COMMISSION OF INQUIRY INTO THE DECLINE OF SOCKEYE SALMON IN THE FRASER RIVER

In the matter of Her Excellency the Governor General in Council, on the recommendation of the Prime Minister, directing that a Commission do issue under Part I of the Inquiries Act and under the Great Seal of Canada appointing the Honourable Bruce Cohen as Commissioner to conduct an inquiry into the decline of sockeye salmon in the Fraser River .

FINAL SUBMISSIONS ON BEHALF OF WEST COAST TROLLERS (AREA G) ASSOCIATION and UNITED FISHERMEN AND ALLIED WORKERS' UNION

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Executive Summary

1. The first task of the Commission is to answer the question as to the cause of the 20-year decline of the Fraser River sockeye fishery. The second task - developing recommendations – should focus on measures to reverse the decline and (in view of the remarkable 2010 return) to ensure that the cycle of decline does not repeat itself.

2. We say, based on the evidence, that the decline is mainly attributable to the 1987 Rebuilding Strategy – a well-intentioned strategy that has backfired. We say, further, that the declining trend line is likely to repeat itself unless certain harvest management policies that caused or contributed to the 20-year decline are changed.

3. These submissions make the following points:

1. The purpose of the *Fisheries Act* and other federal statutes and treaties is to provide yield (harvest benefits) not conservation of fish *per se*. The constitutional and statutory context provides the guiding framework for the Commission's work and, in particular, for rejection by the Commission of the suggestion made by some participants that conservation is the primary and overriding consideration for fishery managers, rather than a consideration that is supportive of the primary statutory objective of sustainable yield of sockeye for present and future generations of Canadians.

2. Maintaining maximum sustainable yield (MSY) requires maintaining an equilibrium in the ecosystem that produces maximum sustainable harvest by humans. This requires an understanding of some basic biological attributes of sockeye salmon, including the density-dependent survival-rate pattern that is the fundamental ecological basis of sustainable harvesting.

a) Once the basic biological attributes of sockeye salmon are understood it becomes clear that the 20-year decline of the sockeye fishery is attributable mainly to the 1987 Rebuilding Strategy.

3. Maintaining MSY in a fishery divided into four run-timing groups and a multitude of CUs requires a mixed stock harvest regime that prevents excessive escapement of major stocks while avoiding any unreasonable and genuine risk of extirpation of minor stocks. This was accomplished in the era of the IPSFC. There is no reliable evidence that it could not continue to be accomplished under a simplified harvest management structure based on biologically defensible escapement reference limits.

a) The structure and wording of the WSP, augmented by its derivative, the FRSSI, is inappropriate and has led to confusion, conflict and huge losses to the

GDP of Canada. A misguided implementation of the WSP has undermined the MSY objective of the *Fisheries Act*.

b) We propose that the WSP be scrapped and replaced with a restatement, in simple and understandable terms, of the intent of the WSP to provide for MSY while avoiding any unreasonable and genuine risk of extirpation. This will require a commitment by DFO to the Adaptive Management Process, including retrospective productivity and socioeconomic analyses to inform future decision-making, and independent oversight by a Commissioner of Sustainable Productivity who is responsible to the Auditor-General and who reports annually to Parliament on the social and economic consequences of DFO's harvest management practices.

4. A harvest management regime consistent with the statutory purpose of maximizing social and economic benefit from the Fraser sockeye fishery would take into account the importance of an economically sustainable fishery to coastal communities, and the undesirable features of terminal fisheries and ITQs.

FIRST POINT. The purpose of the *Fisheries Act* is and other federal statutes and treaties is to provide yield (harvest benefits) not conservation of fish *per se*. The constitutional and statutory context provides the guiding framework for the Commission's work and, in particular, for rejection by the Commission of the suggestion made by some participants that conservation is the primary and overriding consideration for fishery managers, rather than a consideration that is supportive of the primary statutory objective of sustainable yield of sockeye for present and future generations of Canadians.

4. The federal fisheries power is not unlimited in scope. The attention of this Commission should be directed to the constitutional and common law limitations set upon the Minister of Fisheries.

5. In the first constitutional case concerning s. 91(12) of the *Constitution Act, 1867*, *R. v. Robertson,* Ritchie C.J. said: [1]

> … I am of opinion that the legislation in regard to 'Inland and Sea Fisheries' contemplated by the *British North America Act* was not in reference to 'property and civil rights'—that is to say, not as to the ownership of the beds of the rivers, or of the fisheries, or the rights of individuals therein, but to subjects affecting the fisheries generally, tending to their regulation, protection and preservation, matters of a national and general concern and important to the public, such as the forbidding fish to be taken at improper seasons in an improper manner, or with destructive instruments, laws with

1 (1882), 6 S.C.R. 52 at p. 12 (QL p 36) [emphasis added]

> reference to the improvement and increase of the fisheries, in other words, **all such general laws as enure as well to the benefit of the owners of the fisheries as to the public at large, who are interested in the fisheries as a source of national or provincial wealth**; in other words, laws in relation to the fisheries, such as those which the local legislatures were, previously to and at the time of confederation, in the habit of enacting for their regulation, preservation and protection,….

6. The meaning of the word "fishery" was considered by Newcombe J. in the Supreme Court of Canada in *Reference as to the Constitutional Validity of Certain Sections of the Fisheries Act, 1914*[2]:

> In Patterson on the Fishery Laws (1863) p. 1, the definition of a fishery is given as follows:
>
> > A Fishery is properly defined as the right of catching fish in the sea, or in a particular stream of water; and it is also frequently used to denote the locality where such right is exercised.
>
> In Dr. Murray's New English Dictionary, the leading definition is:
>
> > **The business, occupation or industry of catching fish or of taking other products of the sea or rivers from the water.**

7. These passages were cited with approval in *Fowler v. The Queen*[3] and in *Northwest Falling Contractors Ltd. v. The Queen*[4]. In the latter case Martland J. said:[5]

> The above definitions were quoted and followed by Chief Justice Davey in *Mark Fishing Co. v. United Fishermen & Allied Workers Union* (1972), 24 D.L.R. (3d) 585, at pp. 591 and 592. Chief Justice Davey at p. 592 added the words:
>
> > The point of Patterson's definition is the natural resource, and the **right to exploit** it, and the place where the resource is found and the right is exercised.

2 [1928] S.C.R. 457 at p. 472 (QL p 12) [emphasis added]
3 [1980] 2 S.C.R. 213 at p. 11
4 [1980] 2 S.C.R. 292
5 *Ibid*. at pp. 299-300

8. Chief Justice Laskin, in *Interprovincial Cooperatives Limited et al. v. The Queen*[6] referred to the federal legislative power over fisheries as being "concerned with the protection and preservation of fisheries as a public resource"[7].

9. Martland J. in *Northwest Falling Contractors Ltd., supra* said that,[8]

> Shellfish, crustaceans and marine animals, which are included in the definition of "fish" by s. 2 of the [Fisheries] Act, are all part of the system which constitutes the fisheries resource. The power to control and regulate that resource must include the authority to protect all those creatures which form a part of that system.

10. But he left open the question whether federal power extended to "fish" that had no connection with a "fishery" that was of economic, recreational or cultural value to humans. This question was determined in the negative in *R. v. MacMillan Bloedel Limited*[9], where the British Columbia Court of Appeal distinguished "fisheries" from "fish" and excluded from federal power fish that were not part of a fishery that was of benefit to the people of Canada.

11. In *R. v. MacMillan Bloedel Limited*, the Court agreed with the following proposition stated by the county appeal court judge: [10]

> With respect, I am persuaded that the contrary position taken by the appellant is sound, that the *Fisheries Act* is for the protection of fisheries, and that fishery does not include every species of fish in every geographical location. I agree with counsel for the appellant that the Supreme Court of Canada has indeed suggested some limitation on the reach of the Statute….
>
> …
>
> It appears to me therefore that in this case the *Fisheries Act* should not apply because the stream in question was not a fishery or part of one. To be identified as a fishery the area involved in this appeal would have to contain fish having a commercial value, or perhaps a sporting value, or would have to form part of the habitat of the anadromous fish below the waterfalls. None of these

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6 [1976] 1 S.C.R. 477
7 *Ibid*. at p 495.
8 *Supra* note 4 at p. 300
9 (1984), 50 B.C.L.R. 280; 1984 CanLII 740 (C.A.) (leave to SCC refused April 30, 1984, [1984] S.C.C.A. No. 279)
10 *Ibid*, B.C.L.R. p 283, CanLII para 8.

> conditions has been established. The appeal is allowed and the conviction quashed.

12. The Court reached this conclusion by construing the *Fisheries Act* "in a way which confined the operation of the *Act* to the scope and purpose of s. 91(12) of the *Constitution Act, 1867*"[11]. The objectives of s. 91(12) relate to fisheries of value to humans, not fish *per se*. This is not to say that ecosystem interactions should be ignored, but it does establish, for example, that protecting bears through MDN (marine derived nutrients) is not within the object, purpose or scope of the federal fisheries power. As stated in the Yukon Territorial Court case of *R. v. Scobey:*[12]

> ... while Parliament has the power to protect the environment in which fish live, this is not a general power to control water pollution. Rather, it must be shown that there is a connection between the *Fisheries Act* regulation in question and a harmful effect on fisheries, not just fish.

13. This is consistent with the oft-quoted passage in *Comeau's Sea Foods Ltd. v. Canada (Minister of Fisheries and Oceans)* that: "Canada's fisheries are a "common property resource", belonging to all the people of Canada. Under the *Fisheries Act*, it is the Minister's duty to manage, conserve and develop the fishery on behalf of Canadians in the public interest (s. 43)."[13]

14. The role of fisheries legislation is to <u>regulate</u> the underlying common law rights to fish, not to extinguish and replace them with statutory rights or privileges:[14]

> …it is very easy for both scientists and managers to forget (or never to have been told in the first place) that fisheries management agencies are first and primarily regulatory agencies; people who do not understand (or care) that their primary role is a regulatory one tend to become promoters of particular fishing interests rather than the interests of their primary employer, the public.
>
> …The purpose of the *Fisheries Act* and Regulations made thereunder, although binding upon all persons, is not to abolish the rights to fish of all persons, but to monitor and regulate, so that the

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11 *Ibid*., B.C.L.R. p. 285, CanLII para 14.
12 [1993] Y.J. No. 210 at para 9.
13 [1997] 1 S.C.R. 12 at pdf p 16
14 C.J.Walters and S.J.D.Martell*, Fisheries Ecology and Management* (Princeton: Princeton University Press, 2004) at p 65.

> fisheries will provide an adequate supply of fish now, and in the future[15.]

15. Like it or not, the federal fisheries power is human-centric or, rather, human-benefit-centric. Its purpose is to produce yield, and to conserve the resource insofar as necessary to produce yield. The purpose is not conservation *per se*. This essential point appears to have been lost in many of the current interpretations of the Wild Salmon Policy and its derivative, the FRSSI model of harvest management.

16. The human-centric purpose of the *Fisheries Act* is further supported by amendments in 1995 to the *Auditor General Act* that required departments and agencies, including DFO, to develop their own sustainable development strategies. This led in 2008 to the passage of the *Federal Sustainable Development Act*. S.C. 2008, c. 33, the creation of the Sustainable Development Office and the adoption of the Federal Sustainable Development Strategy – all of which require DFO to: [16]

> Deliver an integrated fisheries program that is credible, science-based, affordable, effective and contributes to sustainable wealth for Canadians.

17. The *Federal Sustainable Development Act* provides:

> **5**. The Government of Canada accepts the basic principle that sustainable development is based on an ecologically efficient use of natural, social and economic resources and acknowledges the need to integrate environmental, economic and social factors in the making of all decisions by government.
>
> **7**(1) The Minister shall establish a Sustainable Development Office within the Department of the Environment to develop and maintain systems and procedures to monitor progress on implementation of the Federal Sustainable Development Strategy.
>
> (2) The Office shall, at least once every three years after the day on which this Act comes into force, provide the Minister with a report on the progress of the federal government in implementing the Federal Sustainable Development Strategy. The Minister shall

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15 *R. v. Agawa* (1988), 65 O.R. (2d) 505 at 525 (QL p 18) (Ont. C.A.), leave to appeal to S.C.C. refused 8 Nov. 1990

16 Federal Sustainable Development Strategy, Annex III, s. 7.1.1 (http://www.ec.gc.ca/dd-sd/default.asp?lang=En&n=2868F61F-1).

cause the report to be laid before each House of Parliament on any of the first 15 days on which that House is sitting after the Minister receives it.

8. (1) The Minister shall appoint a Sustainable Development Advisory Council composed of one representative from each province and territory, and three representatives from each of the following:

(*a*) Aboriginal peoples;

(*b*) environmental non-governmental organizations;

(*c*) organizations representative of business; and

(*d*) organizations representative of labour.

11. (1) Each Minister presiding over a department named in Schedule I to the *Financial Administration Act*, or an agency named in the schedule of this Act shall cause the department or agency to prepare a sustainable development strategy containing objectives and plans for the department or agency that complies with and contributes to the Federal Sustainable Development Strategy, appropriate to the department or agency's mandate and shall cause the strategy to be laid before each House of Parliament within one year after the Federal Sustainable Development Strategy is first tabled in a House of Parliament under section 10.

18. The Federal Sustainable Development Strategy provides:[17]

Chapter 1: Context

Why Sustainable Development Matters

In the 21st century, the world faces tremendous challenges, including economic crises, global warming, air pollution, poverty, poor health, and loss of biodiversity. For more than two decades, *sustainable development* has been advanced as a means of reconciling human development with the earth's ecological systems. The journey toward truly sustainable development and decision-making has become a key goal of public policy in Canada and around the world. Development that is not sustainable will inevitably lead to negative economic, environmental, and social repercussions. Advancing sustainable development is about safeguarding our future and improving the quality of life in Canada and for the global community.

17 *Ibid*, p. 1

The sustainable development concept emphasizes the importance of maintaining and improving the quality of life by ensuring that decisions made today take into consideration social, economic, and environmental consequences. It integrates the social, economic, and environmental objectives of society in order to maximize human well-being in the present without compromising the ability of future generations to meet their own needs (OECD, 2001).

…

Stakeholder Consultations

…. The FSDS with its broad goals, targets and implementation strategies makes transparent how key environmental themes will contribute to the overall vision for Canada that:

- **Builds the jobs and industries of the future** by investing in Canadians' skills and education, keeping taxes low, opening markets to Canadian goods and services, and creating the conditions for continued success of industries that are the foundation of Canada's prosperity;

…

Chapter 2: Environmental Decision-Making in Canada

The *Federal Sustainable Development Act* states that, "The Government of Canada accepts the basic principle that sustainable development is based on an ecologically efficient use of natural, social and economic resources." The Government of Canada's approach to sustainable development therefore reflects a commitment to minimize the environmental impacts of its policies and operations as well as maximize the efficient use of natural resources and other goods and services. This is expressed in the FSDS through the specific implementation strategies found in the Annexes that provide details on the actions and programs undertaken by the Government of Canada. For example, in the implementation strategy 7.1.1 in Annex 3, the federal government commits to delivering an integrated fisheries program that is credible, science-based, affordable, effective **and contributes to sustainable wealth** for Canadians. (emphasis added).

Annex 3: Theme III
Protecting Nature

7. Goal: Biological Resources
Sustainable production and consumption of biological resources are within ecosystem limits.

> 7.1 Target: Sustainable Fisheries
> Improve the management and conservation of major stocks.
> (Minister of Fisheries and Oceans)
>
> Implementation Strategies for Sustainable Fisheries (7.1.1 to 7.1.4)
>
> *Enabling Capacity*
>
> 7.1.1 Deliver an integrated fisheries program that is credible, science-based, affordable, effective and contributes to sustainable wealth for Canadians. (DFO)
>
> 7.1.2 Sustainable development and integrated management of resources in or around Canada's aquatic environment through oceans and fish habitat management. (DFO)
>
> *Advancing Knowledge and Communications*
>
> 7.1.3 Undertake research to improve understanding of marine ecosystems and knowledge of straddling stocks and highly migratory species such as tuna, swordfish and Greenland halibut. (DFO)
>
> 7.1.4 Increase knowledge of fisheries resources, their productivity and the ecosystem factors affecting them. (DFO)
>
> Annex 5: List of Departments
>
> Departments and Agencies required to table SD strategies under the *Federal Sustainable Development Act*: …
>
> 6. Department of Fisheries and Oceans

19. The third relevant federal statute is the *Oceans Act.*[18] Its preamble reiterates the principle that the purpose of ocean resource development is to provide sustainable yield and economic benefit (particularly for coastal communities):

> WHEREAS Canada promotes the understanding of oceans, ocean processes, marine resources and marine ecosystems to foster the **sustainable development** of the oceans and their resources;

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18 S.C. 1996, c. 31

> WHEREAS Canada holds that conservation, based on an ecosystem approach, is of fundamental importance to maintaining biological diversity and productivity in the marine environment;
>
> WHEREAS Canada promotes the wide application of the precautionary approach to the conservation, management and exploitation of marine resources in order to protect these resources and preserve the marine environment;
>
> WHEREAS Canada recognizes that the oceans and their resources offer significant opportunities for **economic diversification and the generation of wealth** for the benefit of all Canadians, and in particular for **coastal communities**;

20. The *Oceans Act* provides as follows in regards to its principles:

> **29.** The Minister, in collaboration with other ministers, boards and agencies of the Government of Canada, with provincial and territorial governments and with affected aboriginal organizations, coastal communities and other persons and bodies, including those bodies established under land claims agreements, shall lead and facilitate the development and implementation of a national strategy for the management of estuarine, coastal and marine ecosystems in waters that form part of Canada or in which Canada has sovereign rights under international law.
>
> **30.** The national strategy will be based on the principles of
>
> > (*a*) **sustainable development**, that is, development that meets the needs of the present without compromising the ability of future generations to meet their own needs;
> >
> > (*b*) the integrated management of activities in estuaries, coastal waters and marine waters that form part of Canada or in which Canada has sovereign rights under international law; and
> >
> > (*c*) the precautionary approach, that is, erring on the side of caution.

Treaties

21. Two international agreements subscribed to by Canada are relevant. Both adopt the MSY principle.

22. The *United Nations Fisheries Agreement 1995* ("UNFA") was incorporated into Canadian policy in 2003.[19]

23. The UNFA is based on the principle of sustainability and optimum utilization, i.e. maximum sustainable yield. It is the genesis of the benchmarks utilized in WSP and FRSSI. Those benchmarks, or limit reference points, were intended by the UNFA to bracket the range of fish harvesting that ensures long-term sustainability while providing maximum yield to humans. If, for example, a CU such as the Late Shuswap generates an adult return of 20 million sockeye to a freshwater system that has a carrying capacity of 2 million spawners, and the benchmarks are set at 20% MSY for the lower benchmark and 80% MSY for the upper benchmark, the harvestable surplus (including other forms of mortality) in the dominant cycle line would be 18.4 million. Conversely, if the adult return is less than 400,000 "conservation and management action should be initiated to facilitate stock recovery".[20]

> Article 5
>
> General principles
>
> In order to conserve and manage straddling fish stocks and highly migratory fish stocks, coastal States and States fishing on the high seas shall, in giving effect to their duty to cooperate in accordance with the Convention:
>
> (a) adopt measures **to ensure long-term sustainability** of straddling fish stocks and highly migratory fish stocks **and promote the objective of their optimum utilization**;
>
> (b) ensure that such measures are based on the best scientific evidence available and are designed to maintain or restore stocks at levels capable of producing **maximum sustainable yield,** as qualified by relevant environmental and economic factors….
>
> Article 6
>
> Application of the precautionary approach
>
> 3. In implementing the precautionary approach, States shall:

19 Bevan, September 27, 2011, p. 73, ll. 44-46.
20 Exhibit 1952, United Nations Fisheries Agreement (emphasis added).

(a) improve decision-making for fishery resource conservation and management by obtaining and sharing the best scientific information available and implementing improved techniques for dealing with risk and uncertainty;

(b) apply the **guidelines** set out in Annex II and determine, on the basis of the best scientific information available, stock-specific reference points and the action to be taken if they are exceeded;

ANNEX II

GUIDELINES FOR THE APPLICATION OF PRECAUTIONARY REFERENCE POINTS IN CONSERVATION AND MANAGEMENT OF STRADDLING FISH STOCKS AND HIGHLY MIGRATORY FISH STOCKS

1. A precautionary reference point is an estimated value derived through an agreed scientific procedure, which corresponds to the state of the resource and of the fishery, and which can be used as a guide for fisheries management.

2. Two types of precautionary reference points should be used: conservation, or limit, reference points and management, or target, reference points. Limit reference points set boundaries which are intended **to constrain harvesting within safe biological limits within which the stocks can produce maximum sustainable yield**. Target reference points are intended to meet management objectives.

3. Precautionary reference points should be stock-specific to account, *inter alia*, for the reproductive capacity, the resilience of each stock and the characteristics of fisheries exploiting the stock, as well as other sources of mortality and major sources of uncertainty….

5. Fishery management strategies shall ensure that the risk of exceeding limit reference points is very low. If a stock falls below a limit reference point or is at risk of falling below such a reference point, conservation and management action should be initiated to facilitate stock recovery. Fishery management strategies shall ensure that target reference points are not exceeded on average….

7. The fishing mortality rate which generates maximum sustainable yield should be regarded as a minimum standard for limit reference points. For stocks which are not overfished, fishery management strategies shall ensure that fishing mortality does not exceed that which corresponds to **maximum sustainable yield**, and that the biomass does not fall below a predefined threshold. For overfished stocks, the biomass which would produce maximum sustainable yield can serve as a rebuilding target.

24. The UNFA is the subject of a CSAS Science Advisory Report. That report supports the interpretation above regarding harvest “removals” of all the surplus above the MSY reference

point. It is quite obvious that this intent has not been incorporated into the WSP or FRSSI, at least, not clearly enough to provide practical guidance to fishery managers. The relevant wording of the CSAS Advisory Report is:[21]

> *The Removal reference* is the maximum acceptable removal rate. The removal rate is the ratio of all human induced removals and total exploitable stock size. To comply with the UNFSA, it must be less than or equal to the removal rate associated with maximum sustainable yield. The Removal Reference includes all human-induced mortality.
>
> The Stock references and Removal reference are defined for "normal" conditions and may be adjusted to reflect changes in stock dynamics. The reference points will be determined by the best available science.

25. The *Pacific Salmon Treaty*[22] also reflects the foundational goal of maximum sustainable yield. The purpose of the Treaty is to provide for optimum production.

> **Article I: Definitions**
>
> As used in this Treaty,
>
> …
>
> 2. "fishery" means the activity of harvesting or seeking to harvest salmon;
>
> …
>
> 5. "overfishing" means fishing patterns which result in escapements significantly less than those required to produce maximum sustainable yields;
>
> **Article III: Principles**
>
> 1. With respect to stocks subject to this Treaty, each Party shall conduct its fisheries and its salmon enhancement programs so as to:
>
> (a) prevent overfishing and **provide for optimum production**; and
>
> (b) provide for each Party to receive benefits equivalent to the production of salmon originating in its waters.

21 Exhibit 1940, A Harvest Strategy Compliant with the Precautionary Approach [CSAS SAR 2006-023], p. 4.
22 Exhibit 65, Treaty Between the Government of Canada and the Government of the United States of America Concerning Pacific Salmon

2. In fulfilling their obligations pursuant to paragraph 1, the Parties shall cooperate in management, research and enhancement.

3. In fulfilling their obligations pursuant to paragraph 1, the Parties shall take into account:

(a) the desirability in most cases of reducing interceptions; and

(b) the desirability in most cases of avoiding undue disruption of existing fisheries; and

(c) annual variations in abundance of the stocks.

Memorandum of Understanding, August 13, 1985

…

A. Implementation of Article III, paragraph 1 (b)

The principal goals of the Treaty are to enable both countries, through better conservation and enhancement, to **increase production** of salmon and to ensure that the benefits resulting from each country's efforts accrue to that country.

Attachment E:
Habitat and Restoration

…

Desiring to cooperate so as to achieve optimum production, the Parties agree:

1) To use their best efforts, consistent with applicable law, to:

a) protect and restore habitat so as to promote safe passage of adult and juvenile salmon and achieve high levels of natural production,

b) maintain and, as needed, improve safe passage of salmon to and from their natal streams, and

c) maintain adequate water quality and quantity.

26. In this statutory and treaty context DFO should have readily agreed that a sustainable and economically prosperous fishery is the prime federal objective. The evidence of DFO's Pacific

Region's Regional Director General towards the end of the Commission paid lip service to this, but their implementation record painted a contrary piccture: [23]

> Q. Yes. Is it still the policy objective of the Government of Canada under the *Fisheries Act* and *Oceans Act* to have sustainable and economically viable ocean fisheries and to benefit coastal communities so far as possible?
>
> Ms. Farlinger: So far as possible, yes, although we've changed the language to "economically prosperous."

27. In summary, the fisheries power in s. 91(12) is subject to a number of limitations, including the principles emphasized above, and the power delegated to the Minister by the *Fisheries Act* and regulations is similarly limited and directed. The purpose of the *Fisheries Act* and the other relevant statutes and treaties is to provide yield (harvest benefits) not conservation of fish *per se*. If this limitation is not constantly borne in mind it is easy to fall into the error of thinking that the Minister can essentially do whatever he or she pleases. Any recommendations to the federal government on fisheries management must be grounded on an appreciation of the interaction of common law, statute law and treaties in this area.

SECOND POINT: Maintaining maximum sustainable yield (MSY) requires maintaining an equilibrium in the ecosystem that produces maximum sustainable harvest by humans. This requires an understanding of some basic biological attributes of sockeye salmon, including the density-dependent survival-rate pattern that is the fundamental ecological basis of sustainable harvesting.

a) Once the basic biological attributes of sockeye salmon are understood it becomes clear that the 20-year decline of the sockeye fishery is attributable mainly to the 1987 Rebuilding Strategy.

Natural equilibrium

28. In a purely natural system, i.e. a system that excludes human intervention, there is no "surplus". Everything is absorbed by the ecosystem. The presence of natural predators and competitors has a stabilizing or equilibrium-creating effect. However, preserving this state of nature is not the purpose of the *Fisheries Act*. A steady sustainable fishery harvest is its purpose, and this harvest (or "human predation") can create its own natural equilibrium or sustainability.

23 Farlinger, September 27, 2011, p. 69, ll. 9-15.

In a sense, humans are part of the ecosystem and are at the top of the food chain. Human fish-harvesters compete with aquatic predators, thus reducing by human intervention the biomass of fish available to support aquatic predators. This adversely impacts the aquatic predators but in light of the lesser economic value of most predator species this altering of nature by humans is perfectly acceptable and is consistent with the purposes of the applicable legislation and policy.

29. The expression "nature abhors a vacuum" is generally attributed to Aristotle. It means that nature requires every space to be filled with something. In the field of fisheries biology it expresses the tendency of the aquatic ecosystem to fill any voids that are created by natural or human forces and which are allowed to extend for several generations. The same kind of adjustment takes place when human or natural forces add something semi-permanent and new or foreign to the ecosystem. The result in either case is that in the space of a few generations a new equilibrium is established by reason of new organisms either entering or being pushed out of the ecosystem.

30. Such equilibria may be either prejudicial or beneficial to sustainable fish harvesting by humans. In the case of Northern Cod, the equilibrium that existed for centuries of fish harvesting was dislodged, apparently by overfishing in the decade or decades preceding the collapse. It was then generally assumed that following the fishing moratorium imposed in 1992 the cod resource would rebound. This did not happen. Instead, because the predatory groundfish population had gradually declined, snow crab and northern shrimp proliferated to fill the void, providing the basis for a new industry that is now roughly equivalent in economic value to the cod fishery it replaced. Meanwhile the cod have remained at a fraction of their former biomass as part of a new biological equilibrium that will be, at best, slow to change.[24]

31. A similar phenomenon was experienced on the West Coast of Vancouver Island where overharvesting of sea otters by First Nations during the early decades of an unregulated fur trade completely extirpated the sea otter. Following that, crabs, clams, mussels and sea urchins proliferated and supported a profitable fishery. In 1969 a transplant of 89 sea otters from Alaska was effected with DFO permission. They were released into the Bunsby Island Group about 25 km. north of Kyuquot Sound, and they have been colonizing up and down the coast ever since. It

24 http://en.wikipedia.org/wiki/Collapse_of_the_Northern_Cod_Fishery

is estimated that over 3,000 individuals now exist between Cape Scott to Barkley Sound. As a consequence the biomass of (and fishery for) crabs, clams, mussels and sea urchins has been much reduced. A new ecological equilibrium, probably similar to the ancient one, has developed. Once again, sea otters have gained dominance and have driven down the abundance of crabs, clams, mussels and sea urchins through predation.

32. These well-known historic facts are mentioned because they illustrate some of the underlying dynamics of nature. On the WCVI the only way to restore the crab, clam, mussel and sea urchin fishery would be to intervene and cull the sea otters. Because such an intervention would nowadays be regarded as unacceptable, the crab, clam, mussel and sea urchin fishery stands no chance of regaining its previous abundance. Nor, however, is there any likelihood that these species will be extirpated through predation. Nature has a way of preserving small stocks, *i.e*. stocks that diminish and are dispersed to such an extent that they fail to attract the interest of predators, human or natural. Horsefly Lake, for example, went from a low of 0-918 fish in the 1930's (following a log dam) to a run of millions by 1985.[25] Every population has within it the capacity to persevere after reduction of biomass; otherwise extinction would be far more prevalent than it is. Generally the recruitment rate of small stocks follows the steep (left) side of the Ricker curve.

33. Sockeye salmon have a complex life history and physiology that allows them to thrive in vastly different conditions and environments:

> For centuries sockeye salmon across the north Pacific have had highly variable, but sustained abundance, while responding to changes in these environments (e.g. Gresh et al. 2000; Finney et al. 2000). The ability of sockeye salmon to thrive across such a large range in environmental conditions and stressors has led to their recognition as an inherently resilient species (Hilborn et al 2003; Healey 2009).[26]

34. The natural processes that have a strong tendency to achieve an equilibrium are an important consideration for this Commission. It is relevant, for example, to the attempt to restore

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25 Riddell, December 1, 2010, pp 25-26.
26 Technical Report 3, *Evaluating the Status of Fraser River Sockeye Salmon and Role of Freshwater Ecology in their Decline*, p 1.

Cultus stocks to their former abundance. That effort is faced with the reality that a new form of equilibrium has been established in the Cultus that will maintain the stock at a low abundance unless there is some form of human "remedial" intervention. Fishing on the Cultus stock has been almost entirely eliminated but, like Northern Cod, that is not enough to break down the new form of low abundance equilibrium.

35. Remedial interventions used by DFO in a variety of situations include stocking, spawning channels, fertilization and predator culling. Economic objectives support the removal of less valuable species (*e.g.* pikeminnow) so as to promote more valuable species such as sockeye. The argument is based on prudent economic risk management – an argument that nowadays has little appeal to DFO.

36. In the case of the Cultus, DFO has adopted the "easy" approach of severely restricted fishing on mixed stocks that include Cultus stocks, with little apparent success but huge losses to the GDP of Canada. This illustrates a basic dysfunctionality (or "complacency") in the structure of DFO which will be addressed later in these submissions.

37. The evidence indicates that after much hesitation and obstruction, a predator removal program initiated by commercial fishing interests was allowed to proceed.

> MR. MORLEY: …The real money, so far, for the major program that's been undertaken, a predator control, and even the milfoil work, has come from the commercial fishing sector, okay; it has not come from the Government of Canada.
>
> Q As we've heard.
>
> MR. MORLEY: And so the Government of Canada, again, in terms of your question about complacency, is certainly the first place they turn when dealing with an issue is harvest management, because there's no direct cost, but there potentially are considerable costs to society and to commercial, recreational and First Nations fishers, but some of the other case, and in Cultus, for example, unless we do some of these other things, that harvest management is not going to be effective.[27]
>
> MR. HUME: In 2004, we did a mark-recapture population estimate of the pikeminnow in the lake and came up with approximately 60 to 70,000 adult northern pikeminnow in the lake. From starting in 2005 through to, well, currently, right now, it's still ongoing, we removed approximately 45,000 adult

27 Morley, February 8, p. 75, ll. 14-29

> pikeminnow from the lake. Of course, there's been replacement from the younger-year classes into the adult life history stage but we removed a significant proportion of the northern pikeminnow from the lake. This has resulted in increased survival at the current densities of sockeye in the lake, as we saw increased survival for those fish relative to years to when no pikeminnow removal occurred.[28]
>
> …
>
> So I guess what we can learn from this is that for populations that are in trouble, low densities and spawners, this may be a way to help rebuild the population by increasing their survival.[29]
>
> MR. HUME: Well, from my Cultus Lake project, we've certainly seen the fry-to-smolt survive work that's not published yet but we're just developing the data now, is that by removing the pikeminnow from the lake or reducing the numbers of pikeminnow in the lake, we're increased the over winter survival of these fish by almost double. So on average, we were getting about 22 percent survival from fall fry to smolts going out of the lake in the following spring and now it's more than double; it's around 50 percent, 55 percent survival on average.
>
> Q All right.
>
> MR. HUME: So indicating that predation is certainly a major factor in mortality during at least that time period of their life history.[30]

38. Removing the aquatic predators was the first essential step towards restoring Cultus stocks to the level where they can again contribute to the GDP of Canada. The predator removal program began in 2005. By 2010 the results were dramatic – a return of 10,632 in the dominant cycle that had produced only 3,521 in the previous generation. In 2011 (the sub-dominant cycle year) the adult return was 6,521, a recent record for this cycle.[31]

(This is reproduced in Appendix "A" *infra*)

39. DFO is committed to preserving all CUs in the Fraser sockeye system. Given the constitutional and statutory mandate of sustainable use of the fishery for the benefit of Canadians, however, it is essential that prudent economic risk management considerations form the basis for sockeye management decisions. Economic losses incurred by reducing harvest

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28 Hume, May 5, p. 30, ll. 14-28
29 Hume, May 5, p. 31, ll. 6-10.
30 Hume, May 5, p. 46, l. 42 – p. 47, l. 10.
31 http://www.pac.dfo-mpo.gc.ca/fraserriver/Escapement/Sockeyeupdate.htm

because of "weak" stocks must be weighed against the cost of "remedial" intervention such as predator (and milfoil) removal or enhancement (hatcheries, stocking, spawning channels etc.). It is simply not good enough to reject such intervention techniques because of cost when that cost is minimal compared to the losses flowing to the GDP of Canada through remedial inaction and fishery closures by DFO. If it is necessary for the industry to shoulder the economic burden of intervention then a means must be found to create the incentives for industry to do so (*i.e*. DFO must be able to assure industry that the benefits will accrue to those making the investment).

40. Lest it be thought that human "remedial" intervention is unacceptable, it should be remembered that that the 1987 Rebuilding Strategy was a deliberate ecosystem-altering policy. The fact that it did not work does not change its proper characterization as an adaptive management experiment. More will be said about this below.

Density dependence

41. Fishery managers cannot change nature; nor can they expect to fully understand it. However, basic density dependent variations are obvious to anyone with an elementary understanding of fish population dynamics. Unlike environmental changes ("regime shifts"), density dependent variations are essentially predictable. As the authors of the leading text on Fisheries Ecology and Management state,

> …the remarkable thing about fish recruitment is not how variable it is but, rather, how stable it is.[32]

42. There has been general agreement amongst salmon biologists for decades on the subject of the basic Ricker bell curve that is represented in the diagram on the following page taken from exhibit 419.[33]

32 Walters and Martell, *Fisheries Ecology and Management*, Princeton University Press, 2004, p. 149.
33 Exhibit 419, Clark et al., Biological and Fishery-Related Aspects of Overescapement in Alaskan Sockeye Salmon *Oncorhynchus nerka*, December 2007, p. 36 (confirmed by Marmorek at Sept. 20, 2011 p. 20).

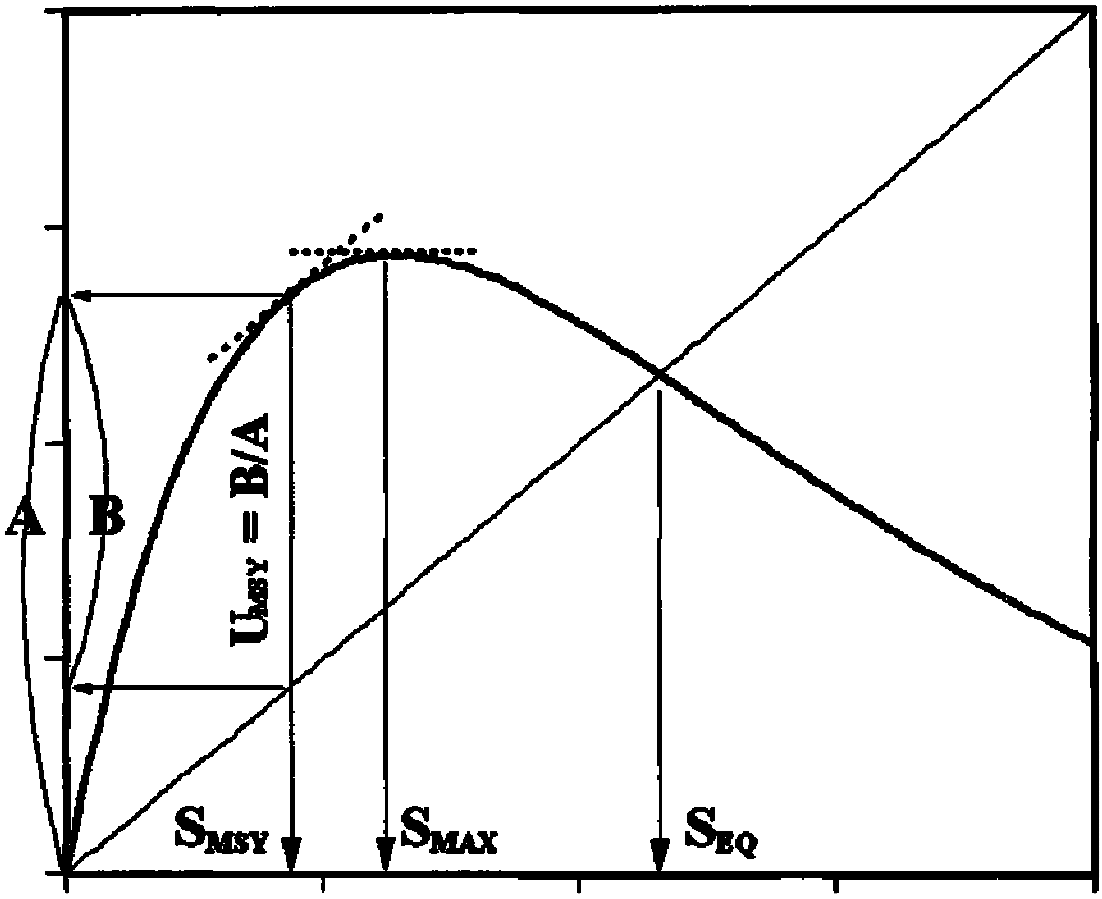

Figure 3-Schematic representation of a Ricker stock-recruitment curve and relevant biological reference points. SMSY is the biological reference point at which escapement produces the maximum sustained yield. SMAX is the maximum carrying limit established either by the productive capacity of the rearing lake or, in some cases, by the capacity of the spawning grounds. SEQ is the point at which productivity is reduced to 1:1, *i.e*. where recruits = spawners. The oblique line depicts the intrinsic rate of increase, *i.e*. the rate at which the population would increase in size if there were no density-dependent forces regulating the population. The curve depicts the actual rate of increase – which diminishes as it approaches the apex of the curve. UMSY measures the range of the harvestable surplus, which is the number of individuals that can be harvested from a population without affecting long term stability or average population size. The harvestable surplus is considered compensatory mortality, where the harvest deaths are substituting for the deaths that would occur naturally. UMSY is bracketed by the upper and lower biological reference points that indicate the boundaries of the optimal equilibrium harvest rate.

43. It will be seen that this model illustrates the basic self-regulating capabilities of fish populations. When the population is reduced in size by a single mortality event, whether fishing or natural, density dependent forces result in a increased rate of population growth provided that the mortality reduces the population to the biomass represented by the area to the left of the SMSY point on the Ricker curve. When a population increases beyond the maximum carrying capacity of the ecosystem (represented by the biomass on the right of the SMAX point at the apex) natural

density dependent forces will slow the intrinsic rate of increase. This slowing process will have the effect of reducing the population size in the next generation once it passes the S_{EQ} point at the intersection of the oblique line and the curve to the right of the apex. Thus, there is a natural "sweet spot" which competent fishery managers aim for in any fish management system in which the goal is maximum sustainable yield for the benefit of humans. The "sweet spot" is bracketed by the upper and lower reference points depicted by U_{MSY} in Figure 3 above.

44. Relatively simple overall recruitment relationships arise from a variety of very complex behavioural ecologies. Witnesses giving evidence to the Commission were in general agreement on the predictability of recruitment losses due to above-optimum spawner density, *i.e.* to the right of the apex on the Ricker curve.[34]

45. Nature also has a way of avoiding population collapse through density dependence:

> Overescapement, in general, is not sustainable as it causes returns and yields to decrease in the next generation, which also result in lower escapements. Lower escapements then result in higher returns and yields in succeeding generations.[35]

46. In other words, productivity losses due to overescapement would - without further human intervention – diminish in one generation due to the fact that excessive escapement leads to smaller smolts, higher marine mortality, lesser adult returns and, thus, less escapement. This natural cycle is depicted in Exhibit 1907 in the following way:

> Escapement increases → sockeye fry recruitment increases → slower fry growth and smaller smolts → marine ecosystem: early growth of juvenile salmon is slow → mortality above average for juvenile salmon → adult returns below average → escapement decreases → faster fry growth and larger smolts….[36]

47. However, this natural cycle, too, can be interrupted by human intervention – and this is what happened following the first generation hammered by increased escapement after the start of the 1987 Rebuilding Strategy. Managers intervened to progressively reduce harvest rates,

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34 See, *e.g.,* Marmorek at Sept. 20, 2011 p. 19, l. 16 – p. 22, l. 6

35 Exhibit 419, Clark et al., Biological and Fishery-Related Aspects of Overescapement in Alaskan Sockeye Salmon *Oncorhynchus nerka*, December 2007, p. 1

36 Exhibit 1907, Hyatt et al, *ENSO Induced Harmonic Oscillations of Marine Survival (HOMS) in Southern BC Sockeye Populations: Adult Sockeye Returns "in HOMS way,*" 2010 at p. 10

thus progressively increasing escapement so that it took roughly until 2006 for escapement levels to fall back to optimum MSY levels. The Shuswap 2006 escapement, for example, was right back to the "sweet spot" found through trial and error by the IPSFC in 1954 (which produced the record 1958 return).[37] This "sweet spot" agrees reasonably well with the predicted optimum escapement generated through photosynthetic-rate analysis by Shortreed and Hume in 1999.[38]

Delayed Density Dependence

48. The Ricker model deals only with density effects on recruitment in the next generation of the same cycle. A more sophisticated model was later developed by Larkin to account for effects crossing cycle lines, called "delayed density dependence". The phenomenon of density effects and delayed density dependence effects is described as follows in exhibit 419: [39]

> We examined the long term effects of overescapement on yields relative to MSY for 29 of the 40 stocks. This subset of stocks was chosen because the observed exploitation rate is less than or equal to the exploitation rate at Maximum Sustained Yield (MSY) allowing examination of yields at levels of escapement that would exceed the escapement that produces MSY. Yields from these stocks decreased below MSY as escapements increased beyond that which produces MSY. Averaged across all of these stocks, long term yields decreased and variability in yields increased when current escapement goals were exceeded. This result is consistent with the generic theory of compensatory production, where spawning efficiency decreases with increasing escapement levels and stocks are limited by the carrying capacity of the habitat. …. We also found evidence of delayed density dependence in five Alaskan sockeye salmon stocks. In three of these stocks, returns per spawner fell below replacement for 2 to 5 years following consecutive overescapements that were greater than twice the upper bound of the escapement goal range..

37 Exhibit 75, Roos, *Restoring Fraser River Salmon: A History of the IPSFC 1937-1985*, p. 125
38 Exhibit 575, Hume et al, Juvenile Sockeye Rearing Capacity of Three Lakes in the Fraser River System, 1996, p. 731; see also exhibit 576, Shortreed and Hume, *Using Photosynthetic Rates to Estimate the Juvenile Sockeye Salmon Rearing Capacity of British Columbia Lakes,* published in Knudsen et al., Sustainable Fisheries Management: Pacific Salmon (esp. pp 518-519)
39 Exhibit 419, Clark et al. (2007), Biological and Fishery-Related Aspects of Overescapement in Alaskan Sockeye Salmon *Oncorhynchus nerka*, p. 1.

49. The top scientists within the local fish biology community (*i.e.* at DFO; UBC and PSC) have concluded that density dependence and/or delayed density dependence is a likely cause contributing to the long-term decline of Fraser Sockeye.

50. In evidence on Feb. 10, 2011 Dr. Riddell explained why there was still a range of views on delayed density dependence at the PSC workshop held on June 15-17, 2010[40]:

> And in something like the delayed density discussion that we've heard here, many people were really probably encountering that discussion for the first time and so you have this fairly wide range of whether or not that was contributing to the long-term decline. Whether it contributed specifically to 2009, most people felt much more strongly that it would not have. My personal opinion on this is that seeing some of Carl's work through the last year, I would suggest that it is a likely cause contributing to the long-term decline. Others didn't share the same opinion.[41]

51. Dr. Walters, the acknowledged world leader in fish population dynamics, said at that workshop: [42]

> …the results in Figure 1 indicate that we can explain most of the recruitment decline from 1990 to 2004 as effects of delayed density-dependence. It is also very suspicious that the two strongest negative recruitment anomalies (poor recruitments relative to predictions based on spawner abundance) prior to 2000, i.e. 1958 and 1991, both occurred shortly after recruitment peaks and influenced a number of stocks in the way that would be expected if the peak abundances had led to some widespread problem like a systemic disease outbreak; the second such event is correctly predicted by the Larkin models, but not the first one.
>
> Delayed density dependence could be caused by predators/parasites, disease, and reduced zooplankton production.
>
> Sockeye are notorious for disease problems, and disease/parasite effects could easily have delayed expression, i.e. not kill the juveniles until they are stressed by downstream migration and early ocean residence.

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40 Exhibit 73, PSC, *Synthesis of Evidence from a Workshop on the Decline of Fraser River Sockeye*, June 15-17, 2010.

41 Riddell, February 10, 2011, pp. 75 l. 42 to p. 76 l. 8.

42 Exhibit 573, Appendix C to Peterman et al, Synthesis of Evidence from a Workshop on the Decline of Fraser River Sockeye June 15-17, 2010, pdf pp. 74-75

52. In the DFO Science Branch Workshop held on April 14-15, 2011 (and attended, *inter alia*, by scientists Daniel Selbie and Jeremy Hume) the following points were made:

> * A large escapement in a given brood year causes the number of resulting adults to be extremely low due to competition for limited resources, disease etc (Peterman & Dorner 2011).[43]
>
> *Large escapements in a brood year negatively impact the brood year and at least the following three broods (Peterman & Dorner 2011).[44]
>
> *Conclusion – R/S data indicates evidence of DDD in specific stocks.[45]
>
> *Larkin fit better than Ricker in 12 of 19 Fraser stocks.[46]
>
> *Conclusion – Where DDD exists, it persists across the entire 4 year cycle (in agreement with Woodey, Lapointe and Hume); Causal mechanisms of DDD most likely stock-specific.[47]
>
> …
>
> *2010-2011 In The Fraser: Shuswap and Chilko
>
> *Potential severe DD in 2010
>
> *Depending upon 2011 escapement, possible repeat of the Quesnel/Alaskan examples.[48]

53. In the DFO Summary of the April 14-15, 2011 workshop, delayed density dependent mortality is upgraded to an "important contributor to the Fraser sockeye situation".[49]

> • Chilko and Quesnel 2010 escapements (S_{MAX}) 200-500% and will likely be hammered in coming years (negative effects observed at S_{MAX} greater than 200%, and apparent in current brood year, plus at least 3 following years).

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43 Exhibit 1908, *Are Overescapement and delayed density dependent mortality important contributors to the Fraser sockeye situation?,* pdf p 2
44 Exhibit 1908, pdf p 5
45 Exhibit 1908, pdf p 7
46 Exhibit 1908, pdf p 8
47 Exhibit 1908, pdf p 11
48 Exhibit 1908, pdf p 16
49 Exhibit 1364, Draft Summary Report: DFO synthesis workshop on the decline of Fraser River sockeye Vancouver Island Conference Centre, Nanaimo, BC April 14-15, 2011, p 4

> • PSC report uncertain LIKELY-UNLIKELY, move to LIKELY for long term decline?[50]

54. It is important to note that marine and freshwater pathogens (bacteria, parasites, and/or viruses) are also reported as "important contributors to the Fraser sockeye situation".[51] This is a significant finding because delayed density dependent mortality and pathogens caused by excessive density are the only causal mechanisms that can be controlled by fishery managers and are within the power of this Commission, by strong recommendation, to rectify. There is no practical way for this Commission to do anything about marine conditions and climate change.

55. US regulators have recognized what is within and what is outside the control of fishery managers: [52]

> …while we cannot control the ocean, we can monitor ocean conditions and related salmon survival and take actions to improve the likelihood that Columbia River Basin salmon can survive varying ocean conditions. A better understanding of the ocean conditions that influence salmon survival should provide insight as to which management actions taken inland will provide the greatest restoration benefit. Recruitment success in the ocean environment is generally believed to occur largely during the first critical months at sea - Ricker 1976".

56. As ocean conditions become more or less challenging the Ricker curve does not change its shape but it will move up and down (as explained by David Marmorek, author of Technical Report 6, on Sept 20, 2011). In other words, as ocean conditions become more challenging the S_{MAX} spawner abundance point at the apex of the curve is reduced.[53]

57. Mr. Marmorek said that mortality depicted on the Ricker curve occurs after the first fry growing season, and likely in the early marine stage.[54] Whether this density dependent mortality

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50 Exhibit 1364, Draft Summary Report: DFO Synthesis Workshop on the Decline of FRS, Apr 14-15 2011, p. 7.
51 Exhibit 1364, p. 3
52 Exhibit 1903, Petrosky & Schaller, "Influence of rover conditions during seaward migration and ocean conditions on survival rates of Snake River Chinook salmon and steelhead" (2010) 19 Ecology of Freshwater Fish, 520 at 522.
53 Marmorek, September 20, 2011, pp 25-26.
54 Marmorek, Sept. 20, p. 24, l. 41 – p. 25, l. 12

is due to pathogens or to reduced size and energy levels, or a combination, is, however, uncertain. Dr. Walters attributes it to parasites and diseases: [55]

> That really feels like the high escapements and high smolt -- high rearing densities and the like, stimulated something to develop in the lake that is now killing Chilko smolts after they leave the lake, at very high rates. Our best candidates for such a "something" is parasites and diseases. I got a grad student to go through and look at a large number of Chilko smolts collected over the years at the Chilko fence, and she found really high parasite loads in those smolts, higher than had been found in other stocks. It's quite possible that high escapements, combined with fertilization of Chilko Lake, led to a dramatic increase in parasite loads being carried by those fish, and that that's what's killing them at such higher rates now as you've heard about from Scott Hinch's tagging study and so on.

58. Although apparently beyond the ken of many DFO regulators, fishery managers in the US have no trouble understanding "the generic theory of compensatory production" and "evaluating foregone annual harvest as a result of overescapement".[56] In our submission, this accounts in large part for the success of the Bristol Bay and Columbia River sockeye fisheries. Both are managed within a narrow band of escapement reference points that avoids the short- and long-term productivity impacts of excessive escapement. This is the only apparent answer to the question why the declining productivity trend in Fraser productivity is inconsistent with the increasing productivity trend in the Columbia and Bristol Bay.

Cyclic Dominance

59. Many Fraser sockeye stocks show strong cyclic fluctuations in total abundance. Eight of the 19 stocks show persistent cycles with a predictable peak in abundance every four years (for example, 2010 was a dominant cycle year for the Adams River stock).[57]

> "Since most sockeye return to spawn in their fourth year of life, each year's spawning perpetuates the stock returning four years later, creating, within each quadrennium, four more or less separate

55 Walters, February 9, p. 31, ll. 15-32
56 Exhibit 419, Clark et al. (2007), Biological and Fishery-Related Aspects of Overescapement in Alaskan Sockeye Salmon *Oncorhynchus nerka*, p. 1.
57 PPR5, *Overview of Fraser River Sockeye Salmon Harvest Management*, p. 47.

> "cycles". For as yet unexplained reasons, most stocks are much more abundant in one cycle than in the other three. This phenomenon, called "quadrennial dominance", was very evident in the early stages of the commercial fishery; the abundance of the runs in dominant cycle years 1893-1987-1901 etc., was greatly in excess of that in the intervening years. Following the drastic decline of the runs after [the Hell's Gate slide] in 1913, cyclic dominance became erratic and the dominant cycle-year in some important stocks shifted (Thompson 1945, Royal 1953). With the recent strong increases in Fraser sockeye abundance, the original dominant cycle has shown evidence of restoration (PSC 1990)."[58]

60. An understanding of the mechanism of cyclic dominance is essential to understanding the phenomenon of the 20-year decline of Fraser River sockeye. Dr. Woodey is one of the most knowledgeable experts in this area. He described cyclic dominance as follows: [59]

> Dr. WOODEY: Cyclic dominance in Fraser River sockeye is a natural, from my point of view, a natural reproduction pattern that was found to be in place in the early years of contact in the early 1800s, and for most stocks became -- or I should say most cyclic dominant stocks, became a pattern that when we began managing fish, actively managing fish in the '40s and '50s, was recognized as being the state of nature and was the accepted norm. And management from that point to the time that the IPSFC was disbanded and in the early years of the PSC, was recognized to be the norm. Cyclic dominance involves one large return year, the dominant line year; generally a subdominant line year, generally that being the year following the dominant year, and then two years where the abundance is somewhat lower from less than one percent of the dominant year abundance to a few percent of the dominant year abundance.
>
> Cyclic dominance appears to be a biologically-driven phenomenon, rather than a fishery-driven phenomenon…

61. Dr. Woodey also touched upon the connection between cyclic dominance, density dependence and the FRSSI model (which does not embody the Larkin delayed density dependence model): [60]

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58 Exhibit 418, Gilhousen, P., 1992, *Estimation of Fraser River Sockeye Escapements from Commercial Harvest Data, 1892-1944*, pp 5-7
59 Woodey, February 9, 2011, p. 9, l. 32 – p. 10, l. 7
60 Woodey, February 9, 2011, p. 9, ll. 1-16

> Q There was, we heard yesterday from Mr. Cass, that in 2006 there was a workshop held to address the topic of cyclic dominance. Were you part of that workshop?
>
> DR. WOODEY: Yes, I was.
>
> Q And were the criticisms that you had of the FRSSI model addressed following that workshop?
>
> DR. WOODEY: Yes, they were. I would have to say that the approach that I had taken and had written about was a slightly different approach than what the group as a whole decided would be the appropriate way of approaching it, and that was to have the FRSSI model use what's called a Larkin model for all stocks on all lines. So that would pick up the delay density dependence, that's a characteristic of cyclic dominant stocks.

62. Dr. Walters explained how he first thought that fishing had created the dominance pattern and that, therefore, the cycle variation could be eliminated by human intervention. This was the basis for the attempt in the 1987 Rebuilding Strategy to rebuild the off-cycle years. Dr. Walters later came to realize that it was a biologically driven phenomenon and that the 1987 Rebuilding Strategy was, therefore, doomed to failure.

> Q Okay. Just to clarify, the experiment to rebuild the off-cycle years, is that the strategy that we've heard about called the Rebuilding Strategy?
>
> DR. WALTERS: That's right. The one that seems to be failing, and that if we had paid closer attention to Jim, and if we'd paid closer attention to other long-term analyses done by Pacific Salmon Commission staff, like Gilhousen, we probably would not have recommended.
>
> Q Okay, thank you. Back to Dr. Woodey. Just to clarify, if you can help us with some names of the stocks that are cyclically dominant that we would be hearing about and ones that are not, just to help us when we're looking at charts and things and the stocks are laid out. If I understand it right, the Shuswap, Quesnel, and some of the Stuart stocks are cyclically dominant; is that right?
>
> DR. WOODEY: That's correct. There are other more minor stocks in the system that do show cyclic dominance, as well, but within the Shuswap there are the Late run Adams, Lower Shuswap stocks,

> and also Seymour and Scotch Creek, which are Summer run fish, which show cyclic dominance.[61]

63. Dr. Woodey explained the driving mechanism:

> DR. WOODEY: …Our view of the world is that cyclic dominance is a freshwater phenomenon, and it's driven by the impact of one cohort or brood year offspring, juvenile sockeye, and their, from my point of view, consumption of the food resources in the year that they're in the lake, and the residual effect of that cropping on subsequent cohorts of juveniles. And when I say cohort, it's just the juveniles from the dominant line spawning affecting the food resources and that impacts the subdominant line juveniles, and then the subdominant line, or in some cases, a two-year lag of impacts, dominant line juveniles impacting the growth and the survival of subdominant and first offline. So it's that delayed density dependence within the freshwater environment that drives cyclic dominance.
>
> Q And the food, the nutrition factor that you've just described is one of the hypotheses. I take it there's a few other hypotheses, including disease transfer and predation, or some other biological hypotheses as to how this kind of cyclic dominance is created; is that right?
>
> DR. WOODEY: Yes, that's correct.[62]

64. Dr. Christensen agreed that cyclic dominance obviously results from something in the freshwater system and that understanding the ecosystem interactions that cause cyclic dominance would be quite essential to sound fishery management decisions. He also referred to the disastrous attempt to break those cycles.[63]

65. Like many other experts, Dr. Christensen agreed that the causes of the 20-year decline could be in the freshwater outward migration and early ocean entry stage. He agreed that smaller smolts have a higher mortality rate and are more susceptible to marine predation.[64]

66. Technical Report 8 authored by Christensen and Trites provides the following:[65]

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61 Walters and Woodey, February 9, 2011, p. 12, ll. 7 -30
62 Woodey, February 9, 2011, p. 12, l. 43 – p. 13, l. 19
63 Christensen, May 5, 2011, p. 77, ll. 12-34.
64 Christensen, May 5, 2011, pp. 77 and 78.

> Related to this is that the Fraser River sockeye may have become the unwitting victims of their own success. As shown in Figure 36, the numbers of effective spawners of Fraser River sockeye salmon have increased in recent decades, which in turn may have increased intraspecific competition and exposed smolts to higher rates of mortality. Previous studies have shown that increased sockeye fry abundance leads to lower average weight of smolts, and that the total biomass of a smolt year class may decrease with increasing number of spawners (Hume et al. 1996). The implication of this is that increased escapement may lead to higher predation mortality in the ocean where there is a strong positive correlation between size and survival (Lorenzen 1996).

67. Jeremy Hume, who has conducted some very impressive research that no one has criticized, has found that the average size of fall fry declines following the dominant year. Average fry size is the smallest in the non-dominant years. The Quesnel 2002 brood year (the 2nd successive year of the highest escapement ever observed in the Quesnel) produced the smallest fall fry ever observed.[66] That is an example of an ecosystem carry-over although it, of course, cannot be definitively proven in the scientific sense of the word "proof".

68. All one can say is that the Larkin Model of delayed density dependence fits almost perfectly with the decline in Quesnel.[67] It explains the failure of the 2009 Quesnel run – which would otherwise have been the prime (largest) producer in 2009 cycle.[68]

69. Some DFO officials argue that in spite of the predicable lost productivity and yield caused by overescapement such as that in the 2001 and 2002 Quesnel returns, overescapement is nevertheless beneficial because it provides nutrients (MDN) to the ecosystem. This ludicrous view presupposes that using the most valuable salmon species in the world as fertilizer is justifiable. The view was expressed by, among others, Dr. Jim Irvine (Research Scientist, Salmon and Freshwater Ecosystems, Pacific Biological Station, DFO).[69]

70. That illustrates the danger of supposedly scientific conclusions that are based on intuition rather than scientific evidence. Jeremy Hume, who had researched this point, had this to say:

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65 Technical Report 8, Predation on Fraser River Sockeye Salmon, p. 74
66 Hume, May 5, 2011, p 79-80 and p. 84-85
67 Technical Report 10, Peterman and Dorner, Fraser River Sockeye Production Dynamics, pp 27-28
68 Exhibit 340, DFO, Pre-Season Run Size Forecasts for Fraser River Sockeye and Pink Salmon in 2009, p. 2
69 Irvine, December 8, 2011, p. 43, ll. 37-46

> MR. HUME: In 2001 and 2002 we had the highest escapement to Quesnel Lake that had ever been observed, and we did not do any limnological sampling in 2001, but we did in 2002. Nutrient levels that increased in the lake in 2002, as fully expected from fertilization from the carcasses, but we -- but the phytoplankton that was produced by that nutrient was unusual in that it produced a large bloom of phytoplankton, called tabellaria, it's a diatom called tabellaria, which was a colonial diatom, and the evidence is a little unclear, but it's unlikely to be a preferred prey item for daphnia so that much of the nutrients produced by the carcasses were diverted into a trophic trap, I guess you could call it, where the food -- the **nutrients didn't work their way up the food chain to the sockeye fry**.[70]

71. These complex ecosystem interactions help explain for the underlying mechanism of cyclic dominance. Even though the carcasses from the dominant run provide nutrients to the ecosystem supporting the cycles that follow, the nutrients are of no assistance to sockeye fry from the following cycle year. Thus, the ecosystem in its natural state, has one large year followed by three much smaller years, as the Gilhousen findings indicate. Marine derived nutrients are incapable of making up for overgrazing in the food web by the fry of the dominant line.

THIRD POINT: Maintaining MSY in a fishery divided into four run-timing groups and a multitude of CUs requires a mixed stock harvest regime that prevents excessive escapement of major stocks while avoiding any unreasonable and genuine risk of extirpation of minor stocks. This was accomplished in the era of the IPSFC. There is no reliable evidence that it could not continue to be accomplished under a simplified harvest management structure based on biologically defensible escapement reference limits.

a) The structure and wording of the WSP, augmented by its derivative, the FRSSI, is inappropriate and has led to confusion, conflict and huge losses to the GDP of Canada. A misguided implementation of the WSP has undermined the MSY objective of the *Fisheries Act*.

b) We propose that the WSP be scrapped and replaced with a restatement, in simple and understandable terms, of the intent of the WSP to provide for MSY while avoiding any unreasonable and genuine risk of extirpation. This will require a commitment by DFO to the Adaptive Management Process, including retrospective productivity and socioeconomic analyses to inform future decision-making, and independent oversight by a Commissioner of Sustainable Productivity

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70 Hume May 5, p. 80, ll. 11-28

who is responsible to the Auditor-General and who reports annually to Parliament on the social and economic consequences of DFO's harvest management practices.

72. The underlying constitutional, statutory and treaty objective (*i.e*. MSY) discussed in the first section of these submissions combined with consideration of the biological constraints of the *Oncorhynchus nerka* salmon, serves two purposes: it demonstrates how a fishery should be managed to achieve its MSY purpose, and it assists in finding the facts regarding the causes of the 20-year decline in productivity of Fraser River sockeye salmon within the meaning of the Terms of Reference of this Commission. In this next section we address those findings of fact and we then address the question of recommendations to avoid a repetition of management policies and practices that led to the decline.

Findings of Fact regarding the Causes for the Decline of Fraser River sockeye salmon

73. The various experts have spent much time looking for correlations between the decline and potential causal mechanisms. However, most of them have overlooked the obvious correlation that is demonstrated by the near mirror-image chart that appears on the next page (from Exhibit 184):[71]

71 Exhibit 184, Grant et al (2010), '*Fraser Sockeye WSP Evaluation of Stock Status: State and Rate*, p. 12.

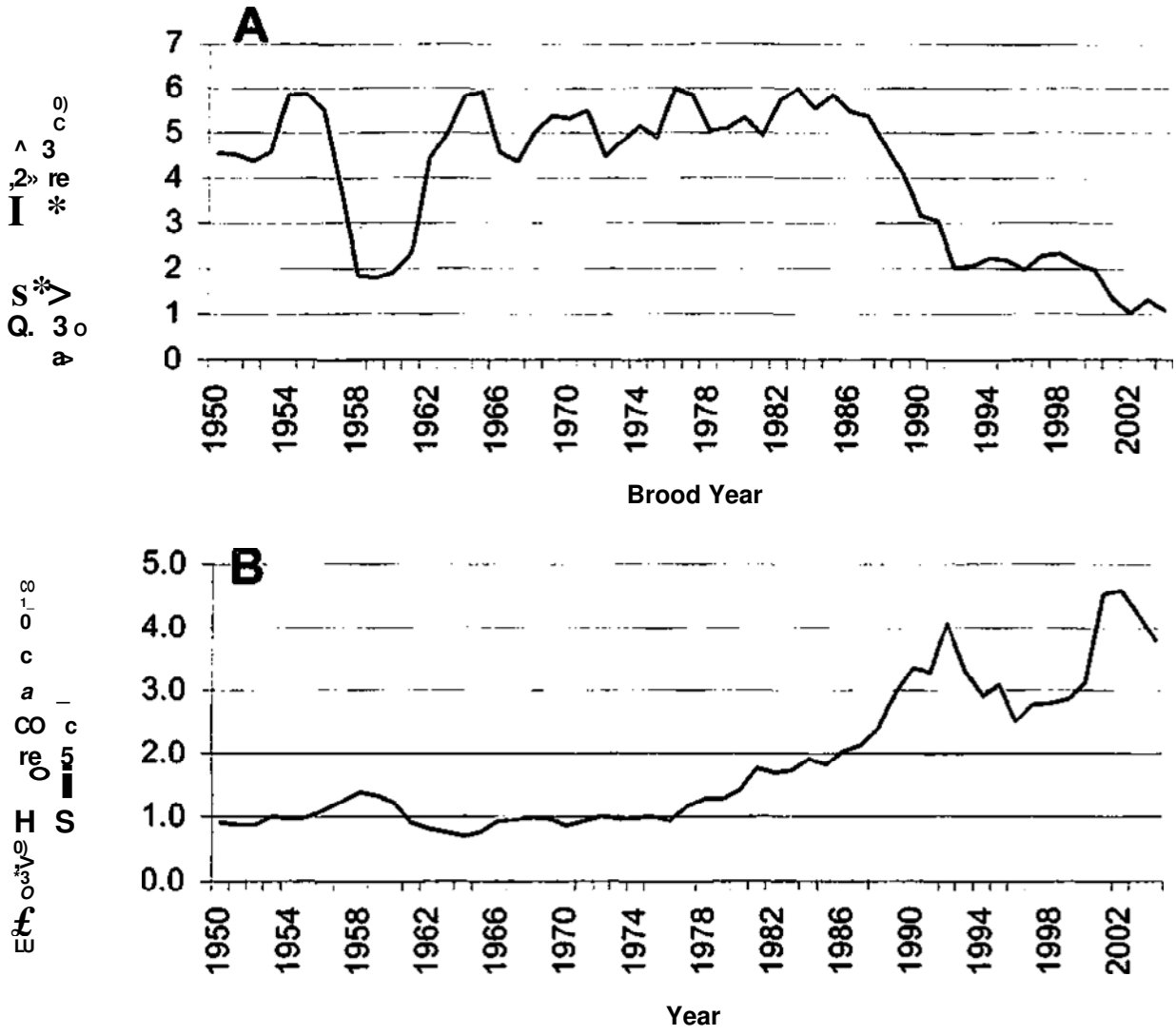

Figure 6. A. Four-year running average productivity in recruits (age-42 plus age-52)-per-effective total spawner and B. escapement (effective total spawners) for Fraser Sockeye populations. These trends are driven by CUs that dominate total abundance (Quesnel-S/McKinley-S, Chilko-ES/Chilko-S, Takla-Tremleur-S/Stuart-S and Fraser-S).

74. This chart demonstrates what Ricker and Larkin modelled decades ago – when escapement approaches and passes the apex of the curve, productivity diminishes sharply. This applies to all the dominant CUs that provide most of the abundance of Fraser sockeye (those listed in Figure 6 plus the Shuswap). The mirror-image is not perfect, partly because escapements in some minor stocks were not pushed past the carrying capacity of the rearing lakes and partly because other factors beyond the control of fishery managers have had a residual influence on the main density-dependence drivers of the decline, such as fluctuating ocean conditions.

75. Ocean conditions provide residual variations to the predictable S-R (spawner - recruit) trend line that Ricker and Larkin modelled. Technical Paper 6 examines the "residuals" but finds no 20-year pattern that correlates with the productivity graph shown in Figure 6. It must be remembered, as Dr. Peterman explained, that there is no question that increasing escapement causes productivity to decline and thus can account for a large part of the 20-year decline in productivity.

> Q….Am I right that your work seeks to identify a decline in productivity that is inconsistent with the Ricker and Larkin Model predictions?
>
> DR. PETERMAN: Yes, I guess you could phrase it that way.[72]
>
> …
>
> Q… that sounds to me like you're looking to identify something that's exacerbating a downward trend.
>
> DR. PETERMAN: Okay, sure.[73]
>
> …
>
> Q. If the question were framed differently, instead of "Does over-escapement cause salmon stock collapse?" if it were, "Does over-escapement cause salmon stock decline in productivity?" you'd answer that as, "Yes," would you?

72 Peterman, April 20, p. 85, ll. 13-18
73 Peterman, April 20, p. p. 87, ll. 39-42

DR. PETERMAN: Decline in productivity, probably yes, because almost by -- if you believe the Ricker and Larker Models, any increase in spawner abundance will cause the returns per spawner to go down.[74]

…

Q …Is there any way you can separate the decline in productivity in the 2009 run attributable to the Larkin model of delayed density dependence from the decline due to residual factors?

DR. PETERMAN: Probably not quickly.[75]

…

Q. And something we can't do anything about that is making the marine ecosystem more challenging for the smolts entering it?

DR. PETERMAN: Well, that seems to be –

Q Right.

DR. PETERMAN: -- the most likely hypothesis.

Q Yes.

DR. PETERMAN: But as I said yesterday, it's conceivable that there's something going on in freshwater –

Q Yes.

DR. PETERMAN: -- that doesn't lead to mortality until the fish are in the marine environment.

Q Yes. But in either event, you would agree, I think, that it becomes important, very important, that fishery managers do everything they can to ensure that the smolts entering the marine ecosystem are as large and healthy as possible

DR. PETERMAN: In general, we've seen that larger smolts tend to survive better in the ocean, so yes.

Q Yes. Because once they enter the ocean there's quite a gauntlet in the Strait of Georgia that they have to run with degraded food web and predators, and that sort of thing?

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74 Peterman, April 20, p. 97, ll. 30-38
75 Peterman, April 21, p. 12, ll. 10-15

DR. PETERMAN: Well, we know that the mortality rate of juveniles is highest in the period between when they leave the lake, in the case of stocks where you estimate the smolts, and in the first year to year and a half of ocean life.

Q Yes.

DR. PETERMAN: So where it is exactly, I wouldn't necessarily pin it down to the Strait of Georgia, but there's high mortality going on early in their life history –

Q Yes, all right.

DR. PETERMAN: -- post-lake.

Q And would you accept this, that what is within the control of fishery managers is, to a certain extent, at any rate, keeping the right balance in the freshwater ecosystem between the biomass of sockeye fry and the carrying capacity of the rearing lakes?

DR. PETERMAN: Well, it's certainly affected by the escapement goal, if that's what you mean, but as you know, there's imperfect control over the fisheries and over en route mortality, so it's not possible to hit the escapement target perfectly by any means, anywhere.

Q Yes. But you would agree that the fishery managers can and should exercise their best efforts in that regard?

DR. PETERMAN: Yes, of course.

Q Okay. You, I think, did not accept Dr. Woodey's characterization of the Quesnel system decline as disastrous, but you would agree, at any rate, that it was most unfortunate?

DR. PETERMAN: Well, it was a substantial decrease.

Q Yes. Something that should be avoided if at all possible?

DR. PETERMAN: Yes.

Q I'm curious, therefore, why you did not include as a recommendation in your report that fisheries managers avoid so far as possible the large numbers of spawners that led to the density dependence declines in the Quesnel system.

DR. PETERMAN: Well, Brigitte might have some additional thoughts on this, but we felt that our report was purely a science

report and that we did not have any -- a role to recommend how management should be done…[76]

…

Q …Would you agree that the conservation goal of sustaining a fishery resource over time requires taking into account the detrimental effects of excessive spawner abundance, and by that I mean excessive -- in excess of the carrying capacity of the freshwater ecosystem?

DR. PETERMAN: Yes.

Q Okay. You're familiar, I guess, with the concept of the ecosystem-based approach to fisheries management?

DR. PETERMAN: Absolutely.

Q Does that approach require taking into account also the food web upon which the sockeye juveniles depend?

DR. PETERMAN: Yes.[77]

…

DR. PETERMAN … So, in general, I think what you're getting at is, given uncertainties, a prudent manager or a set of managers would take into account the potential impacts on the dynamics of the ecosystem that support the salmon.

Q Yes.

DR. PETERMAN: For sure.

Q Yes. The same [precautionary] principle that we think of as being applied to salmon has to also be applied to the microscopic organisms that the salmon rely on for survival?

DR. PETERMAN: To the extent they can be documented to effect the survival of salmon, yes.[78]

…

76 Peterman, April 21, p. 13, l. 35 – p. 15, l. 11
77 Peterman, April 21, p. 16 ll. 19-34
78 Peterman, April 21, p. 17, ll. 7-19.

Q. [discussing the apex of a Ricker curve based on photosynthetic rate (PR) analysis]: So it's analyses such as this that tell you what the optimum escapement should be?

DR. PETERMAN: Well, again, it's only based on assuming that your definition of "optimum" is the escapement level that produces the maximum number of smolts.

Q Yes, and if you want to -- the qualification would be if you want smolts that are healthy and well nourished and a good size by the time they reach the sea, you might have to back it off a little?

DR. PETERMAN: Right.

Q All right.

DR. PETERMAN: Yeah.

Q So there's less competition for food?

DR. PETERMAN: Yes.[79]

…

Q Right. So I'm not faulting you for it, but you would agree with me that the three stocks that you identify as fitting appropriately within the Larkin model with the delayed density dependence, are the major stocks in terms of production for the Fraser River.

DR. PETERMAN: No, sorry, not true. The late Shuswap is the major producer in the whole system and it did not have the Larkin model fit best, as I recall here. I'm just looking through my notes.

DR. DORNER: There was no clear evidence either way.

DR. PETERMAN: For the Shuswap.

DR. DORNER: Yes.

DR. PETERMAN: So in other words, the Ricker and the Larkin models fit equally well for the Shuswap.

DR. DORNER: Within the four AIC points.

DR. PETERMAN: (Indiscernible - overlapping speakers).

Q But the others are major producers, obviously.

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79 Peterman, April 21, p. 19, lines 33-47

DR. PETERMAN: Yeah, the Chilko is definitely a major producer.

Q Yes.

DR. PETERMAN: As is Quesnel.[80]

76. It is now clear that cyclic dominance and delayed density dependence are linked to the same causal mechanism, and that failure to understand this phenomenon led to the 1987 Rebuilding Strategy and the debacle that followed. That was a well-intentioned attempt to rebuild the sockeye fishery at a greater rate of increase than had been accomplished incrementally by the IPSFC. Dr. Walters described this and other rebuilding "experiments" in his evidence, all of which had disastrous results. [81]

77. The 1987 Rebuilding Strategy and the earlier Rivers Inlet experiment are also described in Walters and Martell, *Fisheries Ecology and Management*: [82]

> Adaptive optimization calculations suggested that the best experiment in such situations is an "all-or-nothing" change in *S*: shut down the fishery and get strongly informative data as quickly as possible, so as to minimize the duration of the experimental testing period. The staff of the International Pacific Salmon Commission argued that they had already been doing a gradual, less economically painful, and less risky "titration experiment" by regulating harvest rates so as to allow a slow rebuilding of the spawning runs while continuing to provide fishery benefits.
>
> While debate continued about whether to subject British Columbia's most valuable salmon fishery (Fraser sockeye) to an adaptive escapement rebuilding experiment, an opportunity arose to test the concept on sockeye salmon in Rivers Inlet, a smaller system where fishery closures to increase spawning would have much less economic impact (Walters er al. 1993). Again, the stock-recruitment analysis and historical catch data had indicated a considerable potential to rebuild the stock, and in this case it was decided to close the fishery entirely for at least five years (one complete life cycle) and decide on the basis of initial recruitment responses whether to continue the closure for even longer. From both a scientific and ecological perspective, this experiment was basically a failure: in designing it, we failed to think carefully about the improvements in *R* and *S* monitoring that would have been needed in order to detect responses quickly, and the crude monitoring data that were collected showed no evidence of any positive recruitment response to the closure. Worse, a few years after increased recruitments might have started to appear, there was a catastrophic decline in recruitment apparently caused by changes in marine survival rates, which also affected the nearby Smith Inlet sockeye stock that we had been viewing as something of an experimental "control."
>
> Just as the evidence of response failure at Rivers Inlet was starting to appear, the Canadian Department of Fisheries and Oceans decided to proceed with experimental escapement increases for Fraser River stocks. But by some peculiar twist of bureaucratic planning,

80 Peterman, April 21, p. 39, l. 33 – p. 40, l. 7
81 Walters February 9 p 72, l. 38 – p. 73, l. 23
82 Walters and Martell, *Fisheries Ecology and Management*, Princeton University Press, 2004, pp. 160-61

> increased escapement goals were set not for the "off cycle" low stocks for which we had originally advocated adaptive experiments but, rather, for the "dominant" cycle lines for which stock-recruitment analysis had clearly indicated that further recruitment increases are very unlikely. This experiment has caused considerable pain for the fishing industry and, predictably, has not resulted in increased salmon abundance.

78. In his the passage cited above Dr. Walters takes refuge in the well-worn excuse of "ocean conditions" ("marine survival rates") but in his evidence, with the benefit of further research, he attributed the error to a failure to fully understand the mechanism of cyclic dominance and delayed density dependence:[83]

> DR. WALTERS: The key mistake I believe we made came out in a paper by Jeremy Collie and I, and Randall Peterman, in 1990, and that's when we sort of officially recommended the off-cycle rebuilding experiment and talked about how to do that in terms of the timing groups. In that paper, we did a formal decision analysis, did a kind of cost benefit/risk analysis-type calculation of whether it was worth pursuing the experiment, because there would be immediate losses in fishing and so on.
>
> And we overtly discounted the possibility of strong delayed density dependent effects. We said, "We just don't believe the Larkin model, we don't believe the delayed effects could be so large." And had I known about and had we looked at the Gilhousen order - I guess it wasn't out quite then - if we'd looked even more carefully at Ricker's older work and seen the violence of the original cyclic behaviour of these populations, I'd have taken Jim Woodey's warnings a lot more seriously. We'd have left the Larkin model in our decision analysis and it would have very likely told us that the downside of potential loss of the experiment exceeded its potential benefits.

That is a key admission.

79. Other commentators have suggested other theories for the cause of the 20-year decline. Most also took refuge in "adverse marine conditions" or "climate change". However, marine conditions and climate are common to all Fraser stocks and cannot explain how most Fraser CUs differ one from the other in the degree of decline, and some, such as the Harrison, have improved while other Fraser CUs have declined. The Harrison smolts spend even more time than other

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83 Walters, February 10, p. 62, ll. 22-46

Fraser smolts in the Strait of Georgia so would be even more affected by adverse conditions there if that were the cause, so it cannot be the cause. What is almost certainly the distinguishing difference with the Harrison is that they are not a lake-rearing CU. They go straight out through the estuary in their first season. This is strong evidence that the problem lies in the lake-rearing stage of the mainstream Fraser CUs – and this is precisely where density effects originate.

80. When the hearing began it was suggested that the fact that the Fraser stocks were at the southern end of the sockeye range pointed to global warming as the primary cause. However, evidence then disclosed that the Columbia sockeye – 500 miles further south – had double-record returns in 2008 and 2009 thus blowing that theory out of the water.

81. Bristol Bay has also had an improving trend, similar to the Columbia. What correlation could there be between Bristol Bay and the Columbia other than that they both share the U.S. approach to sockeye fishery management? The U.S. approach is decidedly MSY-centric, or human-centric. It is governed by the same UN Fisheries Agreement that is said to be the foundation of the Canadian precautionary approach.[84] The difference is that U.S. managers properly interpret and apply the UNFA.

82. The clarity and priority of the U.S. approach was recommended by Karl English for adoption in Fraser fisheries management:

> One aspect of the Bristol Bay fisheries that should be considered seriously for application to the Fraser is the clarity and priority associated with their escapement goals. A clearly defined set of escapement goals for Fraser sockeye would not guarantee success but is one way that the management of stocks could be made simpler and increase the potential for achieving these escapement goals.
>
> …
>
> …Salmon fisheries in Alaska, including Bristol Bay, are somewhat unique compared to other jurisdictions in that the Commissioner of ADF&G delegates full management authority to open the fishery to local Area Management Biologists (AMBs). ADF&G's research biologists develop biological escapement goals for individual river

84 Exhibit 1952, (treaty) and http://www.un.org/Depts/los/reference_files/status2010.pdf (US adhesion to treaty)

systems based on sustained yield and/or maximum sustained yield (MSY) principles using relationships between escapement levels and subsequent returns (termed stock-recruit analyses). The primary duty of all AMBs is to hit these goals and distribute the escapements across the season based on historical run timing schedules. The tools available to AMBs in more or less chronological order are: (1) pre-season forecasts, (2) offshore test fishing at Port Moller, (3) district test fishing, (4) commercial fishery performance with catch and age sampling, (5) inside test fishing, (6) aerial surveys, (7) escapement monitoring. Historically, AMBs have been very adept at hitting escapement goal targets for several reasons: (1) catch and escapement estimates are very accurate, precise, and timely, (2) essentially no exploitation occurs up-river of the enumeration projects, (3) the nine systems are managed more or less individually with few interception/mixed stock fishery issues, (4) high exploitation rates (80-90%) can be turned on and off from tide to tide, and (5) managers are given immediate and direct authority.

Four area management biologists manage escapements to nine river systems and are very adept at hitting escapement goal targets…

Since the Bristol Bay commercial fishery began in the 1880s, over 1.8 billion sockeye salmon have been harvested, and the fishery is in the midst of its most productive era. Annual harvests over the last 20 years have averaged 26 million fish and have ranged from 10 million to 45 million. Daily harvests at the peak of the annual fishery exceed 2 million fish on a regular basis and have been as high as 5.2 million fish on a single day (1993)[85]

…

ADF&G's research biologists develop biological escapement goals for individual river systems based on sustained yield and/or maximum sustained yield (MSY) principles using relationships between escapement levels and subsequent returns (termed stockrecruit analyses). In 2000, the BOF and ADF&G adopted a "Policy for the Management of Sustainable Salmon Fisheries" (SSFP) (See 5 AAC 39.222: Policy for the management of sustainable salmon fisheries) that specifies guiding principles and protocols for the management of salmon fisheries to achieve maximum or optimum salmon production. Among other things, the SSFP sets out how and when a stock is deemed weak (conservation

85 Exhibit 718, Cohen Commission Technical Report 7 - Fisheries Management, pp. 126-7.

> concern) and how the burden of conservation should be shared among users.[86]

83. It is apparent from the graph at p. 137 of Technical Report 7 that escapement levels in Bristol Bay peaked to about 35 million in 1980 (having reached about 30 million in prior years) but that between 1980 and 2010 escapement levels were fairly consistent at about half that amount. This reduction in escapement would have mitigated the damaging effects of excessive spawner density; it also provided a huge harvestable surplus for the benefit of Alaskan fishermen and processors. It illustrates the MSY principle and the UNFA reference points in operation.

84. It is clear from Technical Report 7 and other exhibits[87] that American managers fully understand the unique biological attributes of sockeye salmon, particularly the damaging effects of excessive spawner density. Understanding this, and applying the precautionary approach derived from the UNFA, they have turned the sockeye resource into a highly productive fishery notwithstanding the same weak stock concerns that we have on the Fraser.

85. Although there is less evidence about the Columbia River management system, it can be presumed to be based on MSY and precautionary approach principles similar to the system in Alaska. And, like Bristol Bay, the productivity has been increasing while the Fraser productivity has declined.

> In 2008, more than 213,000 adult sockeye salmon *Oncorhynchus nerka* returned to the Columbia River Basin. This is the highest return since 1959. As in the previous 40 years, greater than 99% of these fish were destined for the Upper Columbia River. Nonetheless, the estimated 805 adults passing Lower Granite Dam marked the highest return there since 1968.
>
> The high adult sockeye salmon returns in 2008 could have been due to increased freshwater production, favorable conditions for juvenile sockeye salmon during downstream migrations, favorable ocean conditions, or a combination of these factors.[88]

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86 Exhibit 718, Cohen Commission Technical Report 7 - Fisheries Management, pp. 139-140.
87 *e.g.* exhibit 419 - Clark et al - Biological and Fishery-Related Aspects of Overescapement in Alaskan Sockeye Salmon, Dec 2007
88 Exhibit 752, Factors Affecting Sockeye Salmon Returns to the Columbia River in 2008, Feb 2009 [NOAA Fisheries], p. ii.

86. The different Canadian approach was described by Mr. Bevan. He felt that the CSAS statement about the "removal rate" being the ratio of all human induced removals and total exploitable stock size (*i.e.* 20M stock size, 18M exploitable, 2M for spawning = 90% removal rate) was "an oversimplification". It is apparent that he would not accept the basic MSY premise of the UNFA as being applicable to sockeye. He said "that's why there's a Wild Salmon Policy".[89]

87. The result of the different Canadian approach to the UNFA "removal rate" formulation that has been implemented in Canada since the inception of the 1987 Rebuilding Strategy has created a stark contrast between the U.S. approach and the Canadian approaches to sockeye management. The results demonstrate which approach fits with sockeye biology and which does not, and which fits with the MSY objective of the governing Canadian legislation.

88. In our submission, this Commission's answer to the question as to "Findings of Fact regarding the Causes for the Decline of Fraser River sockeye salmon" should state emphatically that the well-intentioned 1987 Rebuilding Strategy created a situation where excessive spawner density reduced and weakened the out-migrating smolts to such an extent that by 2009 the resource was unable to replace itself even with the commercial fishery completely closed.

89. The findings of fact should include the fact that whereas overescapement is generally unsustainable (because it generally results in a reduction in recruits and thus reduced escapement in the next generation)[90] escapement levels continued to increase until about 2002 by reason of management action by DFO to progressively further reduce harvest levels during that time. And that it was not until 2006 that escapement on the major Shuswap stock had returned to the optimum level recognized decades ago by the IPSFC based on common sense applied to observed stock-recruit variations; In 1954 the escapement was "optimum" and in 1958 was excessive. This accords with the first downward blip in the productivity graph that increased thereafter until the 1990s. 1958 was the year that a large return combined with an "unexpected reduction in fishing efficiency" to cause at least 1.5M surplus sockeye to reach the mouth of the Fraser past the fishing fleet. An electric fence was then installed at the mouth of Adams River to prevent excessive spawner abundance, but despite this effort the spawner abundance

89 Bevan, September 27, 2011, p. 76, l. 28 – p. 77. l. 5
90 See Marmorek, September 20, 2011, p. 19, l. 44 – p. 22, l. 12.

substantially surpassed the 2M optimum level. As a result the 1962 return was substantially diminished.[91]

90. The Commission's report should refer to the various hypotheses that marine conditions had something to do with the decline, but should say that there is no satisfactory proof of this and that it is inconsistent with the fact that U.S.-managed stocks to the south and north experienced no similar declining trend. The ocean-condition hypothesis is much overblown. Marine conditions no doubt have some effect on recruitment, but they have been constantly changing for decades. When they become more challenging for out-migrating smolts it becomes even more important for DFO to avoid escapement levels that produce small, weak smolts that are less able to withstand stressors encountered in the marine environment.

<u>The Problem with DFO harvest management has not gone away; if anything it is getting worse.</u>

91. The easiest way to identify the problem, and the seriousness of the problem, is to examine the results of 2010 and to compare them with the known disastrous results of the 2001 and 2002 escapements in the Quesnel system.

92. Research conducted in the Quesnel system by Jeremy Hume indicates that the Ricker S_{MAX} level of spawners, or the level at which fry numbers peak, is 800,000.[92] That denotes the apex of the Ricker curve. Yet in 2001 (when the current DFO management policy was largely in place) the escapement was 3,510,000 – almost six times Ricker S_{MAX}. Recruitment was reduced to about 1:1. Then, in 2002, DFO repeated the exercise. Spawner density was 3,062,151. Consistent with the Larkin predictive model - which is more sophisticated and fits the Quesnel experience better - the 2002 escapement resulted in a much diminished adult return of 640,000.[93]

93. It is now accepted by the DFO scientists who are most knowledgeable about the delayed density dependant characteristics of sockeye that the Quesnel escapements of 2001 and 2002 were "disastrous" (Woodey and Walters). Dr. Peterman said that it was something that should

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91 Exhibit 75, Roos, *Restoring Fraser River Salmon: A History of the IPSFC 1937-1985*, p. 164.
92 Exhibit 575, Hume et al, Juvenile Sockeye Rearing Capacity of Three Lakes in the Fraser River System,, 1996, p. 726; transcript, May 6, pp. 8 and 9.
93 Hume, May 6, 2011, p. 11, l. 41 – p. 13, l. 6.

be avoided if at all possible.[94] Dr. Peterman agreed that it "played a role" in the long-term decline of productivity of the Quesnel[95] and agreed that "it fits pretty much perfectly with the Larkin density dependence model".[96] He couldn't say how many cycles it would take the Quesnel system to recover from that long-term productivity loss.[97]

94. DFO never did a retrospective analysis to determine the loss to the GDP of Canada resulting from this colossal blunder, and showed no interest in learning from this experience.. That is what is most troubling. Without any such exercise any beneficial results from any adaptive management experiment will be lost and the errors will repeat themselves. That is precisely what happened in 2010. Some scientists within DFO have recognized that "Chilko and Quesnel 2010 escapements (S_{MAX}) 200-500% and will likely be hammered in coming years (negative effects observed at S_{MAX} greater than 200%, and apparent in current brood year, plus at least 3 following years)" [98] but the head of Science, Dr. Laura Richards, considers this to be nothing more than "speculation".[99] She is obviously still intent on defending the present DFO system in the face of this overwhelming evidence that it has led to a 20-year cycle of decline that this cycle will now likely repeat itself as a result of the 2010 escapement levels. Mr. Bevan gave similar evidence:

> Q One last chance for either of you prepared to admit that there's been any significant failures that you wish you could have again, you could go back and do something again and do it very differently.
>
> MR. BEVAN: You know, I can't cast -- I'm not aware of any significant failures, but I share the frustration of everybody that science often cannot answer the question in a prescriptive want that would then remove doubt. But I believe that would be a claim I would make against -- about any science.

95. All the DFO witnesses paid lip service to the various policy statements that social and economic considerations are to be taken into account by fishery managers, but it is evident that stating this in policy documents is not enough. The purpose of the WSP is to make the socio-

94 Peterman, April 21, p. 13, l. 35 – p. 15, l. 11
95 Peterman, April 20, 2011, p. 95 ll. 30-35
96 Peterman, April 21, 2011, p. 7 ll 31-38
97 Peterman, April 21, 2011, p. 8, ll 13-16
98 Exhibit 1364, Draft Summary Report: DFO Synthesis Workshop on the Decline of FRS, Apr 14-15 2011, p. 7.
99 Richards, September 27, 2011, p. 80, l. 10.

economic losses transparent by calculating them and weighing them in the balance with the degree of risk of extirpation of weak stocks, yet this is never done. Sometimes it is mentioned but that is as far as it ever goes. See *e.g.* the internal DFO e-mail dated September 26, 2008:[100]

> Part of the answer to question 1 below relates to being clear about the fishery objectives. The "PA" [precautionary approach] applies equally well whether there is one stock or many. The difficulty is that we have some capacity building to do within DFO and with stakeholders to learn how to define measurable fishery objectives for a multi-species or multi-stock situation. The lessons from salmon indicate that the total yield from a mix of stocks is less than the sum of the individual single-stock yields, and development of the Wild Salmon Policy indicates how difficult it is to grapple with stating the objectives. … Furthermore, being clear about what is desired in terms of measurable objectives across the species in a multi-species fishery is as close as we are likely to come to making "eco-system" management operational. For example, focus on maximizing harvest from the more productive stocks will inevitably result in over harvest of weaker stocks. The goal is to make those trade-offs explicit in order to inform decision-makers. The job of Science Guys is to make these trade-offs clear and describe the risk in the face of uncertainty which will never go away.

96. The WSP contains the following statements, none of which have made any difference to DFO's refusal to calculate the economic losses to Canada flowing from their harvest closures:

> The goal of the Wild Salmon Policy is to restore and maintain healthy and diverse salmon populations and their habitats for the benefit and enjoyment of the people of Canada in perpetuity. This policy goal will be advanced by safeguarding the genetic diversity of wild salmon populations, maintaining habitat and ecosystem integrity, and managing fisheries for sustainable benefits. (Page vi).
>
> Preserving maximum genetic diversity would eliminate human harvesting of salmon and prohibit human activities that might harm salmon habitat….
>
> Maintaining CUs requires protecting populations and demes, but not necessarily all of them, all of the time….

100 Exhibit 1938, Email thread ending Oct 1 2008 re National Precautionary Approach Framework, p. 2.

> While it is the clear intent of this policy to prevent losses resulting from management and use, it is unrealistic in natural environments to expect all losses can be avoided. (p. 10)
>
> Pacific salmon have been diverse and adaptable enough to survive floods and drought, disease, volcanic eruptions, and ice ages. Their survival strategies should continue to serve them in the future, unless human-caused pressures become insurmountable. (p. 11)
>
> In reality, the interests of both salmon and people need to be accounted for in a successful conservation program. This policy reflects a management framework that can provide care and respect for a resource and its ecosystem and for the people within it. (p. 14)
>
> The higher benchmark between Green and Amber will be established to identify whether harvests are greater or less than the level expected to provide, on an average annual basis, the maximum annual catch for a CU, given existing environmental conditions. (p. 18)
>
> An independent review of the success of the WSP in achieving its broad goals and objectives will be conducted within 5 years of its adoption. (p. 34)
>
> Management must be based on good scientific information and consider biological, social, and economic consequences. (p. 37)

97. The structure of lower and upper benchmarks at least provides a structure for DFO to determine retrospectively whether escapement above the higher benchmark has occurred and, if so, to quantify the economic value of the foregone harvest. It should be an easy process after all the numbers are in, and it would guide decision-making in the future.

98. It is easy to be misled by statements in documents such as the WSP. The true test of DFO's management practices lies not in the countless documents and consultative meetings they produce but in the on-the-ground decisions. There was a brief glimpse of the "application of harvest management rules" (which, in fact, was nothing more than an uninformed *ad hoc* decision) in a critically important moment in 2010 when DFO decided to shut the fishery. With hindsight this decision cost the GDP of Canada over $100M in foregone harvest in only one CU – the Shuswap (and we know that there was a similar overescapement on the major Chilko CU).

Ms. Farlinger was asked who made the decision. She said "it was made on the grounds by the fishery manager".[101]

> Q All right. Ms. Farlinger, finally, I'd like to turn to Exhibit 1908 for a moment. 1908, at page 0014. The Shuswap graph in the middle indicates the 2010 run, this is only the females, affected females at over 3.5 million, the carrying capacity with the red asterisk, somewhat less than a million, indicating that there's over 5 million fish that were not removed from that particular CU that could have been removed. And I want to ask Ms. Farlinger this, that before the Late Summer run fishery was closed in 2010, leading to this situation, there was a seine opening at the mouth of the Fraser, correct?
>
> MS. FARLINGER: There were a number of seine fisheries, but there was a seine fishery at the mouth of the Fraser.
>
> Q Yes. And there was such an abundance of sockeye that they were catching huge catches. One is up to 35,000 sockeye in one set, I'm told?
>
> MS. FARLINGER: There were big seine catches in that fishery, yeah.
>
> Q Yes. And one advantage of the seine fleet is it provides a tap for fishery managers, does it not, that you can turn off to regulate escapement levels, correct?
>
> MS. FARLINGER: I'm not sure I understand your reference.
>
> Q Well, all right. Well, at any rate, the fishery was closed primarily to protect weak stocks; is that correct?
>
> MS. FARLINGER: Ultimately, the limiting factor on the fishery at the end of the fishery on the Late stocks had to do with protecting weak stocks, yes.
>
> Q Primarily, Thompson coho?
>
> MS. FARLINGER: It would depend on the date of the fishery. It could be Thompson coho.
>
> Q Yes.

101 Farlinger, September 27, 2011, p. 84, ll. 13-16

MS. FARLINGER: It could, a little later, be steelhead. It could earlier be Cultus sockeye.

Q Yes. If we look at 5 million sockeye in the Shuswap alone and we give them a $20 value each, that's $100 million. Ms. Farlinger, supposing you were asked whether to close the fishery or not, in circumstances like that, do you think you'd want to do a quick calculation of the amount of the loss to the GDP of Canada resulting from foregone harvest of sockeye?

MS. FARLINGER: I think that that's certainly one of the factors that needs to be considered and is considered by fishery managers and one of the reasons we need a policy like the Wild Salmon Policy to guide us when we have extraordinary runs as we did in the 2010.

Q Who made the decision to close the fishery?

MS. FARLINGER: The decision to close the fishery would have been made on the grounds by the fishery manager.

Q Did they do a calculation, do you know, of the amount of the foregone harvest, or the number of Thompson coho that they were attempting to save, or the possibility of lost production through density effects?

MS. FARLINGER: I know there was discussion at the time in which I participated about the value of the fish that had been landed already in the commercial fishery, the value of fish that may additionally be landed in that fishery as part of the management decision.

Q Supposing you were engaged in the sockeye fishery as a seine boat operator who had struggled for years to keep his business viable, you would have expected those calculations to be made before the sockeye fishery was closed, would you not?

MS. FARLINGER: Not being a seine operator, I couldn't say, but I suppose a seine operator might expect that.

Q Yes. And you would expect, given the huge importance of the decision, you'd expect a retrospective analysis afterwards to see if it was properly done and you'd expect transparency; would you not so that stakeholders could see whether the decision was the right one?

MS. FARLINGER: I think that the post-season review is, in fact, exactly that, yeah.

> Q Has an analysis been done to show, basically, the cost of each coho that was saved?
>
> MS. FARLINGER: I don't believe an analysis has been done on the cost to the coho.[102]

99. That critical decision was purportedly guided by the WSP and the FRSSI model, but it is evident that these two hopelessly complex documents provided no practical guidance whatever. The current FRSSI document acknowledges that its complexity creates "substantial communication challenges". It sets out a series of "options" for choice through discussion – a ludicrous suggestion for something that no one can understand and which, in any event, should be for scientists knowledgeable in population dynamics to determine, not uninformed laymen..

> The FRSSI model is intended as a formalized, quantitative tool for exploring the expected long-term performance of escapement strategies for Fraser Sockeye Salmon under a wide range of alternative assumptions (e.g. population dynamics, future changes in productivity). The model is simply a thinking aid, a consistent way of linking and tracking some of the many considerations that are debated during the annual planning process. Alternative options and assumptions can be easily explored through a series of "what if?" scenarios. This process works best in a collaborative setting, but the inevitable complexities create substantial communication challenges in multi-stakeholder workshops.[103]

100. This FRSSI model is what stands in the place of decisions made in the Bristol Bay fishery by the four experienced area management biologists discussed at pp. 127-7 of Technical Report 7. Without any of the complexity of a FRSSI model they "manage escapements to nine river systems and are very adept at hitting escapement goal targets". The old IPSFC did the same competent job with a similar application of biological judgment (and clear MSY and conservation guidelines) in the Fraser prior to 1985. The IPSFC was probably as cost effective as the Bristol Bay managers as well, unlike the current and financially wasteful DFO system.

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102 Farlinger, September 27, 2011, p 83 l. 7 to p 84 l. 47

103 Exhibit 411, Guidelines for Applying Updated Methods for Assessing Harvest Rules for FRSS - [2010-070] Jan 18 2011, p. 2

101. In an attempt to extract some practical meaning to FRSSI, written questions were posed to the man in charge of it, Paul Ryall. Even he could not give any firm practical guidance The following is a sample of the questions and answers:[104]

> 7. At p. 5 in Staley [Staley, October 2010, FRSSI Review for the Cohen Commission, Exhibit 400]. it is stated that spawning escapement targets for the 2007 through 2010 seasons were set using the FRSSI. What were they for Chilko, Quesnel and Late Shuswap for each year from 2007 to 2010?
>
> TAM rules are set at the level of Management groups (i.e., Early Stuart, Early Summer, Summer & Lates), not at individual stocks (e.g., Chilko, Quesnel, Late Shuswap)
>
> 8. What was the spawning escapement target for Late Shuswap in 2006?
>
> TAM rules are set at the level of Management groups (i.e., Early Stuart, Early Summer, Summer & Lates), not at individual stocks (e.g., Chilko, Quesnel, Late Shuswap). Table 10 in the 2006 South Coast IFMP (page 53) [CAN002644] shows the TAM rule for Late run stocks. Applying that TAM rule to the final run size for Late runs produces a escapement target of 2,078,000 (Birkenhead 190,000+ Late 1,888,000 FRP Annual Report Table 2).
>
> 27. In Exhibit 601 prepared for DFO by GSGislason & Associates the conclusion is drawn at s. 5.4 that "DFO needs to integrate the FRSSI modelling results with the socio-economic results of this report. This will highlight the tradeoffs between classes of indicators and enhance decision-making e.g., higher catches and economic activity are associated with lower escapement levels." Has that integration taken place and, if so, explain how, when and with what results?
>
> It is important to keep in mind the statements at 5.2 and 5.3 in the same report…. There have been significant improvements to the FRSSI model since 2006. However, the socio-economic analysis has not presently occurred.

102. One of the more obvious failings of the FRSSI model is its built-in harvesting cut-off point of 60% of adult biomass. Thus, to take the example of a return of 20M adults and a carrying capacity (S_{MAX}) of 2M, the model requires an escapement of 8M and, thus, a foregone

104 Exhibit 755, Responses to Written Questions for Paul Ryall from Area G-UFAWU, Apr 21 2011

harvest) of 6M. At $20/fish the lost GDP to Canada in primary dollars would be $120M. Taking DFO's own multiplier for processing (2.15) the lost GDP at the wholesale level would be $250.8M. The present government should be made aware of this gross disregard for the economic welfare of Canada. There has been much bleating about the inadequacy of the DFO budget allocation. We seem to have forgotten the simple fact that if we want government services we have generate tax revenue to pay for them.

103. The central objective of modern fisheries science should be to clearly expose trade-offs among conflicting objectives and to develop effective ways to decide where to operate along the trade-offs. The WSP and FRSSI do neither. They disguise the social and economic values that they are designed to identify and promote.

104. The red zone acts as a red light to fishery managers, whereas the intent is to alert managers to an increasing degree of prudence. The one thing that any manager would take from the model is that red means stop. The WSP's emphasis on biodiversity, combined with its silence of the danger of oversupplying the spawning grounds, turns it into an instrument that inevitably leads resource managers to err on the side of over-escapement – to the detriment of both the resource and all those who depend on it.

105. It is apparent that the whole complex DFO scheme of harvest (and escapement) management is completely confusing to any fishery manager, contrary to the MSY mandate of the constating legislation and treaty framework within which DFO operates, and extremely detrimental to the GDP of Canada. We cannot but agree with the following comment by Walters and Martell:[105]

> So far, we are not seeing the development of such alternative visions of restoration and sustainable management for aquatic ecosystems. Instead, we are seeing lists of ill-defined, broad objectives, much complaint about how complicated nature is, much quibbling about precisely how to model and regulate both single-species and multispecies harvest dynamics, and much hand-wringing and debate about how environmental variability creates short-term unpredictability and confounds our ability to detect the effects of human activities like fishing. There is no clear consensus about what constitutes "ecosystem management" beyond improving single-

105 Walters and Martell, *Fisheries Ecology and Management*, Princeton University Press, 2004, pp. 335

> species management by reducing overcapacity and fishing effort (Sissenwine 2001). In some cases, we are seeing progressively more complex regulatory schemes, that critics of bureaucratic management often call "fire fighting" and that fishers call "the death by a thousand cuts." Partly in reaction to such schemes, at an opposite extreme we are seeing a tendency toward simplistic policy recommendations based on the same sort of protected area tactics that have dominated terrestrial conservation activities, justified by arguments of the form "we cannot regulate fisheries and so should have large protected areas where fishing is not allowed at all." Hidden in such arguments is not only the presumption that traditional harvest-regulation systems have failed but also the presumption that more natural is always better, i.e., that ecosystem management and ecosystem restoration should be basically the same thing. Further, there is often a barely hidden contempt for fishers and fishing communities and their rights and values, as though fishers were capable only of rapacious and greedy behavior.

106. It is impossible to imagine that science will ever remove the uncertainty from fisheries management; ecosystem-interactions are simply too complex. But the more complexities we try to take into account, the more complex the model becomes; yet fisheries management is no better. The wiser solution is to base decisions on the inherent predictability of the stock-recruit relationships much as the IPSFC did with great success.

<u>What can be done to reverse the decline in the Fraser sockeye fishery?</u>

107. We propose a scrapping of the present WSP and a restatement, in simple and understandable terms, of the intent of the WSP to provide for MSY while avoiding any unreasonable and genuine risk of extirpation. This will require a commitment by DFO to the Adaptive Management Process, including retrospective productivity and socioeconomic analyses to inform future decision-making, and independent oversight by a Commissioner of Sustainable Productivity who is responsible to the Auditor-General and who reports annually to Cabinet on the social and economic consequences of DFO's harvest management practices.

108. One of the very useful suggestions made in the hearings related to the Adaptive Management Process ("AM"). If DFO were compelled to adopt it, it would go a long way to restoring the sockeye fishery. The process was described by David Marmorek who was qualified

as an expert in AM. He has been retained to assist in setting up AM processes by, *inter alia*, the BC Forest Service and the U.S. National Commission on Science and Sustainable Forestry. For the latter body he wrote a report dated May 15th, 2006, portions of which were read into the record and he adopted:[106]

> Adaptive Management (AM) is a rigorous approach for learning through deliberately designing and applying management actions as experiments. It was first developed under the name "Adaptive Environmental Assessment and Management" in the 1970s by Dr. C.S. Holling and Dr. C.J. Walters and associates at the University of British Columbia and the International Institute for Applied Systems Analysis in Vienna. It has since been applied to a wide range of resource and ecosystem management problems throughout North America and elsewhere... AM is an approach to management that involves synthesizing existing knowledge, exploring alternative actions, making explicit predictions of their outcomes, selecting one or more actions to implement, monitoring to see if the actual outcomes match those predicted, and then using these results to learn and adjust future management plans and [policies]...
>
> Adaptive management may be essential for achieving sustainable forestry...
>
> AM is enabled through consideration of the desire for fair and equitable treatment of tenure holders, other resource users, and communities (i.e. trying to ensure the costs and benefits of management experiments are borne equally); creative approaches to sharing the costs and benefits of AM; and compensation programs to mitigate losses associated with decisions based on AM. It can help to compare the real costs and benefits of traditional management (including the costs of litigation) versus the cost and benefits of an AM approach. Finally, there needs to be strong, explicit links between the results of management experiments and the use of those results to modify regulations and future practices—often referred to as "closing the loop."
>
> Adaptive management combines science and management in order to learn from management experience. To enable adaptive management, both science and management have to combine in a way that transforms both. In doing so, management becomes more scientifically rigorous, and research becomes more policy relevant. Without scientific rigor initiatives billed as adaptive management

106 Marmorek, September 20, 2011, p. 10, l. 27 – p. 13, l. 15 and

> may be little more than undisciplined trial and error, a poor paradigm for effective learning.

109. Mr. Marmorek explained that AM is "only appropriate where there's a lot of uncertainty" and he readily agreed that would be useful in the Fraser sockeye fishery context.[107] His evidence when asked about the 1987 Rebuilding Strategy was interesting:[108]

> Q Yes. Now, are you aware of what's been referred to, here, as the 1987 Rebuilding Plan for Fraser River Sockeye?
>
> A Not in detail, only in general terms.
>
> Q All right. In general terms, do you understand it to be a program that was designed on the assumption that if you cut back harvest, increased escapement, you would rebuild the sockeye stocks?
>
> A Yes.
>
> Q All right. If you had been advising at that time, you would have advised an adaptive management approach, I expect?
>
> A Most likely.
>
> Q Yes. And including the retrospective?
>
> A You're correct.

110. Returning to this topic later in his testimony, he said:[109]

> A Now, I think it would be fair to say, because I know something about Dr. Peterman's work on this area that were you to explore what you're proposing of changing harvest rates, you would want to do a very careful analysis as you talked about earlier in the adaptive management approach, of what all the uncertainties are, both with respect to stock recruitment relationships, potential marine survival rates, ability to meet target harvest rates, which is sometimes difficult, implications for non-harvested -- sorry, implications for co-migrating weaker stocks, implications for the Wild Salmon Policy. So there's a host of tradeoffs you need to examine if you were to explore designing a manipulative experiment to alter harvest rates.

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107 Marmorek, September 20, 2011, p. 14. 15, ll. 6-15.
108 Marmorek, September 20, 2011, p. 15, ll. 6-15
109 Marmorek, September 20, 2011, p. 32, l. 45 – p. 33, l. 17.

> Q Yes. And included in the tradeoffs, as you said earlier, is the cost to the --
>
> A Yes.
>
> Q -- to the economy.

111. What Mr. Marmorek had to say about the importance of a retrospective analysis (to guide future decision-making) is of critical importance. As he says, without scientific rigor initiatives billed as *adaptive management* may be little more than undisciplined trial and error, a poor paradigm for effective learning. The same may be said of initiatives billed as implementation of the WSP.

112. It should be noted that Dr. Walters (who is one of the pioneers of AM according to Mr. Marmorek's evidence above) strongly urged David Levy to include a retrospective analysis in this Commission's Technical Reports, but it was refused.[110]

> Q Thank you. Dr. Walters, do you have any comment to make on this very question of retrospective estimate of yield lost to my clients and other harvesters from this so-called experiment?
>
> DR. WALTERS: Yes. As the Scientific Advisory Committee was being disbanded for the Cohen Commission, I contacted Dave Levy and recommended very strongly that such a retrospective analysis be carried out as part of the Commission's work. I recommended it be an add-on to Randall Peterman's work or contract with Steve Martell. Martell and I had done a similar analysis on earlier data from the Fraser. I also contacted Jeff Grout from DFO and recommended that they do that. And I sent a spreadsheet with the beginnings of a retrospective analysis to Al Cass with the request that DFO's FRSSI team use the big FRSSI model to carry out such an analysis. There's been no response to the request to the DFO people and I don't know what the Commission decided to do about it. I believe there is a study that is going to attempt something like that. I carried out a retrospective spreadsheet analysis for the 1995 to 2009 period and looking forward for about eight years. And using the model, that retrospective analysis showed that the total loss in value from harvesting, if the Larkin-type models are correct, has been about $200 million not including the loss from 2010, which would be

110 Walters, February 10, 2011, p. 37, l. 19 – p. 38, l. 9.

> another probably $40 million. So it appears to me that the economic losses were very substantial.
>
> Q When you referred to the Commission, for example, in reference to phoning or contacting Dr. Levy, you're, of course, referring to this Commission as opposed to the Pacific Salmon Commission?
>
> DR. WALTERS: That's right.

113. By way of postscript, a comment should be made about Dr. Levy's role as Technical Advisor to this Commission. David Levy is the author of ex. 1947 - prepared in 2006 for the Sierra Club of Canada - BC Chapter. It deals with BC Sockeye Salmon Population Declines: Probable Causes and Recommended Response Strategies. In other words, it deals with the very question before the Commission. Among other things his report to the Sierra Club contains the following statement under the heading "Restructuring of the Commercial Fishery".[111]

> The best opportunity for restructuring the fishery lies in the development of terminal fisheries. To protect sockeye biodiversity and the reduction of fishing pressure on weak stocks, this will require the development of commercial inland fisheries. There will be a reduction in the value of the fishery due to reduced fish quality. Nevertheless, a cannery grade product can usually be obtained at locations which permit the selective harvesting of abundant stocks.

114. That statement reflects not only a very poor grasp of what it takes to maintain a viable commercial fishing enterprise, it creates a very unfortunate public perception problem. Dr. Levy is the Commission's technical advisor. To preserve the perception of impartiality during the stage when the Commissioner will be receiving advice from his staff privately it would be appropriate to state publicly at an early stage that Dr. Levy will take no further part in the Commission. Enough said.

115. At p. 34 the WSP provides that "An independent review of the success of the WSP in achieving its broad goals and objectives will be conducted within 5 years of its adoption". That aims in the right direction, but to be effective and truly independent and properly focused on

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111 at p. 26

social and economic consequences of DFO decisions the review should be done by a different arm of the government, such as the Auditor General's Department, so that it is truly uninfluenced by DFO. Under the present arrangement DFO insiders have no incentive whatever to expose the costs to the GDP of Canada of their harvest decisions. The decision in 2010 to close the fishery with $100M worth of harvestable surplus still in the water is the sort of decision that would cause a scandal in a government hard-pressed to balance the national budget if it were exposed to public view by an independent retrospective assessment.

116. We propose that a new oversight system be established so that a new Commissioner of Sustainable Productivity, who is responsible to the Auditor-General, can investigate and report annually to Parliament or Cabinet on the social and economic performance of DFO's harvest management practices.

117. We urge this Commission to recommend to the government of Canada that the *Auditor General Act* be amended to provide for a new office within the Auditor General's Department charged with the specific responsibility to report annually in the same manner as the Commissioner of the Environment and Sustainable Development but with a mandate specific to the economic productivity of fisheries. This would be a more specific focus on the same general matter referred to in strategy 7.1.1 in Annex 3 of the Federal Sustainable Development Strategy, namely the commitment of the federal government to deliver "an integrated fisheries program that is credible, science-based, affordable, effective and contributes to sustainable wealth for Canadians". The Commissioner of the Environment and Sustainable Development is concerned with both the "Environment" and "Development" aspects of his or her mandate. There is no need to duplicate the work of either that Commissioner or the Minister of Fisheries on the conservation ("environment") side of their mandates, since they both amply fulfill that role. It is the "social and economic" side of their mandate that is and always will be inadequately handled by the Minister of Fisheries. Someone in the Auditor General's Department should fulfill a critical oversight function in that regard specifically. Only in that way will there be any hope realizing the goal making the social and economic trade-offs explicit in order to inform and improve DFO decision-making.[112]

112 See the discussion re Exhibit 1938, *supra*, and the discussion *supra* re the retrospective analysis required by the Adaptive Management Process.

118. Some way must be found to break through the root problem of a total lack of any consequences for bad decisions made by DFO. Commercial fishing has a business model that must be unique in that few other businesses lack any control whatever over their source of raw product supply. The entity that controls supply has no built-in incentive to facilitate the supply. There is no reward for doing a good job and no consequence for doing a bad job. This is an inherently dysfunctional business model. It is not surprising that preserving business profits or enhancing the GDP of the nation is the last thing in a DFO fishery manager's mind.

119. These participants agree wholeheartedly with the closing comments in Walters and Martell, *Fisheries Ecology and Management*:[113]

> In sharp contrast to other professional disciplines, fisheries scientists and managers in public agencies are almost never held accountable for the consequences of their assessments and recommendations. Indeed, it is not far off the mark to say that one of the best ways to get promoted is to really foul up a fishery, i.e., to say that people who make the worst mistakes are the ones most likely to be promoted to positions of higher responsibility. This sad state of affairs is not going to change just by making people accountable or liable on paper for their mistakes. There is a need for both the statutory recognition of accountability and the development of more effective public review, "watchdog," and performance-auditing systems that bring independent and objective expertise to bear on the complicated tangles of data and paperwork that typically surround fisheries decision-making. Such review processes are needed not only to make public employees accountable for their mistakes but also to identify and correct poor policy choices and mistakes as quickly as possible.

120. Other recommendations should be made with regard to scrapping the WSP and FRSSI, and developing a simple management structure with clear MSY goals. We agree with the comments of Karl English:[114]

> ***Escapement Goals***
>
> Currently, management goals for each run-timing group of Fraser sockeye are defined through the FRSSI process which has employed shared decision making techniques and a complex set of objectives and evaluation criteria. The key missing pieces from this process are (1) a clear definition of the escapement goals for each stock by cycle year, and (2) a method for integrating stock-specific

113 Walters and Martell, *Fisheries Ecology and Management*, Princeton University Press, 2004, p. 348.
114 Exhibit 718, Cohen Commission Technical Report 7 - Fisheries Management - Feb 2011, p. 171

> goals into a management rule for each run-timing group. As demonstrated in the Bristol Bay fisheries, clearly defined escapement goals are critical for providing managers with the targets needed to make fisheries management decisions and assess stock status.
>
> The WSP has identified the need to define lower benchmarks (LBs) and upper benchmarks (UBs) for each CU. Holt et al. (2009) describe the methods that should be used to define these benchmarks and Grant et al. (2010) provided a range of estimates for each benchmark generated from alternative stock-recruitment models. However, the interim LBs and UBs defined through the FRSSI process and recent CSAS working papers are fixed values intended to be compare with the 4-year average escapements for each stock or run-timing group (Staley 2010; Grant et al. 2010). As indicated earlier, these types of benchmarks are not very informative or useful for the management of cyclic stocks. There should be at least two different LBs and two UBs for each cyclic stock. Since each run-timing group contains at least one cyclic stock, managers need cyclic-specific LBs and UBs for each run-timing group. These benchmarks or escapement goals would make it easier to assess stock status and trends for each cycle year relative to these defined goals and determine if fisheries should be permitted to target specific stocks in a specific year.

121. In Pestal, Ryall, and Cass, 2008 ("Collaborative Development of Escapement Strategies for Fraser River Sockeye: Summary Report 2003-2008") there is a discussion of a "simplified sharing rule for Fraser Sockeye". Under this strategy, if commercial TAC is greater than 5 million, then 8% is shared with Area G.[115] This is obviously highly beneficial in terms of value-added GDP since troll-caught salmon are individually handled and attract the highest market value of all. Nevertheless, the rules and models in effect in 2010 resulted in the Area G trollers having no access whatever to the huge return of sockeye that year. This is a good illustration that in a complex and consensus-based management system decisions will generally disadvantage small minority sectors within the overall fishery and will not necessarily adhere to statutory and treaty principles. If the system were science-based and driven by economic return considerations, this would not happen.

115 Exhibit 398, Collaborative Development of Escapement Strategies for Fraser River Sockeye, p. 65.

FOURTH POINT: A harvest management regime consistent with the statutory purpose of maximizing social and economic benefit from the Fraser sockeye fishery would take into account the importance of an economically sustainable fishery to coastal communities, and the undesirable features of terminal fisheries and ITQs

Coastal communities

122. The evidence is replete with tales of hardship in the coastal communities with a historic dependence on the commercial fishery, of fine-sounding statements by ministers about the need to provide sustainable fishing for those communities and about callous disregard by DFO in the development of measures designed to reduce coastal fishing opportunities. The following statements recorded by the Standing Senate Committee on Fisheries and Oceans are a sample:[116]

> I would say, Senator, that our prime responsibility is to ensure conservation and make sure that we have a fisheries management system that provides sustainable fishing for those communities. – The Hon. Geoff Regan, Minister of Fisheries and Oceans, Committee Proceedings, 8 February 2005
>
> What we are looking at doing is saying to groups of licence holders, "Let's try to have you make [a] choice; if you want to move toward economic efficiency very quickly, that should be a choice that you and the communities make – the communities that you live in and that rely on the employment." – David Bevan, DFO, Assistant Deputy Minister, Fisheries and Aquaculture Management, Committee Proceedings, 4 November 2004
>
> There is a real need for the country to take a look at the crisis of coastal communities and find a way to solve it. … Otherwise, social havoc will be created; it will happen slowly and then increase, and then we will deal with it as a crisis. – Sandy Siegel, Executive-Secretary, Maritime Fishermen's Union, Committee Proceedings, 24 February 2005
>
> We want a different kind of wealth; we want community wealth. – Simon Lucas, Chief, Hesquiaht Tribe, member of the West Coast Vancouver Island Aquatic Management Board, Committee Proceedings, 10 March 2005
>
> I think that rural life is exceptionally important for Canadians. I think that for too long we have accepted the idea that economic

116 Exhibit 502, Senate Interim Report on Canada's New and Evolving Policy Framework for Managing Fisheries and Oceans, May 2005, p. 38.

> dictates will empty the rural areas. – Dr. Daniel MacInnes, Department of Sociology, St. Francis Xavier University, Committee Proceedings, 10 February 2005

123. A socioeconomic review commissioned by the Nuu-chah-nulth Tribal Council makes reference to statutory and policy statements of principle that have been ignored in practice:117

> *1.1.6 Adjacency Principle and Accessibility*
>
> WHEREAS Canada recognizes that the oceans and their resources offer significant opportunities for economic diversification and the generation of wealth for the benefit of all Canadians, and in particular for coastal communities; Canada Oceans Act, 1997
>
> Canada has re-affirmed its commitments and goals in fisheries management as signatory to the U.N Code of Conduct on Responsible Fisheries Management and in the passing of the Oceans Act (1997). These state that the goal of in management is to ensure that adjacent communities receive economic benefits from the resource around them (Adjacency Principle).
>
> The Chinook Pilot was consistent with these principles. The majority of the fish were landed with the region, using the existing infrastructure. Local businesses such as food stores, gear suppliers, marine ways and repair facilities, all reported positively on the benefits of the Pilot. The fishery was best suited for local resident fishermen who could take advantage of good weather. The fishery encouraged local fishermen to continue to reside in the region.
>
> Additional benefit was the community-facilitated training of observers. This created new employment within the region. Sadly, local administration of the program was curtailed when the local delivery organization lost federal funding and no other administrative capacity existed within the region to continue to run the program
>
> */. /. 8 Community and Processing Impacts*
>
> The magnitude of the collapse of the salmon fishery in B.C. is well documented, as are the regions most affected, which includes West Coast Vancouver Island.
>
> After years of little to salmon being landed on the West Coast of Vancouver Island, the majority of the landed value of salmon in

117 Ex. 486 - Industry and Coastal Communities, Socioeconomic Review

> the region has the recent small harvest of Winter Chinook in the Pilot Project. This economic hardship has added considerable pressure in implementing to the Pilot Project.
>
> Once home to the most significant fishing ports in British Columbia, this region is suffering from economic hardship and lose of access to the aquatic resources at its doorstep.
>
> With the near complete closure of the commercial salmon fishery in the region, there is concern of the ability to maintain infrastructure such as docks, fueling stations and landing and storage facilities. New economic development is expensive, slow and requires capacity. There is concern that an extend on of closures of the commercial fleet in the region will jeopardize of and the future rebuilding, and access to, resources.
>
> *1.1.9 First Nation Impacts*
>
> The Tribal council of Nuu-chah-nulth has an active participation in the local commercial troll fleet. There is much concern over First Nations access to economic opportunity in fisheries. The Nuu-chah-nulth First Nations are attempting to derive economic benefit from their present participation in a commercial fishery in their local regions.

124. Of the 165 Area G troll licences, 12 are held by DFO in PICFI "inventory" for the purposes of moving access to terminal areas.[118]

125. In the *Ahousaht* case concerning the PICFI program, Garson J. had this to say:[119]

> **p. Pacific Integrated Commercial Fisheries Initiative (PICFI) (2007)**
>
> [728] PICFI is an initiative aimed at supporting the long term economic viability of the province's commercial fisheries and the sustainability of fisheries resources, while at the same time addressing aboriginal interest in access to commercial fisheries. PICFI provides additional funding to First Nations to acquire commercial licences, quotas, vessels and gear for transfer to First Nations through voluntary relinquishment by regular licence holders.

118 Exhibit 591, 2010-2011 - Salmon Area Report (by fee type).
119 *Ahousaht Indian Band and Nation v. Canada (Attorney General)*, 2009 BCSC 1494 (CanLII),

> [729] Canada has provided $175 million over a five-year period to implement this initiative. Of that amount, $115 million is specifically allocated for the acquisition of licences, vessels, quotas and gear. The Nuu-chah-nulth Tribal Council has been integrally involved in the consultation and formation of the PICFI program. The Tribal Council is part of the PICFI working group, and is one of the first six aboriginal organizations to apply to participate in the initiative.
>
> [730] The plaintiffs contend that PICFI is a recently announced program and has provided little or no fishing opportunities to date. They note that any benefits of this program are at the present time speculative, and that speculation is no basis upon which to justify an infringement of constitutional rights.

126. There was further evidence from Chief Jones to this Commission about the role of First Nations people in the commercial fishery and the dependence of coastal communities on the fishery:[120]

> Q Chief Jones, I wanted to ask you this, something more about the coastal First Nations. You owned a boat yourself I see from your c.v. from 1979 to 1985; is that correct?
>
> CHIEF JONES: That's correct.
>
> Q Was that a troller?
>
> CHIEF JONES: Yes, it was.
>
> Q Yeah. Your father, I think, was a good fisherman as well and a good shipwright; is that correct?
>
> CHIEF JONES: That's correct.
>
> Q Your grandfather, Albert Jones, was a renowned fisherman as well and a prospector; is that right?
>
> CHIEF JONES: Yes, he was.
>
> Q Yes. Am I right, then, in 1958 - you may have to answer this in general terms - but I understand in 1958 there were 52 trollers in Skidegate when the population was only 213. Does that sound about right to you?

120 Jones, June 30, 2011, p. 26, l. 10 – p. 28, l. 8.

CHIEF JONES: Yes, it does. We've had many people talk about the loss of access in Skidegate.

Q Yes. And there's been a loss of access and the Haida Nation is pressing for a restoration or greater access to the commercial fishery; correct?

CHIEF JONES: Yeah, fisheries is one of the few kinds of economic opportunities in our area.

Q Yes.

CHIEF JONES: We have a large fishery, something like 18 percent of all the commercial values of all fisheries occurs around in our waters, and we would like access to that.

Q Yeah. And there's a similar story in other communities, Port Simpson or Lax Klamaans, Kitkatla, Metlakatla, Hartley Bay, Klemtu, Bella Coola, Owikeeno, Alert Bay, Fort Rupert, Quatsino, Kyuquot, Zabellos, Ahousaht, Ucluelet, a similar story. A former presence in the commercial fishery that was greater, very much a need for a commercial presence because of the remote location and dependence on the sea and a pressing desire to have a greater presence today. Is that pretty much a common theme?

CHIEF JONES: Yeah, I think that's -- if you go back historically, certainly that's what's happened, and a lot of that has been through licensing policies and sometimes it's like buybacks. It's also been new fisheries like shellfish fisheries, dive fisheries for geoduck, or sea urchin. Basically in those policies, there hasn't been -- we would consider there hasn't been fair distribution, I guess, or access for First Nations in those new fisheries.

Q Yes. The fishermen in the past decades in your area and other coastal First Nations have made huge contributions, haven't they? I'm talking about people like Dempsey Collinson in your area, Roy Jones, Sr., Paul Pearson, Willis Crosby, Sidney Crosby, all Haida I think fishermen.

CHIEF JONES: Yes. Yes, they are. They have been very –

Q They all made huge contributions to the communities, did they not, in terms of employment and economic well-being?

CHIEF JONES: That's right. It does make a big difference having someone in the commercial fishery and having a commercial fishing business or a vessel.

> Q Yes. And the same thing in Old Masset, Robin Brown, Wilson Brown, Jeff White, Oliver White and lots more.
>
> CHIEF JONES: Yes, and of course I don't think any of the ones you've mentioned are still involved in the commercial fishery.
>
> Q In the Alert Bay area, the Assus and the Sewids and the Beans families who've been in the fishery for generations, are you aware of that?
>
> CHIEF JONES: Yes, I am, and I think it's the same situation in many of those communities. There's very few boats or licences.
>
> Q Yes. Fort Rupert, James Walkus, Walter Cadwallader, Alfred Hunt. Actually I think those three are still involved in the fishery, aren't they?
>
> CHIEF JONES: Possibly.
>
> Q Campbell River, the Robert and Chikkites families, they're still involved in the fishery, I think, aren't they?
>
> CHIEF JONES: I know the Roberts' are.
>
> Q Yes, all right. And the coastal communities all have this in common, don't they, that there are remote communities, many without even roads to them, and they have miniscule reserves, correct?
>
> CHIEF JONES: Yes, I think Doug Harris spoke of that as well.

127. Similar evidence formed the basis of the following finding of fact by Garson J. in the *Ahousaht* case, *supra*: [121]

> [686] I find that the evidence of the actual participants in the industry, that is, the Nuu-chah-nulth community members, paints a more accurate picture of Nuu-chah-nulth participation than the statistical evidence of the experts based on licences and quota. I also find that the loss of a fishing job in the Nuu-chah-nulth communities imposes greater hardship on the plaintiffs than it does on non-aboriginal communities because of the isolation of Nuu-chah-nulth communities and the lack of other significant economic opportunities. Evidence of other economic opportunities such as guiding recreational fishers, working in fishing lodges, working in

121 *Ahousaht Indian Band and Nation v. Canada (Attorney General)*, 2009 BCSC 1494 (CanLII), para 686

> aquaculture (which is relevant to this conclusion and is therefore admissible), and tourism does not refute the evidence of historical economic dependence on the fishery and the relative absence of other significant economic opportunities.

128. Among other things, commercial fishermen from the First Nations communities are able to supply DFO with a lot of valuable Aboriginal Traditional Knowledge. An example of this is given in Exhibit 1988 by Chief Assu. It describes Chief Assu's attempts to tell DFO that they were increasing escapement too much in the mid-1980s. History has proven him right: [122]

> I know what is happening in the sea. I know how many salmon are moving down to the Fraser River to spawn and how many we can take without affecting a good spawning. I know because I have a lifetime of experience on the water and the experience of my people before me. In 1984 I went to Fisheries to tell them that there were a million salmon between our area and the Fraser River, so we should have a few more days fishing here while the fish are in good condition and bring the best price. The Fisheries officer said to me, "Oh, is that what you think?" "No!" I answered. "That's not what I think, that's what I know."

Terminal Fisheries

129. It is not enough to simply say, as Associate Deputy Minister Bevan does, that the choice is between no fishing or terminal fishing. It has to be based on sound scientific analysis. An analysis was done on the Skeena (where the justification for terminal fisheries would be far greater by reason of the huge preponderance in a mixed stock fishery of Babine stocks produced by a very productive spawning channel enhancement). No similar analysis has been done on the Fraser. The Skeena analysis concluded that:[123]

> …the maximum possible gain in yield by moving from pure mixed-stock fishing to pure stock-selective fishing is somewhere 15-25%. This is a surprisingly small potential gain, and it reflects the fact that the less productive Skeena stocks also tend to be the smaller (lower carrying capacity) ones.

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122 Exhibit 1988, Ch 5 - My Life in the Fishing Business, Excerpt from Assu with Inglis, Assu of Cape Mudge - Recollections of a Coastal Indian Chief, 1989 [UBC Press], p. 80.

123 Exhibit 944, Report of the Skeena Independent Science Review Panel, May 15 2008 [DFO and BC MOE], at p. 54

130. That "small potential gain" would have been more than offset by the diminishment in value of the fish due to deteriorating quality in the terminal areas.

131. It is also evident from the evidence that the DFO objective of viable and prosperous commercial fisheries could never be met by an inland commercial fishery that necessarily lacks the "diverse portfolio" of other stock opportunities to tide it over between the dominant 4-year cycles. In switching from a portfolio model to a single population model,

> "…what you're actually doing is destabilizing [the] commercial fishery by ensuring that it relies on a single population in a terminal area, which is much more highly variable in terms of its amounts from year to year and much more risky.[124]

132. Rob Morley, VP of Canadian Fishing Company (Canfisco) and Director of the BC Salmon Marketing Council, confirmed that a viable processing industry could not likely be built around terminal fisheries.[125]

133. Terminal fisheries are inherently risky for another reason. Without very close supervision to prevent it, overfishing at a terminal location risks extirpation of the stock.

134. This is another area where the statements made by DFO officials depart widely from reality. Terminal fisheries were presented as highly selective. It took the seriousness of aerial photographs adduced by Mr. Eidsvik (and accepted by Ms. Farlinger as representative) to show the reality of terminal fisheries.[126] Bycatch wastage to the extent of the mass of sockeye seen floating belly-up down the river would have been enough to close down any regular commercial fishery. It is also apparent that no one was counting those mortalities. This gives a glimpse of the reason for "DBEs" in DFO records.

135. Terminal fisheries are also wasteful. On their way upriver, fish die. Environmental causes such as warm water and other stressors cause mortality. As pointed out by Mr. Morley,

> "…in order to transfer fish to develop a new commercial fishery upstream, you may have to transfer one and a half or two fish out

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124 Morley, March 1, 2011, p 42, ll. 40-45.
125 Morley, March 1, 2011, p 42, l. 26 to p 43 l. 16
126 September 27, 2011, pp. 57 – 62.

> of a fishery at the mouth of the river, or in Johnstone Straits, in order to get one fish to that terminal fishery up the river. So you've got a loss of yield as well …"[127]

136. Part of the DFO objective in moving to ITQs is to provide a "transparent" method for transferring access opportunities inland. However, no analysis has apparently ever been done as to who is going to pay the coastal quota-holder for this ITQ. If it is intended to be paid from government funds no indication has been given as to which department and which budget will provide the funds. All in all, the terminal fishery proposal is totally impractical. The whole thrust of DFO financial planning is to download expenses onto the commercial fishing industry. It cannot do this by destroying that industry and creating an inherently non-viable industry inland.

137. On the subject of selective fishing, the best policy would be to let the industry chose best ways to fish selectively by providing incentives to do so. It has been mainly inventive fishers faced with possible regulatory and market sanctions who have come up with effective means to reduce the bycatch. Policies should harness this inventiveness not only in the commercial fishery but also the FSC fishery. The form of "selective fishing" shown on Mr. Eidsvik's photos is not the answer.

Share-based management (ITQs)

138. The DFO policy to convert the fishery from a "derby" style fishery to an ITQ-based fishery is another example of a harvest management change without any socio-economic assessment in advance or any retrospective assessment after the event in those fisheries where it has been implemented. It appears to have become a pet policy of DFO for reasons of DFO convenience. It is clearly disadvantageous from the point of view of fishers and coastal communities. It creates a financial instrument that can be traded on the market, not unlike credit derivatives in its novelty and lack of market regulatory oversight. It adds a layer of expense to fishers who already struggle to meet expenses. In a fishery like the Area G troll fishery, where about one third of the salmon licences are "inactive" in the sense that they are used for Schedule II species such as tuna or are not used at all, it provides an obvious benefit to inactive fishers

127 March 1, 2011, p 43, ll. 22-29

who acquire a tradable financial commodity for free, but disadvantageous to the active fishers who will have to lease quota from the inactive fishers to preserve the harvest levels that they have enjoyed under the derby system by dint of hard work.

139. A number of socioeconomic studies, such as exhibit 491, have identified the implications of ITQ systems, such as: a) the concentration of quota among fewer boat owners; b) a reduction in employment; c) an inequitable distribution of benefits; d) the windfall benefits to the first generation of quota-holders at the expense of later entrants; e) leasing costs as high as 80% of the value of the catch; f) an alienation of resource access from smaller fishing communities; g) diminished viability of coastal community-based fishing enterprises; h) diversion of quotas to larger centres of population; i) shrinking income in the local economy; j) a loss of flexibility or adaptability by fishers; k) a limitation of the ability of fishery managers to make in-season adjustments if stock monitoring indicates catches must be reduced; and l) new impediments to government's ability to move to another management system as ITQ systems become irreversible due to capital investment in quota.

140. Similar conclusions are presented in exhibit 484; ITQ's: a) promote leasing, not ownership; b) give fishermen a false sense of security; c) facilitate privatization; d) increase capitalization in fisheries; e) hurt the financial performance of working fishermen; f) do not enhance sound science and monitoring; and g) create safety problems.[128]

141. Other exhibits, such as exhibit 470, indicate that DFO is virtually coercing fishers to shift to ITQs by means of a fleet reduction program that the Area G harvest committee is currently fighting in the Federal Court of Appeal:[129]

> Area G - This is a highly polarized fleet divided into those who believe that fishermen should have to actively fish their allocation to benefit and those who support an ITQ approach. The elected Area Harvest Committee is dominated by the former group and has rebuffed any attempts by the minority to discuss demonstration fishery options with DFO fishery managers, in spite of the results of the survey in Table 2. Reducing the size of this fleet through the Pacific Salmon Treaty mitigation program may cause this fleet to reconsider.

128 Exhibit 484, Briefing-A Cautionary Tale about ITQ Fisheries, 2009 [Ecotrust Canada].
129 Exhibit 470, Strategic Plan for Salmon Share Based Mgmt, Draft Mar 23 2009 [DFO], pdf. 6

Recommendations to improve management and avoid a repetition of the 20-year cycle of decline

142. The Terms of Reference direct the Commissioner "to develop recommendations for improving the future sustainability of the sockeye salmon fishery in the Fraser River including, as required, any changes to the policies, practices and procedures of the [DFO] in relation to the management of the Fraser River sockeye salmon fishery"[130].

143. The evidence presented at the Commission relating to escapement clearly points to a significant cause for the decline in Fraser River sockeye. The following recommendations relate primarily to that issue.

Fisheries Management: General

1. That the *Auditor General Act* be amended to provide for a new office within the Auditor General's Department charged with the specific responsibility to report annually in the same manner as the Commissioner of the Environment and Sustainable Development but with a mandate specific to the economic productivity of fisheries.

2. That DFO be required to follow Adaptive Management Processes as described in evidence by Mr. Marmorek.

3. That the conservation goal of sustaining fisheries resources over time requires taking into account the pronounced decrease in productivity which takes place when spawner abundances exceeds the carrying capacity of the freshwater system.

4. That DFO apply the precautionary principle to the freshwater ecosystem that Fraser sockeye depend upon for their survival to ensure that the freshwater ecosystem is not overtaxed by excessive fry abundance, i.e. abundance of fry beyond the carrying capacity of the rearing lakes.

5. That to better understand the dynamics of juvenile sockeye in the freshwater ecosystem, DFO should continue to build its longer-term data sets and expand them to other lake systems. It would be helpful for DFO to gather more information about what is happening to over-wintering fry and to smolts in the migratory corridor by looking at the fry and smolts not only as to their size but also as their fat reserves and energy levels as they prepare for the ocean environment.

6. That carrying-capacity estimates for the sockeye rearing lakes be further developed using photosynthetic rate ("PR") data together with biomass estimates of competitors of juvenile sockeye that are similarly planktivorous as discussed in exhibit 184 (Grant et al.,

130 Terms of Reference, para. a(i)(D).

2010).

7. That the present WSP be scrapped and be replaced with a restatement, in simple and understandable terms, of the intent of the WSP to provide for MSY while avoiding any unreasonable and genuine risk of extirpation.
8.
9. That the determination of WSP lower and upper benchmarks be based on the "best fit" Ricker, partial Larkin or full Larkin models as determined by known stock-recruit data as discussed in exhibit 399 (Pestal & Cass, 2010).

10. That as agreed by David Marmorek (September 20, 2011, p. 44, ll. 8-12): fishery managers adhere, so far as possible, to scientifically defensible escapement goals. As recommended in Technical Project 7 at p. 171 clearly defined escapement goals are critical and should be integrating into run-timing groups.

11. That the determination of lower and upper benchmarks for those stocks exhibiting cyclic dominance (i.e. the 8 out of 19 stocks discussed in exhibit 399, pdf p. 0019) should be adjusted so far as possible in a mixed stock fishery in a manner that takes into account the historic pattern of dominant, sub-dominant and off-cycle run sizes with the object of maintaining patterns of cyclic dominance rather than attempting to even out the run sizes. Under this management system the lower benchmark for the lowest of the 4-year cycles would be calculated as SGEN based on the average of the lowest spawner levels in the applicable cycle year, with the same method being adopted for each of the three other cycle years; and the upper benchmark for each of the four cycle years would be similarly determined as 80% of SMSY based on the average of each applicable cycle year. For stocks not exhibiting cyclic dominance the determination of benchmarks should be similarly adjusted using the Ricker model.

12. That the WSP upper benchmark be applied as an upper limit in a manner similar to the application of the upper limit in Alaska so as to mitigate the pronounced decrease in productivity resulting from escapement that exceeds carrying capacity.

13. That DFO enhance its science arm with a view to: (a) further understanding the mechanism causing cyclic dominance; (b) expanding its knowledge of carrying capacity beyond the major lake systems in which carrying capacity has already been determined; (c) determining the method of sockeye management in the Columbia River system and the likely reasons for the three consecutive record returns in that system in 2008, 2009 and 2010; and (d) generally improving knowledge of sockeye population dynamics so as to permit the setting of a lower benchmark (limit) at a level which is high enough to unsure sustainability of weak stocks but not so high as to jeopardize the productive capacity and beneficial harvest of strong stocks in a mixed stock fishery.

14. That managers should move from their current consensus-based approach to a system of basing their management decisions on clearly-defined and defensible science-based escapement goals.

15. That all agencies in Canada and the USA that manage or conduct research on sockeye salmon should create and actively participate in a formal, long-term working group devoted to the study of sockeye population dynamics. This new working group would facilitate communication of current data and analyses and would assist in the determination of the causes of trends that are similar as those experienced by Fraser sockeye and those trends that are different (*e.g*. the Columbia). (Ref recommendation #2 at p. 4 of exhibit 748: Technical Paper by Peterman & Dorner).

16. That the Area E Gillnetters northern pikeminnow removal program should be viewed as a good example of an ecosystem-based management approach with community involvement that is fully supported.

17. That DFO uses insufficient social science in its management of stocks, and that economists need to be involved early in the process so that there is enough really good economic analysis to properly inform fisheries management decisions. This will assist in the oversight function by the Auditor General's Department as recommended above.

18. That major policy initiatives by DFO should be referenced to the social wellbeing principle so that the effect of decisions on fishers and fishing communities is properly taken into account, and so that DFO appreciates that its function is primarily to sustainably manage fisheries for beneficial human use, not to conserve fish. DFO should have a stronger socio-economic analytical capacity.

19. That harvest in the Fraser of Summers overlapping with Late-run early migrants (i.e. until late August) be allowed so as to (a) minimize foregone yield by harvesting early-migrating late-run fish that are susceptible to *en route* mortality, and (b) maintain the level of escapements below the upper benchmark of 80% of S_{MSY}.

20. That the timing group containing the Quesnel run be managed in a manner similar to that of the 1950s-1980s so as to re-establish the dominant cycle in the 2001-2005-2009 adult recruit line for Quesnel stocks.

21. That in assessing and reporting to the public the results of the unprecedented high levels of escapements to the Quesnel system in the last decade the full Larkin model should be used.

22. That allocations for non-target species (bycatch) be included into the allocation policy to provide incentives for responsible users to continue fishing by adopting selective fishing measures.

23. That extreme caution be exercised in moving toward ITQs because they add costs, thus compromising economic viability of those actively fishing, are they tend to move the access privilege from active fishers to inactive quota holders; and that other measures be considered first, like pooling options without transferability (as proposed by Area E).

24. That socio-economic analyses of the effects of weak stock management should be done so that the public and fishery managers are fully informed of the impacts of management decisions on those fishers and communities affected by them, and to ensure that fishery managers fully understand the trade-offs contemplated by the WSP. Such analyses should be done prior to harvest closure decisions, *and* should be done on a retrospective basis when all escapement data is available so as to inform future decision-making.

25. That DFO should shift its financial resources back to its core responsibility of run-size data-collection, scientific analysis, monitoring and enforcement at the expense, if necessary, of consultation and modelling; and that DFO financial resources stop being diverted to intuitively appealing but questionable investments in models and mapping; and that if funds are available for consultation the integrated watershed model of the West Coast Vancouver Island Aquatic Management Board (with coastal communities, First Nations and industry represented) should be adopted with clearly agreed upon principles and MSY goals. [Ref. ex. 267]

26. That it is essential to maintain and improve the test fishing program since salmon managers are grossly uncertain about abundance at the times when they must make key harvest-management decisions of huge import to the GDP of Canada, recognizing that such decisions must be taken well before the fish reach their spawning rivers and that poor forecasts create risk of costly mistakes.

27. That attempts be made to quantify the trade-off between a loss in catch due to precautionary harvest goals and the direct costs of obtaining better data in the first place.

Fisheries Management: Aboriginal Fishing

28. That the term “food, social and ceremonial” be clearly defined in terms of reasonable food, social and ceremonial needs of First Nations so that the FSC priority over public fishing rights carries the same meaning as it does in the law developed by the Supreme Court of Canada.

29. That the level of FSC fishing should be set by DFO based on reasonable need objectively determined.

30. That DFO should keep FSC fishing separate and distinct from commercial fishing by aboriginal people in all areas where no sales component to the s. 35 priority has been established in law.

31. That illegal sales of FSC fish should be taken into account as a factor in determining whether reasonable FSC needs, and thus the s. 35 priority, have been satisfied.

32. That a system of tracing FSC fish, commercial fish and recreational fish, into and out of cold storage or processing facilities be developed by DFO and rigorously enforced.

33. That the C&P budget be increased as necessary to permit effective independent monitoring and enforcement of FSC fishing and enforcement of the requirement that a commercial licence be acquired before any commercial fishing or sale of fish takes place.

34. That, to provide confidence in First Nations Fraser River sockeye catch estimates, independent validation of catch numbers should be conducted by C&P, and C&P estimates of illegal sales should be taken into account in all determinations of sockeye harvest levels.

35. That the following essential features of current government policy be strictly maintained: (a) that all commercial fishers operate under a common set of rules; and (b) that DFO policies should so far as possible ensure that the commercial fishing industry is economically self-sustaining.

36. That no further experimental terminal commercial fisheries should be established until DFO receives an opinion from and independent economist familiar with fish harvesting and marketing (a) that such fisheries are or will be economically viable on a long-term self-sustaining basis, and (b) that removing access to salmon from the integrated coastal fishery will not compromise the economic viability of the integrated coastal fishery.

37. That an independent science review on the Skeena model (ex. 944) be conducted for the Fraser to determine whether any scientific, social or economic justification exists for shifting commercial fishing opportunities from the coast to terminal areas.

All of which is respectfully submitted.

Dated at Vancouver, BC this 17th day of October, 2011.

"C. Harvey"
Counsel for the Standing Group

THESE WRITTEN SUBMISSIONS are delivered for and on behalf of the United Fisherman and Allied Workers' Union – CAW and the West Coast Trollers' Area G Association (collectively the "Standing Group") by the law firm of **MacKenzie Fujisawa LLP**, Barristers and Solicitors, whose place of business and address for service is 1600 – 1095 West Pender Street, Vancouver, British Columbia, V6E 2M6, Telephone: 604-443-1202, Fax: 604-685-6494, Attention: **Christopher Harvey, Q.C.**

LIST OF AUTHORITIES

1. *R. v. Robertson* (1882), 6 S.C.R. 52
2. *Reference as to the Constitutional Validity of Certain Sections of the Fisheries Act, 1914.* [1928] S.C.R. 457
3. *Fowler v. The Queen,* [1980] 2 S.C.R. 213
4. *Northwest Falling Contractors Ltd. v. The Queen,* [1980] 2 S.C.R. 292
5. *Interprovincial Cooperatives Limited et al. v. The Queen,* [1976] 1 S.C.R. 477
6. *R. v. MacMillan Bloedel Limited* (1984), 50 B.C.L.R. 280; 1984 CanLII 740 (C.A.) (leave to SCC refused [1984] S.C.C.A. No. 279)
7. *R. v. Scobey* [1993] Y.J. No. 210
8. *Comeau's Sea Foods Ltd. v. Canada (Minister of Fisheries and Oceans),* [1997] 1 S.C.R. 12
9. *R. v. Agawa* (1988), 65 O.R. (2d) 505 (C.A.)
10. *Ahousaht Indian Band and Nation v. Canada (Attorney General*), 2009 BCSC 1494; appeal all'd in part 2011 BCCA 237, application for leave to appeal to SCC Aug. 17, 2011

APPENDIX A

Table 1. Daily fence counts of sockeye salmon through Sweltzer Creek, 1999-2011.

Date	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	
													Lake	Brood
21-Jul	-	-	-	-	0	-	-	-	-	-	0	-	0	0
22-Jul	-	-	-	-	0	-	-	-	-	-	0	-	0	0
23-Jul	-	-	-	-	0	-	-	-	-	-	0	-	0	0
24-Jul	-	-	-	-	0	-	-	-	-	-	0	-	0	0
25-Jul	-	-	-	-	0	-	-	-	-	-	0	-	0	0
26-Jul	-	-	-	-	0	-	-	-	-	-	0	-	0	0
27-Jul	-	-	-	-	0	-	-	-	0	-	0	-	0	0
28-Jul	-	-	-	-	0	-	0	-	0	0	0	1	0	0
29-Jul	-	-	-	-	0	-	0	-	0	2	0	0	0	0
30-Jul	-	-	-	-	0	-	0	-	0	1	0	2	0	0
31-Jul	-	-	-	-	0	-	0	1	0	0	0	4	0	0
01-Aug	-	-	-	0	0	-	0	1	0	0	0	1	0	0
02-Aug	-	-	-	0	0	-	0	0	0	0	0	4	0	0
03-Aug	-	-	-	2	0	0	0	3	0	0	0	5	0	0
04-Aug	-	-	-	8	0	0	0	9	0	0	0	0	0	0
05-Aug	-	-	-	23	1	0	0	8	0	2	0	21	1	0
06-Aug	-	-	-	17	2	0	0	14	0	7	0	18	1	0
07-Aug	-	-	-	9	0	0	0	5	0	2	0	9	2	0
08-Aug	-	-	-	10	0	0	0	5	0	1	0	18	7	0
09-Aug	-	-	-	71	0	0	0	13	0	2	0	11	3	0
10-Aug	-	-	-	19	0	0	0	10	2	2	0	15	5	0
11-Aug	-	-	-	55	3	0	0	15	0	6	0	5	2	0
12-Aug	-	-	-	24	1	0	0	1	2	1	1	34	0	0
13-Aug	-	-	-	22	2	0	0	10	4	6	2	51	3	0
14-Aug	-	-	-	27	4	0	0	15	2	1	0	30	5	0
15-Aug	-	-	-	40	4	0	0	28	3	6	0	8	5	0
16-Aug	-	-	5	30	7	0	0	22	0	7	1	7	1	0
17-Aug	-	-	4	16	7	0	0	31	1	2	1	25	5	0
18-Aug	-	-	3	20	0	0	1	86	1	7	0	7	3	4
19-Aug	-	28	20	29	4	0	3	70	1	6	0	35	2	0
20-Aug	-	32	17	32	5	0	0	48	4	0	0	33	2	0
21-Aug	-	6	23	46	7	0	1	42	4	28	0	47	1	0
22-Aug	-	18	12	23	10	0	1	41	2	15	2	52	1	3
23-Aug	-	10	14	19	2	1	1	46	4	12	0	54	0	11
24-Aug	-	4	9	30	10	0	2	27	15	18	1	63	1	6
25-Aug	-	77	33	11	13	1	1	100	8	5	3	33	1	2
26-Aug	-	14	12	12	9	0	4	97	1	1	0	35	9	0
27-Aug	1	3	16	25	15	4	2	59	7	1	3	27	6	0
28-Aug	5	28	15	5	13	5	2	34	4	8	1	41	4	1
29-Aug	128	23	34	1	2	4	1	28	0	16	3	30	0	8
30-Aug	115	13	21	6	10	3	3	32	3	48	14	17	0	4
31-Aug	96	14	19	8	9	3	3	28	13	14	0	20	0	2
01-Sep	114	30	13	9	6	1	3	54	3	17	5	29	4	0
02-Sep	46	18	26	10	10	4	8	107	4	20	8	16	2	0
03-Sep	63	14	14	16	6	1	6	111	7	1	6	54	9	0
04-Sep	167	36	9	9	6	1	5	72	3	2	15	72	2	0
05-Sep	135	24	1	7	5	2	0	64	5	25	22	33	6	0
06-Sep	142	16	26	22	4	2	5	56	2	5	0	39	1	4
07-Sep	175	20	8	35	2	2	6	74	0	13	8	31	10	0
08-Sep	152	12	1	28	22	2	14	30	10	8	7	41	0	10
09-Sep	220	65	11	19	7	1	0	53	12	0	0	45	0	16
10-Sep	53	38	22	43	5	0	8	70	17	0	6	61	25	0
11-Sep	28	48	41	67	7	2	1	53	7	1	46	53	24	0
12-Sep	151	25	12	21	1	1	12	48	5	6	100	34	53	2
13-Sep	229	43	15	6	1	0	0	58	25	4	126	28	81	33
14-Sep	151	23	22	16	14	0	0	33	19	3	151	78	185	21
15-Sep	140	149	8	3	23	0	0	21	27	7	31	94	183	20
16-Sep	79	47	11	10	0	0	0	41	63	0	74	92	236	0
17-Sep	89	17	7	34	10	0	0	28	55	0	26	69	142	0
18-Sep	46	28	4	62	6	0	0	65	21	0	33	113	221	0
19-Sep	55	32	2	13	69	2	1	11	15	0	32	34	151	2

Continued

APPENDIX A

Table 1. Daily fence counts of sockeye salmon through Sweltzer Creek, 1999-2011 continued.

Date	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011 Lake	2011 Brood
20-Sep	172	20	1	70	63	0	0	45	19	0	29	546	57	2
21-Sep	226	2	4	48	56	2	0	103	27	2	27	190	64	25
22-Sep	210	3	7	43	107	0	0	5	25	0	17	134	184	0
23-Sep	163	0	11	116	35	0	3	203	17	0	5	103	451	0
24-Sep	204	0	12	177	4	0	2	350	30	1	20	154	272	0
25-Sep	446	19	6	482	3	0	4	257	1	0	15	226	318	0
26-Sep	302	5	2	378	6	0	8	102	0	2	12	430	271	5
27-Sep	225	3	1	137	14	1	0	76	2	2	2	939	1,144	38
28-Sep	122	18	0	117	6	0	0	55	10	1	9	719	724	6
29-Sep	42	5	1	113	20	0	16	36	14	1	13	1347	548	0
30-Sep	218	20	1	109	2	0	31	31	6	0	5	653	262	0
01-Oct	84	1	0	53	1	0	23	19	32	0	1	423	200	0
02-Oct	30	13	1	37	10	1	27	14	19	0	2	523	57	0
03-Oct	42	20	4	37	8	0	0	6	11	4	2	328	128	0
04-Oct	78	13	1	93	5	0	0	0	12	1	3	216	124	4
05-Oct	77	1	0	58	9	0	0	2	2	1	2	102	131	10
06-Oct	248	2	0	22	5	1	2	1	4	0	1	78	47	0
07-Oct	171	7	0	22	11	0	1	0	6	0	1	39	25	0
08-Oct	2,681	9	1	18	89	0	1	4	12	0	1	36	22	0
09-Oct	1,015	8	0	12	158	1	0	1	2	2	5	22	6	0
10-Oct	164	1	0	7	8	0	0	5	2	1	4	56	79	0
11-Oct	100	0	1	17	6	1	2	0	0	0	0	254		
12-Oct	336	4	6	1	6	0	0	0	1	0	1	206		
13-Oct	593	0	9	6	47	0	0	3	0	0	0	154		
14-Oct	26	0	14	9	48	0	0	4	1	0	5	76		
15-Oct	43	2	5	2	13	0	0	10	1	0	0	50		
16-Oct	40	1	0	0	4	0	0	2	1	0	14	76		
17-Oct	125	0	3	8	93	0	0	7	1	1	14	35		
18-Oct	73	5	3	6	36	1	5	8	1	0	78	18		
19-Oct	70	15	2	6	112	0	2	2	0	1	36	29		
20-Oct	16	14	1	4	128	0	0	2	1	0	28	22		
21-Oct	21	16	5	7	62	1	1	5	1	0	1	15		
22-Oct	11	1	2	12	13	0	0	0	2	0	47	20		
23-Oct	19	2	1	4	11	0	0	4	0	0	40	13		
24-Oct	27	2	9	2	25	0	0	1	2	0	48	15		
25-Oct	7	3	1	6	11	0	0	2	0	0	7	18		
26-Oct	24	0	5	1	24	0	0	1	1	0	22	41		
27-Oct	19	0	1	1	38	0	0	6	1	0	21	66		
28-Oct	32	0	3	6	21	0	0	10	0	0	18	25		
29-Oct	194	0	3	23	11	0	1	9	0	0	16	6		
30-Oct	447	0	4	15	4	0	0	10	0	0	9	13		
31-Oct	374	0	4	3	10	0	0	6	0	0	10	15		
01-Nov	56	2	2	3	9	0	0	7	0	0	2	53		
02-Nov	24	0	2	7	6	1	0	8	0	1	9	43		
03-Nov	17	0	2	0	15	0	0	24	1	0	8	44		
04-Nov	74	14	3	16	7	0	0	42	0	0	6	14		
05-Nov	24	1	1	15	7	0	0	17	0	0	5	52		
06-Nov	14	1	3	132	6	0	0	11	0	0	0	27		
07-Nov	18	4	0	314	2	0	0	7	0	0	4	71		
08-Nov	7	7	1	130	2	0	1	5	0	0	1	29		
09-Nov	6	1	1	75	6	0	0	2	0	0	3	14		
10-Nov	0	0	1	39	13	0	1	1	0	0	3	9		
11-Nov	16	0	1	31	12	0	0	3	0	0	9	12		
12-Nov	40	0	1	78	15	0	0	1	0	0	2	2		
13-Nov	0	0	1	276	22	0	0	2	0	0	3	27		
14-Nov	0	0	1	116	2	0	0	2	0	0	2	7		
15-Nov	0	0	1	44	3	0	0	0	0	0	2	12		
16-Nov	3	0	2	50	11	0	0	0	0	0	1	4		
17-Nov	-	1	2	18	11	0	0	2	0	0	0	0		
18-Nov	-	0	2	9	15	0	0	0	0	0	0	1		
19-Nov	-	0	0	72	7	0	0	0	0	0	0	1		

continued

APPENDIX A

Table 1. Daily fence counts of sockeye salmon through Sweltzer Creek, 1999-2011 continued.

Date	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011 Lake	2011 Brood
20-Nov	-	0	1	15	11	0	0	0	0	0	2	0		
21-Nov	-	0	0	42	9	0	0	0	0	0	2	0		
22-Nov	-	0	1	16	2	0	0	0	0	0	2	0		
23-Nov	-	1	1	5	2	0	0	0	0	0	1	0		
24-Nov	-	2	0	7	7	0	0	0	0	-	0	0		
25-Nov	-	0	0	2	3	0	0	0	0	-	1	0		
26-Nov	-	0	0	1	2	0	0	0	0	-	2	0		
27-Nov	-	0	0	3	10	0	0	0	0	-	0	0		
28-Nov	-	0	0	0	1	0	0	0	0	-	0	0		
29-Nov	-	0	0	2	1	0	0	0	-	-	0	-		
30-Nov	-	1	0	0	3	0	0	0	-	-	0	-		
01-Dec	-	0	0	0	3	0	0	0	-	-	2	-		
02-Dec	-	0	0	1	1	0	0	0	-	-	1	-		
03-Dec	-	0	0	0	2	0	-	0	-	-	0	-		
04-Dec	-	-	0	0	0	0	-	0	-	-	0	-		
05-Dec	-	-	0	0	0	0	-	0	-	-	-	-		
06-Dec	-	-	0	0	1	-	-	0	-	-	-	-		
07-Dec	-	-	0	0	0	-	-	0	-	-	-	-		
08-Dec	-	-	0	0	0	-	-	0	-	-	-	-		
09-Dec	-	-	0	0	1	-	-	0	-	-	-	-		
10-Dec	-	-	0	0	0	-	-	0	-	-	-	-		
11-Dec	-	-	-	0	0	-	-	0	-	-	-	-		
12-Dec	-	-	-	0	0	-	-	0	-	-	-	-		
13-Dec	-	-	-	1	0	-	-	0	-	-	-	-		
14-Dec	-	-	-	0	0	-	-	-	-	-	-	-		
15-Dec	-	-	-	0	0	-	-	-	-	-	-	-		
16-Dec	-	-	-	-	-	-	-	-	-	-	-	-		
Total	12,398	1,227	675	4,882	1,939	52	227	3,521	649	360	1,392	10,632	6,521	239

COMMISSION OF INQUIRY INTO THE DECLINE OF SOCKEYE SALMON IN THE FRASER RIVER

In the matter of Her Excellency the Governor General in Council, on the recommendation of the Prime Minister, directing that a Commission do issue under Part I of the Inquiries Act and under the Great Seal of Canada appointing the Honourable Bruce Cohen as Commissioner to conduct an inquiry into the decline of sockeye salmon in the Fraser River .

LIST OF AUTHORITIES

WEST COAST TROLLERS (AREA G) ASSOCIATION and UNITED FISHERMEN AND ALLIED WORKERS' UNION

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2. *Reference as to the Constitutional Validity of Certain Sections of the Fisheries Act, 1914.* [1928] S.C.R. 457
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9. *R. v. Agawa* (1988), 65 O.R. (2d) 505 (C.A.)
10. *Ahousaht Indian Band and Nation v. Canada (Attorney General*), 2009 BCSC 1494; appeal all'd in part 2011 BCCA 237, application for leave to appeal to SCC Aug. 17, 2011