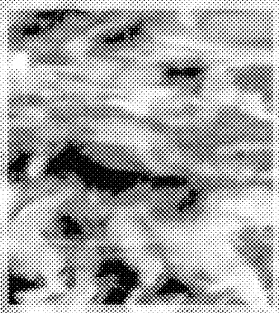

A Policy Framework for Conservation of Wild Pacific Salmon

FISHERIES AND OCEANS CANADA

DRAFT • NOVEMBER 3, 2004

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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 of all Canadians.

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 benefit.

3. Conservation of wild salmon and their habitat is the first priority for resource management decision-making. After satisfying the priority for conservation, fisheries will be managed to meet constitutional obligations to First Nations, and to optimize the benefits from harvesting.

4. Implementation of the policy will involve an open and inclusive process which aims at making decisions about salmon stewardship that balance social and economic benefits with biological risks. People throughout British Columbia and the Yukon will be able to contribute to those decisions and ensure that conservation choices reflect societal values for wild salmon.

5. Wild salmon will be maintained by identifying and managing spawning aggregates designated as "Conservation Units" (CUs) that reflect the geographic and genetic diversity of Pacific salmon. A CU is an aggregation of a salmon species that, if lost, could not be replaced by natural processes within a reasonable timeframe.

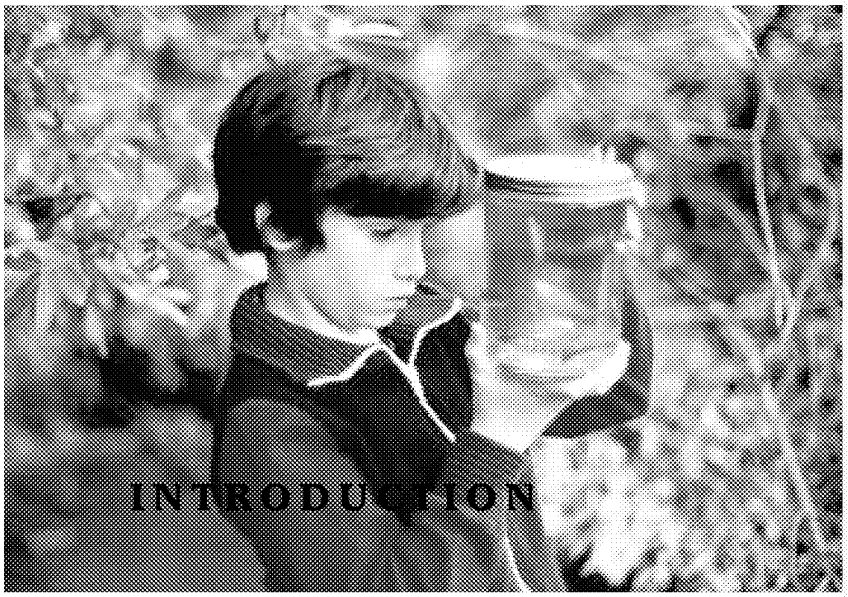
6. The status of CUs will be monitored, assessed against selected benchmarks, and reported publicly. Where monitoring indicates low levels of abundance, or deterioration in the distribution of spawning components within a CU, a full range of management actions – including habitat, enhancement and harvest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

7. The management of habitat protection and salmon enhancement activities will focus on sustaining wild salmon. An integrated approach to habitat management involving the assessment of its wellbeing, identification of risks and constraints, and monitoring of status to identify changes over time, will be adopted to link fish production goals with watershed protection and stewardship initiatives.

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

9. While the Policy's aim is to maintain CUs to the fullest extent possible, it recognizes two circumstances where there may be losses of wild salmon. First, the loss of some localized groups within a CU may occur, but by preserving the larger unit, such losses can be restored through straying from adjacent components within the CU. Second, where an assessment indicates that conservation measures will be ineffective or the social and economic costs to maintain or rebuild a CU are excessive, the Minister of Fisheries and Oceans may decide to forego active measures to maintain and restore the unit. Such decisions will be made openly and transparently.

10. The outcome of the Policy will be a healthy, diverse and abundant salmon resource that supports robust and sustainable fisheries meeting the cultural and subsistence needs of First Nations, provides recreational opportunity, and contributes to the economic prosperity of fishery dependent communities.



INTRODUCTION

Canadians on the West Coast have an enduring connection with Pacific salmon that was 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 coastal 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, as some people claim, wild salmon runs disappearing rapidly, at the expense of our coastal waters, streams and lakes, estuaries and rainforests? Will the Pacific species survive to provide social and economic benefits for future generations? How can we ensure the long-term health and productivity of wild salmon populations? Canadians with wide-ranging attachments to salmon want answers to these questions, and expect action and accountability from Fisheries and Oceans Canada (DFO) as the entrusted manager of this precious resource.

WHAT ARE WILD PACIFIC SALMON?

There are five species of Pacific salmon in B.C. and the Yukon, all in the genus Oncorhynchus: chinook, chum, coho, pink and sockeye. These species form part of the larger classification of Pacific salmonids, which include steelhead and cutthroat trout. DFO has authority under the 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 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, and are frequently called "enhanced" salmon. This term may also be 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 has not been altered, and therefore they will be deemed "wild" under the Wild Salmon 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 systems from which they originated, for rebuilding or maintenance of populations. In order to maintain the genetic characteristics of native salmon, both wild and enhanced fish are used as broodstock, as prescribed in broodstock collection and spawning guidelines.

A NOTE ON TERMINOLOGY

Conservation. *The conservation of wild salmon means different things to different people. To some, it requires protecting every spawning site on every stream where salmon are found. To others, having reasonable levels of abundance for each species on a coast-wide basis is enough. DFO defines conservation as the wise use of the salmon resource for the long-term health and productivity of wild populations. Conservation is neither preservation (i.e., no consumptive use) nor use that threatens the biodiversity of Pacific salmon. The Wild Salmon Policy seeks to conserve wild salmon.*

Population. *A population is a group of interbreeding salmon that is sufficiently isolated from other populations that there will be persistent adaptations to the local habitat. 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 populations, which themselves are composed of partially isolated 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 "geographically or genetically distinct" populations, thereby allowing salmon to be listed as "endangered" at the sub-species level.*

THE STATUS OF PACIFIC SALMON

Despite declines in abundance over the past decade and problems with certain populations, wild salmon in Canada are relatively plentiful. A 1996 study for the American Fisheries Society identified more than 8,000 natural spawning streams by species in British Columbia and the Yukon[2]. Salmon were acknowledged to be extirpated in 1.4% of the streams and assessed as being at risk in another 8%, based on the current size of the spawning groups and/or the rate of change in the number of spawners. Although there are limitations to these data and notable concerns for some populations, about 90% of the known spawning populations on Canada's west coast were assessed not to be at risk of extinction.

During the 1990s, a period of climate-related poor marine survival led to declining abundance of many salmon runs. In response, DFO took strong measures to conserve unique groups of salmon populations, first for chinook along the west coast of Vancouver Island in 1996 and then for upper Skeena River and Interior Fraser River (Thompson) coho in 1998. While overall abundance and catch are down, the annual escapement of spawning salmon returning to BC streams has been maintained at a relatively consistent level since the 1950s (see Figure 1).

The health of Pacific salmon depends not only on their abundance, but also on the geographic distribution of populations, the genetic differences among them, and the habitats from which such differences derive. This biological diversity, or "biodiversity", provides insurance against future environmental change, notably climate variation and habitat loss. Protecting biodiversity is therefore our insurance policy for the future evolution and continuance of wild salmon and ecological processes, as well as the basis for production for cultural and socio-economic benefit and people's enjoyment.

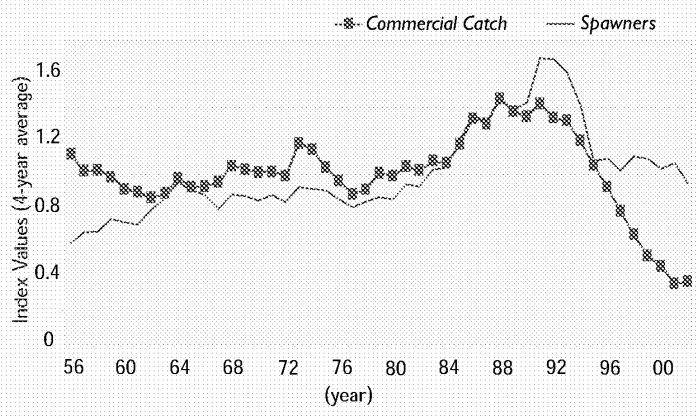
Within the last decade, various measures have been implemented to advance the conservation of Pacific salmon beyond those mentioned above. For example, the commercial fishing fleet was reduced, Canada and the United States renewed the Pacific Salmon Treaty, selective harvesting practices have been developed 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.

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."[3]

Figure 1 **BC Commercial catch and spawning escapement**



THE IMPORTANCE OF HABITAT

To survive and prosper, wild salmon need productive freshwater and marine habitat; without habitat, there can be no salmon. Productive habitat in the Pacific Region faces growing pressures from human activities that threaten its capacity to sustain salmon populations over the long term. The reason is that habitat is not just important for salmon, but also has significant economic value to non-fishery uses, such as urban development, forestry, agriculture and other industry. However, these uses may compromise the value of 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 like climate change.

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

TRENDS IN TOTAL 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 BC 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 extent of the shift from harvesting salmon to providing more spawners is evident. The numbers of salmon spawning in BC streams (based mostly on visual estimates of spawners) has increased since the early 1950s. While catch declined dramatically in the 1990s, the total number of spawning salmon was maintained. 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, conservation actions for late-run Fraser sockeye, available markets for salmon, and a reallocation from harvest to spawning populations.

The figure does not include First Nation or recreational catches, but their addition would not significantly alter the trend. One intent of the Wild Salmon Policy is to provide a sustainable harvest level for all fishing communities, recognizing that the catch in any given year will always vary with the abundance of salmon produced.

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 US 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.

ENHANCEMENT AND WILD SALMON

Enhancement activities contribute a significant proportion of the salmon currently produced in British Columbia and the Yukon. This proportion varies by species, geographic area and year, but overall between 10% and 20% of the BC commercial catch originates from the Salmonid Enhancement Program (SEP). Moreover, some recreational fisheries are completely dependent on enhanced salmon, such as the Strait of Georgia coho hatchery mark selective fishery and various freshwater fisheries.

SEP has developed many useful tools for producing and restoring Pacific salmon, and also enjoys substantial public support; however, enhancement poses some acknowledged risks to wild populations. Fishery-related risks are associated with the harvesting of productive enhanced populations with less productive wild populations in mixed-stock fisheries. Genetic risks relate to the potential reduction in genetic diversity as a result of hatchery practices. Ecological risks can arise from enhanced and wild salmon competing 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 considered in this policy.

AQUACULTURE

Over the past decade, production from salmon aquaculture has expanded threefold, and the landed 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 focussed 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 directly in the middle of this debate; nonetheless, protection of the wild resource remains our first priority. All new fish farm sites must undergo a rigorous screening for environmental effects under the Canadian Environmental Assessment Act (CEAA) and a review for potential habitat effects under section 35 of the Fisheries Act. The Department has adopted guidelines for new farms that require 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. 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 our 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 Pacific salmon conservation, there are continuing challenges for wild populations and the fisheries that rely on them. Three populations – Interior Fraser River coho, Cultus Lake sockeye in the Lower Fraser and Sakinaw Lake sockeye in the Strait of Georgia – have been recommended for listing as endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), with recovery plans underway.[4] The commercial fishery continues to be hit hard by the recent declines in salmon abundance, reduced catches and falling prices.[5] A new approach to managing Pacific salmon is needed that will anticipate and reverse conservation problems before they worsen, and maintain the full array of benefits from the wild resource.

The drive for a new management approach comes from the evolution in public attitudes, science, laws and decision-making over the past 20 years. Thousands of volunteer streamkeepers and many local watershed groups now actively protect and restore Pacific salmon and their 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. The *Species at Risk Act* 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 and non-government organizations are demanding more say in decisions about wild salmon, through regional management boards and other mechanisms. At the same time, within DFO, the focus has shifted from managing to maintain the salmon harvest towards managing for a better balance of harvest, population conservation and the maintenance of biodiversity.

The benefits potentially lost if we do not adopt a new approach to salmon management are only too apparent. 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 aboriginal people make a major contribution to the commercial fishery. Further, well in excess of a hundred other species of fish and wildlife are known to depend on Pacific salmon for their survival.[6] Together with the enjoyment wild salmon provide, the place they occupy in our cultural identity, and the expectations of Canadians for responsible stewardship, these factors make a compelling case for a new policy approach.

Dimensions of the BC Salmon Fisheries, 2002

Commercial Fishery

Catch
11.7 million salmon[a]

Number of Active Vessels
1,700[b]

Direct Employment
2,584 person-years[c]

Aboriginal Employment
30-35 %[d]

Recreational Fishery

Catch
583 thousand salmon[e]

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

Associated Businesses
125 lodges; 500 charters[f]

Direct Employment
1,120 person-years[g]

Aboriginal Employment
3 %[h]

Aboriginal Food, Social and Ceremonial Fishery

Catch
1.2 million salmon[i]

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[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] GSGislason & Associates (2004). Includes employment from both harvesting and processing wild salmon, but excludes employment 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 (2000), *"Survey of Recreational Fishing in Canada"*.

[f] GSGislason & Associates (2004).

[g] GSGislason & Associates (2004). Includes employment form lodge and charter businesses, but excludes employment in other supporting businesses.

[h] GSGislason & Associates (2004).

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

THE WILD SALMON POLICY (WSP)

Until now, DFO's management of wild Pacific salmon has been guided by the broad policy direction of the Fisheries Act, has tended to focus on the major salmon stocks, and has often been reactive to changing circumstances. The expectations for salmon management today require that we progress to a more proactive, forward-looking approach that sets clear conservation goals for a diverse wild salmon resource, develops comprehensive strategies for achieving these goals, and anticipates and addresses the future pressures on wild salmon.

The Wild Salmon Policy is intended to do so. It presents a framework to guide future decisions about conserving wild salmon populations in British Columbia and the Yukon. As such, the policy defines the specific elements of wild salmon that should be conserved, discusses the nature of appropriate conservation limits and targets, and proposes how policy success could be measured. Most importantly, it identifies appropriate processes for making management decisions about wild Pacific salmon that will balance the needs of this important resource with those of all Canadians who have an interest in it.

The policy builds on previous consultations with First Nations, user groups and the general public on a draft discussion paper released in March 2000.[7] Attempts have been made to address the many comments received in these earlier consultations, particularly those related to the need for greater clarity and detail. The WSP is meant to engage further discussion that will lead to consensus on a balanced framework for the conservation and wise use of the wild salmon resource.

Some user groups may argue that the policy will only lead to less and less fishing opportunity; however, that is not our intention. The WSP does not advocate 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 will 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 the rebuilding of 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.

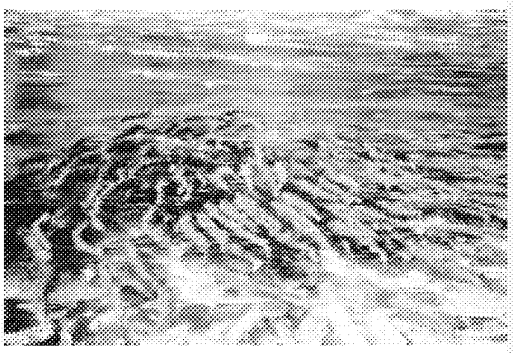
The Diversity of Wild Salmon

Most people know that there are differences among the species of Pacific salmon. However, few may be aware that each species is composed of many genetically distinct groups showing an impressive diversity in their life histories and the way in which they have adapted to local circumstances. Indeed, it is at the sub-species level that biological diversity becomes clear – a diversity that allows the salmon to survive in, and take advantage of, a broad array of habitats.

Population diversity

Diversity exists both among and within wild populations. A good example is chinook salmon found in the Harrison/Lilloet River drainage of the lower Fraser River watershed. It is hard to imagine chinook populations more different from each other than those in the Harrison and Birkenhead Rivers. Harrison River chinook, probably the world's largest natural spawning population of chinook salmon, are a fall run that migrate to sea as fry and spend their entire marine life in southern BC waters. They are relatively homogeneous, all spawning in a fairly short section of river downstream of Harrison Lake.

Birkenhead chinook live further up the watershed above Harrison Lake and are genetically distinct from the Harrison fall chinook. They are among the earliest returning spring chinook, spend one year as juveniles in freshwater, and are frequently caught in Alaskan fisheries. In contrast to Harrison chinook, there is considerable diversity within the much smaller Birkenhead population. This population spawns and rears in various tributaries and, although fish in different locations do not appear to be genetically separate, they all contribute to within species diversity.



Homing versus straying

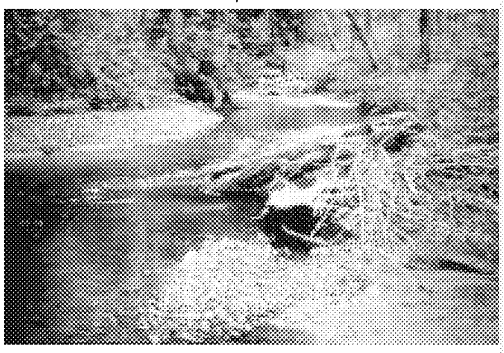
The remarkable ability of salmon to find their way home to their natal stream, in some cases to the exact spot where they were spawned, has led to the thousands of locally adapted and genetically distinct populations that exist today. But, because homing is imperfect, a fraction of returning fish (rarely more than 15%) stray and spawn in nearby streams. Some amount of straying is essential to introduce new genes and repopulate areas where salmon have disappeared; too much straying, on the other hand, can dilute the local adaptations and reduce genetic diversity.

The current biodiversity of wild salmon evolved over millennia. Ten thousand years ago, as the glaciers retreated at the end of the last ice age, salmon emerged from a few coastal refuges and spread out across British Columbia. As habitats developed and salmon returned to 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 to 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 biodiversity is the result of adaptation to local habitat, habitat diversity – both in location and in type – underlies the genetic differences 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 for genetically distinct local adaptations.

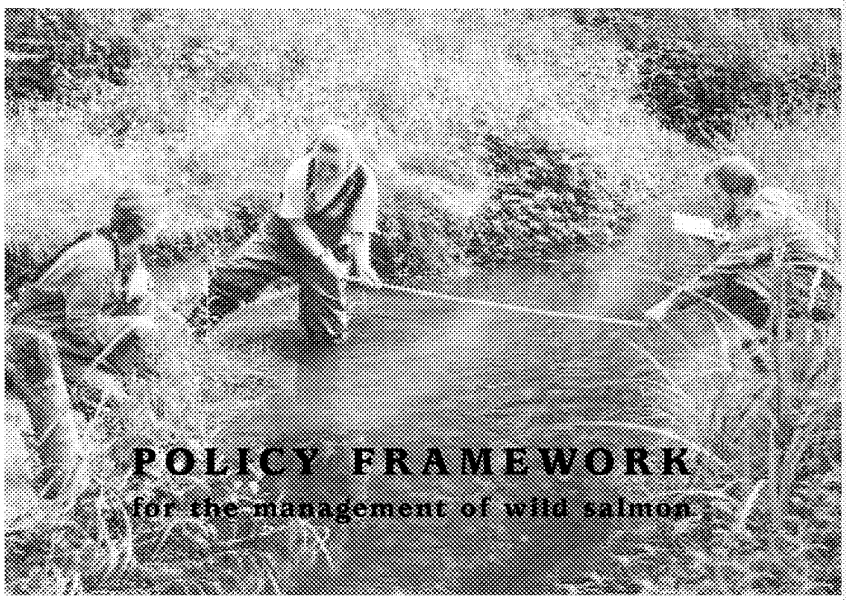


At the same time, to ensure gene flow, straying salmon must be able to reproduce with other salmon, which requires that populations not be fully isolated from one another. Without suitable intervening habitat, populations will become disconnected and lose the benefits of genetic interaction. Therefore, habitat connectedness is critical to the genetic diversity of wild salmon.

Why biodiversity is important

Biological diversity encompasses genetic and habitat (or ecosystem) diversity. Biodiversity is valuable not just as an end in itself, but also as a means to protect the health of wild salmon populations and the benefits they provide. Having the largest number of spawning populations that are most productive for their individual streams results in a higher abundance of each salmon species. Moreover, biodiversity spreads the risk, creates redundancy and increases the likelihood of species and populations surviving both short-term catastrophic events like landslides and longer-term forces such as climate change.

Biologists still have much to learn about the importance of local adaptation 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. For thousands of years, Pacific salmon have survived floods and droughts, disease, volcanic eruptions and ice ages, thanks to their diversity and processes allowing adaptability to change. There is no reason to expect that this strategy should not continue to serve them well in the future, except that human-caused pressures add another challenge. We must ensure that our human footprint does not preclude the functioning of these essential processes and their continued adjustments to change.



The policy framework outlined below describes how DFO will meet its responsibilities for the management and 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 stipulate objectives and associated strategies that will be pursued 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 the enjoyment of future generations;
- Robust, valuable and sustainable fisheries that meet the cultural and subsistence needs of First Nations, provide recreational opportunity, and contribute to the economic prosperity of fishery dependent communities; and
- The maintenance of overall environmental health.

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.

The policy's implementation will be founded on three principles that will provide direction for all decisions and activities pertaining to the conservation of wild Pacific salmon:

LEGAL CONTEXT FOR THE WILD SALMON POLICY

Three key tenets provide the legal foundation for this policy:

- *Pacific salmon are a common property resource that is managed by the Government of Canada on behalf of present and future generations. Although salmon are held in common for the benefit of all Canadians, common property does not imply open or equal access to the resource. The federal government has constitutional responsibility to conserve and manage the Pacific salmon on behalf of the people of Canada.*
- *The Minister of Fisheries and Oceans retains the authority and accountability to ensure the conservation and sustainable use of fisheries resources and their habitat, and to make decisions about allocation and access. The Fisheries Act provides the Minister with legislative authority for fish conservation. That authority includes Ministerial 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 Wild Salmon Policy 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)

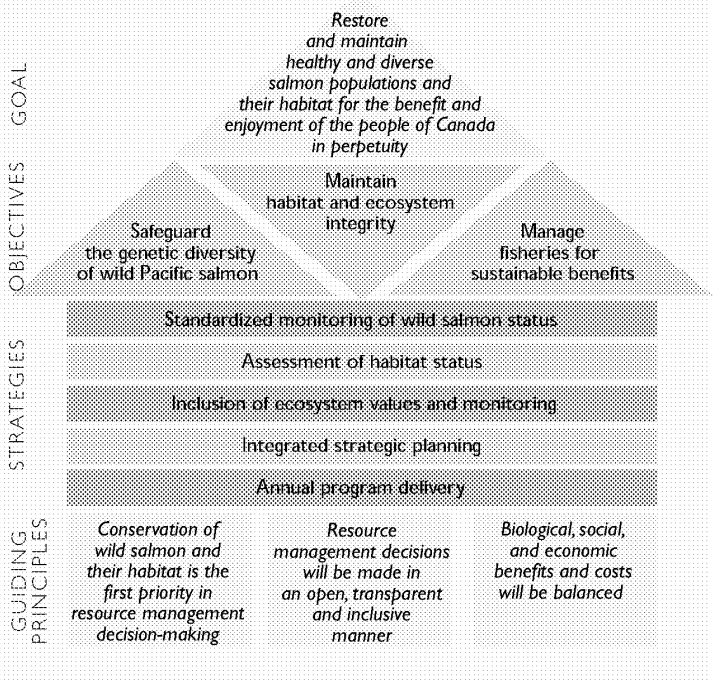
Agreements

Pacific Salmon Treaty (1985)
UN Convention on Biological Diversity (1992)
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 Salmon Policy**



PRINCIPLE 1

CONSERVATION OF WILD SALMON AND THEIR HABITAT IS THE FIRST PRIORITY IN RESOURCE MANAGEMENT DECISION-MAKING.

Conservation is wise use; it includes the rational exploitation, maintenance and restoration of wild salmon and their habitat. It is neither preservation (i.e., no consumptive use) nor use that threatens the biodiversity of Pacific salmon. Rather, conservation encompasses restoring and protecting salmon abundance for future harvest and enjoyment. 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.

Broad public support for decision-making requires that salmon be managed with the input of a wide range of interests in the resource. This will ensure that decisions about salmon conservation and sustainable use reflect societal values. Decision-making processes must be fair, transparent and subject to clear and consistent rules and procedures.

PRINCIPLE 3

BIOLOGICAL, SOCIAL AND ECONOMIC BENEFITS AND COSTS WILL BE BALANCED.

Conservation decisions should not be based solely on biological information. The conservation of biodiversity is aimed at protecting healthy ecosystems including their human element now and in the future. Conservation actions should not be taken independently of their cost or consequences. Social, economic and biological considerations will play a role in finalizing decisions on salmon conservation.

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, as well as their habitats. While there is consensus that maintaining diversity is essential for the health of wild salmon, quantifying how much diversity to maintain is a significant policy issue. Attempts to maximize the preservation of genetic diversity would effectively eliminate human harvesting of salmon. At the other extreme, the preservation of salmon species while ignoring population structure and the wellbeing of populations would reduce diversity within species and threaten their long-term survival.

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

There are important implications to this definition of a Conservation Unit. The persistence of salmon in a CU, and the associated fish production, rely on responsible management of the population structure and habitats within the CU. Decision-makers will therefore protect these units by maintaining population structure within CUs, and by protecting habitat and the ability of fish to move among areas (connectivity). Since extirpated CUs are not expected to recolonize in a human lifetime, the loss of a CU can have long-term consequences for the people and other ecosystem components that benefit from salmon produced from that unit.

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 to species. Their precise homing to natal streams and death after spawning restricts gene flow among fish at different spawning locations. However, since salmon stray, genetic exchange usually occurs among fish at various persistent spawning sites (demes) in a geographic area, forming a network of geographic organization.

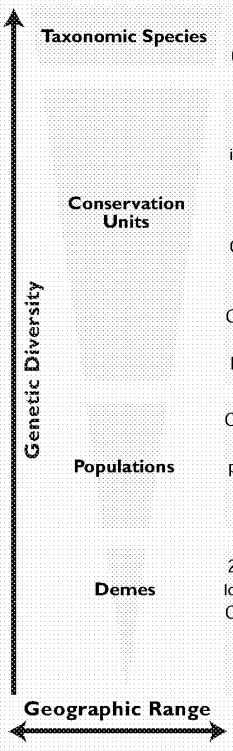
The further apart persistent spawning sites are from one other, and/or the greater the physical differences among sites, the less genetically similar fish at these sites will generally be. Eventually, when distance or environments severely limit gene flow, these limits will define aggregates of spawning groups that function independently in their genetics and production of fish. These independently functioning aggregates are what we call ***Conservation Units****.*

Populations are units of diversity that are usually intermediate between demes and CUs. There can be limited gene flow among populations, although for sockeye in particular it is often negligible, and sockeye populations are often the same as CUs. For other species, a CU will normally be comprised of more than one population (Figure 3).

SPECIES DIFFERENCES IN CONSERVATION UNITS

The number and sizes of CUs will vary across species. For instance, pink and chum salmon generally stray more than the other salmon species, so that their CUs will be relatively large. Sockeye CUs will typically be at the level of individual lakes, while those for coho and chinook salmon will tend to be intermediate in size by comparison (see Figure 3).

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



	O. nerka (sockeye)	*O. kisutch* (coho)	*O. tshawytscha* (chinook)	*O. gorbuscha* (pink)	*O. keta* (chum)
Taxonomic Species					
Conservation Units	60–100 CUs in Pacific & Yukon of which 20–25 CUs are in Fraser of which Chilko Lake is one Fraser CU	6–18 CUs in Pacific & Yukon of which 2 CUs are in Fraser of which Interior Fraser is one Fraser CU	20–40 CUs in Pacific & Yukon of which 6 CUs are in Fraser of which South Thompson is one Fraser CU	15–30 CUs in Pacific & Yukon of which 2–3 CUs are in Fraser of which lower Fr. odd year pinks are one Fraser CU	10–30 CUs in Pacific & Yukon of which one CU is in Fraser
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	2 spawning locations in Chilko Lake CU	Spawning sites in 200 streams in interior Fraser CU	Spawning sites in 13 rivers in South Thompson CU	Spawning sites in 43 streams in lower Fraser odd year CU	Spawning sites in 114 streams in Fraser CU

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

Over the geographic area of a CU, variation in habitat type and quality may result in differences in salmon productivity. To maintain viable CUs, these differences must be accounted for, even if each population and deme within a CU is not maintained at equal levels of production, or risk of loss. By focusing on the maintenance of CUs, the Wild Salmon Policy recognizes the need for a balance between conservation risk and continued resource use.

In effect, the Policy accepts that the temporary loss of some localized spawning groups within CUs may occur. However, these losses, whether due to natural events or human activities, do not necessarily mean extirpation of the CU. The WSP acknowledges that the maintenance of CUs requires protecting demes and populations, but not necessarily all of them at all times. A prerequisite for maintaining healthy abundances within CUs is to provide opportunities for the recolonization of spawning areas and other habitat that will ensure continued production.

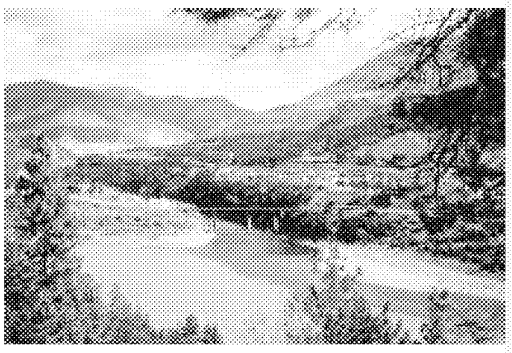
Conservation Units in the Fraser River Watershed

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, there are several hundred sites where sockeye regularly spawn. These persistent spawning sites or demes aggregate into about 25 populations that consist of major lakes and, in some cases, run timing groups within lakes. The number of sockeye CUs is expected to be less than the number of populations because of genetic mixing among run timing groups within lakes.

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 be run 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, this does not necessarily mean that every CU will have an 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 reasonable timeframe. Coho salmon from above the Fraser canyon are isolated from coho below the canyon, and 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

Substantial 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 coherence related to large development projects.*

Under this plan, DFO staff will apply an objective, science-based risk management framework to focus attention on development proposals that are high risk to important fish habitat, using the most appropriate regulatory tool(s) for the circumstance. They will provide more definitive guidance materials to developers early on, before projects are designed.

The plan will also build on partnerships and other arrangements with all levels of government, industry, First Nations and the public to protect and restore fish habitat and enhance program effectiveness.

The goal will be 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.

OBJECTIVE 2

MAINTAIN HABITAT AND ECOSYSTEM INTEGRITY

The health of wild Pacific salmon is inextricably linked to the availability of productive freshwater and marine habitat. However, these and adjacent terrestrial areas are also valued for a wide range of human requirements. Intense competition for accessible land and fresh water, particularly in heavily populated areas, challenges the maintenance of healthy salmon habitat.

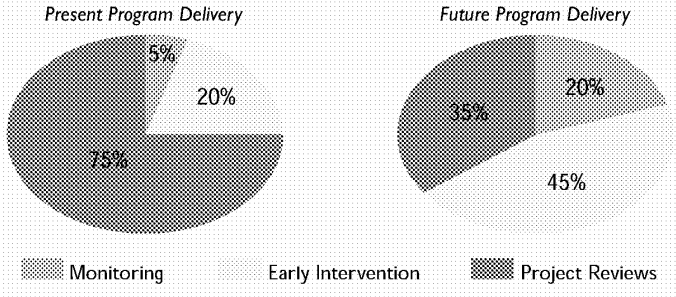
Human activities cause physical and water quality impacts in both freshwater and marine areas. Development in estuaries and the marine foreshore can affect wild salmon during critical rearing and migration periods. In the open ocean, activities such as commercial fishing, shipping and waste disposal can have a negative impact on the salmon marine habitat.

Pacific salmon have a critical function in aquatic and terrestrial ecosystems where they transport marine-derived nutrients inland. Numerous studies have identified salmon as providing a food and nutrient source for organisms ranging from microbes to top predators, as well as playing a key biological role in increasing the survival and growth of juvenile salmon.

In BC and the Yukon, the effective management of fish habitat for the multitude of salmon spawning streams and associated rearing habitat is a considerable challenge. Since 1986, habitat management has been guided by DFO's *Policy for the Management of Fish Habitat*. Under this regime, the Department has focused on a "no net loss" guiding principle for the protection of habitat, where avoidance and mitigation strategies are used to control adverse habitat impacts. Where habitat is affected, as required by human activities, losses are balanced with habitat replacement.

Among the Habitat Policy's eight identified strategies for achieving no net loss, efforts have been focused primarily on project-by-project review, including the detailed negotiation of avoidance and, if necessary, compensation arrangements. Recent internal evaluation has shown that often habitat losses are not offset by the creation of new habitat or by restoration efforts. It is clear that making greater use of planning and evaluation of strategies on a watershed scale will improve the effectiveness of habitat protection for a Conservation Unit.

Figure 4 **Evolution in DFO's habitat management program**



A more effective balance of the available strategies focused on the salmon habitat of greatest importance in a CU will clarify decision-making and more effectively link to harvest and stock assessment (see Strategy 4 for an explanation of how this will be done).

Across the country, DFO is making changes to its Habitat Management program to achieve a better balance between project reviews and other habitat protection and monitoring strategies. There will be increased emphasis on habitat planning and stewardship, and on monitoring not just for compliance but also for program effectiveness. Habitat planning and stewardship encompasses many activities, including watershed assessments to define habitat status and risks, preventative and early intervention, as well as restoration, public education and community involvement. An important goal is to integrate the work of BC stewardship groups and stakeholders with that of the Department, in order to focus protection and restoration on areas where productive capacity of habitat is at highest risk of loss.

Increased monitoring of habitat status, effectiveness of techniques and compliance with regulatory requirements will ensure that programs evolve and improve.

OBJECTIVE 3

MANAGE FISHERIES FOR SUSTAINABLE BENEFITS

In implementing this policy, conservation of wild salmon and their habitat is the first priority for resource management decisions. However, a policy framework that achieved only biological objectives while failing to acknowledge the high value that the salmon resource provides to Canadian society would be incomplete.

DFO has a responsibility to do all it can to provide sustainable harvesting opportunities that will best meet the subsistence needs of First Nations, contribute to social and cultural wellbeing, and provide employment and other economic benefits to individuals and fishery dependent communities. Addressing the imperative to safeguard genetic diversity and, at the same time, optimizing the benefits from harvesting activities is the Department's most fundamental policy challenge, and ultimately will be a key measure of our success.

Under the WSP, a balanced approach to resource conservation is required that accounts for the potential impacts of harvest restrictions on communities and individuals. Some interests will suggest that such balancing is simply a trade-off that threatens the wellbeing of Pacific salmon, but this is not the case. Rather than taking a "win/lose" or human-versus-ecosystem approach, the management process must provide parallel care and respect for the ecosystem and the people within it. The success of salmon resource management should be judged by the achievement of human and ecosystem wellbeing together.

Finding the appropriate balance of social and economic benefits with biological risks, 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, 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

LINKING HABITAT TO WILD SALMON CONSERVATION UNITS AND HARVEST PLANNING

A key response of the regional Habitat Program to the WSP is an increased emphasis on integrated resource planning where fish production and harvest objectives for wild salmon CUs will be linked to the conservation, restoration and development of fish habitat.

Integrated resource planning provides a process under which fish habitat management plans can be reviewed and discussed, and, where possible, integrated with the objectives and plans of other resource managers and stakeholders.

Better integration of habitat requirements with the fisheries resources they support, and with fish management objectives, will allow meaningful habitat protection priorities to be established. It will also ensure that habitat plans are implemented with sufficient knowledge of the current and future demands of other natural resource users.

Strategies to maintain habitat and ecosystem integrity under the WSP will build on existing approaches to integrated resource planning, with a focus on establishing habitat plans consistent with objectives for fisheries and watersheds for priority CUs.

THE APPLICATION OF PRECAUTION IN THE WSP

In the context of WSP decision-making, the principles provided to federal agencies in the Privy Council Office's "A Framework for the Application of Precaution in Science-based Decision Making About Risk" (www.pco-bcp.gc.ca) are adopted. The framework outlines guiding principles for applying the precautionary principle in federal regulatory decisions concerning the environment, health and safety, and the conservation of natural resources. The five general principles for the application of precaution and four applicable principles for precautionary measures are listed below.

Decisions on recovery and fisheries objectives will be made as part of the Strategic Planning Process described under Strategy 4.

General Principles for the Application of Precaution

1. *The application of precaution is a legitimate and distinctive decision-making approach within risk management.*

   The application of precaution to science-based decision-making to manage risk is appropriate when three conditions are met: need for a decision, a risk of serious or irreversible harm, and a lack of full scientific certainty.

2. *It is legitimate that decisions be guided by society's chosen level of protection against risk.*

   Societal values and public willingness to accept risk are key in determining the level of protection.

3. *Sound scientific information and its evaluation must be the basis for applying precaution: the scientific information base and responsibility for producing it may shift as knowledge evolves.*

4. *Mechanisms should exist for re-evaluating the basis for decision and for providing a transparent process for further consideration.*

5. *A high degree of transparency, clear accountability, and meaningful public involvement are appropriate.*

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

In order to achieve the WSP goal and objectives, five strategies are proposed that represent changes to the current approach to salmon and habitat resource management. These changes are intended to strengthen the scientific basis for management, modernize delivery of the habitat management program, and expand integrated resource planning to ensure decisions reflect societal values. The details of each strategy, including major action steps required for implementation, are described below and summarized in Table 1.

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
- Document important habitat by species and life history
- Develop indicators and benchmarks of habitat quality and quantity
- Assess habitat status
- 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 to use in monitoring the status of freshwater ecosystems
- Monitor annual variation in climate and ocean conditions, integrate with assessments of marine survival, and incorporate the knowledge into annual salmon management

4. Integrated Strategic Planning
- Build on and extend present salmon planning structures
- Implement a structured five-stage planning process

5. Annual Program Delivery
- Conduct annual stock assessments
- Conduct annual fisheries planning
- Conduct annual habitat planning
- Conduct annual enhancement planning
- Conduct performance reviews

In implementing each of the strategies, decision-making will be guided by the federal government's Principles for the Application of Precaution and the UN Food and Agriculture Organization's (FAO's) *Precautionary Approach to Capture Fisheries and Species Introductions*.[8]

STRATEGY 1

STANDARDIZED MONITORING OF WILD SALMON STATUS

In order to evaluate whether the WSP goal is being achieved, it is essential to monitor wild salmon status. For instance, are wild salmon populations improving, staying about the same, or deteriorating? Does status vary among species and areas? How does it compare against expectations and targets?

Monitoring wild salmon status in a cost-effective manner will pose a challenge. Since not all salmon demes can be practically monitored, attention will focus on a selection of Conservation Units identified. When groups of CUs are exposed to common threats, the approach will be to monitor a sample of these units. If it is not reasonable to monitor an entire CU, DFO will look for abundance and status indicators within units that can be monitored. Status 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 plans to cost-effectively monitor wild salmon status.

Action Step 1.1:
Identify Conservation Units

All spawning streams and lakes will be aggregated into Conservation Units based on best available science and local knowledge. Work is already underway to determine CUs, and their associated persistent spawning units and populations, for all five species of Pacific salmon. As this work proceeds, it will be assessed though peer review processes established by the Pacific Scientific Advice Review Committee (PSARC). This structured review body allows for participation by outside experts, First Nations, fisheries stakeholders and the public. As new information is obtained, CUs will be adjusted to ensure adherence to the WSP objectives.

Identifying which CUs are exposed to particular fisheries and other risk factors will also be an ongoing process involving PSARC review. Lists of CUs with common risk factors will need to be adjusted since these factors will change over time.

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

Evaluation or assessment procedures will vary across species and CUs, and will build on existing programs (e.g., abundance of juvenile salmon, catch per unit effort at a test fishery) and local partnerships (e.g., First Nation agreements, local Streamkeeper initiatives). Procedures will be consistently executed and will reflect a long-term commitment to the management of those local salmon resources.

THE APPLICATION OF PRECAUTION IN THE WSP (cont'd)

Principles for Precautionary Measures

1. *Precautionary measures should be subject to reconsideration, on the basis of the evolution of science, technology and society's chosen level of protection.*
2. *Precautionary measures should be proportional to the potential severity of the risk being addressed and to society's chosen level of protection.*
3. *Precautionary measures should be non-discriminatory and consistent with measures taken in similar circumstances.*
4. *Precautionary measures must be cost-effective, with the goal of generating (i) an overall net benefit for society at least cost and (ii) efficiency in the choice of measures.*

   The real and potential impacts of making a precautionary decision (whether or not to act), including social, economic, and other relevant factors, should be assessed.

THE PACIFIC SCIENTIFIC ADVICE REVIEW COMMITTEE (PSARC)

PSARC is the Pacific Regional body responsible for the review and evaluation of all scientific information on the status of living aquatic resources, their ecosystems, and on biological aspects of stock management (www.pac.dfo-mpo.gc.ca/sci/psarc/Default.htm) It advises DFO's Resource Management Executive Committee and other bodies on stock and habitat status and the potential biological consequences of fisheries management actions and natural events.

PSARC's Salmon Subcommittee serves as the primary regional forum for peer review and evaluation of scientific research and literature, as well as traditional ecological knowledge, on wild Pacific salmon. Subcommittee meetings are open to outside representatives from academia, First Nations, stakeholders, other government or private institutions, and the general public. As such, the PSARC process is well structured to provide peer review of the identification of conservation units under the WSP.

BIOLOGICAL STATUS ZONES AND MANAGEMENT RESPONSE

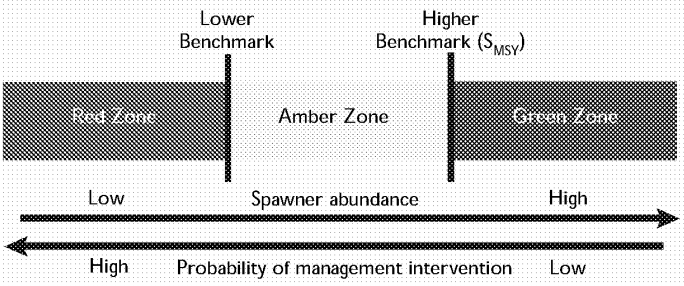
Having a Conservation Unit in the Red Zone is undesirable. A CU in the Red Zone should trigger an immediate consideration of ways to protect the unit, increase its abundance and reduce the potential risk of loss (see further under Strategy 4).

The Amber Zone 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 risk of extirpation. It may also be a suitable recovery objective for units listed under SARA.

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

Local knowledge of all parties dedicated to assessment of the CU will be considered in developing each procedure, and results from all assessment procedures will be documented.

***Figure 5* Benchmarks and biological status zones**



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

The biological status of a CU will normally be based on the abundance of spawners in the unit, or some proxy thereof. However, when a CU is comprised of more than one population, it will be necessary to monitor how abundance is distributed among the populations. For each CU, two benchmarks will be defined that will delimit three status zones: green, amber and red (Figure 5). Moving from the Green Zone to the Red Zone, as spawner abundances decrease, the likelihood and intensity of management responses will escalate.

CUs in the Green Zone can sustain fisheries, provide ecosystem benefits, and are the preferred state under the Wild Salmon Policy. However, it is recognized that there will sometimes be environmental and/or socioeconomic reasons why the abundance of a CU will be in the Amber Zone. Decisions about management actions to safeguard CUs in the Red Zone and increase spawner abundance will be made in a structured and transparent way (see Strategy 4). While the intent will be to protect the CU, in practice our ability to restore production may be limited by the cause, and the management response will need to be considered on a case-by-case basis. If an analysis concludes that production cannot be restored, or that the consequences of doing so are unacceptable, other alternatives will be considered. Any such decisions will be made by the Minister, and the rationale publicly explained.

The lower benchmark will be established to ensure that there is a low probability of the Conservation Unit being recommended for listing by COSEWIC. The intent will be to identify and react to vulnerable CUs before they decline to a level where such a listing might occur. There is no single or simple formula to use for selection of the 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:

a) The spawning escapement required to produce 10% of maximum juvenile production;

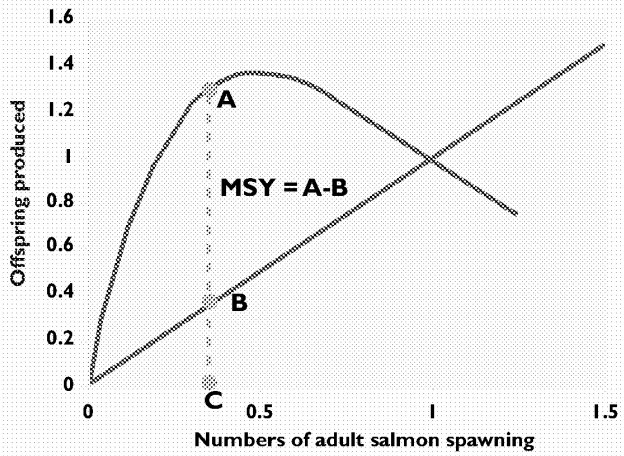
b) Spawning escapement estimated to permit recovery to Maximum Sustainable Yield (MSY) with an agreed probability within an acceptable period of time;
c) The abundance and distribution of spawners within a CU sufficient to provide confidence that populations are not in jeopardy from environmental variation; and
d) A proportion of the number of spawners (S) estimated to provide MSY (e.g., 25% S_{MSY}).

The higher abundance benchmark is the number of spawners estimated to provide MSY, or a proxy thereof. A proxy might be 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.

Benchmarks associated with MSY are widely used by fisheries scientists and can often be readily calculated. However, the estimation of MSY values requires a historical set of spawner and progeny production information, and is seldom available for all populations within a geographic area. To address this deficiency, stock assessment programs may identify Indicator Systems (IS), or streams that are assumed to be representative of other streams within the area.

An IS would reflect the total return to a Conservation Unit and thereby serve as a barometer for annual changes in production expected for the entire unit. The assumption that an IS is representative of all streams in a CU introduces a degree of uncertainty. This issue will be addressed in the assessment strategy for the CU, which will likely involve detailed abundance surveys in the IS(s) in conjunction with less rigorous surveys in other streams. The assessment strategy will allow the distribution of spawners among spawning sites to be monitored, and the relationship between changes in the indicator and the remaining streams assessed.

Figure 6 **Example of a Ricker stock-recruitment function**



MAXIMUM SUSTAINABLE YIELD

For many years, Pacific salmon have been managed by identifying the number of adults that should spawn to produce the maximum number of offspring for harvest in the next generation. The production function relates the number of spawners to the estimated number of offspring they produce. In Figure 6, the curved line shows the estimated function and the straight line the replacement equation (offspring = numbers of spawners). A management target has been to identify the "optimal number of spawners" **C** *(S_{MSY}) that is expected to produce* **A** *number of offspring. The difference between* **A** *and the number of fish needed to replace the spawners* **B** *has been called the Maximum Sustainable Yield (MSY) – on average the maximum number of fish that can be harvested on an sustained annual basis.*

However, the production function for each salmon population differs to some degree, and all production functions vary over time depending on climate and ocean conditions. A significant change under the WSP will be to acknowledge the differences between populations and over time, and to protect the diversity of populations as well as the yield from larger populations.

Action Step 1.3:
Monitor status of CUs

Annual results from assessment system monitoring and comparisons with the two benchmarks will be used to categorize CUs into one of the three biological status zones. Status determinations will help to guide resource management planning and ongoing stock assessment activities.

When a CU is in the Green Zone, a detailed assessment of its biological status will not normally be needed. In the Amber Zone, such an assessment may be necessary as input for the consideration of Strategies 2 and 3 below. If the CU is in the Red Zone, a detailed status assessment, which will consider the role of fishing and habitat in determining status, will normally be required.

STRATEGY 2

ASSESSMENT OF HABITAT STATUS

Maintaining the integrity and productivity of habitat necessary to sustain Pacific salmon depends on good science, the timely stipulation of measures to prevent habitat disruption, and effective compliance with regulatory requirements. However, experience has demonstrated that these prerequisites alone will not provide assurances that habitat objectives will be met.

Success in sustaining habitat requires that traditional regulatory strategies be complemented by a more comprehensive and strategic approach. The Habitat Management Program must evolve to link watershed protection and stewardship initiatives with fish production initiatives, through habitat assessment and planning. It must be able to assess the effectiveness of regulatory measures and track changes in habitat status over time, in order to set priorities and guide regulatory interventions. Strategy 2 is intended to address these needs, and improve the effectiveness of habitat protection.

Under this strategy, habitat status for wild salmon will be assessed in a series of steps using science-based indicators and benchmarks to measure habitat condition and identify significant threats to important habitats. Selected indicators that are reflective of overall habitat fitness will be monitored and, over time, an integrated database will be developed to assist habitat planning. The assessment will identify important habitat and its status, and will highlight habitat constraints to wild salmon production on a watershed and Conservation Unit scale. This information will serve as a key input to integrated strategic planning (Strategy 4), where management actions for protecting or rebuilding wild salmon are established to complement fisheries and harvest planning objectives.

Action Step 2.1:
Document important habitat by species and life history.

Habitat requirements for Pacific salmon vary by species, life history phase and geography. While much is known about these requirements, the knowledge has not been effectively consolidated and is not easily available to developers, watershed planners and regulatory staff. A synthesis of this knowledge into a generic compendium that identifies important habitat to sustain the five

salmon species in freshwater, estuarine and marine environments will be prepared. The resulting document will assist in watershed planning and stewardship, and will serve as an effective initial guide for habitat management decisions. It will also be a valuable educational tool for informing developers, the public and other interests about habitat that is important to sustaining salmon, and for promoting more effective planning of work near the water.

Action Step 2.2

Develop indicators and benchmarks of habitat quality and quantity.

The first step in implementing a more holistic approach to habitat management is the ability to assess and document habitat condition and to monitor changes over time. This will be achieved by progressively developing generic indicators of habitat status, and establishing benchmarks that delineate acceptable and unacceptable ranges for each indicator. In effect, we must understand what needs to be measured to determine habitat fitness, and what standards represent good or poor conditions.

The identification of indicators to assess habitat condition will be guided by species and life history requirements highlighted in the compendium described in Action Step 2.1. Indicators may include aspects such as water quality, temperature, stream flow, riparian functions and habitat productivity. Appropriate characteristics will also be selected for estuarine and marine environments. As well, biological indicators (e.g., length frequency distribution of salmonids in the habitat, fish and invertebrate densities) will be defined. Benchmarks reflecting the desired range for key indicators will also be developed. Once completed, the indicators and benchmarks will provide the yardsticks for measuring habitat conditions within a watershed.

Action Step 2.3

Assess habitat status.

The status of habitat within a watershed will be assessed to provide a snapshot of existing conditions using the yardsticks (indicators and benchmarks) described in Action Step 2.2. This assessment will be developed using available 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. In addition to documenting the habitat condition, information will be compiled on factors that threaten the health and productivity of important habitats. Habitat status will be evaluated by comparing existing conditions against the benchmarks to provide a picture of habitat wellbeing.

The integration of information on habitat status will provide three key inputs to guide the operational implementation of the habitat management program. It will identify:

- Important habitat in need of protection to maintain the productivity of a CU;
- Habitat risks and constraints that are adversely affecting that productivity; and

THE ROLE OF ENHANCEMENT AND CUs

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 time frame 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.

- Areas where habitat restoration or rehabilitation would be desirable to rebuild 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 be developed to 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 habitat condition.

The 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 a watershed or CU. This monitoring, in conjunction with the habitat assessment, will inform integrated strategic planning and guide annual operating programs for habitat management. Where habitat monitoring shows a decline in habitat quality or quantity over time, efforts will be made to identify the causes for the decline, and response measures will be considered as part of an integrated management plan for the Conservation Unit (Strategy 4).

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 for the collection and dissemination of information on fish habitat status. The Province has an extensive data system describing watersheds and habitat conditions with which the Department could connect to provide an integrated fish and habitat data system for BC. An improved ability to share and cooperatively utilize information will enable the timely assessment and reporting of habitat status for CUs. Over time, it would 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 the delivery of DFO's responsibility for protecting salmon habitat. The changes will not be implemented overnight, but will be introduced progressively. While these adjustments will require substantial time and energy, the investment will be worthwhile. The reshaping of the program should enhance regulatory responsiveness and effectiveness, strengthen linkages between habitat protection and fish production objectives, and provide guidance to watershed planning initiatives.

STRATEGY 3

INCLUSION OF ECOSYSTEM VALUES AND MONITORING

The role 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) has now clearly 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 fitness of adult spawners (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 target abundance of salmon across populations within a CU will also benefit related ecosystems. However, achieving these targets is only partially under our control.

Survival rates from when salmon enter the sea and return to coastal waters as adults have been measured to vary by more than a hundred fold (even a thousand fold 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.

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 this gradual 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 the key parameters that are indicative 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. It is anticipated that research will be needed on indicator systems (see Action Step 1.2) to identify appropriate parameters for monitoring and assessment.

In the broader perspective of freshwater and marine ecosystems, networks of freshwater indicator systems are being discussed internationally to assess the magnitude and spatial scale of changes in climate and ocean conditions on salmon production. Linking variations in salmon returns to changes in the marine ecosystems requires large-scale monitoring programs that are potentially costly and likely 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 effect 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.

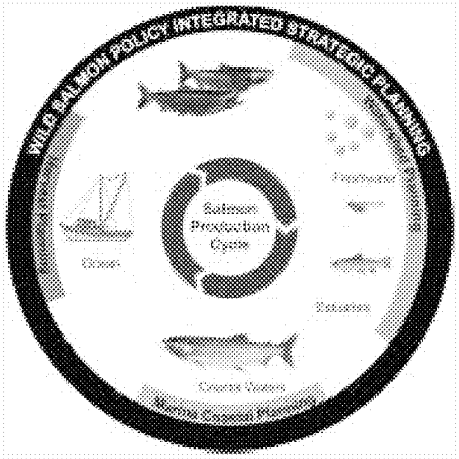
A more holistic view of salmon production and its determinants, from egg to spawning adult, is necessary to more accurately direct management actions and effectively conserve the Pacific salmon resources in an uncertain future.

STRATEGY 4

INTEGRATED STRATEGIC PLANNING

Integrated planning for the conservation of wild salmon involves balancing harvest, land and water use decisions to ensure that the benefits from the resource can accrue to Canadians in perpetuity. How people throughout BC and the Yukon will contribute to these decisions, and how integrated plans that reflect their values can be developed, is the central theme of Strategy 4.

Figure 7 **Wild Salmon Policy integrated strategic planning**



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

Strategies 1, 2 and 3 are important in providing essential scientific information to meet the objectives of the Wild Salmon Policy; however, good science is not enough. Salmon and the conservation of wild populations potentially touch everyone within their range. Successful conservation and sustainable benefits from fisheries requires cooperation and the balancing of objectives among user groups, communities and governments, as much as it does good science. Historically, salmon planning has fallen short of these needs, largely due to the scope of the issues and differences between the groups involved.

The life cycle of wild salmon necessitates a fully integrated planning process that addresses salmon conservation from the eggs in the gravel in parental generations to the eggs produced by their offspring (see Figure 7). The most demanding challenge in implementation of the Wild Salmon Policy is integrating the goals for salmon production and the management of watersheds, coastal areas and fisheries, and balancing these goals with social and economic objectives that reflect people's local and regional values and preferences.

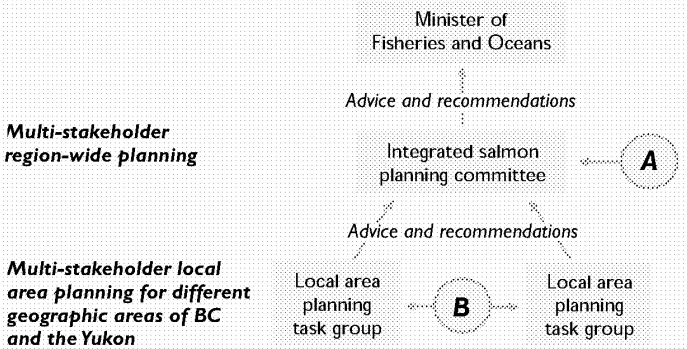
Strategy 4 is intended to address this challenge and produce integrated longer-term strategic plans that will guide the management of fisheries and development within watersheds. It includes proposals to augment consultative arrangements and implement a structured five-stage process for developing strategic management plans on a geographic basis. Outcomes of these plans will include biological objectives for salmon production from Conservation Units and, where appropriate, anticipated timeframes for rebuilding, as well as management plans for fisheries and watersheds, which reflect decision processes involving First Nations, communities, environmental organizations, fishers and governments.

Action Step 4.1:
Build on and extend present salmon planning structures.

Local and region-wide input on fisheries and watershed objectives and conservation needs will be essential to ensure that strategic plans balance the needs of the resource and those of people. To do so, the Department proposes to build on and extend the integrated salmon harvest planning structures currently under development in the Pacific Region.

An Integrated Harvest Planning Committee has already been formed that 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 more localized 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 overall structure of this Committee and its linkages to local communities and individuals interested in the wild salmon resource make it an appropriate starting point for obtaining and coordinating local input into watershed and marine planning processes. However, to effectively play this broader role as an Integrated "Salmon" Planning Committee for the entire Pacific Region, the current balance of interests on the "Harvest" Planning

***Figure 8* Integrated planning for Pacific salmon**



A Representatives from all commercial gear and area license committees, the Sports Fish Advisory Board (FAB), First Nations, the Marine Conservation Caucus and the Province of British Columbia

B Representatives from appropriatecommercial gear and area license committees, SFAB local committees,individual First Nations, local communities and local stewardship groups and other watershed interests

Example:
Local Area Planning Task Groups could be established for the Skeena River, Fraser River, West Coast of Vancouver Island, and so on.

Committee may need to be augmented. This issue will be considered as part of the public consultations on the Wild Salmon Policy.

In addition, it will be essential that the Integrated Salmon Planning Committee build on its linkages with communities and interest groups to obtain local input on fisheries and watershed objectives and conservation needs. This should be done through the establishment of local planning groups that include fishing, community and watershed interests. As an example, these local task groups could take a similar form to the multi-stakeholder Skeena Watershed Committee that successfully operated during the early 1990s. A number of such groups will be needed to cover the different geographic regions of BC and the Yukon[9] An overview of this planning structure is provided in Figure 8.

DFO recognizes that its responsibilities do not cover all aspects of land and water use. In BC and the Yukon, however, the vast majority of developmental uses will likely influence Pacific salmon. This proposal enables the Department to proceed immediately with implementing the WSP, and provides an initial step towards more integrated watershed and fisheries planning. While it will take some time for the planning structure to become fully established and mature, substantial progress towards more integrated planning can be achieved right away.

Action Step 4.2:
Implement a structured five-stage planning process.

Salmon management is complex involving five species, 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 overlap both between fisheries and among species within watersheds, planning at the level of individual CUs is unrealistic. For management purposes, the multiple species, CUs, watersheds, users and fisheries will need to be aggregated in a practical way. These planning units can then facilitate the application of the five-stage planning sequence described below to arrive at reasoned and balanced decisions on fisheries and watershed activities in local areas. A more detailed discussion of the potential Management Planning Units that may be used for Pacific salmon is provided below.

Stage 1 – Identify planning priorities

DFO staff will provide, for appropriate Management Planning Units (MPUs), overview reports that identify the Conservation Unit(s) exploited by fisheries within the planning unit and summary information on their biological status (red, amber or green, as per Action Step 1.2). Key habitat and ecosystem constraints and/or threats to individual CUs will also be summarized on a watershed basis. For those CUs of significant conservation concern (i.e., within a Red Zone), more detailed peer reviewed reports will also be provided as they become available. The reports will be peer reviewed through PSARC and will consider and incorporate Aboriginal Traditional Knowledge (ATK).

Management Planning Units (MPUs)

MPUs are an organizational construct needed for practical resource management planning that will link watersheds and Conservation Units to the fisheries that affect them. These planning units may include single fisheries or groups of fisheries that can be planned and managed together and that target and pose a common risk to either individual Conservation Units or aggregates of different CUs in one or more watersheds. MPUs permit all of the relevant information on the status of individual CUs and their habitat to be collated, and the potential impact of fisheries and watershed activities across units to be considered within the planning process.

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

FISHING AREA

Local Fisheries	Target Species					Watersheds
	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 Management Planning Units	12	8	10	14	12	

The above chart indicates a potential total of 56 Management Planning Units for Pacific salmon. However, MPUs may be further aggregated or subdivided from those above 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, the MPU may 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 these fisheriese

The overview reports and more detailed peer reviewed information will be used in consultations with local and regional stakeholders, through the Integrated Salmon Planning Committee, to identify fisheries and watershed planning priorities for each of the MPUs. These priorities will be established 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.

Stage 1 will provide lists of specific key priorities to be addressed in the development of integrated salmon management plans for the various MPUs.

Stage 2 – Identify resource management options and alternative management strategies

Local fishery stakeholders and watershed-based interests through the Integrated Salmon Planning Committee will play a central role in developing, reviewing and finalizing lists of management options for consideration[10]. The various management options that are identified will then be used to develop a range of management alternatives for the MPU. In some cases, a management alternative may reflect a single management option (e.g., reduced fishing), but in many cases it may involve a combination of different management options (e.g., some reduced fishing and some habitat rehabilitation).

The outcome of Stage 2 will be a number of management alternatives that reflect a realistic range of different approaches to addressing the management priorities for each planning unit.

Stage 3 – Establish biological, social and economic performance indicators

Weighing and evaluating the management alternatives will require the development of explicit, measurable performance indicators for different planning units (see the box below for some examples of biological, social and economic indicators). These indicators will be needed to rate and rank the management alternatives before making decisions, and to assess performance over time after decision-making. A decision on the most appropriate management alternative will involve finding the best balance among 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. For this reason, it will be important that the measurable indicators used in the planning process reflect broad social input.

The key role in identifying these performance indicators will be assigned to local and regional fisheries and watershed interests through the Integrated Salmon Planning Committee. The outcome of Stage 3 will be credible, broadly accepted management assessment frameworks for each planning unit that capture and reflect all significant biological, social and economic considerations.

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 conservation unit 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 conservation unit) may be adequate. Similarly, the projected harvest by the single user group may be adequate as a single social and economic indicator.

Selecting indicators will be much more difficult where the fishery planning unit is large and encompasses harvesting a complex mix of different conservation units by a range of different and geographically distinct interest groups. For example, Skeena River and Fraser River sockeye fisheries involve the mixed harvesting of numerous distinct conservation units. In addition, the fish are harvested by a wide range of coastal and interior First Nations, commercial and recreational fishers. Each of these groups exploit a mixture of the conservation units and the individual harvests need to be carefully linked and coordinated.

Some example indicators that could be used in the planning complex fisheries such as these are outlined below.

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

Wild Salmon Policy Objectives	Planning Priorities	Possible Measurable Indicators
Safeguard the genetic diversity of wild salmon	Ensure an acceptably high probability of exceeding lower population benchmarks	Number of Conservation Units where Probability exceeds 5% of falling below the established lower benchmark
Maintain the integrity of wild salmon habitat and ecosystem	Ensure an acceptably high probability of exceeding the established higher population benchmarks	Number of Conservation Units where the probability exceeds 50% of rising above the established higher benchmark
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 the "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

Stage 4 – Assess the likely impacts of management alternatives

At this stage, the various management alternatives identified in Stage 2 will be evaluated using the performance indicators developed in Stage 3. In assessing the different management alternatives for each planning unit, it will be important for the evaluation process to be forward-looking and focused on their likely "future" impacts (both positive and negative). This will require predicting the likely effects of the various alternatives on each of the selected biological, social and economic 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, in order to facilitate comparison between the alternative approaches identified. An illustrative summary of anticipated outputs from this type of analysis is outlined below.

Stage 5 – Select the preferred management alternative

Predicted future outcomes of the resource management alternatives from Stage 4 will inform discussions on the preferred management approaches for each Management Planning Unit at both a local level and at the Integrated Salmon Planning Committee. 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.

Based on constructive dialogue and input from the local task groups, the Integrated Salmon Planning Committee will be encouraged to provide consensus recommendations to the Department for all planning units.

In the absence of consensus, differences of view will be fully documented by the Committee and provided to DFO to inform final decision-making. The Minister of Fisheries and Oceans will consider the input received and will make the final decisions for these cases. Public records of all decisions will be made available.

Achieving consensus on how to address conservation concerns while balancing social and economic impacts of alternative management actions is the most fundamental challenge in successfully managing wild salmon. The process described in this strategy will explicitly encourage the pursuit of innovative solutions; however, acceptable outcomes are not unbounded. These outcomes must be consistent with the principles and objectives underlying the WSP, and management actions will be measured by the degree to which they advance the overall policy goal.

Potential Impact Summaries for a Hypothetical Management Planning Unit

The hypothetical planning unit includes First Nations (food, social and ceremonial) and Commercial harvesting of 3 Conservation Units located within a single watershed. The current biological status of the 3 conservation units varies widely with Conservation Unit 3 already within the red zone and Conservation Unit 2 within the amber zone but with indications that abundance is declining over time. Conservation Unit 1 appears to be healthy and indications are that it is currently within the green zone. Summary reports are provided that reflect two different sets of indicators.

Summary I

	Biological Indicators			Social and Economic Indicators		
	Probability that CU 1 will be less than its lower benchmark within 3 generations	Probability that CU 2 will be less than its lower benchmark within 3 generations	Probability that CU 3 will be less than its lower benchmark within 3 generations	Projected food, social and ceremonial harvest over 3 generations (salmon)	Projected commercial harvest over 3 generations (salmon)	Projected total harvest over 3 generations (salmon)
Base case: Status quo management	1%	68%	100%	10,141	125,877	136,018
Management alternative 1	0% (Impact = minus 1%)	50% (Impact = minus 18%)	92% (Impact = minus 8%)	14,338 (Impact = plus 4,197)	120,570 (Impact = minus 5,307)	134,908 (Impact = minus 1,110)
Management alternative 2	0% (Impact = minus 1%)	28% (Impact = minus 40%)	53% (Impact = minus 47%)	20,672 (Impact = plus 10,531)	97,883 (Impact = minus 27,994)	118,555 (Impact = minus 17,463)
Management alternative 3	0% (Impact = minus 1%)	13% (Impact = minus 55%)	16% (Impact = minus 84%)	29,533 (Impact = plus 19,392)	59,725 (Impact = minus 66,152)	89,258 (Impact = minus 46,760)

Potential Impact Summaries for a Hypothetical Management Planning Unit

Summary 2

	Biological Indicators			Social and Economic Indicators		
	Probability that CU 3 will be less than its lower population benchmark	Probability that CU 3 will fall below 100 spawners within 3 generations	Probability that CU 3 spawners will decline by 30% or more within 3 generations	Projected food, social and ceremonial harvest over 3 generations (salmon)	Projected commercial harvest value over 3 generations ($ present discounted value)	Projected total harvest over 3 generations (salmon)
Base case: Status quo management	100%	8%	49%	10,141	$850,738	136,018
Management alternative 1	92% (Impact = minus 8%)	1% (Impact = minus 7%)	20% (Impact = minus 29%)	14,338 (Impact = plus 4,197)	$816,945 (Impact = minus $33,793)	134,908 (Impact = minus 1,110)
Management alternative 2	53% (Impact = minus 47%)	0 (Impact = minus 8%)	3% (Impact = minus 46%)	20,672 (Impact = plus 10,531)	$666,988 (Impact = minus $183,750)	118,555 (Impact = minus 17,463)
Management alternative 3	16% (Impact = minus 84%)	0 (Impact = minus 8%)	less than1% (Impact = minus 48% plus)	29,533 (Impact = plus 19,392)	$413,907 (Impact = minus $436,831)	89,258 (Impact = minus 46,760)

The first summary report indicates that the key conservation issue for management planning relates to Conservation Unit 3. Under status quo management, there is certainty (100% probability) that the CU 3 population will fall below its lower population benchmark. Increasing restrictions on the commercial harvest under Management Alternatives 1 through 3 results in steady improvement in this biological indicator. Under the most restrictive management approach (Alternative 3), the probability that the population will be below the lower population benchmark declines to 16%.

However, the related social and economic cost of this alternative is a substantial predicted reduction in both the commercial and total harvest (minus 66,152 pieces and minus 46,760 salmon, respectively). The key question for stakeholders will be whether the lower risks to CU 3 (and, to a lesser extent, to CU 2) associated with the most extreme conservation measures are in balance with the foregone harvest from the planning unit as a whole. The second summary report indicates that less extreme harvesting restrictions (e.g., under Management Alternative 2) effectively eliminate the probability that the CU 3 population will fall below extremely low levels (i.e., 100 spawners) and reduce the probability of further substantial decline in the population to very low levels (i.e., there is only a 3% probability that the CU 3 population will decline by greater than 30%).

The strategic planning process is intended to identify and react to vulnerable CUs before they decline to a level where their status is threatened. Resource management decision-making will be guided by the precautionary approach, and will adhere to the principle that conservation is a first priority. While the policy's aim is to maintain CUs to the fullest extent possible, it recognizes two circumstances where there may be losses of wild salmon. First, the loss of some localized groups of salmon within a CU may occur, but by preserving the larger unit such losses can be restored through natural straying from adjacent components within the CU. Second, where an assessment indicates that conservation measures will be ineffective, or the social and economic costs to maintain or rebuild a Conservation Unit are excessive relative to modest conservation benefits, the Minister of Fisheries and Oceans may decide to forego active measures to maintain and rebuild the CU. Such decisions will be made openly and transparently, and the rationale will be clearly explained.

The decisions made for each planning unit will collectively form a strategic plan for the management of fisheries and watersheds that addresses the conservation issues of the wild salmon resource and the social and economic importance of salmon fisheries. This plan will include a combination of 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 the resource.

The progress made towards achieving the targets will be reviewed on an annual basis (as described in Strategy 5 below) 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 objectives of the Wild Salmon Policy.

STRATEGY 5

ANNUAL PROGRAM DELIVERY

Modern planning approaches recognize that the goals of strategic plans are achieved over a number of years and therefore embed annual operational and business planning cycles within a longer-term strategic plan. The strategic plan described in Strategy 4 will establish the overall objectives for the future and the various approaches that will be followed to achieve them. The specific short-term actions required will be reflected in annual operational plans.

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.

Action Step 5.1:
Conduct annual stock assessments.

A key requirement of the WSP is ongoing monitoring and assessment of the status of wild salmon populations at the Conservation Unit level. This will require the periodic assessment of abundance for each CU in relation to its benchmarks. A range of assessment approaches will meet this need in the most cost-effective manner possible. The CU status will generally determine the frequency and intensity of the assessment effort. For example, when a CU falls within the Red Zone, ongoing annual assessment of its status may be required.

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 accounting for information on catch and spawning escapement, and linked to the habitat database (to be developed), so that threats or impacts can be identified and monitored.

Action Step 5.2:
Conduct annual fisheries planning.

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 for the fisheries within each MPU. 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 also be explicitly linked to these management measures. The operational targets and performance measures will be the basis of 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 decision rules. While the inevitable uncertainties and variation in fish availability associated with natural survival cannot be eliminated, 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:
Conduct annual habitat planning.

The operational delivery of habitat management program objectives will be achieved through the development of annual work plans that set priorities, assign resources and specify performance targets. These work plans will shift from being largely reactive, in response to project proposals, to being more strategic, in response to habitat assessment

and monitoring results (Strategy 2) and management actions identified for the protection of CU's (Strategy 4).

Integrated plans will identify important habitat for salmon production needing protection, or degraded habitat needing rehabilitation to complement the achievement of fish production objectives. Annual work plans for the Habitat Management Program will stipulate the habitat protection, restoration and enforcement priorities required to help meet overall objectives for Conservation Units. They will also inform watershed restoration and habitat enhancement projects conducted by volunteers and stakeholder groups. Habitat assessment and monitoring will feed back into the Habitat Management Program to evaluate the adequacy of habitat protection measures, as well as compliance, and to guide future program improvements. This new 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:
Conduct annual enhancement planning.
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 be of more than one year's duration, but on an annual basis production targets and strategies will be prepared and/or reviewed for each project to make certain that they are consistent with the CU objectives. Adult production will be assessed to ensure adherence with the rebuilding schedule and enhancement guidelines and practices. Priority projects will be for those 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.

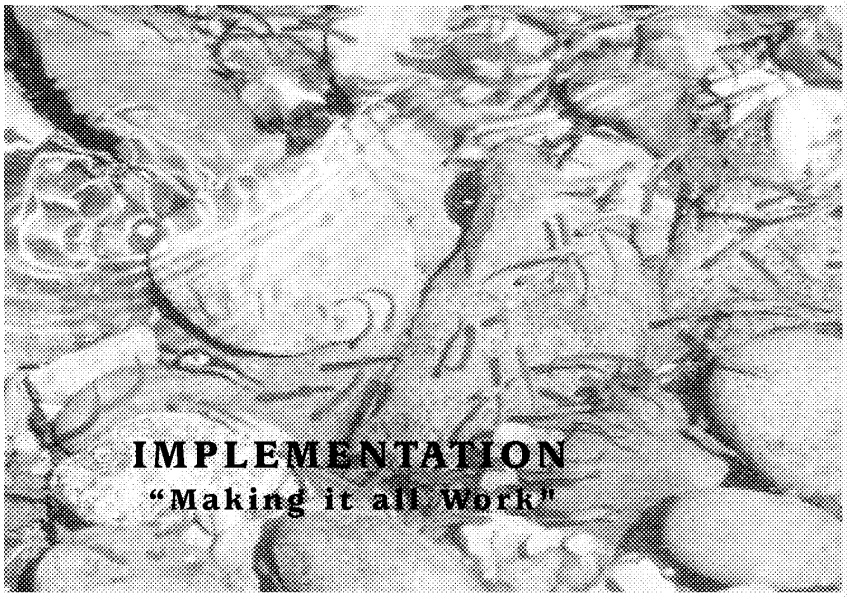
Action Step 5.5.
Conduct performance reviews.
The purpose of performance review is to determine what is and is not working, and to enable continuous improvement over time. Performance review under the Wild Salmon Policy will borrow heavily from procedures that are being adopted more generally in fisheries management planning throughout Canada. These procedures involve three levels of evaluation that can provide comprehensive guidance with respect to required changes over time.

The first two levels of evaluation will provide more immediate feedback and will form the basis for short-term performance improvements. The first level will evaluate 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 feet of habitat rehabilitation. Again, regardless of the targets, whether they were achieved needs to be known.

Annual post season reviews of stock assessment, fishing, habitat and enhancement work plan implementation will incorporate these two levels of evaluation. The outcome will be recommendations on adjustments for the next season. Annual results will feed into longer-term improvements to the strategic plan, as considered by 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 case of the WSP, the key issue is whether 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 the salmon resource, its habitat and ecosystem. The outcome will be recommendations for improvements to the overall strategic plan for the resource.



IMPLEMENTATION
"Making it all Work"

The five strategies proposed in the Wild Salmon Policy represent a set of mutually dependent activities that must work together for the policy 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 selected that address conservation concerns 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.

The process is complex, in keeping with the challenge of salmon management, and full implementation will clearly 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 DFO's research, enforcement and Aboriginal programs. All of these activities, ongoing and new, must be accomplished within the envelope of available funding.

There is one further requirement for successful policy implementation. No matter how strong the Department's commitment to implementing the WSP, ultimate success will demand better collaboration with all of the groups and individuals having an interest in the resource. First Nations, streamkeepers, volunteers and fisher 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. More effective cooperation with partners will be an important ingredient for future success.

IMPLICATIONS OF THE POLICY

The key implications of the Wild Salmon Policy are summarized as follows.

1. HARVEST MANAGEMENT PRACTICES

- The WSP's implications for harvest management will vary across salmon species.
- There will likely be few impacts on the management of chum and pink salmon, as these fisheries currently target smaller population units than may be identified as Conservation Units under the Policy.
- Some modest impacts could result for the management of coho and chinook salmon.
- Impacts on sockeye management could be major, since these fisheries currently target population aggregates that likely encompass numerous CUs.
- The Policy 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.

2. SALMONID ENHANCEMENT PROGRAM

- The enhancement program will continue to evolve towards greater emphasis on community stewardship, habitat restoration and rebuilding of priority CUs.
- Enhancement may continue to provide harvest opportunities and fishery benefits as part of an integrated strategic plan. Where there are targeted fisheries supported by enhancement, funding constraints may require that beneficiaries contribute towards the cost of production.

- The risks of hatchery production to wild salmon will be assessed through the development of a biological risk assessment framework.

3. HABITAT MANAGEMENT PROGRAM

- The Habitat Management Program will be adjusted to improve the link between watershed protection and stewardship initiatives and fish production objectives by shifting emphasis to habitat assessment and 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 to assess the effectiveness of regulatory interventions.
- An integrated data system for the collection and dissemination of information on fish habitat status will be developed and maintained.
- 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 effectiveness of habitat management in sustaining fish production.

4. 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 for each Pacific salmon species.
- Stock assessment programs will have to develop monitoring programs for population and spawning diversity within CUs, and to conduct stock (i.e., CU) assessments at appropriate geographic scales.
- New programming will emphasize the status of CUs, identification of benchmarks for abundance, understanding of changes to productivity and distribution, and the development of risk management tools to guide decision-making.
- New programs will be required in science and assessments to meet the commitments to incorporating ecosystem and habitat status reviews within CU assessments.
- More partnerships will be necessary with public and private groups to collect required data, given the expanded monitoring needs and constraints on available funding.

5. SPECIES AT RISK

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

6. AQUACULTURE

- If specific Conservation Units of wild salmon are threatened by aquaculture operations, corrective actions may be taken under Section 35 (fish habitat) or Section 56 (fish transfer licensing) of the *Fisheries Act*.
- Alternatively, if an aquaculture operation affects demes of wild salmon but does not threaten the existence of the CU, then responses may be determined through an area-based planning process.

7. FIRST NATIONS FISHERIES

- First Nations fisheries and fishing rights will not be impacted by the Wild Salmon Policy.
- 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.
- Subject to conservation needs, the Department will continue its efforts to manage fisheries such that First Nations fishing for food, social and ceremonial purposes has priority over fishing by other harvesters.
- Where treaty rights exist (such as under the Treaty with the Nisga'a First Nation) or are established in the future, fisheries will be managed in a manner consistent with the treaty provisions.

CONCLUSION

Over 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. Although harvest management has adapted to changing circumstances, it is clear that a more fundamental reshaping of policy and programs is required if we are to successfully 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 in order to provide for a more robust resource and sustainable fisheries for the 21st century. 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 wellbeing.
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 science, and must incorporate a balanced assessment of biological objectives and risks with social and economic considerations.
5. Decisions have to be made using open and accountable public processes to ensure that they reflect societal 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 energy and resources by the Department, 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.

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 wise use of the salmon resource for the long-term health and productivity of wild populations.

Conservation Unit (CU). A group of wild salmon that is sufficiently isolated from other groups that, if extirpated, is very unlikely to recolonize naturally within an acceptable time (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 and demes may be partially isolated from one another. Their partial isolation may or may not be persistent over generations.

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

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 fish culture techniques are considered enhancement.

Escapement. The number of mature salmon that pass through (or escape) the fisheries and return to their rivers of origin to spawn.

Extirpate. 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 less than a year old.

Genetic diversity. For a species, the sum of the genetic variation within the species, which includes both variability among individuals within a population and differences among populations.

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 a productive fisheries resource.

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.

Juvenile. Salmon older than fry that are sexually mature.

Maximum sustainable yield. 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. Five salmon species of chinook, chum, coho, pink and sockeye belonging to the *Oncorhynchus.*

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, the 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 upon which fish depend.
Riparian functions.

Riparian zone. The band of land beside a stream or other body of water.

Salmonid. A group of fish that includes salmon, trout and char, belonging to the 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 bycatch unharmed.

Species. A taxon of the rank of species; in the hierarchy of biological classification the category below genus; the basic unit of biological classification; the lowest principal category of zoological classification.

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 man-agement choices.

Watershed-based Fish Sustainability Planning.

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

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 BC 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:

- BC 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 BC 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 BC commercial catch; and
- Spawning escapements in BC 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."*[11]

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 alternation, 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***[12] 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 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.

POLICIES AND PROGRAMS

In 1986, DFO introduced the ***Policy for the Management of Fish Habitat***[13] 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.[14] 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***[15] 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***[16] 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***[17] 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.[18] 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.

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

[2]*Slaney et al. (1996), "Status of anadromous salmon and trout in British Columbia and the Yukon."* The numbers reported in the paper have been adjusted to exclude steelhead, which are not covered by this policy. Of the populations identified, 43% could not be classified because of a lack of reliable data on their status.

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

[4]See www.cosewic.gc.ca COSEWIC is the Committee on the Status of Endangered Wildlife in Canada that works at arm's length from the Government of Canada to assess and designate which wild species are in danger of disappearing from Canada.

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

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

[7]DFO (2000), *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.*

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

[9]Linkages will also have to be forged between any broader local task groups that are formed and other more localized or focused planning processes that are either already established (e.g., the Nimpkish Watershed Planning initiative) or may be established in the future (e.g., recovery planning teams under SARA to identify management options for listed Conservation Units).

[10]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.

[11]DFO (2001a), *Building Awareness and Capacity: An Action Plan for Continued Sustainable Development* 2001-2003

[12]DFO (2002), *Canada's Oceans Strategy: Our Oceans, Our Future.*

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

[14]See www.dfo-mpo.gc.ca/communic/fish_man/afs_e.htm

[15]DFO (1998), *A New Direction for Canada's Pacific Salmon Fisheries.*

[16]DFO (1999), *An Allocation Policy for Pacific Salmon.*

[17]DFO (2001b), *A Policy for Selective Fishing in Canada's Pacific Fisheries.*

[18]See www.dfo-mpo.gc.ca/media/backgrou/2003/hq-ac99a_e.htm

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