed more fully in See Ratcliff & Co. memo to FNFC, January 2010).

Part of the problem is that First Nations have not been fully included in the government's development of aquaculture from the start[9]. They have not even had a voice in framing the federal vision of aquaculture.

Additionally, First Nations will need structures and processes to communicate among themselves in order to effectively participate in governance. Although First Nations seek a common vision and principles towards the management of aquaculture, they wish for the flexibility to adopt approaches

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[8] For example, a proposed amendment would allow license holders to change aquaculture species under the same license without consultation (R. Harry, pers. comm., 2010)

[9] Failure to seek out First Nations concerns and vision is discussed in the Assembly of First Nations *Aquaculture Discussion Paper* 2006.

and institutions appropriate to different geographic areas. An intertribal mechanism which would not only manage intertribal disagreement over aquaculture but would facilitate information sharing, reaching consensus on issues, and assisting one another.

Areas for Developing Best Practices:

1. Bilateral governance structure and process between First Nations, federal, provincial and local governments that includes decision-making authority within a First Nations' traditional territory
2. Development of a First Nations common vision and principles on the management of aquaculture that would protect habitat and water resources
3. First Nation-to-First Nation structure and process
4. Incorporating Aboriginal traditional knowledge into plans and practices by developing standards

3.2.2 Interference with Fisheries

The potential for aquaculture to interfere with fisheries can occur if farms are sited inappropriately. The concern around sea lice impacts to pink salmon runs in the Broughton Archipelago is an example of the impact farms may have if improperly sited on migratory routes. There is also concern from First Nations in the interior of BC who wonder if decreasing runs of interior sockeye salmon migrating through areas of high fish farm density such as Johnstone Strait or the Broughton Archipelago are being impacted by sea lice, Infectious Hematopoietic Necrosis (IHN) or other diseases. Shellfish fisheries (commercial and traditional) could also be impacted by discharge from nearby fish farms. Another potential for interference with fisheries arises with wild fish that get trapped in net pens, or the potential that herring are spawning on fish farm nets (see Section 3.3.4 Species Attraction to Farm Sites).

The BC government's aquaculture siting criteria sets distance limits for various marine resources. For example, a fish farm cannot be sited closer than 1 km from the mouth of a significant salmonid bearing stream; 1 km from herring spawning areas of vital, major or high importance; 300 m from inter-tidal shellfish beds regularly or traditionally used by First Nations or other users; 125 m from other wild shellfish beds and commercial shellfish growing operations. These criteria should be reviewed with the latest available scientific information. They should also be reviewed to ensure they are complete, e.g., distance limits for wild fish migration routes are missing.

More indirectly, the management and research demands of aquaculture may be diverting limited funds that would otherwise be channelled into conservation of wild fisheries stocks and habitat. For example in 2008, $70 million of federal funds were allocated to aquaculture research and development[10], but the same level of investment has not been designated to wild fisheries conservation, restoration or rehabilitation.

Areas for Developing Best Practices:

1. Identify marine resources other than salmon that should be evaluated within an ecosystem-based research or management program

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[10] $70 million to fund aquaculture research over 5 years was allocated in the 2008 budget. It is to be apportioned into four areas: $25 million for new technology or management techniques, $13 million towards improved governance to support aquaculture management, $22 million towards science for improving regulation, and $10 million for product certification and market access. Presented in a DFO power point presentation to the BC Shellfish Growers Association. Accessed at: *bcsga.ca/wp-content/uploads/2008/.../andy_thomson_aquaculture2012.pdf*

2. Wild fish capture in net pens – research and best management practices to mitigate the inadvertent capture of wild fish or herring spawning on nets

3.2.3 Economic Benefits

Most of the aquaculture in BC takes place on the coast and in remote areas and thus presents economic opportunities for First Nations in the form of running their own aquaculture or supporting businesses, benefits sharing agreements, or employment in aquaculture. A wide range of skills and services are required to support the industry, from divers, boat operators, fish feed producers, independent environmental monitors, processing plant workers, researchers, accountants, veterinarians, sales and administrators, etc. Many of these require skilled workers and are well paying.

Coastal First Nations are particularly interested in shellfish aquaculture. Governments have recognized this and have promoted this area of business through various initiatives over the years such as the 1998 provincial Shellfish Development Initiative (SDI), BC Economic Measures Fund, commissioning of business strategies, strategy and planning workshops with First Nations, support for the Aboriginal Aquaculture Association, and research and development through various research programs. The PSF report also recognizes the link between diverse economic communities and overall ecosystem health and encourages providing information on new development opportunities.

Increased and more focused support for First Nations to succeed as aquaculture entrepreneurs is called for by First Nations (e.g., First Nations Fisheries Action Plan, AFN report). The vision drawn is one where First Nations build their companies or co-ops on traditional economies and best practices. Focus should be on developing markets for First Nations products, creating a set of best practices including certification, and identifying opportunities for First Nations companies and co-ops. Training in areas of business, economics and operations will be important to success. Completion of a coastal assessment of areas with aquaculture potential whereby First Nations could reserve areas they might in future wish to develop would also encourage First Nations to participate in aquaculture.

The Aboriginal Aquaculture Association has been instrumental in assisting First Nations starting and running a business[11]. For example, the association has a planning guidebook available for First Nations considering getting into the business. It also provides a report summarizing the obstacles facing First Nations and how they may be overcome, including access to sites, clearing the tenure application process, policy or regulatory constraints, access to financing, training and First Nation community issues. The association's outline for an Aboriginal Certification of Environmental Sustainability program for aquaculture management consists of codes of practice, environmental compliance protocols, operational standards, a coastal management framework for assessing performance, and certification levels.

Application are also a challenge and getting through the environmental assessment process can be confusing and costly. First Nations can also run into opposition from local governments over their applications. Industry associations like the Aboriginal Aquaculture Association or the BC Shellfish Growers Association can provide new enterprises with valuable advice and assistance. An integration and harmonization of the regulatory framework, if implemented, would simplify the process. A bilateral consultation process could also assist First Nations to work through conflicts with local governments.

Economic opportunities exist through third party environmental monitoring of aquaculture operations

[11] The Aboriginal Aquaculture Association website: http://www.aboriginalaquaculture.com/resources_main.htm

or monitoring of local indicators through a watchman program, but have not been implemented to any extent (discussed further in the AFN report).

Areas for Developing Best Practices:

1. Support for First Nations Businesses
   - Planning an aquaculture business or an aquaculture-related business
   - Getting through the permitting and regulatory process
   - Aquaculture management and operations
   - Coast-wide assessment and map reserve
1. Developing Aboriginal Certification for aquaculture products or wild fishery products
2. Third party monitoring or watchman programs
3. Opportunities for revenue-sharing with aquaculture companies

3.3 Science

Science is the tool used to investigate potential impacts, understand interactions of components, quantify risk, and evaluate performance. It is also used to develop new methods, materials, equipment, tools or technologies that are applied to operations and management of aquaculture. As such, it plays a key role in the governance and management of aquaculture.

While there is general agreement in the policies and reports that scientific support is needed in all these areas, one of the recurring themes calls for a re-thinking of how science is conducted and accessed.

First, inclusion of First Nations (among others) is critical if science is to provide clarity especially on controversial topics. Inclusion means First Nations participating to the extent they wish to: e.g., sitting on research committees, designing research programs, framing research questions, providing traditional knowledge and knowledge about indicators, determining local thresholds, collecting data, analysing and interpreting results. For First Nations with the capacity, it may mean running their own research programs in partnership with a fish farm, with government or on their own.

Currently, the Aquaculture Collaborative Research and Development Program (ACRDP) is the main body for public aquaculture research in Canada. Its goal is to increase the competitiveness of the industry through projects between DFO and industry partners. Although this kind of research focus is necessary, it is non-inclusive of First Nations or other non-industry stakeholder groups; none of the research projects described in the ACRDP 2009 review listed a First Nation as a partner[12].

A perusal of the latest ACRDP research review report indicates there is work being done to solve problems to do with issues First Nations care about. For example, projects on sea lice transfer to wild fish and affects of SLICE on the environment, and reducing wastes through integrated multi-trophic aquaculture, or feeding systems that reduces wastage. However, the lack of First Nations inclusion in the scientific process does not create the confidence in the results that industry or government would hope for[13].

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[12] See *Canadian Aquaculture R&D Review 2009.* http://www.dfo-mpo.gc.ca/aquaculture/RD2009/toc-tdm-eng.htm

[13] An independent review of the program concluded that the ACRDP is a relevant and needed program. It further noted that the research being conducted through the program has 'the opportunity to clarify some of the misinformation that persists', regarding the opposition to aquaculture that is strong in BC. See Strategic Review of the Aquaculture Collaborative Research and Development Program Final Report. 2005. Goss Gilroy Management Consultants. http://www.dfo-mpo.gc.ca/science/enviro/aquaculture/acrdp-pcrda/strateg-eng.htm

Second, establishing a science secretariat that would oversee ecosystem-based research would improve collaboration and coordination among scientists with different perspectives and disciplines. Much existing research is conducted silo-style, that is, by each industry according to each industry. This is appropriate for some areas of research, but for other areas, such as impact assessments, it is more appropriately pursued at an ecosystem level, and taking into account different user groups, one of which is aquaculture.

Third, the secretariat, inclusive process, and research should be funded by governments. DFO distributes $4.5 million/year across Canada to the Aquaculture Collaborative Research and Development Program[14]. BC has a smaller funding capacity through the BC Aquaculture and Environment Fund (Aqua E Fund). Funding is also granted to research centres at UBC and Malaspina University College to support aquaculture research. A science secretariat set up to oversee science being conducted through all channels is needed to ensure that dedicated research funding for inclusive research is a recognized component of any aquaculture research program.

Fourth, reliance on current pathways for dispersing information is less than ideal. A lot of money and effort has been expended on aquaculture research, e.g., sea lice research in the Broughton Archipelago. Yet it is not clear if First Nations are benefiting from the research. Although research and data are disseminated in meetings, as published journal articles or online government websites, is it being taken up by First Nations? Much of the information is highly technical, crosses disciplines, may be preliminary in nature, contradictory, or written in mathematical language. Alternate ways to share information should be sought so that research results are accessible.

Finally, there should be a mechanism whereby industry is compelled to adapt to new scientific understandings. This could be accomplished with conditions in a regulation that require adaptive management along with a requirement to meet standards, best practices or thresholds that are subject to change with new information.

If the modifications to how science on aquaculture is conducted above were followed, First Nations would be in a more informed position and in a better position to make decisions on any of the environmental issues.

<u>Areas for Developing Best Practices</u>:

1. Developing a coordinated and collaborative research program to support ecosystem-based research
   1.1. Science Secretariat for ecosystem-based research on marine and watershed systems
      - Funding for research on wild salmon and other fish at the ecosystem level (e.g., federal funding equivalent or greater towards than the federal 5 year, $70 million aquaculture research program)
   1. Baseline information on the environment and resources
   2. Environmental monitoring and data collection
   3. Funding ecosystem-based research
   4. Structure for First Nations involvement in eco-system based science
      - Collaborative research process
      - Setting research priorities
      - Integrating Aboriginal traditional knowledge (issues, indicators, thresholds, methods)

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[14] See Research and Development webpage on the BC Ministry of Agriculture and Lands website. http://www.agf.gov.bc.ca/fisheries/rd_main.htm

- First Nations access to data collected through regulatory programs, for purposes of conducting research
- First Nations access to research funding
- Communicating scientific research to First Nations

2. Routing the results of new knowledge back to aquaculture management and operations

What follows is a summary of five categories of environmental issues that First Nations have concerns about and how an inclusive, ecosystem approach to research could address these.

3.3.1 Fish farm Effluent and Contaminant Issues

First Nations rely on and value marine resources, such as geoduck, butter or littleneck clams, prawns, urchins, salmon, herring, oolichan, and rockfish. So the presence of a nearby source of pollution, such as a fish farm, is of great concern. How are the waste and feed effluent affecting the ocean floor habitat? Are contaminants entering the food web? Are species' habitats degraded? These are the sort of questions First Nations have that are not fully addressed by the regulations.

BC Aquaculture Waste Control Regulation indicators and thresholds were established in 2002 using available science. However, the indicators and thresholds chosen (sulphide levels and benthic richness and abundance under and beyond the tenure perimeter) are not meaningful to many First Nations who may be concerned that effluent is reaching a nearby clam beach.

Reports are commonly heard from First Nations about deterioration in the quality of shellfish habitats and fish abundance in their territories. From 2004-2006, three coastal First Nations communities investigated wastes from fish farms impacting their traditional marine resources[15]. The project involved sampling contaminants in marine species using locally significant indicators that were identified by each First Nation. Results were highly variable and no clear relationship could be made between fish farms and contaminant levels. The exception was the higher levels of mercury that were found in rockfish, although these elevated levels rarely exceeded the Health Canada guideline.

There is a high demand by First Nations for such research and monitoring of contaminants, but funding is very limited. Consequently, very little research on environmental effects of effluent is undertaken at an ecosystem-level. It is important to note that research of this kind requires access to fish farm information and data on contaminants that may be released into the environment through feed, drug or pesticide use.

Ocean dispersal and uptake of waste discharge and contaminants is complex. Ocean dispersal models may be helpful in revealing patterns of deposition. An oceans model was developed recently through the work of the Pacific Salmon Forum that may help First Nations in understanding if important areas are being impacted or likely to be impacted.

Finally more stringent compliance measures may need to be imposed if research shows ecological integrity is being comprised. Appropriate measures such as reduced production limits, lower discharge limits or even relocation should be established in a new federal aquaculture regulation.

Areas for Developing Best Practices:

1. Ecosystem level control of aquaculture waste effluent
2. Research on waste and contaminants in the marine ecosystem and First Nations resources

[15] The project was coordinated by the BC Aboriginal Fisheries Commission and funded by Health Canada's First Nations Environmental Contaminants Program. http://www.environmentalcontaminants.ca/Resources/FundedProjectHistory

3.3.2 Transfer of Disease and Parasites

In the past decade, sea lice effects from farmed salmon to pink and chum salmon has been the dominant concern on the topic of disease and parasite transfer from farmed fish to wild fish. The concern that sea lice infection may be impacting wild salmon stocks has mobilized an exceptional level of scientific effort centred mainly in the Broughton Archipelago[16].

The question of sea lice management was a main topic of the Pacific Salmon Forum report. The forum commissioned much research and subsequently produced a number of recommendations for managing sea lice and protecting wild fish. Practices to reduce sea lice impacts on wild fish include timing the stocking and harvesting on farms to avoid local fish migrations, fallowing and setting thresholds (3% of juvenile pink and chum salmon less than 0.5 g must carry less than 1 pre-adult or older sea lice (*Lepeophtheirus salmonis* during the salmon out-migration period), limiting farms to one age class and lowering stocking densities. (The PSF report recommended setting stocking limits for the Broughton Archipelago at 18,500 tonnes, which is the average annual production over 8 years).

Although the science is not unanimous, there is agreement sea lice on farms has to be managed better. As a result, measures for minimizing sea lice on farms have been tested and are required by the province. As part of the monitoring and reporting for sea lice measure, fish farms growing Atlantic salmon[17] are required to monitor their stock for sea lice during the wild salmon out-migration period. If a threshold of 3 motile lice per fish is reached, the company must either harvest its fish or apply lice treatment (Emamectin benzoate "SLICE" is commonly used).

Another management approach is to move to closed containment systems. At this point it is not practical because the technology has not been proven on a commercial scale. In an effort to encourage development of these systems, the PSF report called for the design and testing of a commercial scale closed containment pilot project that if successful could lead to a movement away from open net pens. The Special Committee report recommended an outright ban on any new salmon farms using open net-pen technology.

Sea lice interactions with pink and chum salmon and IHN infections on sockeye salmon are the two main disease concerns in BC, but other disease issues may emerge with time. Recently, concerns have been raised that Fraser sockeye and Pacific herring populations migrating out past fish farms may be experiencing high mortalities due to sea lice infection[18]. It seems to be a different species of sea lice involved, and sockeye juveniles are larger and may be less susceptible to other species, but there has been limited research directed at the possible adverse effects on sockeye and herring populations.

What is needed to coordinate is a program or process that can deal with disease issues before they get out of hand. It would take an agreed-upon commitment among governments, First Nations and stakeholders. There is an existing program to protect against disease in aquatic animals, the National Aquatic Animal Health Program (NAAHP). Whether this program would be appropriate is not clear.

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[16] For a summary of recent scientific articles on sea lice and wild salmon see: "Science and Sea Lice: What Do We Know?" B. Harvey (2008) and "Science and Sea Lice: A Second Look". B. Harvey (2009). Available on the Pacific Salmon Forum website. http://www.pacificsalmonforum.ca/reports/index.php?op=commissioned_reports.

[17] The Ministry of Agriculture and Lands informs that Pacific salmon grown in net pens are not burdened with sea lice or only mildly and so monitoring and reporting is not required. (sea lice monitoring requirements protocol: http://www.al.gov.bc.ca/ahc/fish_health/sealice_MS.htm)

[18] Sockeye salmon passing through areas of fish farms in the Discovery Islands on the east coast of Vancouver Island were found to have sea lice. A., R. Routledge, and M. Krkosek. 2008. N. Am. J. of Fish. Manage. 28: 523-532.

The focus of the NAAHP seems to be more directed at protecting the fish and seafood industry even though its mandate includes serving activities that rely on aquatic species by protecting against the introduction or spread of serious infectious disease to fish, molluscs and crustaceans [19].

Carrying out research and tests is expensive, takes time and may not always lead to conclusive results about a link between aquaculture and disease in wild fish. One of the conclusions from the example of the sea lice issue is that there may be areas or regions where salmon farms simply should not be sited. Decisions on area-wide siting questions should be addressed through an area and ecosystem-based planning, decision-making and management approach. Possibly even through a region or coast-wide level planning process.

Areas for Developing Best Practices:

1. Sea lice research and monitoring on an area and ecosystem scale (Broughton Archipelago and other areas as needed)
2. Adaptive management of sea lice (fallowing, sea lice levels on farm and wild fish, limiting age classes on a site, production limits, etc.)
3. Determining research issues with input from First Nations

3.3.3 Escaped Farmed Fish

The 2003 Standing Committee report discussed escapes at length and came up with recommendations calling for a DFO led nation-wide regulation to minimize escapes. In addition, it recommended government funding to research methods of preventing escapes. Such a regulation would include independent monitoring of all farm operations, maintenance of containment system records, tracking of inventory and losses, an identification system for all farmed fish, immediate reporting of escapes, active recovery and that operating licenses be tied to compliance, with fines or loss of license for escaped fish. At present, these activities are required and regulated through the provincial Aquaculture Regulation.

The Standing Committee report also recommended that the annual surveys of rivers under the Atlantic Salmon Watch Program be expanded on the west coast. The Atlantic Salmon Watch Program is operated through DFO. Its purpose is to track numbers of escaped Atlantic salmon found in streams and the ocean. With Atlantic salmon escapes continuing to occur[20], a review of the program should consider to which areas it may need to be expanded.

The Special Committee's recommendation to move to marine-based closed containment would minimize the issue of escapes more directly (discussed in Section 3.1.2).

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[19] Protection of terrestrial wild and farmed animals from infectious dis eases falls under the federal *Health of Animals Act.* Wild and farmed aquatic animals are not protected under this act, however the regulation is being amended to include these animals. See Canada's National Aquatic Animal Health Program website. www.inspection.gc.ca/english/anima/aqua/aquaproge.shtml

[20] Over 19,000 Atlantic salmon were reported to escape in 2006 and 2007. Regulatory Compliance of British Columbia's Marine Finfish Aquaculture Facilities: 2007. BC MAL website: http://www.agf.gov.bc.ca/fisheries/aqua_report/index.htm

Areas for Developing Best Practices:

1. A federal aquaculture regulation with provisions, prohibitions and standards on preventing escapes from finfish farms
2. Prevention and mitigation against escaped farmed fish (research and development)
3. First Nations monitoring of Atlantic salmon in marine and freshwater environments

3.3.4 Species Attraction to Farm Sites

Fish, marine mammals and birds are attracted by the food and lights at fish farm sites. Mammals and birds can sometimes get entangled in the nets and become injured or drown. Fish may swim inside and remain trapped, i.e., by-catch.

The capture of wildlife is prohibited under the *Wildlife Act*, however the definition of wildlife according to the *Wildlife Act* suggests that some of the animals that might be captured by nets are not protected ('wildlife' defined by the Act means raptors, threatened species, endangered species, game and other species of vertebrates). The *Fisheries Act* prohibits capture of fish without a license, where 'fish' also includes marine mammals and shellfish species. While finfish farm operators do need a *Wildlife Act* or *Fisheries Act* permit to trap mammals or shoot 'nuisance' predators, they so far have not been required to obtain a fisheries permit to capture wild fish or birds that are inadvertently captured. Furthermore, no requirement exists to report such mortalities or by-catch.

Some First Nations in the Broughton Archipelago and on the central coast have reported cases of herring spawning on salmon farm nets with the subsequent destruction of the eggs during net maintenance. There is concern that spawning on nets may be a growing or widespread behavioural pattern that could affect herring stocks. The herring by-catch in fish farm pens is unmeasured, unreported, and unaccounted. DFO has a program that monitors herring. In 2005, DFO reported it had never observed herring spawn on fish farm nets (J. Schweigart pers. comm. 2005). At this point, there is no independent monitoring or reporting of wild fish by-catch (salmon, herring and other species) to verify how widespread or large the problem is.

The industry recognizes that wild species are attracted to farm sites. The BC Finfish Aquaculture Waste Control Regulation contains a requirement for best management practices that limit or prevent the attraction of wildlife such as seals, birds and otters to fish farm sites. The BC Salmon Farmers Association has a code of conduct that requires members to maintain a predator avoidance plan, but these seem to be designed to deter animals (predators) from capturing stock and creating tears in the netpen. A common measure is the installation of predator nets which hang around the netpen and provide a double layer of protection. Predator nets do not prevent entanglement or fish from entering the netpen. Other practices are in place for reducing disturbance from lighting and noise, but these are intended to minimize disturbance to neighbours, not necessarily to reduce a farm's attractiveness to animals.

The issue around herring attraction to farm sites is not recognized by governments or industry. Regulations that include monitoring and reporting of by-catch or herring spawning on nets would identify the scope of the problem, if indeed it is a problem. Moreover, reviewing and managing the industry on an ecosystem level would allow considerations of migratory routes or spawning grounds for many wild species. These characterizations could be used to assist in siting to minimize some of the issues.

Areas for Developing Best Practices

1. By-catch and other species attraction issues attached to a federal aquaculture regulation and subsequent guidelines
2. Independent monitoring to determine scope of issue wild fish by-catch in fish farm nets and herring spawning on nets
3. Characterize wild fish habitat and routes in the ecosystem and avoid these areas in siting to minimize inadvertent capture of wild fish in netpens

3.3.5 Wild Fish Use in Farm Fish Feed

Over the years the proportion of plant-based proteins going into fish feed has increased, thereby reducing the reliance on wild fish as a feed component. Wild fish used in farm feed is a question of sustainability. Continued research and innovation is needed to ensure that the marine ecosystem is not being depleted at one level to grow farmed fish. Reduction of wild fish content in farm fish feed to a ratio below 1 (less than 1 pound of wild fish to product 1 pound of farm fish) is the goal.

Areas for Developing Best Practices:

1. Develop new formulas for reducing wild fish content in feed
2. Thresholds for wild fish content

3.4 Monitoring and Compliance

Environmental monitoring enables the detection of changes in environmental indicators to ensure regulatory requirements are met and to manage resources better.

Aquaculture monitoring and compliance is done by DFO and the Ministry of Agriculture (MAL). MAL does most of the regular monitoring in three areas: licensing and compliance, aquaculture development, and fish health management. DFO's monitoring functions support conservation and protection, science, and habitat and enhancement. DFO is mainly involved on an as-needed basis. For example, DFO will monitor or investigate in response to a *Fisheries Act* violation. Or sometimes a Canadian Environmental Assessment Act (CEAA) review will stipulate the need for monitoring. In this case, a Monitoring and Mitigation Agreement is developed between DFO and the aquaculture proponent and DFO may be called upon to monitor for possible habitat impacts. Monitoring the abundance and distribution of escaped Atlantic salmon is another DFO monitoring activity.

Industry conducts and reports on a lot of monitoring as required through regulation. For example, monitoring sea lice and other disease incidence, sulphide levels and benthic community health, integrity of nets and fish pen equipment, escapes, farm fish mortalities, drugs administered, and others.

Despite the wide range of monitoring that is done, First Nations, among others, believe regulation and compliance monitoring does not provide a full picture of environmental impacts. Most importantly, key indicators of ecosystem health are not being monitored. Various reports have called for the development of ecosystem based indicators, using First Nations traditional knowledge and expertise, to monitor particular issues within an ecosystem or the overall health of the ecosystem.

Presently, some First Nations people may be involved in monitoring aquaculture at the individual level, e.g., working as an environmental monitor for a company or government department. But a First Nation may want a stronger role for monitoring aquaculture activities in their territories. A 'watchman'

program or one similar to the independent program the Kitasoo/Xai-xai[21] have been operating that measures ecosystem indicators important to their community members may be appropriate. The goal of an independent program is to provide the First Nation with information on locally important resources and an opportunity to use the information to engage in decision-making.

Areas for Developing Best Practices:

1. Monitoring health of the ecosystem
2. Federal program for ensuring compliance with regulations along with enforcement measures
3. First Nations as independent monitors or a watchman program

3.5 Shellfish Aquaculture

For the most part, principles and approaches recommended by the reports as synthesized above are applicable to finfish or shellfish aquaculture. That is, a governance regime inclusive of First Nations that manages development from an ecosystem level, researches questions that are relevant, that provides monitoring, compliance and enforcement and offers economic benefits.

However, under the new regulatory regime, beach forms of shellfish aquaculture will remain under provincial jurisdiction, whereas regulation of suspension shellfish aquaculture will transferred to DFO. Some separation between finfish aquaculture from shellfish aquaculture in the regulatory framework would be beneficial since some best practices would not necessarily be applicable to both.

3.6 Federal Aquaculture Regulation Development

DFO's Discussion Document presents a scope and outline of the new regulation within the context of a renewed national aquaculture strategy. The ideas for a new regulation are primarily focused on advancing the aquaculture industry in Canada. First Nations rights and title, are minimally acknowledged, beyond a obligatory sharing of information. In this way it is similar in tone to the 2002 Aquaculture Policy Framework. Its basic failing from a First Nations perspective is that it does not capture the essence of recent judicial rulings on rights and title, consultation and accommodation (see Ratcliff & Co. memo to FNFC, January 2010). There is little in the draft that indicates that DFO is willing to share in managing the industry, or that First Nations infringement issues need to be accommodated.

Yet the review of the policies and inquiry reports demonstrate wide-spread agreement that First Nations must be meaningfully involved in all aspects of aquaculture. So the question becomes one of ensuring that good ideas are implemented. Encoding directives or intentions in law, even in a non-specific way is the most direct way. The judicial ruling that DFO must draft a new federal BC aquaculture regulation opens an opportunity to ensure that First Nations legitimacy as a rights holder is encoded in the law, so that subsequent policies, guidelines and best practices are informed by the basic directives.

The first step in drafting the regulation should be defining an agreed upon consultation structure and process between First Nations and the federal government. From that point, First Nations will be better able to express their expectations in the four areas of aquaculture management: decision-making, involvement in day to day management, science, and monitoring and compliance.

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[21] The Kitasoo/Xai-xai are partners in a salmon farming operation at Klemtu. They run an independent environmental monitoring program that measures effects from fish farms on important community indicators.

4. Best Practices Toolkit

Regulations and policies for aquaculture would be strengthened by the adoption of best practices. A best practice is the most effective technique, method, process, activity, incentive, or reward available for delivering a particular outcome. The idea is that with proper processes, checks, and testing, a desired outcome can be delivered with fewer problems and unforeseen complications. For example, if the desired outcome is to site farms in ecologically appropriate locations, a best practice might consist of siting criteria. The siting criteria would be developed within an inclusive framework, would include local ecological, economic, cultural and social indicators, and would incorporate the best available science to define thresholds.

A given best practice is only applicable to particular condition or circumstance and may have to be modified or adapted for different circumstances. In addition, a 'best' practice can evolve to become better as improvements are discovered.

A set of best practices that capture the recurring themes in the policies and reports is proposed below. The next step is to develop these best practices. In fleshing them out, First Nations traditional knowledge and views on acceptable risk should be incorporated.

Siting Best Practices

I Resource and Land-Use Decision-Making

1. Bilateral co-management structure with First Nations, federal, provincial and local governments
   - Capacity for First Nations and First Nations organizations
2. Environmental Assessment of Aquaculture on an Area and Ecosystem Scale
   - Involve all First Nations with territories in the defined area, in marine or land use planning
3. Process for siting decisions
   - review, identify gaps and update siting criteria
   - integrating data from other user groups, agencies and sources, and continuous information sharing
   - characterizing an ecosystem: defining the baseline data necessary for an environmental review
   - identification of local indicators and thresholds;
   - risk-management tools
4. Independent regulatory oversight authority to audit land-use decisions
5. Restrictions. Province-wide planning to determine if, when or where restrictions are needed (e.g., species restrictions or regional restrictions)

II Sustainability of Aquaculture

1. Research, design and test commercial-scale, marine-based closed containment systems
2. Definition of sustainability within an area, based on area management and ecosystems-based research and management of aquaculture operations.
3. Monitoring area-based sustainability indicators and thresholds over time (including estuaries, watersheds, wild fish habitat and status, and stock assessments)
4. Models and risk management tools

Day-to-Day Management of the Aquaculture Industry Best Practices

I First Nations Governance

1. Bilateral governance structure and process between First Nations, federal, provincial and local governments that includes decision-making authority within a First Nations' traditional territory
2. Development of a First Nations common vision and principles on the management of

aquaculture that would protect habitat and water resources

3. First Nation to First Nation structure and process
4. Incorporating Aboriginal traditional knowledge into plans and practices by developing standards

II Interference with Fisheries

1. Identify marine resources other than salmon that should be evaluated within an ecosystem-based research or management program
2. Wild fish capture in net pens – research and best management practices to mitigate the inadvertent capture of wild fish or herring spawning on nets

III Economic Benefits

1. Support for First Nations Businesses
   - Planning an aquaculture business or an aquaculture-related business
   - Getting through the permitting and regulatory process
   - Aquaculture management and operations
   - Coast-wide assessment and map reserve
2. Developing Aboriginal Certification for aquaculture products or wild fishery products
3. Third party monitoring or watchman programs
4. Opportunities for revenue-sharing with aquaculture companies

Science Best Practices

2. Developing a coordinated and collaborative research program to support ecosystem-based research
   - 2.1. Science Secretariat for ecosystem-based research on marine and watershed systems
     - Funding for research on wild salmon and other fish at the ecosystem level (e.g., federal funding equivalent or greater towards than the federal 5 year, $70 million aquaculture research program)
   - 2.1. Baseline information on the environment and resources
   - 2.2. Environmental monitoring and data collection
   - 2.3. Funding ecosystem-based research
   - 2.4. Structure for First Nations involvement in ecosystem based science
     - Collaborative research process
     - Setting research priorities
     - Integrating Aboriginal traditional knowledge (issues, indicators, thresholds, methods)
     - First Nations access to data collected through regulatory programs, for purposes of conducting research
     - First Nations access to research funding
     - Communicating scientific research to First Nations
3. Routing the results of new knowledge back to aquaculture management and operations

I. Fish Farm Effluent (Waste Control)

1. Control aquaculture output
2. Research on waste and contaminants in the marine ecosystem and traditional First Nations resources

II. Disease and Parasites

1. Sea lice research and monitoring on an area and ecosystem scale (Broughton Archipelago and other areas as needed)
2. Adaptive management of sea lice (fallowing, sea lice levels on farm and wild fish, limiting age

classes on a site, production limits, etc.)
3. Determining research issues with input from First Nations

III. Escaped Farmed Fish
1. A federal aquaculture regulation with provisions, prohibitions and standards on preventing escapes from finfish farms
2. Prevention and mitigation of escaped farmed fish
3. First Nations monitoring of Atlantic salmon

IV. Species Attraction to Farm sites
1. By-catch and other species attraction issues
2. Independent monitoring to determine scope of issue with species attraction
3. Characterize wild fish habitat and routes in the ecosystem and avoid these areas in siting to minimize impacts of species attraction

V. Wild Fish Use in Farm Fish Feed
1. Develop new formulas for reducing wild fish content in feed
2. Thresholds for wild fish content

Monitoring and Compliance Best Practices
1. Monitoring health of the ecosystem
2. Federal program for ensuring compliance with regulations along with enforcement measures
3. First Nations as independent monitors or a watchman program

5. Conclusion

The main conclusion from this review of policies and inquiry reports is that improvements need to be made to the way the aquaculture industry in BC is governed and managed. That the reports provide a wide range of recommendations for improving conditions offers hope that the concerns associated with aquaculture can be resolved. There is reason to believe that with cooperation and good will from all parties, aquaculture can provide benefits to First Nations and other British Columbians without threatening the environment and way of life.

The consensus emerging from the reports and policies were that changes in siting, day-to-day management, science and monitoring are needed for aquaculture to be a productive and valuable component to BC's economic mix. The common themes were: 1) over-hauling the regulatory environment of the industry; 2) prioritizing wild salmon and the environment; 3) applying an ecosystem approach to managing the industry; 4) creating an inclusive process (including a co-management role for First Nations) in management and decision-making; 5) revising or creating policies and regulations that include best practices for dealing with environmental issues such as disease and parasite transfer, waste discharge and contaminants, escapes, etc.; 6) using science to guide decision-making and taking an adaptive management approach to day-to-day management; and 7) developing a commercially viable technology for closed containment finfish aquaculture. There was a high degree of convergence in the recommendations that came out of the reports. This made it possible to organize them into areas for the development of best practices.

The review identified thirty-seven areas where best practices could be developed within the four priority areas of siting, day-to-day management, science, and monitoring. Identifying these best practices is only a first step. Further work needs to be done to prioritize these and to expand their content. But a list of best practices offers a starting point for consultations with DFO and the province on aquaculture regulation reform and strategic direction of the industry in BC.

There is one suggestion for best practices that was not explicitly mentioned in the reports. Creation of an oversight body at either the local, provincial or federal level with the joint governance partners. Its function would be to ensure a timely and appropriate response to emerging issues and to aquaculture adapts to new techniques and approaches as they become available. It could also be responsible for ensuring a timeframe is put in place to review regulations and policies, e.g., once a year for the first five years.

As the extensive list above suggests, a deep level of First Nations participation may require more resources than many First Nations have available. First Nations are often fully committed to fisheries management and other resource development processes. It is important that any additional management obligations can be met. Situations where a First Nation cannot effectively participate in joint processes can lead to feelings of powerlessness and frustration. Government funding and capacity should be part of the solution. However, this issue of capacity needs to be evaluated realistically when developing best practices that informs regulations and policies.

As participants in the drafting of a new federal regulatory regime, First Nations have an opportunity to significantly change the way aquaculture is managed. Based on two premises, that First Nations have rights and title that must be considered and even accommodated, and that the wild species and their aquatic environments are a defining characteristic of BC, First Nations can articulate their vision of a future for aquaculture in BC.

Appendix 1 Policy and Inquiry Report Summaries

I. Federal BC Aquaculture Regulation and Strategic Action Plan Initiative Discussion Document. DFO. 2009.

DFO is seeking input from First Nations regarding structure and content of a federal BC aquaculture regulation as well as a national strategic action plan. The discussion paper has two goals, to inform the regulation drafting process and to prepare a strategic action plan to support sustainable industry development. It proposes content for the regulation: the application of the regulation, management tools (licenses and conditions), pollution prevention measures, notification and reporting requirements, enforcement, inspections and audits, attestations of regulatory compliance and monitoring results, fees, policies and guidelines supporting the regulation.

The principles guiding the regulation include:

- upholding the *Fisheries Act*, i.e., 1) protect fish and fish habitat, 2) properly manage and control fisheries (including aquaculture), and 3) pollution prevention
- developing and implementing policies and programs to support scientific, ecological, social and economic interests in water
- supporting sustainable growth of aquaculture
- modernizing the regulation of aquaculture (adding risk management measures, recognizing the industry in law, efficiency)
- engaging and seeking input from First Nations and others.

Take home message: The emphasis in the discussion document seems to be focused on facilitating aquaculture development in BC and less about ensuring a healthy marine environment. There should be a prominent role (possibly co-management or joint management) for First Nations in developing regulations, policies and guidelines around siting, day-to-day management, science and monitoring, but this level of participation is not being considered. Establishing licensing and conditions is critical to ensure that conservation of fish and fish habitat, fisheries management and pollution prevention are met. Siting criteria that includes salmon or other wild species migratory routes is not in the BC guidelines and should be considered in the new DFO aquaculture regulation. Within each of these topic areas are numerous elements that First Nations would wish to have input on. These should be looked at closely.

II. Aquaculture Policy Framework. DFO. 2002.

The Aquaculture Policy Framework (APF) is a statement of a vision for aquaculture and nine principles DFO will follow to govern its development as an industry. The framework is intended to guide the development of aquaculture policies, programs, operational policies, and any changes to DFO's legal and regulatory framework, among others. The nine principles are summarized:

- undergo development consistent with ecosystem-based and integrated management;
- address issues of public concern based on science and risk-management approaches;
- provide the public with information and listen to public comment;
- respect Aboriginal and treaty rights and work with Aboriginal communities to participate in aquaculture development;
- access to aquatic resources for broodstock;
- provide legislation and regulation to enable aquaculture to develop on an even footing with other sectors;
- support responsible development of aquaculture through research and development;

- recognize aquaculture as a DFO client group and bring a solutions-oriented approach to policies, programs, laws or other governance measure affecting aquaculture development; and
- coordinate with other departments and governments on policy development, regulatory frameworks and service delivery.

Take home message: The APF is strongly oriented towards supporting and enabling aquaculture development. It states that DFO is moving from its focus on the management of the wild fishery to integrating and managing marine and inland water uses, including aquaculture. This re-orientation may be in conflict with the priorities on the west coast (see Inquiry Report summaries below), which have found that British Columbians value the wild fisheries and all the opportunities these represent above other marine uses. The framework talks about sustainability and the precautionary approach, but it is not easy to see how these concepts, which are notoriously difficult to quantify, would be accommodated in situations where there is disagreement about sustainability or environmental impacts. It does recognize Aboriginal rights and title obligations, but it does not seem to extend participation or decision-making to day-to-day management of aquaculture, science, or monitoring and compliance. That is, the level of consultation anticipated is low and passive. The tone of the policy is paternalistic, where DFO will seek input, but ultimately be the decision-maker.

III. Wild Salmon Policy. DFO. 2005.

The Wild Salmon Policy outlines a plan for achieving the goal of conserving wild Pacific salmon by meeting three objectives:

- Conserve genetic diversity of wild salmon
- Maintain habitat and ecosystem integrity
- Manage fisheries for sustainable benefits

The WSP establishes strategies to meet these objectives, and presents a decision-making process that takes into account societal values and is consistent with sustainability principles and the precautionary approach. Its four principles are 1) conservation of wild salmon and their habitats; 2) honouring obligations to First Nations in resource management processes and decisions; 3) decisions based on sustainable use; and 4) decision-making will be made in an open, transparent and inclusive manner.

Delineating salmon conservation units (CUs) based on salmon genetics, biology and ecology is the first step towards conservation. Following the establishment of CUs, habitat and ecosystem conservation will be accomplished by identifying, protecting, restoring and rehabilitating critical freshwater and marine habitats. Habitat will be assessed and monitored using ecosystem indicators and on an ecosystem level. The goal is to link habitat management (land-use, conservation, restoration) with fish production and harvest objectives within each CU. A key element is the integration of resource management with other governments, First Nations, stewardship groups, industries, etc. Fisheries management involves monitoring and stock assessment for each CU.

Take home message: First Nations involvement is promoted in all aspects of the policy: bilateral consultation, planning, research, and monitoring. Secondly, aquaculture governance is subject to the planning and implementation within the WSP. Thus, the principles and strategies to conserve wild salmon will need to be incorporated into the new aquaculture regulation that DFO is designing. It falls short in that it specifically relates to wild salmon. Many of the habitat initiatives will benefit other species, but the focus is wild salmon.

IV. Pacific Salmon Forum Final Report and Recommendations. Pacific Salmon Forum. 2009.

The Pacific Salmon Forum concluded a four-year study on effects of the salmon farming industry on wild salmon, with 16 policy recommendations to protect and enhance the viability of wild salmon

stocks and their economic, social and environmental benefits; increase public confidence in fisheries management generally, and aquaculture in particular, in the marine environment; and enhance the economic, social and environmental sustainability of aquaculture for all coastal communities. There are two central premises that inform this report. One is that the wild salmon are critical to the cultural and economic vitality of BC. Another is that First Nations title and rights elevate them to a level of government, not a stakeholder, and thus must be collaborators in all areas of management (siting, science, monitoring and compliance, and day-to-day management. The conclusions are that the current system of governance for salmon is inadequate and that a transformative management approach must replace the old way. The report recognizes there are many threats to wild salmon, salmon farming being one of them, and that the way to manage wild salmon is to manage all resource industries using an ecosystem-based approach, from the watersheds to the estuaries and to the ocean. The recommendations (below) are intended to lead to a future where salmon farming is viewed by the public as important and compatible with healthy wild salmon populations.

The report's sixteen recommendations for policy reform would cover almost all the issues and concerns First Nations have raised in the various inquiries. That is, through establishing area management, involving and supporting First Nations involvement, sharing and integrating data, adopting First Nations indicators and thresholds, monitoring in partnership with First Nations, conducting appropriate research, setting up a single office to process all land and water use applications, establishing an independent provincial regulatory oversight authority to audit land-use decisions, and continuing to research and test new technologies (e.g., polyculture and closed containment), among other ideas.

Summary of recommendations (each of the following recommendations contains additional direction in the rationale):

- Apply ecosystem-based approach to managing watersheds
- Establish ecosystem indicators for watersheds and marine systems
- Link measures to meet the BC carbon budget with measures designed to support wild salmon in watersheds
- Increase habitat restoration and enhancement programs to maintain, rebuild or restore natural biodiversity and abundance of wild salmon
- Create a BC Water and Land Agency responsible for making all water and land use decisions
- All levels of government (including First Nations) will collaborate on pilot watershed governance projects to strengthen ecosystem management of watersheds
- Support the economic and social resilience of communities through the development of diversified economies
- Set performance based indicators for aquaculture and support a area management approach in the Broughton Archipelago
- Apply ecosystem based approach for aquaculture in the Broughton Archipelago to other regions
- Adopt a coordinated area management approach to salmon aquaculture throughout BC
- Adopt integrated pest management and disease management approaches to management of aquaculture
- Establish independent provincial regulatory oversight authority to monitor and audit decisions that affect watersheds according to ecosystem-based indicators
- Establish a science secretariat for ecosystem based research on marine and wtaershed systems that support salmon
- Third-party certification for commercial salmon fisheries and salmon aquaculture

- Data required for ecosystem based management must be shared with public
- Establish and independent technical committee to recommend specifications for a commercial scale closed containment demonstration project.

Take home message: This report is probably the most progressive in terms of seeking accommodation for First Nations. It envisions that First Nations will work with other levels of government in a collaborative governance structure and anticipates First Nations participation and decision-making in all areas of wild salmon and aquaculture management, from strategic planning to on-the-ground implementation.

V. Final Report. Special Committee on Sustainable Aquaculture. 2007.

A Special Committee was appointed to investigate 1) the economic and environmental impacts of the aquaculture industry in BC; 2) sustainable options for aquaculture that balances economic goals with environmental imperatives; and 3) BC's regulatory regime in comparison with other jurisdictions. The principles behind the recommendations were that the health of BC's wild salmon populations is paramount and that First Nations inclusion and partnership be ensured. It concluded that aquaculture brings economic benefits, but that in the face of unresolved environmental impacts (sea lice, disease, effluent and waste, and attraction of wild species to the nets) closed containment technology should be phased in. Such a move would place BC as a leader in technology-answered solutions to environmental problems. Fifty-five recommendations were put forward, too many to include here. Some of the key recommendations are:

- Phase in ocean-based closed containment immediately and complete the transition by 2012.
- No new finfish sites approved north of Cape Caution
- Any expansion must utilize closed containment technology
- Restrictions around closed containment expansion to include: local government and residents' right to approve the siting of new finfish sites; First Nations and others must be fully involved in aquaculture applications
- Establish a First Nations watchman program to monitor fish farms for compliance.
- Protect juvenile salmon with a following regime where farms are sited on migration routes
- No stocked adult fish should be in pens along migratory routes during periods of salmon migration
- A moratorium on non-salmon finfish aquaculture until the transition to closed containment technology is completed
- All protection, regulation and monitoring should be done by the Ministry of Environment, not the Ministry of Agriculture and Lands
- Government inspections should be carried out at random and without notice to operators
- Establish sea lice protocols for monitoring and control, including thresholds
- Ratio of wild fish used in feed must not exceed one pound of wild fish for one pound of cultured fish
- Impose mandatory labelling for consumers
- Increased government support to protect and improve BC's river systems
- Increase support from federal government for fisheries management and hatcheries
- Research the feasibility of salmon ranching as a form of aquaculture
- Designate shellfish aquaculture areas on the coast
- Provide local governments and First Nations with the authority to approve siting of tenures
- Create clear siting criteria for shellfish aquaculture
- No approval for new species aquaculture until there is a scientific consensus that the potential impact on the marine environment is minimal

Take home message: This report emphasizes the priority of a healthy coastal ecosystem over aquaculture. The Special Committee's position is that sustainability lies in ocean-based closed containment systems. In the face of present environmental uncertainties it recommends clear restrictions about expansion, production limits, and specie until such a time as closed containment technology is available. The weakness of this approach is that it does not allow for flexibility. There may be some situations where a recommendation is overly restrictive, or does not allow for other management approaches.

VI. First Nations Fisheries Action Plan. 2007.

The action plan was developed by BC First Nations to set out new ways of working with each other and with governments on fisheries and fisheries related matters. The goals involve restoring ecosystems so that First Nations can use resources sustainably, share them with others, and jointly manage the resources with federal and provincial governments. While many of the action items speak more broadly to the issues of managing fisheries, two areas are of specific relevance to aquaculture. First, aquaculture as a potential threat to marine habitat is addressed. On this issue, First Nations must be engaged during the assessment, planning, policy development and decision-making stages. It is noted that First Nations ability to participate effectively in stewardship or watchman programs is limited by lack of funding. Sixteen action items are put forward including convening a First Nations, government and industry forum to assess threats to aquatic habitats and develop specific action plans. Second, the action plan recognizes economic opportunities presented by aquaculture and calls for a strategy for realizing these opportunities, including building on traditional economies and economic practices, learning from First Nations 'best practices', developing markets for First Nations products, and identifying opportunities for First Nations companies and co-ops.

Take home message: First Nations have experience, knowledge that they could put toward managing the fisheries, but they are limited by government unwillingness to let them co-manage the resources, and secondly by capacity. Action plan items focus on activities that would facilitate the management of fisheries and fish habitat. These items include calls for stewardship or watchman programs, greater baseline information, involvement in integrated land-use planning, improved monitoring, developing standards for traditional knowledge and incorporating it into plans and practices, among others. Economic opportunities may be realized by building on traditional economies and practices, developing markets for First Nations products, utilizing First Nations best practices and exploring First Nation run companies and coops. Training in business, economics and technical fields would be required.

VII.Aquaculture Discussion Paper: An Overview of Concepts and Terms Associated with Aquaculture, Sustainable Aquaculture in Canada, and Impacts Aquaculture has on First Nation Peoples. Report to the Assembly of First Nations. 2006.

The AFN Discussion Paper's primary objective was to identify gaps and issues in federal aquaculture policy that would affect First Nations title and rights as well as economic interests. At the time, DFO was planning to develop an Aquaculture Framework Agreement (AFA). The AFA would have brought the federal government and the provinces together in agreement on a renewed aquaculture development strategy. This paper was commissioned to assist the AFN and its members in developing a response to the proposed DFO agreement. It concluded that First Nations input into a renewal strategy would be problematic since terms have already been established by existing policies (e.g., the Aquaculture Policy Framework) and without First Nations consultation. In a renewal strategy, First Nations input is needed in four broad areas: 1) a consultation process that would enable First Nations to have meaningful input; 2) aquaculture's ability to meet sustainability goals; 3) the place of First Nations

in DFO's aquaculture vision; and 4) impact of renewed development on First Nations title and rights.

Take home message: The paper is relevant to the concerns First Nations have regarding the National Aquaculture Strategic Action Plan (NASAPI) initiative currently underway. Thus, a consultative process, sustainability, an inclusive aquaculture vision, and impacts on Aboriginal title and rights are all areas that should be closely reviewed with DFO.

VIII. Our Place at the Table. First Nations in the BC Fishery. Report by the First Nation Panel on Fisheries. 2004.

The First Nations Panel report articulated a vision for future fisheries management and allocation and the principles upon which the vision would be achieved. It was written to address uncertainties facing First Nations and their legal rights to fisheries resources. The topics included a summary of the legal precedents establishing First Nations fisheries rights, a history of fisheries management in BC, present-day fisheries and emerging trends, and the treaty process and implementation. Results of public meetings in seven communities around BC were summarized on fisheries topics of interest to First Nations: food and societal access, aboriginal rights, economic access, government policies and programs, licensing and quota systems, recreational fisheries and tourism, habitat, ecosystems and local stewardship, fisheries management and treaty issues. The vision emphasizes healthy ecosystems and equitable sharing of resources for aboriginal and non-aboriginal fishers, achieved through an ecosystem approach to management, applying the precautionary approach, sustaining the resource for future generations, sharing responsibility for management with federal and provincial governments. A three tier management option is proposed for reconciling aboriginal and Crown interests and various allocation options were recommended. The report concludes with seven recommendations.

Take home message: The report was focused on management of the wild fisheries, but many of the issues discussed were similar to those surrounding aquaculture, i.e., lack of First Nations input in resource management decisions and a desire to play a stronger role in sharing information, providing local knowledge, monitoring, and stewardship. Thus many of the principles could be adapted to aquaculture policies and best practices.

IX. The Federal Role in Aquaculture in Canada. Report on the Standing Committee on Fisheries and Oceans. April 2003.

This comprehensive study of finfish aquaculture was undertaken to examine the regulatory environment, potential environmental concerns and the role of the federal government. Federal jurisdiction through the *Fisheries Act* and *Oceans Act* requires DFO to protect and conserve wild fish and their habitat. The Committee came up with 26 recommendations. One of the most findings was that there is no federal aquaculture act or statutes or regulations addressing aquaculture. The Committee advised that DFO take on a direct role in managing aquaculture through enactment of a federal *Aquaculture Act*, or regulation, that would serve to establish policies, regulations and best practices for issues involving governance, siting, day-to-day management, monitoring, compliance and enforcement, and research and development.

Take home message: It provides a clear set of directives intended to clarify how fish and fish habitat would be protected against impacts from the aquaculture industry. These are developed within a context of sustainability and precaution. The recommendations are focused on steps government should take unilaterally. It does not put forward recommendations about involving First Nations in any kind of consultative or collaborative process.