Fisheries and Oceans Canada | Pêches et Océans Canada

WILD SALMON POLICY

A New Direction

20 February 2002
DRAFT

Canada

Table of Contents

EXECUTIVE SUMMARY

On October 14, 1998, the Minister of Fisheries and Oceans Canada (DFO) released *A New Direction for Canada's Pacific Salmon Fisheries*. This new policy direction focuses on conservation, *sustainable use*[1], and improved decision making. Its general principles set out a broad policy framework under which specific operational policies and guidelines for managing Pacific salmon are to be developed. The Wild Salmon Policy (WSP) is one in a series of policy papers that specifies these operational policies and guidelines.

The WSP builds on a draft discussion paper that was released in March 2000. Members of the public, stakeholders, and First Nations provided input at meetings, community forums, and open houses across the Pacific Region, as well as through written submissions and response forms. The WSP was modified in response to feedback received during this extensive consultation process.

Fisheries and other human activities, as well as environmental variation including climate change affect *wild salmon*. In this unpredictable environment there are many demands on the *wild salmon* resource and the habitat on which its survival depends. Decisions about fishing, habitat management, and salmon cultivation must therefore be made with care to provide sustainable social and economic benefits for future generations of Canadians. The WSP offers an explicit conservation framework for conserving the *genetic diversity* in wild Pacific salmon and for protecting their habitat from irreversible depletion.

DFO has the legislative authority under the federal *Fisheries Act* to protect Pacific salmon and their habitat. At the same time, other levels of government have legislative control over activities on land and in fresh water that can adversely affect *fish habitat*. In addition, the 1999 renewal of the Canada-U.S. Pacific Salmon Treaty provides greater assurance that conservation requirements will be met for Pacific salmon that are caught

[1] This and other italicised terms are defined in the Glossary or footnoted in the main body of the report.

outside Canadian waters. Over the longer term, *fish habitat* will be maintained only if *fish habitat stewardship* is practised by all elements of society.

The primary goal of the WSP, consistent with the United Nations *Convention on Biological Diversity* is to:

> *"promote the long-term viability of Pacific salmon populations in natural surroundings, and fish habitat for all salmon life stages, for the sustainable benefit of the people of Canada."*

Accordingly, the WSP applies to all wild Pacific salmon, including those mixed with enhanced populations that are able to reproduce in natural surroundings. The following three principles will serve to guide decisions and activities that affect the conservation of *wild salmon.*

Principle 1: "Conserve wild salmon by maintaining diversity of local populations and their habitats."

Preservation of the quality and variety of salmon habitat, and its accessibility to salmon, is essential to conserve wild Pacific salmon. Salmon evolved in a diverse and complex landscape, developing many different adaptations to that diversity.

One such adaptation is the ability of adult salmon to return to the river, and sometimes even to the exact spot, where they were born. This homing allows salmon to mate with other salmon that are similarly adapted to the particular conditions found in that river. It allows the genetic qualities that underlie adaptations to develop and to be finely tuned to local conditions.

Adaptation to local conditions is what makes populations productive and able to sustain harvest. Conservation of those adaptations should be the objective of any policy to conserve *wild salmon.* The surest conservation strategy is to maintain healthy salmon populations in as many diverse habitats as possible.

With climate change, urban growth, and other developments, salmon habitats are bound to change. In this uncertain environment there is no

way of predicting accurately which populations will succeed or fail. Maintaining diverse and healthy populations will help wild Pacific salmon continue to adapt and thrive for the benefit of all Canadians.

Principle 2: "Acknowledge and protect the key role that wild salmon play in their ecosystems."

DFO is committed to an *ecosystem* approach to managing activities that impact *marine ecosystems*. Pacific salmon are not only a product of their *ecosystems*, but they also make a key contribution to the ecological health and *productivity* of those systems.

Salmon are an important food in *marine*, freshwater, and terrestrial *ecosystems*. Numerous studies have identified them as a critical food source for animals ranging from microbes to invertebrates, bears, eagles, and killer whales. Salmon also play a key role in transporting *marine* nutrients inland from the *marine* environment. Their carcasses provide dissolved nutrients that are often in short supply, limiting the *productivity* of many aquatic and forest *ecosystems* in the Pacific Northwest.

The *ecosystem* linkages among salmon and other *species* are extensive and have not always been fully recognized.

Principle 3: "Establish operational guidelines consistent with best practices in risk management for carrying out harvest, habitat, and fish cultivation activities."

Wild salmon will be managed and conserved as aggregates of *local populations* called *Conservation Units* (CUs). To guide harvest management and other uses, target levels of abundance will be determined for each CU. Formal operational guidelines will be developed in consultation with interested parties so that fisheries, habitat management, and cultivation (*aquaculture* and *enhancement*) activities will be carried out in ways that do not compromise the WSP's primary goal.

Operational guidelines for resource management, habitat, enhancement, and aquaculture will be released after the WSP. Where guidelines already exist, they will be reviewed, summarised, and revised and extended as

necessary. Where they do not exist, new guidelines will be developed. Guidelines will allow managers some flexibility, while at the same time requiring that decisions about *wild salmon* are made in an open and transparent manner.

INTRODUCTION

> *"Pacific salmon have long served as food for First Nations and are a source of their cultural identity; they provide jobs and income for Canadians, businesses and coastal communities; they provide recreation and enhance our quality of life; and serve as a measure of our environmental health and well being. Pacific salmon help define who we are and where we live. They are our heritage and our responsibility; they must also be our legacy."*[2]

The *Wild Salmon Policy* (WSP) was developed to preserve this legacy. The policy provides a framework for conserving the long-term *viability* of Pacific salmon populations, their natural habitats, and the resulting production.

Fisheries and other human activities, as well as environmental variation including climate change, affect *wild salmon*.[3] In this unpredictable environment there are many demands on the *wild salmon* resource and the habitat on which its survival depends. Decisions about fishing, habitat management, and salmon *cultivation* must therefore be made with care to provide sustainable social and economic benefits for future generations of Canadians. An explicit conservation framework is needed to conserve the *genetic diversity* in wild Pacific salmon and to protect their habitat from irreversible depletion.

To survive, *wild salmon* require *fish habitats* in the freshwater and *marine* environments, and are often considered to be indicators of *ecosystem* health. To maintain suitable environments for *wild salmon*, human activities often must be restricted. Conflicts inevitably arise where there are other valuable uses of salmon habitat (e.g., hydroelectric power generation, forestry).

---

[2] A New Direction for Canada's Pacific Salmon Fisheries, Statement by Minister of Fisheries and Oceans, Canada, 14 October 1998 (see http://www-comm.pac.dfo-mpo.gc.ca/english/publications/alloc/st9808e.htm.

[3] Wild Pacific salmon are coho (*Oncorhynchus kisutch*), chinook (*O. tshawytscha*), sockeye (*O. nerka*), chum (*O. keta*), and pink (*O. gorbuscha*) salmon produced by natural *spawning* in *fish habitat* from parents that were spawned and reared in *fish habitat*.

Societies throughout the world have dealt with these inherent conflicts, but often unsuccessfully from the perspective of *wild salmon*. For instance, in much of Japan *wild salmon* and their natural habitat have virtually disappeared. Pink and chum salmon, the most important commercial *species*, are maintained by artificial propagation in hatcheries. The Japanese accept that the long-term *viability* of their pink and chum salmon depends on the success of hatchery programs.

In the United States, the decision to develop the hydroelectric potential of many salmon bearing watersheds is now seen largely as a failure in salmon conservation. Enormous costs have been incurred in an effort to preserve the remaining salmon populations in the Columbia River and other watersheds.

Similarly, after decades of damming their rivers, people in Scandinavian and Baltic countries rely on hatchery production to support their Atlantic salmon fisheries. They now recognize the importance of *wild salmon* conservation and have implemented strong policies in support of it.

Canadians can take pride in their approach to managing Pacific salmon resources. Canada has restricted hydroelectric development on large salmon bearing rivers, and has been more careful than other nations in augmenting natural production through large-scale hatchery supplementation, *ocean ranching*, and *aquaculture*.

On October 14, 1998, the Minister of Fisheries and Oceans Canada (DFO) released *A New Direction for Canada's Pacific Salmon Fisheries*. This new policy direction focuses on conservation, *sustainable use*, and improved decision making. Its general principles set out a broad policy framework under which specific operational policies and guidelines for managing Pacific salmon are to be developed.

The first principle in the *New Directions* document states that conservation of Pacific salmon *stocks* is DFO's primary objective and will take precedence in managing the resource. The second principle states that a *precautionary approach* to fisheries management will continue to be adopted. The *precautionary approach* recognizes that the absence of full scientific

certainty should not be used as a reason to postpone decisions where there is *risk* of serious or irreversible harm.[4] The WSP is one of a series of policy initiatives[5] that are being developed based on these and other *New Directions* principles.

This document builds on a draft WSP discussion paper that was released in March 2000.[6] Between April and November 2000, DFO held information and consultation meetings on the draft WSP with members of the public, stakeholders, and First Nations. Participants provided input at meetings, community forums, and open houses across the Pacific Region, as well as through written submissions and response forms. The structure and principles of the WSP were modified in response to feedback received during this extensive consultation process.

The WSP documents the approach that DFO proposes to follow to conserve wild Pacific salmon for present and future generations. It contains: (1) background information on government jurisdiction and international commitments to conserve the diversity of the Canada's biological resources; (2) a description of the major factors that affect the long-term *viability* of *wild salmon*; (3) principles to guide the conservation and management of *wild salmon*; and (4) an overview of operational principles that are being developed to help conserve *wild salmon*.

---

[4] The *precautionary approach* is enshrined in Principle 15 of the *Rio Declaration on Environment and Development* (http://www.unep.org/Documents/Default.asp?DocumentID=78&ArticleID=1163), which states:

> *"In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."*

However, the *precautionary approach* has been interpreted in various ways (see Glossary). In the WSP, when citing other reports that have used this term, the intent of the original authors(s) is maintained.

[5] These include the following DFO documents: *An Allocation Policy for Pacific Salmon*, October 1999; *A Framework for Improved Decision Making in the Pacific Salmon Fishery*, June 2000; and *A Policy for Selective Fishing in Canada's Pacific Fisheries*, February 2001 (see http://www-comm.pac.dfo-mpo.gc.ca/english/newdirections/default.htm).

[6] DFO, *Draft Wild Salmon Policy Discussion Paper*, March 2000.

JURISDICTION

Pacific salmon are *anadromous fishes*. They begin life in freshwater, migrate to sea to feed and grow, and return to spawn and die in the lake or stream where they hatched. Because of their migratory life history, salmon fall under the jurisdiction of several levels of government.

DFO has the legislative authority under the federal *Fisheries Act* to protect Pacific salmon and their habitats. At the same time, other levels of government have legislative control over activities on land that can adversely affect *fish habitat*. Such land-based activities include the development and regulation of road and rail transportation corridors, urban and industrial development, hydroelectric projects, water diversion and extraction, agriculture, forestry and mining activities, and waste management. *Fish habitat* can be significantly compromised if provincial and municipal jurisdictions fail to consider the potential impacts of their decisions.

The *Fisheries Act* allows DFO to manage fisheries to achieve conservation objectives. First Nations, recreational, and commercial fisheries fall within this jurisdiction. After conservation needs are met, DFO will manage fisheries such that aboriginal and treaty food, social, and ceremonial fisheries are provided priority.[7]

Pacific salmon are caught in fisheries that occur beyond Canada's national boundaries. Canada, through participation in international commissions, was able to reduce and then virtually eliminate high seas interception of Pacific salmon originating in Canadian waters. The four-nation North Pacific Anadromous Fish Commission protects Canadian salmon from foreign driftnets.

The Canada-U.S. Pacific Salmon Treaty was signed in 1985 to prevent overfishing in interception fisheries, and to encourage both countries to take measures to increase salmon production for their mutual benefit.

---

[7] Other documents in the *New Directions* series deal more specifically with First Nations issues. See for example the *New Directions* document itself (Principle 7) and an *Allocation Policy for Pacific Salmon* (Principle 2).

Since then, many salmon populations have declined in abundance because of poor ocean survival, unusual environmental conditions, overfishing, and habitat degradation.

The 1999 Pacific Salmon Agreement[8] provides greater assurance than the 1995 Treaty that conservation requirements will be met. It also distributes both the burden and benefits of conservation more equitably between the two countries. The agreement's abundance-based framework places priority on the health of the *stocks*, rather than on entitlements to the fishing fleets of either nation. In principle, fisheries will be conducted at levels that can be sustained by the resource given current environmental conditions.

If Canadians want *wild salmon* to be conserved, they must manage their land and water resources and related activities in a manner that conserves *fish habitat*. If *fish habitat* quality continues to decline, with a concomitant decline in *productive capacity*, conservation of *wild salmon* will require additional fishery closures and *habitat restoration*. Activities that appear to be economically beneficial in the short term may turn out to be uneconomic and ecologically disastrous in the long term.

GLOBAL CONSERVATION ETHIC

The *United Nations Convention on the Law of the Sea*[9] was adopted in 1982 to provide an international framework for the development and use of global *marine* resources. Recognition that overexploitation threatens many of the world's fisheries has helped stimulate a new global conservation ethic.

In 1992, Canada and 167 other countries signed the UN *Convention on Biological Diversity*[10] to encourage the conservation and *sustainable use* of biological resources. The Convention requires governments to integrate its

---

[8] *1999 Agreement between Canada and the US under the Pacific Salmon Treaty*, June 3, 1999, http://www.dfo-mpo.gc.ca/pst-tsp/agree/toc_e.htm.

[9] UN Division of Ocean Affairs and the Law of the Sea, *United Nations Convention on the Law of the Sea*, December 10, 1982, http://www.un.org/Depts/los/convention_agreements/convention_overview_convention.htm.

[10] United Nations, *Convention on Biological Diversity*, June 15, 1992, http://www.biodiv.org/convention/articles.asp.

principles into national policies and legislation. In particular, governments must promote the protection of *ecosystems*, natural habitats, and the maintenance of viable populations of *species* in natural surroundings.

Canada played a key role in developing the UN Food and Agriculture Organization's (FAO's) *Code of Conduct for Responsible Fisheries*[11] in 1995. A major objective of this code is to consider *ecosystems* and socio-economic aspects of fisheries. Canada's fishing industry is also committed to achieving sustainable *marine* and freshwater fisheries and has developed its own *Canadian Code of Conduct for Responsible Fishing Operations.*[12] These non-binding agreements encourage responsible fishing practices, and will contribute to the conservation of fish *stocks* and their aquatic environments.

The federal *Oceans Act*[13], passed in 1997, includes a commitment to manage *marine ecosystems* based on the *precautionary approach*, with a view to conserving *biological diversity* and habitat *productivity*. The *UN Fish Agreement*[14] also commits Canada to apply the *precautionary approach* to conservation and fisheries management.

FACTORS AFFECTING THE CONSERVATION OF WILD SALMON

The health and *viability* of wild Pacific salmon are affected by many factors. Some, such as climate and *marine* environmental conditions, are beyond direct human control. Others, including fisheries and habitat degradation, can be controlled, but require a shared vision and commitment by all stakeholders.

---

[11] FAO, *Code of Conduct for Responsible Fisheries*, October 31, 1995, http://www.fao.org/fi/agreem/ codecond/ficonde.asp

[12] *Canadian Code of Conduct for Responsible Fishing Operations*, 1998, http://www.dfo-mpo.gc.ca/communic/fish_man/code/eng/con_eng.htm

[13] See http://laws.justice.gc.ca/en/O-2.4/76838.html.

[14] UN Division of Ocean Affairs and the Law of the Sea, *United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of December 10, 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks*, August 4, 1995, http://www.un.org/Depts/los/convention_agreements/convention_overview_fish_stocks.htm.

FISHERIES

Maximum sustainable harvest (MSH) will result from an intermediate level of *spawning* abundance at which enough eggs are laid to provide good recruitment to the next generation without reducing growth and survival by overcrowding the available habitat. In practice, it is difficult to determine the *spawning* abundance that will provide MSH. Reliable historical data are not always available, and even when they are they may not apply because of changes in *productivity* caused by habitat loss, climate change, or past over-harvest.

The most serious challenge for salmon fishery managers is the "mixed-*stock*" problem. Most salmon fisheries catch mixtures of *species* and populations. *Productivity* and the ability to sustain harvest vary among *species* and populations, in part because of differences in their life histories. The optimum harvest rate for productive populations and *species* will be too high for less productive, co-migrating populations and *species*.

Difficulties arise when productive and unproductive populations and *species* are caught in the same fisheries. Unless it is possible to *selectively harvest* productive populations, the overall harvest rate must be reduced to avoid over-harvesting less productive populations and *species*.

As the value of *stock* diversity becomes increasingly recognized, fisheries are being modified to harvest salmon more *selectively* than in the past. However, it is not always practicable to *selectively harvest* productive populations when they are mixed with less productive populations, especially for mixed populations of the same *species*.

The complex linkages between salmon and other *species* in *marine*, freshwater, and terrestrial *ecosystems* are not well understood. From a freshwater *ecosystem* perspective, when fisheries reduce the number of returning salmon, *productivity* will be reduced. Pacific salmon gain almost all their weight at sea and die in fresh water after *spawning*. *Marine* derived nutrients transported to fresh water by returning salmon can significantly influence survival of the next generation. In addition, large *spawning escapements* help maintain the quality of some *spawning* habitats because the act of *spawning* can improve gravel quality.

Salmon are consumed by a wide variety of *marine*, freshwater, and terrestrial *species*. For example, adult salmon and in particular chinook are the preferred prey of resident pods of killer whales. Many bears time their seasonal *migrations* to coincide with the salmon's return. Reductions in salmon biomass and numbers may negatively impact these and other *species*.

HABITAT

Wild salmon depend on natural *fish habitat*. Therefore, preserving *wild salmon* means protecting natural *fish habitat*. All levels of government and stakeholders must share in this responsibility.

A positive step in protecting salmon habitat is the implementation of the *Canada - British Columbia Agreement on the Management of Pacific Salmon Fishery Issues* [15], which gave rise to a Canada-BC Fish Habitat Management Agreement in 2000. This agreement focuses on collaboration and worksharing arrangements between the federal and provincial governments, as well as cooperative arrangements with municipal governments, First Nations, industries and non-governmental organisations, to promote the protection and restoration of *fish habitat*.

DFO has a long-term policy objective, outlined in the 1986 *Policy for the Management of Fish Habitat*,[16] to achieve an overall net gain in the *productive capacity* of *fish habitats*. Under this policy, development proposals are reviewed for their potential threats to *fish habitat* and measures are stipulated to avoid, mitigate, or compensate for adverse impacts. The guiding principle of "no net loss" strives to balance unavoidable habitat losses with habitat replacement on a project-by-project basis to prevent further reductions in Canada's fisheries resources due to habitat loss or damage.

---

[15] *Canada - British Columbia Agreement on the Management of Pacific Salmon Fishery Issues*, April 1997, http://www-comm.pac.dfo-mpo.gc.ca/english/publications/mou/toc.htm. See Section 4.0 on "Protecting the Resource and its Habitat".

[16] DFO, *Policy for the Management of Fish Habitat*, 1986, http://www.dfo-mpo.gc.ca/habitat/Policy/english/index_e.htm.

In spite of the *Habitat Policy*, population and industrial growth often results in the continuing loss and degradation of freshwater habitat, which is believed to have contributed to declines in the abundance of Pacific salmon. Urban growth, particularly on eastern Vancouver Island and in the Lower Mainland, has significantly reduced salmon production in small streams. Urban and industrial development within watersheds also degrades water quality through pollution from chemical spills, fertiliser and pesticide runoff, and aerial deposition. These effects sometimes extend to estuaries and coastal *marine* habitats that are important rearing areas for salmon.

SALMON CULTIVATION

Humans have been artificially rearing Pacific salmon and trout for over a century. As a result, salmon cultivation has become an important component of fisheries management in the Pacific Region.

Salmon *enhancement*, which is defined here to include only *fish culture*, involves the use of hatcheries or other incubation facilities and production *spawning* channels to supplement natural reproduction. Mortality is reduced during the early life states, thereby increasing the number of juvenile salmon per parent. Juveniles (fry or smolts) are released into rivers, lakes, or the ocean where they grow and develop naturally. In contrast, salmon aquaculture (or salmon farming) involves the cultivation of an artificial population that is reared in captivity throughout its entire life cycle.

Carefully managed, salmon enhancement should be an effective way to provide opportunities for *selective* or *terminal harvest*, or to restore badly depleted *wild salmon populations*. However, cultivation can have demographic, ecological, and genetic impacts on *wild salmon populations*, although the interactions between wild and *cultivated* salmon are not well understood. For example, by increasing the *productivity* of a supplemented population, enhancement may exacerbate problems for managing less productive wild populations caught in mixed-*stock* fisheries. Enhanced salmon may also compete with *wild salmon* for food, territory, or mates.

Salmon enhancement also influences the evolutionary process. It may erode *genetic diversity* or the genetic adaptation of salmon to their natural

habitat through *hybridization, artificial selection,* or *inbreeding*. While most negative effects of *hybridization* and *inbreeding* can be prevented through the careful choice of *broodstock* and mating schemes during artificial propagation, some degree of *artificial selection* is unavoidable. *Genetic diversity* will be most affected by artificial *selection* when cultivation continues for many generations, affects many life stages, and greatly reduces mortality from natural levels.

The salmon aquaculture industry cultivates both Atlantic salmon and Pacific salmon (mostly chinook) in net pens in BC and Washington State. Farmed salmon do escape accidentally and are caught in Pacific salmon fisheries, but usually in small numbers. Escaped Atlantic salmon cannot interbreed with wild Pacific salmon and so do not pose a genetic *risk*. However, they can be an ecological threat if they occur in sufficient numbers or become established as naturalized populations. Several instances of natural reproduction of Atlantic salmon in BC coastal streams have been confirmed.

Compared to Atlantic salmon, less is known about the number and distribution of escaped farmed chinook and coho salmon because they are difficult to distinguish visually from wild Pacific salmon. These escapees pose the same kinds of ecological concerns for *wild salmon* as hatchery released fish, although probably to different degrees. Farmed fish are genetically distinct from wild fish because they typically derive from different populations, and because farmers intentionally select for characteristics that are desirable in domestic culture. Consequently, Pacific salmon that escape from farms would constitute a serious genetic threat if enough were to interbreed with *wild salmon*. The genetic *risk* to *wild salmon* is likely small where interbreeding is rare.

Environmental Variability, Uncertainty, and Knowledge Gaps

Given historical records of Pacific salmon abundance, until recently the ocean was thought to have ample capacity for both wild and cultivated salmon. However, new research suggests that changes in ocean climate have reduced the ocean's *productivity* and capacity to support salmon. As habitat carrying capacity is reached, salmon growth and survival may decrease since the available food must be shared among greater numbers of salmon.

It is now recognized that ocean climatic conditions can change in a persistent pattern. For example, according to almost every historical climate and oceanographic record, the climate of the Northeast Pacific Ocean has altered dramatically since the late 1970s. This major climate change has been accompanied by a decline in the overall abundance of salmon in the North Pacific.

During the past decade, south coastal BC has experienced unprecedented high *marine* temperatures, unusual El Nino events, and extreme fluctuations in freshwater flow. For much of the same period, many salmon populations in the affected region experienced an unusually persistent period of poor *marine* survival and altered behavioral patterns. Increasingly, fisheries management plans must take these changing climatic conditions into account.

Trends in freshwater and *marine productivity* depend on environmental conditions that cannot be forecast precisely. Recent years have been characterized by record high ocean temperatures and sea levels, and by extreme ranges in water temperature and flow in the Fraser River. These events have sometimes reduced the numbers of Fraser River salmon reaching their *spawning* grounds, as well as the *spawning* success of those successfully completing their *migration*.

DFO manages fisheries to achieve *spawning escapement* targets or prescribed harvest rates in the face of tremendous uncertainty in pre-season forecasts of abundance and run timing. This uncertainty can be recognized and accommodated when the conservation objectives are fairly simple and focused on maintaining production from large salmon-producing rivers. Increasingly however, management efforts will be judged by their success in conserving both production and biological diversity.

DFO is committed to working with others so that the best available information is used in conservation and management decisions. Traditional Ecological Knowledge (TEK) describes the knowledge of First Nations peoples pertaining to their immediate environments, and the

cultural practices that build on that knowledge. It is prudent to document these observations and, where possible, integrate them with contemporary scientific *stock assessment* views and advice.

Ultimately, the effectiveness of the WSP in guiding decisions will depend on how accurately today's knowledge reflects reality and anticipates the future. Although the approaches described in this document are based on current understanding or best judgement, they may still be inadequate to provide long-term protection for wild Pacific salmon. Different strategies may be needed as more is learned about how climate, habitat, fishing, and salmon cultivation interact to affect the *productivity* and *viability* of *wild salmon*.

BIODIVERSITY AND WHAT TO CONSERVE?

The remarkable ability of salmon to return to their natal stream is called "homing". Precise homing creates *local populations*, allowing for genetic adaptation whereby inherited traits improve survival (*productivity*) in the local environment. These local adaptations may be very important and explain why it is so difficult to establish new populations by transplanting eggs or juveniles from one location to another.

On the other hand, homing is not perfect and small numbers of salmon stray to locations other than their natal streams. How far local adaptation extends depends on the amount of straying among *spawning* sites and the degree to which different adaptations are favored at each site. Much of today's research in conservation biology is concerned with identifying adaptive features that allow discrimination of one *local population* from another:

> *"There is no "correct" answer to the question of precisely how much biological diversity and population structure should be maintained or can be lost to provide a long-term future for salmon. Scientific estimates – including uncertainties associated with them – are only part of the argument. Society must decide what degree of biological security would be desirable and affordable if it could be achieved, i.e., the desired probability of survival or extinction of natural populations, over what time and what area, and at what cost. Nonetheless, biological diversity and the structure of salmon populations are being lost at a substantial rate, and this loss*

> *threatens the sustainability of naturally reproducing salmon populations in the Pacific Northwest."*[17]

The conservation of biological diversity involves tradeoffs. At one time the primary objective of salmon management was to maximize the sustainable catch for commercial fisheries. In recent years, however, more resource users and obligations to First Nations mean that salmon populations must be maintained in more areas than previously required. It is now recognized that the utilization by fish of different habitats has a genetic basis. Therefore, maintaining fish in what appear to be low *productivity* habitats is important to the conservation of *genetic diversity.*

PRINCIPLES FOR WILD SALMON CONSERVATION

The primary goal of the WSP, consistent with the UN *Convention on Biological Diversity,* is to:

> *"promote the long-term viability*[18] *of Pacific salmon populations in natural surroundings, and fish habitat for all life stages, for the sustainable benefit*[19] *of the people of Canada."*

Accordingly, the WSP applies to all wild Pacific salmon, including those mixed with enhanced populations that are able to reproduce in natural surroundings. The following principles reflect the advice received during consultations on the draft WSP, and will serve to guide decisions and activities that affect the conservation of wild Pacific salmon:

PRINCIPLE 1: "CONSERVE WILD SALMON BY MAINTAINING DIVERSITY OF LOCAL POPULATIONS AND THEIR HABITATS."

---

[17] U.S. National Research Council Committee on Protection and Management of Pacific Northwest Anadromous Salmonids, *Upstream: Salmon and Society in the Pacific Northwest,* 1996, National Academy Press, Washington, D.C., p 8.

[18] For long-term *viability,* salmon must have the capacity to adapt to changes, including climate change. This means that salmon must be genetically diverse, which in turn requires the maintenance of diverse habitats.

[19] Sustainable benefits will occur when sufficient salmon are available for conservation and for the present and future needs of human generations.

Preservation of the quality and variety of salmon habitat, and its accessibility to salmon, is essential to conserve wild Pacific salmon. Salmon evolved in a diverse and complex landscape, developing many different adaptations to that diversity.

One such adaptation is the ability of adult salmon to return to the river, and sometimes even to the exact spot, where they were born. This homing allows salmon to mate with other salmon that are similarly adapted to the particular conditions found in that river. It allows the genetic qualities that underlie adaptations to develop and to be finely tuned to local conditions.

Adaptation to local conditions is what makes populations productive and able to sustain harvest. Conservation of those adaptations should be the objective of any policy to conserve *wild salmon*. The surest conservation strategy is to maintain healthy salmon populations in as many diverse habitats as possible.

With climate change, urban growth, and other developments, salmon habitats are bound to change. In this uncertain environment there is no way of predicting accurately which populations will succeed or fail. Maintaining diverse and healthy populations will help Pacific salmon continue to adapt and thrive for the benefit of all Canadians.

PRINCIPLE 2: "ACKNOWLEDGE AND PROTECT THE KEY ROLE THAT WILD SALMON PLAY IN THEIR ECOSYSTEMS."

This reinforces Principle 4 in *New Directions* that an ecological approach will guide fisheries and oceans management in the future. Pacific salmon are not only a product of their *ecosystems*, but they also make a key contribution to the ecological health and *productivity* of those systems.[20]

Salmon are an important food in *marine*, freshwater, and terrestrial *ecosystems*. Numerous studies have identified them as a critical food

---

[20] See for example Robert E. Bilby, Brian R. Fransen, Jason K. Walter, C. Jeff Cederholm, and Warren J. Scarlett, "Preliminary Evaluation of the Use of Nitrogen Stable Isotope Ratios to Establish Escapement Levels for Pacific Salmon," *Fisheries* 26(1): 6-14. http://www.fisheries.org/fisheries/archive/FISHJan06-14.pdf

source for animals ranging from microbes to invertebrates, bears, eagles, and killer whales. Salmon also play a key role in transporting *marine* nutrients inland from the *marine* environment. Their carcasses provide dissolved nutrients that are often in short supply, limiting the *productivity* of many aquatic and forest *ecosystems* in the Pacific Northwest.

The *ecosystem* linkages among salmon and other *species* are extensive and have not always been fully recognized.

PRINCIPLE 3: "ESTABLISH OPERATIONAL GUIDELINES CONSISTENT WITH BEST PRACTICES IN RISK MANAGEMENT FOR CARRYING OUT HARVEST, HABITAT, AND FISH CULTIVATION ACTIVITIES."

Wild salmon will be managed and conserved as aggregates of *local populations* called *Conservation Units* (CUs). To guide harvest management and other uses, target levels of abundance will be determined for each CU. Formal operational guidelines (described later in the policy) will be developed in consultation with interested parties so that fisheries, habitat management, and cultivation (aquaculture and enhancement) activities will be carried out in ways that do not compromise the WSP's primary goal.

ACHIEVING THE GOALS OF THE WILD SALMON POLICY

Operational guidelines will be developed and released in separate documents for resource management, habitat sustainability, enhancement, and aquaculture. These guidelines will permit managers some flexibility to balance *risk*, the biological necessities of conservation, and social and economic realities, while ensuring that decisions are made openly and transparently. Where guidelines already exist, these will first be reviewed to identify gaps that must be filled. Then, new ones will be developed as needed. Guidelines will describe requirements for monitoring and performance assessment, where relevant.

To make sound resource management decisions requires accounting for the multiple perspectives on resource use and the tradeoffs among conflicting uses. This is best achieved through a structured, inclusive process that considers social and economic objectives as well as biological

ones when evaluating management options. The concept of zonation, which is widely applied in land use planning and the designation of *marine* protected areas, is one tool that can be used to accommodate society's multiple objectives with respect to *wild salmon*. Salmon habitat could be zoned for different activities based on the level of *risk* the activities pose to the long-term *viability* of *wild salmon*.

The WSP will be implemented in a phased manner consistent with available resources.

RESOURCE MANAGEMENT GUIDELINES

Scientific staff conduct *stock assessments* and provide advice to fishery managers who make decisions about the operation of fisheries. Since the activities of the two disciplines are closely linked with respect to *wild salmon*, operational guidelines for fisheries management and stock assessment will be developed jointly. Fisheries management guidelines will include the definition of CUs and *reference points* (RPs) and will describe the management of in-season activities. Assessment guidelines will describe how to monitor and assess the long-term *viability* of salmon populations at the CU level, as well as at the local level.

Reference points, including a target *reference point* (TRP), will be specified for each CU, based on estimates of *productive capacity*. The TRP will define the lower end of the target zone and will reflect the management objective. Guidelines will be established to make sure that RPs are defined in a consistent manner. RPs will be reviewed and updated through the scientific review process as further information and knowledge becomes available.

Harvest management plans will be specified for each CU through pre-season consultation that includes resource users. These plans will include options or "harvest rules" based on abundance forecasts (including inseason estimates when developed) relative to targets established for the CU. The pre-defined nature of these harvest rules should facilitate prompt in-season management actions.

Typically, harvest rules will be chosen to be consistent with the *productivity* of *wild salmon* populations in each CU under their present environmental conditions. Progress in achieving targets for all CUs will be evaluated annually. Guidelines for the longer-term assessment of population *viability* will be specified.

HABITAT SUSTAINABILITY GUIDELINES

The *Fisheries Act* is the legislative basis for protecting and conserving fish and *fish habitat* to sustain Canada's freshwater and *marine* fishery resources, commercial and recreational fisheries, and aboriginal fisheries. The *Policy for the Management of Fish Habitat*, along with other procedural documents, provide policy direction for interpreting the Act's broad powers in keeping with the concepts of sustainable development and *ecosystem* management.

DFO has developed numerous guidelines for the protection and restoration of *fish habitat*.[21] These guidelines, many of which are germane to the WSP, have been developed in concert with other federal, provincial, and municipal agencies, as well as specific industries. There is an ongoing process to identify guidelines that require updating due to new information, and areas where new guidelines are required. This work is being done cooperatively with other government agencies and industries and, when appropriate, in consultation with non-governmental organisations and the public.

ENHANCEMENT GUIDELINES

The WSP does not preclude salmon enhancement, but does require that enhancement activities be managed to protect the *genetic diversity* and long-term *viability* of *wild salmon*. This will be accomplished through a new enhancement policy and supporting operational guidelines that define how enhancement projects should be planned, executed, and evaluated under the WSP.

---

[21] Habitat-related legislation, policies, and technical guidelines are available in hardcopy or online. See http://www.dfo-mpo.gc.ca/habitat/publications_e.htm.

Existing operational guidelines for enhancement will be reviewed to mesh with the WSP. In addition, new guidelines will be developed to minimize the *risk* of negative impacts on *wild salmon* resulting from enhancement. Assessment programs will also be developed to monitor the effectiveness of guidelines. A comprehensive set of guidelines within a policy framework should assure that enhancement activities are well managed.

For example, to address genetic concerns, guidelines for collecting broodstock and protocols for *spawning* are already in use at hatcheries. These guidelines and protocols are designed to maintain *stock* integrity and optimize genetic variability. They will be reviewed to make sure that they reflect current scientific thinking.

Demographic *risks* to *wild salmon* will continue to be minimized by *selective harvesting* of enhanced fish where possible. Lessons learned from departmental initiatives on *selective* fisheries and integrated watershed resource management will be used to revise, and develop as necessary, guidelines that address other demographic concerns.

With regard to ecological concerns, guidelines for the release of juvenile salmon will be reviewed and further developed so that releases match freshwater carrying capacities, and do not compromise resident freshwater populations. Research activities to better understand ocean carrying capacity will continue.

AQUACULTURE GUIDELINES

DFO is the lead federal agency for aquaculture development in Canada. The federal vision for aquaculture development is to:

> *"benefit Canadians, now and in the future, through the culture of aquatic organisms, while upholding the ecological and socio-economic values associated with Canada's oceans and inland waters."*[22]

The BC government has authority for the overall development and management of the province's salmon aquaculture industry. This includes

[22] DFO Office of Sustainable Aquaculture, Policy Sector, *Aquaculture Policy Framework*, January 2002.

control over the location, size, and development of farm sites within provincial boundaries, reporting requirements, and standards for design, construction, and layout. Achieving the federal vision will require that DFO continue to work collaboratively with the province and the aquaculture and traditional wild fisheries industries.

There are a number of existing aquaculture guidelines that address escapees, waste discharge, fish farm siting, rearing of non-native *species*, and fish health. These will be reviewed, revised where appropriate, and summarized with respect to their implications for wild Pacific salmon.

GLOSSARY [1]

Anadromous. The life history characteristic of returning from the sea to reproduce in fresh water.

Artificial selection. Selection by humans.

Aquaculture.[2] The farming of aquatic organisms in the *marine* environment or freshwater.

Biological diversity.[3] 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 Unit (CU). A group of one or more *local populations* that share a common genetic lineage and can be managed effectively as a unit by virtue of their common *productivity* and vulnerability to existing fisheries.

Cultivated. Characteristic of a *species* or population that is artificially propagated completely or in part to increase production or meet other human needs. It includes both *aquaculture* and *enhancement.*

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, production *spawning* channels). In the context of this policy, only *fish culture* techniques are considered *enhancement.*

Ecosystem.[4] A community of organisms and their physical environment interacting as an ecological unit.

Escapement.[5] The number of mature salmon that pass through (or escape) the fisheries and return to their rivers of origin to spawn.

Fish culture. The use of hatcheries, other incubation facilities, and production *spawning* channels to protect fish during high-mortality life stages to increase the number of surviving juvenile fish per parent.

Fish habitat.[6] *Spawning* grounds and nursery, rearing, food supply, and *migration* areas on which fish depend directly or indirectly to carry out their life processes.

Fish habitat stewardship.[7] Acting responsibly to conserve *fish habitat* for present and future generations.

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.[8] The treatment or clean-up of *fish habitat* that has been altered, disrupted, or degraded for the purpose of increasing its capability to sustain a productive fisheries resource.

Hybridization.[4] Any crossing of individuals of different genetic composition resulting in hybrid offspring.

Inbreeding.[4] Mating or crossing of individuals more closely related than average pairs in the *population*.

Local population.[9] 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. In the WSP, the use of the word *population*, unless qualified, is equivalent to a *local population*.

Marine.[4] Pertaining to the sea.

Maximum sustainable harvest (yield).[10] The largest catch (yield) that can be continuously taken from a *stock* under existing environmental conditions.

Migration.[4] The movement of an organism or group from one habitat or location to another.

Ocean ranching. The artificial propagation of a fish *stock* by a private group with the expectation of some privileged access to increased production in order to cover operating and harvest costs.

Precautionary approach.[11] 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.[8] *The* maximum natural capability of habitats to produce healthy fish, safe for human consumption, or to support or produce aquatic organisms upon with fish depend.

Productivity. The capacity of an environment/population to produce numbers or biomass of organisms (e.g., fish).

Reference point.[11] An estimated value derived from an agreed scientific procedure and/or an agreed model which corresponds to a state of the resource and/or of the fishery and can be used as a guide for fisheries management.

Risk.[12] The expression of the likelihood and impact of an event.

Risk management.[12] *A* systematic approach to setting the best course of action under uncertainty by identifying, assessing, understanding, acting on, and communicating *risk* issues.

Selective harvest/fishery.[5] A conservation-based management approach which allows for the harvest of surplus target *species* or *stocks* while

aiming to minimize or avoid the harvest of *species* or *stocks* of conservation concern, or to release bycatch unharmed.

Selection.[4] Non-random differential reproductive success of different genotypes in a population.

Spawning.[4] The release of gametes or eggs into the water.

Species.[4] 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.

Stock.[10] The part of a fish population that is under consideration for actual or potential utilization.

Stock assessment.[13] The use of various statistical and mathematical calculations to make quantitative predictions about the reactions of fish populations to alternative management choices.

Sustainable use. The use of components of *biological diversity* in a way and at a rate that does not lead to the long-term decline of diversity, thereby maintaining its potential to meet the needs of present and future generations. *Sustainable* is not meant to imply that abundance is constant.

Terminal harvest/fishery. A fishery in a river or near the mouth of a river where returning salmon pass through or congregate near to and prior to *spawning*, and where *stocks* are relatively unmixed.

Viability. The ability to continue to grow or survive.

Wild salmon. Salmon produced by natural *spawning* in *fish habitat* from parents that were spawned and reared in *fish habitat.*

Wild salmon population. A *local population* comprising naturally *spawning* and rearing *wild salmon.*

Sources of Definitions

1. Unless indicated otherwise, definitions have been developed by DFO staff for the WSP or are taken from unpublished DFO reports.
2. DFO Office of Sustainable Aquaculture, Policy Sector, *Aquaculture Policy Framework*, January 2002.
3. UN, *Convention on Biological Diversity*, June 15, 1992, http://www.biodiv.org/convention/articles.asp.
4. R.H. Lincoln, G.A. Boxshall, and P.F. Clark (eds.), *A Dictionary of Ecology, Evolution and Systematics*, 2nd edition, Cambridge University Press, Cambridge, UK, 1998.
5. DFO, *A Policy for Selective Fishing in Canada's Pacific Fisheries*, January 2000.
6. *Fisheries Act*, Section 34.
7. Howard Paish, *Draft Habitat Stewardship National Action Plan*, Prepared for DFO, Ottawa, September 2001.
8. DFO, *Policy for the Management of Fish Habitat*, 1986, http://www.dfo-mpo.gc.ca/habitat/Policy/english/Index_e.htm.
9. Chris C. Wood and L. Blair Holtby, "Defining Conservation Units for Pacific salmon using Genetic Survey Data." In World Fisheries Trust, *Action before Extinction: International Workshop on Fish Genetic Extinction*, Victoria, 1998, pp. 233-250.
10. W.E. Ricker, "Computation and Interpretation of Biological Statistics of Fish Populations," *Bulletin of the Fisheries Research Board of Canada*, No. 191, Ottawa, Department of Environment, Fisheries, and Marine Sciences, 1975.
11. UN FAO, FAO Technical Guidelines for Responsible Fisheries, Vol. 2, "Fisheries Management," Rome, 1997.
12. Treasury Board, *Integrated Risk Management Framework*, 2001. See http://www.tbs-sct.gc.ca/pubs_pol/dcgpubs/riskmanagement/rmf-cgr_e.html.
13. R. Hilborn and C.J. Walters, *Quantitative Fisheries Stock Assessment: Choice, Dynamics and Uncertainty*, Chapman and Hall, New York. 1992.