



Pacific Fisheries Resource Conservation Council

**“Wild Salmon Policy” and
the Future of the Salmonid
Enhancement Program:**

*The Response of the Pacific
Fisheries Resource
Conservation Council*

PFRCC Council Advisory

June 2000

“Wild Salmon Policy” and the Future of the Salmonid Enhancement Program: The Response of the Pacific Fisheries Resource Conservation Council

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

June 2, 2000

The Honourable Herb Dhaliwal
Minister of Fisheries and Oceans
Government of Canada
Ottawa

The Honourable Corky Evans
Minister of Agriculture, Food and Fisheries
Government of British Columbia
Victoria

Dear Ministers:

The Wild Salmon Policy is the most important policy document that Fisheries and Oceans Canada will produce in this decade. It will be key to determining the future of salmon resources in British Columbia. If the policy is strong, explicit and addresses the foreseeable issues, it will contribute to conserving and sustaining salmon resources. If the policy is general and does not address current and foreseeable problems, it will not provide the direction required. Without direction, the indecision on how to deal with issues will continue. Unnecessary delays and compromises in fisheries and habitat management and in enhancement will be made at a long-term cost in fish production, local spawning populations, genetic diversity and social harmony.

The comments of the Pacific Fisheries Resource Conservation Council are a response to the department's request for input to a developing policy. They are intended to help create a strong and effective policy that will direct salmon conservation and management for the foreseeable future.

Based on recent Fisheries and Oceans policy direction and programs, it is clear that the department is taking a new direction to meet a redefined mandate, which has resource conservation as a primary focus. The Wild Salmon Policy is intended to be a part of that redirection. Because this policy will direct the future rather than the past, it must go beyond the status quo and address future needs. Clearly, present conservation practices have not been adequate to protect wild salmon. There has been significant erosion of many salmon populations, loss of habitat capacity and compromise of genetic diversity. The Council's comments are presented in the context of trying to ensure that the policy contributes to stopping such losses and, where possible, reversing them.

Examples of how the policy would deal with individual wild salmon populations within a specific geographic area would help the Council and the public to better understand the intent and implications of the new policy.

The comments on the Salmonid Enhancement Program relate primarily to hatcheries, to the impacts of their production on other local populations and to the difficulties in harvesting hatchery stocks separately from wild stocks. The result has been erosion of wild stock production. A review of hatchery operations with regard to impacts on wild salmon is required.

In view of the public consultation process on the Wild Salmon Policy discussion paper that is currently underway, the Council feels it is timely to provide our views on these important issues to federal and provincial ministers of fisheries and the public.

The Honourable John A. Fraser
Chairman

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EXECUTIVE SUMMARY

The March 15, 2000, *Wild Salmon Policy—Discussion Paper* is the latest in a series of Fisheries and Oceans Canada projects flowing from the New Directions policy initiative which was begun in October 1998 by former Fisheries Minister David Anderson. The New Directions initiative is being developed in tandem with Pacific Fisheries Adjustment and Restructuring Program. Fisheries and Oceans is at present engaged in a round of public consultations with respect to its proposed Wild Salmon Policy, as well as the future of the Salmonid Enhancement Program.

The Pacific Fisheries Resource Conservation Council was established in September 1998 when its chairman, the Honourable John A. Fraser, and its members were appointed by the federal fisheries minister. The Council is charged with the responsibility of providing long-term strategic advice to the federal fisheries minister, the British Columbia fisheries minister, and the general public on matters related to the conservation of salmon and their habitat.

Among the Council's obligations is the duty to publish "extraordinary reports" on serious matters, to alert the Minister of Fisheries and Oceans on issues which threaten the achievement of departmentally-defined objectives, and openly to advocate responsible stewardship and public awareness of fisheries and conservation issues.

Because of the significance of both the proposed federal policy related to wild salmon and the review of federal salmonid enhancement initiatives, the Council has chosen to issue this extraordinary report.

I. The Wild Salmon Policy—Discussion Paper

The Council wishes to congratulate Fisheries and Oceans officials who have seen the necessity of establishing a clearly-articulated policy with respect to the conservation of wild Pacific salmon. However, after careful review, the members of the Pacific Fisheries Resource Conservation Council are in agreement that the six principles proposed to guide Fisheries and Oceans policy in the conservation of Pacific salmon are flawed.

1. The proposed principles fail to articulate a single, clear and unequivocal statement that wild salmon will enjoy management priority when it comes to making decisions about salmon on Canada's west coast. The statement originally proposed by the Fisheries and Oceans' science branch, as set out during a workshop, "Pacific Salmon: Status of Stocks and Habitat," at Simon Fraser University, June 1, 1999, was rewritten and compromised. Consequently, a fundamental shortcoming of the principles set out in the *Wild Salmon Policy—Discussion Paper* is the lack of unequivocal, clear and explicit policy direction.
2. Federal government policy of the kind anticipated by the six principles set out in the *Wild Salmon Policy—Discussion Paper* is likely to condone the persistence of management practices that are inconsistent with the precautionary principle and the concept of risk-averse management. Certain of the approaches counseled by the proposed principles are likely to put wild salmon at risk and would, in fact, narrow the opportunities to aim more explicitly on the side of caution.
3. The six principles cannot be considered consistent with Fisheries and Oceans' own departmentally-defined conservation objective for wild salmon.
4. In the course of its evaluation, the Council asked itself these questions: Would a policy articulated by the six principles set out in the *Wild Salmon Policy—Discussion Paper* protect

ecosystem functioning? Would it protect biological diversity? Would such a policy be consistent with the precautionary principle? Would it be risk-averse? Unfortunately, the answer to each of these four questions is "no."

II. The Salmonid Enhancement Program

Much can be said in favour of the Salmonid Enhancement Program. Many of its features are laudable and generally without controversy, such as: construction of fishways and fish-ladders to repair damage caused by industrial development; obstruction removal, side channel development and "natural stream complexing"; construction of small, remedial spawning channels and rearing channels; and so on. The public-education initiatives undertaken through the Salmonid Enhancement Program may prove its most enduring legacy.

However, the Council review of the Salmonid Enhancement Program leads inevitably to the conclusion that some facilities created by it have resulted in the displacement of wild salmon by hatchery-produced fish. This has occurred when hatchery salmon have attracted fishing effort that unavoidably produced unsustainably high rates of harvest on co-migrating wild salmon. It has also occurred because juvenile fish from wild populations have been subjected to competition from hatchery fish in rearing areas and ocean phase of the salmon life cycle.

Declines in numerous wild-salmon populations, concurrent with increases in production from a few large hatcheries, tend to create a situation in which salmon abundance is attributable to ever-fewer stocks. This places the salmon resource at an increasingly greater risk of random, catastrophic disruption.

1. It is the view of the members of the Pacific Fisheries Resource Conservation Council that salmonid enhancement policy should be explicit in stating that under no circumstances should hatchery production or other cultivation practices serve to replace wild salmon production.
2. The principles set out in the Wild Salmon Policy, meanwhile, appear to anticipate the continuation of practices pursued under the Salmonid Enhancement Program which have caused harm to wild salmon populations.
3. The Salmonid Enhancement Program should be re-dedicated to the purpose of restoring, conserving and protecting the abundance and diversity of wild salmon.

INTRODUCTION

By its Terms of Reference, objectives, mandate and scope, the Pacific Fisheries Resource Conservation Council is required, on several grounds, to assess objectively the *Wild Salmon Policy—Discussion Paper* and provide advice regarding it to the federal and provincial governments, as well as to the public. The Council is also required, in this context, to offer commentary on the future of the Salmonid Enhancement Program.

The Council is expected to provide “advice to the Minister of Fisheries and Oceans, the British Columbia Minister of Fisheries and the public” on matters dealing with the “conservation of Pacific fish populations and the status of their freshwater and ocean habitat in British Columbia.” Included in the specific objectives assigned to the Council in its Terms of Reference is an explicit direction to “review and make recommendations pertaining to... government policies and practices related to conservation of Pacific salmon and their freshwater and ocean habitat.” Under the stated mandate and scope of its Terms of Reference, the Council is expected to respond to requests for advice, and we received just such a request from Fisheries and Oceans regarding the *Wild Salmon Policy—Discussion Paper*. We are also explicitly instructed to provide our recommendations “to the Ministers and the public simultaneously.”

The Council is expected to carry out its obligations either by publishing the results of our work in the annual report, or by issuing “an extraordinary report.” Further, the Council’s first annual report made it plain that we will “openly advocate responsible stewardship and public awareness of fisheries and conservation issues.” Because of these commitments, and because of the significance of the development of federal policy related to wild salmon and salmonid enhancement, the Council has chosen to issue an extraordinary report on this subject.

I. Standards and methods of evaluation

The Council’s first annual report set out the standards by which its members would evaluate government policy and practice. We began by stating that we understood the term “conservation” as it appears several times in the Terms of Reference to mean “conservation” as described by Olver et al. in the *Canadian Journal of Fisheries and Aquatic Sciences*, 1995: “The protection, maintenance and rehabilitation of native biota, their habitats and life-support systems, to ensure ecosystem sustainability and biodiversity.”

We then set out a summary of principles by which the Council intended to pursue the mandate. Principle I refers to “the conservation of biologically diverse and abundant” fish populations, as well as the conservation of “the health of the ecosystems upon which they depend.” Principle III refers to “the importance of marine biological diversity, sustainability in fisheries management regimes and fishing practices, and the cultural, recreational and economic values” associated with the Pacific fisheries.” We refer to the United Nations’ 1992 Convention on Biological Diversity, particularly the intent of the signatory nation-states to be conscious of the “intrinsic value of biological diversity and of the ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic values of biological diversity” and its components.

We then went on to specifically address the central question that government policy respecting wild salmon would be expected to address: “At what level of diversity should fish populations be conserved?” To address this question, the Council set out five specific principles that were significantly informed by Dr. Brian Riddell’s seminal 1995 paper, “Spatial Organization of Pacific Salmon: What to Conserve?” The principles were these:

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1. In the absence of proof, Pacific salmon habitat should be protected, and salmon fisheries managed, from the premise that separate spawning populations are genetically different, and valuable to the long-term production of the resource.
2. To avoid too narrow a focus on specific conservation problems, fisheries should be managed, and habitat-protection priorities should be assigned, in a way that takes into account long-term trends in abundance, and ensures the maximum spatial distribution of sub-populations to preserve individual stocks.
3. Priority should be given to maintaining groupings of fragmented populations and races, and to maintaining contiguous distributions between these populations and races, in order to maintain "gene flow."
4. Every effort should be made to maintain genetic inheritance and variation within enhanced populations, and to prevent their genetic impacts upon salmon populations that have not been enhanced.
5. Salmon populations that have not been enhanced, and habitat areas that have not been disrupted, should be protected over a broad spatial range. Special emphasis should be placed on protecting salmon populations with unique or atypical traits, particularly traits uniquely developed for local conditions.

The Council noted that government conduct in fisheries management and habitat protection would be evaluated according to the extent to which it was consistent with the "precautionary principle" and the related "risk-averse" approach to fisheries management decisions. The Council also made it clear that fisheries management and habitat protection should take "ecosystem functioning and inter-species relationships" into account, and the Council declared its intention to be "vigilant about government conduct in the context of integrated ecosystem approaches" to fisheries management and habitat protection.

We then identified standards that would apply in the evaluation of government policy and practice, stating that the Council would "hold governments to conduct themselves, and regulate private activity, in a manner consistent with the conservation and protection of ecological integrity and biological diversity..." and that the Council would rely upon the United Nations' Convention on Biodiversity, as well as the U.N. Food and Agriculture Organization's Code of Conduct for Responsible Fisheries, when considering matters related to fish conservation as well as habitat protection. The Council then reiterated that we would expect governments to uphold the precautionary principle and a risk-averse approach in both fisheries management and habitat protection.

The statements summarized the way we would evaluate government conduct in the salmon conservation by noting that the Council would, in essence, ask certain questions of itself: Does this practice protect ecosystem functioning? Does it protect biological diversity? Is this practice consistent with the precautionary principle? Is it risk-averse?

Finally, the Council's Terms of Reference require that we "alert the Minister of Fisheries and Oceans and the public on issues which threaten the achievement of departmentally-defined conservation objectives for Pacific fish populations or their freshwater or ocean habitat." The departmentally-defined objective relevant to this evaluation can be found in the 1995 definition of conservation as it relates to salmon, established by the Salmon Subcommittee of Fisheries and Oceans' Pacific Stock Assessment Review Committee (PSARC), namely: "Conservation is that aspect of *Oncorhynchus* management that maximizes the potential for sustainable benefits by providing for the greatest spatial and temporal diversity of naturally spawning populations."

II. An Evaluation of the Six "Principles" Proposed as Policy in the March 15, 2000 *Wild Salmon Policy—Discussion Paper* Document

The Council chose to confine itself to an evaluation that is strictly within its Terms of Reference and its established standards and principles, as well as the "departmentally-defined" objective of managing salmon fisheries according to the PSARC "conservation" definition. Furthermore, this document proposes that the Council evaluate only the six proposed "principles" of the *Wild Salmon Policy—Discussion Paper*, with only necessary reference to language that appears elsewhere in it. In sum, there is much that the Discussion Paper contains that suggests approaches clearly consistent with the standards the Council has articulated. But much of the document is contradictory as well, and its contents, as the Council's discussions with Fisheries and Oceans officials have revealed, often appear to suggest approaches to salmon policy that were unintended.

The proposed principles, as set out in the *Wild Salmon Policy—Discussion Paper*, are these:

Principle One:

"Wild Pacific salmon will be conserved by maintaining diversity of local populations and their habitats."

Principle Two:

"Wild Pacific salmon will be managed and conserved as aggregates of local populations called conservation units."

Principle Three:

"Minimum and target levels of abundance will be determined for each conservation unit."

Principle Four:

"Fisheries will be managed to conserve wild salmon and optimize sustainable benefits."

Principle Five:

"Salmon cultivation techniques may be used in strategic intervention to preserve populations at greatest risk of extinction."

Principle Six:

"For specified conservation units, when genetic diversity and long-term variability may be affected, conservation of wild salmon populations will take precedence over other production objectives involving cultivated salmon."

After careful review, the members of the Pacific Fisheries Resource Conservation Council are in agreement that these six principles are flawed.

In some respects, a cursory reading of the six principles articulated in the *Wild Salmon Policy—Discussion Paper* suggest that practices guided by these principles would appear to be an articulation of practices which have governed Fisheries and Oceans' decision-making for several years.

In other respects, the principles appear to anticipate new approaches to salmon-fisheries management. An example is the establishment of "minimum and target levels of abundance" for spawning aggregates which would be called "conservation units" as proposed in Principle Two. But salmon fisheries have long been prosecuted upon "aggregates of local spawning populations,"

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a policy and a practice that has resulted in losses of biological diversity which Fisheries and Oceans has recently attempted to stem by moving to more "selective" fisheries.

Particularly worrisome is the apparent inability of Fisheries and Oceans Canada to articulate a single, clear and unequivocal statement that wild salmon will enjoy management priority when it comes to making decisions about salmon on Canada's west coast. In the early stages of the development of these principles, just such a clear and unequivocal statement was proposed by Fisheries and Oceans' science branch. Between the early draft prepared by scientists, as presented during a workshop, "Pacific Salmon: Status of Stocks and Habitat," at Simon Fraser University, June 1, 1999, and the March 15, 2000, discussion paper, that statement was compromised. The effect of the revision removes explicit policy direction, which the Council concludes is a fundamental shortcoming of the principles set out in the *Wild Salmon Policy—Discussion Paper*.

This is particularly the problem with Principle One, which is less a statement of policy than a statement of the obvious, or at least a statement of intention. It maintains formally what has become implicit management policy. There is nothing new in the position that wild salmon will be conserved by maintaining the diversity of local populations and their habitats. The question is, at what level of diversity is Fisheries and Oceans committed to conserving wild salmon?

The "conservation unit" concept, as it is described in the Discussion Paper, would afford no specific protection at all to local spawning populations of salmon, of which there are believed to be more than 9,000 in British Columbia. Instead, the objective of the proposed policy appears to be a grouping of all those spawning populations into fewer than 100 "conservation units," a level of diversity that does not take into account the distribution, status, genetic characteristics or spatial distribution of the spawning populations within conservation units.

Principles Two and Three do little to clarify the matter. Establishing minimum and target levels of abundance may be a laudable innovation, but nowhere in the principles, or in the Discussion Paper's supporting statements, does Fisheries and Oceans accept the responsibility to ensure that minimum targets of abundance take into account the need to maintain salmon's role in ecosystem functioning and inter-species relationships. Nowhere is there any policy direction that clearly provides for integrated, ecosystem approaches to fisheries management and habitat protection. Nowhere is there a clearly stated intent to ensure that abundance targets reflect defensible, historically-determined "baselines" of salmon abundance.

Nowhere does Fisheries and Oceans explicitly commit itself to the widely-accepted requirement of protecting the maximum spatial distribution of sub-populations within spawning aggregates. Nor is there any apparent intent to conserve groupings of fragmented salmon populations, or to maintain contiguous distributions between these populations and races. Neither is there any apparent intent, by introducing the "conservation unit" concept, to prevent genetic impacts from enhanced populations upon populations that have not been enhanced. Fisheries and Oceans policy should clearly and unequivocally declare its intentions along these lines. These are necessary and well-recognized safeguards for maintaining biological diversity in salmon, and they should be clearly reflected in Fisheries and Oceans policy.

These safeguards do not appear in Principles Four or Five, which express a clear intent to balance salmon conservation with sustainable use, but which imply that "salmon cultivation techniques," such as hatcheries, can be used where wild salmon populations have been allowed to fall to such low levels of abundance that they are at risk of extinction. While small-scale hatchery interventions may be useful as a temporary last resort in such cases, Principle Five, particularly, does not make it plain that hatcheries themselves should be evaluated primarily on the basis of the

contributions they make to wild salmon conservation, particularly in light of the fact that artificial production can actually threaten the integrity of wild salmon populations.

Principle Six, meanwhile, should simply and clearly state that the "conservation of wild salmon populations will take precedence over other production objectives involving cultivated salmon," which is what Fisheries and Oceans science branch initially proposed. Instead, that statement was compromised by the addition of two subordinate clauses which severely weaken Fisheries and Oceans' commitment to wild salmon.

Under Principle Six, Fisheries and Oceans commits itself to ensure that salmon conservation will take precedence only "for specified conservation units," and only "when genetic diversity and long-term variability may be affected." This reduces the role of Fisheries and Oceans, which is responsible for conservation of salmon under Section 96 of the Constitution, to a function more similar to that of the U.S. federal government, which is entitled to intervene to protect wild salmon only when state agencies have allowed salmon abundance to fall to levels requiring emergency action under the U.S. Endangered Species Act.

Federal salmon policy guided by the proposed principles set out in the *Wild Salmon Policy—Discussion Paper* may well condone the persistence of management practices that have been clearly demonstrated to be inconsistent with the precautionary principle and the concept of risk-averse management. It is also the Council's opinion that certain of the approaches counselled by the proposed principles would likely put wild salmon at greater risk, and would narrow the opportunities to make appropriately cautious management decisions.

Furthermore, in their totality, the six principles cannot be considered consistent with Fisheries and Oceans' own departmentally-defined conservation objective for wild salmon, as set out in the PSARC Salmon Subcommittee's 1995 salmon conservation definition.

To paraphrase the questions the Council said it would ask itself when evaluating government conduct and policy with respect to salmon conservation: Would a policy articulated by the six principles set out in the *Wild Salmon Policy—Discussion Paper* protect ecosystem functioning? Would it protect biological diversity? Would such a policy be consistent with the precautionary principle? Would it be risk-averse?

Unfortunately, the answer to each of these four questions is "no."

III. Wild Salmon Policy: Recommendations and Advice

It is encouraging that Fisheries and Oceans is setting about the work of establishing policy with respect to wild salmon on Canada's west coast. In its first report, the Council observed that Fisheries and Oceans "demonstrates no clear and consistent policy" in these matters. We conceded that this was a difficult policy to articulate, noting that defining conservation with any precision should be considered a work-in-progress. The Council wishes to congratulate Fisheries and Oceans officials who have seen the necessity of a clearly-articulated policy with respect to the conservation of wild Pacific salmon, a term the Council considers to mean naturally-spawning populations of salmon. The Council strongly urges the Minister of Fisheries and Oceans to oversee the further development of just such a wild salmon policy, and looks forward to advising the Minister and his staff in developing such a policy.

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An appropriate policy for the conservation of wild salmon and their habitat in British Columbia must:

1. Provide for the conservation of biologically diverse and abundant fish populations, as well as the health of the ecosystems upon which they depend.
2. Recognize the intrinsic value of biological diversity, including its ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic values.
3. Provide protection for salmon and salmon habitat from the premise that separate spawning populations, in the absence of proof to the contrary, are genetically different and valuable to the long-term productivity of the resource.
4. Take into account long-term trends in abundance, and ensure the protection of the maximum spatial distribution of sub-populations.
5. Assign priority to the conservation of groupings of fragmented populations to maintain contiguous distributions between these populations and races, to maintain "gene flow."
6. Maintain genetic inheritance and variation with enhanced populations and prevent any genetic impacts from enhanced populations upon populations that have not been enhanced.
7. Conserve non-enhanced populations and their habitat over a broad spatial range, particularly for those populations that exhibit unique or atypical traits uniquely developed for local conditions.
8. Demonstrate with practical examples how the policy would support the precautionary principle and a risk-averse approach to fisheries management and habitat protection.

The Pacific Fisheries Resource Conservation Council, in its evaluation of government policy and conduct with respect to the conservation of salmon, is guided primarily by what science tells us about the requirements for salmon's survival. The conservation of genetic diversity in salmon populations, for instance, is a key test by which the Council assesses conservation policy. On this basis, we recommend that if "conservation units" are adopted as Fisheries and Oceans policy, they must be defined so as to protect genetic integrity within each unit, so that the loss of a population or populations within a conservation unit can be addressed by re-establishing lost runs from surviving populations within the unit. Conservation units should be then further subdivided to reflect the presence of populations that tend to fluctuate together in abundance. Also, conservation units must reflect cultural, aesthetic and heritage values, and must also take into account the fact that scientific knowledge evolves and changes, as do salmon populations, their habitats, and the ecosystems within which they occur.

But conservation policies that meet the tests established by the sciences should not be regarded as a lofty ideal. Meeting these tests should be regarded as a bottom line by Fisheries and Oceans, because there are other tests that must also be met.

A salmon run is important not only for its genetic information, but to the ecosystem within which it occurs, and to dozens of species within that ecosystem. A salmon run is not expendable simply because its genetic information is overwhelmingly similar to another salmon run, or if a nearby hatchery produces fish of a similar or even identical genetic character. That same salmon run may be central to the exercise of a particular First Nation's constitutionally-protected fishing rights. That same salmon run may have been the object of care and attention by generations of settler families. That same salmon run's very existence may be the consequence of vigilant stewardship and dedication, against all odds, of the kind practiced by thousands of British Columbians.

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These values, along with what science tells us about the genetic value of salmon runs, must also be considered in the articulation of policy to conserve wild Pacific salmon.

It is true that Fisheries and Oceans cannot be expected to manage fisheries in ways that will ensure the conservation of each and every little salmon run in British Columbia. But it is also true that fisheries-management decisions, and particularly habitat-protection decisions, must be made in ways that do not accept the extinction of salmon runs, or even the possibility of their extinction.

The conservation of wild salmon is largely dependent upon cultural values. Over the years, those values have changed dramatically in British Columbia. Salmon have been involved in that change. British Columbian culture has changed. So has Canadian culture.

This has been reflected recently in the policies of Fisheries and Oceans. The cultural change at work within Fisheries and Oceans must continue.

IV. The Salmonid Enhancement Program—Its Historical Context

The Salmonid Enhancement Program was originally envisioned as one designed primarily to develop more sophisticated salmon-fisheries management regimes, with enhancement intended to supplement wild production only where the fishing effort on enhanced stocks could be properly managed. But the political attractiveness of simply producing "more fish" resulted in the Salmonid Enhancement Program being geared to doing just that: producing more fish.

It is useful to consider the historical context in which this program was created. From the late 1950s until well into the 1990s, it was official Canadian policy to exert extreme fishing pressure upon chinook and coho stocks. This policy was intended to be used to influence U.S. negotiators at the Pacific Salmon Treaty table because chinook and coho bound for American rivers, not just Canadian rivers, were caught in these intensive fisheries. The main fishing pressure was applied on the West Coast of Vancouver Island, but the policy was also pursued in the Strait of Georgia and in north coast waters. The catch in these fisheries was essentially unregulated. High short-term earnings attracted considerable commercial fishing effort and investment.

Meanwhile, the capitalization and catching power of the Canadian commercial salmon fleet grew rapidly through the 1960s and the 1970s. The commercial fleet, fish processing sector and organized recreational fisheries lobby exerted tremendous political influence to urge the federal government to produce "more fish."

Because of British Columbia's mountainous landscape, most residential and industrial development occurred along the valley bottoms, in salmon watersheds, often with dramatic direct and indirect impact upon the productive capacity of salmon, despite many noble efforts to mitigate those impacts. In the 1960s and 1970s, industrial and residential development was rapid. Salmon habitat was poorly protected. At the same time, salmon stocks were fished as though habitat productivity remained unaffected.

In the 1970s, increased chinook and coho production in Washington and Oregon was attributed to the hatchery programs in those states. In B.C., large amounts of public funds were invested in hatcheries at the Big Qualicum, Capilano and Quinsam rivers, in spawning channels on the Babine and Fraser river systems, and in "fish ladders" at Hells Gate, Meziadin and Moricetown. These investments in salmonid enhancement showed initial signs of strong, long-term returns. New enhancement technologies, such as lake and stream enrichment initiatives, "Japanese style"

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hatcheries and incubation boxes offered great hope for increased fish production, especially in areas where production would not be intercepted by the U.S. fishing fleet.

Before long, however, public investments in these enhancement initiatives became controversial, as their unintended consequences became known. Those consequences have included: harmful effects of mixed-stock fisheries; fisheries prosecuted upon salmon runs that exhibited differing productivity rates; genetic interactions between wild and hatchery populations that undermined the wild runs' uniquely adapted characteristics; and competition between wild and hatchery salmon for limited freshwater and early-ocean habitat resources.

Within Fisheries and Oceans, conflicts developed over the wisdom of proceeding with such massive experiments in artificial salmon production without a management strategy or institutional resources to accommodate existing fisheries, as well as fisheries prosecuted upon enhanced runs.

Initially, the Salmonid Enhancement Program was intended to be a long-term, federal-provincial partnership. The perceived benefits of enhanced production were expected to accrue in employment creation, regional economic development, aboriginal fisheries, and other positive results. Consequently, several federal and provincial agencies were involved in developing Salmonid Enhancement Program strategies. The program was also expected to be evaluated on purely fiscal terms, and was to be implemented on a cost-recovery basis.

In the first five-year phase, begun in 1977, the strategic objective of the Salmonid Enhancement Program was to increase salmon production in British Columbia by about 23,000 tonnes per year within five years, at a cost of \$150 million. The long-term goal was to double salmon production to 86,000 tonnes per year.

From the very beginning, the Salmonid Enhancement Program was biased towards large-scale capital projects, such as hatcheries. Such projects, on paper, presented convincing arguments about investment and profitability. A great degree of scientific uncertainty surrounded these approaches. Biologists could not say with any certainty which of the proposed new techniques would work, or how well, or in some cases, whether they would produce more fish in the long-term at all. Management biologists were also uncertain about whether it would be possible to alter fishing practices in such a way as to ensure sustainable harvests upon enhanced stocks without causing damage to wild stocks.

Where biologists expressed uncertainty, engineers offered confidence. Engineers could make a convincing case that for a specified cost, they could build a physical structure to make more fish. They could confidently claim the ability to control many of the physical variables that were known to affect salmon survival.

Small-scale projects, while potentially more benign, were difficult to justify on narrow cost-benefit terms, and they were inherently more difficult to manage than a small number of large-scale projects. The Community Economic Development Program was designed to start with small community projects that would allow the evaluation of various technologies and at least begin to increase local production, scaling up the projects as soon as they were fully operational. But small, community projects were often passed over in favour of larger projects. Far more money was spent on large-scale hatcheries and spawning channels than on low-technology, semi-natural and temporary approaches.

Another aspect of the Salmonid Enhancement Program that did not easily meet strict cost-benefit analyses was its public-education component, particularly the Salmonids In The Classroom program. The commercial industry lobbied against these initiatives because they generally did not produce fish.

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However, there was strong public support for these initiatives, so they persisted as a high-profile feature of the Salmonid Enhancement Program. Funding levels, however, were limited through time.

In hindsight, it is difficult to say whether the Salmonid Enhancement Program and its predecessors, which have accounted for close to a half-billion dollars in public investments over the years, have produced any net return on investment, if measured by a net gain of salmon. There is evidence to suggest a net loss of wild salmon abundance, directly and indirectly because of enhancement initiatives. Several enhancement facilities, for instance, have aggravated mixed-stock fisheries problems that have put wild stocks at risk. One example of this impact is Strait of Georgia coho populations that were fished for several years at unsustainably high harvest rates due to fishing effort based largely on hatchery coho. Another example can be found in small populations of wild sockeye and populations of steelhead and coho in the Skeena watershed, which were overfished for several years because of fisheries directed upon enhanced sockeye runs to the Babine system in the Upper Skeena watershed.

V. The Salmonid Enhancement Program: Recommendations and Advice

The most obvious lessons to be drawn from this historical overview is that there are often serious consequences that result, over the long-term, in attempting to improve upon nature, and grave consequences that result from natural-resource management that is not guided by a precautionary approach. The history of the Salmonid Enhancement Program is, to an unfortunate extent, a history of failing to manage cautiously, and of not responding to emerging knowledge about the program's negative effects. It has been far easier to attend a ribbon-cutting ceremony at a hatchery complex than it has been to focus on the long-term, difficult commitments necessary to ensure the abundance of wild salmon.

The expression "long-term" is not just about the future, either. It is also about the past, as is the case with the establishment of minimum abundance levels in the "conservation unit" concept proposed by the *Wild Salmon Policy—Discussion Paper*. What has been lacking in salmonid-enhancement policy is a clearly established, historic "baseline" to provide objectives around which restoration efforts can be built.

At the same time, it would be wrong to dismiss the contributions of the Salmonid Enhancement Program out of hand. Its non-controversial benefits include: construction of fishways and fish-ladders to repair damage caused by industrial development; obstruction removal, side channel development and "natural stream complexing"; construction of small artificial spawning channels and rearing channels; and so on. In hindsight, however, the public-education initiatives undertaken through the Salmonid Enhancement Program may be its most enduring legacy.

But, in evaluating Fisheries and Oceans' efforts to enhance salmon production through artificial means, such as cultivation through hatchery production, it is important to recognize that under no circumstances should hatchery production or other cultivation practices serve to replace wild salmon production.

The Council's review of the Salmonid Enhancement Program leads inevitably to the conclusion that some facilities created by it have resulted in the displacement of wild salmon by hatchery-produced fish. This has occurred when hatchery salmon have attracted fishing effort that unavoidably produced unsustainably high rates of harvest on co-migrating wild salmon. It has also occurred because juvenile fish from wild populations have been subjected to competition from hatchery fish in rearing areas, and in the ocean phase of the salmon life cycle.

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Declines in numerous wild-salmon populations, concurrent with increases in production from a few large hatcheries, tend to create a situation in which salmon abundance is attributable to ever-fewer stocks. This places the salmon resource at an increasingly greater risk of random, catastrophic disruption.

As a general principle, hatchery production can be justified only when it can be clearly shown that:

1. such interventions are necessary to assist temporarily in the conservation of a wild population that has declined in abundance to a point at which its existence is threatened;
2. such interventions will produce demonstrable benefits without causing negative impacts upon wild salmon, either through competition among juveniles, undesirable genetic interactions, or the attraction of fishing effort that presents risks to wild populations.

Salmon-enhancement initiatives should provide the general public with constructive ways to participate in the restoration of salmon runs. Throughout British Columbia, there is a vast, untapped human resource that could be harnessed for the purposes of conserving wild salmon.

That resource exists in the presence of thousands of hatchery volunteers, "creek watch" volunteers, members of streamkeeper groups, commercial fishermen, anglers, and members of British Columbia's 196 Indian bands. They are public-spirited citizens who have demonstrated their willingness and enthusiasm for an idea of British Columbia as a place in which people and wild salmon might co-exist and thrive in the same landscape.

Such individuals deserve better than to be assigned as groundskeepers around the tombs to biological diversity that so many large salmon hatcheries have become. They should be given all the necessary resources, under the auspices of a re-dedicated Salmonid Enhancement Program, to the purpose of restoring, conserving, and protecting wild salmon in all its abundance and diversity.

The Salmonid Enhancement Program should explicitly declare itself to that same purpose.

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