7 Aboriginal Fishing Rights and Salmon Management in British Columbia: Matching Historical Justice with the Public Interest

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Abstract.—At the time of European contact, Aboriginal peoples inhabiting the Fraser and Skeena watersheds in what is now British Columbia pursued river fisheries on spawning runs of salmon, for both domestic use and trade. In support of a salmon canning industry established in the 1870s, the Canadian government severely restricted Native river fisheries, limiting them to fish for household needs, and prohibiting the use of their most productive gears, such as weirs and traps. This contributed to the impoverishment of Aboriginal communities, with many descending into social dissolution and despair. Recent decisions by the Supreme Court of Canada have affirmed the constitutionally protected priority rights of Aboriginal peoples to fisheries integral to their culture at the time of European contact. An Aboriginal Fisheries Strategy, implemented in June 1992 in response to Supreme Court edicts, has modestly increased salmon available to some river tribes and has allowed parts of the catch to be sold. This has engendered strong opposition from commercial fishing interests, fearful of a decline in their catches. It has also added to current public concerns regarding alarming declines in some salmon stocks, particularly those of interest to recreational fishers. This chapter proposes a salmon management strategy for the dual purpose of strengthening the economies of First Nation river communities and substantially increasing the production of salmon from the Fraser and Skeena watersheds for the benefit of all stakeholders. This would involve an additional transfer of a modest share of the salmon harvest from the mixed-stock commercial sea fisheries to the Aboriginal river fisheries. The latter would be restructured to use selective fishing gears and terminal fisheries to improve stock-specific spawning escapements significantly. Spawning habitat restoration and improvement, undertaken by local Aboriginal communities, would further assist stock recovery. The objective would be to greatly increase sustainable salmon harvests, by rebuilding and enhancing weak stocks and allowing fuller utilization of surplus production from strong stocks. A program of experimental fisheries to develop and test appropriate gears and fishing techniques is proposed, in conjunction with the development of management models to establish optimum escapement targets, fishing locations, and harvest allocations. These would balance biological and economic considerations and observe the need for an equitable distribution of benefits in which all stakeholder groups would participate.

INTRODUCTION

For thousands of years prior to the arrival of Europeans, the abundant salmon of what is now British Columbia (B.C.) provided a major source of food for Aboriginal peoples (Mitchell 1925; Ware 1978; Carlson 1992). Surpluses from the catch, at times, served as important trading goods. Because Pacific salmon swim long distances up numerous tributaries from which they originated, they have

been available not only to the coastal peoples of the region, but also to the tribes inhabiting the inland watersheds. Indeed, as coastal people had access to many alternative marine resources, it was often among inland river tribes that the greatest dependence on salmon was established. Coincidentally, salmon harvesting was exceptionally productive in the "gauntlet" fishery of the rivers, where fish were concentrated in dense spawning runs.

In the 1870s, Euro-Canadians established a salmon canning industry in B.C., with the raw material being supplied by a newly developed coastal commercial fishery. While the canning industry and associated harvesting operations provided employment for many Aboriginal people, primarily from coastal settlements, these operations adversely impacted the established salmon harvest of inland river tribes. Added to the existing Aboriginal catch, the expanding demand for cannery fish was leading to unsustainable harvest levels. Faced with the need to conserve salmon stocks, the federal government, in support of the canneries, severely curtailed the Aboriginal river catch under the 1888 Fisheries Act.

The 1888 regulations confined Native people to a "food fishery" for their domestic use and prohibited them from selling salmon, thus eliminating what for many was their primary source of cash and barter. They were also prohibited from using their efficient weirs and traps, and confined to Jess efficient fishing devices. These regulations above all impacted tribes inhabiting the watersheds of the two great rivers, the Fraser and Skeena (Figure 7.1), who mostly lived too far from the sea for them to join the commercial fishery in which many of the coastal Native people participated. This chapter primarily concerns the Fraser and Skeena, although the analysis is also applicable to a number of Aboriginal fisheries on smaller B.C. river systems.

In recent decades the Aboriginal peoples of B.C., now identifying themselves as "First Nations," have become much more assertive of their rights, for which they have received increasing recognition through appeals to the courts. The 1990 "Sparrow" decision by the Supreme Court of Canada has been particularly important in strengthening Aboriginal fishing rights (Binnie 1990; Helin 1994). Demands by First Nations for greater access to salmon catches have been coupled with extant land claims, pursued in part by court appeals and in part by negotiations in a treaty-making process that will take many years to complete. The most elaborate case heard by the courts thus far has been that of the Gitxsan and Wet'suwet'en inhabiting the upper Skeena region (Copes and Reid 1995).

The Sparrow decision assigned priority to the quantitatively undefined Native food fishery over all other fisheries. In response, Canada's federal government, which has jurisdiction over the salmon fisheries, implemented an Aboriginal Fisheries Strategy (AFS). In agreements with a number of First Nations, the federal Department of Fisheries and Oceans (DFO) started in 1992, on a modest scale, to allocate more fish to the food fishery. The sale of fish from these negotiated allocations was also permitted. This removed, for the time being, an important source of friction, legal uncertainty, and repeated court challenges. In return the Aboriginal groups concerned agreed to a negotiated cap on the amount of fish allocated to the food fishery, which helped to restore DFO control over aggregate catch levels. The expanded Aboriginal food fishery permitted under the AFS was initially plagued by problems of hasty implementation, including inadequate controls on the catch. This added to other management problems in the salmon fishery, provoking a major government-ordered enquiry in 1994 (Fraser 1995) that resulted in the application of stronger enforcement measures.

The AFS has been fiercely opposed by groups representing the commercial salmon fishery. This opposition has been predicated largely on the notion that reapportionment of the salmon catch is a "zero-sum game," with gains by First Nations on the rivers resulting in corresponding losses suffered individually by commercial operators. Yet the government has taken pains to demonstrate that this has not been the case and will not be so in the future. For example, additional allocations to First Nations are being matched by catches attributable to vessels withdrawn from the commercial fishery (through voluntary buyback from fishers retiring from the industry) and by increased production through stock and habitat enhancement. Therefore, average catches of individual operators remaining in the fishery should not be affected by the additional allocations made to First Nations.

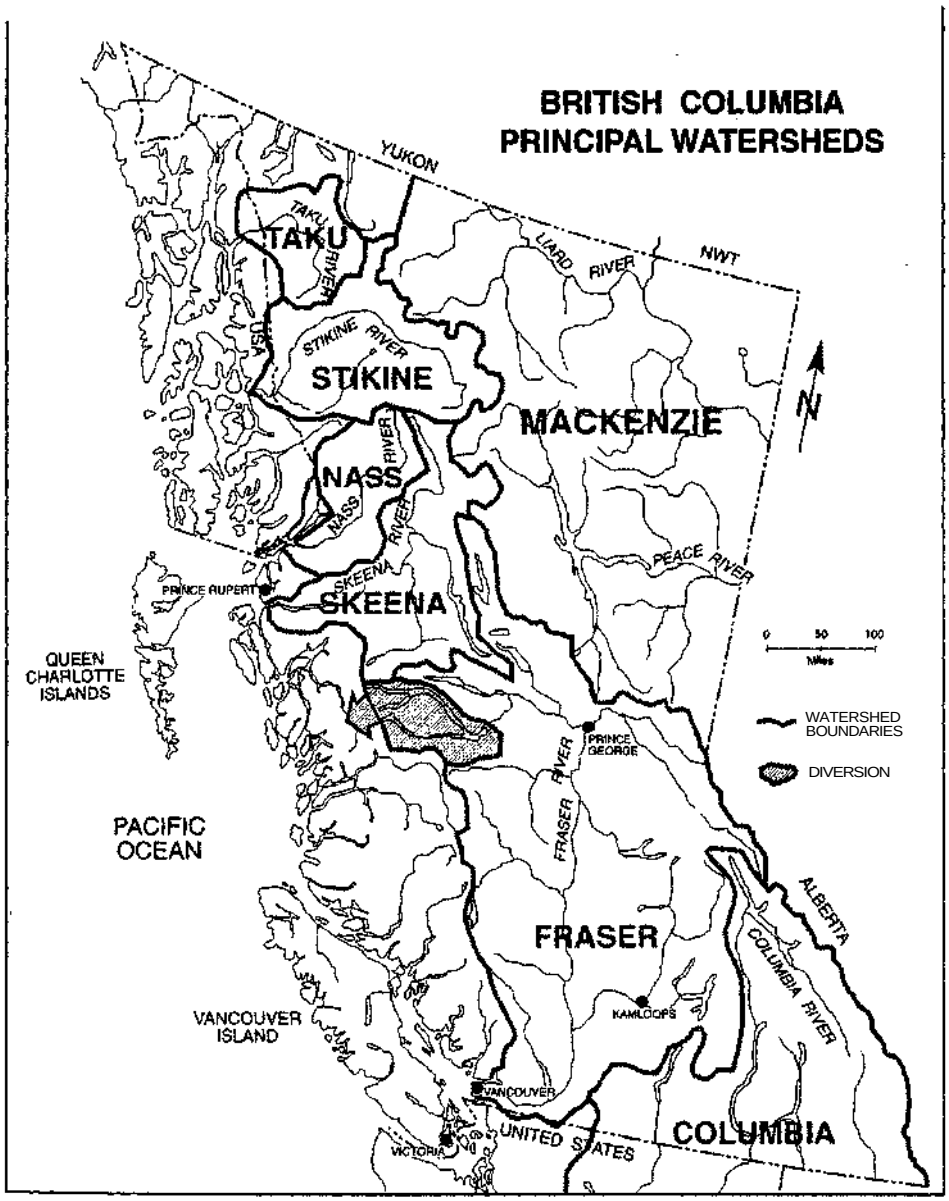

FIGURE 7.1 The principal watersheds of British Columbia.

The purpose of this chapter is twofold. It will present brief arguments to establish, on grounds of historical justice, a case for the allocation to river-based First Nations of significantly greater catches of salmon than they currently receive. The equally important second purpose is to make the case that an increase in the allocation of salmon to river fisheries makes it possible to introduce greater stock-specific selectivity in harvesting salmon, both through the increased use of selective inriver gears and through the use of terminal fisheries in appropriate locations and circumstances. This should allow for improved spawning escapement of weaker stocks and fuller harvest utilization of stronger stocks, both leading to increased total stock productivity. The end result should be much greater sustainable catches of salmon in which all stakeholder groups may share. To reconcile non-Aboriginal salmon fishery Participants to this process, it should be emphasized that the proposal envisages maintaining their individual harvest shares in the short run and increasing them in the long run.

The case made in this chapter is speculative, based on *a priori* reasoning in relation to the known general circumstances of the salmon fisheries. It lacks hard data to demonstrate the feasibility of the management strategy proposed on a scale sufficient to generate large benefits. Therefore, a modeling exercise is also proposed, supported by experimental fisheries, to test feasibility and provide cost-benefit estimates.

THE SALMON RESOURCE AND ITS MANAGEMENT

Pacific salmon comprise the genus *Oncorhynchus,* of which six species are represented in the B.C. salmon catch: sockeye *Oncorhynchus nerka,* pink *O. gorbuscha,* coho *O. kisutch,* chinook *0. tshawytscha,* chum *O. keta,* and steelhead *O. mykiss.* See Burger (2000) in this volume for a description of their life history and habitat requirements. To demonstrate the possibilities for a major improvement in productivity of B.C. salmon stocks, it is necessary to refer to the basic features of the salmon life cycle and the principles by which the stocks may be effectively managed.

An important factor affecting the total size of the salmon resource is the extent to which available spawning and/or rearing habitats are used to full capacity. To obtain the best rate of reproduction (i.e., resulting in the largest number of surviving offspring) the number of spawners should be sufficient to fully utilize the available spawning or rearing habitat, depending on which is limiting for a given population. Returning salmon in excess of such numbers should be kept off the spawning grounds to prevent them from disturbing the redds of preceding spawners and thereby causing mortality of deposited eggs.

Fisheries scientists concerned with salmon reproduction management are particularly interested in identifying "stocks" consisting of groups of one or more distinguishable breeding populations (i.e., fish of the same species spawning at a particular location and time that as a consequence do not spawn with fish spawning at another location or time). With fish of the same stock managers attempt to secure optimal spawning by opening and closing the fishery in particular locations to allow for safe passage of the right "escapement" for each stock, while ensuring that the remainder of the stock is taken in the fishery as a harvestable surplus.

There are, however, many hundreds of distinct breeding stocks in the Fraser and Skeena systems. Thus, there often are several migrating stocks mixed in the river at the same time. Some of these are very strong, requiring only a short period of fisheries closure to secure sufficient escapement, while others are weak and require a longer period of closure—or even a complete closure—to guarantee adequate escapement. This creates a mixed-stock management problem with compromise closures that are not long enough to produce adequate escapements for weak stocks, but too short to allow full utilization of surpluses from strong stocks (Knudsen 2000).

The mixed-stock problem has been exacerbated in recent years by the successes of the Salmonid Enhancement Program (SEP), carried out by DFO in cooperation with provincial authorities and various local interests. The objective of this program has been to increase British Columbia's salmon resources by various artificial means. The largest undertaking was a 1960s project on Babine Lake in the Skeena River watershed, which greatly expanded the spawning capacity for sockeye salmon through the construction of a large number of artificial spawning channels, to supplement those naturally available (West and Mason 1987). This has resulted in runs of Babine sockeye that dwarf the runs of other Skeena salmon stocks. On the Fraser River, enhancement projects have also produced a number of very large sockeye stocks.

Heavy fishing on enhanced sockeye stocks has resulted in serious depletion of smaller wild stocks that are mixed in with them (Healey 1993) and has threatened many with extinction (Slaney et al. 1996). Reduction or extirpation of the weaker wild stocks is a serious matter because, not only will these stocks no longer contribute to the total salmon catch but, more importantly, the available gene pool will also be reduced, threatening loss or reduction of diversity and extent of many desirable traits. These relate, for instance, to disease resistance, adaptability to environmental change, ability to utilize diverse ecological niches, time and place of availability, and end product

variety and quality. The practice of developing large stocks of enhanced salmon has been implicated in a variety of deleterious effects (Hindar etal. 1990). For example, approximately 60% of all Skeena sockeye are derived from the enhanced Babine Lake stocks, suggesting limited genetic diversity for the Skeena system sockeye (Sprout and Kadowaki 1987; Jakubowski 1990). One concern is that, if large stocks are depleted by disease and need rebuilding, it may be difficult to draw sufficient numbers of disease-resistant spawners from the few remaining wild stocks. Similar considerations apply to the large enhanced stocks of Fraser River sockeye.

Because many of the smaller and weaker stocks of the Fraser and Skeena systems are now threatened with extinction (Slaney et al. 1996), managers have imposed some fisheries closures to reduce the threat. In turn, this has resulted in large numbers of surplus sockeye being left to rot unharvested in some years (e.g., on the Babine River) because they could not be fished during the closures.

To solve or reduce the mixed-stock problem, two strategies are available. One is to reduce the fishing effort on mixed stocks as much as possible, by using "terminal fisheries" that target stocks separately at points where there is no mixing or little mixing with other stocks. A second strategy is to employ selective fishing techniques, using gear such as weirs and traps, fishwheels, beach and purse seines, fykes, reefnets, dragnets, bagnets, and dipnets. These allow for retention of fish from strong stocks and live release (with low mortality) of fish from weak stocks. This will be discussed further below.

If the mixed-stock problem is adequately contained, considerable advantage may be drawn from the remaining potential for an increase in B.C. salmon stocks, which appears to be substantial. Such a conclusion is supported by the evident availability of additional ecological capacity and by the larger size of B.C. stocks in former times. Large increases in salmon runs are considered possible (Ricker 1987, 1989). Sockeye constitute the most valuable component of the B.C. salmon fishery, accounting for about 60% of the commercial landed value. Henderson (1991) notes that the Fraser watershed, in the 1970s and 1980s, produced about 66% of the province's sockeye, and refers to estimates that Fraser sockeye stocks could be tripled to an average of about 30 million fish per year.

The launching of SEP is evidence of the opinion that the stocks could be brought back to larger size and the successes of the SEP so far confirm the practical feasibility of the techniques that have been developed. These SEP techniques, by and large, have concentrated on physical manipulation of the stocks and their environment in a harvest management setting that has otherwise remained constrained and little changed by institutional conditions.

This chapter suggests that progress toward larger salmon stocks and larger harvestable surpluses may be substantially advanced by strategic changes in institutional structures. This would be based on an increased role for Aboriginal river fisheries, with the proviso that these fisheries would be conducted in a highly selective manner to optimize stock-specific spawning escapements and minimize non-harvest mortality. A review of past and present patterns of salmon fishing will set the stage for the subject of stock-specific management.

THE TRADITIONAL ABORIGINAL FISHERY

There is clear prehistorical evidence of the utilization of fish resources by the people inhabiting the Fraser and Skeena watersheds (Carlson 1992). On the Skeena, for instance, numerous settlements were established in prime fishing areas (MacDonald etal. 1987). While relevant archaeological exploration has not been extensive, excavations have turned up bone fragments of salmon and other fish at four Skeena sites, namely at Hagwilget (Ames 1979), at Kitwanga (MacDonald 1989), and at two Kitselas Canyon sites (Allaire 1978; Coupland 1985). Some of the fragments may date back as far as 2000 B.C.

At the time of European contact in the late 18th century it was evident that the Northwest Coast First Nations had developed societies that had—in relation to time and place—a notable level of material sufficiency, cultural expressiveness, and artistic refinement. Fish resources played an

especially important role in providing them with a plentiful supply of food, in response to which they developed a variety of ingenious and very efficacious fishing techniques. These have been described effectively, attractively, and artistically by Stewart (1977) in her book on Indian fishing; Among the fish resources salmon was evidently the most important. Garfield (1966) wrote: "Salmon was the decisive food resource of the Tsimshian, as it was of most other Northwest Coast tribes. Cohoes or spring salmon and sockeye salmon furnished the bulk of the fish dried for winter use."

When, in the early 19th century, the North West and Hudson's Bay (HBC) Companies brought the fur trade to the region, several tribes gained an opportunity for a significant extension of their salmon trade. Native-caught salmon—both fresh and smoke-dried—became an important staple for provisioning the HBC, and later other frontier groups, such as miners and construction workers (Ray 1984; McDonald 1985; Morrell 1985; Shepard and Argue 1989). Salmon was so important a commodity that it was accepted as a form of currency, with a well-known exchange rate (Ray 1984).

In their traditional fishery, the First Nations of the upper Fraser and Skeena rivers made great use of a variety of highly effective weir and trap systems (Stewart 1977; Morrell 1985), which intercepted salmon on their migration paths. These systems, operating under the authority of local chiefs, were eminently compatible with effective conservation. Fish were easily taken from the traps or along the weirs with dipnets, gaffs, and baskets. When enough fish was taken to occupy fully those engaged in processing the fish, the weirs and traps would be opened to let migrating fish pass through. Intermittently, the weirs and traps would be put into operation again to provide further raw material for processing, which mostly involved drying and smoking. This fishing system ensured bountiful harvests with escapement that was quite adequate to maintain the stocks in a healthy state, as evidenced by the prosperous condition of the tribes at the time of European contact and the healthy state of salmon stocks then observed (Morrell 1985, 1989).

The establishment of salmon canneries in the 1870s marked the beginning of a Euro-Canadian commercial salmon fishery. Initially it relied to a great extent on local Aboriginal labor, with the men employed in fishing and the women in processing. Over the ensuing decades, the commercial fishery expanded by attracting non-Aboriginals, often from outside the region. Competition for raw material with local tribal fisheries became more acute. Government fishery managers, evidently preoccupied with the interests of the Euro-Canadian dominated commercial fishery, were concerned that the effective weir and trap fisheries of the upriver Natives would take too much fish and endanger the stocks. In reality, of course, it was the additional pressure of an expanding commercial fishery that upset the pre-existing balance of catches and escapement, leading initially to large increases in harvests, but thereby subsequently depressing stock strength and threatening sustainability of catch levels.

As the commercial fishery expanded, progressively tighter restrictions were placed on upriver Aboriginal fishing (Lane and Lane 1978; Morrell 1985; Copes et al. 1994). In 1888 regulations were proclaimed that limited the authorized Aboriginal catch to the satisfaction of domestic needs, the so-called "food fishery," while prohibiting the Aboriginal salmon trade (Ray 1984). More productive Aboriginal fishing gears, such as weir-and-trap systems, referred to as "barricades" by fisheries officials, were banned by order-in-council in 1884.

For some years many Aboriginal groups managed to evade the restrictions. John T. Williams, Inspector of Fisheries, in 1905 reported to the Dominion Commissioner of Fisheries that conditions for salmon in the head waters of the Skeena River were "dangerous in the extreme" because of "illegal fishing by the Indians" which threatened "complete annihilation of this valuable fish and entire depletion of the river" (Williams 1906). Fishery Officer Hans Helgeson was sent out to enforce regulations and reported how he secured the destruction of all Aboriginal barricades throughout the area.

Helgeson's report (1906) incidentally gave impressive evidence of the size of the Aboriginal salmon industry in the area and of its importance to the Native population. Most striking was his description of two barricades on the Babine River, of "formidable and imposing appearance ...

constructed of an immense quantity of materials, and on scientific principles." He found "no less than 16 houses ... filled with salmon" and "an immense quantity of racks" for drying, which if od close together would have covered "acres and acres of ground." He judged the catch "to be nearly three quarters of a million fish ... and though the whole tribe had been working for six weeks and a half it was a wonder that so much salmon could be massed together in that time."

Helgeson also reported the local chief's protest that

> said they have had an indisputable right for all time in the past, that if it was taken away the old people would starve, that by selling salmon they could always get "iktahs" [i.e., goods], and he wanted to know to what extent the government would support them, he thought it unfair to forbid them selling fish when the cannerymen sold all theirs, and I had to promise him to tell the government to compel the canners to let more fish to come up the rivers, as some years they did not get enough, that the canners destroyed more spawn than they, that formerly he could not see the water below his barricade for fish, that they were so plentiful that some of them were forced out on the beach, but latterly they had diminished, little by little every year.

In justification of their destruction of Aboriginal barricades, official reports described them as utterly incompatible with conservation. This ignored the survival of healthy salmon stocks over hundreds or thousands of years of Aboriginal fishing and the evidence that the barricades, as they were operated with alternating openings and closures at their accustomed rates of exploitation, demonstrated an understanding of, and adherence to, essential conservation practices. Nevertheless, there is good reason to believe that the British Columbia salmon stocks were seriously threatened. The Aboriginal fishery, by itself, had proven to be sustainable on the evidence of a long past. But the combination of a strongly developed salt-water fishery and continuation of the traditional Native fishery for domestic consumption and trade goods might well spell disaster.

While Native peoples on the upper Skeena were not the originators of the new pressures on the fish stocks, they were easy targets to blame for the results. Apart from having little influence with government, the media, or the general public, they were also in the unfortunate position of being the last user group in line along the migration path of salmon to their spawning grounds. By force of circumstance the ultimate onus of letting enough fish through to make up an adequate escapement was then placed on them. Any attempt by them to maintain their historical harvest levels, in the face of much greater catches downstream, except in very good years, might then have the "depensatory" effect of not leaving enough spawning escapement (Peterman 1980).

The foregoing account indicates that a large part of the salmon resources held and utilized by Native peoples in the Upper Skeena region (and elsewhere) about 100 years ago, was forcibly taken from them, without any significant compensation. It was handed over, essentially free of charge, to a new user group favored by the government and protected by the force of law. The Aboriginal population was compelled to use often inefficient and wasteful fishing practices with nets and gaffs, instead of weirs and traps. The supply of food fish left to them was at times inadequate, occasionally leading to starvation (e.g., in 1916; Sprout and Kadowaki 1987). Their salmon trade, which supplied them with many needed goods, was prohibited by law and greatly inhibited in practice.

The descent of several Skeena and Fraser River tribes from economically and culturally vibrant societies, by their standards of place and time in the mid-19th century, to socially and materially depressed communities 100 years later, is no doubt due in part to the severe reduction in access to the salmon resource that they suffered. The equity implications of the foregoing require no elucidation. Surely any attempt in that direction today would be quickly negated by the courts. Indeed, the courts are now in the process of reversing, to some degree, the effects of the injustices exemplified in the above account.

There is a concept in law, known as the "abstention principle," which is used both intra- and internationally. It holds that when a (fishery) resource is fully exploited by a user group, no new group is entitled to join in the exploitation of that resource. Canada and the U.S. have called on

this principle in persuading Japan and other countries to refrain from fishing for salmon of Canadian or American origin in most of the North Pacific. The principle, in fact, is enshrined in Article 66 of the United Nations Convention on the Law of the Sea (United Nations 1983). Past actions of the Canadian government in suppressing Aboriginal fishing rights would appear to constitute a flagrant violation of the abstention principle.

After the removal of barricades, Aboriginal fishers in the B.C. interior were restricted largely to using nets and gaffs, which were relatively inefficient and damaging to the stocks. When gaffs are not used in conjunction with traps or weirs that inhibit the escape offish, they become a wasteful technique. Many fish drop off gaffs gravely wounded and die. In an open-river fishery, they cannot be retrieved and are therefore lost for purposes of both consumption and spawning. Similar stock damage results when nets are lost in swift-flowing river waters and continue to entangle and kill fish ("ghost-fish"), unseen and unattended on the river bottom.

CURRENT USER GROUPS

The salmon fishery has been referred to as a gauntlet fishery. After spending much of their life on ocean feeding grounds, salmon return to the coast to assemble in concentrations that migrate upstream to spawn. In doing so, they are intercepted by various fishing groups along the way. The order of interception has significant implications. Fishing fleets that are furthest out to sea have the first opportunity to capture returning fish and thus have the most fish available for exploitation. Fishing groups on the river can exploit only what is left of a stock after other groups have taken their catch. However, they do have the advantage of fishing in confined waters where fish are concentrated and easy to capture.

During their return migration from the high seas some of the salmon originating in B.C. rivers first pass through Alaskan fisheries. When they reach Canadian coastal waters, returning salmon are subject to a commercial fishery conducted by trailers and seiners. Next in line is the commercial gillnet fleet, operating mostly near or in estuaries of major salmon rivers. It is only after all commercial fleets have taken their catches that the various First Nations on the rivers have an opportunity to exploit the remainder of the stocks for their food fishery. One further user group should be noted; sport fishermen angle for salmon in coastal waters and for salmon and steelhead on many rivers.

It is important to note that with current techniques and equipment, the various groups exploiting B.C. salmon stocks have an aggregate fishing capacity that is several times as large as necessary to take the entire harvestable surplus (Pearse 1982). With no constraints on fishing effort they could fish the salmon stocks to extinction in a few years, with each group blaming the others for the result. Only the restraint of government regulation and management has prevented this from happening.

Fisheries regulations imposed by DFO, particularly including time and area restrictions that impact diversely on the different components of the harvesting sector, are the prime determinant of how much fish each group is able to take. Thus the government in effect has responsibility for deciding the allocation of benefits from the fishery among the various user groups.

ECONOMIC EFFICIENCY

Fisheries regulation and catch allocation have bearing both on efficiency in resource use and on equity in the distribution of benefits among user groups. Efficiency comparisons may be made in terms of the total value of net benefits (i.e., the total value produced minus the costs of production) achieved under alternative regimes or processes. Value concepts underlying efficiency calculations are subject to conceptual controversy and practical ambiguity, which would be quite substantial in the case of the complex socioeconomic implications of this chapter. Moreover, given the extent

and uncertainty of the material changes in the fishery that are being considered, calculation of meaningful efficiency estimates in absolute terms would require a major project, far beyond the scope of this chapter. Instead, the focus here will be on identifying major *improvements* in efficiency that may be achieved as a result of the strategic management changes proposed in this chapter. These changes will be linked to the allocation of more fish to river tribes and will refer to the resulting quantities and qualities of salmon harvested by different stakeholder groups in different locations.

A large body of knowledge has developed regarding the estimation of harvestable surplus (see Hilborn and Walters 1992 for a review). Suffice to say that, for each stock, it is theoretically possible to apportion the returning run into the harvest taken; the non-catch mortality of fish from natural causes and from harvesting-induced stress while en route to the spawning grounds; and the final escapement of fish onto the spawning grounds.

The primary test of efficiency for the proposed new management measures in the Fraser and Skeena systems will be (cost-effective) achievement of sustainable harvests that are much greater than those currently obtained. This is to be accomplished by pursuit of two goals: (1) maximizing production of fish (recruitment) through optimal stock-by-stock spawning escapement and (2) minimizing non-catch mortality losses from harvesting-induced stress. I abstract here from environmental questions, important as they are, to simplify the arguments advanced. Environmental objectives, such as habitat improvement, should be pursued for the net benefits they may bring, regardless of whether we are dealing with the current management system or the one proposed.

Stock-specific management is a requirement to achieve optimal spawning escapements in support of maximum production. There is considerable mixing of stocks in coastal waters where they are targeted by the largely indiscriminate fishing of commercial fleets, which is a major factor in the overfishing of weak stocks and underfishing of strong stocks. Once in the river, stocks are separated from those migrating to other rivers and also from many same-river stocks by the timing of their runs. As they move upriver the stocks separate further into different tributaries on the way to their respective spawning areas. Stock separation in time and space facilitates the culling of individual stocks to achieve precise escapement targets. Nevertheless, particularly in lower river sections and larger river systems, some mixing of migrating stocks remains, calling for selective fishing of the mixed aggregates.

A number of experimental Aboriginal fisheries, using selective harvesting techniques with live release of fish from weak stocks, have been authorized and supported by federal and provincial departments in conjunction with the AFS, notably in the Fraser and Skeena watersheds, on the Nass River (Figure 7.1), and on Vancouver Island. The gears used have included weirs and traps, fishwheels, beach seines, purse seines, reefnets, dragnets, bagnets, and dipnets. In the course of federal and provincial negotiations with B.C. First Nations in respect of land claim settlements, a first Agreement in Principle has been reached with the Nisga'a on the Nass River. It includes a proposed salmon allocation to the Nisga'a structured to mesh with management objectives including, notably, the use of fishwheels.

First Nations on the rivers have been demanding a greater allocation of salmon to allow them an income from fish sales in addition to their supply of fish for domestic consumption. Strategically located, large traps would be a particularly appropriate gear for an inriver fishery with a commercial component. Given the high concentration of fish during river migration, there is ample reason to believe that traps which are well designed and appropriately placed will be both harvest productive and cost effective. From an industry-wide standpoint, what is even more important is that traps have great utility, both in escapement management and in catch handling. Traps may be constructed to allow fish to be readily live-sorted by species. In well-designed and well-operated traps, stress on captured fish may be minimized. Fish from weak stocks may then be released with relatively low mortality. This contrasts with commercial net fisheries in which most fish are killed outright. The exception is that seiners may recover fish live by brailing them from the seine net, but that is a costly operation and not lacking in stress or mortality for fish meant to be released.

Commercial gillnet fisheries present an additional deleterious effect in that many fish are killed by entanglement but are not part of the catch because they drop out of the net dead or struggle free to die later from the stress endured. A report to the Minister of Fisheries and Oceans regarding salmon management problems on the Eraser (Larkin 1992; Pearse 1992) offered a rough estimate that in a phase of the (mostly) gillnet fishery that produced a catch of 583,000 fish, another 248,000 were lost to mortality, half of which was from natural causes while the other half was fishing, induced. A similar problem occurs in the troll fishery with "shaker mortality," wherein hooked fish struggle loose but die uncaught as a result of injury and stress.

In a well-designed trap fishery, fishing-induced, non-catch mortality could be greatly reduced or nearly eliminated. By using liftable culling platforms, from which fish from strong stocks could be harvested and the remainder returned to the water without handling, mortality in non-target stocks may be minimized. In the case of the Fraser and Skeena rivers, selective trap fisheries that released all steelhead, chinook, and coho—most stocks of which are weak—would greatly advance their conservation. Pink salmon that are often discarded (dead) by Aboriginal fishers, because of their poor quality when caught upriver, could also be released live when taken in upriver traps at locations where discarding is otherwise a problem. Released fish would add to spawning escapement and allow for a larger commercial pink catch in salt water.

There remains a problem, most notably with sockeye stocks on the Fraser and Skeena, when strong and weak stocks of the same species migrate upriver simultaneously. As the fish are indistinguishable, visual sorting is infeasible. However, intraspecific stock identification is possible using various laboratory techniques—depending on the species—including electrophoresis, scale pattern analysis, and parasite identification (James Woodey, Pacific Salmon Commission, personal communication). Test results may be secured within a few days (or in one day for some procedures), so that by sampling fish near the start of their river migration, separate breeding stocks may often be identified in time to determine appropriate schedules of fisheries openings and closures. In the important case of sockeye the current practice is to use scale analysis, for which next-day results may be obtained. Ongoing experiments with DNA analysis may lead to even greater precision in stock identification (Park and Moran 1994).

With migrating runs taking about a month to pass a location on the river, the overlap of strong and weak stocks can be severe. However, the peak of a run takes much less time to pass, so there is much more separation of the run peaks. By sampling the runs, peak migration assemblages for various weak stocks may be identified and appropriate closures set. This is already being done to the extent feasible in the current sockeye fishery.

The fact that salmon deteriorate in perceived quality as they enter freshwater and ascend their home rivers underlies a widely held prejudice against commercial inriver fisheries. This notion is subject to challenge. The extent to which change or deterioration takes place varies greatly by species, stock, and river system. Generally speaking, chum and pink salmon show a distinct deterioration in quality as fish move upriver, while sockeye, chinook, and coho are much less affected. Steelhead, which do not necessarily die after spawning, are least affected. Extensive quality testing of gillnet-caught sockeye on the Skeena was undertaken for DFO in 1982 (Slaney and Birch 1983). The results generally showed that sockeye caught in the lower river were of "number one" quality and those caught in the middle reaches of the river were of "number two" quality, apparently largely related to increased water- and netmarking. Fish taken near Hazelton, in the upper Skeena, were found suitable for export grade canned products and yielded smoked products of "acceptable quality."

Ocean-caught salmon, at its best, has qualities that cannot be matched—at least not in every respect—by salmon harvested upriver. Ocean fish may be superior particularly in producing commodities in the fresh and frozen product sector. However, there are some quality-based counter-considerations. River traps allow fish to be taken live and butchered fresh at an adjacent processing facility, whereas seiner- and gillnet-caught fish normally arrive at processing facilities dead, often after an extended trip for delivery. It appears also that both the quality and quantity of salmon roe (a by-product, now of considerable value) increase as the fish migrate upriver. In addition, upriver

fish is considered more suitable for certain smoked products. It bears noting that upriver Aboriginal groups in British Columbia have used local salmon for ages as a staple food and as a valuable trading commodity. Their continuing trade (whether or not illegal) has demonstrated that the general population also finds their smoked salmon to be an attractive product. Therefore, it is evident that an upriver Aboriginal fishery should have little trouble in producing marketable commodities.

In judging the net economic benefits that may be generated by an enhanced First Nations river fishery as proposed in this chapter, there are evidently trade-offs to be considered. There is the quantity-quality trade-off of generating potentially much larger fish stocks and harvests through selective inriver fishing, as against the lower quality of inriver fish for the end-product market. This trade-off loses significance if it is established that increased harvest production will be sufficient to achieve larger catches both in the commercial marine and Aboriginal river sectors. Moreover, the perceived lower quality of inriver fish from physiological change in freshwater may be offset, in whole or in part, by quality-quality trade-offs. In a well-designed trap system, fish may be freshly butchered and iced directly out of the trap, whereas boat-caught fish is often drowned and net-marked during harvesting and may have to travel a considerable distance for delivery.

Both from a macroeconomic efficiency viewpoint and that of social equity, there is one other important consideration. The lack of employment opportunities in Aboriginal communities is severe. Annual labor force surveys of Aboriginal communities in the northwest of British Columbia—covering the Skeena watershed and areas to the north and west (Figure 7.1)—have been conducted over the years 1994-1997 by Pacific Northwest Employment Training and Development (a First Nations organization). Their census data for 1997 showed unemployment for the 25 Aboriginal communities in the area ranged from 45 to 86%, with an average of 68% (Pacific Northwest Employment Training and Development 1997). The provision of a worthwhile amount of employment that would result from establishment of commercial inriver fisheries for inland tribes is likely to have a positive impact on the economy by reducing structural unemployment. While some employment downstream would likely be displaced initially, this might be absorbed by normal turnover of labor in the coastal commercial fishery. In any case, the coastal fishing labor force is drawn from a population that generally has much better prospects for alternative employment than are available to inland Aboriginal communities. It is also important that increased employment in an industry highly compatible with traditional activities of Native communities may help significantly to overcome the chronic conditions of economic depression, demoralization, and dissolution in many Aboriginal communities.

DISTRIBUTIONAL EFFECTS

Predictably, there has been a strongly negative response to the AFS and to claims for a greater share of salmon catches by river-based First Nations, coming from other stakeholder groups, including some Aboriginal fishers working in the commercial sector. These other stakeholders know that the immediate effect of more fish for Aboriginal river communities will mean less fish for them collectively, and fear (erroneously, so far) that it will mean less for them individually. Understandably, they are inclined to look at the equity issue in terms of maintaining their current share of the catch, with most of them probably ill-informed about the historical injustices suffered by Aboriginal river communities.

To allay the concerns of stakeholders other than the river-based First Nations, it is important to make two points at the outset. The first is that the diversion of fish from saltwater commercial fisheries to Aboriginal river fisheries need not be very large and should be undertaken with full compensation to those affected. Provided the commercial fleet is targeted as much as possible on stronger stocks with relatively low admixtures of weaker stocks, it should remain possible to leave the bulk of the catch to the commercial fishery. As the long-term allocation of food fish to both coastal and river First Nations has been about 4% of the salmon catch, the allocation to river communities only would be somewhat less than that. A tripling or quadrupling of that allocation

would still leave the bulk of the harvest to the commercial fishery, while allowing for a multiple increase in weak stocks reaching the rivers.

This leads directly to the second important point. If Aboriginal river fisheries convert to selective gear and terminal fisheries with live-release of fish from weak stocks, then a three- or four-fold increase of fish in the river may be parlayed into a much larger multiple of fish from weak stocks reaching the spawning grounds, resulting in considerable restoration of those stocks. Given selective harvesting on the river it should then also be possible to engage in the strengthening of many other stocks with a potential for enhancement. Allocating a greater share of the catch to Aboriginal fishers on the river then is not just a matter of redistributing the harvest among stakeholders. It is also extremely important for improved management potentially leading to much larger aggregate catches.

To make inriver commercial fisheries for inland First Nations at all palatable to commercial fishermen, it is undoubtedly necessary to provide them with compensation for any reduction in the marine commercial harvest. This appears to be recognized by the federal government, which has justified the AFS allocations made to Aboriginal river fisheries by actions of two kinds. The government has bought out licensed vessels from some operators retiring from the commercial fishery, withdrawing those vessels from the fishery and transferring their estimated catch allocations to the river fisheries. Second, they have made allocations to the river fisheries from some of the salmon stock additions attributable to government-financed enhancement projects. Continuing such compensation measures for further salmon allocations to river fisheries appears in order, although this might not satisfy the processing companies who would fear reduced throughput for their plants. However, the larger total harvests in prospect, plus the likelihood that much of the river catch will flow through their establishments, could result in an outcome they would eventually find amenable.

The catching capacity of the salmon fleet is in excess of any current or prospective needs, resulting in excessive harvesting costs in relation to the value of the catch (Pearse 1982). Fleet capacity reduction should result in greater net benefits for the harvesting sector. Unfortunately, vessel buybacks by government so far have done little to reduce excess capacity overall (Pearse and Wilen 1979; Copes 1990, 1997). The federal government, however, appears to have a commitment to further rationalization, so a reduction of the coastal salmon fleet to accommodate more upriver fishing could be made part of any larger program of capacity management.

Sport fishers are likely to benefit significantly from stock-specific management. Their target species consist largely of steelhead, chinook, and coho, all of which are represented by stocks that have been quite vulnerable to depletion in mixed-stock fisheries. Initially there was much opposition to the allocation of more fish to Aboriginal communities among recreational fishers, who simply feared that it would leave less fish for them. This may change with the discovery that a shift of fishing effort, from the mixed-stock marine fisheries to a selective inriver Aboriginal fishery, could result in much better conservation, particularly of the vulnerable stocks of coho, chinook, and steelhead, with which they are primarily concerned.

MANAGEMENT AUTHORITY

An effective fisheries management agency should possess a competent administration, well-developed scientific capability, powerful regulatory capacity, and a correspondingly adequate budget. Most essentially, the management agency needs to have the legal power to structure, administer, and enforce a system-wide management plan. Effective use of the salmon resource requires that the fishery for each river system be carefully regulated and coordinated by a management authority able to follow a consistent plan and enforce regulations for all participants, so they will not exceed catch allocations or otherwise subvert the plan. This authority also needs the power to apply inseason management (i.e., to impose fishery closures and other strictures at short notice in any part of the system, based on information on stock conditions). In Canada, only the federal government has all of the requisite powers and resources to provide a management agency meeting the above criteria.

The Gitxsan-Wet'suwet'en land claims policy includes an important fisheries component. It incorporates a stock-specific management strategy for the tribal area and recommends "that Tribal Council take the necessary legal and political steps to establish a Gitxsan and Wet'suwet'en fishery agency with full authority over fishery management within the territory and with a mandate to negotiate with agencies from other jurisdictions regarding management of Skeena stocks while they are outside of Gitxsan and Wet'suwet'en territory" (Morrell 1985, 1989). This approach reflects the tribal group's position that it is unacceptable to be considered just another supplicant "user group" pleading for a favored share of the fishery resource from an omnipotent federal government.

In their current mood of self-assertion, First Nations are demanding recognition of what they consider to be unextinguished and inextinguishable rights to their traditional fishery resources. The establishment and legal recognition of a tribal fishery agency, such as proposed by the Gitxsan-Wet'suwet'en Tribal Council, undoubtedly would be of great political advantage in defending their fishery claims. However, the full range of powers envisioned—at least in their literal form—have little chance of being accepted *in toto* by the Canadian government. If they were taken literally and applied with full force, they might well risk unacceptable levels of conflict with other stakeholder groups, while complicating efforts and weakening authority of DFO in meeting its responsibilities for management of the Skeena River salmon stocks. Protracted conflict with Americans over interception of B.C.-origin fish already seriously debilitates DFO's salmon management capacity. To concede competing autonomous fisheries jurisdiction to any stakeholder group within Canada could well lead to unresolvable conflicts over allocation and other matters, with a consequent further erosion of effective management. There is notably strong and wide support in B.C.—publicly expressed—for the retention of final and effective authority by DFO in managing the salmon resource, notwithstanding constant criticism aimed at this department of government.

Despite these reservations, the Canadian government now appears well disposed to community-based Aboriginal fishery agencies with special and unique responsibilities in tribal areas, in the context of a developing system of comanagement (Cassidy and Dale 1988). This would involve the many tribes in addition to the Gitxsan-Wet'suwet'en that have shown an interest in assuming fisheries management responsibilities of some kind within their territories (Richardson and Green 1989; MacLeod 1989). Given the strong propensity for controversy and confrontation in the fishing industry, there is, in any case, merit in the establishment of a "comanagement" process involving the government management authority and all user groups, in an effort to foster cooperation, understanding, and mutual consultation (Pinkerton 1989). Elements of this process are already present in Canadian fisheries through various advisory councils but, overall, the arrangements made so far represent, at best, a low-level form of comanagement. There remains much room for further delegation of management authority to be exercised by user groups in agreement with the constitutionally empowered authority, provided the delegated responsibilities are not subject to serious conflicts of interest, are carried out competently, and are adequately monitored (Copes 1997).

In conjunction with the AFS some comanagement arrangements with Aboriginal agencies have already been made by DFO on the Fraser, Skeena, and Nass rivers, and at Port Alberni on Vancouver Island. The initial arrangements focused particularly on administering the "pilot sales" fisheries agreements that DFO concluded with a limited number of First Nations, which essentially converted their open-ended food fisheries into quantitatively capped fisheries with permission to sell any part of the catch. Comanagement here included delegated authority to Aboriginal agencies in the policing of the fisheries, as well as control and recording of landings. Other comanagement features, that have been started or may be included, are collaboration in establishing optimally located selective and terminal fisheries, the operation and control of such fisheries, the design of enhancement works, and the carrying out of enhancement activities. The complex of such activities could provide considerable economic benefits for some of the First Nations. There would be larger fish catches, much of which would be available for commercial sale, possibly with value-added benefits from processing. In addition, work carried out on enhancement, of benefit to salmon fisheries overall, presumably would be paid for from federal funds and provide much needed employment.

CONCLUSION

Historical evidence indicates that, at the time of first European contact, many of the First Nations inhabiting the Fraser and Skeena watersheds had economies strongly dependent on local salmon resources. These economies were suppressed in the interest of a Euro-Canadian commercial marine fishery and fish processing industry. A restoration of salmon allocations to Aboriginal river communities, sufficient to allow reestablishment of a commercial fishery component, would provide some redress for past injuries and provide much needed employment and income.

The salmon resources of B.C. have been significantly reduced by excessive mixed-stock fishing and a variety of environmental impacts. Scientific estimates suggest that prior to European contact salmon stocks in B.C. were considerably larger than now and that sustainable harvests could be at least doubled. Important factors in achieving this would include selective fishing practices for stock-specific management and reduction of non-harvest mortality, restoration of degraded habitats, and additional enhancement undertakings.

The strategy proposed in this chapter is for the simultaneous achievement of justice in restoring substantial salmon harvest benefits to Aboriginal river communities and of significantly increasing the salmon catch in B.C. for the ultimate benefit of all stakeholders. This dual strategy draws on the felicitous circumstance that river tribes are in a position to play a key role in selectively harvesting salmon on the final leg of their journey to the spawning grounds, when fine-tuning of target escapements for individual stocks is possible. Aboriginal river communities are also well situated to cany out needed habitat restoration projects.

There is at present no evidence of a clear policy, at either the federal or provincial government level, to address the question of salmon management consistently and forcefully in the light of combined considerations of Aboriginal entitlement and optimal salmon resource management. However, the time seems right for establishing a joint federal-provincial policy and comanagement plan of action in collaboration with First Nations and other stakeholder groups. Indeed, a few positive steps have already been taken consistent with the strategy proposed in this chapter.

What is now needed is recognition by the federal and provincial governments of the importance of linking the fisheries question in Aboriginal land claims with that of improved salmon management, and a decision to pursue an optimal joint solution as a matter of public policy. A key component of land claim settlements with river tribes should be that the amount of additional fish made available would be linked to the use of approved selective fishing techniques as part of an optimal salmon management strategy. The resulting prospect of greater salmon harvests would provide both the means and the justification for a more generous catch allocation to Aboriginal fisheries.

Full implementation of the suggested policy will take time. It should be supported by a vigorous program of technical experimentation, coupled with successive refinements of a management plan model. Among gears to be developed and tested should be various trap or trap-and-weir systems, as well as fishwheels, and a full range of live-capture net systems. Gear design considerations should include timing and location of their use, harvest success, low mortality from stress of fish intended for live release, and cost-effectiveness in construction and operation.

Agencies currently responsible for overall management of B.C. salmon stocks and runs, namely DFO and the Pacific Salmon Commission, use a variety of models in setting and executing their present management plans. Moving a larger part of the fishery into the river should allow for superior escapement management. However, it will require an elaborate and complex plan of harvest allocations to various sites and gears. Biological concerns for various escapement management scenarios will have to be balanced in new models with economic considerations, such as fish quality, and with equity considerations in terms of allocations to stakeholder groups. Moreover, new models will support better management under the plan by allowing for adjustments from preseason estimates to "real time" allocations in accordance with run sizes and patterns actually experienced inseason.

The current claims by river tribes for reestablishment of their entitlement to a greater share of the salmon resource may be settled by the courts, by a political process, or both. Whatever the process, it is important that the solution arrived at be compatible with sound use of the resource and with a high level of added benefits. Historical justice suggests that a priority share of these benefits be assigned to First Nations. I contend there is a credible "win-win" management strategy leading to a sufficiently substantial increase in the harvest of salmon that may both do justice to Aboriginal claims and provide a share of the benefits to all other stakeholders.

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