RIVERS AND SMITH INLETS
SALMON ECOSYSTEM
RECOVERY PLAN

Prepared for
Pacific Salmon Endowment Fund Society

By

The Rivers and Smith Inlets
Salmon Ecosystem Planning Society

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Rivers and Smith Inlet Ecosystem Recovery Plan 2003

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EXECUTIVE SUMMARY

Since 1992, the salmon populations in Rivers and Smith Inlets have experienced dramatic declines. The major sockeye populations dropped to less than 5% of spawner targets, with many individual populations much lower. Despite closure of commercial fisheries, sockeye populations have yet to recover. Nothing definite is known about the causes of the declines. Only a few salmon populations and their freshwater habitat have been regularly monitored. The marine habitat had not been monitored until the last few years. Also, there is limited information on the impacts on populations of other species within the salmon ecosystem, including bears, eagles, and other fish. The collapse of salmon production has also heavily impacted people and communities dependent on local fisheries resources and resulted in economic and socio-cultural hardship.

The situation is dire and requires a bold, new initiative to restore the salmon populations and their ecosystems to their full sustainable production. The initiative is the Rivers and Smith Recovery Planning process, which has resulted in the production of the Rivers and Smith Inlets Recovery Plan. The long-term objective of activities associated with the Recovery Plan is ***to re-establish numbers and production equivalent to best estimates of long-term capacity and historic levels. In so doing we further aim to maximize the net sustainable biological, economic and social benefits from Rivers and Smith Inlet fish, ecosystem and people resources.***

This plan sets the course for finding new ways to restore populations, manage fisheries, involve local and other interests, and contribute to sustaining local communities and others with a long term interest in the resource.

Clearly, first priority is to protect fish and their ecosystem and to restore them to safe levels of abundance. This plan goes beyond that to rebuild populations to their full productive capacity. Once local salmon stocks have recovered to historic levels, a priority will be getting as much sustainable economic and social benefit from the salmon and their ecosystem as possible, while maintaining healthy stocks.

This plan has been developed by a multi-party team, which is now known as the Rivers and Smith Inlet Salmon Ecosystem Planning Society (RSSEPS). The team comprises two First Nations, two senior public governments, local governments, forest companies, environmental non-governmental organizations and members from sport and commercial fisheries. The Pacific Salmon Endowment Fund and the staff of the Pacific Salmon Foundation have provided additional support.

Our plan builds on the shared priority among all members for the goal of recovery and future stewardship for the salmon and their ecosystems. It also is consistent with DFO policy direction in "A New Direction For Canada's Pacific Salmon Fisheries" and "Canada's Ocean Strategy". An "integrated management through co-management" approach is proposed. The plan is meant to give all concerned parties a clear indication of where local fisheries policy should go in the future. The plan will serve as a framework for developing detailed 5 and 10-year plans as well as annual work plans.

1 INTRODUCTION

1.1 The Rivers and Smith Inlets Salmon Ecosystem Problem

The Rivers and Smith Inlets area, located on the Central Coast of British Columbia, has historically been a rich and diverse ecosystem. The resources of this productive vicinity have sustained the people of the Wuikinuxv and Gwa'sala-'Nakwaxda'xw Nations for thousands of years. More recently, the salmon and forestry resources have also provided for the people of British Columbia.

The watersheds, which empty into the Inlets of Rivers and Smith, comprise ideal habitat for several species of anadromous salmonids (including pink, chum, sockeye, chinook, coho, and steelhead), as well as several resident salmonids (including rainbow trout, cutthroat trout, kokanee, and dolly varden). These habitats were responsible for the great abundances of salmon present earlier in the century. For example, the size of the sockeye runs was regularly over 2 million fish, second in size only to the mighty Fraser River runs. Chinook salmon were world famous for their tremendous size, and were sought by the sports angler in the latter half of the past century. The richness of the salmon resource in Rivers and Smith Inlets appeared inexhaustible. Unfortunately, recent experience has shown that this is not so.

Since 1992, the salmon populations in Rivers and Smith Inlets have experienced dramatic declines. The major sockeye populations dropped to less than 5% of spawner targets, with many individual populations much lower (DFO 2000b). Despite closure of commercial fisheries, sockeye populations have yet to recover. Nothing definite is known about the causes of the declines. Only a few salmon populations and their freshwater habitat have been regularly monitored. The marine habitat had not been monitored until the last few years. Also, there is limited information on the impacts to populations of species in the salmon ecosystem, including bears, eagles and other salmon predator and prey species. The collapse of salmon stocks has also heavily impacted people and communities dependent on local fisheries resources, and has resulted in economic and socio-cultural hardship.

In an effort to halt the decline of the salmon stocks, and to commence with the rebuilding of these stocks, the "community" of Rivers and Smith Inlets has developed a comprehensive recovery plan. The development of this plan is the first step toward the recovery of the salmon ecosystem within Rivers and Smith Inlets. This plan is aimed at setting a course for nothing less than the return of sockeye, other salmon and the ecosystems of which they are such a key part, to full health. It is a plan produced by a multi-party table of organizations and individuals[1] (for convenience known as the RSSEPS). The plan will be a living document, and will serve as the blueprint for all the activities aimed at "Recovery" of the Rivers and Smith Inlets Ecosystem.

[1] The group was named the Rivers and Smith Planning Group (RSPG) from its inception in August 2000 to quite recently when it was officially registered as a society under the BC Societies Act, as the Rivers and Smith Salmon Ecosystem Planning Society (RSSEPS).

1.2 Purpose of the Recovery Plan

The primary purpose of a recovery plan is to identify and set priorities for activities required to achieve the recovery goals for the specific area, its fish stocks and dependent ecosystem. Consequently, the recovery plan must focus on what is good for the fish, and the plan must be permitted to evolve as new information is collected. Sections 2, 3 and 4 of this recovery plan summarize the available information on the selected stocks, watersheds and ocean habitat. Sections 5 and 6 are a synthesis of this information and identify information gaps and the potential for recovery. Section 7 identifies realistic goals and priority activities required to achieve the recovery goals. Specific goals, strategies and recovery activities regarding habitat, stock use, land use and fresh and ocean water use will focus on what is good for the fish while taking into consideration competing uses within the ecosystem. Section 8 provides the framework for monitoring and assessing the effectiveness of the overall recovery plan, specific recovery projects/activities and the processes used to implement the recovery plan. Section 9 defines the priorities and implementation schedule for each set of activities. Section 10 contains a list of projects and approximate funding requirements.

1.3 Watershed Selection Criteria, Rationale for Species, and Geographic Focus

It has already been stated that the overall objective of the RSSEPS is ecosystem-wide in breadth – no species is disregarded, and no component of the very extensive range of Rivers and Smith salmon is outside concern. Because this plan must be strategic, however, we must begin by identifying measures that are feasible. Thus, while part of the plan is to be constantly expanding knowledge of all components of the "salmon ecosystem", the initiatives to be undertaken are more narrowly concerned with the activities that can be performed in the next several years under optimistic funding assumptions.

The partners involved in the RSSEPS, including Fisheries and Oceans Canada (DFO) have identified many of the once highly productive salmon stocks in the Rivers and Smith Inlet area as at-risk, and in immediate need of restoration. The watersheds in this region are relatively large systems, with many salmonid populations that appear to have been impacted by common factors. In the past, these watersheds supported the second largest sockeye catch in BC for many years. They also support a world famous fishery for trophy sized chinook salmon, and a valuable sport fishery for coho. The other salmon species are lower profile but make an important biological, economic and social contribution to the area and are key parts of the ecosystem. The initial focus will be on restoring Owikeno and Long Lake sockeye, the salmon species considered most at risk of extirpation.

1.4 Guiding Principles for Recovery Planning

The RSSEPS has reviewed the principles that guide other groups and organizations in recovery planning and has adopted its own specific approach and guidelines for this initiative. The RSSEPS drew on the National Marine Fisheries Service (NMFS 1996), Pacific Salmon Endowment Fund (PSEF 2001), DFO Wild Salmon Policy (DFO 2000a) and other directives on conservation and recovery planning to identify the following guidelines for recovery planning. Based on the review of other approaches, but, equally, based on the shared values and understandings of its membership, the RSSEPS has adopted the following 5 principles for recovery planning:

1. ***Conservation of fish stocks, their habitat and ecosystem integrity to sustain productivity will take precedence in managing the resource.***

2. ***Recovery is to include the entire ecosystem and all its evolutionarily important components. All species, stocks and populations are valued.***

3. ***Benefits and costs will be defined in the broadest sense, including social and ecological valuations.***

4. ***Local people and interests must be involved in recovery initiatives.***

5. ***The maintenance and further development of collaboration among the many parties concerned with Rivers and Smith, is essential to recovery and future stewardship.***

1.5 Recovery Planning

The PSEF approach to recovery planning is similar to Stage II of the Watershed-Based Fish Sustainability Planning Guidelines (WFSP draft 2000). In Stage II of the WFSP, a watershed profile is developed which describes the current conditions of the watershed and fish stocks. Objectives, targets and strategies are then developed to guide recovery. Finally, a monitoring and assessment framework is established. Throughout the process public involvement is integrated into the planning. This recovery plan for the Rivers and Smith Inlets area includes each of these components, but extends beyond the watersheds to include the coastal and ocean range of all salmon species.

1.6 Community and Multi-Party Engagement in Recovery Planning

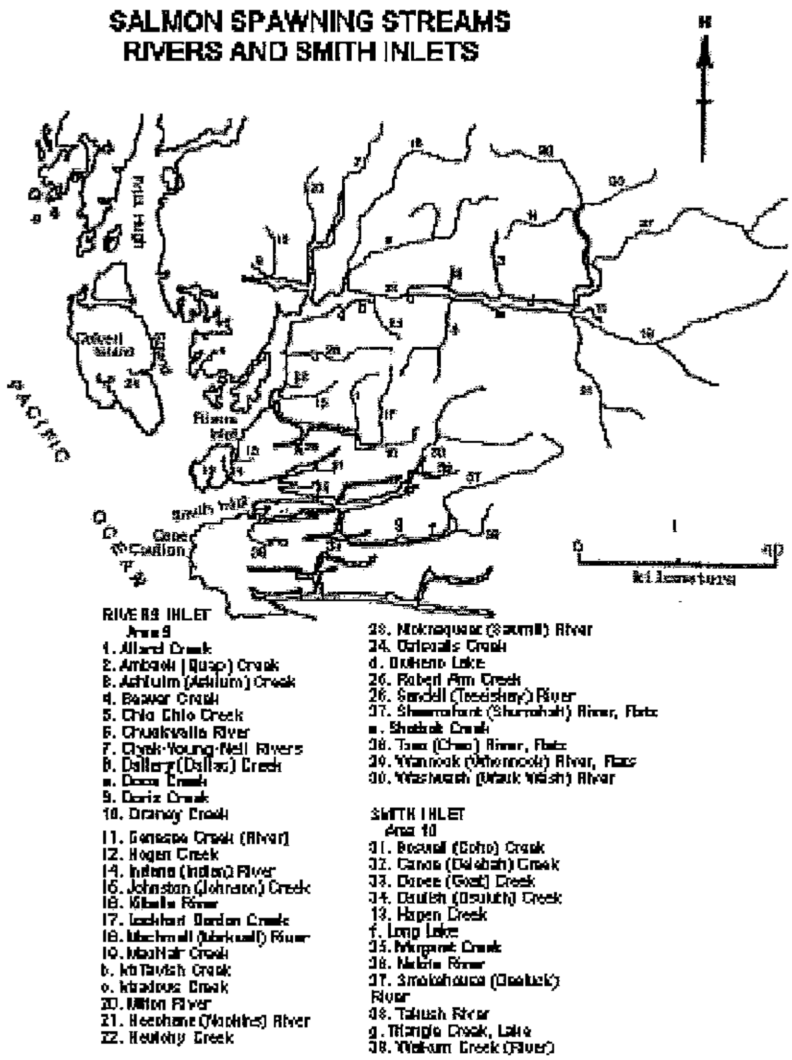
The RSSEPS arose from the consolidation and integration of the work of many parties. The First Nations, in whose territories the salmon originate, played a leading role in convening all of the parties in the midst of the precipitously low returns of the late 1990s. Fisheries and Oceans Canada strongly encouraged the concept of a table where all those with responsibilities, concerns and interests could cooperate. From an earlier and more limited Fisheries Renewal BC group, the RSSEPS evolved to comprise those First

Nations, federal officials, local governments, forest tenure holders, environmental non-government organizations, sport and commercial fisheries interests. Numerous group meetings have been held in the development of the background to and the contents of this plan. This mechanism has worked well especially in light of the very dispersed location of the various parties. Appendix 1 details the evolving membership.

2 STOCK PROFILES

Rivers and Smith Inlets are located between Calvert Island to the north, and Cape Caution to the south, as illustrated in Figure 1. Owikeno Lake and Long Lake encompass an estimated 96 km^2 and 21 km^2 respectively and are fed by numerous salmon-bearing tributaries (Shortreed et al. 2001).

Figure 1. Location of Salmon Streams in Rivers and Smith Inlets.



2.1 Fish Population Status and Trends

The Rivers and Smith Inlet watersheds provide spawning and early juvenile rearing habitat for significant populations of salmon. Numerically, sockeye are the dominant species followed by pink, chum, coho, chinook and steelhead. The DFO (2000) draft sockeye recovery plan describes the sockeye populations, life history and research findings. Information on chinook and coho in the area is in Pacific Fisheries Resource Conservation Council (PFRCC) 2001. The other species are described in the Rutherford and Wood (2000) and Pacific Region Salmon Stock Management Plan for Rivers and Smith Inlets DFO (1986). Information on spawning for each population is described in Thompson et al (1987).

Appendix 2 lists the spawner counts for 2001 by stream and species (more recent spawner counts will be added on an annual basis as they become available – see the society website for updates). These counts provide an indication of current spawner abundance versus the target abundance, and demonstrate how many populations were formally monitored:

- 8 of 15 sockeye populations;
- 1 of 29 coho populations;
- 3 of 21 pink populations;
- 4 of 20 chum populations;
- 9 of 13 chinook populations;
- 0 of 7 steelhead populations.

The spawner counts for each population in the area are available on the DFO website.

2.1.1 Adult Abundance

Sockeye

There are two main components of adult abundance – escapement and catch. Once the second largest sockeye run (Rivers and Smith Inlets combined) in the province, escapements in recent years have declined precipitously, with less that 10,000 adults returning to both systems in recent years. In the two most recent years (2002 and 2003), stocks appear to have rebounded somewhat, according to escapement estimates generated via the Docee River enumeration fence in the Long

Figure 2. Rivers Inlet Sockeye Catch and Escapement

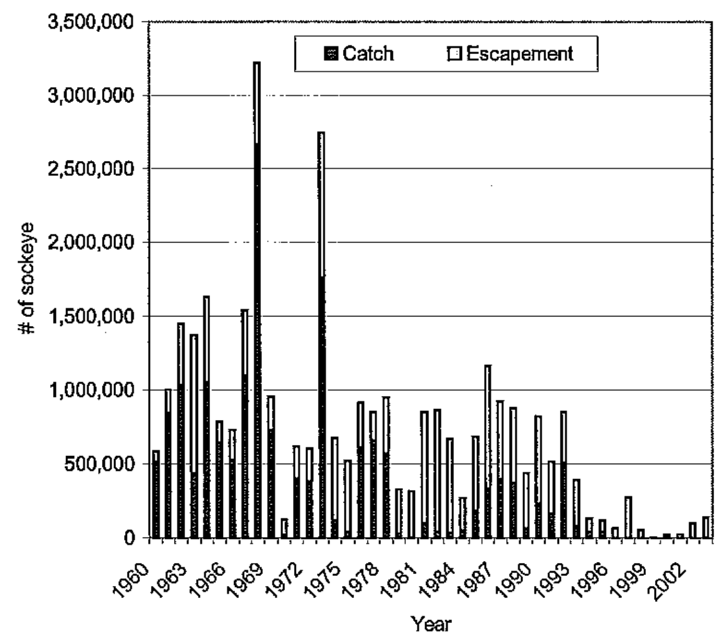
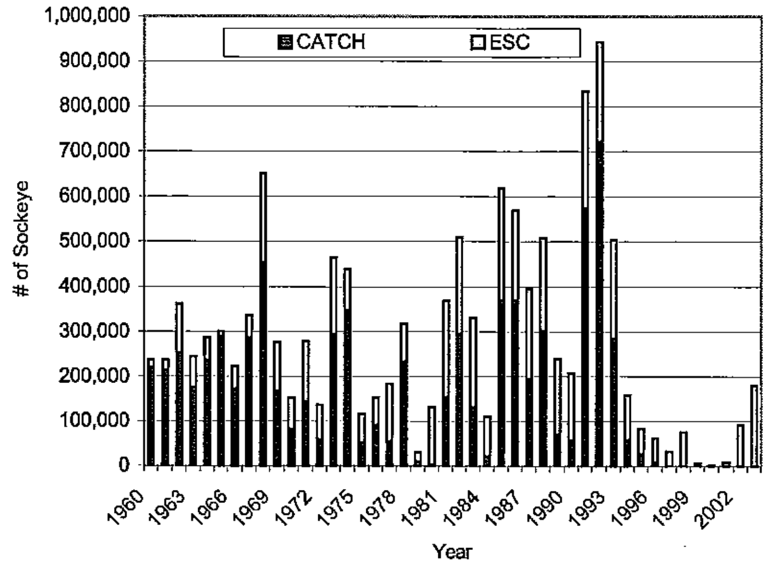


Figure 3. Smith Inlet Sockeye Catch and Escapement

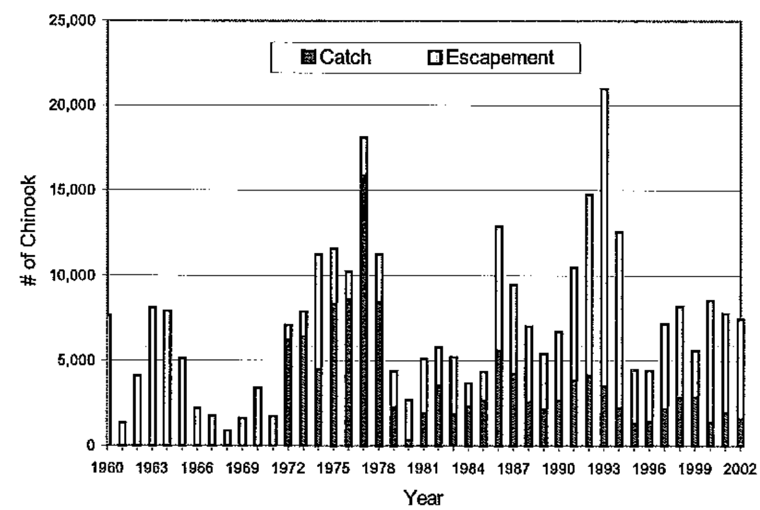


Lake watershed, and the stream assessment program in the Owikeno Lake watershed. The Docee fence has allowed for reliable escapement estimates for sockeye stocks originating in Long Lake, but within the Owikeno watershed, the escapement estimates are unreliable as the clear streams are used as an index for the glacial-fed tributaries. An experimental hydroacoustic program on the Wannock River has completed the second year of testing and has not been used to generate escapement estimates to date. Currently, the known stocks of concern include all populations originating from the Owikeno Basin in Rivers Inlet and Long Lake Basin in Smith Inlet.

Historic catch records of sockeye in Rivers and Smith Inlets were pooled and averaged 1.2 million per year from 1900 to 1974. Figures 2 and 3 show sockeye catch and escapement for Rivers and Smith Inlets. From about 1975, Smith Inlet catch increased and Rivers Inlet and total catch declined, then both collapsed in the 1990s. The Rivers Inlet commercial fishery has been closed since 1996. The fishery in Smith Inlet has been closed since 1996.

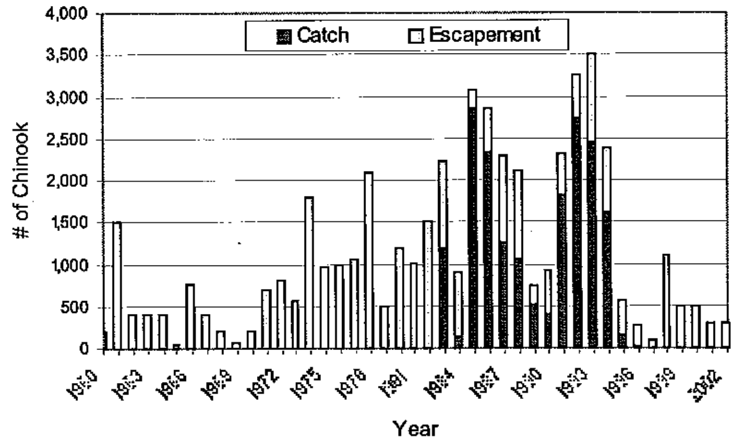
Chinook

Figure 4. Rivers Inlet Chinook Catch and Escapement



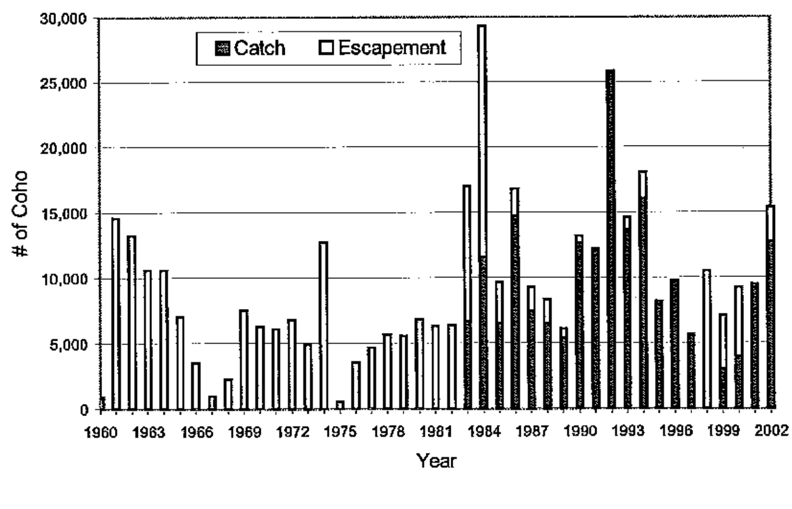
In Rivers Inlet chinook escapements are derived from a combination of stream walks in the Owikeno watershed, aerial surveys for the Chuckwalla/Kilbella Rivers, and carcass recovery in the Wannock River estuary. In Smith Inlet, chinook escapement estimates are generated from the Docee fence counts. There is difficulty in obtaining accurate escapement estimates for chinook in both inlet systems, since all streams are not enumerated, and access is extremely difficult. The intensity and coverage of chinook spawner counts decreased in the 1990s but have recently been increased. There are 11 chinook spawning streams in Rivers Inlet and 2 in Smith Inlet. The largest spawning populations are in the Wannock, Chuckwalla and Kilbella Rivers in Rivers Inlet, and the Docee River in Smith Inlet. (See Appendix 2 for a list of spawning streams for each species). Best estimates suggest that chinook populations in both inlet systems are below historic levels (Figures 4 and 5). Currently, the known stocks of concern include Wannock River chinook within Rivers Inlet and the Docee/Long Lake chinook in Smith Inlet.

Figure 5. Smith Inlet Chinook Catch and Escapement



The complexity of many chinook stocks being harvested together in the Rivers and Smith Inlet area makes it difficult to estimate the catch of local chinook. Despite the difficulty in obtaining precise catch estimates, it is apparent that both commercial and sport harvesting has had an impact on escapements, particularly in Rivers Inlet, where the sport fishery is much more active than in Smith Inlet. The commercial fishery, prior to the complete closure in the mid 1990s, was estimated to harvest as many as 10,000 chinook annually from Rivers and Smith Inlet waters (S MacLaurin pers. comm.). While some of these fish were undoubtedly from other watersheds, many must have originated from Rivers and Smith watersheds.

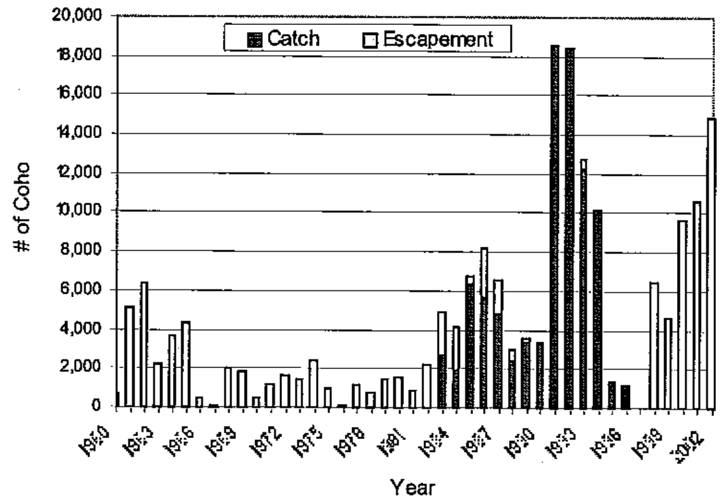
Figure 6. Rivers Inlet Coho Catch and Escapement



Coho

Coho catch and escapement estimates are presented in Figures 6 and 7. They are not a complete count of spawners in any stream or of all spawning streams. For example, in Smith Inlet, coho were not enumerated at the Docee fence until 1998 (prior to 1998, coho

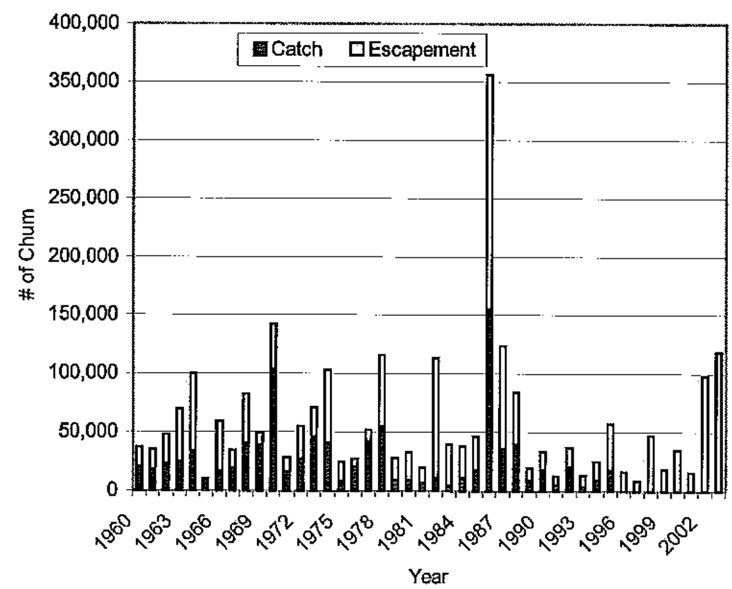
Figure 7. Smith Inlet Coho Catch and Escapement



escapement was determined using the incidence rate in the Smith Inlet gillnet fishery). Since then, the fence count has been the only estimate of coho in the area (other than the recent initiatives in the Nekite watershed by the Gwa'sala-'Nakwaxda'xw Band), and has been 3 to 5 times previous estimates. There are seven known coho systems in Smith Inlet, the largest of which are the Nekite and Smokehouse Rivers. The escapements of coho through the Docee Fence in 2003 were the largest in recent history (over 23,000 pieces). High escapements from the Nekite River in 2003 were also reported (Patricia Sewid pers. comm.). Given the absence of reliable abundance indicators, coho stocks of concern cannot be identified at this time.

In Rivers Inlet, coho spawn in more than 23 streams, but few have been monitored in the last decade. DFO did look at aerial enumeration in 2002 and 2003 but the streams are turbid during the coho spawning period, making counting difficult. The largest recorded coho populations have been in the Sheemahant, Wannock, Chuckwalla, and Kilbella Rivers, and in Johnston Creek. Recent escapement estimates are unavailable.

Figure 8. Rivers Inlet Chum Catch and Escapement



Prior to the complete closure of commercial salmon fisheries in the area in 1996-97, coho were heavily impacted through commercial fisheries. Sport fishing has also had an impact, although reduced in recent years as a result of closures.

Chum

The total production for chum is difficult to determine because of unaccounted interceptions in ocean fisheries and limited escapement information. Recently, fewer spawner populations have been enumerated than from the 1950s to 1980s. Of 16 chum streams in Rivers Inlet, the Wannock, Clyak-Young-Neil, Draney and Lockhart-Gordon systems are the largest. The Nekite River is the largest of the 3 main chum streams in Smith Inlet. Currently, the known stocks of concern include those from the Wannock River in Rivers Inlet and Nekite River in Smith Inlet.

Chum salmon populations in the area tend to be relatively small with catches from 1984 to 1993 averaging about 540,000 pieces. Catch and escapement in each area are summarized in Figures 8 and 9.

Pink

There are 18 streams with pink spawner targets in Rivers Inlet. The largest populations are in Chuckwalla, Clyak-Young-Neil, Johnston, and Kilbella / Chuckwalla systems. In Smith Inlet 3 streams have pink targets, but only the Nekite River has a significant population. Given the absence of reliable abundance indicators, pink stocks of concern cannot be identified at this time.

Figure 9. Smith Inlet Chum Catch and Escapement

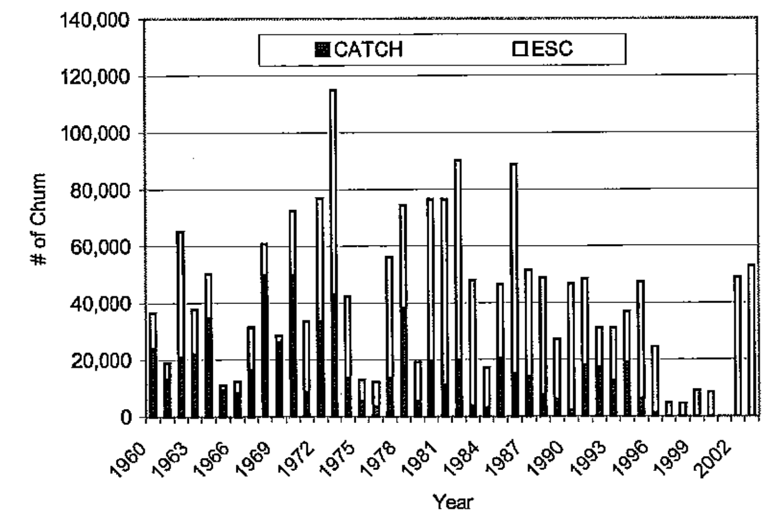


Figure 10. Rivers Inlet Pink Catch and Escapement

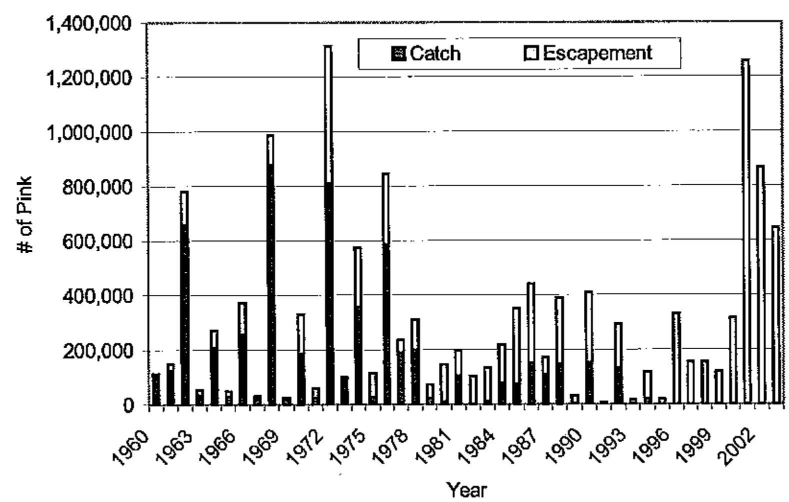
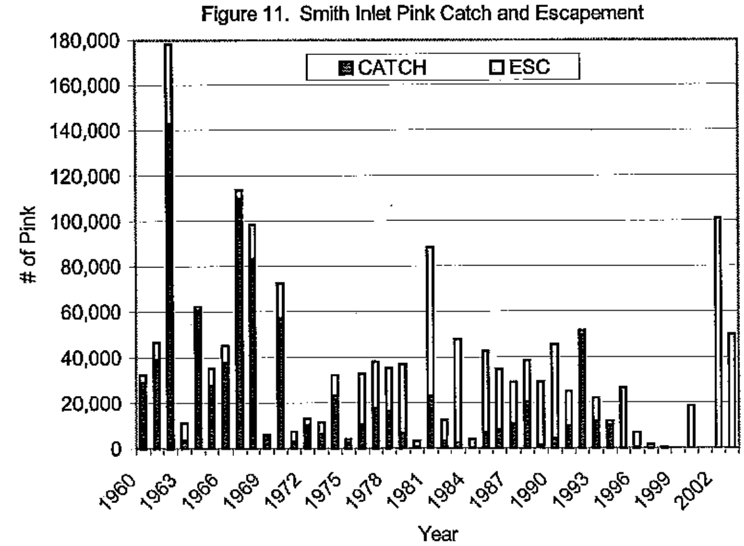


Figure 11. Smith Inlet Pink Catch and Escapement



Pink salmon populations in the area tend to be relatively small with catches from 1984 to 1993 averaging about 150,000. Catch and escapement in each area are summarized in Figures 10 and 11 with yearly counts shown. It should be noted that these populations see a majority of their stock return on even years.

Steelhead
In the 1950s and 1960s, commercial fisheries annually harvested an average of 2,000 steelhead in the area as bycatch during other salmon fisheries. The reported catch decreased with changes in the fishery. Reported steelhead catch has been insignificant in the 1990s. Little is known about current population levels in the steelhead bearing systems in Rivers and Smith Inlets.

2.1.2 Juvenile Abundance

McKinnell et al. (2001) describe the two-boat trawl sampling program used in Owikeno Lake from 1960 to 1978, and 1995 to the present to monitor juvenile sockeye. Sampling was conducted in spring, summer and fall except for 1995-1997 when only the summer sampling was conducted. This sampling provides a measure of juvenile abundance, size and distribution. Juvenile sockeye abundance has been indexed in Long Lake by hydroacoustic sampling since 1977 (Shortreed et al. 2001).

Juvenile salmonid abundance has been monitored sporadically in the Wannock, Chuckwalla-Kilbella, Marble, Milton Rivers, and Max, Johnstone and Genesee Creeks, and Owikeno Lake using various methods (Mortimer 2000). Instream sampling has also been conducted, but not on a continuing basis. Downstream trapping for juvenile sockeye has recently been attempted at the outlet of Long Lake in Smith Inlet.

One time sampling of stream rearing species has been conducted in a number of the streams in the watersheds, especially those that are planned for forest harvesting activities. There has been no juvenile abundance sampling of chum and pink salmon. Also, redd sampling has been irregularly conducted in a number of areas.

2.1.3 Survivals

Freshwater survival is defined as the proportion of eggs that survive to smolts; marine survival is defined as the proportion of smolts that survive to adults that return to coastal waters. The ratio of total returns (catch plus escapement) to numbers of spawners in the parent generation provides a general indication of total fecundity and survival.

Sockeye
For Owikeno Lake sockeye salmon, McKinnell et al. (2001) constructed an index of smolt abundance from a variety of sources including results from pre-smolt lake surveys where available. Finding no evidence of a clear decline in this index over time, they concluded that the collapse of this fish population could not readily be explained by deterioration in the freshwater ecosystem. By contrast, the ratio of adult returns to the index of smolt abundance showed significant evidence of a decline. Hence, the available

evidence indicates that the collapse was caused by a decline in marine survival. Similar evidence has been discovered for the sockeye populations within Long Lake in Smith Inlet (Hyatt et al. 2000).

There has been very limited scientific investigation into the marine phase of Owikeno and Long Lake sockeye salmon. Ware (2000) proposed a marine survival predictor for Long Lake sockeye that incorporated June sea surface salinity at McInnes Island lighthouse. Based on the work of Tanasichuk (2001), RSSEPS sponsored a project by Routledge et al. (2002 and 2003) to monitor the abundance of juvenile sockeye and their prey species in Rivers and Smith Inlet and adjacent coastal areas. It is anticipated that this could also eventually provide an index of marine survival. As these indices relate to local marine productivity, they may also apply for pink, chum, and possibly other species.

Estimates of catch, spawning escapement, and smolt abundance are key to providing indices of abundance. The RSSEPS believes that it is essential that these monitoring programs continue. In addition, DFO (2000b) describes weaknesses in both the spawner and the juvenile abundance indices. Further work is required to improve the underlying methodology.

Chinook
The only estimates of chinook smolt to adult survival are from coded wire tagged enhanced production. This provides a measure of the number harvested. These estimates are considered weak, however, due to a lack of reliable escapement estimates and difficulty in sampling for marked fish in the spawning populations.

Other species
There are no direct measures of freshwater or marine survival of other species in the area.

2.1.4 Enhancement and Restoration History

Salmon enhancement and habitat restoration have been employed in Rivers and Smith Inlet to achieve one or more of the following goals: augment salmon production for economic benefit, release marked groups of salmon for assessment purposes, re-build depressed stocks, experiment with enhancement technique, build community capacity, restore primary productivity. The type of intervention has ranged from lake fertilization to hatchery production. While numerous enhancement activities have taken place in the region over the years, only the major enhancement efforts are discussed here and detailed in Appendix 3.

Rivers Inlet Enhancement
The major enhancement activities (both level of effort and production) in Rivers Inlet have centered on Owikeno Basin sockeye, Wannock River chinook and Kilbella/Chuckwalla River chinook. There has been very limited enhancement of coho, chum and other chinook stocks and no enhancement at all of pink salmon.

Sockeye
Sockeye enhancement employed in Owikeno Basin has consisted of both hatchery and habitat projects.

From 1902 to 1937 a Dominion hatchery located on Owikeno Lake (one of several sockeye facilities in the province) produced millions of sockeye eggs/fry and several hundred thousand chinook annually. The focus of sockeye production was to experiment with intensive fish culture and feed an expanding commercial fishery. This facility, along with all other Dominion facilities, closed in 1937. Since assessment techniques were not well developed at the time, it is difficult to determine what impact the hatchery had on overall Owikeno Basin sockeye; whether it be in changes to genetic diversity, increases in production, or what contribution the enhancement effort made to the commercial fishery.

Enhancement of sockeye stocks was initiated again in 1999, when extremely low escapement numbers (after several years of general decline) raised concerns over the ability of the stocks to recover naturally, despite complete fishing closures being in place. The enhancement program was managed out of the Snootli Hatchery in Bella Coola, and was directed at brood years 2000 through 2004. The enhancement was seen as an emergency intervention technique, aimed at avoiding extirpation of local stocks. Eggs were taken from several stocks of concern within Owikeno Basin. Each stock was held in isolation within the Snootli Hatchery, and released to natal rivers in early May to coincide with wild fry migration to Owikeno Lake. The enhancement target was to obtain 500,000 fry. More details of the enhancement program can be obtained through Hilland 2002.

While the extent of the contribution of the enhanced fish to the natural stocks cannot be assessed until the fall of 2004 (with the returns of age 4 fish from brood year 2000), there are indications that enhanced fry have survived to the fall of the release year and to pre-smolt stage. Otolith analysis of pre-smolt sockeye captured during September 2001 and March 2002 lake trawls suggest that the incidence of marked brood 2000 juveniles was close to that predicted using SEP bio-standards (MacLaurin 2003).

Chinook
Wannock River chinook enhancement commenced in 1983, when the escapement estimate dipped below 500 fish, from an escapement target of 10,000 fish. Enhancement was to be employed not only as a means to re-build the stock, but also as a way of obtaining important information related to migration, timing, commercial interception and survival (via tagging studies). Production has ranged from 29,000 to 636,000 (mixture of fry and smolt releases) with the average during intensive culture (1985-1997) being 432,000. Production was reduced during the period 1998-2001 to 64,000, primarily due to insufficient funding. Enhancement continues today through private funding. The current production target is for release of 200,000 smolts. Marked fish have been released in all years except between the period 1994 and 1998. Marks are recovered in commercial and sport fisheries in tidal waters and through broodstock capture and carcass recovery programs in the Wannock River. While total survival and contribution calculations are not possible (no reliable escapement figure exists for

Wannock River chinook), there is data to indicate survival to the commercial/sport fishery (Appendix 3).

The Kilbella and Chuckwalla River(s) chinook enhancement program commenced in 1986 in response to several years of declining escapements (Appendix 3). The enhancement program was an initiative of the River's Inlet Hakai Pass Sportfishing Association. Enhancement continued until 2001, and release numbers (fry and smolt) ranged between 30,000 - 200,000 for the Chuckwalla River, and between 1000 - 220,000 for the Kilbella River. Fry and smolt releases from 1999-2001 also consisted of progeny from a captive brood program (progeny from broods 1994-1998 were reared to adult in saltwater netpens). A portion or all of the production were marked in most of these brood years. Marks are recovered in commercial and sport fisheries and in carcass recovery programs. While total survival and contribution calculations are not possible (no reliable escapement figure), there is data to indicate survival to the commercial and sport fisheries (See Figures 4 and 5). Enhancement of Kilbella and Chuckwalla chinook ended with the 2001 brood as escapement indexes for both systems had improved. It is hoped that these stocks will continue to re-build naturally.

Rivers Inlet Restoration

Three major habitat enhancement projects have been constructed within the Owikeno Basin. These projects were directed at protecting and / or improving spawning and incubating conditions for sockeye. Project 1 was built in the early 1980's, and consisted of a flow exclusion dyke that was constructed in an attempt to prohibit overflow from the Machmell River entering Genesee Creek. During periods of high water discharge, a distributary channel of the Machmell River would transport glacially turbid water into the clear water Genessee Creek. There was concern that the turbid water would dramatically increase silt deposition within reaches of Genessee Creek, resulting in reduced egg survival. The long-term benefit of the remediation effort has not been monitored in enough detail to determine the success of the project.

In 1973 and again in 1986, channel stabilization works were completed on the Washwash River to reduce braiding and improve spawning and egg incubating conditions (Project 2). While the restoration efforts appeared to provide an initial benefit, the condition of the riprap may be deteriorating, thus requiring further examination.

The most recent and largest habitat project (Project 3) in terms of size and budget is the Xausmdas Channel within the Machmell Watershed. Constructed in 2001, the channel was designed to create spawning and rearing habitat that would benefit sockeye and other salmonids. The channel has been used by adult and juvenile salmonids (Adaptive Resource Management 2003) though population data has not been obtained via the limited monitoring performed.

Additional smaller habitat restoration projects have been undertaken within the Owikeno Basin, and within other watersheds in River's Inlet. The majority of these projects have been attempts to re-establish access to off-channel habitat that had been impacted by road building and would mostly benefit coho, cutthroat and rainbow trout that rear for more extensive periods in fresh water.

Smith Inlet Enhancement

There are three significant salmonid enhancement and restoration activities that have occurred within Smith Inlet. Two were directed at Long Lake sockeye and one at Nekite River chum. There has been no directed effort at enhancement of coho, chinook or pink salmon.

Long Lake Sockeye

A lake fertilization program for Long Lake was initiated in 1977 with the goal of increasing primary productivity, thus increasing sockeye smolt size and survival to adult. The program continued through to 1997 with only three years where fertilizer was not applied (1979, 1980 and 1986). In Stockner and Hyatt 1984, they indicated that lake fertilization had resulted in production of larger smolts on average and estimated that at least 50% of adult production could be attributed it. However, they also note that it is difficult to compare adult production between treated or untreated lakes, as there is a lack of data from Long Lake during a period of no treatment where fry densities were similar to those during treatment. In DFO 1986, it is stated that average return rates increased in the years following fertilization in Long Lake, but that it was difficult to attribute the increase solely to fertilization as sockeye stocks in Owikeno Lake also returned at an exceptionally high rate during the same period. The Long Lake fertilization program was discontinued in 1998. Adult returns had declined and there was some question as to the utility and cost/benefit of increasing primary productivity during years when the natural carrying capacity of the lake was seen as sufficient to support the production of large smolts.

More recently (2000), a conservation enhancement program managed out of Snootli Hatchery in Bella Coola was initiated for both the Long Lake stocks; Smokehouse River and Canoe Creek. As was the case for Owikeno Basin, the program was aimed at augmenting stocks through hatchery production to prevent further decline and possible extirpation. The enhancement strategy set annual release targets of 50,000 fry to Canoe Creek and 200,000 fry to Smokehouse River in brood years 2000 – 2004. Using DFO bio-standards, these fry releases could add an estimated 2,500 adults to Long Lake in return years. All the enhanced fish were marked (thermal banding during incubation) to allow for follow-up assessment in return years 2005-2007. It should be noted that no eggs were taken in 2003, as the number of sockeye counted through the Docee fence was over 180,000, approaching the DFO escapement target of 200,000. Enhancement may again be necessary in 2004 when returns from the two worst brood years ever recorded (5,900 adults in 1999 and 1,430 adults in 2000) are expected.

Smith Inlet Restoration

An unmanned spawning channel was constructed on the Nekite River in 1986 to augment and stabilize chum production for First Nation and commercial fisheries (Winther et al. 1989). The channel also provides opportunity for use by other species. While the channel is still operational and is being utilized by chum and coho salmon each year, it is not functioning as intended. Silt has settled over the gravels in the upstream third of the channel, impacting spawning activity. Maintenance is required if the channel is to return to its productive potential.

2.2 Salmon Resource Use

The salmon resources in the Rivers and Smith Inlets area have been used for millennia. The First Nations who have taken a leading role in the RSSEPS and in recovery planning are like others of the "Northwest coast" in having relied on salmon and other aquatic resources as the underpinnings of unsurpassed cultural development (see Drucker 1965 for discussion). Until the 1880s, the salmon from Rivers and Smith Inlets were used exclusively by the Wuikinuxv and Gwa'sala-'Nakwaxda'xw peoples. Then commercial fisheries started and more recently, recreational fisheries have become significant.

2.2.1 First Nations Fisheries

It is now widely recognized that the richness of coastal First Nations in what is now British Columbia, arose significantly from the natural endowment of salmon runs and the unique cultural and managerial relationship First Nations established vis-à-vis these stocks (Suttles 1990). Traditionally, the Wuikinuxv and Gwa'sala-'Nakwaxda'xw communities harvested enough salmon to sustain their entire local population. For the Wuikinuxv, with fewer people now living in the area than in the early contact and pre-smallpox period, harvests have averaged 2,000-3,000 sockeye per year recently. Catch has ranged from zero in the recent very low return years, to a high of 4,156 in 1995. The Wuikinuxv now take very few chinook, coho and chum, depending on overall catch and availability. It is anticipated that Wuikinuxv catch will increase as the local sockeye stocks rebuild and as the population of the village at Rivers Inlet increases with the inception of new infrastructure and local economic opportunities.

Traditionally, the Gwa'sala-'Nakwaxda'xw people also harvested enough salmon to sustain their entire local population. Since the population was relocated to Port Hardy, access to their traditional resources has been very difficult and they have been taking very few salmon. The Gwa'sala-'Nakwaxda'xw people plan to increase their presence and harvesting in Smith Inlet. Limited food fishing for sockeye in Smith Inlet occurred in 2003.

By agreement, other First Nations may be allowed to harvest fish in a local Band's traditional territory. Heiltsuk Nation Fisheries, conducted along the outer coast and within Fitzhugh Channel, likely take Rivers and Smith Inlet salmon when those stocks migrate through those areas.

2.2.2 Commercial Fisheries

Catch in commercial fisheries is summarized in Figures 2 – 11 in Section 2.1.1 (see also Wood 2000). The Rivers and Smith Inlet area once had an important commercial fishery. In the past, the area has been the number 2 sockeye producer in BC with fairly consistent catches over 1.0 million and long-term average of 1.2 million (1900-1974). Commercial catches of other salmonid species have averaged annually: 150,000 pink, 540,000 chum, 10,000 chinook, 30,000 coho, and 2,000 steelhead (as bycatch only for steelhead). It is important to note that some of the local catch of chinook and coho is of stocks from south of the area. Much of the catch of Rivers and Smith Inlet chinook and coho is taken north of the area (PFRCC Advisory 2001; Spilstead & Hudson 1996).

2.2.3 Recreational Fisheries

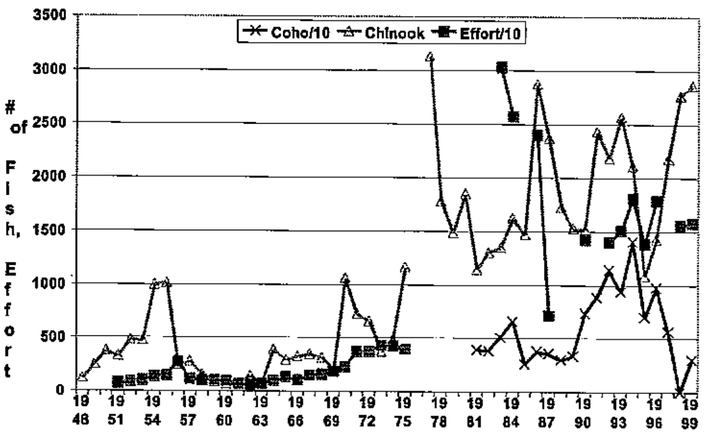


Figure 12: RIVERS INLET SPORT FISHERY

The sport fishing is described in the PFRCC 2001 and the Central Coast Land and Coastal Resource Management Plan (CCLRCMP) 1999. The target species tend to be chinook and coho, although sockeye and pink have also been harvested in recent years. The sports fishing season generally lasts from early June to early September in this area. The Rivers Inlet chinook fishery has been a high profile fishery for trophy-sized chinook for many years. Coho became an important component of the fishery in the early 1990's just prior to the closure implemented in 1997. Catch statistics have been recorded since 1948 as illustrated in Figure 12. Previous to the 1980s, the Rivers Inlet sport fishery was mainly by private fishermen. Since then, the number of boats and effort has increased significantly. There are concerns that sport catch has been significantly underestimated because of limited monitoring of private (non-lodge) sport catch for many years.

The minor recreational fishery that occurs in Smith Inlet involves local and non-resident anglers. There are no lodges and no permanent guides operating in the area. Recent angling closures to conserve rockfish will likely further limit angling pressure in the area. The sport fishing effort is very low, most from local logging camps. Occasionally private boats fish the inlet. The non-tidal fishery is small and mainly by fly-in to the Nekite and Smokehouse Rivers for coho in the fall and steelhead in the spring.

2.2.4 Fisheries Management

The strength of Smith Inlet sockeye management is the in-season Docee fence count that allows directly managing the fishery to achieve escapement goals. In contrast, Rivers Inlet sockeye management relied mainly on commercial catch related indices that were inconsistent, unreliable and very risky. Since 1990, Rivers Inlet sockeye management has also been tied to Docee fence counts (DFO Annual Fishing Plans). The RSSEPS believes that the Rivers Inlet sockeye populations should be managed separately from the Smith Inlet populations. Alternative abundance indicators, such as hydroacoustic enumeration, are being explored for Rivers Inlet sockeye. Pink, chinook, coho, and chum salmon are managed to their observed abundance (i.e. abundance estimates are not expanded statistically over what has been observed). The biggest weakness in fisheries management in the area is the lack of information on returning stock abundance and stock specific catch and escapement. Escapement goals are either lacking or poorly defined and further work is required.

2.3 Ecosystem Dependency on Salmon

From 1980-89, the average sockeye escapement was likely over 750,000 in Rivers and Smith Inlets. In addition, there was likely in excess of 175,000 pink, 100,000 chum, 4,500 chinook, more than 10,000 coho and an unknown number of steelhead. Assuming average weights of each species, it can be estimated that in excess of 50 million pounds (25,000 tons) of protein and very substantial amounts of nutrients were delivered to the Rivers and Smith Inlet watersheds. Some of these fish are eaten by predators, but most spawn and their decaying carcasses provide nutrients to the watershed (Reimchen 2001, Watkinson 2001).

Loss or severe reduction of these inputs has significant impacts on the species that eat the salmon, their carcasses, eggs or fry, as well as the species that benefit from the nutrient additions – including the next generation of salmon. The nutrient additions have an especially large impact in these generally nutrient-poor coastal watersheds. Consequently, these nutrient additions could have a major impact on productivity, enriching phytoplankton, then zooplankton and finally salmonids.

There is limited information on the level of use and dependency of the various species that are dependent on the salmon. Local people reported that eagle, black and grizzly bear, seal, and sea lion numbers decreased in the area at the time of the collapse (Percy Walkus, pers. comm.). This is an issue that needs attention so that ecosystem needs can be incorporated into management. At the very least, ecosystem needs include sufficient salmon for major predators as well as an unknown amount to fertilize riparian area and sockeye lakes. Allowance must be made for increased ecosystem needs as the ecosystem recovers.

3 WATERSHEDS PROFILE

The Rivers and Smith Inlet watersheds have many similarities but also some important differences. They occupy the same basic area and geo-climatic zone and have similar proximity to coastal and ocean rearing areas. Outer coastal portions of both areas have low altitude, flat terrain, with tannic water and are reliant on seasonal water. Inland areas drain coastal mountains and are heavily influenced by coastal weather. Further inland, Owikeno Lake tributaries drain higher mountains and permanent ice fields. The Machmell River drains the Silverthrone Glacier and Sheemahant River drains the Monarch Icefield. Consequently, as the Owikeno Lake watershed is glacial fed, it is turbid and has a different runoff pattern than Long Lake.

Long Lake, in Smith Inlet, is less turbid and therefore has higher primary production. Runoff from a number of large rivers within Rivers Inlet provides a strong freshwater influence out to the mouth of the Inlet. In contrast to Rivers Inlet, Smith Inlet has less freshwater influence throughout its length.

Overviews of the watersheds and coastal waters are provided in DFO (2000b), BC Ministry of Sustainable Resource Management (2001), Hilland (2002), Braden Ecological Resources (2003). More detailed information is available in a number of reports.

Flow Regime
In this area, only the Wannock River discharge has been monitored for a significant time. Figure 9 shows the following changes in the Wannock River discharge from 1961 to 1998:

- Annual discharge decreased about 15%;
- Spring (March-April-May average) discharge increased about 25%;
- Summer (June-July average) discharge decreased about 25%. There appears to have been a marked drop in summer discharge from 1977 to 1981 and onward.

It is not known how much of the change in discharge patterns is related to change in the amount of precipitation and change in temperature. The decreased summer runoff suggests earlier melting of snow. Also, the glaciers feeding Owikeno Lake have all receded significantly over the last 40 years. It is not known whether the increased spring discharge has affected salmon downstream migration timing or survival. Preliminary evidence from the RSSEPS coordinated study, however, suggests that runoff conditions may play a major role in the ecosystem in the lead up to juvenile sockeye migration (Routledge et al. 2003). Logging and global climate change may be causing or contributing to the change in runoff patterns.

3.1 Freshwater Habitat Description and Condition

A basic summary overview of the freshwater habitat characteristics by stream is presented in Appendix 4. DFO (2000b) and Hilland (2002) provide additional details.

Under the CCLCRMP process, protected areas are proposed for the Owikeno and Long Lake basins which include: the Ashlulm and upper Inziana; lower Genesee and Walkus Lake in its headwaters; lower Machmell, Neechanz and floodplain; Owikeno Lake second narrows - Sheemahant beach spawning areas; and the entire Long Lake watershed. Limiting development in these areas may help to protect important salmon spawning and rearing areas.

3.1.1 Spawning Habitat

The area of accessible habitat and the percent gravel, and average spawner density for Owikeno and Long Lake tributaries are summarized in DFO (2000b). Thompson et al, 1987 provide a general description of Owikeno Lake and its tributaries, including maps of lake beach spawning areas.

Within Rivers Inlet, spawning habitat has been disturbed and degraded in logged watersheds such as the Machmell and Sheemahant Rivers (Hillaby 1998a&b, Hillaby and Neudorf 1998). At current spawner abundances, however, spawning habitat is not limiting survival enough to be apparent. Pendray (1988) found that the Sheemahant and Machmell Rivers, with the most extensive anadromous habitat, had the lowest sockeye spawner densities. The highest spawner densities were in the Genesee, Amback and Washwash rivers that had the least available habitat within the Owikeno Watershed. There are lake shoreline and outlet areas that logging debris has covered where sockeye and chinook previously spawned.

Spawning habitat within Smith Inlet has been impacted by human activity in some watersheds (i.e. Nekite, Takush), but not in others (Smokehouse, Canoe). Road building and forestry activities have been the primary cause of spawning habitat degradation, since any other form of development in the vicinity has been very limited. One specific area where spawning habitat has degraded over time is the lakeshore spawning area near the outlet of Long Lake. Long Lake chinook, noted for their large size, once spawned in the lakeshore gravels (James Walkus pers. comm.). The area previously used for spawning has been covered over with wood waste, and may have contributed to the decline in the numbers of Long Lake chinook.

3.1.2 Rearing Habitat

Lake Rearing

The salmonid species most dependent on lake habitat for rearing is sockeye. Sockeye rearing habitat within Owikeno and Long Lakes is generally typical for coastal lakes, although limnetic differences do exist between the two lakes. In general, both Owikeno and Long Lakes are large, oligotrophic lakes, subject to heavy precipitation that results in relatively rapid flushing (water residency <2.0 years for Owikeno, 1.1 years for Long). Both lakes have relatively limited euphotic zones, which may limit productivity. In Owikeno Lake, the glacially turbid water limits the euphotic zone, while the organically stained water limits the euphotic zone in Long Lake (Shortreed et al. 2001).

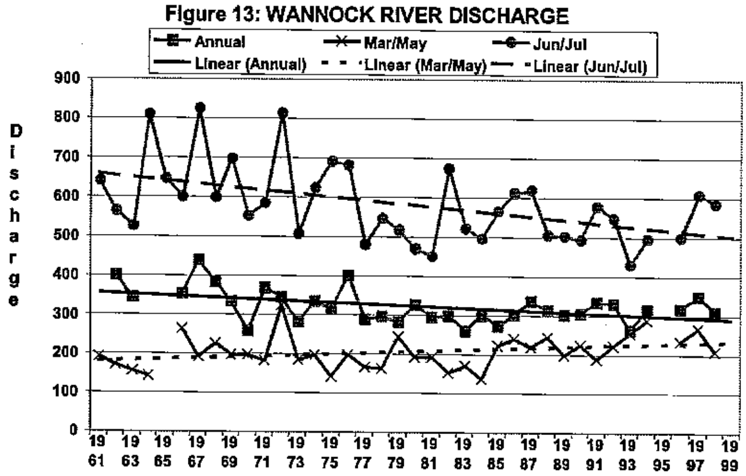
Owikeno and Long Lakes, due to their low productivity, are typically known to produce extremely small sockeye smolts (mean weight = 0.7g for Owikeno, 1.1g for Long). In recent years, however, dramatically reduced escapements have resulted in fewer fry entering the lakes. Thus, food has not been a limiting factor, and smolt size has increased (up to 3.0g in Owikeno Lake)(Braden 2003).

Impacts that may be adversely affecting rearing success of sockeye within Owikeno and Long Lakes are limited. In Owikeno Lake, several areas known to be utilized by juvenile sockeye have been affected by forestry activities; primarily the deposition of wood waste in the nearshore lake environment (Braden 2003). Harmful affects, ranging from decreasing dissolved oxygen to decreasing primary productivity within the lake, have been identified but not conclusively tested (Braden 2003; Sloan 1972). Wood waste impact within Long Lake is limited to an area of submerged wood debris near the lake outlet.

Stream Rearing

Chinook, coho and steelhead all rear in streams and have been variously impacted by logging and changes in runoff patterns. Rearing habitat has been impacted in watersheds where roadbuilding adjacent to the mainstem has resulted in the loss of off-channel habitat (Hillaby 1998a&b). Pink and chum do not rear in freshwater for a significant period. Generally, freshwater rearing habitat is not thought to be limiting at current population levels, but could become limiting as the populations increase.

Figure 13: WANNOCK RIVER DISCHARGE



The salmon in this area have a very short downstream migration to the ocean, unlike the long trip that salmon in the Fraser, Skeena and other large watersheds must take. Most streams in this area do not pose difficult downstream passage. The short downstream trip is thought to be a major advantage to local stocks. For example, it allows very small sockeye to get to coastal rearing areas quickly, with limited expenditure of energy and exposure to freshwater predators. In Rivers and Smith Inlets, the longest migration between rearing areas is from freshwater to the coastal feeding areas.

3.1.3 Environmental Changes

There have been and are environmental changes going on in this area. Few of the changes, however, have been documented and therefore cannot be properly assessed. Most observations are anecdotal. An exception is the change in Wannock River discharge. There may also be photographic records of the extent of ice fields feeding the Rivers and Smith Inlet drainage area, but they have not been assessed. There is local knowledge that a number of small ice fields that existed in the 1950s and 1960s have melted away. This means that the streams that drained those areas are probably clearer, with lower, warmer summer runoff. The precipitation patterns also seem to have changed, possibly on a long-term cycle (Beamish et al. 1999). Preliminary findings from Long Lake sediment cores suggest that there may have been a significant decrease in zooplankton over the last 50 years (R. Routledge pers. comm.). More information will become available when sediment core samples are fully analyzed.

3.2 Spawner / Rearing Productive Capacity

The Rivers and Smith Inlet salmon ecosystems have tremendous capacity to produce millions of salmonids. Historically, the abundance of these runs fueled lucrative commercial and sport fisheries, and provided food for two First Nations. While the current state of the stocks returning to Rivers and Smith Inlets may be depressed, the capacity of the region to produce salmonids in historical quantities remains. Further discussion on productive capacity, and target production and escapement estimates, are presented for all species in Chapter 7.

3.3 Use of Land and Freshwater Resources

The primary land and freshwater resource use in both Rivers and Smith Inlet areas is forest harvesting.

3.3.1 Forestry

Less than half of the Owikeno Basin is forested. The areas with merchantable timber tend to be in river valley bottoms or near the lakeshore. This means that much of the forest harvesting can have a direct impact on salmon habitat by affecting the rate and timing of snow-melt and runoff, riparian vegetation, stream bed stability and spawning gravel siltation. The logged areas and planned cuts in the Owikeno Lake watershed are described in DFO, 2000. The largest impacts have been in the Sheemahant and Machmell watersheds where logging has been extensive. Other logged watersheds include the Washwash, Tzeo, Inziana, Neechanz, Genesee, and Wannock (Hilland 2002). Sloan (1972) found that turbidity, suspended wood and fibre concentrations, and benthic wood debris accumulation increased in the vicinity of log dumps and log load-out areas in Owikeno Lake. Hilland (2002) outlined the past logging related activities in the area, including sorting and booming in Owikeno Lake, log driving down the Wannock River, and sorting and booming in the Wannock estuary. Future logging activities within the Owikeno drainage for the Doos, Dallery, Neechanz and Phinney Creek watersheds have been identified, but land use processes may affect those plans.

In Rivers Inlet, the Chuckwalla and Kilbella Rivers have been extensively logged. Other logging activity in the Rivers Inlet area in the last few years includes:

- A-frame logging in Draney Inlet;
- handlogging at the head of Moses Inlet and some other shore areas;
- logging on the north shore of Hardy Inlet (McNair and Dorris Creeks) ended about 3-4 years ago;
- heli-logging on Walbran Island (no roads);
- conventional road based logging in Pearce Bay;
- conventional road based logging in Machmell, Neechanz, and Sheemahant river areas tributary to Owikeno Lake.

A number of other watersheds in the Rivers Inlet area are also slated for future harvesting.

Within Smith Inlet, there has been some A-frame logging along the Long Lake shore. Logs were boomed in the lake, transported down the Docee River, and sorted in Wyclees Lagoon. These activities left wood debris in these waterways. Some aerial harvesting is occurring in the Wyclees Lagoon area and logs are boomed and out-loaded there. Other Smiths Inlet areas where forest harvesting has occurred include Naysash Inlet and the Nekite and Takush watersheds.

3.3.2 Water Use

The only consumptive uses are for domestic water for logging camps, Owikeno Village, sport fishing lodges and other settlements in the area. Non-tidal waters have also been used for booming and transportation of logs. The result has been deposition of bark and wood debris in a number of areas in Owikeno and Long Lakes. Both of these lakes and large rivers are also used for general transportation with little apparent impact.

A number of rivers and streams were developed as water and power supplies for now defunct canneries, including McTavish Creek, Sandell River, Hogan Creek, Margaret Creek, Boswell Creek. There was a salmon hatchery on Medowese Creek, tributary to Owikeno Lake. Owikeno Village is considering developing a local stream for a small hydro project to meet its electric power needs.

3.3.3 Recreational Areas

There is very limited use of land and freshwater for recreation. The primary uses are hunting and sport fishing.

3.3.4 Rural Residential

In the Owikeno Basin and River's Inlet, human habitation is limited to logging camps, Wuikinuxv village, Dawson's Landing, Duncanby, a number of single family floathouse sites and recreational fishing lodges that operate seasonally. There are also two DFO facilities (a float camp in Owikeno Lake and residence/float at Dawson's Landing.
Potential impacts are from physical development (destruction or displacement of habitat), fuel storage, fueling activities and sewage.

In Smith Inlet and Long Lake there is only seasonal human habitation at International Forest Products Ltd. Burnt Island Harbour and Security Bay camps, and the DFO fisheries camp at the mouth of Long Lake.

3.3.5 Industrial

Other than forestry, there is no land-based industry in the area.

3.3.6 Habitat Management

The Rivers and Smith Inlets area is remote and expensive to access for DFO and BC government habitat staff, making intensive management of habitat difficult. Planning and monitoring forest harvesting is done cooperatively with forest harvesting companies. Past practices and legislation have not always accommodated all components of the ecosystem. It is hoped that a more ecosystem based planning process will lead to a more inclusive consultation process and focus on achieving long term sustainable use of resources. Other habitat management issues may arise if finfish aquaculture and offshore oil and gas exploration are proposed. A major challenge to improved habitat management is a lack of baseline data and the ability for long term monitoring.

4 MARINE PROFILE

It is commonly thought that the cause of the recent collapse of the Rivers Inlet sockeye is primarily a result of adverse ocean conditions (McKinnell et al. 2001). This might be a result of a decrease of available food organisms in the area, increased predation rates by species normally resident in warmer southern waters, and/or from other factors associated with sea temperature increases and hydrodynamic changes. Rivers and Smith Inlet sockeye smolts are very small when they migrate seawards and so would be especially susceptible to such factors.

For the purposes of this plan, the marine environment is divided into four basic components: estuary, inlet, coastal and ocean. Each has different, but important, characteristics and impacts on salmon survival and growth. The various estuary, inlet and coastal areas and their importance to salmon are described in Appendix 5.

4.1 Estuary Habitat Description and Condition

There are numerous estuaries present within Rivers and Smith Inlets, with varying size and importance to salmonids. The largest estuaries within Rivers Inlet are the Wannock and Kilbella / Chuckwalla estuaries, while the largest estuaries within Smith Inlet are the Nekite River Estuary, and the estuary habitat at the outlet of the Docee River.

While there has been very limited effort directed at monitoring and assessment of the estuaries within Rivers and Smith Inlets, the information that does exist suggest that at least some of the estuaries are important to several species in their early life stages. Surveys performed on both the Wannock and Kilbella / Chuckwalla estuaries discovered that chum, chinook, coho, were all found to utilize the estuary as juveniles (Braden 2003; Routledge et al. 2002). These preliminary investigations suggest that the largest estuaries within Rivers Inlet are important rearing areas for these species. Sockeye smolts do not appear to rear in these estuaries for much time (Routledge et al. 2002). The estuary of the Docee River is Wyclees Lagoon and Quascilla Bay area. These and other estuaries within Smith Inlet have not been monitored, assessed or reported on.

There have been several development impacts in some of the estuaries within the Rivers and Smith Inlet area. Approximately 25% of the Wannock estuary was dyked and filled in 1973 for a log dump facility (Braden 2003). The lost habitat included tidal grasslands that chum, chinook and coho were thought to rear in. Additional impacts may also include metal contamination from old cannery waste in the Wannock estuary. Many of the smaller estuaries also had old cannery developments, and log dumping facilities, associated with them that may have resulted in impacts to fish habitat. Currently, some of these estuaries are being used by sport fishing lodges.

4.2 Inlet Habitat and Ecosystem Condition and Use

The inlet habitat is a transition between estuary and coastal habitats. There is a range of types of inlet habitats in the area. For example, Rivers Inlet has a detectable though highly variable freshwater surface layer throughout much of the inlet (Routledge et al. 2003). In contrast, Smith Inlet has a very limited surface freshwater layer which is restricted primarily to Wyclees Lagoon and Quascilla Bay. The tributary inlets in both Rivers and Smith Inlets also differ, depending on freshwater inflow and tidal exchange and mixing. The changes in Wannock River discharge amount and timing likely have affected Rivers Inlet. Wind intensity and direction likely affects mixing and productivity in the inlets (Rout). Global climate change might be having local impacts.

Prior to the formation of the RSSEPS, the biological aspects of inlet ecosystems have not been monitored, reported on, or assessed, however, PSEF co-funded research is currently underway in Rivers Inlet and beginning in Smith Inlet. The RSSEPS coordinated research on the juvenile sockeye salmon migration through Rivers and Smith Inlets in 2002 and 2003. This research has highlighted the potential importance of these ecosystems. For example, sockeye salmon caught near the mouth of Rivers Inlet in 2003 averaged more than three times the weight of those caught near the inlet head. In addition, substantial numbers were caught near the junction of Moses and Hardy inlets, considerably off the direct, seaward migration route. Both observations suggest that the juvenile sockeye salmon are using the inlet as an important staging area as they adjust to saltwater conditions.

Generally the inlet habitat has experienced limited development. Potential future concerns include marine vessel traffic, salmon farming, refuse from increased recreational use, fuel and oil spills, sewage, and oil & gas exploration.

4.3 Coastal Habitat and Ecosystem Condition and Use

Until recently, there has been limited monitoring or scientific work performed on marine habitats within Rivers and Smith Inlets and outer coastal areas. Hence there is little historical information for nearshore marine areas. The theory that changing marine conditions may be the primary cause of declining salmonid abundances has been developed more from eliminating freshwater impacts as the cause, than from identifying specific causes within the marine environment.

Nonetheless, there is a long-held, general consensus that "the annual variations in conditions encountered in individual environments at this early sea life stage are generally believed to be largely responsible for the variation seen in overall marine survival of cohort populations" (Burgner, 1991). In addition, recent work conducted in the marine environment provides further insight into the importance of coastal habitats for survival of salmonids. Beamish and Mahnken (2001) hypothesized that if salmon fail to reach a critical size before their first ocean winter they have a low chance of survival. Under productive upwelling conditions there is an abundant supply of food organisms. This allows rapid salmon growth, which in turn reduces predation and over-wintering mortality. Upwelling is related to the intensity and direction of storm tracks in the area. Beamish (1999) suggested that the weather pattern in the area follows a cycle.

D. Welch (personal communication) found that juvenile salmon from the Rivers and Smith Inlets area rear in the Central Coast – Queen Charlotte Sound – Hecate Strait area for an extended period before migrating north to the Gulf of Alaska. Consequently, they are highly subject to conditions in the area, both natural and anthropogenic.

As coastal ecosystems have not yet been adequately monitored, assessed or reported, little is known about the relative importance of the various salmon food organisms, predators or competitors. In Barkley Sound, Tanasichuk (2001) found that sockeye growth and survival is highly dependent on the available supply of preferred sizes of euphausiids.

Ware (2000), related ocean survival to McInnes Island ocean conditions and predicted survival rates. The quality of those predictions has not yet been assessed.

In RSSEPS-sponsored research, juvenile salmon (mainly sockeye) and their habitat were sampled in 2002 and 2003 as they migrated from freshwater to the outer coastal area (Routledge et al. 2002, 2003). Preliminary results of this study indicate that the speed with which the juvenile sockeye migrate through the upper sections of the inlet is highly variable. In 2002, when the fresh-to-brackish surface layer extended over almost the entire inlet, and when food was scarce in the upper inlet, few fish were caught above Dawson's Landing. By contrast, in 2003, when the surface layer was restricted to the upper inlet where more food was available, by far the largest juvenile sockeye catches were in the upper reaches. Juvenile sockeye salmon were also caught that year at the junction of Moses and Hardy inlets, 2.5 km up from the junction with Rivers Inlet. These observations suggest that out-migrating sockeye salmon may seek out brackish water with sufficient available food to allow them to adjust to salt water more gradually.

Further evidence supporting this hypothesis emerged from similar observations in Smith Inlet. In that system, the freshwater surface layer is primarily restricted to Wyclees Lagoon. Small juvenile sockeye salmon have been found tarrying in the lagoon well after the bulk of the migration run (consisting of larger fish) had left Smith Inlet. In addition, some of these fish were caught near the end of the East Wing of the lagoon, 6 km off the main migration route.

Hence, it appears that smaller smolts may use such estuary areas to feed and adjust more slowly to marine salinity levels. In years following high fry abundance in the lakes, food competition will cause most of the smolts to be small. Hence, there is reason to anticipate that these estuarine areas may provide critical habitat for maintaining historic abundance levels.

Changing abundance of predator species may also be a contributing factor to changing salmon survival. With the recent El Nino warm water, more mackerel, sardines and possibly hake have been present in the area.

In addition, in recent years, there have been visible signs of increased productivity of the coastal area with many more whales, birds and fish feeding in the area (S MacLaurin pers. comm.). This, in turn, has been accompanied by a remarkable rebuilding of the Smith Inlet population and a modest increase in returns to Rivers Inlet. This is further circumstantial evidence pointing to the importance of coastal productivity in marine survival of out-migrating sockeye salmon.

Development impacts in the coastal habitat are limited and related to transportation and commercial fisheries. However, petroleum transportation and handling requirements pose a risk to habitats in the area. Also, plans have been discussed for aquaculture development, including farming of salmon and other finfish and shellfish, and for offshore oil and gas exploration and development in the area.

4.4 Ocean Habitat and Ecosystem Condition and Use

Conditions in the ocean have apparently changed as a result of factors outside our knowledge and capability to address. Beamish and Bouillon (1993) identified the relationships between salmon production and the size, strength and location of the Aleutian Low pressure weather system in the ocean. In turn, changes in the Aleutian Low are associated with the Pacific Decadal Oscillation (PDO) and its interactions with the El Nino-Southern Oscillation (ENSO). This subject is summarized in the PFRCC Annual Report for 2000-2001 (http://www.fish.bc.ca/html/fish2310.htm). Important new information on this area has been reported in the last few years.

Development impacts in the open ocean area are essentially unknown, but could include transportation, global warming, petroleum handling impacts.

5 INFORMATION NEEDS

The rebuilding of Rivers and Smith Inlet salmon stocks requires detailed understanding of stock size, production capability, etc. which is seriously lacking for this area. As well, this information is critical for the sustainable management of these salmon stocks. The precautionary principle dictates cautious management in the absence of reliable data. Unfortunately, reliable data only exists for Smith Inlet sockeye; specifically only adult escapement data. This is a serious threat to successful ecosystem recovery and fisheries management. As a first step, there is an immediate need to develop and implement tools and methodologies for assessing juvenile and adult abundance, production capacity, and ecosystem function.

5.1 Ecosystem Framework

A basic understanding of ecosystem interdependencies and interactions is important to restoring the salmon ecosystem. Ecosystem information is generally lacking, however, and where available, has not been brought together into a usable form for management.

An important unknown is whether there have been previous collapses of salmon production. It would also be important to know what salmon population levels were before commercial harvesting and before watershed logging. Information on the many species of land and marine mammals, birds, insects and other organisms dependent on salmon is essential to developing and understanding an ecosystem framework.

Traditional Ecological Knowledge is being assembled to help address this issue. Recent advances in trophodynamic modeling hold some hope of establishing 'benchmarks' in past production. These can also be linked to future oceanic regimes. There is good potential to use sediment cores to determine past production (Stockner and Shortreed 1975). Tree ring data also throw light on past production levels (Reimchen 2001).

5.2 Stock Status

Reliability of information related to stock status is a major limitation to recovery planning and implementation, especially for Rivers and Smith Inlet sockeye. Spawner counts only include a portion of the actual spawners and that portion has likely been increasing through time as access and technology have improved. Estimates in the 1950s probably accounted for less than 1/3 of actual spawners (Brett 1952). Recent counts include a higher percent, but still probably significantly less than 100 percent. In addition, there are major, habitat related spawner and juvenile assessment problems due to turbid water in several systems in both Rivers and Smith Inlet watersheds. The lack of an accurate and reliable measure of spawners to these areas is a major stock assessment and management problem. Without this information it is not possible to assess freshwater survival and production rates and there is no basis to set spawner targets or to manage the fisheries to meet spawner needs.

Recently, most salmon populations have not been assessed (Appendix 2 or (www.pac.dfo-mpo.gc.ca/ops/northfm/Areas/Area9/Default.htm). There have been summary or no spawner counts, and no juvenile abundance indexing. This makes it impossible to assess stock condition in detail. However, the decrease of salmon returns has been so large that it is readily apparent overall. In general, sockeye, chinook, pink and chum stocks decreased significantly in the latter half of the 1990s. In 2001, pink salmon populations started to increase. In 2002, sockeye, chinook and pink returns and survivals increased. Little is known about past or current coho and steelhead populations.

With recently increased ocean survivals, the condition of stocks has generally improved (PFRCC 2000). It is important to note that individual populations each recover in response to their specific capabilities and conditions. For example, despite a lack of accurate data, Owikeno coho abundance apparently has not increased at the same rate as Chuckwalla-Kilbella populations (Percy Walkus pers. comm.). Also, available information indicates that sockeye spawning populations in the 1990s have been so low that it will likely take several generations to rebuild them. The continuing lack of basic stock information is a major risk and concern. Basic information on distribution of chinook and coho harvest is required to better protect and rebuild at risk stocks.

There may be an opportunity to assess population specific survival, migration timing and route differences and to rationalize population conservation and production targets, using the marked incubated sockeye from the 2000, 2001, 2002 and subsequent broods.

5.3 Freshwater and Marine Habitat Condition

Due to the extreme size and inaccessible nature of the Rivers and Smith Inlets area and a lack of sufficient baseline data, a comprehensive examination of freshwater habitat condition is incomplete. While it is generally accepted that the overall decline of local salmonid stocks is likely the result of unfavorable marine conditions, specific freshwater habitat impacts need to be identified and remediated to ensure that freshwater survivals are maximized.

Little is known about the limits to salmonid productivity in the river estuaries, inlets, coastal and open ocean areas. In the past, these areas supported significant salmon production. Recent studies in the coastal marine area have shown generally low productivity in Rivers Inlet and higher productivity in coastal areas at the mouth of that inlet and in Smith Sound (Routledge et al. 2002). Further examination of these areas must continue in order to draw conclusions on specific critical habitats.

Little is known about juvenile salmonid rearing areas, migration routes, rates and timing, and food dependencies. The physical and chemical characteristics of the various marine areas are poorly known. It is known that freshwater influence can extend a long way out Rivers Inlet and that this impact is likely influenced by wind and precipitation patterns. Recently, sampling of oceanographic conditions and juvenile salmon abundance and condition has been conducted in the Rivers and Smith Inlets area. It will likely take a number of years of that sampling to better understand the dynamics that are affecting marine survival.

A better understanding of inlet and coastal ecosystem factors that affect salmon survival is needed to guide management and development in these areas. Ideally, predictors of marine survival and production would be developed to guide management.

6 PROGNOSIS

While the last two years have generally shown increased escapement in several stocks in the Rivers and Smith Inlets areas in comparison to recent years, it is difficult to develop a prognosis due to a poor understanding of the factors that influence salmonid recovery in the area. The following section attempts to take stock of the factors that will affect the recovery plan and its individual projects. These have been organized into biogeophysical (i.e. all non-human influences of the environment) and human factors.

6.1 Bio-physical Factors Influencing Recovery

Biological

Key factors influencing population recovery are thought to be coastal and inlet survival, and growth rates. The progeny to parent ratio declined dramatically to the point where the population was unable to replace itself even in the absence of fishing pressure. Recent changes in ocean conditions, however, have apparently resulted in increased productivity levels in coastal areas (PFRCC 2000), which has resulted in increased salmonid survivals (progeny to parent ratios for Rivers and Smith Inlet sockeye have increased for brood years 1998 and 1999 – see Appendix 6). If ocean survival results in increased spawner abundance, then freshwater spawning and rearing habitat may be limiting.

Ocean Conditions

While the extent to which changes in climate impact on salmon populations is still uncertain, increasingly compelling evidence from lake sediment records points to very considerable "natural" oscillations that long predate humanity's ability to drastically reduce stocks (Finney et al. 2000).

Marine survival of Pacific salmonids has in general been highly variable. The variability has been influenced by factors including climate change, El Nino events, and a decade-scale oscillation of ocean circulation patterns. These factors may have contributed to the decline in progeny-to-parent ratio (Appendix 6). Consequently, variability of returns and rebuilding should be expected. Indexing productivity and food organisms in the coastal and inlet areas could provide a real time predictor of productivity and survival.

6.2 Human Factors Influencing Recovery

The RSSEPS has identified the following human influences as factors contributing to the rate of salmonid recovery within the Rivers and Smith Inlets area.

- Fisheries
- Land use activities
- Coastal and Ocean uses
- Climate change
- Marine transportation
- Availability of program funding

6.2.1 Fisheries

There have been no commercial salmon fisheries in Rivers Inlet since 1995 and in Smith Inlet since 1996. All fisheries known to intercept sockeye have been limited and controlled to eliminate interceptions. The commercial fishing fleet has been decreased to less than half of what it was in 1995. The remaining fleet eligible to fish in the area has been halved again by area and gear licensing. However, catch potential of the remaining fleet is still significant. Consequently, it is difficult to assess the potential impact of the fleet on population abundances, and will depend highly on future management strategies. The RSSEPS remains concerned and alert to the possibility that some of the recovering stocks from the area will be caught in mixed fisheries with stronger stocks elsewhere. This underscores the need for better and more precise stock management.

The sport fishery primarily targets local chinook salmon and secondarily coho and pink salmon. The sport fishery has a high potential impact, especially where it targets a specific population. For example, even with limited enhancement, the depressed Wannock chinook population is not recovering. This is a concern because the Rivers Inlet sport fishery timing coincides with the Wannock chinook run. The fishery can be especially intensive because it uses the coho fishery to sustain local fishing effort and as a fallback for the chinook fishery.

An added concern is that the non-lodge portion of the sport fishery is heavily focused on catching chinook and has had very limited monitoring in the last decade. In 2001, there was a monitoring and enforcement program that covered this portion of fishery. The need for adequate monitoring of the sport fishery raises the issue of the sport fishing interests paying for, or at least contributing to, that monitoring. The lodges in the area monitor their clients catch and provide statistics to DFO. The shortfall is with the non-lodge fishermen.

The First Nations food fisheries take a very small portion of an average return. This harvest would only be a concern if a food fishery occurred when populations are at risk of extirpation, as they have been recently. However, the conservation values and concerns of First Nations participating in RSSEPS have been amply demonstrated. Both the Wuikinuxv and Gwa'sala-'Nakwaxda'xw people voluntarily reduced their harvest of sockeye in 1999-2001 return years to protect local populations. It should be noted that the Heiltsuk Nation, which is not a member of the RSSEPS, also harvest unknown numbers of salmon originating in Rivers and Smith systems.

6.2.2 Land Use

Within the watersheds of Rivers and Smith Inlets, the most significant land use activity is forestry. While both inlets have experienced past and current forestry developments, there are differences to the extent of these activities, and their possible impact on fish habitat.

Forest harvesting within Rivers Inlet, and specifically within the Owikeno Basin, has been extensive. Hand logging activities within the inlet began nearly 100 years ago. The first industrial scale harvesting within the Owikeno basin commenced in the early 1960s. A logging road was constructed linking Owikeno Lake to the Rivers inlet Cannery site at tidewater. The road, and associated log de-watering and log dump facilities, allowed logs to be dumped into Owikeno lake, transported via boom down the lake to the dewatering site, and transported via road to tidewater, where they could be transported via tug to market. In 1971, a log dump and camp were constructed up Owikeno Lake at the confluence with the Sheemahant River (DFO 2000b). Additional developments on other watersheds within the Owikeno Basin have also occurred in past years. The Forest

License (FL A16847) within the Owikeno Basin is operated by Western Forest Products Ltd.

While Smith Inlet, and several of its watersheds have been logged extensively, the Long Lake Basin has experienced very little harvesting activity. Small volumes have been handlogged from the steep sides of Long Lake in the 1960's and 1070's. Significantly, Smokehouse River and Canoe Creek, the two most significant salmon streams within the basin, have not been logged.

Additional land use activities within Rivers and Smith Inlets have been very limited, given that forestry is the only industrial activity of any significance that occurs in the area. The only permanent community in existence is the Wuikinuxv Village on the north shore of the Wannock River.

6.2.3 Coastal and Oceanic Activities

In 2002 the BC Government lifted a longstanding ban on new fish farm leases in coastal waters. Some members of the RSSEPS have numerous and strong concerns about salmon farming in the area, especially until after the salmon stocks have recovered to sustainable levels. The concerns include local pollution, spread of disease and parasites, possible predation on wild juveniles, and escaped farm fish competing with wild fish for spawning and rearing areas (PFRCC 2002). The Wuikinuxv Nation is on record as opposing farming of fish in open net-cages in natural waters.

First Nations and other parties concerned with the future of salmon also are troubled by the recent increase in pressures for a possible lifting of moratoria on offshore oil and gas exploration and development. There remain unknown potential impacts of seismic exploration, oil spills and chronic effluents in highly productive nearshore areas. A major concern in both aquaculture and oil and gas is the lack of pre-development baseline information to measure impacts from.

The area has always been subject to impacts from marine traffic. Of growing concern is the expansion of the nearshore cruise industry on the Central Coast. The potential impact of dumping effluent from cruise ships in the vicinity of Rivers and Smith Inlets is a concern to the RSSEPS

6.2.4 Climate change

Trends in river discharge patterns have been widely observed and linked to climate change (e.g., in the Similkameen River [Leith and Whitfield, 1998], the Fraser River [Smith and Fraser, 2002], and more generally [Cannon and Whitfield, 2002]). Impacts on El Niño have also been noted. Since these in turn can have a major influence on inlet hydrology and coastal ocean productivity, the impact on sockeye salmon cannot be dismissed. In light of continuing escalation of world carbon dioxide emissions, any prognosis for the future of these sockeye salmon populations must not ignore the potential impact of climate change.

6.2.5 Program Funding

A major limitation to salmon recovery is inadequate funding to understand and act on many basic stock and ecosystem issues. Lack of basic information and funding shortfalls have contributed to the delays in acting on the sockeye collapse.

The development of remedial measures to deal with the decline of salmon stocks has depended significantly to date on special federal and provincial programming. It is estimated that Canada has invested several million annually in a variety of measures in the Rivers and Smith systems. This has led to significant leveraging of other funding sources. Also, the province of BC through its Forest Renewal and, later, Fisheries Renewal programs, funded a great deal of work on watersheds in the area. Fisheries Renewal BC was instrumental in supporting the first two years of the RSSEPS, including a special grant that has paid for the coordination and logistics until recently. Both programs were entirely discontinued as of 2001. There is considerable uncertainty in core funding for programs essential to the recovery of salmon and salmon-based ecosystems.

The success of rebuilding salmon populations in Rivers and Smith Inlets will depend on appropriate funding from both government and non-government sources. While there is demonstrated willingness by non-governmental sources to step up their support for salmon recovery – the Pacific Salmon Endowment Fund being an excellent example – potential growth in such philanthropic support will not be realized if it is seen as merely replacing budget cuts from government agencies.

RSSEPS' recovery plan includes much increased effort at private fundraising but we will also continue to work with federal and provincial agencies whose mandate includes fisheries resource management and the economic well-being of coastal communities.

7 RECOVERY TARGETS

The following goals, objectives, guidelines and long-term goals provide the basic recovery direction for the Rivers and Smith Inlet areas. The RSSEPS has attempted to follow the guiding principle of the PSEF, which states that "the approach to salmon recovery be holistic and supported by realistic goals." In practical terms, the principle dictates that firstly, the recovery goals (or numerical targets) must be attainable, and secondly, that stakeholders must be willing to adhere to the obligations mandated by the recovery plan (policy targets).

7.1 Fish Abundance Targets

Interim recovery targets are presented in Table 7.1.1. For each species, they have been derived through various methods, explained separately below. It should be noted that the recovery plan must be a living document, and that these targets are a preliminary estimate of recovery numbers that may be modified as the recovery effort proceeds.

Table 7.1.1. Abundance targets for Rivers and Smith Inlet salmon populations.

		Abundance Targets			**Escapement Targets**
Species	**Watershed**	**Juveniles**	**Smolts**	**Adults**	**Adults**
Sockeye	Smith Inlet	9,923,964	4,075,000*	183,375	200,000
	Rivers Inlet	52,359,563	21,500,000*	967,500	1,000,000
Chinook	Smith Inlet			6,500	
	Rivers Inlet			22,700	
Coho	Smith Inlet			10,700	
	Rivers Inlet			49,800	
Chum	Smith Inlet			95,500	
	Rivers Inlet			140,700	
Pink	Smith Inlet			65,600	
	Rivers Inlet			342,450	
Steelhead	Smith Inlet			unknown	
	Rivers Inlet			unknown	

* sockeye smolt to adult survival rate used was 4.5% for this region (DFO Biostandards)

Sockeye

Sockeye have been recognized by the RSSEPS as the initial species for recovery in Rivers and Smith Inlets. Fisheries and Oceans Canada, in response to the recent crash in escapement for both Rivers and Smith Inlets, originally set conservation level target escapements (Limit Reference Points) at 30,000 for Rivers and 8,000 for Smith. These escapement levels were thought to be sufficient to avoid extirpation and maintain genetic integrity of the stocks (DFO 2000b). The RSSEPS and PSEF, however, have the goal of returning the local salmonid populations to historic, sustainable levels.

The combined escapement goal of 1,150,875 sockeye for the Rivers and Smith Inlet area is based on the rearing capacity of Owikeno and Long Lakes (Shortreed et al. 2000). While additional factors can influence the production of sockeye within a system, lake productivity estimates are the accepted means of estimating sockeye production (K. Hyatt pers. comm.). The extrapolation to adult escapement estimates was derived by employing data from DFO biostandards. Fisheries and Oceans Canada is in the process of reviewing escapement targets and management strategies for the region. Further work is required in order to refine targets for Rivers and Smith Inlet sockeye.

Chinook

The preliminary combined recovery escapement target for chinook is 29,200 (22,700 for Rivers, 6,500 for Smith). These estimates are based on historic observed abundance, and will be updated in future years as part of this recovery plan. Currently, there is limited information on chinook spawning populations or productive capacity. Recent escapements are well below recovery target escapements.

Coho

Historic coho spawner targets in Rivers Inlet were calculated to be 49,800 spawning adults. In Smith Inlet, the historic target for coho spawners was 10,700 spawning adults.

Coho spawn late in the season when access to spawning areas is very difficult and counting is almost impossible. Since 1998, Docee fence counts have been extended to cover the coho migration. These coho counts have often been more than previous total counts for both Rivers and Smith Inlets. The coho populations passing through the Docee fence are now being treated as an index-population for assessment. The initial recovery target for coho will remain the historic coho spawner target, but will be adjusted early in 2004 using habitat based capability models (Bocking and Peacock 2004).

Chum

Historic chum spawner targets in Rivers Inlet were calculated to be 140,700 spawning adults. In Smith Inlet, the historic target for chum spawners was 95,500 spawning adults. The historic spawner targets, which are based on observed historic abundance, will be used as recovery plan targets.

Pink

Historic pink spawner targets in Rivers Inlet were calculated to be 342,450 spawning adults based on observed abundance. In Smith Inlet, the historic target for pink spawners was 65,600 spawning adults. The historic spawner targets, which are based on observed abundance, will be used as recovery plan targets.

Steelhead

Little is known about steelhead populations in the area. More information on stock status may be gathered in future years as part of this recovery plan.

7.2 Habitat Protection Targets

The RSSEPS habitat protection objectives are to achieve no net loss of habitat capacity and to strive for a net gain. To achieve those objectives, credible pre and post-impact assessments are essential for protection and, if necessary, for restoration. In the case of potential large-scale impacts, contingency plans should be developed and agreed to, and funding and equipment provided before the potential impacts. These plans should be in the interest of protecting critical habitat and recovery of lost capacity. For example, there should be mutually agreed contingency plans and local capability to respond to oil spills that might result from offshore oil exploration and development or from salmon farming problems. The productive potential of foreshore and riparian areas should be protected.

7.3 Habitat Rehabilitation Targets

The two areas where the RSSEPS can affect the most physical influence with respect to the rehabilitation of salmonid habitat are the watershed(s) and their estuaries. In both the watersheds and estuaries, habitats requiring rehabilitation have been previously impacted by past forestry activities; the dominant land use activity in the region. While habitat restoration and rehabilitation in the area have been performed on only a few systems, there is growing interest among RSSEPS members that these works continue and expand. Further investigation needs to continue to identify areas where the most benefit to depressed salmonid stocks can be realized through freshwater and estuary habitat improvements. Agreed habitat rehabilitation goals and/or a process for defining those goals by adaptive management should be developed to provide direction and to measure and assess progress.

7.4 Knowledge Targets

Life history and ecosystem
It is important to develop a better collective understanding of the life history and ecosystem of salmon originating in Rivers and Smith Inlets, past and present. Modeling of past run strengths have been suggested, as well as current studies on emigration timing, age structure, and early marine residency.

Salmonid abundance
It is essential to continue monitoring juvenile abundance of sockeye in Owikeno and Long Lakes and counting adults through the Docee Fence. Furthermore, improvements particularly to the juvenile abundance estimates are needed. An accurate count of sockeye escapement to Owikeno Lake is also essential. Ideally it would be an in-season count that could also be used for fisheries management. Assessing inlet, coastal and ocean survival factors and developing an effective index is key to improving stock assessment and reducing the risk of over-harvesting.

Habitat limitations
A program to analyze lake sediment cores to determine marine derived Nitrogen15 levels in each time period could determine whether the Rivers and Smith Inlet sockeye stocks have collapsed before. This analysis could also provide an estimate of spawners in different time periods relative to now. Additional knowledge gaps for habitat include the impact of development on fish populations (primarily forestry), the productive capacity of several watersheds, marine habitat requirements for all species, and specific habitat considerations for individual stocks (i.e. Long Lake chinook).

8 MONITORING AND EVALUATION FRAMEWORK

The purpose of basic monitoring is to provide the information necessary to assess and manage salmon stocks, their habitats, and ecosystem. Ultimately, the purpose is to facilitate the recovery of salmon in the Rivers and Smith Inlets area.

8.1 Stock Recovery Monitoring

A monitoring system needs to be devised and implemented that achieves two broad objectives: (1) Monitoring escapements to major basins such as Owikeno and Long Lakes, and (2) Monitoring the health of smaller stocks to ensure the maintenance of local genetic adaptations. Monitoring priorities and schedules will be developed to ensure that monitoring activities are matched with recovery goals and objectives. While the recovery of stocks is ultimately measured by the number of adults returning to the watersheds, monitoring of smolt populations may also be used in some instances to gauge recovery.

8.2 Physical Works / Activity Effectiveness Monitoring

Assessing the effectiveness of physical works and many types of projects requires clearly defined evaluation criteria at the start of the project and a long-term commitment to continuing the project and monitoring it. For example, the contribution a spawning channel makes ultimately takes a number of generations to assess – until the fish produced return, and populations build and the ecosystem stabilizes. Similarly, developing a predictor of ocean survival or measuring the escapement up the Wannock River may require many years to develop a reliable tool. The bottom line is that monitoring is a long-term commitment that requires long-term funding to realize.

8.3 Evaluation of Ecosystem Recovery

The primary indicator of successful ecosystem recovery within the Rivers and Smith Inlets region should be the achievement of adult sockeye targets. Secondary indicators will include the increased escapement of other species to target levels, and the physical recovery of specific, critical habitats within several watersheds. The evaluation must ensure that two important questions can be answered:

1. Are the various treatments affecting ecosystem recovery?
2. What is the rate of recovery within the ecosystem?

9 RECOVERY PLAN PROJECT SUMMARY

Table 9.1 summarizes the myriad of projects that will make up the RSSEPS Recovery Plan for the next five years. The table (and the projects within the table) will evolve over time as new information becomes available (feedback from the evaluation process). Because of the number of individual projects that have been proposed for the Rivers and Smith Inlet area, the RSSEPS must focus on prioritizing the projects, and determine which projects are to be undertaken immediately, and which are to be deferred. The projects have been separated into six broad categories. Specific details of the plan are presented under each project description.

Table 9.1. Implementation schedule for the 24 ecosystem recovery projects in the Rivers and Smith Inlet area. Projects specific to Rivers Inlet are in blue. Projects specific to Smith Inlet are listed in red. Projects occurring in both areas are in black.

	Category	Project Name	Target Species / Lifestage	Location	Year	Season	Description of Activity
1	*Information and Coordination*	Planning Group Coordination and Support		Rivers and Smith Inlets	Continuing	Year-Round	A Coordinator position is required on a contract basis to assist with planning group projects and logistics. Also includes meeting support
2	*Knowledge*	TEK study	All	Entire area	2005	Year-round	Knowledge regarding fish populations is held by those familiar with the area. Wuikinuxv have partially completed a marine TEK study, while G-N has not. We will try to gather some of this data.
3		Ecosystem modeling	All	Entire area	2005-2007	Year-round	Ecosystem modeling will be carried out using collected information
4		Analysis of lake and fjord sediments	All	Owikeno and Long Lake	2005	Year-round	Sediment cores to be taken from Owikeno and Long lakes and Wyclees Lagoon, and analyzed for isotopes and microfossils to give indications of past salmon abundance and ecosystem conditions.
5		Analysis of glacial retreats	All	Rivers and Smith Inlet Watershed	2005	Year-round	Analysis of past aerial photos for evidence of glacial retreats.
6		Analysis of past primary productivity	All	Inlets and beyond	2005	Year-round	Analysis of satellite images for evidence of past and present phytoplankton abundance in coastal waters.
7		Hydrodynamic modeling	All	Rivers Inlet and Wyclees Lagoon	2005	Year-round	Construction of a hydrodynamic model to generate understanding of the impacts of changes to river discharge and influxes of deep ocean waters on fjordal conditions.
8	*Stock Assessment*	Adult sockeye enumeration	Sockeye, coho, chinook / adult	Docee River	2004 - 2008	June-Nov	Continue to use the Docee fence to count inbound Smith Inlet salmon and determine the age structure by sampling returning adults.

9		Adult sockeye enumeration	Sockeye	Wannock River, Owikeno Lake	2004 - 2008	Summer – Fall	An accurate count of the returning adult population to Owikeno Lake is necessary and a priority for 2004. Current methods including hydroacoustics will be reviewed and a comprehensive plan drawn up.
10		Juvenile sockeye assessment	Sockeye	Long Lake	2004	Spring	A suitable juvenile assessment method for smolts emigrating from Long Lake must be decided upon.
11		Juvenile assessment	Sockeye, chinook, coho	Wannock River, Owikeno Lake	2004	Spring	An enumeration program for in-lake and out-migrating smolts will be developed and implemented later this year.
12		Adult assessment - Creel surveys	All	Rivers Inlet	2004 - 2008	Summer	During the busiest fishing months DFO creel surveys should take place in popular fishing areas within the inlet. Lodges should also be involved, tracking information from guests.
13		Adult chinook enumeration	Chinook	Rivers Inlet, Smith Inlet	2004 - 2008	Fall	Chinook salmon will be caught, sampled, marked, and released. All dead chinook salmon will be handled and counted to recover marks and determine run size.
14		Adult chum assessment – Nekite River	Chum	Nekite River	2004 - 2008	August - October	Estimate the run size of chum salmon into the Nekite River through channel counts and dead pitch activities.
15		Coho juvenile surveys (fry density)	Coho	Smith / Rivers Inlet drainages	2004 - 2008	Summer, Fall	Coho fry surveys will be conducted on identified systems to compare abundances from previous years.
16		Sockeye enhancement / mark recapture / fecundity estimates	Sockeye	Long Lake, Owikeno Lake	2004 - 2005	Fall – Winter	Restoration incubation may be necessary this year. There may also be an opportunity to gain information on average fecundities, and increase the recaptures of a mark-recapture program.
17	*Habitat Assessment and Rehabilitation*	Lake limnology monitoring	Sockeye	Owikeno and Long Lake	2004		Specific physical parameters will be measured and monitored in conjunction with pre-smolt abundance to determine freshwater survival.

18		Long Lake enrichment	Sockeye	Long Lake	2004 - 2007	Spring – Summer	Nutrients may be added in order to improve levels of primary productivity and sockeye survival rates.
19		Critical habitat surveys	All	Smith Inlet and Rivers Inlet drainages	2004, 2005	July - Nov	Gather information regarding salmon utilization of river systems within Rivers and Smith Inlets. Identify key spawning and rearing areas in order to monitor and possibly protect.
20		Log debris study	All	Owikeno Lake, Long Lake	2004		The effects of years of industrial forest activities (including dumping and booming) will be examined in terms of effects on fish utilization and survival.
21		Instream Restoration	All	Rivers and Smith watersheds	Unknown		Suggested rehabilitation projects including road deactivation, placement of instream structures, and construction off-channel habitat, and monitoring of completed projects.
22		Wannock River estuary assessment	All	Wannock River	2005		The Wannock River estuary has been adversely impacted by industrial uses in the area. It will be assessed and possibly restored to meet fish utilization needs.
23		Seal survey	All	Owikeno Lake, Wannock estuary, Wyclees Lagoon	2005		Seal predation will be monitored to determine when/if remedial action is necessary.
24		Early marine study	Sockeye	Smith Inlet, Rivers Inlet	2004-2008		Study of the early marine environment around Rivers and Smith Inlets will continue, in an effort to gain insight into recent salmonid population declines, and to attempt to devise a marine survival indicator.
25		Hatchery Feasibility Study	All	Owikeno Basin	Unknown		Investigation into the logistics, cost, and effectiveness of a hatchery within the Owikeno Basin will be examined.

10 RECOMMENDED RECOVERY PLAN PROJECTS

The following section details the 24 projects that have been identified for inclusion in the Rivers and Smith Inlets Recovery Plan. The projects have been identified through long discussion during several meetings of the RSSEPS over the past two years.

10.1 Information and Coordination

Project 1: RSSEPS Coordination and Support

In order to ensure that the Recovery Plan stays on track and continues to be an exercise involving all members of the RSSEPS, effective coordination will be vital. A portion of Project 1 will involve the hiring and funding of a coordinator, who will be tasked with ensuring the RSSEPS remains effective in administering the Recovery Plan.

Unlike the situation for many other watershed stewardship groups, the mere act of meeting is a major expense and effort due to the remoteness of the plan area, and the dispersion of the membership. In order to maintain and increase participation of existing members in the RSSEPS a minimum of 4 face-to-face meetings and an equal number of full RSSEPS conference calls will be needed. Meeting costs will be partially covered within the Project 1 budget.

Estimated Project Duration *Continuing*

10.2 Knowledge

Project 2: Traditional Ecological Knowledge Study

A wealth of knowledge regarding fish populations is held within the local First Nations, community members, and others familiar with the area. We will try to gather some of this information for the entire area.

Estimated Project Duration *1 year*

Project 3: Ecosystem Modeling

Part of salmon population, watershed and ecosystem recovery is the development of a basic ecosystem framework/model for the area to help to guide planning, monitoring, management, and assessment within the context of ecosystem priorities and needs. This will require drawing on knowledgeable individuals from a number of different government agencies and universities. Cooperative workshops are proposed to develop the basic model and populate it with information. The findings would help to guide research and monitoring.

Estimated Project Duration *3 years*

Project 4: Analysis of Lake and Fjord Sediments

Lake sediment cores were extracted from Owikeno and Long Lakes and Wyclees Lagoon in 2003. A further core needs to be extracted from the uppermost basin of Owikeno Lake. By analyzing the lake core samples for nitrogen isotopes and all samples for microfossils, the RSSEPS hopes to obtain information about historic sockeye escapements and ecosystem conditions. The work will be similar to previous work performed in Alaska and elsewhere in British Columbia.

Estimated Project Duration *1 year*

Project 5: Analysis of Glacial Retreats

There is local and traditional ecological knowledge that glaciers have retreated in these inlet watersheds. Evidence from elsewhere indicates that these changes will have altered the level and timing of river discharges and of the amount of silt carried into the lakes and fjords. As a first step in assessing the potential impact of these changes, the RSSEPS will examine aerial photos for evidence of the extent of these retreats.

Estimated Project Duration *1 year*

Project 6: Analysis of Past Primary Productivities

Primary production (photosynthesis by plant life) forms the base of the food chain that feeds juvenile salmon. Satellite images can be used to estimate the amount of primary production in aquatic ecosystems. The RSSEPS will perform this analysis, where possible on coastal waters encountered by juvenile sockeye salmon migrating out from Owikeno and Long Lakes.

Estimated Project Duration *1 year*

Project 7: Hydrodynamic Modeling – Rivers Inlet and Wyclees Lagoon

Work performed over the past two years in these fjords suggests that juvenile salmon are heavily influenced by the extent and depth of the freshwater surface layer. In Rivers Inlet, this layer is particularly heavily influenced by the influx of fresh water from the Wannock River. In addition, preliminary evidence suggests that the surface layer in Wyclees Lagoon, though more stable, becomes thinner as the summer progresses. A hydrodynamic model can be used to estimate the impact of river discharge rates on freshwater surface layers – both in the past as far back in time as discharge rates are available, and into the future using predictions of climate change models. This will be an important tool in assessing the impact of climate change on these sockeye salmon populations.

Estimated Project Duration *1 year*

10.3 Stock Assessment

Currently, there are 9 stock assessment activities listed as proposed projects within the recovery plan. The number of projects will likely be reduced as the program becomes more streamlined, and activities become amalgamated. The final stock assessment programs undertaken must address the information needs as outlined in Chapter 5, and provide a basis for evaluating the recovery effort.

Project 8: Adult Sockeye Enumeration – Docee Fence

The Docee River Counting Fence has provided a reliable escapement estimate for sockeye in past years, and Chinook and coho in more recent years. The RSSEPS plans to rely on the data generated from fence operations for escapement estimates of sockeye, chinook and coho in Smith Inlet.

Estimated Project Duration *Continuing*

Project 9: Adult Sockeye Enumeration – Wannock River / Owikeno Lake

Unlike the Long Lake system in Smith Inlet, a reliable escapement estimation method currently does not exist for the Owikeno Lake system in Rivers Inlet. The RSSEPS has made it clear that the use of the Docee Fence as an indicator system for Owikeno is no longer acceptable. A hydroacoustic counter was tested in 2002 and 2003 with questionable results. The method may be employed in 2004 during a final test year. If the hydroacoustic counter is proven useful, the RSSEPS may take steps to implement the counting procedure in future years. In the meantime, enumeration will be performed via clear stream indexing, aerial enumeration, and mark-recapture deadpitch estimates. The entire adult enumeration program for Owikeno will be reviewed by the RSSEPS in January 2004.

Estimated Project Duration *Continuing*

Project 10: Juvenile Sockeye Assessment – Long Lake

In past years, hydroacoustic sampling of Long Lake has generated juvenile sockeye abundance estimates. While the hydroacoustic work continues, there has been recent effort focused on estimating emigrating juvenile abundances via floating fyke nets (2002) and rotary screw traps (2003). There is no disputing that obtaining accurate estimates of juvenile salmonids emigrating from Long Lake remains a priority of the RSSEPS. The RSSEPS, however, must refine the juvenile program so that it produces reliable estimates on a yearly basis, and is affordable. The program will be reviewed in January 2004.

Estimated Project Duration *1 year*

Project 11: Juvenile Sockeye Assessment – Owikeno Lake

This project has the identical challenges that are faced in Project 7. The program in Owikeno is very similar to that which has occurred in Long Lake. Review of Project 8 will also take place in January 2004.

Estimated Project Duration *1 year*

Project 12: Adult Assessment – Creel Surveys

Many members of the RSSEPS believe that the sportsfishing fleet in Rivers Inlet may be having an adverse impact on the escapement of fish returning to Rivers inlet watersheds. By ramping up a creel program, better data on how many fish are being caught, and proportion of species, could be obtained. In addition, a sampling program could be implemented providing additional information on age, fecundity, and possibly, genetic origin. The survey would hopefully involve lodge and non-lodge vessels.

Estimated Project Duration *5 years*

Project 13: Adult Chinook Enumeration

A chinook deadpitch program has been ongoing on several systems within the region. With the absence of a more accurate enumeration method, the program is likely the best indicator of escapement of chinook to local streams. The program will be reviewed as part of the entire Owikeno enumeration program in January 2004.

Estimated Project Duration *1 year*

Project 14: Adult Chum Assessment – Nekite River

The Nekite River has been enumerated by various methods over the past several years, including channel counts, mark-recapture deadpitch, and snorkel surveys. The hope is that a program can be developed that will allow the Nekite to serve as an index system for Area 10 chum. An additional system within Smith Inlet will be investigated this year to determine its suitability.

Estimated Project Duration *Continuing*

Project 15: Juvenile Coho Surveys (fry densities) – index systems

Fry density surveys have been performed by Fisheries and Oceans Canada in selected systems as an abundance index to previous years. Other than possible trapping programs that may occur next year, these surveys would be the only effort directed at juvenile coho.

Estimated Project Duration *Continuing*

Project 16: Sockeye Enhancement / mark-recapture / fecundity estimates

Restoration incubation is used to increase egg – fry survival when returns are low to try and meet conservation levels. Given that poor sockeye returns are anticipated for next year, intervention in the form of enhancement may be an important part of the recovery plan. While enhancement is on going, there will be an opportunity to gain information on average fecundities, and possibly, increase the recaptures of a mark-recapture program.

Estimated Project Duration *2 years*

10.4 Habitat Assessment and Rehabilitation

There are currently 8 projects proposed under the heading of Habitat Assessment and Rehabilitation. The projects are diverse, and focus on a range of species and habitats. Some of these projects require long-term commitments of effort and funding, while others will only be performed in a single year.

Project 17: Lake Limnology Monitoring – Owikeno and Long Lakes

Continuance of lake monitoring is vital for both Owikeno and Long Lakes. Specific physical parameters will be measured and monitored in conjunction with pre-smolt abundance (sockeye) to determine freshwater survival. Limnology monitoring will be essential if nutrient additions are being considered (Long Lake).

Estimated Project Duration *1 year*

Project 18: Lake Enrichment – Long Lake Sockeye

In past years, Long Lake was fertilized in an attempt to improve levels of primary productivity. The belief was that an increase in food supply for juvenile sockeye would result in increased freshwater survival. In addition, the fertilization may produce larger smolts, possibly resulting in an increase in marine survival. The RSSEPS is considering nutrient additions to Long Lake for one full cycle of sockeye.

Estimated Project Duration *4 years*

Project 19: Critical Habitat Surveys – Rivers and Smith Watersheds

In Chapter 5 several information gaps were identified. One of these gaps was the lack of information on critical freshwater habitats. The purpose of Project 16 would be to gather information regarding salmon utilization of river systems within Rivers and Smith Inlets, and identify key spawning and rearing areas in order to monitor and possibly protect. An example of unknown critical habitat that may be affecting salmonid recovery is that of the Long Lake Chinook. These fish, which are renown for their extreme size, have been reduced to escapements of only a few dozen. While there is some thought that habitat damage within Long Lake may have contributed to their decline, little is known about the habitat requirements of these fish. Effort must be directed to obtaining more information, which may lead to the protection of critical habitats.

Estimated Project Duration *2 years*

Project 20: Log Debris Study – Owikeno and Long Lakes

This project is a specific example of Project 16. Past industrial activity has resulted in wood waste deposition within the lakes. The RSSEPS is concerned that the presence of the wood waste may be hindering stock recovery of several species. A study to examine the impacted areas of Owikeno and Long Lakes is proposed.

Estimated Project Duration *1 year*

Project 21: In-stream Restoration – Rivers and Smith Watersheds

There are specific areas in various watersheds within Rivers and Smith Inlets where past forestry activities may have had adverse impact on fish habitat. The RSSEPS has suggested several activities aimed at restoring and rehabilitating damaged habitat. These activities include road deactivation to prevent further habitat degradation, placement of instream structures, and construction and re-watering of groundwater channels. Specific habitat projects will be discussed in January 2004.

Estimated Project Duration *Unknown*

Project 22: Wannock River Estuary Assessment

The Wannock River estuary has been adversely impacted by past industrial uses. It will be assessed and possibly restored to meet fish utilization needs.

Estimated Project Duration *1 year*

Project 23: Seal Predation Survey – Lake and Estuarine Areas

Seal predation on salmonids, especially in Owikeno Lake and Wannock Estuary, has been substantial in past years. There is a fear that seal predation may be putting undue stress on depressed salmon stocks. Further investigation may be required to determine the degree of impact seals are having on the salmon.

Estimated Project Duration *1 year*

Project 24: Early Marine Study – Rivers and Smith Inlets

Work performed over the past two years in Rivers Inlet has generated valuable insight on (i) the functioning of the inlet ecosystems and (ii) the migration behaviour of sockeye salmon in these inlets as they adjust to the marine environment. Given that existing circumstantial evidence points to this life stage as the most likely source of the recent collapse of Rivers and Smith Inlet sockeye salmon, this information is vital to recovery planning. In addition, estimates of food availability have proved to be useful predictors of marine survival for salmon populations in Barkley Sound. Such predictors are useful for in-season management of harvest activities.

Estimated Project Duration *5 years*

Project 25: Hatchery Feasibility Study – Owikeno basin

A study examining the biological, engineering and economic feasibility of constructing a hatchery within the Owikeno Basin will be undertaken.

Estimated Project Duration *1 year*

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APPENDICES

Appendix 1: Rivers and Smith Inlets Salmon Ecosystem Planning Society (RSSEPS) Members

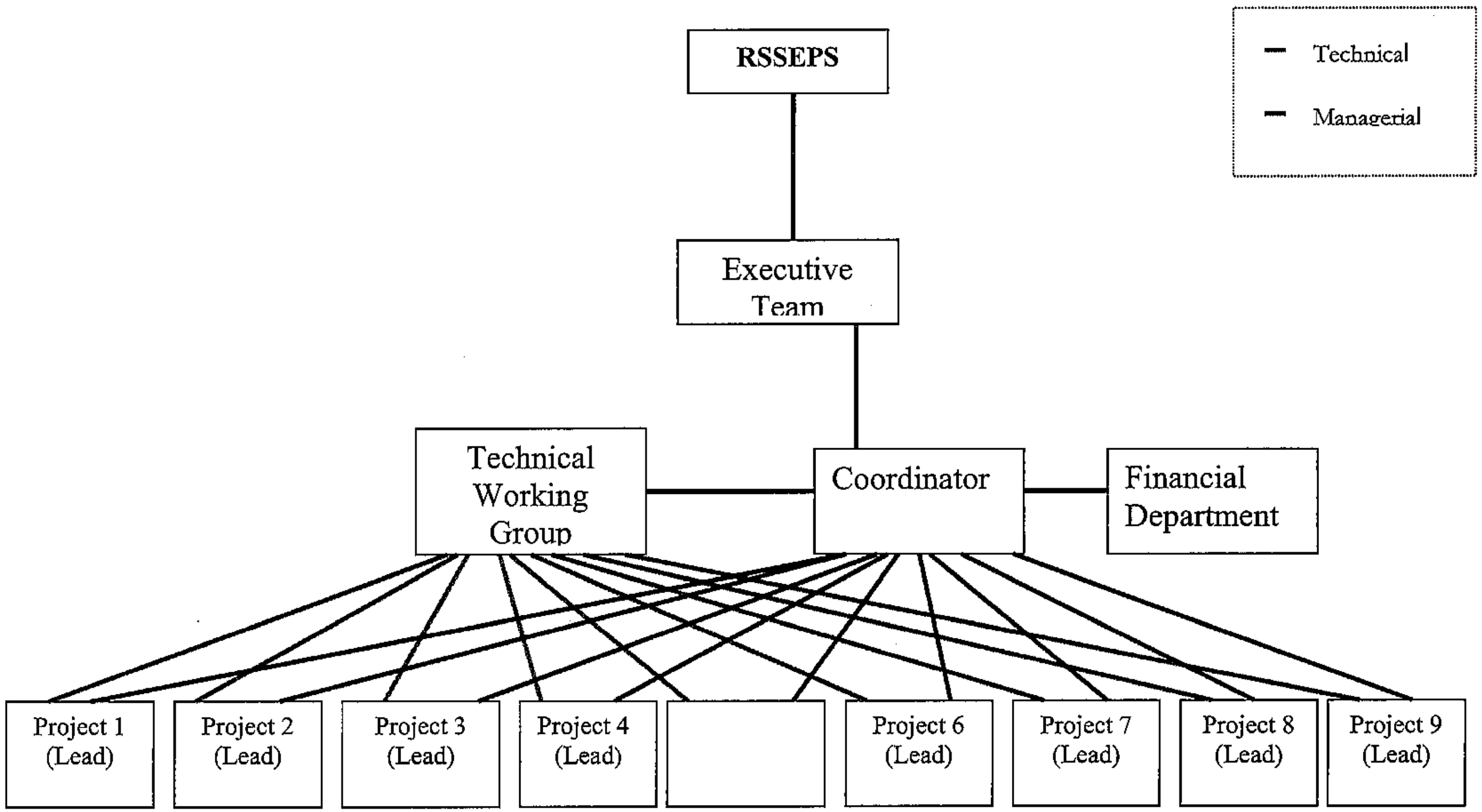
The Rivers and Smith Inlets Salmon Ecosystem Planning Society have had relatively informal procedures regarding membership since its inception in 2000. The following lists all sectors and representatives since August 2000, denoting those that remain current in **bold.**

Wuikinuxv Nation	**Bruce Burrows** Percy Walkus Jennifer Walkus Frank Johnson
Gwa'sala-'Nakwaxda'xw Nation	**Colleen Hemphill** **Doug McCorquodale** Dave Schmidt
Rivers Inlet/Hakai Pass Sport Fishing Association	**Michael Rough** George Ardley
BC Seafood Sector Council	
Western Forest Products Ltd.	**Corby Lamb**
International Forest Products Ltd,	**Wayne Wall**
Fisheries and Oceans Canada	**Sandie MacLaurin** Greg Savard **Jonathan Hepples** Russ Hilland **Gary Taccogna** Rebecca Reid
Fisheries Renewal BC	Angus MacKay
District of Port Hardy	**Mayor Harry Mose**
Coastal Ecosystems Research Foundation	**William Megill**
Sierra Club	**Sharon Chow**
Combined North Island Fisheries Centre	Jennifer Gold
UBC Fisheries Centre	**Nigel Haggan**
Commercial fishing sector	**Lewis Bublé**
Simon Fraser University	**Rick Routledge, Seana Buchanan**
Pacific Salmon Endowment Fund	**Rich Chapple, Bob Bocking**
Coordinator	**David Stevenson** Norman Dale James Wilson
Consultant	Al Wood

Appendix 2. Organizational Structure of the Rivers and Smith Inlets Salmon Ecosystem Planning Society

The diagram below outlines the organizational structure of the Rivers and Smith Inlets Salmon Ecosystem Planning Society. The structure was adopted in December 2003 and has been used as the structure for group governance, project selection, project administration and project oversight. The various levels of the organization are described on the page following the diagram.

PROPOSED STRUCTURE OF THE RIVERS / SMITH SALMON ECOSYSTEM PLANNING SOCIETY



RSSEPS: This is the overall group, responsible for ultimately approving all decisions. In particular, the RSSEPS as a whole must give the final approval for projects selected to be performed on an annual basis.

Executive Team: Composed of four representatives of the entire group, the roles of the executive team include providing the Coordinator with direction, making day to day financial decisions, and signing of contracts.

Technical Working Group: A group of individuals representing various groups involved with the RSSEPS that possess technical fisheries knowledge. The Technical Working Group meets regularly to provide oversight on projects, and recommend action on technical matters that are reviewed and approved by the Executive Team and the RSSEPS.

Coordinator: Acts as a liaison between all groups that comprise the organization. Also responsible for the day-to-day operation of the Rivers and Smith Inlets Salmon Ecosystem Planning Society.

Financial Department: Responsible for working with the Coordinator and the Executive Team to track the revenues and expenditures of the Rivers and Smith Inlets Salmon Ecosystem Planning Society.

Project Leads: Liaise back to the TWG and report on individual projects. The project leads may be responsible for running the project themselves, or supervising a contractor.

Appendix 3. Spawner Counts of salmon returning to Rivers and Smith Inlets Watersheds for 2001.
(More recent data will be added as it becomes available).

ZONE	STREAM	Sockeye	Coho	Pink	Chum	Chinook	Steelhead
RIVERS INLET							
Owikeno Upper	Washwash Creek	3,500				15	
	Tzeo River					143	
	Inziana River	1,500					
Owikeno Mid	Sheemahant River	Yes					
	Owikeno Lake Spawn.						
	Genesee Creek	250					
Owikeno Lower	Machmell River						
	Machmell Channel						
	Neechanz River	Yes				444	
	Ashlulm Creek	2,500				147	
	Amback Creek	3,900					
	Dallery Creek	3,200				15	
	Doos Creek						
	Meadows Creek						
	Owikeno Lake						
Owikeno Outlet	Wannock River & Flats	Yes	Yes		Yes	2,000	
Upper Rivers In.	Nicknaqueet River			500	30		
	McTavish Creek						
	Chuckwalla River				10,000	700	
	Kilbella River					1,298	
	Shotbolt Creek						
Moses-Hardy In	Clyak-Young-Neil River						
	Milton River						
	MacNair Creek						
	Doris Creek						
Mid Rivers In.	Sandell River						
	Newichy Creek						
	Johnston Creek						
Draney In.	Robert Arm Cr.						
	Allard Creek						
	Lockhart-Gordon Cr.				2,600		
	Draney Creek				3,200		
Outer Rivers In.	Hogan						
	Beaver Creek						
	Oatsoalis Creek						
	Chic Chic Creek						
SMITH INLET							
Long Lake	Canoe Creek	2,110					
	Triangle Creek/Lake						
	Smokehouse Creek	6,340					
	Long Lake						
Long Outlet	Docee River	*8,450*				*300*	
Upper Smith In.	Nekite River					4	
	Nekite Spawn. Chan.						
	Walkum Creek						
Boswell Inlet	Boswell Creek						
Outer Smith In.	Takush River						
	Dsulish Creek						
	Margaret Creek						
	Hagen Creek						

Appendix 4. Summary of enhancement activities that have occurred in the Rivers and Smith Inlets area.

SUMMARY OF HATCHERY RELEASES OF SOCKEYE AND CHUM SALMON TO OWIKENO LAKE AND LONG LAKE BASINS						
	HATCHERY(S)	BROODSTOCK USED			NUMBER	NUMBER
BROOD	& COMMUNITY			EGG	EGGS	FISH
YEAR	PARTNERS	FEMALES	MALES	TARGET	TAKEN	RELEASED
OWIKENO BASIN SOCKEYE including the Wannock River						
1982	Oweekeno Nation				41,000	16,000
1999	Snootli, Oweekeno Nation & RIRS	29	35		54,564	50,984
2000	Snootli, Oweekeno Nation	170	177	550,000	607,120	522,184
2001	Snootli, Oweekeno Nation	158	160	550,000	640,733	592,666
2002	Snootli, Oweekeno Nation	151	167	550,000	731,108	675,991
2003	Snootli, Oweekeno Nation	117	129	550,000	570,068	*504093
OWIKENO TOTAL		**625**	**668**		**2,644,593**	**2,361,918**
LONG LAKE BASIN SOCKEYE						
2000	Snootli, Oweekeno Nation	7	10	200,000	7,906	6,666
2001	Snootli, Oweekeno Nation	66	82	200,000	265,134	241,151
2002	Snootli, Oweekeno Nation	61	53	200,000	281,584	236,259
2003	Snootli, Oweekeno Nation			0	0	0
LONG LAKE TOTALS		**134**	**145**		**554,624**	**484,076**
All releases include eyed egg outplants						
*on hand or outplanted as eggs						
OWIKENO BASIN CHUM - Wannock River						
1984	Oweekeno Nation				97,543	74,167
1986	Oweekeno Nation				382,599	271,000
WANNOCK RIVER CHUM TOTAL					**480,142**	**345,167**
No hatchery releases of chum in Smith Inlet						

SUMMARY OF HATCHERY RELEASES OF WANNOCK RIVER & NEECHANZ RIVER CHINOOK SALMON (OWIKENO BASIN) 1983-2003

BROOD YEAR	HATCHERY(S) & COMMUNITY PARTNERS	EGGS TAKEN	FISH RELEASED
1983	Snootli, Oweekeno Nation	88,000	53,318
1984	Snootli, Oweekeno Nation	183,510	149,819
1985	Snootli, Oweekeno Nation, RIHPSFA	269,774	245,314
1986	Snootli, Oweekeno Nation, RIHPSFA	516,006	315,223
1987	Snootli, Oweekeno Nation	603,322	469,085
1988 (cwt)	Snootli, Oweekeno Nation	517,801	417,859
1989 (cwt)	Snootli, Oweekeno Nation	669,397	436,624
1990 (cwt)	Snootli, Oweekeno Nation	688,672	612,487
1991 (cwt)	Snootli, Oweekeno Nation	869,934	636,268
1992 (cwt)	Snootli, Oweekeno Nation	593,179	478,057
1993 (cwt)	Snootli, Oweekeno Nation	694,088	564,702
1994	Snootli, Oweekeno Nation	494,058	378,913
1995	Snootli, Oweekeno Nation	417,339	367,449
1996	Snootli, Oweekeno Nation	361,623	278,984
1997	Snootli, Oweekeno Nation	304,490	273,374
1998	Snootli, Oweekeno Nation	95,240	76,916
1999 (cwt)	Snootli, Oweekeno Nation	34,019	29,222
2000* (cwt)	Snootli, Oweekeno Nation, RIHPSFA	131,317	90,845
2001* (cwt)	Snootli, Oweekeno Nation, RIHPSFA	75,914	60,669
2002* (cwt)	Snootli, Oweekeno Nation, RIHPSFA	302,403	295,978
2003* (cwt))	Snootli, Oweekeno Nation, RIHPSFA	18,808	~17000 on hand
TOTAL WANNOCK		**7,928,894**	**6,248,106**
1990	Snootli, Oweekeno Nation	19,811	18,885
TOTAL NEECHANZ		**19,811**	**18,885**

*Major funding provided by Rivers Inlet Hakai Pass Sportfishing Assoc. (RIHPS

(cwt) = A portion of releases coded wire tagged marked prior to release

SUMMARY OF HATCHERY RELEASES OF KILBELLA RIVER and CHUCKWALLA RIVER CHINOOK SALMON (RIVERS INLET) 1986-2001

	HATCHERY(S)	KILBELLA RIVER		CHUCKWALLA RIVER	
BROOD	& COMMUNITY	EGGS	FISH	EGGS	FISH
YEAR	PARTNERS	TAKEN	RELEASED	TAKEN	RELEASED
1986	Shotbolt (RIHPSFA)	57,000	54,000	0	0
1987	Shotbolt (RIHPSFA)	170,000	129,320	85,540	67,500
1988	Shotbolt (RIHPSFA)	45,000	35,400	240,000	207,500
1989*	Shotbolt/Snootli	75,657	966	292,702	30,030
1990 (cwt)	Shotbolt/Snootli	6,586	5,743	82,117	63,461
1991 (cwt)	Shotbolt/Snootli	51,043	44,637	152,213	85,497
1992 (cwt)	Shotbolt/Snootli	63,352	38,176	208,662	97,915
1993 (cwt)	Shotbolt/Snootli	28,842	13,963	183,036	137,033
1994 (cwt)	Shotbolt/Snootli	77,396	43,956	114,614	66,901
1995 (cwt)	Shotbolt/Snootli	87,530	65,901	87,998	66,789
1996 (cwt)	Shotbolt/Snootli	96,975	59,257	159,969	84,672
1997** (cwt)	Shotbolt/Snootli	96,099	54,639	137,275	73,877
1998 (cwt)	Shotbolt/Snootli	46,826	6,220	73,023	42,470
1999** (cwt)	Shotbolt/Snootli	126,059	60,109	213,835	27,018
2000*** (cwt)	Snootli,RIHPSFA	26,457	10,416	504,183	128,004
2001*** (cwt)	Snootli,RIHPSFA	498,421	222,092	313,183	202,336
TOTAL CHINOOK		**1,553,243**	**844,795**	**2,848,350**	**1,381,003**

Shotbolt Hatchery funded and operated by Rivers Inlet Hakai Pass Sportfishing Assoc. (RIHP

Hatchery program ended with release of 2001 brood

*Flood wiped out hatchery incubation room, salvaged alevins airlifted to Snootli Hatchery

**Includes progeny of captive brood fish

***Soley from captive brood fish - Shotbolt Hatchery closed

(cwt) - a portion of releases coded wire tag marked prior to release

HATCHERY RELEASES OF CHUCKWALLA RIVER COHO SALMON (RIVERS INLET) 1986 & 1998

	HATCHERY(S)	KILBELLA RIVER		CHUCKWALLA RIVER	
BROOD	& COMMUNITY	EGGS	FISH	EGGS	FISH
YEAR	PARTNERS	TAKEN	RELEASED	TAKEN	RELEASED
1998	Shotbolt			15,000	13,000
1999	Shotbolt			14,829	13,882
TOTAL COHO				**29,829**	**26,882**

Appendix 5: Overview of salmon spawning habitats within Rivers and Smith Inlets

Source?

ZONE	STREAM	Habitat
RIVERS INLET		
Owikeno Upper	Washwash Creek	Clear, logged, impassable falls at 4km, unstable, breakthrough to Tzeo
	Tzeo River	Clear, logged, passable cascade at 6.5km
	Inziana River	Clear, logged, impassable falls at 1.25km
Owikeno Mid	Sheemahant River	**Glacial**, logged, cascades at 20km, 24km accessible, beach spawning
	Owikeno Lake Spawn.	Silty
	Genesee Creek	Clear, logged, impassable falls at 1.5km; flood channel from Machmell
Owikeno Lower	Machmell River	**Glacial**, logged, cascade at 20km, 32km accessible, shifts course
	Machmell Channel	
	Neechanz River	Clear(?), logged, passable cascades at 4.5km, accessible 6.5km
	Ashlulm Creek	Clear, unlogged, rapids at 5km,
	Amback Creek	Clear, unlogged, 8km accessible, lake beach spawning near mouth
	Dallery Creek	Clear, unlogged, 6.5km impassable cascade
	Doos Creek	Clear, unlogged, falls at mouth, habitat above(?)
	Meadows Creek	Clear, unlogged, falls at mouth, old hatchery water source
	Owikeno Lake	Main basins glacial, 56km long
Owikeno Outlet	Wannock River & Flats	Silty, logged, 6.5km,
Upper Rivers In.	Nicknaqueet River	Clear, logged, impassable falls at 2km
	McTavish Creek	Clear, water for cannery
	Chuckwalla River	Clear, logged, cascades at 16km, limited spawning above
	Kilbella River	Clear, logged, accessible to 48km, second growth forest, road removal
	Shotbolt Creek	Clear, water for cannery
Moses-Hardy In.	Clyak-Young-Neil Rivers	Clear, logged, Clayak accessible to 3km, Y-N excellent area to 13km
	Milton River	Clear water, logged, passable falls at 5km, 11km accessible
	MacNair Creek	Clear, passable cascades at 2km, accessible to 11km
	Doris Creek	Clear,
Mid Rivers In.	Sandell River	Clear, 0.5km accessible, lakes above, water for cannery
	Newichy Creek	Clear, 0.5km accessible
	Johnston Creek	Clear, unlogged, 10km accessible
Draney In.	Robert (West) Arm Cr.	Clear, spawning to 100m
	Allard Creek	Clear, falls at 300m, spawning area excellent above Allard Lake
	Lockhart-Gordon Cr.	Clear, logged? Impassable falls at 3km
	Draney Creek	Clear, logged? 2km accessible,
Outer Rivers In.	Hogan	Clear, cannery water/hydro source
	Beaver Creek	Brown(?) water, 1.5km, sockeye above Elsie Lake, other species below
	Oatsoalis Creek	Clear, 1km accessible
	Chic Chic Creek	Brown water, unlogged
SMITH INLET		
Long Lake	Canoe Creek	Clear water, unlogged, passable cascades from 1 to 2.5km
	Triangle Creek/Lake	
	Smokehouse Creek	Clear water, unlogged, impassable cascades at 5km
	Long Lake	Clear water
Long Lk. Outlet	Docee River	Clear water, logged, 1.5km, counting fence
Upper Smith In.	Nekite River	Clear water, logged, passable cascades at 4km, accessible to 11km
	Nekite Spawn. Chan.	When due for cleanup?
	Walkum Creek	Clear water, impassable falls at 2.5km, some logging,
Boswell Inlet	Boswell (Coho) Creek	passable cascade at 1km, accessible to 2km, cannery water source?
Outer Smith In.	Takush River	Brown (?) water, passable falls at 5km
	Dsulish Creek	Brown (?) water, 3km accessible
	Margaret Creek	Clear water, impassable falls at 1km, water for cannery
	Hagen Creek	Brown water
Total Kilometres of accessible stream habitat = 286+ [not all good or usable]		

Appendix 6. Marine salmon habitats and habitat factors for Rivers and Smith Inlets – preliminary information

ZONE	LOCAL	HABITAT FACTORS
RIVERS INLET		
Upper Rivers In.	Wannock Estuary	juvenile rearing area; diking, booming, debris
	Head Rivers Inlet (9-6)	juvenile migration; adult holding area
	Kilbella Bay (9-6)	juvenile rearing area
	Rutherford Point (9-6)	juvenile/adult migration
Moses-Hardy In.	Upper Moses Inlet (9-8)	juvenile rearing area (?), migration, log handling?
	Lower Moses Inlet (9-7)	migration
	Hardy Inlet (9-9)	migration, log handling?
Mid Rivers In.	McAllister-Stone Pt. (9-5)	juvenile migration, adult fishing (?)
	Stone Pt.-Good Hope (9-4)	juvenile migration, adult fishing (?)
	Good Hope-Hemasila (9-3)	juvenile migration, adult fishing (?)
	Darby Chanel (9-11)	juvenile migration, adult fishing (?)
Draney In.	Upper Draney Inlet (9-10)	juvenile migration, log handling?
	Robert Arm (9-10)	juvenile migration, log handling?
	Lower Draney (9-10)	juvenile migration
Outer Rivers In.	Hemasila-Dimsey (9-2)	juvenile migration, adult fishing (?)
	Fish Egg Inlet (?)	juvenile migration, rearing (?)
SMITH INLET		
Upper Smith	Head Smith Inlet (10-10)	juvenile migration, log handling?
	Mid Smith Inlet (10-9)	juvenile migration
Mid Smith	Wyclees Lagoon (10-11)	juvenile rearing(?), migration, adult fishing (?) logging
	Quascilla Bay (10-8)	juvenile migration, adult holding, fishing (?)
	Naysash Inlet (10-7)	logging
	Outer Smith Inlet (10-7)	juvenile migration, adult holding, fishing (?)
	Ahclakerho Channel (10-12)	juvenile migration (?), adult migration (?)
	Boswell Inlet (10-6)	juvenile migration
Smith Sound	Inner Sound (10-5)	juvenile migration, adult fishing (?)
	Mid Sound (10-4)	juvenile migration, adult fishing (?)
	Outer Sound (10-3)	juvenile migration, adult fishing (?)
COASTAL		
Smith	Caution-Calvert (10-1, 10-2)	juvenile feeding & migration, adult migration
Rivers	Calvert-Addenbroke Pt. (9-1)	juvenile feeding & migration, adult migration
FFH	Addenbroke Pt.-Island (9-12)	juvenile feeding & migration, adult migration
FFH	Addenbroke-Whidbey (8-16)	juvenile feeding & migration, adult migration

Appendix 7. Parent to progeny ratios for sockeye salmon in Rivers and Smith Inlets.

Rivers Inlet sockeye data

Year	Progeny per Parent Ratio	Decadal Average
1965	6.807925428	
1966	2.53137047	
1967	2.285420505	
1968	4.27614445	
1969	2.670205168	3.714213204
1970	0.713032486	
1971	1.947069658	
1972	1.212837162	
1973	7.032973111	
1974	4.117160701	
1975	3.272877573	
1976	4.177713763	
1977	1.412464153	
1978	1.234327589	
1979	0.628477368	2.145172089
1980	0.803900503	
1981	3.465341741	
1982	3.00096763	
1983	1.973952463	
1984	0.878522583	
1985	1.285037169	
1986	1.475905652	
1987	1.261463157	
1988	2.056922695	
1989	1.228213132	1.461508361
1990	1.237943194	
1991	0.764070463	
1992	1.661116424	
1993	0.897647963	
1994	0.27414382	
1995	0.254068016	
1996	0.188541055	
1997	0.844336052	
1998	0.258484472	
1999	0.043768997	0.317839719
2000	0.305797101	
2001	0.143652888	
2002	0.609533098	
2003	4.998202086	1.514296293

Smith Inlet sockeye data

Year	Progeny per Parent Ratio	Decadal average
1965	6.807925428	
1966	2.53137047	
1967	2.285420505	
1968	4.27614445	
1969	2.670205168	3.714213204
1970	0.713032486	
1971	1.947069658	
1972	1.212837162	
1973	7.032973111	
1974	4.117160701	
1975	3.272877573	
1976	4.177713763	
1977	1.412464153	
1978	1.234327589	
1979	0.628477368	2.574893356
1980	0.803900503	
1981	3.465341741	
1982	3.00096763	
1983	1.973952463	
1984	0.878522583	
1985	1.285037169	
1986	1.475905652	
1987	1.261463157	
1988	2.056922695	
1989	1.228213132	1.743022672
1990	1.237943194	
1991	0.764070463	
1992	1.661116424	
1993	0.897647963	
1994	0.27414382	
1995	0.254068016	
1996	0.188541055	
1997	0.844336052	
1998	0.258484472	
1999	0.043768997	0.642412046
2000	0.305797101	
2001	0.143652888	
2002	0.609533098	
2003	4.998202086	1.514296293