Pacific Fisheries Resource Conservation Council

1998–1999
Annual Report

Prepared by
Pacific Fisheries Resource
Conservation Council

June 1999

1998–1999 Annual Report

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

June, 1999

Hon. David Anderson
Minister of Fisheries and Oceans
Government of Canada

Hon. Dennis Streifel
Minister of Fisheries
Government of British Columbia

Dear Ministers:

Our purpose in the Pacific Fisheries Resource Conservation Council is to advise governments and the public about conservation of fish, specifically salmon and steelhead, and their freshwater and ocean habitat in British Columbia.

This is the first report of the Council since it was established in September, 1998. As a new institution, it is still at an early stage of evolving into a forceful champion for salmon and their habitat.

It has been gratifying for me to work with such enthusiastic and knowledgeable colleagues on the Council—Carl Walters, Don Ryan, Rick Routledge, Paul LeBlond, Terry Glavin, Murray Chatwin, Mary-Sue Atkinson and Mark Angelo. The ex-officio members—Dick Beamish and Fred Fortier—have also made valuable contributions. Together, we have begun to define how the Council can be most effective in its advocacy for salmon conservation.

As a Council, we chose to take a long-term perspective of conservation solutions and what could be achieved. In preparing this report we found that there is no shortage of immediate problems and crisis conditions, particularly for many small and isolated salmon stocks.

We strongly believe, as a Council, that there must be a clearer conservation strategy to enable everyone involved with salmon—including governments, First Nations, stewardship groups, fishers, communities and interested public—to work towards common goals with mutually reinforcing effort.

We look forward to having the Province of British Columbia become directly involved in the work of the Council this year, and to seeing an increasing level of cooperation and consensus among governments at all levels to improve salmon habitat conditions.

In this report we have given credit where we felt it was due, and criticism where we felt there is a need for improvement. In all instances where problems and shortcomings were evident, we have tried to identify their cause and offer constructive alternatives and solutions, rather than simply assign blame.

A set of four background papers has been produced in conjunction with this report. Those papers provide the underpinning for much of the report's contents and advice, and serve as a valuable reference about Pacific fisheries conditions and challenges.

The Council chose to emphasize, as our initial task, a few key problems and opportunities. That selection was not meant to suggest that other issues lack importance or would be overlooked. Rather, there are major structural issues that should be addressed first. The Council is assembling an ambitious work plan for the coming year, and will consider a wide array of conservation issues, including those listed in the final section of this report.

Leading to the preparation of this report, the Council met with several individuals and representatives of organizations involved in fisheries and conservation. We appreciate their insights and opinions, and we will expand on those contacts to ensure further dialogue in the future.

Hon. John A. Fraser

Chairman

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INTRODUCTION

Throughout the 1990s, overfishing and the collapse of fish populations around the planet have contributed to a heightened sense of public alarm about the state of the world's oceans. Analyses undertaken by the United Nations have concluded that most of the world's commercial fish populations are in decline. These analyses also demonstrate that the world's primary fishing grounds have either reached peak production, are producing fewer fish, or have been abandoned because fish populations have crashed.

Canada has not been immune to these trends. In 1992, one of the oldest and most productive fisheries on the planet—the cod fisheries of Newfoundland's Grand Banks—was brought to a close. The North Atlantic cod moratorium remains in effect to this day. There is little evidence that cod populations, or other depleted groundfish populations in the North Atlantic, will be able to sustain a resumption of fishing anytime soon.

On Canada's West Coast, similar collapses have occurred, although on an economic and social scale much smaller than the Atlantic cod closure. West of the Rockies, at least 142 salmon stocks have been rendered extinct over the past century. Hundreds more runs are at present considered at risk of extinction. Other fish populations have undergone dramatic declines, or have collapsed. Examples include: Strait of Georgia lingcod; Fraser River oolichan, sturgeon, and surf smelts; petrale sole off Vancouver Island's west coast; and abalone coast-wide.

Unlike the case of the Newfoundland cod fishery, fishery closures on Canada's West Coast have tended to be relatively small-scale and spread out over a long period of time, causing only localized hardships. Cumulatively, however, these events are significant. They undermine and erode Canada's heritage, First Nations' cultures, local communities, marine biological diversity, and ecological integrity. They foreclose options in British Columbia's long-term economic and conservation decisions, and they diminish the legacy we leave to coming generations.

Public alarm over these events is not misplaced. Fish in the sea, like trees in a forest, are a public resource, subject to public concern. This concern has been expressed in a variety of ways that have lately forced fisheries management to become driven more by conservation policy than by economic considerations. In recent years, Canadians have developed a heightened awareness of the planet's ecosystems. In British Columbia, this appreciation is uniquely augmented by a firmly rooted cultural attachment to wild salmon populations. This profound cultural identification with salmon, anchored in the traditions of First Nations' communities, has come to resonate deeply throughout the region in ways that are often difficult to explain to people from other parts of Canada.

In spite of this, and perhaps to some extent because of it, British Columbians are often presented with a particularly confusing picture of the state of salmon stocks, the state of salmon habitat, and the health of fish populations generally. Reasonable and simple questions about the state of the fish and fish habitat in British Columbia are often met with contradictory and confusing answers. The presence of vested interests—including governments—along with fiercely competing claims to the fisheries resource, contribute to that confusion. So does the fact that government agencies that should be able to answer apparently simple questions often do not have immediate answers. This is true despite the dedication and competence of the civil servants entrusted with the conservation of fish and fish habitat.

Complicating matters further is the fact that the 1990s has been a decade of profound change in the West Coast's fisheries. Fisheries management practices are undergoing radical change.

Managing for the simple and popular purpose of achieving "maximum sustained yield" became a discredited practice by the late 1980s. Practices have shifted to reflect objectives such as reducing the by-catch of non-target species in various fisheries, and to respond to the general public's concerns for preserving and restoring biological diversity.

Meanwhile, the ocean environment is undergoing change, and scientists have documented significant changes in the marine survival rates of some salmon species. Some fish populations are exhibiting signs of rapid decline, while others appear to be rebounding dramatically. The economics of the commercial fisheries are in a state of rapid change; there is a resurgence underway in Aboriginal fisheries; and the recreational fisheries are growing in economic importance and political influence. By the late 1990s, the boom in the aquaculture industry had allowed farmed salmon production to eclipse wild salmon landings. Irresponsible forest-industry practices have attracted wide attention, as has the harm caused to salmon streams by the rapid urban development that has characterized British Columbia during the 1990s.

As a result of these factors, there has been significant erosion of public confidence in the capability of governments to conserve fish and protect habitat. For the past decade, these factors have contributed to an atmosphere of uncertainty, anxiety and confusion in the West Coast's fishing communities and elsewhere. In such an emotionally charged environment, controversies will erupt from time to time. Just such a controversy was the 1994 "missing sockeye" affair on the Fraser River. When Canadian government officials and the Canada-U.S. Pacific Salmon Commission were taken to task that year for failing to account for several hundred thousand Fraser River sockeye, Fisheries Minister Brian Tobin ordered a public inquiry.

The Fraser River Sockeye Public Review Board identified a wide range of problems associated with the sustainability of the sockeye fisheries, and offered a wide range of recommendations. Their report noted:

> *"The Board believes that an independent Pacific Fisheries Conservation Council should be established to act as a public watchdog for the fishery, to report to the Ministers and the public annually and any other time it is deemed necessary. The Council would have no vested interest except the health of the fish and their habitats."*

Further, the Public Review Board's report identified the establishment of such a council as "...an essential condition for building public confidence in the fairness, rationality and effectiveness of fisheries resource conservation policies, priorities, strategies and activities."

For the next three years, the federal and provincial governments maintained an ongoing dialogue over fisheries matters which was sometimes productive and sometimes not. When the provincial government declared its desire to assume jurisdiction over fisheries management on the BC coast, the federal government announced it would oppose a surrender of fisheries jurisdiction to the province.

In July 1997, the governments of Canada and British Columbia agreed, as part of a more comprehensive arrangement, to establish jointly a fisheries resource conservation council. Its purpose was to provide Ministers with advice "...on conservation and long-term sustainable use of salmon resources and habitat." Both governments were to appoint the members and share operating costs, but there were further delays in proceeding with action on this aspect of the federal-provincial agreement.

In the absence of provincial implementation of that agreement for more than a year, Fisheries Minister David Anderson, proceeded autonomously with a federal government initiative in

September, 1998 to establish the Pacific Fisheries Resource Conservation Council. At that time, he appointed its chair and members, stating:

> *"The governments of Canada and British Columbia share a common interest in conserving, enhancing and protecting the salmon resource, its habitat and the marine environment, to ensure a sustainable fishery for the future. Cooperation is essential if we are to achieve our mutual goal of conserving the salmon resource."*

The Council members (see Appendix 1) subsequently decided it would be appropriate to direct their advice to both the federal and provincial fisheries ministers and to have the Council conduct itself as a body reporting to the governments of Canada and British Columbia, and to the general public.

OVERVIEW

This report and its four accompanying background papers are the first products of the Pacific Fisheries Resource Conservation Council. They are intended to present, together, a package of information and advice to governments and the Canadian public on the conservation of Pacific fish populations and habitat in British Columbia.

As a new organization, the Council and its objectives are not yet widely understood, nor is its evolving role as an agent for public accountability by gathering, analyzing and reporting facts about the status of fish populations and fish habitat.

The Council's independence is crucial. In its role as a public watchdog over fisheries management and habitat protection measures, the Council could not serve its purpose if it were simply a creature of government policy.

When the Council was established, no formal terms of reference for it existed beyond: the initial description proposed by the Fraser River Sockeye Public Review Board; a brief version of a mandate contained in the 1997 federal-provincial agreement; a discussion paper prepared for the BC Ministry of Agriculture, *Fisheries and Food;* and the September, 1998 press release by Fisheries Minister David Anderson's office.

The Council requested and received a draft document that officials of the Department of Fisheries and Oceans (DFO) had prepared for Minister Anderson's consideration. Amendments to that initial draft were discussed and various versions were exchanged over a period of more than six months, at the same time as the Council proceeded with what it considered to be its essential tasks. For example, the Council insisted on explicit recognition of steelhead as a salmonid within its ambit, the terms under which the status of non-salmonid fish populations would be considered, and the type of scientific information DFO would be obliged to make available to the Council.

Minister Anderson agreed to consider the Council's concerns and, in consultation with DFO officials, the draft terms were revised to recognize steelhead explicitly as a salmon species falling within the Council's immediate mandate. Further, the preamble to the Terms of Reference was amended to make it plain that the Council's initial focus was on salmon, but that the Council's mandate could be expanded to include other species at a later date.

The Council's Terms of Reference are set out in Appendix 2 of this report. They provide a clear statement of the scope and formal mandate. For instance, the terms of reference make it clear that the Council is to have access to all scientific information it wishes to obtain and is relevant to its mandate, not merely documents that governments might or might not wish to provide. While its initial attention has been limited to Pacific salmon, the Council also intends to deal with other marine species, consistent with the need to consider the range of fisheries resource issues and inter-species relationships in conservation.

To date, the Council has cause to be optimistic that its role as originally conceived, which was to ensure public accountability, will not be hampered by either political or bureaucratic considerations.

Beyond the Terms of Reference, Council members considered it necessary, as an initial task, to determine their guiding concepts. They also decided to establish and articulate the principles, standards and objectives to use as the underpinnings of their analysis and approach to the issues.

For instance, the phrase, "conservation and long-term sustainable use" is not as straightforward as it might seem, but the concept of sustainability is not difficult to articulate. The 1987 report of the

World Commission on Environment and Development, known as the Brundtland Report, defined sustainable resource use as activity that "...meets the needs of the present without compromising the ability of future generations to meet their own needs."

But setting out a clear articulation of what constitutes "conservation" is more problematic. Widely divergent approaches and judgments would be possible, depending on how the Council might interpret its mandate to advise governments and the public about matters related to fish conservation. For this reason, the Council chose to articulate, to some extent, what it means by the term "conservation."

It often comes as a surprise to members of the general public to learn that it wasn't until after 1967 that the federal *Fisheries Act* contained a clear and direct statement of purpose to "...provide for the conservation and protection of fish and waters frequented by fish." It will likely come as a greater surprise that Fisheries and Oceans, despite its clear conservation mandate, still has not established for itself a clear definition of the term "conservation" as it relates to the management of salmon fisheries. This is a matter of some relevance, since in its absence, there was no clear policy directive under which fisheries managers were expected to conserve fish and fish habitat. Does the *Fisheries Act* mean fisheries managers should conserve as many fish as possible? Does it matter if certain species are severely depleted, and the diversity and variety of fish populations is diminished, so long as aggregate production volume is maintained?

The Council does not propose to resolve these dilemmas all at once, nor does it claim competence to do so. Attempts at arriving at a reasonable answer to the question, "What are we to conserve?" have been described as an ongoing task. A useful, provisional description of the conservation objective that will guide the Council was set out by Olver et. al in a 1995 document published by the *Canadian Journal of Fisheries and Aquatic Sciences:*

> *"The protection, maintenance and rehabilitation of native biota, their habitats and life-support systems to ensure ecosystem sustainability and biodiversity."*

Because the public trust is at stake, the Council intends to hold public and private conduct in fisheries conservation and habitat protection to the highest standards. The Council recognizes that its unique mandate implies a dual role. First, the Council must serve the public by obtaining accurate information and providing objective information about all pertinent matters related to the conservation and protection of fish and fish habitat. And second, the Council will openly advocate responsible stewardship and public awareness of fisheries and conservation issues.

What follows is a summary of the principles under which the Council intends to fulfill its mandate, and the standards by which the Council will assess public and private conduct with respect to fish conservation and habitat protection.

1. The Pacific Fisheries Resource Conservation Council promotes public accountability in the conservation of biologically diverse and abundant Pacific fish populations, as well as the health of the ecosystems upon which they depend.

2. The Council provides governments and the general public with objective information regarding the state of the Pacific's fisheries resources and fisheries habitat.

3. The Council promotes and encourages:

    a) an integrated, "ecosystem approach" to fisheries management;

    b) responsible public and private stewardship of marine resources and fish habitat; and

c) public awareness of the importance of marine biological diversity, sustainability in fisheries management regimes and fishing practices, and the cultural, recreational and economic values associated with the Pacific fisheries.

The articulation of standards the Council intends to apply—the standards to which it intends to hold government conduct and private sector conduct—is a way to make it clear to everyone how the Council will go about its business.

As its principles suggest, the Council will assess government policy and performance, as well as private maintaining biological diversity in fish populations. Biological diversity has been described as a form of insurance that provides resilience in the face of large-scale ecological disturbances. Protecting biological diversity is clearly in the public interest.

Canada is a signatory to the *United Nations' 1992 Convention on Biological Diversity,* the objectives of which are three-fold: conservation, sustainable resource use and equitable sharing of benefits. While the Convention refers to equitable sharing of natural resource benefits, the Council has no mandate to provide advice to government or the public on matters of fisheries allocation, and does not wish to comment on fisheries allocation matters. However, the Council will provide governments with the conservation advice it deems to be appropriate, regardless of the implications that acceptance of that advice may present with respect to the allocation of fisheries resources.

It is useful to consider that signatories to the 1992 Convention declared themselves to be "...conscious of the intrinsic value of biological diversity and of the ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic values of biological diversity and its components." Further, the 1992 signatories declared themselves "...conscious also of the importance of biological diversity for evolution and for maintaining life sustaining systems of the biosphere."

However, as is the case with the term "conservation," a related question arises with the term "biological diversity." Simply put, the question is: "At what level of diversity should fish populations be conserved?"

The complexity of salmon populations, and the elaborate hierarchies into which salmon species are organized, makes it necessary to consider appropriate approaches to the objective of conserving biological diversity. In biological terms of classifying fish, salmon occur in species, sub-species and ecotypes, races, populations (neighbourhoods), and sub-populations (demes). But within sub-populations, levels of diversity also exist. In its attempts to manage fisheries based upon various salmon "stocks" and to conserve them, DFO, at present, demonstrates no clear and consistent policy about what, exactly, constitutes a "stock." In fisheries management terms, it may vary from a race level to a sub-population level.

As is the case with the conservation definition, attempts at arriving at an answer to the biological diversity question should be regarded as a work in progress. For the time being, the Council will confine its attempts to address the biological diversity question as it relates to fisheries management decisions, and decisions with respect to habitat, as they relate to salmon and steelhead. In doing so, the Council will also be guided by a set of principles that follow from a 1993 discussion paper by Brian Riddell, a respected scientist with DFO's Biological Sciences branch, titled "Spatial Organization of Pacific Salmon: What to Conserve?"

Those principles are summarized as follows:

1. In the absence of proof, Pacific salmon habitat should be protected, and salmon fisheries managed, from the premise that separate spawning populations are genetically different, and valuable to the long-term production of the resource.

2. To avoid a too-narrow focus on specific conservation problems, fisheries should be managed, and habitat-protection priorities should be assigned, in a way that takes into account long-term trends in abundance, and ensures the maximum spatial distribution of sub-populations to preserve individual stocks.

3. Priority should be given to maintaining groupings of fragmented populations and races, and to maintaining contiguous distributions between these populations and races, in order to maintain "gene flow."

4. Every effort should be made to maintain genetic inheritance and variation within enhanced populations, and to prevent their genetic impacts upon salmon populations that have not been enhanced.

5. Salmon populations that have not been enhanced, and habitat areas that have not been disrupted, should be protected over a broad spatial range. Special emphasis should be placed on protecting salmon populations with unique or atypical traits, particularly traits uniquely developed for local conditions.

In the preceding principles, a key phrase is: "In the absence of proof". This is an important caveat guiding decision-making in natural resource exploitation. Described as the "precautionary principle," this has emerged in the 1990s as an effective standard by which governments can both protect biological diversity and allow the sustainable use of natural resources.

The precautionary principle was first described in the context of marine pollution in the North Sea, establishing that it is the resource users, harvesters, and parties engaged in potentially harmful activities that must bear the burden of proof with respect to fish conservation and habitat protection. The principle is based on the understanding that scientific uncertainty about the impacts of human activities upon ecological systems constitutes grounds for restraining potentially harmful activities, rather than an excuse to allow such activities to proceed. The precautionary principle has recently been incorporated into the *Code of Conduct for Responsible Fisheries,* developed by the United Nations' Food and Agriculture Organization, as well as other international conventions and agreements.

The *Code of Conduct for Responsible Fisheries* states, in part, that governments:

> *"...should apply the precautionary approach widely to conservation, management and exploitation of living aquatic resources in order to protect them and preserve the aquatic environment. The absence of adequate scientific information should not be used as a reason for postponing or failing to take conservation and management measures."*

The notion of "risk-averse" fisheries management is directly related to the precautionary approach in fisheries conservation and habitat protection. The Fraser River Sockeye Public Review Board report stated:

> *"We recommend that DFO and PSC [the Pacific Salmon Commission] adopt a risk aversion management strategy because of the great uncertainty in stock estimates,*

> *in-season catch estimates and environmental problems. Conservation goals must be achieved before any other priorities are addressed."*

An illustration of the way in which the precautionary principle, the protection of biological diversity and risk-averse management might be applied to salmon-fisheries management regimes is set out in the U.S. National Research Council's 1996 document, *Upstream: Salmon and Society in the Pacific Northwest:*

> *"To achieve long-term sustainability, which requires sufficient genetic diversity, fishing should occur only where the identity (i.e. the originating population) of the salmon is known, when total fishing mortality is consistent with the productivity of the fish, and when the catching technology ensures minimal mortality in depleted demes [local breeding populations]. This will require fishing methods that allow different degrees of fishing effort on various salmon populations and that allow identification of fish taken from depleted demes so that they can be avoided or released alive."*

DFO has declared publicly that it will be guided by the precautionary principle and risk-averse management. Both the federal and British Columbia governments have been far less clear, however, about the importance of managing fisheries and protecting fish habitat in ways that account for ecosystem functioning and inter-species relationships. The Council intends to be vigilant about government conduct in the context of integrated, ecosystem approaches to fisheries management and habitat protection.

The Council agreed to apply the following standards:

1. The Council will hold governments to conduct themselves, and regulate private activity, in a manner consistent with the conservation and protection of ecological integrity and biological diversity as it relates to the conservation of fish and the protection of fish habitat.

2. As a general rule, the Council will rely upon the *United Nations' Convention on Biodiversity,* as well as the *Code of Conduct for Responsible Fisheries,* when considering matters related to fish conservation as well as habitat protection.

3. The Council will endeavour to ensure that within both federal and provincial jurisdiction, governments conform with the precautionary principle and risk-averse practices in fish conservation and habitat protection.

When considering an issue that relates either to fish conservation or habitat protection, the Council will be guided by questions such as these: Does this practice protect ecosystem functioning? Does it protect biological diversity? Is this practice consistent with the precautionary principle? Is this practice risk-averse?

These are not the only questions the Council will ask in the course of its duties, but these are key questions, and they will allow the Council to reach objective and defensible conclusions. Further, the Council intends to develop more detailed standards, policies and procedures in the months and years ahead.

This first report of the Council is intended to provide a review of 1998, as well as observations, advice and recommendations. In assembling the report, Council members relied on several sources of information and analysis obtained from background papers, research studies and reports, consultations with stakeholders, and discussions with various individuals who provided opinions and suggestions.

The Council also commissioned the four background papers that provide valuable detailed technical information and data from which members drew many of the observations and recommendations. The papers, published with this report, also serve as a more extensive factual review of the 1998 season and conservation issues from the perspectives of both habitat and stocks. In many instances, segments of the text in those background papers were selected to serve as text for this report.

FRESHWATER HABITAT

Salmon and steelhead habitats in British Columbia are almost as varied as the province's geography. Recognizing the crucial nature of these conservation issues, the Council initiated a background paper entitled "Freshwater Habitat". This chapter is a condensed version of the introductory section of that paper.

The rich biological diversity of salmon mirrors the physical and chemical variability of the habitats in which these fish live. Furthermore, this habitat is inalienably linked to the geography and natural flow of water to the sea.

The consequences of these links can be seen in many ways, from the spawning and rearing of coho in the smallest of rivulets, to pink salmon spawning in the vast fields of gravel in the middle of the Fraser River near Chilliwack.

In British Columbia, almost any land draining into the Pacific Ocean is in some way salmon habitat, as long as there are salmon in the watershed. Human activities and natural events can profoundly affect habitats in the lower reaches.

Salmon are generally resilient. They can cope with the challenges they face in nature and will normally come back to spawn, year after year, in abundant numbers. However, salmon populations often decline when humans intervene and disrupt the complex framework of natural processes upon which they depend. Such interventions include disturbance of the physical and chemical constituents of habitat, and impacts of urban development, forestry, mining, hydro-electric power production, agriculture, and fishing.

Managing, protecting and restoring salmon habitat is a complex and difficult endeavour. Firstly, while the recognition of some kinds of salmon habitat is straightforward and obvious—such as the sockeye spawning beds in the world-famous Adams River—other critical habitats are not often recognized. For instance, a farmer's ditch in the upper Fraser Valley may dry up in the summer yet contribute important food resources in the form of insects in spring to a small population of coho living downstream.

How well or how poorly Canadians are protecting salmon and habitat is also not well understood. Part of the problem lies in the lack of knowledge and consensus, even among experts, about how to manage salmon habitat. Much of the science and technology surrounding habitat management, protection and restoration is less than a decade old. It is a very young and evolving science; there is still much to learn and many well-intentioned mistakes are made. The default management strategy often suggests that habitat should simply be left alone and undeveloped—an unpalatable course of action in tight economic times.

In other respects, the problem is a lack of resources to deal with the identified needs for habitat restoration or protection initiatives. Protection of fish habitat becomes increasingly more difficult as national economies continue to depend on high levels of growth. This is relevant to local salmon populations as well as global ecosystems.

The demands that British Columbians place on the resources connected to salmon habitat—such as land, trees, and water for hydro-electric power and human consumption—often conflict with salmonid well-being. The short-term economic pressures to compromise salmon habitat for the sake of consumption are enormous.

Nevertheless, the general public expects governments at all levels to move in directions that foster better management, protection and restoration of salmon habitat. Indeed, there is now a complex

maze of legislation, regulations and initiatives that provide the framework for how habitat is managed. Some of these initiatives are neutral or positive, and some of these activities actually produce superlative results. However, it is also true that some government effort actually hinders protection of habitat. Some of the recommendations contained in this report address the changes that the Council believes are needed to re-direct the focus of governments in habitat protection.

It is useful to recognize the crucial elements and linkages of freshwater salmon habitat. Salmon make direct use of a wide variety of water bodies from small streams and sloughs to large rivers, and little ponds to large lakes.

Streams

British Columbia has an estimated 430,000 streams comprising a total linear distance of 793,000 kilometers. Fish can be found in many of these waters, from the very smallest of streams to the very large Fraser and Skeena rivers.

Salmon benefit from flowing water. The flow helps move gravel when the female is digging her nest or "redd," and also helps to fertilize eggs during the spawning event. The currents percolate through the gravel constantly, washing vital oxygen over the embryos and larvae while they develop. Once they emerge from the gravel, some stocks and species of juvenile salmon rear in the stream environment for some time before going to sea. The time spent in freshwater can range from a few hours to many years.

The benefits of moving water for these stream-rearing salmon are many. The flow of water acts like a food-conveyor belt of insects for the fish living in the streams. The stream flow also distributes nutrients and leaf litter that provide the basis for insect production. Streams also provide a highway for migrating fish, either for adults moving upstream, juveniles moving to other feeding locations or overwintering areas, or sea-going young moving downstream.

A very important component of stream habitat is the pattern of water flow over time. Floods, for instance, can be destructive, but can also be important in maintaining and renewing spawning beds. Salmon populations have adapted through evolution to natural water flow patterns. A disruption—either too much or too little water at the wrong time of the year—can devastate fish populations.

Lakes and Stillwater Habitats

British Columbia is extraordinarily rich in lakes, ranging tremendously in size, from tiny ponds and sloughs to large, glaciar-fed water bodies. These stillwater habitats are particularly critical to the survival and production of young sockeye salmon. The juveniles of the world-famous sockeye runs to the Adams and Horsefly rivers live in Shuswap and Quesnel lakes for a year before migrating to sea.

Some populations of juvenile coho and chinook also use the shorelines of lakes for rearing. Coho fry are particularly well-suited to rear in very small lakes and beaver ponds. Some sockeye salmon actually spawn in lakes, relying upon groundwater flowing through clean gravel.

Warmer, clearer and relatively nutrient-rich lakes tend to produce more and bigger sockeye smolts. In northern lakes, some fry remain an extra year in order to reach a size that is large enough to begin their encounters with the perils of an ocean life.

Estuaries

Estuaries are among the richest and most productive ecosystems on Earth, and the Fraser River estuary and the associated Boundary Bay area appear to contain some of the most productive estuary habitats anywhere in the world. It is notable that the Coast Salish historically viewed the whole of the Strait of Georgia as the estuary of the Fraser River—a valid conclusion by some of today's determinants.

All species of juvenile salmon benefit from this rich habitat to varying degrees as they migrate from fresh to marine waters, but chum and chinook salmon particularly profit from the estuary's intense food production. Fraser chum normally reside in the estuary for a number of weeks before moving on to saltwater, and some populations of chinook spend as much as three months there before heading to sea.

Because of their usefulness as marine transportation centres, and because of the richness of the soil and the flatness of the terrain, estuarine areas are particularly attractive for industrial and residential development, agriculture, shipping and log storage. Impacts on the natural environment have been severe. For example, it has been estimated that 82 percent of the Fraser River's salt marsh has been lost in recent times. Other, highly productive estuaries have been disturbed by humans to various degrees. Estuary loss on the Cowichan River is estimated to be 53 percent, and the Squamish and Nanaimo estuaries have been reduced by at least half.

The Council assumes that habitats that have been severely impacted by human activities have lost carrying capacity for salmon. These losses can never be fully quantified. However, the Council believes that effort should be made to rehabilitate those habitats that can be protected into the future.

OCEAN HABITAT

For much of the 1990s, coastal residents, fishermen, and even the most casual observers have noticed unusual events unfolding in the waters of the North Pacific, from California to Alaska. Along the California coast, dolphins and squid appeared to be undergoing a population explosion. Halfway through the decade, ocean sunfish and mackerel seemed to appear suddenly off the West Coast of Vancouver Island. In Alaska, sea lion and sea otter populations have been declining rapidly throughout the 1990s. Along the Oregon, Washington and British Columbia coasts, coho salmon, and some runs of chinook salmon, have exhibited alarming declines in marine survival. In some cases, it has been as though the salmon headed to sea as they always had, but simply failed to return.

These anecdotal observations are largely consistent with scientific findings, and they also coincide with what a growing number of biologists throughout the Pacific Rim have described as a "regime shift" in the Pacific Ocean's broad-scale ecosystems. A "regime" in climate and ocean conditions, in theory, is a fairly consistent and stable pattern in such factors as atmospheric pressure, sea-surface temperatures, population dynamics of various fish species, and density of plankton and other forage species that provide vital food for various fish species. A regime shift occurs when a change takes place in several or all of such patterns, at more or less the same time.

A regime shift can produce particularly dramatic impacts on the survival rates of fish such as salmon. A female salmon may produce thousands of eggs, and those eggs may be fertilized and well-protected in pristine spawning gravel. Thousands of juvenile salmon may enter the sea, but usually, only a few of those juveniles survive to conclude their sojourns in the sea and begin their homeward migration. A regime shift, even at a relatively small scale that is difficult to detect, can dramatically reduce the number of those salmon that survive to adulthood in the sea.

Recent changes in weather patterns and ecosystem functioning in the North Pacific are often attributed to an effect known as the 1997-98 "El Niño," a climatic phenomenon that originated in the equatorial Pacific. Without question, it was the culprit for many of the strange events unfolding in the Pacific over the period, but a significant body of evidence now points to other, large-scale trends unfolding in the ocean from decade to decade. El Niño may trigger or signal the unfolding of such patterns in ocean productivity, but that is just part of the picture. The Pacific Ocean is changing, and it appears to have changed before. Regime shifts are believed to have occurred in 1925, 1947 and 1977. In Japan, scientists and historians have established evidence of similar events going back to the 17th century.

The science associated with these fields of inquiry is in its infancy. It is often contentious, and it is often difficult to discern changes in marine survival rates among salmon populations from declines in freshwater survival rates. Recent research, for instance, suggests that around 1985, general declines began in the survival rates of freshwater-rearing salmon. At the close of the 20th century, many scientists are concerned that broad-scale ecological regimes in the ocean may soon be influenced by human-caused activity such as the increased loading of greenhouse gas emissions in the stratosphere. Some say greenhouse gases may already be contributing to disruptions in ocean ecosystems.

There is much discussion and debate among biologists, oceanographers, statisticians and other scientists about the nature of regimes, whether shifts in regimes can be anticipated, and how much human activity contributes to such phenomena. Many of the scientific tools employed in the study of climate change and broad-scale ecological functioning—such as satellite scanning—are

relatively new. Similarly, North American scientists have only begun to have long-term catch statistics, sea-surface temperature records and barometric-pressure data to analyze.

It is only very recently that the ocean has been looked upon as being anything but endlessly bountiful. For at least the first half of this century, DFO laboured under the assumption that the number of salmon returning from the sea was limited only by the number of salmon that spawned in its parent generation, and that fishing effort was the only demonstrable restraint on abundance. It was a convenient fisheries-management model, based on a straightforward stock recruitment ideal. If the fishing industry wanted more fish, or if natural habitat was lost during the settlement and industrial development of the province, it was simply a matter of building more hatcheries or artificial spawning channels. The idea was straightforward: the more fish that spawn, the more fish will go to sea; the more fish that go to sea, the more will come home to be caught.

By mid-century, scientists had begun to accept that things weren't so simple, and that other factors—such as competition between salmon for food—also had to be taken into account. In the latter half of the 20th century, fisheries scientists have undergone far greater changes in their thinking. Experience has shown that broad environmental factors—not just the condition of spawning habitat, or the number and density of spawners, or restraints on fishing effort—have extremely significant influence on salmon abundance.

The role of "inter-species relationships" is only now being explored. These relationships include: killer whales and seals preying on salmon; salmon preying on forage species from plankton to herring; and bear and eagle populations consuming salmon.

By the 1990s, nobody was suggesting that the ocean was endlessly bountiful. And nobody was suggesting that it did not matter what happened to salmon in the sea. Experience had shown that, beyond influencing the numbers of returning salmon, ocean conditions affected the physical status of returning fish: their weight and the stored energy which would allow them to reach their spawning grounds. From the point of view of reproductive success, many small and relatively weak returning fish may not be any better than fewer stronger ones. The life of salmon at sea conditions their reproductive success, as individuals as well as by stocks.

There is a healthy and vigorous debate in the scientific community about what to expect from the oceans in the coming years. Some scientists have suggested that if ocean warming trends persist, sockeye may vanish from the Fraser River, which is near the southern extent of the sockeye's range. Russian scientists have analyzed long-term trends and concluded that if present trends persist, the Pacific Ocean may be capable of supporting only half the 1990s abundance of salmon by the year 2020. These sorts of suggested trends are hotly debated within the scientific community.

The North Pacific Marine Science Organization (PICES), a treaty organization which provides a forum for ocean scientists from Canada, China, Korea, Japan, Russia and the United States, has as its main research program a study of Climate Change and Carrying Capacity of the North Pacific. This ambitious program seeks to: describe ecosystem variability in North Pacific regions; explain ocean-atmosphere interactions; conduct research into El Niño and broad-scale regime shifts; and develop a more elaborate understanding of the way salmon populations are affected.

Fisheries scientists from throughout the Pacific Rim recently gathered at a Vancouver conference hosted by the North Pacific Anadromous Fish Commission (NTAFC) to compare notes about El Niño and other matters related to the salmon's survival in the Pacific Ocean. The conference organizers summed up the proceedings this way:

> *"There was a recognition that environmental conditions need to be explicitly accounted for in our assessment and management of fish stocks. This concept is not new and has been alluded to in the process of explaining away large discrepancies encountered with traditional fisheries models. What is new is the relative importance given to the environment and ecosystem changes. The effects of climate change on fish production are now being given nearly equal consideration to the competing hypothesis that fish production is governed solely by an intrinsic stock recruitment relationship and fishing... Such fundamental changes in approach will require time and, above all, education, both within and outside the scientific community."*

The absence of an understanding of the role that ocean conditions play in determining long-term salmon abundance can result in distorted but firmly entrenched assumptions about what "works" in salmon fisheries management and what does not. A case in point is Alaska.

Alaskans and Alaskan fisheries managers should be congratulated for taking relatively bold steps to protect habitat and guard against overfishing in the years since the state was established in the 1950s. It must be observed, however, that changes in freshwater survival rates over time may also have produced effects on the survival rates of Alaskan salmon for which fisheries managers deserve neither credit nor blame. Recent research suggests that favourable ocean conditions, at least as much as sound policy, should be credited with the strength of Alaska's salmon runs. Alaska's catch of sockeye, chum and pink salmon between 1925 and 1994 has been shown to be directly related to favourable surface temperatures in large regions of the eastern North Pacific—in other words, favourable ocean conditions. Recently, there are indications that these ocean conditions may be undergoing change.

DFO has recently become only too aware of the role ocean conditions play in salmon abundance. In the case of South Coast coho, DFO managers anticipate that under current ocean survival conditions, many coho populations are expected to continue to decline, even in the absence of any fisheries. Special measures to conserve these coho populations are expected to remain in place for the next five years.

By being more acutely aware of trends and patterns in the ecosystems of the North Pacific, fisheries managers can adopt measures that may counterbalance the adverse impacts of conditions that produce poor ocean survival rates in fish populations. By becoming more adept at tracking and detecting trends and patterns, fisheries scientists will be capable of informing a more rational and fact-based public discourse about appropriate policies in fisheries management and freshwater habitat protection.

A better understanding of how the variability of the ocean environment affects the fate of salmon at sea would be of great value as a strategic planning tool. At present, annual salmon returns often produce surprises. Pre-season forecasts of returning adults—based on escapements in the previous life-cycle, some monitoring of smolts that entered the sea, and some rough guesses based on what little is understood about prevailing ocean conditions—are not very reliable. A more thorough understanding of ocean influences could increase the reliability of these forecasts.

The Council's strategic advice and recommendations are outlined later in this report. With respect to federal and provincial policy related to the salmon's marine habitat, the Council states that DFO, in particular, should support the efforts of scientists to understand ocean conditions. DFO's policies must more clearly reflect an awareness of the significance of ocean conditions. DFO must include uncertainty about ocean conditions, in a precautionary fashion, in its approach to decision-making.

There are, however, four areas of current concern that deserve the attention of fisheries policy-makers within the realm of controllable factors that influence salmon in the marine environment.

1. Impacts of herring fishing

There is a widely held view that the herring roe fishery is to blame for declines of chinook and coho abundance, particularly in the Georgia Strait. The Strait is a critical ocean habitat for these species, because a significant proportion of South Coast chinook and coho populations spend most of their ocean phase in this relatively confined marine ecosystem. For various reasons, it has been difficult for biologists to say anything definitive about the issue. Assessments based on spawn surveys and harvest indicate that total spawner abundance in the Strait is very high relative to the period of the herring "reduction fishery" in the 1960s, but the spawn surveys indicate the Strait's herring abundance is overwhelmingly concentrated in very few locations. Throughout the Strait, at scores of sites where herring were known to spawn, herring no longer spawn in any abundance. Juvenile herring from the large spawning concentrations tend to leave the Strait during their first year of life, to rear on the outer coast. It is quite possible that resident chinook and coho have been dependent mainly on smaller resident herring stocks, but at present Fisheries and Oceans is incapable of addressing these issues adequately.

2. Impacts of hatchery production

A related issue, again most important in the Strait of Georgia, is whether large-scale releases of chinook and coho from British Columbia and Puget Sound hatcheries have overstocked the coastal ecosystem. The result of this would be declines in marine survival that would have greatest impact on wild populations. Two lines of evidence support this concern. First, high stocking rates have been shown to cause severe decreases in survival rates of freshwater salmonids (rainbow trout), apparently by forcing juveniles to spend more time feeding where they are exposed to predators. Second, very large increases in hatchery smolt production occurred through the 1970s, and wild-fish contributions to the catch declined as hatchery contributions increased.

3. Impacts of marine mammal predation

Marine mammal protection is viewed by many people as a real success story, particularly for harbour seals that are considered to be at or near their "pre-contact" population levels. Many participants in the salmon fisheries see seals "steal" fish from lines and nets, and hatchery managers often watch helplessly as seals discover and exploit vulnerable salmon at the mouths of rivers. Most marine mammal predation probably occurs where and when there are extremely high concentrations of migrating fish (such as Johnstone Strait), and when a salmon's escape behaviours are limited by being tangled in a gillnet or hooked on the end of someone's line. The issues of marine mammal predation, in some circumstances, may be addressed by factoring that predation into fisheries-management plans. It may be more difficult to address such issues that way when particular salmon runs are immediately jeopardized.

4. Impacts of arriving species

British Columbia's coastal waters are becoming warmer, and at least one predatory fish species (mackerel) has thrived under the "new" regime. There are likely other species that have escaped notice by biologists for various reasons, not the least of these being the fact that the ocean is a very large and costly place to monitor such changes. The impact would be on both the fisheries and the extent of competition for existing food. It has been argued that we should try and profit

from the changes, and protect salmon at the same time, by fostering new fisheries for the invaders. Countering arguments range from concern that such fisheries could do more harm than good, to questions about the economic wisdom of promoting a development that might not be naturally sustainable in the first place.

SALMON STOCKS

A key objective for the Pacific Fisheries Resource Conservation Council is the development of strategic advice regarding stock conservation and enhancement. An understanding of the status of salmon stocks in British Columbia is a prerequisite to providing such advice.

The Council's background paper entitled "Salmon Stocks" was commissioned to serve as an integral part of this report. Much of that paper has been summarized to constitute this chapter.

The most recent attempt at providing the public with a picture of the state of British Columbia's salmon stocks was a 1996 study undertaken by Canadian scientists associated with the North Pacific Chapter of the American Fisheries Society. That study illustrated the significant information gaps encountered in efforts to determine the status of salmon stocks. The scientists identified 9,662 salmon stocks in British Columbia and the Yukon, but assessments (determining stock trends) were possible for only 57 percent of the stocks, and those assessments were often based on unreliable and outdated data. Still, of the 5,487 stocks where assessments were possible, the study concluded that 142 stocks had been rendered extinct in the 20th century, 624 were at high risk of extinction, 78 were at moderate risk of extinction, and 230 stocks were considered of "special concern."

The Council, for this first report, considered it important to provide a broad species-by-species overview of stock status and trends, as well as consideration of the relevant fisheries management issues associated with determining stock status. The aim is to highlight major concerns and identify needs for further analysis, rather than provide a detailed enumeration of all stock conservation issues.

As this Council has noted, there is a staggering diversity in salmon populations. At the species level, British Columbia is home to six species of salmon—chinook, coho, sockeye, pink, chum and steelhead. Over the thousands of streams and lakes where they spawn, salmon have developed a remarkable variety in their life histories and in the way they have adapted to local conditions. This diversity is critical from a resource production perspective, because in production terms, "adaptation" means producing the most offspring possible for each type of environmental pattern that the fish can utilize. The Council believes Pacific salmon habitat must be protected. The Council also believes that salmon fisheries must be managed from the premise that local spawning populations reflect genetic diversity that is valuable to the long-term maintenance of the salmon resource.

The long-term overall catch provides a very broad indicator of overall abundance. This has been highly variable, but relatively consistent during the last few years. The catches in the last five years are among the lowest in the last 50 years. The number of stocks contributing to this catch has also declined from many diverse stocks to only a few strong stocks. The abundance of stocks in widespread areas is down. The number of stocks is also down and many are at risk. Some stocks are stable, others are in decline, and many are unknown. This indicates serious conservation difficulties that must be addressed.

Chinook Salmon

There are two types of chinook life histories and they differ radically. Spring-type chinook spawn mainly in the upper reaches of larger river systems. Fall-type chinook generally spawn in lower river reaches or in smaller coastal streams.

Spring-type chinook runs have been something of a conservation success story. Concerns in the 1970s and 1980s led to ocean harvest restrictions that eventually contributed to a rebuilding of these stocks. While habitat degradation affected important spawning runs, in overall terms the spring chinook spawning runs are considerably healthier today than they were 20 years ago. There is still a long way to go to restore these chinook populations.

The status of fall-type chinook gives cause for concern. Spawning abundance has generally declined in recent years. Strait of Georgia and Puget Sound fall-type chinook, for example, are in serious trouble despite special fishing restrictions and closures at various times in the past two decades. Today, the stock of fall-type chinook available for fishing in the Strait of Georgia appears to be substantially smaller than it was before 1980, perhaps by as much as 90 percent. Something is very wrong with one of the most valuable salmon fisheries in British Columbia. It is clearly time for a major reassessment of the state of fall-type chinook salmon from the Strait of Georgia and Puget Sound, and for extensive cooperation with Washington State in analysis and policy development to address the challenge of improving on the current situation.

Coho Salmon

In examining long-term escapement trends, it is obvious that coho salmon in British Columbia have been in trouble for a long time. This situation has not been isolated to coho from the interior Fraser and Skeena streams, nor did it begin with the alarming declines in marine survival rates that began in the late 1980s. The data strongly indicate a chronic long-term problem of declining productivity or overfishing, or both. The data, in conjunction with estimates of average exploitation rates and information from stock recruitment methods, indicate that most coho stocks should not have been subject to exploitation rates exceeding 50 percent. However, historic exploitation rates have been far higher, averaging between 60 percent and 80 percent for most stocks year after year. Under current marine survival conditions, there are some coho stocks that may not even survive under a zero exploitation rate. In other words, this is not just a short-term problem that would correct itself if fishing were to go back to past practices. Many coho stocks will probably never be able to withstand the harvesting rates and habitat changes that have driven them down steadily for the past 40 years.

Sockeye Salmon

Very broadly, sockeye salmon management can be viewed as quite a success story on some large stocks, if we focus only on the sockeye runs and ignore other species and stocks that have been impacted by the fisheries that target sockeye.

The Central Coast area once supported the second largest sockeye fishery in British Columbia, after the Fraser. The Rivers and Smith Inlet fisheries are now essentially closed. Since 1990, total returns to both systems have fallen dramatically and are well below escapement goals determined from historical spawning and recruitment data. The magnitude of the problem suggests that the causes of this decline should be investigated.

Little is currently known about the myriad of small sockeye stocks that once contributed significantly to overall commercial catches and that are a key part of local Aboriginal fisheries. For compelling conservation reasons, these small stocks should be assessed.

Innovative approaches to management are being tested on the relatively small Nass River run, where biologists and Aboriginal communities are working together to develop harvesting methods that combine species selectivity and provide information for management. These innovations should be encouraged. However, considerable conservation problems exist in each of

the main sockeye fisheries, ranging from mixed-stock impacts in the Skeena to difficulties with the regulation of the complex gauntlet of fisheries that take Fraser River fish.

Pink Salmon

Pink salmon return at two years of age. There are separate even and odd year stocks that do not interbreed. Fraser River stocks return on odd years only. Most southern stocks have declined significantly. Most northern stocks return on both even and odd years. The abundance of even and odd cycle returns has varied but most northern stocks had not declined significantly until the last few years.

Pink returns from south of Cape Cook on the West Coast of Vancouver Island tend to be spasmodic and the data are difficult to interpret. In the Queen Charlotte Islands, even-year pink spawning populations appear to be satisfactory, but odd-year populations are very low. It is unclear why one cycle line should prosper while the other does not.

Chum Salmon

Chum salmon are particularly sensitive to large-scale habitat damage, but they are remarkably "invasive," meaning they can quickly take advantage of new spawning opportunities created by accidental and deliberate habitat improvements. They show highly variable returns within and between stocks. Some stocks on the inner south coast have increased as a result of a long-term rebuilding strategy. Elsewhere, others have been relatively stable and some have declined. There are three regions of some conservation concern for chum salmon, where escapement data indicate considerable declines since 1950. In the Queen Charlotte Islands, chum spawner abundance statistics show a sudden decline in the early 1950s and stocks have not recovered to past levels of production. In the southern part of the Central Coast and in the Johnstone Strait area, there has been a long-term pattern of decline. Some of these runs have likely been impacted by directed fisheries.

Steelhead Salmon

There is no directed commercial fishery for steelhead, although they are intercepted as a by-catch. Since 1989, provincial angling regulations have required catch-and-release of all wild steelhead in most of the province. Bait bans and barbless hooks in rivers with depressed steelhead populations are used to minimize mortality.

Assessment of steelhead stocks is generally poor, except for three stocks that are enumerated using counting fences. Provincial biologists consider some runs to be at high risk of extinction, e.g., runs to the Quatse, Puntledge, French and Cowichan on the East Coast of Vancouver Island.

In the Fraser watershed, target escapements for the Thompson have not been realized over the past two decades, and for the Chilicotin system only once. In other areas of the province, such as Bella Coola/Atnarko and Lower Mainland steelhead stocks are depressed. On the other hand, good steelhead escapements to streams on the West Coast of Vancouver Island and the Skeena were attributed to the coho-related fisheries closures of 1998.

Meeting Management Information Needs

The importance of knowledge-based management for salmon stocks cannot be overstated. Fisheries managers require consistent standards and targets for protecting weak stocks and

biodiversity. These standards should define appropriate spatial units for protection and provide clear guidelines for dealing with tradeoffs between productivity and diversity.

The Council is convinced that a systematic annual review of stock status and assessment for all salmon stocks in BC is required if DFO is to set meaningful catch and escapement targets. This review should describe long-term stock size trends, exploitation rate goals, factors that may prevent achievement of these goals, estimated current impact of habitat alterations, and critical needs for improved assessment. Wherever possible, assessments should be based on historic productivity (recruitment/spawner) assessments rather than simple stock trends. Where productivity assessments are not immediately possible, DFO staff should develop plans and proposals for obtaining the needed data as soon as possible.

The capability of fisheries managers to work effectively depends on reliable and timely information, including historical data for trend analysis and solid bases for estimation where facts cannot readily be obtained. A key fisheries management measure is the productivity ratio that identifies how many "harvestable" fish a stock produces, and how many spawners are required to sustain the stock. Productivity ratios cannot be established without reliable, historical and current data on catch and spawner abundance and habitat factors by stock. Productivity ratios can only be determined by relying upon direct field data and hard experience.

Catch information is, with some exceptions, generally adequate. The major weaknesses are that total catch includes a mix of stocks such that the amount of a specific stock is generally not known and, control of fishing effort is indirect. Also, in some fisheries, "induced" mortality in fish escaping from fishing gear or from catch and release is significant but not accounted. The Council believes both of these weaknesses should be addressed. Coded wire tagging programs for chinook and coho should be greatly expanded to provide stock specific exploitation rate and catch/escapement ratios for many more stocks. This can be done using coast-wide opportunities for tagging and enumeration offered by small-scale enhancement and habitat restoration projects. This information is critical for evaluation of conservation measures and assessment of productivity.

Progress has been made to ensure that existing gear protects non-target stocks and species, but further gear development and changes elsewhere are necessary. There should be increased investment in development of selective fisheries practices and informative fisheries practices that provide better in-season estimates of run sizes as salmon enter the various fisheries. This need might best be served by developing new fishing procedures, areas, and licensing aimed expressly at improving assessment information. To these ends, DFO should continue to encourage innovation by fishers in development of selective and informative fisheries practices, by providing licence incentives and loans or grants for fishermen with reasonable proposals.

A major review and analysis of regulatory options and approaches for ocean sport fisheries is required. These fisheries now exert major harvest rates upon some chinook and coho stocks, and past regulatory methods have done little to moderate the impacts. As well, there should be a review and further field studies on mortality of hook-and-release sport fishing situations.

Salmon spawning information is generally inadequate. There has been a program for systematic examination of spawning streams since well before the 1950s. However, since the late 1980s, the number of streams and intensity of coverage has been reduced. This visual inspection program currently lacks clear standards, field instructions, "expansion factor" methods, and recording procedures. As a result, most historic spawner data provide a relative indication of stock abundance that is not useful for formal scientific stock assessment of the "productivity" of various salmon stocks. Also, this information is likely to cause gross underestimates of proper

escapement goals for healthy production. There has been increased reliance on a few more intensively monitored index streams to provide an indication of what is happening over a broad area. Such monitoring of select streams is relatively recent and may create a new baseline that does not adequately reflect historic abundance. To be of value in regulating fisheries, index streams must bridge this knowledge gap and be demonstrably representative of other stocks in the area.

Accordingly, the Council perceives that a major revision of the escapement monitoring system is required. This current system is grossly inadequate for assessment of biodiversity issues for defining of escapement targets, setting exploitation rate goals, and evaluating both habitat damage impacts and efficacy of habitat restoration measures. There is a need for a careful review of historical escapement data for as many stocks as possible, to determine wherever practical just what has been recorded by field staff and what factors were used to convert field observations into escapement estimates. There should be a major public investment in escapement monitoring programs, including the use of automated counting methods for a much larger set of index streams than is currently monitored. This investment should have high priority, particularly for streams subject to considerable investment in habitat restoration, taking into account the importance of evaluating restoration methods in terms of actual improvements in fish abundance.

Habitat monitoring information, if collected, is often used for habitat management with little, if any, linkage into stock assessment or fisheries management. A key area needing attention is the Strait of Georgia, where a complete review of the total salmon situation is required. This review should lead to the development of effective regulatory and enhancement policies for protecting the whole complex of stocks that support the Strait of Georgia fisheries. Current fishery statistics and escapement data provide conflicting assessments about what is going on in the Strait, and this uncertainty is not going to be resolved simply by emphasizing trends in a few Lower Georgia Strait “index” populations.

Another key issue to examine is whether to accept further risk to Strait of Georgia and Puget Sound wild chinook and coho stocks by continuing large scale hatchery production. The concern is that this production may directly impact wild salmon and may encourage levels of fishing pressure higher than the wild stocks can withstand. Moreover, it is time for a synthesis of information and an analysis of the salmon/herring interaction issue, commencing in the Georgia Strait. The long-term trend data do not indicate clearly whether changes in herring abundance have been associated with changes in salmon survival or abundance.

Efforts are under way to provide accurate information for more small salmon populations through cooperation with local enhancement and habitat restoration groups, such as Streamkeepers and Aboriginal communities. DFO should encourage carefully monitored experiments in community-based stewardship where management functions ranging from habitat protection to stock assessment and harvest management are delegated to local authorities under supervision and review by DFO.

The Council firmly believes that, of all the things DFO needs to do, there is nothing more important than acquiring adequate information for stock management and rebuilding. Ultimately, the wages of poor information systems extend far beyond issues of harvest management. Poor information also severely limits the capability to objectively determine the impacts of a wide variety of factors on salmon production and health. Ultimately, a price will be paid in terms of:

- loss of stock diversity and production;
- failure to deal with ecosystem management issues effectively;

- inappropriate responses to perceived habitat damage risks;
- inadequate or unnecessary harvest regulations; and
- inability to conduct effective performance review, thereby increasing the probability of repeating past mistakes.

Stock Rebuilding

There are at least some populations of every salmon species that have been over-harvested or severely reduced through past habitat damage and other environmental effects. Most visible are coho, Rivers Inlet sockeye, Fraser River off-cycle sockeye, Strait of Georgia chinook and pink, and Johnstone Strait and Queen Charlotte Islands chums. The problems that caused the stock reductions should be addressed in order to rebuild stocks to their sustainable levels.

Through most of this century, the development of salmon fisheries and fishing methods has been accompanied by efforts to regulate harvesting to ensure sustainable production. In recent years, to some degree at least, regulatory efforts have also been moving towards maintaining the biological diversity of production systems. Clearly, these initiatives haven't gone far enough. The Council believes that it is important to examine closely the conservation impacts of the existing harvest and regulatory system to see if they might be restructured to reduce risks to biological diversity, and to make fishing more selective and less prone to over-harvesting.

The recent introduction of "selective fisheries" (avoidance and live release) as a cornerstone of salmon management will bring major changes in commercial fishing practices. This new policy initiative should not be seen as merely a way to protect coho salmon. The shift to selective fishing practices marks the beginning of a radical change in the way salmon are harvested commercially. The Council encourages DFO to continue this initiative with special emphasis on avoiding problem interceptions of depressed stocks. Special emphasis should also be placed on developing strategies to harvest strong stocks selectively.

There have also been proposals and field tests for methods to improve in-season assessment of abundance. These proposals range from providing explicit harvest allocations to creating "new" fisheries operating in locations and with gear especially suited to provide abundance index information. DFO is encouraging more involvement by industry and local groups in enumerating and assessing stocks, fisheries and habitat. The Council supports this DFO initiative and encourages industry and local groups to continue to move towards local stewardship.

Rebuilding stocks also requires preventing further loss of habitat capacity and restoration of degraded habitat. Over the long term, highly productive artificial production systems such as large hatcheries and spawning channels often aggravate fisheries management problems by encouraging over-harvest of wild stocks. Enhanced production may also compete with wild stocks and reduce their production. However, enhancement is not just big hatcheries and spawning channels. It includes an array of other tools that can be used prescriptively to address conservation and stock and habitat restoration. These tools range from obstruction removal and fishways to habitat restoration and side channel development. Enhancement also offers opportunities for marking fish to get key stock specific information on distribution and harvest rates. The Council encourages DFO in its Salmonid Enhancement Program to develop specific initiatives that would help to conserve stock diversity, restore habitat and rebuild production of the many stocks that are now significantly below previous production levels. Ideally, many of these initiatives should be implemented through local stewardship.

Effective stock rebuilding will require close coordination of habitat and fisheries management, and restoration and enhancement initiatives. However, there is little value in restoring habitat or enhancing production if fisheries management is not changed to complement such actions. Similarly, without more information about stock status and productivity, stock rebuilding will be difficult and erratic. The Council recommends that DFO develop fisheries and habitat management, as well as restoration and rebuilding plans, that integrate the various DFO programs and local stewardship initiatives.

FRASER RIVER SOCKEYE

Fraser River sockeye have been a treasured heritage and vital resource for millenia. Yet the abundance of this complex collection of stocks has also been very unpredictable. Large components have been devastated or threatened through such causes as natural and human-caused landslides, ill-conceived dams, unfavourable ocean and river conditions, and overfishing. Management of human impacts on this complex and unpredictable resource has been a cause for frequent public concern. This occurred most recently in 1994, when major discrepancies in abundance estimates and widespread concern that the fishery was not being properly managed led to the formation of the Fraser River Sockeye Public Review Board.

In 1998, there were again widespread concerns over the health of the resource and management of the fishery. There were disputes, both before and during the fishing season, over spawner-abundance goals and Aboriginal fishing opportunities. Record high river temperatures, accompanied by unusually high flows followed by record low flows, also raised the spectre of devastating natural mortality. By the end of the season, there was no accounting for 3.5 million fish estimated to have passed Mission.

A background paper, "Fraser River Sockeye," was commissioned by the Council to provide an historical overview, to review the 1998 season, and to present a perspective on key issues. The report highlighted how difficult it is to manage the fishery in the presence of much uncertainty, and pointed to the value of solid policies and operating procedures for safeguarding the resource.

Uncertainties such as the 1998 record-setting river temperatures are unlikely to diminish in the immediate future. For example, this winter's incessant storms deposited an unusually large snowpack in southern British Columbia, especially in the coastal mountains. New records were set even at long-term monitoring stations. The British Columbia Ministry of the Environment has predicted that the melting snowpack will result in high flows with possible widespread flooding. Once again, returning sockeye in 1999 will likely face adverse conditions.

Recent years have brought unusually frequent and intense El Niño events, major shifts in Fraser sockeye migration patterns, and record-breaking temperatures at Hell's Gate. Some or all of these events may simply be a part of the usual vagaries of nature. Yet, major trends in global climates have been clearly documented, with discernible local components. Coastal watersheds are highly sensitive to changes in temperature and precipitation. In south-central BC streams, there is clear evidence of lower late-summer and early-fall flows and higher early-winter flows. Hydrologists expect such changes to accompany global warming. The possibilities that these trends will either continue or worsen, and that they will have a debilitating effect on Canada's Pacific salmon, must not be taken lightly.

Climate shifts make the task of realizing conservation goals for Fraser sockeye more complex than they otherwise might be. Although the causes of these shifts are poorly understood, it is known that their impacts on salmon and their environments can be major. In recent years, fisheries managers responsible for managing Fraser River sockeye fisheries have been confronted by a sequence of climate-induced uncertainties that have disrupted pre-season fishing plans. Managers will need to continue to be particularly cautious and flexible in adjusting fisheries to take into account the harmful influences of climate changes.

Even without these extra difficulties, managing the fishery is a complex task. Beginning in late June and continuing through September, wave after wave of sockeye migrate down the BC coast eventually to enter the river enroute to the many spawning grounds scattered throughout the

watershed. A major challenge for fisheries managers is to obtain sufficient information to assess the strength of discrete stocks and determine the numbers that may be available to harvest. Managers have yet to find a way to generate accurate estimates without either catching a substantial fraction of the incoming run of fish or waiting until the fish are well into the river where fish passage can be more reliably estimated by a combination of echo-sounding and test fishing. Even well after the migration has completed, much uncertainty often remains. In 1998, there were large discrepancies totaling 3.5 million fish between estimates of fish passage at Mission vs. upriver estimates of catch and numbers of spawners.

It is unknown whether this apparent loss was due to natural causes brought on by record high in-river temperatures, by inaccuracies in the estimates, or by other causes. Whatever the cause, escapement targets were not met for any of the runs except the Summer Run. The Early Stuart, Early Summer Run and Late runs were below target. In addition, Early Stuart Run sockeye arrived on the spawning grounds in such poor condition that they died without spawning. With the exception of the Summer Run, escapements were remarkably close to the 1994 levels. This represented a modest setback to an otherwise very successful long-term rebuilding.

The perverse environmental conditions experienced in 1998 caused fisheries managers to impose severe limitations, resulting in one of the lowest exploitation rates in the history of the Fraser River sockeye fishery.

Were the spawner-abundance targets set too high? For 1998, escapement targets were set higher than 1994 escapements, but lower than those for 1990, with one exception. The target for summer runs exceeded both the 1990 and 1994 escapements. This higher goal was, nonetheless, consistent with longer-term rebuilding objectives.

Yet to many people in the commercial sector in particular, these escapement goals came as a shock. This is a serious matter when people's livelihoods are at risk. The Council believes that such surprises can and should be avoided. The present policy is too vaguely defined. The Canadian Caucus of the Fraser River Panel has formally raised their concerns with DFO. The Department in turn apparently intends to improve the process of establishing escapement goals and the strategy to realize the goals, recognizing that other groups and interested parties will wish to be involved. The Council supports this initiative and recommends that DFO develop a consistent, long-term rebuilding policy which will protect against the depletion of genetic diversity; promote the rebuilding of depressed stocks; and, continue to provide opportunities to probe the capacity of the Fraser system to produce fish.

Policy changes should be made only after widespread consultation among all interest groups including Aboriginal, commercial, and recreational fishing interests and others with a non-consumptive interest in the fish. However, no interest group must feel it has a right of veto. The Minister has the authority and obligation to act on behalf of all Canadians to conserve the fish and to provide abundant fish for traditional Aboriginal fisheries, particularly in upper areas of the watershed.

It is also apparent to the Council that DFO needs to develop formal procedures for determining annual escapement goals that are consistent with the rebuilding policy. This policy should also contain provisions for in-season adjustment of escapement targets in light of information on the size and health of the runs. To this end, general, risk-averse principles for dealing with uncertainties should be clearly stated. Where possible, management actions should flow automatically from these procedural guidelines as the season unfolds.

Changes to these guidelines and principles should also be made only after widespread consultations among all interest groups including Aboriginal, commercial, and recreational fishing interests and others with a non-consumptive interest in the fish. Finally, in implementing these guidelines and principles, managers must neither be encumbered during the fishing season by overly inflexible allocation commitments nor be vulnerable to pressure from vested interest groups.

The events of last summer also underscored the need for reliable, timely information. Staff at both the Pacific Salmon Commission and DFO have been working to improve techniques for in-season run size estimation and prediction of in-river migration difficulties. This work needs to be continued.

Fisheries managers must continuously look for cost-effective ways to minimize the uncertainties in management information. For Fraser River sockeye, the Council identifies three major areas of concern:

- Run size estimation. Changes are needed in light of altered fishing regulations and fish migration patterns;
- The capability to anticipate and assess significant sources of in-season natural mortality and to respond as needed; and
- Maintenance of the capacity to estimate spawning population levels.

Finally, one of the many major conservation decisions of the past year deserves special comment. Under the Agreement between Canada and Washington State signed on July 2, 1998, American fisheries could harvest a 24.9 percent share of the Fraser sockeye catch. Concurrently, a more restricted operating period [July 27-August 21] for the American fishery was agreed to and this provided a significant advantage for conservation of the expected low return of Adams River sockeye run. Furthermore, without this Agreement, the U.S. could have fished longer for sockeye and, in so doing, could have intercepted endangered Thompson coho that return to the Fraser River through U.S. waters during late August and September. The Council applauds the decisions to make this Agreement, for both conservation impact and clear policy direction.

COAST-WIDE COHO

The Council considered it essential to take a close look at matters related to coho stocks and their particular status issues. The background paper entitled "Coast-Wide Coho" provided the detailed information and analysis on which this chapter is based.

In 1998, the Minister of Fisheries and Oceans implemented unprecedented conservation measures to protect coho stocks. The coho crisis has been and will continue to be a long-term problem. While there was a primary concern for severely depleted Thompson River and Upper Skeena coho, it was clear that other coho stocks from coastal and interior streams also needed protection and would benefit from stringent conservation measures. The patterns of severe declines observed in many of BC's coho stocks had occurred earlier in Washington and Oregon where many stocks have been placed in the "endangered" category. It seemed obvious that BC coho stocks faced the same dark future as those to the south unless intervention was both massive and sustained over several coho generations.

It was not until 1995 that Canada began to pay serious management attention to coho stocks off the south coast. Even then, management actions were far too tentative to address the rapid declines in survival. Until 1997, Canadian fishermen were allowed to consistently over-exploit many of BC's wild coho stocks. This was particularly true for wild stocks that spawn in Georgia Basin tributaries and the Upper Skeena and Nass watersheds.

Management inaction was linked to the Canada-US salmon impasse. Approximately half the coho that were harvested in Canada's ocean troll fishery off the West Coast of Vancouver Island originated in US streams. It was thought that fishing hard for these coho would provide Canada with leverage in negotiations with the US on salmon allocations. These coho harvested by Canada were also considered compensation for Canadian sockeye and chinook taken by American fisheries. In the end, neither Canadian nor American coho stocks could withstand the exploitation rates and stocks in both countries declined drastically.

For a number of years, exploitation rates for southern coho were very high, often over 80 percent. This excessive rate of exploitation was sustained for a number of years by hatchery production. Wild stocks, however, declined at a disturbing rate, and between the late 1970s and late 1980s biologists estimated that the average catch of wild Strait of Georgia and Fraser River coho had declined by over 50 percent. They also noted that if the decline were allowed to continue at the same rate, these wild coho would be extinct by the turn of the century. In the Upper Skeena, evidence had been mounting of a steady decline in coho abundance beginning in the 1960s. By 1998, abundances were forecast to dip below interim targets for protecting against extinction threats. There was also cause for concern in other parts of the North and Central coasts where, despite spotty information, there were indications that coho were seriously depressed.

In January, 1998 the Minister of Fisheries and Oceans made a statement that radically changed the course of Canada's coho management regime when he said that he would not use conservation as a weapon in the allocation battle with the U.S. In other words, conservation of salmon stocks will now take precedence over other considerations. The Council endorses this change in policy.

In addition to the stringent conservation measures applied in 1998 to protect endangered coho stocks, the Department, with the cooperation of fishermen and university researchers, launched a greatly expanded program of selective fishing experiments. The aim of these experiments was to test ways to minimize the mortality of coho caught in intercepting fisheries by releasing them

alive and unharmed. The enthusiasm and ingenuity that developed over selective fishing was astounding. The Council applauds this initiative and supports its continuation, but with more emphasis on avoidance. While much was learned in, and gained from, the 1998 selective fishing experiments, the Council concludes that avoidance of interceptions remains the most effective strategy for reducing fishing induced coho mortality.

In addition to over-exploitation, another factor in the decline of coho stocks has been the loss of freshwater coho habitat. Loss and degradation of coho habitat are very widespread and this loss represents a significant long-term threat to wild coho production. Although stock declines have been too rapid and over too large an area to be explained simply by freshwater habitat loss, it has certainly contributed to the declines of specific stocks of coho in southern British Columbia. The Council believes that habitat loss may well be a major factor in the continuing declines of some stocks.

A third factor in the decline of coho stocks has been attributed to changes in the marine environment that can affect the availability of food, the distribution of predators and other survival factors. More is being learned about the marine environment, but it is as yet poorly understood. The Council is of the view that this is a field that needs much more scientific work.

Very little is known about the health of many coho populations. In many areas, there is virtually no firm evidence available on spawning abundance let alone marine survival or fishing-induced mortality. Moreover, gaps and inconsistencies in historic data make it difficult to detect trends. Fisheries management also gains vital information from long, uninterrupted series of reliable estimates of spawner, smolt and adult-return abundance for individual populations. The Department has focussed such monitoring efforts on hatcheries and a few of the more productive wild stocks. Reliance on such data can easily mask conservation concerns for less productive systems. The Council takes note of this very serious information gap.

Despite the stringent coho conservation measures in 1998, spawning abundances in the Thompson and Upper Skeena remain at critically low levels, and it is clear to the Council that stock assessments, scientific research, and restrictions on fishing will be required for some years to come. In the Georgia Basin area, stocks generally show continuing signs of weakness, with stream escapement estimates averaging half those of the low 1995 parent year. For other coastal areas (including the Lower Fraser), inconsistent and sparse data make it impossible to provide a definitive assessment of the stock status. The Council believes that this problem severely constrains proper management of these stocks.

An important corner was turned in 1998, but much hard work and sacrifice will continue to be needed. The firm restrictions on fishing must be continued in order to reduce the total fishing mortality on Thompson River and Upper Skeena coho to near zero for at least another five years (i.e., for at least a total of two coho generations). Other stocks should also be added to this list if they are deemed to face comparable conservation risks. The Council endorses a more proactive approach that apprehends and addresses a significant decline in abundance (in any fish species) before it reaches the crisis levels of Thompson and Upper Skeena coho.

It is also important to continue the precedent set last year of announcing firm pre-season plans for protecting weaker coho stocks. It is impossible, in most coho fisheries, to detect and correct for stock-specific abundance shortfalls in-season. These pre-season plans provide certainty for fishing interests and managers as well as for protecting severely depressed stocks.

It is important that fish managers know what must be protected at all costs. In the U.S., this concern has been addressed through the delineation of segments of their fish populations called

Evolutionarily Significant Units (ESUs). The Department has made a good first attempt at delineating ESUs for coho, but there are still many key information gaps. Until these gaps are filled, fisheries managers must err on the side of caution in identifying population groups that must be protected. The Department should also delineate ESUs for other salmon species. Furthermore, for each ESU, the Department needs to develop specific operational goals to ensure that the genetic information there is preserved.

The Council views this work as crucial. The North Pacific, like much of the rest of our planet, has been warming, and El Niño events have been increasing in both intensity and frequency. There were record temperatures in the Fraser River last year, and salmon continue to lose freshwater habitat. All these factors point to continuing conservation concerns. Canadians cannot guarantee that we shall succeed in conserving our salmon stocks any better than our neighbours have to the south. Nor is there any reason to suppose that our problems will be restricted to coho. Along with seven other U.S. salmon populations, Ozette Lake sockeye (30 kilometers south of the northwest tip of the Olympic Peninsula) and Puget Sound chinook were listed as threatened on March 16 of this year by the US National Marine Fisheries Service. Severe conservation concerns, not restricted to coho, have been identified very close to the Canadian border.

Nonetheless, in expectation of a brighter future, it is important to develop rebuilding targets for Canada's coho stocks and operational objectives for working toward these targets. It is clear to the Council that vital complements to these targets and objectives are improved stock assessment and mortality estimation systems to monitor success in achieving these fundamental goals. The existing system will clearly have to be overhauled. The system must provide clear signals of any declines within any Evolutionarily Significant Unit. The present network of indicator streams and counting fences leaves major gaps in vast areas. In addition, DFO must have a program in place to monitor other streams in each ESU. A monitoring program should include information collected by volunteers and should meet the standards of a professionally designed sampling scheme.

Furthermore, to successfully implement the above-described changes, the Department needs to provide solid, ongoing support for research in order to provide for a better understanding of:

- the effects of habitat degradation;
- the reasons for recent declines in marine survival;
- the potential impact of marked-only fisheries for coho stock assessment;
- the effects of catch-and-release events on survival and eventual reproductive success; and
- the risks associated with widespread depressed abundances.

Valuable research initiatives were begun in the last two years in response to the coho crisis and these should be continued over the long-term. Furthermore, last year's selective fishing experiments demonstrated the importance of fostering cooperative effort. Outside perspectives and expertise should also continue to be enlisted through collaborative studies when these are feasible and appropriate.

INSTITUTIONAL ARRANGEMENTS FOR SALMON CONSERVATION

The management of salmon stocks and related habitat involves dealing with a complex set of conservation issues. The process comprises so many salmon stocks and is impacted by so many factors in so many places, it is difficult to identify how comprehensive planning and decision-making can be feasible.

The management challenge is complicated by the involvement of federal, provincial, municipal and Aboriginal governments, each with conservation-related jurisdictions, and by the increasingly important involvement of community and stewardship groups. The complexity is compounded further by two crucial elements. The first is the changing culture and organization within these institutional groups, particularly DFO. The other element involves the changing ways in which these many institutions work together and assume responsibility and authority.

Both of these elements have a direct significance for conservation. They go to the heart of the capability of Canadians, through governments and volunteer organizations, to work effectively towards improved fisheries conservation. Without an effective structure in which to work, these groups could find their efforts wasted.

DFO has been undergoing dramatic shifts in its institutional culture. In broad terms, it has been reorganizing at the same time as it has been changing its priorities and coping with reduced funding. The result for DFO staff has been an overwhelming sense of change; some of it has been for the better, and some has caused confusion, anxiety and frustration about the sense of direction.

Simply stated, DFO cannot meet its conservation mandate, given current resources and strategies. For example, there is a shortfall in basic enumeration and assessment monitoring to the extent that only a few stocks, primarily large ones, have adequate data for their management and protection.

In these circumstances, the Council wants to ensure that DFO maintains a focus on conservation priorities, and does not sacrifice the best aspects of its work. It would be tragic if DFO were to become bogged down or overwhelmed due to its inadequate resources or its institutional structure in any ways that diminished its conservation capability.

Senior management of DFO appears to be aware of problems and symptoms within the organization. These include DFO's long-standing inadequacies in its monitoring programs, especially of spawning escapement. They also include the frustration expressed by staff that they spend too much of their time "firefighting" immediate crises, rather than being prepared with strategies and plans to deal with them. They extend to concerns about inadequate manpower to monitor and enforce regulations to protect stocks, and to undertake habitat protection and restoration activity.

The Council's concern in this case is not to oversee or pass judgement on the quality of management. The ways in which DFO and provincial or municipal governments are managed are matters to be evaluated elsewhere. The Council has an interest only so far as there may be consequences for fisheries conservation.

The second element mentioned above—how institutions work together—is of more immediate concern to the Council.

The federal government has, over the years, shifted various decision-making and planning responsibilities back and forth between Ottawa and the regions. The decentralization in many

cases allowed flexibility to respond to local conditions and considerations that could not be recognized by centralized Ottawa decisions.

Beyond the DFO's own decentralization, there has been a more profound but gradual involvement by local organizations in what have traditionally been DFO's operational activities. Over the past twenty years, DFO has reached out into the fishing and community sectors for advice and assistance with monitoring and enhancement. For example, in a few places like Rivers Inlet there was much use of local knowledge in an attempt to improve the management of fishing.

Initiatives have emerged, variously termed "community-based management", "regional management autonomy", "local co-management" and "local stewardship". Each of them shares the basic notion that, wherever possible, the management system should create incentives for local participation. This applies particularly to conservation activities such as habitat protection and restoration, enhancement, and abundance monitoring. In some cases they extend to allocation among user groups and the planning and execution of local fisheries.

Around the coast and in the interior of the province, early Salmonid Enhancement Program projects encouraged cooperation by supporting local organizations and individuals. It was apparent from those efforts that there should be comprehensive inclusion of public groups and fishermen who should all contribute, particularly to enhancement and habitat protection.

Among local groups, the concept of these innovative institutional arrangements is widely accepted and participation is strong. Several Aboriginal groups have had exceptional success in establishing innovative arrangements of this sort. It has been demonstrated that community and regional organizations representing diverse interests can work together productively. Indeed, protecting and producing salmon may now generate more employment opportunities than fish harvesting.

While the Council is supportive of the concept of this decentralized approach, there are concerns about ensuring that it leads to real conservation benefits. As this report has pointed out, there is an especially important role for community-based organizations, in cooperation with governments, to help conserve smaller fish stocks that have not been receiving enough attention from fisheries managers. Preserving the diversity of salmon stocks and protecting vital stocks and habitats would ideally become a primary concern of these groups.

The management of these new institutional arrangements is difficult, particularly for DFO which is itself in considerable transition. However, it is only by working together with an array of other groups that both DFO and the provincial government will be able to get much-needed assistance in achieving their conservation and resource management goals. For example, cooperative arrangements with the following groups would be particularly helpful:

- Fishermen and communities both have a strong interest in sustaining and rebuilding local resources and have shown enthusiasm at opportunities to participate in experiments, such as selective fishing;
- Intergovernmental coordination of conservation activities across jurisdictions could help minimize duplication and redundancy;
- Industries offer a source for monitoring stocks and habitat, if working with clear and objective standards; and
- Universities and colleges have some technical and analytical strength in fisheries science, and they should develop programs to provide education for local stewardship and support.

It will continue to be important for everyone involved in these institutional arrangements to maintain reasonable expectations about what can be achieved. There are still concerns that local knowledge and experience is under-valued.

People who are working hard to produce and protect fish are starting to demand a share of the potential harvest benefits that should result from their work. There are requests for more responsibility and authority for production and harvest management. Having opened the opportunities for wider involvement, DFO faces the task of satisfying several diverse interests and high expectations.

There are conservation implications in delegating authority and decision-making in cases where there may be particularly high risks to habitat or stocks. It is crucial for individuals involved in such institutional arrangements to become aware of the full conservation implications of their decision options. What may seem, in some instances, to be a reasonable local decision could have serious implications elsewhere and at later times for salmon with their wide-ranging migrations. A combination of technical assessment capability and anecdotal evidence may be needed to provide balance in local decision-making. A balance in the representation of interests within these organizations is necessary to ensure that self-interest is kept in check and in perspective.

What is needed now is an overarching policy framework that will guide the delegation of more responsibility and authority in ways that will ensure that conservation goals can be met. For example, cooperative arrangements to be effective should involve the following:

- Ideally, specific cooperative endeavours should be laid out and pre-agreed in line with a plan for resource management of each local area;
- Delegation to local groups should be matched to technical capability at the local level and to DFO's capacity to monitor and audit local activities;
- Local production-side and consumption-side activities should be limited to the local area;
- Production targets and enhancement (including habitat restoration and improvement) standards should match DFO's;
- Where there is a possibility of mixed-stock fisheries in some part of a local area, DFO should set the catch target and monitor the fishery (for example, coordinate local management with regional management of intercepted (non-local) stocks;
- Local fishing and enhancement activities require timely reports to DFO and should be subject to a random audit; and
- All local management initiatives should be structured to maintain the public interest and ensure fairness to all stakeholders.

While endorsing the use of innovative institutional arrangements, the Council wants to ensure that conservation is not inadvertently compromised. DFO will be expected to define its policy framework in greater detail and spell out the terms and conditions of how it will interact with these organizations. Throughout the process, a considerable degree of cooperation and willingness to accommodate will continue to be needed.

FINDINGS AND CONCLUSIONS

Fisheries conservation issues are often perceived to be a confusing portrayal of trends, science, business and political considerations. It is not an easy task for anyone to draw informed conclusions about matters involving so many controversial elements and emotionally charged attitudes.

It should be no surprise that the Council's findings about the 1998 overall status and trends of salmon stocks defy any absolute statements about their health or peril.

The Council hopes the detailed material contained in the four background papers accompanying this report will provide the degree and level of information that will be of value to the scientists and government managers who can use it for management purposes. Those four papers are an integral part of this report.

For the public who have an interest in salmon stocks and habitat conservation, the Council can report that there are events and trends that give cause for both encouragement and concern.

There is no overall consistency evident from the assessment of stocks. While total numbers (not by species) for 1998 returns were about the same as those of the past five years, they have been exceptionally low. An examination of particular stocks and places shows there are huge inconsistencies and profoundly disturbing signs. Some stocks, such as Upper Fraser spring-type chinook, have been rebuilding. Others, including some coho stocks and Rivers Inlet sockeye, have declined to dangerously low levels.

In addition, the state of many stocks is unknown. The Council has found that there are such glaring information gaps, particularly about the less commercially significant stocks and production areas, that no valid conclusions could be drawn about the state of many stocks. Nonetheless, there is evidence that salmon biodiversity is being eroded.

The low catch of Pacific salmon during the past five years is indicative of widespread declines. It did not point to any extraordinary effort to rebuild stocks by leaving them on the spawning grounds. The 1998 catch of 29,000 tonnes was about half of the long-term average catch. It appears that unfavourable marine conditions, past overfishing, and habitat damage have been significant causes of the reduced catch.

As this report and its accompanying background papers explain in some detail, there continue to be serious conservation concerns, particularly for diversity losses and habitat degradation. The Council considers it essential that fisheries management entrench its recently adopted risk-averse precautionary approach.

It is also notable that more than half of the 1998 salmon catch was chum, a lower market-value species, and that there were 43,000 tonnes of farmed salmon produced in British Columbia during 1998. Both of these circumstances are noted by the Council, and their implications will be reviewed in future discussions.

The 1998 season demonstrated the commitment and professionalism of government officials who have a conservation mandate. It is clear that they are often working under extraordinary pressures, and with limited financial and technical resources.

The Council was encouraged by recent efforts of DFO management to establish better ways of ensuring greater openness and transparency in handling the research work and findings of their

scientists and technical staff. This should help to ensure the credibility of DFO analyses and the validity of knowledge-based decisions needed for conservation purposes.

The impressive activities of voluntary organizations and stewardship groups across the province are an increasingly important component of the overall conservation effort. Their work in habitat restoration, for instance, has been particularly significant. With the focus of governments on high-profile stocks, fisheries and habitat, local stewardship groups may have to become the primary conservation force in their areas to maintain salmon diversity.

The Council strongly endorses the 1998 decision of Fisheries Minister David Anderson to institute the stringent measures to protect coho salmon. This policy was controversial and difficult, coming at a time when the fishing industry was already facing the prospects of a record low catch. The Council firmly believes that it was the right decision and that it will have a positive consequence for decades to come.

The introduction of selective fishing initiatives in 1998 also marked a turning point. DFO should build on those incentives by increasing its efforts to foster selective and informative fisheries practices. By embracing conservation and selective fishing as a cornerstone of the future Canada-US agreement, both countries would be better able to conserve and rebuild their salmon resources.

Another positive recent conservation program is the Water Use Planning process that BC Hydro is currently undertaking, with respect to its water licences around the province. This planning could have the result of more water for fish at a wide variety of diversion and impoundment sites around the province. The Council supports the process as an important contributor to the restoration of fish habitat and stock rebuilding. The sooner these gains can be realized, the better.

The Council notes the serious shortcomings of DFO's information systems. The problem is especially acute for stock status and assessment information, on which management of the fisheries is based. The data generated are, with some exceptions, inconsistent and incomplete, which constrains their value for management purposes. With such limited tools at their disposal for assessing the salmon stocks, DFO management will have continuing difficulty in fulfilling their conservation responsibilities. It is for this reason that many of the Council's concerns in this report are related to the need for fisheries managers to have better information and decision-making tools.

This shortfall creates an unacceptable degree of risk of further declines in the biodiversity of salmon. This issue is not being addressed to the extent that it should, and it is a matter the Council intends to pursue vigorously with DFO and provincial officials.

Council members are looking forward to full participation by the Province of British Columbia, as was originally envisioned and agreed by both federal and provincial governments two years ago. The common interests of the two governments and their dedication to conservation make their cooperation in this Council indispensable. Salmon conservation crosses the jurisdictional boundaries of the two levels of government. The considerable authority of the provincial government in forestry, minerals, agriculture, water rights, highways, municipalities and other activities is especially vital to protect watershed habitat.

The creation of this Council and the work it has initiated should not be interpreted by anyone as meaning that this organization would become the sole advocate for salmon stocks and habitat. In fact, the Council will be effective only if it maintains its work with the broad cross-section of fish conservation advocates who continue to be vocal, active and passionate on behalf of fish and their habitat.

SYNOPSIS OF RECOMMENDATIONS

Throughout the text of this report, the Council has suggested changes in conservation policies, strategies and practices, particularly those of DFO. Within each of the chapters and in the accompanying background papers, there are specific and implied recommendations.

As most people recognize, there is a pressing need for action on a wide front to deal with the many problems of salmon stocks and habitat.

The Council faced a difficult choice in selecting its recommendations. Members did not want to overlook any issues, but also felt obliged to put forward those which seemed to require immediate attention or priority.

In many cases, the Council reviewed aspects of other issues, but felt that more time was needed to discuss and deliberate before making fully informed recommendations that would lead to results. In some instances, this advice is general in nature and proposes broad shifts in approach; in other instances, the recommendations are specific and prescriptive.

The recommendations in synopsis form are grouped within three categories: conservation policy; stock conservation and assessment; and habitat protection and restoration.

Conservation Policy

The Council recommends development of policies on biodiversity and habitat protection that are jointly endorsed by the federal and provincial governments.

In addition, both governments should provide specific policy direction on cooperative stewardship. They should encourage carefully monitored experiments at the watershed level involving delegated authority to local communities and groups under the supervision of responsible agencies. These experiments should include an array of stewardship functions ranging from habitat protection and stock assessment to harvest management. Innovative funding sources and ways to provide local management services should be explored by both levels of government.

The Council reinforces the need for positive policy directions such as those taken last year to protect and rebuild the Thompson and Upper Skeena coho and weaker stocks in general.

The Council, in coming months, will review existing fisheries conservation policy and recommend on further needs.

Stock Conservation and Assessment

The Council endorses the view that governments should act to meet the basic information needs for managing salmon stocks. Those information needs are acute in four primary areas:

Improving Policy Direction on Stock Management

The Council recommends creation of a long-term stock rebuilding policy that includes standards and measures to protect weak stocks and maintain biodiversity. This is needed to establish the context and direction for province-wide stock rebuilding and habitat restoration strategies. As part of this, governments should delineate Evolutionarily Significant Units and set goals for preservation of genetic potential in each of those Units. Also, governments should set escapement goals that are consistent with the recommended stock rebuilding policy and continue to provide firm pre-season plans for protecting weak stocks.

Meeting Stock Status Knowledge Needs

The Council recommends that a systematic annual review of stock status and escapement monitoring systems be undertaken for all salmon and steelhead stocks in BC. In response to the findings of this review, escapement monitoring systems should be revised, where necessary, to improve capacity to assess biodiversity, population and habitat factors. Escapement monitoring also should be increased, including a broader use of index streams and electronic counting. Where feasible, the documentation on historic escapement data and methodology should be organized and published. The annual review of stock status must provide a clear, unambiguous assessment of success in meeting escapement objectives and in preserving biodiversity. The escapement monitoring system must provide the capacity to make this evaluation.

Assessing Stock Productivity

The Council recommends implementation of more advanced stock assessment and mortality estimation systems. In conjunction with these systems, DFO should be collecting more stock-specific information by expanded tagging and other measurement means. As part of the overall rebuilding strategy, there are a number of stocks that require intensive assessments including: Georgia Strait chinook and coho; Fraser and Rivers Inlet sockeye; Fraser and Skeena coho; and East Coast of Vancouver Island steelhead.

Testing New Directions in Fisheries

The Council perceives a continuing need for the live-release experimentation for all fisheries and also development of selective fishing practices including time and area closures to avoid interception of non-target species. It recommends that governments should undertake a review and analysis of regulatory options and approaches for all fisheries, including field studies of release mortality under various situations.

Habitat Protection and Restoration

The Council reinforces the need for governments to collaborate to provide for the basic habitat protection and restoration needed to conserve and sustain salmon. These needs include:

Maintaining Water Quantity

The Council recommends that governments apply existing legislation and processes to ensure that water licences are evaluated in terms of their impact on fish habitat and that licence conditions are enforced. Particularly, water licences for dams should be reviewed as to whether the water could be used more beneficially for fish production than for current uses. Groundwater reserves should also be reviewed as part of the aquatic ecosystem.

Ensuring Water Quality

The Council recommends research on the cumulative impacts of permitted pollution and the impacts of gravel extraction and flood control on fish and their ecosystem. It is further recommended that governments undertake aggressive wetland and riparian buffer restoration and protection programs and develop a joint program for providing exclusive protection to key habitat areas and special protection in developed areas.

Improving Protection From Development Impacts

Adequate salmon habitat should be protected to preserve remaining stocks as viable populations. Accordingly, the Council recommends that governments work together to evaluate existing mechanisms to protect fish habitat from urban development and forest harvesting, and that they implement improved mechanisms where necessary. It is also important to identify and protect Environmentally Sensitive Areas as part of Official Community and Forest Harvesting plans. As an aid to protection, implementation of discretionary ticketing with fines for minor habitat related offenses is recommended.

Council Perspectives on Habitat

A list emerged from the processes that involved preparation of the background papers, consultations with stakeholders and extensive discussions among Council members. These provided an instructive and valuable guide for the Council in formulating its synopsis of recommendations.

The following constitutes the detailed advice, policy concepts, conservation guidelines, and proposed courses of action which emerged:

- The federal and provincial governments should develop and institute a habitat policy that is jointly endorsed and consistently applied.
- DFO should encourage carefully monitored experiments in community-based management, where management functions ranging from habitat protection to stock assessment and harvest management are delegated to local authorities under DFO's supervision and review.
- The various levels of government should be encouraging a watershed approach to the planning and management of fish habitat based on natural boundaries. Where multiple jurisdictions are involved in the same drainage, such an approach should integrate across all levels of government.
- Grassroots advocacy and stewardship are critical to the protection of fish habitat in urban and rural environments. This should be encouraged and supported and the Alouette River Management Society could be put forward as a successful example where this kind of effort has worked. BCIT's Watershed Pledge Program could also provide the template for engaging even more citizens, who may not actually want to join a club or society, but still want to participate in stream and watershed stewardship.
- Given the inadequate number of field staff to monitor and manage fish habitat, it is essential for all levels of government to identify personnel shortages and to address staffing issues.
- The provincial government should undertake a review of its water licences in fish-sensitive watersheds to identify ways to ensure more extensive and effective compliance with the conditions of those licences.
- There is a need to understand the impacts of the province's 40,000 water licences on fish and fish habitat. An auditing process should be undertaken for all licences, and in particular, on those streams where there are high-value fish populations.
- Given that there are more than 2,000 dams in the province and recognizing that perhaps 10-15 percent of them have outlived their usefulness, the province should undertake an assessment of those that could feasibly be dismantled or decommissioned. The Theodosia Diversion Dam

is a good example where dismantling could have significant benefits in terms of restoring salmon and steelhead stocks. Because these dams are operated under water licences, there should also be an audit on whether or not the water affected by the dam is being used beneficially, as defined by the *Water Act.*

- There must be renewed efforts to protect and adequately manage groundwater reserves as part of protecting aquatic ecosystems. The provincial government has stated its intention to undertake new initiatives in this direction, and it should proceed.

- There is a need for the provincial government to undertake more research on, and give more attention to, the cumulative fish-related impacts of pollution permits that allow toxins to enter waterways.

- Gravel extraction from streams for commercial purposes or flood control is becoming an increasing problem from a fish protection perspective. Consequently, proper research, inventory and assessment should be undertaken before gravel is removed from streams.

- Wetland areas not necessarily associated directly with water frequented by salmon and steelhead, but still providing important reservoir and nutrient-producing capacity, should receive protection under legislation or regulation. This includes protection from impacts relating to forest harvesting, agriculture (e.g., potential cranberry bogs, sloughs) and urban development.

- Aggressive riparian buffer restoration programs should be undertaken not only in harvested forest lands, but also in agricultural and urban properties where historic impacts have taken place.

- There must be a requirement to incorporate the federal/provincial land development guidelines pertaining to riparian protection into pertinent, municipal legislation. These must be biologically relevant and adequate to protect salmon and steelhead.

- Urban streams in the Strait of Georgia contribute significantly to salmon and trout populations. There is a need for improved mechanisms to protect urban streams (including riparian protection and the management of storm water). Municipalities should also attempt to identify Environmentally Sensitive Areas as part of their Official Community Plan process.

- In order to contribute to the recovery and conservation of salmon, planning in both urban and forested settings should ensure that adequate salmon habitat is protected so as to preserve remaining populations and enable their reproduction and dispersal into surrounding areas.

- In light of the results-based approach now being taken under the *Forest Practices Code* (as opposed to the use of specific standards when the Code was first developed), there is a need to audit the impacts of this new approach on fish habitat. There must also be continued efforts to improve stream classification under the Code, particularly relating to smaller streams. From a water quality perspective, there is a need to better protect small, non fish-bearing streams that lead into fish-bearing waters.

- Many minor but significant offenses are ignored by Canada Fisheries Officers and the British Columbia Conservation Officer Service simply because of a lack of resources and the time and effort required to obtain a conviction. The alternative to this cumbersome, expensive and ineffectual method of protecting habitat may be a discretionary ticketing system involving fines to deal with minor offenses, yet allow prosecution for more serious violations.

Council Perspectives on Salmon Stock

A further list emerged regarding conservation of salmon stock:

- The federal and provincial governments should jointly develop, promulgate and apply a policy on biodiversity, as it relates to the protection of fish stocks.
- DFO must continue the firm restrictions reducing the total fishing mortality on Thompson River and Upper Skeena coho to near zero for at least another five years. Other stocks should also be added to this list if they are deemed to face comparable conservation risks. DFO needs to develop rebuilding targets for Canada's coho stocks and operational objectives for working toward these targets.
- DFO needs to develop a consistent, long-term rebuilding policy. The policy must protect against the depletion of genetic diversity, promote the rebuilding of depressed stocks, and continue to provide opportunities to probe the capacity of the system to produce fish.
- DFO should develop consistent standards for application of measures aimed at protecting weak stocks and biodiversity; these standards should involve definition of appropriate spatial units for protection and clear guidelines about dealing with tradeoffs involving economic harvesting versus stock protection. An obvious example of where such standards are needed is with coho, but there are similar if less extensive problems with productivity versus diversity tradeoffs with all species.
- DFO must be able to delineate what scientists call Evolutionarily Significant Units for each salmon species. DFO has made a first attempt at this task for coho, but identified many key information gaps. Until these gaps are filled, they must err on the side of caution in identifying population groups that must be protected. They need to develop specific operational goals to ensure that the genetic information within Evolutionarily Significant Units is preserved.
- DFO needs to develop formal procedures for determining annual escapement goals. These must be consistent with the rebuilding policy, but should also contain provisions for adjusting escapement targets in light of information on the size and health of the run. The procedural guidelines must also lead to clear, unequivocal directions for in-season fish management, including the authority of the government regulators to increase escapement targets in response to adverse migration conditions. Where possible, management actions should flow automatically from these procedural guidelines as the season unfolds. However, it is not possible to anticipate all contingencies in procedural guidelines. To this end, general, risk-averse principles for dealing with uncertainties should be clearly stated.
- DFO needs to continue the precedent set last year of announcing firm pre-season plans for protecting weaker stocks.
- DFO should undertake a systematic annual review of stock status and assessment for all salmon stocks in British Columbia. It should describe stock size trends, exploitation rate goals, factors that may prevent achievement of these goals, estimated current impact of habitat alterations, and critical needs for improved assessment. Wherever possible assessments should be based on productivity (recruitment/spawner) assessments rather than simple stock trends, and where productivity assessments are not possible DFO staff should develop plans and proposals for obtaining the needed data as soon as possible.

- DFO should undertake a major revision of the escapement monitoring system. This system is now grossly inadequate for assessment of biodiversity issues, definition of escapement and exploitation rate goals for most stocks/species, and for evaluation of habitat damage impacts and efficacy of habitat restoration measures.

- There should be a major public investment in escapement monitoring programs, most likely using automated counting methods for a large set of index streams. This investment should have high priority, particularly for streams subject to considerable investment in habitat restoration, considering the importance of evaluating restoration methods in terms of actual improvements in fish abundance.

- There should be a careful review of historical escapement data for as many stocks as possible, to determine wherever practical just what information was recorded by field staff and what factors were used to convert field observations into escapement estimates. These factors should be carefully reviewed and field studies conducted wherever improvements are possible.

- Coded wire tagging programs for chinook and coho should be greatly expanded to provide exploitation rate and catch/escapement ratios for many more stocks, using coast-wide opportunities for tagging and enumeration offered by small-scale enhancement and habitat restoration projects. This information is critical for evaluation of conservation measures and assessment of productivity.

- DFO should make an immediate examination of the extent of risk to Georgia Strait and Puget Sound wild chinook and coho stocks of continuing large scale hatchery production, given that this production may directly impact wild salmon and may encourage levels of fishing pressure higher than the wild stocks can withstand and considering that conservation policy, at least for the next few years, will result in harvesting only a small portion of the production.

- DFO should undertake a major review of the Georgia Strait chinook situation, with the aim of developing effective regulatory and enhancement policies for protecting the whole complex of stocks that support the Georgia Strait fisheries. Fishery statistics and escapement data provide conflicting assessments about what is going on in the Strait, and this uncertainty is not going to be resolved simply by emphasizing trends in a few Lower Georgia Strait "index" populations.

- Managers must continuously look for cost-effective ways to minimize the uncertainties in management information. For Fraser River sockeye, the Council can identify three major areas of concern:

    - Run size estimation and the ability to anticipate and assess significant sources of in-season natural mortality;

    - Maintenance of the capacity to estimate spawning population levels; and

    - Stock assessment and mortality estimation systems that provide the capacity to monitor success in achieving these basic goals.

- DFO should undertake a major review and analysis of regulatory options and approaches for ocean sport fisheries. These fisheries now exert major harvest rates upon some chinook and coho stocks, and past regulatory methods have done little to moderate the impacts. There likewise needs to be a review and further field studies on release mortality of hook-and-release sport fishing situations. The impact of sport fishing may be considerably larger than previously suspected.

CURRENT AND EMERGING ISSUES

The Pacific Fisheries Resource Conservation Council is continuing to scan the wide range of public policy issues related to salmon and steelhead stocks and habitat. As the Council has been setting its agenda and establishing its work plan, several topics and issues have been put forward as matters that should be reviewed, studied or commented upon. The Council will be giving attention in the coming years to a range of matters, including:

Institutional issues:

- Canada-US fisheries agreements
- Aboriginal rights, title, self-government, and treaties
- Mixed federal, provincial and local jurisdictions
- Increased amount and scope of local stewardship for fisheries and habitat management
- Priority-setting in DFO in the wake of budget reductions

Habitat conservation issues:

- The conservation implications of climate change and global warming
- Causes and impacts of recent changes in marine survival
- Effects of habitat degradation and restoration
- Water use, planning, impacts and implications
- Conservation implications of hydroelectric and alternative energy sources
- Impacts of fish farming and enhancement on local carrying capacity and stocks

Ecosystem issues:

- Understanding the risks associated with widespread depressed salmon abundance
- Reducing the risks to biodiversity
- Considering the interactions between salmon, herring, mackerel and marine mammals
- Evaluating the options for protected areas

Fisheries management issues:

- Monitoring conservation and fisheries management practices
- Getting more stock-specific, reliable, and timely catch estimates
- Determining the potential impacts of catch-and-release and marked-only fisheries on survival and reproductive success of salmon
- Understanding the management and ecological implications of enhanced salmon production, specifically hatcheries
- Assessing the use of avoidance strategies
- Understanding the artificial selection pressures on salmon

APPENDIX 1: COUNCIL MEMBERS

Chairman
Hon. John A. Fraser, P.C., Q.C., Vancouver

Members
Mr. Mark Angelo, Burnaby

Ms. Mary-Sue Atkinson, North Vancouver

Mr. Murray Chatwin, Vancouver

Mr. Terry Glavin, Mayne Island

Dr. Paul LeBlond, Galiano Island

Dr. Rick Routledge, Burnaby

Mr. Don Ryan, Hazelton

Dr. Carl Walters, Vancouver

Ex-Officio Members
Dr. Dick Beamish, Nanaimo, representing Fisheries and Oceans Canada

Mr. Fred Fortier, Kamloops, representing the Aboriginal Fisheries Commission

APPENDIX 2: TERMS OF REFERENCE

1. Introduction

The Government of Canada is committed to a more comprehensive approach to the conservation of Pacific fish populations and their freshwater and ocean habitat. This approach requires a better understanding of complex freshwater and marine ecosystems and the requirements of Pacific fish populations. The initial focus of the PFRCC will be on Pacific salmon, including steelhead, with the possibility of expanding the mandate to other marine species on the direction of the Minister of Fisheries and Oceans. The Government of Canada is also committed to a more effective role in decision making for those with practical experience and knowledge of Pacific fish populations.

The Minister of Fisheries and Oceans announced the creation of the Pacific Fisheries Resource Conservation Council (PFRCC) on September 18, 1998. The Council will provide advice to the Minister of Fisheries and Oceans, the British Columbia Minister of Fisheries and the public on matters dealing with the conservation of Pacific fish populations and the status of their freshwater and ocean habitat in British Columbia. The Council will also assist in encouraging the free exchange of information among governments, First Nations, stakeholders and the general public.

2. Objectives

The PFRCC is an independent body that will provide strategic advice to Ministers and the public on the conservation and long-term sustainable use of Pacific salmon stocks and their freshwater and ocean habitat in British Columbia. Specifically, the Council will:

- provide strategic advice regarding stock conservation and enhancement, habitat restoration, protection and improvement, and fisheries conservation objectives. This will include identifying stocks in need of conservation actions and stocks where there is insufficient information to assess their conservation status;
- describe the effects of conditions in freshwater and marine ecosystems on the conservation of Pacific salmon;
- review and make recommendations pertaining to research programs, stock and habitat assessments, enhancement initiatives, and government policies and practices related to conservation of Pacific salmon and their freshwater and ocean habitat;
- integrate scientific information with knowledge and experience of First Nations, stakeholders and other parties;
- alert the Minister of Fisheries and Oceans and the public on issues which threaten the achievement of departmentally-defined conservation objectives for Pacific fish populations or their freshwater or ocean habitat;
- provide information to governments and the public on the status of Pacific salmon stocks and their freshwater and ocean habitat in order to enhance understanding and support for fish conservation and habitat protection.

3. Activities Beyond the Scope of the Terms of Reference

The PFRCC will not be involved in:

- In-season management of Pacific salmon.
- Allocation of Pacific salmon.

4. Mandate and Scope

The PFRCC will provide its recommendations to Ministers and the public simultaneously.

- The recommendations will provide an overview perspective on long-term strategic priorities for the conservation of Pacific salmon stocks and their freshwater and ocean habitat in British Columbia.
- The PFRCC will convene and host public meetings each year at several locations in the Province of British Columbia to receive, review and discuss information pertaining to the status of salmon stocks and their habitat.
- The PFRCC will provide recommendations to the Minister of Fisheries and Oceans, British Columbia Minister of Fisheries, and the public, in its annual report due March 15 of each year, and from time to time as the Council deems appropriate.
- The PFRCC will work with Federal and Provincial government agencies to ensure comprehensive data and information sources related to Pacific salmon stocks and their habitat are available to First Nations, stakeholders and the general public.
- The PFRCC may review progress on implementation and the degree of success achieved by their previous recommendations.
- From time to time, the Minister of Fisheries and Oceans will refer specific requests for advice to the PFRCC. This advice may be incorporated into the annual report of the Council or provided at other times as an extraordinary report.
- The PFRCC will set its own agenda on an annual basis within the context of its terms of reference and taking into account requests from the Minister of Fisheries and Oceans.
- The PFRCC will provide advice in its annual report on anticipated stock and freshwater and ocean habitat assessment information requirements, stock and freshwater and ocean habitat assessment priorities and the appropriateness of stock and freshwater and ocean habitat status reports.

5. Sources of Scientific Information Provided by the Department of Fisheries and Oceans

The PFRCC will receive all published information requested of DFO on the status of Pacific salmon stocks, their freshwater habitat and the ocean environment. This information will normally be status reports and research documents approved by the Pacific Stock Assessment Review Committee (PSARC). Other available information on salmon stock status, salmon habitat and the ocean environment will be provided on request and in a timely manner when possible. The PFRCC may also request that DFO staff attend Council meetings to provide expert advice. Requests for information or the attendance of DFO staff should be made from the Chair of the

Council through the office of the Regional Director-General, DFO, Pacific Region. The Chair and members of the PFRCC may participate in meetings of the Salmon and Habitat Sub-Committees of PSARC.

6. Other Sources of Information on Pacific Fish Stocks and Their Habitat

The PFRCC may request input on Pacific fish conservation issues from individuals and organizations including but not restricted to First Nations, individual stakeholders, non-governmental experts, community organizations, fishers, environmentalists, academics and universities in Canada and abroad.

7. Structure and Composition of the Council and the Secretariat

The PFRCC will consist of a Chair and eight (8) members appointed by the Minister of Fisheries and Oceans. Appointments will normally be for a three-year period. The period of appointment can be extended at the pleasure of the Minister of Fisheries and Oceans.

There will be one ex-officio member each from the DFO, the Province of British Columbia, and BC First Nations on the PFRCC. Ex-officio members will participate in the deliberations and work of the Council and act as a liaison between the Council and their respective organization. Ex-officio members of the Council will have a non-voting status and will not participate directly in the development of advice for the minister and the public.

The Chair and members of the PFRCC will be chosen based on merit and standing in the community and not as representatives of organizations, areas or special interests.

The Chair and members of the PFRCC must disclose their interests in any Pacific fishery or associated industry and take the appropriate measures to avoid potential or real conflict of interest situations during their term of appointment.

The PFRCC will be supported by a Secretariat. The Secretariat will provide overall organizational and operational support for the Council which will include: coordinating Council meetings and consultations with the public; liaison between the Council and various external groups and organizations; communications; and all other functions required by the Council to meet the objectives of its mandate. The Council will also undertake strategic planning to achieve its objectives, and review and evaluate research and traditional-knowledge based information.

8. Operating Procedures

The following operating procedures will apply to the PFRCC:

- Funding levels will be set by the Minister of Fisheries and Oceans.
- The Council will submit a proposed budget to the Minister of Fisheries and Oceans for the next fiscal year (i.e. April 1 to the following March 31) by January 31 of each year.

APPENDIX 3: BACKGROUND PAPERS AND REFERENCES

Angelo, Mark and Marvin Rosenau. 1999. *Freshwater Habitat.* Pacific Fisheries Resource Conservation Council, Vancouver. Background Paper No. 1999/1a.

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APPENDIX 4: GLOSSARY

Abundance:	Number of fish, as in a stock or fishery.
Allocation:	Sharing; dividing the fishing opportunities, catch, risks, costs, etc.
Anadromous:	Fish that spawn in freshwater and rear to adults in the ocean.
Assessment:	Evaluation of the productivity of a stock as a basis for deciding spawner goals and harvest rates.
By-catch:	Unintended catch of a species; interception of a species or stock that the fishery is not intended to catch.
Catch monitors:	Individuals who enumerate the catch of fish for the purpose of catch reporting.
Closing:	Formal or official end to a period of legal fishing.
Coded Wire Tags:	Microscopic metal tag with a code etched into it. The tags are inserted into the nose cartilage of salmon smolts to identify them.
Co-management:	Sharing of management responsibilities among two or more agencies or parties.
Depressed Stock:	Stock with an abundance or production rate that is significantly below its expected or average capability.
DFO:	Department of Fisheries and Oceans (Government of Canada).
Directed Fishery:	Fishery to catch a particular species or stock of fish.
Diversion:	Act of the fish moving away from a course or purpose.
Echo sounder:	Electronic equipment which uses sound waves to detect fish in water.
Enhancement:	Man-made improvements to natural habitats or the application of artificial fish culture technology that will lead to the increase of abundance of salmon stocks.
Enumeration:	Ascertaining or counting the number of fish.
Enumeration fence:	Structure placed across a river through which migrating fish must pass. Fish are counted as they pass the fence.
Escapement:	Number of fish escaping from a fishery. The escapement from all fisheries is the spawning population.
Estuary:	Area consisting of the mouth or the lower course of a river in which the river's current meets the sea's tide.
Evolutionarily Significant Units (ESUs):	Equivalent to distinct population segments; a geographic area containing genetically related or similar groups.
Expansion Factor Methods:	Factors used by fisheries managers to expand a partial count of a spawning population into an estimate of the total population.
Exploitation Rates:	Harvest rates; the percent of a population of fish that are harvested.

Fishery:	Used in many contexts as a result of wording in the Fisheries Act; the act of catching; the presence of fish.
Fry:	Young or freshly hatched fish.
Habitat:	Area in which an organism would naturally be found; the place that is natural for the life and growth of an organism.
Index Streams:	Those with stocks that are monitored as representative of other streams/stocks in an area, includes monitoring the stream itself.
Interception:	Catching of fish from an area or stock other than where the fishery is targeted.
Jacks:	Sockeye returning to the spawning grounds after one winter in the ocean, a year earlier than other sockeye hatched in the same year.
Juvenile salmon:	Young, non-mature salmon.
Mark recapture techniques:	Process used to estimate the number of fish on a spawning ground. Involves marking some fish and then re-sampling all fish on a spawning ground to determine the marked: to unmarked ratio.
Migration:	Movement of fish from one region or climate to another.
Monitoring:	Sampling on a continuing basis; tracking and reporting.
Negative Bias:	Inaccuracy in an estimation technique or calculation that causes under-estimation of the number of fish.
Opening:	Formal or official beginning of a period of legal fishing.
Overfishing:	Excessive fishing, fishing to depletion.
Positive Bias:	Inaccuracy in an estimation technique or calculation that causes an overestimation in the number of fish.
Productivity ratios:	Ratio between the parent and the number of adult progeny they produce.
Redds:	Depression in the gravel of a spawning stream where a female lays her eggs.
Risk aversion management:	Management system weighted to conservation of a stock.
Runs:	One or more stocks of the same species that return to a river over a particular time period.
Salmonid:	Group of fish that includes salmon and steelhead.
Smolt:	Young, silvery salmon entering the first stage of its migration to sea.
Spatial distribution:	Describes how fish are located and dispersed over an area.
Spawning:	Act of producing or fertilizing eggs.
Stock:	Identifies those fish returning to a general geographical area for spawning.
Stock enumeration:	Ascertaining the number of fish in each of the stocks.
Stock rebuilding:	Increasing the size of a fish stock, usually through increasing spawning escapement.

Tagging:	Process used for placing a mark on a fish so it can be uniquely identified at a later time.
Test fishing:	Fishing activity designed to provide data from which an estimate of run size can be generated.
Under-reporting:	Fish caught during an official fishery that are not reported in the official catch reporting system.
Visual surveys:	Process of estimating the number of fish on the spawning grounds based on visual observations from land or air.
Watershed:	Area or region drained by a river and its streams and tributaries. Also known as a drainage area.

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