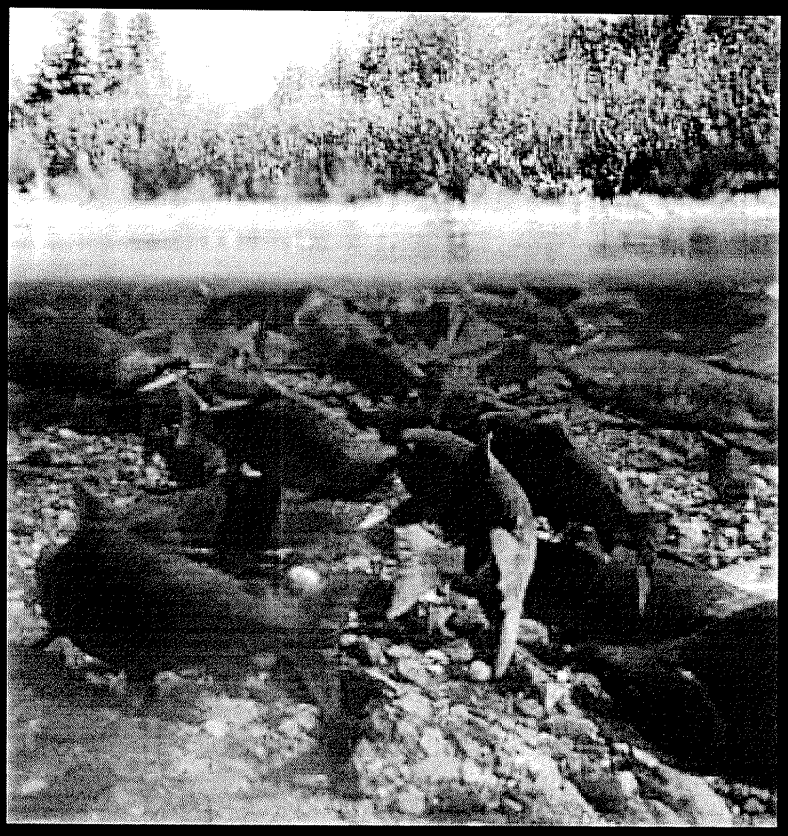
Protecting the Public Interest
in the Conservation of Wild Salmon
in British Columbia

A Strategy for the Conservation of Pacific Salmon



A report by Terry Glavin for the
Sierra Club of British Columbia

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BRITISH COLUMBIA

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A Strategy for the Conservation of Pacific Salmon

A Report by Terry Glavin
for the Sierra Club of British Columbia
January, 2003

DEDICATION

To Yvon Chouinard and Giles and Parry Mead, whose vision and generosity got the whole thing going.

CREDITS

Writing: Terry Glavin

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SUMMARY

Findings

An overwhelming majority of British Columbians understand that salmon are worth far more to society, to local landscapes and to ecological functioning, than their mere commercial value.

Salmon have come to play an irreplaceable role in the British Columbian identity and in our pride of place. While still economically significant to some coastal communities, salmon are no longer of any direct consequence to the provincial wage economy. Salmon conservation has become a deeply held social and cultural concern of British Columbians. It is the concern of specific communities for specific salmon runs, and it is also an across-the-board priority for British Columbians, wherever they live.

While salmon depend upon healthy terrestrial ecosystems, the converse is also true: the health of terrestrial ecosystems often relies heavily upon salmon.

Dozens of species, from sculpins to grizzly bears, directly rely upon the wide dispersal of salmon throughout the landscape. The famous productivity of much of British Columbia's terrestrial ecosystems can be understood, in large measure, as a consequence of the presence of salmon.

The recent history of B.C.'s salmon runs is not simply a story of persistent decline.

Dozens of B.C.'s salmon runs have become biologically extinct, and hundreds of others have been rendered commercially extinct and persist only in remnants. However, salmon runs can exhibit dramatic recoveries following years of overfishing and habitat loss. Also, throughout their range, salmon fluctuate in abundance over time, in step with broad-scale environmental forces.

Technological approaches to the challenge of salmon conservation have consistently failed to live up to their promises.

Even though hatchery production has been shown to result in the genetic dilution of locally adapted wild strains, and fishing pressure attracted by hatcheries has resulted in overfishing of nearby wild salmon runs, technological approaches such as hatcheries persist as a government spending priority. Canada has spent more than half a billion dollars on Pacific salmon hatcheries and other artificial enhancement initiatives. These spending priorities persist, even though hatchery fish have displaced wild fish, spawning channels have replaced natural spawning habitat and ecological functioning has been seriously disrupted, from the Little Campbell River in South Surrey to the Skeena River on B.C.'s north coast.

The greatest challenge facing the relationship between people and salmon at the beginning of the 21st century is the persistence of outmoded government policies.

These policies are relics of the past and do not accord with the changing conditions that salmon are encountering in the post-industrial era. Government policy fails to accord with the scientific understanding of the conditions necessary for salmon conservation, and, most importantly, government policy is completely out of step with changed public values in B.C.. Profound cultural changes are sweeping British Columbian society, but institutional cultures within government simply have not kept pace.

A continuing, chronic dysfunction besets Fisheries and Oceans Canada (DFO).

At its heart is a deeply rooted conflict between the public interest in salmon conservation and DFO's institutional interest in resource extraction and production. DFO officials routinely demonstrate their inability to reconcile their duty to protect the public interest in salmon conservation with DFO's other various obligations. The federal government's inability to rise to the challenge that this unnecessary conflict presents has resulted in a lack of leadership and vision within DFO, as well as within the provincial government. The federal government's emphasis on hatcheries and its heavy subsidies to salmon aquaculture are evidence of this. Of seven different "management objectives" DFO identifies for salmon fisheries, only one identifies objectives under a general heading of "conservation/sustainability."

The way forward

Salmon are involved in ancient and specific relationships with aboriginal communities. Salmon are rightly subject to the legally enforceable fishing rights of B.C.'s First Nations, and aboriginal communities are rightly afforded priority in the allocation of harvestable surpluses of salmon. Salmon remain a Crown-owned resource. Salmon do not belong to the government, or to industry. They belong to all Canadians, and all British Columbians, to generations long dead and generations unborn. Our duty to conserve salmon is a duty to generations of Canadians to come.

The public will to conserve salmon must take precedence over the imperatives of outmoded economic measurements and institutional convenience.

For these reasons, Fisheries and Oceans Canada must be reformed to ensure that the federal authority over salmon and salmon habitat places the public interest in salmon conservation before all other "stakeholder" interests. The public will to conserve salmon must take precedence over the imperatives of outmoded economic measurements and institutional convenience.

If salmon are to persist as a key feature of the B.C. landscape through the 21st century, a healthy relationship between people and salmon must be allowed to grow and flourish. Conservation must be truly paramount, and B.C.'s economic, social and cultural values for salmon must directly inform government policy. A wholly new vision must guide government decision making on salmon conservation, one that ensures that all production objectives are subsidiary to the importance of salmon as a keystone species upon which B.C.'s environmental health so deeply depends, and to the importance of salmon in B.C.'s cultural consciousness.

Specifically:

The conservation of B.C.'s salmon populations must take precedence over all other objectives for salmon production, and salmon populations must be conserved, in the greatest biological and genetic diversity and abundance, for their intrinsic values.

These values are not exclusively and directly economic in nature. In keeping with the purposes of the United Nations Convention on Biological Diversity, the diversity and abundance of B.C.'s salmon populations must be maintained for ecological, genetic, social, scientific, educational, cultural, recreational and aesthetic values.

The federal government, through DFO, must commit itself to protecting and maintaining salmon habitat on an ecosystem basis.

Both the federal and provincial governments should assume joint responsibility for protecting the health of the ecosystems upon which salmon depend.

Federal fisheries-management and fisheries-habitat policies must take into account the role salmon play in ecosystem functioning.

Salmon must be conserved to ensure the continued diversity and abundance of myriad aquatic and terrestrial species that depend upon the diversity and abundance of salmon across the broadest possible range.

The federal government must commit itself to a precautionary approach in its decision-making, and must always make efforts to regulate fisheries and protect salmon habitat in a risk-averse manner.

This will mean ensuring that, at a minimum, fisheries are managed so that their impacts upon salmon runs are predictable and sustainable, and the genetic integrity of salmon populations is protected. It will also mean that, at a minimum, habitat is protected in ways that allow gene flow between fragmented populations. Similarly, safeguards must be established to ensure that hatcheries and other enhancement or production initiatives, including aquaculture, pose no threat of adverse impacts upon wild salmon populations.

Introduction

People and salmon have maintained a complex relationship throughout the northwestern quarter of the North American continent for at least 10,000 years.

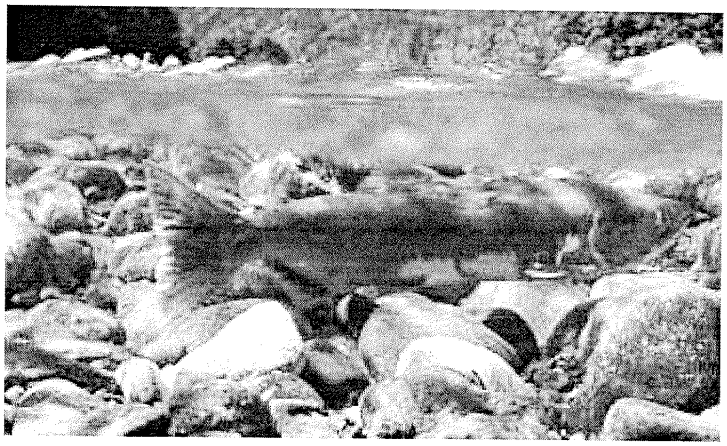
The relationship began at the close of the long Pleistocene winter, as salmon returned from their far-off ice-age refugia to colonize glacier-scarred valley bottoms from Cape Mendocino to the Gulf of Alaska. From the spawned-out bodies of those early salmon pioneers, the first forests found necessary nutrients. From those first salmon runs, the first human communities, placed here by Raven, X:als and Coyote, found sustenance.

From those early times, human communities began to develop elaborate customary laws to govern their relationships with salmon. The result, over thousands of years, was a ritualised economic and cultural intimacy between people and fish that was without parallel in human history.

By the middle of the 19th century, however, those old relationships were already being severely disrupted. Epidemic diseases had devastated ancient fishing communities, and after the settlement of Europeans and the rise of the industrial revolution, the great valleys were mined of their forests, and hydroelectric dams turned rivers into holding ponds. Huge hatchery complexes were constructed in the belief that salmon did not even need rivers. Great fishing fleets scoured the coast, and the clanging and whirring of salmon canneries broke the silence of wind-sheltered coves and bays from San Francisco to Sitka.

Now, at the beginning of the 21st century, the industrial empires that were built upon salmon are producing only the most vague background noise in the economies of North America's Pacific coast. But something quite unexpected has happened, and the relationship between people and salmon has once again reached an historic threshold. The salmon that once swam at the vortex of aboriginal cosmologies have now come to occupy a totemic place within settler cultures.

Something historically important is taking place, and it manifests in public-opinion surveys, in the issues debated during local municipal elections and in the forum of national, provincial and state politics. Its consequences are being given expression in everything from real-estate values to popular art. It is a complex phenomenon, and it arises from profound cultural changes that have been under way for many years.



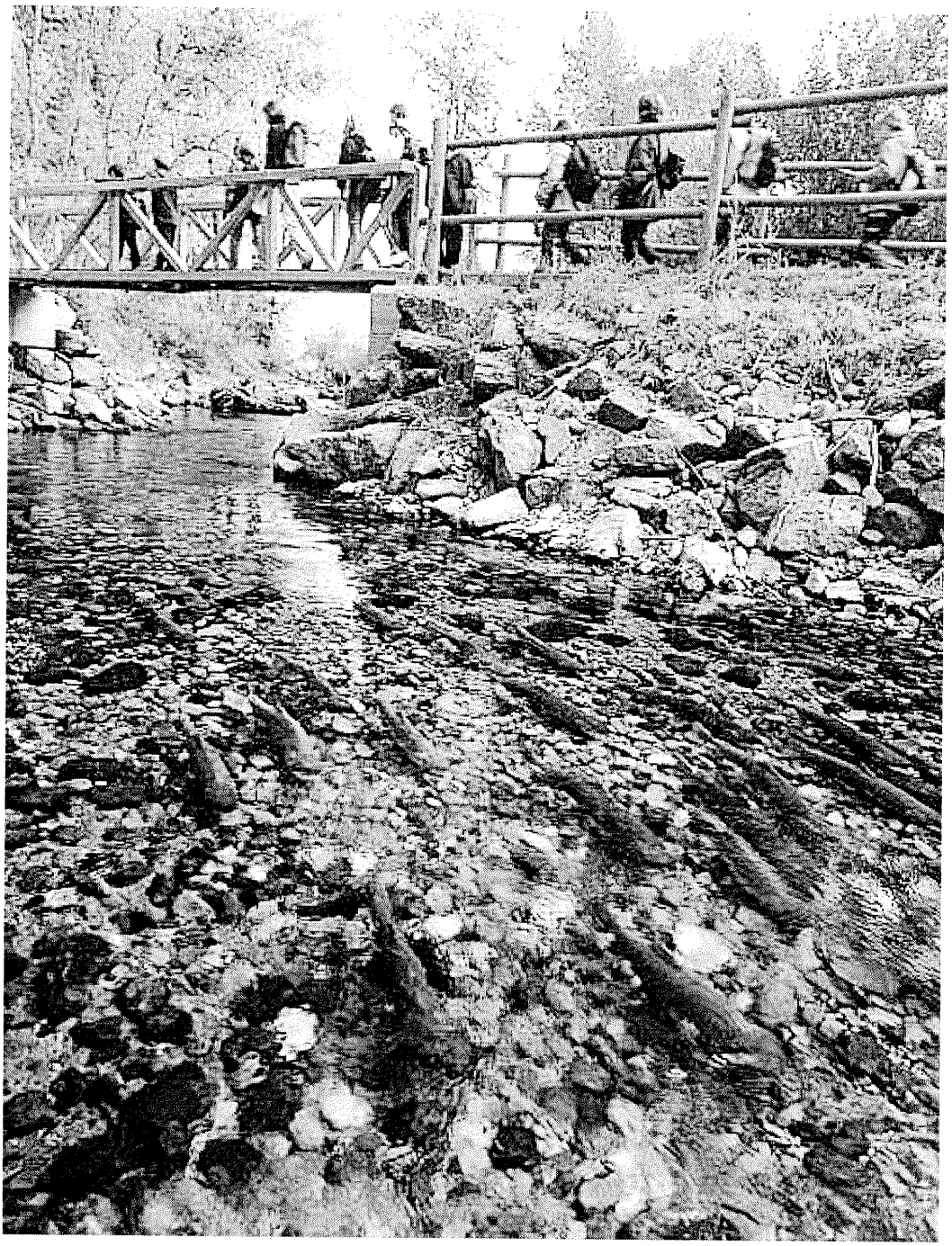
TERRY BROWN

Co-existing with Salmon

Within the six Pacific salmon species are subpopulations that exhibit a dizzying array of survival strategies. Some salmon are known to travel more than a thousand kilometres inland to their spawning grounds. Some Fraser River sockeye traverse a dozen different types of habitat in their lifetimes. Many coho salmon spend half their lives in freshwater, quite commonly in close proximity to human communities, in some of the most heavily urbanized areas of the B.C. coast.[3]

Unlike other marine species, salmon require habitats that tend to coincide directly with the kinds of landscapes preferred by human communities: valley bottoms nourished by clean, cold water and protected by lush vegetation. In contrast to public perceptions, most of the Fraser River's salmon runs arise in the lower portion of the river basin. Sockeye are the only species that spawn predominantly above Hope; 60 per cent of the coho, 90 per cent of the chum, 80 per cent of the pink salmon and about half the chinook salmon spawn in British Columbia's southwest corner—which is also where most British Columbians live.[4]

There is not a single major salmon run in B.C. that has not been subjected to intensive human harvest for thousands of years. There is not a single salmon run anywhere in British Columbia with a future that does not depend upon a healthy relationship with human communities. Just as the history of salmon is inextricably linked with people, the future of salmon will depend upon people. Salmon have always co-existed with human societies, and salmon are destined to co-exist with human societies.



GARTH LENZ

GARTH LENZ

Salmon and Society

Changing public values

Canadians have begun to demonstrate an increasing awareness of the importance of environmental health—the importance of biological diversity and healthy ecological functioning. Environmental values have become mainstream values. Public-opinion surveys routinely show this sea change in public thinking.

The British Columbian concern for salmon

Salmon are now recognized as a vital component of the British Columbia landscape.

In British Columbia, environmental values are deeply entrenched, and are given expression in the most pronounced ways when it comes to salmon. Recent public-opinion polls show an overwhelming majority of British Columbians understand that salmon are worth far more to society, to local landscapes and to ecological functioning, than their mere commercial value. Salmon are now recognized as a vital component of the British Columbian landscape itself, and salmon are accepted as the most significant keystone species in terrestrial ecosystems west of the Rocky Mountains. Salmon have come to play an irreplaceable role in British Columbians' identity and heritage and in British Columbians' collective pride of place.

These values reflect profound changes that are becoming embedded in human cultures throughout the range of Pacific salmon. In December 1997, Oregon's largest newspaper conducted a public-opinion poll that demonstrated that 85 per cent of Oregonians favoured the conservation of wild salmon runs for their own inherent value. The majority of Oregonians stated they were also willing to pay higher taxes to protect salmon, and regarded the conservation of salmon runs as more important than any commercial use of salmon rivers. Residents of Idaho

have come to favour breaching dams in order to restore populations of salmon and steelhead. In Washington State, where the application of the federal *Endangered Species Act* to protect salmon in large urban areas was widely expected to provoke a backlash, in fact, the opposite happened. In the Seattle area, residents have demonstrated that they are more than willing to co-exist with salmon, and are willing to make sacrifices to ensure that salmon persist even in the most urbanized environments.

Public-opinion polls in B.C. show a consistent willingness by British Columbians to place the conservation of salmon and salmon habitat as a higher priority than economic development.

These same values are reflected in public-opinion polls in B.C., which show a consistent willingness by British Columbians to place the conservation of salmon and salmon habitat as a higher priority than economic development. Every weekend, thousands of British Columbians routinely involve themselves in a variety of salmon-conservation initiatives. The various non-extractive values associated with salmon are now being afforded higher public priority than the conventional commercial and extractive values of salmon.

These changed public priorities are not well reflected in political priorities, however, and the cultural changes under way in mainstream society have been slow to produce changes within the policies and institutions of government. As an example, the November 2000 federal election campaign in Canada was dominated by fiscal issues, such as the appropriate extent of curbs on government spending and tax cuts. The public, however, had other things on its mind. Only two months after the election, a public-opinion poll showed that Canadians were far less interested in tax cuts than in government action to effectively protect endangered species.

This Pollara poll showed that 94 per cent of Canadians wanted laws to protect endangered species: an anomaly in public-opinion surveys, which rarely show public support exceeding 90 per cent for any issue. The survey showed no demonstrable difference in urban and rural opinion on the subject; in fact, a third of rural residents, who would be most affected by land-development restraints to protect endangered species, said they would willingly sacrifice a third of their lands if that was necessary to protect endangered species. The overwhelming majority of Canadians—86 per cent—said endangered-species protection should take priority over economic development.[1]

An exhaustive public-opinion survey conducted in April 2000 by the Habitat Conservation and Stewardship Program of Fisheries and Oceans Canada (DFO) shows just how deeply British Columbians have come to identify with salmon.[2]

This survey showed:

- A majority of British Columbians say salmon runs should be protected and salmon habitat should be conserved, even if it means a slowdown in the rate of economic development or paying higher taxes.
- Support for conserving salmon habitat, even at the expense of economic development, ranged from 61 per cent in north coastal B.C., where the economic aspects of salmon-fishing are most important, to 72 per cent in the Lower Mainland, where the economic value of salmon is least significant.
- Support for the idea of paying higher taxes if necessary to protect fish and wildlife habitat ranged from 58 per cent of respondents in the southern interior to 69 per cent in B.C.'s south coast areas.
- Most British Columbians rank the commercial value of salmon behind a range of other values. These included the contributions salmon make to ecological health, to the "beauty of the region" and to tourism, recreation and the enhancement of "community involvement."
- One in ten British Columbians identified themselves as being actively involved in environmentalist activities, ranging from public-education efforts to "lobbying" and conservation initiatives.

Clearly, in the years since the first encounter between salmon and the industrial revolution, something has changed in the relationship between people and salmon. Despite widespread extinctions of local salmon populations, massive habitat loss and declines in biological diversity, salmon have persisted throughout much of their former range. They continue to arise from the depths of the Pacific Ocean to seek out the watersheds of their ancestors, usually returning to spawn in precisely the same places within the creeks and rivers where they were born.

Salmon and Terrestrial Ecology

There are dozens of species that rely directly upon the wide dispersal of salmon throughout terrestrial ecosystems.

Since the 1970s, scientific research has provided detailed descriptions of the ways in which salmon, in the freshwater phase of their lives, rely upon the healthy ecological functioning of terrestrial ecosystems. Spawning salmon rely upon cold, clean water in streams, with forest cover that regulates stream hydrology and allows for a steady recruitment of gravel for egg nests. Emerging from salmon eggs, alevins and salmon fry rely upon oxygen-rich water, with plenty of leaf litter and detritus that form the basis of micro-ecosystems of benthic invertebrates and insects. Leaving their home streams, some salmon species linger for long periods in the brackish ecosystems of river estuaries.

It is only in recent years that science has also shown just how the converse is also true—that the health of terrestrial ecosystems often relies heavily upon salmon. The productivity of much of B.C.'s terrestrial ecosystems can be understood, in large measure, as a consequence of the presence of salmon.

Contribution to ecosystem health

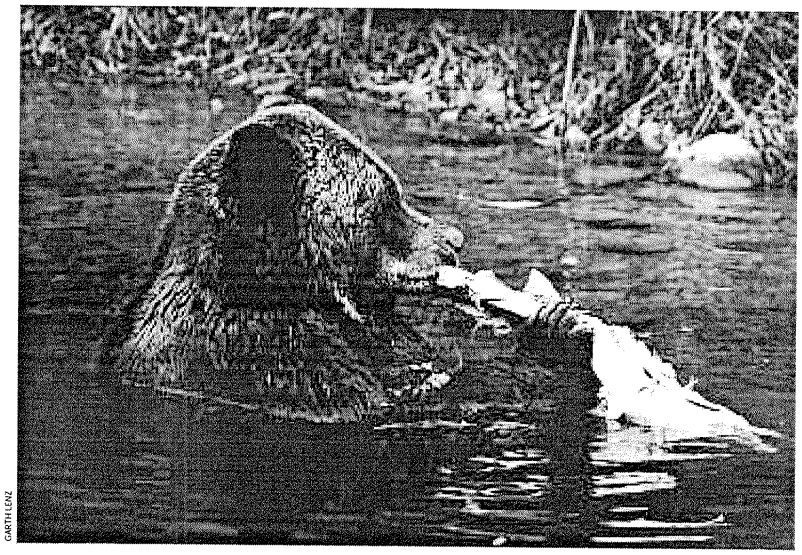
For thousands of years, salmon have been retrieving millions of tonnes of marine protein, nitrogen and phosphorous from the depths of the Pacific Ocean and depositing these nutrients throughout the vast landscapes west of the Rocky Mountains. From these nutrients the first forests emerged, and down through the millennia marine-derived nutrients have sustained the great arboreal cloak of the temperate rain forest, which, in turn, supports thousands of species from a wide spectrum of phyla. There are dozens of species that rely directly upon the wide dispersal of salmon throughout terrestrial ecosystems. These include wolves,

bears, weasels, coyotes, seals, otters, red fox, shrews, mice, squirrels, eagles, hawks, ravens, crows, gulls, kingfishers, jays, wrens and dippers. Many fish species rely on salmon as well, including fry-predators such as cutthroat trout, Dolly Varden, sculpins and grayling.[5]

Analysis of grizzly bear bones from the upper Columbia River, more than 1,000 kilometres from the sea, show that as much as 90 per cent of the carbon and nitrogen in the bears' diets came from salmon. Half the bald eagles on the North American continent south of Alaska, some from as far away as Wyoming, Saskatchewan and Arizona, routinely congregate in large concentrations during the chum-spawning season on B.C.'s salmon rivers.[6, 7]


TERRY BROWN

Although diminished in its range and extent, the biomass of salmon in the landscape continues to provide a central foundation for everything we have come to associate with the richness of British Columbia's ecosystems.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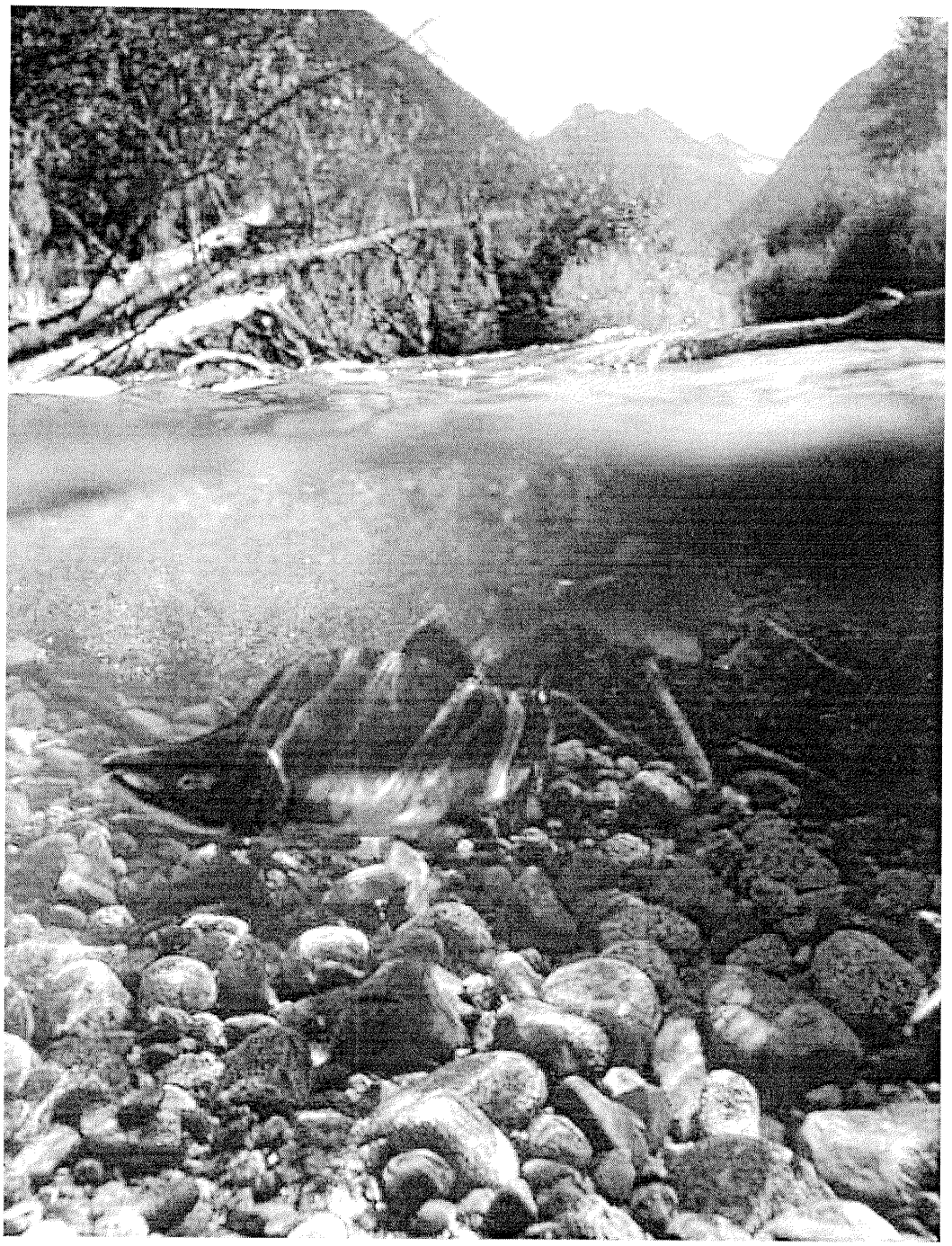

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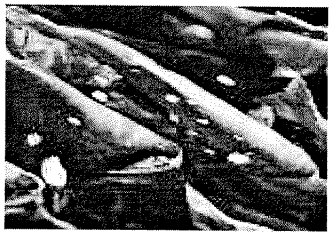


The State of Salmon in British Columbia

Natural variations in abundance

Dozens of B.C.'s salmon runs have become biologically extinct in recent years.

Some of the richest and most diverse marine ecosystems in the northern hemisphere lie on Canada's Pacific coast, which takes in nearly 25,000 kilometres of shoreline and 6,500 islands. B.C.'s terrestrial landscapes, meanwhile, are among the most ecologically diverse in North America, and salmon frequent streams and rivers within these ecosystems from the ragged coastline to the shadow of the Rocky Mountains.

Dozens of B.C.'s salmon runs, however, have become biologically extinct in recent years. Hundreds of others have been rendered commercially extinct, and persist only in remnants. *(See map, back page.)*

Salmon are not alone in suffering such losses. Localized stock collapses have taken their toll on Strait of Georgia halibut, Fraser River sturgeon, Straight of Georgia humpback whales, Strait of Georgia lingcod and rockfish and English sole, Hecate Strait petrale sole and at least 170 locally spawning herring populations. Coastwide, dramatic declines have befallen abalone, geoduck and butter sole. Of the 15 rivers in B.C. supporting oolichan runs, all were in decline in the late 1990s, and many no longer supported any fisheries. Coastal ecosystems have suffered greatly as a consequence of these losses, as have B.C.'s coastal fishing communities.[8]

For almost two centuries, human activities have caused severe damage to salmon populations.

While Alaska remains the region in North America with the healthiest salmon runs, salmon are now gone from about half of their former range south of the 49th parallel. The losses occurred so quickly and so early in the years of European settlement that it has been difficult to construct estimates of the pre-industrial abundance of salmon in the landscapes now encompassed by the U.S. Pacific Northwest. A 1999 study by three prominent U.S. biologists, however, suggests that less than 10 per cent of the pre-industrial biomass of salmon remains between Washington and California.[9]

It is precisely because of long-term shifts and changes in salmon abundance that salmon are particularly vulnerable to human activities.

In recent years, listings of endangered and threatened salmon runs under the U.S. *Endangered Species Act* have been invoked on an almost annual basis. Using broadly defined "evolutionarily significant units" of salmon, the U.S. National Marine Fisheries Service has documented salmon declines across the landscape of the Pacific Northwest that have left no region without significant losses. Some regions have lost salmon entirely.

In B.C., the scale and scope of salmon declines have been difficult to document, partly because the province is so vast and thinly populated, but also because federal stock-assessment efforts have tended to focus on the relatively few productive and commercially important salmon runs. A 1996 American Fisheries Society review of B.C.'s salmon runs identified 9,600 salmon stocks, but the review found that assessments were possible for only about half those stocks. Of those, 142 were found to be extinct, 624 were found to be at "high risk" of extinction, 78 were at moderate risk and 230 were of "special concern."[10]

The story of B.C.'s salmon, however, is not simply a story of persistent declines and extinctions. Many salmon runs have exhibited dramatic recoveries following years of overfishing and habitat loss. Throughout their range, salmon fluctuate in abundance over time, in step with broad-scale environmental forces that scientists have only recently begun to investigate. These forces include the recurring subtropical weather event known as El Nino, as well as a phenomenon known as the Pacific Decadal Oscillation.

It is precisely because of these long-term shifts and changes in salmon abundance that salmon are particularly vulnerable to human activities. Assumptions about

the extent to which salmon utilize certain freshwater habitats, and assumptions about what sustainable rates of fishing pressure might be, have been proved tragically wrong in recent years. Many of those false assumptions are directly responsible for the troubled state of salmon.

As an example, changes in ocean productivity meant poorer ocean survival rates for coho salmon during the 1980s, but those changes went undetected and did not produce changes in fisheries-management practices. Harvest rates were allowed to remain as high as 90 per cent, on the assumption that sustainable harvest rates were fixed and constant. The result was a disastrous crash in coho populations throughout B.C.'s south coast.

The impact of hatcheries

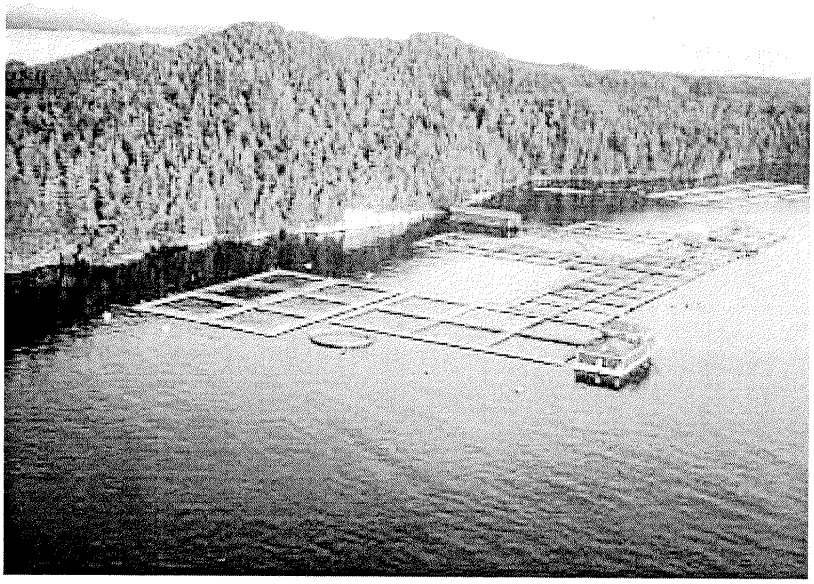
Another example concerns hatcheries, which were built on the assumption that they could produce long-term net gains in salmon abundance. After more than a century of what one fisheries historian has described as an "idolatrous" faith in hatcheries, there is still no evidence that hatcheries have contributed to any increase at all in Pacific salmon. Indeed, experience has shown that hatcheries can actually contribute significantly to wild salmon declines, in various ways.[11]

Canada has spent more than half a billion dollars on Pacific salmon hatcheries and other artificial enhancement initiatives, and hatcheries still consume the lion's share of DFO's salmonid-enhancement budget. These spending priorities persist, even though hatchery production has been shown to result in the genetic dilution of locally adapted wild strains, and fishing pressure attracted by hatcheries has resulted in overfishing of nearby wild salmon runs. Hatchery smolts also compete with wild salmon in the ocean—competition that can dramatically tilt in favour of hatchery fish, quite suddenly, when shifts and changes take place in broad-scale environmental forces at work in the ocean. Still, more than five billion juvenile salmon from hatcheries and other artificial-enhancement initiatives throughout the Pacific Rim enter the Pacific Ocean every year.[12, 13]

The problems of farmed salmon

The lack of effective monitoring and research makes it impossible to determine the extent to which wild salmon are suffering harm from sea-lice infestations common to salmon farms.

Meanwhile, the production of farmed salmon from B.C.'s aquaculture industry has now surpassed production from the conventional harvest of salmon. The salmon-farming industry emerged in a regulatory vacuum, and the presence of net pens containing hundreds of thousands of farmed salmon, mainly a domesticated variety of Atlantic salmon, will unavoidably pose clear threats to local coastal ecosystems. On Canada's East Coast, salmon farms have become vectors of diseases that have been transmitted to wild fish stocks, and escaped farmed salmon in B.C. waters pose a variety of direct and indirect threats to wild salmon runs. Feral Atlantic salmon runs—from the 400,000 Atlantics that are known to have escaped from B.C. fish farms over the years—are establishing themselves in rivers on Vancouver Island's east coast, competing for spawning sites with wild steelhead salmon. Escaped Atlantic salmon have been sighted in more than 80 B.C. rivers, and neither the federal nor the provincial government is engaged in any methodical effort to determine how widespread the problem is, or what its long-term implications might be.[14]



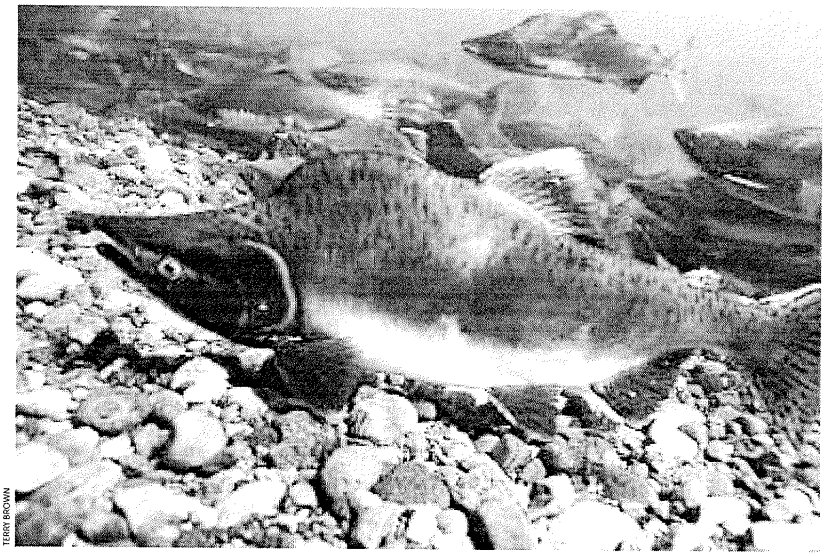
SHARON CHOW

Similarly, the lack of effective monitoring and research makes it impossible to determine the extent to which wild salmon are suffering harm from sea-lice infestations common to salmon farms. Wild Atlantic salmon runs in Norway, Scotland and Ireland have suffered greatly as a result of being infested with sea lice from salmon net pens, and in 2002 a catastrophic collapse of pink salmon runs in the vicinity of the Broughton Archipelago appears to be directly and irrefutably attributable to a sea-lice outbreak in area salmon farms during the pink smolts' outmigration period. However, in that case, neither the salmon farms' sea-lice outbreak nor the collapse of nearby wild salmon runs was detected, or even noticed, by federal or provincial agencies. It took an independent study conducted by local conservationist Alexandra Morton, whose findings were initially dismissed by Fisheries and Oceans officials, to draw attention to the matter. Fisheries and Oceans scientists later determined that the collapse of the local pink salmon runs could be explained by no other means except a likely sea-lice infestation from area salmon farms. [15]

After more than a 150 years of industrialization, urbanization, and fisheries-management regimes based on false assumptions, there is no doubt that salmon have suffered greatly in British Columbia. The status of salmon species and populations within those species varies widely, however, throughout the province.[16]

Sockeye salmon

Sockeye salmon are still returning to North America's West Coast in numbers that may be comparable to returns in the pre-industrial period, but contemporary sockeye abundance is associated mainly with Alaskan stocks and only a handful of B.C. stocks. The Fraser River's great sockeye runs have yet to recover from over-fishing and habitat destruction that occurred prior to the 1920s. In recent years, B.C.'s remaining sockeye stocks have undergone troubling declines. Rivers Inlet and Smith's Inlet sockeye—which once ranked with the Skeena and Fraser sockeye runs, in some years—have crashed, for reasons that continue to perplex salmon scientists. These central-coast sockeye crashes appear to mirror an overall, across-the-board decline in the abundance of salmon throughout the central-coast area—ironically, the least populated and most "pristine" area throughout the range of salmon in B.C. Meanwhile, two small sockeye runs—the Cultus sockeye in the Lower Fraser and the Sakinaw Sockeye on the Malaspina Peninsula, were recently listed as "endangered" by the Committee on the Status of Endangered Wildlife in Canada.[17]



TERRY BROWN

Pink salmon

Pink salmon suffered perhaps their greatest losses—at least losses from which they have never recovered—as a result of an event known as the Hell's Gate slide of 1913: an incident in which railroad-construction crews inadvertently blasted the side of the mountain in the Fraser Canyon. The event rendered the river impassable to salmon for much of that year and severely hampered upstream salmon migration for several years to follow. Coastwide, pink salmon are in relatively healthy shape and tend to be "opportunistic" spawners, meaning that they will spawn where they can find suitable gravel if they cannot spawn in their natal spawning beds.

Chum

Chum salmon are similarly opportunistic, although more susceptible to large-scale habitat damage than pink salmon. Chum salmon are also noticeably sensitive to changes in ocean productivity and are particularly vulnerable to heavy fishing pressure.

Coho, chinook, steelhead

Coho, chinook and steelhead are the three most troubled salmon species in B.C. They have undergone their most dramatic declines, and continue to face their greatest threats, in B.C.'s southern waters, in the upper and lower Fraser River, the Thompson River watershed and the east coast of Vancouver Island.

These three species continue to bear the brunt of the classic "four H's" that have proved so ruinous to Pacific salmon throughout their range: habitat loss, hatcheries, hydroelectric dams and harvesting.

The overwhelming evidence is that steelhead are undergoing dramatic and rapid declines throughout the Georgia Basin.

Alone of the six Pacific salmon species, steelhead fall primarily under provincial jurisdiction. This is because the federal government delegated responsibility for freshwater fish to the province early in the 20th century, and steelhead were then considered a trout. Steelhead are unique among Pacific salmon in that they may spawn more than once in their lifetimes, whereas the other five species all die when they spawn. Also, most steelhead spawn during the winter and spring months, rather than with the other species in the summer and fall.

Because they spend up to three years of their lives in freshwater before heading to sea, steelhead are particularly vulnerable to freshwater habitat degradation. Because they fall under provincial jurisdiction, and have rarely been of any commercial significance, steelhead have received relatively scant biological attention. Stock assessment generally consists of estimating abundance based on reports from anglers, sometimes augmented by test fisheries and swim surveys. The overwhelming evidence is that steelhead are undergoing dramatic and rapid declines throughout the Georgia Basin. Most B.C. steelhead runs are subjected to catch-and-release sports fishing only. In 1997, the provincial government closed several Vancouver Island rivers to steelhead fishing, and several steelhead runs on the mainland side of the Strait of Georgia are on the verge of extinction. In the winter of 2000, only 150 steelhead returned to the Squamish River. Even fewer returned to the Capilano River. Roughly 100 steelhead populations persist on B.C.'s south coast, and almost all are considered to be of grave conservation concern.[18, 19, 20]

With the possible exception of steelhead, chinook salmon exhibit the widest variety of survival strategies and characteristics of all Pacific salmon species. Chinook are the largest Pacific salmon, known to reach 45 kilograms in weight.

The flesh of chinook salmon ranges in colour from white to red. There are two basic types of chinook. Spring chinooks arise in interior streams and small rivers, where they spend up to six months before heading to sea and spend two or three years in the ocean before returning to freshwater, spending several months in rivers and creeks before spawning. Fall chinooks generally arise in the lower reaches of large rivers, head to sea almost immediately and spend almost all their lives in the ocean, spawning soon after returning to freshwater.

As with steelhead and chinook, changing ocean conditions appear to have been a key factor behind crashes in coho populations throughout the 1980s and 1990s.

Spring chinooks, very generally, have been recovering in recent years from decades of overfishing. Fall chinooks, however, particularly on B.C.'s south coast, have suffered greatly from overfishing and habitat loss. Competition with hatchery chinooks appears to be a factor as well. As is the case with steelhead, the marine-survival rates of many fall chinook runs began a sharp downward trend around 1980. By the year 2000, the south coast's fall chinooks, which were once the mainstay of the Strait of Georgia recreational fishery, had declined in abundance by perhaps 90 per cent.

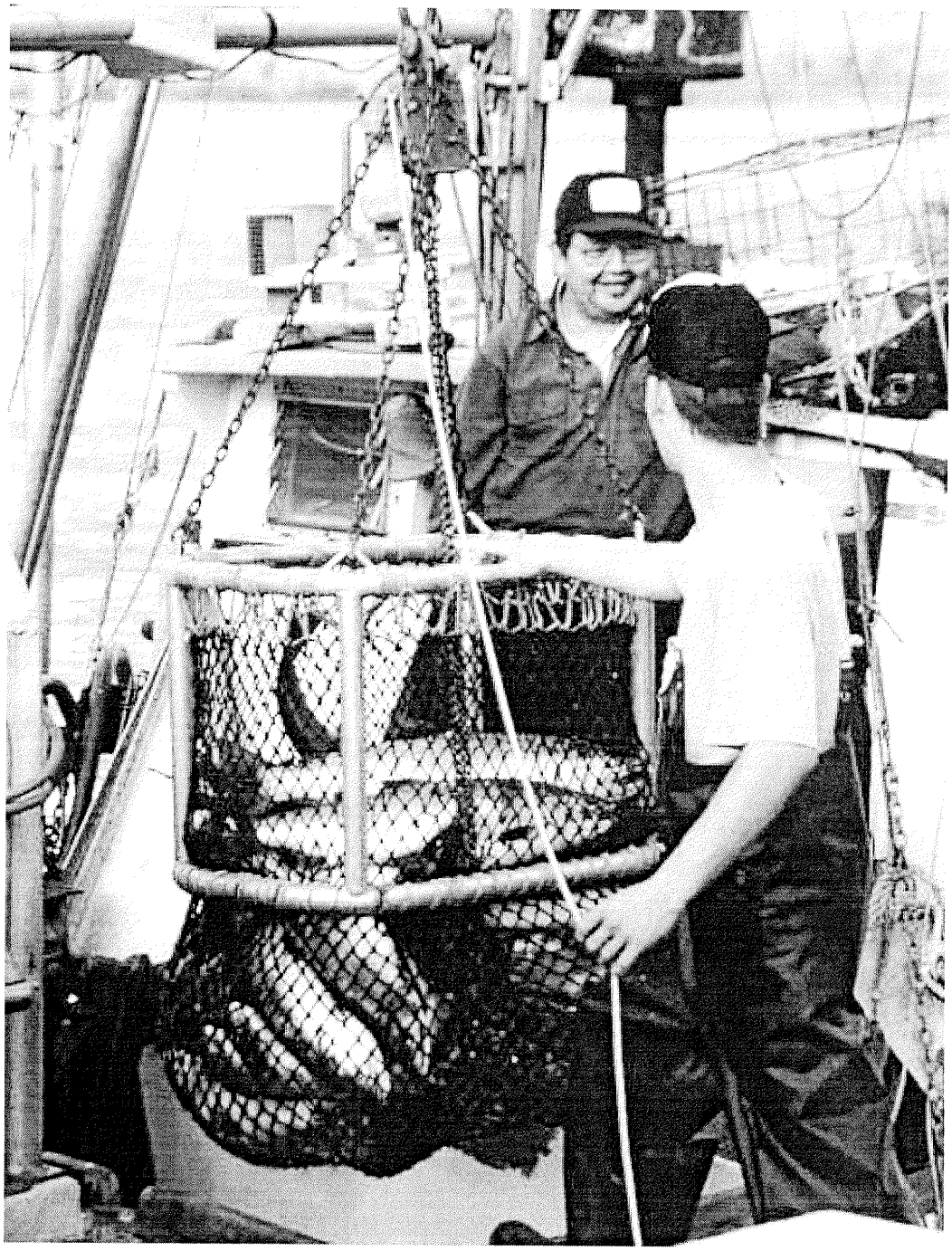
Coho salmon have suffered declines in abundance and diversity perhaps more dramatic than any other salmon species in B.C. Like steelhead and chinook, coho spend much of their lives in freshwater, commonly spending their first year in the watersheds where they emerged as fry before migrating to the ocean. Most coho spawn in their third year, but, like chinook, tend to spend much of the ocean phase of their lives in near-shore environments, making them particularly vulnerable to various fishing fleets. As with steelhead and chinook, changing ocean conditions appear to have been a key factor behind crashes in coho populations throughout the 1980s and 1990s.

On the north coast, the troubled coho were mainly of the "long-run" type that spawns in the upper reaches of coastal rivers and their tributaries. On the south coast, all types of coho, which had already been exhibiting long-term, persistent declines for years, began to crash around 1980.

Six Thompson River stocks were reported extinct in 1996. That same year, in North Vancouver's Seymour River, coho spawners fell from returns routinely reaching 14,000 in the early 1980s to fewer than 500 fish. Coho spawners returning to Black Creek, near Courtenay on Vancouver Island, fell from 8,000 in 1978 to 147 in 1996. Strait of Georgia coho had declined to a small fraction of

their abundance by 1998, when public pressure and threats of litigation by interior aboriginal groups prompted federal Fisheries Minister David Anderson to impose major restraints on the various fishing sectors in order to conserve coho.

The public outcry that prompted Fisheries and Oceans Canada to respond to the coho crisis was an historic moment in the relationship between people and salmon in B.C. It signalled a major turning point in the relationship. It was the first time that the public had demanded major restraints on fishing activity in order to conserve salmon, despite the adverse impacts those restraints would have upon commercial and recreational fisheries. It also marked the first time in history that a federal fisheries minister could afford the political risks of defying B.C.'s commercial fishing industry, in the interests of salmon conservation.



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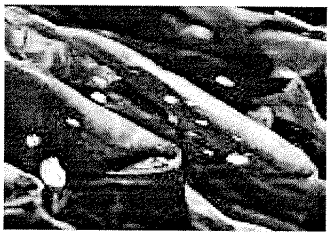

The Salmon Economy

The changed relationship between salmon and people in B.C. has occurred even though salmon, while still economically significant to some coastal communities, are no longer of any consequence to the provincial wage economy.

By the late 1990s, the entire fisheries sector of the B.C. economy—commercial fisheries, recreational fisheries, fish processing and aquaculture—had declined to the point that it accounted for less than one per cent of B.C.'s gross domestic product. The various sectors within the salmon fisheries made less than half of that contribution. By 1997, the total number of part-time and full-time jobs in the entire fisheries sector was less than 13,000. Nearly half of those jobs were associated with recreational fisheries, which accounted for about $244 million in value added to the provincial economy in 1997. While recreational fishing makes the largest contribution of any of the various sectors within B.C.'s fishing industry, the recreational fishery's contribution represents only about five per cent of the overall contribution the provincial tourism industry makes to B.C.'s economy. And contrary to public opinion, the overall economic significance of B.C.'s recreational fishery is actually declining, falling by 11.4 per cent since the early 1980s.[21]

Recreational fisheries

As recently as the late 1980s, the Strait of Georgia accounted for the vast proportion of "angler days" in the B.C. recreational salmon fishery. The overall trend over the past 30 years, however, has seen recreational-fishing effort move to the north coast of the mainland and to the west coast of Vancouver Island, mostly

By the late 1990s, anglers were making an estimated 210,000 "boat trips" to various locations around the Strait of Georgia—a decline of two thirds over the course of a decade.

in association with the expansion of fishing-lodge operations that cater to non-resident anglers.

By the late 1990s, anglers were making an estimated 210,000 "boat trips" to various locations around the Strait of Georgia—a decline of two thirds over the course of a decade, mostly in association with declines in chinook and coho abundance. Meanwhile, recreational-fishing pressure was growing elsewhere on the coast, mainly due to the expansion of fishing-lodge operations that cater to tourist anglers (the fishing-lodge industry is largely unregulated, and is dominated by a few firms, such as the Oak Bay Marine Group). By the late 1990s, anglers were involved in 80,000 boat trips on the West Coast of Vancouver Island and 17,000 more trips in Johnstone Strait. On the central and north coasts of the mainland and in the Queen Charlotte Islands, DFO reckons 65,000 "angler days" in the annual recreational fishery.[22]

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Commercial fisheries and processing

During the final years of the 20th century, a variety of fleet-reduction schemes reduced the number of salmon vessels on Canada's West Coast by half. Fewer than 2,500 vessels were licensed to catch Pacific salmon, and about half the fish were being caught by fewer than 400 vessels. Several dozen salmon canneries once provided crucial seasonal income to several B.C. coastal communities. By the end of the 20th century, only half a dozen major salmon-processing facilities remained, confined to the Lower Mainland and Prince Rupert. Where there were once dozens of companies involved in the commercial harvest and processing of salmon, a handful of firms had come to dominate what was left of the industry, most notably the Canadian Fishing Company (Canfisco), which accounts for perhaps half the commercial fishery's salmon production.[23, 24]

The number of jobs associated with B.C.'s commercial fisheries tends to fluctuate dramatically from year to year, but had fallen to 2,300 by 1998. During the 1990s, the average annual employment in the harvesting sector of the commercial fishing industry declined by about 40 per cent. While 6,800 jobs are associated with B.C.'s fish-processing industry, jobs in fish plants are increasingly dependent on Alaskan salmon and production from salmon farms.

Aquaculture

Salmon aquaculture on the B.C. coast has grown by a phenomenal 4,000 per cent since the early 1980s, and farmed-salmon production now easily eclipses wild-salmon production (the ubiquity of farmed salmon in the retail market has also dramatically reduced the landed value of wild salmon, which has seriously undermined the viability of most conventional salmon fisheries). In 1999, B.C.'s salmon farms produced 48,000 tonnes of fish—an amount that exceeded the amount of salmon harvested by the conventional commercial salmon fisheries. And compared to conventional commercial salmon fishing, salmon farms are extremely capital intensive. Salmon farms coastwide produce the equivalent of only 1,500 direct full-time, year-round jobs.[25]

A single company, Stolt Sea Farm—with operations in Norway, New Brunswick, Maine, Scotland and Chile as well as B.C.—has reached annual production levels

of 60,000 tonnes worldwide, which by itself exceeds B.C.'s entire commercial catch of Pacific salmon.

Other significant players in B.C.'s salmon-farming industry are:

- Nutreco, a vertically integrated Dutch agribusiness operation, which provides fish feed to much of the world's salmon aquaculture industry and also owns Marine Harvest, the world's second-largest farmed-salmon producer. All alone, Nutreco accounts for one-fifth of the world's one-million-metric-tonne farmed-salmon production.
- Pan Fish, a Norwegian company that owns all the salmon farms in Washington State, is a major B.C. player. Its B.C.-Washington production amounted to about 20,000 tonnes in 1999.
- George Weston Ltd., an Ontario-based food conglomerate with annual international sales of about $15 billion, was once the corporate parent of B.C. Packers, which is to B.C.'s coastal history what the Hudson's Bay Company is to Canadian history. In the late 1990s, Weston abandoned the wild-salmon business altogether, selling its assets to Jimmy Pattison, whose Canfisco is now one of the largest players in the wild-salmon business on North America's West Coast, with holdings in Washington, B.C. and Alaska. Weston's Heritage Salmon is expanding its farmed-salmon operations on the B.C. coast, as well as in Maine, New Brunswick and Chile.[26]

The overall economic effect of world production of farmed salmon has been a drastic decline in prices paid to fishermen for wild salmon, further marginalizing the commercial salmon fisheries.

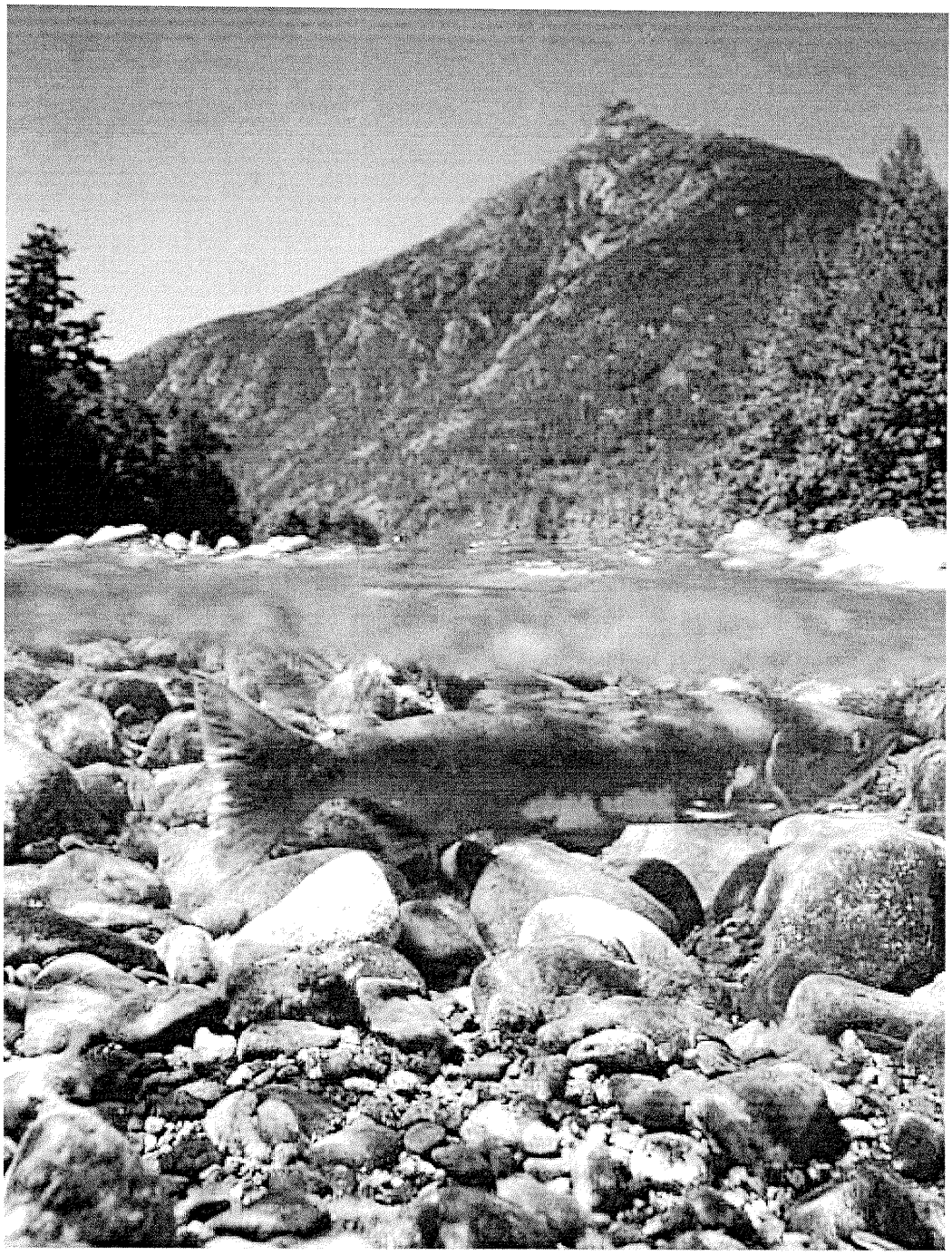
Together, these four companies—Stolt, Nutreco, Pan Fish and Weston's Heritage Salmon—now produce more than half the farmed salmon sold in North America every year, and sell mainly through large chain operations, such as Weston's stores, Costco and other volume-based retail chains. The overall economic effect of world production of farmed salmon has been a drastic decline in prices paid to fishermen for wild salmon, further marginalizing the commercial salmon fisheries.

Summary

Salmon conservation is a deeply held social and cultural concern.

Commercial fishing, recreational fishing and salmon aquaculture do make significant local economic contributions to many B.C. communities.

However, salmon conservation is no longer regarded as either a significant economic issue or an abstract "environmental" issue by British Columbians. Salmon conservation is a deeply held social and cultural concern. It is the concern of specific communities for specific salmon runs, and it is also an across-the-board priority for British Columbians, wherever they live.



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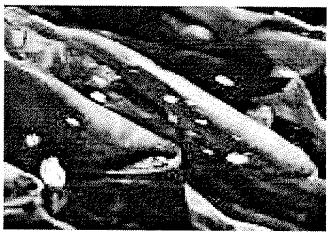


Government Policies and Institutional Culture

Defining conservation

The greatest challenge facing the relationship between people and salmon at the beginning of the 21st century is the persistence of government policies that do not accord with the changing conditions that salmon are encountering in the post-industrial era. Neither does government policy accord with the scientific understanding of the necessary elements of salmon conservation. Most importantly, government policy is completely out of step with the cultural changes under way in human communities throughout the range of salmon.

While profound cultural changes have been under way in British Columbian society, institutional cultures within government simply have not kept pace. The various levels of government with jurisdictions that affect the health of salmon runs—particularly Canada's federal government—take an approach to the challenge of salmon conservation that is entrenched in the industrial era. It is an approach still largely driven by antiquated economic measurements and outdated fisheries-management objectives.

On Canada's West Coast, the received wisdom for many years has been that salmon declines are largely attributable to federal "mismanagement." To be fair, Fisheries and Oceans Canada is not solely to blame. We are all responsible, in varying degrees. City dwellers, farmers, loggers, fishermen, fisheries managers, even environmentalists—none of us are without virtue and none without blame for the fate that has befallen so many salmon runs.

It wasn't until 1967 that the federal fisheries department was specifically obliged to conserve salmon at all. The *Fisheries Act* requires fisheries officials to exercise their statutory authority for "the conservation and protection of fish and waters frequented by fish." This duty, however, is not as straightforward as it may seem. At the heart of the matter is the question, "What should we conserve?"

As the economic significance of wild salmon has declined, there has been a general retreat by the federal government in the exercise of its duty to conserve salmon.

Generally, the federal government has answered this question by identifying salmon as merely a renewable resource that should be managed as a raw commodity in ways that provide for the greatest annual economic yield. This policy has often resulted in what can only be described as deliberate overfishing. An example is the case of B.C.'s chinook and coho populations: From the 1950s and well into the 1990s, federal fisheries policy was to encourage heavy fishing on southerly chinook and coho runs, knowing that American salmon were among the fish being targeted. The idea was that by threatening salmon bound for U.S. rivers, American negotiators in the Pacific Salmon Treaty would be disinclined to demand greater shares of more valuable Fraser-bound sockeye runs.[27]

As the economic significance of wild salmon has declined, there has been a general retreat by the federal government in the exercise of its duty to conserve salmon.

In 2002, DFO chopped $7 from its annual habitat-restoration and salmonid-enhancement budget (while still finding funds to keep hatcheries operating), $3 million from its habitat-conservation and stewardship funds and $3.5 million from community-run salmonid-enhancement projects. With the landslide election of the budget-cutting B.C. Liberal Party in 2001, provincial commitments to salmon conservation were also reduced. About $30 million was cut in annual funds dedicated to watershed restoration, urban salmon habitat restoration and various industry-support and forestry-monitoring programs.[28]

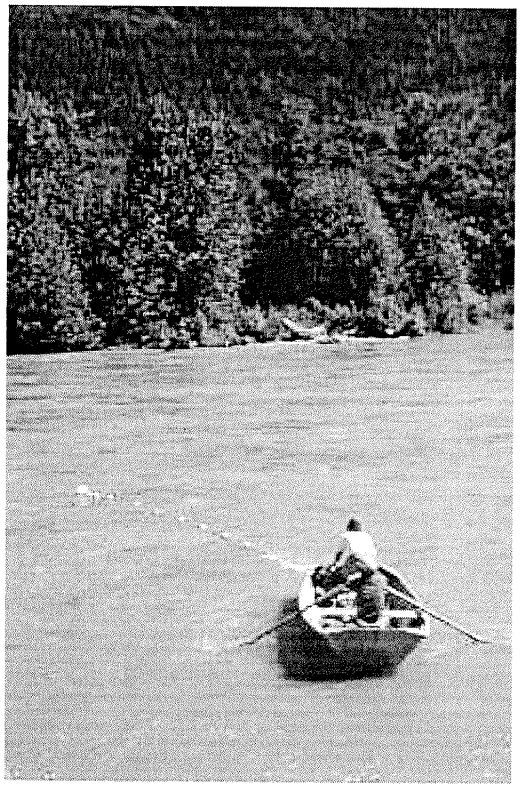
While the primary legal and political responsibility for salmon conservation still rests with the federal government, DFO persists in seeing that duty through the prism of economic yield.

Throughout the 1980s and 1990s, the question, "What should we conserve?" continued to trouble policy analysts, fisheries managers and biologists within DFO. Their deliberations over the question were part of a broader environmental debate unfolding throughout society in the latter years of the 20th century, involving social-sciences academics, conservationists, industrial interests and economists. Along the way, advances in the ecological sciences, environmental policy and genetics helped clarify the debate.

Aboriginal fishing rights

The courts have contributed, too. The federal fisheries department was forced to confront the question in 1990, when the Supreme Court of Canada rendered its judgment in a case that came to be known as Sparrow vs. The Queen. Ostensibly, the case was about the legal propriety of arbitrary restraints on the traditional fishery of the Musqueam aboriginal people, at the mouth of the Fraser River. But the issues raised in the case required the courts to consider the extent to which B.C.'s aboriginal fisheries were protected under Section 35 of the Constitution.

Very generally, the judges in the case held that aboriginal fisheries were protected by the Constitution and deserved priority in allocation decisions. The court also found that the federal government was entitled to regulate aboriginal fisheries, but fishing restraints had to be justified, and regulations had to meet certain strict tests. The primary test was whether regulations that interfered with traditional fisheries could be justified on the grounds that they served the purposes of conservation.[29]



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As a result, DFO was forced to focus on defining its salmon-conservation mandate in a way that was scientifically and legally defensible. Just using the excuse of "conservation" to close an aboriginal fishery—when "conservation" meant merely ensuring that an arbitrary number of salmon returned to spawn in an artificial spawning channel so that their offspring would provide benefits to the commercial fishery years later—would no longer suffice.

Shortly after the Sparrow decision, federal fisheries scientists redoubled their efforts to identify defensible and legitimate salmon-conservation policies, in an attempt to define what the "conservation" of salmon would really require. Several proposed definitions and operating principles were forwarded to Ottawa, each of which would have required major changes in the ways the industrial fisheries were managed. Ten years after the Sparrow decision, however, senior fisheries officials still had not confirmed a formal policy on the

conservation of wild salmon, despite several recommendations from federal fisheries scientists.[30]

Biological diversity in salmon is important ... as a form of insurance against both short-term, catastrophic events that can devastate individual salmon runs, and long-term, persistent threats to salmon generally.

As a result, conflict between the federal fisheries department and aboriginal fishing communities became commonplace during the 1990s, often involving confrontations that arose from DFO's inability to justify its restraints on aboriginal fisheries with any defensible "conservation" objective. Judges routinely found themselves turning to DFO witnesses for explanations as to why a particular aboriginal person had been arrested for fishing during a closure, only to be confounded in their attempts to discern a valid "conservation" reason for the arrest. Routinely, DFO officials cited "conservation" objectives that were really just aspects of government-industry salmon management plans, often implemented at the expense of the necessary biological diversity in salmon and to the detriment of the small salmon runs to which the defendant's aboriginal community enjoyed constitutionally protected fishing rights.

Protecting habitat

By 1995, DFO's mandate to "provide for the conservation and protection of fish and waters frequented by fish" was complemented by a habitat-protection policy that was articulated very generally as a goal of no "net loss" of productive salmon habitat. But the policy has been hampered by the absence of a comprehensive definition of what constitutes salmon habitat in the first place.

Also by 1995, DFO's Pacific-salmon scientists settled on their own, informal working definition of salmon conservation, 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."

Protecting biological diversity

The importance of maintaining "the greatest spatial and temporal diversity" of salmon—in other words, the biological diversity of salmon—can be understood in terms of everyday common sense. Biological diversity in salmon is important not just because of some esoteric purposes understood only by deep ecologists or conservation biologists. It is important as a form of insurance against both short-term, catastrophic events that can devastate individual salmon runs, and long-term, persistent threats to salmon generally. Maintaining the greatest number of individual spawning populations over space and time makes the same basic sense

as the management of investment risk through a diversified, low-risk stock portfolio, as opposed to a portfolio with only a few stocks that promise high potential returns at great risk.

Such approaches to salmon conservation may make eminently good sense, but the 1995 definition of salmon conservation articulated by DFO's salmon biologists was never formally accepted by senior departmental staff in Ottawa, and it has served only as an internal working definition which has been honoured in its breach as much as anything else.[31]

Fisheries managers and the commercial-fishing lobby have resisted the idea of conserving the diversity of "naturally spawning populations" of salmon, preferring instead to focus fishing effort and management attention on a few large productive salmon "stocks." These large stocks were said to be "actively managed," while smaller, co-migrating stocks were said to be "passively managed," which is a euphemism for ignoring them altogether.

This approach has been consistently favoured by the industrial-fishing sector, and as recently as 2002 DFO's decisions aimed at protecting small, imperilled "late-run" Fraser River sockeye stocks were protested by the industry with illegal fishing during the salmon season. Industry leaders cried "mismanagement" when fisheries managers reluctantly cancelled fisheries upon large stocks to protect co-migrating small, threatened and endangered stocks.[32]

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The problem of stocks

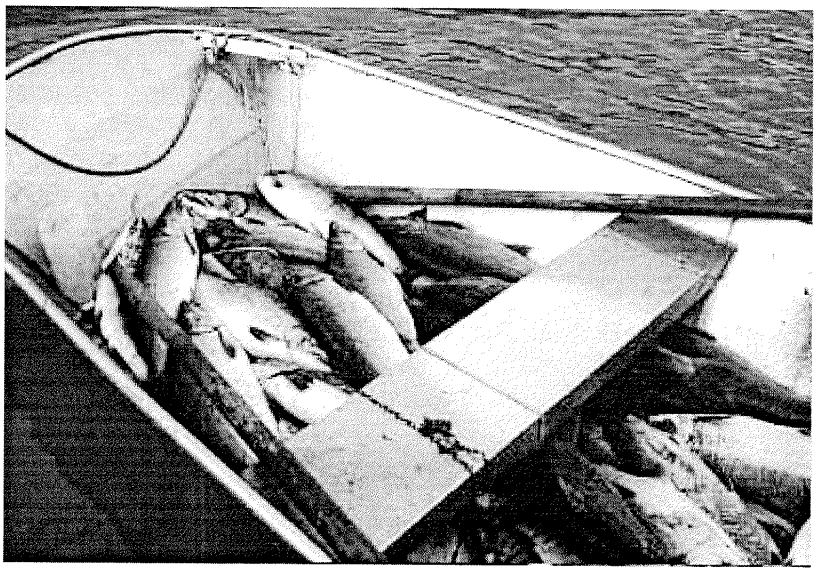
It is also important to remember that managing fisheries according to salmon "stocks," whether large or small, does not necessarily reflect a recognition of the structure or complexity of wild salmon. As often as not, salmon stocks are artificial constructs—administrative conveniences designed to serve industrial purposes and make fisheries more manageable and predictable. One informed observer has described the situation this way: "The stock concept has been transformed from a scientific concept to a regulatory one, as reconstructed by the various stakeholders involved in salmon management with respect to their various institutional agendas... masking the social, economic and political considerations which shape and constrain management decisions."[33]

The policy vacuum and its consequences

Some scientists, for instance, have gone so far as to argue that as predators, human beings should remove no more than five per cent of a given salmon run annually.

In the absence of a clear mandate to conserve and protect the natural diversity and variety of salmon populations, federal fisheries authorities have generally catered solely to the industrial and commercial interest in fisheries. Most federal salmon-enhancement funds are still committed to "production" objectives, primarily though hatcheries. Ten years after the Sparrow decision, aboriginal fisheries persist on the margins, and efforts to accommodate aboriginal fishing rights in the absence of coherent, scientifically and legally defensible "conservation" objectives, continue to produce bitter controversies.

The importance of salmon in the functioning of terrestrial ecosystems continues to be ignored. It is without question that it will be difficult to integrate fisheries management with the needs of the ecosystems inhabited by salmon. Some scientists, for instance, have gone so far as to argue that as predators, human beings should remove no more than five per cent of a given salmon run annually. Current DFO policy, however, authorizes annual harvest rates that routinely exceed 50 per cent. Meanwhile, because of the persistence of "passive" management of small salmon runs, scores of these stocks to which so many British Columbians have dedicated tireless stewardship efforts are afforded no specific protection from fisheries or from fisheries-management decisions.[34]



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Conflict of interest

Rather than prevent losses in productivity due to habitat destruction, federal policy has been to mitigate such losses with a variety of technological solutions. Federal policy has tended to address declines in salmon abundance by constructing hatcheries and spawning channels, by facilitating lake-fertilization programs and by encouraging aquaculture. As University of B.C. fisheries biologist Carl Walters puts it, the policy can be compared to "putting your nest egg in penny mining stocks." The provincial government, meanwhile, has been guided by policy that accommodates industrial and urban developments that encroach upon salmon habitat—encroachments then subjected to mitigation measures overseen by the federal government.

The results of this approach have been disastrous. Technological approaches have consistently failed to live up to their promises. Hatchery fish have displaced wild fish. Spawning channels have replaced natural spawning habitat. Ecological functioning has been seriously disrupted, from the Little Campbell River, just north of the 49th parallel, to the Skeena River, on B.C.'s north coast.

Institutional dysfunction

All this arises from a continuing, chronic dysfunction with government agencies, particularly Fisheries and Oceans Canada. At its heart is a deeply rooted conflict between the public interest in salmon conservation and the institutional and

commercial interest in resource extraction. The federal fisheries department's inability to reconcile its duty to protect the public interest in salmon conservation with its other obligations to serve commercial interests compromises almost every fisheries-management decision. The federal government's inability to rise to the challenge presented by this unnecessary conflict has resulted in a lack of leadership and vision within DFO, as well as within the provincial government.

The federal fisheries department's inability to reconcile its duty to protect the public interest in salmon conservation with its other obligations to serve commercial interests compromises almost every fisheries-management decision.

The problem manifests itself in the absence of policies that foster true conservation and the presence of practices that work against conservation. The problem is structural, embedded within fisheries management, and it is disturbingly similar to the dynamic at work while North Atlantic cod stocks declined and ultimately crashed in 1992. As Carol Corbin of the University College of Cape Breton has observed of that disaster, corporate decision-makers were under pressure to return profits to shareholders, fisheries managers wanted fisheries to manage, fishery workers had children to feed and bills to pay and the interdependent functions of participants in the cod fishery "precluded the raising of a collective voice."[35]

It is a dysfunction that confounds even the best intentions, from the highest federal policy levels to the day-to-day operations of fisheries management.

It is a fate that befalls even such principles as are contained in the United Nations' Convention on Biological Diversity, to which Canada is a signatory, and in the UN's Code of Conduct for Responsible Fisheries, which Canada played a key role in developing.

The UN's biodiversity convention acknowledges the intrinsic value of biological diversity, and recognizes that the conservation of biological diversity provides the greatest insurance against species extinction and ecological collapse—an insurance particularly necessary in the context of climate change, global warming and exponentially increased human impacts upon the planet's ecosystems. Canada's approach to Pacific salmon acknowledges none of these things. As for the UN's responsible-fishing code, DFO assigned the task of devising a Canadian version of the code to the fishing industry itself.

The boldest policy statements of fisheries ministers, along with attempts by senior department officials to make DFO a more public, transparent institution, continue to founder on the shoals of the dysfunction within the fisheries department. In 1998, for instance, Fisheries Minister David Anderson, in a long-overdue declaration, announced that selective fishing methods were to be the "corner-

stone" of salmon-fisheries management on Canada's West Coast. The announcement was a recognition of an obvious need to match fishing effort with the known surpluses of specific salmon runs. Since 1998, however, selective fisheries have become just another internal departmental initiative that competes for program funds with other well-intentioned initiatives.

The bureaucrat's dilemma

So long as the public interest in the conservation of salmon is relegated to a kind of honourable mention in four of 12 principles to guide fisheries management ... the institutional dysfunction will persist.

At the operations level, the integrated high-level plans that govern actual salmon-fisheries management provide another useful illustration of the way that the federal duty to conserve salmon is compromised by other priorities. The management plans routinely contain a dozen "management principles." One of these principles states that conservation of the resource—a mandate that remains undefined—is paramount, but only four of the 12 management principles are even vaguely related to conservation. Compounding the fisheries manager's dilemma is the fact that among the remaining eight principles, the responsibility for ensuring sustainable fisheries is specifically articulated as a responsibility shared between government and "stakeholders," which, at present, are the same vested interests that management plans are ostensibly intended to regulate.

Further, from these 12 principles, seven management objectives are identified, only one of which identifies objectives under the general heading of "Conservation/Sustainability." The remainder identify international obligations; opportunities for aboriginal, commercial and recreational fisheries; exploratory and experimental fisheries and, under the rubric of "domestic considerations," the obligation to consider the goals of society for economic, social and cultural values.

So long as the public interest in the conservation of salmon is relegated to a kind of honourable mention in four of 12 principles to guide fisheries management—and is only one of seven competing "objectives" in fisheries management—the institutional dysfunction will persist. And reasonable public expectations for the conservation of salmon and the protection of ecosystems will continue to be disregarded.

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Fisheries and Oceans Canada's Wild-Salmon Policy:

An Institutional Retreat from the Challenge of Salmon Conservation

A decade after the Sparrow decision, DFO at last developed a draft policy on the conservation of Pacific salmon. The proposed "wild-salmon policy," ordered by a new Pacific regional director-general, involved an intensive effort by federal salmon scientists, policy analysts and fisheries managers to come to terms with their confused "conservation" mandate. On March 15, 2000, DFO released the proposal in the form of a public discussion paper.

Like so many good intentions that preceded it, the draft wild-salmon policy ended up being severely compromised within the federal fisheries bureaucracy, well before it was released for public consideration. The draft policy began as a reasonable document, if timid, and was watered down from there. Between the time the first draft left a committee of salmon scientists in the Pacific region and the time it was released for public discussion, the draft policy was severely compromised. The imperatives of industrial volume production and fisheries-management convenience had once again held sway.

The first draft, although not without its shortcomings, was bold compared with what was to follow. The original document stressed the need to conserve salmon by protecting "the greatest diversity of local populations and their historic range." It acknowledged the need to ensure against "the extirpation or extinction of local populations," and proposed that wild salmon be afforded a clear, unequivocal priority over all other production objectives, including hatcheries and aquaculture.

The March 2000 document was a shadow of what preceded it. The final draft policy asserted that wild salmon would be afforded some priority over hatchery production and aquaculture, but the priority would apply only to salmon runs so badly damaged that their genetic diversity and long-term viability was at stake. While the need to conserve the "diversity of local populations and their habitats" was acknowledged, the proposed policy confined the federal fisheries department's conservation obligations only to broad "conservation units" of salmon.[36]

Public alarm

The proposed policy was seen as an abdication of the federal government's duty to conserve salmon ... and probably place wild salmon at even greater risk.

Conservationists and salmon scientists responded to the public discussion paper quickly and negatively. The document was almost universally condemned as a surrender by the federal government in the face of a crucial policy challenge. The proposed policy was seen as an abdication of the federal government's duty to conserve salmon, and as an instrument that would simply entrench DFO's worst practices and probably place wild salmon at even greater risk.

On May 12, 2000, Simon Fraser University's Institute of Fisheries Analysis convened a meeting of scientists from several Canadian and American fisheries agencies and universities to review DFO's draft wild-salmon policy. Each scientist had an extensive background in salmon research, and the participants in the gathering concluded that the fisheries department's proposed "conservation unit" approach "may actually place entire aggregates of wild salmon populations, which contain irreplaceable genetic information, at considerable risk of extinction."[37]

The scientists concluded that the proposed "conservation unit" approach would group more than 9,000 salmon populations in B.C. into fewer than 100 units: 10-20 for chinook and coho, fewer than 10 for pink and chum and about 20 for sockeye. The dozens of chinook populations on Vancouver Island's west coast would be considered a single "conservation unit." Similarly, the lower Fraser River's coho populations would be classified as a single unit. What this meant was that the federal fisheries department could still judge itself to be conserving salmon adequately even if only one or two chinook populations remained in good shape on Vancouver Island's west coast, and even if only one or two coho populations remained strong in the Fraser system below Yale.

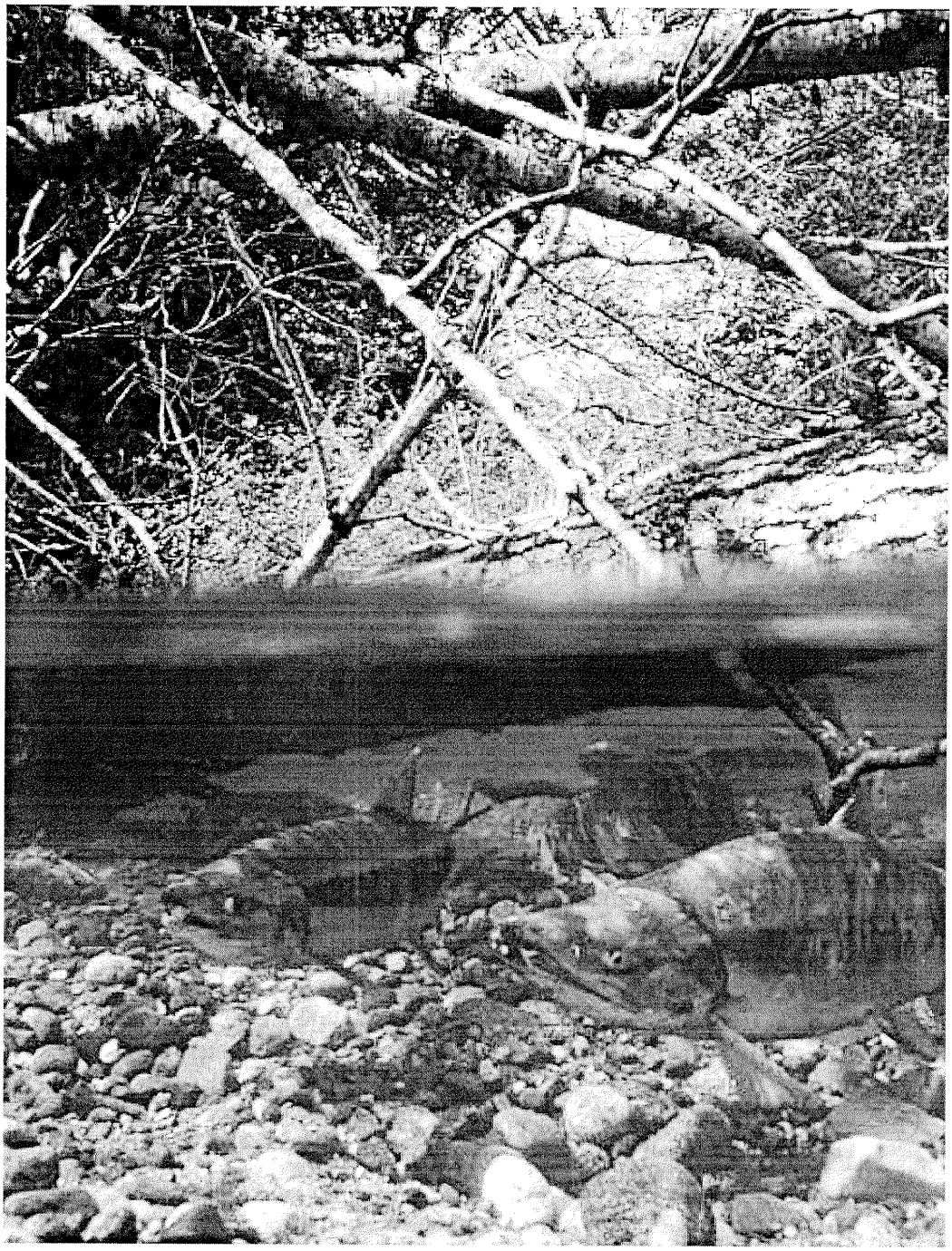
The scientists gathered at Simon Fraser insisted that DFO could not claim to be interested in effective salmon conservation at all unless it was prepared to explicitly commit itself to the protection of the local, genetically-based adaptations within and among wild Pacific salmon species.

Similar conclusions about DFO's draft wild-salmon policy were reached in a May 29, 2000, analysis prepared by the Pacific Fisheries Resource Conservation Council, a body the federal government established in 1998 to provide governments and the public with long-term strategic advice on matters related to salmon conservation.

The council, whose members were appointed by the federal fisheries minister, found that the proposed wild-salmon policy had been "rewritten and compromised" by senior DFO officials before its public release. The council also concluded that DFO's proposed approach to salmon conservation was actually "likely to put wild salmon at risk."[38]

Both the analysis by the scientists at Simon Fraser and the review of the conservation council observed two striking omissions in the proposed wild-salmon policy.

First, nowhere in the "principles" of the proposed policy was there any recognition of the enormous contribution salmon play in the health and functioning of terrestrial ecosystems. Second, nowhere in the proposed principles was there any acknowledgement of the cultural, social, aesthetic and heritage values that local salmon runs contribute to B.C.'s aboriginal and non-aboriginal communities. In other words, the public interest in the conservation of wild salmon had been completely overlooked.



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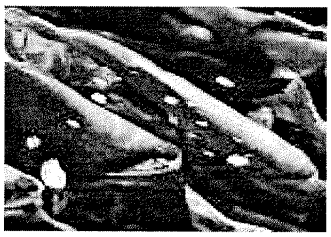

Conserving Salmon in the 21st Century

"The public must be educated that fisheries scientists and managers are willing and anxious to fulfil their roles to the greatest extent possible, but the future of salmonids and their habitats will be determined by the direction of society as a whole. . . . If there is to be a reprieve for Pacific Northwest salmonids, it must come in the form of initiatives that reach into areas of society beyond fisheries science and management."[39]

Conforming with public expectations

Government conservation priorities must be informed more directly by the public will to conserve salmon ...

If salmon are to persist as a key feature of the British Columbia landscape through the 21st century, a healthy relationship between people and salmon must be allowed to grow and flourish. Government conservation priorities must be informed more directly by the public will to conserve salmon, and less by the imperatives of outmoded economic measurements and institutional convenience.

The moral responsibility for conserving salmon falls on all our shoulders. But the constitutional and political responsibility for the conservation of salmon rests with the federal government, and with its fisheries department. As citizens, we express our collective will through our governments, and the will to conserve and restore salmon in abundance and diversity must be reflected in the policies, practices, purposes and objectives to which the federal government, through Fisheries and Oceans Canada, commits itself.

Clearly, government institutions, particularly DFO, must break through barriers of their own making in order to conform with the public's reasonable expectations that B.C.'s salmon runs will be protected and conserved, in all their

diversity, variety and abundance, for future generations. But this means a wholly new vision must guide government decision-making on salmon conservation. It means institutional reform to ensure that all other "production" objectives for Pacific salmon are made subsidiary to the importance of salmon in B.C.'s cultural consciousness and the importance of salmon as a keystone species upon which B.C.'s environmental health so deeply depends.

Economists have contributed greatly to an emerging realization that the indirect, long-term values associated with healthy salmon runs and a healthy environment far outweigh the direct, short-term extractive values associated with salmon and a healthy economy.

Scientists, particularly geneticists and conservation biologists, have made tremendous contributions to the public's understanding about the necessary conditions for the long-term survival of salmon. Science must be credited with developing a broad public awareness that salmon must be protected and conserved in greatest possible natural diversity, over the greatest possible range, if they are to be part of our common future. Similarly, economists have contributed greatly to an emerging realization that the indirect, long-term values associated with healthy salmon runs and a healthy environment far outweigh the direct, short-term extractive values associated with salmon and a healthy economy.

The will to conserve

But when it comes to the relationship between people and salmon in B.C., there is far more at stake than science or economics. Ultimately, although salmon are involved in ancient and specific relationships with aboriginal communities—and salmon are rightly subject to the legally enforceable fishing rights of B.C.'s First Nations—salmon remain a Crown-owned resource. Salmon are a public resource. They do not "belong" to the government or to industry. They belong to all Canadians, and all British Columbians, to generations long dead and generations unborn. Our duty to conserve salmon is a duty to the generations of Canadians to come.

British Columbians should not be obliged to defend or justify their will to conserve salmon to anyone. British Columbians should not be required to resort to the terminologies of the sciences or economics to defend their desire to persist in their relationships with salmon. Salmon do not exist simply to be "managed." Salmon exist because they exist, uniquely and distinctly, wherever they occur, and we are all the richer for it. British Columbians have always been enriched by their presence. British Columbia continues to be enriched by their presence, and British Columbians should not have to make excuses for their desire to see salmon protected and conserved for generations to come.

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Even the smallest salmon streams, regardless of their economic, genetic or ecological significance, are worthy of protection. The vast majority of British Columbians understand this, and it does not matter that conserving salmon at such local and difficult-to-manage scales presents challenges to federal fisheries officials. Salmon conservation at the small-stream level also presents enormous challenges to city dwellers, loggers and farmers. But these are challenges that British Columbians are showing an increasing willingness to face.

The evidence of that willingness can be found in the dedication of thousands of British Columbians organized in "creek watch" committees, streamkeeper groups and watershed stewardship groups all over the province. As many 40,000 British Columbians actively participate in local salmon-conservation activities around the province. These British Columbians include commercial fishermen, anglers and members of B.C.'s 198 First Nations. They also include many people with no vested interest at all in the harvest of salmon.

To give the public will to conserve salmon its full expression in government policy, the federal authority over salmon and salmon habitat must be exercised in a way that places the public interest in salmon conservation before all other "stakeholder" interests.

To that end, Fisheries and Oceans Canada should re-dedicate itself to its primary purpose of conserving salmon and salmon habitat, and the department's resources should be marshalled to assist British Columbians in that purpose. Providing the public with volunteer programs at hatcheries is not enough. Until recently—with its re-assigned budget priorities—the department made some real strides in developing stewardship programs and in assisting local communities in the development of habitat-conservation programs. These efforts must be more

than mere auxiliary activities. They must form the basis of a wholly revitalized public agency. The federal government's jurisdictional powers over salmon must be marshalled to assist British Columbians engaged in the necessary work of conserving and protecting salmon and salmon habitat.

A formula for effective change

Specifically, the federal authority over salmon and salmon habitat must be exercised in a way that is consistent with the following principles:

1. The conservation of B.C.'s salmon populations must take precedence over all other objectives for salmon production, and salmon populations must be conserved, in the greatest biological and genetic diversity and abundance, for their intrinsic values. These values are not exclusively and directly economic in nature. In keeping with the purposes of the UN Convention on Biological Diversity, the diversity and abundance of B.C.'s salmon populations must be maintained for ecological, genetic, social, scientific, educational, cultural, recreational and aesthetic values.
2. The federal government, through Fisheries and Oceans Canada, must commit itself to protecting and maintaining salmon habitat on an ecosystem basis. Both the federal and provincial governments should assume joint responsibility for protecting the health of the ecosystems upon which salmon depend.
3. Federal fisheries policy must take into account the role salmon play in ecosystem functioning. Salmon must be conserved from the premise that the diversity and abundance of myriad aquatic and terrestrial species depend upon the diversity and abundance of salmon across the broadest possible range.
4. The federal government must commit itself to a precautionary approach in its decision-making, and must always make efforts to regulate fisheries and protect salmon habitat in a risk-averse manner. This will mean ensuring that, at a minimum, fisheries are managed so that their impacts upon salmon runs are predictable and sustainable, and the genetic integrity of salmon populations is protected. It will also mean that, at a minimum, habitat is protected in ways that allow gene flow between fragmented populations, and safeguards are established to ensure that aquaculture, hatcheries and other "enhancement" initiatives pose no threat of adverse impacts upon wild-salmon populations.

These four principles merely reiterate, in summary fashion, what salmon scientists and conservation biologists have long considered to be the necessary conditions for the survival of salmon over the long term. As such, there is nothing necessarily new in their articulation. What is new is that the establishment of these necessary conditions for the long-term survival of salmon has at long last become politically achievable in British Columbia.

The above principles are scientifically defensible. As such, they provide a legally defensible and valid conservation objective within which aboriginal fisheries could be regulated in a comprehensive, just manner. The principles also provide a conservation framework within which commercial and recreational fisheries could be reasonably regulated and within which sustainable land-use decisions could be made.

A more liberal and generous definition of salmon habitat is already long overdue.

We recognize that adherence to these principles would require fundamental change on the part of federal and provincial decision-makers, as well as change within the institutions vested with the duties of salmon conservation. It is not our purpose here to identify a detailed program that each government agency should implement in order to conduct itself in accordance with these principles. It should go without saying that the recklessness of both the federal and provincial governments with respect to salmon aquaculture would have to be addressed immediately, as would the B.C. government's continued foot-dragging on the necessary retooling of hydroelectric dams. Some specific changes, however, are worth considering in some detail.

Shared burden

Clearly, the federal power to protect salmon habitat must no longer be compromised by the delegation of authority to provincial agencies and questionable instruments such as the Forest Practices Code and its anticipated successor, the "streamlined" results based code. Similarly, the federal power to protect salmon habitat in residential areas will become increasingly necessary as B.C.'s valley bottoms become increasingly urbanized. For practical purposes, however, the burden of ensuring that salmon habitat be protected and restored must be shared by Canada and British Columbia.

Further, a more liberal and generous definition of salmon habitat is already long overdue. While there are enormous economic benefits associated with the presence of salmon habitat, there can also be "costs" associated with habitat protection, including foregone economic opportunities. British Columbians who

bear more direct burdens of salmon conservation—landowners whose properties contain salmon habitat, for instance—should not be expected to bear these burdens alone. Those burdens should be shared equitably by all British Columbians. At the same time, rigorous conservation of salmon habitat should be understood as a policy objective that will contribute to and uniquely enhance the quality of life in urban settings. The conservation of productive salmon streams in the urban environment must be understood as an aesthetic value added to property and not as an undue restraint on property development.

Weak stock management

A fisheries-management regime informed by the four principles outlined in this document would obviously require a complete break from "passive" management of small salmon runs. Such a regime would also necessarily adhere to stock-specific harvest goals, and would require far greater precision in fisheries openings and far more adaptive and flexible management models. Ensuring that returning salmon reach the greatest possible diversity of spawning streams is an objective that by itself would mean, in many instances, far fewer fish available to commercial harvesters, at least in the short term. Ensuring that salmon are allowed to pass through the fisheries gauntlet in numbers sufficient to rebuild small stocks in B.C.'s interior, and in numbers sufficient to contribute to terrestrial ecosystem functioning, would also mean fewer fish available for commercial fishermen, again in the short term.

The unregulated growth of the sports-charter industry on the B.C. coast has led to a situation in which federal fisheries scientists often have no basic information about how much fish the sector is catching and which salmon runs the sector is impacting.

Much change has been forced upon B.C.'s commercial salmon fishery in recent years—change which has been informed in part by the principles outlined in this document. Management of the commercial salmon fisheries would necessarily produce greater fishing restraints as a consequence of the policies this document anticipates. "Weak stock management" should be expected to rise in fisheries-management policy priorities.

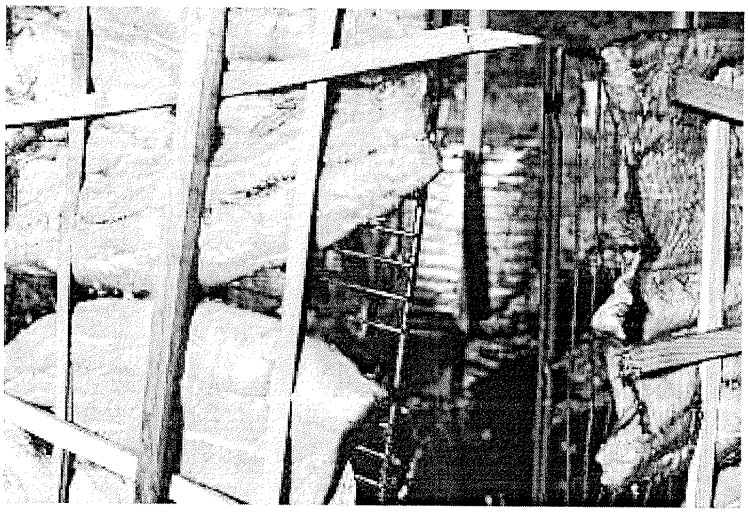
The fleet sector that would face the greatest immediate change is the recreational sector. The unregulated growth of the sports-charter industry on the B.C. coast has led to a situation in which federal fisheries scientists often have no basic information about how much fish the sector is catching and which salmon runs the sector is impacting. This is particularly true of the lodge fisheries on B.C.'s central and north coast.

Terminal fishing

Traditional aboriginal subsistence fisheries, meanwhile, stand to gain the greatest long-term benefit from the policy objectives identified in this document, precisely because those fisheries were based upon the localized abundance of thousands of distinct salmon runs. As small salmon runs are restored throughout their range throughout the B.C. interior, traditionally sustainable "terminal" aboriginal fisheries can be restored.

At least in the short-term, aboriginal fisheries that have taken on greater significance in the marine approach areas in recent years, and coastal aboriginal communities that have come to rely on the limited-entry commercial salmon fisheries, will face restraints along the same lines as those anticipated for the commercial salmon fishery generally. However, there is a significant consistency of interest between the objective of restoring B.C.'s traditional aboriginal fisheries and restoring the spatial and genetic diversity of salmon in the province.

The most obvious example lies in the aboriginal fisheries of the Fraser River basin (fully half of B.C.'s First Nations are vested with fishing rights within the Fraser system). For thousands of years, the Fraser basin's aboriginal fisheries were spread out among all six salmon species, with most of the fishing effort concentrated above Yale on the main stem and in the tributary river systems. Over the past half-century, the Fraser's aboriginal fishery has become primarily a sockeye fishery on the lower main stem. Restoring the spatial and genetic diversity of the six species of Fraser salmon is a policy objective that holds the hope of fulfilling the promise of restoring the aboriginal fishing rights of the Fraser's "interior" tribes, in keeping Section 35 of the Constitution.



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No salmon aquaculture subsidies

There is a significant consistency of interest between the objective of restoring B.C.'s traditional aboriginal fisheries and restoring the spatial and genetic diversity of salmon in the province.

Meanwhile, Fisheries and Oceans Canada, if it were to adhere to the principles set out in this document, would have no business in the salmon-aquaculture industry. Currently, DFO provides millions of dollars in subsidies to the salmon-farming industry every year, in research-and-development assistance, in genetic engineering research and in studies of alternative feeds. This intimacy with an industry that presents serious threats to wild salmon and to conventional salmon fishing serves only to deepen the conflicts of interest that have so badly damaged DFO's public credibility, and have also undermined the department's ability to place the public interest in salmon conservation above all other considerations.

Public involvement in decision-making

Perhaps the most significant change anticipated by this document, however, is the degree of institutional reform required of Fisheries and Oceans Canada. Fisheries-management decisions must be made publicly, in a transparent fashion. DFO's consultation should be broadened to include public-interest conservation groups as formally recognized "stakeholders." DFO officials cannot be expected to make the "right decisions"—which many of them do make, or attempt to make, on a daily basis—on their own.

Good decisions must be based on policy that the public has been given a full opportunity to support. When difficult decisions are required, DFO decision-makers would be much better off with the active support of a public that has been given an opportunity to form and shape salmon-conservation policy.

In the current decision-making structure, the constituency with the least influence in federal fisheries decision-making is precisely the constituency that expends the greatest amount of time and resources in the conservation and protection of salmon. That constituency is composed of the tens of thousands of volunteers in "creek watch" groups, watershed-stewardship groups and other organizations dedicated to the protection of B.C.'s wild-salmon heritage.

Rethinking hatcheries

One of the more contentious matters that unavoidably arises from the principles outlined in this document is DFO's continued support of and reliance upon salmon hatcheries. The general public, often because of the profile and activism of hatchery advocates, has often associated hatcheries with progressive measures to conserve salmon. Hatcheries are often seen as a "good" thing by ill-informed environmentalists as well.

However, the evidence is overwhelming that salmon hatcheries commonly present direct and indirect threats to the abundance and diversity of B.C.'s wild salmon. Small sockeye and steelhead runs in the Skeena watershed have been dramatically overfished because they are mingled with fisheries directed upon hatchery-enhanced sockeye runs to the Babine system in the Upper Skeena watershed. Coho in the Strait of Georgia were fished throughout the late 20th century at unsustainably high harvest rates because fishing effort was directed largely on hatchery coho. By 2001, hatchery coho had come to represent about 70 per cent of all coho in the Strait of Georgia.[40]

Too many fisheries, for too long, have been allowed to become far too reliant upon hatchery production—which is itself dependent upon the expenditure of significant public funds.

The evidence is overwhelming that salmon hatcheries commonly present direct and indirect threats to the abundance and diversity of B.C.'s wild salmon.

Nonetheless, this document does not propose dogmatic opposition to salmon hatcheries. It is not helpful to espouse too narrow a view of what constitutes a "wild" salmon; hatchery-origin salmon have interbred with countless "wild" salmon populations in B.C. over the past century. However, each hatchery should be rigorously evaluated according to the extent to which it contributes to the conservation of naturally spawning salmon populations. In all enhancement policy, the conservation of locally adapted salmon populations and the genetic integrity of wild salmon populations must be paramount. Hatcheries may be relatively benign when they are used as a temporary, last-resort measure to conserve a wild population that is threatened with outright extinction. But hatcheries must demonstrate that they are not producing negative impacts upon wild salmon, either by producing competitors for food in the marine environment, or by raising the risk of undesirable genetic interactions, or by attracting fishing effort that presents risks to wild populations. Most importantly, hatchery production should never be contemplated as a way to replace wild salmon.

A new direction

In conclusion, this document has taken what might be considered an optimistic view of British Columbian values on environmental protection generally and salmon conservation specifically. This document was written with the conviction that historic and encouraging changes are under way among British Columbia's diverse settler cultures. At the same time, we understand that cultural values are not static. The opportunities we have identified may be fleeting.

In these first years of the 21st century, British Columbia is adding to itself the equivalent of the population of the city of Nanaimo, every year. Many newcomers readily embrace B.C.'s unique civic values. Many newcomers, however, are not given sufficient opportunities to adopt these values.

Fisheries and Oceans' successful "salmonids in the classroom" initiative is only one way to address this matter. The initiative is probably the most useful contribution the Salmonid Enhancement Program has made, and it should be expanded from its present form, which is often little more than a hands-on experiment in basic salmon biology. A substantial portion of B.C.'s school-age children now come from immigrant families with a language other than English in the home. These children deserve to learn about B.C.'s great wild-salmon heritage. The wonder and awe of wild salmon is now their birthright, too. The children of recently arrived families, and the children of long-established British Columbian families, are our future. The future of wild salmon rests with them.

Further, despite the optimism of this document, we fully understand that the future of salmon is by no means assured. The future of the relationship between people and salmon in British Columbia cannot be predicted. The persistence of salmon into the future is not guaranteed, and neither is the persistence of the great ecosystems that salmon have played such a vital role in supporting down through the millennia.

For these reasons, the principles outlined in this document should not be seen as a wish list to be considered at some time in the future, or as a synopsis of the way governments might conduct themselves in some far-away, ideal world. They are immediately necessary.

They should be understood as the bottom line.

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SIERRA CLUB
BRITISH COLUMBIA

Join the Sierra Club's Marine Program

Our goal is to maintain the abundance and diversity of species in a healthy marine environment.

Key elements of our program include:

- Promotion of sustainable fisheries (e.g. groundfish)
- Protection of wild salmon
- Conserving and protecting marine ecosystems

Your support will help the Sierra Club of BC to:

- Work with fishermen and other groups to halt unsustainable fishing practices and waste;
- Encourage government to develop more transparency in decision-making and devote more funds to better science;
- Manage salmon and other marine life while providing for a network of marine protected areas; and
- Protect marine ecosystems by ensuring a moratorium on offshore oil and gas drilling exploration off B.C.'s coast, on salmon-farms, and other harmful activities.

Other marine reports:

(available at http://www.sierraclub.ca/bc/campaigns/marine/)

Scott Wallace and David Boyd, *Out of Sight, Out of Mind and Almost Out of Time: Towards an Effective System of Marine Protected Areas in British Columbia.* April 2000.

Terry Glavin, *Groundfish—A Case Study: The Conservation of Marine Biological Diversity and Species Abundance on Canada's West Coast—Institutional Impediments.* March 2001.

Scott Wallace, *State of the Strait—The History and Future Outlook of the Strait of Georgia Marine Fisheries,* Interim Report, November 2002.

Terry Glavin and Ken Wilson, *Conservation Sector Submission re: 2002 Fraser River Sockeye Review,* January 2003.

For more information, or to join, please contact us at:

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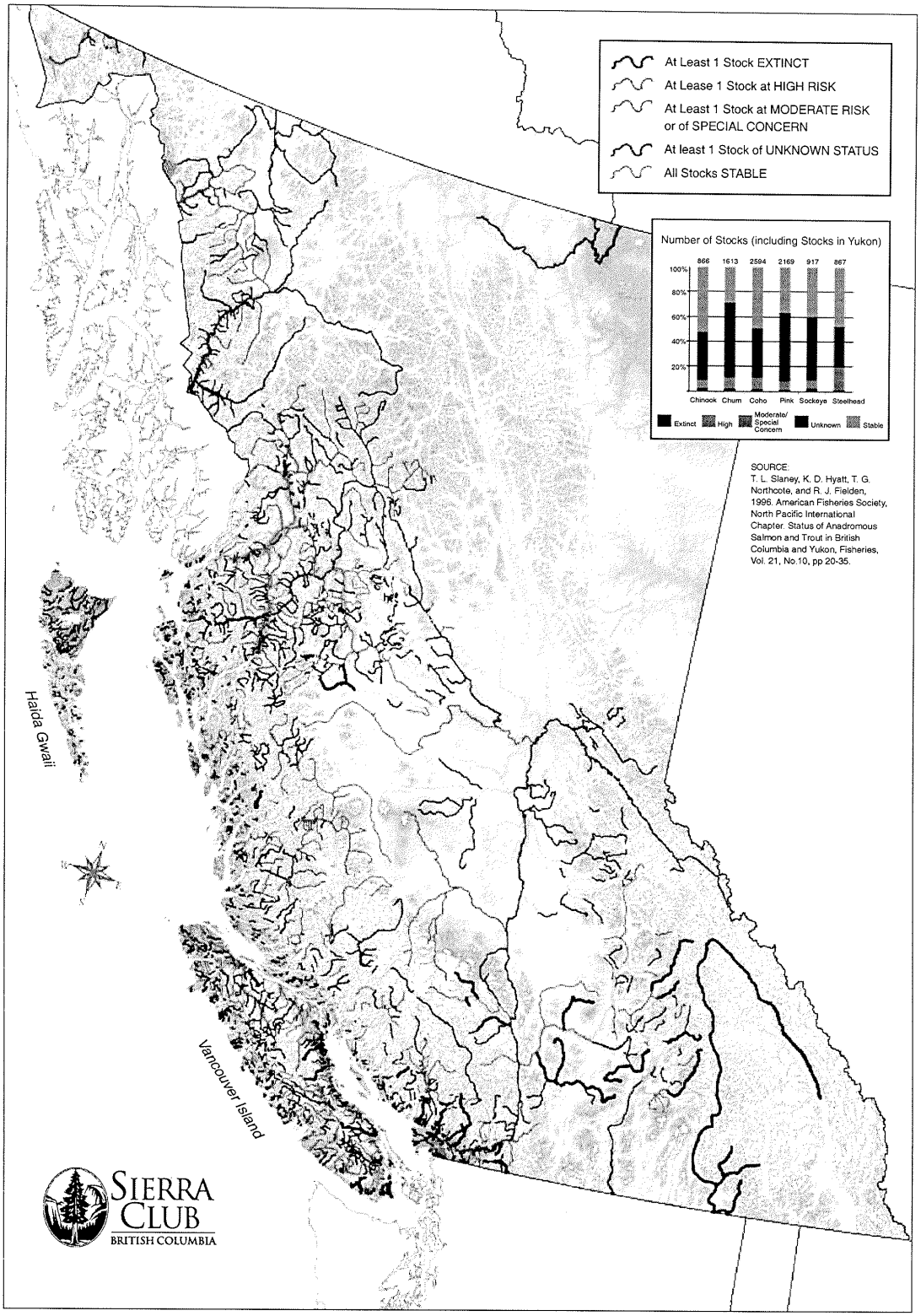
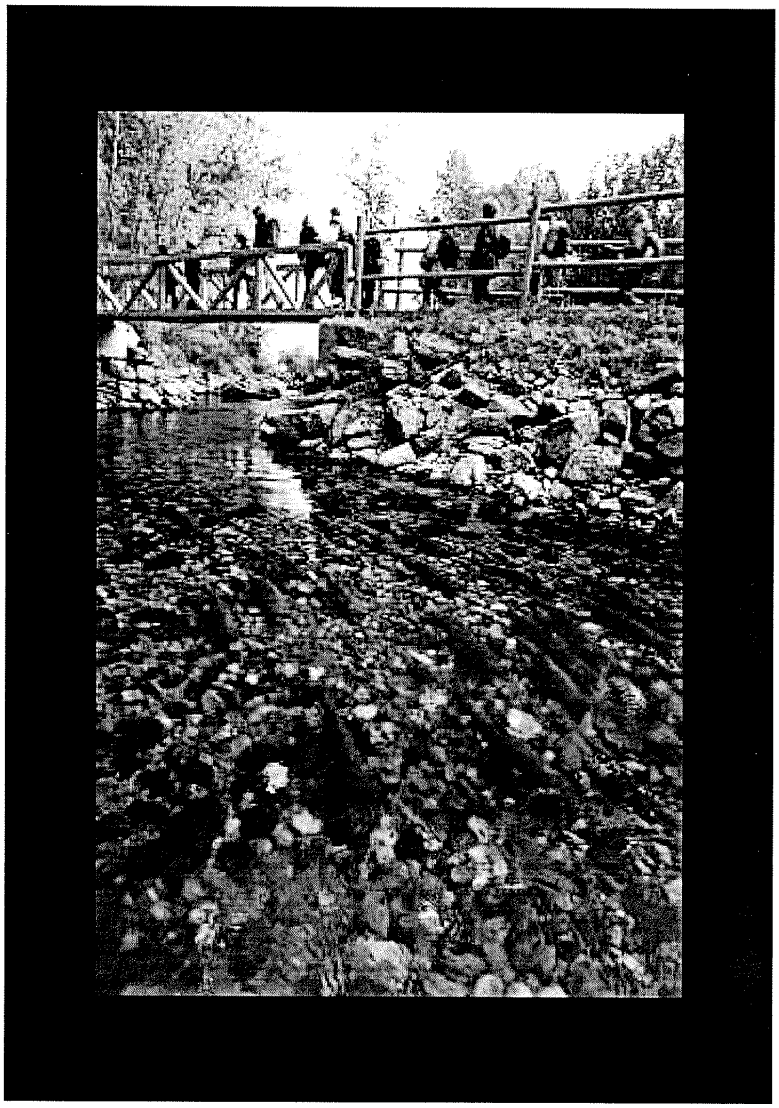
Salmon Stocks At Risk in British Columbia

Coho, Chinook, Chum, Pink, Sockeye, Steelhead





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