THE FUTURE OF THE FRASER RIVER SOCKEYE SALMON

A PRESENTATION TO:

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

PRESENTED BY:

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ABSTRACT

While we appreciate the "good news" side of the 2010 Adams River run of sockeye salmon, we must remember that: (i) this is but one run of one species (>40 breeding populations) of salmon utilizing the Fraser watershed; (ii) the sockeye runs in 2009 were dangerously low; and (iii) the predictions for the runs for the next three years are for low numbers of returns. This presentation deals with the three of the Commission's key questions: (i) a vision for the sustainability of Fraser sockeye is defined; (ii) solutions (key knowledge and awareness strategies) are recommended to attain future security of the Fraser sockeye, and (iii) habitat issues are identified and possible mitigations measures are outlined.

The vision for the sustainability of Fraser sockeye is: healthy, breeding populations of all genetic variants of Fraser sockeye. 'Healthy' means disease-free populations being able to migrate unencumbered up clean rivers, lakes and creeks to spawn in clean habitats free from man-made disturbance. 'Healthy' also means sockeye returns of sufficient size to support First Nations and other British Columbia communities, and the fishing and fish-processing industries.

More knowledge and awareness of sockeye biology and ecology (especially spawning and rearing habitat needs) are required and must be implemented. An integral part of this research must be an assessment of the impacts of industrial, agricultural, residential, and community activities on the quality and availability of spawning and rearing habitat. When assessing knowledge and awareness needs and strategies, the necessity for involvement of all stakeholders is self-evident. Only through meaningful partnerships can we address the issues associated with the Fraser sockeye and the other species of Fraser salmon.

There is a need to establish an interior salmon research program centered at the University of Northern BC's Dr. Max Blouw Quesnel River Resarch Centre located in Likely BC. This institute/program should involve a multi-stakeholder partnership: Government of Canada (Fisheries and Oceans Canada), Government of British Columbia (Ministry of Environment, Ministry of Forests and Range), First Nations, research institutions (e.g., University of Northern BC, Simon Fraser University, University of British Columbia Okanagan, and Thompson Rivers University), commercial fisheries, sport fisheries, fisheries associations, Fraser Basin Council, relevant NGOs (e.g., Pacific Salmon Foundation, Watershed Watch Salmon Society), and FORREX (Forum for Research and Extension in Natural Resources).

There are significant habitat concerns, both freshwater and marine, with regard to the sustainability of the Fraser River sockeye. These habitat concerns are, for the most part, because of industrial, agricultural and residential developments and operations. Mitigation measures include: philosophical change (in the way we do business); policy change; better enforcement of management policies, guidelines, and standards; research (best management practices, restoration practices); and extension/communications.

Our vision for healthy, breeding populations of all genetic variants of Fraser sockeye must be a priority. This vision requires an ethic of no-net-loss (quality and quantity) of salmon habitat in any future industrial, agricultural or residential developments, and a commitment to habitat restoration where required. The same no-net-loss policy should be applied to riparian ecosystems as well. Better compliance and enforcement measures and implementation of these measures are critical.

Regardless of how long we have claimed to practice sustainability in this province and country, we have failed miserably. We need to re-think our strategies for sustainability to bring them more in line with the biological context of the word, and we need to understand that we cannot sustain our lives in isolation of the natural world. One of the biggest barriers to ecological sustainability is the disconnection between the human population and the natural world. This disconnection has been accompanied by a decrease in awareness and understanding of humankind's natural heritage and how dependent we are upon it. The public displays of surprise, interest and enthusiasm with the 2010 Adams River sockeye run are good examples of the disposition of the people of this province to re-make that connection.

1.0 INTRODUCTION

1.1 A "Good News" Story

One of the truly great "good news" stories of the past several years in British Columbia is the outstanding returns we have seen for the Adams River sockeye run over the past two months. If there was any doubt that the wild salmon is iconic in this province, that doubt should have been erased completely. All the stakeholders were astonished at the size of the run, and all segments of the fishing industry seemed very happy to be able to capture 11-12 million sockeye. But what struck me the most was the reaction of the public – the enthusiasm and awe expressed by people flocking to the docks to buy fresh sockeye. One TV news reporter interviewed someone who went down to the docks, not to buy salmon, but to see what the fuss was all about, to be part of this "good news" event.

1.2 Background

What we have witnessed over the past couple of months is the tremendous impact such salmon runs can have on the fishing and fish-processing industries. But, to me, it is equally important to recognize that such runs of sockeye in particular, and salmon in general, have substantial social and cultural impacts as well. However we choose to examine and explain this 2010 phenomenon, we have seen first-hand evidence of the ecological, social, cultural and economic importance of the Pacific salmon. I have a friend, an elder with the Xat'súll Nation (Soda Creek Band), who talks about his grandmother's concerns about salmon. The message she repeatedly told her young grandson was that without salmon, their people could not survive. We have seen an unprecedented example this year of how **one** run of **one** species of salmon can feed not only the First Nations along the south coast and the Fraser River but also all the other communities in the same area. I have heard the same survival message on a number of different occasions from friends in the Tl'azt'en Nation and the Takla Band in the Stuart-Trembleur-Takla drainage area.

One of the more disturbing aspects of this phenomenon was some of the commentary I have heard in the main-stream media in south-western British Columbia, specifically:

(1) that the sockeye have obviously recovered from last year's disastrous run; and
(2) that the unexpected size of the run was another example of Fisheries and Oceans Canada's ineptitude in predicting the size of returning runs and in overall management of the salmon resource.

What became apparent to me as I listened to such discussion is that, for a population which has exploited the salmon for so many years, we really do not understand the ecological nature of these fish. Once the fish are beyond the Mission-Hope stretch of the Fraser River, the residents down here tend to forget about them. And, we tend to forget also that:

(1) the sockeye generally have a four-year return cycle;
(2) there are in excess of forty breeding populations of sockeye which migrate to various rivers through the Fraser Basin;
(3) we have not been kind to the quality of the salmon-spawning habitat throughout the interior;

(4) the Fraser River Basin covers a huge portion of the province and collects run-off and pollutants from different industries, in particular the forest industry, mining operations, and agriculture, and from many different communities; and
(5) we have little understanding about the salmon's life in the high seas, especially the sockeye which spend three years in the Pacific Ocean.

Rather than pointing our fingers at different resource management agencies (federal and provincial), we need to look seriously at the perceptions of society as a whole in order to begin to think meaningfully about being able to sustain our Fraser River sockeye, and indeed all the other salmon species as well.

2.0 VISION FOR THE SUSTAINABILITY OF FRASER SOCKEYE

My vision for the sustainability of the Fraser sockeye is quite simple:

- healthy, breeding populations of all genetic variants of Fraser sockeye.

'Healthy' means disease-free populations being able to migrate unencumbered up clean rivers, lakes and creeks to spawn in clean habitats free from man-made disturbance. 'Healthy' also means sockeye returns of sufficient size to support First Nations and other British Columbia communities, and the fishing and fish-processing industries.

This vision is based on the premise that the various populations of Fraser sockeye salmon must be healthy and stable, i.e., 'sustainable,' before we can talk of sustainable communities and industries which may be dependent upon this resource. Economic sustainability must be only one component of the sustainability circle, along with ecological, social and cultural sustainability. The wild salmon resources provide an exemplary opportunity to finally determine what the appropriate salmon management strategy should be for British Columbia and Canada.

3.0 FUTURE SECURITY OF THE FRASER SOCKEYE

Sockeye salmon are finely tuned to the individual streams and lakes in which they were born, and are thus incredibly diverse. Some populations do better in cold, wet years - others thrive when it's hot or dry. Each population experiences its own boom and bust cycles based on environmental conditions and pure chance. But given sufficient diversity, there should be enough winners to make up for the losers every year for the species overall. To maintain the steady flow of fish and other ecosystem services people depend upon, managers will need to put an explicit priority on preserving population diversity *within* species.[1] Such strategies require aggressive protection of the habitat networks that ultimately generate and maintain population diversity. Both approaches will become increasingly important as a first line of defense against climate change. Protecting weaker populations is a challenge. Managers must reduce fishing pressure below the levels that the stronger populations can tolerate, or distribute fishing pressure to protect diversity within stocks.[1] In addition to protecting existing population diversity, we must also preserve and protect the variety of habitats that generate population diversity in the first place.

[1] Schindler, D.E., R. Hilborn, B. Chasco, C.P. Boatright, T.P. Quinn, L.A. Rogers and M.S. Webster. 2010. Population diversity and the portfolio effect in an exploited species. Nature 465(3): 609-612. Doi:10.1038/nature09060

Having spent the better part of the last forty years in ecological and resource management research programs, my first is: "More knowledge and awareness needed and applied." When one delves into the research component, there tends to be a limited involvement of sectors other than the research scientists. When one expands one's perspective to include knowledge and awareness, the need for involvement of all stakeholders is self-evident. Only through meaningful and effective partnerships can we address the issues associated with the Fraser sockeye and the other species of Fraser salmon. There needs to be a change in the way we do business. And all stakeholders must recognize the basic premise: the ecological sustainability of the Fraser sockeye must be paramount.

3.1 Relevant Questions

Some of the more important areas lacking knowledge and awareness include:

(1) What are the factors determining rates of sockeye return and spawning success?
(2) Why are certain of the once-abundant runs (e.g., Stuart-Takla, Quesnel River/Lake, Horsefly River/Lake) now in jeopardy?
(3) What impacts are we having on the quality and quantity of water in the rivers, lakes, and creeks used as migration channels?
(4) What impacts are we having on the quality and integrity of spawning and rearing habitat?
(5) What role does groundwater play in sustaining the quantity and quality of sockeye spawning and rearing habitat?
(6) What are the predation pressures facing the sockeye fry in the rearing areas in the creeks, lakes and rivers?
(7) What are the marine factors in the Pacific Ocean which regulate sockeye abundance, growth rates, mortality rates, and return rates?
(8) What are the factors in coastal waters (e.g. Salish Sea) which regulate sockeye return rates?
(9) What is required for maximum spawning success and escapement from the interior streams and lakes?
(10) Is there a need for an enhanced Salmonid Enhancement Program to provide hatchery-produced fry for release in those streams which have sockeye runs in jeopardy?
(11) What impact is our changing climate having on the biology and ecology of the Fraser sockeye?
(12) What are the impacts of off-shore fishing on sockeye numbers and health?

3.2 Knowledge and Awareness Strategies

I recommend that the following strategies be implemented:

(1) Senior levels of government (federal and provincial) should dedicate a total of $10 million per year in a ten-year agreement to increase our knowledge of the biology and ecology of the Fraser sockeye.[2] The option for renewal for an additional 10-year period should be included in the initial agreement. Given our changing climate, monitoring sockeye populations over a minimum of three life cycles (twelve years) would be the minimum time period required.

[2] A worthwhile precedent to consult is the Canada-British Columbia Forest Resource Development Agreements I (1982-87) and II (1988-1992). The funding was split 50/50. The agreements were administered by the Canadian Forest Service and the BC Ministry of Forests. The research and extension components were administered and delivered by the Pacific Forestry Centre and the BC Ministry of Forests' Research Branch.

Various funding mechanisms, including endowed research chairs,[3] can be considered. The administration of the ten-year agreement should be maintained by the contributing governments. The strategic planning for the research program should be undertaken by a technical committee comprised of salmonid researchers and managers working in the interior of British Columbia. The delivery of the research and extension programs should be managed by the institute mentioned below.

(2) An interior salmonid research institute should be established to develop and deliver a research program focused initially on Fraser sockeye and coho. This institute/program should involve a multi-stakeholder partnership: Government of Canada (Fisheries and Oceans Canada), Government of British Columbia (Ministry of Environment, Ministry of Forests and Range), First Nations, research institutions (e.g., University of Northern British Columbia, Simon Fraser University, University of British Columbia Okanagan, and Thompson Rivers University), commercial fisheries, sport fisheries, fisheries associations, Fraser Basin Council, relevant ENGOs (e.g., Pacific Salmon Foundation, Watershed Watch Salmon Society), and FORREX (Forum for Research and Extension in Natural Resources) (see Appendix 1 for an overview of a precedent-setting multi-stakeholder research program located in north-central British Columbia).

(3) The interior salmonid research institute and program should be based at the University of Northern British Columbia's Dr. Max Blouw Quesnel River Research Centre (QRRC) (formerly a Fisheries and Oceans Canada hatchery) located at Likely, BC.

(4) The focus for the interior salmonid research program should be on the portions of their life cycle spent in freshwater prior to their emigration to the Pacific. While Fisheries and Oceans Canada scientists are well-placed to deal with the ecology and management of salmonids in coastal waters and the high seas, the interior research program would be more effective in dealing with the ecology and management of salmonids in freshwater.

(5) To help with the planning of the research program and the funding mechanism, a think-tank session should be held at QRRC in the autumn of 2010. The possible goals and objectives of this session are identified in Appendix 2. QRRC is currently seeking funding for such a think-tank session.

(6) An integral part of the research strategy is be an effective communications and extension program which will ensure better distribution of information and knowledge arising from the research projects, and increased awareness among the public of the ecological, cultural, social and economic importance of sockeye and the other salmon species.

4.0 HABITAT CONCERNS

4.1 Habitat Issues

There are some significant habitat concerns, both freshwater and marine, with regard to the sustainability of the Fraser River sockeye. These habitat concerns are, for the most part, because of industrial, agricultural and residential developments and operations. Some of the more challenging concerns include:

[3] Forest Renewal British Columbia (1994-2001) developed what has amounted to an excellent example of a provincially-funded research endowment program dedicated to natural resource management.

(1) Industrial activities in watersheds have led to increased levels of siltation and sedimentation in streams home to spawning salmon. This is of particular concern in the slower-moving, smaller streams located mid- and higher-levels in the watersheds. As water tends to run downhill, the downstream siltation and sedimentation impacts tend to be cumulative.

(2) Industrial activities throughout the Fraser watershed have generally not recognized the importance of riparian ecosystems to surrounding terrestrial ecosystems or, in particular, to aquatic ecosystems home to spawning salmon. Many riparian ecosystems have disappeared because of industrial activities in British Columbia.

(3) Forest harvesting has increased the exposure of streams, particularly the smaller streams, to increases in water temperatures, surface run-off, debris accumulation, mass wasting, landslides, and channel disturbance. Streams have traditionally been seen as a barrier or constraint to overcome in forestry operations, not as a natural resource which is part of the province's natural capital.

(4) The pulp and paper industries in the Fraser watershed have been dumping effluent into the Fraser River for decades. While substantial investments have been made in cleaning up the effluent as much as possible, the Fraser is still being used as an industrial sewer. Is such effluent having an effect on the habitat of migrating sockeye?

(5) Mining activities have, in many cases, completely disrupted watersheds (including lakes), and caused increases in run-off rates, stream-water temperatures, and the toxic chemical content of stream and lake waters. Placer mining has a long history in the central part of British Columbia, and has produced several examples of severe disruption of salmon habitat (e.g., Quesnel River, Bullion Pit). And, the province continues to consider mining proposals which will result in the destruction of salmon-producing waterways.

(6) The use of inorganic fertilizers and pesticides in the industrial-scale agriculture industries along the Fraser River has been a source of pollution for many years. Riparian ecosystems and streams in areas of open grazing range have been severely impacted by grazing cattle in the interior. Such activities have resulted in increased siltation and sedimentation and increased manure deposition in salmon-spawning streams.

(7) Residential developments have disrupted floodplains and stream channels in different areas throughout the Fraser watershed, resulting in severely-compromised riparian ecosystems, and in concentrated run-off (during storms, for example), and increased pollution from particulate material and toxic chemicals.

(8) Groundwater is believed to be an important spawning and rearing habitat component during low-water periods in interior streams. We have little or no knowledge of the impacts industrial activities have on such groundwater sources and supplies.

(9) Local, regional and global climate patterns are changing, with several potential effects on the Fraser sockeye. What are the impacts of increasing mean daily temperatures in terrestrial ecosystems which surround the streams and lakes? What are the cumulative impacts on water temperatures, acidity, and oxygen levels in the Pacific Ocean?

4.2 Mitigation

Philosophical Change

Regardless of how long we have claimed to practice sustainability in this province and country, we have failed miserably. The term "sustainability" has been over-used, misused, and misunderstood over the past 25 years. Emphasis has been placed on the term, "sustainable development," which has been used interchangeably with "sustainability," and which has been interpreted by many sectors to mean economic growth only. Over a number of years, this has resulted in ecological and social sustainability being ignored or, in some cases, subverted. We need to re-think our strategies for sustainability to bring them more in line with the biological context of the word, and we need to understand that we cannot sustain our lives in isolation of the natural world.[4]

One of the biggest barriers to ecological sustainability is the disconnection between the human population and the natural world. Over the past 5o years we have "progressed" from a nation of people working on the land to a nation which has very little direct connection to the land. This disconnection has been accompanied by a decrease in awareness and understanding of humankind's natural heritage and how dependent we are upon it.[1] The public displays of surprise, interest and enthusiasm with the 2010 Adams River sockeye run are good examples of the disposition of the people of this province to re-make that connection.

The wild salmon play a vital ecological role throughout the Fraser watershed:

(1) They provide food for many indigenous animal species along the waterways: e.g., charismatic species such as grizzly and black bears, bald and golden eagles, ravens, and wolves; and many scavenging species such as gulls, crows, and wolverines,.

(2) They are a substantial source of nutrition in the streams in which they spawn and then die. These nutrients either stay in the sediments and pools of the streams or are washed downstream to lakes and rivers.

(3) They are a significant source of nutrition in riparian and adjacent terrestrial ecosystems (an anadromous nutrient pump). The animals preying on the spawning salmon and those animals scavenging salmon carcasses drag their catch up from the creeks and rivers, devour the fish, and leave portions of the carcasses on the forest floor. Because of the concentration of animals around the streams during the spawning period, there is an increased deposition of nutrient-enriched faeces.

Also, the salmon are an ecological gift to the people of British Columbia, a gift we can enjoy only if we begin to respect the nature and source of that gift, and the importance of that gift to plant and animal species along the Fraser waterways. Consider also that this gift is wrapped in water, a component of our natural capital which is becoming increasingly difficult to sustain.

Our vision for healthy, breeding populations of all genetic variants of Fraser sockeye must be a priority. This vision requires an ethic of no-net-loss (quality and quantity) of salmon habitat in any future industrial, agricultural or residential developments, and a commitment to habitat restoration where required.

[4] Sustainability: Defining the Concept. 2010. Discussion Paper, Social Ecology Institute of BC. www.bcise.com.

Policy Change

The western economic system has, for many years, ignored the true costs of goods and services provided by what we call our economy. The prices we pay for everyday products do not include, for example, the costs of environmental degradation, resource depletion, energy expended, and ultimate disposal of these products. Companies are given tax breaks, reduced energy costs, and reductions in royalties to help them meet their economic bottom lines. Environmental standards are relaxed and the taxpayer is often left with the bill to clean up after a development or operation has ended. The government policy to permit these things to happen is covert subsidization.

For too long in this province, values associated with aquatic ecosystems have been set aside when governments, industries, and communities are reviewing and evaluating proposals for economic development, be they for timber harvesting, mining sites, residential areas, or energy generation and transmission, for example. Thus, in several areas of the province, we have seen an erosion of the quality and quantity of spawning and rearing habitat for Fraser sockeye and other wild species of salmon.

When it comes to protection of riparian ecosystems and water bodies during forestry operations, we have the knowledge and the tools with which to employ world-class practices and measures to ensure that our watersheds provide clean and safe habitat for spawning sockeye. Over the past ten years we have seen a relaxation of the 'red tape' surrounding applications and approvals affecting riparian ecosystem and stream protection in forestry operations, and we have also seen a reduction in the application of compliance and enforcement standards in the provincial agencies. Environmental standards and regulations must not be viewed as constraints or barriers to any economic development but as necessary natural resource management objectives.

Extension

The first step in an extension program would be to compile all knowledge of Fraser sockeye and develop a number of communications products to raise the profile of wild Fraser salmon populations throughout the Fraser River watershed. The target audiences would be commercial fishers, sports fishers, food fishers, agency decision- and policy-makers, resource managers, and communities in the Fraser watershed. The objective of these communications products will be to ensure as much accurate information as possible can be provided to all communities of interest and place so that better decisions can be made to ensure Fraser sockeye sustainability.

Of particular significance to this learning objective will be the traditional ecological knowledge available through the many First Nations which are located in the Fraser watershed, and the operational knowledge provided by the various groups of fishers.

Better Enforcement

As part of the extension process, there needs to be a review of regulations, guidelines, and practices which are utilized to manage the salmon populations and aquatic ecosystems in British Columbia. Those regulations, guidelines, and practices may require testing and further development through field-oriented research trials.

Regardless of the quality and quantity of regulations, guidelines and practices available to those charged with the responsibility of sustaining the Fraser sockeye populations, if there is insufficient monitoring of compliance and enforcement when required, little progress will be made. Better protection of riparian ecosystems is needed in British Columbia.

Research

While there is an immense need for research into the basic biology and ecology of the Fraser sockeye, especially while resident in the Fraser watershed, other research priorities of similar importance are:

(1) what are the best management practices, for the resource development industries and the residential developments, to avoid impacts resulting in net loss of salmon habitat in the watersheds, and
(2) what are the practices and measures best suited to mitigate existing and future negative impacts of industrial and residential activity.

5.0 CONCLUSION

This presentation was given on behalf of the newly-established Social Ecology Institute of British Columbia, and dealt with three of the Cohen Commission's key questions:

- What is your vision for the sustainability of Fraser sockeye?
- What is required to secure the future of Fraser sockeye?
- What are the major habitat issues for Fraser sockeye and how can these be mitigated?

We trust the information and recommendations provided in this presentation will be useful to the Commission in its deliberations.

Thank you for this opportunity, and thank you for your attention.

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APPENDIX 1. AN OVERVIEW OF THE STUART-TAKLA FISH-FORESTRY INTERACTION PROJECT[5,6,7]

The Stuart-Takla Fish-Forestry Interaction Project (STFFIP) was born in 1990 from the recognition that our knowledge of the interactions between forest harvesting and the productive capacities of aquatic habitats was very limited for the interior forests of British Columbia (Macdonald et al 1992). At the time, forestry guidelines and regulations for the protection of fish in British Columbia were largely based on fish-forestry research projects conducted in coastal watersheds such as the Carnation Creek project (Hartman and Scrivener 1990) and others conducted in the coastal Pacific Northwest (Poulin 1984, Naiman et al 2000). This research significantly improved both our scientific knowledge and our management capability for mitigating the effects of logging activities on aquatic habitats. However, there are significant differences in climate, hydrology, geology, vegetation and aquatic species between coastal and interior watersheds that could affect the functional relationships between forestry and fisheries and their responses to logging disturbances. This uncertainty about the applicability of coastal forest management practices to interior forests was one of the primary driving forces behind the creation of the STFFIP.

The STFFIP was sited in the Stuart-Takla drainage in the northernmost watersheds of the Fraser River basin. Initially, four streams and their watersheds along Takla Lake and the Middle River were selected for the study (Bivouac, Forfar, Gluskie and O'Ne-ell creeks) because of their proximity to each other and similar physiographic characteristics. Later, Van Decar and Baptiste creeks and their watersheds were added to meet specific research objectives. For example, the Baptiste Creek upper watershed is an important site where studies of riparian management on small headwater streams are being conducted.

The Stuart-Takla streams are also the spawning grounds of the Early Stuart sockeye salmon (*Oncorhynchus nerka*), the earliest and longest migrating sockeye run in the Fraser River system. They are of great economic and cultural importance to the First Nations of the Fraser River and they are an important early sockeye run harvested by commercial ocean fisheries. The Stuart-Takla drainages were also areas of active forest development and harvesting, and there were concerns about the impacts of logging activities on these important sockeye salmon stocks. The STFFIP study site was thus an ideal location to improve our knowledge of the interactions between forestry and fish in BC interior watersheds.

From its inception, the STFFIP was designed to be a long-term, multidisciplinary study of the effects of current forest harvesting practices on the ecology of interior BC salmon and stream ecosystems. The site selection criteria, experimental and harvesting design, and the various research projects and project leaders of the STFFIP in the first 6 years of the project are described in detail by Macdonald and Herunter (1998). Two of the watersheds would be subject to forest harvesting (Gluskie and O'Ne-ell) and Forfar would remain an unharvested control for

[5] MacIssac, E.A. 2003. An overview of the Stuart-Takla Fish-Forestry Interaction Project. Pp. 1-5 in: MacIsaac, E.A. (ed.). 2003. Forestry impacts on fish habitat in the northern interior of British Columbia: A compendium of research from the Stuart-Takla Fish-Forestry Interaction Study. Can. Tech. Rep. Fish. Aquat. Sci. 2509: v + 266p

[6] MacIsaac, E.A. (ed.). 2003. Forestry impacts on fish habitat in the northern interior of British Columbia: A compendium of research from the Stuart-Takla Fish-Forestry Interaction Study. Can. Tech. Rep. Fish. Aquat. Sci. 2509: v + 266p

[7] Fisheries and Oceans Canada, Co-operative Resource Management Institute, School of Resource and Environmental Management, 8888 University Drive, Simon Fraser University, Burnaby, BC V5A1S6

the duration of the project. The early years of the project were devoted to collecting baseline and pre-harvest data on the salmon, creeks and watersheds and studying natural physical, chemical and biological processes thought to be sensitive to forest harvesting effects. The STFFIP was designed to use spatial and temporal controls to separate forest harvesting effects from natural variations. These components of the study design and the early data collected are discussed in the proceedings of two workshops held early in the life of the project (Bernard et al 1994, Macdonald 1994).

To satisfy its multidisciplinary design, the STFFIP involved numerous researchers from various organizations including the Canadian Department of Fisheries and Oceans (DFO), BC Ministry of Forests, BC Ministry of Environment, Land and Parks, Environment Canada, Canadian Wildlife Service, University of North British Columbia, University of British Columbia and Simon Fraser University (Macdonald and Herunter 1998). DFO was the lead agency and Dr. Steve Macdonald provided overall liaison and coordination from the beginning of the project. DFO also provided field logistical support for many of the other researchers including some of the routine field sampling. The DFO Middle River camp, established and operated by Stock Assessment staff of DFO for the enumeration of Early and Late Stuart sockeye salmon escapements, was an important base of operations for many of the research activities that otherwise would have been difficult to complete in such a remote area of BC. DFO also established and maintained stream gauging stations on all of the main creeks and operated a weather station at the DFO camp.

The early involvement and collaboration of a forest industry partner was required for the success of the project to ensure harvesting and other forestry activities met the experimental designs and schedules of the investigators while reflecting current harvesting methods and forest management practices. Canadian Forest Products Limited (CanFor) was the forest licensee for the study watersheds and shared their harvesting plans and schedules, modifying them as required to meet specific research objectives. CanFor also provided invaluable project signage on the study streams, maps and geographic data, winter and summer road maintenance, and logistical support for field tours.

The early involvement of the local First Nations bands in the STFFIP was also an important element of the project. The study watersheds are part of the traditional territories of the Tl'azt'en Nation. Tl'azt'en band members, as well as members from other First Nations bands of the Carrier Sekani Tribal Council, were involved in many areas of the research. Many were employed in the DFO Stock Assessment enumeration programs for the Early Stuart sockeye salmon escapements and fry emigration on the study streams, projects which could not have been completed without their involvement. Thomas Alexis, a Tl'azt'en fisheries intern, was a full member of the DFO research team that provided field sampling and baseline data collection for many of the research projects.

This compendium provides a sampling of some of the STFFIP research based on papers given at a STFFIP workshop in Vancouver in 2000. Some projects are completed or ongoing while others are in the early stages of development. Not all research projects and types of data collected are described in this volume because the data hasn't been completely collected or analyzed or because publication in this compendium might jeopardize their ability to publish the data in a primary scientific journal. This compendium should only be considered a starting point for any future collations of the research conducted in the STFFIP. It is divided into three parts:

(1) **Watershed, Stream Habitat and Salmon Studies**: papers describing some of the hydrologic, salmon and stream productivity research from the study watersheds and main-stem STFFIP creeks and watersheds

(2) **Sediment and Bedload Studies**: papers describing research into the physical stream bed and sediment characteristics of the main-stem creeks

(3) **Small Stream Studies**: papers describing research conducted on small fish-bearing and headwater streams in the STFFIP watersheds

Ultimately, the majority of the research conducted by the various investigators involved in the STFFIP is destined for publication in the primary and secondary scientific literature and readers are encouraged to search in the future for other publications by the authors in this volume. For example, some of the early research has been published in the proceedings of the Forest-Fish Conference: Land Management Practices Affecting Aquatic Ecosystems sponsored by the Canadian Forest Service in Calgary, Alberta in 1996. Macdonald and Herunter (1998) describe the design of the STFFIP while Heinonen (1998) and Beaudry (1998) discuss early results from hydrology and suspended sediment studies conducted in the watersheds. Petticrew (1998) looked at fine-grained sediment storage in the sockeye spawning streams while Gottesfeld and Mitchell (1998) illustrated bedload transport by sockeye redd digging and flood events. Scrivener and Macdonald (1998) discussed the intricate relationships between stream gravels, bedload movement, beavers and spawning salmon in the STFFIP streams. Cope and Macdonald (1998) looked at the intragravel environments for incubating salmon eggs and Macdonald et al (1998) described the impacts of changing stream temperatures on salmon incubation habitats. Tschaplinski (1998) described the distribution and habitat preferences of adult spawning sockeye salmon in the STFFIP streams while Hogan et al (1998) gave preliminary results from their channel morphology studies.

At this time, there has been limited forest harvesting in the study watersheds but the STFFIP has already significantly improved our knowledge of the natural processes that make interior watersheds and aquatic ecosystems different from coastal systems. STFFIP is also one of the first studies to begin looking at variable-retention riparian management on headwater streams in the upper Baptiste and Gluskie watersheds. Small streams receive little riparian buffer protection under the current BC Forest Practices Code and relatively little is known about the ecological roles of headwater streams in BC. Although the science is of penultimate importance, one of the great legacies of the STFFIP is the determination and effort of a diverse group of researchers and resource managers from university, industry, government agencies and the private sector to collaborate and address important resource management issues that affect all BC stakeholders.

REFERENCES

Beaudry, P.G. 1998. Suspended sediment regimes of three experimental watersheds in the Takla area of north-central British Columbia. *In* M. Brewin and D. Monita, (ed.) Forest-Fish Conference: land management practices affecting aquatic ecosystems. Nat. Resour. Can., Can. For. Serv., Information Report NOR-X-356. pp. 231-240.

Bernard, D.P., C.L. Murray, J.D. Lousier, J.S. Macdonald, N.T. Johnston and D.L. Hogan. 1994. Stuart-Takla Fisheries/Forestry Interaction Project: research design workshop. Prov. B.C. Fish. Tech. Circ. No. 96: 58p.

Cope, R.S. and J.S. Macdonald. 1998. Responses of sockeye salmon (*Oncorhynchus nerka*) embryos to intragravel incubation environments in selected streams within the Stuart-Takla watershed. *In* M. Brewin and D. Monita, (ed.) Forest-Fish Conference: land management practices affecting aquatic ecosystems. Nat. Resour. Can., Can. For. Serv., Information. Report NOR-X-356. pp. 283-294.

Gottesfeld, A. and S.J. Mitchell. 1998. Bedload transport during sockeye redd excavation and by floods in the Stuart-Takla experimental watershed, British Columbia. *In* M. Brewin and D. Monita, (ed.) Forest-Fish Conference: land management practices affecting aquatic ecosystems. Nat. Resour. Can., Can. For. Serv., Information. Report NOR-X-356. pp 249-258.

Hartman, G.F. and J.C. Scrivener. 1990. Impacts of forestry practices on a coastal stream ecosystem, Carnation Creek, British Columbia. Can. Bull. Fish. Aquat. Sci. 223: 148p.

Heinonen, J. 1998. Description of selected hydrology and geomorphology studies in the Stuart-Takla experimental watersheds. *In* M. Brewin and D. Monita, (ed.) Forest-Fish Conference: land management practices affecting aquatic ecosystems. Nat. Resour. Can., Can. For. Serv., Information. Report NOR-X-356. pp. 227-230.

Hogan, D., A. Cheong and J. Hilger. 1998. Channel morphology of small central interior streams: Preliminary results from the Stuart-Takla Fish/Forestry Interaction Program. *In* M. Brewin and D. Monita, (ed.) Forest-Fish Conference: land management practices affecting aquatic ecosystems. Nat. Resour. Can., Can. For. Serv., Information. Report NOR-X-356. pp. 455-470.

Macdonald, J. (ed.). 1994. Proceedings of the Takla Fishery/Forestry Workshop: a two year review. April 1, 1993, Prince George, B.C. Dept. of Fisheries and Oceans, West Vancouver, B.C. Can. Tech. Rep. Fish. Aquati. Sci. 2007: 104p.

Macdonald, J.S., J.C. Scrivener, and G. Smith. 1992. The Stuart-Takla Fisheries/Forestry Interaction Project: study description and design. Can. Tech. Rep. Fish. Aquat. Sci. 1899: 39p.

Macdonald, J. and H. Herunter. 1998. The Takla Fishery/Forestry Interaction Project: study area and project design. *In* M. Brewin and D. Monita, (ed.) Forest-Fish Conference: land management practices affecting aquatic ecosystems. Nat. Resour. Can., Can. For. Serv., Information. Report NOR-X-356. pp. 203-208.

Macdonald, J., J. Scrivener, D. Patterson, A. Dixon-Warren. 1998. Temperatures in aquatic habitats: the impacts of forest harvesting and the biological consequences to sockeye salmon incubation habitats in the interior of B.C. *In* M. Brewin and D. Monita, (ed.) Forest-Fish Conference: land management practices affecting aquatic ecosystems. Nat. Resour. Can., Can. For. Serv., Information. Report NOR-X-356. pp. 313-324.

Naiman, R.J., R.E. Bilby, and P.A. Bisson. 2000. Riparian ecology and management in the Pacific Coastal rain forest. BioScience 50(11): pp. 996–1011.

Petticrew, E.L. 1998. Influence of aggregation on storage of fine-grained sediments in salmon-bearing streams. *In* M. Brewin and D. Monita, (ed.) Forest-Fish Conference: land management practices affecting aquatic ecosystems. Nat. Resour. Can., Can. For. Serv., Information. Report NOR-X-356. pp. 241-248.

Poulin, V.A. 1984. A research approach to solving Fish/Forestry interactions in relation to mass wasting on the Queen Charlotte Islands. B.C. Ministry of Forests and Lands, Victoria, B.C., Land Manag. Rep. 27: 16p.

Scrivener, J.C. and J.S. Macdonald. 1998. Interrelationships of streambed gravel, bedload transport, beaver activity and spawning sockeye salmon in Stuart-Takla tributaries, British Columbia, and possible impacts from forest harvesting. *In* M. Brewin and D. Monita, (ed.) Forest-Fish Conference: land management practices affecting aquatic ecosystems. Nat. Resour. Can., Can. For. Serv., Information. Report NOR-X-356. pp. 267-282.

Tschaplinski, P.J. 1998. The abundance, distribution, and habitat preferences of adult sockeye salmon in streams tributary to Takla Lake and the Middle River of British Columbia. *In* M. Brewin and D. Monita, (ed.) Forest-Fish Conference: land management practices affecting aquatic ecosystems. Nat. Resour. Can., Can. For. Serv., Information. Report NOR-X-356. pp.

APPENDIX 2. GOALS/OBJECTIVES OF THE THINK-TANK

The overall goals of the think-tank are two-fold:

(1) to develop a long-term research strategy to address the knowledge needs related to the recovery and management of the Pacific salmon species, especially sockeye and coho, which spawn in interior streams; and
(2) to develop a strategy for the formation of an interior fisheries research centre.

For Goal #1, the long-term research strategy, the specific objectives of the think-tank session are to:

- identify the key issues and knowledge needs;
- identify the potential research partners;
- identify the potential supporting partners;
- identify the potential funding sources; and
- define the highest priority research topics.

From this information, we can:

- develop a five-year research action plan (including a research schedule), renewable after two years;
- develop a five-year knowledge transfer plan, renewable after two years; and
- develop a logic model for the research and extension activities, with expected short-, medium- and long-term outcomes.

For Goal #2, the strategy for an inland fisheries research centre, the specific objectives of the think-tank session are to:

- identify the key goals and objectives of an inland fisheries research centre;
- identify the resources required to facilitate addressing of each goal and objective;
- identify the potential collaborating partners and their roles; and
- identify the potential funding partners (endowments, grants, etc.).

From this information, we can:

- develop a strategy for the preparation of funding proposals;
- assign tasks and responsibilities to each of the collaborating partners;
- develop an action plan for the preparation of the funding proposals; and
- prepare, review and submit the proposals.