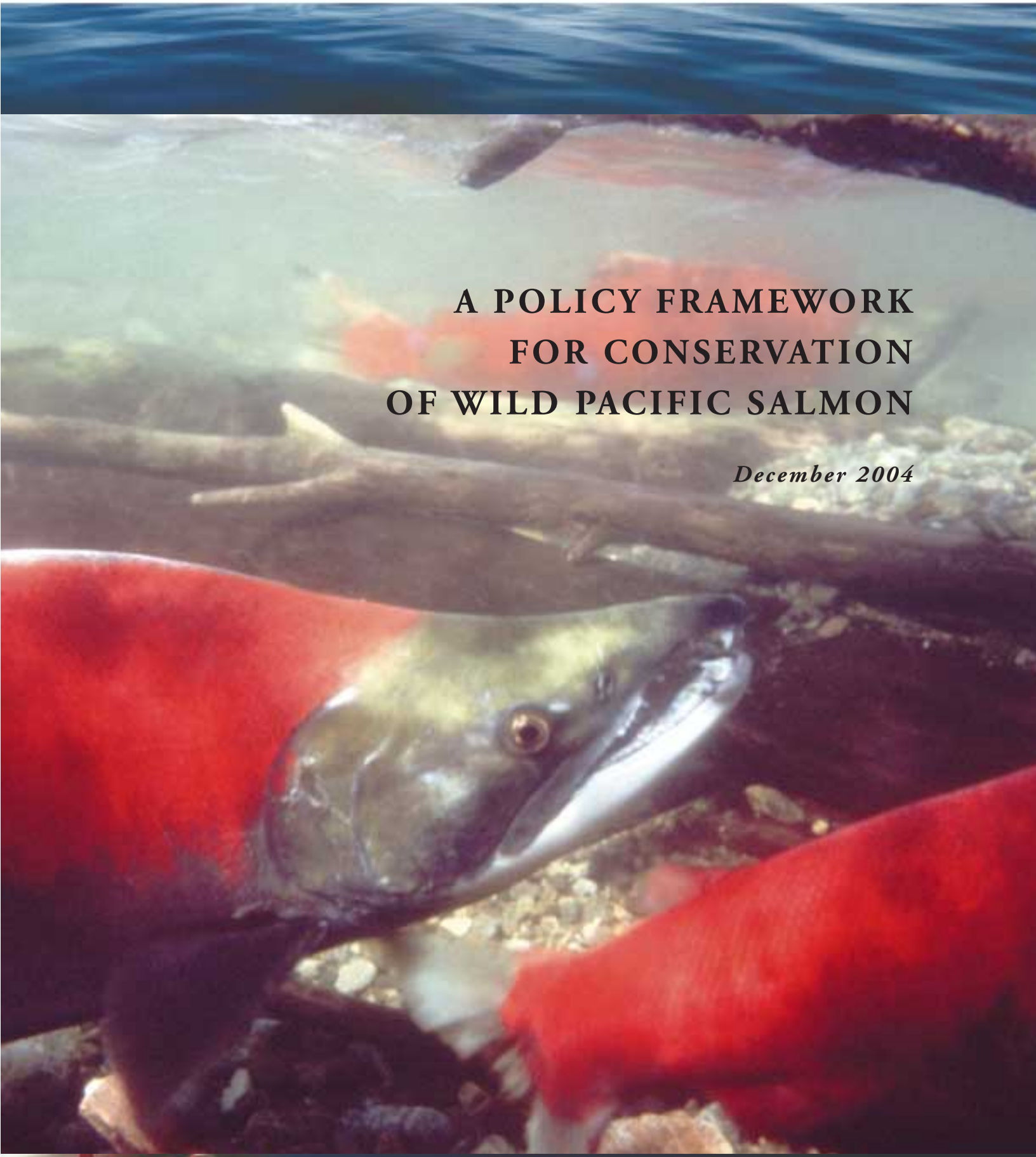
Fisheries and Oceans Canada
Pêches et Océans Canada



A POLICY FRAMEWORK FOR CONSERVATION OF WILD PACIFIC SALMON

December 2004

Canada

Published by
Fisheries and Oceans Canada
401 Burrard Street
Vancouver, B.C.
V6C 3S4

Photos courtesy of
Mr. Harv Sawatzky
West Coast Fishing Club
Fisheries and Oceans Canada

December, 2004

A POLICY FRAMEWORK FOR CONSERVATION OF WILD PACIFIC SALMON

ACRONYMS

AAROM	Aboriginal Aquatic Resource and Oceans Management Program
AFS	Aboriginal Fisheries Strategy
ATK	Aboriginal Traditional Knowledge
CEAA	*Canadian Environmental Assessment Act*
CMA	Coastal Management Area
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CU	Conservation Unit
DFO	Department of Fisheries and Oceans Canada
FAO	Food and Agriculture Association of the United Nations
HADD	Harmful Alteration, Disruption or Destruction of fish habitat
IFMP	Integrated Fisheries Management Plan
IRM	Integrated Resource Management
IS	Indicator System
ISHPC	Integrated Salmon Harvest Planning Committee
MSY	Maximum Sustainable Yield
NPAFC	North Pacific Anadromous Fish Commission
PCO	Privy Council Office
PSARC	Pacific Scientific Advice Review Committee
QCI	Queen Charlotte Islands
SARA	*Species at Risk Act*
SEP	Salmonid Enhancement Program
SFAB	Sport Fishery Advisory Board
WCVI	West Coast of Vancouver Island
WFSP	Watershed-based Fish Sustainability Planning
WSP	Wild Salmon Policy

CONTENTS

Figures and Table

The Wild Salmon Policy – A Snapshot

1. The goal of the Wild Salmon Policy is to restore and maintain healthy and diverse salmon populations and their habitat for the benefit and enjoyment of the people of Canada in perpetuity.

2. This policy goal will be advanced by safeguarding the genetic diversity of wild salmon populations, maintaining habitat and ecosystem integrity, and managing fisheries for sustainable benefits.

3. Conservation of wild salmon and their habitat is the first priority for resource management decision-making.

4. Implementation of this policy will involve an open and inclusive process aimed at making decisions about salmon stewardship that balance social, economic, and biological benefits and costs. People throughout British Columbia and the Yukon will contribute to decisions that reflect society's values for wild salmon.

5. Wild salmon will be maintained by identifying and managing "Conservation Units" (CUs) that reflect the geographic and genetic diversity of Pacific salmon. A CU is a group of wild salmon sufficiently isolated from other groups that, if lost, is very unlikely to recolonize naturally within an acceptable timeframe (e.g., a human lifetime).

6. The status of CUs will be monitored, assessed against selected benchmarks, and reported publicly. Where monitoring indicates low levels of abundance, or significant deterioration in the distribution of the spawning components of a CU, a full range of management actions – including habitat, enhancement, and harvest measures – will be considered in the integrated planning and decision-making process.

7. Measures for habitat protection and salmon enhancement will focus on sustaining wild salmon. An integrated approach to habitat management – involving assessment of its well-being, identification of risks and constraints, and monitoring of status – will be adopted to link fish production goals with watershed and coastal planning and stewardship initiatives.

8. Ecosystem considerations will be incorporated into salmon management. Indicators will be developed to assess the status of freshwater ecosystems. Forecasts from ocean climate studies of marine survival and of the biological condition of salmon will be integrated into the annual assessments of salmon abundance that guide salmon harvest planning.

9. Though the aim of the policy is to maintain CUs, it may not always be possible to avoid losses of wild salmon. In exceptional circumstances, when an assessment shows that conservation measures will be ineffective or that the social or economic costs to maintain or rebuild a CU are extreme, the Minister of Fisheries and Oceans may decide to limit the range of measures undertaken. Such a decision will be made openly and transparently.

10. This policy will foster a healthy, diverse, and abundant salmon resource for future generations of Canadians. It will support sustainable fisheries to meet the cultural and subsistence needs of First Nations and contribute to the current and future prosperity of Canadians.

INTRODUCTION

Canadians in British Columbia and the Yukon have an enduring connection with Pacific salmon forged thousands of years ago with the arrival of the first peoples. Wild salmon serve as a vital source of food and cultural identity for First Nations; they provide jobs, income, and enjoyment for individuals, businesses, and communities; and they play a key role in natural ecosystems, nourishing a complex web of interconnected species. The ties of Pacific salmon with west coast communities, people, and ecology have been eloquently described in the writings of the late Roderick Haig-Brown, who observed:

"The salmon runs are a visible symbol of life, death and regeneration, plain for all to see and share ... The salmon are a test of a healthy environment, a lesson in environmental needs. Their abundant presence on the spawning beds is a lesson of hope, of deep importance for the future of man."[1]

It is no wonder, then, that views on the management and use of wild salmon are so passionately expressed and defended in this part of the world.

With the heated public debate over salmon policy in recent years, Canadians may well worry what will become of Pacific salmon and the many advantages they bestow. Are wild salmon runs disappearing rapidly, as some people claim, to the detriment of our coastal waters, streams and lakes, estuaries, and rainforests? Will the Pacific salmon survive to provide social and economic benefits for future generations? How can we ensure the long-term health and productivity of wild salmon populations? Given our wide-ranging attachments to Pacific salmon, Canadians want answers to these questions from Fisheries and Oceans Canada (DFO) as the manager entrusted with this precious resource.

[1] Haig-Brown (1974), *The Salmon*.

WHAT ARE WILD PACIFIC SALMON?

The Wild Salmon Policy will address five species of Pacific salmon found in B.C. and the Yukon: *Oncorhynchus nerka* (sockeye), *O. kisutch* (coho), *O. tshawytscha* (chinook), *O. gorbuscha* (pink), and *O. keta* (chum). These species form part of the larger classification of Pacific salmonids, which include steelhead and cutthroat trout. DFO has authority under the federal *Fisheries Act* to manage Pacific salmon and their habitat. The management of steelhead and cutthroat trout fisheries has been delegated to the Province of British Columbia, and so is not covered by this policy.

Salmon are considered "wild" if they and their parents are offspring of fish that spawned and grew up in natural surroundings.

Salmon that originate directly from hatcheries and managed spawning channels are not considered wild in this policy, and are frequently called "enhanced" salmon. This term is sometimes also applied to salmon that originate from other enhancement activities, such as habitat restoration and lake enrichment, since their rate of production has been augmented. However, the reproduction of these fish is not controlled and therefore they are deemed "wild" in this policy.

In river systems where there is a hatchery or spawning channel, fish spawning naturally in the river usually consist of both wild and enhanced salmon. This often reflects a deliberate strategy to ensure that a portion of the enhanced fish spawn naturally in the waters from which they originated in order to rebuild or maintain the population. Broodstock collection and spawning guidelines are stipulated to minimize the probability of genetic changes in wild salmon.

IMPORTANT TERMINOLOGY

Conservation. Conservation means different things to different people, but any definition should include the protection of wild Pacific salmon, their sustainable use, and a process for protecting the interests of future generations of Canadians.

For this policy, conservation is defined as wise use. It denotes the protection and sustainable use of salmon and their habitats, both for the long-term health and productivity of wild populations and for the maintenance of present and future social and economic values. The Wild Salmon Policy describes a framework to conserve wild Pacific salmon in this sense.

"Conservation is fair and honest dealing with the future, usually at some cost to the immediate present." [2]

Population. A salmon population is a group of interbreeding salmon that is sufficiently isolated from other populations (through "homing") so that persistent adaptations to the local habitat can develop over time. Local adaptations are an essential part of the biodiversity and long-term viability of Pacific salmon (see The Diversity of Wild Salmon below). Each species is composed of a number of partially isolated populations, which themselves are composed of localized spawning groups, known as "demes".

Biodiversity. Biodiversity is defined by the United Nations Convention on Biological Diversity as "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems."

Consistent with the Convention, Canada's *Species at Risk Act* (SARA) recognizes the importance of the diversity within species by defining "wildlife species" to mean "a species, subspecies, variety or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and (a) is native to Canada; or (b) has extended its range into Canada without human intervention and has been present in Canada for at least 50 years" (S 2.1).

The Wild Salmon Policy will define the geographic or genetically distinct populations of salmon and the habitats and ecosystems necessary to protect their biodiversity. These groupings of salmon fit the definition of "wildlife species" in SARA.

[2] Haig-Brown (1950), *Measure of the Year*.

THE STATUS OF PACIFIC SALMON

The current status of Pacific salmon is frequently debated in B.C. and the Yukon. Despite declines in abundance during the past decade and problems with certain populations, wild Pacific salmon in Canada are relatively plentiful. During the 1990s, a period of climate-related poor marine survival led to a declining abundance of many salmon runs. In response, the Department took strong measures to protect groups of salmon populations, first for chinook salmon along the West Coast of Vancouver Island in 1996 and then for upper Skeena River and interior Fraser River (Thompson River) coho in 1998. While overall abundance and catch decreased, the total number of Pacific salmon returning to B.C. streams for spawning was maintained (see Figure 1).

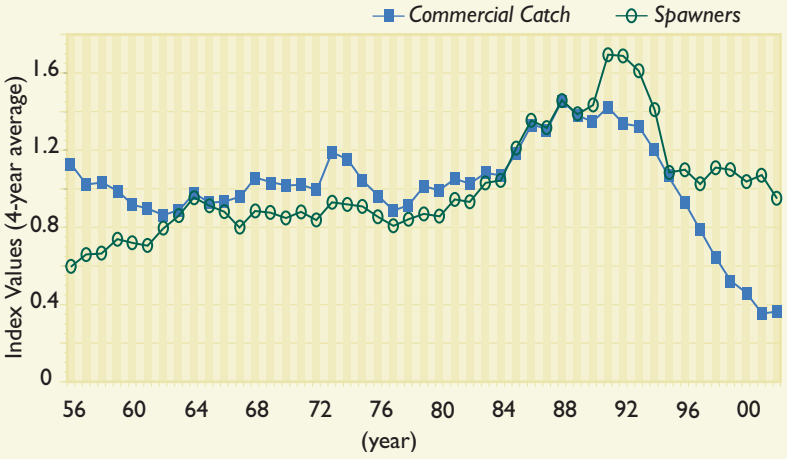
The health of Pacific salmon depends not only on their abundance but also on their biological diversity, that is, the irreplaceable lineages of salmon that evolved through time, the geographic distribution of these populations, the genetic differences among them, and the habitats which support these differences. This "biodiversity" enables adaptation to future change in climate, fishing, and habitat. Protecting biodiversity is our "insurance policy" for the future continuance of wild salmon and therefore of both the ecological processes that depend on them and the cultural, social, and economic benefits drawn from them.

The diversity of Pacific salmon has been an increasing concern. In Figure 1, the totals mask the distribution and number of individual salmon populations. Losses of small populations, for example, would not even be discernible in the figure. Concern for the diversity in Pacific salmon emerged as a significant issue during the 1990s, including Canada's support for the 1992 UN Convention on Biological Diversity. By 1990 in southwestern B.C., salmon from one-third of the spawning locations known since the 1950s had been lost or diminished to such low numbers that spawners were not consistently monitored at these sites.[3] This portion of British Columbia is clearly the centre of urbanization and development and would not be considered representative of the province.

[3] Riddell (1993), "Spatial organization of Pacific salmon: What to conserve?"

In 1996 though, a study for the American Fisheries Society identified 8,171 natural spawning locations throughout B.C. and the Yukon.[4] The study reported that salmon had been extirpated in 2 per cent of the locations assessed and were at high risk of extinction in another 12 per cent, based on the current numbers of spawners and/or the rate of change in those numbers. More recently, fisheries were severely restricted to protect some chinook and coho salmon, and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) recommended listing three groups of Pacific salmon as Endangered under the Canadian *Species at Risk Act* (SARA).[5] These examples have been strong motivations for the development of a policy to conserve diversity in wild Pacific salmon.

Figure 1 **B.C. commercial catch and spawning escapement**



Within the last decade, various measures have been implemented to advance the conservation of Pacific salmon beyond those mentioned above. For example, the commercial fishing fleet was reduced, Canada and the United States renewed the Pacific Salmon Treaty, selective harvesting practices have been developed and adopted, and there is now a greater recognition of the role of wild salmon in Pacific Northwest ecosystems. Each of these actions, in turn, has contributed to the growth of a more informed conservation ethic for Pacific salmon, one that recognizes the inherent value of salmon, the importance of biodiversity among and within populations, and the obvious and enduring cultural, social, and economic benefits.

[4] Slaney et al. (1996), "Status of anadromous salmon and trout in British Columbia and the Yukon" The numbers reported here exclude steelhead, which are not covered by this policy. The paper assessed trends in 4,906 combinations of species within streams (i.e., a stream with three species spawning would account for three spawning locations). The 4,906 spawning locations were 60 per cent of the total number of known locations, but the remaining 40 per cent did not have adequate data to support an assessment.

[5] See www.cosewic.gc.ca COSEWIC works at arm's length from the Government of Canada to assess and designate which wild species are in danger of disappearing from the country.

TRENDS IN COMMERCIAL SALMON CATCH AND SPAWNING ESCAPEMENTS

Figure 1 shows the trends in commercial catch of all Pacific salmon (five species combined) and the total number of Pacific salmon spawning in B.C. streams. Annual values have been averaged over four years to reduce year-to-year variation and illustrate the overall trend. For example, the catch and spawner data plotted for 1956 are averages of values for 1953 through 1956. More information on these calculations and data is presented in Appendix 1.

The reduction in catch to provide more spawning salmon is evident in the figure. The numbers of salmon spawning in B.C. streams (based mostly on visual estimates of spawners) have increased since the early 1950s while catch declined dramatically in the 1990s. The extreme reduction in commercial catch, from record high values in the early 1990s to record low levels recently, reflects declines in marine production of salmon during the mid-1990s, changes in markets for salmon, and significant conservation actions since 1996.

The figure does not include First Nation or recreational catches, but their addition would not significantly alter the trend. Nor are the contributions of enhanced and wild salmon distinguished. Because it deals in totals, Figure 1 does not reflect the change in diversity of salmon populations over time. It is meant simply to show the shift in Departmental actions towards conservation.

THE SALMONID ENHANCEMENT PROGRAM

The cultivation of salmon in British Columbia began in the early 1880s, when a number of sockeye hatcheries were built throughout the province. These facilities were closed in the late 1930s. Interest in fish culture was rekindled with the construction of the world's first spawning channel at Jones Creek west of Hope in 1954, and the increased production from U.S. chinook and coho hatcheries during the 1960s.

The Salmonid Enhancement Program was launched in 1977 to augment production for harvest through a combination of natural and artificial enhancement techniques. The program was also designed to involve the public, raise awareness of the salmon resource, and generate jobs and economic development in coastal and First Nations communities. Its focus has since broadened to encompass rebuilding depleted stocks for conservation purposes and a greater emphasis on the integration of harvest and habitat management with stock rebuilding.

Today, there are nearly 300 SEP projects in operation, producing all five species of Pacific salmon as well as small numbers of steelhead and cutthroat trout. In addition, SEP includes a public involvement and education program that offers technical support and funding to volunteers. Some 10,000 volunteers operate community salmon enhancement and stewardship projects and are engaged in other enhancement activities and habitat monitoring, protection, and improvement.

The overall health of wild salmon, and the progress in protecting populations at risk, has been recognized by the Pacific Fisheries Resource Conservation Council, an independent body that advises government on the conservation of Pacific salmon and their habitat:

[After] about 150 years of development in BC, it is apparent to this Council that there remains a rich diversity of Pacific salmon populations and an abundance of salmon in many locations… [Improving] conditions in the ocean and the conservation measures taken by governments and concerned fish user groups have led to greater salmon production and also contributed to a degree of recovery, particularly of coho salmon in southern BC. It is important to note that there have been successes in conservation, not just problems.[6]

THE IMPORTANCE OF HABITAT

To survive and prosper, wild salmon need appropriate freshwater and marine habitat: no habitat, no salmon. Productive habitat in the Pacific Region faces growing pressures from human activities that threaten the capacity to sustain salmon populations over the long term. Habitat suitable for salmon also has significant economic value to non-fishery uses, such as urban development, forestry, agriculture, and other industry, and these competing uses may compromise the value of the habitat for salmon and associated species. An ongoing concern is that habitat productivity can deteriorate as the result of many small, incremental and often unidentified impacts accumulating over time. In addition, ocean and freshwater habitat can be affected by global-scale phenomena, such as climate change.

Habitat pressures will continue to grow as human population expands and, with it, demands for space, food, and livelihood. The challenge for habitat managers is to implement policies and programs that minimize adverse impacts on fish habitat and protect the well-being of salmon, while enabling development in support of these social and economic priorities. The Wild Salmon Policy proposes an approach to effectively meet that challenge and maintain habitat and ecosystem integrity for the long-term health of Pacific salmon populations.

ENHANCEMENT AND WILD SALMON

Enhancement activities have contributed a significant proportion of the salmon produced in British Columbia and the Yukon. The proportion varies by species, geographic area, and year, but since the 1980s 10 to 20 per cent of the B.C. commercial catch has originated in the Salmonid Enhancement Program (SEP). Moreover, some recreational fisheries are dependent on enhanced salmon, such as the Strait of Georgia mark-selective fishery on coho salmon, chinook fishing in Barkley Sound, and various freshwater fisheries.

SEP has developed many useful tools for producing and restoring Pacific salmon, and it enjoys substantial public support. However, enhancement poses some acknowledged risks to wild populations. Less productive wild populations may be harvested along with more productive enhanced populations in mixed-stock fisheries. Hatchery

[6] Pacific Fisheries Resource Conservation Council (2002), *Annual Report 2001-2002*.

practices may reduce genetic diversity. Wild salmon may have to compete with enhanced salmon for food and space in the marine and freshwater environments. As with any risk factor, the effects of enhanced production can be managed, and those pertaining to wild salmon conservation will be addressed by this policy.

AQUACULTURE

Over the past decade, production from salmon aquaculture has expanded threefold, and the value of farmed salmon now exceeds that from commercial salmon fisheries. The industry's development has provided much-needed employment and income in coastal communities, where economic opportunities are often limited. This expansion has not been without controversy. In fact, it has been accompanied by fierce public debate focused on the sustainability of aquaculture operations and the potential for adverse impacts on the marine environment and wild salmon.

As the lead federal agency for aquaculture development, DFO is in the middle of this debate. Nonetheless, protection of the wild resource remains the first priority. All new fish farm sites must undergo a review for potential habitat effects under Section 35 of the *Fisheries Act*. If a *Fisheries Act* authorization or *Navigable Waters Act* permit is issued, as is often the case, a rigorous screening is mandatory for environmental

effects under the *Canadian Environmental Assessment Act* (CEAA). In its review of fish farm site applications, the Department uses guidelines for new farms. These guidelines include, for example, a minimum buffer of one kilometre from salmon spawning streams and an approved Fish Health Management Plan for each site, to ensure proper animal husbandry and thereby limit the possibility of disease transfer.

DFO's goal, as set out in the Aquaculture Policy Framework, is to manage aquaculture to ensure that it is environmentally sustainable, socially responsible, and economically viable.[7] This means that the Department will support aquaculture development consistent with its commitments to ecosystem-based and integrated management, as specified in legislation, regulations, and policies. Accordingly, the goal, principles, and objectives of the Wild Salmon Policy will guide regulatory actions, particularly with respect to site reviews under section 35 and fish transfer licensing under section 56 of the *Fisheries Act.*

THE NEED FOR A NEW MANAGEMENT APPROACH

Although progress has been made in salmon conservation, there are continuing challenges for wild populations, their ecosystems, and the people that rely on them. Three groups – interior Fraser River coho, Cultus Lake sockeye in the lower Fraser, and Sakinaw Lake sockeye in the Strait of Georgia – have been designated as Endangered by COSEWIC. The Department has initiated recovery plans for these groups. The commercial fishery continues to be hit hard by the recent declines in salmon abundance, reduced catches, and falling prices.[8]

[7] DFO (2002), *Aquaculture Policy Framework*. See the Department's website at www.dfo-mpo.gc.ca/index.htm

[8] McRae and Pearse (2004), *Treaties and Transition: Towards a Sustainable Fishery on Canada's Pacific Coast*.

Within DFO there has been an increasing awareness that past management of large fisheries and "stocks" has failed to protect or recognize the value of biodiversity in Pacific salmon. A new approach to managing salmon production *and* diversity is needed to conserve salmon and protect and restore their full array of benefits.

The drive for a new management approach comes from the evolution in public attitudes, science, laws, and decision-making over the past twenty years. Thousands of volunteer streamkeepers and many local watershed groups now actively protect and restore Pacific salmon and habitat. Biologists are learning more about the genetic diversity of wild salmon, the impact of climate on survival, and the relationship of salmon to their habitat and surrounding ecosystems. SARA mandates the protection of geographically or genetically distinct populations at risk, while the *Oceans Act* calls for integrated resource management and an ecosystem perspective. First Nations and non-governmental organizations are demanding more say in decisions about wild salmon through regional management boards and other mechanisms.

In addition to benefits for salmon, there are broader benefits that will potentially be lost if a new approach to salmon management is not developed. Despite its recent problems, the commercial fishery continues as a vital part of coastal economies and way of life. Recreational fishing generates hundreds of millions of dollars in revenue and significant employment for British Columbians. Salmon dominate the Aboriginal food fishery – now an enshrined constitutional right with a priority over all other fishing – and First Nations make a major contribution to the commercial fishery. Further, more than a hundred other species of fish and wildlife are known to depend on Pacific salmon for their survival.[9] Together with the enjoyment wild salmon provide, their place in our cultural identity, and the expectations of Canadians for responsible stewardship, these factors make a compelling case for a new policy approach.

THE WILD SALMON POLICY (WSP)

Until recently, DFO's management of wild Pacific salmon has been focused on the major fisheries and stocks, and has often been reactive to changing circumstances. Expectations for the management of Pacific salmon today require that we progress to a more proactive, forward-looking approach that sets clear conservation goals and acknowledges the importance of protecting biodiversity to sustain diverse healthy wild salmon populations, their habitats, and associated benefits. Management of wild Pacific salmon must recognize the potential importance of all wild salmon populations when determining allowable levels of harvest and development.

The Wild Salmon Policy presents a framework to guide future decisions about conserving wild salmon populations in B.C. and the Yukon. It defines the specific elements of wild salmon that should be preserved and discusses the nature of appropriate conservation limits.

[9] Washington Department of Fish and Wildlife (2000a), *Pacific Salmon and Wildlife: Ecological Contexts, Relationships, and Implications for Management*.

DIMENSIONS OF THE B.C. SALMON FISHERIES, 2002

Commercial Fishery

Catch
11.7 million salmon[a]

Number of Active Vessels
1,700[b]

Direct Employment
2,584 person–years[bc]

Aboriginal Employment
30–35 per cent[d]

Recreational Fishery

Catch
583 thousand salmon[e]

Number of Participants
330,000 licensed tidal anglers[b]

Associated Businesses
125 lodges; 500 charters[bf]

Direct Employment
1,120 person–years[b]

Aboriginal Employment
3 per cent[b]

Aboriginal Food, Social, and Ceremonial Fishery

Catch
1.2 million salmon[g]

[a] Irvine et al. (2003), "An update on catch trends for Pacific Salmon in British Columbia Canada".

[b] GSGislason & Associates (2004), *British Columbia Seafood Sector and Tidal Water Recreational Fishing: A Strengths, Weaknesses, Opportunities, and Threats Assessment*.

[c] Includes employment in harvesting and processing of wild salmon, but not in other supporting businesses.

[d] Estimate based on GSGislason & Associates (2004) and Michelle James (2003), *Native Participation in British Columbia Commercial Fisheries*.

[e] Estimate based on Irvine et al. (2003) and DFO (2000b). *Survey of Recreational Fishing in Canada*.

[f] Includes employment in lodge and charter businesses, but not in other supporting businesses.

[g] DFO Pacific Region. Based on preliminary estimates, which may be incomplete.

Most important, it identifies appropriate processes for making management decisions about wild Pacific salmon that will balance the needs of salmon with the values of Canadians who have an interest in them.

The policy builds on previous consultations with First Nations, user groups, and the general public on a draft discussion paper released in March 2000.[10] Attempts have been made to address the many comments received in these earlier consultations.

The WSP is meant to engage further discussion that will lead to implementation of a balanced framework for the protection and wise use of Pacific salmon, their habitats, and ecosystems.

[10] DFO (2000a), *The Wild Salmon Policy Discussion Paper*, and Dovetail Consulting et al (2000), *Final Report on Consultations for the Wild Salmon Policy Discussion Paper and the Salmonid Enhancement Program: Analysis of Input from Provincial Stakeholder Group Meetings, Community Forums, Response Forms and Submissions.*

The Diversity of Wild Salmon

Most people know that there are several different species of Pacific salmon. However, fewer may be aware that each species is composed of many genetically distinct groups showing an impressive diversity in their life histories and in the ways they have adapted to local circumstances. Indeed, it is at the sub-species level that biological diversity becomes clear – a diversity that has resulted from the evolution of separate lineages, each able to survive in, and take advantage of, its specific habitat within the broad array of available habitats.

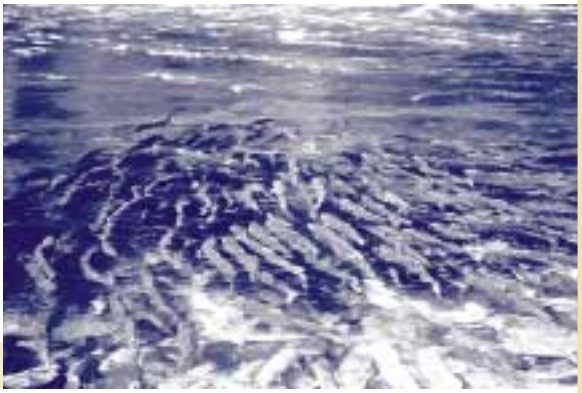
Population diversity

Diversity exists both among and within wild populations. A good example is chinook salmon found in the Harrison/Lillooet river drainage of the lower Fraser River watershed. The chinook populations in the Harrison and Birkenhead rivers contrast sharply with one another in almost every respect.

Harrison River chinook, one of the largest natural spawning populations of chinook salmon, are a fall run that migrate to sea as fry and spend their entire marine life in southern B.C. waters. They are relatively homogeneous, all spawning in a fairly short section of river downstream from Harrison Lake.

The genetically different Birkenhead chinook live farther up the watershed, above Harrison Lake. They are among the earliest returning spring chinook, spend one year as juveniles in fresh water, and are frequently caught in Alaskan fisheries. The Birkenhead population is much smaller than the Harrison population, but more internally diverse. Spawning and rearing in various tributaries, these fish utilize a much broader array of different habitats than Harrison chinook.

If one of these two populations were lost, the other could not be used to substitute for or recreate it.



Homing versus straying

The remarkable ability of salmon to find their way home to their natal stream, in some cases to the exact spot where they were spawned, has led to the thousands of locally adapted populations that exist today. However, a small and variable fraction of returning fish may stray and spawn in nearby streams. Some amount of straying is essential to maintain genetic variation within populations and to repopulate areas where salmon have disappeared. On the other hand, excessive straying among populations, possibly because of natural events or human impacts, can reduce between-population diversity and local adaptations.

The current biodiversity of wild salmon evolved over millennia. At the end of the last ice age more than ten thousand years ago, as the glaciers retreated, the surviving salmon emerged from a few coastal refuges and spread out across British Columbia. As habitats developed and salmon adopted localized spawning areas, genetic differences between groups began to accumulate. However, a low level of straying between groups provided an important source of genetic variation for these increasingly isolated spawning populations, as well as a means for colonization of new habitat.

The Diversity of Wild Salmon (cont'd)

Habitat diversity and connectedness

Since salmon diversity reflects adaptation to local habitat, habitat diversity – both in location and in type – promotes genetic differentiation among wild salmon. To varying degrees, salmon populations use different habitats over their life histories: freshwater streams, rivers, and lakes for spawning and juvenile rearing; estuaries for rearing; and offshore marine waters for feeding and growth. The greater the number and variety of habitats, and the broader their geographic range, the greater the opportunity to maintain genetic diversity.

Without suitable intervening habitat to allow straying, populations will become disconnected and lose the benefits of genetic exchange. Therefore, habitat connectedness is also important to the maintenance of genetic diversity in wild salmon.

Why biodiversity is important

Biological diversity reflects genetic and habitat diversity and the evolution of lineages of salmon over thousands of years.[11] These lineages cannot be replaced once lost, and the more numerous they are the greater the chances for salmon to adjust to future environmental changes. Diversity is a kind of insurance that spreads the risk of loss by increasing the likelihood that species and populations will survive. Furthermore, maintaining the largest number of spawning populations that are adapted to their individual habitats will result in higher abundances of salmon.

Biologists still have much to learn about the importance of local adaptations at the stream level, the rate at which salmon adapt, and the value of biodiversity. However, since no one can foresee the future stresses on wild salmon, a responsible and precautionary approach recommends conserving a wide diversity of populations and habitats. Pacific salmon have been diverse and adaptable enough to survive floods and drought, disease, volcanic eruptions, and ice ages. Their survival strategies should continue to serve them in the future, unless human-caused pressures become insurmountable. We must ensure that these survival strategies are allowed to function and not destroyed by our growing human footprint. The diversity that exists today is our foundation for tomorrow.

[11]For further reading on biodiversity and Pacific salmon, see for example: Greer and Harvey (2004), *Blue Genes: Sharing and Conserving the World's Aquatic Biodiversity*; Gallaugher and Wood (2004), *The World Summit on Salmon: Proceedings*; Hilborn et al. (2003), "Biocomplexity and fisheries sustainability"; Harvey (2002), *Biodiversity and Fisheries: A Primer for Planners*; Wood (2002), *Managing biodiversity in Pacific salmon: The evolution of the Skeena River sockeye salmon fishery in British Columbia*; Harvey et al. (1998), *Action before extinction: an international conference on conservation of fish genetic diversity*; Wood and Holtby (1998), "Defining conservation units for Pacific salmon using genetic survey data"; and Levin and Schiewe (2001), "Preserving salmon biodiversity."

POLICY FRAMEWORK
for the conservation of wild Pacific salmon

The policy framework presented below describes how DFO will meet its responsibilities for the conservation of wild Pacific salmon. Our approach is to adopt an overall policy goal for wild salmon, identify basic principles to guide resource management decision-making, and set out objectives and strategies to achieve the goal (Figure 2).

The successful implementation of this policy framework will provide Canadians with:

- Healthy, diverse, and abundant wild salmon populations for future generations;
- Sustainable fisheries to meet the cultural and subsistence needs of First Nations and contribute to the current and future prosperity of Canadians; and
- Improved accounting for ecosystem values in salmon and habitat management decisions.

GOAL AND GUIDING PRINCIPLES

The goal of the Wild Salmon Policy

is to restore and maintain

healthy and diverse

salmon populations and their habitat

for the benefit and enjoyment

of the people of Canada in perpetuity.

LEGAL CONTEXT FOR THE WILD SALMON POLICY

Three key tenets provide the legal foundation for this policy:

- Pacific salmon are a common property resource managed by the Government of Canada on behalf of present and future generations of Canadians. Although salmon are held in common for our communal benefit, common property does not imply open or equal access to the resource. The federal government has constitutional responsibility to conserve and manage Pacific salmon on behalf of the people of Canada.

- The Minister of Fisheries and Oceans retains the authority and accountability for the protection and sustainable use of fisheries resources and their habitat, and for decisions regarding allocation and access. The *Fisheries Act* authorizes the Minister to conserve fish. That authority includes the discretion and powers necessary to regulate access to the resource, impose conditions on harvesting, and develop and enforce regulations.

- The Aboriginal and Treaty rights of Aboriginal peoples will be respected and accorded appropriate priority, consistent with the protection provided by section 35 of the *Constitution Act*, 1982 and case law. The WSP will support DFO policies on aboriginal fisheries and the federal initiatives to negotiate aboriginal treaties and self-government agreements. The Department seeks to manage aboriginal fisheries in a manner consistent with the decision in R. v. Sparrow and subsequent Supreme Court of Canada decisions. Several policies and programs have been put in place for aboriginal fishing, including the Aboriginal Fisheries Strategy and the Aboriginal Aquatic Resources and Oceans Management Program.

LEGAL CONTEXT FOR THE WILD SALMON POLICY (cont'd)

Key legislation, agreements, and policies and programs relating to wild salmon and biodiversity include (see Appendix 2):

Legislation

Fisheries Act (1867)
Fisheries Development Act (1985)
Canadian Environmental Assessment Act (1995)
Oceans Act (1997)
Species at Risk Act (2003)

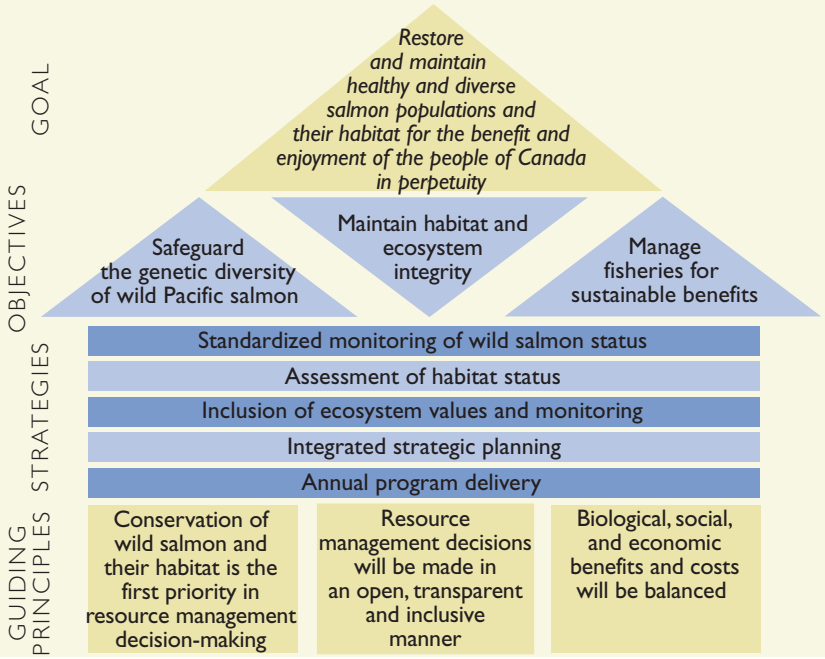
Agreements

Pacific Salmon Treaty (1985)
UN Convention on Biological Diversity (1992)
Convention for the Conservation of Anadromous Stocks in the North Pacific Ocean (1992)
Accord for the Protection of Species at Risk in Canada (1996)
Pacific Salmon Agreement (1999)

Policies and Programs

Policy for the Management of Fish Habitat (1985)
Aboriginal Fisheries Strategy (1992)
A New Direction for Canada's Pacific Salmon Fisheries (1998)
Salmon Allocation Policy (1999)
Selective Fishing Policy (2001)
Aboriginal Aquatic Resource and Oceans Management Program (2003)

Figure 2 **Overview of the Wild Pacific Salmon Policy framework**



All decisions and activities pertaining to the conservation of wild Pacific salmon will be guided by three principles:

PRINCIPLE 1

Conservation of wild salmon and their habitat is the first priority in resource management decision-making.

Conservation means wise use. The protection and sustainable use of salmon and their habitats will enable the long-term health and productivity of wild populations and the maintenance of present and future social and economic values. To safeguard the long-term viability of wild Pacific salmon in natural surroundings, the Department will strive to maintain healthy populations in diverse habitats.

PRINCIPLE 2

Resource management decisions will be made in an open, transparent, and inclusive manner.

To gain broad public support for decision-making, salmon management must accommodate a wide range of interests in the resource. Decisions about salmon protection and sustainable use must reflect society's values. Decision-making processes will therefore be fair, transparent, and governed by clear and consistent rules and procedures.

PRINCIPLE 3

Biological, social, and economic benefits and costs will be balanced.

Conservation decisions cannot be based solely on biological information. The maintenance of biodiversity and healthy ecosystems must be balanced with human needs now and in the future. Decisions will not be taken without regard to their cost or social consequences. Social, economic, and biological considerations will together guide decisions on salmon, their habitats, and their ecosystems.

OBJECTIVES

To achieve the outcome expressed in the policy goal for wild salmon, three objectives must be fulfilled:

1. Safeguard the genetic diversity of wild Pacific salmon;

2. Maintain habitat and ecosystem integrity; and

3. Manage fisheries for sustainable benefits.

Key considerations associated with each of these objectives are described below.

OBJECTIVE 1

Safeguard the genetic diversity of wild Pacific salmon

To sustain Pacific salmon and their associated benefits, it is necessary to safeguard their geographic and genetic diversity and their habitats. While maintaining diversity is broadly accepted as essential for the health of wild salmon, the significant scientific and policy issue is how much diversity? To preserve the maximum genetic diversity could effectively eliminate human harvesting of salmon and prohibit human activities that might harm salmon habitat. To preserve a taxonomic species, such as sockeye salmon, but ignore within-species population structure and the well-being of individual populations would reduce diversity and be contrary to the intent of the UN Convention on Biological Diversity and SARA.

Under this policy, DFO will strive to maintain diversity through the protection of "Conservation Units" (CUs). A CU is a group of wild salmon sufficiently isolated from other groups that, if extirpated, it is very unlikely to recolonize naturally within an acceptable timeframe, such as a human lifetime.

There are important implications to this definition of a Conservation Unit. The persistence of salmon within the CU, and its associated production, demand responsible management of its population structure and habitats, as well as the ability of fish to move among habitat areas (connectivity). The loss of a CU for the length of a human lifetime would clearly have serious consequences for the people and other ecosystem components that benefit from or depend on it.

Over the geographic area of a CU, variations in habitat type and quality may result in differences in salmon productivity. The existence of such differences means that not all populations within a CU need to be maintained at equal levels of production. By emphasizing the maintenance of the CU as a whole, the Wild Salmon Policy acknowledges the need for a balance between protection and continued resource use. Maintaining CUs requires protecting populations and demes, but not necessarily all of them all of the time. Temporary loss of some localized spawning groups within CUs may occur. However, these losses, whether due to natural events or human activities, do not imply extirpation of the CU. Maintaining healthy abundances within CUs requires sufficient spawning salmon to recolonize depleted spawning areas and use of other habitats to provide continued production and promote diversity.

THE POPULATION STRUCTURE OF WILD SALMON

Salmon have a complex hierarchical population structure extending from groups of salmon at individual spawning sites all the way up to taxonomic species. Their precise homing to natal streams and their death after spawning restrict gene flow among fish at different spawning locations. However, since salmon stray, some genetic exchange also occurs among fish from different persistent spawning sites (**demes**) in a geographic area. Thus is formed a geographic network of genetic organization.

The farther apart demes are from one another, or the greater the physical differences between sites, the fewer the strays, the less genetic mixing, and the greater the genetic differences between fish at these sites. Eventually, as distance or environmental differences grow to severely limit gene flow, the spawning groups will function as separate lineages in their genetics and production of fish. These independently functioning aggregates are what we call **Conservation Units**.

Populations are usually intermediate between demes and CUs. There can be limited gene flow between populations, and a CU usually contains more than one population. However, sockeye is an exception, because the exchange between its populations is usually so small that a sockeye population tends to be its own CU (Figure 3).

SPECIES DIFFERENCES IN CONSERVATION UNITS

The number and sizes of CUs will vary among species. For instance, pink and chum salmon generally stray more than the other species, so their CUs will be relatively large. Similarly, coho rarely exhibit marked genetic boundaries, so their CUs will tend to be large and at times somewhat difficult to define. Chinook salmon, with more varied life histories, will tend to have more CUs. (The differences described earlier between Harrison and Birkenhead chinook within the same watershed mean that they will be separate CUs.) A sockeye CU will typically be at the level of an individual lake, though sometimes it may turn out that several small lakes will constitute one CU, or that different timing components ("runs") within large lakes may represent separate CUs (see Figure 3).

***Figure 3* Schematic representation of genetic diversity and Conservation Unit structure**

Genetic Diversity	*O. nerka* (sockeye)	*O. kisutch* (coho)	*O. tshawytscha* (chinook)	*O. gorbuscha* (pink)	*O. keta* (chum)
Taxonomic Species					
Conservation Units	~100 CUs in B.C. & Yukon of which 20–25 CUs are in Fraser of which Chilko Lake is one Fraser CU	~15 CUs in B.C. & Yukon of which 2 CUs are in Fraser of which Interior Fraser is one Fraser CU	~30 CUs in B.C. & Yukon of which ~6 CUs are in Fraser of which South Thompson is one Fraser CU	~25 CUs in B.C. & Yukon of which 2–3 CUs are in Fraser of which lower Fr. odd year pinks are one Fraser CU	~15 CUs in B.C. & Yukon of which Fraser chum is one CU
Populations	Chilko Lake is a population and a CU	5 populations in interior Fraser CU	2 populations in South Thompson CU	~15 populations in lower Fraser odd year CU	~8 populations in Fraser CU
Demes	3 spawning locations in Chilko Lake CU	Spawning sites in ~200 streams in interior Fraser CU	Spawning sites in ~15 rivers in South Thompson CU	Spawning sites in ~45 streams in lower Fraser odd year CU	Spawning sites in ~115 streams in Fraser CU
Geographic Range					

Under the genetic hierarchy, individuals within demes are genetically more similar to each other than between demes within populations, and so on.
Examples provided for each species of Pacific salmon are based on preliminary results and may change.

OBJECTIVE 2

Maintain habitat and ecosystem integrity

The health of wild Pacific salmon is inextricably linked to the availability of productive freshwater, coastal, and marine habitat. The long-term well-being of salmon depends on maintaining diverse and productive salmon habitats. However, these and adjacent terrestrial areas are also valued for a wide range of human requirements. Healthy salmon habitat is challenged by human competition for accessible land and fresh water, for ocean spaces, and for the interconnecting estuarine and coastal areas.

In both freshwater and marine areas, human activities affect water quality. In estuaries and the marine foreshore, development can affect wild salmon during critical rearing and migration periods. In the open ocean, commercial fishing, shipping, waste disposal and other activities can damage the marine habitat of salmon.

Pacific salmon have a critical function in aquatic and terrestrial ecosystems where they transport marine-derived nutrients inland. Salmon also play an important role in marine ecosystems, with their bodies and waste products providing nutrients for organisms from microbes to top predators.

Conservation Units in the Fraser River Watershed

The application of the concept of CUs is illustrated by the following description of our current understanding of the population structure of salmon in the Fraser River watershed (see Figure 3).

In the Fraser River, more than 300 sites have been identified where sockeye regularly spawn. These persistent spawning sites or demes aggregate into around 25 populations that correspond mostly to major lakes and, in some cases, run timing groups within lakes. However, genetic mixing between run timing groups within lakes will probably result in a somewhat smaller number of Fraser sockeye CUs.

Individual sockeye CUs will not normally be managed separately, nor will each CU be assessed on an annual basis. For example, CUs that migrate together and face similar risk factors may continue to have their common risk factors jointly managed.

Many Fraser River fisheries are expected to continue to operate on the basis of the four major run timing groups: early run (late June to late July), early summer run (mid-July to mid-August), summer run (mid-July to early September), and late run (early September to mid-October). However, managers will need to be aware of the CUs contributing to each run timing group, and fisheries will be evaluated, in part, in terms of the status of these CUs. For example, the late run timing component consists of CUs of varying productivity, including the Harrison/Lillooet, Shuswap, Adams, and Cultus populations.

To monitor the performance of CUs, indicator systems will be identified that reflect their status. However, not every CU will have its own indicator system.

Other salmon species in the Fraser River watershed will have fewer CUs than sockeye. There appear to be five or six CUs for chinook salmon that are sufficiently genetically distinct and geographically isolated that they would probably not replace themselves through natural processes within a human lifetime. Coho salmon from above the Fraser canyon are isolated from coho below the canyon, so these groups constitute separate CUs. Odd- and even-year returning pink salmon rarely, if ever, exchange genetic material and therefore constitute separate CUs. Fraser chum salmon may all belong to one CU.

CHANGES IN HABITAT MANAGEMENT

As part of the National Smart Regulation initiative, changes are underway to modernize the national Habitat Program and better conserve, protect, and manage fish habitat. The Program's new direction is captured in five elements:

- Risk management to focus resources on projects that have high risk to fish habitat;
- Tools to create more effective and efficient processes for habitat reviews;
- Greater consistency and predictability in habitat decision-making;
- Renewed emphasis on partnerships to improve fish habitat protection and restoration; and
- A new management approach to environmental assessment to improve consistency of application.

Under this plan, DFO staff will apply an objective, science-based risk management framework to identify development proposals that are high risk to important and sensitive fish habitat, and then select and apply the most appropriate regulatory tools to mitigate the risks. The plan will build on partnerships and other arrangements with all levels of government, First Nations, industry, and the public to protect and restore fish habitat and enhance program effectiveness among all stakeholders.

The goal is a more transparent decision-making process that is understandable to stakeholders. This, in turn, will open up opportunities for collaboration with a range of partners – an essential feature of a modern approach to regulation.

Since 1986, DFO's Habitat Management Program has endeavoured to find the balance required for sustainable development. The program has been guided by the "no net loss" principle for the protection of habitat.[12] The first and preferred approach is prevention of habitat loss through avoidance and mitigation. Where habitat is damaged, losses are balanced with habitat replacement.

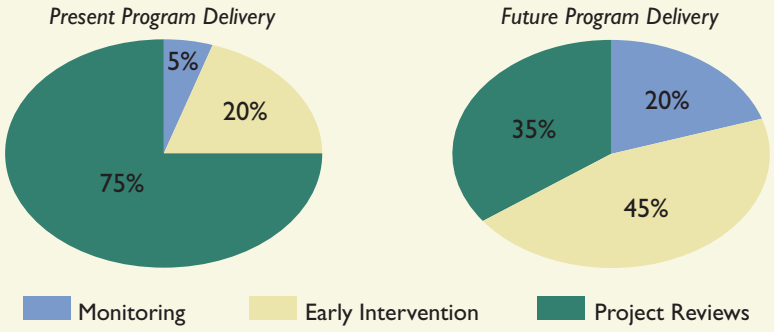
The strategies for achieving no net loss have focused primarily on project-by-project review, mainly in freshwater environments. A modern, more effective approach will assess the importance of habitat on an ecosystem basis, balancing the degree and type of impact with the most effective strategy. In evolving to a more integrated approach, Habitat Management is exploring indicators to assess and monitor the health of freshwater and marine habitat.

A new focus on the most sensitive and important salmon habitat in a CU will clarify decision-making and better link management strategies to harvest and salmon assessment (see Strategy 4 below for an explanation of how this will be done).

To focus on areas where productive capacity of habitat is at highest risk of loss, DFO must integrate its work with that of provincial agencies, stewardship groups, and stakeholders. Monitoring of ecosystem health, habitat planning, and stewardship in the freshwater and marine environments encompass many activities, such as assessments of habitat status and risks, preventive and early intervention, as well as restoration, public education, and community involvement. Integrated management of this array of activities is consistent with DFO's national strategies.

Increased monitoring of habitat status, policy effectiveness, and compliance with regulatory requirements will ensure that programs evolve and improve. Figure 4 illustrates the shift underway in the Habitat Management Program.

Figure 4 **Evolution in DFO's Habitat Management Program**



OBJECTIVE 3

Manage fisheries for sustainable benefits

The first priority in this policy is conservation, defined as wise use of wild salmon and their habitat. A policy framework that achieved only preservation while failing to address the high value that Pacific salmon provide to society would be incomplete. Many Canadians depend on wild salmon for their social and economic needs and have additional expectations for wild salmon.

[12]DFO (1986), *Policy for the Management of Fish Habitat.*

DFO has a responsibility to provide sustainable harvesting opportunities that will best meet the subsistence needs of First Nations, contribute to social well-being, and provide employment and other economic benefits to individuals and fisheries-dependent communities. Harvest restrictions affect communities and individuals. The greatest challenge for this policy is to balance the maintenance of genetic diversity with these benefits of the salmon catch.

Some critics will suggest that such "balancing" merely masks a giveaway on salmon preservation. Others will claim that it means the elimination of major salmon fisheries. The interests of both salmon and people need to be accounted for in a successful conservation program. This policy reflects a management framework that can provide parallel care and respect for a resource and its ecosystem and for the people within it. The full measure of the WSP's success will not be salmon preservation alone but the achievement of preservation accompanied by human well-being.

Finding the appropriate balance of social, economic, and biological benefits and costs, in order to make the right decisions, cannot be done by scientists or other technical specialists alone. While choices must certainly be informed by scientific and technical information, the right decisions will ultimately reflect public values. To achieve a balanced outcome will require structured processes that: (1) establish specific objectives and priorities, and (2) allow the consequences of different conservation measures and activities to be considered and weighed in an open and transparent way.

First Nations, harvesters, environmental groups, and community interests in the resource need to be engaged directly in these processes, and in the determination of the most appropriate management actions. Individual and community involvement in salmon management decision-making, in turn, will sustain the social and cultural ties between people and salmon. These ties will ultimately lead to the more successful implementation of conservation plans and the better protection of wild salmon.

STRATEGIES AND ACTION STEPS

This policy will implement the new approach to salmon and habitat resource management through five strategies. These strategies will strengthen the scientific basis for management, modernize delivery of habitat management, and foster planning methods that balance the demands of competing uses and values. The five strategies are detailed here and summarized in Table 1.

Strategies 1 through 3 provide the information on wild salmon populations, their habitats, and ecosystems required as inputs into decision-making. Strategy 4 is the integrated process that will produce long-term strategic plans for salmon and habitat management. Strategy 5 brings together the annual planning and other activities to put these long-term plans into action.

In implementing the strategies, decision-making will be guided by the federal government's Principles for the Application of Precaution[13] and the UN Food and Agriculture Organization's (FAO's) *Precautionary Approach to Capture Fisheries and Species Introductions.*[14]

[13] See www.pco-bcp.gc.ca/docs/Publications/precaution/precaution_e.pdf

[14] FAO (1996), *Precautionary Approach to Capture Fisheries and Species Introductions.*

LINKING HABITAT TO WILD SALMON CUs AND HARVEST PLANNING

A key response of the regional Habitat Management Program to the WSP is an increased emphasis on integrated planning. Fish production and harvest objectives for wild salmon CUs will be linked to the conservation, restoration, and development of fish habitat. Ultimately, decisions on salmon production and harvest will be made with the participation of other users of freshwater and the ocean.

At the resource planning level, better habitat protection priorities will be established by integrating habitat requirements with the fisheries resources they support and with fish management objectives. Habitat plans will incorporate knowledge of the current and future demands on the environment and the aquatic resources, and will be aligned with objectives for fisheries and watersheds for priority CUs.

THE WSP AND THE PRECAUTIONARY APPROACH

Categorizing Conservation Units into one of three status zones (Green, Amber, or Red) is consistent with the "precautionary approach" as envisaged by the UN Fisheries Agreement[15] and the principles provided to Canadian federal agencies by the Privy Council Office (PCO) in *A Framework for the Application of Precaution in Science-based Decision Making About Risk*.[16]

The WSP proposes an inclusive integrated planning process (Strategy 4) to balance biological, social, and economic benefits and costs when making management decisions. This differs from a less flexible prescriptive approach that could result in specific management actions associated with each benchmark. The relative importance of biological, social, and economic factors in decision-making will vary depending on the status of the CU.

For CUs in the Green zone, social and economic factors will be paramount. Moving below the upper benchmark and through the Amber zone, biological considerations will be increasingly important in decision-making, though social and economic factors will also be considered. Crossing the lower benchmark into the Red zone, where preservation of the CU is at stake, biological considerations will dominate resource management decisions.

The WSP is consistent with the five principles of precaution as identified in the PCO document:

- The application of the precautionary approach is a legitimate and distinctive decision-making approach within a risk management framework.
- Decisions should be guided by society's chosen level of risk.
- Application of the precautionary approach should be based on sound scientific information.
- Mechanisms for re-evaluation and transparency should exist.
- A high degree of transparency, clear accountability, and meaningful public involvement are appropriate.

[15]FAO (1996), *Precautionary Approach to Capture Fisheries and Species Introductions*.

[16]See www.pcobcp.gc.ca/docs/Publications/precaution/precaution_e.pdf

Table 1 **WSP strategies and action steps**

1. Standardized monitoring of wild salmon status
- Identify Conservation Units
- Develop criteria to assess CUs and identify benchmarks to represent biological status
- Monitor status of CUs

2. Assessment of habitat status
- Develop generic standards for habitat sensitivity for Pacific salmon by species and life history
- Develop indicators and benchmarks of habitat quality and quantity
- Assess habitat status within CUs
- Monitor habitat status
- Promote and support linkages to develop an integrated data system for watershed management

3. Inclusion of ecosystem values and monitoring
- Identify indicators (biological, physical, and chemical characteristics) to use in monitoring the status of freshwater ecosystems
- Monitor annual variation in climate and ocean conditions, integrate with assessments of marine survival of Pacific salmon, and incorporate the knowledge into the annual salmon management processes

4. Integrated strategic planning
- Design and implement a fully integrated planning process for salmon conservation
- Implement an interim process for developing strategic plans for the management of Conservation Units

5. Annual program delivery
- Assess the status of Conservation Units and populations
- Plan annual fisheries
- Plan and implement habitat management activities
- Plan and implement annual enhancement activities
- Review performance

STRATEGY 1
STANDARDIZED MONITORING OF WILD SALMON STATUS

This policy requires systematic tracking of wild salmon to answer such questions as the following: Is the status of wild salmon populations improving, staying about the same, or deteriorating? Does the status vary among species and areas? How does it compare with expectations and targets?

To conduct such monitoring cost-effectively will be a challenge. It will not be practical to monitor every salmon deme or population or even every Conservation Unit. Attention must therefore focus on selected CUs. When groups of CUs are exposed to a common threat, the approach will generally be to monitor a sample of these CUs. If it is not reasonable to monitor an entire CU, DFO will look for abundance and other status indicators in locations that can be monitored. Benchmarks will be identified so that CUs can be categorized into biological status zones. Finally, an assessment monitoring program and reporting schedule will be developed.

The following Action Steps outline in more detail how the Department proposes to cost-effectively monitor wild salmon status.

Action Step 1.1: Identify Conservation Units.

Based on science and local knowledge, the salmon that use particular freshwater habitats will be aggregated into Conservation Units. CUs will be delineated consisting of one or more genetically similar interbreeding fish populations that will have a defined geography or spatial

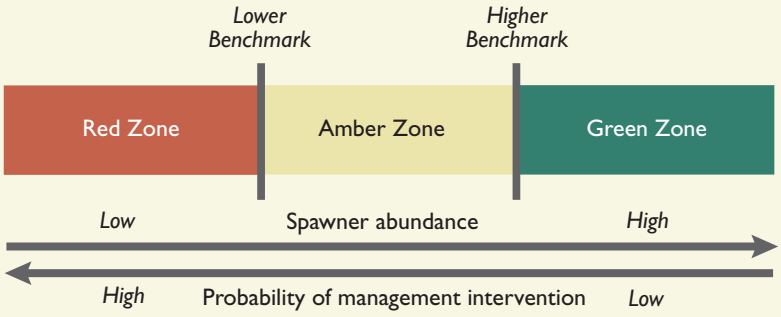
distribution. A CU will therefore include genetically similar lineages of fish with a spatial distribution of populations and demes that is dependent on a set of habitats. This linkage recognizes the need for interconnected spawning populations for genetic processes, defines important habitat for these lineages and for future production, and defines the groups of fishes whose status will be measured under this policy.

Work is underway to determine CUs, with their associated demes, populations, and habitats, for the five taxonomic species of Pacific salmon covered in this policy. Lists of CUs that are exposed to particular fisheries and other risk factors will be compiled. The number of CUs in each species will be a function of our knowledge base that will change over time. As this work proceeds, it will be assessed though peer review processes established by the Pacific Scientific Advice Review Committee (PSARC). This review process allows for participation by outside experts, First Nations, fisheries stakeholders, and the public.

Action Step 1.2
Develop criteria to assess CUs and identify benchmarks to represent biological status.

The biological status of a CU will normally be based on the abundance of spawners in the unit, or some proxy thereof. When a CU contains more than one population, it will be necessary to determine how abundance is distributed among the populations. For each CU, upper and lower benchmarks will be defined that will delimit three status zones: Green, Amber, and Red (Figure 5). As spawner abundances decrease, a CU may move from a Green status across the upper benchmark to an Amber status then across the lower benchmark to a Red status. As this occurs, the likelihood and intensity of management responses will escalate.

Figure 5 **Benchmarks and biological status zones**



As spawner abundances decrease, the likelihood and intensity of management responses will escalate.

The lower benchmark between Amber and Red will be established at a level of abundance high enough to ensure there is a substantial buffer between it and any level of abundance that could lead to a CU being considered at risk of extinction. The objective is to identify and react to vulnerable CUs before they decline to a level where such a designation might occur. There is no single or simple formula to use for selection of this lower benchmark. Rather, it will be determined on a case-by-case basis, and may draw on the following criteria, depending on the species and types of information available:

THE PACIFIC SCIENTIFIC ADVICE REVIEW COMMITTEE (PSARC)

PSARC is the Pacific Region body responsible for the review and evaluation of scientific advice to fishery and habitat managers on the status of aquatic resources including salmon.[17]

PSARC meetings, including those of the Salmon and Habitat Subcommittees, are open to outside representatives from academia, First Nations, stakeholders, other government or private institutions, and the general public. Therefore the PSARC process is well structured to provide peer review of the identification and status of Conservation Units and habitat indicators under this policy.

BIOLOGICAL STATUS ZONES AND MANAGEMENT RESPONSE

Having a Conservation Unit in the Red zone is undesirable because of the risk of extirpation, and associated loss of ecological benefits and present and future salmon production. Biological considerations will be the primary drivers for the management of CUs with Red status. The presence of a CU in the Red zone should trigger an immediate consideration of ways to protect the fish, increase their abundance, and reduce the potential risk of CU loss (see further under Strategy 4).

Amber status is also not a desirable state for most Conservation Units. While a CU in the Amber zone is not at immediate risk of loss, there will be a degree of lost production. Still, this situation may be acceptable for lower productivity CUs – particularly those that share risk factors with other more productive units – since abundance in this zone should be "safe" in terms of a low probability of extirpation. Amber status may also be a suitable recovery objective for units listed under SARA.

Social and economic considerations will tend to be the primary drivers for the management of Conservation Units in the Green zone.

Decisions on recovery and fisheries objectives will be made as part of the integrated strategic planning process described in Strategy 4.

[17] See www.pac.dfompo.gc.ca/sci/psarc/Default.htm

- The spawning escapement required to produce a percentage (e.g., 10 per cent) of maximum juvenile production;
- The spawning escapement estimated to permit recovery with an agreed probability within an acceptable period of time (e.g., three salmon generations);
- The abundance and distribution of spawners within a CU sufficient to provide confidence that the CU is not at risk of extirpation; or
- A proportion of the number of spawners (S) estimated necessary to provide maximum yield on a sustained basis (e.g., 25 per cent of S_{MSY}).

The higher benchmark between Green and Amber will be established to identify whether harvests are greater or less than the level expected to provide, on an average annual basis, the maximum annual catch for that CU. This level will vary through time and is difficult to estimate with confidence, but the CU would not be at risk of loss. As with the lower benchmark, no single or simple formula can decide the upper benchmark. It will also be determined on a case-by-case basis, and may draw on the following criteria, depending on the species and types of information available:

- The estimated number of spawners necessary to provide, on an average annual basis, the maximum catch (or yield, MSY); or
- The maximum exploitation rate for the CU that would limit harvest based on a rate of fishing mortality rather than the number of fish killed; or
- The number of smolts (or spawners) estimated to correspond with habitat capacity.

Benchmarks associated with maximum sustainable yield are widely used by fisheries scientists. However, estimates of MSY values are typically based on historical data on spawner and progeny production (see margin), which are seldom available for all populations within a geographic area. To address this deficiency, a stock assessment program may identify one or more indicator systems or streams (IS) that are intensively monitored and

intended to be representative of other streams in the area. The IS would be intended to reflect trends in a Conservation Unit and thereby serve as a barometer for annual changes in production expected for the entire CU.

Information from IS monitoring may include trends in spawners over time, estimated exploitation rates in fisheries, and/or juvenile production to habitat type relationships. However, an IS may not accurately represent the other streams in the CU. Such uncertainty would be addressed in the assessment strategy for the CU, which might combine detailed abundance surveys for the indicator stream(s) with less rigorous surveys of other streams. The assessment strategy will be designed to monitor the distribution of spawners among spawning sites and to assess how well the indicator stream(s) reflect conditions in the other streams.

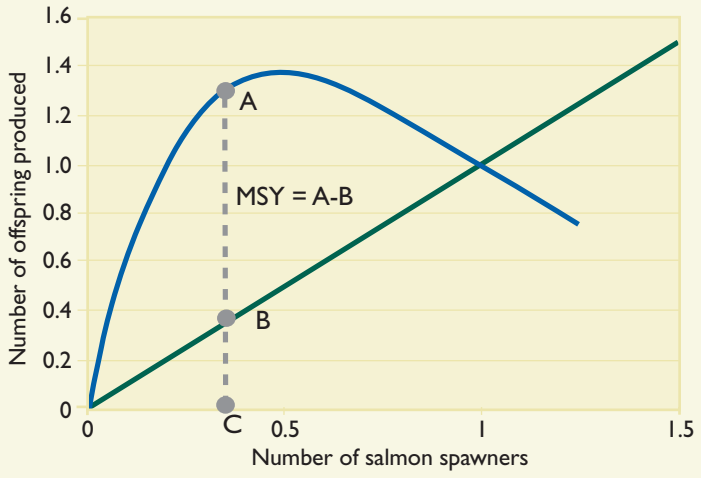
Action Step 1.3:
Monitor status of CUs.

Assessment results for a CU compared to its two benchmarks will determine the biological status of the CU. This status determination will help to guide resource management planning and further stock assessment activities.

When a CU is in the Green zone, a detailed assessment of its biological status will not usually be needed. For a CU in the Amber zone, a detailed assessment may be necessary as input to the remaining strategies. If the CU is classified as Red, a detailed status assessment will typically be triggered to assess the impacts on the CU of fishing, habitat degradation, and other human factors.

Evaluation or assessment procedures will vary among species and CUs. Field work will be required for representative CUs within each status category. It will build on existing programs (e.g., surveys to estimate spawner/juvenile abundance, catch per unit of effort at a test fishery) and local partnerships (e.g., First Nations agreements, local Streamkeeper initiatives). The assessment procedures will be developed using local knowledge and results will be documented. Despite regional variations, assessment procedures will be consistently executed and reflect a long-term commitment to the protection of local salmon resources.

Figure 6 **An example of a salmon production relationship**



SALMON PRODUCTION RELATIONSHIPS AND THE USE OF BENCHMARKS

Maximum sustainable yield (MSY) is a management objective that has been applied to Pacific salmon for many years. MSY is the "largest average catch that can be continuously taken from a stock under existing environmental conditions."[18] Estimating how many fish to catch requires a mathematical relationship between the number of spawning adults and the number of offspring produced in the next generation.

Figure 6 is an example of a production relationship (curved line) and the offspring required to replace the number of spawners (straight line). The maximum difference between the offspring produced (at point **A**) and the number of offspring required to replace the spawners (point **B**) is MSY. A common management goal has been the number of spawners expected to provide MSY on a sustained basis (point **C** or S_{MSY}). In practice, however, our ability to estimate S_{MSY} is limited by the uncertainty in data from natural populations, changes in relationships over time, and differences between populations.

The potential lower and upper benchmarks described in Action Step 1.2 may be better understood from the figure. Some benchmarks require an estimate of S_{MSY} for a CU, or a portion of that value (e.g., 10 to 25 per cent). Another benchmark refers to the rate of fishing or exploitation rate – the portion of the mature fish in a CU that are killed by fishing. In Figure 6, the maximum sustainable rate would be determined as MSY/(MSY + C).

Other possible benchmarks are based on juvenile production or number of smolts. Juvenile or smolt production can be related to numbers of spawning adults, as in Figure 6. Juveniles could also be related to habitat characteristics, such as kilometres of stream. One benchmark refers to the abundance and distribution of spawners in a CU such that the CU would not be at risk of losses due to chance events. This likely requires the least amount of historical information. For example, it could be an observed low number of spawners that a CU recovered quickly from in the past.

[18] Ricker (1975), *Computation and Interpretation of Biological Statistics of Fish Populations.*

STRATEGY 2
ASSESSMENT OF HABITAT STATUS

The maintenance of sound, productive salmon habitat in both fresh water and the marine environment depends on good scientific information, timely measures to prevent habitat disruption, and compliance with regulations. DFO's Habitat Management Program must evolve to link habitat protection and stewardship with fish production initiatives, through integrated resource planning.

Habitat management requires extensive information on changes in habitat status over time, in order to assess the effectiveness of regulatory measures, set priorities, and guide regulatory interventions. Strategy 2 is intended to address these information needs.

To develop a transparent basis for habitat management, habitat protection requirements will be established by documenting the aquatic effects of various generic human activities and systematically evaluating mitigative measures to address them. At the same time, sensitive and important habitats vulnerable to these activities will be identified. The result will be a general set of findings that can then be applied to particular CUs.

Based on the particular development activities and sensitivities of a CU, its habitat status will be assessed using indicators that combine scientific and local knowledge. Indicators will be selected as reflective of overall habitat fitness then tracked to assist in habitat planning. Habitat data gathered from many sources within and outside DFO will be linked and made accessible to habitat planners. The assessment will highlight habitat constraints to wild salmon production on the scale of a Conservation Unit and will inform strategic planning for salmon conservation (see Strategy 4).

Action Step 2.1:
Develop generic standards for habitat sensitivity for Pacific salmon by species and life history.

Habitat requirements for Pacific salmon vary by species, life history characteristics and phase, and geography. While much is known about salmon habitat requirements, this knowledge has not been used so far to compare the effects of habitats on fish productivity. Information will now be assembled by DFO to produce a scale of habitat sensitivity, which will help identify sensitive habitat in freshwater, estuarine, and marine environments. The scale will assist in assessing risk to wild salmon production. It will also contribute to watershed planning and stewardship and will serve as an effective initial guide for habitat management decisions. The improved understanding of salmon habitats will be valuable as an educational tool for stakeholders and will promote more effective planning of work near the water.

Action Step 2.2
Develop indicators and benchmarks of habitat quality and quantity.

Comprehensive habitat management will prepare an overview of the status of habitats and how they have been improving or deteriorating. This will be achieved by developing indicators of habitat status and establishing benchmarks to apply to those indicators. In effect, we must understand what needs to be measured to determine habitat fitness and what indicator values represent good or poor conditions.

In fresh water, such indicators may include water quality, temperature, stream flow, riparian functions, fish and invertebrate densities,

and habitat productivity. In estuarine and marine environments, indicators such as the Marine Environmental Quality standards may be used. The desired ranges of key indicators will also be developed as benchmarks, which will be used to guide monitoring programs that provide a snapshot of habitat conditions within a particular watershed or marine area.

Action Step 2.3
Assess habitat status within CUs.

Once an overview of existing habitat status has been developed as just described, it will be assessed using biophysical information from a variety of sources (government agencies, watershed-based fish sustainability planning, oceans integrated management), supplemented by data from studies carried out in priority watersheds. Factors that threaten the health and productivity of important habitats will also be investigated.

This assessment of habitat status will provide three key inputs to guide habitat management:

- Important habitat in need of protection to maintain the productivity of a CU;
- Habitat risks and constraints that are adversely affecting that productivity; and
- Areas where habitat restoration or rehabilitation would be desirable to rebuild a CU or enhance CU productivity.

These key inputs will also guide the development of integrated strategic plans (Strategy 4), where priorities for habitat protection and restoration are established to complement fish production objectives.

Action Step 2.4.
Monitor habitat status.

A monitoring framework will identify changes in habitat condition over time and help assess the effectiveness of regulatory decisions and rehabilitation measures. This framework will be integrated with salmon stock assessments and ecosystem evaluations. The intent will be to better understand the relationship between changes in CU abundance and distribution and changes in habitat condition.

Monitoring results will be used to reassess habitat condition during the next planning cycle and refine the array of indicators for measuring habitat status in an area, watershed, or CU. These results will inform both longer-term strategic planning and annual operations in habitat management. If a decline in habitat quality or quantity over time is detected, efforts will be made to identify the causes and response measures will be considered as part of an integrated management plan for the Conservation Unit.

Action Step 2.5.
Promote and support linkages to develop an integrated data system for watershed management.
Together with the Province of British Columbia and other partners, DFO will promote the design, implementation, and maintenance of a linked, collaborative system to increase access to information on fish habitat status. A more unified salmon habitat data system can be achieved by improving common access to the extensive data holdings of DFO, provincial and territorial agencies, other levels of government, and stakeholders that describe watersheds and habitat conditions. Improved sharing of information will accelerate and strengthen assessment and reporting of habitat status for CUs. Over time, it will also shed light on cumulative changes in habitats and wild salmon status.

These Action Steps, along with complementary efforts to modernize the Habitat Management Program, represent a major change to DFO's delivery of protection for salmon habitat. The reshaping of the program will enhance regulatory responsiveness and effectiveness, strengthen linkages between habitat protection and fish production objectives, and provide guidance to watershed planning initiatives. The changes will not be implemented overnight but progressively. Though these adjustments will require substantial time and energy, the investment will be worthwhile.

STRATEGY 3
INCLUSION OF ECOSYSTEM VALUES AND MONITORING

The roles that Pacific salmon play in marine (oceanic, coastal, and estuarine), freshwater (lake, stream, and wetland), and terrestrial ecosystems (adjacent to streams and rivers, the riparian zone) have become a significant issue in salmon management. There is ample scientific evidence demonstrating that nutrients derived from salmon carcasses are important to freshwater and riparian ecosystems. However, few studies provide advice on the numbers of salmon necessary for healthy freshwater ecosystems, or link these ecosystems with the dramatic effect that changes in climate and marine conditions can have on the survival and production of Pacific salmon.

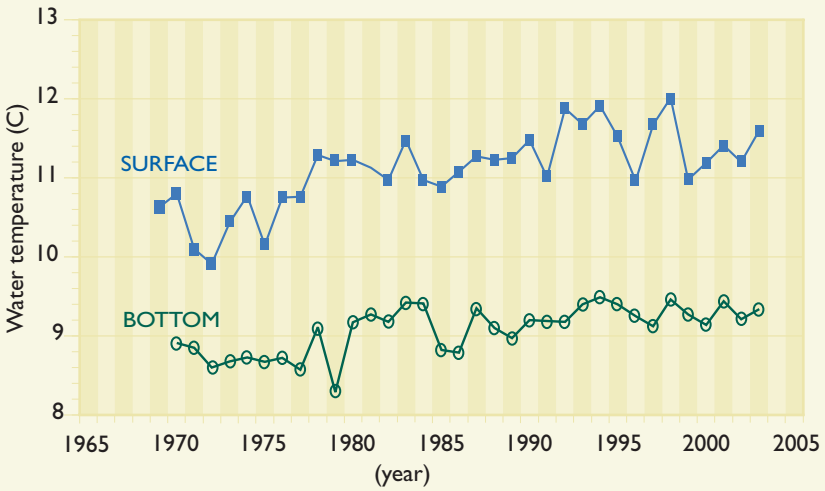
Understanding the influence of marine ecosystems on salmon has undoubtedly been one of the major advances in recent knowledge about Pacific salmonids. For example, we now know that the ocean's capacity for salmon production can be limited, is highly variable over time, and has an enormous effect on the abundance and condition of adult salmon (e.g., body size, energy content).

A challenge for the Wild Salmon Policy is how to incorporate an ecosystem objective that is widely appreciated but difficult to quantify.

Other outcomes of this policy will be beneficial to ecosystems supporting Pacific salmon. For example, achieving large escapements of salmon across populations within a CU will also benefit related ecosystems. However, achieving these abundances is only partly under our control.

Survival rates from when salmon enter the sea until they return to coastal waters as adults have been measured to vary by more than a hundredfold (even a thousandfold in some cases). Coupled with this uncertainty is increasing concern for long-term climate change that will affect marine and freshwater ecosystems. Monitoring this variation and implementing appropriate management responses to address potential impacts will be increasingly important to future conservation efforts.

***Figure 7* Climate change and the Wild Salmon Policy**



Mean annual surface and bottom water temperatures in the Strait of Georgia near Nanoose Bay, B.C.

The strategy presented here expresses DFO's intent to progressively consider ecosystem values in salmon management, but acknowledges a limited ability to do so at the present time. The following steps are intended to provide the scientific understanding and technical capacity to accomplish a progressive inclusion of ecosystem values.

Action Step 3.1

Identify indicators (biological, physical, and chemical characteristics) to use in monitoring the status of freshwater ecosystems.

The Department will use existing data and expert advice to identify key indicators of the current and potential state of lake and stream ecosystems (diversity of organisms, rates of biological production, etc.). Within two years, an ecosystem monitoring and assessment approach will be developed and integrated with ongoing assessments and reporting on the status of wild salmon. Implementation of this approach will be coordinated with the monitoring of CU status (Action Step 1.3), their habitats (Action Step 2.4), and marine conditions (Action Step 3.2). In the process, knowledge gaps and areas requiring further research will also be identified.

In the broader perspective of freshwater and marine ecosystems, networks of freshwater indicator systems (see Action Step 1.2) are being discussed internationally to assess the magnitude and spatial scale of changes in climate and ocean conditions. Linking variations in salmon

CLIMATE CHANGE AND WILD SALMON

There is increasing evidence and support that the world's climate is changing and, in particular, that "global warming" is taking place.[19] A local example of recent warming is the temperature of surface and bottom waters in the Strait of Georgia, collected over 35 years near Nanoose Bay north of Nanaimo, British Columbia (see Figure 7).

The climate-related effects anticipated for wild salmon are difficult to predict. Common expectations include increased summer water temperatures, changes in seasonal flow patterns, more extreme flow events, and changes to ecosystems. When and where change occurs will also be highly variable. So how can the Wild Salmon Policy possibly protect Pacific salmon against these events? Changes under the WSP will have limited ability to directly protect salmon, but the policy's premise – to protect diversity and their habitats – is likely critical to allowing Pacific salmon to adapt to future changes. By maintaining the genetic diversity of wild salmon and the integrity of their habitat and ecosystems, the WSP will help ensure viable wild salmon populations in the future.

The importance of protecting diversity and maintaining healthy diverse populations of fish was also recognized as an important strategy in a recent federal government report on climate change impacts and adaptation.[20]

[19]See the findings of the Intergovernmental Panel on Climate Change (www.ipcc.ch/) and B.C. Ministry of Water, Land and Air Protection (2002), *Indicators of Climate Change for British Columbia, 2002.*

[20]Natural Resources Canada (2004), *Climate Change Impacts and Adaptation: A Canadian Perspective.*

returns to changes in the marine ecosystems requires large-scale monitoring programs that are potentially costly and require extensive planning and collaboration with many domestic and international organizations.

Action Step 3.2

Monitor annual variation in climate and ocean conditions, integrate the monitoring with assessments of marine survival of Pacific salmon, and incorporate this knowledge into the annual salmon management processes.

For strategic planning and successful management of Pacific salmon, it will be essential to link variation in salmon production with changes in climate and their ecosystems. Studying only a few freshwater systems or salmon populations will not be adequate for monitoring and understanding the effects of climate and marine factors on Pacific salmon. To understand changes in climate and oceans and their consequences for salmon production, the freshwater monitoring programs identified in Step 3.1 will be integrated with programs investigating variability in climate and ocean conditions. Canada is developing programs to monitor and study these conditions.

Information on climate and marine conditions will continue to be provided through DFO's State of the Ocean reports, and will be linked with assessments of the marine survival of Pacific salmon. Coupled with results from Action Step 3.1 and ongoing assessment of salmon survival, research in this area should lead to improved forecasts of salmon abundance for management purposes. This step is also linked to Canada's Oceans Strategy, which recognizes the need to better understand ecosystem dynamics, including climate variability and impact of change on living marine resources.

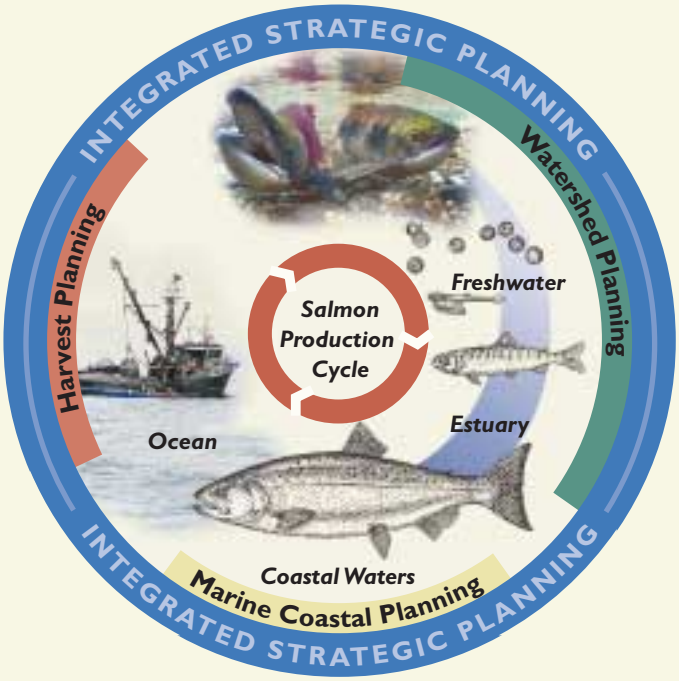
A more comprehensive view of salmon production and its determinants, from egg to spawning adult, is necessary to direct management actions more accurately and effectively conserve Pacific salmon in an uncertain future.

STRATEGY 4
INTEGRATED STRATEGIC PLANNING

The life cycle of Pacific salmon necessitates a planning process that addresses salmon conservation from the eggs in the gravel in parental generations to the eggs in the gravel produced by their offspring (see Figure 8). At present, planning for Pacific salmon falls short of this need. Many different planning activities currently take place, each with its own role but operating in relative independence from the others. The most demanding challenge in implementing the Wild Salmon Policy will be the establishment of an effective planning process that is responsible for the conservation of Pacific salmon, considers the needs of Canadians, and involves those affected by decisions. Strategy 4 is intended to address this challenge and produce integrated long-term strategic plans to achieve the goal and objectives of the WSP.

Developing an appropriate process will be difficult. Ecologists refer to Pacific salmon as "keystone species" because they are an integral part of the biodiversity in many ecosystems from headwater streams and rivers to estuaries to coastal and ocean habitats, eventually contributing to fisheries and these ecosystems again as returning adults. They can

Figure 8 **Wild Salmon Policy Integrated Strategic Planning**



Schematic showing that the Integrated Strategic Planning Process will cover all stages of Pacific salmon life history.

affect the lives of everyone in B.C. and the Yukon. Pacific salmon are part of the natural environment, culture, economy, and enjoyment for a large portion of the population. With this breadth of influence, the challenge of implementing the Wild Salmon Policy is immediately apparent.

The purpose of Strategy 4 is to develop strategic plans for CUs and groups of CUs that will address the biological status and define production objectives for salmon, identify other land and water uses within CUs that may limit production, and provide recommendations on salmon conservation that reflect the interests of people at local and regional levels. Strategies 1, 2, and 3 will provide information on the status of salmon in the CUs, their habitat, and the ecosystem as inputs to the planning process. However, strategic plans need to integrate this information and:

- Specify long-term biological goals for CU's and groups of CUs;
- Identify recommended management actions to protect or restore Pacific salmon, their habitats, and ecosystems in order to achieve these goals; and
- Establish timeframes and priorities for actions.

Ultimately, these plans must inform the development of annual fishery management, habitat, and enhancement plans and support sustainable fishing practices for Pacific salmon in Canada.

There is no pretense that establishing an integrated process will be easy or immediate. Successful development and implementation will require extensive effort and cooperation between many groups. Strategy 4 therefore proposes two action steps: the development of a new planning structure and procedure (Step 4.1) and an interim process (Step 4.2) that provides for immediate progress towards achieving the goal and objectives of this policy.

RECENT PROGRESS TOWARDS INTEGRATED MANAGEMENT – THE INTEGRATED SALMON HARVEST PLANNING COMMITTEE

Some early progress towards integrated management has already been achieved with salmon harvest planning. For example, the recently formed Integrated Salmon Harvest Planning Committee includes elected representatives from all commercial gear and area groups, and representatives nominated by First Nations and the sports fishing community, non-governmental environmental organizations, and the Province of British Columbia. As operation of this committee evolves, it will help to provide inclusive and balanced information for the development of commercial and recreational fishing plans in B.C. This is a useful starting point, but much more needs to be done to link it with more localized First Nations and other watershed-based planning processes and interests, as well as with broader marine area planning initiatives.

KEY ATTRIBUTES OF AN EFFECTIVE PLANNING PROCESS

An effective planning structure will require that the various interests involved build the mutual trust necessary to work together toward their goals. Key attributes of the new structure should be:

Inclusiveness: All parties that are affected by a planning outcome should have the opportunity to provide input to the articulation of objectives, the identification of management options, and the evaluation and selection of management alternatives. All parties should respect the others' opinions and processes, and work towards consensus.

Transparency: Responsibility for final decision-making and linkages between the various parts of the planning structure should be clearly described and agreed upon. Information considered in making recommendations should be publicly available and communicated in a timely manner. Recommendations and decisions should be carefully described and the reasons for them clearly explained.

Effectiveness: Individual planning bodies within the planning structure should be small enough to provide for focused discussion and dialogue but large enough to represent the full range of interests in the matters under discussion.

Respect for Existing Processes: Present planning processes must be respected, particularly those that deal with First Nations fishing rights, legal requirements under SARA, and obligations under international treaties.

Accountability: Participants in the planning process must act so they can be accountable to the people they represent by defending the advice they have provided and standing by the manner in which decisions were made.

Action Step 4.1:
Design and implement a fully integrated planning process for salmon conservation.

The Department will consult with First Nations, communities, and stakeholders to design an effective integrated planning process that respects people's interests in Pacific salmon, land and water uses, watersheds, fisheries, and marine areas. This policy should not dictate that process because it ultimately touches on the activities of people throughout B.C and the Yukon. Those affected should be directly involved in the process design and implementation. It is however appropriate to describe in general terms what is envisioned and provide examples for discussion. The planning process will ultimately consist of a new planning structure that will develop the plans through an organized procedure.

A New Planning Structure

At present across B.C. and the Yukon, planning related to salmon occurs at various geographic scales and for a variety of purposes. Local consultations take place with individual First Nations on their food, social, and ceremonial fishing needs. Watershed-based Fish Sustainability Planning (WFSP) initiatives are underway in local areas involving First Nations, local stewardship groups, and other community interests brought together to sustain fish habitat. More broadly, Integrated Fisheries Management Plans are developed for Northern British Columbia, Southern British Columbia, and the Yukon in consultation with individual harvesting groups and others interested in Pacific salmon. Coastal zone planning, a key component of Canada's Ocean Strategy and Action Plan, is proceeding on a pilot basis. At the broadest geographic scale, the Government of Canada with input from advisors engaged in planning related to the Pacific Salmon Treaty and other international agreements such as the North Pacific Anadromous Fish Convention.

Ultimately, these diverse planning processes and the various interests involved need to be linked to provide inclusive and comprehensive input to integrated plans that encompass salmon, fisheries, watersheds, and marine areas throughout the Pacific Region.

To facilitate discussion with First Nations, communities, and other stakeholders, two possible approaches are outlined for consideration in Appendix 3. One approach builds on the new Integrated Harvest Planning model, while the other advances the model utilized in Integrated Coastal Zone Management. But these are only examples and do not limit the range of structures that may be considered in consultation.

A Planning Procedure

The planning structure described above will be tasked with developing reasoned and balanced long-term strategic plans for CUs that will guide fisheries and other activities in specific areas affecting the CUs. These plans will need to weigh biological risks, as summarized in the status assessment of the CU, with the social and economic benefits and costs of fishing and other activities. To develop them, the planners should follow a formal and open procedure that will result in balanced recommendations for decision-making.

This policy proposes a structured procedure for development of the strategic plans. The procedure breaks down decisions into a logical and manageable sequence of five steps. It seeks to engage the various interests in Pacific salmon throughout the planning process – from the establishment of planning priorities through to the evaluation and selection of the preferred management alternative. This, in turn, will help build consensus on the most appropriate management approach and will facilitate understanding of the final management decision. The structured five-step procedure is summarized below and further details are provided in Appendix 4.

Step 1 – Identify planning priorities. Based on information on the status of CUs and their associated habitat and ecosystems from Strategies 1, 2, and 3 and on input from stakeholders, Step 1 will provide lists of specific key priorities to be addressed.

Step 2 – Identify resource management options and alternative management strategies. Several management alternatives will be developed that reflect a realistic range of different approaches to addressing the planning priorities.

Step 3 – Establish biological, social, and economic performance indicators. To evaluate and compare the management alternatives and select the best one for the planning unit will require the development of explicit, measurable performance indicators applicable to the planning unit and its component CUs. This step should generate an assessment framework that captures and reflects all significant long-term and short-term biological, social, and economic considerations.

Step 4 – Assess the likely impacts of management alternatives. At this step, the various management alternatives identified in Step 2 will be evaluated according to their expected results on the performance indicators developed in Step 3. The "net effect" of each management alternative (relative to status quo management) on each of the selected indicators will be projected for appropriate time periods, resulting in a set of estimated outcomes for each alternative.

LINKING CUs, FISHERIES, AND WATERSHEDS FOR PLANNING PURPOSES

Salmon management is complex, involving five species subdivided between numerous Conservation Units resident in many different watersheds that are exploited by a wide variety of users in a myriad of fisheries. There are interdependencies and overlaps between fisheries and among species within watersheds. As a result, planning for the "wise use" of an individual CU cannot always be done in isolation from other CUs. Considerations of biology and geography need to be brought together in an organized way with social and economic interests for practical and efficient planning and balanced decision-making.

For planning purposes, CUs may sometimes need to be aggregated. For example, a wide range of user groups in numerous different fisheries harvest Skeena River sockeye salmon. Skeena River sockeye may include more than 20 CUs originating throughout the Skeena River drainage system. Habitat, fisheries, and marine area planning for any CU within the system must consider and account for potential impacts on all the others. As a result, the appropriate planning unit for Skeena sockeye will likely encompass all these associated sockeye CUs.

Although the resulting plan will be developed for the aggregate, the ultimate effect will be individual plans for each CU within the aggregate. Planning choices made at the aggregate level with respect to habitat, enhancement, and fisheries management measures will effectively translate into different impacts on and targets for each of the individual CUs within the aggregate. Furthermore, the plan for an individual CU will reflect balanced consideration of the impacts on the whole.

More detailed discussion of the planning aggregates that may be used for Pacific salmon is provided in Appendix 4.

THE ROLE OF ENHANCEMENT

Where Conservation Units are comprised of more than one population, individual populations or demes of importance to local First Nations or communities may be depleted or at risk of local extinction, even when the CU is not at risk. Although such populations may be repopulated over time by salmon straying within the CU, the depleted stock status and the projected timeframe of repopulation may not meet local social objectives.

In these circumstances, enhancement techniques such as habitat restoration, spawning channels, and hatcheries may provide a strategic means of conserving or rebuilding those biological units at greatest risk of extirpation while addressing local objectives. However, it is recognized that some enhancement techniques (e.g., hatcheries) can have an impact on the genetic diversity of wild salmon populations. As a result, there will be prescribed practices to minimize the risk of genetic impacts and prevent indiscriminate transfers between populations or demes.

Step 5 – Select the preferred management alternative. The comparison of future outcomes of the management alternatives will inform discussions on the preferred management approach that are consistent with the goals and objectives of the WSP. Throughout the planning process, the goal will be to use constructive dialogue and draw on all the help available from other local and region-wide planning processes to develop consensus recommendations. If a consensus cannot be reached, the differences of view will be fully documented. Then, the Minister of Fisheries and Oceans will consider the input received and make the necessary decisions. Public records of all information and decisions will be provided. Future consensus-building would still be encouraged.

Action Step 4.2:
Implement an interim process for developing strategic plans for the management of Conservation Units.

In the transition to a fully integrated planning process, an interim approach is needed that will immediately improve integration between habitat, enhancement, fisheries, and marine area planning, and provide more inclusive input to resource management. This interim approach will use existing planning processes with First Nations, harvesters, and stewardship groups and collate their advice to protect CUs and to manage fisheries, watersheds, and marine areas.

Interim procedures would build on and improve the approach now used to develop Integrated Fisheries Management Plans (IFMPs) for salmon. The biological status of a CU or group of CUs vulnerable to fisheries in a region would be reviewed.[21] CUs in the Red zone and those that could significantly limit fishing and other activities would be identified as management priorities. Biological considerations will be the primary drivers for the management of CUs with Red status. For these priority CUs, DFO would bring together, as needed, the various interests from existing processes to provide recommendations for protection and restoration. In collaboration with the Department, these "response teams" would collate information from all sources and make recommendations using the five-step process outlined above. Response teams would include representatives of First Nations and other local and regional interests. The recommendations from these response teams will inform harvesting, habitat, enhancement, and marine area planning. This interim approach will continue until overall planning responsibilities (including for the priority CUs) can be assumed by representative planning bodies (Action Step 4.1).

In addition to addressing priority conservation issues in this interim period, the Department will focus on identifying and responding to vulnerable CUs before they decline to Red zone status. Resource management decision-making will be guided by the precautionary approach and will adhere to the principle that conservation of wild salmon is first priority.

The progress made towards achieving management targets will be reviewed annually (as described in Strategy 5) and adjustments to plans made as appropriate. On a less frequent but regular basis, more comprehensive evaluation of the strategies of the Wild Salmon Policy will be undertaken to monitor progress towards achieving its overall goal and objectives.

[21] The concept of planning units for Pacific salmon is described in Appendix 4 and is an organizational construct to associate a group of CUs (CUs that are subject to common risk factors) with regional fisheries.

Some losses in salmon diversity may be anticipated

Plans developed through Action Steps 4.1 and 4.2 will aim to maintain CUs to the fullest extent possible, but there will likely be circumstances when losses of wild salmon are unavoidable. For example, catastrophic events are beyond human control and DFO may not be able to recover the habitat or spawning demes. The rate of climate change in some areas may exceed the ability of salmon populations to adjust. In exceptional circumstances, where an assessment indicates that management actions will be ineffective, or the social and economic costs to maintain or rebuild a Conservation Unit are extreme, the Minister of Fisheries and Oceans may decide to limit the extent of active measures undertaken. The new planning process described above is expected to minimize the need for such decisions, but the possibility should be recognized. Such decisions will be made openly and transparently, and the rationale will be clearly explained. The cumulative effect of these decisions will be closely monitored.

STRATEGY 5
ANNUAL PROGRAM DELIVERY

A strategic plan gives a longer-term context for annual operational and business planning cycles. The strategic plan described in Strategy 4 will establish overall objectives and the various approaches that will be followed to achieve them. It will be left to annual operating plans to detail the specific short-term actions that actually implement the long-term strategy.

Annual plans will identify the particular activities to be undertaken, the short-term operational targets for these activities, and the linkages to longer-term goals and objectives. In addition, they will include provisions for ongoing monitoring and performance review. This performance review will influence future annual plans and, over time, the evolving strategic plan for the resource.

WSP IMPLICATIONS: SCIENCE, INCLUDING STOCK ASSESSMENT

This policy will have the following implications for stock assessment and science priorities:

- Scientific programs will be refocused in step with the changes to fisheries management, the immediate need being identification and documentation of Conservation Units and benchmarks for each Pacific salmon species.
- Stock assessment programs will build on existing monitoring programs to assess wild salmon at appropriate geographic scales.
- Refocused programs will emphasize assessing the status of CUs, understanding changes to productivity and distribution, and developing risk management tools to guide decision-making.
- DFO scientists will work with habitat and fishery managers to develop approaches to integrate ecosystem considerations into assessment and management.
- More partnerships will be necessary with public and private groups to collect required data, given the expanded monitoring needs and constraints on available funding.

Action Step 5.1:
Assess the status of Conservation Units and populations.

Under this policy, DFO will assume a leadership role in monitoring and assessing the status of wild salmon. Assessment will include field activities, which will build on existing programs as much as possible, and detailed stock assessments, which will identify the reasons for changes in status. The assessment of CUs will be staged over time, cost-effectively using a range of approaches. CU status will influence the frequency and intensity of the assessment effort. For example, when a CU falls within the Red zone, it will likely require a detailed assessment.

Stock assessment work plans describing the assessment framework for each CU and related activities will be updated annually for each region (e.g., North Coast, Yukon). They will be reported as part of a database that describes for each region major risk factors and changes to these factors, assessment strategies within the region, resource management objectives, enhancement activities, and benchmarks. DFO will also commit to providing an open database of information on catch and spawning escapement, with links to the habitat integrated data system (Action Step 2.5), so that threats or impacts can be identified and monitored.

Action Step 5.2:
Plan annual fisheries.

The specific short-term fisheries management measures required by the management strategies selected under Strategy 4 will be identified and documented in annual fishing plans. These plans will include the selective harvesting and other regulatory measures that will be put in place, such as bag and possession limits and anticipated open and close times. Annual operational targets and performance measures for the different fisheries and groups of fisheries (e.g., anticipated harvest rates) will be explicitly linked to these management measures and will contribute to comprehensive annual post-season reviews of performance (see Action Step 5.5).

Another key element of annual fisheries planning will be the development of explicit agreed-upon rules for in-season decision-making. The uncertainties and variations in fish availability associated

with natural survival cannot be eliminated, but they can be better anticipated. The management responses to be taken in different circumstances will be more transparently identified and documented in advance of the fishing season. Important input on these decision rules will be sought from the Integrated Salmon Planning Committee.

Action Step 5.3:
Plan and implement habitat management activities.

Habitat program work will shift from being largely reactive, in response to project proposals, to being planned and strategically directed to deal with risks shown by habitat assessment and monitoring (Strategy 2) and to implement management actions to protect CUs (Strategy 4).

Integrated plans will identify important habitat for salmon production needing protection or degraded habitat needing restoration to meet fish production objectives. Important and sensitive habitats will be identified in planning to help meet overall objectives for Conservation Units. Planning for restoration and habitat improvement will also incorporate projects conducted by volunteers and stakeholders and make use of more accessible data from a variety of sources.

Habitat assessment and monitoring will feed back into the Habitat Management Program to evaluate measures for habitat protection measures and compliance and to guide future program improvements. This new strategic approach to program delivery should ensure that fish habitat protection objectives are better integrated with fish management objectives at the CU level, leading to better habitat protection and salmon conservation.

Action Step 5.4:
Plan and implement annual enhancement activities.

The long-term objectives for enhancement projects will be set as part of a planning or recovery process for a Conservation Unit. Enhancement programs will generally last more than a year, but annual production targets and strategies will make certain that they are consistent with the CU objectives. Adult salmon production will be assessed for adherence with

WSP IMPLICATIONS: FIRST NATIONS FISHERIES

This policy will have the following implications for First Nations fisheries:

- First Nations fisheries and fishing rights will be respected under the WSP.
- DFO will continue to consult bilaterally with First Nations on their needs for food, social, and ceremonial fish and matters that may affect their fishing and preferred fishing methods.
- The Department will continue to manage fisheries such that First Nations fishing for food, social, and ceremonial purposes takes priority over fishing by other harvesters.
- Where treaty rights exist or are established in the future, fisheries will be managed in a manner consistent with the treaty provisions.

WSP IMPLICATIONS: HABITAT MANAGEMENT

This policy will have the following implications for habitat management:

- The Habitat Management Program will change to better link watershed protection and stewardship initiatives with fish production objectives by integrating habitat monitoring, assessment, and program planning at the CU scale.
- Habitat condition will be assessed through the development of indicators and benchmarks, and monitoring will be conducted to identify changes in habitat status over time and assess the effectiveness of regulatory interventions.
- An integrated data system for the collection and dissemination of information on fish habitat status will be supported through improved access between existing systems.
- These new approaches will complement existing efforts to modernize the national Habitat Management Program, aimed at moving from a focus on project reviews to a more balanced approach with greater emphasis on program planning, stewardship, and monitoring the success of habitat management in sustaining fish production.
- If specific Conservation Units of wild salmon are threatened by development proposals or other human activities, corrective actions will be taken under Section 35 (fish habitat) of the *Fisheries Act*, or longer-term solutions will be pursued as part of integrated planning processes.

WSP IMPLICATIONS: AQUACULTURE

This policy will have the following implications for aquaculture:

- Aquaculture operations will be regulated in a manner consistent with other human activities that may adversely affect salmon or their habitat.
- If specific Conservation Units of wild salmon are threatened by aquaculture operations, corrective actions will be taken under the *Fisheries Act*, or longer-term solutions will be pursued as part of an integrated planning process.

WSP IMPLICATIONS: SALMONID ENHANCEMENT PROGRAM

This policy will have the following implications for SEP:

- The enhancement program will continue to evolve towards greater emphasis on community stewardship, habitat restoration, and rebuilding of priority CUs.
- Enhancement may be used to provide harvest opportunities and fishery benefits as part of an integrated strategic plan.
- The risks of hatchery production to wild salmon will be assessed through the development of a biological risk assessment framework.

the rebuilding schedule and enhancement guidelines and practices. Priority projects will target CUs in the Red or Amber zone, where enhancement has been identified as a contributor to rebuilding. Secondary priority will be given to CUs where enhancement has been identified in planning processes as a means to maintain or develop fisheries.

Action Step 5.5.
Review performance.

A performance review determines what is and is not working to encourage continuous improvement over time. Performance review under the Wild Salmon Policy will borrow heavily from procedures that are being adopted more generally in fisheries management planning throughout Canada. These procedures involve three levels of evaluation that can provide comprehensive guidance on changes required over time.

The first two levels of evaluation provide more immediate feedback and form the basis for short-term performance improvements. The first level evaluates whether the annual plans were implemented as designed. For example, if an annual fishing plan calls for a substantial reduction in fishing time, or an annual enhancement work plan calls for certain fry release levels in a given year, it is important to know whether these events took place. The second level of evaluation considers whether the annual plans achieved the operational targets that were intended. For example, the operational targets may be exploitation rates in certain fisheries, return levels to hatcheries, or lineal metres of habitat rehabilitation. Again, regardless of the targets, it needs to be known whether or not they were achieved.

Annual post-season reviews of work plan implementation for stock assessment, fishing, habitat, and enhancement will incorporate these two levels of evaluation. The outcome will be recommended adjustments for the next season. Annual results will feed into longer-term improvements to the strategic plan, which is the task of the third evaluation level.

The third evaluation level will look at the more fundamental question of whether the overall strategic plan for the resource is achieving what was intended. In the WSP, the key issue is the extent to which the policy's goal and objectives are being achieved over time. This type of evaluation will be done less frequently, but on a regular basis, building on the information derived from annual evaluations and ongoing monitoring of the state of wild Pacific salmon, their habitats, and ecosystems. The outcome will be recommendations for improvements to the strategic plans for the resource.

IMPLEMENTATION "Making it all Work"

The five strategies proposed in the WSP represent a set of mutually dependent activities that must work together for the policy's goal and objectives to be achieved. Since the individual strategies are not autonomous, successful implementation of each one of them is necessary to ensure the overall success of salmon resource management.

Monitoring and assessment of the status of wild salmon, their habitat, and ecosystems will inform the development of plans for resource management, watershed protection, and enhancement. Based on these inputs, management alternatives can be identified and strategic plans adopted that respond to the need to protect and rebuild CUs while balancing the social and economic impacts of management actions. The strategic plans will guide annual program delivery for fisheries management, habitat management, stock assessment, and enhancement. Performance in meeting annual targets and contributing to longer-term objectives will be evaluated and subject to ongoing public review. Plans will be adjusted over time, as appropriate, to reflect performance and changing circumstances.

This new approach to salmon conservation is complex, and the pace and effectiveness of implementation will be influenced by two key factors. First, implementation must be accomplished within DFO's existing resource capability and will be phased in over time. Second, it will depend on the effectiveness of our sharing of responsibilities with First Nations and stakeholders.

Full implementation will not be achieved overnight. Establishing the management and consultation process, and allowing it to mature, will take time. The completion of scientific work to define Conservation Units, establish benchmarks, and design new assessment systems will depend on the availability of data and scientific capacity. In addition, the policy introduces new challenges for the conduct of ongoing programs, and ultimate success depends on effective delivery of the Department's research, enforcement, and Aboriginal programs. All of these activities, ongoing and new, must be accomplished within the envelope of available funding.

WSP IMPLICATIONS: HARVEST MANAGEMENT

This policy will have the following implications for salmon harvest management:

- Under the WSP, harvest management will change from a focus on conservation of runs of salmon to the conservation of CUs.
- The practical implications of this change for harvest management will depend greatly on the extent to which the CUs identified under this policy differ from the salmon runs currently targeted by the different fisheries. This, in turn, will vary among salmon species.
- There will likely be few impacts on the management of chum and pink salmon, as these fisheries currently target smaller population components than may be identified as CUs under the WSP.
- Some modest impacts could result for the management of coho and chinook salmon, as the number of CUs will likely increase marginally from present management aggregates.
- Impacts on sockeye management could be major, since these fisheries target runs that often encompass numerous CUs.
- The WSP will not preclude fisheries operating on population aggregates that include numerous CUs, but increased attention to all of the units within the aggregate will likely require significant changes to current management practices.

WSP IMPLICATIONS: SPECIES AT RISK

This policy will have the following implications for species at risk:

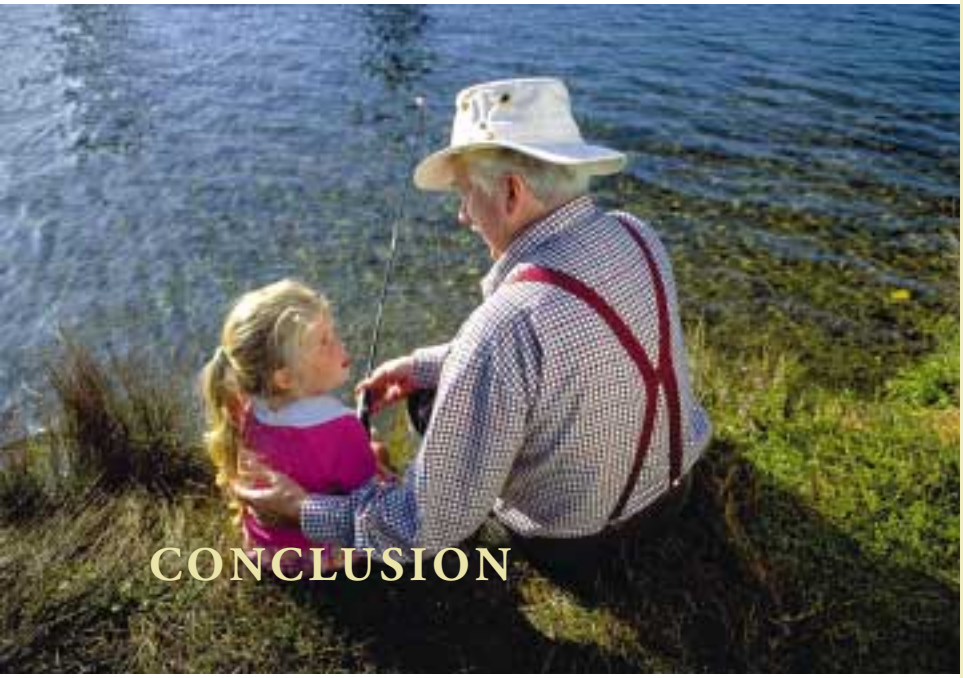
- The WSP will facilitate taking management actions in advance of biological listing under COSEWIC and legal listing under the *Species at Risk Act*.
- This will directly contribute to meeting DFO's legal obligations under SARA, by helping to prevent aquatic species from being extirpated or becoming extinct.
- In addition, proactive responses in advance of listing will help to manage and reduce any adverse social and economic impacts that might arise from required conservation actions.

Accordingly, it must be emphasized that complete implementation will not be achieved instantaneously, but will be phased in gradually.

There is a second requirement for successful policy implementation. We must adopt better partnerships with First Nations and stakeholders and share responsibility and accountability for program delivery. It is clear that DFO cannot and should not attempt to do it all. No matter how strong our commitment to implementing the WSP, success will demand better collaboration with all of the groups and individuals having an interest in wild Pacific salmon. First Nations, streamkeepers, volunteers, and harvester organizations have important roles to play in achieving sustainable management of wild salmon and their habitat. These groups monitor and report catches, protect and restore habitat, and carry out biological assessment work. Too often, this work is not integrated effectively with departmental activities, which can diminish its value or simply result in wasted effort and funds. More collaboration is required to develop data standards, agree on methodologies, and share responsibility if we are to get the full benefit from the financial and human resources that are collectively dedicated to salmon stewardship. Improved cooperation with partners will be an important ingredient for future success. The more transparent process for decision-making underlying this policy will ensure that we are better equipped to achieve this important outcome.

Some user groups may argue that the WSP will only lead to less and less fishing opportunity; however, that is not the intention. This policy cannot guarantee the preservation of all wild populations at all times, but rather urges the balanced consideration of the complete array of impacts associated with conservation decisions. Taking steps to enable spawning populations to make the most of their habitats can yield three major benefits: (1) maximum potential fish production from the full utilization of habitat; (2) diverse spawning populations for the continuation of evolutionary processes; and (3) the greatest opportunity for sustainable benefits to Canadians, including fishing opportunities for all users.

Some localized groups of salmon may disappear over time as the result of natural variation or human impacts. Regardless of the cause, the WSP recognizes and protects the natural processes needed to potentially restore these losses. Likewise, in some localized areas and at certain times, fishing may have to be restricted. However, this policy offers increased opportunity for the consideration of alternatives, such as habitat and enhancement initiatives, to assist in rebuilding those fisheries. The Wild Salmon Policy represents a significant change, and will require widespread cooperation. Nonetheless, we believe that it provides the right direction for DFO to evolve and fulfill our mandate to protect this cherished resource.



CONCLUSION

During the past decade, the management of Pacific salmon has become progressively more challenging for various reasons. Supreme Court decisions, varying ocean productivity, conservation concerns, international agreements, new Canadian legislation governing species at risk, shifts in global markets, and altered public expectations have all contributed to this dynamic operating context. DFO has adapted to changing circumstances but policy and programs must continue to be reshaped to address contemporary challenges and secure a healthy future for Canada's Pacific salmon.

The Wild Salmon Policy will transform our approach to managing Pacific salmon, their habitat, and dependent ecosystems. It is intended to foster a more robust resource that supports sustainable fisheries and recognizes the intrinsic value of salmon to society and to ecosystem functioning. Key elements of the policy recognize that:

1. Protection of the genetic and geographic diversity of salmon is a prerequisite to their future evolutionary adaptation and long-term well-being.
2. Habitat requires effective protection and rehabilitation if salmon are to prosper.
3. Ecosystem integrity needs to be considered in management decision-making to foster the conservation of salmon in an increasingly uncertain future.
4. Management must be based on good scientific information and must incorporate a balanced assessment of biological, social, and economic benefits and costs.
5. Decisions have to be made using open and accountable public processes so that they reflect society's values.

The goal, objectives, principles, and strategies that underpin the WSP represent a new way of doing business. Moving ahead will require a redirection of the Department's energy and resources, along with a commitment to embrace and advance new practices. Success will also require the cooperation of all who have an interest in the conservation of Pacific salmon. We are confident that making these changes is a wise investment that will yield a brighter future for salmon and the Canadians who enjoy them.

NEXT STEPS

This document has presented a policy framework describing how the Department of Fisheries and Oceans will meet its responsibilities for the conservation of wild salmon. This framework is not yet final. Rather, it is a proposal that is now being released for public review and comment. In particular, DFO is seeking input on the feasibility and effectiveness of the strategies proposed for meeting the goal and objectives of this policy. A detailed schedule for consultations will be announced concurrently with the proposal's release.

Following consultations with First Nations and others with an interest in salmon conservation, this draft framework will be revised, as appropriate, to reflect feedback received. A final policy framework will then be submitted for approval by the Minister of Fisheries and Oceans. A final Policy for Conservation of Wild Pacific Salmon is expected to be announced by June 30, 2005.

The adoption of a wild salmon policy is an important, long-awaited objective, but not an end in itself. Once it is adopted, attention must shift to implementation. The WSP requires acceptance of new ways of doing business and introduces a number of new program obligations. To ensure its commitments are met, an implementation plan will be prepared after the policy's finalization. This plan will stipulate what tasks are required, how they will be performed, and when they will be completed. On completion, the plan will be publicly released and will constitute the Department's commitment to meeting its responsibilities for salmon conservation.

GLOSSARY

Aquaculture. The farming of aquatic organisms in the marine environment or freshwater.

Biodiversity. The variability among living organisms from all sources – including terrestrial, marine, and other aquatic ecosystems – and the ecological complexes of which they are a part. This includes diversity within species, between species, and of ecosystems.

Broodstock. Mature salmon from which milt and roe are extracted to produce the next generation of cultivated fish.

Conservation. The protection and wise use of the salmon and their habitats for the long-term health and productivity of wild populations, and for present and future social and economic values.

Conservation Unit (CU). A group of wild salmon sufficiently isolated from other groups that, if extirpated, is very unlikely to recolonize naturally within an acceptable timeframe (e.g., a human lifetime).

Deme. A group of salmon at a persistent spawning site or within a stream comprised of individuals that are likely to breed with each other (i.e., well mixed). A single population may include more than one deme.

Ecosystem. A community of organisms and their physical environment interacting as an ecological unit.

Ecosystem-based management. A process that integrates biological, social, and economic factors into a comprehensive strategy aimed at protecting and enhancing sustainability, diversity, and productivity of our natural resources.

Enhancement. The application of biological and technical knowledge and capabilities to increase the productivity of fish stocks. It may be achieved by altering habitat attributes (e.g., habitat restoration) or by using fish culture techniques (e.g., hatcheries, spawning channels). In the context of this policy, only salmon originating from hatcheries and managed spawning channels will be considered enhanced.

Escapement. The number of mature salmon that pass through (or escape) fisheries and return to fresh water to spawn.

Extirpation. The local extinction of a species.

Fish habitat. Spawning grounds and nursery, rearing, food supply, and migration areas on which fish depend directly or indirectly to carry out their life processes.

Fry. Salmon that have emerged from gravel, completed yolk absorption, remained in freshwater streams, and are less than a few months old.

Genetic diversity. The variation at the level of individual genes, and provides a mechanism for populations to adapt to their ever-changing environment. It refers to the differences in genetic make-up between distinct species and to genetic variations within a single species.

Geographic diversity. Spatial variability observed within a species. This variation may have a genetic basis and/or may reflect habitat and developmental differences expressed by the species.

Habitat restoration. The treatment or cleanup of fish habitat that has been altered, disrupted, or degraded for the purpose of increasing its capability to sustain fish production.

Indicator system (IS). Comprised of fish from one or more persistent spawning locations or populations (perhaps enhanced) that are assumed to be representative of some aspect of a Conservation Unit. An IS may be an index site or stream selected to detect annual changes in abundance and/or survival, or an extensive site or stream, selected to monitor species distribution and general habitat status. The status of the surrounding CU is inferred, in part, by comparing measures of abundance gathered by monitoring the IS to benchmarks.

Integrated resource management (IRM). Can be defined as a way of using and managing the environment and natural resources to achieve sustainable development. Using an IRM approach means that environmental, social, and economic issues are considered, while finding ways for all uses to exist together with less conflict.

Juvenile. Salmon older than fry and smolts but not yet mature.

Managed spawning channels. Spawning channels where the entry of spawners and spawning density is controlled.

Maximum sustainable yield (MSY). The largest catch (yield) that can be continuously taken from a population under existing environmental conditions.

Mixed-stock fishery. A fishery where salmon from more than one Conservation Unit are susceptible to being caught.

Pacific salmon. Salmon of the Pacific Ocean regions, of which there are currently eleven species recognized in the *Genus Oncorhynchus*. The five species addressed in this policy are sockeye *(Oncorhynchus nerka)*, pink *(O. gorbuscha)*, chum *(O. keta)*, coho *(O. kisutch)* and chinook *(O. tshawytscha)*. Also in B.C. are steelhead *(O. mykiss)* and cutthroat trout *(O. clarki)*. The remaining species include the masu (Asian distribution, *O. masou)*, Mexican golden trout *(O. chrysogaster)*, apache trout *(O. apache)*, and gila trout *(O. gilae)*. These latter three species have limited distributions in the western U.S. and northern Mexico.

Population. A group of interbreeding organisms that is relatively isolated (i.e., demographically uncoupled) from other such groups and is likely adapted to the local habitat.

Precautionary approach. When used in an advisory context in support of decision-making by the Government of Canada, this term conveys the sense that the advice is provided in situations of high scientific uncertainty. It is intended to promote actions that would result in a low probability of harm that is serious or difficult to reverse.

Productive capacity. The maximum natural capability of habitats to produce healthy fish, safe for human consumption, or to support or produce aquatic organisms on which fish depend.

Riparian zone and functions. The area of vegetation near streams is known as the riparian zone. Riparian function includes the interaction of hydrologic, geomorphic, and biotic processes within the riparian environment that determine the character of the riparian zone and the influences exerted on the adjacent aquatic and terrestrial environments (e.g., temperature controls, shading, large woody debris).

Salmonid. A group of fish that includes salmon, trout, and char, belonging to the taxonomic Family *Salmonidae.*

Selective harvesting. A conservation-based management approach that allows for the harvest of surplus target species or Conservation Units while aiming to minimize or avoid the harvest of species or stocks of conservation concern, or to release by catch unharmed.

Smolt. A juvenile salmon that has completed rearing in freshwater and migrates into the marine environment. A smolt becomes physiologically capable of balancing salt and water in the estuary and ocean waters. Smolts vary in size and age depending on the species of salmon.

Species. The fundamental category of taxonomic classification consisting of organisms grouped by virtue of their common attributes and capable of interbreeding. A taxonomic species is equivalent to the term "species" but the phrase may be used to indicate the collective species throughout its distribution.

Stewardship. Acting responsibly to conserve fish and their habitat for present and future generations.

Stock assessment. The use of various statistical and mathematical calculations to make quantitative predictions about the reactions of fish populations to alternative management choices.

Straying. The migration of a mature salmon into a stream other than that in which it was reared (i.e., its "home" stream). Straying is not equivalent to gene flow (the exchange of genetic material) unless the straying fish successfully reproduces in the receiving stream.

Sustainable Development. Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.[22]

Sustainable Use and Benefits. The use of resources in a way and at a rate that does not lead to their long-term decline, thereby maintaining the potential for future generations to meet their needs and aspirations. Sustainable use refers to consumptive uses of biological resources.[23] Sustainable benefits, on the other hand, derive from a broader range of consumptive and non-consumptive resource uses.

Watershed-based Fish Sustainability Planning (WFSP). A new approach to the management of fish stocks and fish habitat in British Columbia. Its overall goal is to ensure effective long-term conservation of fish and fish habitat – including spawning grounds and nursery, rearing, food supply, and migration areas on which fish depend directly or indirectly. WFSP is based on a standard planning sequence that can be applied to regions and watersheds across the province.[24]

Wild salmon. Salmon are considered "wild" if they and their parents are offspring of fish that spawned and grew up in natural surroundings.

[22]Brundtland (1987). *Our Common Future*: *The World Commission on Environment and Development.*
[23]Environment Canada (1994), *Canadian Biodiversity Strategy: Canada's Response to the Convention on Biological Diversity.*
[24]See www-heb.pac.dfo-mpo.gc.ca/publications/pdf/sustainability_planning_e.pdf

APPENDIX 1: METHODOLOGY FOR FIGURE 1

This appendix provides background to the calculation of the indices of commercial salmon catch and spawning escapements in Figure 1 on page 3.

The index of commercial catch is based on the total annual catch, in weight landed, of all salmon species from 1953 through 2002. It was calculated by: (1) summing all landed commercial catches within a given year; (2) dividing each year's value by the average landed weight over the entire period; and (3) averaging every four years to account for the annual variation in returns of Fraser sockeye salmon and the two-year cycles of pink salmon in British Columbia (four-point moving average).

The value used for each year is the deviation of the landed weight from the long-term average landed weight. This calculation will not change the trend pattern, but does standardize for different units of measure when comparing with other trends, such as total spawning escapements in Figure 1. Escapements are largely based on visual surveys and extrapolations to total numbers of salmon spawning in a stream. While these estimates are of unknown accuracy in terms of the true number of fish spawning, they are considered to be a consistent index of annual changes in spawning numbers.

The index value for spawners in Figure 1 is calculated by summing the numbers recorded for all salmon species in all B.C. streams for each year (data based on DFO BC16 spawning escapement records). These annual values are then treated in the same way as steps (2) and (3) above for commercial catch.

Certain data have not been included in the figure, as they were not available for the full time period and/or their inclusion would not change the trends shown, for example:

- B.C. recreational catches and First Nations catches in British Columbia and the Yukon were not available for every year, and would not have changed the catch trend as presented;
- Catches in B.C. transboundary rivers and the Yukon River were not included, since they would not change the trend due to their relatively small magnitude compared to the total B.C. commercial catch; and
- Spawning escapements in B.C. transboundary rivers and the Yukon River were similarly excluded.

APPENDIX 2: LEGAL AND POLICY BACKGROUND

DFO exercises the following mandate with respect to fisheries and other responsibilities:

> *"Fisheries and Oceans Canada is responsible for policies and programs in support of Canada's economic, ecological and scientific interests in oceans and inland waters; for the conservation and sustainable utilization of Canada's fisheries resources in marine and inland waters; for leading and facilitating federal policies and program on oceans; and for safe effective and environmentally sound marine services responsive to the needs of Canadians in a global economy."*[25]

This appendix outlines some of the key legislation, national and international agreements, and programs and policies with particular implications for the conservation and management of Pacific salmon.

Legislation

Since 1867, the ***Fisheries Act*** has been the primary legislative basis for fisheries management in Canada. It authorizes the Minister of Fisheries and Oceans to make decisions about the conservation of fisheries resources and habitat, to establish and enforce standards for conservation, and to determine access to and allocation of the resource. Sections 35 (prohibiting the harmful alteration, disruption and destruction, or HADD, of fish habitat) and 36 (prohibiting the deposit of deleterious substances into waters frequented by fish) confer strong powers to protect fish habitat. The ***Fisheries Development Act*** of 1985 further authorizes the Minister to undertake projects and develop partnerships to improve or develop commercial fisheries.

The ***Canadian Environmental Assessment Act*** (CEAA) came into force in 1995 and was updated through amendments in November 2003. Federal agencies must conduct environmental assessments of development proposals requiring decisions under federal legislation (e.g., decisions under section 35 of the *Fisheries Act*). The CEAA process requires the advice of relevant federal agencies to assess significant environmental effects in the planning of a project. Smaller and routine projects typically undergo a "screening" assessment, while larger and environmentally sensitive projects undergo a more intensive "comprehensive study".

In 1997, the ***Oceans Act*** extended the Department's role in managing the use of marine resources and habitats. It called for the development of a national oceans management strategy guided by the principles of sustainable development, integrated management and an ecosystem perspective. Integrated management is a collaborative approach to decision-making that aims to balance the various interests in the marine and coastal environment, while incorporating conservation requirements. Ecosystem-based fisheries management considers the interactions between species and their environment, as well as the impact of fishing on the ecosystem. ***Canada's Oceans Strategy***[26] released in 2002 defines an oceans-centred planning framework combining these principles.

The ***Species at Risk Act*** (SARA) was proclaimed in June 2003, fulfilling a key national commitment under the United Nations Convention on Biological Diversity (see below). As one of two federal departments charged with SARA's implementation, DFO is responsible for protecting aquatic species at risk and their habitat. This responsibility includes the legal requirements to implement automatic prohibitions, develop recovery and action plans, plan and implement critical habitat protection, and conduct consultations within specified timelines.

Agreements

In 1985, Canada and the United States signed the Pacific Salmon Treaty requiring the conduct of fisheries so as to provide for optimum production and equitable exploitation of salmon stocks. Under the Treaty, each party is to receive benefits equivalent to the production of salmon originating in its waters, and each is to avoid undue disruption to the other's fisheries. Bilateral agreements must be periodically developed to implement the Treaty's principles for long-term conservation and harvest sharing. In addition, the Pacific Salmon Commission was established to advise both countries on the implementation of Treaty provisions.

Canada was the first industrialized nation to ratify the **UN Convention on Biological Diversity** signed by more than 150 countries at the 1992 Earth Summit in Rio de Janeiro. The Convention has three main goals: (1) the conservation of biodiversity; (2) sustainable use of the components of biodiversity; and (3) fair and

[25]DFO (2001a), *Building Awareness and Capacity: An Action Plan for Continued Sustainable Development 2001–2003.*
[26]DFO (2002), *Canada's Oceans Strategy: Our Oceans, Our Future.*

equitable sharing of the benefits arising from the commercial and other use of genetic resources. In terms of defining at what level biodiversity should be conserved, it advocates the conservation of genes, species and ecosystems, without providing guidance on which one should receive priority.

In 1996, the federal, provincial and territorial governments signed the **Accord for the Protection of Species at Risk in Canada**. Under this agreement, the Canadian Endangered Species Conservation Council was created to determine responses to assessments made by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), the independent body of scientists responsible for designating the status of species.

After years of dispute over the conservation and harvest provisions of the Pacific Salmon Treaty, Canada and the US signed the **Pacific Salmon Agreement** in 1999. This agreement established abundance-based fishing regimes for the salmon fisheries under its jurisdiction. Two bilaterally managed regional funds were created to promote cooperation, improve fisheries management, and assist salmon and habitat enhancement efforts. The Agreement also included a commitment by the two countries to improve how scientific information is obtained, shared and applied to salmon management decisions.

The **North Pacific Anadromous Fish Commission (NPAFC)** was established by the Convention for the **Conservation of Anadromous Stocks in the North Pacific Ocean** (the Convention) which became effective in 1993. The NPAFC includes Canada, Japan, the Republic of Korea, Russia, and the U.S., the primary states of origin for salmon stocks in the North Pacific. The Convention prohibits directed fishing for salmonids on the high seas of the North Pacific and includes provisions to minimize the number of salmonids taken in other fisheries. The NPAFC promotes the conservation of salmonids in the North Pacific and its adjacent seas and serves as a venue for cooperation in and coordination of enforcement activities and scientific research.

Policies and Programs

In 1986, DFO introduced the ***Policy for the Management of Fish Habitat***[27] to provide guidance to departmental staff, developers and the public on habitat conservation, restoration and development. The policy's overall objective is a net gain in the productive capacity of fish habitat, using the guiding principle of "no net loss" to ensure that habitat is conserved.

The **Aboriginal Fisheries Strategy** (AFS) was launched in 1992 in response to the Supreme Court of Canada's Sparrow decision on the Aboriginal food fishery.[28] The AFS program is applicable where DFO manages and the fishery and where land claims settlements have not already put a fisheries management regime in place. It seeks to provide for the effective management and regulation of fishing by Aboriginal communities through negotiation of mutually acceptable and time-limited agreements between the Department and Aboriginal groups.

In 1998, ***A New Direction for Canada's Pacific Salmon Fisheries***[29] established conservation as the primary objective for managing the wild salmon resource. The new policy set out 12 broad principles in the areas of conservation, sustainable use and improved decision-making. It stated that conservation should take precedence over other uses and that a precautionary approach to fisheries management should be adopted.

New Directions called for more detailed policies to put its principles into operation. ***An Allocation Policy for Pacific Salmon***[30] confirmed the precedence of conservation and described a balanced allocation among the commercial, recreational and aboriginal fisheries once conservation requirements have been met. ***A Policy for Selective Fishing in Canada's Pacific Fisheries***[31] outlined principles and an implementation framework for selective harvest practices, as part of a long-term conservation and sustainable use strategy. For improved decision-making, there is work underway to create stakeholder committees that will help develop salmon harvest plans, as well as a formal public policy advisory process.

The **Aboriginal Aquatic Resource and Oceans Management Program** (AAROM) announced in October 2003 will help Aboriginal groups acquire expertise to participate more effectively in processes for aquatic resources and oceans management.[32] A major objective of AAROM is to provide these groups with the capacity to contribute to technical and advisory committees in areas of DFO responsibility, including fisheries and habitat management and oceans planning and management.

[27]DFO (1986), *Policy for the Management of Fish Habitat.*
[28]See www.dfo-mpo.gc.ca/communic/fish_man/afs_e.htm
[29]DFO (1998), *A New Direction for Canada's Pacific Salmon Fisheries.*
[30]DFO (1999), *An Allocation Policy for Pacific Salmon.*
[31]DFO (2001b), *A Policy for Selective Fishing in Canada's Pacific Fisheries.*
[32]See www.dfo-mpo.gc.ca/media/backgrou/2003/hq-ac99a_e.htm

APPENDIX 3: ALTERNATIVE APPROACHES TO BUILDING A FULLY INTEGRATED PLANNING STRUCTURE FOR PACIFIC SALMON

To initiate discussion, two forms of an integrated planning structure are described here that provide fundamentally different ways to develop integrated strategic plans. Combinations of the two are also possible.

The first approach would build on and extend the integrated harvest planning structure currently under development in DFO Pacific Region. It would take advantage of existing relationships between representatives on the recently formed Integrated Salmon Harvest Planning Committee (ISHPC) and other existing area planning processes and area-specific harvest interests.

The second approach would build on existing area-specific initiatives, such as watershed fish sustainability groups or the Aboriginal Aquatic Resource and Oceans Management initiatives, to develop localized multi-interest planning bodies that link upwards to a regional planning process advising the ISHPC.

These alternatives are analogous to what ecologists commonly refer to as "top-down" versus "bottom-up" controls of biological populations. The basic difference between these approaches is whether planning initiatives and conservation of wild Pacific salmon should be oriented to harvest concerns (top-down) or to resource and local area concerns (bottom-up). In either case, the planning process would have to be designed to bring both elements together in an internally consistent way.

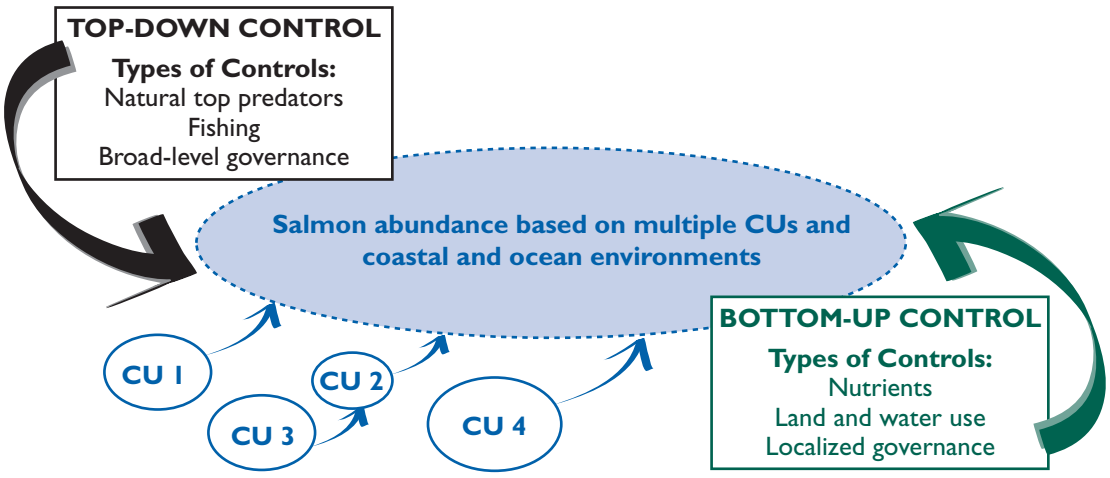
TOP-DOWN AND BOTTOM-UP CONTROLS IN ECOLOGICAL SYSTEMS

Ecologists have debated for years the importance of "top-down" versus "bottom-up" controls in natural populations. In ecological systems, the debate concerns whether the size of a population is ultimately limited by nutrients and lower levels of biological production (bottom-up controls) or by predators and competitors (top-down controls).[33]

The concept, though developed for biological systems, has also been applied to social and economic issues.[34] For the Wild Salmon Policy, the choice is whether to allow broad-based regional processes (including fishery impacts on multiple CUs) to limit the distribution and health of Pacific salmon (top-down) or to allow ecological and localized processes to limit their distribution and use (bottom-up). A bottom-up decision process would be most consistent with the genetic and habitat/ecosystem Objectives 1 and 2, while a top-down process might emphasize the balancing of biological, social, and economic considerations involved in Objective 3.

In fact these alternatives are useful for highlighting the distinction between approaches and their relation to the objectives. The planning process required to protect the resource while achieving sustainable use will reflect both views.

***Figure 9*: Diagram of top-down and bottom-up control on population sizes**
(Examples of control mechanisms include ecological, resource uses, and governance)



[33] Matson and Hunter (1992), "Special Feature: The Relative Contributions of Top-down and Bottom-up Forces in Population and Community Ecology."
[34] Cairns (2003), "Integrating top-down/bottom-up sustainability strategies: an ethical challenge."

Approach 1 (Top-Down)

An Integrated Harvest Planning Committee for salmon has recently been formed in the Pacific Region. It includes elected representatives from commercial gear and area groups as well as nominated representatives from First Nations, the sport fishing community, non-governmental environmental organizations and the Province of British Columbia. Each of these interests is supported by local structures, including commercial gear and area licensing committees, the Sport Fishery Advisory Board (SFAB) and its local committees, First Nations Fisheries Commissions, individual First Nations and local stewardship groups. The comprehensive structure of this Committee and its linkages to local communities and individuals interested in the wild salmon resource could make it an appropriate starting point for obtaining and coordinating local input into fisheries, watershed and marine planning processes.

In this approach, the new Integrated "Harvest Planning" Committee would evolve further to become an Integrated "Salmon Planning" Committee for the Pacific Region. To effectively play this broader role, the current balance of interests on the Harvest Planning Committee may need to be augmented. This issue could also be considered in consultations with all interests.

The proposed Integrated Salmon Planning Committee would build on its existing Harvest Committee linkages with communities and interest groups. It would establish local planning task groups that include fishing, community, First Nations, coastal, and watershed interests. These planning groups would be established as needed to cover the different geographic regions of B.C. and the Yukon. Linkages would be formed between these planning groups and other local planning processes that exist (e.g., local First Nations planning processes, Watershed-based Fish Sustainability Planning bodies) or may be established in the future (e.g., recovery planning teams under SARA to identify management options for listed Conservation Units).

Approach 2 (Bottom-Up)

The alternative approach would be organized geographically and start from a CU-based planning process to build upwards through regional planning groups that provide advice for harvest management.

An example of this approach in DFO Pacific Region is the development of Coastal Management Areas (CMA) which divide the Pacific Region into a number of smaller sub-regions. A CMA would bring together local First Nations, harvesters, stakeholders, and other community interests to assemble, assess, and analyze information, engage with projects important to local areas (like WFSP processes), and seek local consensus for CMA decisions. Each CMA would develop a strategic plan for each species. This approach would create and empower local CMA planners and allow them a degree of local autonomy to develop partnerships and set priorities.

The bottom-up approach links salmon production, habitat, ecosystem values, and social and economic issues at a local scale, but requires the creation of an extensive process that does not currently exist in most parts of the region. Based on advice and recommendations from CMA planners, the role of the IHPC would be to develop fishery management plans that respect local decisions and provide for sustainable use of Pacific salmon.

APPENDIX 4: A STRUCTURED FIVE-STEP PLANNING PROCESS

Salmon management is complex, involving five species consisting of numerous Conservation Units resident in many different watersheds and exploited by a wide variety of users in a myriad of fisheries. Because of interdependencies and overlaps between fisheries and among species within watersheds, planning at the level of individual CUs is not always realistic. To bring together all of the affected interests and important considerations efficiently, it will often be necessary to aggregate CUs for practical planning. These aggregates will be the basis for the development of integrated fisheries and watershed plans in local areas (and together across the region as a whole) that nevertheless address conservation issues for individual CUs within the planning unit.

These planning units can allow the application of a structured five-step planning procedure that will allow broadly based input to be received and aggregated in an organized way to arrive at reasoned and balanced management decisions. The five-step planning procedure is designed to open up current planning processes to public involvement. The procedure will improve dialogue among the affected parties and enable them to participate throughout the development of plans from the establishment of planning priorities through to the identification of management alternatives, their evaluation, and the selection of a preferred management alternative. In the longer term, the application of the planning procedure and the ultimate development of plans will be delegated to appropriate representative planning bodies (Action Step 4.1). In the interim, until these planning responsibilities can be delegated, the Department will bring together the various interests from existing planning processes, as needed, to provide focused recommendations for conservation and the rebuilding of CUs that are in low abundance (Action Step 4.2).

Step 1 – Identify planning priorities

For each planning unit, DFO staff will provide an overview report that identifies the Conservation Unit(s) exploited by fisheries within the planning unit and gives summary information on their biological status (Red, Amber, or Green, as per Action Step 1.2). Key habitat and ecosystem constraints or threats to individual CUs will also be summarized by watershed. For a CU in the Red zone, a more detailed peer reviewed report will also be provided as it becomes available. These detailed reports will consider and incorporate Aboriginal Traditional Knowledge (ATK) and will be peer reviewed through PSARC.

The overview reports and the detailed reports will be used in consultations with First Nations, local stakeholders, and the Integrated Harvest Planning Committee, to identify fisheries and watershed planning priorities for each of the planning units. These priorities will be consistent with the WSP objectives and principles, and will include addressing conservation concerns. However, priorities may also include rebuilding or enhancing returns of wild salmon where these are below their sustainable production potential, or maintaining harvest levels in specific fisheries where these are important for social or economic reasons.

For every planning unit, Step 1 will provide a list of specific key priorities to be addressed in the development of integrated salmon management plans.

Step 2 – Identify resource management options and alternative management strategies

First Nations, local fishery stakeholders, watershed-based interests, and the Integrated Harvest Planning Committee will play a central role in developing, reviewing, and finalizing management options to be considered. For example, selective harvesting measures or fishery time and area closures may be identified as fishery management options to minimize the impacts on particular CUs exploited by fisheries within the planning unit. Similarly, habitat restoration activities, watershed development constraints, and enhancement options may be identified to address concerns in individual CUs. The various management options that are identified will then be used to develop a range of alternative management strategies for the planning unit. In some cases, a management alternative may reflect a single management option (e.g., reduced fishing), but in many instances it may involve a combination of different management options (e.g., some reduced fishing and some habitat rehabilitation).

For every planning unit, Step 2 will provide a number of alternative strategies that reflect a realistic range of different approaches to address the management priorities for each planning unit.

Planning Units for Pacific Salmon

Planning units are an organizational construct needed for practical resource management planning that will link Conservation Units and watersheds to the fisheries that affect them. These planning units may include single fisheries or groups of fisheries that can be jointly planned and managed. It may also include single CUs or groups of CUs in one or more watersheds. Planning units will permit all of the relevant information on the status of individual CUs and their habitat to be collated with information on fisheries and watershed activities in the planning process.

The following chart identifies (with an X) potential planning units for Pacific salmon cross referenced to local fishing areas and relevant watersheds:

Fishing Area	Target Species					Watershed(s)
	Sockeye	Pink	Chum	Chinook	Coho	
Yukon River			X	X	X	Yukon
Alsek River	X			X		Alsek
Taku River	X	X	X	X	X	Taku
Stikine River	X	X	X	X	X	Stikine
Nass River	X	X	X	X	X	Nass
Skeena River	X	X	X	X	X	Skeena
Central Coast	X	X	X	X	X	Numerous
Fraser River	X	X	X	X	X	Fraser
Somass River	X			X	X	Somass
WCVI "Inside"	X		X	X	X	Nitinat/Nootka
South Coast "Inside"	X	X	X	X	X	Numerous
North Coast "Outside" & QCI	X	X		X	X	Numerous
WCVI "Outside"				X	X	Numerous
Okanagan River	X			X		Okanagan
Potential Planning Units	12	8	10	14	12	

The above chart indicates a potential total of 56 planning units for Pacific salmon. However, there may be further aggregation or subdivision of these units where practical and useful for management purposes. For example, Fraser River sockeye is currently managed on the basis of four distinct run timing groups. These four groups will likely remain the appropriate planning units for Fraser sockeye. Similarly, a planning unit might encompass a single fishery directed at one Conservation Unit, or even a subcomponent of a CU. For example, commercial net fisheries targeting Nitinat chum salmon on the West Coast of Vancouver Island may themselves represent an appropriate planning unit. At the other extreme, Central Coast pink and chum salmon may be treated as one planning unit due to linkages between their fisheries.

Step 3 – Establish biological, social, and economic performance indicators

Weighing and evaluating the management alternatives will require the development of explicit, measurable performance indicators for every planning unit (see the examples of indicators provided on page 50). These indicators must be suitable both to rate and rank the likely performance of each management alternative before making decisions, and to assess performance over time following decision-making and implementation. The indicators should directly relate to the biological objectives (safeguard the genetic diversity of wild salmon and maintain the integrity of their habitat and ecosystem) and the social and economic objectives (manage fisheries for sustainable benefits) of the WSP. It will be important that the choice of indicators reflect broad social input.

The key role in identifying these performance indicators will be assigned to local First Nations, fisheries and watershed interests, and the Integrated Harvest Planning Committee. For each planning unit, the outcome of Step 3 will be a credible, broadly accepted management assessment framework that captures and reflects all significant biological, social, and economic considerations.

Step 4 – Assess the likely impacts of management alternatives

At this step, the alternative management strategies identified in Step 2 will be evaluated using the performance indicators developed in Step 3. The evaluation process will be forward-looking and focused on estimating the "future" impacts (both positive and negative) of each strategy on each of the indicators for the planning unit. These predictions will need to reflect the uncertainties and risks associated with each alternative.

Under the Wild Salmon Policy, DFO will play a lead role in providing or obtaining these predictions from appropriate technical experts. For some planning units, computer simulation models may be available to assist, but in other cases it will be necessary to rely on expert opinion. Ultimately, the likely "net effect" of each management alternative (relative to status quo management) on all of the selected indicators for the planning unit will need to be projected for appropriate time periods. These projections will be used to compare the strategies. A high-level summary of the anticipated outputs from this type of analysis is outlined below.

	Biological Indicators	***Social Indicators***	***Economic Indicators***
Base Case: Status Quo	Forecast Indicator Values	Forecast Indicator Values	Forecast Indicator Values
Management Option 1	Forecast Indicator Values Impact = Net Change in Indicator Values (versus Base Case)	Forecast Indicator Values Impact = Net Change in Indicator Values (versus Base Case)	Forecast Indicator Values Impact = Net Change in Indicator Values (versus Base Case)
Management Option 2	Forecast Indicator Values Impact = Net Change in Indicator Values (versus Base Case)	Forecast Indicator Values Impact = Net Change in Indicator Values (versus Base Case)	Forecast Indicator Values Impact = Net Change in Indicator Values (versus Base Case)
Management Option 3	Forecast Indicator Values Impact = Net Change in Indicator Values (versus Base Case)	Forecast Indicator Values Impact = Net Change in Indicator Values (versus Base Case)	Forecast Indicator Values Impact = Net Change in Indicator Values (versus Base Case)

Step 5 – Select the preferred management alternative

The predicted impacts from Step 4 will help in selecting a preferred management strategy. In many cases, tradeoffs will be apparent among different biological, social, and economic indicators. It is anticipated that differences of opinion will occur between individuals and interest groups about the "best" alternative because of their different priorities and tolerances to risks.

Sample Biological, Social, and Economic Performance Indicators

Specific biological, social, and economic considerations of importance will inevitably vary from one planning unit to another. If a single CU is harvested in a planning unit, and the harvest is taken by a single user group, then a single biological indicator (such as the probability of falling below the established lower benchmark for the CU) may be considered adequate. Similarly, the projected harvest by the single user group may be considered adequate as a single social and economic indicator.

Selecting indicators will be much more difficult where the management planning unit is large and encompasses a variety of CUs and a range of interest groups. For example, Skeena River and Fraser River sockeye fisheries involve many CUs originating throughout the watershed. The fish are caught by a wide range of coastal and interior First Nations, commercial, and recreational harvesters. Each of these groups exploit a mixture of the CUs and the individual harvests need to be carefully linked and coordinated.

Examples of indicators that could be used in complex planning units such as these are outlined below.

Example: Translating Wild Salmon Policy Objectives and Fishery Planning Priorities into Possible Measurable Indicators in Complex Planning Units.

Wild Salmon Policy Objectives	Planning Priorities	Possible Measurable Indicators
Safeguard the genetic diversity of wild salmon	Ensure an acceptably low probability of falling below the lower Conservation Unit benchmarks Ensure an acceptably high probability of exceeding higher population benchmarks	Number of CUs where the probability exceeds 5% of falling below the lower benchmark established under Strategy 1 Number of CUs where the probability exceeds 50% of rising above the higher benchmark established under Strategy 1 Number of CUs where the running average spawner abundance over the lifespan of the species is expected to fall below 1,000
Maintain the integrity of wild salmon habitat and ecosystem	Ensure an acceptably low probability of falling below the lower Conservation Unit benchmarks	Number of CUs where the probability exceeds 5% of falling below the lower benchmarks established in Strategies 2 and 3 (e.g., the number of CUs where total dissolved solids and nutrient levels are expected to fall below certain levels, or where less than 50% of suitable habitat is expected to be occupied)
Manage fisheries for sustainable benefits	Ensure that First Nations food, social, and ceremonial needs are addressed Maintain and to the extent possible increase domestic commercial and recreational harvest levels Maintain and to the extent possible improve the financial viability of "all citizens" and First Nations commercial fishing Maintain and to the extent possible improve the financial viability of recreational fishing businesses Maintain and to the extent possible improve the financial viability of fish processing	First Nations food, social, and ceremonial harvest Commercial tidal harvest and harvest value Commercial non-tidal harvest and harvest value Total commercial harvest and harvest value Recreational harvest Processing sector employment

Based on constructive dialogue and input from the local planning processes, and at the Integrated Harvest Planning Committee, an attempt will be made to develop consensus recommendations for all planning units.

In the absence of consensus, differences of view will be fully documented to inform final decision-making. The Minister of Fisheries and Oceans will consider the input received and will make the final decisions. Records of all decisions will be made available to the public.

The most fundamental challenge in successfully managing wild salmon is to achieve consensus on how to address conservation concerns while balancing the social and economic impacts of alternative management actions. In the planning process described here, the interested parties will be directly engaged throughout the development of management plans from the establishment of planning priorities through to the evaluation and selection of the preferred management alternative. This will explicitly encourage the pursuit of creative solutions, but acceptable outcomes will not be unbounded. The deliberations will be guided by the principles and objectives expressed in the WSP, and the acceptability of the recommended management actions will be determined by the degree to which they advance the overall policy goal of restoring and maintaining healthy and diverse salmon populations for the benefit and enjoyment of the people of Canada in perpetuity.

The decisions made for each planning unit will collectively form the regional strategic plan for the management of salmon fisheries and watersheds. This plan will include activities and management actions to be undertaken over a medium- to long-term timeframe. It will also stipulate explicit biological targets to be achieved for individual Conservation Units and groups of CUs and, where appropriate, anticipated timeframes for rebuilding. All of this information will be documented in an Integrated Management Plan for Pacific salmon.

The progress made towards achieving the targets will be reviewed on an annual basis (as described in Strategy 5) and adjustments to elements of the strategic plan will be made as appropriate. On a less frequent but regular basis, more comprehensive evaluation of the overall strategy will be undertaken in light of progress towards achieving the overall goal and the objectives of the Wild Salmon Policy.

REFERENCES

British Columbia. 2002. Ministry of Water, Land and Air Protection. *Indicators of Climate Change in British Columbia, 2002*. Victoria: Water, Air and Climate Change Branch.

Brundtland, G. (ed.) 1987. *Our Common Future: The World Commission on Environment and Development.* Oxford: Oxford University Press.

Canada. Privy Council Office. 2003. *A Framework for the Application of Precaution in Science-based Decision Making About Risk.* Ottawa: PCO.

Cairns, J. Jr. 2003. "Integrating top-down/bottom-up sustainability strategies: an ethical challenge" *Ethics in Science and Environmental Politics* (ESEP) 2003: 1-6.

Dovetail Consulting Inc., Judith Cullington & Associates, and Devon Knight Events. 2000. *Final Report on Consultations for the Wild Salmon Policy Discussion Paper and the Salmonid Enhancement Program: Analysis of Input from Provincial Stakeholder Group Meetings, Community Forums, Response Forms and Submissions*. Report Prepared for the WSP–SEP Steering Committee, Fisheries and Oceans Canada. Vancouver: DC, November.

Environment Canada. 1995. *Canadian Biodiversity Strategy: Canada's Response to the Convention on Biological Diversity*. Hull: Biodiversity Convention Office.

Fisheries and Oceans Canada. 2002. *Aquaculture Policy Framework*. Ottawa: DFO.

_____. 2002. *Canada's Oceans Strategy: Our Oceans, Our Future*. Ottawa: Oceans Directorate.

_____. 2001a. *Building Awareness and Capacity: An Action Plan for Continued Sustainable Development* 2001-2003. Ottawa: DFO.

_____. 2001b. *A Policy for Selective Fishing in Canada's Pacific Fisheries*. Vancouver: DFO, January.

_____. 2000a. *The Wild Salmon Policy Discussion Paper*. Vancouver: DFO, March.

_____. 2000b. *2000 Survey of Recreational Fishing in Canada*. Ottawa: Statistical Services.

_____. 1999. *An Allocation Policy for Pacific Salmon*. Vancouver: Habitat and Enhancement Branch, October.

_____. 1998. *A New Direction for Canada's Pacific Salmon Fisheries*. Vancouver: DFO, June.

_____. 1986. *Policy for the Management of Fish Habitat*. Ottawa: Fish Habitat Management Branch.

Food and Agriculture Organization of the United Nations. 1995. *Precautionary approach to fisheries; Part 1: Guidelines on the precautionary approach to capture fisheries and species introductions*. FAO Technical Paper 350/1. Rome: FAO.

Gallaugher, P. and L. Wood. (eds.) 2004. *The World Summit on Salmon: Proceedings*. Burnaby: Simon Fraser University, June. Available at www.sfu.ca/cstudies/science/salmon.htm

GS Gislason and Associates. 2004. *British Columbia Seafood Sector and Tidal Water Recreational Fishing: A Strengths, Weaknesses, Opportunities, and Threats Assessment. Vancouver*: GSG, February.

Greer, D. and B. Harvey. 2004. *Blue Genes: Sharing and Conserving the World's Aquatic Biodiversity*. London: Earthscan Publications. Available at http://web.idrc.ca/en/ev-64749-201-1-DO_TOPIC.html

Haig-Brown, R. 1974. *The Salmon.* Ottawa: Environment Canada.

Harvey, B. 2002. *Biodiversity and Fisheries: A Primer for Planners*. Washington, D.C.: Global Environment Facility, Biodiversity. Available at www.unep.org/bpsp/Fisheries/Main%20Report%20(Fish).pdf

Harvey, B., C. Ross, D. Greer, and J. Carolsfeld. (eds.) 1998. *Action before extinction: an international conference on conservation of fish genetic diversity*. Victoria: World Fisheries Trust.

Hilborn, R., T.P. Quinn, D.E. Schindler, and D.E. Rogers. 2003. "Biocomplexity and fisheries sustainability." PNAS 100(11): 6564-6568. Available at www.pnas.org/content/vol100/issue11/#ECOLOGY

_____. 1950. *Measure of the Year*. Toronto: Collins.

Irvine, J.R., L. Bijsterveld, and L. Nagy. 2003. *An update on catch trends for Pacific Salmon in British Columbia Canada*. NPAFC Doc. 709, Rev. 1. Vancouver: Department of Fisheries and Oceans. Available at www.npafc.org/ or North Pacific Anadromous Fish Commission, Suite 502, 889 West Pender Street, Vancouver, B.C.

James, M. 2003. *Native Participation in British Columbia Commercial Fisheries*. Teakerne Resource Consultants. Report Prepared for the B.C. Ministry of Agriculture, Food and Fisheries. TRC, November.

Levin, P.S. and M.H. Schiewe. 2001. "Preserving salmon biodiversity," *American Scientist* 89(3): 220. Available at www.americanscientist.org/template/AssetDetail/assetid/14347?fulltext

Matson, P.A. and M.D. Hunter. 1992. "Special Feature: The Relative Contributions of Top-down and Bottom-up Forces in Population and Community Ecology," *Ecology* 73(12): 723-765.

McRae, D.M. and P.H. Pearse. 2004. *Treaties and Transition: Towards a Sustainable Fishery on Canada's Pacific Coast.* Report of the Joint Task Group on Post-Treaty Fisheries. Vancouver: Joint Task Group, April.

Natural Resources Canada. 2004. *Climate Change Impacts and Adaptation: A Canadian Response*. Ottawa: Climate Change Impacts and Adaptation Directorate.

Pacific Fisheries Resource Conservation Council. 2002. *Annual Report 2001–2002*. Vancouver: PFRCC, October.

Ricker, W.E. 1975. "Computation and Interpretation of Biological Statistics of Fish Populations." *Bulletin of the Fisheries Research Board of Canada*, 191.

Riddell, B.E. 1993. "Spatial organization of Pacific salmon: What to conserve?" In J.G. Cloud and G. H. Thorgaard, *Genetic Conservation of Salmonid Fishes*, pp. 22–41. New York: Plenum Press.

Slaney, T.L., K.D. Hyatt, T.G. Northcote, and R. J. Fielden. 1996. "Status of anadromous salmon and trout in British Columbia and Yukon." *Fisheries* 21(10): 20-35.

Washington Department of Fish and Wildlife. 2000. *Pacific Salmon and Wildlife: Ecological Contexts, Relationships, and Implications for Management.* Olympia: WDFW, May.

Wood, C.C. 2002. *Managing biodiversity in Pacific salmon: The evolution of the Skeena River sockeye salmon fishery in British Columbia*. Washington, D.C.: Global Environment Facility. Available at www.worldfish.org/bm_chapter2.html

Wood, C.C. and L.B. Holtby. 1998. "Defining conservation units for Pacific salmon using genetic survey data." In Harvey et al. (eds.), *Action before extinction: an international conference on conservation of fish genetic diversity.* Victoria: World Fisheries Trust.