Pacific Fisheries Resource Conservation Council

# Advisory: Salmon Conservation Challenges in British Columbia with particular reference to Central and North Coast

*Prepared by*
Pacific Fisheries Resource
Conservation Council

February 2004

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Printed and bound in Canada

ISBN 1-897110-20-0

Pacific Fisheries Resource Conservation Council
Conseil pour la conservation des ressources halieutiques du pacifique

February 2004

The Hon. John van Dongen
Minister of Agriculture, Food and Fisheries
Government of British Columbia
Victoria

The Hon. Geoff Regan
Fisheries and Oceans Canada
Government of Canada
Ottawa

Dear Ministers:

Enclosed with this letter is a brief advisory that we prepared subsequent to our review of the background paper entitled *Pacific Salmon Resources in Central and North Coast British Columbia*. We are also enclosing an executive summary of that study.

The background paper was authored by the Council's science advisor, Dr. Brian Riddell. We concur with his findings about the serious shortcomings in the salmon assessment programs. Council action must be taken to renew the mandate and funding necessary to ensure that Fisheries & Oceans Canada more adequately carries out its conservation management mandate.

We hope your officials will carefully review the background paper and executive summaries, along with this advisory, and we look forward to discussing with you what could be done to remedy the emerging problems.

John A. Fraser
Chairman

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Our science advisor to the Pacific Fisheries Resource Conservation Council, Dr. Brian Riddell, has carried out an extensive review of Pacific salmon in the central and northern regions of British Columbia and the programs of Fisheries and Oceans Canada to monitor the spawning escapements of these salmon. The review has by necessity been at a broad level rather than portraying in detail the diversity of these resources or conducting in-depth assessments of individual stocks or programs. However, this review combined with his earlier report on southern BC stocks (PFRCC Annual Report, 2001-2002) has provided sufficient basis for the Council to suggest that Fisheries and Oceans Canada is at a crucial decision point. It continues to experience reductions in budget and survey coverage of Pacific salmon at a time when more information is urgently needed to meet increasing demands.

Issues related to data and access to data are not new, and have been identified by the Auditor General's 1999 Report (Chapter 20) and by the 2001 National Stock Assessment Review by Fisheries and oceans Canada. The latter report comments that "although there is a general relationship between stock "value" and resources invested in assessment, overall the program is currently unable to deliver all the information required for effective management decision-making." (page 6). Those comments were directed to several marine species, but the situation is now clearly applicable to Pacific salmon. These Council reports document the reductions in stream surveys in the past decade and we have been informed of further reductions in this activity during 2003.

Those not directly involved with Pacific salmon may not appreciate the breadth of issues facing Fisheries and Oceans Canada and their management of Pacific salmon. While budgets allocated to salmon assessment and data decrease, several important issues demand higher quality and consistent data, not less information. The demand for more extensive and higher quality of information is coming from several sources:

- The 1999 Pacific Salmon Treaty agreement and abundance-based management of ocean fisheries provides substantial protection to Canadian resources, but requires annual quantitative assessments on key stocks.
- Canada's adherence to the International Convention on Biological Diversity of 1992, the application of precautionary approaches, development of ecosystem management and compliance with the Oceans Act of 1996 all necessitate the provision of Canadian salmon stock information.
- The process of identifying environmental conditions and local fisheries resources is of growing importance in negotiations with First Nations.
- The recent passage of the Species at Risk Act, with its provisions for conservation of specific populations, presents an imminent requirement for detailed stock status information beginning with the three (Thompson River coho, Sakinaw Lake sockeye and Cultus sockeye salmon) endangered stocks, and the recovery programs underway for Rivers Inlet and Smith Inlet sockeye.
- The Canadian fishing companies interested in receiving Marine Stewardship Certification will have to demonstrate the sustainability of their fishing activities and accountability in management and data.

- Several new fisheries conditions, such as the late-run Fraser sockeye mortality and sea lice on pink salmon in the Broughton Archipelago, are forcing changes to science priorities and drawing funds from existing uses.

Possibly the greatest demand for more and better information will be from an increasingly aware and concerned public. Environmental groups, academics, stewardship volunteers, and people across the province are concerned about the future of the wild salmon. Reduction to assessment programs while some stocks become listed under the Species At Risk Act (SARA), and the inability of Fisheries and Oceans Canada to deal with crucial issues such as the Wild Salmon Policy have strained public confidence in the Government of Canada's commitment to protect Pacific salmon. There has been a regrettable loss of trust that Fisheries and Oceans Canada can adequately assess or take the measures necessary to conserve the wild salmon when resources continue to be withdrawn from monitoring the stocks. The old adage of accountants to do-more-with-less is no longer a reasonable approach.

In the Council's view, the Pacific Region of Fisheries and Oceans Canada is seriously at risk of losing sight of its core responsibility to provide the information base for salmon management and decision-making purposes, and for long-term scientific knowledge. It is not apparent, if the current trend of assessment reductions continues that fisheries managers will be able to maintain their time series of information to monitor salmon trends, study impacts of climate change, or fulfill the increasing information demands noted above. We understand that Fisheries and Oceans Canada staff and managers are aware of these needs and are trying to adapt to continued budget pressures. We strongly believe, however, that there must be an explicit and continuing commitment of funds for a core assessment program that will ensure the needed long-term data to fulfill immediate and future requirements. Without this commitment, the assessment programs are at serious risk of irrevocable disruptions to essential datasets and information that were painstakingly collected and assembled over decades.

Canadians have trusted that Fisheries and Oceans Canada would maintain a responsible standard of care for their legacy of information on fisheries resources. They should be able to trust it has and will maintain that information on Pacific salmon for the future. Meeting this expectation requires the assurance of reliable data series on salmon populations over time, for science studies and stock management use. This core information is critical to conserve salmon, maintain social, cultural, and economic benefits from the resource, and restore public credibility in the government's determination of protect wild salmon.

The decision point for Fisheries and Oceans Canada is how it can respond effectively to both the budgetary pressures and the need to fulfill its basic mandate. We have, as a Council, made several recent requests for clarification of the current and impending budget cuts, program changes and personnel reductions in the Pacific region of Fisheries and Oceans Canada. We have not been particularly satisfied with the information provided to us, although we recognize that the process of downsizing and re-allocating resources is difficult for everyone who is involved or affected. We are suggesting three criteria that we hope will help guide any budget changes and program decisions related to stock assessment:

- Any reductions to core salmon assessment programs and science should not be disproportionately larger than reductions in other program areas.

- The budget reductions should not be made where that would involve creating or worsening conservation risks.

- Any decisions with long-term consequences, particularly with conservation impacts, should be made only after full consultation involving those affected by the decisions.

There is no doubt that public confidence and trust is at stake in how these decisions are reached and how affected groups are involved in developing these core programs.

The background paper by Dr. Riddell and the earlier review of salmon stocks in southern British Columbia have provided a picture of the scope of the task involved in managing and conserving Pacific salmon. They have acknowledged the extent of effort that Fisheries and Oceans Canada has made in the past and credited that effort.

In each of the species reviewed in this report, the Council has basically made the same recommendation to establish a core assessment framework, whose essential aspect must be the generation of quality of information collected within a structured monitoring program. The Pacific Region of Fisheries and Oceans Canada has continually been dealing with uncertain funding levels, moving budget targets, and changing priorities. We strongly advise, therefore, that a commitment be made to establish a core assessment program for Pacific salmon, and that this program be developed in an open and consultative process to encourage partnerships and maximize cost effectiveness. Admittedly, these discussions are likely to involve questioning of all aspects of the Pacific Region's budget related to salmon. **But we emphasize that reliable information on naturally-produced Pacific salmon should be the first priority; salmon conservation relies upon provision and maintenance of this legacy.**

# EXECUTIVE SUMMARY

## Pacific Salmon Resources in Central and North Coast British Columbia

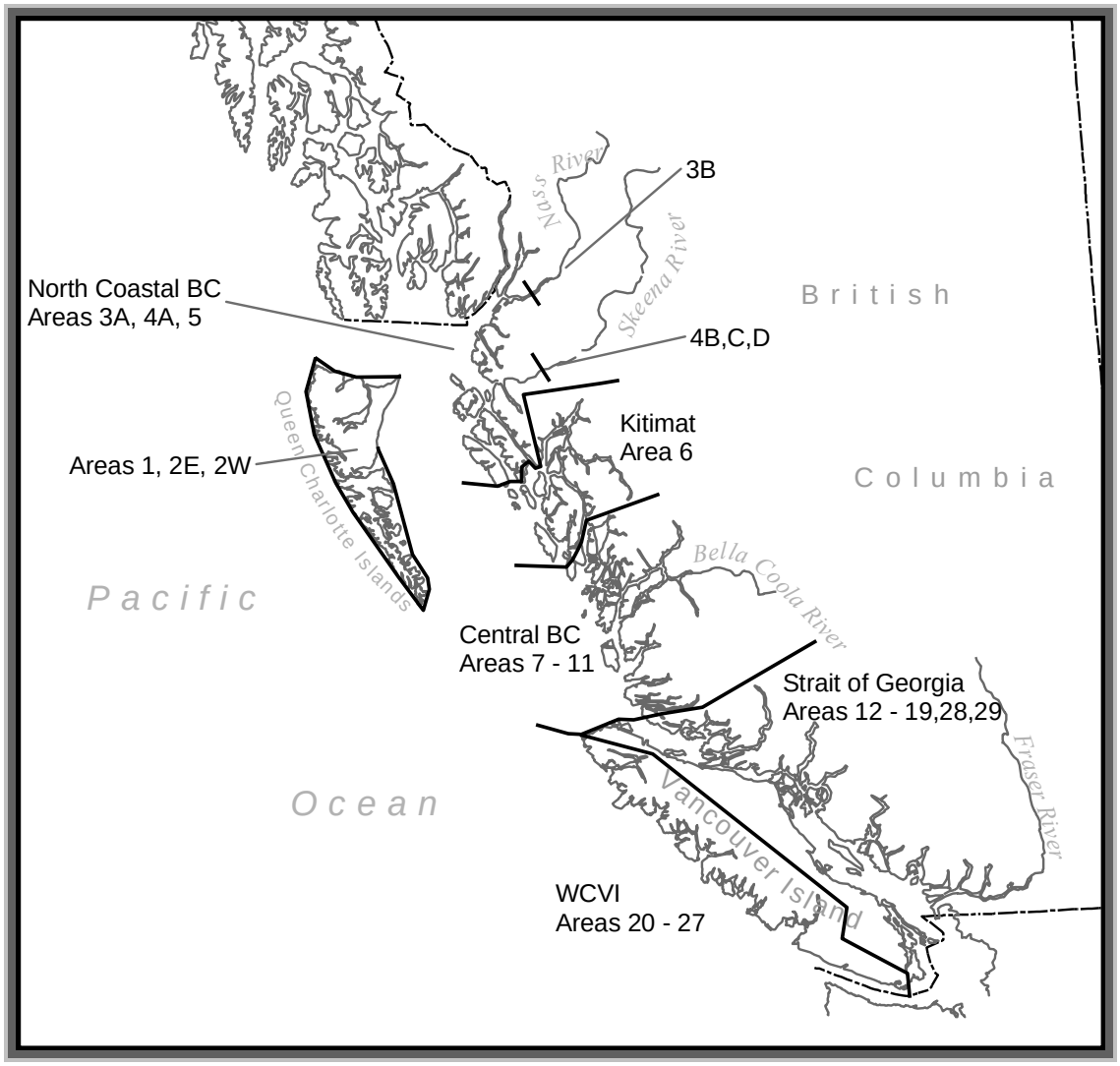
This is the second in a series of three reports by the Pacific Fisheries Resource Conservation Council (PFRCC) describing the Pacific salmon resource in British Columbia and Yukon, its current state, and the ability to assess and understand this important resource. It deals with the wild salmon in central British Columbia (DFO statistical areas 7 to 11) and the northern region (DFO statistical areas 1 to 6). In geographic terms this is the area from southern Queen Charlotte Sound northwards to Portland Canal, including the Queen Charlotte Islands (Map 1).

The information in this report is derived from Fisheries and Oceans Canada salmon spawning records, reports reviewed and accepted by the Pacific Scientific Advice Review Committee (website: www-sci.pac.dfo-mpo.gc.ca/sci/psarc), and published technical references. Most of the data are reported numbers of salmon spawning in specific streams and based on visual surveys. While there is a long record of these observations, the accuracy of the estimates is usually unknown. Efforts are made to make the annual surveys comparable, but differences in the numbers of spawning salmon from year to year may reflect several sources of change; including actual production of progeny per spawner, fishing pressures, local effects of freshwater habitats, as well as revised procedures in annual spawning surveys. The interpretation of these data is typically limited to trends over time in specific streams or local areas. These data usually provide the only means to monitor continuance and abundance trends in these spawning populations, but they may not be representative of changes in production status since the catch for each stream is very seldom known. The data are frequently of limited value in explaining trends since there could be several possible causes of reductions in the number of spawners. Explanations require more complete data, but there are very few salmon populations with the necessary data in central and northern BC.

Public attention is frequently focused on crisis and conflict over salmon issues and generally on the negative circumstances associated with salmon. **Salmon are indeed threatened by continued economic development, climate change, and human population growth. They also remain a diverse, highly dynamic, and resilient group of species.** This report attempts to document the breadth of this important resource in central and northern British Columbia and presents a long-term perspective on their stock status. Where possible, we comment on current challenges and monitoring programs.

**Map 1. Fisheries and Oceans Canada (DFO) statistical area designations and sub-areas used in this report.**

*Six sub-areas discussed in the text include: central BC (area 7 to 11 inclusive), the Queen Charlotte Islands (areas 1, 2E, 2W), north coastal BC (areas 3a, 4a, 5 coastal zones), and interior areas of the Nass River (Area 3B) and Skeena River (Areas 4B,C,D). Individual statistical areas are described in detailed DFO maps at:* www.pac.dfo-po.gc.ca/ops/fm/Areas/areamap_e.htm



## Overview of Council Advice

The PFRCC has provided comments at the end of each section of the report concerning each species. There is a strong common thread of problems and opportunities across the species and geographic area.

It is a credit to past staff in Fisheries and Oceans Canada that such a broad and informative set of historical data exist for assessments and decision-making. It is regrettable that this wealth of information is not being sufficiently replenished and that across each species these annual surveys of spawning escapements are being reduced.

We note in our report that in many cases the numbers of streams surveyed may still be an adequate sample. This situation depends upon their adequate geographic distribution and comparability of the information from current methods with historical ones.

Furthermore, the quality of data needed for an assessment is related to the intensity of fisheries, or other impacts, that are expected to effect the salmon populations. If harvest rates are expected to be high, then more quantitative data should be collected, and visa versa. Our major concern, though, is about how federal government budget reductions may undermine salmon stock assessments. At the same time, it is troubling to observe that too often decisions are made in response to budget restriction on an ad hoc basis, and not part of a planned response that matches information requirements to anticipated needs or long-term information values.

The PFRCC must stress an important point concerning the collected data and information. Given the limited quantitative information available for most species and areas in the central and northern regions, the historical escapements surveys and data are the core base for any future assessments. Even with the concerns for how repeatable survey methods have been over time or between streams, and the unknown accuracy of these surveys, they are the legacy of data that people must work with. There is potential to improve these surveys, but care must be taken in selecting which surveys are maintained and evaluating the comparability of future data with past information.

Given the obvious need to control budgets while providing information for resource assessment and fishery management decisions, our strongest advice is to develop a core stock assessment framework for each species and area. The information needs will vary by species and location, but a commitment is needed to maintain a core annual program of essential information. This would provide stability to the information that will be available for future use and reduce risks of ad hoc decisions that could otherwise have detrimental impacts. The PFRCC is aware that Science Branch of Fisheries and Oceans Canada have discussed developing such plans and that North Coast Stock Assessment program has been examining alternative assessment procedures for sockeye salmon. However, with the extent of reductions in stream surveys and the continuing concerns for budget reductions, there is an increasing urgency for the completion of these frameworks.

This report also identifies several specific issues for the consideration of Fisheries and Oceans Canada.

1. Fisheries and Oceans Canada should conduct a concerted assessment of the smaller sockeye lake populations during the next few years and study the genetic structure of these stocks in order to properly define the conservation units for sockeye.

2. Each chum population in the regions should be designated by run-timing, and genetic variation between summer and fall chums should be assessed. Fisheries and Oceans Canada should establish some quantitative capacity to assess summer chum salmon, including the estimation of marine survival, fishery harvest impacts, and variability in productivity of these populations.

3. The indicator stock programs for coho and chinook salmon are essential to evaluate changes in marine survival rates and fishery impacts over time. Indicator stocks provide the only means that the Council is aware of to assess the causes of changes in coho and chinook production and to provide verification for the visual escapement surveys. We note that presently there are no indicator stocks for coho and chinook salmon in some areas of central and northern BC.

4. Fisheries and Oceans Canada should establish an assessment framework for each salmon species, and consider how the salmon "stocks" may be accounted for under the Canadian Species at Risk Act.

5. There should be a thorough review of the need and/or value of the major hatchery programs, addressing the questions of whether or not they are providing the expected or desired benefits, and how they could be modified to aid other populations, assessment programs, or uses. These evaluations should clearly involve the local communities in consultations.

Recent reductions in fishing pressures and improvements in marine survival of salmon provide positive indicators of better spawning, but we also know that these conditions will change over time. The outstanding question from our perspective is whether Fisheries and Oceans Canada and other resource users will be prepared to invest sufficiently in fisheries management and monitoring of Pacific salmon stocks to maintain the legacy of valuable data and information for future uses.

## Summaries of Report by Species

### Sockeye salmon *(Oncorhynchus nerka)*

People commonly associate sockeye salmon in north and central BC with four major lake systems that have been important economic resources for many years. Many smaller sockeye lakes are also important components of the biological diversity of this species. For example, Babine Lake in the upper Skeena River is the largest sockeye producing system in the northern region, and includes three large artificial spawning channels built during the 1960s. Babine Lake sockeye are the most accurately enumerated salmon in the region; the adults entering it have been counted past a fence since 1946 and juvenile production emigrating from the lake has been estimated each year since 1961. At the same time, there are 27 non-Babine sockeye lakes within the Skeena watershed but the ability to assess sockeye populations in these lakes is much more limited than for Babine Lake.

While there have been increased catch of sockeye and spawning returns to Babine Lake, the effect of enhancement programs has been less positive for the other non-Babine sockeye lakes. Most of those systems show a decline in escapements and a subsequent recovery (Figure 1), but the declines are not synchronous or equal in their degree.

Similarly, variable status was determined in sockeye systems outside of the Skeena River. Sockeye escapement to Meziadin Lake (Nass River) is increasing but returns to Owikeno and Long lakes (Rivers and Smith Inlets) are currently depressed. These latter two lakes include

multiple spawning populations and are recovering from very poor marine survival during the mid-1990s. The status of another 116 sockeye lakes in central and northern BC is much more difficult to summarize.

With the possibility that the numerous smaller sockeye populations could become management concerns, the Council provided extensive tables and graphs in this report to qualify and compare conditions of the sockeye stocks. The number of true sockeye populations is difficult to define when so many of the lake systems have multiple spawning streams and separate spawning escapement records. In the central and northern regions, the spawning records report 236 sockeye streams and about half of these streams are surveyed on a regular basis. Between 1950 and 1990, between 110 and 118 streams were surveyed in six or mores years each decade. During the 1990s, funding limitations substantially reduced survey coverage in the coastal lakes and non-Babine systems in the Skeena River. Since the mid-1990s, fewer than 100 streams have been monitored annually and one-third of those are tributary to Babine, Owikeno, and Long lakes.

The Council notes that data are inadequate to assess the status of: many of the non-Babine sockeye lakes in the Skeena River; any of the 52 other lakes listed as Unknown in our assessment; and, in the vast majority of the 22 lake systems listed as Depressed. Overall, these data shortcomings could involve approximately half of all the sockeye rearing lakes in central and northern British Columbia.

## Pink Salmon *(Oncorhynchus gorbuscha)*

Pink salmon have a fixed two-year life cycle producing separate even and odd-year lines of pink salmon production. Overall in central and northern BC, spawning has been recorded in about 520 different streams in the Odd-year line and over 600 streams in the Even-year line. Pink salmon production in the central region is dominated by the Atnarko/Bella Coola River system, but others have increased in significance during recent years (particularly the Kimsquit, Chuckwalla and Kilbella rivers). In the north, there are relatively few very large pink salmon populations (most notably the Lakelse River in the Skeena and the Yakoun during Even-years on Queen Charlotte Islands), but several moderate-sized rivers have substantial production. There are also areas where pink salmon are much less abundant, including Smith and Seymour Inlets, Nass River system up-stream of the lower river tributaries, and Queen Charlotte Islands during the Odd-years.

The return of pink salmon to the Bella Coola (Area 8, Figure 2) region has dominated pink production in central and northern BC. Returns in the Even-year line have averaged 4 million since 1954 and have been three times more abundant than returns in the Odd-year line. Recent annual production has become more stable between years and harvest rates (proportion of the production taken as catch) have been reduced to between 20 and 30% on average.

In recent years there has been an increase in spawning escapements recorded in most of the pink salmon streams that were surveyed. These results are, however, confounded with a significant reduction in the number of streams surveyed (particularly during 2001 and 2002) and less frequent surveys between years, particularly during the 1990s. These reductions are in contrast with substantial effort invested by Fisheries staff to maintain stream surveys during the 1950 to 1990 period. Since there is very limited quantitative data on pink salmon in these regions, the historical spawning escapement surveys are the core of assessment information. Changes in the relative size of spawning populations between streams, and within a stream but between years, are the best available indicators of trends in pink salmon status. The recent reductions in escapement monitoring are of particular concern in the Skeena River where pink production can be substantial in both year lines.

## Chum Salmon *(Oncorhynchus keta)*

Chum salmon have been reported in 140 different streams in the central region and 470 different streams in the north since 1950. The estimated average escapements in the central region have consistently been about 500,000 since the 1950s. The distribution of spawning population sizes includes a few large populations and a much wider variety of moderate to small populations. Very few streams are reported to have, on average, more than 10,000 chum spawners. In the northern region, the total estimate of chum spawning escapements has declined from as high as one million to possibly half of that number, but any analysis of the changes in total escapement must account for the variable number of streams surveyed over time. As in the central region, very few of the northern chum streams are reported to have more than 10,000 chum spawners per year, on average.

In both regions, the distribution of spawning population sizes between streams has changed substantially over time. Of the streams surveyed, those associated with major hatcheries have increased in numbers of spawners, but most medium-sized and smaller populations are now smaller than in past years. This is most pronounced in the north, but is also true for smaller populations in central BC (Figure 3).

Given the remoteness of some rivers and the local climate, the consistency of the spawning escapement monitoring for central BC chum salmon has been exceptional. During the 53 years of recorded escapements, over half of these streams were enumerated 40 or more years. Coverage of escapement surveys between streams in north has not been as consistent, but even there 33% of the 470 different streams have been enumerated in 40 or more years. This number of streams (155 different ones) with high frequency of surveys still provides an adequate sampling basis for monitoring of northern chum, depending on the distribution of the streams and the consistency of the survey methods. However, the number of streams surveyed for chum escapements in the regions declined during the 1990s, and much more during 2001 and 2002. While the estimates of chum spawning escapements have been increasing in recent years, this reduction in survey coverage could compromise a long history of detailed information.

The frequency of escapement surveys does not address concerns about the accuracy of these data, but the consistent effort over time and large set of streams monitored provides a large dataset for assessing chum salmon. As with pink salmon, this depth of historical information, based on the visual escapement surveys, is the core of the Department's assessment capacity for chum salmon. Unfortunately, the trend is to reduced survey coverage which could substantially weaken our capability to assess chum salmon. Careful attention should be given to which streams will continue to be monitored.

Chum enhancement activities in these regions are quite diversified, involving unmanned spawning channels, numerous small-scale programs managed by local groups, and major hatchery programs. The vast majority of the releases, though, are associated with the major hatcheries: Snootli Hatchery (Bella Coola River), Kitimat Hatchery (Kitimat), and the Pallant Creek Hatchery (Cumshewa Inlet, Area 2E).

## Coho Salmon *(Oncorhynchus kisutch)*

Coho salmon are the most widely distributed of the wild salmon in central and northern BC. The escapement records since 1950 list 745 streams with coho spawning. These numbers are likely conservative as the later spawning season for coho makes their visual enumeration difficult. Estimates of coho spawning numbers and their distribution are almost certainly under estimated. For the same reasons, our ability to assess coho salmon in the vast majority of streams is very limited, and more so in remote watersheds.

In the central region, coho salmon have been reported in essentially the same number of streams as the chum salmon (137 steams plus 2 spawning channels). Coho returns to the Bella Coola River system account for the majority of the central region coho escapement. Essentially all these coho escapement data are based on visual surveys and are acknowledged to be of limited value for assessment (counts to the Bella Coola system are the most complete). Based on the escapement data only, central BC coho spawning escapements had been declining through to the late 1990s, but have increased very recently. It is notable that there are no quantitative indicator sites for coho salmon in the central BC, but Fisheries and Oceans Canada is attempting to establish one in the Martin River, near Ocean Falls.

Unlike central BC pink and chum salmon surveys, the vast majority of coho streams have recorded escapements in less than half of the years, and the consistency of inspections by streams has not been as well maintained. The reduction in surveys has continued during 2001 and 2002.

Coho salmon in the north are widely distributed and reported in over 600 streams. Trends in their spawning escapements have been similar to the pattern in central BC. The poorest recorded return of coho salmon occurred in the Skeena River in 1997, leading to the controversial fishing closure. Coho returns have apparently improved in recent years; based on: increases in the reported escapements based on the visual surveys; improved annual indices in the Skeena test fishery (Figure 4); and increased marine survival estimated in four indicator stocks. Quantitative programs for spawning escapements and tag recovery are maintained in four northern indicator stock programs, but there is no equivalent program in the Queen Charlotte Islands (nor in central region).

Monitoring of spawning escapements to other northern coho streams is problematic. Only 14% of these streams have annual records for 40 or more years, and the distribution of spawning population sizes suggests a significant reduction in the number of spawners in many of the streams. This latter trend is of particular concern since the reduced escapements have been occurring in spite of numerous enhancement programs. This limited ability to enumerate spawners and the limited number of streams with an adequate number of years of data indicates why the four indicator stocks are essential for assessment of coho salmon. Quantitative information from the indicator stocks allows estimates of fishing impacts and distribution of the stocks, variation in marine survival rates between years, and estimation of the productivity in the freshwater habitats.

Coho enhancement in the regions involves three major hatcheries and many enhancement strategies using smaller scale programs. Coded-wire tagging of coho released from enhancement facilities has provided good information on the distribution of these coho populations in Alaskan and Canadian fisheries. However, in many cases, the total spawning return has not been quantitatively estimated or sampled for tag returns. Given the major changes in fishing impacts over time and the variability evident in marine survival, quantitative escapement data are essential for full utilization of this tagging data and for assessment of trends through time.

## Chinook salmon *(Oncorhynchus tshawytscha)*

Chinook salmon in central and northern BC are the most diverse of the species in terms of life history variations, but are the least abundant and utilize the fewest streams. Life history variation in chinook includes differences in length of freshwater rearing in juveniles, seasonality of adult return migrations, and size or age-at-maturity of adults.

In the central BC, chinook salmon have been reported in 30 different streams, but only nine of these have escapement records that average greater than 100 spawners. Numerically, chinook in

the region are dominated by returns to the Bella Coola River system including the Atnarko River and the Snootli Creek Hatchery. These returns are frequently five to tens times larger than the next largest chinook system. In the north, chinook salmon utilize substantially more streams (105 different streams) and have been consistently reported in about 83 streams. By northern sub-areas, the Queen Charlotte Islands have only one chinook population (Yakoun River), and the Skeena River has about 40 chinook systems, but the interior Nass River, north coastal areas, and Kitimat Arm each have about 14 streams with consistently reported chinook spawning. Most of these populations declined in escapements through the 1970s, but trends for more recent years vary depending on: return timing of the adults (earlier returning chinooks have had greater reductions in fishing impacts), the extent of enhancement in the system, and changes in marine survival rates. For example, the annual test fishery index of chinook returns to the Skeena River demonstrates the improved escapements following the 1985 Pacific Salmon Treaty (Figure 5). However, the annual index in Figure 5 does not indicate that early-returning stocks account for a significant proportion of that increase. Spawning escapements have been increasing in many central and northern BC populations, but areas of concern remain that required more detailed investigations.

Enumeration efforts for chinook spawning escapements are highly variable between areas. In the central BC region, only nine chinook systems have been surveyed in over half of the years since 1950 and the methods used in some areas and years were poorly documented. The most thorough escapement assessments are in the Bella Coola/Atnarko system and the Dean River. In the north, the vast majority of the escapement surveys are based on visual methods and the frequency of surveys has been better than in the central region. Efforts have also been made to provide more quantitative estimates, such as the Nisga'a Tribal Council program estimating the return of chinook salmon to the upper Nass River using a mark-recapture program. In the Skeena River, chinook salmon are counted as they pass the Babine River fence and, since 1984, the Kitsumkalum summer chinook has been the only northern indicator stock. Data from the Kitsumkalum indicator stock has been particularly useful in identifying changes in fishing pressures from changes in marine survival. Unfortunately and as with coho salmon, there is no tagged indicator stock for central BC chinook. Continued reductions in DFO funding are reducing the numbers of streams surveyed each year, and some have resulted in a significant loss of information in recent years.

Enhancement of chinook salmon in the regions involves the two major hatcheries (Snootli Creek and Kitimat) and several smaller community programs. Enhancement strategies and releases of chinook are explained in detail in this report. In many of the river systems though, an assessment or accounting of hatchery returns cannot be presented because of the lack of information about escapement to the spawning grounds.

Figures are appended.

# APPENDIX

**Figure 1. Sockeye spawning escapement records to the Babine Lake systems, and an aggregate total of the non-Babine lakes, Skeena River (1950-2002).**

*Total escapement to the Babine Lake systems includes the tributary lakes and returns to the spawning channels. A logarithmic scale is used to plot both returns on one graph. The aggregate escapements recorded for the non-Babine lakes declined from about 80,000 spawners in the early 1950s to only 20,000 to 40,000 recently. Babine system returns increased from about 430,000 in the early 1950s to approximately 1.1 million spawners, on average, in the past decade. Trend lines are 5-pointing moving averages.*

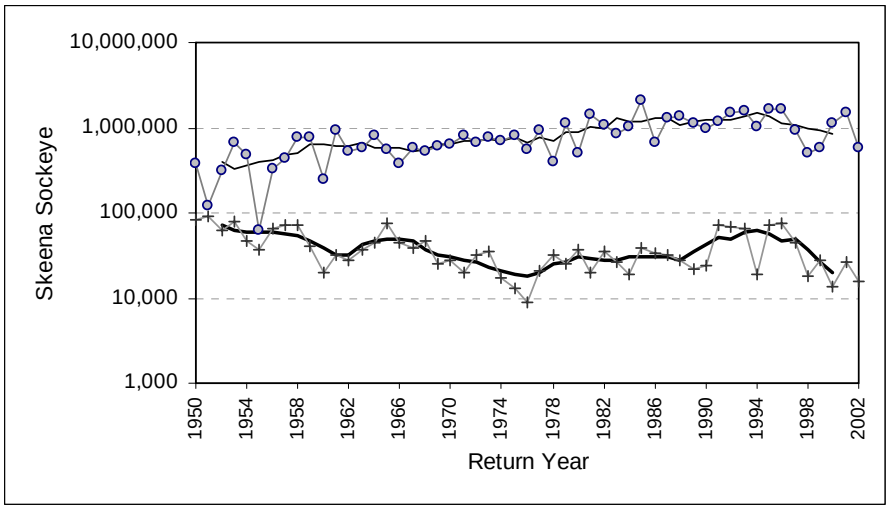



**Figure 2. Total production (catch plus spawners) of Area 8 (Bella Coola) pink salmon, 1953-2002 returns.**

*The maximum return occurred in 1962 (16 million pinks) but the minimum return was only 80,000 pinks in 1969. Even and Odd-year returns have been much more consistent in recent years and the proportion as catch has been reduced.*

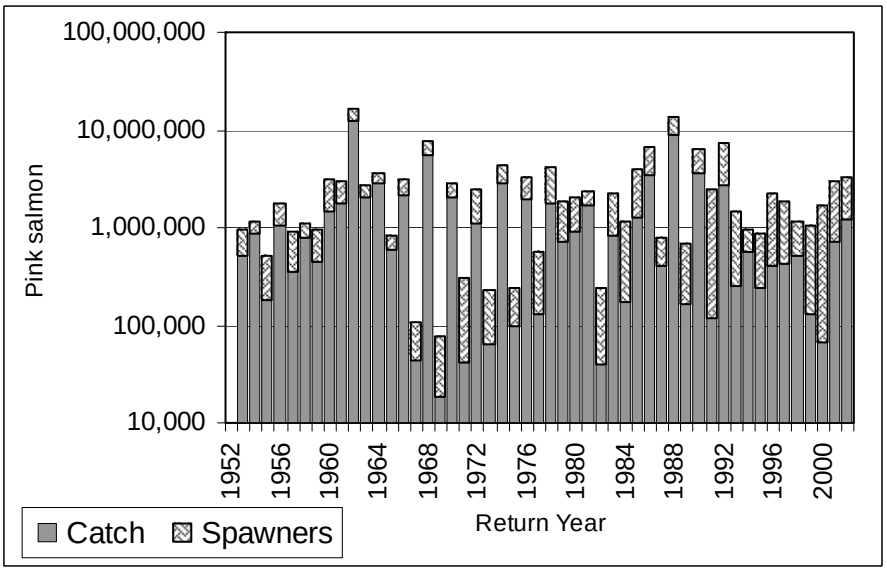


**Figure 3. Distribution of chum spawning population sizes in central and northern BC during the first decade of escapement records (1951-1960) compared against the most recent escapements in 2001-2002.**

*In both central and northern BC, most chum populations are medium to smaller in size and, by rank, escapement sizes are smaller in the recent period.*

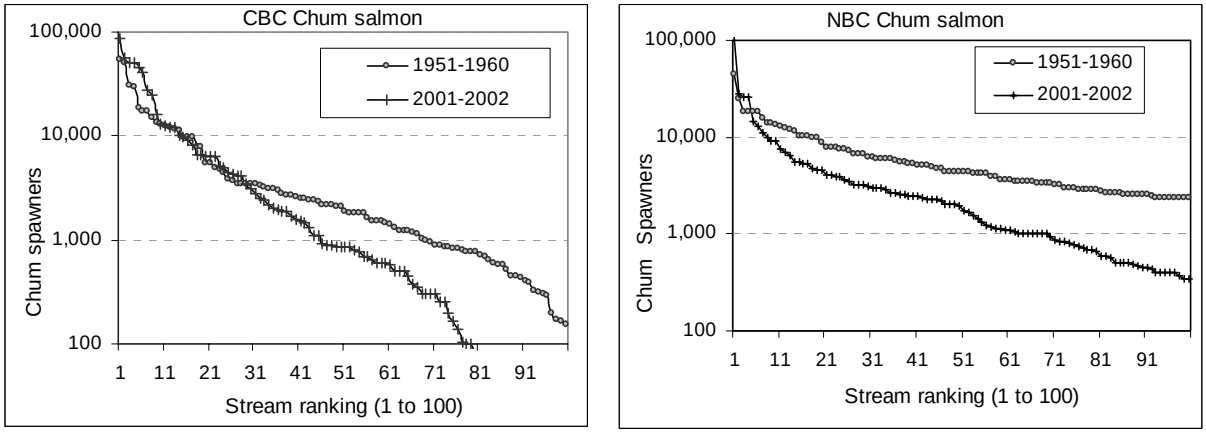
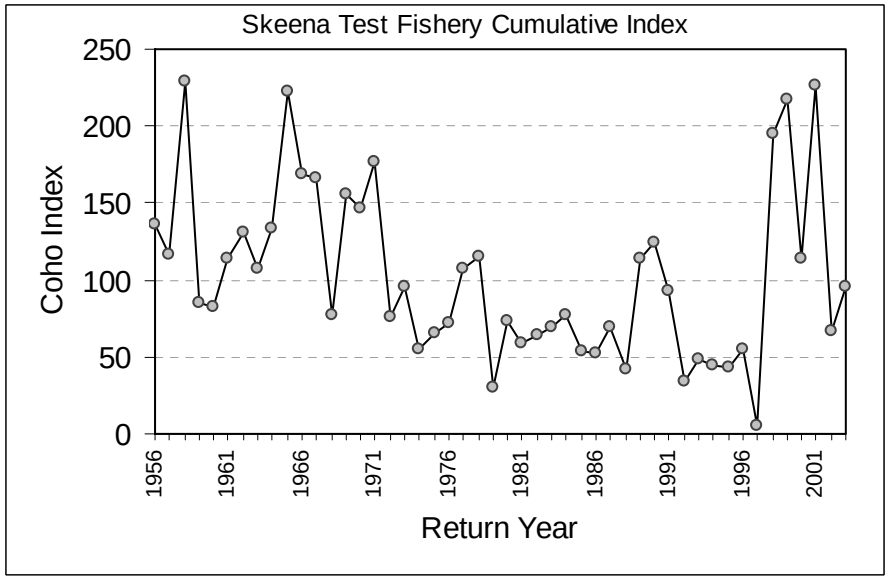


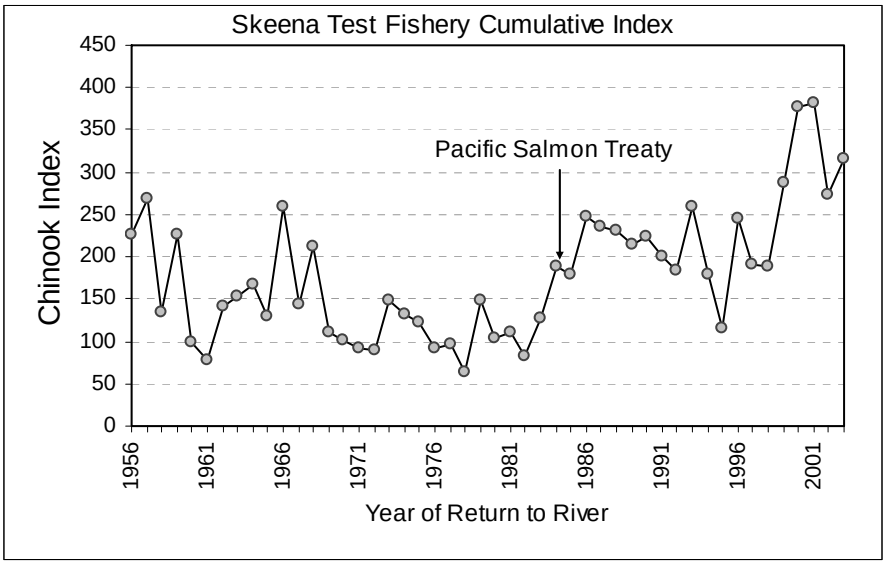

**Figure 4. Annual index of coho salmon returns to the Skeena River (1956-2003). Annual values are the summation of daily catch rates within each year from the Skeena River test fishery.**

*The test fishery is a standardized Departmental monitoring program that has operated at Tyee, BC (lower Skeena River) since 1956.*



## Figure 5. Annual index of chinook salmon returns to the Skeena River (1956-2003).

*Annual values are the summation of daily catch rates within each year from the Skeena River test fishery. The test fishery is a standardized Departmental monitoring program that has operated at Tyee, BC (lower Skeena River) since 1956. The increased chinook index in the mid-1980's resulted from the Pacific Salmon Treaty (1985) that was intended to reduced ocean harvest impacts on chinook.*



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